STORMWATER FACILITIES PLAN

TETRA TECH

#200-74765-16005

July 2016

Stormwater Facilities Plan

#200-74765-16005
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PRESENTED TO

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EXECUTIVE SUMMARY

Tetra Tech has been tasked by the Town to develop a facilities plan for projected stormwater improvements. This plan is intended to aid the Town in securing necessary funding for the implementation of the plan as well as identifying existing deficiencies and proposed improvements within the system. At this time, portions of the Town have undergone stormwater retrofits or are under design.

The scope of the facilities plan is described below:

1. Inventory of existing stormwater facilities, service area characteristics, and environmental conditions.
2. Establish design needs for the planning period.
3. Identify and evaluate stormwater system alternatives.
4. Recommend the most cost-effective, environmentally sound facilities to meet the planning needs.
5. Describe, in detail, the recommended facilities and their cost.
6. Present a schedule of implementation of the recommended facilities.
7. Identify any adverse environmental impacts and propose mitigating measures.
8. Outline the financial feasibility of the facilities plan

The Town has begun a retrofit program to improve existing infrastructure within certain portions of the island. Namely, the *North Estero Stormwater Improvements Project* and *Water Main Replacement and Drainage Improvements for the Basin Based Neighborhood Phases 1A and 1B* have been constructed are in operation. Plans for these projects are located in **Attachment 1**. The *North Estero Phase II* project is currently under design and has been divided into two sub-phases, IIA and IIB, to accommodate an accelerated design and construction schedule. This project encompasses residential and commercial areas at the north end of the Town from Carlos Circle to Palermo Circle. Phase IIA comprises Carlos Circle, Matanzas Court, Lagoon Street, and Primo Drive. Phase IIB comprises Crescent Street, First Street, Second Street, Third Street, Fourth Street, Fifth Street, Harbor Court, Bonita Street, Palermo Circle, and Santos Road. All other areas within the Town have been analyzed and evaluated at a planning level to identify stormwater needs and potential improvement options. The current design plans for *North Estero Phase IIA* (streets completed by Tetra Tech) are included in **Appendix A**. These plans are at various levels of design and have been on hold pending Town Council approval of this document. A map of the Town showing the planning area covered herein, limits of the recently completed areas, and areas currently under design and associated costs is shown in **Figure A**.

Within the limits of the planning area and including the areas currently under design, the town is responsible for the maintenance of 132 acres of right-of-way. The combined residential and Town right-of-way runoff area, which is drainage basin area, included in this plan is approximately 409 acres. Of this, approximately 10 acres have been identified as having no infrastructure. Fifty-nine basins, with a total area of 200 acres, contain a minimal amount of infrastructure (along 25% or less of the roadways). Eighteen basins, with a total area of 65 acres, contain a medium amount of infrastructure (along 25-75% of the roadways). Twenty-nine basins, with a total area of 134 acres, contain the largest amount of infrastructure (along greater than 75% of the roadways). A summary of the infrastructure provided by the Town is given in the following table. Private commercial development accounts for 320 acres of basin area and is responsible for its own stormwater management. A majority of these developments drains to the bay and do not contribute runoff to the Town's stormwater management system. Lee County right-of-way within the Town totals 57 acres, solely Estero Boulevard right-of-way, and the total basin area that contributes to this area comprises 236 acres.

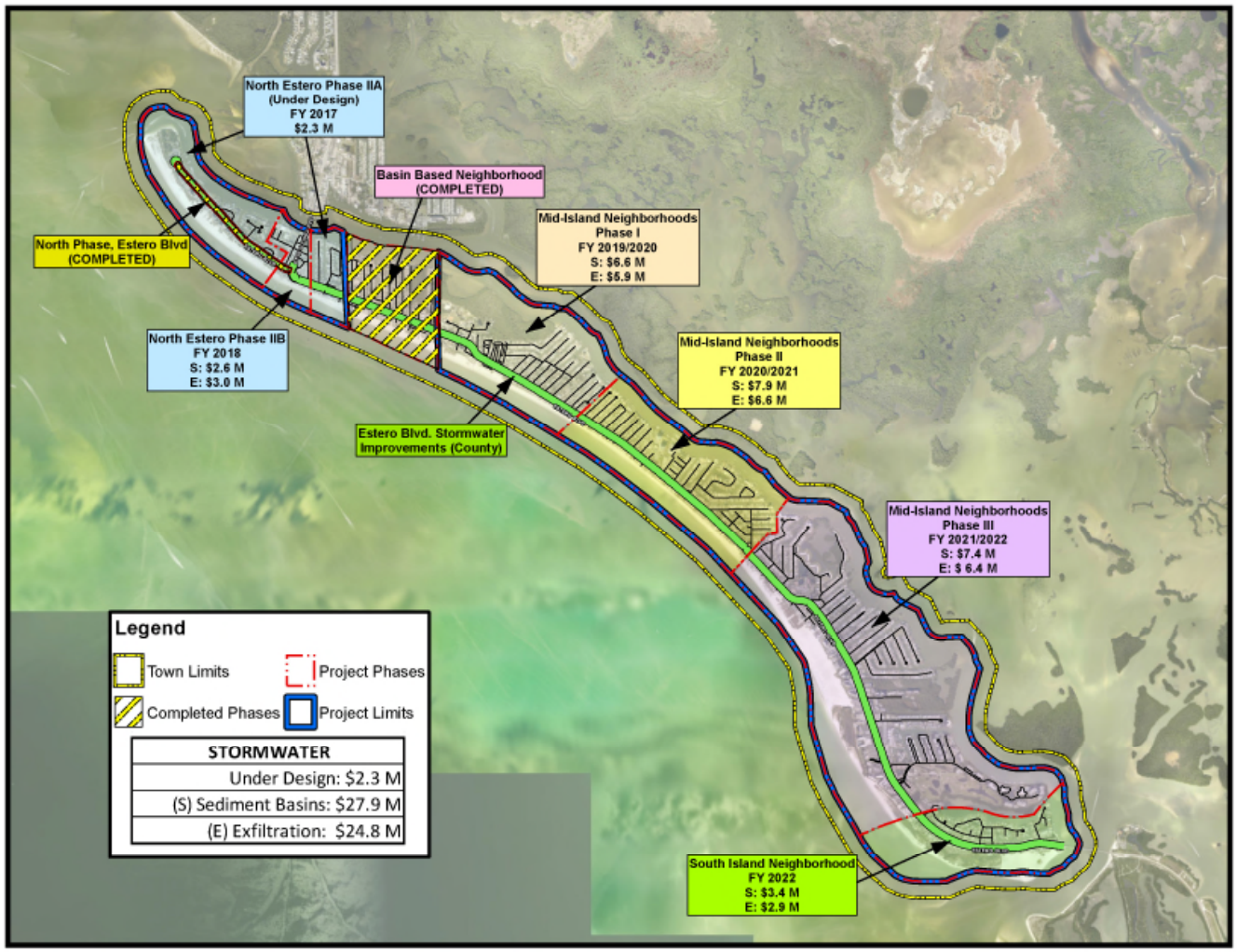

Figure A. Fort Myers Beach Stormwater Improvement Projects.

Summary of Existing Town Infrastructure

Amount of Infrastructure	Number of Basins	Basin Area in Acres	Percentage of Total Town Basin Area
No Infrastructure	4	10	2.4%
Along 25% or less of roadway	59	200	48.9%
Along 25% to 75% of roadway	18	65	15.9%
Along 75% or more of roadway	29	134	32.8%
Total	110	409	100%

The existing stormwater management system is in need of improvements over the next five years to meet the Town's level of service (LOS) goals and reduce nuisance flooding throughout the Town's public rights-of-way. In 2013, CDM Smith completed a stormwater master plan for the Town and suggested recommendations for improvements using three areas as a representative sample of the Town's system: 1) School Street to Lovers Lane, 2) Donora Boulevard to Hibiscus Drive, and 3) Lazy Way to Aberdeen Avenue. These areas were found to be deficient in providing adequate stormwater management. Based on anecdotal evidence gathered by Town staff, these deficiencies have been confirmed and many other stormwater issues have been documented. The Basin Based Neighborhood (Carolina Avenue to Gulf Beach Road) and Estero Boulevard north of Old San Carlos Boulevard have been identified as having stormwater issues and have undergone drainage improvements.

The tidal behavior of the surrounding water bodies encompassing the Town also affects the performance of the Town's stormwater management system. This generates a potential to create nuisance flooding due to unrestricted surcharging of the system. Provisions have been included in this plan to mitigate stormwater system issues caused by tidal influences.

To provide the most economical solutions to the deficiencies identified, alternatives were evaluated that would help reduce the cost of project. Although the stormwater issues being experienced within the Town are primarily caused by a lack of conveyance infrastructure within the system, the Town desires to provide water quality treatment as a part of its overall plan. Therefore, the alternatives explored in this plan have, as one of its main objectives, a means of treating the quality of the stormwater prior to discharge into the bay. In addition to improvement alternatives, a "no action" alternative was developed to determine the baseline costs of operating and maintaining the existing system.

The first of the improvement alternatives explored consists of the installation of nutrient separating baffle boxes, or sediment boxes. These units are installed immediately upstream of basin outfalls with the purpose of collecting sediment, suspended solids, floating debris, and other pollutants prior to discharging to open water. Basins exceeding three (3) acres in runoff area are proposed for installation of these devices.

The second alternative proposed in this plan involves the installation of exfiltration chambers within the Town right-of-way to impound stormwater runoff, provide water quality treatment, and reduce the peak flows into the receiving water body. In order to minimize the cost associated with this system, only areas with available right-of-way but limited green space, as well as larger basins with peak flows above 13 cubic feet per second (cfs), were selected as suitable for exfiltration chambers.

To evaluate the most cost effective alternative, a net present value life cycle analysis was performed. A life cycle of 50 years was assumed based on industry standards. This analysis accounted for initial capital improvement costs, annual maintenance costs, and recurring capital costs in the case of the exfiltration trenches whose typical lifespan is 15 to 20 years.

The no action alternative would include the performance of regular maintenance on the existing system as well as the removal and replacement of failing infrastructure that is beyond its useful life. Existing stormwater management infrastructure within the planning area serves drainage basins totaling approximately 399 acres. Existing infrastructure is shown in **Figure 5** through **Figure 9**. Careful planning to establish a rotating operation and maintenance (O&M) and removal and replacement (R&R) programs can avoid this process from becoming reactive and performed in short notice at a premium cost. In addition to the costs detailed in this plan, if the no action option is chosen, the County may elect to solicit funds from the Town to cover costs associated with collection and conveyance of stormwater runoff from the Town's jurisdiction.

Based on the life cycle analysis, the cost differential between the two alternatives is negligible. Therefore, the sediment basin alternative was chosen due to its lack of recurring capital costs that would require additional construction, roadway closures, and pavement replacement. However, each street will be evaluated at the time of design and the most appropriate method of improvement will be made on a street-by-street basis.

Summary of Cost for Proposed Alternatives

Alternative	Net Present Value
No Action	$5,200,000
Sediment Boxes	$34,200,000
Exfiltration Chambers	$34,000,000

The design phase of the *North Estero Phase II Water Main and Stormwater Improvements* project is underway. This project has been separated into two (2) sub-phases to facilitate an accelerated construction schedule. Phase IIA of North Estero Phase II is currently in design. Phase IIA includes Carlos Circle, Matanzas Court, Lagoon Street, Primo Drive. Permitting is underway and final design is scheduled to be completed by August 2016. The Town has on-going contractor services that will perform the construction. This project is scheduled to be completed by August 2017. Phase IIB of North Estero Phase II is included in the planning level design included in this plan. Phase IIB includes Crescent Street, First Street, Second Street, Third Street, Fourth Street, Fifth Street, Harbor Court, Bonita Street, Palermo Circle, and Santos Road. Upon completion of the Phase IIA design, the design of Phase IIB will commence. This project is scheduled to be completed FY 2018.

Additional funding is required to construct the North Estero Phase IIA project currently under design. The current Engineer's Estimate of Probable Cost approximates the cost of the stormwater portion of this project at **$2,266,000**. North Estero Phase IIB is included in the planning area of this facilities plan, and the infrastructure cost is **$2,600,000**.

The *Mid-Island Neighborhood Improvements* project will be completed in multiple phases. Preliminary work will be completed in conjunction with drainage improvements performed by Lee County on Estero Boulevard. The remaining areas will be constructed in three separate phases. Mid-Island Neighborhoods Phase 1 will include the portion of the Town from School Street to St. Peters Drive. This will include improvements within all public right-of-way on the bay side and beach side of Estero Boulevard. Construction on this phase is scheduled to be completed FY 2019/2020 and the infrastructure cost is $6,600,000. Mid-Island Neighborhoods Phase 2 includes Bay Mar Drive to Lazy Way. This portion is scheduled to be completed FY 2020/2021 and the infrastructure cost is $7,900,000. Mid-Island Neighborhoods Phase 3 will consist of Sterling Avenue to Lenell Road. This is scheduled to be completed FY 2021/2022 and the infrastructure cost is $7,400,000.

The *South Island Neighborhood Stormwater Improvements* includes the Laguna Shores development and Estrellita Road neighborhood. This is the final stormwater retrofit project included in the facilities planning area and is scheduled to be completed FY 2022, and the infrastructure cost is $3,400,000.

The intended improvements will be within existing developed residential and commercial areas. The Town is nearly completely built-out and there are no anticipated impacts to the flora and fauna, threatened and endangered species, or wetlands and surface waters. The planning area is not projected to increase due to population growth, and no service area increases are anticipated. The proposed improvements are intended to benefit the residents by increasing the stormwater management facilities' capacity and conveyance capabilities to reduce nuisance flooding that adversely affects the public's health, safety, and welfare.

Financial Feasibility

This information can be found in **Appendix C**.

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APPENDICES AND ATTACHMENTS

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
BMP	Best Management Practice
EPA	Environmental Protection Agency
cfs	Cubic feet per second
LF	Linear Feet
LOS	Level of Service
O&M	Operation and Maintenance
MS4	Municipal Separate Storm Sewer Systems
NPDES	National Pollutant Discharge Elimination System
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids

1.0 INTRODUCTION

The Town of Fort Myers Beach (Town) is located along the west coast of Lee County, approximately 13 miles south of the City of Fort Myers along the Gulf of Mexico. The Town was incorporated in 1995, following a referendum supported by the citizens of Estero Island for incorporation. Long before incorporation, Estero Island was inhabited by Calusa Indians (dating back to over 2,000 years ago). The Island was used as a fishing village by Cuban fishermen and later developed as an American settlement in part as a result of the Homestead Act of 1862. Since incorporation, the Town has developed into an island community consisting of full- and part-time residents and is recognized as a popular tourist destination.

The Town provides a comprehensive range of municipal services including general government, public safety, community development, public works, planning, utilities, and parks and recreation.

1.1 SCOPE OF STUDY

Tetra Tech has been tasked by the Town to develop a facilities plan for projected stormwater improvements. This plan is intended to aid the Town in securing necessary funding for the implementation of the plan as well as identify existing deficiencies and propose improvements within the system.

The Town has begun a retrofit program to improve existing infrastructure within certain portions of the island. Namely, the *North Estero Stormwater Improvements Project* and *Water Main Replacement and Drainage Improvements for the Basin Based Neighborhood Phases 1A and 1B* have been constructed. Plans for these projects are located in **Attachment 1**. The *North Estero Phase II* project is currently under design. This project encompasses residential and commercial neighborhoods at the north end of the Town from Carlos Circle to Palermo Circle. The *North Estero Phase II* project has been divided into two sub-phases, IIA and IIB, to accommodate an accelerated design and construction schedule. Phase IIA comprises Carlos Circle, Matanzas Court, Lagoon Street, and Primo Drive. Phase IIB comprises Crescent Street, First Street, Second Street, Third Street, Fourth Street, Fifth Street, Harbor Court, Bonita Street, Palermo Circle, and Santos Road. The current design plans for *North Estero Phase IIA*, completed by Tetra Tech, are included in **Appendix A**. **Figure 1** shows the planning area covered herein, the limits of the recently completed areas, and areas currently under design.

The scope of the facilities plan is described below:

1. Inventory of existing stormwater facilities, service area characteristics, and environmental conditions.
2. Establish design needs for the planning period.
3. Identify and evaluate stormwater system alternatives.
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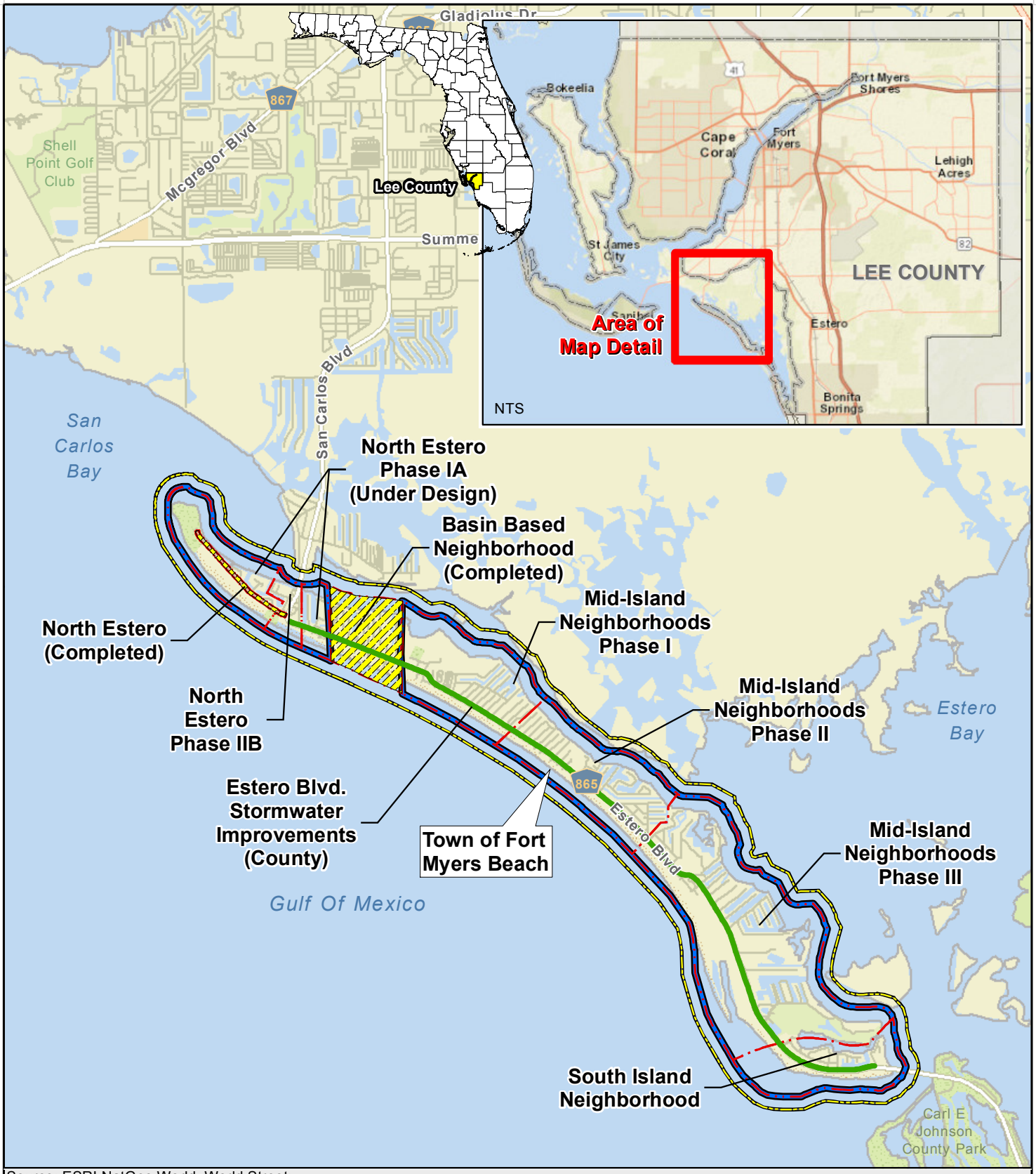

Source: ESRI NatGeo World, World Street;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases
- Completed Phases
- Estero Blvd. Stormwater Improvements (County)

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TOWN OF FORT MYERS BEACH
FACILITIES PLAN

PLANNING AREA LOCATION MAP

FIGURE 1

1.1.1 Assumptions

This facilities plan is based on a preliminary analytical model developed using existing data provided by Lee County and the Town. The stormwater master plan, dated September 2010 and updated May 2013, developed for the Town addressed various storm events and volumes. It identified the highest level of service (LOS) storm event for the type of road within this project as a 10-year, 72-hour storm event with a total rainfall of 9.5 inches and allowable flooding of less than 9-inches. Therefore, a 10-year storm event peak intensity of 6.5 inches per hour for this event was used for evaluation in the facilities plan. This type of evaluation only considers conveyance needs due to peak flows and does not account for volumetric storage. Using this information, the following assumptions were made in evaluating the existing watersheds, system infrastructure, system deficiencies, and proposed recommendations.

- Basin Flows calculated using Rational Equation:
  - Q = cia, where
    - Q = peak runoff flow
    - c = runoff coefficient
    - i = intensity of rainfall
    - a = basin area
  - A uniform time of concentration of 15 minutes was assumed for all areas.
  - A uniform runoff coefficient of 0.55 was assumed for all areas based on a typical developed site.
  - A uniform rainfall intensity of 6.5 inches per hour was assumed for all areas based on FDOT rainfall intensity-duration-frequency data.
- No retention volume assumed
- Basin delineation based on available GIS infrastructure data provided by the Town and Florida Department of Emergency Management LiDAR contours
- Minimum pipe flushing velocity of 2.5 fps and maximum scour velocity of 7.5 fps assumed
- A maximum pipe slope of 0.2% assumed
- Minimum pipe size of 15-inches assumed
- Manning's n value of 0.01 assumed (smooth wall PVC pipe)
- Flows from County improvements on Estero Boulevard provided by TY Lin Engineering

The effort performed has been preliminary in nature and has not included a specific street-by-street detailed analysis for final sizing of stormwater management infrastructure. Detailed modeling and design efforts will be performed as part of a future design.

1.2 EXISTING CONDITIONS

The planning and service area, or project area, is located within Fort Myers Beach, which is bounded by the extent of the island in which the Town resides, Estero Island. The surface features include mangrove forests, canals, sandy beaches broken up by lagoons and tide pools, and developed land along Estero Boulevard that runs through the central area of the island.

1.2.1 Climate

Due to its proximity to the Gulf Coast, the area is humid with warm temperatures most of the year. According to the Soil Survey of the area provided by the USDA Soil Conservation Service, the average temperature in winter is approximately 65ºF with an average summer temperature of 81° F. During brief periods extending from the month of June through the month of August, daytime temperatures often exceed 90° F. Winters are generally short and mild although rare cold spells can drop temperatures to as low as 26° F.

The average annual rainfall is approximately 54 inches. Rainfall is commonly high from June through September. Rainfalls of more than eight inches may occur during hurricane events.

1.2.2 Topography and Drainage

The planning area is characterized by flat terrain and bordered by water on all sides. The average elevations in the service area range from 0 to 5 feet above mean sea level. Soils in the area are classified mostly in the Hydro Soils Groups C and D. These soils have a slow or very slow infiltration rate when thoroughly wet, or a slow rate of water transmission. The D soils have the highest runoff potential. Soils have been mapped using the USDA NRCS Soils Survey for Lee County, FL in **Figure 2**.

1.2.3 Geology, Soils, and Physiography

The narrow island consists of mostly sandy soils and beaches, which are characteristic of the geologic formation in the planning area.

1.2.4 Environmentally Sensitive Areas or Features

The following features are found on Estero Island and contribute to the natural and historical environment within the Town and project area.

1.2.4.1 Wetlands

According to the South Florida Water Management District's LULC map, the only wetlands that are found throughout the planning area are mangroves and non-vegetated wetlands. These are shown in **Figure 3**. These areas will be unaffected by the stormwater infrastructure.

1.2.4.2 Environmentally Sensitive Lands

According to the USDA Natural Resources Conservation Service, there are no prime or unique farmlands in the planning area. Areas within the Town limits have been identified as Strategic Habitat Conservations Areas for the Snowy Plover, Wading Birds, and Black-whiskered Vireo. These areas will not be affected by construction.

1.2.4.3 Plant and Animal Communities (Endangered Species)

The dominant types of natural vegetation are mangrove trees and coconut palms. There are no rare, endangered or threatened species of vegetation. Raccoons can be found in the planning area and its environs. Amphibian and reptiles include various species of turtles, lizards, and snakes. A wide variety of water and land birds are present in the area. There is one (1) bald eagle located on the island, however it lies outside of the planning area and will be unaffected by the stormwater and water main installation. No rare, endangered, or threatened animal species would be affected within the project area.

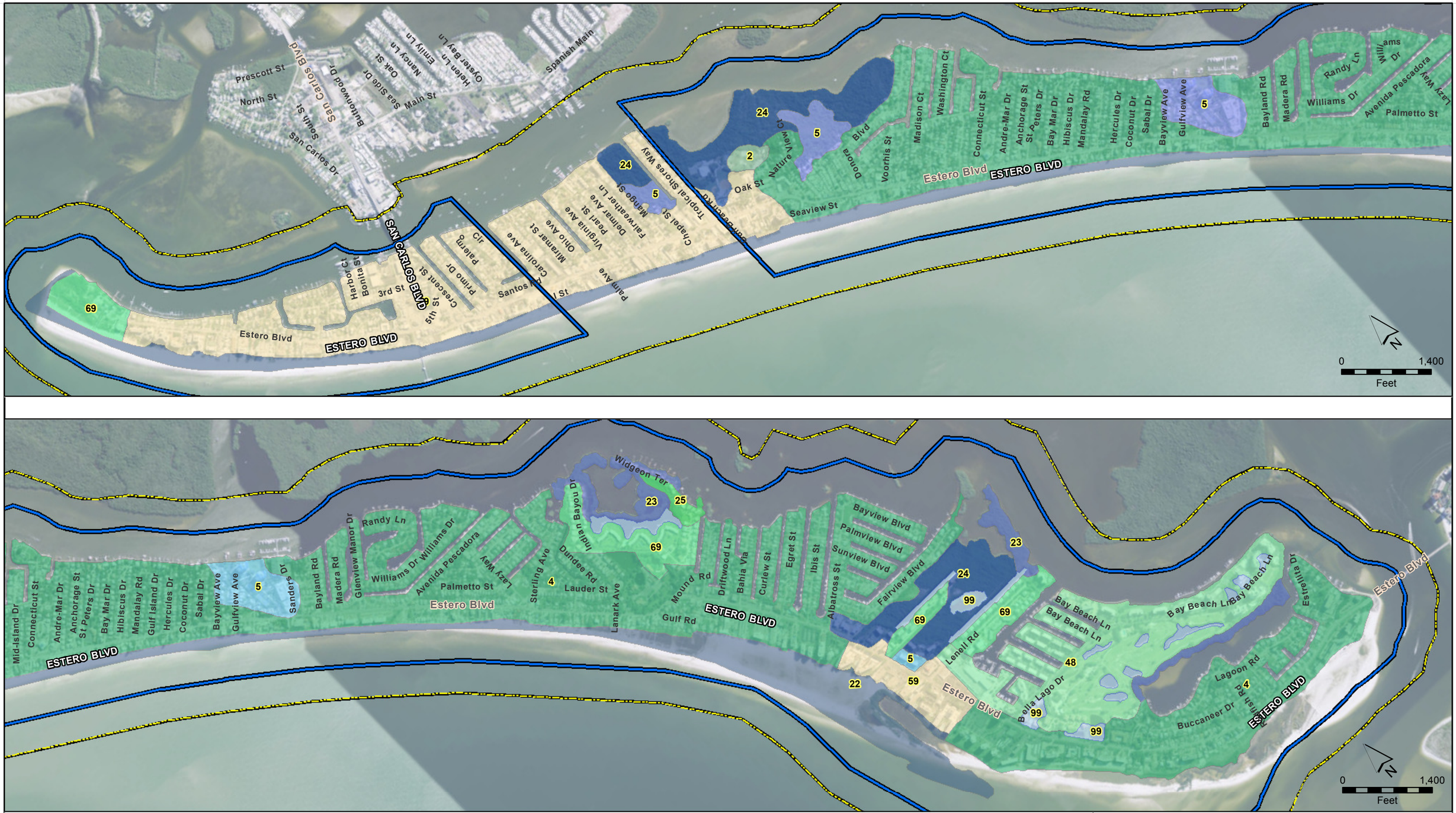
Sea turtle season ranges from May to October on the island. Although sea turtles are not located within the work zone, construction activities will be near their nesting areas along the beach. Any work to be completed at night will be required to use light shields to keep light directed away from the beach as well as be under the supervision and approval of the Town's biologist. The Contractor will have to go through a sea turtle awareness course from the Town's resident biologist prior to commencement of construction activities.

1.2.4.4 Archaeological and Historical Sites

The proposed work will upgrade existing utilities within the existing ROW. Therefore, there will be no disturbance of untouched archeological or historical sites. According to the Bureau of Archaeological Research, there are 125 historic structures within the limits of the Town of Fort Myers Beach. No new easements have been proposed in this facilities plan. Any easements identified during the design phase will take into account these structures.

1.2.5 Flood Plain

Flood hazard zones for the Town are designated on **Figure 4**. Since the Town is located on a barrier island, the Town lies completely within a floodplain. This is one of the main contributing factors for the localized flooding. FEMA provides Flood Insurance Rate Maps (FIRMs) to delineate both the special hazard areas and the insurance risk premium zones applicable to the community. The maps define the Base Flood Elevations (BFEs) as "the computed elevation to which floodwater is anticipated to rise during the base flood. The BFE is the regulatory requirement for the elevation or floodproofing of structures. The relationship between the BFE and a structure's elevation determines the flood insurance premium." The Town lies within the VE and AE Zones, which exhibit a one percent (1%) or greater chance of flooding each year.



Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits

Soils Survey

Hydro Soils Group C

- 2, Canaveral, C
- 25, St. Augustine, C
- 4, Canaveral, C
- 48, St. Augustine, C
- 69, Matlacha, C

Hydro Soils Group B/D

- 5, Captiva, B/D

Hydro Soils Group D

- 22, Beaches, D

- 23, Wulfert, D
- 24, Kesson, D

Other

- 59, Urban land,
- 99, Water,

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

SOIL SURVEY MAP

TETRA TECH

FIGURE 2

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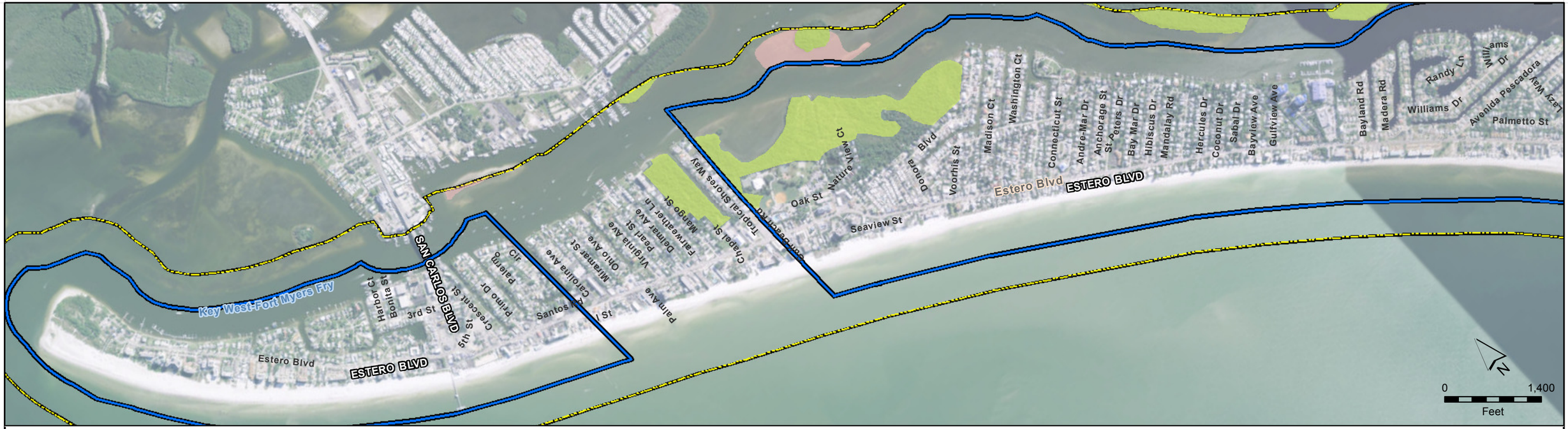

Source: ESRI World Imagery; SFWMD LULC 2008

LEGEND

- Town of Fort Myers Beach
- Project Limits

Land Cover 2008

Wetlands

- Mangrove
- Non-Vegetated Wetland (Tidal Flats)

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

WETLANDS MAP

TETRA TECH

FIGURE 3

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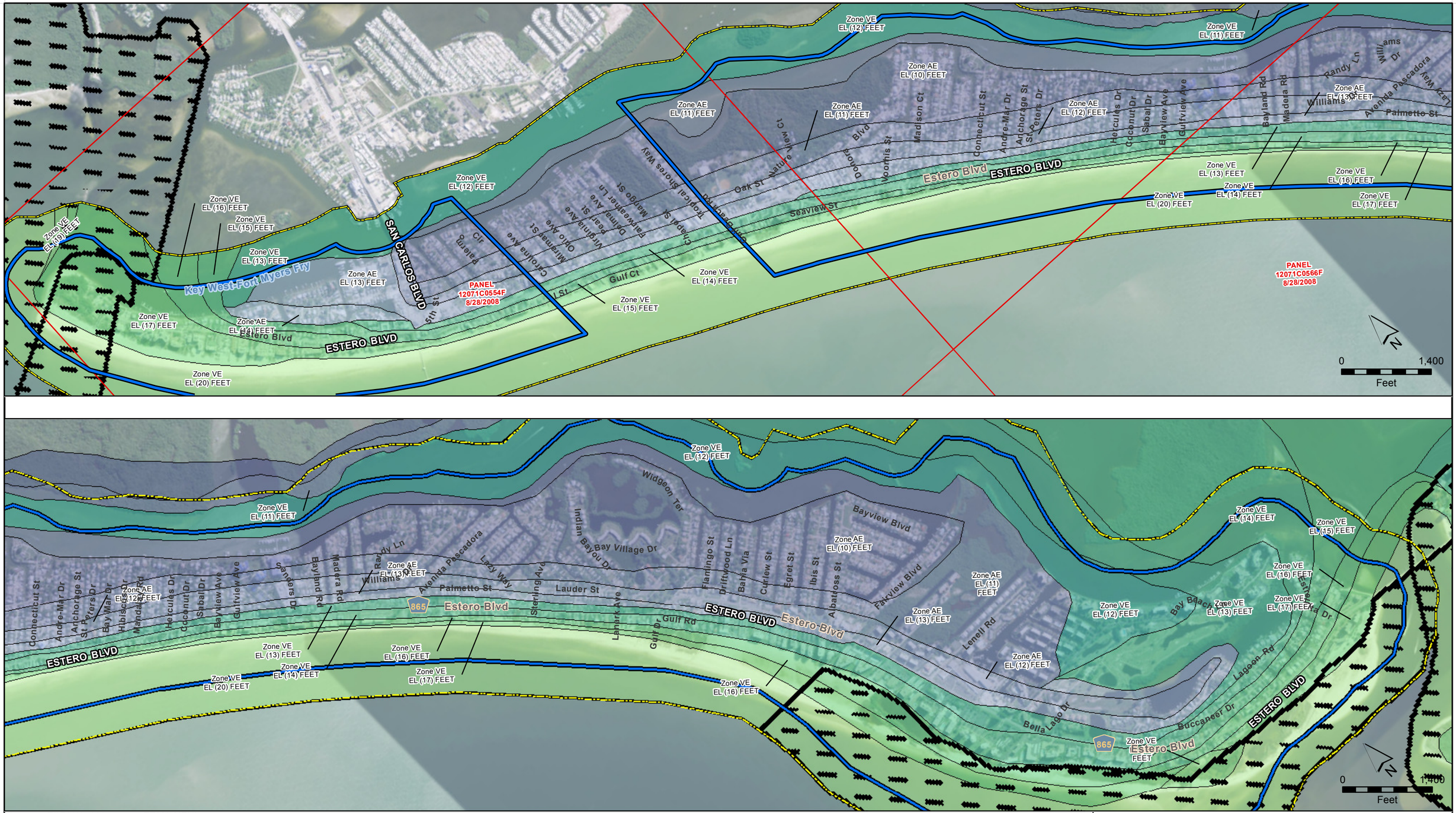

Source: ESRI World Imagery; FEMA NFHL

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Coastal Barrier Resources System Area
- Zone AE — 1% Annual Chance Flood Hazard
- Zone VE — 1% Annual Chance Flood Hazard; Coastal flood zone with velocity hazard (wave action)

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

FLOOD HAZARD ZONES

TETRA TECH

FIGURE 4

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2.0 STORMWATER FACILITIES

Within the limits of the planning area, the town is responsible for maintaining 132 acres of right-of-way. The combined residential and Town right-of-way runoff area included in this plan is approximately 409 acres. Private commercial development accounts for 320 acres of basin area and is responsible for its own stormwater management. A majority of these developments drain to the bay and do not provide flow into the Town's system. Lee County right-of-way within the Town totals 57 acres, solely Estero Boulevard right-of-way, and the total basin area that collects within this area comprises 236 acres. This is summarized in **Table 2-1** below.

Table 2-1. Basins Area in Acres by Land Use and Maintaining Entity

Land Use	Town of Fort Myers Beach	Lee County
Right-of-way	132	57
Outside of Right-of-way	277	179
Total	409	236

2.1 EXISTING SYSTEM

The Town's primary means of stormwater management includes utilization of roadside swales that collect runoff and convey it to outfalls. Where green space is limited within the right-of-way, inlets are employed to collect runoff, conveying it through culverts. Within the planning area, 81 basins have been identified as having piped outfalls. These outfalls range from 4-inches to 30-inches for a single pipe outfall. **Figure 5** through **Figure 9** show the basin delineations of the Town within the planning area.

Lee County is in the planning stages for improvements to Estero Boulevard across its entire length (less portions previously improved) and currently is in the design phase for the initial project area, which will extend from Lovers Lane on the east to Crescent Street on the west, a distance of approximately 5,600 linear feet (1.1 miles). The Town is working in conjunction with the County to coordinate stormwater management. The County has identified at least 20 locations along Estero Boulevard for discharge into the Town's stormwater system in which the runoff will be directed to outfalls into Estero Bay. The County system includes exfiltration and possible storage; however, for the purpose of this study, no retention or infiltration is assumed.

Table 2-1 provides a summary of each basin including whether the basin is within the Town's limits of responsibility and contains infrastructure (managed), has no infrastructure yet is the responsibility of the Town (not managed), is part of the Town's regular maintenance regime (maintained), or part of a private development (private). Also included is the basin size in acreage and the basin outfall size (in diameter) if piped or description of any non-piped outfall conditions.

2.2 EXISTING DEFICIENCIES

The existing stormwater management system is in need of improvements over the next five years to meet the Town's LOS goals and reduce nuisance flooding throughout the Town's public rights-of-way. In 2013, CDM Smith completed a stormwater master plan for the Town and suggested recommendations for improvements using three areas as a representative sample of the Town's system. These areas were found to be deficient in providing adequate stormwater management. Based on anecdotal evidence gathered by Town staff, these deficiencies have

been confirmed and many other stormwater issues have been documented. Areas within the Town outside of the scope of this plan have undergone drainage improvements or are currently under design.

2.2.1 Managed Areas

Within the planning area and including the areas currently under design, 409 acres of basin area drain to the Town's right-of-way and ultimately to Estero Bay. Some small areas drain through Estero Boulevard, which is maintained by the County, but this runoff then continues into the Town system via combined outfalls as discussed previously. There are four basins, with a combined area of 10 acres, which do not contain any stormwater infrastructure. Fifty-nine basins, with a total area of 200 acres, contain a minimal amount of infrastructure (along 25% or less of the roadways). Eighteen basins, with a total area of 65 acres, contain a medium amount in infrastructure (along 25-75% of the roadways). Twenty-nine basins, with a total area of 134 acres, contain the largest amount of infrastructure (along greater than 75% of the roadways).

0 800
Feet

Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin
- Maintained
- Managed
- Not Managed
- Private
- Under Design

- Basin Boundary
- County Basin

Existing Infrastructure
- Inlets
- Junction Boxes
- Outfalls

- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

NORTH ESTERO PHASE IIB EXISTING INFRASTRUCTURE AND BASIN MAP

TETRA TECH

FIGURE 5

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Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin

- Maintained
- Managed
- Not Managed
- Private
- Under Design

- Basin Boundary
- County Basin

Existing Infrastructure

- Inlets
- Junction Boxes
- Outfalls

- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

MID-ISLAND NEIGHBORHOODS PHASE I EXISTING INFRASTRUCTURE AND BASIN MAP

TETRA TECH

FIGURE 6

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Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin

- Maintained
- Managed
- Not Managed
- Private
- Under Design

- Basin Boundary
- County Basin

Existing Infrastructure

- Inlets
- Junction Boxes
- Outfalls

- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

MID-ISLAND NEIGHBORHOODS PHASE II
EXISTING INFRASTRUCTURE
AND BASIN MAP

TETRA TECH

FIGURE 7

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Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin

- Maintained
- Managed
- Not Managed
- Private
- Under Design

- Basin Boundary
- County Basin

Existing Infrastructure

- Inlets
- Junction Boxes
- Outfalls
- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

MID-ISLAND NEIGHBORHOODS PHASE III
EXISTING INFRASTRUCTURE
AND BASIN MAP

TETRA TECH

FIGURE 8

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LEGEND

Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin

- Maintained
- Managed
- Not Managed
- Private
- Under Design

- Basin Boundary
- County Basin

Existing Infrastructure

- Inlets
- Junction Boxes
- Outfalls

- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

SOUTH ISLAND NEIGHBORHOOD EXISTING INFRASTRUCTURE AND BASIN MAP

TETRA TECH

FIGURE 9

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Table 2-2. Basins by Type Including Area and Existing Outfall

Phase	Basin	Type	Area (ac)	Existing Outfall
Mid-Island Phase I	1A	Managed	3	18”
	1B	Managed	5	12”
	1C	Managed	3	2 @ 16”
	1D	Maintained	3	Drains to Wetland
	1E	Maintained	8	24”
	1F	Maintained	8	12”
	1G	Maintained	4	18”
	1H	Managed	4	12”
	1I	Managed	12	15”
	1J	Managed	7	16”
	1K	Maintained	4	18”
	1L	Managed	4	15”
	1M	Managed	7	16”
	1N	Maintained	2	15”
	1O	Maintained	7	Swale to Bay
	1P	Managed	2	15”
	1Q	Maintained	6	15”
	1R	Private	4	Private
	1S	Private	7	Private
	1T	Not Managed	2	Landlocked
	1U	Managed	2	Landlocked
Mid-Island Phase II	2A	Managed	6	15”
	2B	Managed	4	18”
	2C	Managed	11	12”x18” Elliptical Pipe
	2C-2	New	5	None
	2D	Managed	5	2 @ 10”,1 @ 12”x18” Elliptical
	2E	Maintained	6	Coconut Drive swales
	2F	Managed	3	15”
	2G	Managed	3	12”
	2H	Private	14	Private
	2I	Managed	4	24”
	2J	Managed	5	20”
	2K	Managed	2	18”
	2L	Managed	1	15”

Table 2-2 (Cont'd.). Basins by Type Including Area and Existing Outfall

Phase	Basin	Type	Area (ac)	Existing Outfall
	2N	Managed	1	***10"***
	2O	Managed	5	15"
	2P	Managed	3	***12"***
	2Q	Managed	3	18"
	2R	Managed	6	16"
	2S	Not Managed	2	Overland flow
	2T	Maintained	2	***18"***
	2U	Managed	12	18"
	2V	Managed	2	18"
	2W	Maintained	1	6"
	2X	Maintained	2	18"
	2Y	Maintained	9	18"
	2Z	Managed	0	Drains to Estero Blvd
	2AA	Managed	1	12"
	2AB	Managed	5	20"
	2AC	Managed	0	Drains to Estero Blvd
Mid-Island Phase III	3A	Managed	2	15"
	3B	Managed	2	15"
	3C	Maintained	2	15"
	3D	Maintained	11	12"
	3E	Maintained	4	Drains to Private (3I)
	3F	Maintained	12	Dundee Road swales
	3G	Maintained	1	15"
	3H	Maintained	1	15"
	3I	Private	20	Private
	3J	Managed	1	15"
	3K	Managed	2	12"x18" Elliptical
	3L	Managed	3	12"
	3M	Maintained	3	18"
	3N	Managed	2	15"
	3O	Maintained	5	16"
	3P	Managed	3	16"
	3Q	Managed	1	16"
	3R	Managed	3	6"

Table 2-2 (Cont'd.). Basins by Type Including Area and Existing Outfall

Phase	Basin	Type	Area (ac)	Existing Outfall
	3S	Managed	1	24"
	3T	Managed	3	14"
	3V	Maintained	3	16"
	3W	Managed	3	17"
	3X	Managed	4	16"
	3Y	Maintained	2	15"
	3Z	Managed	1	12"x18" Elliptical
	3AA	Managed	1	12"
	3AB	Managed	1	15"
	3AC	Managed	3	18"
	3AD	Private	3	Private
	3AE	Maintained	2	16"
	3AF	Managed	1	24"
	3AG	Managed	0	15"
	3AH	Managed	3	12"x18" Elliptical
	3AI	Managed	2	16"
	3AJ	Managed	2	16"
	3AK	Private	6	Private
	3AL	Private	3	Private
	3AM	Managed	13	15"
	3AN	Private	3	Private
	3AP	Managed	0	Drains to Estero
	3AR	Managed	2	15"
	3AS	Managed	5	Drains to Private (3I)
	3AT	Private	4	Private
	3AU	Managed	7	Landlocked
	3AV	Private	127	Private
South End Neighborhoods	SA	Managed	8	15"
	SB	Managed	14	24"
	SC	Managed	9	15"
	SD	Managed	2	15"
	SE	Managed	4	6"
	SF	Managed	4	4"

Table 2-2 (Cont'd.). Basins by Type Including Area and Existing Outfall

Phase	Basin	Type	Area (ac)	Existing Outfall
North Estero Phase IIB (Times Square)	TA	Managed	12	18"
	TB	Managed	9	15"
	TC	Private	2	Private
	TD	Managed	1	18"
	TE	Managed	0	24"
	TF	Not Managed	3	Landlocked

Note: Bolded outfall sizes are inferred based on upstream pipe size.

2.2.2 Maintained Areas

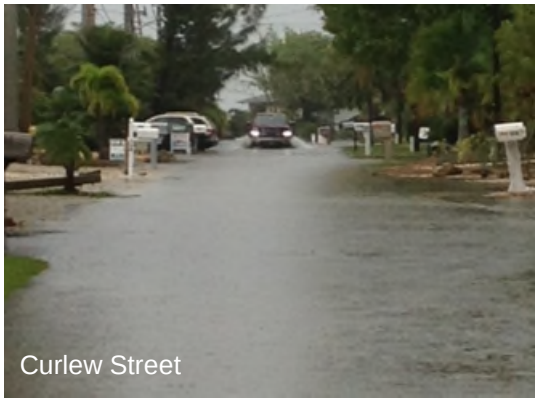
Of the 73,000 linear feet of right-of-way within the project area, approximately 19,000 linear feet of the roadways have been identified by the Town as part of the regular maintenance regime. **Figure 10** shows the locations of the 16 roads that are designated as maintained within the project area basins.

2.2.3 Problem Areas

A number of problem areas were identified within the Town following a high rain event on January 15, 2016, with 2.59 inches of rainfall within 24 hours. Below are photos of sample accounts of flooding on Curlew Street, Sterling Avenue/Lazy Way, and Sterling Avenue/Seminole Way. Areas of nuisance flooding are listed below:

Problem Areas:

- Lauder Street & Dundee Road
- Lauder Street & Lanark Avenue
- Indian Bayou Drive
- Shell Mound Boulevard
- Jefferson Street
- Bahia Via
- Donora Boulevard
- Dakota Avenue
- Sterling Avenue/Lazy Way
- Eucalyptus Court
- Sterling & Seminole Way
- Driftwood Lane
- Bay Road
- Bayland Road
- Madison Court
- Curlew Street
- Egret Street
- Ibis Street
- Gulf Island Drive
- Connecticut Street
- Bay Mar Drive
- Andre Mar Drive
- Lennell Road
- Flamingo Street
- Lagoon Road & Buccaneer Drive
- Old San Carlos Boulevard
- Crescent Street & 3rd Street


Curlew Street


Sterling & Seminole Way


Sterling Avenue/Lazy Way

North Estero Phase IIA (Under Design)

North Estero Phase IIA Under Design

Mid-Island Neighborhoods Phase I

Mid-Island Neighborhoods Phase II

Mid-Island Neighborhoods Phase III

South Island Neighborhood

0 1,400 Feet

Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases
- Established Maintenance Schedule
- Basin Boundary
- County Basin

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

FORT MYERS BEACH STORMWATER MAINTENANCE MAP

TETRA TECH

FIGURE 10

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2.2.4 Outfalls

Basin flow calculations were performed based on the Rational Equation expressed in Section 1.1.1. Then, assuming a maximum slope of 0.2%, each diameter of pipe ranging from 15-inches to 48-inches was evaluated using Manning's equation, which determines flow based on pipe slope and material roughness, to determine a maximum full flow amount. A maximum diameter outfall was assigned for each of the outfalls for conservative design purposes. In addition to maximum pipe sizing, a minimum flow capacity for each size pipe was determined to evaluate if the existing outfall meets the peak flow identified for the basin. A minimum outfall size of 15-inches should be considered for public stormwater discharge to minimize restrictive conditions due to debris and sediment. From these assumptions, it was determined that 15 outfalls were adequately sized in the planning area, meaning the existing outfall size was greater than or equal to the determined maximum outfall size, and 66 outfalls should be increased in size. There are five basins, with a total area of 24 acres, where an outfall structure is not present. One basin area is proposed to be separated into two basins, with the existing outfall servicing one part of the basin, and a proposed outfall servicing the remaining area. A majority of the outfalls are located either directly on Estero Bay or on the finger canals that connect to Estero Bay. A sample outfall in the project area is shown below.

Donora Boulevard Cul-de-sac Outfall

3.0 SYSTEM-WIDE IMPROVEMENTS

A detailed description of stormwater infrastructure improvements recommended system-wide is contained in the following section. Each component of the system is described, including the justification for its inclusion in the proposed improvements. **Figure 11** through **Figure 15** show the proposed improvements included in this plan by phase.

3.1 OPEN SYSTEM

Many basins within the project area are relatively small and produce peak stormwater flows manageable by a maximum pipe size of 24-inches. In many areas, the Town owns right-of-way that has space available for an open drainage system. This system includes open swales, or roadside grass-lined ditches, for conveyance of stormwater, as well as treatment, to the basin outfall. Depending on driveway grades and available depth of cover, driveways may be culverted or inverted for cross flow.

The selected alternative includes 37,120 LF of open drainage that will drain to an outfall of 24-inches or smaller.

3.2 CLOSED SYSTEM

Multiple criteria were applied to basins to determine the need for a closed drainage system. This system is subsurface with flow entering through grated or curb inlets. Since the neighborhood roads within the Town are primarily without curb and gutter, grated inlets were assumed to be the only means of stormwater collection. Closed drainage systems typically involve a single trunk line that runs down one side of the road with cross drains spaced in a manner to collect the opposite side's flow and direct it to the trunk line.

Areas with limited right-of-way or those collecting off-site flows from the County's Estero Boulevard system were assumed to require a completely closed system. This type of system will account for 13,090 LF of the proposed improvements.

3.3 MIXED CONVEYANCE

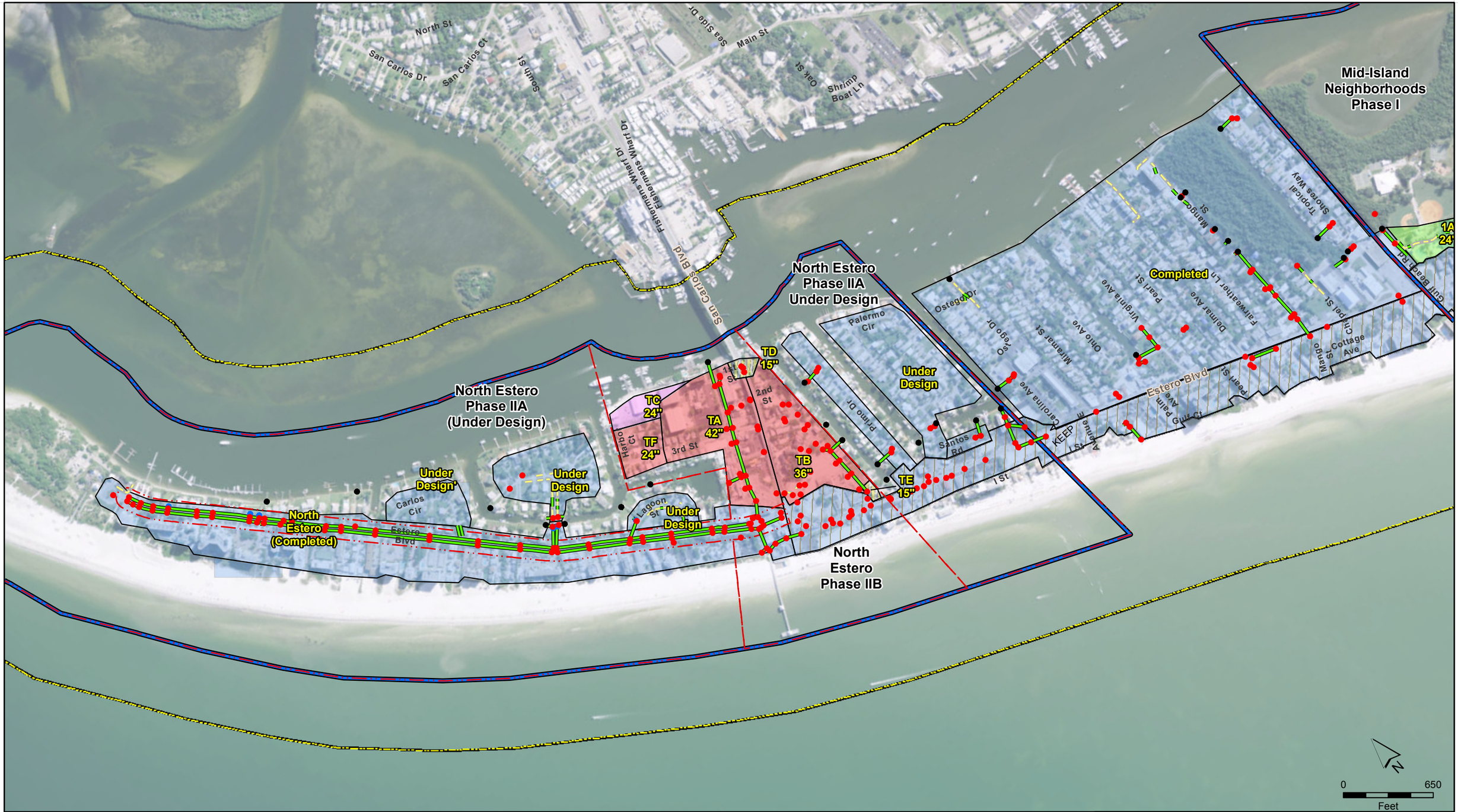
Multiple areas were deemed to require a mixture of both open and closed systems. These areas have available right-of-way for an open system; however, as the required flow capacity increases in the system, an open conveyance system becomes unfeasible. Where appropriate, inlets deemed will collect the open system flow and convey it to the outfall via a subsurface, closed system.

It is estimated that the mixed systems will comprise 63,727 LF of open drainage and 16,157 LF of closed drainage.

3.4 MAINTENANCE AREAS

Within the system, multiple areas were found to have adequate flow capacity at the outfall. Meaning, the calculated maximum diameter outfall for the basin is equal to or less than the existing outfall. In these areas, it is assumed that the conveyance system is also adequately sized for the design storm event. In these cases, it is proposed that the Town perform maintenance on these areas to ensure the existing system is operating at ideal conditions. Maintenance would include desilting swales and inlets, lining any cracked pipe, and rehabbing any damaged outfalls.

Existing right-of-way totaling 5,390 LF has been identified for this type of work.



Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin System Type
- Closed
- Mix
- Open

- Private
- O and M
- N/A

- Basin Boundary
- County Basin

Existing Infrastructure
- Inlets
- Junction Boxes
- Outfalls

- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

NORTH ESTERO PHASE IIB
PROPOSED INFRASTRUCTURE
AND BASIN MAP

TETRA TECH

FIGURE 11

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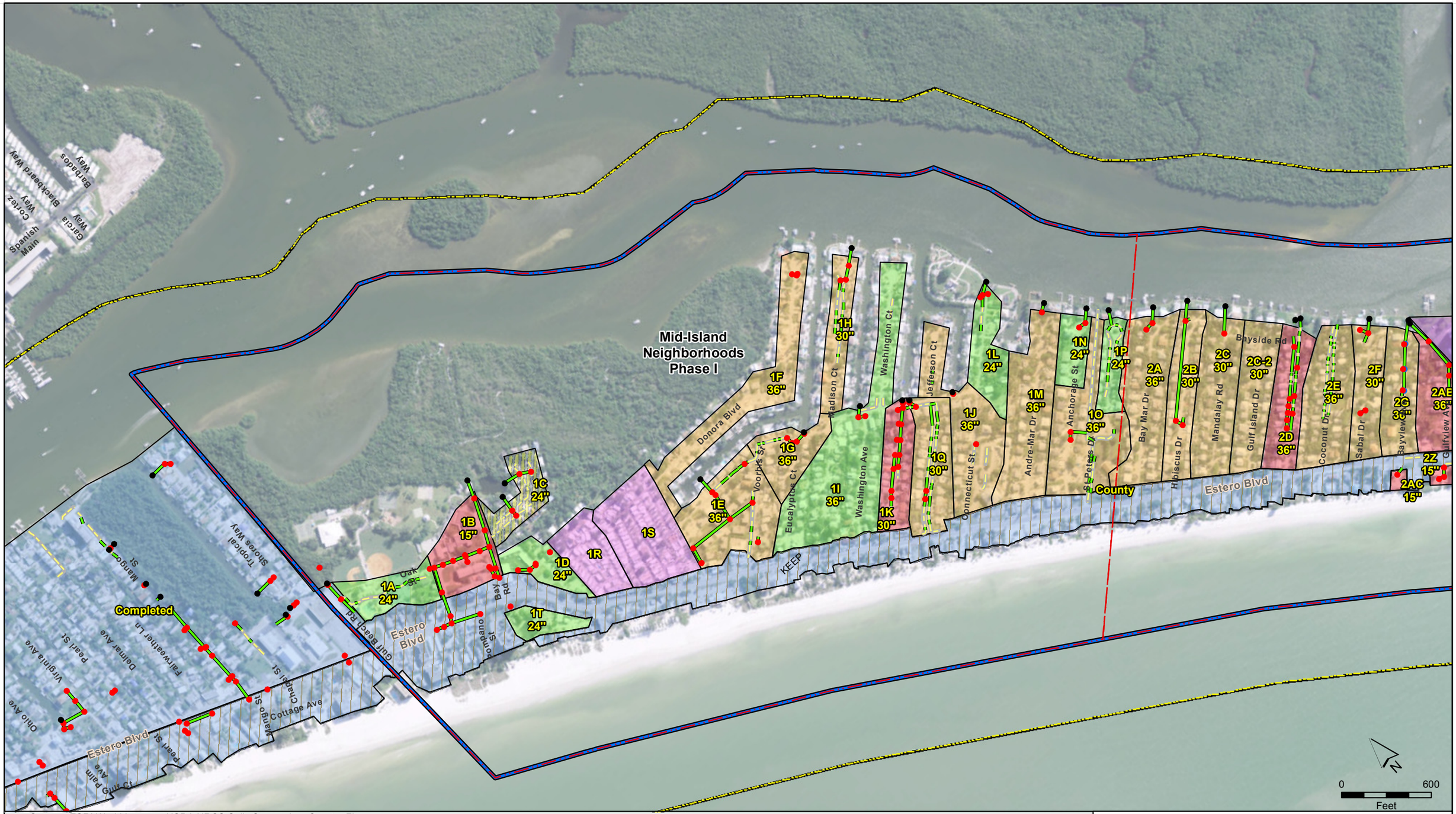

Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin System Type
- Closed
- Mix
- Open

- Private
- O and M
- N/A

- Basin Boundary
- County Basin

Existing Infrastructure
- Inlets
- Junction Boxes
- Outfalls

- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

MID-ISLAND NEIGHBORHOODS PHASE I PROPOSED INFRASTRUCTURE AND BASIN MAP

TETRA TECH

FIGURE 12

P:\IER\74765\200-74765-16005\GIS\Maps\20160518\BL_BasinsF12.mxd [alex.montalvo 6/1/2016]

Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin System Type
- Closed
- Mix
- Open
- Private
- O and M
- N/A

- Basin Boundary
- County Basin

Existing Infrastructure
- Inlets
- Junction Boxes
- Outfalls

- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

MID-ISLAND NEIGHBORHOODS PHASE II
PROPOSED INFRASTRUCTURE
AND BASIN MAP

TETRA TECH

FIGURE 13

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Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin System Type
- Closed
- Mix
- Open
- Private
- O and M
- N/A
- Basin Boundary
- County Basin

Existing Infrastructure
- Inlets
- Junction Boxes
- Outfalls
- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

MID-ISLAND NEIGHBORHOODS PHASE III
PROPOSED INFRASTRUCTURE
AND BASIN MAP

TETRA TECH

FIGURE 14

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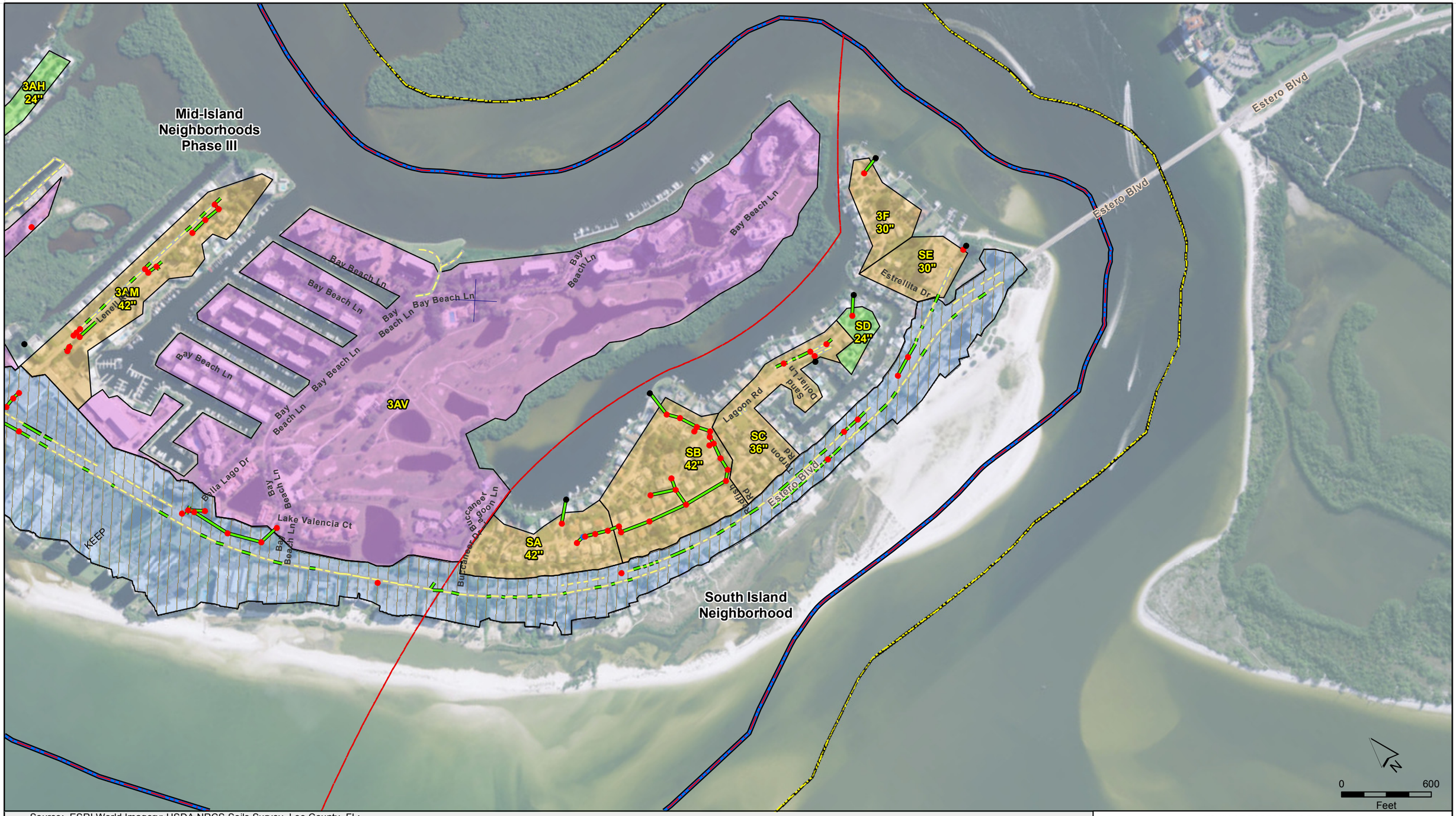

Source: ESRI World Imagery; USDA NRCS Soils Survey, Lee County, FL;

LEGEND

- Town of Fort Myers Beach
- Project Limits
- Project Phases

Basin System Type
- Closed
- Mix
- Open
- Private
- O and M
- N/A

- Basin Boundary
- County Basin

Existing Infrastructure
- Inlets
- Junction Boxes
- Outfalls
- Drain Pipes
- Roadside Swales

TOWN OF FORT MYERS BEACH
FACILITIES PLAN

SOUTH ISLAND NEIGHBORHOOD
PROPOSED INFRASTRUCTURE
AND BASIN MAP

TETRA TECH

FIGURE 15

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3.5 OUTFALLS

Outfalls are a key component to the proposed system. It is proposed that each outfall will undergo construction to ensure proper function of the system and adequate evacuation of stormwater. The following improvements are proposed for the outfalls.

3.5.1 New Outfalls

Certain basins have been identified as having no existing piped outfall. These locations are proposed to include a new piped outfall. New seawalls will be installed to provide a stable shoreline and support for an outfall penetration. This seawall will be constructed to tie into existing seawall in the vicinity to provide consistent storm surge resiliency.

For the selected alternative, 6 basins have been identified for installation of a new piped outfall.

3.5.2 Up-sized Outfall

As mentioned in Section 2.2.4, many outfalls have been identified as functionally deficient. It is proposed that these outfalls be replaced with a new outfall with a larger diameter to meet the peak flow requirement of the design storm. Construction of a larger outfall will require removal of a section of existing seawall and installation of new seawall that has been fabricated with a larger penetration. The existing pipe will be excavated and removed. The new outfall pipe will be installed through the new seawall and grouted in place for a watertight seal around the exterior of the pipe.

It is proposed that 66 outfalls be retrofit with a larger size pipe as part of the sediment basin alternative. The exfiltration alternative has less outfalls, 54, that require upsizing due to an assumption that including exfiltration will reduce the necessary pipe outfall diameter by one pipe size (6-inches) as a result of impoundment and reduction of peak flow rates.

3.5.2.1 NPDES/TMDL

Currently, there are no Total Maximum Daily Load (TMDL) pollutants set for the Town's receiving water bodies (Estero Bay and Gulf of Mexico). However, waterways that flow into these water bodies are listed as impaired. Therefore, it is likely that Estero Bay will be listed as impaired in the future and additional discharge requirements will have to be met by the Town.

The Town and Lee County currently act as co-permittees for a Phase I NPDES Municipal Separate Storm Sewer System (MS4) permit. At this time, there are no outfalls designated as major outfalls within the Town's system. A major outfall is defined as a single piped outfall with an inside diameter of 36-inches or greater or drainage area of more than 50 acres. The current permit is in its final year and the Town will be obtaining a new permit in the near future. A condition for the new permit is anticipated to require additional monitoring and sampling for specified pollutants.

The results of the analysis performed in this plan have designated twenty-five (25) outfalls to be sized 36-inches and larger to provide adequate flow capacity for the largest of basins. This would require the Town to provide additional monitoring and testing to meet the requirements of the Town's NPDES permit. The majority of the outfalls have homogeneous runoff contribution characteristics. It is assumed the NPDES program managers will allow for a representative sample of outfalls to be monitored for the entire system. This monitoring effort is anticipated to require 5 man-hour per qualifying rain event with sampling performed on a quarterly basis. Additionally, the Town will need to contract laboratory services to perform sample testing. These services are anticipated to cost $5,000 annually.

The current estimates show that all the outfalls that convey County runoff would require a pipe 36-inches or larger to meet the hydraulic constraints of the Estero Boulevard system.

As an alternative, these larger basins could be subdivided into smaller basins that would require smaller outfall sizes. Additional locations for outfalls would be considered during the engineering design phase with input from the Town regarding preferred easement locations.

3.5.3 Rehabilitated Outfalls

Outfalls that are determined as adequate for flow capacity are recommended for rehab based on existing conditions that have been observed within the Town. Due to age and environmental conditions, outfall piping may be inundated with barnacles, cracked, misaligned, separated at the joints, or deteriorating. Conservatively, all adequately sized outfalls should be replaced in-kind or lined to improve the functionality of the system. It is proposed that 15 outfalls be rehabbed.

3.5.4 Tidal Backflow Prevention Device

The Town currently has no backflow prevention measures within the existing stormwater system. To provide additional protection from storm surge on the island, backflow prevention devices are proposed for every outfall within the Town's system. Within the project area, 87 backflow prevention devices are proposed for installation.

Backflow prevention will reduce the impacts of regular high tide conditions and surge events lower than the top of the existing seawall. It also allows for maximum storage capacity of the system and reduces the amount of brackish water intrusion in the system. This will not protect the Town from storm surge conditions above the existing seawall elevation, but it will decrease the recovery time after a significant surge event. The backflow preventer will allow for evacuation of the system after the storm has receded below the seawall and fluctuates back to normal conditions.

3.6 ROADWAY DRAINAGE

To reduce on street ponding of surface water runoff, it is proposed that roadways within basins that include proposed capital improvements be milled and resurfaced to provide a normal roadway crown. This crowning of the road will direct runoff away from the center of the road to the roadside stormwater management system. A raised roadway center will also provide increased service during high storm events in providing a few inches of higher ground in elevation.

3.7 BEACH SIDE RIGHT-OF-WAY

Although, the majority of property on the beach side of Estero Boulevard is privately owned and maintained, the Town does own some of the right-of-way. The County is accounting for flows within these areas as a part of the Estero Boulevard improvement plan. However, the Town should consider improvements within the right-of-way by directly connecting these areas to the County's system. This would be the most cost-effective solution for achieving the desired LOS and reducing nuisance flooding. However, alternative solutions may also be explored and include pervious pavement and/or exfiltration absorption beds with a connection to the County's system as an overflow measure.

4.0 ALTERNATIVE ANALYSIS

To provide the most economical solutions to the deficiencies identified above, alternatives were evaluated that would have a lower overall opinion of probable construction cost. Although the stormwater issues being experienced within the Town are primarily caused by a lack of stormwater conveyance infrastructure within the system, the Town also desires to provide water quality treatment of stormwater runoff prior to the discharge into the canals and bay. Therefore, the alternatives explored in this plan have water quality treatment as a high priority prior to discharge into the bay.

Although data related to flood damages were not available for analysis as a part of this study, our preliminary estimates of the costs of not providing the recommended improvements is provided hereafter to establish a benchmark of the potential effects related to the ongoing operation and maintenance (O&M) of this deteriorating system.

4.1 NO ACTION

Existing stormwater management infrastructure within the planning area serves drainage basins totaling approximately 184 acres. A no action alternative would include the performance of regular maintenance on the existing system as well as the removal and replacement of failing infrastructure that is beyond its useful life. Careful planning to establish a rotating O&M and removal and replacement programs can avoid this process from becoming reactive and performed in short notice at a premium cost.

Table 4-1 provides a summary of the existing infrastructure inventory within the Town's areas of responsibility as well as projected annual maintenance costs by facility type.

Table 4-1. Existing Town Stormwater Infrastructure

Facility Type	Unit	Quantity	Maintenance Costs per Unit and Frequency	Total Annual Maintenance Cost
Swale	LF	29800	$0.50 Annually	$ 14,900
Storm Pipe	LF	33100	$6.00 Every 4 years	$ 49,650
Inlet	EA	396	$100 every 4 years	$ 9,900
Outfall	EA	100	$1,000 every 10 years	$ 10,000

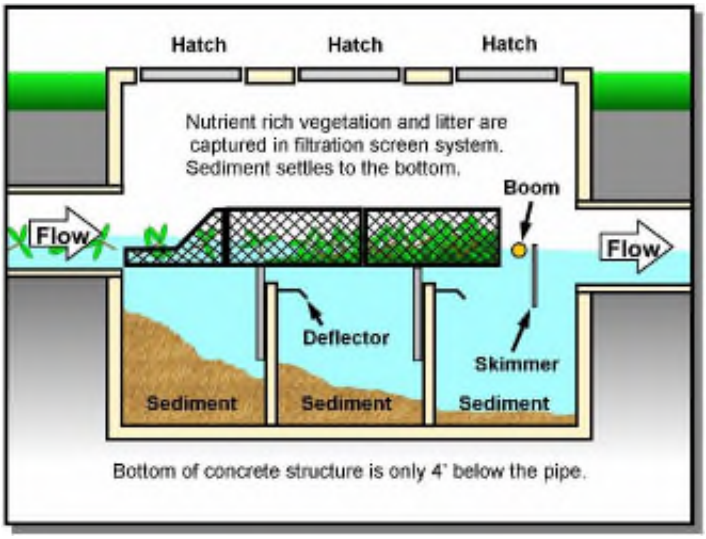
Typical lifespans for stormwater management facilities range from 20 years to 50 years depending on a number of factors. These include the type of material; amount of salt in the air and water; and an effective operation and maintenance program. Upon failure due to deterioration, collapse, or blockage due to sedimentation, stormwater facilities may cause upstream issues that could lead to a reduction in the LOS. This includes flooding in the roadway at a minimum, and habitable structure flooding in the worst case. Based on estimates, assumptions, and visual inspection, the entire system could require complete replacement within 20 years. The total cost of replacement in complete replacement today would be approximately $7,500,000. Spread over the next 50 years, this equates to $179,076 annually in today's dollars, but prices would increase with inflation. The net present value of the replacement and O&M is $5,200,000 in today's dollars with a 4.625% present value discount factor per FDEP State Revolving Fund staff. **Table 4-2** provides a summary of these replacement costs by facility type.

Table 4-2. Replacement Cost of Existing Town Stormwater Infrastructure

Facility Type	Unit	Quantity	Replacement Cost per Unit	Total Replacement Cost
Swale	LF	29800	$1	$ 29,800
Storm Pipe	LF	33100	$47	$ 1,555,700
Inlet	EA	396	$6000	$ 2,376,000
Outfall	EA	100	$35,000	$ 3,500,000
Total				$ 7,500,000

4.2 SEDIMENT BOXES

This alternative focuses the pollutant removal at the discharge point of the stormwater. At the end of the collection system a sediment box is inserted which includes multiple baffled chambers (with options for trash removal) that act to intercept sediment and other pollutant loads. A typical sediment baffle box is designed to remove sediment from the entire stormwater flow. The US Environmental Protection Agency (EPA) states that the total removal of a standard box will provide an average of 70.6% Total Suspended Solids (TSS) removal, and even higher for coarse sediment that this project would mostly encounter. Head loss is minimal and comparable to a large square catch basin because water flow is not directed off line for treatment.



Images: Suntree, Technologies, Inc.

For example, with the nutrient removal system, the Nutrient Separating Baffle Box® by SunTree Technologies, Inc., the system meets or exceeds National Pollutant Discharge Elimination System (NPDES) requirements for capturing a wide variety of pollutants including TSS, sediment, debris, organic material, hydrocarbons, and trash.

The baffle boxes will be precast concrete structure (or fiberglass), sized according to the storm pipe, and placed as close to the outfall as practical. Due to the proximity of the box to seawater, a higher grade of concrete should be used to withstand the aggressive environment. Sediment boxes are considerably smaller than exfiltration chambers but require space within the alignment of the pipe system near the outfall and are best suited outside of the roadway.

An illustration and image of a partially constructed sediment basin are shown on the right.

Sediment boxes are sized according to stormwater pipe sizes. The effective flows for removal of pollutants can be found in literature provided by the manufacturer.

4.3 EXFILTRATION CHAMBERS

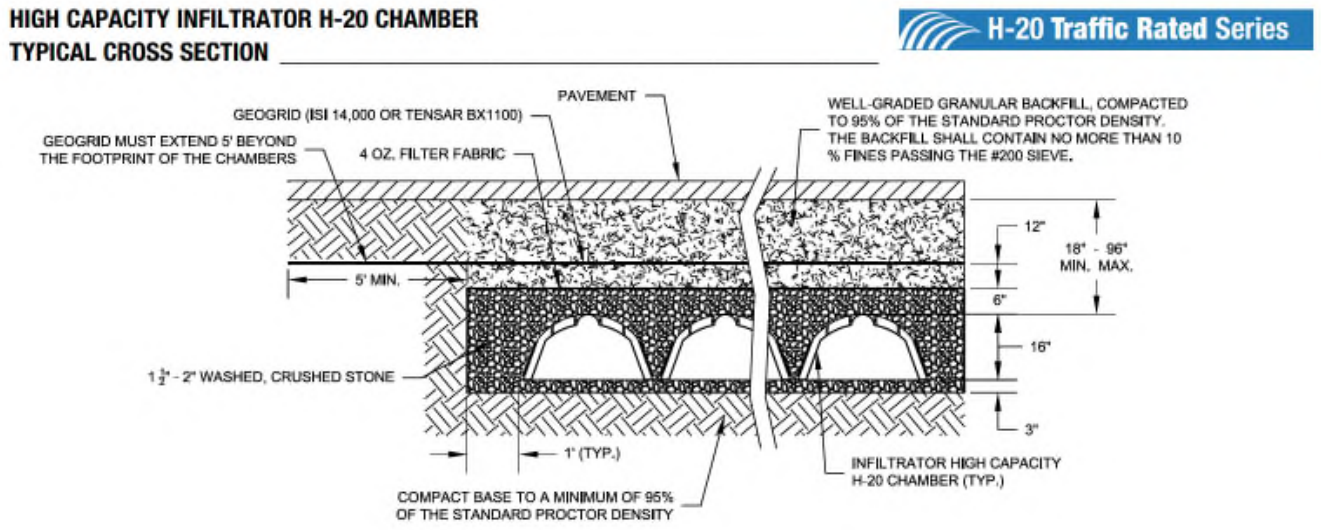
There are numerous forms of exfiltration devices, which disposes stormwater directly into the ground by placing hydraulic head pressure on a permeable distribution facility, thus forcing the stormwater into the void spaces in the surrounding soil. These systems are highly efficient in treating water quality since they do not allow discharges to downstream water bodies, if they are designed correctly. They typically consist of slotted culverts, perforated pipes, gravel trenches, and specialized corrugated plastic distribution galleries that are wrapped with special filter fabrics to prevent the fine soil materials from entering into the distribution system and clogging the perforations.

The ability of these systems to operate is dependent upon their use in soils where the groundwater table remains below the exfiltration system allowing the hydraulic pressure to force collected water through the native soils. The amount of void space in the surrounding soils controls how much stormwater can be stored in the system at a given time. Then, percolation rates associated with those soils will determine how fast the stormwater will infiltrate into the groundwater table, leaving the system available for mores stormwater volume. Silty soils, organic soils and clayey soils do not lend themselves to the proper operation of these systems. Often exfiltration pipes and galleries work very well in coastal communities when placed in relic dune systems where the water table is low and the sands have high percolation rates.

A typical exfiltration system's removal efficiency for total nitrogen (TN) and total phosphorus (TP) is dependent on the treatment volume of the system. For this plan, the removal efficiencies for a system serving a smaller basin area are approximately 74% for TN and 74% for TP. For a system serving a larger basin area, the removal efficiencies are approximately 84% for TN and 84 % for TP.

To achieve water quality treatment in basins not suited for exfiltration, due to limited space or high groundwater conditions, but larger than 3 acres, it is recommended that sediment basins be utilized as the option.

Typical Exfiltration Chamber Cross Section



Underdrains are typical of this type of stormwater best management practice (BMP). Underdrains are used extensively in communities that have high water tables and where exfiltration practices are not feasible. Underdrains allow the vertical recovery of stormwater management areas where the native soils do not provide sufficient time to evacuate the design treatment volume to allow the pond to be available for the next storm event.

4.4 COST COMPARISON

Within this plan, it has been assumed that each outfall within a basin larger than 3 acres will be retrofitted with a sediment box as a best management practice. These boxes vary in price based on size and range from $120,000 to $140,000, installed. The total number of sediment boxes proposed for this project area is 47. The estimated opinion of probable construction cost, including sediment boxes, is approximately $30,200,000. In this alternative, the sediment boxes account for $5,800,000 of construction costs.

Exfiltration systems cost approximately $150 per linear foot on average. The minimum roadway elevation assumed for effective installation of exfiltration chambers is elevation 4.0. This will provide a maximum chamber size of 36-inches using a bottom-less arch system as shown above. Based on required flows for each basin, a total linear

footage of exfiltration chamber within the project area is approximately 27,000 feet. This equates to a total project cost of $27,100,000 with $4,075,050 estimated for construction of exfiltration systems within the project.

In addition to the initial capital improvement costs required to construct the project, life cycle and maintenance costs should also be considered. For the purposes of consistency in comparing the projects, a life cycle analysis was performed using a 50-year maximum lifespan for the systems. All improvements within the sediment chamber alternative have been assumed to have a lifespan of 50 years and maintenance costs of approximately $287,997 annually. The exfiltration chambers have been assumed to require replacement twice within the 50-year life cycle. This alternative has annual maintenance costs of approximately $244,847 annually. The detailed project cost summary and results of the net present value analysis are contained in **Appendix B**. A summary of the results of the analysis are contained in **Table 4-3**.

Table 4-3. Net Present Value Analysis

Alternative	Net Present Value
No Action	$5,200,000
Sediment Boxes	$34,200,000
Exfiltration Chambers	$34,000,000

4.5 ALTERNATIVE SELECTION

Based on these costs, the projected difference between the two improvement alternatives is not significant. Based on the need for complete replacement of the exfiltration chambers during the life cycle and reduced water quality benefits as the effectiveness of each system gradually reduces, the selected alternative for construction is the sediment box alternative.

5.0 IMPACTS AND BENEFITS

The following impacts and benefits to the environment and socio-economic life of the Town are included in this section.

5.1 ENVIRONMENTAL

5.1.1 Flora and Fauna

The intended improvements will be within existing developed residential and commercial areas. Estero Island is nearly completely built-out and there are no anticipated impacts to flora or fauna in the area.

5.1.2 Threatened and Endangered Species

The intended improvements will be within existing developed residential and commercial areas. There are no anticipated T&E impacts, other than the temporary concerns for the outfall connections and cofferdams required to construct the modified seawall segments and outfalls. A “duckbill” type backflow preventer will be attached to outfall locations to reduce the potential for wildlife to enter the proposed stormwater system. Riprap will be added to reduce erosion from pipe discharges. There is a known Eagle nest, outside of the improvement area that will not be affected by the improvements.

As a condition of the contacts to work on this project, the Contactor will be required to educate the construction crews and sub-contractors of the environmental concerns and steps to avoid impacts to the environment.

5.1.3 Wetlands and Surface Waters

The intended improvements will be within existing developed residential and commercial areas. Estero Island is nearly completely built-out and there are no anticipated herbaceous wetland impacts. Impacts will be limited to required temporary impacts to construct the outfall connections along the existing seawall described in 5.1.2 above. No stormwater improvements are assumed to take place in the identified wetland in section 1.2.4.1.

Currently, Estero Island consistently floods during moderate to heavy rain and during extreme high tide events and surge conditions. Although this project will not reduce extreme event flooding, it will reduce the impact caused by moderate rain events in the existing flood-prone areas. Backflow preventers will provide sufficient protection from high tide conditions that inundate the pipe network during tide fluctuations.

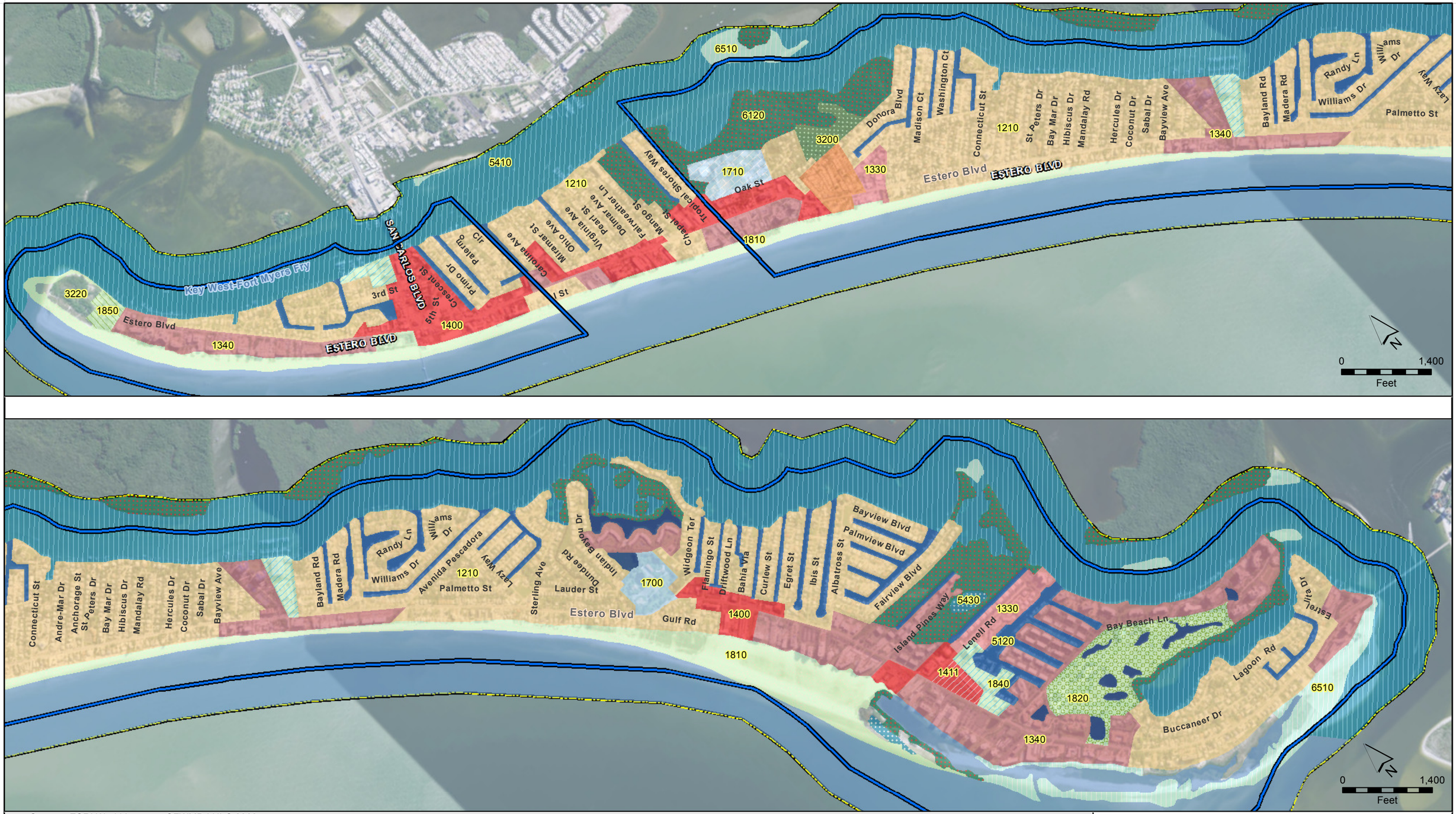
5.1.4 Population

The non-seasonal population in the Town is 6,277. The seasonal peak population is approximately 25,000 people for a duration of five (5) months from December to April.

Due to Estero Island being completely built-out, the planning area does not expect to see an increase in population. The facilities to be implemented are to replace the existing infrastructure and will be designed to handle the current flow conditions as dictated by the model provided by the Town.

5.1.5 Land Use and Development

Estero Island is diverse in its land use, ranging from single-family homes to hi-rise condominiums and beaches to shopping centers. The Town does not expect any further development. **Figure 16** illustrates the varying land uses throughout the planning area.



TOWN OF FORT MYERS BEACH
FACILITIES PLAN

LAND COVER MAP

TETRA TECH

FIGURE 16

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6.0 PROJECT IMPLEMENTATION SCHEDULE

The project will be completed in multiple phases. Preliminary work will be completed in conjunction with drainage improvements performed by the County on Estero Boulevard. Areas currently under design will also be constructed in the near future. The remaining areas will be constructed in four separate phases as described in previous sections. These are the Mid-Island Neighborhoods Phases 1, 2, and 3, and the South Island Neighborhoods.

6.1 NORTH ESTERO PHASE II

The design phase of the North Estero Water Main and Stormwater Improvements project is underway. This project has been separated into two (2) sub-phases to facilitate an accelerated construction schedule.

Phase IIA

Phase IIA of North Estero Phase II is currently at the 90% design stage. This project includes Carlos Circle, Matanzas Court, Lagoon Street, Primo Drive, Palermo Circle, and Santos Road. Permitting is underway and final design will be completed by August 2016. The Town has on-going contractor services that will perform the construction. This project will be completed by August 2017.

Phase IIB

Phase IIB of North Estero Phase II is included in the planning level design included in this plan. This project phase includes Crescent Street, First Street, Second Street, Third Street, Fourth Street, Fifth Street, Harbor Court, and Bonita Street. Upon completion of the Phase IIA design, the design of this phase will commence. This project will be completed FY 2016/2017.

6.2 ESTERO BOULEVARD OUTFALLS

As the County prepares to complete drainage improvements within the Estero Boulevard right-of-way, the Town will also perform construction on the installation of the proposed water main as well as future outfalls for Estero Boulevard runoff. Currently, the County is preparing to construct the portion of Estero Boulevard from Crescent Street to Sanders Drive (Publix). Based on the best available information provided by Lee County at the finalizing of this report, flows have been estimated for the outfalls of this portion of Estero Boulevard. Design plans and calculations include at least eight (8) outfalls to neighborhood streets that will ultimately outfall to Estero Bay. Of these streets, the following are included in this plan:

- Eucalyptus Court
- Jefferson Street
- Hercules Drive
- Bayview Avenue

Future improvements to Estero Boulevard east of Sanders Drive (Publix) will include additional outfalls to neighborhood streets. At least twelve (12) locations have been identified by Lee County for this use. Of these, nine (9) are included in this plan and the remainder will be determined at a later date. These are:

- Madera Road or Glenview Manor Drive
- Dakota Avenue
- Aberdeen Avenue
- Mound Road
- Curlew Street
- Albatross Street
- Lenell Road
- Buccaneer Drive
- Redfish Road

This work is scheduled to be completed during FY 2016/2017.

6.3 MID-ISLAND NEIGHBORHOODS

All other construction will be completed in three separate phases.

Phase 1
The first portion of neighborhood improvements will include the portion of the Town from School Street to St. Peters Drive. This will include improvements within all public right-of-way on the bay side and beach side of Estero Boulevard. Construction on this phase will be completed FY 2017/2018.

Phase 2
The second portion of the neighborhood improvements includes Bay Mar Drive to Lazy Way. This portion will be completed FY 2018/2019.

Phase 3
The final portion of the project will consist of Sterling Avenue to Lenell Road. This is scheduled to be completed FY 2019/2020.

6.4 SOUTH ISLAND NEIGHBORHOODS

The South Island Neighborhood Stormwater Improvements includes the Laguna Shores development and Estrellita Road neighborhood. This is the final stormwater retrofit project included in the facilities planning area and is scheduled to be completed FY 2020/2021.

7.0 FINANCIAL FEASIBILITY

This information can be found in **Appendix C**.

8.0 RECOMMENDATION

Based on the findings of this study, it is recommended that the Town proceed with the design and construction of the selected alternative. Through analysis, a comparison of the flow capacity of existing outfalls to peak flows generated by the contributing outfall has shown deficiencies in a majority of the project area. It is assumed that a deficiency of flow capacity at the outfall will cause upstream staging of runoff, and in turn, nuisance flooding, at a minimum.

To achieve the desired LOS flow capacity for the design storm, the recommended alternative proposes to increase the size of the conveyances within the system as well. Where possible, it is recommended that available right-of-way be utilized to convey flow via open swales, thus providing a level of water quality treatment prior to discharge. For basins projected to contribute large flows due to having drainage areas larger than three (3) acres, it is proposed that the Town install nutrient separating baffle boxes within the stormwater management system immediately upstream of the outfall to provide for the collection of sediment, suspended solids, and floating debris collected in the stormwater system.

This overall recommended plan is proposed due to the Town's susceptibility to consistent flooding and the overall condition of the existing stormwater system.

It should be noted that the Town is already in the process of securing funding for potable water system improvements in the same areas covered by this stormwater facilities plan. If these projects are constructed by the Town as one single project, the costs related to roadway reconstruction could see significant decreases due to economies of scale. It is recommended that the Town follow this course of action to capitalize on this.

APPENDIX A NORTH ESTERO PHASE IIA DESIGN PLANS

APPENDIX B COST INFORMATION ON ALTERNATIVES AND NET PRESENT VALUE ANALYSIS

APPENDIX C FINANCIAL FEASIBILITY

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