

Appendix F

Stormwater Technical Report



FLL Intermodal Center

PDD Stormwater Planning

Technical Report (DRAFT)

PREPARED FOR:

Broward County Aviation Department

PREPARED BY:

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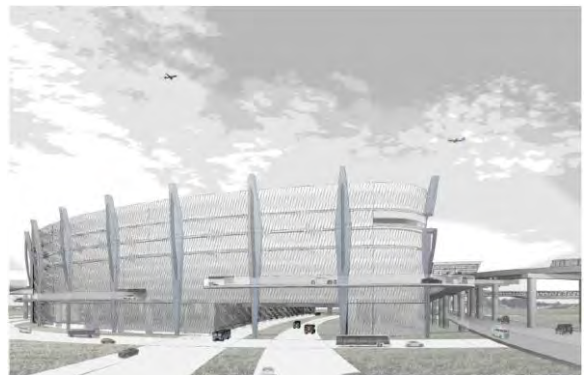
February 2024

DRAFT

Introduction

The planned future development activities at FLL have been defined within the FLL Master Plan along with the associated FLL Future Airport Layout Plan (ALP), which established the location and extent of future development projects throughout FLL. The planned future development activities at FLL will increase the impervious surfaces throughout FLL and eliminate existing stormwater management areas throughout FLL, which will further increase the need for additional stormwater management areas throughout FLL. Based on the analysis completed for the 2021 FLL Stormwater Master Plan Update, the proposed stormwater management system at FLL will not provide sufficient storage capacity for stormwater runoff within existing and proposed stormwater management areas throughout FLL to enable the future “build out” conditions at FLL. To ensure the stormwater management system at FLL meets various level of service criteria related to flood control and meets various regulatory requirements related to water quality treatment, BCAD needs to identify, reserve, and potentially acquire additional land area at FLL for the implementation of additional stormwater retention areas throughout FLL.

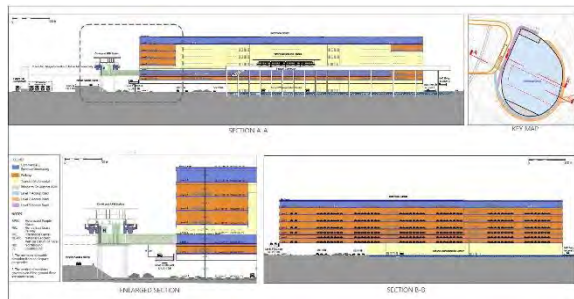
A key planned future development project defined within the FLL Master Plan is the proposed FLL Intermodal Center (IMC), which will be located immediately east of the Terminal Area within the FDOT right of way for US Highway 1. The proposed FLL IMC Facility will be a transportation hub that integrates the current and planned regional countywide transportation network, including the planned first/last mile transit connectivity between the Fort Lauderdale-Hollywood International Airport and Port Everglades. The location of the proposed FLL IMC Facility is shown in **Exhibit 1** at the end of this report.



BCAD has retained a consultant team to prepare the Project Definition Document (PDD) for the FLL Intermodal Center, which is currently underway. According to the FLL IMC Advanced Planning Technical Report, the planning consultant team is investigating both on-site and off-site strategies to mitigate the impact of the proposed FLL IMC development on the existing stormwater management areas within the FDOT right of way that serves the FLL Terminal Area. The planning consultant team has identified various constructability concerns about the on-site mitigation options related to preserving the stormwater storage capacity within the footprint of the proposed FLL IMC Facility, which could potentially increase the estimated construction costs. The planning consultant team is investigating the feasibility of various off-site mitigation options for stormwater management related to the proposed FLL IMC Facility.

The planning consultant team has identified various vacant parcels owned by Broward County that could potentially be modified into new stormwater management areas immediately east of the proposed FLL IMC Facility on the east side of NE 7th Avenue. These vacant parcels are currently wetland areas that act as the receiving water body for the existing stormwater management system within FDOT right of way, which discharges stormwater runoff via one 48” outfall pipe and three 24”x32” elliptical outfall pipes into this existing wetland area. A potential off-site mitigation option for the impacts of the proposed FLL IMC Facility would be to stage stormwater runoff within this existing wetland area, which would retain stormwater runoff from the FLL Terminal Area and from the FDOT right of way. This off-site mitigation option could potentially cause adverse impacts to the hydraulic capacity within upstream portions of the existing stormwater management system, which may exacerbate any existing flooding issues within the FLL Terminal Area along with the FDOT right of way areas. Additional modeling analysis should be completed to assess the hydraulic feasibility of this off-site mitigation option to ensure there are not any adverse impacts within upstream portions of the existing stormwater management system serving the FLL Terminal Area.

The FLL IMC Facility is located within the FDOT US1 Drainage System, which is interconnected to Drainage System 2 serving the eastern portion of the FLL Terminal Area. The limits of the primary stormwater basins within the FLL boundaries are shown in **Exhibit 2** at the end of this memorandum. The primary stormwater basins are further subdivided into sub-basins, which are shown within **Exhibit 3** at the end of this memorandum. Under the existing conditions, all stormwater runoff generated within the System 2 and within the FDOT US1 System eventually flows into the existing dry retention area located within the footprint of the proposed FLL IMC Facility before discharge off-site to the east. Due to various site limitations, the 2021 FLL Stormwater Master Plan Update recommended that the proposed FLL IMC Facility maximize the on-site storage capacity for stormwater runoff.



Broward County Aviation Department (BCAD) has retained Chen Moore and Associates (CMA) to complete a stormwater study on the proposed FLL IMC. The conceptual design of the FLL IMC Facility was presented in the FLL IMC Advanced Planning Technical Report, which was prepared by Ricondo and Kimley Horn. This stormwater study is intended to support and supplement the ongoing Project Definition Document (PDD) effort for the FLL IMC Facility, which will also be completed by Ricondo and Kimley Horn. The purpose of the stormwater study is to evaluate the impact of the proposed footprint of the FLL IMC Facility on the existing stormwater management system serving FLL and the FDOT US-1 System along with additional stormwater needs created by this new development. The implementation of stormwater improvements will be required to provide sufficient stormwater capacity to offset the loss of existing stormwater retention volume within the footprint of the proposed FLL IMC Facility along with handling additional stormwater runoff generated from new impervious surfaces created by the proposed FLL IMC Facility. These stormwater improvements will need to prevent any adverse upstream impacts on the performance of the existing stormwater management system serving the FDOT right of way for US1 and the eastern portions of the FLL Terminal Area along with providing sufficient flood control and water quality treatment for the proposed FLL IMC site.

The various stormwater improvement alternatives for the FLL IMC Facility were evaluated from a flood control, a flood attenuation, and a water quality treatment perspective along with any potential impacts of the existing wetland areas east of the FLL IMC. The permitting requirements for these various stormwater improvement alternatives were also evaluated with the relevant regulatory agencies, which include the South Florida Water Management District (SFWMD) and Broward County Environmental Permitting Division (BCEPD). CMA also evaluated several stormwater alternatives that could potentially be implemented within the proposed stormwater management system for the FLL IMC Facility. The hydraulic performance of the various stormwater improvement alternatives was analyzed with an ICPR4 stormwater model to develop the recommendation to avoid any adverse upstream impacts within the FLL Terminal Area and within FDOT US-1 System.

Project Documentation

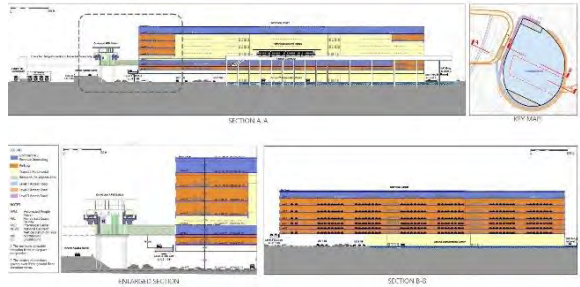
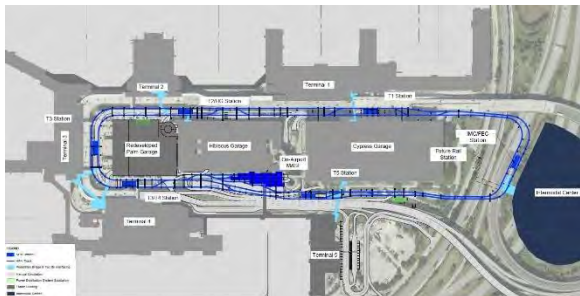
CMA reviewed various documentation provided by BCAD with relevant information on the future planned projects at FLL. CMA used this documentation to confirm the existing conditions and the planned future conditions within Drainage System 2 and FDOT US1 Drainage System, which was used to analyze the stormwater impacts and stormwater needs related to the FLL IMC Facility along with any other associated projects. CMA used the following documentation as the basis for this stormwater analysis for the proposed FLL IMC Facility:

- FLL Master Plan Update (2020)
- FLL Stormwater Master Plan Update (2021)
- FLL Terminal 5 PDD Report (2021)

- FLL IMC Advanced Planning Technical Report (2022)
- FLL APM PDD Report (2022)

Relevant Planned Projects

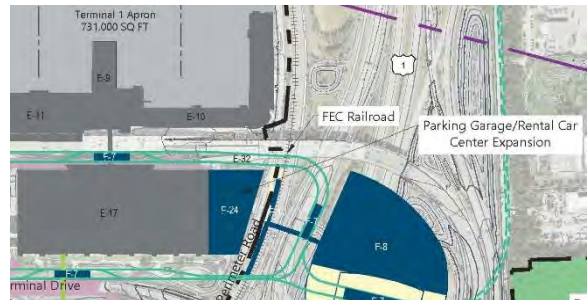
BCAD completed the FLL Master Plan in 2020, which identified all planned future development at FLL in phases over a 30-year planning timeframe. Since all stormwater runoff generated within the System 2 and within the FDOT US1 System currently flows into the existing dry retention area located within the footprint of the proposed FLL IMC Facility, it is important to consider the stormwater needs for all future planned development within System 2 and FDOT US1 System when evaluating the stormwater needs of the FLL IMC Facility. Based on the FLL Master Plan, the planned development projects within the limits of the System 2 and FDOT US-1 System stormwater basins are shown within Exhibit 4 at the end of this memorandum, which are also summarized below.

- **FLL IMC Facility** – This project will be a transportation hub that will integrate the current and planned regional and countywide transportation network, including the planned first/last mile transit connectivity between the airport and seaport. The purpose of the FLL IMC Facility is to provide a hub for Broward County Transit at FLL, to provide additional vehicular parking capacity at FLL, to capture a share of vehicular demand prior to entering the Terminal Area, to alleviate vehicular congestion along Terminal Drive, to provide connectivity with alternate transportation modes, and to provide for passenger rail connectivity at FLL. According to the FLL Master Plan, this project is planned to be implemented during Phase 1 Sequence 1 of the program implementation phasing plan. At this time, the construction of the FLL IMC Facility is projected to start in Fiscal Year 2026 and to be completed in Fiscal Year 2028. Since the FLL IMC Facility will eliminate a large existing dry retention area serving all of System 2 and the FDOT US1 System, this stormwater evaluation will need to identify options for compensating for the loss of the existing stormwater storage volume along with any additional stormwater needs related to the new development.
 
- **FLL Automated People Mover (APM)** – This project is intended to facilitate landside and terminal development by enhancing connectivity between the terminals, the parking garages, and the proposed FLL Intermodal Center while alleviating landside congestion along Terminal Drive. The FLL APM Project will consist of 16,000 linear feet of dual guideway routed along Terminal Drive that will be connected to six stations at Terminal 1, Terminal 2, Terminal 3, Terminal 4, Terminal 5, and the Intermodal Center. At this time, the construction of the FLL APM Project is projected to start in Fiscal Year 2026 and completed in Fiscal Year 2030. The FLL APM Project is not expected to create significant amounts of new impervious surfaces and is not expected to eliminate any existing stormwater storage within the existing stormwater retention. Due to the elevated conceptual design of the FLL APM, the project is not expected to have significant impacts on the existing stormwater system (beyond the relocation of existing stormwater infrastructure that may conflict with structural elements of the project).
 
- **FLL Terminal 5** – This project is a new terminal serving domestic flights that will be located east of Terminal 4 Concourse G. The proposed footprint of Terminal 5 is located on a portion of existing airside apron area that currently provides overnight aircraft parking and storage for ground service equipment. The

project will also include a new elevated multi-level pedestrian connector between Terminal 5 and Terminal 4 Concourse G. The area immediately west of Terminal 5 will include a new landside roadway system for passenger pick-up, drop-off, and commercial vehicles. Terminal 5 will be located within existing Drainage Basin 2.7, which is part of Drainage System 2 that discharges into the FDOT US1 Drainage System. According to the stormwater management concept within the Terminal 5 PDD Report, stormwater runoff from the Terminal 5 roof along with associated airside areas will no longer discharge into the FDOT US1 Drainage System and will now flow via a new 42-inch RCP routed south into Drainage System 1 (Basin B). The Terminal 5 landside areas will continue to discharge into Basin US1-16 with the FDOT US-1 Drainage System. According to the stormwater management concept within the Terminal 5 PDD Report, the Terminal 5 landside areas will have on-site stormwater management facilities, which will minimize the need for additional stormwater storage capacity within the FDOT US1 Drainage System.



- RCC Cypress Garage Expansion** – This project includes the expansion of the existing parking garage structure to the east toward Perimeter Road. The Rental Car Center (RCC) Cypress Garage originally opened in 2005 and includes 5 levels with a quick turn-around at the ground level. The RCC Cypress Garage Expansion Project is located within Basin 2.4, which currently discharges into the FDOT US1 Drainage System. The project is expected to eliminate three existing stormwater retention areas located within the expansion footprint and to create new impervious ground surface, which will generate additional stormwater runoff. Due to these impacts, the RCC Cypress Garage Expansion Project will need to create on-site stormwater storage volume to compensate for the loss of the existing stormwater retention areas and to handle the additional stormwater runoff generated by the project. Based on a preliminary review, the project is expected to meet its stormwater needs on-site by the implementation of a stormwater storage chamber system below the ground floor.
- Broward Commuter Rail South** – The plan is to construct a new FLL Airport Commuter Rail Station between Perimeter Road and the FEC Railway immediately east of the RCC Cypress Garage, which will have commuter connectivity to the proposed FLL IMC Facility and the proposed FLL APM. The footprint of the FLL Airport Commuter Rail Station is not expected to significantly impact any existing stormwater storage and will have limited stormwater needs. Based on conceptual map from the FDOT PD&E Study for this project, the proposed improvements are expected to include a realignment of the existing railways to the north and south of the proposed FLL Airport Commuter Rail Station. The realignment of the existing railway will encroach into the FDOT US1 Drainage System and will require the relocation and reconfiguration of the existing wet pond in Basin US1-6, which will likely eliminate the possibility of expanding this existing wet pond to support the impacts of the FLL IMC Facility.
- Dynegy Site** – According to the FLL Future ALP, the parcel located on northeast corner of US1 and Eller Drive is identified for future joint use development, which will likely be demand driven. Since this parcel is hydraulically isolated from the FDOT US1 Drainage System, any stormwater needs related to future development at this parcel will likely need to be implemented on-site and are not expected to have any impact on the stormwater needs for the proposed FLL IMC Facility.



connected to corresponding primary outfall(s) that discharge stormwater runoff off-site. The primary system basins are further divided into sub-basins within the FLL stormwater model, which are shown within **Exhibit 3** at the end of this memorandum. The FLL IMC Facility is located entirely within the FDOT US1 Drainage System. Under the existing conditions, all stormwater runoff generated within the System 2 serving the eastern portion of the FLL Terminal Area and within the entire FDOT US1 System eventually flows into the existing dry retention area located within the footprint of the proposed FLL IMC Facility before discharge off-site to the east. Since the FLL IMC Facility will eliminate a large existing dry retention area serving all of System 2 and FDOT US1 System, this stormwater evaluation will need to identify options for compensating for the loss of the existing stormwater storage volume along with any additional stormwater needs related to the new development.



The FDOT US1 Drainage System consists of a series of interconnected dry retention areas and wet ponds throughout the FDOT right of way for US1, which are displayed on **Exhibit 5** at the end of this memorandum. These stormwater management areas provide storage volume for stormwater runoff for flood attenuation and water quality purposes. The water quality storage is the available volume provided with these interconnected dry retention areas and wet ponds below the control elevation for the FDOT US1 Drainage System, which is +2.50 feet NAVD. The existing water quality storage volume provided within these interconnected dry retention areas and wet ponds throughout the FDOT US1 Drainage System was formally defined within the most recent surface water license approval from BCEPD and SFWMD, which was for the FLL Access Roads and Valet Ramps Improvements Project in 2019.

According to the water quality calculations provided for this surface water license for the FLL Exit Road and Valet Ramp Improvements Project, the FDOT US1 Drainage System and Drainage System 2 should provide at least 53.54 acre*feet of water quality storage based on the existing impervious ground coverage throughout these drainage systems. Based on these same water quality calculations provided for this surface water license, the existing interconnected dry retention areas and wet ponds within the FDOT US1 Drainage System provides a water quality volume of 28.99 acre*feet within existing dry retention areas and 35.08 acre*feet within existing wet retention areas. Based on this previous water quality analysis, dry retention areas and wet ponds throughout the FDOT US1 Drainage System provide surplus water quality treatment volume within the FDOT US1 Drainage System of 20.10 acre*feet under the existing conditions.

Based on a detailed review of the water quality calculations for the FLL Access Roads and Valet Ramps Improvements Project, it appears that some inappropriate design assumptions were used to estimate the water quality storage volume provided by the existing interconnected dry retention areas and wet ponds within the FDOT US1 Drainage System. Based on our review, the estimated water quality provided within existing dry retention areas in the FDOT US1 Drainage System included all available volume from +0.42 feet NAVD up to the system control elevation of +2.50 feet NAVD. The estimated water quality provided within existing dry retention areas should only be the available volume from +1.42 feet NAVD, which corresponds to 12 inches above the seasonal high groundwater elevation, up to the system control elevation of +2.50 feet NAVD. It also appears the 0.75 factor was not consistently applied to the water quality storage volume provided within existing wet ponds versus existing dry retention areas. These design assumptions made under water quality calculations for the FLL Access Roads and Valet Ramps Improvements Project have overestimated the total water quality storage volume provided within the FDOT US1 Drainage System.

During the completion of the FLL Stormwater Master Plan, the storage volume provided by the existing interconnected dry retention areas and wet ponds within the FDOT US1 Drainage System was re-evaluated

using the appropriate design assumptions related to water quality storage. Based on these updated water quality calculations, the FDOT US1 Drainage System and Drainage System 2 should provide at least 53.63 acre*feet of water quality storage based on the existing impervious ground coverage throughout these drainage systems. These updated water quality calculations for FDOT US1 Drainage System and Drainage System 2 are included within the Appendix. Based on these updated water quality calculations, the existing interconnected dry retention areas and wet ponds within the FDOT US1 Drainage System provides a water quality volume of 31.61 acre*feet within existing dry retention areas and 22.40 acre*feet within existing wet retention areas. Based on this updated water quality analysis, dry retention areas and wet ponds throughout the FDOT US1 Drainage System provide surplus water quality treatment volume within the FDOT US1 Drainage System of only 0.38 acre*feet under the existing conditions. For comparison purposes, the estimated water quality storage volume provided within relevant drainage basins in the FDOT US1 Drainage System are summarized in the table below from both sources. Any water quality storage volume eliminated from these drainage basins due to the FLL IMC Facility will need to be compensated for to maintain the flood attenuation and water quality treatment provided throughout the FDOT US1 Drainage System. As noted, there is a significant discrepancy between the estimated storage volumes from both sources, which will need to be verified as more survey data becomes available for this project.

FDOT US1 Drainage System – Existing Water Quality Storage Volume		
Basin	FLL Exit Road and Valet Ramps	FLL Stormwater Master Plan
Basin US1-6	35.08 acre*feet	27.05 acre*feet
Basin US1-12	0.70 acre*feet	0.70 acre*feet
Basin US1-14	7.10 acre*feet	6.90 acre*feet

The existing dry retention areas and wet ponds throughout the FDOT US1 Drainage System are interconnected by existing drainage piping to allow for stormwater runoff to equalize and stage before discharging to the east via the existing outfalls, which is displayed in **Exhibit 5** at the end of this memorandum. CMA reviewed available documentation to confirm the existing drainage connections throughout the FDOT US1 Drainage System. The FLL IMC Advanced Planning Technical Report included Exhibit 5-1, which displayed the locations and sizes of the existing drainage pipe throughout the FDOT US1 Drainage System but had incomplete information on pipe inverts and any control structure information. BCAD maintains a GIS utility atlas of the existing stormwater system, which was missing significant information on the existing drainage piping within the FDOT US1 System. Although FDOT provided their available drainage as-built drawings for the FDOT US1 System, these record drawings did not include any relevant information since the FDOT US1 System was significantly reconfigured after these record drawings. The existing drainage pipe connections throughout the FDOT US1 System will need to be confirmed as more survey data becomes available for this project. Based on the available documentation, the existing drainage pipe interconnecting the drainage basins immediately upstream and downstream were assumed to be as follows:

- Dual 36” RCP between Basin US1-6 and Basin US1-12
- Dual 42” RCP between Basin US-12 and Basin US1-14
- Single 48” RCP from Basin US1-14 to existing wetland areas east of NE 7th Avenue

Existing Wetland Areas

The FDOT US1 Drainage System discharges stormwater runoff via a single 48” RCP outfall from Basin US1-14 into an existing wetland area to east of NE 7th Avenue that acts as the receiving water body. There are also three 24”x32” oval outfall pipes that discharge stormwater runoff from the NE 7th Avenue right of way into this same existing wetland area. This existing wetland area is located within County owned parcels that encompasses approximately 54.92 acres. This existing wetland area is bounded by NE 7th Avenue on the west, development on the north, and an FPL maintenance access road on the east and south, which act as barriers to any overland

flow from this existing wetland area. Any stormwater runoff flows from this existing wetland area via seven existing culverts under the FPL maintenance access road into the existing drainage ditch that flows south toward the Dania Cutoff Canal. The configuration of this existing wetland areas along with the drainage pipe connections is displayed on **Exhibit 6** at the end of this memorandum.

CMA performed a desktop review of existing GIS databases for the areas east of NE 7th Avenue along with subsequent field reviews on September 26, 2023 and January 31, 2024 to verify the presence and type of wetlands within these areas.

Based on aerial photo interpretation and limited ground truthing, these County owned wetland areas to the east of NE 7th Avenue consists of mangrove wetlands. The canopy stratum throughout these County owned wetland areas to the east of NE 7th Avenue was composed of red mangroves (*Rhizophora mangle*), black mangroves (*Avicennia germinans*), and white mangroves (*Laguncularia racemosa*) with minor inclusion by green buttonwood (*Conocarpus erectus*). Plant cover in the groundcover stratum was limited due to dense canopy cover throughout these County owned wetland areas to the east of NE 7th Avenue. Species present in the groundcover stratum included leather fern (*Acrostichum danaeifolium*), coin vine (*Dalbergia ecastaphyllum*), and red, black, and white mangrove seedlings.



The west and southern perimeters of the mangrove areas displayed dense cover by invasive/exotic species, including Australian pine (*Casuarina equisetifolia*) and Brazilian pepper (*Schinus terebinthifolia*), which may be indicative of uplands. However, these minor areas were not deducted from overall estimated mangrove coverage for the purposes of this preliminary evaluation. In addition, several FPL access roads and FPL transmission structures were observed within the footprint of these County owned wetland areas to the east of NE 7th Avenue. The access roads were not deducted from the mangrove coverage estimate. A formal wetlands delineation would be required to verify the extent of uplands within the retention area footprint.

An existing system of open water ditches are routed throughout the mangrove wetlands within these County owned wetland areas to the east of NE 7th Avenue. Existing drainage culverts provide a hydrologic connection between the mangrove wetlands and an FDOT drainage ditch that runs south along the eastern boundary these County owned wetland areas to the east of NE 7th Avenue to the Dania Cutoff Canal. This existing drainage ditch system provides for both tidal flushing and detrital transport, which improve the health of the mangrove system.

Site Visits

BCAD has no available records on any existing drainage infrastructure within the existing wetland areas east of NE 7th Avenue. Since flow patterns of any stormwater runoff discharge from the FDOT US1 Drainage System needed to be confirmed, CMA staff conducted a site visit on January 31, 2024 of the existing wetland areas east of NE 7th Avenue from the FPL access road. The primary purpose of the site visit was to conduct a visual inspection of the wetland areas immediately adjacent to the FPL access road, which will help inform any preliminary wetland mitigation calculations and to confirm the number and sizes of any existing drainage culverts under the FPL access, which is necessary to develop an accurate stormwater model for the FLL IMC stormwater analysis. CMA travelled along the entire length of the FPL access road while stopping to visually inspect each drainage culvert crossing under the FPL access road along with the condition of the existing wetland areas to west of FPL access road. A photo inventory from this site inspection is enclosed within the Appendix at the end of this memorandum.

The site inspection confirmed the presence of seven drainage culverts that allow for stormwater flow from the wetland areas under the FPL access road into the FDOT drainage ditch/canal, which include 1-42" culvert, 4-36" culverts, 1 oval culvert (likely 24"x36"), and 1 small culvert (likely 12"). Based on site observations, it will be feasible to retrofit a control structure on the upstream end of each existing culvert with minimal wetland impacts, which will allow for the staging of limited additional stormwater runoff area within the wetland area to the west of the FPL access road. The site inspection confirmed that some isolated segments of the FPL access road have very low elevations, which allow stormwater runoff to sheet flow from the wetland areas over the FPL access road into the FDOT drainage ditch/canal. These segments of the FPL access road should be raised to allow for the staging of limited additional stormwater runoff area within the wetland area to the west of the FPL access road. The site inspection confirmed that the existing wetland areas to the west of the FPL access road within the County owned parcels are indeed mangrove wetlands. The FLUCCS and NWI GIS databases had Parcel 8 incorrectly labelled as "freshwater forested wetlands".

Stormwater Impacts

The entire footprint of the FLL IMC Facility is located within Drainage Basins US1-12, US1-14, and US1-18 within the FDOT US1 Drainage System, which impacts stormwater drainage infrastructure shown on **Exhibit 7** at the end of this memorandum. The development of the proposed FLL IMC Facility will impact existing drainage facilities within these drainage basins, which include existing dry retention and existing drainage pipe connections. Since these existing drainage facilities serve all stormwater runoff generated throughout the FDOT US1 Drainage System and from the Drainage System for the eastern FLL Terminal Area, new stormwater improvements will need to be implemented within on-site and off-site areas to compensate for the impacts on existing stormwater facilities and to handle additional stormwater runoff generated by the proposed FLL IMC Facility. The primary stormwater impacts of the proposed FLL IMC Facility will be the elimination of dry retention within the footprint along with the need to reconfigure and/or upsize the existing drainage pipe connection upstream and downstream of the footprint to maintain the flood control provided throughout the entire FDOT US1 Drainage System and Drainage System 2. The expected stormwater impacts from the FLL IMC Facility are summarized below.

The development of the proposed FLL IMC Facility will modify the ground surface coverage within the FDOT US1 Drainage System, which will eliminate existing dry retention and create new impervious ground surfaces. The footprint of the FLL IMC FLL is located within Drainage Basins US1-12, US1-14, and US1-18 which are primarily pervious surface with dry retention storage. The limits of existing impervious and pervious ground surface throughout the FDOT US1 Drainage System and Drainage System 2 are displayed on **Exhibit 8** at the end of this memorandum. The development of the FLL IMC Facility will increase impervious ground surface within the FDOT US1 Drainage System, which will increase stormwater runoff generated within the footprint and will eliminate existing pervious area that allows for the infiltration of stormwater runoff into the ground. The development of the FLL IMC Facility will also eliminate the storage volume provided for stormwater runoff within existing retention in the footprint. Due to the decreased storage volume provided within existing retention areas to be eliminated along with the increased stormwater runoff generated by the additional impervious areas, the proposed FLL IMC Facility would cause additional flooding throughout the FDOT US1 Drainage System and Drainage System 2 without sufficient on-site and off-site stormwater improvements.

The impacted dry retention within the FDOT US1 Drainage System provides storage volume for both flood attenuation purposes and water quality treatment purposes, which will need to be maintained under the proposed conditions. The existing ground surface elevations throughout the FDOT US1 Drainage System are displayed on **Exhibit 9** at the end of this memorandum. The existing retention areas within Basin US1-12 and Basin US1-14 conflict with the footprint of the FLL IMC Facility. Based on a preliminary evaluation, the water quality storage volume within the existing retention in Drainage Basins US1-12, US1-14, and US1-18 to be potentially eliminated by the FLL IMC Facility was estimated to be 7.60 acre*feet. The proposed FLL IMC Facility is

estimated to create approximately 11.29 acres of new impervious ground coverage, which will generate additional stormwater runoff into the FDOT US1 Drainage System. Based on this additional impervious ground surface, an additional stormwater storage volume of up to 2.35 acre*feet will need to be created within the FDOT US1 Drainage System to enable the proposed FLL IMC Facility to be built while meeting regulatory requirements for water quality treatment.

Based on the existing retention to be eliminated along with the additional stormwater needs related to the new development, the total stormwater impact from the FLL IMC Facility is estimated to be up to 9.95 acre*feet in the worst-case scenario. This stormwater storage volume will need to be created in new on-site and off-site stormwater facilities to support the proposed development. The goal will be to maximize the stormwater storage volume provided on-site within the footprint of the FLL IMC Facility. Any additional stormwater storage needs will need to be provided off-site elsewhere within the FDOT US1 Drainage System or within the existing County owned wetland areas to the east of the NE 7th Avenue.

Some existing drainage pipe connections within the FDOT US1 Drainage System will need to be relocated to avoid conflicting with the proposed FLL IMC Facility or will need be upsized to avoid upstream flooding impacts due to the proposed development. The existing drainage pipe connections throughout the FDOT US1 Drainage System are displayed on **Exhibit 5** at the end of this memorandum. Basin US1-12 and Basin US1-14 are connected by dual 42" RCP, which conflict with the footprint of the FLL IMC Facility and will need to be relocated. Based on a preliminary analysis, various existing drainage connections will need to be upsized to avoid upstream flooding impacts due to the proposed development, which include the existing dual 36" RCP between Basin US1-6 and Basin US1-12, the existing dual 42" RCP between Basin US1-12 and Basin US1-14, and the existing 48" RCP from Basin US1-14 into the existing wetland area east of NE 7th Avenue. All existing stormwater infrastructure impacted by the FLL IMC Facility are displayed on **Exhibit 7** at the end of this memorandum.

Avoidance and Minimization of Wetland Impacts

Under the existing conditions, the FDOT US1 Drainage System discharges all stormwater runoff via existing outfalls into the existing wetland areas to the east of NE 7th Avenue. In order to offset the loss of existing water quality storage within the FDOT US1 Drainage System due to the proposed FLL IMC Facility, the limited staging of stormwater runoff within these existing wetland areas will be required to meet regulatory requirements for water quality treatment. The incorporation of dry retention and wet retention alternatives within these County owned parcels were initially reviewed to meet these regulatory requirements for water quality treatment. The incorporation of dry retention within these County owned parcels would require clearing and grading of these existing high quality wetland areas, which is not desirable. The incorporation of wet retention would avoid these severe impacts to these existing high quality wetland areas. Based on this initial review, the incorporation of wet retention was identified as the preferred option to "avoid and minimize" wetland impacts under these proposed improvements.

The existing County owned wetland area to east of NE 7th Avenue is surrounded by existing uplands, which acts as a perimeter berm, which blocks free overland flow of stormwater runoff. This existing perimeter berm would eliminate the need for constructing a berm in wetlands and avoiding the need to clear and/or fill any existing wetland areas. The only construction activities would be limited to modifications to the existing drainage culverts routed under the existing FPL access road along the eastern and southern perimeter of the existing wetland area. In general, the use of the existing mangrove wetlands for stormwater retention is expected to incur minor alterations, which are anticipated to consist of the following:

- Additional periodic discharges of stormwater runoff from the FDOT US1 Drainage System into the existing wetland areas.

- Additional staging of stormwater runoff from the FDOT US1 Drainage System within the existing wetland areas, which is expected to be less than 2 inches..
- Alteration of tidal connectivity between the existing mangrove wetlands and existing FDOT drainage ditch leading to the Dania Cutoff Canal due to control weirs.

Stormwater Alternatives

CMA evaluated the feasibility of implementing various stormwater alternatives within the footprint of the FLL IMC Facility to maximize the on-site stormwater facilities and to minimize the off-site stormwater facilities. Each of these potential stormwater alternatives is summarized below.

Wet Retention/Detention

Wet retention or detention are permanent wet ponds, which is intended to provide storage capacity for stormwater runoff and water quality treatment when the stormwater runoff is retained or detained within the wet pond. The primary advantages are that wet retention or detention is the most efficient option for maximizing storage capacity for stormwater runoff. Under the pending Statewide Stormwater Rule, wet retention or detention is considered to be very effective for water quality treatment, particularly for nutrient removal efficiency. The primary disadvantages are that wet retention or detention requires a large continuous area for implementation and does not have flexibility to configure with small sites. Wet retention or detention should be avoided adjacent to active airfields since it is considered a bird attractant.



The proposed building structure for FLL IMC Facility encompasses the majority of the project footprint within the FDOT US1 Drainage System. There are also multiple access roadways that will enter and exit the proposed FLL IMC Facility. Due to these factors, there will be limited available and continuous space around the perimeter of the proposed building structure for the implementation of wet retention or detention. Based on these site limitations, the implementation of proposed wet retention or detention is not feasible option for an on-site stormwater solution at the FLL IMC Facility.

Dry Retention/Detention

Dry retention or detention is a graded depressional area with a pervious ground coverage that allows for infiltration of stormwater runoff into the ground surface. Dry retention or detention is intended to provide storage capacity for stormwater runoff and water quality treatment when the stormwater runoff is retained or detained within the wet pond. The primary advantages are that dry retention is an efficient option for maximizing storage capacity for stormwater runoff if the groundwater level is not close to the ground surface along with limited maintenance requirements and flexible configurations. The primary disadvantage is that dry retention or detention is not efficient for sites with low ground surface elevations and high groundwater elevation since the bottom of the dry retention needs to be set at least 12 inches above the seasonal high groundwater elevation. Dry retention and detention areas can also be prone to standing water during the wet season in areas with high groundwater elevations and/or poorly



draining soils, such as the FLL IMC Facility. Dry retention or detention is considered to have reduced efficiency for water quality treatment, particularly for nutrient removal efficiency, under the pending Statewide Stormwater Rules as opposed to the current Statewide Stormwater Rules.

The proposed building structure for FLL IMC Facility encompasses the majority of the project footprint within the FDOT US1 Drainage System. There are also multiple access roadways that will enter and exit the proposed FLL IMC Facility. Due to these factors, there will be limited available space around the perimeter of the proposed building structure for the implementation of dry retention. Based on these site limitations, the implementation of proposed dry retention or detention may be feasible as an on-site stormwater solution at the FLL IMC Facility on a limited basis.

Due to the proposed finish floor elevation of +8.5 feet NAVD for the FLL IMC Facility along with the limited space around the building perimeter and the elevation of existing roadway surrounding the site, it may not be feasible to regrade the perimeter to create stormwater storage volume below the control elevation for the FDOT US1 Drainage System of +2.5 feet NAVD. Once a topographic survey along with a more detailed site plan is available for the FLL IMC Facility, the implementation of dry retention around the perimeter of the proposed building structure could be evaluated further. Based on these site limitations, the implementation of proposed dry retention or detention may be a feasible option for on-site stormwater solution at the FLL IMC Facility on a limited basis.

Swales

Swales are shallow graded depressional areas with a pervious ground coverage that allows for infiltration of stormwater runoff into the ground surface. Swales are intended to provide limited storage capacity for stormwater runoff and water quality treatment when the stormwater runoff is retained or detained within the swale. The primary advantages are that swales are an efficient option for maximizing storage capacity for stormwater runoff on sites with limited available space along with limited maintenance requirements and flexible configurations. The primary disadvantage is that swales provide limited storage volume due to their shallow depth. Swales can also be prone to standing water during the wet season in areas with high groundwater elevations and/or poorly draining soils, such as the FLL IMC Facility. Swales are also considered to have a reduced efficiency for water quality treatment, particularly for nutrient removal efficiency, under the pending Statewide Stormwater Rules as opposed to the current Statewide Stormwater Rules.



Due to the limited space around the building perimeter, swales are the best option for implementing an on-site stormwater solution at the FLL IMC Facility. Once a topographic survey along with a more detailed site plan is available for the FLL IMC Facility, the stormwater storage volume provided by any proposed swales around the perimeter of the proposed building structure could be estimated accurately upon developing preliminary site grading. Based on these site limitations, the implementation of proposed swales will be the most feasible option for an on-site stormwater solution at the FLL IMC Facility on a limited basis.

Due to the limited space around the building perimeter, swales are the best option for implementing an on-site stormwater solution at the FLL IMC Facility. Once a topographic survey along with a more detailed site plan is available for the FLL IMC Facility, the stormwater storage volume provided by any proposed swales around the perimeter of the proposed building structure could be estimated accurately upon developing preliminary site grading. Based on these site limitations, the implementation of proposed swales will be the most feasible option for an on-site stormwater solution at the FLL IMC Facility on a limited basis.

Bioswales

Bioswales are similar to swales but include the installation of vegetated mediums along the bottom of the bioswales, which are efficient at providing water quality treatment of stormwater runoff. The primary advantage is that bioswales provide greater water quality benefits due to their higher



efficiency in removing pollutants from the stormwater runoff when compared to unvegetated grass swales. The vegetation planted within bioswales can also decrease erosion impacts from stormwater runoff, which maintains the efficiency of the bioswale in the long term. The primary disadvantages are that bioswales provide limited storage volume due to their shallow depth and the planted vegetation require significant routine maintenance effort.

Due to the limited space around the building perimeter, bioswales are an option for implementing an on-site stormwater solution at the FLL IMC Facility. Once a topographic survey along with a more detailed site plan is available for the FLL IMC Facility, the stormwater storage volume provided by any proposed bioswales around the perimeter of the proposed building structure could be estimated accurately upon developing preliminary site grading. Based on these site limitations, the implementation of bioswales will be a feasible option for an on-site stormwater solution at the FLL IMC Facility on a limited basis if BCAD concurs with the level of routine maintenance that will be required.

Vegetated Filter

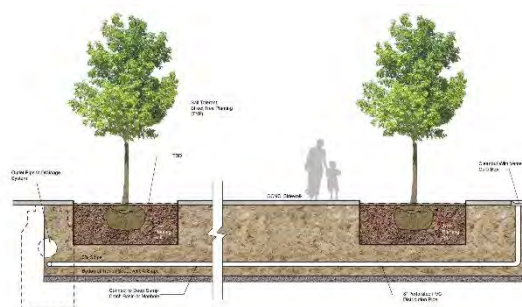
Vegetated filters are open channels with vegetated side slopes, which are intended to provide water quality treatment of stormwater runoff flowing through the channel. The side slopes of these open channels are typically very shallow slopes to promote slow sheet flow of stormwater runoff through the vegetated medium to increase the pollutant removal efficiency. Some of the stormwater runoff may also infiltrate into the underlying soil before continuing to flow downstream within the open channel, which can decrease the total stormwater discharge off-site. The primary advantage of a vegetated filter is to incorporate water quality treatments within a linear open channel that is used to transport stormwater runoff. The primary disadvantage is that vegetated filters are not compatible with small sites. Vegetated filters should also be avoided adjacent to active airfields since it is considered a bird attractant.



The proposed building structure for FLL IMC Facility encompasses most of the project footprint within the FDOT US1 Drainage System. There are also multiple access roadways that will enter and exit the proposed FLL IMC Facility. Due to these factors, there will be limited available space around the perimeter of the proposed building structure for the implementation of a vegetated filter. Based on these site limitations, the implementation of proposed vegetated filters is not feasible as an on-site stormwater solution at the FLL IMC Facility.

Tree Wells

Tree wells are pervious openings where trees are planted between impervious surfaces, such as concrete sidewalks or paths. The tree wells can be used to collect stormwater runoff from these pedestrian sidewalks or pathways and to allow for infiltration into the ground surface. The growth of the tree roots below the tree well location will decrease the soil compaction in the long-term, which will allow stormwater runoff to infiltrate efficiently long after installation. Tree wells also encourage evapotranspiration, which decreases the stormwater discharge to an off-site location. The primary advantage of tree wells is the associated tree canopy provided on-site. The primary disadvantage is that tree wells provide a very small storage volume for stormwater runoff compared to other stormwater best



management practices. The primary disadvantage is that tree wells provide a very small storage volume for stormwater runoff compared to other stormwater best

management practices (BMPs). The root system of any proposed trees could also conflict with any underground utilities.

The proposed building structure for FLL IMC Facility encompasses most of the project footprint within the FDOT US1 Drainage System so there is limited space around the building perimeter for mature tree canopies. The proposed underground infrastructure (particularly the proposed stormwater piping) will likely be routed around the building perimeter of the proposed FLL IMC Facility, which would conflict with any new trees. Considering the stormwater storage capacity provided by tree wells is negligible, the implementation of tree wells should not be considered a feasible option for as an on-site stormwater solution at the FLL IMC Facility. But tree wells should be considered as part of any planned landscaping improvements.

Green Roof

A green roof is a building structure roof that is either partially or fully covered by vegetation. Green roofs are configurable and provide pollutant filtering before stormwater enters a roof drain. The vegetation covering the green roof that would otherwise be covered by other materials encourages the reduction of the heat island effect present in urban areas. The primary advantage is that green roofs can repurpose a building roof area to provide ancillary benefits, which would otherwise not have any uses. The primary disadvantages are that green roofs will require enhanced structural support and building of the building roof and will have significant routine maintenance requirements.



The proposed building structure for FLL IMC Facility encompasses the majority of the project footprint within the FDOT US1 Drainage System so there would be a large area to potentially implement a green roof. That said, the top level of the proposed FLL IMC Facility currently has programmed use, which would preclude the implementation of a green roof. The implementation of green roofs should not be considered a feasible option for an on-site stormwater solution at the FLL IMC Facility but could be considered as part of any facility accreditation on a limited basis if space allows.

Stormwater Harvesting

Stormwater harvesting is a form of stormwater reuse where stormwater runoff is collected typically from building roofs, stored within tanks, and then reused on an as-needed basis, which is typically for irrigation purposes. In general, roof drains are typically routed into a storage tank, which can be installed at ground level or underground. The primary advantage is that stormwater harvesting can reduce the extent of stormwater infrastructure needed on-site due to the reduced amount of stormwater runoff. The primary disadvantage is that the irrigation demand during the dry season does not align with the stormwater supply during the wet season along with high routine maintenance requirements.



The proposed FLL IMC Facility is not expected to have a significant amount of landscaped areas, which would result in a limited water demand for irrigation via stormwater harvesting. The implementation of stormwater harvesting should not be considered a feasible option for an on-site stormwater solution at the FLL IMC Facility but could be considered as part of any facility accreditation on a limited basis should BCAD desire.

Permeable Pavement

Permeable pavement is a porous surface that allows stormwater runoff to infiltrate into the underlying soil below. The types of permeable pavement can include porous asphalt, pervious concrete, and/or pervious interlocking concrete paver systems. In general, most permeable pavement systems are unable to meet the same vehicular loading as typical asphalt or concrete pavement. Permeable pavement systems are not typically used for travel lanes with significant vehicular traffic but are used for vehicular parking areas or for pedestrian areas. The primary advantage of permeable pavement is that it can reduce the extent of stormwater infrastructure needed on-site due to the reduced amount of stormwater runoff. The primary disadvantage is that permeable pavement is not granted a water quality credit by local regulatory agency, which limits any benefit during stormwater permitting.

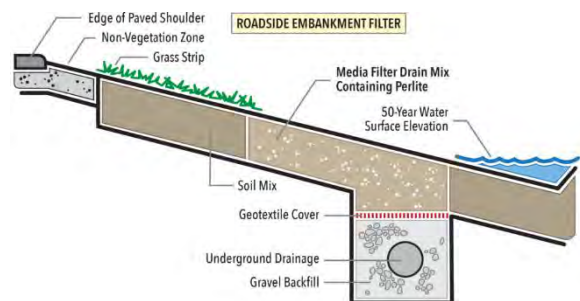


The proposed building structure for FLL IMC Facility encompasses the majority of the project footprint within the FDOT US1 Drainage System so there will be limited available area around the building perimeter to implement permeable pavement. Most permeable pavement systems would be unsuitable for the access drives entering and exiting the FLL IMC Facility due to the expected heavy duty vehicular loading. The implementation of permeable pavement on the ground level of the FLL IMC Facility would not provide any tangible benefit. The implementation of any permeable pavement would likely need to be limited to the pedestrian pathway outside of the building footprint for the FLL IMC Facility. The implementation of permeable pavement should not be considered a feasible option for an on-site stormwater solution at the FLL IMC Facility but could be considered as part of any facility accreditation on a limited basis should BCAD desire.

Surface Filter

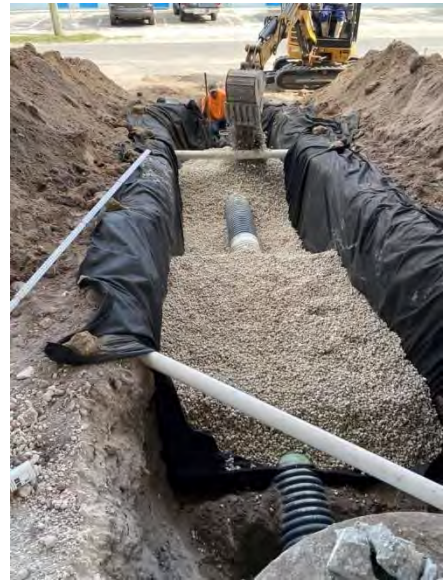
A surface filter is a flexible BMP alternative that can be installed on flat ground or on a sloped embankment. A surface filter is used to intercept and divert any stormwater runoff through a filtered medium before being collected by an interconnected underground drainage system for storage and percolation into the surrounding soils, which is similar to an exfiltration trench. The primary advantage is that a surface filter can be installed within a sloped roadway embankment. The primary disadvantage is that a surface filter will accumulate sediments and debris over time and requires routine maintenance to extend the useful life.

Due to the limited space around the building perimeter along with the elevated roadways surrounding the project limits, surface filters should be considered a viable option for implementing an on-site stormwater solution within the existing embankment areas surrounding the FLL IMC Facility. Once a topographic survey along with a more detailed site plan is available for the FLL IMC Facility, the stormwater storage volume provided any proposed surface filters around the perimeter of the proposed building structure could be estimated accurately upon developing preliminary site grading. Based on these site limitations, the implementation of proposed surface filters may be a feasible option for an on-site stormwater solution at the FLL IMC Facility on a limited basis.



Exfiltration Trench

Exfiltration trench consists of perforated or slotted drainage pipes installed within a porous stone medium that allows for the storage of stormwater runoff and for the infiltration of stormwater runoff into surrounding soils. Exfiltration trench is typically interconnected with the stormwater management system to provide storage capacity for flood attenuation and to provide water quality treatment. The primary advantage is that exfiltration trench is the most common stormwater solution within South Florida due to various regional limitations. The primary disadvantage is that exfiltration trench is not effective in areas with low ground surface elevations and high groundwater elevations. Exfiltration trench can also accumulate sediments and debris over time, which requires on-going routine maintenance to extend the useful life.



The implementation of exfiltration trench within the proposed footprint of the FLL IMC Facility is a feasible option around the building perimeter and/or under the 5 drive aisles routed through the ground level of the building structure. Due to the proposed finish floor elevation of +8.5 feet NAVD for the FLL IMC Facility, it will be feasible to keep the exfiltration trench above the seasonal high groundwater elevation to maximize the storage capacity for stormwater runoff. The implementation of a proposed exfiltration trench will be a feasible option for an on-site stormwater solution at the FLL IMC Facility.

Storage Chamber Systems

Stormwater storage chamber systems typically consist of a manufactured modal chamber network installed above a porous stone base that allows for the storage of stormwater runoff and for the infiltration of stormwater runoff into subsurface soils. In addition to manufactured products, a custom stormwater storage chamber can be constructed to be integrated with the structural and foundation elements of an above ground building structure. Stormwater storage chamber systems are typically interconnected with the stormwater management system to provide storage capacity for flood attenuation and to provide water quality treatment. The primary advantage is that stormwater storage chamber systems are the most efficient option for maximizing storage capacity for stormwater runoff below the ground surface and maximizing the land area available for land development. The primary disadvantage is that stormwater storage chamber systems are not effective in areas with low ground surface elevations and high groundwater elevations. Stormwater storage chamber systems can also accumulate sediments and debris over time, which requires on-going routine maintenance to extend the useful life.



The implementation of stormwater storage chamber systems within the proposed footprint of the FLL IMC Facility is a feasible option under the 5 drive aisles routed through the ground level of the building structure. Due to the proposed finish floor elevation of +8.5 feet NAVD for the FLL IMC Facility, it will be feasible to keep the stormwater storage chamber systems above the seasonal high groundwater elevation to maximize the storage capacity for stormwater runoff. The implementation of a proposed stormwater storage chamber system will be a feasible option for an on-site stormwater solution at the FLL IMC Facility. Various stormwater storage chamber systems were evaluated further to identify the most appropriate option for the FLL IMC Facility, which are summarized below.

Contech ChamberMaxx

The Contech ChamberMaxx system is an underground open-bottom chamber system that provides storage capacity for stormwater runoff, allows for infiltration of stormwater runoff into subsurface soils, and reduces the off-site discharge of stormwater runoff. The Contech ChamberMaxx system consists of interconnected polypropylene corrugated wall stormwater collection chambers installed over a stone bedding. The Contech ChamberMaxx system is most effective on sites where the depth from finished grade to storm outfall is less than 54 inches. Relevant reference documentation on the Contech ChamberMaxx system is included within the Appendix of this memorandum.



CMA held a design coordination meeting with representatives for the Contech ChamberMaxx system on November 28, 2023 to discuss the feasibility of implementing it within the FLL IMC Facility. The meeting notes from this discussion are included within the Appendix of this memorandum. The discussion focused on the conceptual design of implementing the Contech ChamberMaxx system under the 5 drive aisles routed through the ground level of the FLL IMC building structure. The Contech representative provide the following preliminary design information on implementing the ChamberMaxx system within the FLL IMC Facility:

- **Estimated Storage Capacity:** The available vertical storage height below the FLL IMC Facility for the proposed ChamberMaxx system was assumed to be 54 inches based on an assumed ground floor elevation of +8.5 feet NAVD, an assumed top of storage elevation of +6.5 feet NAVD, and an assumed future groundwater elevation of +2.0 feet NAVD. Using these assumed vertical dimensions, the recommended sizing for the ChamberMaxx system would include integrating 54-inch diameter pipe design, which would be estimated to provide 3.2 cubic feet in storage volume for each square foot of system footprint area. If the bottom 12 inches of the assumed 24-inch thick road section consists of #57 stone as a subbase, the ChamberMaxx system is estimated to provide up to 3.7 cubic feet in storage volume for each square foot of system footprint area.
- **Available Footprint:** The ChamberMaxx system is appropriate for installation under roadway areas, parking areas, or pedestrian areas. The ChamberMaxx system could be installed under 5 drive aisles routed through the ground level of the FLL IMC building structure, which are assumed to be 24 feet wide with pedestrian areas on each side. The limiting factor for the ChamberMaxx width will be the proximity to any structural elements and foundations support the FLL IMC building structure. The proposed structural foundations for the FLL IMC building structure were assumed to be approximately 60 feet apart. The ChamberMaxx system should have a minimum horizontal separation of 10 feet separation from any structural elements and foundations. Based on these design assumptions, the assumed footprint of each ChamberMaxx segment below each drive aisle would be 50 feet wide.
- **Estimated Storage Volume:** Based on the design assumptions noted above, each segment of ChamberMaxx system would be 500 feet in length and 50 feet in width under each drive aisle and is estimated to provide approximately 80,000 cubic feet to 92,500 cubic feet per drive isle. Based on these estimates, the ChamberMaxx system is estimated to provide approximately between 9.2 acre*feet to 10.6 acre*feet within the footprint of the FLL IMC Facility.
- **Storage System below Building Structures:** Contech provided several design considerations to verify for implementing the ChamberMaxx system below the proposed building structure. There will need to be adequate vertical clearance between finished grade and any building structure components to allow for the installation of the underground storage system and to potentially repair any underground storage system if the need ever arises. Based on the conceptual section views for the FLL IMC Facility, there appears to be 23

feet in vertical clearance from the ground floor and the bottom of the first level, which should be adequate. While installation of the ChamberMaxx system below portions of a parking garage structures, Contech does not allow the installation of the ChamberMaxx system below any habitable or occupied portions of a building structure.

- Preliminary Costing: The estimated material costs for the ChamberMaxx system is expected to be in the range of \$5.7 per cubic feet of provided storage volume. The estimated construction costs are difficult to predict for these underground storage systems but generally range from 50% to 100% of the total material costs. Based on these preliminary assumptions, the installation of the ChamberMaxx system at the FLL IMC Facility is estimated to range between approximately \$680,000 and \$1,050,000.
- Additional Considerations: In addition to the 5 drive isles below the ground floor of the FLL IMC Facility, it may be feasible to implement the ChamberMaxx system below additional access roadways entering and exiting the FLL IMC if additional storage volume is needed.

ADS StormTech

The ADS StormTech system is an underground open-bottom modular chamber system that provides storage capacity for stormwater runoff, allows for infiltration of stormwater runoff into subsurface soils, and reduces the off-site discharge of stormwater runoff. The ADS StormTech system consists of corrugated arch segments, which are interconnected to form the linear stormwater collection chambers with additional end cap components. The ADS StormTech segments are composed of molded impact modified resins. The ADS StormTech chambers are typically installed over geotextile fabric and stone bedding. The ADS StormTech system can also integrate their isolator row components, which is used to enhance the capture of any total suspended solids within stormwater runoff, to allow for ongoing maintenance to remove accumulated sediments, and to provide additional water quality benefits. Relevant reference documentation on the ADS StormTech system is included within the Appendix of this memorandum.



CMA held a design coordination meeting with representatives for the ADS StormTech system on December 5, 2023 to discuss the feasibility of implementing it within the FLL IMC Facility. The meeting notes from this discussion are included within the Appendix of this memorandum. The discussion focused on the conceptual design of implementing the ADS StormTech system under the 5 drive aisles routed through the ground level of the FLL IMC building structure. Based on the various design assumptions for the FLL IMC Facility, the ADS representative prepared preliminary storage calculations and developed a conceptual design layout to implement the StormTech system within the FLL IMC Facility, which is included within the Appendix of this memorandum. Based on this conceptual design, the StormTech system at the FLL IMC Facility would consist of the 230 MC-3500 chambers and 10 MC-3500, which would be installed above 9 inch thick stone bedding and would include stone backfill to 12 inches above the top of the chamber system. Based on this conceptual design, the StormTech system at the FLL IMC Facility is estimated to provide 49,482 cubic feet in storage volume for stormwater runoff, which would be equivalent to 1.14 acre*feet.

StormTrap

The StormTrap system is an underground modular chamber system that provides storage capacity for stormwater runoff, allows for infiltration of stormwater runoff into subsurface soils, and reduces the off-site discharge of stormwater runoff. The StormTrap system consists of precast concrete segments,

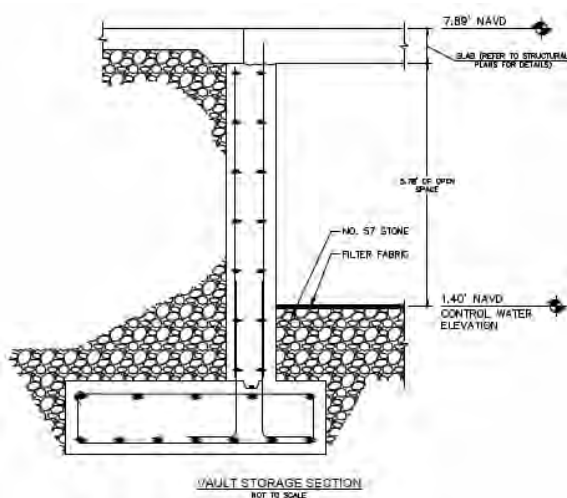


which are interconnected to form the stormwater collection chambers. The StormTrap chambers are typically installed over geotextile fabric and stone bedding. The StormTrap system can be used to enhance the capture of any total suspended solids within stormwater runoff, to allow for ongoing maintenance to remove accumulated sediments, and to provide additional water quality benefits. Relevant reference documentation on the StormTrap system is included within the Appendix of this memorandum.

CMA held a design coordination meeting with representatives for the StormTrap system on December 6, 2023 to discuss the feasibility of implementing it within the FLL IMC Facility. The meeting notes from this discussion are included within the Appendix of this memorandum. The discussion focused on the conceptual design of implementing the StormTrap system under the 5 drive aisles routed through the ground level of the FLL IMC building structure. Based on the various design assumptions for the FLL IMC Facility, the StormTrap representative prepared preliminary storage calculations and developed a conceptual design layout to implement the StormTrap system within the FLL IMC Facility, which is included within the Appendix of this memorandum. Based on this conceptual design, the StormTrap system at the FLL IMC Facility would consist of 809 Single Trap chambers with 5 feet height. Based on this conceptual design, the StormTrap system at the FLL IMC Facility is estimated to provide 427,695 cubic feet in storage volume for stormwater runoff, which would be equivalent to 9.82 acre*feet.

Custom

Another alternative would be to implement a custom designed stormwater vault below the FLL IMC Facility that is structurally integrated with the building foundation. The proposed stormwater vault would be an enclosed structure below the ground floor of the FLL IMC Facility. The stormwater vault will be constructed of cast in place concrete with associated reinforcement. The interior surfaces within the stormwater vault would need to be water-proofed with a concrete admixture to prevent spalling and corrosion of the rebar reinforcement. The ground floor of the FLL IMC Facility would need to be composed of a concrete structural slab that can bridge over the stormwater vault. The bottom of the stormwater vault would consist of stone bedding overlaid with geotextile to allow for infiltration of stormwater runoff into the subsurface soils. A custom stormwater vault below the FLL IMC Facility would maximize the storage capacity for stormwater runoff compared to the alternatives but would be more expensive to construct and have more extensive maintenance requirements compare to the manufactured alternatives.



The feasibility of implementing various stormwater alternatives within the footprint of the FLL IMC Facility along with the associated flood control, flood attenuation, and water quality treatment impacts is summarized within the table below.

Stormwater Alternative	Site Feasibility	Flood Control Benefit	Flood Attenuation Benefit	Water Quality Benefit
Wet Retention/Detention	No	Yes	Yes	Yes
Dry Retention/Detention	Yes	Yes	Yes	Yes
Swale	Yes	Limited	Limited	Yes
Bioswale	Yes	Limited	Limited	Yes
Vegetated Filter	No	No	No	Yes
Tree Wells	Limited	Limited	Limited	Limited

Stormwater Alternative	Site Feasibility	Flood Control Benefit	Flood Attenuation Benefit	Water Quality Benefit
Green Roof	Limited	Limited	Limited	No
Stormwater Harvesting	Limited	Limited	Limited	No
Permeable Pavement	Limited	Limited	Limited	No
Surface Filter	Yes	Limited	Limited	Yes
Exfiltration Trench	Yes	Limited	Limited	Yes
Storage Chambers	Yes	Yes	Yes	Yes

Based on this review of various stormwater alternatives, CMA would recommend further evaluation of implementing stormwater storage chambers below the FLL IMC Facility and a combination of dry retention, swales, surface filter, and/or exfiltration trench around the perimeter of the FLL IMC Facility.

Stormwater Concept

Based on the evaluation of the expected stormwater impacts of the proposed FLL IMC Facility, CMA has developed a preliminary concept of the on-site and off-site stormwater improvements, which will be needed to compensate for the loss of existing retention areas and to avoid negative upstream flooding impacts throughout the FDOT US1 Drainage System and Drainage System 2 for the eastern portion of the FLL Terminal Area. The preliminary stormwater concept is displayed on **Exhibit 10** at the end of this memorandum. The proposed stormwater concept for the FLL IMC Facility will include the following on-site stormwater improvements:

- **Stormwater Storage Chambers** – The implementation of stormwater storage chamber systems within the proposed footprint of the FLL IMC Facility is proposed under the 5 drive aisles routed through the ground level of the building structure. The purpose of the stormwater storage chamber system is to provide water quality storage to offset the loss of existing dry retention areas due to the proposed development and to provide flood attenuation throughout the FDOT US1 Drainage System. All stormwater collected from the roof of the building structure should be routed via roof drains directly into the stormwater storage chamber system, which would have a control weir to retain stormwater up to a defined control elevation. Once the levels within the stormwater storage chambers exceed the control elevation, the stormwater runoff would overflow the weir toward the stormwater outfall for off-site discharge.
- **Dry Retention Areas** – There is expected to be open green space around the perimeter of the FLL IMC Facility between the various access roadways and below elevated portions of the FLL IMC Facility. The stormwater concept includes implementing a series of dry retention areas within any open green space within the footprint of the FLL IMC Facility. The purpose of the dry retention areas is to provide water quality storage to offset the loss of existing dry retention areas due to the proposed development and to provide flood attenuation throughout the FDOT US1 Drainage System. At this time, the extent of any new dry retention areas is based on general assumptions since there is currently not sufficient site information to develop an accurate layout of new dry retention areas.
- **Surface Filters** – The footprint of the FLL IMC Facility is primarily surrounded by elevated roadways. Some of the stormwater runoff generated from these elevated roadways flows down the roadway embankments into the footprint of the FLL IMC Facility. The stormwater concept includes implementing surface filters within the appropriate embankment areas surrounding the FLL IMC Facility. The purpose of the surface filters is to intercept any stormwater runoff flowing down from the elevated roadways and minimize the stormwater needs for the FLL IMC Facility.
- **Upsized Stormwater Piping Network** – All stormwater runoff generated within the FDOT US1 Drainage System and Drainage System 2 currently flows into Drainage Basin US1-12 and Drainage Basin US1-14, which is within the footprint of the FLL IMC Facility. The new stormwater infrastructure will need to be routed around the perimeter of the building structure, which will allow the stormwater runoff from upstream portions of the FDOT US1 Drainage System to bypass the FLL IMC Facility and flow directly toward the

system outfall to the east. The purpose of these stormwater pipe upgrades is to prevent any negative impacts within upstream areas in the FDOT US1 Drainage System. Additional modeling analysis will be conducted to develop preliminary recommendation for the pipe sizing.

The proposed stormwater concept for the FLL IMC Facility will include the following off-site stormwater improvements:

- Basin US1-6 / Basin US1-12 Pipe Connections – All stormwater runoff generated within the FDOT US1 Drainage System and Drainage System 2 eventually flows into Drainage Basin US1-12 and Drainage Basin US1-14, which is within the footprint of the FLL IMC Facility. The existing drainage infrastructure connecting these drainage basins will need to be upsized to avoid adverse flooding impacts in upstream portions of the FDOT US1 Drainage System.
- Basin US1-12 and Basin US1-14 Pipe Connections – All stormwater runoff generated within the FDOT US1 Drainage System and Drainage System 2 eventually flows into Drainage Basin US1-12 and Drainage Basin US1-14, which is within the footprint of the FLL IMC Facility. The existing drainage infrastructure connecting these drainage basins will need to be relocated and upsized to avoid adverse flooding impacts in upstream portions of the FDOT US1 Drainage System.
- Basin US1-14 Outfall – All stormwater runoff generated within the FDOT US1 Drainage System and Drainage System 2 eventually flows into Drainage Basin US1-12 and Drainage Basin US1-14, which is within the footprint of the FLL IMC Facility. The existing drainage infrastructure connecting this drainage basin to the existing wetland area to the east of NE 7th Avenue will need to be upsized to avoid adverse flooding impacts in upstream portions of the FDOT US1 Drainage System.
- Basin US1-26 Outfall – All stormwater runoff generated within the FDOT US1 Drainage System flows into Drainage Basin US1-12 and Drainage Basin US1-14, which is within the footprint of the FLL IMC Facility. The proposed stormwater concept includes directly connecting this drainage basin to the existing wetland area to the east of NE 7th Avenue to avoid adverse flooding impacts in upstream portions of the FDOT US1 Drainage System.
- FPL Access Road Culvert Control Structures – All stormwater runoff generated within the FDOT US1 Drainage System discharges into the existing County owned wetland area to east of NE 7th Avenue, which is bounded by an FPL maintenance access road. Any stormwater runoff flows from this existing wetland area via 7 existing drainage culverts under the FPL maintenance access road into the existing drainage ditch that flows south toward the Dania Cutoff Canal. The stormwater concept includes retrofitting a control structure with an overflow weir at the upstream end of the 7 existing drainage culverts. The purpose of these control structures is to increase the staging of stormwater runoff throughout the existing drainage and to offset the loss of existing water quality storage lost due to the impacts of the FLL IMC Facility.
- FPL Access Road Modifications – All stormwater runoff generated within the FDOT US1 Drainage System discharges into the existing County owned wetland area to east of NE 7th Avenue, which is bounded by an FPL maintenance access road. Some segments of the FPL maintenance access road have very low elevations. The stormwater concept includes raising the FPL maintenance access road up to at least +3.0 feet NAVD. The purpose of raising any low access road segments is to prevent any stormwater runoff staging within the existing wetland areas from sheet flowing over the FPL maintenance access road.

Stormwater Modeling

CMA conducted a hydraulic modeling analysis of the proposed stormwater concept for the FLL IMC Facility on an iterative basis to evaluate the stormwater impacts due to the proposed development. The primary purpose of this hydraulic modeling analysis was to develop preliminary recommendations on the potential sizing and configuration of any stormwater improvements needed to ensure the proposed FLL IMC Facility does not cause adverse stormwater impacts within upstream areas of the FDOT US1 Drainage System and the Drainage System 2. CMA used the ICPR4 stormwater model developed during the 2021 FLL Stormwater Master Plan to conduct

the hydraulic modeling analysis of the proposed stormwater concept for the FLL IMC Facility. CMA only used a portion of the ICPR4 stormwater model related to the FDOT US1 Drainage System and Drainage System 2 for the FLL Terminal Area to conduct this analysis. CMA had to adjust the ICPR4 stormwater model setup for this analysis specific to the proposed FLL IMC Facility, which is summarized below.

Model Boundaries

The stormwater modeling analysis for the FLL IMC Facility was limited to the boundaries of the FDOT US1 Drainage System and the Drainage System 2, which serves the eastern portion of the FLL Terminal Area. Most sub-basin boundaries within these two primary systems were left unchanged within the ICPR4 stormwater model for the existing conditions and future conditions with a few exceptions, which are noted below.

- Basin US1-12 – Even though the proposed FLL IMC Facility will be primarily located within Basin US1-14, the facility is also partially located within Basin US1-12. The boundary for Basin US1-12 was adjusted to not include any of the area occupied by Basin IMC, which encompasses the proposed footprint of the FLL IMC building structure. This adjustment of this basin boundary will allow for a more precise routing analysis of stormwater runoff generated from the roof of the proposed FLL IMC Facility and generated from the open areas surrounding the perimeter of the FLL IMC Facility.
- Basin US1-14 – The proposed FLL IMC Facility will be primarily located within Basin US1-14, which was sub-divided to allow for an analysis of the future development conditions. Basin US1-14 was divided into two sub-basins. Basin IMC encompassed the proposed footprint of the FLL IMC building structure. The area around the perimeter of the FLL IMC building structure that includes the access roadways and remaining green space retained the name Basin US1-14. This adjustment of this basin boundary will allow for a more precise routing analysis of stormwater runoff generated from the roof of the proposed FLL IMC Facility and generated from the open areas surrounding the perimeter of the FLL IMC Facility.
- Basin US1-18 – Even though the proposed FLL IMC Facility will be primarily located within Basin US1-14, the facility is also partially located within Basin US1-18. The boundary for Basin US1-18 was adjusted to not include any of the area occupied by Basin IMC, which encompasses the proposed footprint of the FLL IMC building structure. This adjustment of this basin boundary will allow for a more precise routing analysis of stormwater runoff generated from the roof of the proposed FLL IMC Facility and generated from the open areas surrounding the perimeter of the FLL IMC Facility.
- Basin US1-28 – The area within this basin encompasses a portion of the existing wetland areas located east of NE 7th Avenue. The north boundary of this basin is now aligned with the high ridge on north side of the existing FDOT drainage ditch that flows from west to east. This adjustment of this basin boundary will allow for a routing analysis of stormwater runoff flowing through this existing wetland area.
- Basin US1-29 – The area within this basin encompasses a portion of the existing wetland areas located east of NE 7th Avenue. The south boundary of this basin is now aligned with the high ridge on north side of the existing FDOT drainage ditch that flows from west to east. This adjustment of this basin boundary will allow for a routing analysis of stormwater runoff flowing through this existing wetland area.

The relevant information on the updated model boundaries is defined within the Appendix at the end of this memorandum. Exhibits 11A and 11B at the end of this memorandum show the nodal diagram of the existing and future ICPR4 models.

Basin Parameters

Within the ICPR4 stormwater model, basins are used to represent areas that receive rainfall during a storm event, which include various hydrologic parameters related to the type of ground coverage. The basin parameters within FDOT US1 Drainage System and the Drainage System 2 were left unchanged for the existing condition scenario. The basin parameters for a few select drainage basins were updated for the future conditions

scenario. These basin parameter changes were necessary to reflect the assumed development conditions of the FLL IMC Facility. The future ground coverages within these select drainage basins were estimated based on the conceptual layouts within the FLL IMC Advanced Planning Technical Report. The assumed impervious, pervious, building, and surface water ground coverages under the future development conditions were used to tabulate a future curve number (CN) parameters for these select drainage basins. The composite CN method defined in the SFWMD SWERP Manual was used to calculate the updated CN parameter for these select drainage basins. The basin parameter updates are summarized below:

- Basin US1-12 – Even though the proposed FLL IMC Facility will be primarily located within Basin US1-14, the facility is also partially located within Basin US1-12. The boundary for Basin US1-12 was adjusted to not include any of the area occupied by Basin IMC, which encompasses the proposed footprint of the FLL IMC building structure. The remaining ground coverage within the adjusted Basin US1-12 was used to calculate the updated CN parameters for incorporation into the future condition model scenario.
- Basin US1-14 – The proposed FLL IMC Facility footprint will be primarily located within Basin US1-14, which was sub-divided to allow for an analysis of the future development conditions. Basin US1-14 was divided into two sub-basins. Basin IMC encompassed the proposed footprint of the FLL IMC building structure, which will be completely impervious due to the proposed building structure. Basin US1-14 encompassed the area around the perimeter of FLL IMC building structure that will include some new impervious surface due to new access roadway along remaining green space. The proposed ground coverage within the two new drainage basins was used to calculate updated CN parameters for incorporation into the future condition model scenario.
- Basin US1-18 – Even though the proposed FLL IMC Facility will be primarily located within Basin US1-14, the facility is also partially located within Basin US1-12. The boundary for Basin US1-18 was adjusted to not include any of the area occupied by Basin IMC, which encompasses the proposed footprint of the FLL IMC building structure. The remaining ground coverage within the adjusted Basin US1-18 was used to calculate the updated CN parameters for incorporation into the future condition model scenario.

The relevant information on the updated basin parameters is defined within the Appendix at the end of this memorandum. Exhibits 11A and 11B at the end of this memorandum show the nodal diagram of the existing and future ICPR4 models.

Node Parameters

Within the ICPR4 stormwater model, nodes are used to represent junction points within a drainage network, which can provide storage capacity for stormwater runoff during a flood routing analysis. The drainage node parameters within FDOT US1 Drainage System and the Drainage System 2 were left unchanged for the existing condition scenario. The drainage node parameters for a few select drainage notes were updated for the future condition scenario. These node parameter changes were necessary to reflect the assumed development conditions of the FLL IMC Facility, which include updated stage storage parameters to reflect the assumed grading under the future conditions. Stage storage parameters are used to define the available volume for stormwater storage at various elevation intervals. The updated stage storage parameters within these select drainage nodes were estimated based on the conceptual layouts within the FLL IMC Advanced Planning Technical Report. The node parameter updates are summarized below:

- Node US1-12 – Although the proposed FLL IMC Facility will be primarily located within Basin US1-14, the building footprint is also partially located within Basin US1-12. The stage storage volume within Basin US1-12 limits was adjusted for the proposed conditions within this node. The FLL IMC Facility is expected to have a finished floor elevation of +8.5 feet NAVD. So all storage volume below this elevation was eliminated from this node except for the additional storage volume created by the new regraded dry retention area around the building perimeter. The proposed stage storage within the adjusted node was

estimated based on preliminary design assumptions for incorporation into the future condition model scenario.

- Node US1-14 – The proposed FLL IMC Facility footprint will be primarily located within Node US1-14, which was sub-divided to allow for an analysis of the future development conditions. Node US1-14 was divided into three separate nodes. Node IMC_Roof encompassed the proposed building footprint of the FLL IMC building structure, which will have a finish floor elevation of +8.5 feet NAVD. This node was assumed to have negligible stage storage volume and was used to collect stormwater runoff from the roof area of the FLL IMC Facility. Node IMC_Storage also encompassed the proposed footprint of the FLL IMC building structure. This node represents the stage storage within the proposed stormwater chamber system to be installed under the FLL IMC Facility. All stormwater storage was assumed between +2.00 feet NAVD and the local control elevation of +7.00 feet NAVD. The area around the perimeter of the FLL IMC Facility was represented by the readjusted Node US1-14. The stage storage within this node was recalculated based on the existing conditions topography. The FLL IMC Facility footprint is expected to be regraded to an elevation of +8.5 feet NAVD so all storage below this elevation was eliminated except for the storage volume created by the new regraded dry retention area around the proposed building perimeter. So all storage volume below this elevation was eliminated from this node except for the additional storage volume created by the new regraded dry retention area around the building perimeter. The proposed stage storage within the adjusted node was estimated based on preliminary design assumptions for incorporation into the future condition model scenario.

The relevant information on the updated node parameters is defined within the Appendix at the end of this memorandum. Exhibits 11A and 11B at the end of this memorandum show the nodal diagram of the existing and future ICPR4 models.

Link Parameters

Within the ICPR4 stormwater model, links are used to represent flow connections between basins and nodes within a drainage network, which can be drainage pipe connections, weir connections, and overland flow connections. The drainage link parameters within the FDOT US1 Drainage System and the Drainage System 2 were left unchanged for the existing condition scenario. The drainage link parameters were updated for the future condition scenario. These drainage link parameter changes were necessary to reflect the assumed development conditions of the FLL IMC Facility along with any proposed stormwater infrastructure improvements throughout these drainage systems. The drainage link parameter updates are summarized below:

- Link US1-6_TO_US1-12 – The existing drainage infrastructure connecting Basin US1-6 and Basin US1-12 will need to be upsized to avoid adverse flooding impacts in upstream portions of the FDOT US1 Drainage System. The proposed sizing of these pipe connections was adjusted within the model on an iterative basis to identify the recommended sizing of the proposed drainage pipe connection between Basin US1-6 and Basin US1-12.
- Link US1-12_TO_US1-14 – The existing drainage infrastructure connecting Basin US1-12 and Basin US1-14 will need to be upsized and relocated to avoid adverse flooding impacts in upstream portions of the FDOT US1 Drainage System. The proposed sizing of these pipe connections was adjusted on an iterative basis to identify the recommended sizing of the proposed drainage pipe connection between Basin US1-12 and Basin US1-14. The link was switched from a pipe link to a drop structure link in the proposed conditions model to simulate a control elevation of +2.50 feet NAVD. The link was readjusted to discharge into Node US1-14A, which represents the junction structure downstream of Node US1-14.
- Link US1-14_TO_US1-14A – The perimeter area around the FLL IMC Facility footprint will collect stormwater through proposed dry retention, which will discharge into an upstream junction structure represented by Node US1-14A. The connection to this junction structure is represented by a drop structure link that represents a proposed pipe and a proposed control structure elevation.

- Link US1-14A_TO_US1-28 – The existing drainage infrastructure connecting Basin US1-14 to the existing wetland areas to east of NE 7th Avenue will need to be upsized to avoid adverse flooding impacts in upstream portions of the FDOT US1 Drainage System. The proposed sizing of these pipe connections was adjusted on an iterative basis to identify the recommended sizing of the proposed drainage pipe connection between Basin US1-14 and the existing wetland areas to east of NE 7th Avenue.
- Link US1-26_TO_US1-28 – New drainage infrastructure connecting Basin US1-26 directly to the existing wetland areas to east of NE 7th Avenue will need to be implemented to avoid adverse flooding impacts in upstream portions of the FDOT US1 Drainage System. The proposed sizing of these new pipe connections was adjusted on an iterative basis to identify the recommended sizing of the proposed drainage pipe connection between Basin US1-26 and the existing wetland areas to east of NE 7th Avenue.
- Links OF1, OF2, OF3, OF4, OF5, OF6, and OF7: – New control structures with overflow weirs and bleeders will need to be added to the 7 existing drainage culverts routed under the FPL maintenance access road. The proposed configuration of these new control structures was adjusted on an iterative basis to identify the recommended control elevations to provide sufficient water quality storage within the existing wetland areas while avoiding adverse flooding impacts in upstream portions of the FDOT US1 Drainage System. The culverts with diameters less than 36 inches were evaluated to potentially be upsized to alleviate upstream stormwater inundation.
- Links HR1, HR2, HR3, HR4, HR5, and HR6 – New overland flow weirs were created for the FPL access road along the boundaries of the existing County owned wetland area to east of NE 7th Avenue, which have very low ground surface elevations. The proposed configuration of these new overland flow weirs was adjusted on an iterative basis to identify the recommended road elevations to eliminate overland flow from the existing wetland areas into the FDOT drainage ditch.
- Links US1-20_TO_US1-14_1 US1-20_TO_US1-14_2 – The future condition ICPR4 model was updated to modify the existing links, which was used to define the proposed drainage infrastructure to be routed around the perimeter of the FLL IMC Facility. These links represent the existing culverts that connect Basin US1-20 and US1-14. Under proposed conditions, the connected stormwater infrastructure around the FLL IMC Facility perimeter bypasses Basin US1-14 and instead discharges into the upstream junction structure represented by Node US1-14A. The links were modified into drop structure links in the proposed conditions to assign a control elevation prior to discharge into the proposed junction structure.
- Link US1-26A_TO_US1-14 – The future condition ICPR4 model was updated to modify the existing link, which was used to define the proposed drainage infrastructure to be routed around the perimeter of the FLL IMC Facility. This link represents the existing culvert that connects Basin US1-26 and US1-14. Under proposed conditions, the connected stormwater infrastructure around the FLL IMC Facility perimeter bypasses Basin US1-14 and instead discharges into the upstream junction structure represented by Node US1-14A. The link was modified into a drop structure in the proposed conditions to assign a control elevation prior to discharge into the proposed junction structure.

The relevant information on the updated link parameters is defined within the Appendix at the end of this memorandum. Exhibits 11A and 11B at the end of this memorandum show the nodal diagram of the existing and future ICPR4 models.

Peak Discharge Comparison

The ICPR4 stormwater model was used to confirm the peak discharges from the FDOT US1 Drainage System into the FDOT drainage ditch do not increase from the existing conditions upon the implementation of the recommended stormwater improvements. As noted within the table below, the total peak discharge from the FDOT US1 Drainage System into the FDOT drainage ditch under the proposed conditions does not exceed the total peak discharge from the FDOT US1 Drainage System under the existing conditions.

ICPR4 Peak Discharge Results (CFS)		
Link Name	Existing Peak Discharge	Proposed Peak Discharge
W:HR1	29.52	0.00
W:HR2	0.13	0.00
W:HR3	0.00	0.00
W:HR4	2.04	0.00
W:HR5	5.13	0.00
W:HR6	197.44	0.00
P:OF1 / DS:OF1	44.05	54.21
P:OF2 / DS:OF2	31.03	44.81
P:OF3 / DS:OF3	31.03	44.81
P:OF4 / DS:OF4	31.03	44.81
P:OF5 / DS:OF5	1.93	44.81
P:OF6 / DS:OF6	31.03	44.81
P:OF7 / DS:OF7	18.81	44.81
Total	423.17	323.07

Peak Stage Comparison

The ICPR4 stormwater model was used to confirm the peak flood stages do not increase throughout the FDOT US1 Drainage System and Drainage System 2 under the proposed development conditions for the FLL IMC Facility. The estimated peak flood stages under the proposed development conditions do not increase throughout the FDOT US1 Drainage System and Drainage System 2. The only exception is where the FLL IMC Facility is located within Basin US1-14, which would be expected due to filling of this areas for the proposed building construction. The comparison of the estimated peak flood stages within basins throughout the FDOT US1 Drainage System and Drainage System 2 under both the existing conditions and the proposed development conditions is summarized within the Appendix at the end of this memorandum.

Recommended Conceptual Stormwater Improvements

CMA conducted a hydraulic modeling analysis of the proposed stormwater concept for the FLL IMC Facility on an iterative basis to evaluate the stormwater impacts due to the proposed development. This hydraulic modeling analysis was used to develop the preliminary recommendations on the potential sizing and configuration of any stormwater improvements needed to ensure the proposed FLL IMC Facility does not cause adverse stormwater impacts within upstream areas of the FDOT US1 Drainage System and the Drainage System 2. Based on this hydraulic modeling analysis, the preliminary recommendations on the potential sizing and configuration of any stormwater improvements needed to enable the FLL IMC Facility are displayed in **Exhibit 10** at the end of this memorandum. The recommended conceptual stormwater improvements needed to enable the FLL IMC Facility is summarized below:

- **Stormwater Storage Chambers** – The implementation of stormwater storage chamber systems within the proposed footprint of the FLL IMC Facility is recommended under the 5 drive aisles routed through the ground level of the building structure. The proposed stormwater storage chamber system will handle all stormwater runoff from the roof the FLL IMC Facility and will provide sufficient water quality storage for the new impervious area. All stormwater collected from the roof of the FLL IMC building structure should be routed via roof drains directly into the stormwater storage chamber system, which would have a control weir to retain stormwater up to weir control elevation of +7.0 feet NAVD. Once the levels within the stormwater storage chambers exceed the control elevation, the stormwater runoff would overflow the weir toward the stormwater outfall for off-site discharge. Based on a preliminary evaluation, the implementation of the StormTrap stormwater chamber is the most appropriate for the FLL IMC Facility since it will

maximize the storage volume for stormwater runoff. Based on the conceptual design, the StormTrap chamber system at the FLL IMC Facility is estimated to provide 427,695 cubic feet in storage volume for stormwater runoff, which would be equivalent to 9.82 acre*feet.

- Dry Retention Areas – There is expected to be open green space around the perimeter of the FLL IMC Facility between the various access roadways and below elevated portions of the FLL IMC Facility. The purpose of these proposed dry retention areas is to help compensate for the loss of existing storage volume due to the FLL IMC Facility. The stormwater concept includes implementing a series of dry retention areas with bottom elevations of +1.42 feet NAVD and maximum side slope of 4:1 within any open green space within the footprint of the FLL IMC Facility. At this time, these new dry retention areas around the perimeter of the FLL IMC Facility encompass approximately 3.70 acres and are estimated to provide approximately 1.07 acre*feet of storage capacity for stormwater runoff. The proposed grading of the roadway embankments surrounding the FLL IMC Facility will need to be developed to confirm the extent of these new dry retention areas.
- On-Site Stormwater Piping Network – The new stormwater infrastructure will need to be routed around the perimeter of the FLL IMC building structure, which will allow the stormwater runoff from upstream portions of the FDOT US1 Drainage System to bypass the FLL IMC Facility and flow directly toward the system outfall to the east. The proposed stormwater infrastructure handling stormwater runoff from Basin US1-20 and Basin 1-26 to the south is expected to include dual 48-inch drainage piping or the hydraulic equivalent, which will be routed around the south and east perimeter of the FLL IMC Facility. The proposed stormwater infrastructure handling stormwater runoff from Basin US1-12 to the west is expected to include dual 48-inch drainage piping or the hydraulic equivalent, which is routed around the north perimeter of the FLL IMC Facility. These proposed on-site improvements are expected to include approximately 3,530 linear feet of 48-inch drainage pipe, 8 drainage structures, and 2 control structures.
- Basin US1-6 / Basin US1-12 Pipe Connections – The existing drainage infrastructure connecting these drainage basins is expected to be upsized to dual 48-inch drainage piping or the hydraulic equivalent. The purpose of these drainage pipe upgrades is to increase the hydraulic transmission capacity to avoid any adverse flooding impacts within upstream areas of the FDOT US1 Drainage System. These proposed drainage pipe upgrades are expected to include approximately 320 linear feet of 48-inch drainage pipe and 4 headwall structures.
- Basin US1-12 and Basin US1-14 Pipe Connections – The existing drainage infrastructure connecting these drainage basins is expected to be relocated and upsized to dual 48-inch drainage piping or the hydraulic equivalent. The purpose of these drainage pipe upgrades is to increase the hydraulic transmission capacity to avoid any adverse flooding impacts within upstream areas of the FDOT US1 Drainage System. These proposed drainage pipe upgrades are expected to include approximately 510 linear feet of 48-inch drainage pipe and 2 headwall structures.
- Basin US1-14 Outfall – The existing drainage infrastructure discharging into the existing wetland area to east of NE 7th Avenue is expected to be upsized to triple 48-inch drainage piping or the hydraulic equivalent while maintaining a system control elevation of +2.5 feet NAVD. The purpose of these drainage pipe upgrades is to increase the hydraulic transmission capacity to avoid any adverse flooding impacts within upstream areas of the FDOT US1 Drainage System. These proposed drainage pipe upgrades are expected to include approximately 940 linear feet of 48-inch drainage pipe, 1 junction structure, and 3 headwall structures.
- Basin US1-26 Outfall – The proposed drainage infrastructure to allow stormwater runoff to discharge from this drainage basin into the existing wetland is expected to be a single 48-inch drainage pipe or the hydraulic equivalent with a control elevation of +2.5 feet NAVD. The purpose of these drainage pipe upgrades is to divert stormwater runoff from Basin US1-26 directly into the existing wetland areas to east of NE 7th Avenue instead of toward the FLL IMC Facility, which will avoid any adverse flooding impacts within upstream areas of the FDOT US1 Drainage System. These proposed drainage pipe upgrades are expected to include approximately 210 linear feet of 48-inch drainage pipe, 1 control structure, and 2 headwall structures.

- **FPL Access Road Culvert Upsize** – The proposed stormwater improvements along the FPL access road within the existing wetland area are expected to include upsizing two existing drainage culverts to 36-inch drainage pipe, which are expected to include 50 linear feet of 36-inch drainage pipe. The purpose of these drainage pipe improvements is to ensure a consistent flow rate from the existing wetland area into the existing FDOT drainage ditch.
- **FPL Access Road Culvert Control Structures** – The proposed stormwater improvements along the FPL access road within the existing wetland area is expected to include retrofitting a control structure with an at the upstream end of the 7 existing drainage culverts, which will include 10 feet wide sharp crested overflow weirs at +0.8 feet NAVD and 3-inch wide rectangular bleeder notches at +0.42 feet NAVD (or the hydraulic equivalent). The purpose of the proposed control structures is to stage stormwater runoff within the existing wetland area up to 0.8 feet NAVD, which is required to meet the water quality requirements for the proposed FLL IMC Facility.
- **FPL Access Road Modifications** – The proposed stormwater improvements are expected to include raising the low lying segments of the FPL maintenance access road up to at least +3.0 feet NAVD. The purpose of these improvements are to prevent water levels within the existing wetland areas from overtopping and sheet flow across the FPL access road directly into the FDOT drainage ditch. The existing FPL access road is approximately 7,800 feet in length. Based on available LIDAR elevation data, it is estimated that approximately 3,200 linear feet of the existing FPL access road will need to be raised up to +3.0 feet NAVD.

Based on the preliminary design assumptions defined within the FLL IMC Advanced Planning Technical Report (2022), CMA developed these preliminary recommendations on the potential sizing and configuration of the proposed stormwater improvements needed to enable the FLL IMC Facility. As more specific information on the proposed FLL IMC Facility is developed throughout the project planning process, these preliminary recommendations for the proposed stormwater improvement will need to be re-evaluated and adjusted as needed moving forward.

Surface Water Permitting

The proposed stormwater improvements related to the FLL IMC Facility will require obtaining a surface water license. South Florida Water Management District (SFWMD) and Broward County Environmental Protection Division (BCEPD) are the primary regulatory agencies with jurisdiction over stormwater issues at FLL. Chapter 40E-4 of the Florida Administrative Code (FAC) empowers the SFWMD to regulate all matters related to stormwater management. Chapter 27, Article V of the Broward County Code of Ordinances similarly empowers the BCEPD with similar regulatory duties.

At this time, each of these regulatory agencies use a single surface water license, which acts as the “master” surface water license for the entire stormwater management system at FLL. All new development projects at FLL are typically required modify these master surface water licenses with SFWMD and BCEPGM. The “master” surface water license for FLL was initially established during the permitting of the FLL South Runway Expansion Project under SFWMD Permit #06-00339-S / Application #101203-7 and under BCEPD Permit #SWM2011-028-0. The most recent modifications of this “master” surface water licenses for FLL appear to be for the FLL North Airfield Pavement Rehabilitation Project (BCEPD License #SWM2011-028-18 and SFWMD License #06-00339-S) and for the Airport Exit Routes and Valet Ramps Project (BCEPD License #SWM2011-028-21 and SFWMD License #06-102518-P).

These regulatory agencies enforce the following requirements related to peak discharge, water quality treatment, and floodplain compensation under current regulations:

- Peak discharge from stormwater outfalls during a 25-year/72-hour storm event shall not exceed the previously permitted peak discharge for FLL according to previous permits issued by SFWMD and BCEPD.

Based on the most recent modification to the “master” surface water license for FLL, the maximum allowable discharge from the FDOT US1/System 2 primary stormwater systems under the most recent permit modification is currently defined at 195.07 CFS during a 25-year/72-hour storm event.

- The retention and detention of stormwater runoff shall be provided for water quality treatment purposes using the following criteria:
 - 1) The total wet detention volume provided within the master stormwater management system at FLL shall equal or exceed one inch of stormwater runoff from the entire FLL area or 2.5 inches of stormwater runoff from the total impervious ground surface within FLL, whichever is greater.
 - 2) The total dry detention volume provided within the master stormwater management system at FLL shall equal or exceed 75% of one inch of stormwater runoff from the entire FLL area or 75% of 2.5 inches of stormwater runoff from the total impervious ground surface within FLL, whichever is greater.
 - 3) The pretreatment retention volume provided within each site prior to discharging into the master stormwater management system at FLL shall equal or exceed 50% of one inch of stormwater runoff from each site or 50% of 2.5 inches of stormwater runoff from the total impervious ground surface within each site, whichever is greater.

Based on the most recent modification to the “master” surface water license for FLL, the FDOT US1 Drainage System and Drainage System 2 was required to provide 53.54 acre*feet of water quality storage based on the existing impervious ground coverage throughout these drainage systems and does provide a water quality volume of 28.99 acre*feet within existing dry retention areas and 35.08 acre*feet within existing wet retention areas. Based on these permit conditions, the existing dry retention areas and wet ponds throughout the FDOT US1 Drainage System provide surplus water quality treatment volume of 20.10 acre*feet under the existing conditions.

- All surface water license applications for future development and redevelopment activities within Broward County fall under County Ordinance 2016-17, which established the Future Conditions Groundwater Map throughout Broward County. According to this County Ordinance, the Future Conditions Groundwater Map shall be used for determining the average wet season groundwater levels for use in calculating a design event for new applications for a surface water management license, applications for major redevelopment of existing sites, and applications for major modifications to existing surface water management licenses submitted after June 30, 2017. Major redevelopment is defined as construction activities which involve the demolition or removal of the principal structure on a site or of more than fifty percent (50%) of the impervious surface of a developed area on a site. Major redevelopment is also defined as multiple minor redevelopments with the cumulative expansion of developed area greater than or equal to twenty-five percent (25%) of the existing developed area of a site or greater than or equal to two (2) acres over a period of ten (10) years. Any minor development at FLL less than the 25% threshold can continue to use the existing seasonal high groundwater map for Broward County within the corresponding drainage calculations. Any major redevelopment at FLL beyond the 25% threshold will be required to use groundwater elevations defined by Future Conditions Groundwater Map within the corresponding drainage calculations. Based on the evaluation completed by FLL Master Plan Update, it was estimated that the development of the FLL IMC Facility should not cause the amount of developed land to exceed the 25% threshold noted above with the currently outlined development limits. The FLL IMC Facility should be able to use the previous seasonal high groundwater elevation of +0.42 feet NAVD.
- Any proposed development should result in no net encroachment into an existing floodplain between the average wet season water table elevation and the 100-year flood elevation to ensure the proposed development will not adversely affect the existing rights of others. It must be confirmed that any existing storage volume eliminated by a proposed development is compensated for creating an equivalent storage volume elsewhere within the same floodplain. Based on the current FEMA flood maps, the 100-year flood elevation for the FLL IMC Facility is at 7.5 feet NAVD. Based on a preliminary evaluation, the proposed

FLL IMC Facility is expected to eliminate approximate 40.32 acre*feet of existing floodplain storage between 0.42 feet NAVD and 7.5 feet NAVD. In order to compensate for this loss of floodplain storage volume, additional floodplain storage volume will need to be created within the vicinity of FLL. According to the FLL Stormwater Master Plan, there are recommended stormwater CIP that will create additional floodplain storage volume within expanded dry retention areas that could used to help meet this floodplain compensation requirement.

Once more detailed site information on the FLL IMC Facility along with the associated stormwater impacts is clarified as the planning and design process proceeds, pre-application meetings should be held with each of the environmental regulatory agencies (SFWMD and BCRED) to verify the permitting requirements for the proposed stormwater improvements.

Pending Statewide Stormwater Rules

The State of Florida is in the process of enacting pending updates to the Statewide Stormwater Rules, which are expected to become effective sometime in 2024. In general, the new Statewide Stormwater Rules will establish more performance-based criteria for water quality treatment of stormwater runoff from new development or redevelopment sites that is more site specific or location specific. The new Statewide Stormwater Rules will supplement and in certain cases replace the current quantitative criteria for water quality treatment, which currently requires providing prescribed water storage volume based on the total site area and/or the total on-site impervious area. These performance-based criteria are expected to focus on the nutrient removal efficiency of various stormwater alternatives for removing total nitrogen and total phosphorous from stormwater runoff, which is summarized below.

Pending Statewide Stormwater Rule – Pollutant Removal Efficiency Requirements			
Project Scenario	TP Removal	TN Removal	Additional Requirements
All Sites	80%	55%	Post Conditions = Pre Conditions
Outstanding Florida Water	90%	80%	Post Conditions = Pre Conditions
Impaired Water	80%	80%	Net Improvement
Impaired Outstanding Florida Water	95%	95%	Net Improvement
Redevelopment Project	80%	45%	N/A
Redevelopment Project + Outstanding Florida Water	95%	60%	N/A

In regards to the FLL IMC Facility, there will be an impact on the designers who have to prepare more detailed / comprehensive water quality calculations during the permitting stage. The designers will need to prepare a “treatment train” drainage analysis that quantifies the total nutrient removal due to all stormwater alternatives proposed under the FLL IMC Facility. At this time, the new Statewide Stormwater Rules are expected to be adopted sometime before July 1st, 2024. It is expected that any conceptual surface permit applications under current criteria will need to be approved before this adoption date. Otherwise, any conceptual surface permit applications will need to be approved under the new criteria. It is expected that any individual surface permit applications under the current criteria will have a grace period of up to 12 months from the adoption date, which would likely be no later than July 1st, 2025. Based on this preliminary information along with the expected project schedule, it is expected that the FLL IMC Facility will need to be permitted under the new Statewide Stormwater Rule.

At this time, it is not clear on how SFWMD and BCEPD will enforce these new Statewide Stormwater Rules during permit approvals, particularly for a project like the FLL IMC Facility which will be a modification to an existing “master” surface water license. At this preliminary stage, the minimum water quality requirements for the proposed FLL IMC Facility under the new Statewide Stormwater Rules is not clear at this time. Based on

our preliminary review of the draft criteria under the new Statewide Stormwater Rules, the implementation of dry retention is no longer considered an effective method for meeting the new water quality criteria but the implementation of wet retention is now considered a more effective method u for meeting the new water quality criteria. It is our understanding that there has been some discussion of potential exemptions for airports since the implementation of wet retention and other similar alternatives is not compatible with aviation uses. But the status of these potential exemption is not known at this time.

Environmental Permitting

The proposed stormwater retention areas east of NW 7th Avenue would require permitting through the following agencies:

- U.S. Army Corps of Engineers (USACE) - Federal 404 Permit.
- South Florida Water Management District (SFWMD) - Environmental Resource Permit (ERP).
- Broward County Resilient Environment Department (BCRED) – Environmental Resource License (ERL).

The existing mangrove wetlands appear to be designated as *Environmentally Sensitive Lands* (ESL) by Broward County. So the regulatory agencies, particularly BCRED, will require that all practicable measures are explored to avoid and minimize impacts to the existing mangrove wetlands, which may include the following efforts:

- Minimize stormwater discharge volumes into the existing mangrove wetlands.
- Maximize stormwater treatment within the FDOT US1 Drainage System prior to discharge into the existing mangrove wetlands.
- Retain tidal connectivity between the existing mangrove wetlands and Dania Cutoff Canal.

The project will be designed to avoid and minimize mangrove impacts. However, if it is determined that unavoidable impacts will occur, then each of the agencies will require mitigation for those impacts. Mitigation may be provided though on-site wetlands enhancement (i.e. invasive/exotic species removal), mitigation bank credits, or a combination of both.

Conclusion

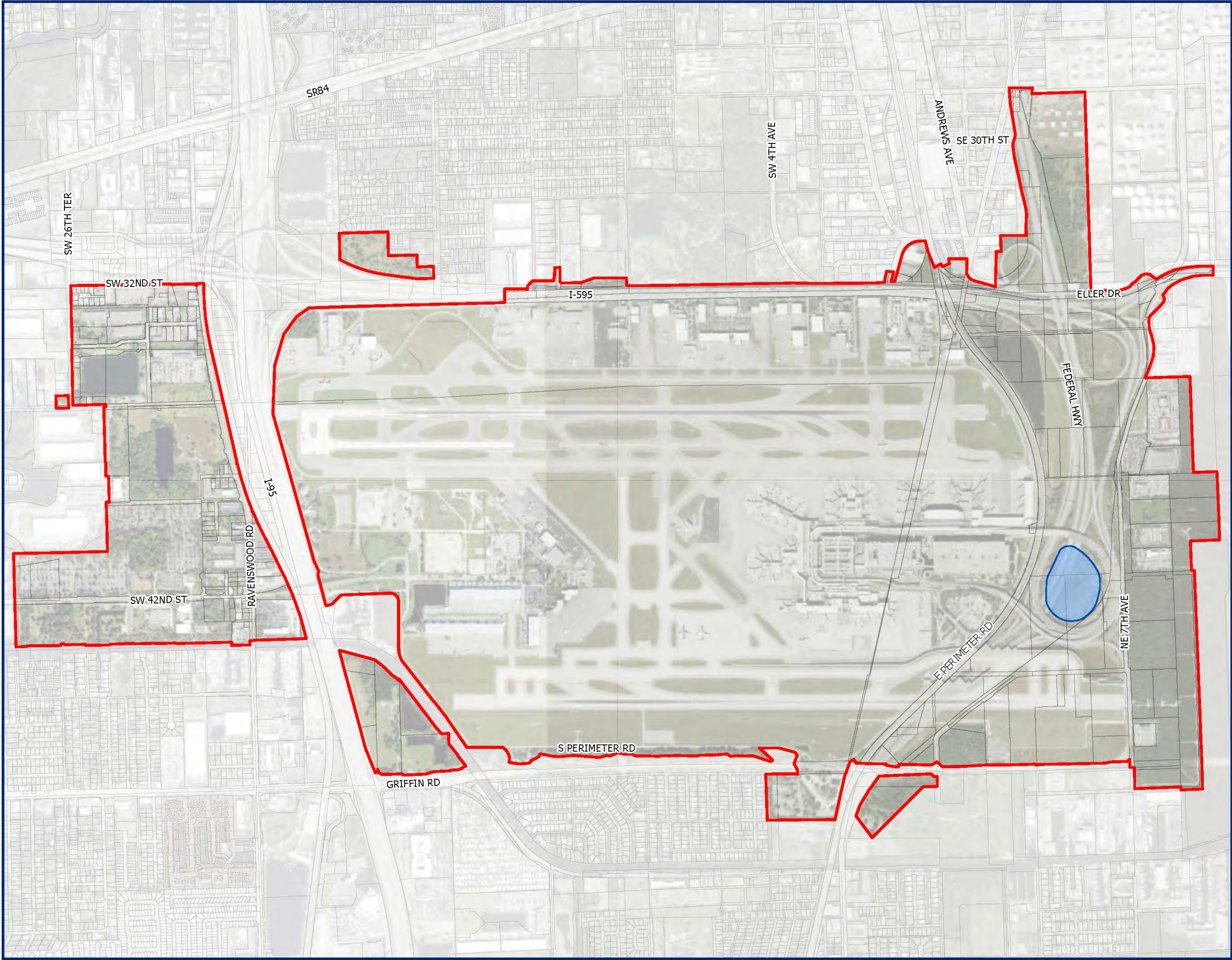
Based on the preliminary design assumptions defined within the FLL IMC Advanced Planning Technical Report (2022), CMA developed the preliminary recommendations on the potential sizing and configuration of the proposed stormwater improvements needed to enable the FLL IMC Facility, which are summarized within this draft technical memorandum and displayed on **Exhibit 10** at the end of this memorandum. As more specific information on the proposed FLL IMC Facility is developed throughout the project planning process, these preliminary recommendations for the proposed stormwater improvement will need to be re-evaluated and adjusted as needed moving forward. At this time, it is our understanding that a topographic survey of the existing conditions within the FLL IMC Facility footprint is currently underway. The additional information within this topographic survey will be useful to refine our recommendations for the proposed stormwater improvements related to the FLL IMC Facility. Prior to finalizing this draft technical memorandum, the next action items are outlined below:

- Evaluate the existing elevations throughout the footprint of the FLL IMC Facility based on the upcoming topographic survey
- Verify the location and configuration of any existing stormwater infrastructure throughout the footprint of the FLL IMC Facility based on the upcoming topographic survey
- Adjust the preliminary configuration of any proposed retention areas around the perimeter of the FLL IMC Facility based on the upcoming topographic survey

- Tabulate the preliminary storage capacity of these proposed retention areas around the perimeter of the FLL IMC Facility
- Evaluate constructability of the proposed stormwater infrastructure around the perimeter of the FLL IMC Facility based on the upcoming topographic survey
- Adjust the preliminary configuration of the proposed stormwater infrastructure around the perimeter of the FLL IMC Facility based on the upcoming topographic survey
- Evaluate the impact of the pending Statewide Stormwater Rules update as more specific information becomes available
- Conduct coordination meetings with surface water regulatory agencies (BCEPD/SFWMD)
- Conduct coordination meetings with environmental regulatory agencies (BCEPD/SFWMD)
- Continue design coordination meetings with FDOT
- Finalize this technical memorandum based on this additional site information

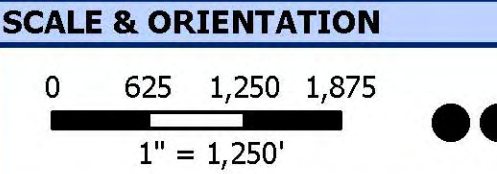
APPENDIX A

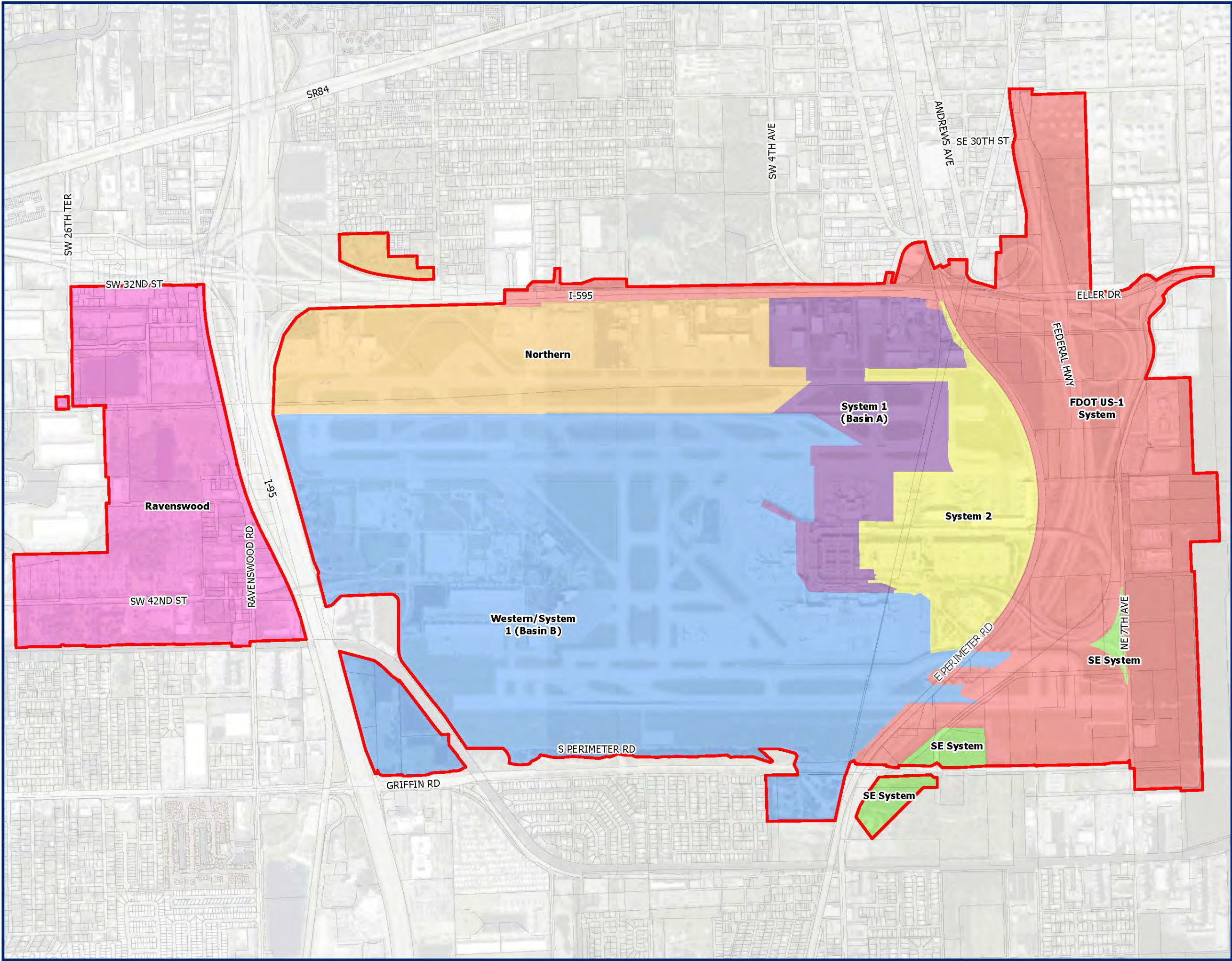
MAP EXHIBITS



Broward County
Aviation Department
FLL IMC PDD Stormwater Planning
Exhibit 1 - Project Location Map

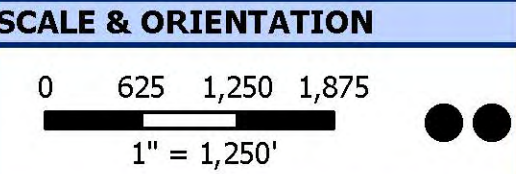
- LEGEND**
-  FLL Limits
 -  Parcels
 -  FLL Intermodal Center Limits

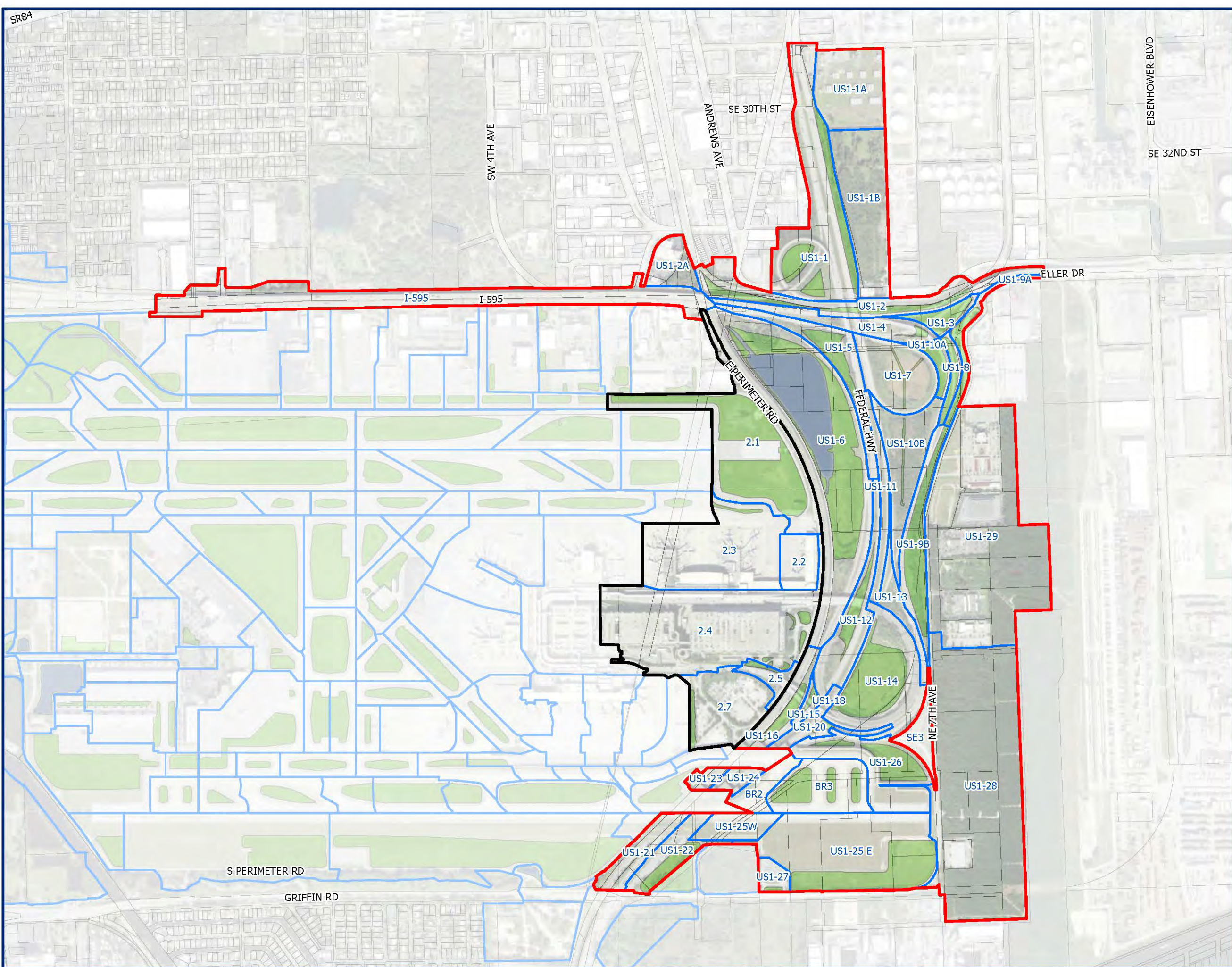




Broward County
Aviation Department
FLL IMC PDD Stormwater Planning
Exhibit 2 - Primary Drainage Basin Map

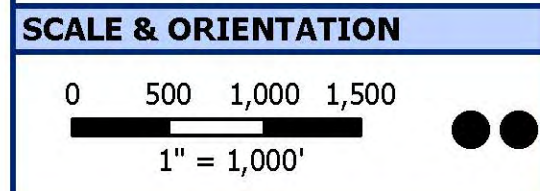
- LEGEND**
- Stormwater Master Plan Limits
 - Parcels
 - Primary Drainage Basin

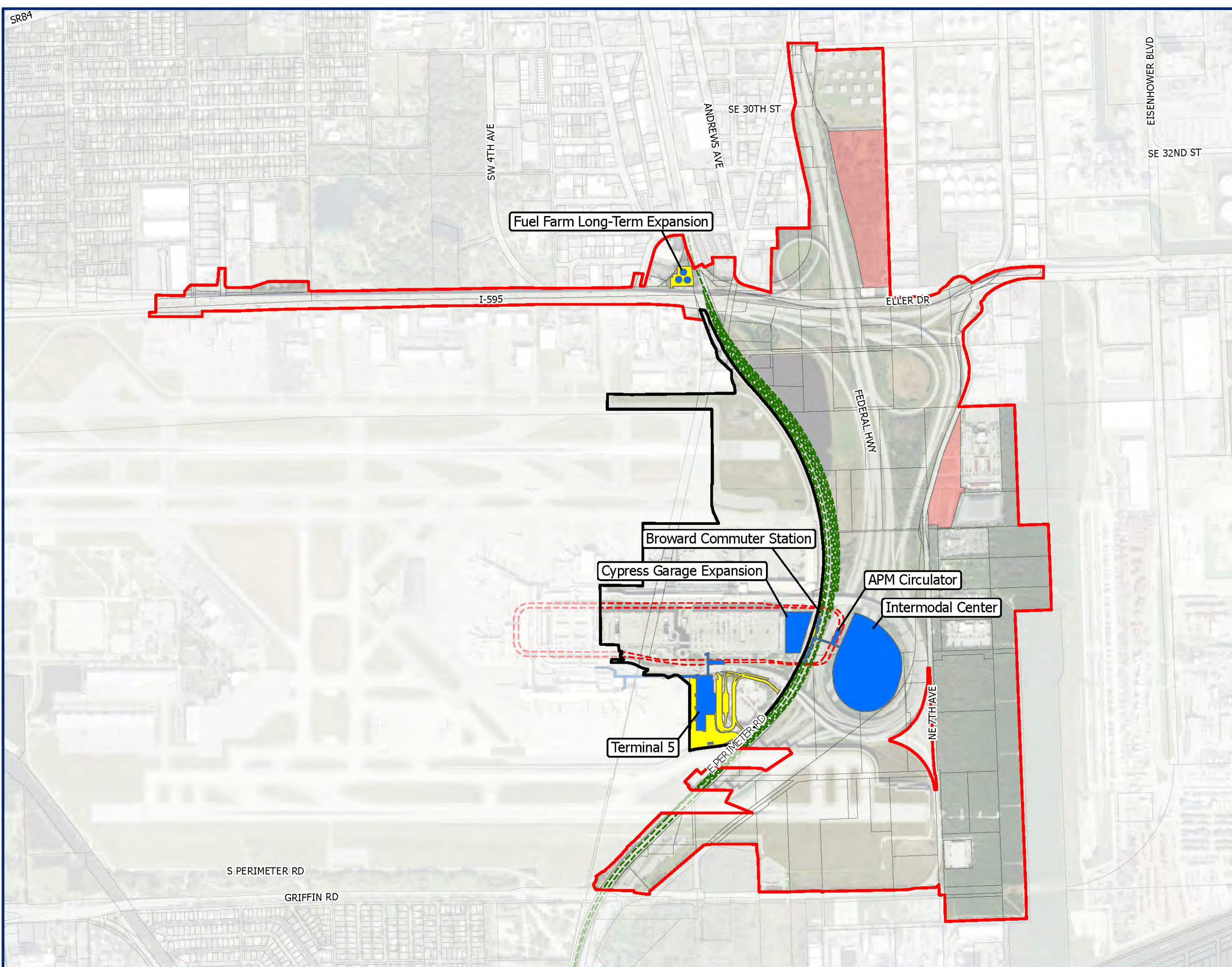




**Broward County
Aviation Department**
FLL IMC PDD Stormwater Planning
Exhibit 3 - Drainage Basin Map

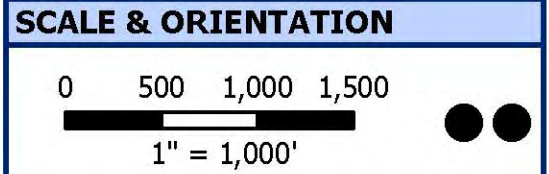
- LEGEND**
- FDOT US-1 System Limits
 - System 2 Limits
 - Parcels
 - Drainage Sub-basin
 - Wet Retention Area
 - Dry Retention Area





**Broward County
Aviation Department**
FLL IMC PDD Stormwater Planning
Exhibit 4 - Planned Developments Map

- LEGEND**
- FDOT US-1 System Limits
 - System 2 Limits
 - Parcels
 - Future Development Parcel
 - Future Development - Building
 - Future Development - Pavement
 - Future Railway Expansion
 - Future FLL APM



Broward County
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FLL IMC PDD Stormwater Planning
Exhibit 5 - Drainage Infrastructure Map

LEGEND

- ▬ FDOT US-1 System Limits
- ▬ System 2 Limits
- ▬ Drainage Sub-basin
- Major Control Structure
- Stormwater Control Structure
- Stormwater Manhole
- Stormwater Inlet
- ▲ Stormwater Outfall
- Stormwater Pipe
- FPL Haul Road
- ▬ FDOT Drainage Ditch
- ▭ Wet Retention Area
- ▭ Dry Retention Area

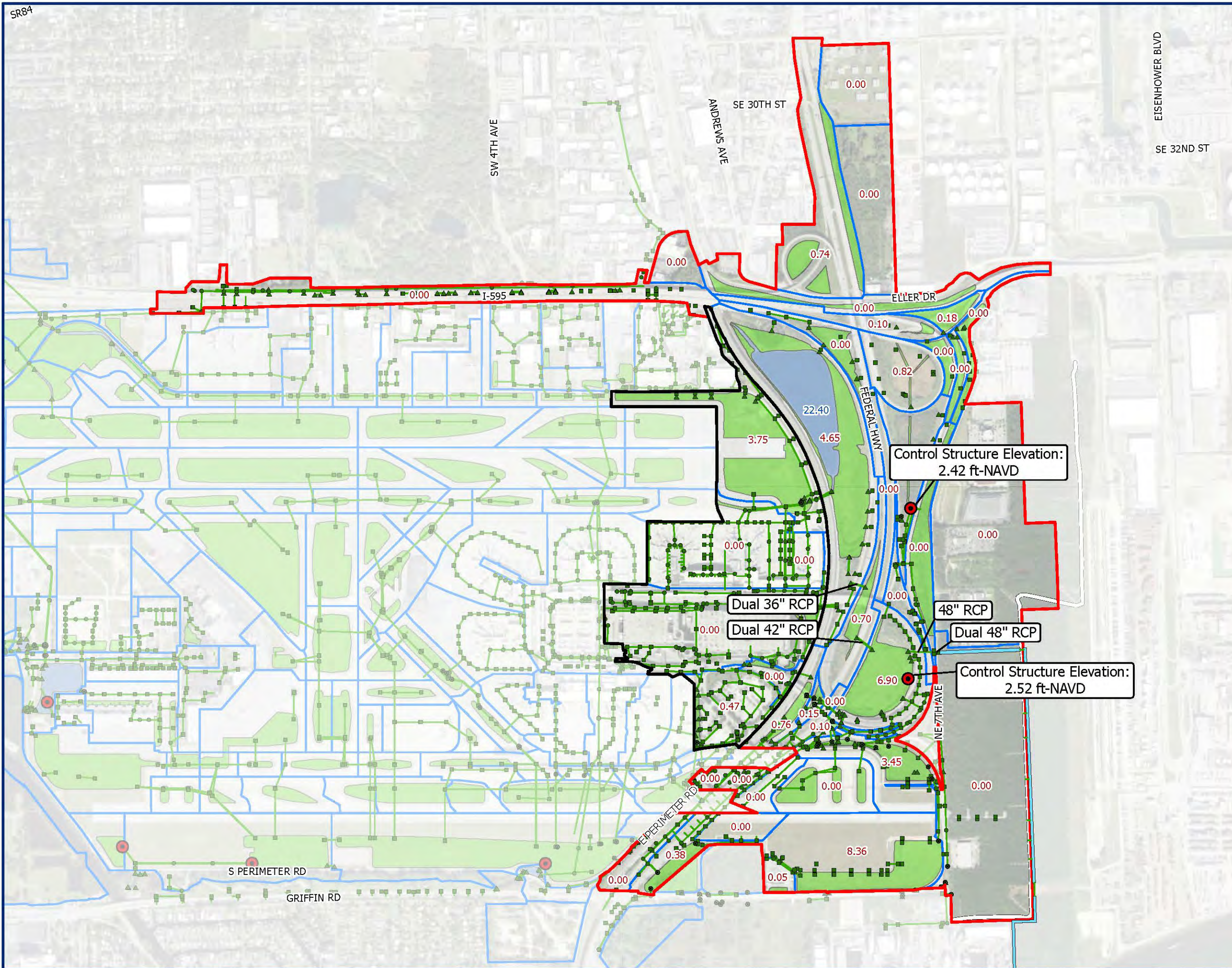
Basin Wet Water Quality (ac-ft)

Basin Dry Water Quality (ac-ft)

SCALE & ORIENTATION

0 500 1,000 1,500

1" = 1,000'





Broward County Aviation Department

FLL IMC PDD Stormwater Planning
Exhibit 6 - Existing Wetland Drainage

LEGEND

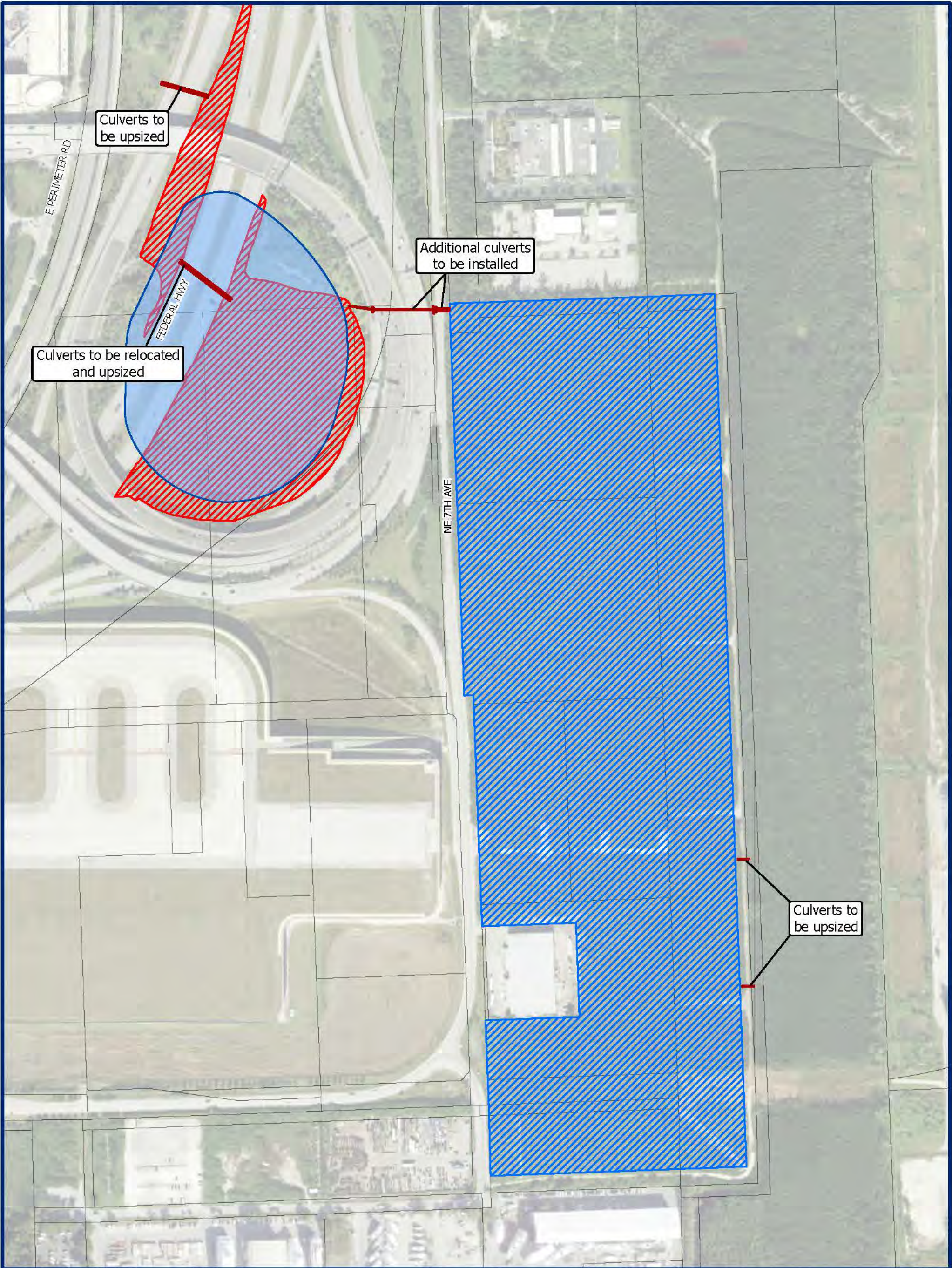
- Parcel Boundaries
- FDOT Drainage Ditch
- Existing County-Owned Mangrove/Wetland (54.92 acres)
- FPL Haul Road
- Existing Haul Road Culvert
- Existing Wetland Outfall

*Assumed Culvert Size

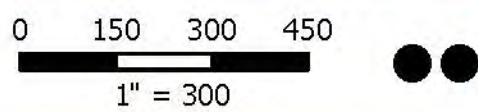
SCALE & ORIENTATION

0 150 300 450
1" = 300





SCALE & ORIENTATION

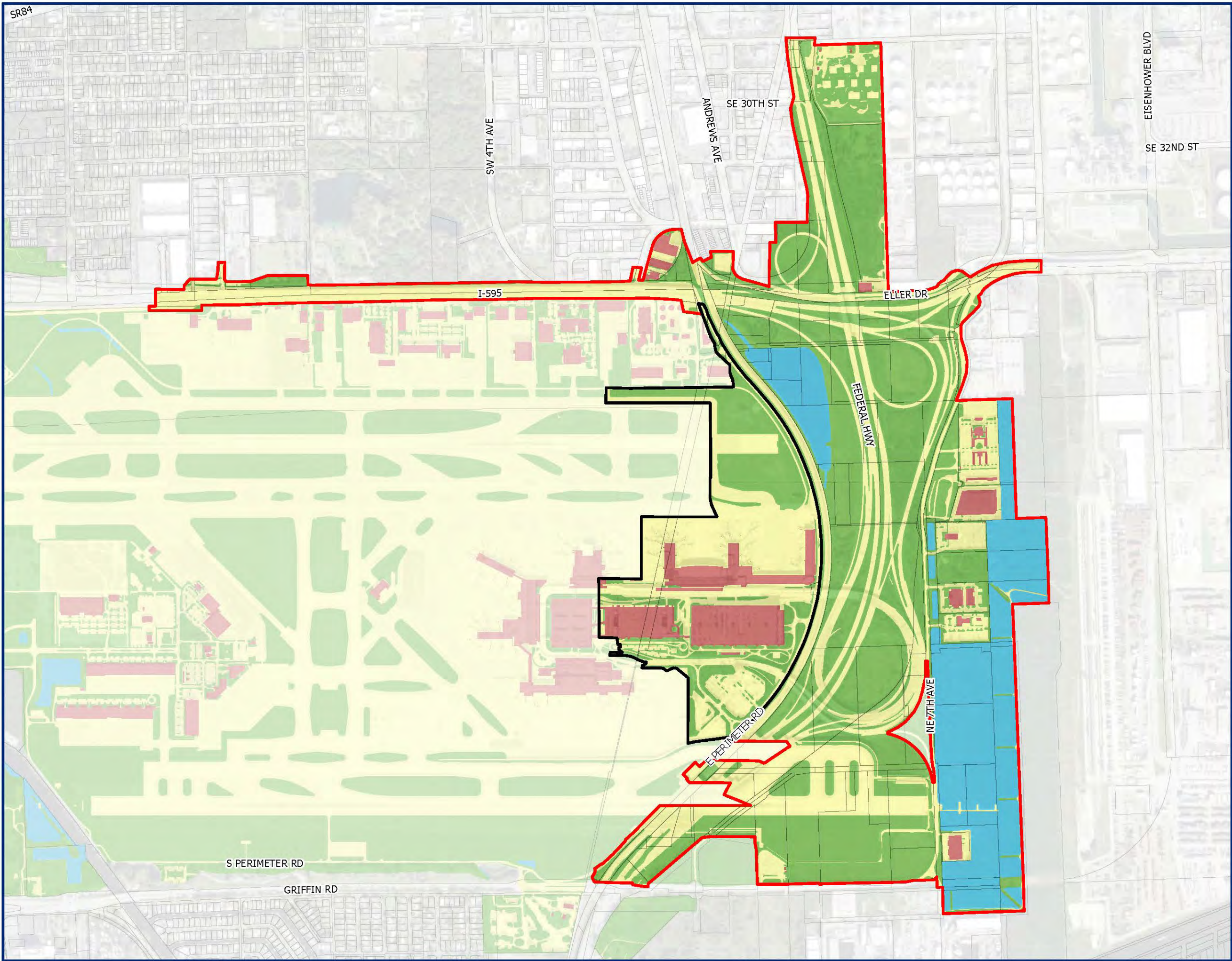


**Broward County
Aviation Department**

FLL IMC PDD Stormwater Planning
Exhibit 7 - Stormwater Impacts Map

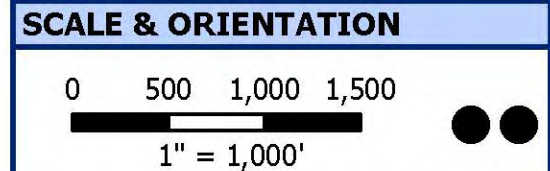
LEGEND

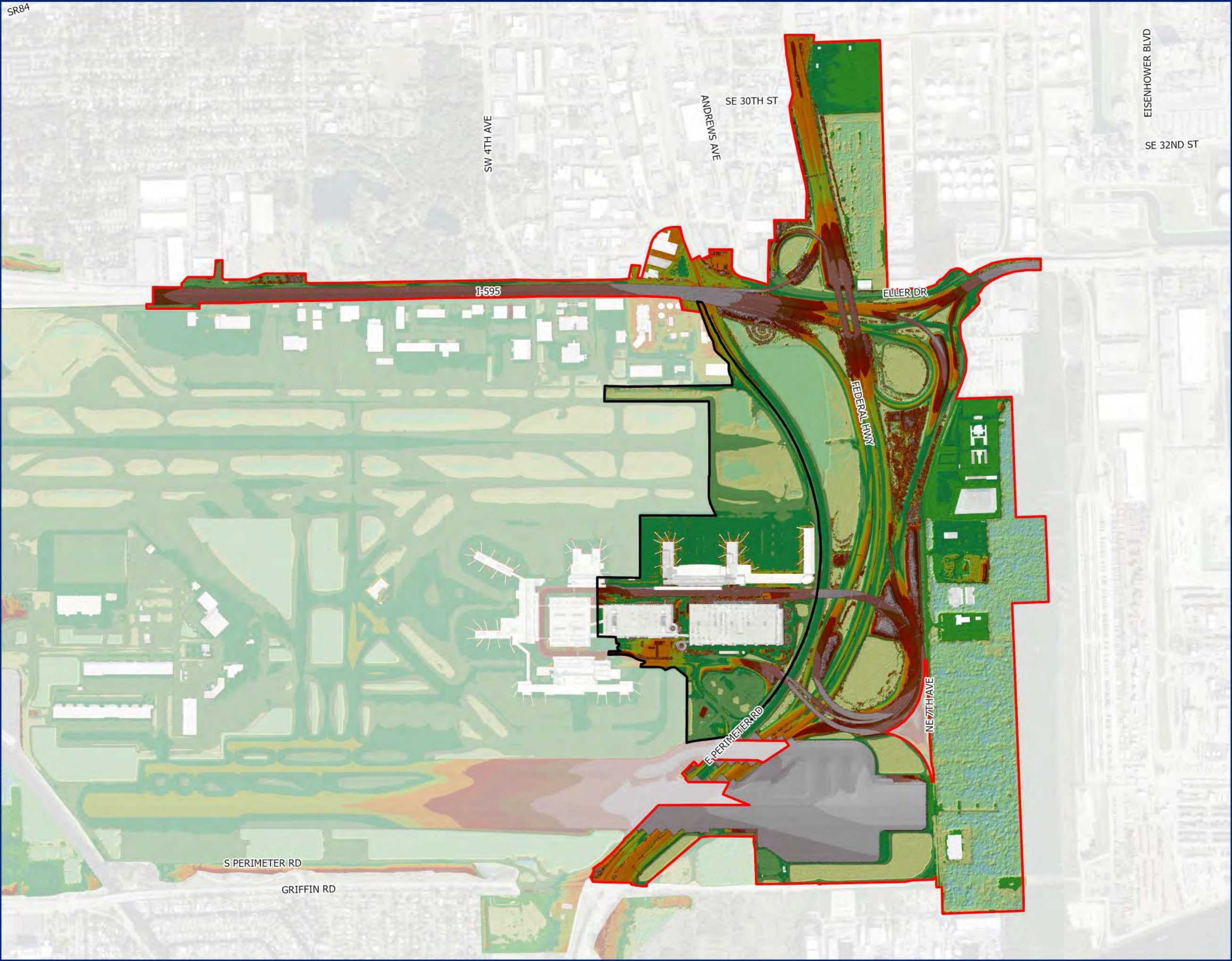
- Parcels
- FLL Intermodal Center Limits
- Impacted Wetland Area
- Impacted Dry Retention
- Impacted Stormwater Pipe



Broward County
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FLL IMC PDD Stormwater Planning
Exhibit 8 - Existing Ground Coverage

- LEGEND**
- FDOT US-1 System Limits
 - System 2 Limits
 - Parcels
 - Existing Surface Coverage Type**
 - Building
 - Impervious Area
 - Pervious Area
 - Waterway





Broward County Aviation Department

FLL IMC PDD Stormwater Planning
Exhibit 9 - Existing Topographic Map

LEGEND

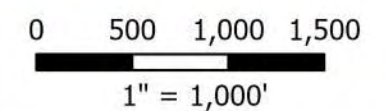
FDOT US-1 System Limits

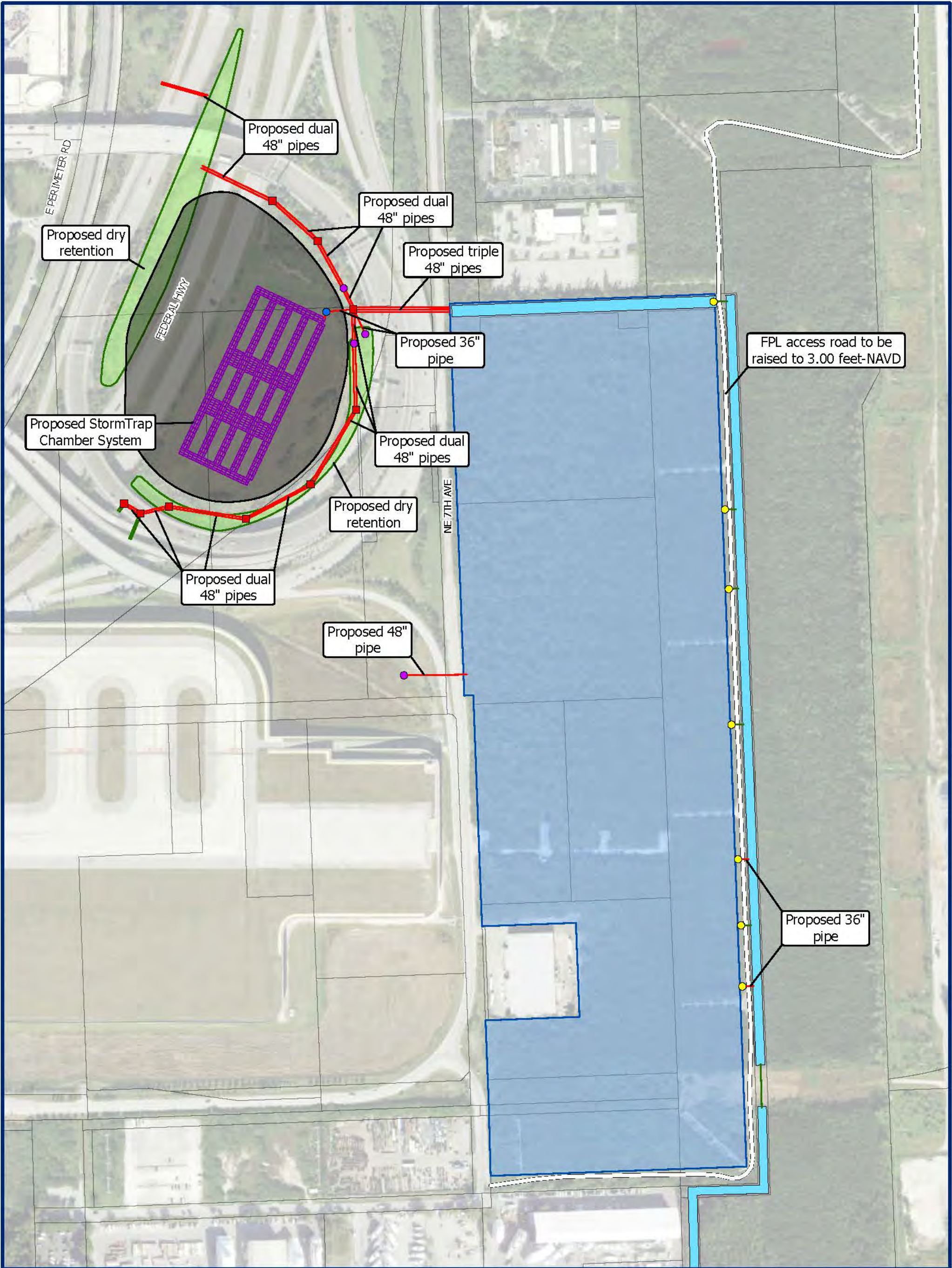
System 2 Limits

Elevation (feet-NAVD)

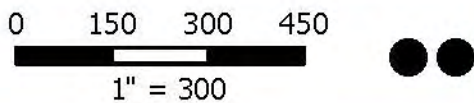
- > 60
- 50 - 60
- 40 - 50
- 30 - 40
- 25 - 30
- 20 - 25
- 15 - 20
- 10 - 15
- 8 - 10
- 6 - 8
- 4 - 6
- 2 - 4
- 0 - 2
- < 0

SCALE & ORIENTATION





SCALE & ORIENTATION



Broward County
Aviation Department

FLL IMC PDD Stormwater Planning
Exhibit 10 - Proposed Improvements

LEGEND

- Parcels
- Intermodal Center Limits
- Proposed Dry Retention
- Wetland Staging Limits
- FDOT Drainage Ditch
- FPL Haul Road
- Existing Pipe to Remain
- Proposed Stormwater Pipe
- Proposed StormTrap System
- Proposed Junction Structure
- Proposed Control Structure**
 - 7.00 feet-NAVD
 - 2.50 feet-NAVD
 - 0.80 feet-NAVD

Broward County
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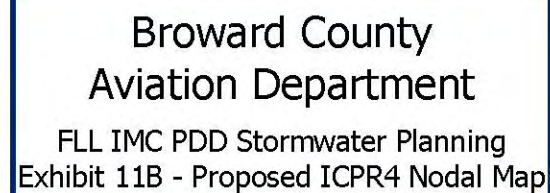
FLL IMC PDD Stormwater Planning
Exhibit 11A - Existing ICPR4 Nodal Map

LEGEND

-  FDOT US-1 System Limits
-  System 2 Limits
-  Parcels
-  Drainage Sub-basin
-  Stage Area Node
-  Time Stage Node
-  Pipe Link
-  Drop Structure Link
-  Weir Link

SCALE & ORIENTATION

0 500 1,000 1,500
1" = 1,000'



- FDOT US-1 System Limits
- System 2 Limits
- Parcels
- Drainage Sub-basin
- Stage Area node
- Stage Volume Node
- Time Stage Node
- Pipe Link
- Drop Structure Link
- Weir Link