SARASOTA BAY WATERSHED PLAN BEST MANAGEMENT PRACTICES ANALYSIS

TASK 4 IDENTIFY AND ANALYZE BMPS FINAL REPORT

This report summarizes the development of conceptual best management practices (BMP) resulting in cost-effective project concepts that can be reasonably expected to contribute to achieving the flood protection and water quality levels of service.

April 28 2022

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Sarasota County

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Project Number:
Task 4 BMP Updated Final Report

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I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF, THAT THE CONCEPTUAL DESIGN OF THIS PROJECT, AS PREPARED UNDER MY PERSONAL DIRECTION AND CONTROL, COMPLIES WITH THE APPLICABLE PORTIONS OF THE SARASOTA COUNTY UNIFIED DEVELOPMENT CODE, THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, FY2022 & FY2023, COOPERATIVE FUNDING INITIATIVE GUIDELINES and THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT WATERSHED MANAGEMENT PROGRAM GUIDELINES AND SPECIFICATIONS.

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CERTIFICATE OF AUTHORIZATION: 27013

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Acronyms/Abbreviations

BAM	Biosorption Activated Media
BCA	Benefit Cost Analysis
BCR	Benefit Cost Ratio
BMP	Best Management Practices
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FFE	Finished Floor Elevation
GIS	Geographic Information System Mapping
ICPR	Interconnected Channel and Pond Routing Model
LID	Low Impact Development
LOS	Level of Service
MHP	Mobile Home Park
O & M	Operations and Maintenance
OSTDS	Onsite Treatment and Disposal Systems
PMA	Priority Management Area
SWFWMD	Southwest Florida Water Management District
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
VRSS	Vegetation Reinforced Soil Slope

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1.0 Introduction

This Report is a compilation of the work effort performed by Stantec Consulting Services Inc., Watershed Management Services, LLC and Janicki Environmental, Inc. to identify best management practices (BMP), to improve watershed conditions relative to flood protection and surface water quality levels of service. 18 Priority Management Areas (PMA) were identified throughout the Sarasota Bay Watershed focusing on locations with potential flood level of service (LOS) deficiencies, (LOS as defined by the County's Stormwater Environmental Utility) as well as locations that have been identified as having high nutrient loads (nitrogen) in stormwater run-off. These PMAs were evaluated, considering potential improvement strategies that could be implemented, based on the characteristics of the location(s). In this report, the methodology, analysis, results, and recommendations to improve the watershed are presented with detailed data and reference documents in the Appendix.

2.0 Priority Management Areas

The results of the technical analysis performed in Task 2 Flood Protection and Task 3 Surface Water Resource Assessment were used to identify the PMAs and target the identification of conceptual BMPs. This section outlines the methodology used to prioritize flooding deficiency areas and pollutant load hot spots to generate the boundaries for the PMAs.

2.1 Flooding Level of Service Deficiency Area Scoring and Ranking

In Task 2.4: FPLOS Report, roadway and structure level of service deficiencies were developed based on the updated ICPR version 4 flood model results and the County's level of service criteria. Both roadway and structure deficiencies were scored and ranked, according to the methodology presented in this section. The roadway flooding data was scored, based on the following variables:

- Evacuation route flooding
    - Whether or not there is an evacuation route that has flooding within it
    - Yes = 1, No = 0
    - Percent of evacuation roadways that are flooded when compared to the total length of evacuation roadways in the subcatchment
    - Score = 1 + (4 * % as a decimal) – a weighting of 4, multiplied by the percent as a decimal
- Arterial roadway flooding
    - Percent of arterial roadways that are flooded when compared to the total length of arterial roadways in the subcatchment
    - Score = (3 * % as a decimal) – a weighting of 3, multiplied by the percent as a decimal
- Collector roadway flooding
    - Percent of collector roadways that are flooded when compared to the total length of collector roadways in the subcatchment
    - Score = (2 * % as a decimal) – a weighting of 2, multiplied by the percent as a decimal
- Local roadway flooding
    - Percent of local roadways that are flooded when compared to the total length of local roadways in the subcatchment
    - Score = (1 * % as a decimal) – a weighting of 1, multiplied by the percent as a decimal
    - If local roadway falls within a plat boundary defined within last 15 years, this score was automatically a "0"

Once the variables were calculated, the Roadway Flooding Score was then calculated by summing the scores, with a maximum score of 10.

Roadway Flooding Score = (Evac + Art + Coll + Local)

The structure flooding data determined in *Task 2.4: FPLOS Report* was scored based on the following variables:

- Structure Flooding Variable
    - To get a decimal representation of the number of structures within a subcatchment that have Finished Floor Elevation (FFE) deficiencies, multiple the total number of deficient structures in the subcatchment by 0.01
    - 0.01 * number of structures with LOS Deficient FFE
- Repetitive Loss Variable

- Calculate the area (in acres) of a subcatchment that overlaps with a repetitive loss area
- Calculate the % of the subcatchment that is in a repetitive loss area (repetitive loss area / total area)
  - Repetitive Loss Variable = (1 * %)
    - 1 multiplied by the percent of the subcatchment within a repetitive loss area (as a decimal)

Once the variables were calculated, the Structure Flooding Score was then calculated by summing the scores, with a maximum score of 1.53.

In order to provide the structure flooding score on a scale from 0-10, it was normalized. This normalization was performed using the following equation:

Structure Flooding Score = (x_i – min(x)) / (max(x) – min(x)) * 10

$$z_i = (x_i - \min(x)) / (\max(x) - \min(x)) * 10$$

- **z_i:** The normalized Structure Flooding Score (on a scale from 0-10)
- **x_i:** The non-normalized score
- **min(x)**: The minimum value possible in the scoring (0)
- **max(x):** The maximum value in the dataset (1.53)

After calculating the structure and roadway scores for each subcatchment, a distribution of the scores was assessed to determine four breakpoints: High, Medium, Low and None. This step was performed individually for Roadway Flooding and Structure Flooding Scores. These rankings were important for identifying subcatchments that have structure or roadway flooding independent of each other.

See Appendix A, Exhibits 1and 2 for Structure and Roadway Flooding LOS Deficiency Ranking Exhibits.

2.2 Pollutant Load Area Scoring and Ranking

Water quality areas of concern with high pollutant loading for Total Nitrogen (TN) and Total Phosphorus (TP) were previously identified in Task 3.7 – Technical Memorandum #9. Pollutant loads were determined for each of the subcatchments within the watershed. The relative loading rates are categorized as low, medium, and high. See Task 3.7 – Technical Memorandum #9 for full details of the pollutant load rankings. Since this watershed is limited by nitrogen, that is the target nutrient pollutant which the team prioritized and utilized in the pollutant load prioritization and ranking.

2.3 Priority Management Area Creation and Ranking

Once each subcatchment had an individual roadway flooding score, structure flooding, and pollutant load priority ranking, the next step was to reduce the number of subcatchments and areas to only those that have overlap between all three deficiencies, and to begin to identify areas of subcatchments that can be logically grouped together as potential PMA's for further study and analysis.

Filters were applied to the subcatchments to identify only those that were of medium to high criticality for roadway flooding, structure flooding and pollutant loading.

The following criteria was used for each variable:

- Pollutant Loading = Only subcatchments ranked “High”
- Structure Flooding = Only subcatchments with a 7 or greater Structure Score (equal to or greater than the mean)
- Roadway Flooding = Only subcatchments with a 0.3 or greater Structure Score (equal to or greater than the mean)

Once these subcatchments were overlayed, a group assessment was performed by the team to identify areas of overlap to form preliminary priority areas. 17 areas were identified through the County as being suitable Priority Management Areas, warranting further evaluation and study. See Appendix A, Exhibit 4 for Priority Management Area Overlay Analysis output exhibit.

These 17 areas were then ranked independently for structure flooding, roadway flooding and TN loading as shown in Appendix A, Exhibits 5, 6 and 7, respectfully. The ranking of those individual factors was then combined for a cumulative ranking, based on the flooding, roadway, and pollutant loading scores of the subcatchments to help prioritize and rank the PMA’s in order of importance or most critical. The order of the 17 PMA’s based off the preliminary cumulative rankings is as follows, with 17 being the highest priority score:

Priority Management Area	**Preliminary Cumulative Ranking**	Individual Roadway Ranking	Individual Pollutant Load (TN) Ranking	Individual Structure Ranking
Iona/Palmer[1]	**17**	16	13	16
US 41 & Proctor	**16**	7	17	10
17th & US 301	**15**	12	11	13
Bee Ridge & Beneva	**14**	13	13	9
Bee Ridge between McIntosh & Honore	**13**	15	15	4
Tri-Par	**12**	10	10	14
Jefferson Ave between Fruitville & Honore	**11**	1	16	11
Pinecraft	**10**	17	3	17
Bee Ridge & US 41	**9**	14	8	5
Tuttle Circle	**8**	11	2	15
SMH & US 41	**7**	8	12	2
US 41 & 10th	**6**	4	6	12
Stickney Point	**5**	9	6	7
US 41 & Highland	**4**	3	9	6
Myrtle and US 301	**3**	6	5	3
Northern Siesta	**2**	2	1	8
Tuttle & Fruitvillle	**1**	5	4	1

[1] = The Iona/Palmer PMA was later removed from the list as the area is undergoing development.

See Appendix A: Exhibit 8 for the combined PMA ranking.

Modifications were made to this list prior to finalizing it as discussed below. After further review, it was determined that the pollutant loading rates for the Iona/Palmer PMA did not reflect the recent residential development, leading to inaccurate results, based on agricultural conditions. In addition, the roadway flooding had not accounted for the County's 12-inch local street flooding level of service. These factors led to the removal of Iona/Palmer from the list.

Two PMAs were added to the list: MLK & Orange and Faubel Street. The MLK & Orange area was added with the knowledge of previous flood control projects in Whitaker Bayou, that utilized pump systems and did not meet effective cost-benefit scoring, with the intent to develop a non-pump flood mitigation project that would provide a preferable score. Based on discussions with County and City of Sarasota staff, Faubel Street on Siesta Key is an area of known flooding in the City of Sarasota and field investigations confirmed the issues in this area.

2.4 Final Priority Management Areas

After removing Iona/Palmer and adding MLK & Orange and Faubel Street, the final Priority Management Area list is comprised of the following list of 18 areas:

- Tri-Par
- US 41 & Highland
- Myrtle & US 301
- MLK & Orange
- 17th & US 301
- US 41 & 10th Street
- Bee Ridge & Beneva
- Tuttle Circle
- Bee Ridge between McIntosh & Honore
- Pinecraft
- Jefferson Ave
- Sarasota Memorial Hospital & US 41
- Downtown
- Bee Ridge & US 41
- Stickney Point
- Northern Siesta Key
- US 41 & Proctor
- Faubel Street

See Figure 1 for locations of the PMAs.

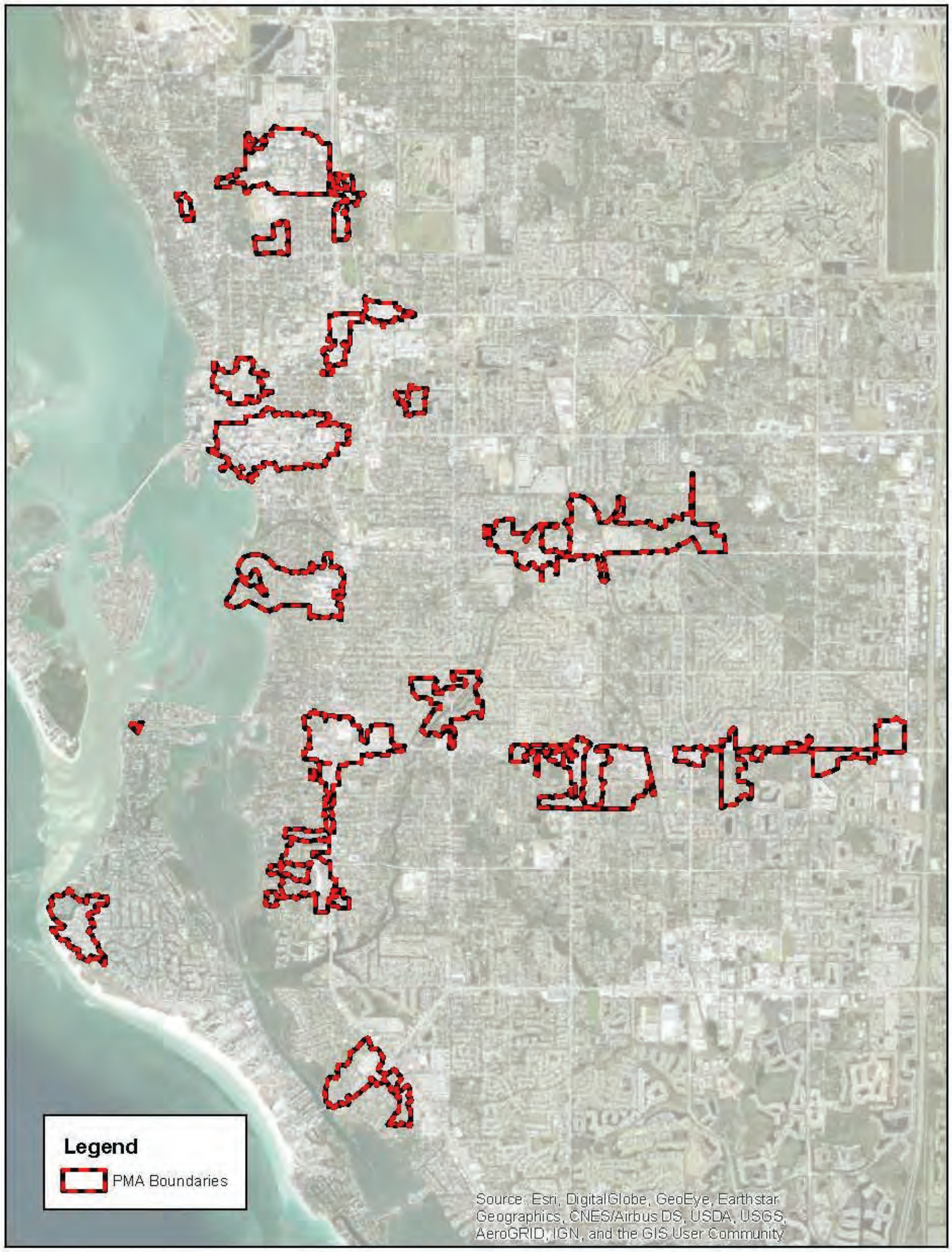


Figure 1 - Priority Management Areas

Tri-Par Area

The Tri-Par Area is subject to historic flooding, located within Whitaker Bayou basin at the confluence of Whitaker Main Canal and Tributary A, as well as confluence of Tributaries A and B. The area has a history of flooding and includes significant nitrogen loading as well – which is primarily due to the age and intensity of land-use and commercial/industrial land-use types.

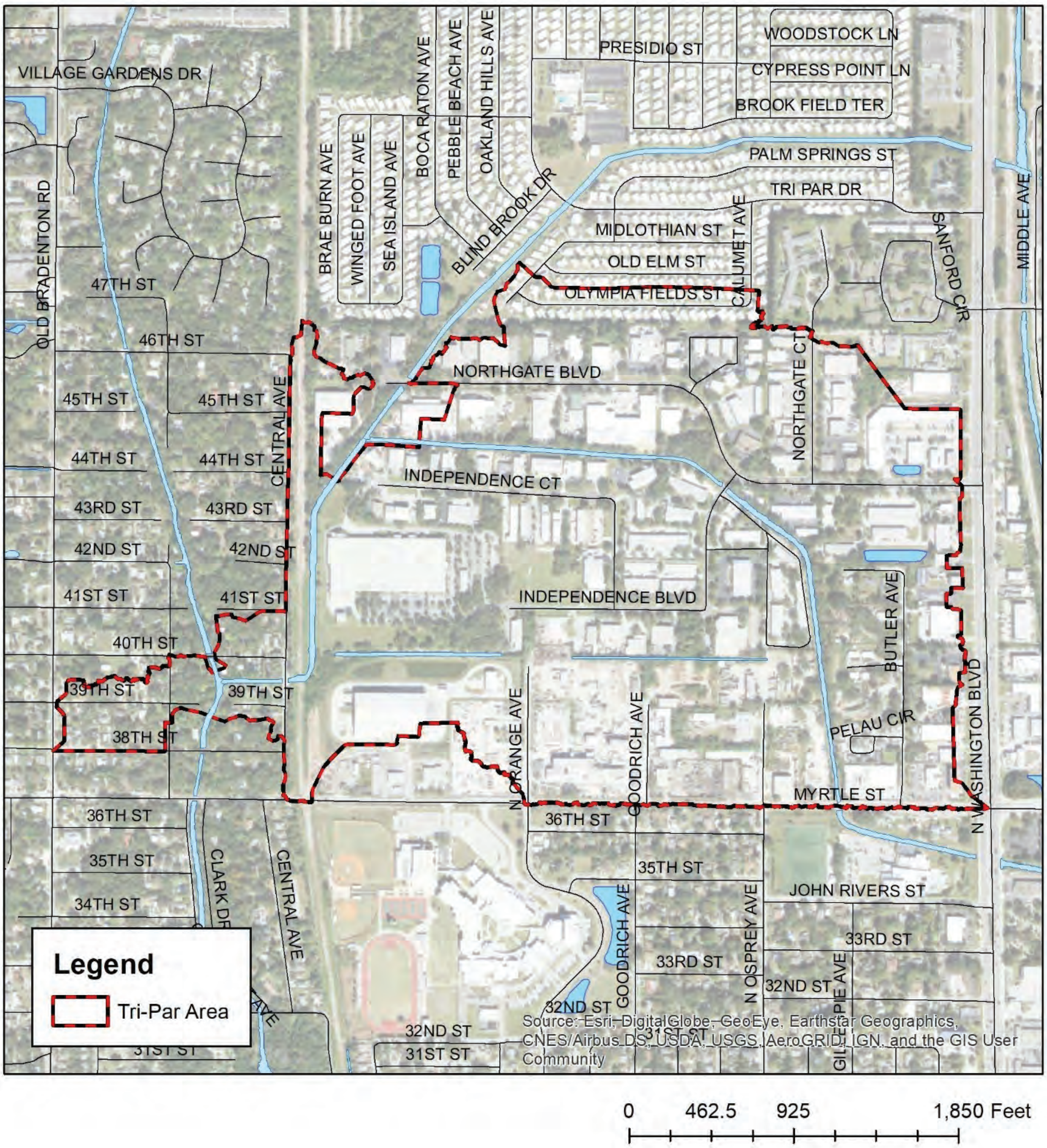


Figure 2 - Tri-Par Priority Management Area

US-41 and Highland Area

This area is along the north US41 corridor with older development along the roadway. There is a Roadway LOS deficiency on US 41 with high or medium nutrient loading. The area is in the northern portion of the City of Sarasota. There are significant areas such as this existing throughout the watershed, that have little or no stormwater treatment facilities due to the age of development and urbanization.

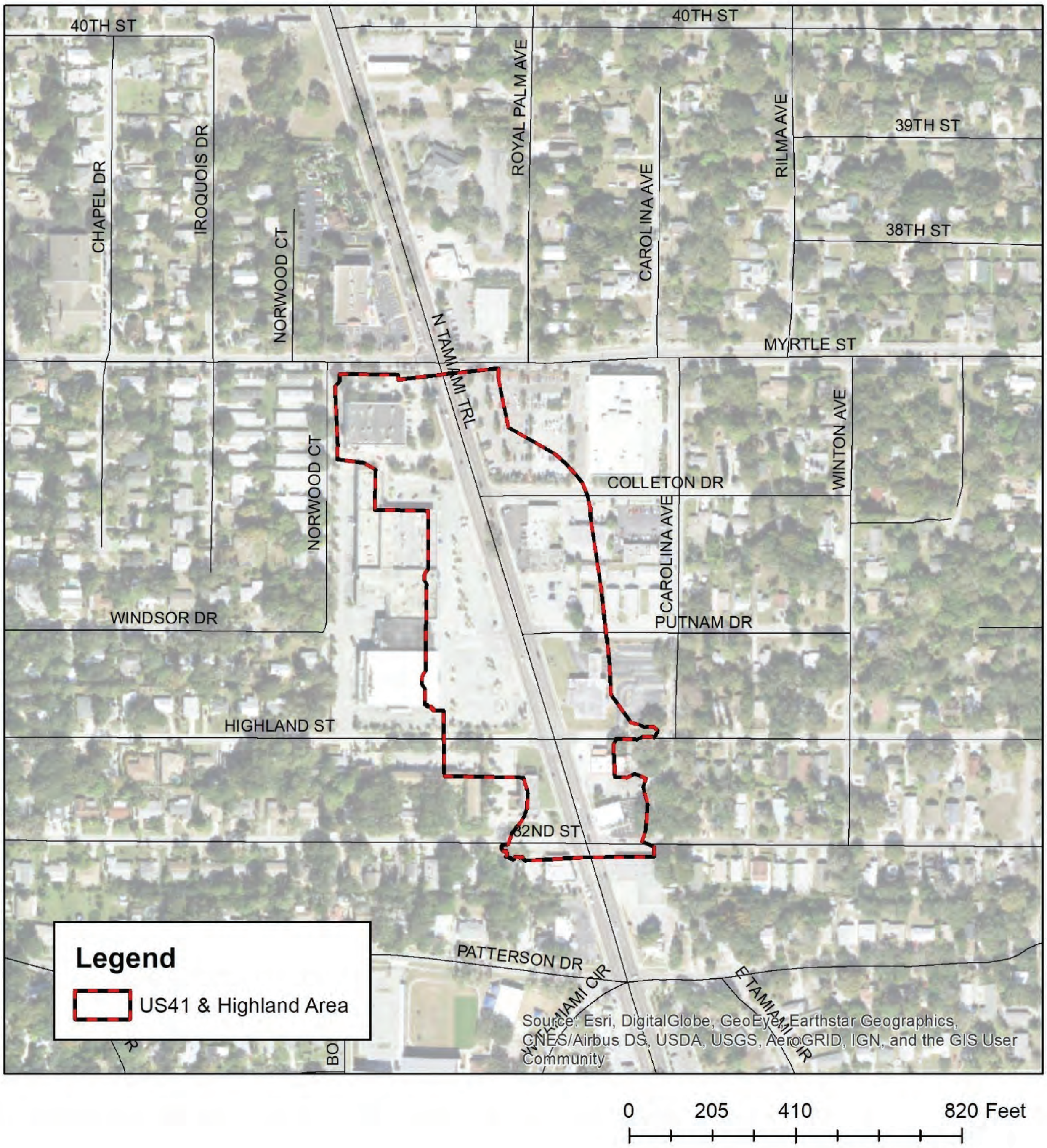


Figure 3 - US 41 & Highland Priority Management Area

Myrtle and US-301 Area

This section of 301 is an evacuation route with existing street flooding; the area has been studied previously with no cost-effective solutions identified. There are recent improvements along Myrtle St that have had some flood benefits.

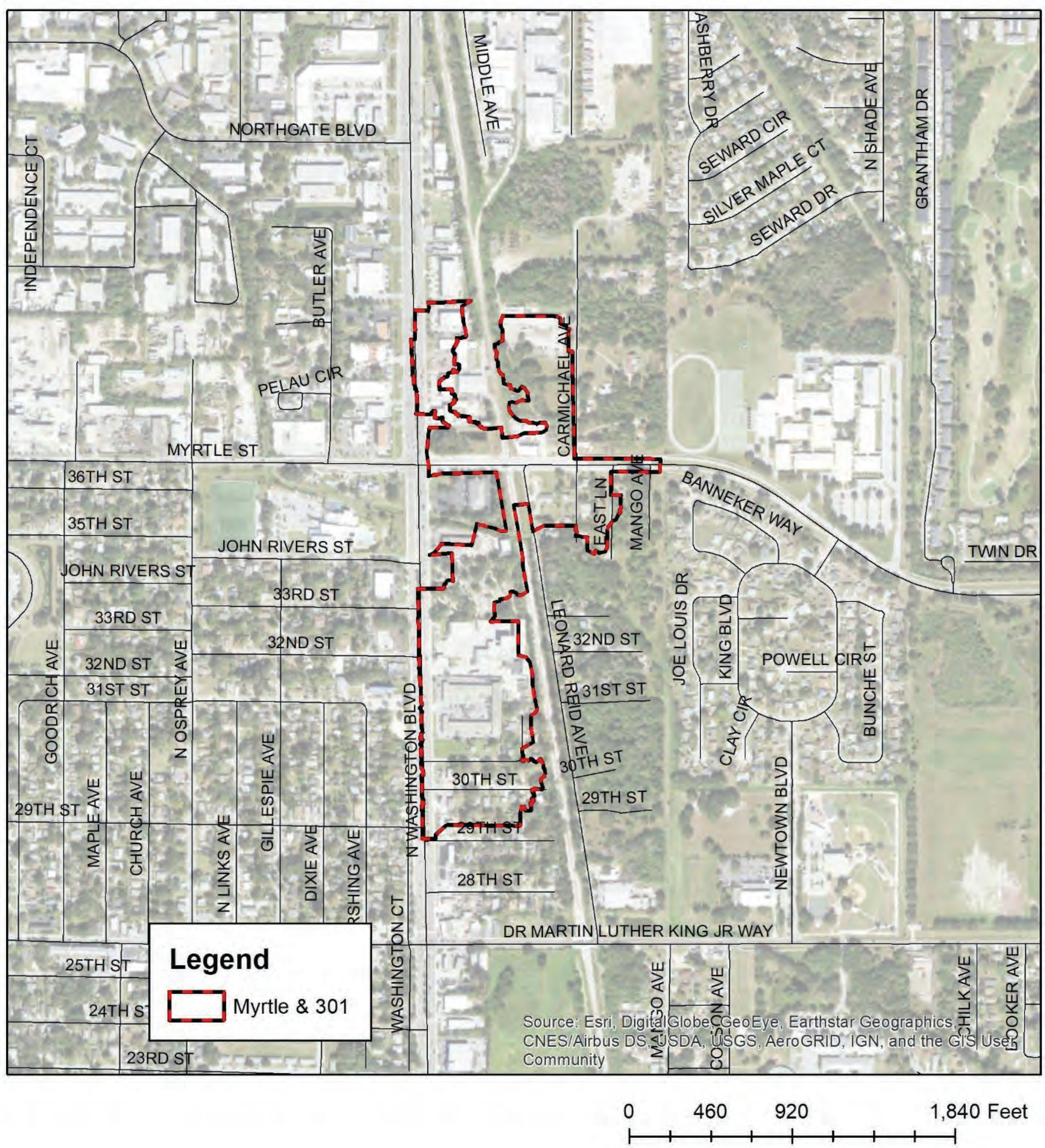


Figure 4 - Myrtle & US 301 Priority Management Area

Martin Luther King and Orange

This is a contributing area to Whitaker Bayou Tributary C and includes close to 60 structures with potential flooding level of service deficiencies. The area has a history of flooding and includes significant nitrogen loading areas as well. Nutrient loading is primarily due to the age and intensity of land-use as well as various land-use types that are common in the surrounding area (commercial / industrial).

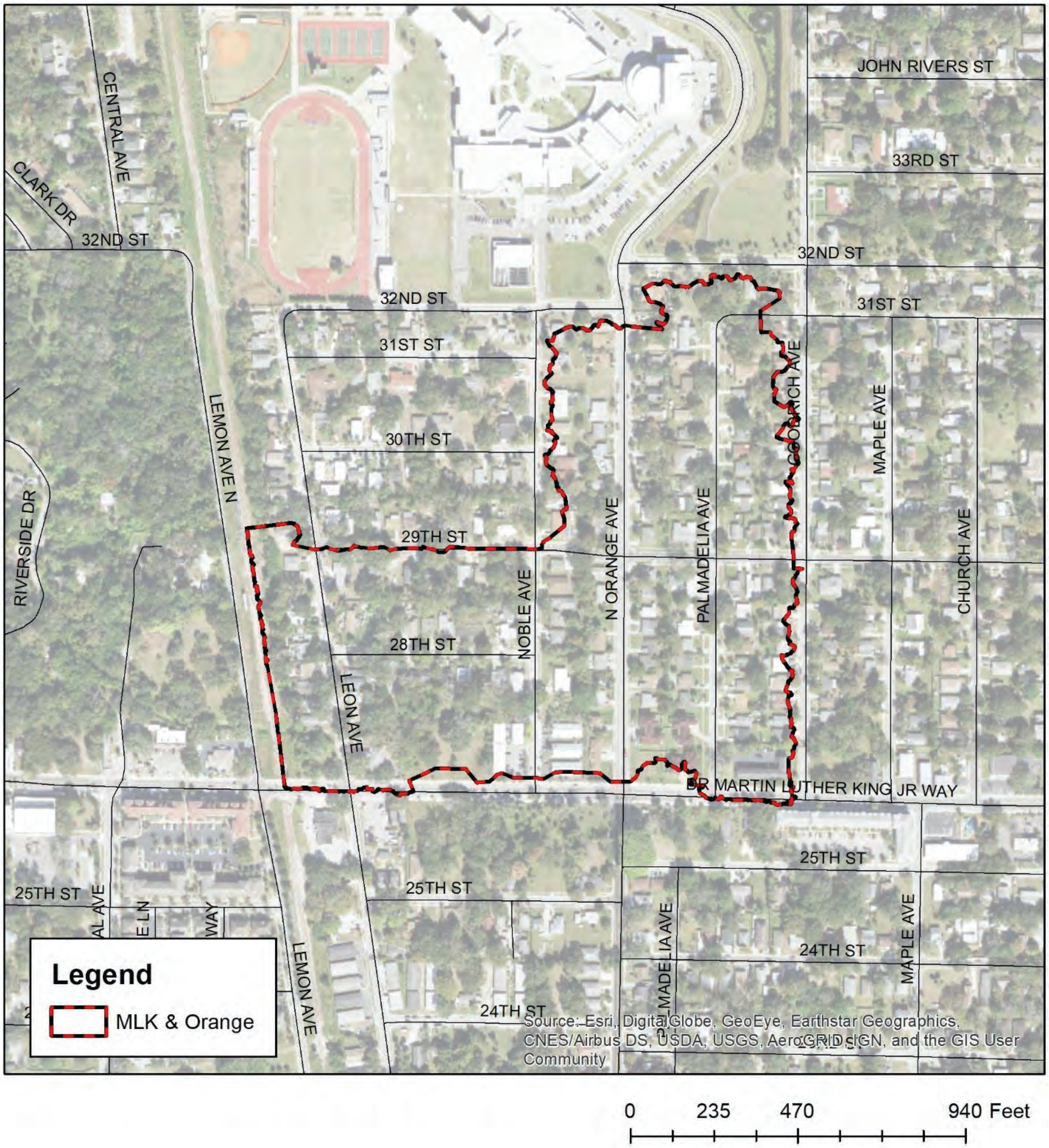


Figure 5 - MLK & Orange Priority Management Area

17th and US-301 Area

This area has street flooding level of service deficiencies on US - 301, existing street flooding on US - 301, 17th Street and N. East Ave and Structure flooding LOS deficient for 10 commercial buildings. The area also experiences high or medium nitrogen loading throughout.

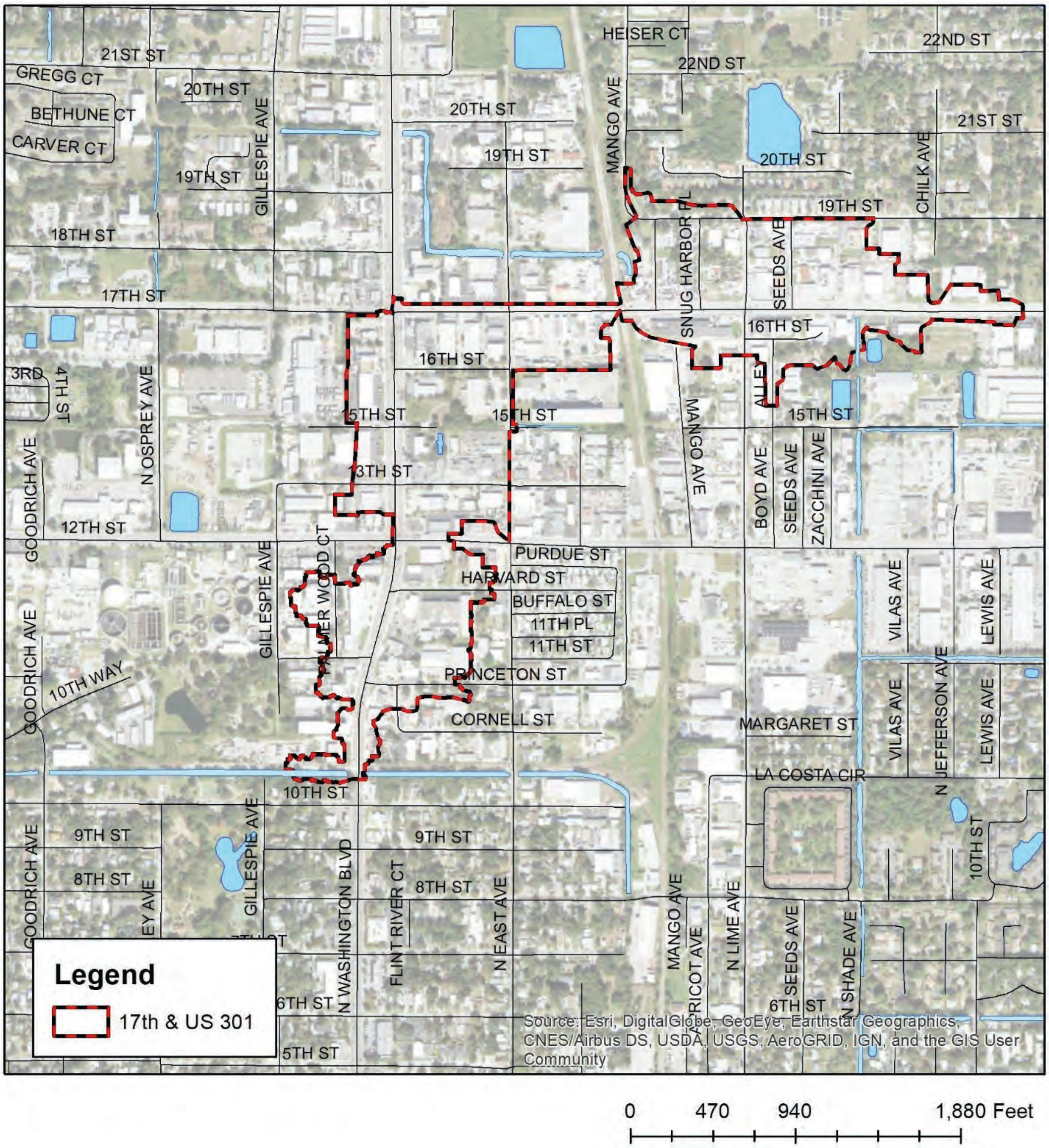


Figure 6 - 17th & US301 Priority Management Area

US-41 and 10th Street Area

There is a roadway LOS deficiency on US-41 with high or medium nutrient loading. Intense urban development upstream of the 10th Street boat basin contributes to the direct discharge of stormwater run-off into Sarasota Bay. The boat basin has been maintained throughout the years and a sediment removal project was completed in 2018. SWFWMD cooperatively funded project No. W606 to install a nutrient separating baffle box on 10th St. just east of Florida Ave. The Bay Partnership is redeveloping the City owned bayfront into a more highly used public space and is interested in partnering on improvements.

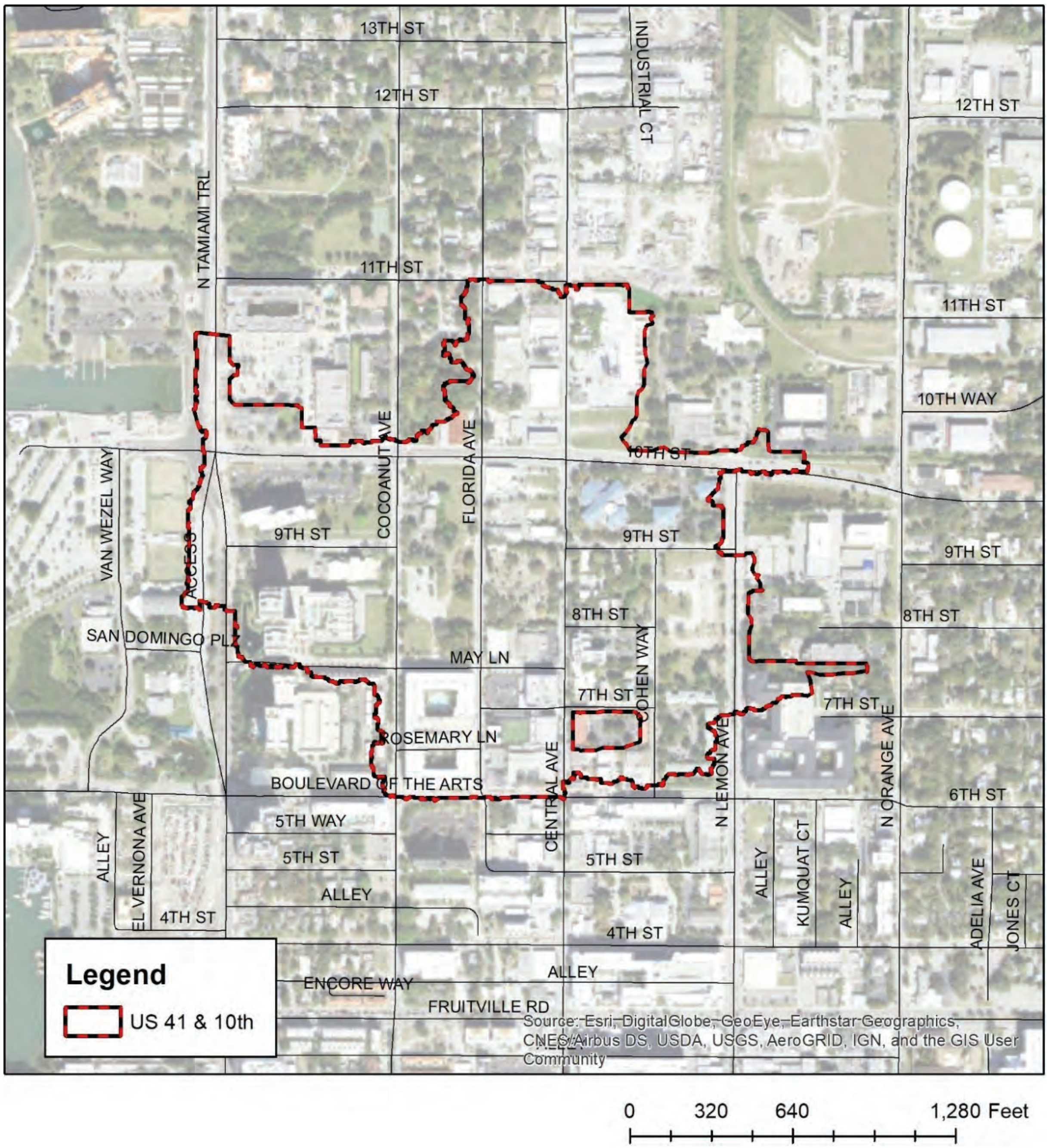


Figure 7 - US 41 & 10th Street Priority Management Area

Bee Ridge Road and Beneva Road Area

This section of Bee Ridge Road is an evacuation route with existing street flooding. The runoff flows through the stormwater ponds in the Forest Lakes subdivision. The pond and existing stormwater infrastructure have experienced significant sediment loading throughout the years.

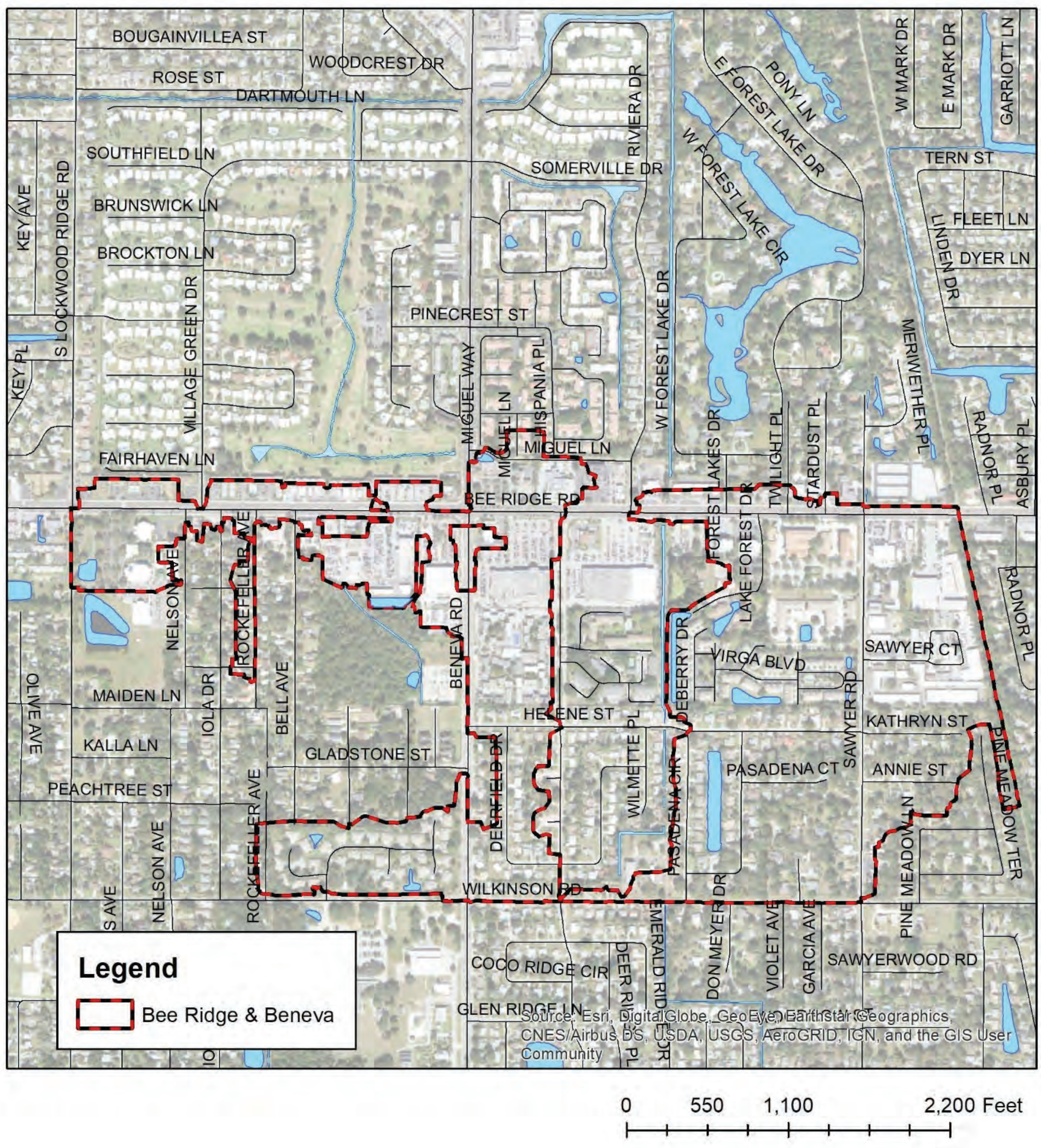


Figure 8 - Bee Ridge & Beneva Priority Management Area

Tuttle Circle Area

Along Phillippi Creek, a historic dam from agricultural use has contributed to significant sediment build up and proliferation of invasive species above and below the dam in the Creek. It was converted to residential in the 1950's with drainage ditches directly discharging stormwater to tidal system with no stormwater BMP's. The County had Weiler Engineering perform a study in 2019 to evaluate options to remove the dam which are incorporated into this analysis and can be found in Appendix C.

Figure 9 - Tuttle Circle Priority Management Area

Bee Ridge between McIntosh and Honore Area

The 486 Canal system has degraded at Cattlemen Road; opportunities may exist for maximizing storage and treatment restoration.

Figure 10 - Bee Ridge between McIntosh & Honore Priority Management Area

Pinecraft Area

This is the area of the original headwaters of Phillippi Creek, as well as the location where tidal influence becomes negligible. Significant sediment deposition occurs at Beneva Road Bridge and the Railroad Trestle Bridge. Further, large, dense development exists along both sides of the creek – all with little existing BMP's.

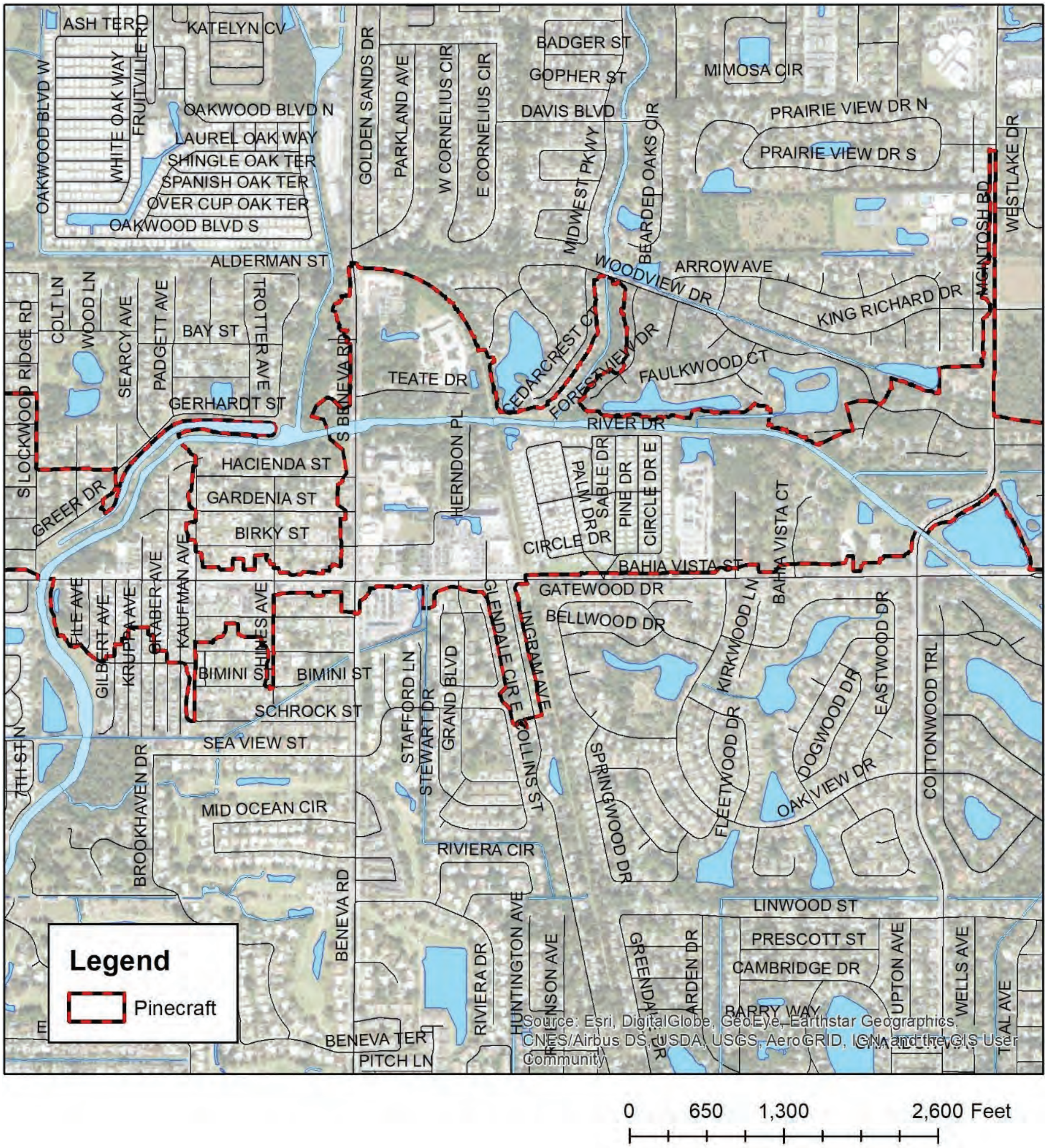


Figure 11 - Pinecraft Priority Management Area

Jefferson Avenue Area

Potential structural LOS deficiencies exist for four multifamily structures, with high or medium nutrient loading. The area is east of the downtown City of Sarasota area. Nutrient loading is primarily due to the age and intensity of land-use.

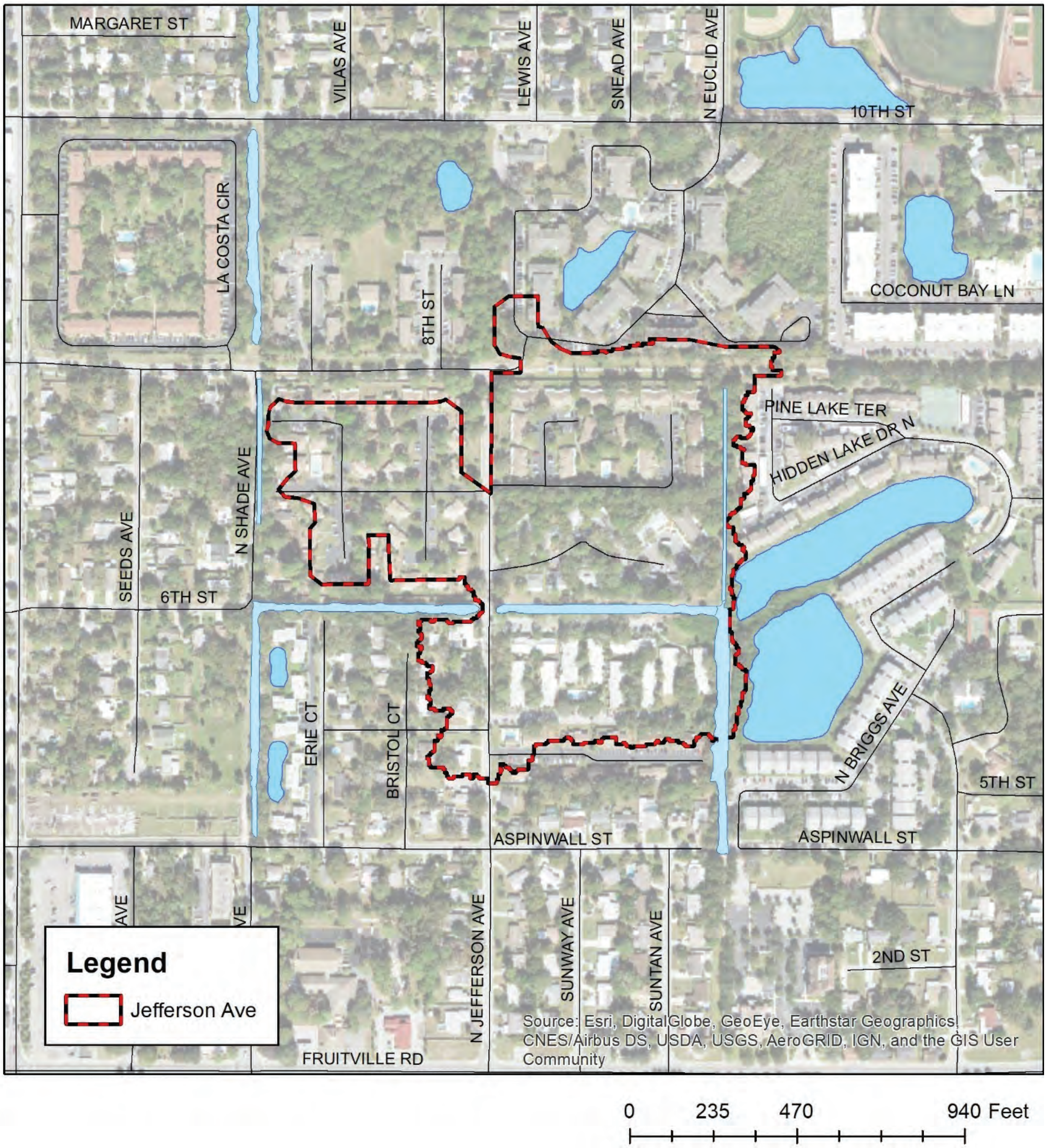


Figure 12 - Jefferson Ave Priority Management Area

Sarasota Memorial Hospital and US-41 Area

Existing street flooding on Harbor Drive, Hillview Drive and Flower Drive in the Harbor Acres subdivision is a function of tidal influence as well as being downstream from a dense commercial development with minimal BMP’s. The drainage within this subbasin drains from the natural ridge along US-41 to the bay through the existing neighborhoods.

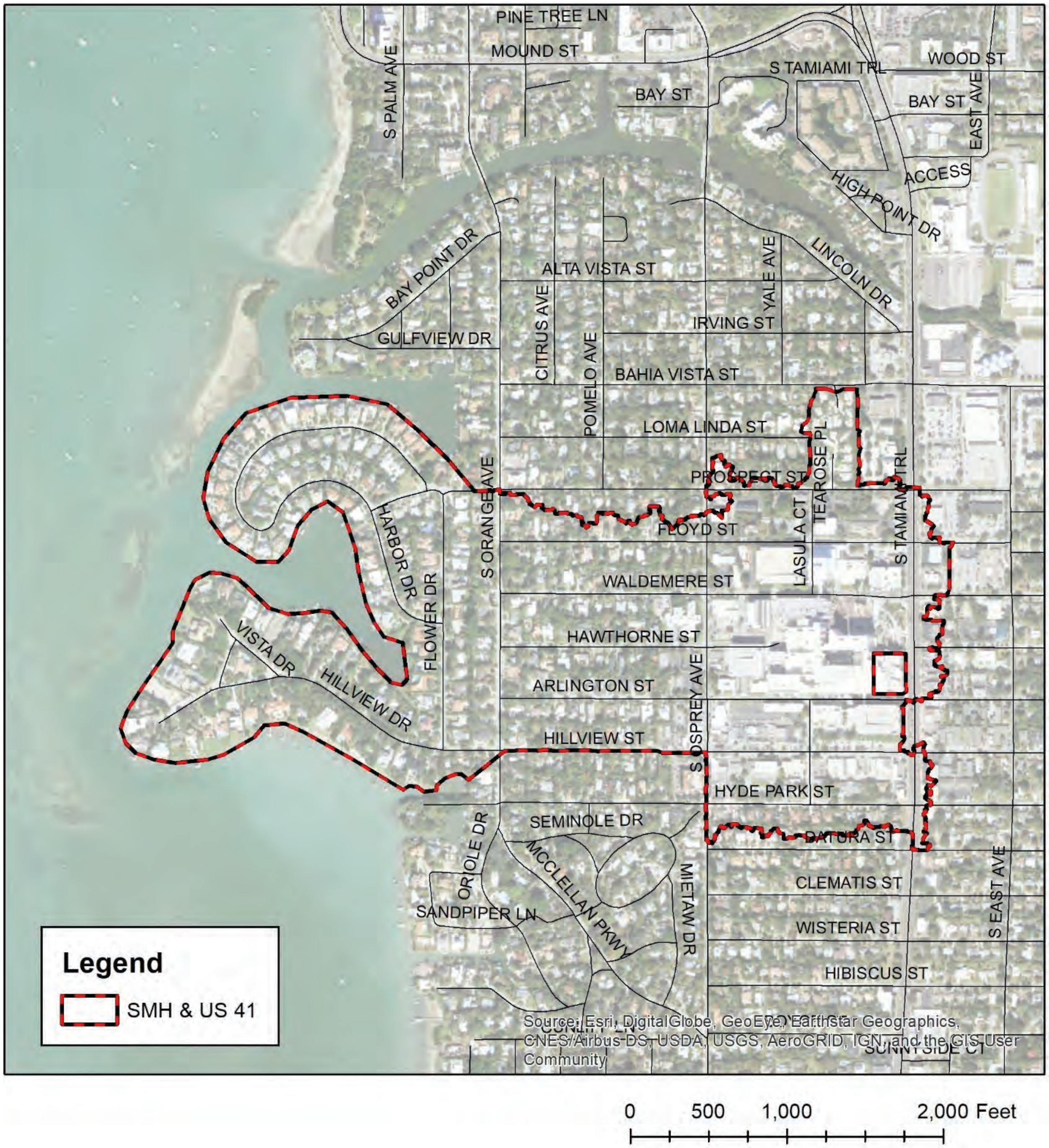


Figure 13 - Sarasota Memorial Hospital & US 41 Priority Management Area

Downtown Area

There are over 20 outfalls that directly discharge from the urban area of the City of Sarasota into the boat basin and bay adjacent to Marina Jack's. Additionally, the stormwater BMP's that exist are stressed and tidally influenced. Further, the existing FDOT ponds are being retrofitted to accommodate intersection improvements at Gulfstream and US41. There is an open space buffer that exists between downtown and the water, however, the open space is used often for civic and public events.

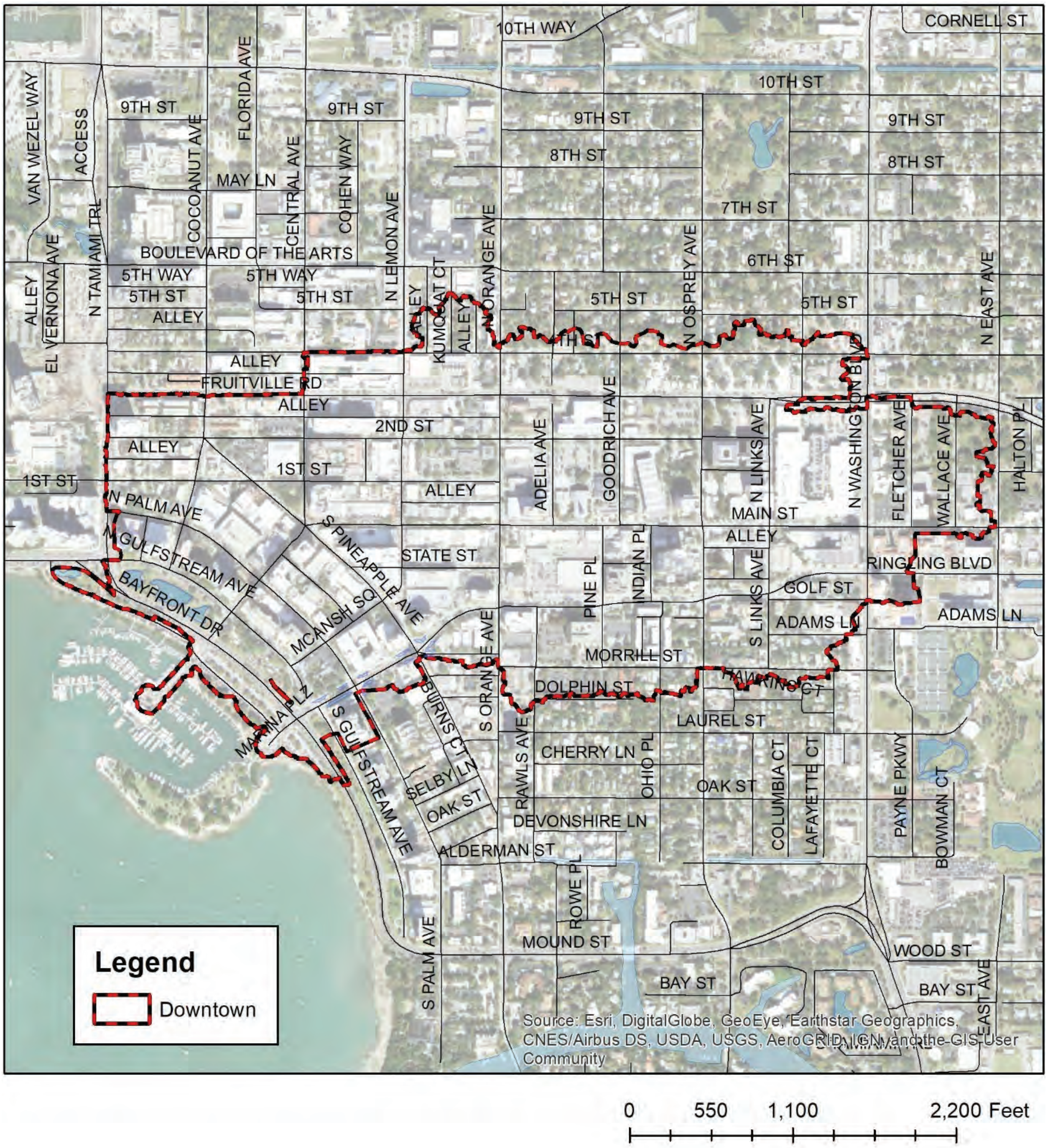


Figure 14 - Downtown Priority Management Area

Bee Ridge Road and US-41 Area

This section of Bee Ridge Road and Bay Street is an evacuation route with existing street flooding. The area is an important evacuation route for Siesta Key and the Coastal areas. Additionally, the neighborhoods are well established, having been built in the 1940's-1960's – thereby existing without major stormwater BMP's. The system outfalls have been improved over the years (stormwater strainer at Tangier Terrace and Bay Street) – but the improvements are not adequate to remove nutrients from the water column.

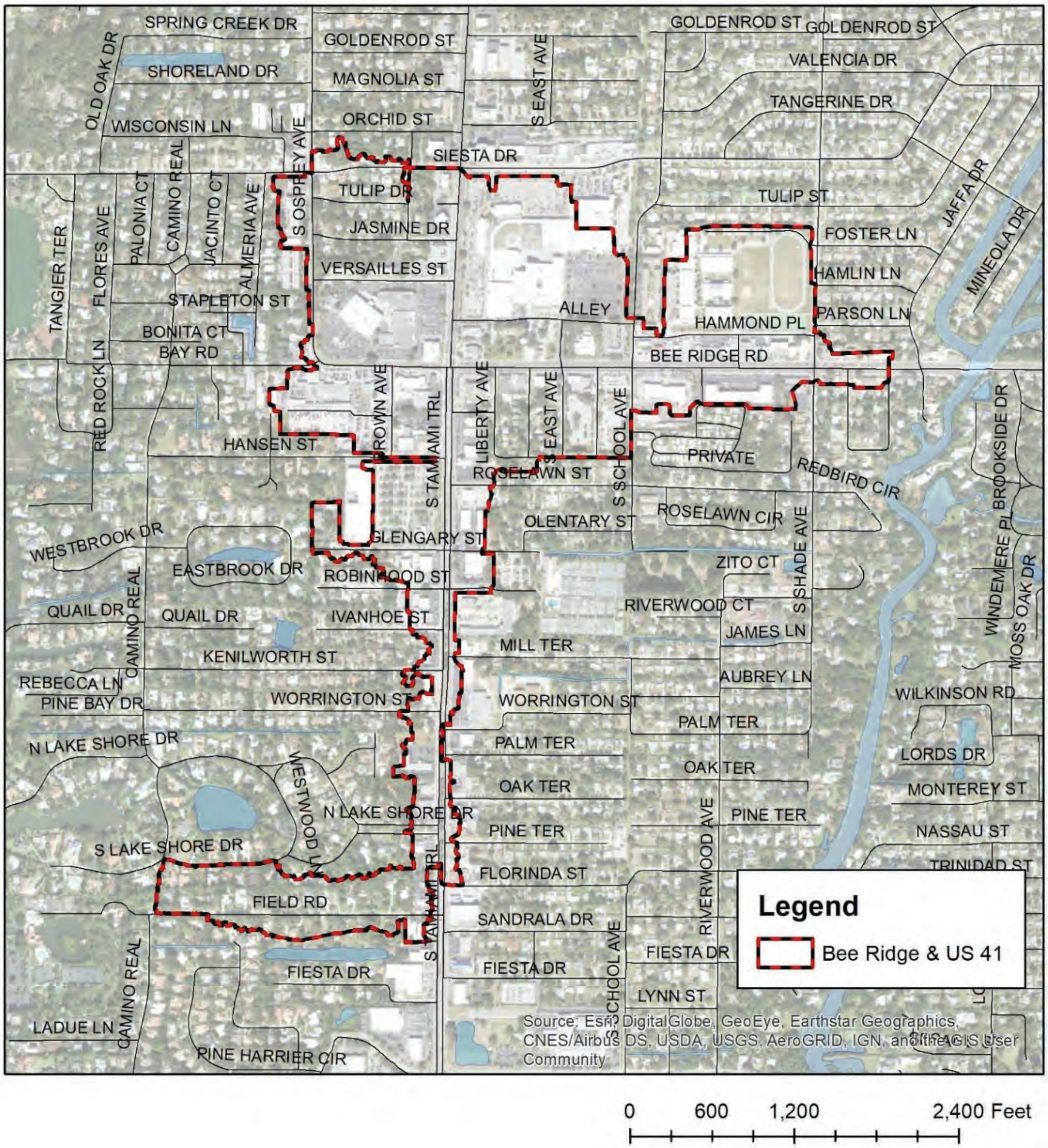


Figure 15 - Bee Ridge & US41 Priority Management Area

Stickney Point Area

This area experiences street flooding associated with stormwater and tidal influences. The areas are well established and exist with minimal stormwater BMP's; most of the drainage discharges directly into the intercoastal waterway.

Figure 16 - Stickney Point Priority Management Area

Northern Siesta Key Area

Minor flooding LOS deficiencies with small area of high nutrient loading exist along Sandy Hook and Grand Canal areas. As part of the Coastal Fringe Roberts Bay North watershed, identifying BMP's resilient to sea level rise is a challenge.

Figure 17 - Northern Siesta Priority Management Area

US-41 and Proctor Road

This section of US-41 has experienced flooding in the past. The area is primarily developed residential, although there is a commercial corridor along the arterial roadways (Tamiami Trail and Proctor Road). The area has aging stormwater ponds that ultimately have direct discharge into the bay.

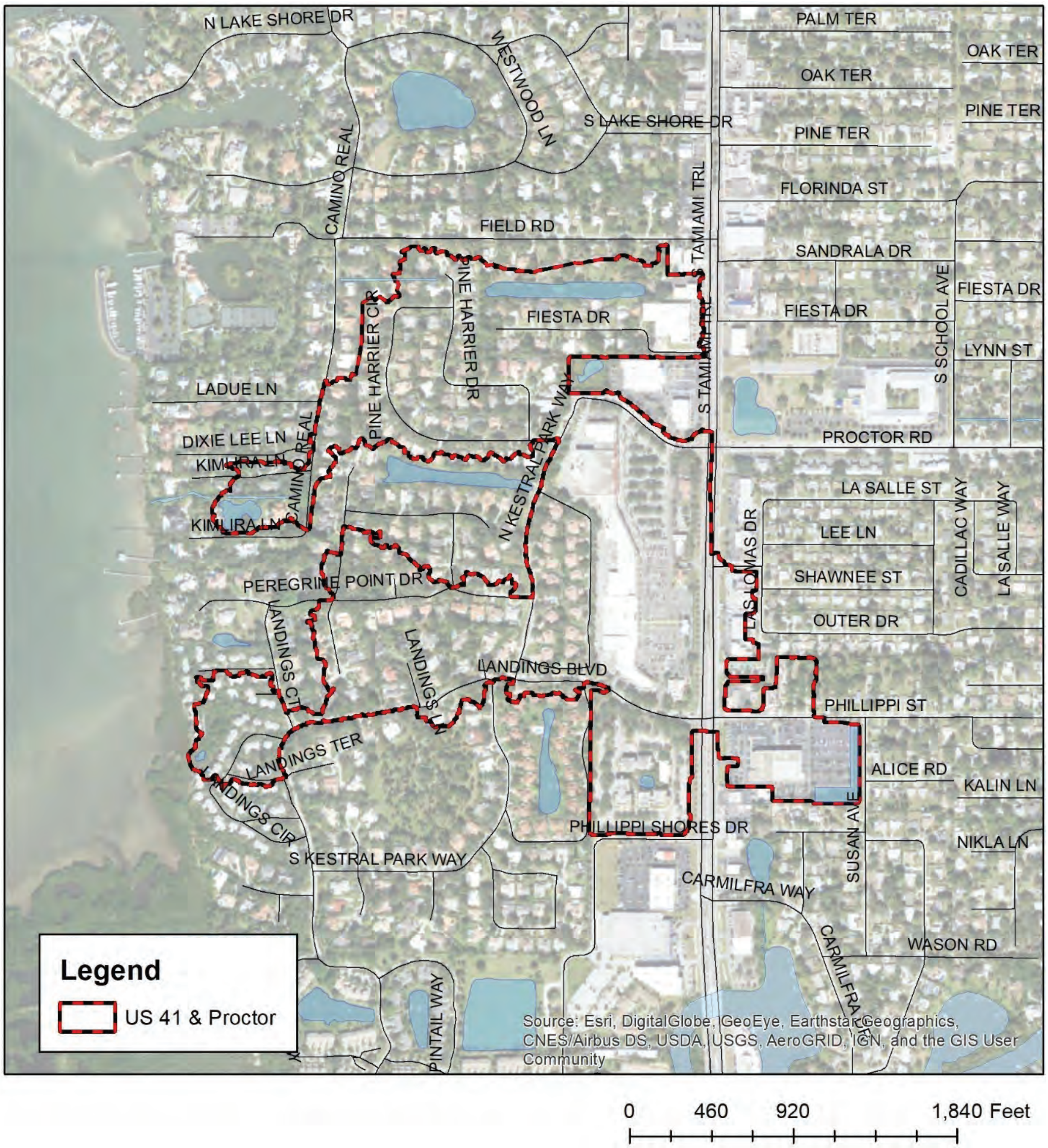


Figure 18 - US 41 & Proctor Priority Management Area

Faubel Street

This area has an existing residential street on the north end of Siesta Key. Faubel Street residents contend with multiple flooding events along their roadway, on a regular basis, during the wet season. The area needs to have upgrades completed to the stormwater system to ensure that the drainage is treated and discharged – instead of attenuating in the roadway. Residents have reported using the sanitary manhole as a way to remove stormwater from the roadway.

Figure 19 - Faubel Street Priority Management Area

3.0 Conceptual Best Management Practices

Once all PMAs were finalized, each area was reviewed with the following considerations to assess the practicality, functionality, and performance of potential BMPs:

- Proximity to publicly owned lands
- Available Right-of-Way
- Land Use types
- Existing stormwater infrastructure
- Flooding and pollutant loading characteristics

A menu of improvement strategies was developed with an exhaustive list of traditional and innovative BMPs that could be considered for a treatment train approach to reduce flooding and pollutant loading. Each conceptual BMP went through a rigorous process to optimize removal efficiencies with the BMP Trains model, determine floodplain impacts with ICPR, and estimate costs as outlined in this section.

3.1 Menu of Improvement Strategies

Potential improvement strategies that were considered to improve conditions at each PMAs consisted of the following:

- Open Conveyance Improvement
- Stormwater Storage Pond with Buffer
- Floating Island Treatment Train
- Raingarden with BAM
- Stream Restoration
- Pervious Pavers
- Baffle Box
- Rain Garden with Depression Retention
- Infiltration Trench
- BAM (Biosorption Activated Media) Filter Treatment
- Stormwater Pump System
- Replace Impervious with Pervious
- Stormwater Park
- Stormwater Detention Vault
- Sediment Sump
- Removal of Built-Up Sediment
- Pipe Conveyance Improvement
- Operable Control Structures
- Partnership with Private Stormwater Systems
- Upflow Filter with Biosorption Activated Media (BAM) Retrofit Sand Filters
- Pond Skimmer for Floatables
- Stormwater Backflow Prevention Valve
- Offline Wetland Treatment System
- Urban Tree Canopy
- Floodplain Bench

3.2 BMP TRAINS Effectiveness Modeling

Eric Livingston, Watershed Management Services, LLC, optimized the pollutant removal efficiencies for each conceptual BMP using BMP TRAINS. Proposed BMPs with water quality benefits were analyzed to determine potential total nitrogen (TN) and total phosphorous (TP) reductions on an annual basis.

BMP TRAINS is a model that calculates the average annual nutrient loadings, Total Nitrogen (TN) and Total Phosphorus (TP), of development projects and the reductions in loadings from their stormwater treatment systems. The program incorporates over 40 years of stormwater related research and monitoring data from Florida, along with statewide rainfall data and analyses. BMP TRAINS originally was developed by the University of Central Florida Stormwater Management Academy, with funding from the Florida Department of Environmental Protection (FDEP) and the Florida Department of Transportation (FDOT). In recent years, FDOT funding allowed the updating of BMP TRAINS to incorporate more recent stormwater research findings on BMP treatment effectiveness. The computer program and its User Manual are in the public domain and available for free download from https://stars.library.ucf.edu/bmptrains/26/. In addition, copies of the research publications, upon which the program's calculations are based, can be downloaded.

Key aspects of BMP TRAINS include:

- It uses the "Harper Methodology" for calculating stormwater pollutant loadings.
- It uses five rainfall zones in Florida to select the average annual rainfall.
- It uses Florida stormwater event mean concentrations.
- It uses Florida BMP treatment effectiveness data.
- It includes the most recent treatment effectiveness data for LID BMPs.
- It incorporates the most recent LID BMP design criteria.

BMP TRAINS can be used to:

- Quantify TN and TP average annual load reductions of individual traditional and LID BMPs.
- Quantify TN and TP average annual load reductions for BMP treatment trains consisting of several different BMPs.
- Evaluate and optimize the pollutant load reduction of proposed BMPs and BMP treatment trains.
- Demonstrate the stormwater system achieves the minimum level of treatment for the receiving waters to which the system will discharge.

BMP TRAINS consists of a series of worksheets and reports that the stormwater professional can use to evaluate the treatment effectiveness of a proposed stormwater system. The worksheets and reports include:

- General site information worksheet
- Watershed characteristics worksheet.
- Treatment options (selecting one or more BMPs, each with its own worksheet).
- Catchment configuration worksheet to establish flow patterns.
- Summary Treatment report of the BMP or BMPs being evaluated.
- Complete report (usually submitted for permit review purposes).

- Optional cost comparisons worksheet.

The order listed above is the general sequence of input and analysis, although users may choose to return to previous steps at any time to revise values or to conduct ”what if” scenarios of BMPs or BMP treatment trains. Once the general site information and watershed characteristics information is input, it is very easy to evaluate different BMPs or BMP treatment trains.

Contributing area and curve number (CN) data for BMP TRAINS input was developed from ICPR basin data, while land use input was derived from publicly available Sarasota County Zoning and Future Land Use designation GIS shapefiles.

BMP TRAINS model input and output data are provided for BMPs with a quantifiable surface water quality benefit.

3.3 Flood Modeling

Flood modeling is done to determine if no adverse impact is achieved for the water quality conceptual BMPs, which could impact flood stages, or to assess the effectiveness of flood improvement conceptual BMPs. ICPR simulations for the 100-year, 25-year and 10-year storms were run with revised model input, representing the proposed conditions for relevant conceptual BMPs. Proposed measurable flood protection benefits are presented in the following sections for each BMP, including roadway and structure Level of Service (LOS) deficiency reductions. Model outputs are available in ICPR for each of the PMAs with flood benefits.

3.4 Cost Estimating

Many iterations took place during the development of the concepts to maximize the benefits with respect to reducing flooding and pollutant loading. Once the conceptual project components were somewhat finalized, conceptual costs were estimated. A conceptual cost is the approximate cost of the project that is calculated at the conceptual stage. The goal of the conceptual cost is to understand construction cost based on as much detail as possible and to recognize the costs of major material/ major manpower required.

A cost estimate was developed for each of the conceptual BMP’s; the cost estimate includes preliminary numbers for material costs, equipment, and manpower estimates. Stormwater infrastructure construction, demolition, excavation, land acquisition and ancillary costs were considered when developing the preliminary costs.

Two sources were used to determine the cost of construction items. The FDOT Historical Cost analysis was used to provide weighted average unit costs for major line items. Awarded contract prices are captured from all over the state each month. These are totaled with the previous 11 months to calculate the weighted average of the unit price. FDOT Historical Costs are located on the FDOT website: https://www.fdot.gov/programmanagement/estimates/historicalcostinformation/historicalcost.shtm

The FDOT published reports include construction material costs, equipment, and labor. The reports are based on executed FDOT construction contracts which have a letting date that falls within the past 6 to 12 months range. In addition to FDOT construction costs, Stantec has developed a database of local construction projects, again based on executed construction contracts in the Manasota Region in the past three years. Both sources are compared to local construction costs and to the published FDOT costs in order to use conservative estimates to develop unit costs.

While larger material costs can be estimated with our databases, construction costs such as traffic control, construction staging areas and contractor mobilization were estimated based on a percentage of the total cost of construction. Generally, the percentages are consistent throughout the cost estimates; however, the percentages are modified to consider density of development adjacent to construction area, length of roadway work and detour(s), and the availability of right of way to stage construction material.

In addition to the construction costs, engineering design and permitting was considered as well as annual operation and maintenance (O&M) costs. The costs for design and permitting are based on our experience designing and permitting similar types of projects. The O&M costs were determined based on the frequency and level of difficulty of maintaining the system(s), i.e., staff costs and equipment costs, as well as number of O&M events required annually.

O&M costs were developed considering predictive maintenance. Predictive maintenance is the ability to forecast and perform necessary repairs, prior to failure, with little to no disruption to system operations, potentially saving valuable resources. A stormwater system operator can only achieve predictive maintenance by incorporating technology into a clear operations plan. Corrective maintenance generally involves repairing an unforeseen asset failure – corrective maintenance was not considered in development of the O&M costs. The O&M cost is included in *Appendix B: Conceptual BMP Project Sheets* and not included in the construction cost in this section.

The final line item in developing construction costs was a contingency; generally, during the development of preliminary costs, a contingency of 30% is used to ensure that items not listed as individual line items are captured and to allow for cost increases from the time of estimating through design and permitting.

Project concepts costs are provided for each BMP in the following sections, which do not include the estimated O&M costs. Full project cost details are presented in *Appendix B: Conceptual BMP Project Sheets*.

3.5 Benefits and Cost Effectiveness

The Cost-Effective Analysis of each individual project was determined using the County's Manual for Costs and Benefits for Flood and Water Quality Projects; and the SWFMWD's 2023 Cooperative Funding Initiative Guidelines. Costs included the design, permitting and construction of the conceptual BMPs and did not include O&M costs in the cost benefit calculations.

Based on the Cost Benefit Analysis adopted by the Board of County Commissioners on December 5, 2000, the Sarasota County Stormwater Division applies a cost benefit analysis to proposed capital projects, to determine if the project will provide stormwater management improvements in a cost-effective investment. The County contracted with Stantec to update the white paper titled *Projecting Damages Associated with Flooding: A Proposed Cost-Effective Analysis for Stormwater Projects* as presented to the Board of County Commissioners, through an Interoffice Memorandum dated December 5, 2000.

In certain instances, even if a project's costs exceed the tangible benefits of flood control, the County may determine the project provides public value supported by numerous intangible benefits such as health, safety, and community support. These intangibles should be given consideration on a case-by-case basis, when deciding whether to go forward with a project.

To update the Sarasota County specific multipliers for building and content damage, Stantec analyzed nearly 800 FEMA claims (historic flood damage costs) for Sarasota County that were made during rain events. The available claim data ranges from 1978 to 2016 and provides a statistically valid sample to analyze. The analysis showed that the average Sarasota County building damage claim was 12% of the building value and the median claim was 6% of the building value. Analysis of the content damage claims showed that the average content damage claim was between 82% and 87% of the building damage claims.

Revisions included using the most current available data (2015) to update the average automobile cost, number of cars per household, landscape / hardscape cost, per diem cost for displacement from structures, the average household income, and the published 2018 IRS per mile cost for the detours. These values are fixed costs that will need to be updated as more current data becomes available.

The Lost Business Income and Lost Wages due to Closed Business were separated from Total Lost Wages for increased accuracy in calculating lost business revenue caused by flooding. Data from the United States Census Bureau - American Fact Finder website was used to derive the average daily commercial revenue for Sarasota County; the average number of employees per business in Sarasota County; and the average wages in Sarasota County.

Each project under evaluation requires the following project specific data:

1. AV - assessed property values
2. FS - number of flooded residential structures
3. HFP - number of residential structures within the horizontal floodplain
4. CFS - number of flooded commercial structures
5. CHFP - number of commercial structures within the horizontal floodplain
6. RD - road detour costs
7. PW - public works costs
8. FI - flood insurance costs

The analysis is very similar to FEMA's Benefit-Cost Analysis. Benefit-Cost Analysis (BCA) is a method that determines the future risk reduction benefits of a hazard mitigation project and compares those benefits to its costs. The result is a Benefit-Cost Ratio (BCR). A project is considered cost-effective when the BCR is 1.0 or greater. Like FEMA's BCR, the County's cost benefit generates a whole number, that is then awarded points based on SWFWMD's Cooperative Funding Initiatives Guidelines, and the cost benefit analysis generated by the EPA.

The Conceptual BMP's that are part of our report have been assigned points based on this table from SWFWMD:

Flood Protection Projects – Implementation Projects For projects that combine benefits, list the primary benefit statement first and follow with secondary benefits.

Flood Protection Projects – Implementation Projects					
Project Type	**5 Points**	**10 Points**	**15 Points**	**20 Points**	**25 Points**
BMPs (benefit/costratio) Required Projects Over $500k	0.50 < 0.70	N/A	> 0.70 < 0.90	> 0.90 < 1.10	≥ 1.10
BMPs (when benefit/cost ratio is not available for projects under $500k)	Higher than Other Projects	N/A	Similar to Other Projects	N/A	N/A

Implementation of BMPs for flood protection is addressed through structural and non-structural methods. SWFWMD encourages Cooperators to maximize opportunities to provide water quality improvements above permit requirements for any flood protection BMP project. Project components eligible for funding include:

- Design and permitting
- Land acquisition and easements — NOTE: SWFWMD may recognize land costs incurred by local government as a match if the land was acquired recently, with the specific purpose of implementing the proposed stormwater improvements.
- Construction of BMPs
- Construction engineering and inspection
- Benefit/Cost Analysis

The County's CBA tool has been expanded to include water quality benefits. However, the SWFWMD has been updated since the last revision to the County's CBA tool. The Conceptual BMP's are scored based on the following:

- Total area treated (acres)
- Total nitrogen (N) removed / year (lbs)
- Total phosphorus (P) removed / year (lbs)[1]

[1] future discussion will be required with County to consider the removal of TP from scoring

Specifically, water quality projects are scored based on SWFMWD's 2023 Cooperative Funding Initiative Guidelines; Water Quality Projects are scored based on the table below:

Water Quality Projects – Based on Water Quality Evaluation Metrics Final Report. For projects that combine benefits, list the primary benefit statement first and follow with secondary benefits.

Water Quality Projects (cost/lb of pollutant removed)					
Project Type	**5 Points**	**10 Points**	**15 Points**	**20 Points**	**25 Points**
Total Nitrogen (cost/lb)	$475-$400	$400-$250	$250-$175	$175-$150	< $150
Total Phosphorus (cost/lb)	$4152-$3500	$3500-$2750	$2750-$2000	$2000-$1350	< $1350
Septic Conversion Total Nitrogen (cost/lb)	$300-$250	$250-$200	$200- $150	$150 - $100	< $100

Natural Systems Restoration Projects are scored based on the table below:

Natural Systems Restoration Projects – Based on past projects Cost/acre restored or Cost /linear foot restored. For projects that combine benefits, list the primary benefit statement first and follow with secondary benefits.

Natural Systems Restoration Projects (cost/acre restored; cost/linear foot restored)					
Project Type	5 Points	10 Points	15 Points	20 Points	25 Points
Shoreline Restoration ($/l.f)	$1250-$900	$900-$750	$750-$650	$650-$500	≤$500
Hydrologic Restoration	$21k-$18k	$18k-$9k	$9k-$4k	$4k-$1500	≤$1500
Comprehensive Ecosystem Restoration	$100k-$75k	$75k-$54k	$54k-$28k	$28k-$15k	≤$15k

c

Intangible benefits including public perception and political climate, along with benefits such as health, safety, and community support continue to be considered for proposed projects. However, a weighting system for intangible benefits has not been developed nor has a sensitivity analysis been performed for the projects to determine how weightings would affect a cost-effective analysis. Due to the high degree of judgment that would be needed, it is reasonable to acknowledge the intangible factors, without assigning a dollar figure to be included in any type of economic analysis. Some examples of these intangible factors include, but are not limited to:

- Health Factors, such as the ability to use septic systems
- Safety Factors, such as access to Emergency Vehicles
- Community Support for a Project
- Public Perception of a Stormwater Problem
- Board Policy for Addressing Stormwater Needs

In certain instances, even if a project's costs exceed the tangible benefits of flood control, it may still be a worthwhile project if it has numerous intangible benefits such as health, safety, and community support. These intangibles should be given consideration on a case-by-case basis, when deciding whether to go forward with a particular project.

3.6 Scoring

Scoring was applied based on methodology defined in the SWFWMD FY2023 Cooperative Funding Initiative with scores between 0-25 for flood, water quality, natural systems (shoreline restoration). As discussed, there are several PMAs that contain multiple Conceptual BMPs. To allow for as much flexibility as possible when choosing projects to move forward into design, there is both a breakout of individual BMPs and also a score of the combined BMPs. In addition, resiliency was scored between 0-5, based on the resiliency of each BMP considering whether the BMP would be inundated by the 2100 "intermediate high" floodplain, provided in the Jones Edmunds Future Conditions Floodplain Analysis. Scoring results are found in Section 5, Table 13.

3.7 Conceptual BMP Results

The original intent included in the scope of work was to propose up to 10 conceptual BMPs. However, the team wanted to provide every PMA with the opportunity for concept development, so BMPs were evaluated for all PMAs. Out of 18 total PMAs, 22 BMPs were conceptually developed for 13 PMAs. See Table 1 for a summary of conceptual BMPs for each Priority Management Area.

Table 1 - Summary of Conceptual BMPs

PRIORITY MANAGEMENT AREA	CONCEPTUAL BMP
TRI-PAR	DRY RETENTION/FLOODPLAIN STORAGE AREA; NUTRIENT SEPARATING BAFFLE BOX
	LINEAR TREATMENT AREA; FLOODPLAIN BENCH
US-41 & HIGHLAND	CONVERT EXISTING UNDERGROUND TREATMENT MEDIA FROM SAND TO BAM
MYRTLE & US-301[1]	NO FEASIBLE BMP CONCEPTS FOR THIS PMA WERE IDENTIFIED. FULLY DEVELOPED INDUSTRIAL BASIN WITH TOO LITTLE AVAILABLE SPACE FOR BMPS DISCHARGING DIRECTLY TO FDOT SYSTEMS.
MLK & ORANGE	STORM INFRASTRUCTURE IMPROVEMENTS; NUTRIENT SEPARATING BAFFLE BOX
17TH & US-301[1]	NO FEASIBLE BMP CONCEPTS FOR THIS PMA WERE IDENTIFIED. FULLY DEVELOPED INDUSTRIAL BASIN WITH TOO LITTLE AVAILABLE SPACE FOR BMPS DISCHARGING DIRECTLY TO FDOT SYSTEMS.
US-41 & 10TH STREET	CONVERT EXISTING PARKING SPOTS TO PERVIOUS PAVMENT
	LOW FLOW WEIRS WITH SIDE-BANK FILTRATION
	SEDIMENT SUMP
BEE RIDGE & BENEVA	FOREST LAKES POND SEDIMENT REMOVAL & BEEMATS; NUTRIENT SEPARATING BAFFLE BOX
	LOW FLOW WEIRS WITH SIDE-BANK FILTRATION IN EXISTING DITCH SYSTEM (4-63)
TUTTLE CIRCLE	TANGLEWOOD CONVERSION OF CANAL TO WET DETENTION WITH BEEMATS
	CONVERSION OF BLOSSOM BROOK CANAL TO WET DETENTION IN SERIES
	PHILLIPPI CREEK DAM REMOVAL; SEDIMENT REMOVAL; SEDIMENT SUMP INSTALLATION
BEE RIDGE BETWEEN MCINTOSH & HONORE[1]	NO FEASIBLE BMP CONCEPTS FOR THIS PMA WERE IDENTIFIED. FULLY DEVELOPED COMMERCIAL BASIN WITH TOO LITTLE AVAILABLE SPACE FOR BMPS DISCHARGING DIRECTLY TO FDOT SYSTEMS.
PINECRAFT	CONVERT EXISTING WET POND TO DRY POND
	DENITRIFICATION TRENCH - ALOHA MOBILE HOME PARK
	STREAM RESTORATION PHILLIPPI CREEEK
JEFFERSON AVE[1]	NO FEASIBLE BMP CONCEPTS FOR THIS PMA WERE IDENTIFIED. SMALL PMA WITH TOO LITTLE AVAILABLE SPACE AND ONLY MULTIFAMILY STRUCTURE FLOODING AND WATER QUALITY LOS ISSUES.
SMH & US-41	NUTRIENT SEPARATING BAFFLE BOX; HARBOR ACRES STORM PIPE IMPROVEMENTS & CHECK VALVES
DOWNTOWN	NUTRIENT SEPARATING BAFFLE BOX; DENITRIFICATION TRENCHES
BEE RIDGE & US-41	STORM INFRASTRUCTURE IMPROVEMENTS; NUTRIENT SEPARATING BAFFLE BOX
	CONVERT EXISTING PARKING SPOTS TO PERVIOUS PAVEMENT
NORTHERN SIESTA KEY[1]	NO FEASIBLE BMP CONCEPTS FOR THIS PMA WERE IDENTIFIED. PROJECTED SEA LEVEL RISE EXASPERATES DIFFICULTY OF IDENTIFYING RESILIENT FLOOD PROJECTS, AND WATER QUALITY LOS DEFICIENCIES ARE NOT HIGH.
STICKNEY POINT	STORM PIPE CHECK VALVES AND STORM INFRASTRUCTURE IMPROVEMENTS
US41 & PROCTOR	THE LANDINGS POND SEDIMENT REMOVAL & BEEMATS; NUTRIENT SEPARATING BAFFLE BOX
FAUBEL STREET	STORM INFRASTRUCTURE IMPROVEMENTS

Note: [(1)] = This PMA was evaluated, and no feasible conceptual BMP concepts were identified

Tri-Par Priority Management Area Conceptual BMP

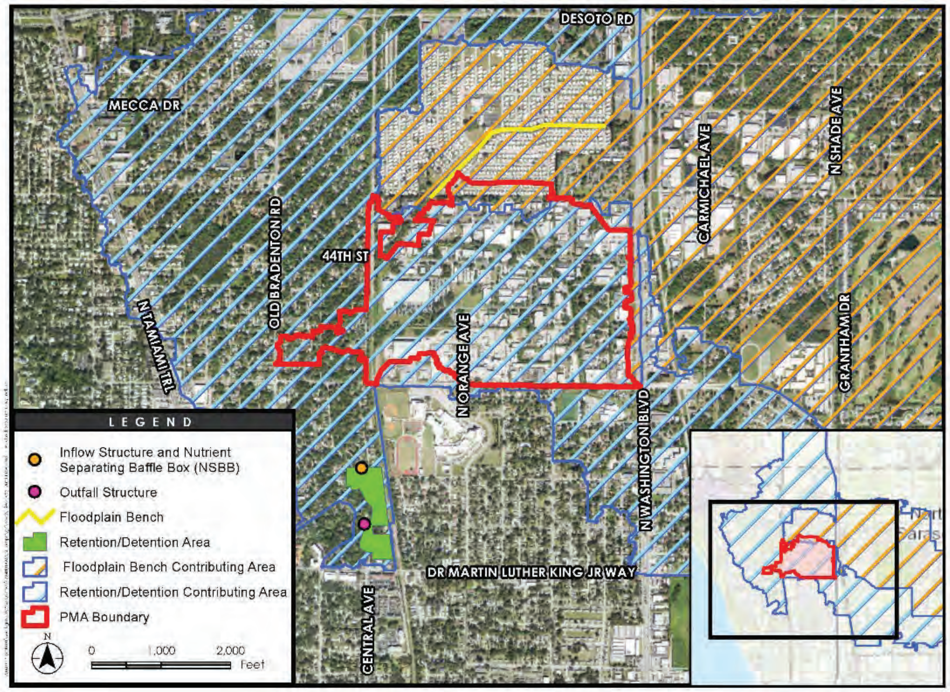


Figure 20 - Tri-Par Area BMPs

Floodplain Bench and Linear Treatment Area

Along the northern portion of this PMA, there is an existing drainage ditch that is part of the Whitaker Bayou drainage system. This northern conveyance has the opportunity to install a floodplain bench and linear treatment area with weirs to control flow allowing for flood protection and nutrient removal. The section of Whitaker Bayou Tributary A that runs through Tri-Par can be modified to provide additional floodplain storage by excavating a "bench" into the bank, as shown in Figure 21.

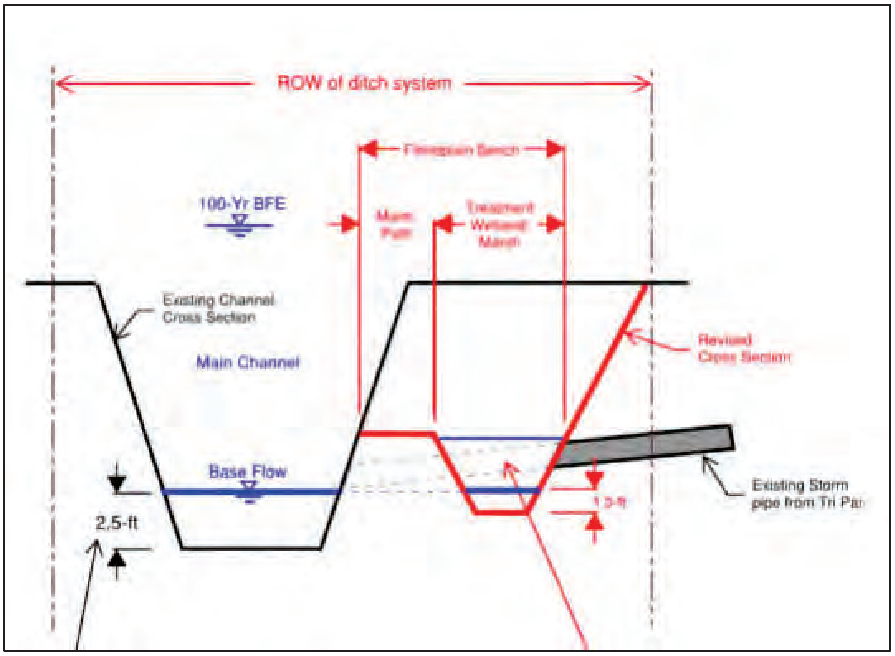


Figure 21 - Floodplain Bench / Linear Treatment System Typical Cross-Section

The project was modeled in ICPR with the Whitaker Bayou Watershed model. **Flood protection benefits include:**

- **Removing 1018 linear feet of roadway from Level of Service (LOS) deficiency, including 416 feet of evacuation route.**
- **Flood Cost-Benefit Ratio = 1.08**
- **Resilient in the NOAA 2100 future condition**

<u>BMP TRAINS 2020 Report: Tri-Par PMA – Channel Marsh Flow Way – Upper Limit Removal</u>

Water quality benefits were assessed in BMP TRAINS 2020, with an assumption of 20% of baseflow capture in the linear treatment system. Model input and output is presented here:

Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Combined catchments
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	1,280.54
Rational Coefficient (0-1)	0.31
Non DCIA Curve Number	84.70
DCIA Percent (0-100)	20.00
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.830
Phosphorus EMC (mg/l)	0.330

Runoff Volume (ac-ft/yr)	1,706.209
Nitrogen Loading (kg/yr)	3,849.872
Phosphorus Loading (kg/yr)	694.239

Catchment Number: 1 Name: Combined catchments
Project: Tri Par Marsh Flowway

Marsh Flowway BMP Design

Contributing Catchment Area (acres)	1,280.540
Length (ft)	3604
Top width (ft)	11
Bottom width (ft)	4
Depth (ft)	2
Volume (cf)	54060
Volume (ac-ft)	1.241
Provided Nitrogen Treatment Efficiency (%)	68
Provided Phosphorus Treatment Efficiency (%)	82

Watershed Characteristics

Catchment Area (acres)	1,280.54
Contributing Area (acres)	1,280.540
Non-DCIA Curve Number	84.70
DCIA Percent	20.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge NOTE: THIS IS FOR FULL VOLUME

Provided TN Treatment Efficiency (%)	68
Provided TP Treatment Efficiency (%)	82

Load Diagram for Marsh Flowway full volume

Load		Treatment		Surface Discharge
N: 3,849.87 kg/yr	→	N: 68 %	→	N: 1,231.96 kg/yr
P: 694.24 kg/yr		P: 82 %		P: 124.96 kg/yr

↓

Mass Reduction
N: 2,617.91 kg/yr
P: 569.28 kg/yr

Load Diagram for User Defined BMP (As Used In Routing)

Upstream Nodes	Load		Treatment		Mass Discharged
None	N: 3,849.87 kg/yr	→	N: 68.0 %	→	N: 1,231.96 kg/yr
	P: 694.24 kg/yr		P: 82.0 %		P: 124.96 kg/yr
	Q: 1,706.21 ac-ft				Q: 1,706.21 ac-ft

↓

Mass Removed
N: 2,617.91 kg/yr
P: 569.28 kg/yr

Summary Report Full flow volume
Nitrogen

Surface Water Discharge

Total N post load	3849.87 kg/yr	
Percent N load reduction	68 %	
Provided N discharge load	1231.96 kg/yr	2716.47 lb/yr
Provided N load removed	2617.91 kg/yr	5772.5 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	694.239 kg/yr	
Percent P load reduction	82 %	
Provided P discharge load	124.963 kg/yr	275.54 lb/yr
Provided P load removed	569.276 kg/yr	1255.254 lb/yr

LOAD REDUCTIONS AT VARIOUS LEVELS OF FLOW CAPTURE AND TREATMENT

	Total Nitrogen Load Reductions kg/yr	Total Phosphorus Load Reductions kg/yr
Full flow capture	2617.91	569.28
10% flow capture	261.79	56.93
20% flow capture	**523.58**	**113.86**
30% flow capture	785.37	179.78

The Linear Treatment System conceptual BMP provides reductions of 1154 lb/yr of TN and 251 lb/yr of TP.

Dry Retention and Nutrient Separating Baffle Box

A second conceptual BMP for the Tri-Par area includes a managed stormwater facility, located north of Martin Luther King Jr. Blvd. and west of the railroad corridor. The intent of this project is to create a detention and retention area for stormwater with capacity to allow storage of increased flows, due to conveyance improvements along Tributary C. This treatment system will also include a nutrient-separating baffle box to provide additional water quality treatment for flows entering the retention area.

The project was modeled with the Whitaker Bayou Watershed ICPR model, and **flooding benefits include:**

- **12 structures were removed from 100-year storm risk.**

- **Resilient in the NOAA 2100 future condition**

The treatment retention area proposed size is approximately 7 acres. Note that part of the conceptual BMP area is currently under public ownership and part is under private ownership; therefore, if the project is to move forward, a partnership could be formed with the private owners, to include potential acquisition, if there is interest. The project concept is completely voluntary and in no way considered a mandatory improvement. There is a potential to reduce the size of the retention area to only government-owned parcels and right-of-way for a reduced benefit, if acquisition is not possible.

BMP TRAINS 2020 Report – Tri-Par PA5 Baffle Box and Dry Retention Area

For the full 7-acre retention area, the BMP TRAINS 2020 input and output data is presented here:

Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Tri Par Retention
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	3,501.60
Rational Coefficient (0-1)	0.24
Non DCIA Curve Number	84.60
DCIA Percent (0-100)	9.40
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.720
Phosphorus EMC (mg/l)	0.287
Runoff Volume (ac-ft/yr)	3,617.095
Nitrogen Loading (kg/yr)	7,670.990
Phosphorus Loading (kg/yr)	1,279.985

Catchment Number: 1 Name: Tri Par Retention
Multiple BMP in Series Design Parameters

BMP in Series Number: 1
BMP Type: Nutrient Separating Baffle Box for trash and debris

Contributing Catchment Area (acres)	3,501.600
Provided Nitrogen Treatment Efficiency (%)	10
Provided Phosphorus Treatment Efficiency (%)	10

BMP in Series Number: 2
BMP Type: Retention Alone

Retention Depth (in)	0.159
Retention Volume (ac-ft)	46.396

Load for Multiple BMP in Series (Baffle box to retention)

Load		Treatment		Surface Discharge
N: 7,670.99 kg/yr	→	N: 32 %	→	N: 5,192.39 kg/yr
P: 1,279.98 kg/yr		P: 32 %		P: 866.40 kg/yr

↓

Mass Reduction
N: 2,478.60 kg/yr
P: 413.58 kg/yr

Summary Treatment Report
Nitrogen

Surface Water Discharge

Total N post load	7670.99 kg/yr	
Percent N load reduction	32 %	
Provided N discharge load	5192.39 kg/yr	11449.22 lb/yr
Provided N load removed	2478.6 kg/yr	5465.31 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	1279.985 kg/yr	
Percent P load reduction	32 %	
Provided P discharge load	866.405 kg/yr	1910.42 lb/yr
Provided P load removed	413.58 kg/yr	911.944 lb/yr

The dry retention system with nutrient separating baffle box conceptual BMP provides reductions of 5465 lb/yr of TN and 912 lb/yr of TP.

Reductions for both conceptual BMPs in the Tri-Par PMA provide removal rates of 6619 lb/yr of TN and 1163 lb/yr of TP .

The estimated cost for both conceptual BMPs in the Tri-Par PMA is $3,787,767.

US-41 and Highland Priority Management Area Conceptual BMP

This is an opportunity to partner with the public to develop a retrofit program for existing filter systems that are very common in urban areas. This isn't necessarily a recommended project at this location but rather an evaluation of cost to use as the basis for a program. The existing underground storage and treatment system, for the commercial business located at the intersection of US-41 and Myrtle Street, can be modified by removing the sand filter media and replacing it with a biosorption activated media (BAM). The water quality benefits were modeled in BMP Trains 2020, comparing the existing sand filter performance with BAM performance. The goal of this conceptual BMP was to provide improvements in the PMA, as well as to provide a unit cost for the conversion of existing sand filters throughout the County.

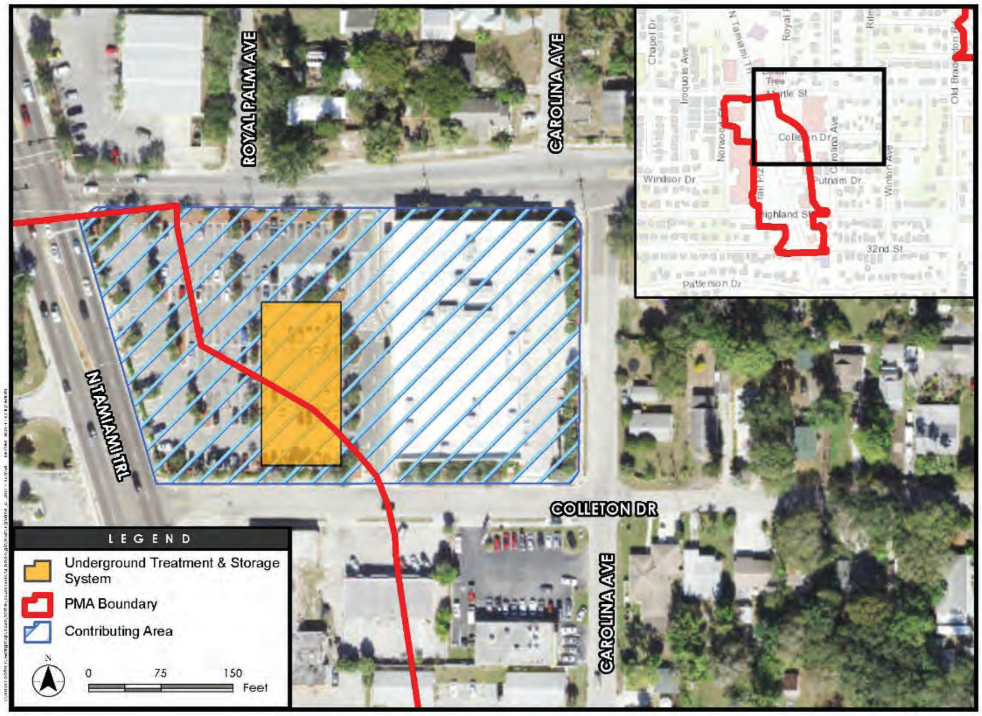


Figure 22 - US 41 & Highland Area BMP

BMP TRAINS 2020 Report US-41 and Highland – Walmart Filter Replacement

Full BMP input and output is presented here:

Existing Filter Effectiveness
Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Walmart
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	High-Intensity Commercial: TN=2.40 TP=0.345
Area (acres)	3.06
Rational Coefficient (0-1)	0.76
Non DCIA Curve Number	94.00
DCIA Percent (0-100)	85.00
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	2.400
Phosphorus EMC (mg/l)	0.345

Runoff Volume (ac-ft/yr)	10.067
Nitrogen Loading (kg/yr)	29.790
Phosphorus Loading (kg/yr)	4.282

Catchment Number: 1 Name: Walmart

Surface Discharge Filtration Design

Treatment Depth (in)	0.650
Hydraulic Capture Efficiency (%)	52
Media Type	User Defined
Media N Reduction (%)	10
Media P Reduction (%)	15

Watershed Characteristics

Catchment Area (acres)	3.06
Contributing Area (acres)	3.060
Non-DCIA Curve Number	94.00
DCIA Percent	85.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	5
Provided TP Treatment Efficiency (%)	8

Media Mix Information

Type of Media Mix	Sand
Media N Reduction (%)	10
Media P Reduction (%)	15

Load Diagram for Surface Discharge Filtration (stand-alone)

Load N: 29.79 kg/yr P: 4.28 kg/yr	→	Treatment N: 5 % P: 8 %	→	Surface Discharge N: 28.24 kg/yr P: 3.95 kg/yr
		↓		Mass Reduction N: 1.55 kg/yr P: 0.33 kg/yr

Nitrogen

Surface Water Discharge

Total N post load	29.79 kg/yr	
Percent N load reduction	5 %	
Provided N discharge load	28.24 kg/yr	62.27 lb/yr
Provided N load removed	1.55 kg/yr	3.42 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	4.282 kg/yr	
Percent P load reduction	8 %	
Provided P discharge load	3.948 kg/yr	8.7 lb/yr
Provided P load removed	.335 kg/yr	.738 lb/yr

BMP TRAINS 2020 Report
US 41 and Highlands - Walmart Filter Replacement Project CTS24 Filter 7" Thick with 0.65"TV
Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Walmart
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	High-Intensity Commercial: TN=2.40 TP=0.345
Area (acres)	3.06
Rational Coefficient (0-1)	0.76
Non DCIA Curve Number	94.00
DCIA Percent (0-100)	85.00
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	2.400
Phosphorus EMC (mg/l)	0.345
Runoff Volume (ac-ft/yr)	10.067
Nitrogen Loading (kg/yr)	29.790
Phosphorus Loading (kg/yr)	4.282

Catchment Number: 1 Name: Walmart

Surface Discharge Filtration Design

Treatment Depth (in)	0.650
Hydraulic Capture Efficiency (%)	52
Media Type	B&G CTS24
Media N Reduction (%)	75
Media P Reduction (%)	95

Watershed Characteristics

Catchment Area (acres)	3.06
Contributing Area (acres)	3.060
Non-DCIA Curve Number	94.00
DCIA Percent	85.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%) 39

Provided TP Treatment Efficiency (%) 49

Media Mix Information

Type of Media Mix B&G CTS24

Media N Reduction (%) 75

Media P Reduction (%) 95

Load Diagram for Surface Discharge Filtration (stand-alone)

Load		Treatment		Surface Discharge
N: 29.79 kg/yr	→	N: 39 %	→	N: 18.15 kg/yr
P: 4.28 kg/yr		P: 49 %		P: 2.16 kg/yr

↓

Mass Reduction
N: 11.64 kg/yr
P: 2.12 kg/yr

Summary Report
For 7" thick filter media
Nitrogen

Surface Water Discharge

Total N post load	29.79 kg/yr	
Percent N load reduction	22.62 %	
Provided N discharge load	23.052 kg/yr	50.821 lb/yr
Provided N load removed	6.738 kg/yr	14.855 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	4.282 kg/yr	
Percent P load reduction	28.42 %	
Provided P discharge load	3.065 kg/yr	6.757 lb/yr
Provided P load removed	1.217 kg/yr	2.683 lb/yr

Media Filter Report
Catchment Name: Walmart
Treatment Depth (in): 0.65
Rate (GPM/SF): 0.05
Effective Impervious Area (acres): 2.77
Minimum Filter Area (sf): 325.99

The existing TN removal rate of 3.4 lbs/yr increases by more than 4 times to 14.9 lbs when the system is converted to BAM from sand, while the TP removal rate increases from 0.74 lb/yr to 2.69 lb/yr.

The estimated project cost is $21,400. This could serve as an example cost for Sarasota County to develop a program, incentivizing local businesses to upgrade existing sand filter treatment systems through the County. This specific location is resilient to the NOAA 2100 future condition.

Martin Luther King Jr Way and Orange Ave Priority Management Area Conceptual BMP

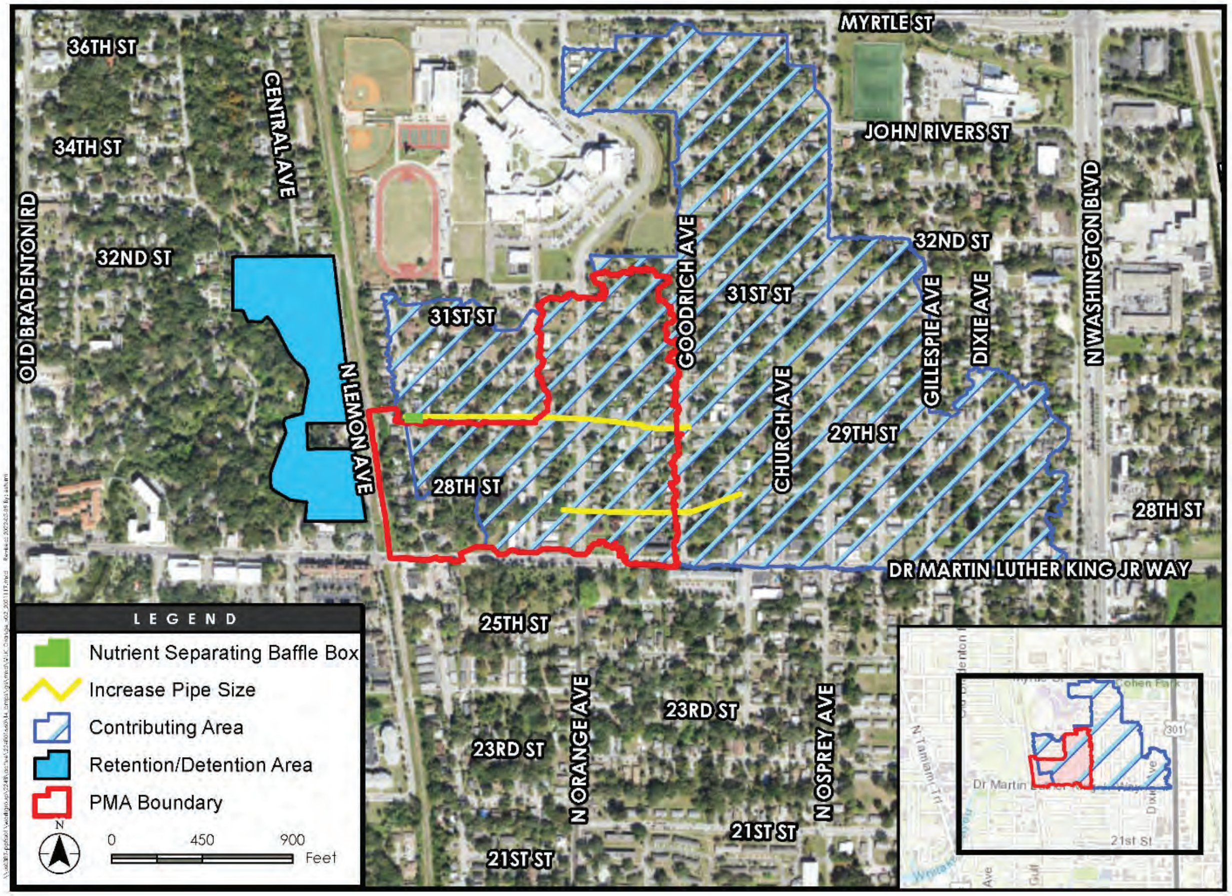


Figure 23 - MLK & Orange Area BMP

Stormwater Pipe Improvements and Nutrient Separating Baffle Box

These improvements will provide a water quality and flood protection component. BMP concept includes replacing existing undersized pipe with larger pipe for approximately 2,400 linear feet, including on 29th Street, from Goodrich Ave. to Lean Ave. and from Maple Ave. to Orange Ave, and installation of a nutrient-separating baffle box on 29th Street.

The improvements were modeled in the Whitaker Bayou watershed model and include changes to 8 pipes, as detailed in Table 2, and shown in Figure 23.

Table 2 - MLK & Orange Ave. ICPR Pipe Changes

Pipe	Change	Length
1517P	from circular 36" to elliptical 43"x68"	36
1518P	from circular 36" to elliptical 43"x68"	218
1519P	from circular 36" to elliptical 43"x68"	390.6
1520P	from circular 15" to elliptical 43"x68"	241.7
1522P	from circular 36" to elliptical 43"x68"	766
1523P	from circular 42" to elliptical 43"x68"	225
1524P	from circular 42" to elliptical 43"x68"	285
1525P	from circular 42" to elliptical 43"x68"	228.7

Measurable benefits from the flood component of the BMP include:

- **Removing 292 linear feet of local roads from LOS deficiency**
- **5 structures removed from 100-year storm risk**
- **Resilient to the NOAA 2100 future condition**

The Benefit-Cost Ratio for the MLK & Orange Stormwater Improvements is 0.94.

<u>BMP TRAINS 2020 Report – Martin Luther King Jr Way and Orange Ave</u>

Nutrient Separating Baffle Box

Water quality benefits for the baffle box were estimated with BMP TRAINS 2020. All input and output data are presented here:

Project: MLK Orange Ave NSBB
Date: 2/15/2022 12:50:05 PM

Site and Catchment Information

Analysis: BMP Analysis

Catchment Name	1521 -1536	1535 -1540	1527-1531
Rainfall Zone	Florida Zone 4	Florida Zone 4	Florida Zone 4
Annual Mean Rainfall	52.00	52.00	52.00
Post-Condition Land use Information			
Land use	User Defined Values	User Defined Values	User Defined Values
Area (acres)	31.97	42.11	22.13
Rational Coefficient (0-1)	0.23	0.24	0.29
Non DCIA Curve Number	85.00	84.79	84.24
DCIA Percent (0-100)	7.44	8.88	17.40

Wet Pond Area (ac)	0.00	0.00	0.00
Nitrogen EMC (mg/l)	2.039	2.031	1.891
Phosphorus EMC (mg/l)	0.325	0.320	0.297
Runoff Volume (ac-ft/yr)	31.810	43.218	27.505
Groundwater N (kg/yr)	0.000	0.000	0.000
Groundwater P (kg/yr)	0.000	0.000	0.000
Nitrogen Loading (kg/yr)	79.974	108.227	64.130
Phosphorus Loading (kg/yr)	12.747	17.052	10.072

Catchment Number: 1 Name: Subbasins1521 -1536

Nutrient Separating Baffle Box BMP Design

Contributing Catchment Area (acres)	31.970
Provided Nitrogen Treatment Efficiency (%)	19
Provided Phosphorus Treatment Efficiency (%)	15

Watershed Characteristics

Catchment Area (acres)	31.97
Contributing Area (acres)	31.970
Non-DCIA Curve Number	85.00
DCIA Percent	7.44
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	19
Provided TP Treatment Efficiency (%)	15

Load Diagram for User Defined BMP (stand-alone)

Load
N: 79.97 kg/yr →
P: 12.75 kg/yr

Treatment
N: 19 %
P: 15 %

→ Surface Discharge
N: 64.78 kg/yr
P: 10.84 kg/yr

↓

Mass Reduction
N: 15.20 kg/yr
P: 1.91 kg/yr

Load Diagram for User Defined BMP (As Used In Routing)

Upstream Nodes
Node: 2
Node: 3

Load
N: 252.33 kg/yr →
P: 39.87 kg/yr
Q: 102.53 ac-ft

Treatment
N: 19.0 %
P: 15.0 %

→ Mass Discharged
N: 204.39 kg/yr
P: 33.89 kg/yr
Q: 102.53 ac-ft

↓

Mass Removed
N: 47.94 kg/yr
P: 5.98 kg/yr

Catchment Number: 2 Name: Subbasins 1535 -1540

No BMPs

Watershed Characteristics

Catchment Area (acres)	42.11
Contributing Area (acres)	42.110
Non-DCIA Curve Number	84.79
DCIA Percent	8.88
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Load Diagram for No BMPs

Load
N: 108.23 kg/yr →
P: 17.05 kg/yr

Treatment
N: %
P: %

→ Surface Discharge
N: 108.23 kg/yr
P: 17.05 kg/yr

↓

Mass Reduction
N: 0.00 kg/yr
P: 0.00 kg/yr

Load Diagram for No BMPs

Upstream Nodes	Load		Treatment		Mass Discharged
None	N: 108.23 kg/yr P: 17.05 kg/yr Q: 43.22 ac-ft	→	N: 0.0 % P: 0.0 %	→	N: 108.23 kg/yr P: 17.05 kg/yr Q: 43.22 ac-ft

↓

Mass Removed
N: 0.00 kg/yr
P: 0.00 kg/yr

Catchment Number: 3 Name: Subbasins 1527-1531

No BMPs

Watershed Characteristics

Catchment Area (acres)	22.13
Contributing Area (acres)	22.130
Non-DCIA Curve Number	84.24
DCIA Percent	17.40
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Load Diagram for No BMPs

Load		Treatment		Surface Discharge
N: 64.13 kg/yr P: 10.07 kg/yr	→	N: % P: %	→	N: 64.13 kg/yr P: 10.07 kg/yr

↓

Mass Reduction
N: 0.00 kg/yr
P: 0.00 kg/yr

Summary Treatment Report Version: 4.3.5

Project: MLK Orange Ave NSBB

Analysis Type: BMP Analysis
BMP Types:
Catchment 1 - (1521 -1536) Nutrient Separating Baffle Box BMP
Catchment 2 - (1535 -1540)

No BMP
Catchment 3 - (1527-1531)

No BMP
Based on % removal values to the nearest percent

Date:2/15/2022

Routing Summary
Catchment 1 Routed to BMP Outlet
Catchment 2 Routed to Catchment 1
Catchment 3 Routed to Catchment 1

Summary Report

Nitrogen

Surface Water Discharge

Total N post load	252.33 kg/yr	
Percent N load reduction	19 %	
Provided N discharge load	204.39 kg/yr	450.68 lb/yr
Provided N load removed	47.94 kg/yr	105.71 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	39.871 kg/yr	
Percent P load reduction	15 %	
Provided P discharge load	33.891 kg/yr	74.73 lb/yr
Provided P load removed	5.981 kg/yr	13.187 lb/yr

The nutrient separating baffle box provides reductions of 105.71 lb/yr of TN and 13.19 lb/yr of TP.

The conceptual BMP cost is $1,242,021

US41 and 10th Street Priority Management Area Conceptual BMP

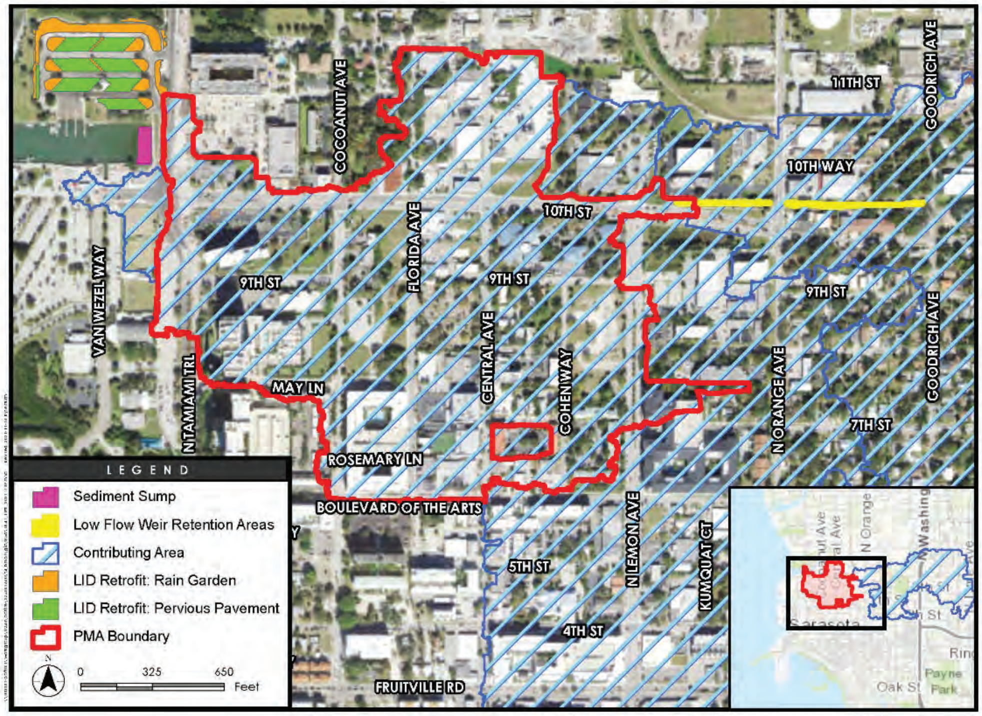


Figure 24 - US 41 & 10th Street Area BMPs

10th Street Boat Ramp Parking Lot Conversion to Pervious Pavement

This conceptual BMP includes removal of existing asphalt in the parking spots and replacing it with pervious pavement. The existing dry retention stormwater management system will remain in place and will be supplemented with additional treatment and storage volume provided by the new pervious areas. The drive aisles will remain impervious asphalt, and the existing drainage inlets and storm pipes will remain in place for all runoff that does not percolate into the pervious pavement. Existing grass islands can also be converted to rain gardens to allow for additional stormwater percolation and nutrient removal. In total, 1.6 acres of parking spots within a 5-acre contributing area would be converted from impervious to pervious, with 6-inch of pervious concrete over an 8-inch layer of stone. This area was chosen as a retrofit due to future plans to reconstruct the boat basin parking area. Parking areas to be converted are shown in Figure 25.

Figure 25 - US-41 & 10th Street Parking Lot Pervious Pavement Conversion

<u>BMP TRAINS 2020 Report US-41 and 10th Street Boat Ramp Parking Lot - Paved drive with retention and pervious pavement parking area</u>

The water quality benefits were modeled in BMP Trains 2020, with full BMP input and output presented here:

Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Paved drive, islands, retention area	Pervious pavement area
Rainfall Zone	Florida Zone 4	Florida Zone 4
Annual Mean Rainfall	52.00	52.00
Post-Condition Land Use Information		
Land use	Highway: TN=1.520 TP=0.200	Highway: TN=1.520 TP=0.200
Area (acres)	3.49	1.60
Rational Coefficient (0-1)	0.53	0.82
Non DCIA Curve Number	78.00	98.00
DCIA Percent (0-100)	58.84	100.00
Wet Pond Area (ac)	0.00	0.00
Nitrogen EMC (mg/l)	1.520	1.520

Phosphorus EMC (mg/l)	0.200	0.200
Runoff Volume (ac-ft/yr)	8.048	5.706
Groundwater N (kg/yr)	0.000	0.000
Groundwater P (kg/yr)	0.000	0.000
Nitrogen Loading (kg/yr)	15.084	10.694
Phosphorus Loading (kg/yr)	1.985	1.407

Catchment Number: 1 Name: Paved drive, islands, retention area

Retention Design

Retention Depth (in)	1.300
Retention Volume (ac-ft)	0.378

Watershed Characteristics

Catchment Area (acres)	3.49
Contributing Area (acres)	3.490
Non-DCIA Curve Number	78.00
DCIA Percent	58.84
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	82
Provided TP Treatment Efficiency (%)	82

Load Diagram for Retention (stand-alone)

Load N: 15.08 kg/yr P: 1.98 kg/yr	→	Treatment N: 82 % P: 82 %	→	Surface Discharge N: 2.68 kg/yr P: 0.35 kg/yr
		↓		Mass Reduction N: 12.40 kg/yr P: 1.63 kg/yr

Catchment Number: 2 Name: Pervious pavement area
Pervious Pavement Design

Surface Area of Pavement (acres)	1.600
Treatment Volume (in over watershed)	3.500

Pavement Type	Thickness (in)	Storage (in)	Storage (ac-ft)
Concrete Permeable Pavement	6.00	1.500	0.200
#89 pea rock	8.00	2.000	0.267
Total		3.500	0.467

Watershed Characteristics

Catchment Area (acres)	1.60
Contributing Area (acres)	0.000
Non-DCIA Curve Number	98.00
DCIA Percent	100.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	95
Provided TP Treatment Efficiency (%)	95

Load Diagram for Pervious Pavement (stand-alone)

Load N: 10.69 kg/yr P: 1.41 kg/yr	→	Treatment N: 95 % P: 95 %	→	Surface Discharge N: 0.50 kg/yr P: 0.07 kg/yr
		↓		Mass Reduction N: 10.19 kg/yr P: 1.34 kg/yr

Summary Report

Nitrogen

Surface Water Discharge

Total N post load	25.78 kg/yr	
Percent N load reduction	88 %	
Provided N discharge load	3.19 kg/yr	7.02 lb/yr
Provided N load removed	22.59 kg/yr	49.82 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	3.392 kg/yr	
Percent P load reduction	88 %	
Provided P discharge load	.419 kg/yr	.92 lb/yr
Provided P load removed	2.973 kg/yr	6.555 lb/yr

The pervious pavement parking lot conversion provides reductions of 49.82 lb/yr of TN and 6.56 lb/yr of TP.

The estimated cost for the pervious pavement parking lot conceptual BMP is $1,485,640.

Low-Flow Weirs with Side-Bank Filtration

A second conceptual BMP in the US 41 and 10th Street basin includes installing Low-Flow Weirs with Side-Bank Filtration, in the existing canal north of 10th Street. The BMP components include installing two concrete weirs and excavating the canal banks for approximately 1,040 feet and installing a side-bank filter system with BAM.

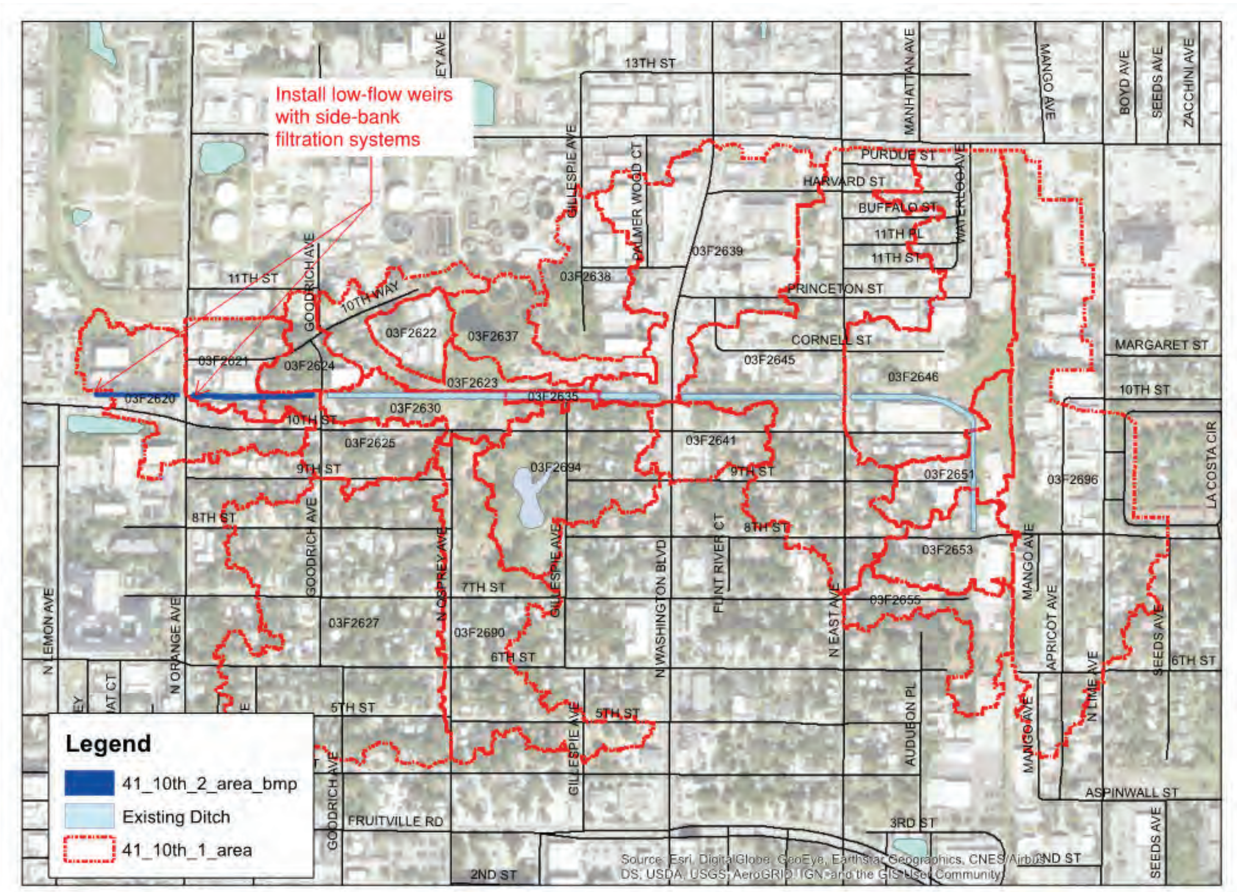


Figure 26 - US-41 & 10th Steet - Low-Flow Weirs & Side-Bank Filters

Contributing areas and proposed side-bank filter locations are shown in Figure 26. The typical section for the side-bank filter is shown in Figure 27.

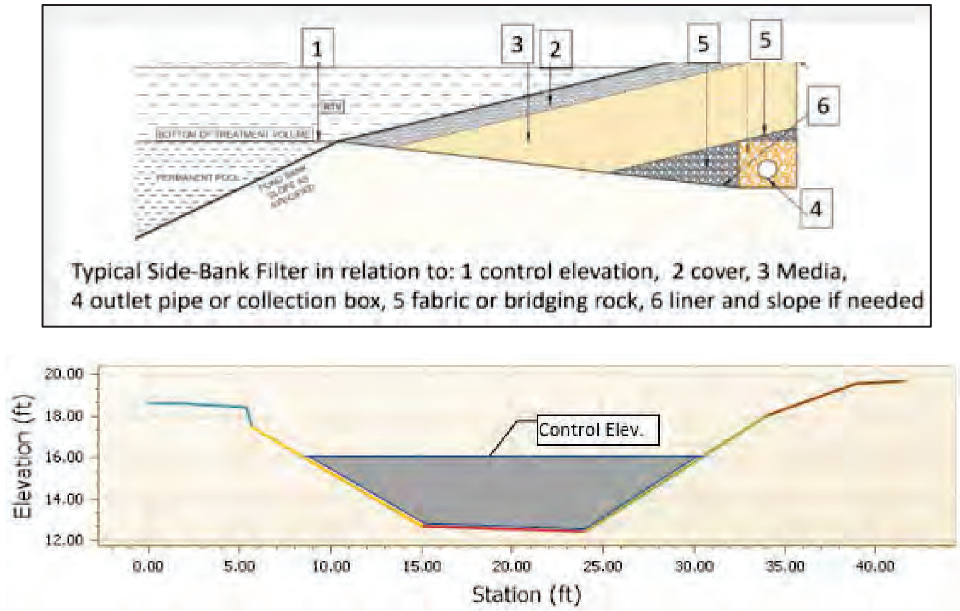


Figure 27 - Typical Side-Bank Filter Detail (source: BMP Trains) and Example Canal with Low Flow Weir Cross Section from ICPR4

<u>BMP TRAINS 2020 Report – US-41 and 10th Street – Low-Flow Weirs with Side-Bank Filters</u>

The water quality benefits were modeled in BMP Trains 2020, with full BMP input and output presented here:

Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Composite all subbasins
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land use Information	
Land use	User Defined Values
Area (acres)	239.11
Rational Coefficient (0-1)	0.36
Non DCIA Curve Number	84.57
DCIA Percent (0-100)	29.00
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.735
Phosphorus EMC (mg/l)	0.279
Runoff Volume (ac-ft/yr)	377.625
Nitrogen Loading (kg/yr)	807.836
Phosphorus Loading (kg/yr)	129.906

Catchment Number: 1 Name: Composite all subbasins

Surface Discharge Filtration Design

Treatment Depth (in)	0.500
Hydraulic Capture Efficiency (%)	58

Media Type	B&G CTS12
Media N Reduction (%)	60
Media P Reduction (%)	90

Watershed Characteristics

Catchment Area (acres)	239.11
Contributing Area (acres)	239.110
Non-DCIA Curve Number	84.57
DCIA Percent	29.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Required TN Treatment Efficiency (%)	
Provided TN Treatment Efficiency (%)	35
Required TP Treatment Efficiency (%)	
Provided TP Treatment Efficiency (%)	52

Media Mix Information

Type of Media Mix	B&G CTS12
Media N Reduction (%)	60
Media P Reduction (%)	90

Load Diagram for Surface Discharge Filtration (stand-alone)

Load
N: 807.84 kg/yr
P: 129.91 kg/yr

→

Treatment
N: 35 %
P: 52 %

→

Surface Discharge
N: 526.73 kg/yr
P: 62.10 kg/yr

↓

Mass Reduction
N: 281.11 kg/yr
P: 67.81 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	807.84 kg/yr	
Percent N load reduction	35 %	
Provided N discharge load	526.73 kg/yr	1161.43 lb/yr
Provided N load removed	281.11 kg/yr	619.85 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	129.906 kg/yr	
Percent P load reduction	52 %	
Provided P discharge load	62.099 kg/yr	136.93 lb/yr

Provided P load removed 67.807 kg/yr 149.514 lb/yr

Media Filter Report
Catchment Name: Composite all subbasins
Treatment Depth (in): 0.50
Rate (GPM/SF): 0.05
Effective Impervious Area (acres): 72.50
Minimum Filter Area (sf): 6,570.69

The proposed Low-Flow Weirs with Side-Bank Filtration conceptual BMP provides reductions of 619.9 lb/yr of TN and 149.5 lb/yr of TP.

The estimated cost for the Low-Flow Weirs with Side-Bank Filtration conceptual BMP is $1,212,640.

Sediment Sump

A third conceptual BMP for the US-41 and 10th Street PMA includes installation of a Sediment Sump at the east end of the 10th Street Boat Ramp Basin. Significant sediment deposition occurs in the basin and this BMP will allow for simplified maintenance and reduction of pollutant loading into Sarasota Bay. The 41.44-acre Contributing area to the sump is shown in Figure 24.

Sediment removal via excavation during initial construction yields 1380 lbs of TN and 665 lbs of TP removed from an estimated 767 cubic yards of material. Values were obtained by utilizing the Florida Stormwater Association MS4 Load Reduction Assessment Tool, dated June 2019, accessed from the Florida Department of Environmental Protection's site (FSA-MS4 Load Reduction Tool updated 2019 | Florida Department of Environmental Protection)

The tool's input screen is presented below in Figure 28, while the results are shown in Figure 29.

Enter Volume of Solids[1] Removed - Calculate Equivalent Dry Weight
FSA 2019

	For Wet or Dry Solids by Volume[2]			
Category of Maintenance Activity	Enter Volume of Collected Solids Cubic Feet	Enter Dry Bulk Density Solids Lb/C.F.	Calculated Weight of Dry Solids (Pounds)	Calculated Equivalent Dry Weight Collected (Kilograms)
Street Sweepings	0	85	0	0
Catch Basin Cleanout	20,709	85	1,758,194	797,517
BMP Cleanout	0	85	0	0

GREEN Denotes Cells for DATA ENTRY
BLUE Denotes Calculation Results

NOTES:
1. "Particulate Matter" from the FSA Final Report is defined as "Solids" for use in this spreadsheet.
2. For measurements of volume, include approximate dry bulk density;
use the default bulk density of 1.36 or 84.9 pounds per cubic foot until confirmed by sampling.

Figure 28 - 10th Street Sediment Sump Load Reduction Assessment Tool Input

Calculated Nutrient Load Reductions from MS4 Maintenance Practices

FSA 2019

TOTAL PHOSPHORUS		Subtotal TP Removed (Kilograms)	Subtotal TP Removed (Pounds)
Street Sweepings - Dry Mass Collected (Kg)	0		
Amount of TP Removed (Kilograms)	0	0	0
Catch Basins - Dry Mass Collected	797,517		
Amount of TP Removed (Kilograms)	301	301	665
BMP - Dry Mass Collected	0		
Amount of TP Removed (Kilograms)	0	0	0
GRAND TOTAL TP REMOVED (KILOGRAMS) =		**301**	
GRAND TOTAL TP REMOVED (POUNDS) =			**665**

TOTAL NITROGEN		Subtotal TN Removed (Kilograms)	Subtotal TN Removed (Pounds)
Street Sweepings - Dry Mass Collected (Kg)	0		
Amount of TN Removed (Kilograms)	0	0	0
Catch Basins - Dry Mass Collected	797,517		
Amount of TN Removed (Kilograms)	626	626	1,380
BMP - Dry Mass Collected	0		
Amount of TN Removed (Kilograms)	0	0	0
GRAND TOTAL TN REMOVED (KILOGRAMS) =		**626**	
GRAND TOTAL TN REMOVED (POUNDS) =			**1,380**

Figure 29 - 10th Street Sediment Sump Load Reduction Assessment Tool Results

An existing Nutrient Separating Baffle Box on 10th Street is in place, SWFWMD Environmental Resource Permit Exemption Application No. 733406, which provides treatment for a 443-acre watershed contributing area. The proposed sediment sump BMP in the 10th St. Boat Ramp Basin provides treatment downstream of the existing Baffle Box, therefore the nutrient and sediment reduction calculations take this into account, with a contributing area consisting only of watershed area locations downstream of the existing BMP's location.

To calculate the estimated annual reductions, an assumed total suspended solids loading rate of 361.66 lb TSS / yr * ac was developed from the "Evaluation of Current Stormwater Design Criteria within the State of Florida" report by Harvey Harper (June 2007). TP and TN concentrations in Total suspended solids (TSS) were also obtained from the same source. Annual TN and TP reductions were calculated based on the estimated performance of the sediment sump.

Calculations for nutrient removal are presented below:

<u>Annual Reductions</u>

Contributing Area: 41.44 ac

$$\textit{TSS Loading Rate: } 361.66 \frac{lb\ TSS}{yr * ac}$$

$$\text{TSS Loading: } 41.44\ ac * 361.66 \frac{lb\ TSS}{yr * ac} = 14{,}987 \frac{lb\ TSS}{yr}$$

Assumed Sediment Sump Efficiency = 80%

$$14{,}987 \frac{lb\ TSS\ removed}{yr} * 0.8 = 11{,}990 \frac{lb\ TSS\ removed}{yr}$$

$$\textit{TP Reduction: } 11{,}990 \frac{lb\ TSS\ removed}{yr} * 0.0049 \frac{lb\ TP}{lb\ TSS} = \mathbf{58.75} \frac{\mathbf{lb\ TP\ removed}}{\mathbf{yr}}$$

$$\textit{TN Reduction: } 11{,}990 \frac{lb\ TSS\ removed}{yr} * 0.0034 \frac{lb\ TP}{lb\ TSS} = \mathbf{40.77} \frac{\mathbf{lb\ TN\ removed}}{\mathbf{yr}}$$

The proposed sediment sump provides annual reductions of 40.77 lb/yr of TN and 58.75 lb/yr of TP. Initial excavation also provides a one-time removal of 1380 lbs of TN and 665 lbs of TP.

The estimated cost for the Sediment Sump conceptual BMP is $274,346.

The estimated cost for all conceptual BMPs in the US-41 and 10th Street PMA is $2,972,626.

Bee Ridge and Beneva Rd. Priority Management Area Conceptual BMP

The conceptual BMPs proposed for the Bee Ridge and Beneva PMA include Sediment Removal from the Forest Lakes Stormwater Pond and installation of a nutrient separating baffle box at the primary inflow point, floating Beemats in the pond, as well as Low-Flow Weirs with Side-Bank Filters in the existing ditch east of Riviera Drive.

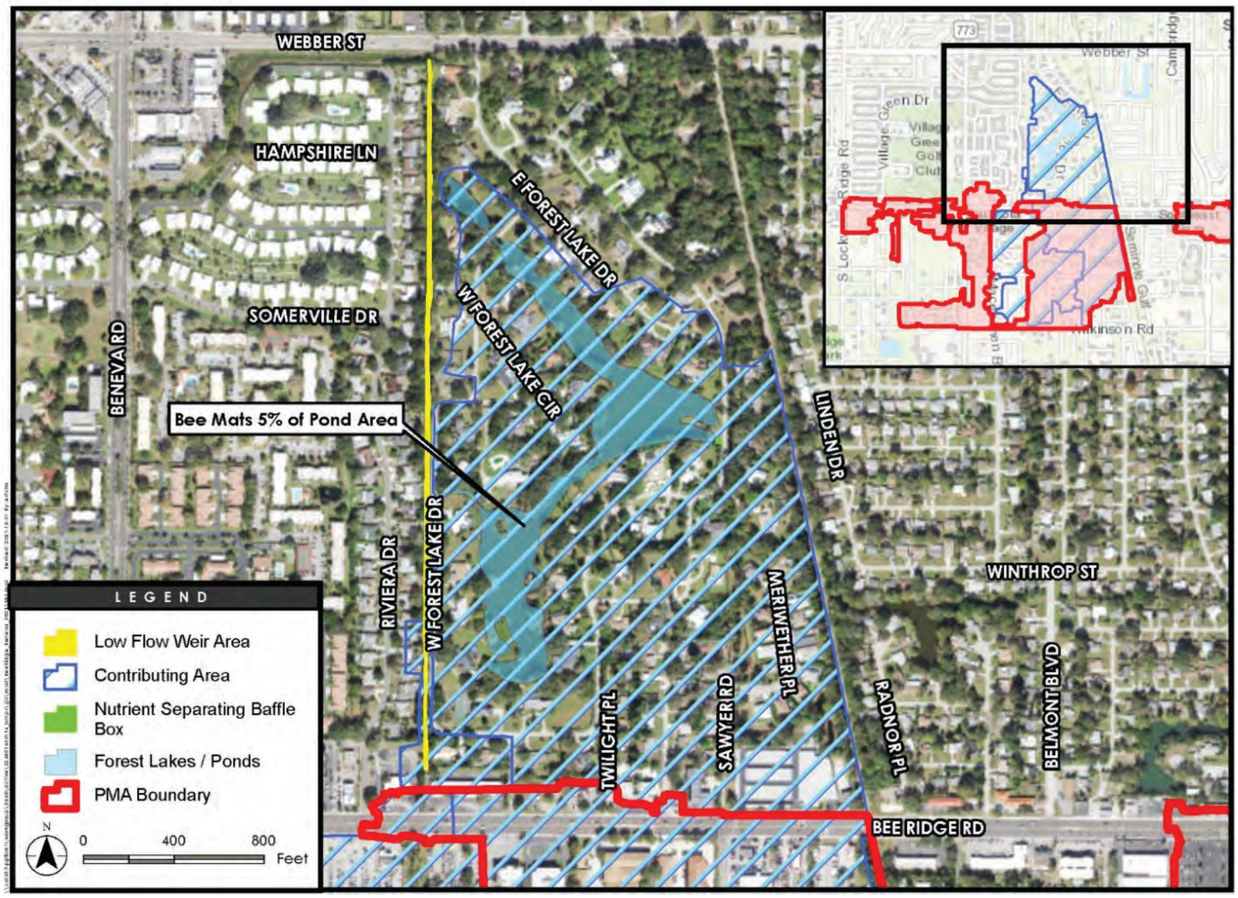


Figure 30 - Bee Ridge & Beneva Area BMPs

Sediment Removal and Nutrient Separating Baffle Box

The estimated sediment removal of approximately 48,400 cubic yards of material from the pond will provide an estimated 30.3 acre feet of additional permanent pool volume available to provide water quality treatment. Installation of a nutrient-separating baffle box at the end of an existing 48-inch storm pipe adjacent to East Forest Lakes drive will provide additional pollutant loading reductions for the stormwater before entering the pond. Floating Beemats, as shown in Figure 31, are estimated to cover approximately 5% of the ponds surface, providing additional nutrient uptake pathways. This is a conservative estimate for planning purposes and assumed to be adjusted during design based on resident desires, maintenance access and cost to cover the highest amount of surface area possible.

Figure 31 - Floating Beemats (source: beemats.com)

The full contributing area for the Forest Lakes Pond is presented in Figure 32, along with the location of the pond and proposed nutrient-separating baffle box.

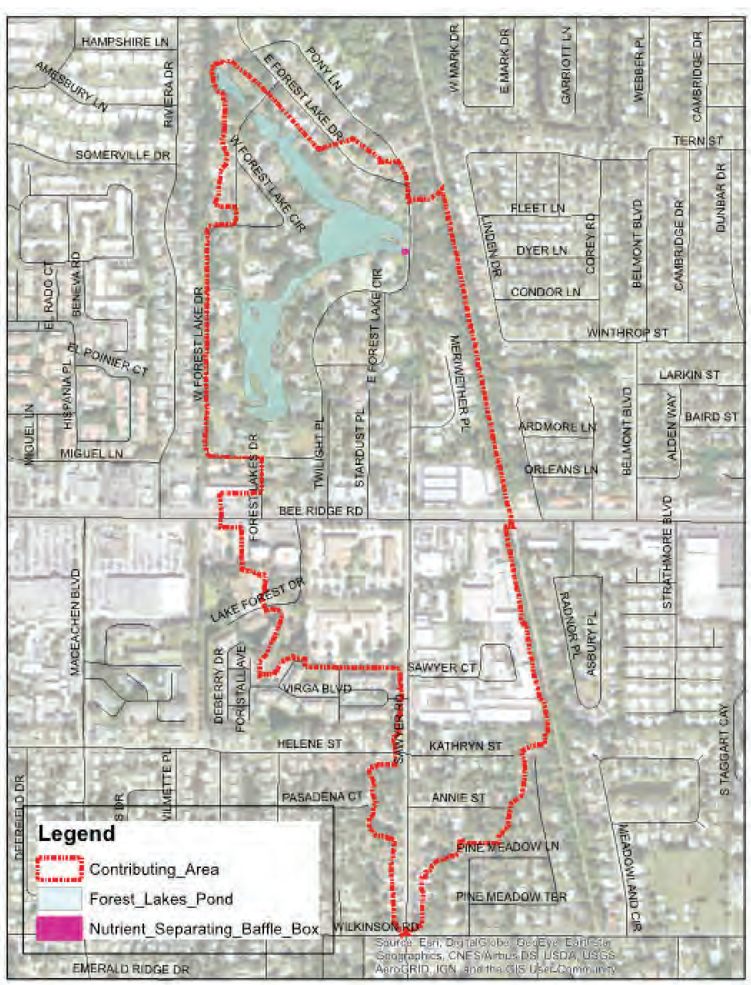


Figure 32 - Forest Lakes Pond Sediment Removal and NSBB

Sediment removal via excavation during initial construction yields 41,946 lbs of TN and 87,110 lbs of TP removed from an estimated 48,400 cubic yards of material. Values were obtained by utilizing the

Florida Stormwater Association MS4 Load Reduction Assessment Tool, dated June 2019, accessed from the Florida Department of Environmental Protection's site (FSA-MS4 Load Reduction Tool updated 2019 | Florida Department of Environmental Protection)

The tool's input screen is presented below in Figure 33, while the results are shown in Figure 34.

Enter Volume of Solids[1] Removed - Calculate Equivalent Dry Weight

FSA 2019

	For Wet or Dry Solids by Volume[2]			
Category of Maintenance Activity	Enter Volume of Collected Solids Cubic Feet	Enter Dry Bulk Density Solids Lb/C.F.	Calculated Weight of Dry Solids (Pounds)	Calculated Equivalent Dry Weight Collected (Kilograms)
Street Sweepings	0	85	0	0
Catch Basin Cleanout	1,306,800	85	110,947,320	50,325,704
BMP Cleanout	0	85	0	0

GREEN Denotes Cells for DATA ENTRY

BLUE Denotes Calculation Results

NOTES:

1. "Particulate Matter" from the FSA Final Report is defined as "Solids" for use in this spreadsheet.
2. For measurements of volume, include approximate dry bulk density; use the default bulk density of 1.36 or 84.9 pounds per cubic foot until confirmed by sampling.

Figure 33 - Forest Lakes Pond Sediment Removal Load Reduction Assessment Tool Input

Calculated Nutrient Load Reductions from MS4 Maintenance Practices

FSA 2019

TOTAL PHOSPHORUS		Subtotal TP Removed (Kilograms)	Subtotal TP Removed (Pounds)
Street Sweepings - Dry Mass Collected (Kg)	0		
Amount of TP Removed (Kilograms)	0	0	0
Catch Basins - Dry Mass Collected	50,325,704		
Amount of TP Removed (Kilograms)	19,023	19,023	41,946
BMP - Dry Mass Collected	0		
Amount of TP Removed (Kilograms)	0	0	0
GRAND TOTAL TP REMOVED (KILOGRAMS) =		**19,023**	
GRAND TOTAL TP REMOVED (POUNDS) =			**41,946**

TOTAL NITROGEN		Subtotal TN Removed (Kilograms)	Subtotal TN Removed (Pounds)
Street Sweepings - Dry Mass Collected (Kg)	0		
Amount of TN Removed (Kilograms)	0	0	0
Catch Basins - Dry Mass Collected	50,325,704		
Amount of TN Removed (Kilograms)	39,506	39,506	87,110
BMP - Dry Mass Collected	0		
Amount of TN Removed (Kilograms)	0	0	0
GRAND TOTAL TN REMOVED (KILOGRAMS) =		**39,506**	
GRAND TOTAL TN REMOVED (POUNDS) =			**87,110**

Figure 34 – Forest Lakes Pond Sediment Removal Load Reduction Assessment Tool Results

BMP TRAINS 2020 Report Bee Ridge at Beneva – Forest Lakes Sediment Removal, Nutrient Separating Baffle Box and Beemats

The BMP Trains 2020 input and output for the Forest Lakes Pond is presented here:

Forest Lakes Pond – After Sediment Removal
Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Forest Lakes
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	139.60
Rational Coefficient (0-1)	0.29
Non DCIA Curve Number	86.00
DCIA Percent (0-100)	14.70
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.910
Phosphorus EMC (mg/l)	0.323
Runoff Volume (ac-ft/yr)	175.750
Nitrogen Loading (kg/yr)	413.897
Phosphorus Loading (kg/yr)	69.994

Catchment Number: 1 Name: Forest Lakes
Wet Detention Design

Permanent Pool Volume (ac-ft)	60.620
Permanent Pool Volume (ac-ft) for 31 days residence	14.931
Annual Residence Time (days)	126
Littoral Zone Efficiency Credit	
Wetland Efficiency Credit	

Watershed Characteristics

Catchment Area (acres)	139.64
Contributing Area (acres)	139.640
Non-DCIA Curve Number	86.00
DCIA Percent	14.70
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	42
Provided TP Treatment Efficiency (%)	76

Load Diagram for Dredged Wet Detention (stand-alone)

Load		Treatment		Surface Discharge
N: 411.85 kg/yr	→	N: 42 %	→	N: 237.72 kg/yr
P: 69.80 kg/yr		P: 76 %		P: 16.81 kg/yr

	↓	Mass Reduction N: 174.12 kg/yr P: 52.99 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	411.85 kg/yr	
Percent N load reduction	42 %	
Provided N discharge load	237.72 kg/yr	524.18 lb/yr
Provided N load removed	174.12 kg/yr	383.94 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	69.797 kg/yr	
Percent P load reduction	76 %	
Provided P discharge load	16.808 kg/yr	37.06 lb/yr
Provided P load removed	52.99 kg/yr	116.842 lb/yr

Project: Forest Lakes After – Wet Detention with Beemats

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	411.85 kg/yr	
Percent N load reduction	48 %	
Provided N discharge load	213.95 kg/yr	471.76 lb/yr
Provided N load removed	197.9 kg/yr	436.36 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	69.797 kg/yr	
Percent P load reduction	78 %	
Provided P discharge load	15.127 kg/yr	33.35 lb/yr
Provided P load removed	54.671 kg/yr	120.548 lb/yr

NUTRIENT SEPARATING BAFFLE BOX ON 48”INFLOW PIPE TO WET DETENTION SYSTEM
Combined Report of all BMP's

Catchment Area (acres)	139.64
Watershed Non-DCIA Curve Number	86.00
Watershed DCIA Percent	14.70

Rainfall Zone	Florida Zone 4
Calculated Annual Coefficient (0-1)	0.29
Total (accumulated) Retention Depth (in over watershed)	0.000
Overall Provided Nitrogen Treatment Efficiency (%)	58
Overall Provided Phosphorus Treatment Efficiency (%)	82
Overall Nitrogen Load (kg/yr)	173.194
Overall Phosphorus Load (kg/yr)	12.782

Load for Multiple BMP in Series

Load		Treatment		Surface Discharge
N: 411.85 kg/yr	→	N: 58 %	→	N: 173.19 kg/yr
P: 69.80 kg/yr		P: 82 %		P: 12.78 kg/yr

↓

Mass Reduction
N: 238.65 kg/yr (526 lb/yr)
P: 57.02 kg/yr (126 lb/yr)

The baffle box is anticipated to remove 525 lb/yr TN and 126 lb/yr TP. Total cost for these two components is $858,535.

Low-Flow Weirs with Side-Bank Filtration

The existing ditch east of Riviera Drive will have 6 concrete weirs installed approximately 500 linear feet apart, along a 3000 ft length of ditch. Side-bank filters on both banks will be installed with BAM as the media. The contributing area and location of the ditch is shown in Figure 35.

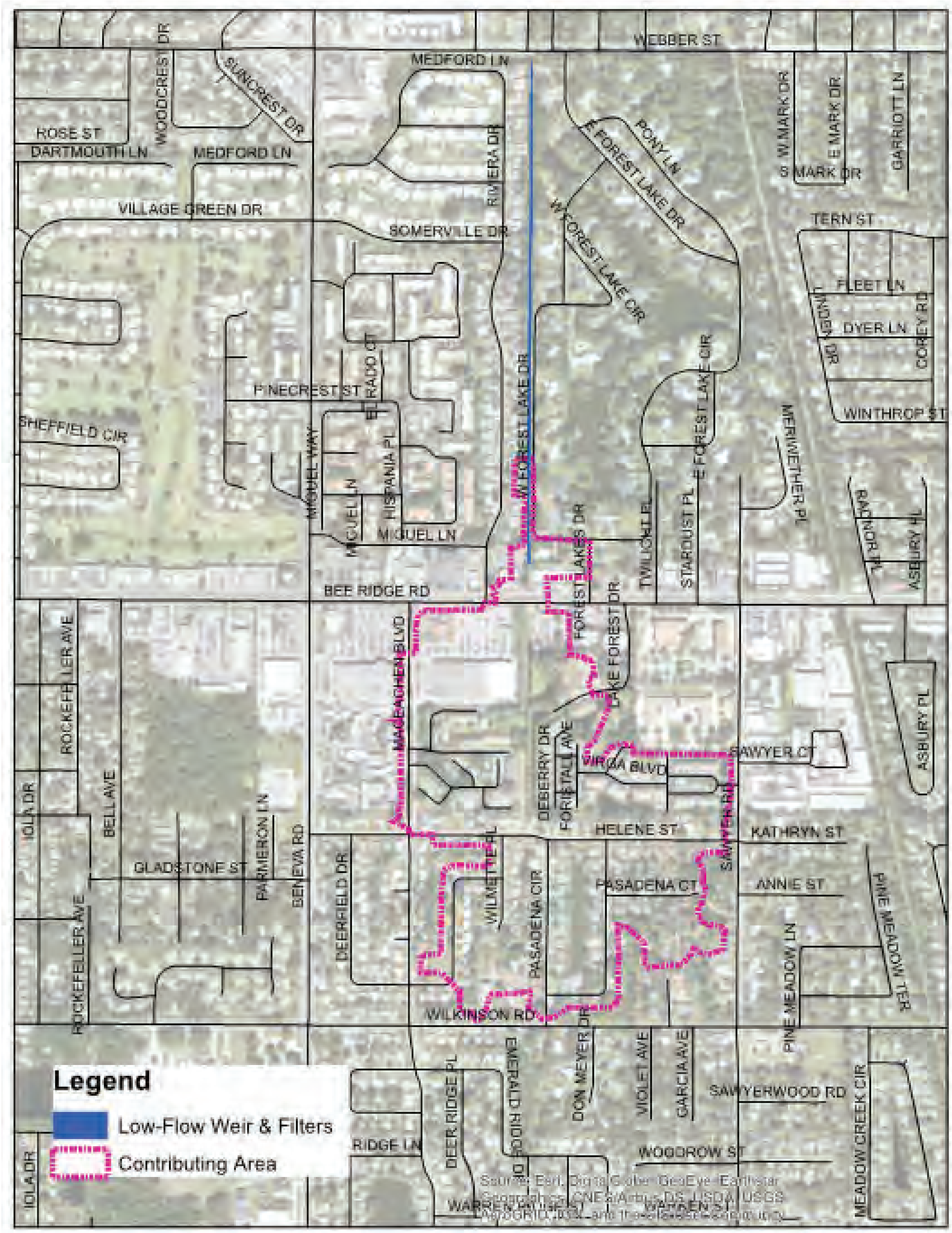


Figure 35 - Bee Ridge and Beneva Low-Flow Weirs BMP Contributing Area

<u>BMP TRAINS 2020 Report Bee Ridge and Beneva Low Flow Weir with Side-bank BAM filter</u>

The BMP Trains 2020 input and output for the low-flow weirs with side-bank filters in the existing ditch east of Riviera Drive is presented here:

Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	All subbasins
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	88.68
Rational Coefficient (0-1)	0.51
Non DCIA Curve Number	81.40
DCIA Percent (0-100)	53.43
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	2.174
Phosphorus EMC (mg/l)	0.390
Runoff Volume (ac-ft/yr)	194.720
Nitrogen Loading (kg/yr)	521.955
Phosphorus Loading (kg/yr)	93.635

Catchment Number: 1 Name: All subbasins

Surface Discharge Filtration Design

Treatment Depth (in)	0.500
Hydraulic Capture Efficiency (%)	55
Media Type	B&G CTS12
Media N Reduction (%)	60
Media P Reduction (%)	90

Watershed Characteristics

Catchment Area (acres)	88.68
Contributing Area (acres)	88.680
Non-DCIA Curve Number	81.40
DCIA Percent	53.43
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Required TN Treatment Efficiency (%)	
Provided TN Treatment Efficiency (%)	33
Required TP Treatment Efficiency (%)	
Provided TP Treatment Efficiency (%)	50

Media Mix Information

Type of Media Mix	B&G CTS12
Media N Reduction (%)	60
Media P Reduction (%)	90

Load Diagram for Surface Discharge Filtration (stand-alone)

Load		Treatment		Surface Discharge
N: 521.96 kg/yr	→	N: 33 %	→	N: 348.61 kg/yr
P: 93.63 kg/yr		P: 50 %		P: 46.99 kg/yr
		↓		Mass Reduction N: 173.35 kg/yr P: 46.65 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	521.96 kg/yr	
Percent N load reduction	33 %	
Provided N discharge load	348.61 kg/yr	768.68 lb/yr
Provided N load removed	173.35 kg/yr	382.23 lb/yr

Phosphorus

Surface Water Discharge

Total P post load	93.635 kg/yr	
Percent P load reduction	50 %	
Provided P discharge load	46.99 kg/yr	103.61 lb/yr
Provided P load removed	46.645 kg/yr	102.853 lb/yr

Media Filter Report
Catchment Name: All subbasins
Treatment Depth (in): 0.50
Rate (GPM/SF): 0.05
Effective Impervious Area (acres): 47.45
Minimum Filter Area (sf): 4,299.91

The combined conceptual BMPs of baffle box, bee mats, low flow weirs with side-bank filtration provide annual reductions of 908 lb/yr of TN and 229 lb/yr of TP. Initial excavation also provides a one-time removal of 87,110 lbs TN and 41,946 lbs of TP.

The estimated cost of the Low Flow Weirs with Side-Bank Filtration is $1,917,525.

The estimated cost for both conceptual BMPs in the Bee Ridge and Beneva PMA is $2,776,060.

Tuttle Circle Priority Management Area BMP

The BMPs proposed for the Tuttle Circle PMA include sediment removal from the Phillippi Creek main channel, removal of the historical agricultural dam, installation of a sediment sump and conversion of two upstream canal systems into linear wet detention treatment systems.

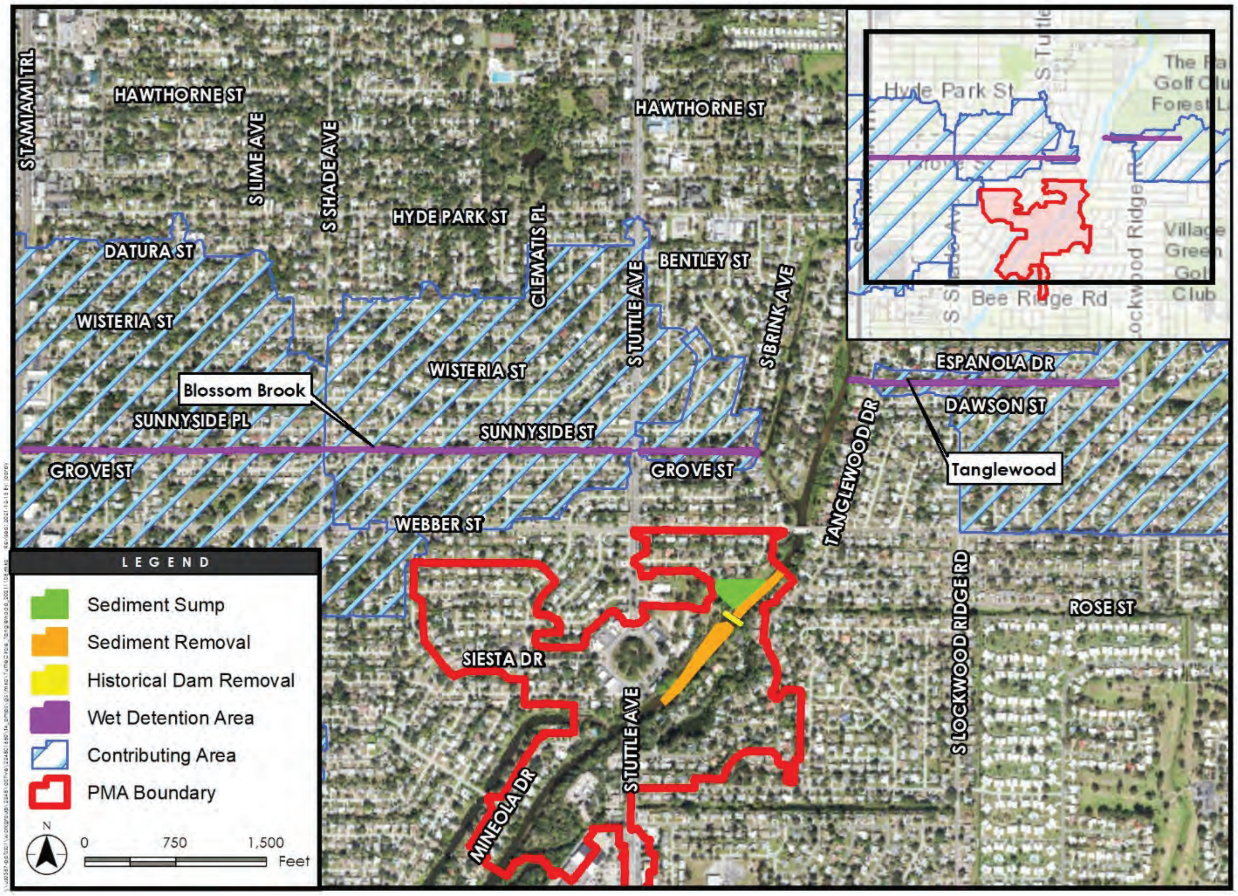


Figure 36 - Tuttle Circle Area BMPs

Tanglewood Canal Conversion to Wet Detention with Beemats

The Tanglewood Canal is a Phillippi Creek tributary canal located east of Tanglewood Dr, north of Dawson St, and south of Espanola Dr. Proposed modifications include installing two concrete weirs, providing an in-line wet detention system with floating Beemats covering 5% of the surface water. The contributing area ICPR basin delineation along with canal and weir locations is provided in Figure 37.

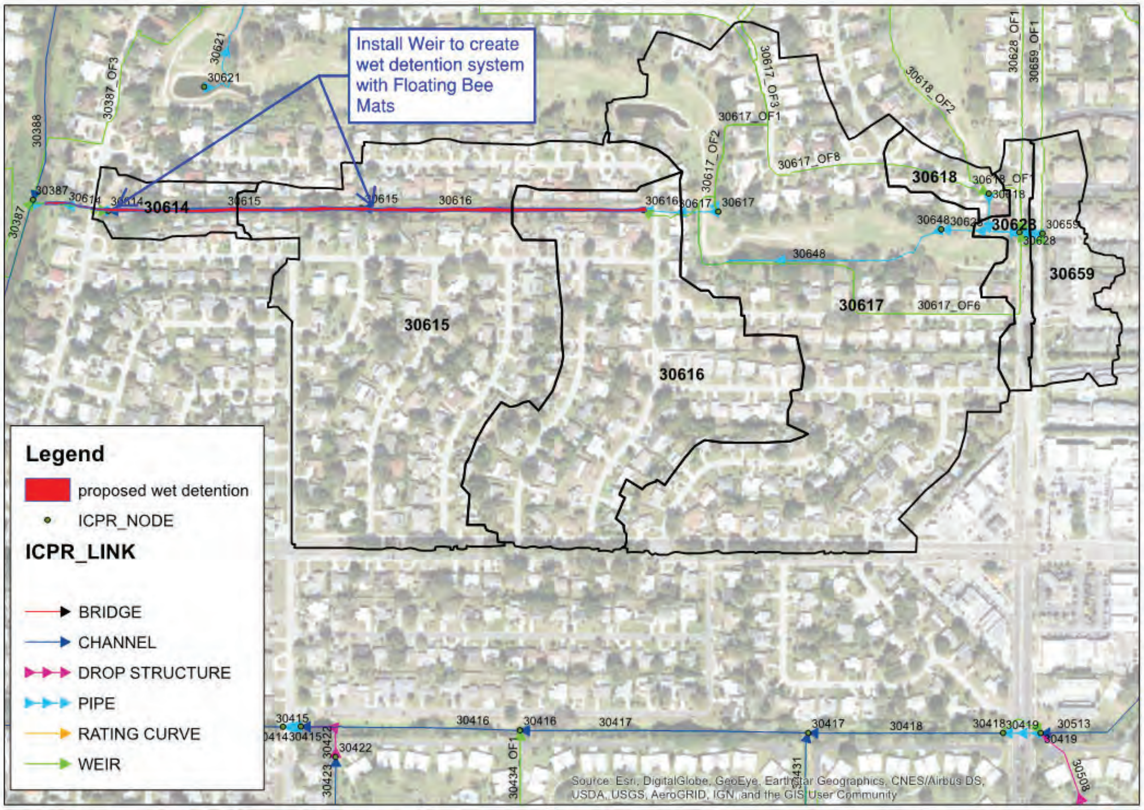


Figure 37 - Tanglewood In-Line Wet Detention Treatment System

<u>BMP TRAINS 2020 Report Tuttle at Tanglewood - Wet Detention with Beemat Floating Wetlands</u>

The BMP TRAINS 2020 input and output for the in-line wet detention system with floating Beemats in the existing canal east of Tanglewood Drive is presented here:

Site and Catchment Information

Analysis: BMP Analysis

Catchment Name	30617
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	103.50
Rational Coefficient (0-1)	0.29
Non DCIA Curve Number	84.00
DCIA Percent (0-100)	17.50
Wet Pond Area (ac)	0.59
Nitrogen EMC (mg/l)	2.058
Phosphorus EMC (mg/l)	0.332
Runoff Volume (ac-ft/yr)	127.272
Nitrogen Loading (kg/yr)	322.955

Phosphorus Loading (kg/yr)	52.100

Watershed Characteristics

Catchment Area (acres)	103.50
Contributing Area (acres)	102.910
Non-DCIA Curve Number	84.00
DCIA Percent	17.50
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Wet Detention with Floating Wetland Mats Design

Permanent Pool Volume (ac-ft)	2.640
Permanent Pool Volume (ac-ft) for 31 days residence	10.809
Annual Residence Time (days)	8
Littoral Zone Efficiency Credit	0
Wetland Efficiency Credit	10

Surface Water Discharge

Provided TN Treatment Efficiency (%)	35
Provided TP Treatment Efficiency (%)	59

Load Diagram for Wet Detention with Floating Wetland Mats (stand-alone)

Load
N: 322.96 kg/yr →
P: 52.10 kg/yr

Treatment
N: 35 % →
P: 59 %

Surface Discharge
N: 210.10 kg/yr
P: 21.62 kg/yr

↓

Mass Reduction
N: 112.85 kg/yr
P: 30.48 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	322.96 kg/yr	
Percent N load reduction	35 %	
Provided N discharge load	210.1 kg/yr	463.27 lb/yr
Provided N load removed	112.85 kg/yr	**248.84 lb/yr**

Phosphorus

Surface Water Discharge

Total P post load	52.1 kg/yr	
Percent P load reduction	59 %	
Provided P discharge load	21.615 kg/yr	47.66 lb/yr
Provided P load removed	30.484 kg/yr	**67.218 lb/yr**

The estimated costs for the Tanglewood Canal conceptual BMP total $85,259 and it is anticipated to remove 249 lb/yr TN and 67 lb/yr TP.

Blossom Brook Canal Conversion to Wet Detention in Series with Side-Bank Filters

The Blossom Brook Canal has a larger contributing area (549 acres) when compared to the Tanglewood system (103 acres), including portions of US-41 and adjacent commercial districts. The canal has one existing weir located just east of Brink Ave, and will be modified, along with installation of two additional weirs, at Tuttle Ave and Shade Ave. Contributing areas for each of the three weirs with ICPR basin delineation are provided Figure 38.

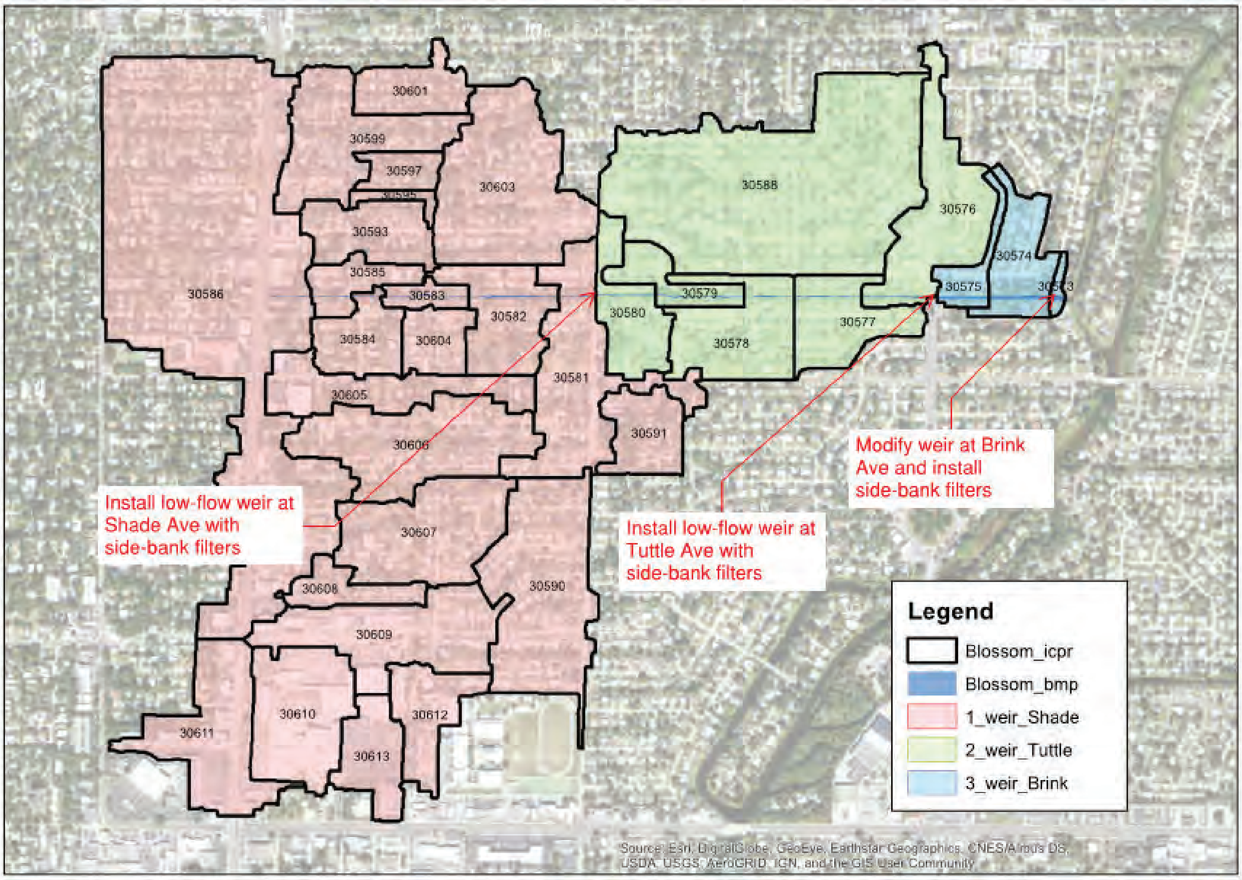


Figure 38 - Blossom Brook Canal BMP System

<u>BMP TRAINS 2020 Report Tuttle Blossom Brook Area Wet Detention with BAM Side-bank Media Filters</u>

The BMP TRAINS 2020 input and output for the in-line wet detention system with side-bank filters (split into 3 Areas, corresponding with Figure 38) in the existing Blossom Brook Canal is presented here:

Tuttle Blossom Brook Area 1 Project - Wet Detention with CTS 24 Side-bank Media Filters
Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Area 1 Subarea 1	Area 1 Subarea 2	catchment 4
Rainfall Zone	Florida Zone 4	Florida Zone 4	Florida Zone 4

Annual Mean Rainfall	52.00	52.00	52.00
Post-Condition Land Use Information			
Land se	User Defined Values	User Defined Values	User Defined Values
Area (acres)	167.07	242.18	409.25
Rational Coefficient (0-1)	0.28	0.36	0.33
Non DCIA Curve Number	82.63	81.77	82.10
DCIA Percent (0-100)	18.00	31.54	26.00
Wet Pond Area (ac)	0.00	0.52	0.52
Nitrogen EMC (mg/l)	2.059	1.894	1.950
Phosphorus EMC (mg/l)	0.323	0.296	0.299
Runoff Volume (ac-ft/yr)	200.477	378.035	577.626
Nitrogen Loading (kg/yr)	508.959	882.825	1,388.815
Phosphorus Loading (kg/yr)	79.842	137.971	212.952

Catchment Number: 1 Name: Area 1 Subarea 1
No BMPs in this Catchment, loadings only

Watershed Characteristics

Catchment Area (acres)	167.07
Contributing Area (acres)	167.070
Non-DCIA Curve Number	82.63
DCIA Percent	18.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Load
N: 508.96 kg/yr →
P: 79.84 kg/yr

Treatment
N: %
P: %

→ Surface Discharge
N: 508.96 kg/yr
P: 79.84 kg/yr

↓

Mass Reduction
N: 0.00 kg/yr
P: 0.00 kg/yr

Catchment Number: 2 Name: Area 1 Subarea 2
No BMPs in this Catchment, loadings only

Watershed Characteristics

Catchment Area (acres)	242.18
Contributing Area (acres)	241.660
Non-DCIA Curve Number	81.77
DCIA Percent	31.54
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Load Diagram for None (stand-alone)

Load		Treatment		Surface Discharge
N: 882.83 kg/yr	→	N: %	→	N: 882.83 kg/yr
P: 137.97 kg/yr		P: %		P: 137.97 kg/yr

↓

Mass Reduction
N: 0.00 kg/yr
P: 0.00 kg/yr

Catchment Number: 4 Name: catchment 4
This is catchments 1 and 2 combined
Date: 10/12/2021

Multiple BMP in Series Design Parameters

BMP in Series Number: 1
BMP Type: Wet Detention

Permanent Pool Volume (ac-ft)	0.210
Permanent Pool Volume (ac-ft) for 31 days residence	49.059
Annual Residence Time (days)	
Littoral Zone Efficiency Credit	0
Wetland Efficiency Credit	0

BMP in Series Number: 2
BMP Type: Filtration

Treatment Depth (in)	0.500
Hydraulic Capture Efficiency (%)	60
Media Type	B&G CTS24
Media N Reduction (%)	75
Media P Reduction (%)	95

Watershed Characteristics

Catchment Area (acres)	409.25
Contributing Area (acres)	408.730
Non-DCIA Curve Number	82.10
DCIA Percent	26.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	46
Provided TP Treatment Efficiency (%)	69

Load for Multiple BMP in Series

Load		Treatment		Surface Discharge
N: 1,388.81 kg/yr	→	N: 46 %	→	N: 750.32 kg/yr
P: 212.95 kg/yr		P: 69 %		P: 65.29 kg/yr

↓

Mass Reduction
N: 638.49 kg/yr
P: 147.66 kg/yr

Summary Report
Nitrogen

Surface Water Discharge		
Total N post load	1388.81 kg/yr	
Percent N load reduction	46 %	
Provided N discharge load	750.32 kg/yr	1654.46 lb/yr
Provided N load removed	638.49 kg/yr	**1407.87 lb/yr**

Phosphorus

Surface Water Discharge		
Total P post load	212.952 kg/yr	
Percent P load reduction	69 %	
Provided P discharge load	65.288 kg/yr	143.96 lb/yr
Provided P load removed	147.663 kg/yr	**325.597 lb/yr**

Media Filter Report
Catchment Name: catchment 4
Treatment Depth (in): 0.50
Rate (GPM/SF): 0.05
Effective Impervious Area (acres): 107.89
Minimum Filter Area (sf): 9,777.71

BMP TRAINS 2020 Report
Area 2 Project Wet Detention with Side-bank CTS12 Or CTS24 Media Filters

Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Area 2
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	125.51
Rational Coefficient (0-1)	0.27
Non DCIA Curve Number	83.42
DCIA Percent (0-100)	16.00
Wet Pond Area (ac)	0.58
Nitrogen EMC (mg/l)	2.053
Phosphorus EMC (mg/l)	0.323
Runoff Volume (ac-ft/yr)	146.505
Groundwater N (kg/yr)	0.000

Groundwater P (kg/yr)	0.000
Nitrogen Loading (kg/yr)	370.855
Phosphorus Loading (kg/yr)	58.347

Catchment Number: Tuttle Blossom Brook Area 2
Multiple BMP in Series Design Parameters

BMP in Series Number: 1
BMP Type: Wet Detention

Permanent Pool Volume (ac-ft)	0.470
Permanent Pool Volume (ac-ft) for 31 days residence	12.443
Annual Residence Time (days)	1
Littoral Zone Efficiency Credit	0
Wetland Efficiency Credit	0

WITH CTS 24 FILTER MEDIA
BMP in Series Number: 2
BMP Type: Filtration with CTS24 Media

Treatment Depth (in)	0.500
Hydraulic Capture Efficiency (%)	58
Media Type	B&G CTS24
Media N Reduction (%)	75
Media P Reduction (%)	95

Surface Water Discharge

Provided TN Treatment Efficiency (%)	49
Provided TP Treatment Efficiency (%)	74

Load for Multiple BMP in Series

Load
N: 370.86 kg/yr →
P: 58.35 kg/yr

Treatment
N: 49 %
P: 74 %

→ Surface Discharge
N: 189.31 kg/yr
P: 15.31 kg/yr

↓

Mass Reduction
N: 181.55 kg/yr
P: 43.04 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	370.86 kg/yr	
Percent N load reduction	49 %	
Provided N discharge load	189.31 kg/yr	417.42 lb/yr
Provided N load removed	181.55 kg/yr	**400.31 lb/yr**

Phosphorus

Surface Water Discharge

Total P post load	58.347 kg/yr	
Percent P load reduction	74 %	
Provided P discharge load	15.305 kg/yr	33.75 lb/yr
Provided P load removed	43.042 kg/yr	**94.907 lb/yr**

BMP TRAINS 2020 Report
Tuttle Blossom Brook Area 3 Project Wet Detention with Side-bank CTS12 Media Filters
Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Blossom Brook Area 3
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	14.42
Rational Coefficient (0-1)	0.29
Non DCIA Curve Number	83.98
DCIA Percent (0-100)	19.00
Wet Pond Area (ac)	0.47
Nitrogen EMC (mg/l)	2.058
Phosphorus EMC (mg/l)	0.325
Runoff Volume (ac-ft/yr)	17.830
Nitrogen Loading (kg/yr)	45.243
Phosphorus Loading (kg/yr)	7.145

Catchment Number: 1 Name: Blossom Brook Area 3

Multiple BMP in Series Design Parameters

Watershed Characteristics

Catchment Area (acres)	14.42
Contributing Area (acres)	13.950
Non-DCIA Curve Number	83.98
DCIA Percent	19.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	49
Provided TP Treatment Efficiency (%)	76

WITH ONE INCH VOLUME TREATMENT CTS12 MEDIA
BMP in Series Number: 1
BMP Type: Wet Detention

Permanent Pool Volume (ac-ft)	0.210
Permanent Pool Volume (ac-ft) for 31 days residence	1.514
Annual Residence Time (days)	4
Littoral Zone Efficiency Credit	0
Wetland Efficiency Credit	0

BMP in Series Number: 2

BMP Type: Filtration

Treatment Depth (in)	1.000
Hydraulic Capture Efficiency (%)	75
Media Type	B&G CTS12
Media N Reduction (%)	60
Media P Reduction (%)	90

Surface Water Discharge

Provided TN Treatment Efficiency (%)	57
Provided TP Treatment Efficiency (%)	84

Load for Multiple BMP in Series

Load		Treatment		Surface Discharge
N: 45.24 kg/yr	→	N: 57 %	→	N: 19.39 kg/yr
P: 7.14 kg/yr		P: 84 %		P: 1.15 kg/yr

↓

Mass Reduction
N: 25.85 kg/yr
P: 6.00 kg/yr

Summary Report

Nitrogen

Surface Water Discharge

Total N post load	45.24 kg/yr	
Percent N load reduction	57 %	
Provided N discharge load	19.39 kg/yr	42.76 lb/yr
Provided N load removed	25.85 kg/yr	**57 lb/yr**

Phosphorus

Surface Water Discharge

Total P post load	7.145 kg/yr	
Percent P load reduction	84 %	
Provided P discharge load	1.149 kg/yr	2.53 lb/yr
Provided P load removed	5.996 kg/yr	**13.221 lb/yr**

Media Filter Report
Catchment Name: Blossom Brook Area 3
Treatment Depth (in): 1.00
Rate (GPM/SF): 0.05
Effective Impervious Area (acres): 4.83
Minimum Filter Area (sf): 875.72

The low flow weir with side bank filter will remove 1,865 pounds of TN and 434 pounds of TP annually. The estimated costs for the Blossom Brook Canal project total $1,882,305.

Sediment Removal, Dam Removal and Sediment Sump

The sediment removal, dam removal, and sediment sump installation were originally proposed in the Sarasota County Sediment Management Project 1: Phillippi Creek Barrier Removal Feasibility Study Final Report by Weiler Engineering Corporation, dated January 2019. The location of each component is presented in Figure 39. The original report is included as Appendix C.

The removal of the remnants of the dam will provide for a more natural flow regime in Phillippi Creek and the removal will preclude additional sedimentation issues from occurring at that location. This project will provide a sedimentation sump that provides easier access for maintenance crews to frequently remove the sediment and any associated nutrients.

Figure 39 - Tuttle Sediment Removal, Dam Removal and Sediment Sump

Estimated Excavation for the canal, dam and sediment sump will result in approximately 20,062 cubic yards of material removed. Removing accumulated sediment and the barrier will help to restore the channel profile to a more natural state and should allow the creek flow rates to return to natural levels. The proposed sediment sump should collect suspended solids from upstream in a controlled location for removal by County maintenance staff.

Sediment removal via excavation during initial construction yields 36,107 lbs of TN and 17,387 lbs of TP removed from an estimated 767 cubic yards of material. Values were obtained by utilizing the Florida Stormwater Association MS4 Load Reduction Assessment Tool, dated June 2019, accessed from the Florida Department of Environmental Protection's site (FSA-MS4 Load Reduction Tool updated 2019 | Florida Department of Environmental Protection)

The tool's input screen is presented in Figure 40, while the results are shown in Figure 41.

Enter Volume of Solids[1] Removed - Calculate Equivalent Dry Weight

FSA 2019

	For Wet or Dry Solids by Volume[2]			
Category of Maintenance Activity	Enter Volume of Collected Solids Cubic Feet	Enter Dry Bulk Density Solids Lb/C.F.	Calculated Weight of Dry Solids (Pounds)	Calculated Equivalent Dry Weight Collected (Kilograms)
Street Sweepings	0	85	0	0
Catch Basin Cleanout	541,674	85	45,988,123	20,860,212
BMP Cleanout	0	85	0	0

GREEN Denotes Cells for DATA ENTRY

BLUE Denotes Calculation Results

NOTES:

1. "Particulate Matter" from the FSA Final Report is defined as "Solids" for use in this spreadsheet.
2. For measurements of volume, include approximate dry bulk density;
   use the default bulk density of 1.36 or 84.9 pounds per cubic foot until confirmed by sampling.

Figure 40 - Phillippi Creek Sediment Sump & Sediment Removal Load Reduction Assessment Tool Input

Calculated Nutrient Load Reductions from MS4 Maintenance Practices

FSA 2019

		Subtotal TP Removed (Kilograms)	Subtotal TP Removed (Pounds)
TOTAL PHOSPHORUS			
Street Sweepings - Dry Mass Collected (Kg)	0		
Amount of TP Removed (Kilograms)	0	0	0
Catch Basins - Dry Mass Collected	20,860,212		
Amount of TP Removed (Kilograms)	7,885	7,885	17,387
BMP - Dry Mass Collected	0		
Amount of TP Removed (Kilograms)	0	0	0
GRAND TOTAL TP REMOVED (KILOGRAMS) =		7,885	
GRAND TOTAL TP REMOVED (POUNDS) =			17,387

		Subtotal TN Removed (Kilograms)	Subtotal TN Removed (Pounds)
TOTAL NITROGEN			
Street Sweepings - Dry Mass Collected (Kg)	0		
Amount of TN Removed (Kilograms)	0	0	0
Catch Basins - Dry Mass Collected	20,860,212		
Amount of TN Removed (Kilograms)	16,375	16,375	36,107
BMP - Dry Mass Collected	0		
Amount of TN Removed (Kilograms)	0	0	0
GRAND TOTAL TN REMOVED (KILOGRAMS) =		16,375	
GRAND TOTAL TN REMOVED (POUNDS) =			36,107

Figure 41 - Phillippi Creek Sediment Sump & Sediment Removal Load Reduction Assessment Tool Results

Annual TN and TP reductions for the Sediment Sump previously calculated in the Phillippi Creek Barrier Removal Feasibility Study Report (Appendix C) based on the estimated performance of the sediment sump are 160 lb/yr and 64 lb/yr, respectively.

The proposed conceptual BMPs for the Tuttle Circle PMA provide annual reductions of 2,274 lb/yr of TN and 565 lb/yr of TP. Initial excavation also provides a one-time removal of 36,107 lbs of TN and 17,387 lbs of TP.

The estimated costs for the Sediment removal, dam removal and sediment sump installation total $1,046,663.

The estimated cost for all the Tuttle Circle PMA conceptual BMPs is $3,013,227.

Pinecraft Priority Management Area Conceptual BMP

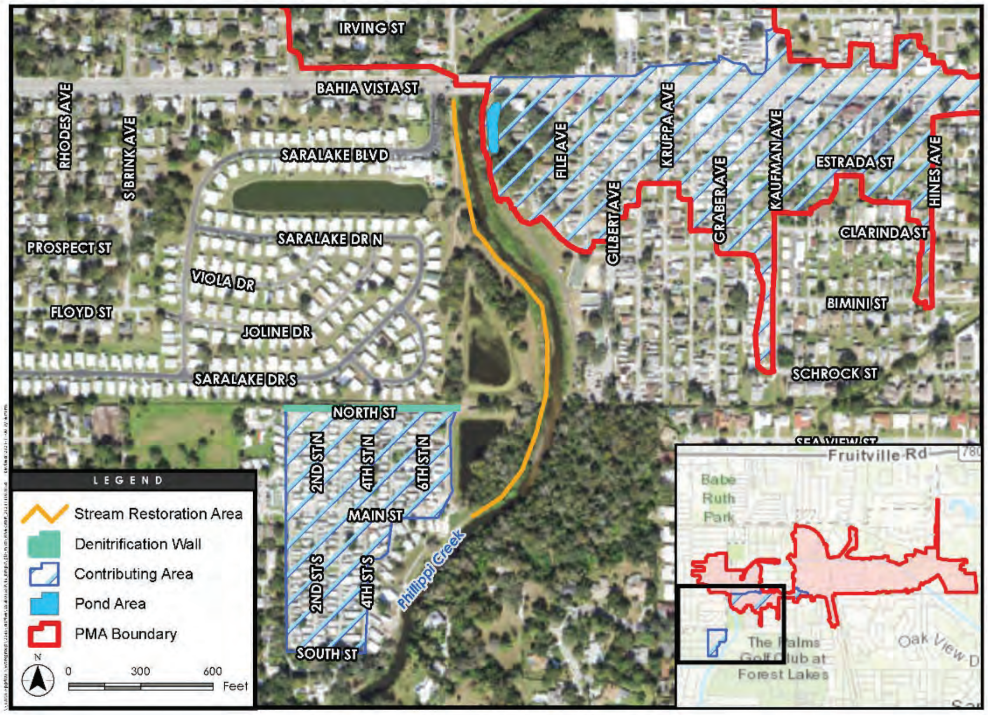


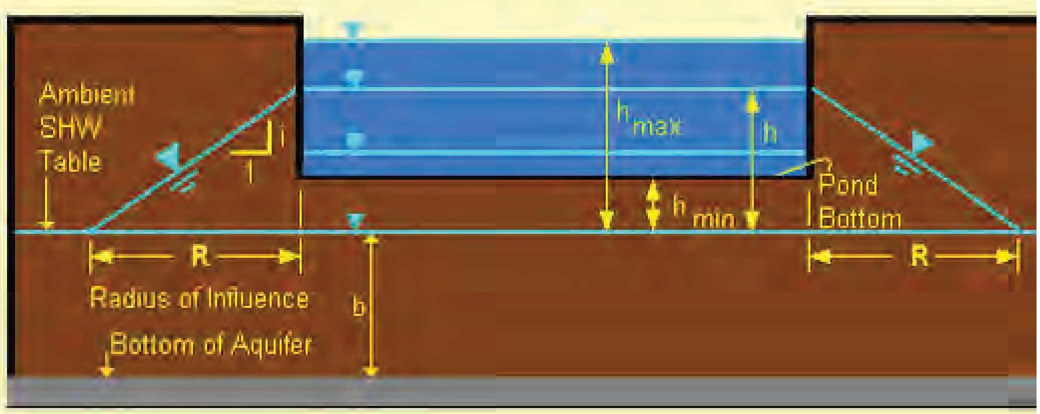
Figure 42 - Pinecraft Area BMPs

Pond Conversion

Conceptual BMPs in the Pinecraft PMA include converting the existing wet detention pond located just east of Phillippi Creek, south of Bahia Vista Street to a dry detention pond. The existing wet pond does not function as intended, with considerable algae and shallow water depth leading to unsightly appearances. Converting to dry retention with percolation will increase the TN treatment efficiency and improve the cosmetic appearance of an existing BMP. Installing a layer of BAM for the dry pond to percolate through provides additional treatment benefits through biosorption during the groundwater infiltration recharge process. The local soils were reviewed and mounding analysis was performed calculation was performed to show that recovery time is less than 72 hours per SWFWMD rules. According to USGS soil survey, the soil type in the vicinity of the subject pond is Pineda fine sand-Urban land complex, which has a saturated permeability rate (Ksat) of 92.0 micrometers per second, or 26 feet per day.

Mounding Analysis - Simplified Analytical Method

Pond Length (L) =	275	feet
Pond Width (W) =	60	feet
Porosity (P) =	1.00	Porosity of material within the pond
Top of Treatment =	6.30	feet
SHW =	2.80	feet
Bottom of Pond =	4.30	feet
Aquifer elevation	-2.00	feet
η =	0.10	Specific yield or effective porosity of aquifer -
k =	26.00	ft/day - horizontal hydraulic conductivity of aq
Recovery Time =	71.96	hours
Recovered Volume =	33,000	cubic feet
R_{max} =	325.5	feet - Maximum Radius of Influence
h_{max} =	3.50	feet - Top of treatment to SHW
h_{min} =	1.50	feet - Bottom of pond to SHW
b =	4.80	feet - initial saturated thickness of aquifer



Mounding analysis calculation shows Recovery Time is 71.96 hours, less than the required 72 hour maximum.

<u>BMP TRAINS 2020 Report - Pinecraft Park Convert Wet Detention to Dry Retention with CTS12 Filter Media</u>

The BMP TRAINS 2020 input and output for the existing wet detention and proposed dry retention pond with BAM configurations is presented here:

Site and Catchment Information

BMP Analysis Existing Wet Detention

Catchment Name	30663
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00

Post-Condition Land Use Information

Land use	User Defined Values
Area (acres)	33.89
Rational Coefficient (0-1)	0.42
Non DCIA Curve Number	91.20
DCIA Percent (0-100)	23.00
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.925
Phosphorus EMC (mg/l)	0.294
Runoff Volume (ac-ft/yr)	62.392
Nitrogen Loading (kg/yr)	148.088
Phosphorus Loading (kg/yr)	22.617

Wet Detention Design

Permanent Pool Volume (ac-ft)	0.270
Permanent Pool Volume (ac-ft) for 31 days residence	5.299
Annual Residence Time (days)	2
Littoral Zone Efficiency Credit	0
Wetland Efficiency Credit	0

Watershed Characteristics

Catchment Area (acres)	33.89
Contributing Area (acres)	33.890
Non-DCIA Curve Number	91.20
DCIA Percent	23.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	12
Provided TP Treatment Efficiency (%)	43

Load Diagram for Existing Wet Detention (stand-alone)

Load N: 148.09 kg/yr P: 22.62 kg/yr	→	Treatment N: 12 % P: 43 %	→	Surface Discharge N: 130.92 kg/yr P: 12.87 kg/yr
		↓		Mass Reduction N: 17.17 kg/yr P: 9.75 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	148.09 kg/yr
Percent N load reduction	12 %

Provided N discharge load	130.92 kg/yr	288.67 lb/yr
Provided N load removed	17.17 kg/yr	**37.86 lb/yr**

Phosphorus

Surface Water Discharge

Total P post load	22.617 kg/yr	
Percent P load reduction	43 %	
Provided P discharge load	12.872 kg/yr	28.38 lb/yr
Provided P load removed	9.745 kg/yr	**21.488 lb/yr**

Retention area with CTS12 media

Retention Design

Retention Depth (in)	0.270
Retention Volume (ac-ft)	0.763

Media Mix Information

Type of Media Mix	B&G CTS12
Media N Reduction (%)	60
Media P Reduction (%)	90

Load Diagram for Proposed Dry Retention (stand-alone)

Load
N: 148.09 kg/yr →
P: 22.62 kg/yr

Treatment
N: 35 % →
P: 35 %

Surface Discharge
N: 95.55 kg/yr
P: 14.59 kg/yr

↓

Mass Reduction
N: 52.54 kg/yr
P: 8.02 kg/yr

Into Media
N: 52.540 kg/yr
P: 8.024 kg/yr

GW Treatment
N: 60 % →
P: 90 %

GW Discharge
N: 21.016 kg/yr
P: 0.802 kg/yr

↓

Retained
N: 31.52 kg/yr **(69.5 lbs/yr)**
P: 7.22 kg/yr **(15.9 lbs/yr)**

Summary Report

Nitrogen

Surface Water Discharge

Total N post load	148.09 kg/yr	
Percent N load reduction	35 %	
Provided N discharge load	95.55 kg/yr	210.69 lb/yr
Provided N load removed	52.54 kg/yr	115.85 lb/yr

Groundwater Discharge

Average Annual Recharge	7.213 MG/yr

Provided N recharge load	21.016 kg/yr	46.34 lb/yr
Provided N Concentration	.77 mg/l	

Phosphorus

Surface Water Discharge

Total P post load	22.617 kg/yr	
Percent P load reduction	35 %	
Provided P discharge load	14.593 kg/yr	32.18 lb/yr
Provided P load removed	8.024 kg/yr	17.693 lb/yr

Groundwater Discharge

Average Annual Recharge	7.213 MG/yr	
Provided P recharge load	.8024 kg/yr	1.7693 lb/yr
Provided P Concentration	.0294 mg/l	

The existing and proposed treatment efficiency and annual TN and TP removal estimates are presented in Table 3.

Table 3 - Pinecraft Pond Conversion Treatment Efficiency

	Treatment Efficiency TN	Treatment Efficiency TP	Estimated TN Reduction (lb/yr)	Estimated TP Reduction (lb/yr)
Existing Wet Detention	11.6 %	43%	21	18
Proposed Dry Retention with BAM	35% - Surface Water 60% - Groundwater	35% - Surface Water 90% - Groundwater	**185.5**	**33.7**

The estimated cost for the Pond conversion conceptual BMP is $267,725.

Aloha Mobile Home Park Denitrification Trench

The Aloha mobile home park (MHP) is located between Bahia Vista Street and Hyde Park Street in Sarasota. It is adjacent to Phillippi Creek. The MHP consists of 15.84 acres with 280 units, all served by on-site treatment and disposal systems (OSTDS). In general, stormwater and ground water flow from the MHP flow into a ditch that is adjacent to North Street. This ditch is designated in Sarasota County's Stormwater Asset Data Base as C4-84.2 (Legacy ID) aka CT_112016_000749 (FacilityID).

High values of TN and TP have been recorded in this ditch over the years.

To reduce the TN and TP loading from the ditch into Phillippi Creek, a denitrification trench is proposed to be constructed on the south side bank of the ditch. The denitrification trench will be 660' long and be 3' by 3' in size. A biosorption activated media (BAM) will be used in the trench to promote removal of TN and TP.

Unfortunately, neither ground water nor surface water monitoring has been done in the ditch adjacent to the Aloha MHP in several years. Therefore, literature values from a recent monitoring project in Brevard County are being used to calculate the TN and TP loadings. The project, Final Report for the

Groundwater Pollution, Engaging the Community in Solutions (FDEP Contract #LP05112) and Save Our Indian River Lagoon Project Plan (SOIRLPP) Groundwater Quality Monitoring, was published in 2020. The project examined groundwater nutrient concentrations in residential communities that had different wastewater treatment types: 1) septic tanks; 2) municipal sewer systems; or 3) municipal sewer systems with reclaimed irrigation. Monitoring wells were installed in 13 residential neighborhoods and 3 natural areas located in five regions of Brevard County including the mainland and barrier islands. The Turkey Creek and Suntree areas have soil types and water table conditions similar to those at the Aloha MHP.

Table 4 below summarizes the TN and TP ground water monitoring data for the Turkey Creek and Suntree areas.

Table 4 - TN and TP groundwater monitoring data for the Turkey Creek and Suntree Areas

Location/Analyte	Mean	Median	25th Percentile	75th Percentile
Turkey Creek TN	7.19 mg/L	4.80 mg/L	1.55 mg/L	7.35 mg/L
Turkey Creek TP	0.938 mg/L	0.970 mg/L	0.580 mg/L	1.200 mg/L
Suntree TN	7.52 mg/L	6.05 mg/L	2.08 mg/L	8.63 mg/L
Suntree TP	0.576 mg/L	0.42 mg/L	0.16 mg/L	0.93 mg/L
Mean of TC/ST TN Mean of TC/ST TP	7.355 mg/L 0.757 mg/L		1.815 mg/L 0.37 mg/L	7.99 mg/L 1.065 mg/L

The annual average ground water flow is 19.91 ac-ft or 0.03 cfs. Using the mean concentrations above, this leads to the following estimates of the average annual TN and TP loadings, which were calculated for the mean, 25th percentile, and 75th percentile values, as shown in Table 5.

Table 5 - Estimated Average Annual TN and TP Loading for Aloha Mobile Home Park

Parameter	Mean Annual Loading lbs/yr	25th Percentile Annual Loading lbs/yr	75th Percentile Annual Loading lbs/yr
TN	397.20	98.01	432.66
TP	40.99	20.04	57.67

Given that the density of OSTDS within the Aloha MHP is much greater than the density of OSTDS within either the Turkey Creek or Suntree areas, we believe the 75th percentile loading is appropriate for use in this project.

To reduce the TN and TP loading from the ditch into Phillippi Creek, a denitrification trench is proposed to be constructed on the south side bank of the ditch. The wall will be 660' long and 3' by 3' in size. A typical section of the trench is provided in Figure 43.

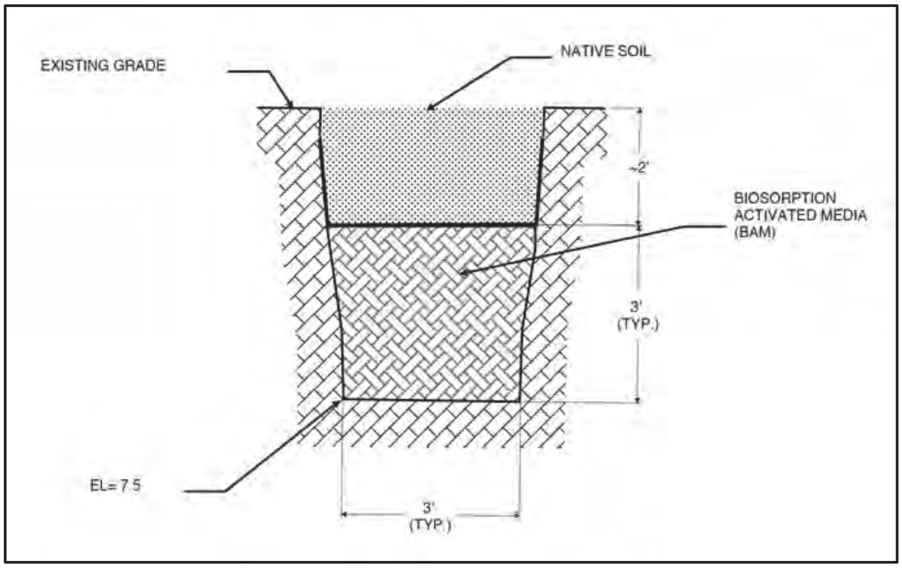


Figure 43 - Aloha Mobile Home Park Denitrification Trench Typical Detail

BAM will be used in the denitrification trench to promote removal of TN and TP. The FDEP approved BAMs are listed in Table 6 below.

Table 6 - Biosorption Media Details

Media[1]	Minimum	Treatment[2]	Treatment Efficiency[3]		Sustain	OP Removal[5]	Density[6]
	Depth (in)	Rate (GPM/SF)	TN (%)	TP(%)	Void %[4]	Rate (mg/g)	Lbs/CF
B&G ECT3	24	1	45/25[7]	45/25[7]	30	0.2	43
B&G CTS12	12	0.052	60	90	30	0.2	95
B&G CTS24	24	0.052	75	95	30	0.2	95
Per Pave[8]	3	0.052	60	90	20	0.2	95
SAT[9]	24	0.02	30	45	30	0	100

Based on the average annual flow rate of 0.03 cubic feet per second and the desired pollutant load reduction, the B&G CTS24 BAM is proposed for use in the Denitrification Wall. The estimated load reductions for the Mean and 75th percentile loadings are shown below in Table 7 below.

Table 7 - Aloha Mobile Home Park Denitrification Wall Estimated Load Reductions

Parameter	Mean Annual Loading lbs/yr	Mean Annual Load reduction	75th Percentile Annual Loading lbs/yr	75th Percentile Annual Load reduction
TN	397.20	**297.9**	432.66	324.50
TP	40.99	**38.94**	57.67	43.25

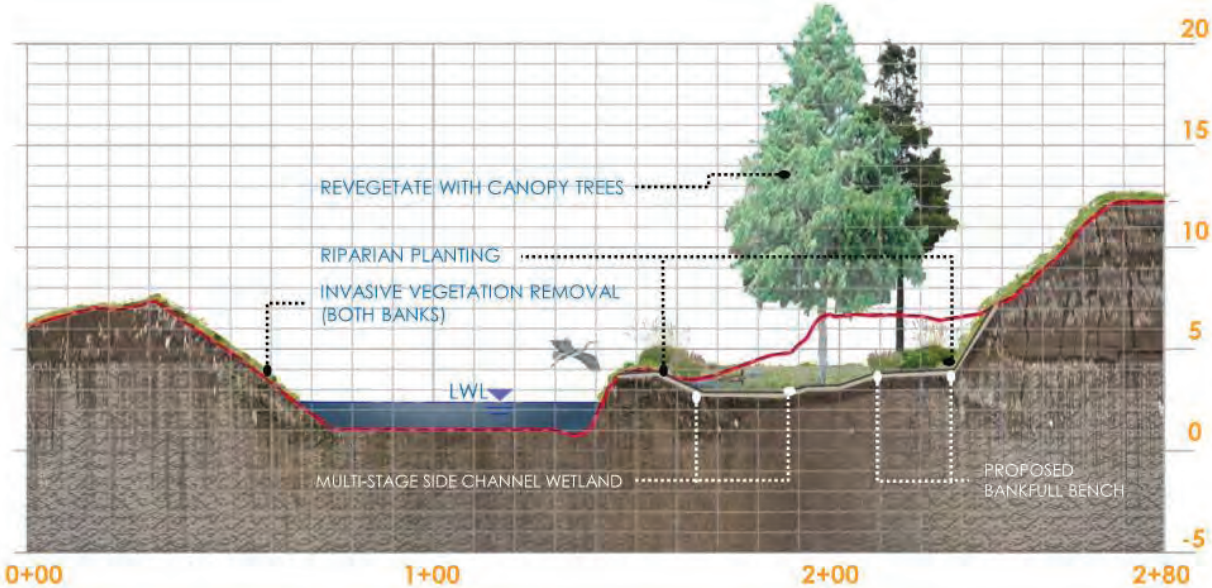
The estimated costs for the denitrification trench conceptual BMP total $125,840.

Stream Restoration along Phillippi Creek

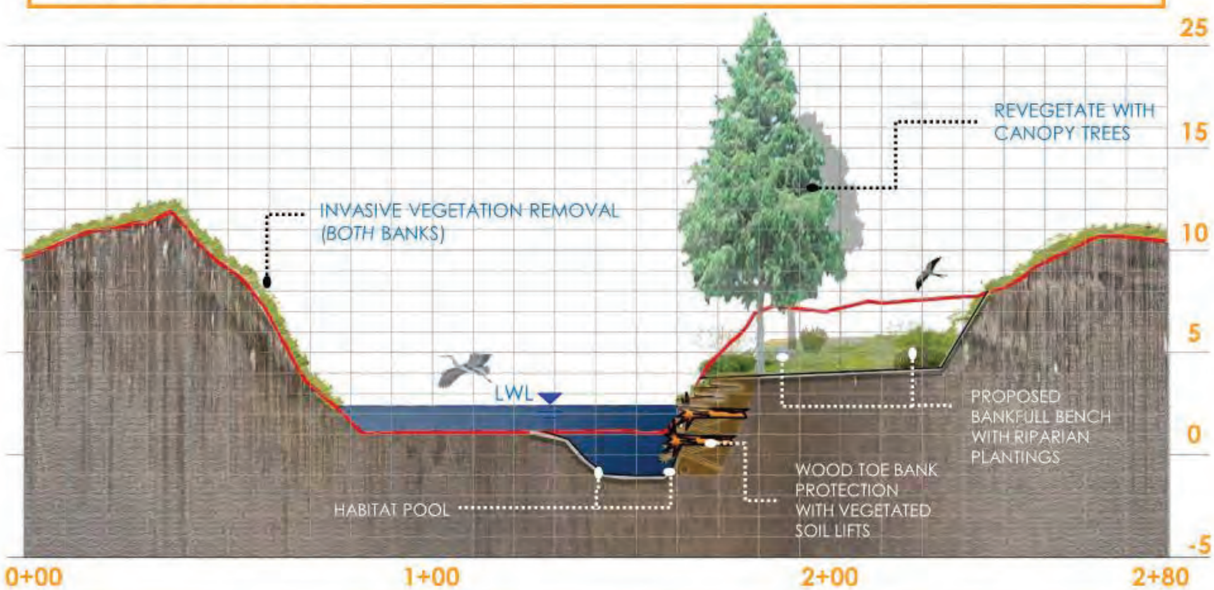
The segment of Phillippi Creek downstream of the Bahia Vista Street bridge and extending to approximately 600 feet downstream of the Pinecraft Park presents the opportunity to implement stream restoration techniques aimed at improving water quality, enhancing a variety of habitat functions, and improving accessibility to the public. This reach is located at the interface between riverine and tidal influences and exhibits indicators of channel instability and aquatic habitat impairment typical of riverine responses to urban development within the watershed, encroachment of adjacent developments, and historic channelization activities. This segment of creek is characterized as an entrenched, single stage channel without adequate floodplain connectivity, and steep unstable banks dominated by shallow rooted non-native grasses and invasive vegetation. Visual observations noted signs of mass wasting and toe erosion that contribute to decreases in aquatic habitat diversity and elevated sediment loading to the downstream channel and ultimately Sarasota Bay.

Figure 44 - Phillippi Creek Stream Restoration Concept Plan

This preliminary concept focuses on utilizing available adjacent land within the limited channel right-of-way to improve floodplain connectivity, implementation of bioengineered stabilization to promote long term and resilient bank protection, and replacement of exotic vegetation with native plantings. The proposed laying back of the channel side slopes and creating a bankfull bench will provide an increase in flood flow conveyance capacity, while improving water quality by reducing erosion potential, providing in-line treatment, and depositional areas for sediment/entrained pollutants. The bankfull benches will be revegetated with appropriate native plants which improve shear strength of the creek bank soils, by establishment of deep root masses.



SECTION ONE: The proposed laying bank of the channel side slopes, and adjacent multi-stage wetland provides a diversity of aquatic and riparian habitat, while allowing for settling of entrained sediment and nutrients during high flow. Establishment of native vegetation will improve soil structure stability and restore a variety of terrestrial habitat.



SECTION TWO: The wood toe bioengineered bank protection structure consists of locally salvaged logs and woody debris placed along the unstable right bank. The roughness of the woody debris reduces near-bank shear stress, provides aquatic habitat enhancement, and conducive subbase medium for vegetation establishment. Vegetated soil lifts create a resilient upper bank and the bankfull bench allows for increase in floodplain connectivity and support of native riparian vegetation community.

Figure 45 - Stream Restoration Plan Sections 1 and 2

The wood toe protection structure utilizes locally salvaged woody debris that serves to provide long term bank stabilization, acts as a hydraulic energy dissipater, and supports biological habitat and carbon sources. Typical historic maintenance operations generally focused on removal of woody debris as they were seen as potentially threats to infrastructure. However, absence of woody debris in channels results in the lack of naturally occurring aquatic habitats critical to a healthy ecosystem. The process of utilizing woody debris in a manner that is embedded into the creek bed or bank such that the wood stays submerged beneath the low water elevation can help to address both the maintenance concerns and habitat improvement goals of restoration projects. The new channel bank above the wood toe will be stabilized with bioengineered soil wraps vegetated with live cuttings (also known as Vegetation Reinforced Soil Slope – VRSS). The use of native live cuttings provides resilient slope stability that gets stronger with time as the root masses mature.

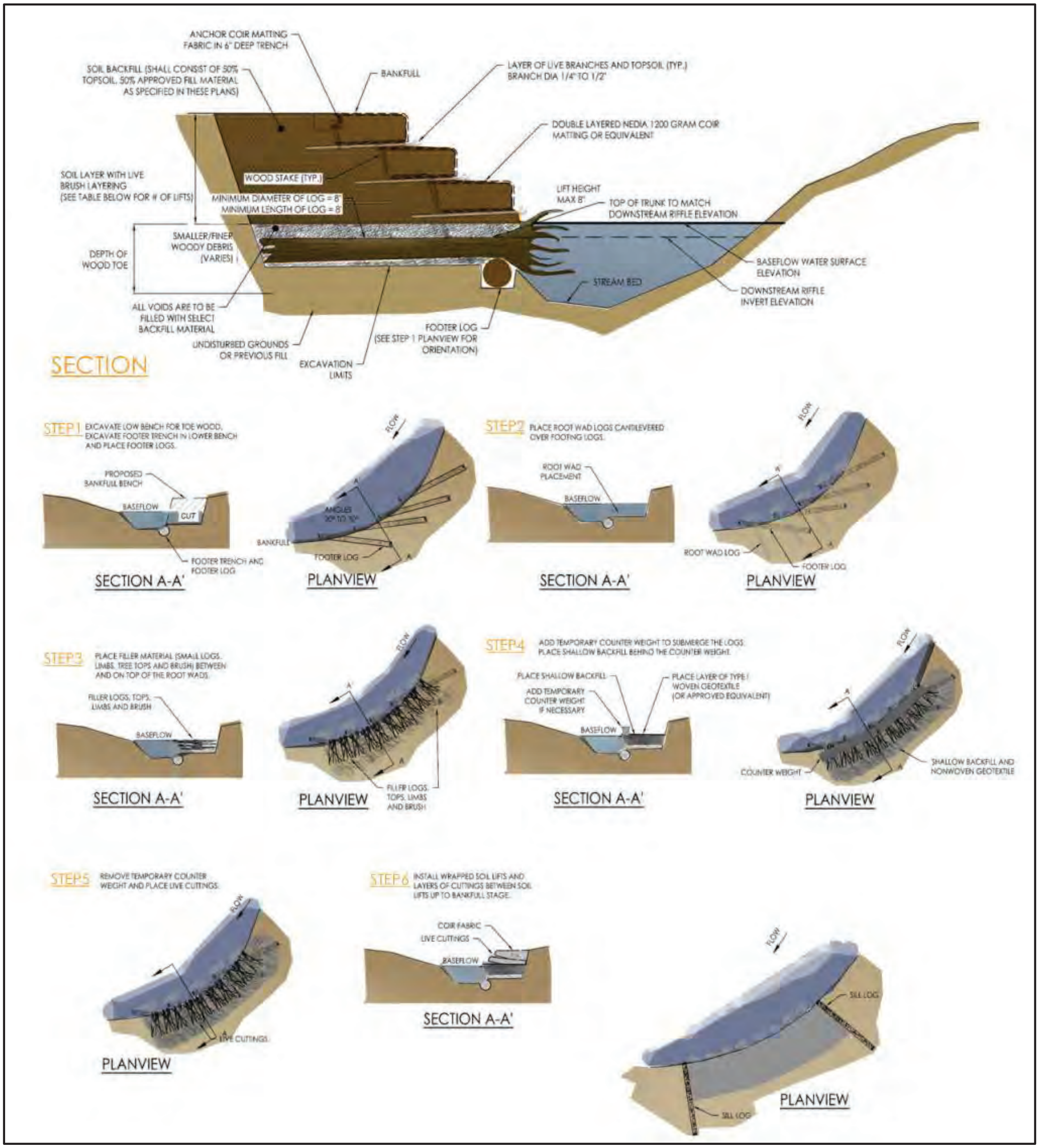


Figure 46 - Wood Toe Protection with Vegetated Soil Lifts Details

The headwater channel stabilization structure is a naturalized way to utilize on-site woody debris that would otherwise require haul-off and disposal in a method that provides effective channel grade and bank protection in steep and/or incised channels. The structure can be incredibly effective in channels dominated by sand and/or fine-grained creek beds, that have experienced erosion or downcutting due to changes in hydrology or lowering of baselevel. The creek bed and banks are reconstructed using a mixture of various size classes of woody debris mixed with native soil, which emulates the naturally occurring subbase in natural channels. The matrix of wood in the subbase provides a “rebar” like effect in improve subsurface soil structure resistant to erosion and scour, which providing improved aquatic habitat.

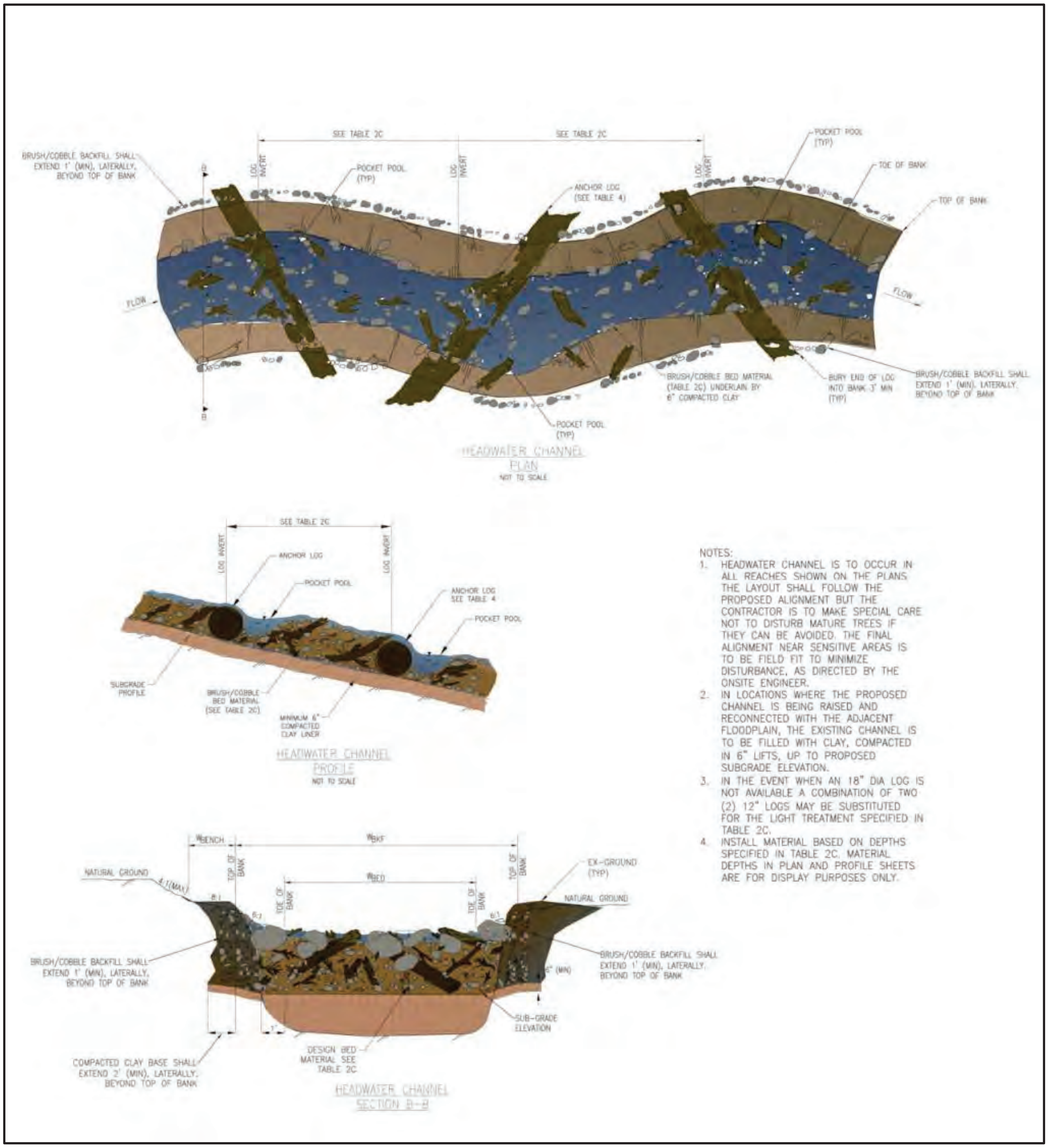


Figure 47 - Stream Restoration Headwater Channel Details

The cost estimate for the stream restoration conceptual BMP is $701,393. With shoreline restoration spanning approximately 2000 linear feet, the unit cost for the project is approximately $350 per linear foot of shoreline.

The proposed water quality improvements for the Pinecraft PMA include annual reductions of 483.4 lb/yr of TN and 72.6 lb/yr of TP.

The total cost for all conceptual BMPs in the Pinecraft PMA is $1,094,958.

Sarasota Memorial Hospital and US-41 Priority Management Area Conceptual BMP

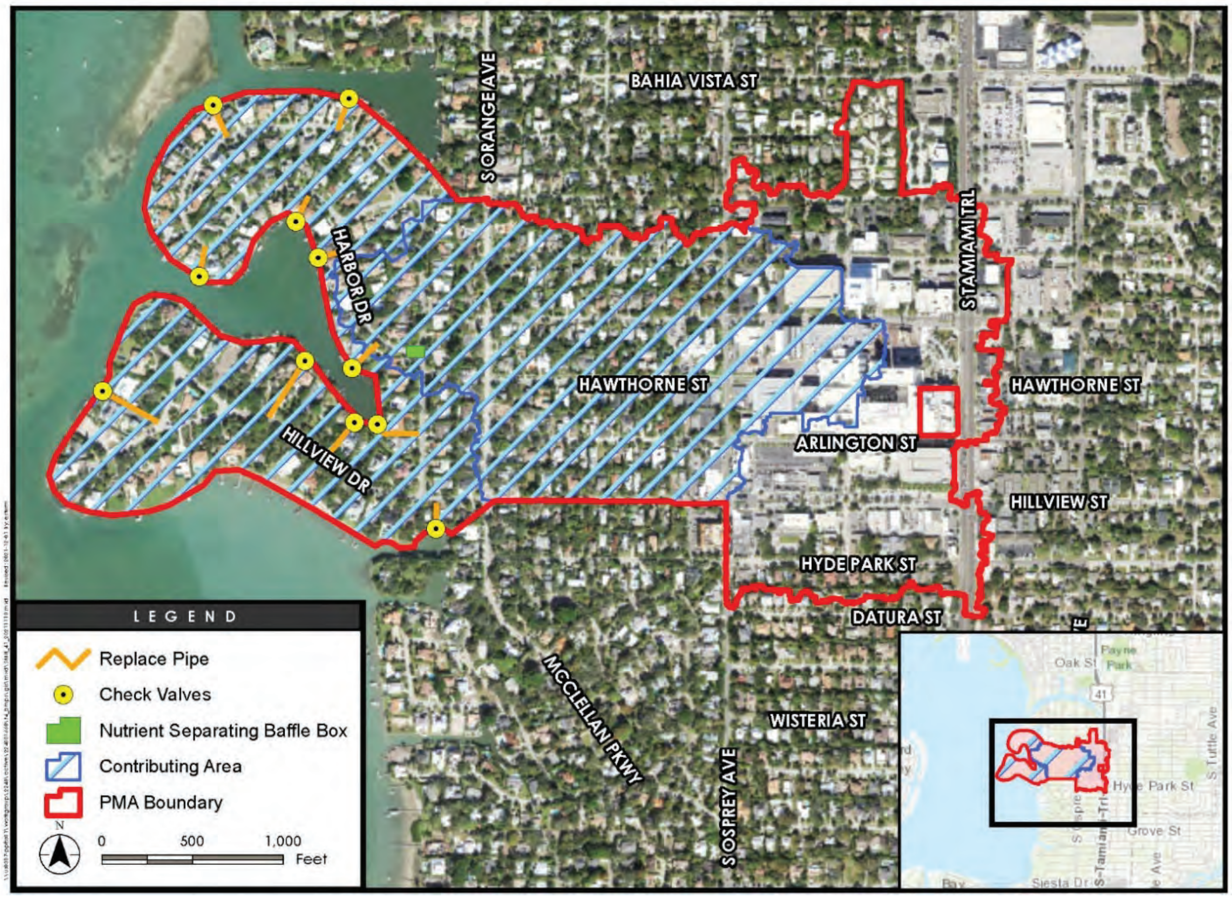


Figure 48 - SMH & US 41 Area BMPs

Nutrient Separating Baffle Box

The first conceptual BMP for the Sarasota Memorial Hospital and US-41 PMA area is a nutrient separating baffle box near the intersection of Harbor Drive and Flower Drive providing treatment for an 81-acre contributing area, as shown in Figure 48. Most of that contributing area does not have any BMPs. Additional nutrient separating baffle boxes were considered at the Bahia Vista Street and Hillview Drive stormwater outfalls, however these locations do not warrant these BMPs due the relatively small size and the low water quality LOS deficiency ranking of their contributing areas. Figure 49 provides a typical detail diagram for a nutrient-separating baffle box.

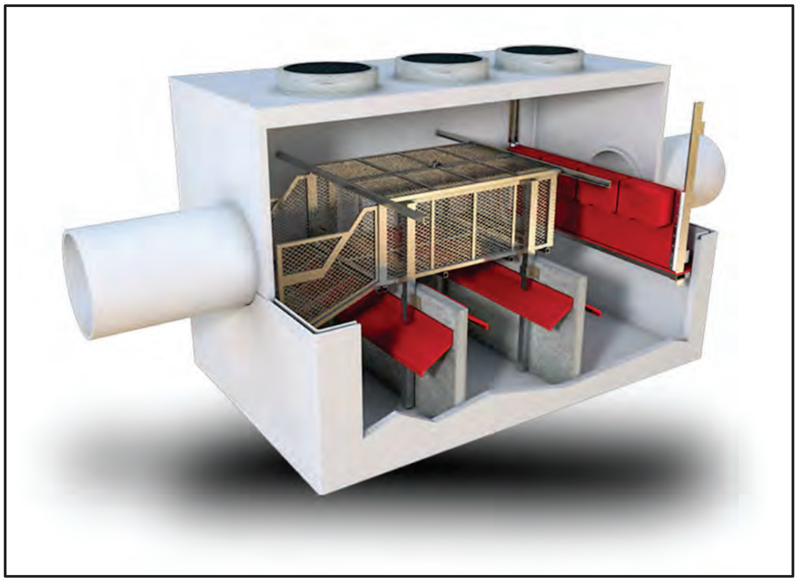


Figure 49 - Nutrient-Separating Baffle Box Diagram (source: Oldcastleinfrastructure.com)

BMP TRAINS 2020 Report – SMH and US41 Nutrient Separating Baffle Box

The BMP TRAINS 2020 input and output for the Nutrient-Separating Baffle Box are presented here:

Site and Catchment Information

Analysis: BMP Analysis

Catchment Name	H0680
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land use Information	
Land use	User Defined Values
Area (acres)	81.01
Rational Coefficient (0-1)	0.34
Non DCIA Curve Number	87.00
DCIA Percent (0-100)	20.70
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.796
Phosphorus EMC (mg/l)	0.284
Runoff Volume (ac-ft/yr)	119.866
Nitrogen Loading (kg/yr)	265.439
Phosphorus Loading (kg/yr)	41.974

Catchment Number: 1 Name: H0680

Nutrient Separating Baffle Box

Contributing Catchment Area (acres)	81.010
Provided Nitrogen Treatment Efficiency (%)	19
Provided Phosphorus Treatment Efficiency (%)	16

Watershed Characteristics

Catchment Area (acres)	81.01
Contributing Area (acres)	81.010
Non-DCIA Curve Number	87.00
DCIA Percent	20.70
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	19
Provided TP Treatment Efficiency (%)	16

Load Diagram for Nutrient Separating Baffle Box (stand-alone)

Load		Treatment		Surface Discharge
N: 265.44 kg/yr	→	N: 19 %	→	N: 214.87 kg/yr
P: 41.97 kg/yr		P: 16 %		P: 35.47 kg/yr
		↓		Mass Reduction
				N: 50.57 kg/yr
				P: 6.51 kg/yr

Summary Treatment Report
Nitrogen

Surface Water Discharge

Total N post load	265.44 kg/yr	
Percent N load reduction	19 %	
Provided N discharge load	214.87 kg/yr	473.79 lb/yr
Provided N load removed	50.57 kg/yr	**111.5 lb/yr**

Phosphorus

Surface Water Discharge

Total P post load	41.974 kg/yr	
Percent P load reduction	16 %	
Provided P discharge load	35.468 kg/yr	78.21 lb/yr
Provided P load removed	6.506 kg/yr	**14.346 lb/yr**

The proposed nutrient separating baffle box provides annual reductions of 111.5 lb/yr of TN and 14.3 lb/yr of TP.

One-way Check Valves and Stormwater Pipe Improvements

Existing street flooding on Harbor Drive, Hillview Drive and Flower Drive in the Harbor Acres subdivision is a function of tidal influence as well as being downstream from a dense commercial development with minimal BMP's. The drainage within this subbasin drains from the natural ridge (US-41) to the bay through the existing neighborhoods.

The 2021 report titled Harbor Acres Alternatives Analysis, performed by Kimley Horn and Associates (KHA) for Sarasota County, was reviewed for this study. The report included modeling the Harbor Acres neighborhood using ICPR version 3 to determine the extent of the existing flooding as well as modeling for three alternative projects to reduce flooding.

The hydrology component of the KHA models did not include the calculation of directly connected impervious area (DCIA), as is the standard modeling practice for Sarasota County watershed models. For this analysis, the modeling was modified to include the calculation of DCIA.

In the KHA report, the alternative with the highest cost benefit ratio was Alternative 1, with a ratio of 0.51. Alternative 1 was shown to achieve the reduction of street flooding to within the local street LOS criteria (12 inches or less of street flooding) and a reduction in the number of structures flooded from 53 to 11, by the additional of inlets and the upsizing of 25 pipes.

Using the revised model with DCIA, the Alternative 1 improvements to find the optimal proposed inlet and pipe improvements that would eliminate the roadway LOS deficiencies within the area. The improvements include changes to 25 pipes, as detailed below in Table 8, and shown in Figure 50.

The BCA tool was used to determine the cost-benefit for this conceptual BMP based on the revised modeling and is determined to be 0.50.

To address the tidal influence in the outfall pipes that is contributing to street flooding, 11 check-valves are proposed with the new concrete pipes to ensure optimal operation and maintenance of the valves on the downstream end. Check valve locations are provided in Figure 48, while an image of an example check valve is shown in Figure 50.

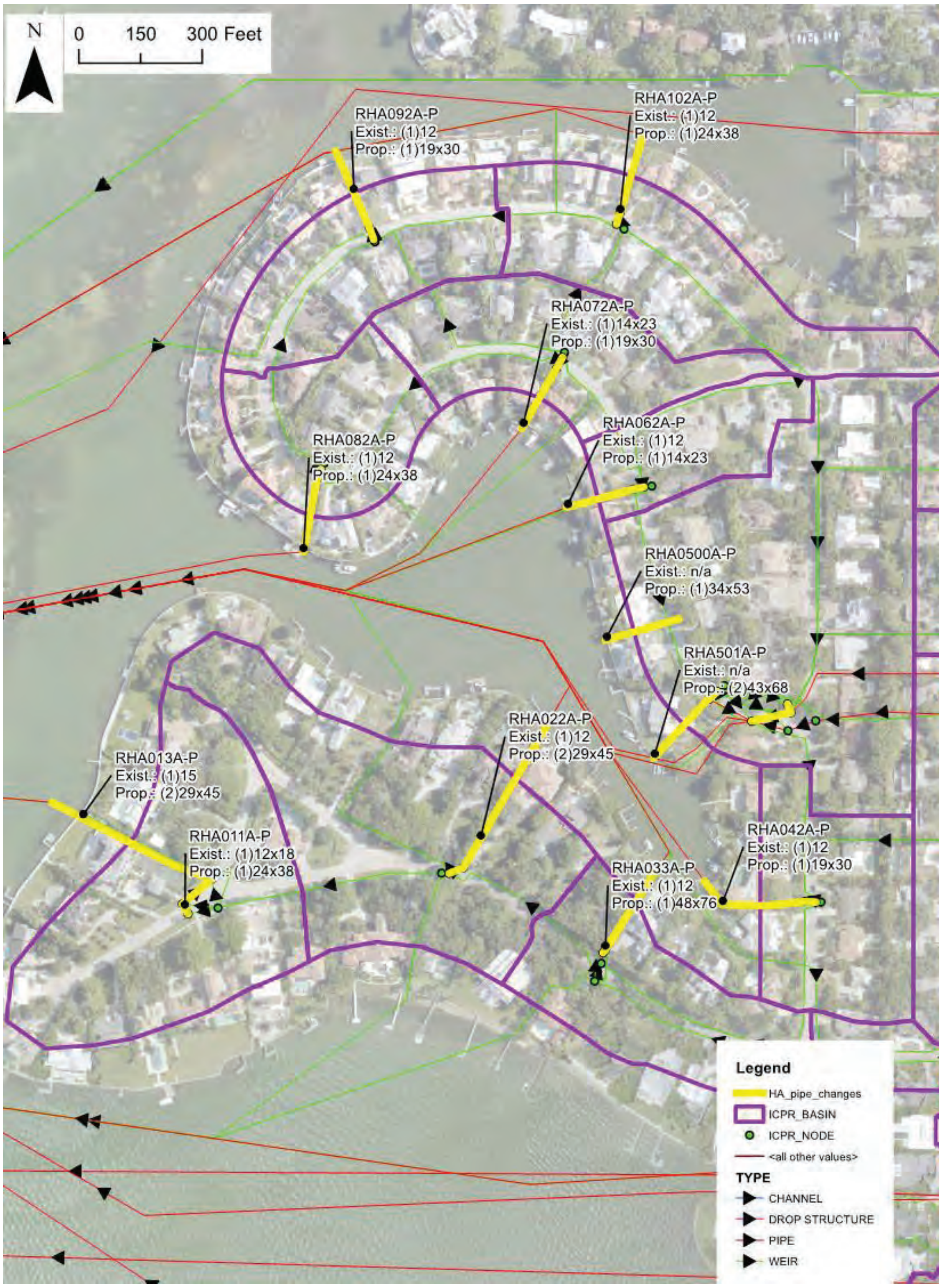


Figure 50 – Harbor Acres ICPR3 Model with Proposed Pipe Changes

Figure 51 – Example One-Way Check Valve (source: redvalve.com/Tideflex)

Table 8 – SMH and US41 ICPR pipe changes

Pipe	Change	Length (ft)
RHA011A-P	from elliptical 18''x12'' RCP to elliptical 24''x38'' RCP	30
RHA012A-P	from circular 15'' CMP to elliptical 24''x38'' RCP	90
RHA013A-P	from circular 15'' CMP to elliptical (2) 29''x45'' RCP	365
RHA021A-P	from circular 18'' CMP to elliptical 29''x45'' RCP	50.9
RHA022A-P	from circular 12'' RCP to elliptical (2) 29''x45'' RCP	380
RHA031A-P	from circular 12'' RCP to elliptical 19''x30'' RCP	40
RHA032A-P	from circular 12'' RCP to elliptical 29''x45'' RCP	5
RHA033A-P	from circular 12'' RCP to elliptical 48''x76'' RCP	250
RHA041A-P	from circular 12'' RCP to elliptical 19''x30'' RCP	30
RHA042A-P	from circular 12'' CMP to elliptical 19''x30'' RCP	275
RHA051A-P	from circular 12'' RCP to elliptical 29''x45'' RCP	30
RHA057A-P	from circular 12'' RCP to elliptical 24''x38'' RCP	8
RHA061A-P	from circular 12'' CMP to elliptical 14''x23'' RCP	25
RHA062A-P	from circular 12'' RCP to elliptical 14''x23'' RCP	150
RHA071A-P	from elliptical 23''x14'' RCP to elliptical 19''x30'' RCP	32
RHA072A-P	from elliptical 23''x14'' CMP to elliptical 19''x30'' RCP	150
RHA081A-P	from circular 12'' RCP to elliptical 19''x30'' RCP	22
RHA082A-P	from circular 12'' CMP to elliptical 24''x38'' RCP	175
RHA091A-P	from circular 12'' RCP to elliptical 19''x30'' RCP	30
RHA092A-P	from circular 12'' RCP to elliptical 19''x30'' RCP	190

RHA101A-P	from circular 12'' RCP to elliptical 24''x38'' RCP	24
RHA102A-P	from circular 12'' RCP to elliptical 24''x38'' RCP	190
RHA112A-P	from circular 12'' CMP to elliptical 12'' RCP	140
RHA0500A-P	new pipe: elliptical 34''x53'' RCP	220
RHA501A-P	new pipe: elliptical (2) 43''x68'' RCP	205

Measurable benefits from the BMP include:

- **Reduction of the number of model basins with roadway LOS deficiency from 10 of 11 to 0 of 11**
- **Reduction of the number of residential structures in the 100-year horizontal floodplain from 53 to 12 (structure flooding as measured by floodplain adjacent to structure polygon – consistent with the previous study).**
- **Elimination of 5500 linear feet of roadway level of service deficiencies within Harbor Acres**
- **Flood Cost Benefit Ratio = 0.50**

The estimated cost for Sarasota Memorial Hospital and US-41 PMA conceptual BMPs are $2,463,173.

Downtown Priority Management Area Conceptual BMP

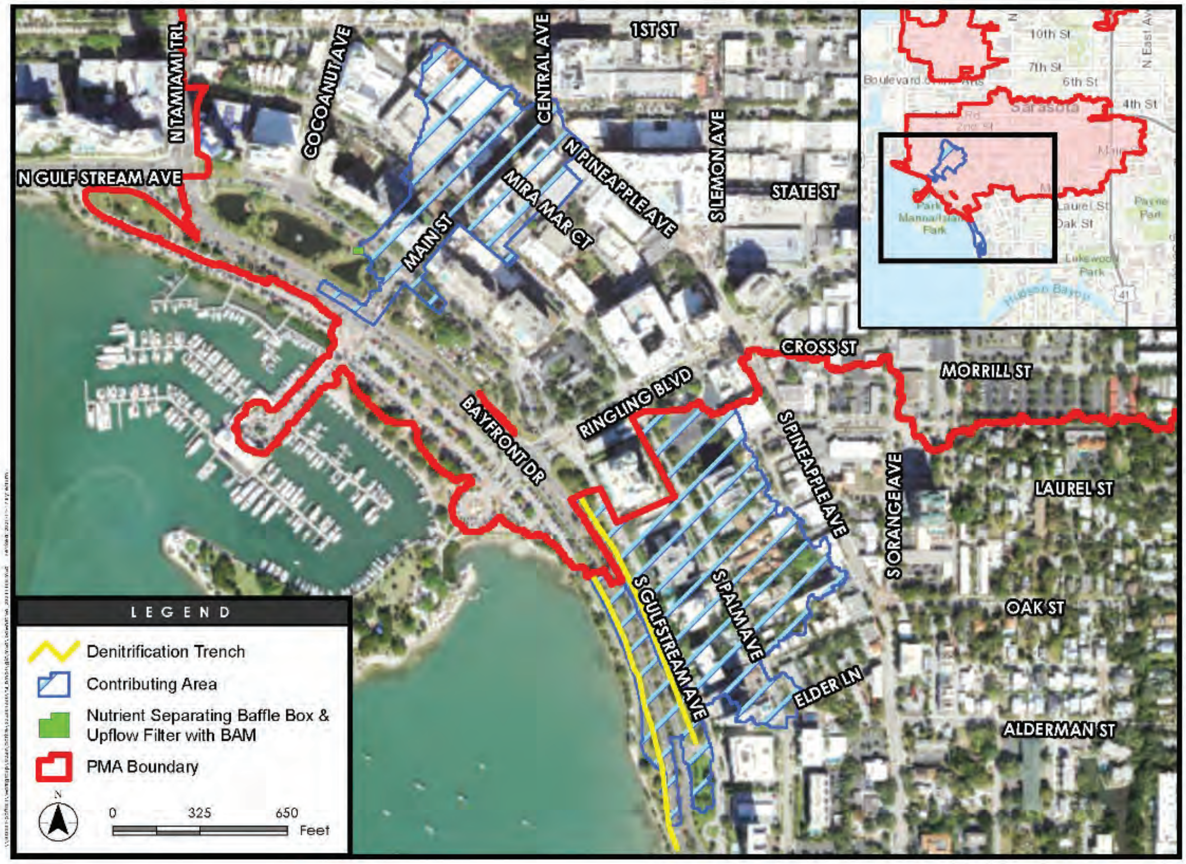


Figure 52 - Downtown Area BMPs

This is a challenging area to fit any projects due to fully developed landscape with very little green space or right of way; however, green infrastructure or low impact development techniques area ideal in this situation because they can be small in size and fit into landscape beds or under parking lots. Techniques to disconnect the impervious area leading to storm pipes can include landscaped raingardens and bioswales, pervious sidewalks and parking lots with storage underneath the surface.

With greater than 20 outfalls that directly discharge to Sarasota Bay in the Downtown PMA this is a target area for pollutant load techniques. Two technologies that utilize minimal space are proposed: a nutrient-separating baffle box followed by an upflow filter with BAM and denitrification trenches.

Nutrient Separating Baffle Box with Upflow filter and BAM

The baffle box and filter are proposed west of Gulfstream Ave, between two FDOT ponds, as shown in Figure 52.

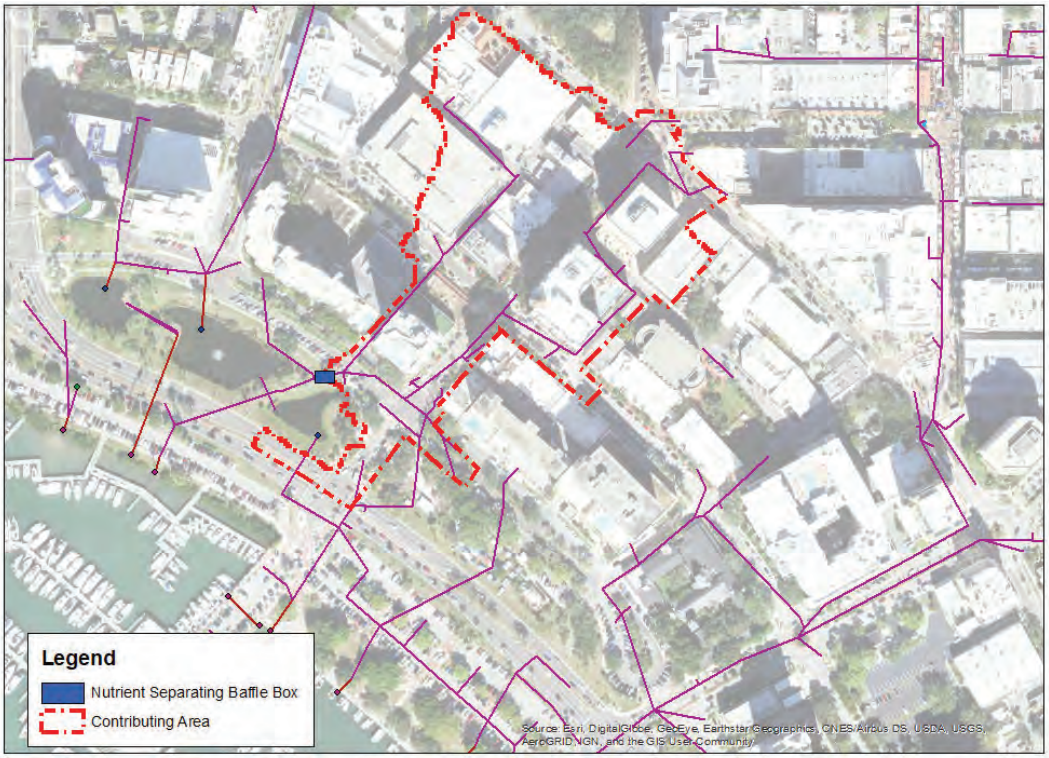


Figure 52 - Downtown Nutrient Separating Baffle Box Conceptual BMP

A typical configuration for the up-flow filter is presented in Figure 53.

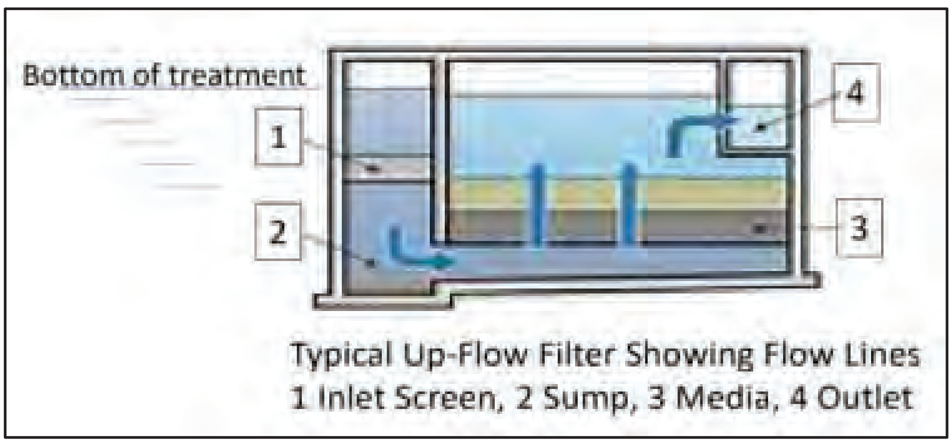


Figure 53 – Up-flow Filter Typical Detail (source: BMP Trains 2020)

BMP TRAINS 2020 Report Downtown PMA -Nutrient Separating Baffle Box

The BMP TRAINS 2020 input and output data for the nutrient separating baffle box and up-flow filter with BAM is provided here:

Site and Catchment Information

Analysis: BMP Analysis

Catchment Name	Downtown PMA
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	High-Intensity Commercial: TN=2.40 TP=0.345
Area (acres)	9.33
Rational Coefficient (0-1)	0.40
Non DCIA Curve Number	89.00
DCIA Percent (0-100)	26.00
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	2.400
Phosphorus EMC (mg/l)	0.345
Runoff Volume (ac-ft/yr)	16.123
Nitrogen Loading (kg/yr)	47.713
Phosphorus Loading (kg/yr)	6.859

Catchment Number: 1 Name: Downtown PMA

Multiple BMP in Series Design Parameters

BMP in Series Number: 1

BMP Type: Nutrient Separating Baffle Box BMP

Contributing Catchment Area (acres)	9.330
Provided Nitrogen Treatment Efficiency (%)	19
Provided Phosphorus Treatment Efficiency (%)	16

BMP in Series Number: 2

BMP Type: Filtration

Treatment Depth (in)	0.100
Hydraulic Capture Efficiency (%)	15
Media Type	B&G CTS24
Media N Reduction (%)	75
Media P Reduction (%)	95

Watershed Characteristics

Catchment Area (acres)	9.33
Contributing Area (acres)	9.330
Non-DCIA Curve Number	89.00
DCIA Percent	26.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%) 28

Provided TP Treatment Efficiency (%) 27

Load for Multiple BMP in Series

Load		Treatment		Surface Discharge
N: 47.71 kg/yr	→	N: 28 %	→	N: 34.41 kg/yr
P: 6.86 kg/yr		P: 27 %		P: 4.99 kg/yr

↓

Mass Reduction
N: 13.30 kg/yr
P: 1.86 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	47.71 kg/yr	
Percent N load reduction	28 %	
Provided N discharge load	34.41 kg/yr	75.87 lb/yr
Provided N load removed	13.3 kg/yr	**29.33 lb/yr**

Phosphorus

Surface Water Discharge

Total P post load	6.859 kg/yr	
Percent P load reduction	27 %	
Provided P discharge load	4.995 kg/yr	11.01 lb/yr
Provided P load removed	1.864 kg/yr	**4.11 lb/yr**

Media Filter Report
Catchment Name: Downtown PMA
Treatment Depth (in): 0.10
Rate (GPM/SF): 0.05
Effective Impervious Area (acres): 2.43
Minimum Filter Area (sf): 43.97

Denitrification Trench

Two denitrification trenches are proposed, which will provide a water quality treatment mechanism for 17.3 acres of contributing area to four (4) outfalls that currently discharge directly into Sarasota Bay with no stormwater treatment. The trench profile is shown in Figure 54, with an 18-inch diameter perforated pipe that allows stormwater runoff to percolate through a BAM layer and into the groundwater.

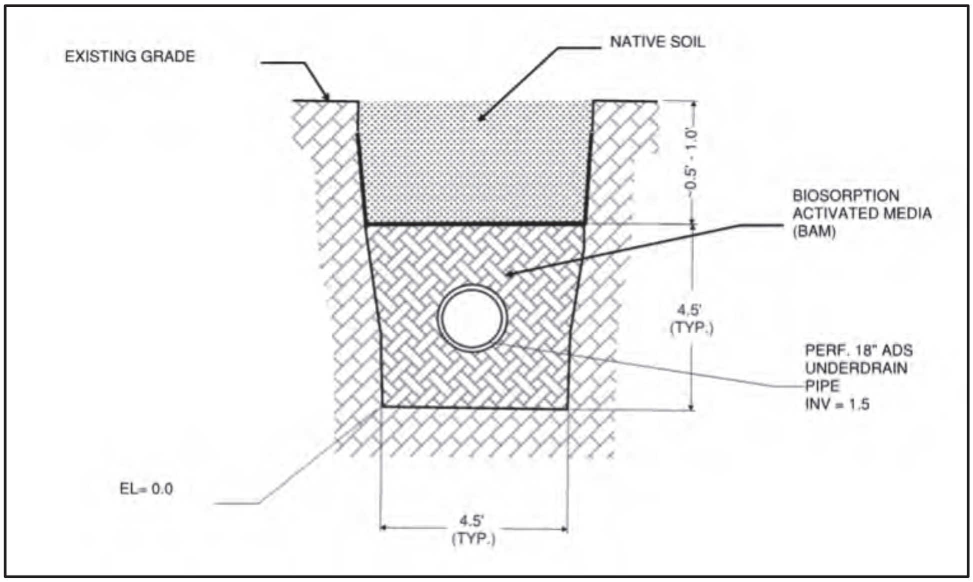


Figure 54 - Downtown Denitrification Trench Detail (source: Stantec)

Locations for the 2,110 total linear feet denitrification trench are shown in Figure 55.

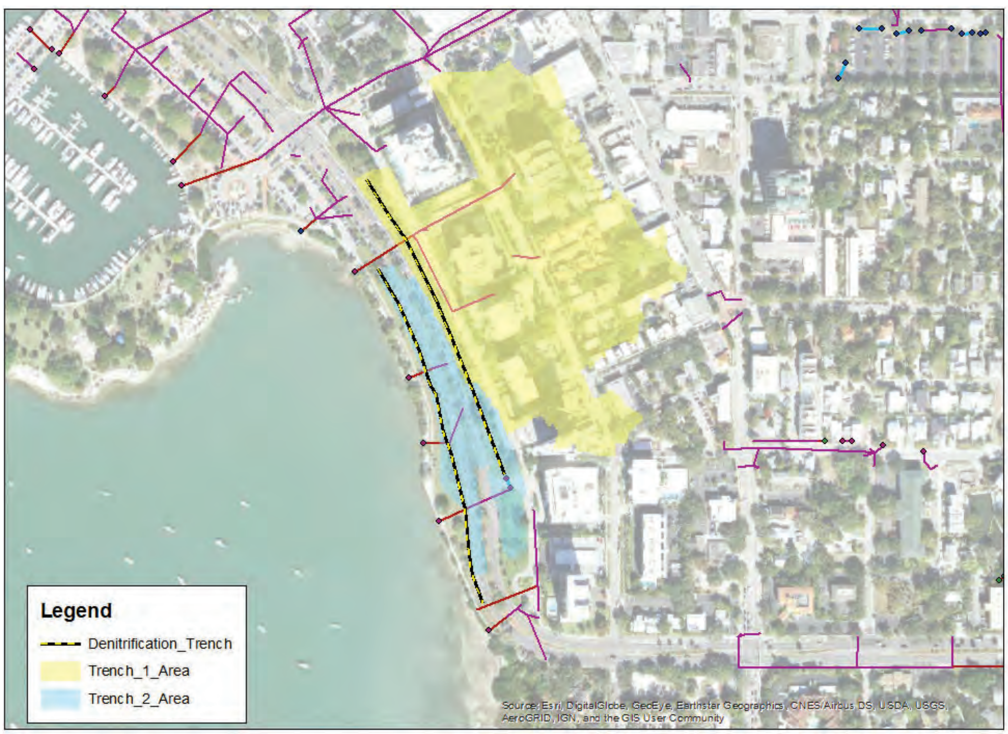


Figure 55 - Downtown Denitrification Trench Locations and Contributing Areas

<u>BMP TRAINS 2020 Report Downtown - Retention Trenches with CTS 24 Media</u>

The BMP TRAINS 2020 input and output data for the denitrification trench system is provided here:

BMP TRAINS 2020 Report Downtown PMA - Retention Trench #1 with CTS 24 Media
Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	Downtown
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	3.13
Rational Coefficient (0-1)	0.47
Non DCIA Curve Number	78.00
DCIA Percent (0-100)	50.50
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.900
Phosphorus EMC (mg/l)	0.275
Runoff Volume (ac-ft/yr)	6.412
Nitrogen Loading (kg/yr)	15.022
Phosphorus Loading (kg/yr)	2.174

Catchment Number: 1 Name: Downtown
Project: Downtown Retention Trench with CTS24 BAM

Retention Design

Retention Depth (in)	0.170
Retention Volume (ac-ft)	0.044

Watershed Characteristics

Catchment Area (acres)	3.13
Contributing Area (acres)	3.130
Non-DCIA Curve Number	78.00
DCIA Percent	50.50
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	25
Provided TP Treatment Efficiency (%)	25

Media Mix Information

Type of Media Mix	B&G CTS24
Media N Reduction (%)	75
Media P Reduction (%)	95

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr)	0.528
TN Mass Load (kg/yr)	0.949

TN Concentration (mg/L)	0.475
TP Mass Load (kg/yr)	0.027
TP Concentration (mg/L)	0.014

Load Diagram for Retention (stand-alone)

Load		Treatment		Surface Discharge
N: 15.02 kg/yr	→	N: 25 %	→	N: 11.23 kg/yr
P: 2.17 kg/yr		P: 25 %		P: 1.63 kg/yr

↓

Mass Reduction
N: 3.80 kg/yr **(8.4 lb/yr)**
P: 0.55 kg/yr **(1.21 lb/yr)**

Into Media	GW Treatment		GW Discharge
N: 3.795 kg/yr	N: 75 %	→	N: 0.949 kg/yr
P: 0.549 kg/yr	P: 95 %		P: 0.027 kg/yr

↓

Retained
N: 2.85 kg/yr **(6.28 lb/yr)**
P: 0.52 kg/yr **(1.15 lb/yr)**

BMP TRAINS 2020 Report
DOWNTOWN PMA RETENTION TRENCH 2 WITH CTS24
Site and Catchment Information
Analysis: BMP Analysis

Catchment Name	All basins together
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	14.16
Rational Coefficient (0-1)	0.39
Non DCIA Curve Number	85.60
DCIA Percent (0-100)	32.20
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.988
Phosphorus EMC (mg/l)	0.400
Runoff Volume (ac-ft/yr)	24.234
Nitrogen Loading (kg/yr)	59.403
Phosphorus Loading (kg/yr)	11.952

Catchment Number: 1 Name: All basins together
Project: Downtown PMA Retention Trench with CTS24

Retention Design

Retention Depth (in)	0.030
Retention Volume (ac-ft)	0.035

Watershed Characteristics

Catchment Area (acres)	14.16
Contributing Area (acres)	14.160
Non-DCIA Curve Number	85.60
DCIA Percent	32.20
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	5
Provided TP Treatment Efficiency (%)	5

Load Diagram for Retention (stand-alone)

Load
N: 59.40 kg/yr →
P: 11.95 kg/yr

Treatment
N: 5 % →
P: 5 %

Surface Discharge
N: 56.64 kg/yr
P: 11.40 kg/yr

↓

Mass Reduction
N: 2.77 kg/yr
P: 0.56 kg/yr

Into Media
N: 2.767 kg/yr
P: 0.557 kg/yr

GW Treatment
N: 75 % →
P: 95 %

GW Discharge
N: 0.692 kg/yr
P: 0.028 kg/yr

↓

Retained
N: 2.08 kg/yr **(4.59 lb.yr)**
P: 0.53 kg/yr **(1.17 lb/yr)**

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	59.4 kg/yr	
Percent N load reduction	5 %	
Provided N discharge load	56.64 kg/yr	124.88 lb/yr
Provided N load removed	2.77 kg/yr	**6.1 lb/yr**

Groundwater Discharge

Average Annual Recharge	.368 MG/yr	
Provided N recharge load	.692 kg/yr	1.53 lb/yr
Provided N Concentration	.497 mg/l	

Phosphorus

Surface Water Discharge

Total P post load	11.952 kg/yr	
Percent P load reduction	5 %	
Provided P discharge load	11.395 kg/yr	25.13 lb/yr
Provided P load removed	.557 kg/yr	**1.228 lb/yr**

Groundwater Discharge

Average Annual Recharge	.368 MG/yr	
Provided P recharge load	.0278 kg/yr	.0614 lb/yr
Provided P Concentration	.02 mg/l	

The proposed denitrification trench and baffle box conceptual BMPs provide annual reductions of 60.5 lb/yr of TN and 10 lb/yr of TP.

The estimated cost for the Downtown PMA conceptual BMPs is $1,104,700.

Bee Ridge and US-41 Priority Management Area Conceptual BMP

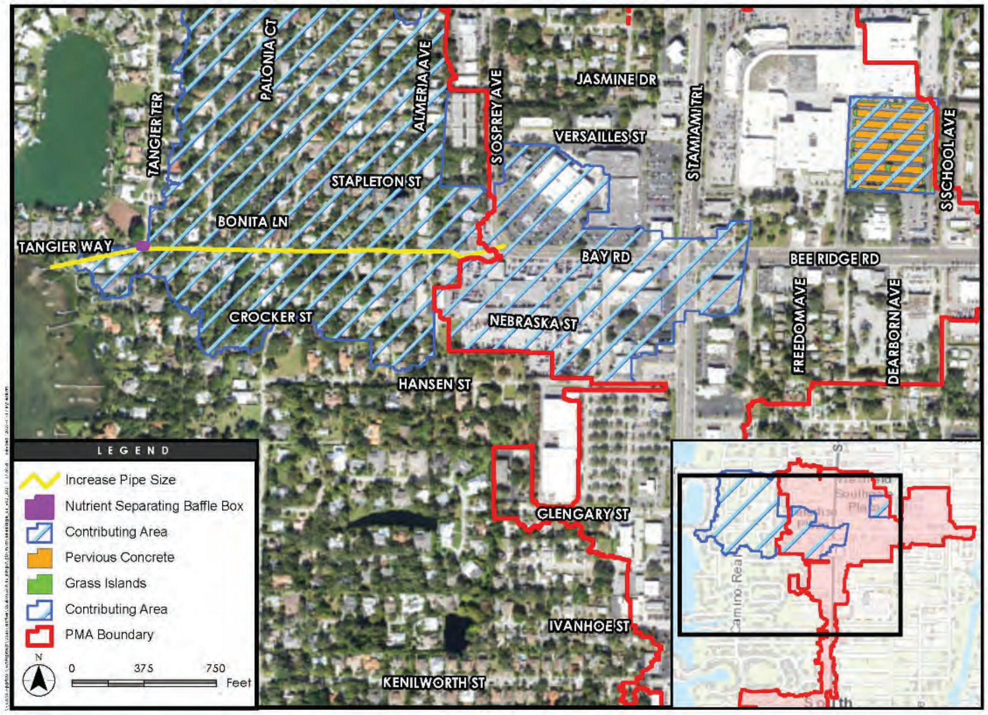


Figure 56 - Bee Ridge and US 41 Area BMPs

Stormwater Pipe Improvements and Nutrient Separating Baffle Box

These improvements will provide a water quality and flood protection component to an area with existing LOS deficiency on an evacuation route and direct discharge to Sarasota Bay, this conceptual BMP proposes removing and replacing 2,340 linear feet of existing stormwater pipe and installation of a nutrient-separating baffle box. The improvements were modeled in the Coastal Fringe Roberts Bay North ICPR model and include changes to 8 pipes, as detailed in Table 8, and shown in Figure 56.

Table 8 - Bee Ridge and US-41 ICPR pipe changes

Pipe	Change	Length
RA0030G-P	from circular 24" to circular 36"	260
RA0085-P	from elliptical 34"x53" to elliptical 38"x60"	355
RA0120C-P	from elliptical 34"x53" to elliptical 38"x60"	235
RA0150D-P	from elliptical 38"x60" to elliptical 43"x68"	215
RA0165-P	from elliptical 38"x60" to elliptical 43"x68"	475
RA0220B-P	from elliptical 38"x60" to elliptical 43"x68"	170
RA0225-P	from elliptical 38"x60" to elliptical 43"x68"	180
RA0230D-P	from elliptical 43"x68" to elliptical 48"x76"	450

Measurable benefits from the flood protection improvements include:

- **220 linear feet of roadway removed from 100-year LOS deficiency, including 186 linear feet of Evacuation Route**

- **Flood Cost-Benefit Ratio = 0.22**
- **Portions of the project will be somewhat affected by the NOAA 2100 sea level rise projection but can be slightly modified with minimum cost**

BMP TRAINS 2020 Report - Bee Ridge and US41 Nutrient Separating Baffle Box

Water quality benefits for the baffle box were estimated with BMP TRAINS 2020. All input and output data are presented here:

Site and Catchment Information

Analysis: BMP Analysis

Catchment Name	AO10 AO70	AO180 30148
Rainfall Zone	Florida Zone 4	Florida Zone 4
Annual Mean Rainfall	52.00	52.00
Phosphorus Loading (kg/yr)	0.000	0.000
Post-Condition Land Use Information		
Land use	User Defined Values	User Defined Values
Area (acres)	44.25	44.98
Rational Coefficient (0-1)	0.43	0.27
Non DCIA Curve Number	81.95	82.18
DCIA Percent (0-100)	41.70	16.98
Wet Pond Area (ac)	0.00	0.00
Nitrogen EMC (mg/l)	2.131	2.081
Phosphorus EMC (mg/l)	0.325	0.323
Runoff Volume (ac-ft/yr)	82.566	51.906
Nitrogen Loading (kg/yr)	216.944	133.184
Phosphorus Loading (kg/yr)	33.086	20.672

Catchment Number: 1 Name: AO10 AO70 Routes to catchment 2 for treatment

Watershed Characteristics

Catchment Area (acres)	44.25
Contributing Area (acres)	44.250
Non-DCIA Curve Number	81.95
DCIA Percent	41.70
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Load Diagram for None (stand-alone)

Load		Treatment		Surface Discharge
N: 216.94 kg/yr	→	N: %	→	N: 216.94 kg/yr
P: 33.09 kg/yr		P: %		P: 33.09 kg/yr

↓ Mass Reduction
N: 0.00 kg/yr
P: 0.00 kg/yr

Catchment Number: 2 Name: AO180 30148

Nutrient Separating Baffle Box

Contributing Catchment Area (acres)	44.980
Provided Nitrogen Treatment Efficiency (%)	19
Provided Phosphorus Treatment Efficiency (%)	16

Watershed Characteristics

Catchment Area (acres)	44.98
Contributing Area (acres)	44.980
Non-DCIA Curve Number	82.18
DCIA Percent	16.98
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	19
Provided TP Treatment Efficiency (%)	16

Load Diagram for Nutrient Separating Baffle Box Catchment 2 loadings only

Load
N: 133.18 kg/yr
P: 20.67 kg/yr

→

Treatment
N: 19 %
P: 16 %

→

Surface Discharge
N: 107.81 kg/yr
P: 17.47 kg/yr

↓

Mass Reduction
N: 25.37 kg/yr
P: 3.20 kg/yr

Load Diagram for Nutrient Separating Baffle Box for both catchment 1 and 2
(As Used In Routing)

Upstream Nodes
Node: 1

Load
N: 350.13 kg/yr
P: 53.76 kg/yr
Q: 134.47 ac-ft

→

Treatment
N: 19.1 %
P: 15.5 %

→

Mass Discharged
N: 283.43 kg/yr
P: 45.43 kg/yr
Q: 134.47 ac-ft

↓

Mass Removed
N: 66.70 kg/yr
P: 8.33 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load 350.13 kg/yr

Percent N load reduction	19 %	
Provided N discharge load	283.43 kg/yr	624.96 lb/yr
Provided N load removed	66.7 kg/yr	**147.07 lb/yr**

Phosphorus

Surface Water Discharge		
Total P post load	53.758 kg/yr	
Percent P load reduction	16 %	
Provided P discharge load	45.426 kg/yr	100.16 lb/yr
Provided P load removed	8.333 kg/yr	**18.373 lb/yr**

The proposed nutrient separating baffle box water conceptual BMP provides annual reductions of 147.1 lb/yr of TN and 18.4 lb/yr of TP.

The estimate project cost for the Storm pipe improvements and nutrient-separating baffle box is $1,475,894.

Convert Existing Parking Spots to Pervious Pavement

This conceptual BMP includes removal of existing asphalt in the parking spots and replacing with pervious pavement, similar to the US-41 and Highlands PMA to provide another benchmarking source for the retrofit of impervious to pervious surfaces. The drive aisles will remain impervious asphalt, and the existing drainage inlets and storm pipes will remain in place for all runoff that does not percolate into the pervious pavement. Existing grass islands can also be converted to rain gardens to allow for additional stormwater percolation and nutrient removal. In total, 2.45 acres of parking spots within a 5.18-acre contributing area would be converted from impervious to pervious, with 6-inch of pervious concrete over an 8-inch layer of stone. Parking areas to be converted are shown in Figure 57.

Figure 57 - Westfield Mall Parking Lot Conversion to Pervious Pavement

BMP TRAINS 2020 Report - Bee Ridge and US 41 Westfield Mall Pervious Parking Lot

BMP TRAINS 2020 input and output data for the parking lot conversion to pervious pavement is provided here:

Site and Catchment Information

Analysis: BMP Analysis

Catchment Name	Parking Lot
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Lands Use Information	
Land use	Highway: TN=1.520 TP=0.200
Area (acres)	5.18
Rational Coefficient (0-1)	0.80
Non DCIA Curve Number	96.44
DCIA Percent (0-100)	92.00
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.520
Phosphorus EMC (mg/l)	0.200

Runoff Volume (ac-ft/yr)	17.928
Nitrogen Loading (kg/yr)	33.600
Phosphorus Loading (kg/yr)	4.421

Catchment Number: 1 Name: Parking Lot

Pervious Pavement Design

Surface Area of Pavement (acres)	2.450
Treatment Volume (in over watershed)	1.419

Pavement Type	Thickness (in)	Storage (in)	Storage (ac-ft)
Concrete Permeable Pavement	4.00	1.000	0.204
#89 pea rock	8.00	2.000	0.408
Total		3.000	0.613

Watershed Characteristics

Catchment Area (acres)	5.18
Contributing Area (acres)	2.730
Non-DCIA Curve Number	96.44
DCIA Percent	92.00
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	77
Provided TP Treatment Efficiency (%)	77

Load Diagram for Pervious Pavement (stand-alone)

Load
N: 33.60 kg/yr →
P: 4.42 kg/yr

Treatment
N: 77 %
P: 77 %

→ Surface Discharge
N: 7.73 kg/yr
P: 1.02 kg/yr

↓

Mass Reduction
N: 25.87 kg/yr
P: 3.40 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	33.6 kg/yr	
Percent N load reduction	77 %	
Provided N discharge load	7.73 kg/yr	17.04 lb/yr
Provided N load removed	25.87 kg/yr	**57.05 lb/yr**

Phosphorus

Surface Water Discharge

Total P post load	4.421 kg/yr	
Percent P load reduction	77 %	
Provided P discharge load	1.017 kg/yr	2.24 lb/yr
Provided P load removed	3.404 kg/yr	**7.506 lb/yr**

The proposed parking lot pervious pavement conceptual BMP provides annual reductions of 57.1 lb/yr of TN and 7.5 lb/yr of TP.

The estimate cost for the pervious pavement conceptual BMP is $2,218,339.

Stickney Point Priority Management Area Conceptual BMP

Figure 58 - Stickney Point Area BMPs

This area experiences exceptional street flooding associated with stormwater and tidal influences noted at least once a year. The areas are well established and exist with minimal stormwater BMP's; most of the drainage discharges directly into the intercoastal waterway.

The conceptual BMP includes removal and replacement of two lengths of existing stormwater pipe with a larger pipe size, installation of one-way check valves on the new pipes, and installation of a concrete flume for surface water to pop-off into a lot-line swale.

The two existing 18-inch diameter pipe locations are shown on Figure 58 and they will be increased to 36-inch diameter pipes. The concrete flume location is proposed over the north pipe. An example flume is provided in Figure 59.

Figure 59 - Concrete Flume Example

The conceptual BMP was modeled in ICPR with the Coastal Fringe-Roberts Bay model.

Measurable flood protection benefits include:

- **Removal of 225 linear feet of roadway from Level of Service (LOS) deficiency**
- **Improvement of existing stormwater infrastructure.**
- **Resilient in NOAA 2100 future condition**
- **Reduction of high tide flooding events**
- **Peak stage reductions: 0.08 to 0.12 feet for 100-year, 0.23 to 0.25 feet for the 25-year, and 0.36 to 0.42 feet for the 10-year storms**

The estimated conceptual BMP costs total $186,115.

US-41 and Proctor Priority Management Area Conceptual BMP

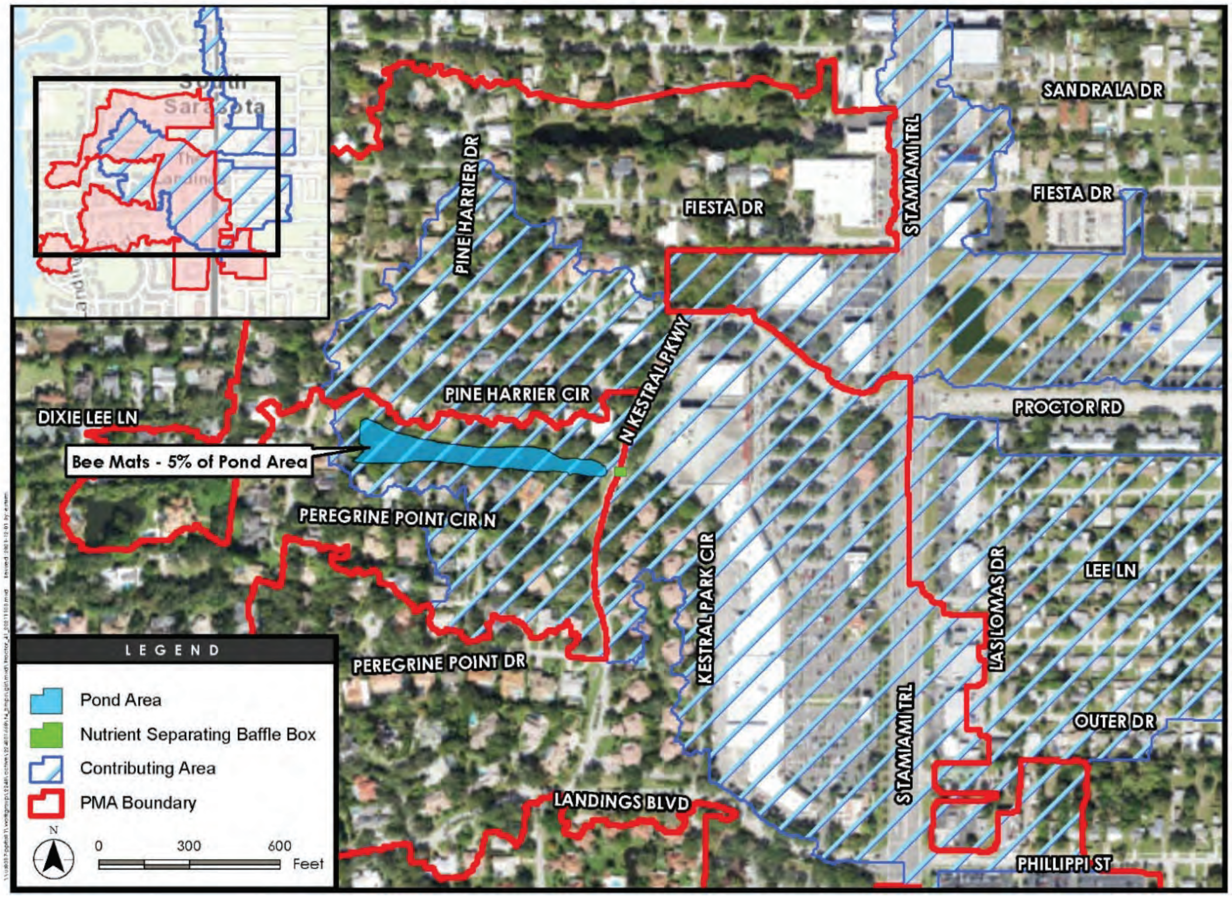


Figure 60 - US41 and Proctor Area BMPs

The US-41 and Proctor Priority Management area includes a substantial portion of the contributing area to a County-Maintained stormwater pond (Facility ID: CT_04142010_001779, Legacy ID: P10-6) located within The Landings private community. This stormwater pond is one of the oldest BMPs in Sarasota County, with significant sediment loading from the upstream commercial and residential contributing area flowing into the bay.

Sediment Removal in Pond, Nutrient Separating Baffle Box and Beemats

Sediment removal from the pond is proposed, which would remove approximately 6,800 cubic yards of material from the pond, providing an estimated 4.2 ac-ft of permanent pool volume available to provide water quality treatment. Installation of a nutrient-separating baffle box at the primary inflow point of the pond (eastern end) will provide additional pollutant loading reductions for the stormwater before entering the pond. Floating Beemats, as shown in Figure 31, will cover approximately 5% of the pond's surface, providing additional nutrient uptake pathways. Best practices for Beemats should be followed during the design and construction to ensure adequate coverage and maintenance frequency.

The full contributing area for The Landings Pond is presented in Figure 61 along with the location of the pond and proposed nutrient-separating baffle box.

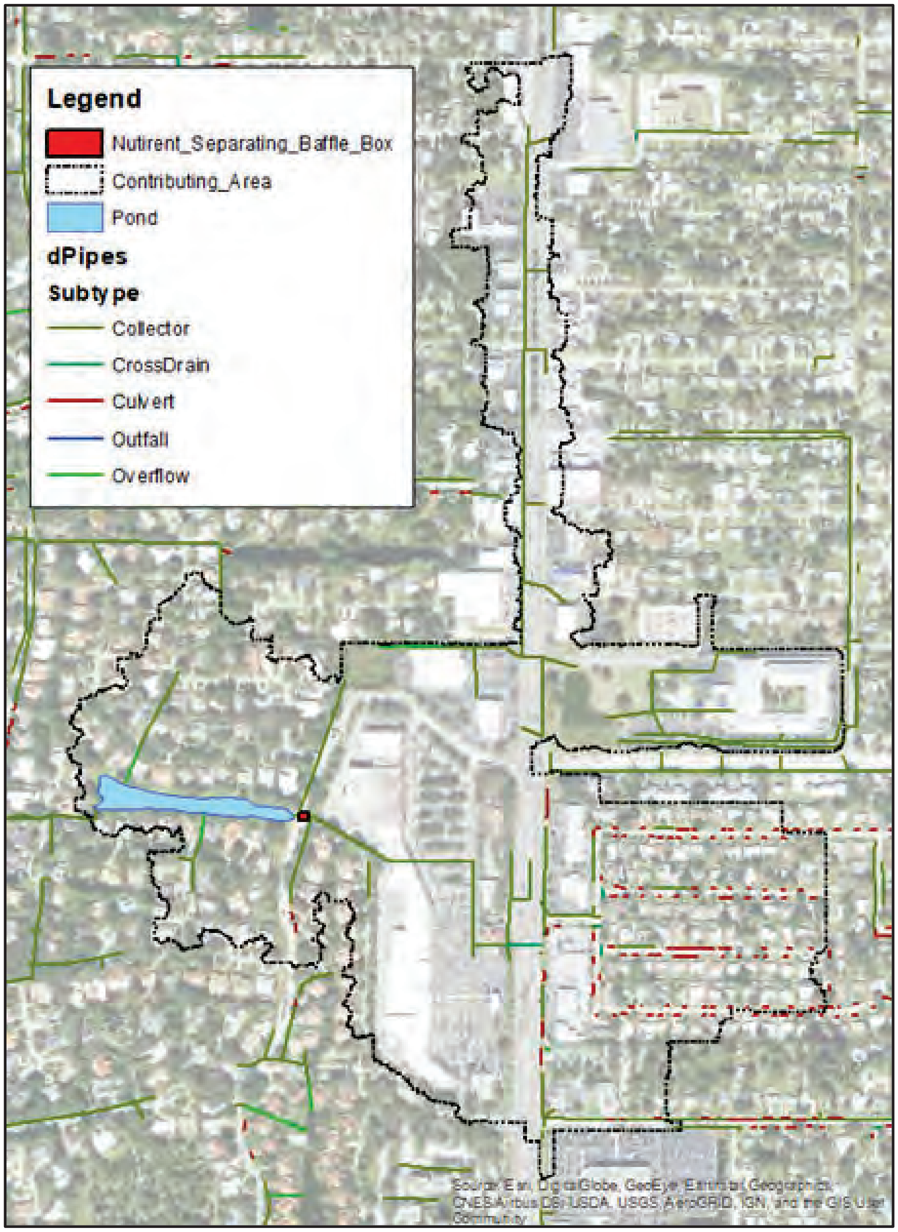


Figure 61 - The Landings Pond Contributing Area

Sediment removal via excavation during initial construction yields 12,239 lbs. of TN and 5,893 lbs of TP removed from an estimated 6,800 cubic yards of material. Values were obtained by utilizing the Florida Stormwater Association MS4 Load Reduction Assessment Tool, dated June 2019, accessed from the Florida Department of Environmental Protection's site ([FSA-MS4 Load Reduction Tool updated 2019 | Florida Department of Environmental Protection])

The tool's input screen is presented in Figure 62, while the results are shown in Figure 63.

Enter Volume of Solids[1] Removed - Calculate Equivalent Dry Weight
FSA 2019

	For Wet or Dry Solids by Volume[2]			
Category of Maintenance Activity	Enter Volume of Collected Solids Cubic Feet	Enter Dry Bulk Density Solids Lb/C.F.	Calculated Weight of Dry Solids (Pounds)	Calculated Equivalent Dry Weight Collected (Kilograms)
Street Sweepings	0	85	0	0
Catch Basin Cleanout	183,600	85	15,587,640	7,070,554
BMP Cleanout	0	85	0	0

GREEN Denotes Cells for DATA ENTRY
BLUE Denotes Calculation Results

NOTES:
1. "Particulate Matter" from the FSA Final Report is defined as "Solids" for use in this spreadsheet.
2. For measurements of volume, include approximate dry bulk density;
use the default bulk density of 1.36 or 84.9 pounds per cubic foot until confirmed by sampling.

Figure 62- The Landings Pond Sediment Removal Load Reduction Assessment Tool Input

Calculated Nutrient Load Reductions from MS4 Maintenance Practices
FSA 2019

		Subtotal TP Removed (Kilograms)	Subtotal TP Removed (Pounds)
TOTAL PHOSPHORUS			
Street Sweepings - Dry Mass Collected (Kg)	0		
Amount of TP Removed (Kilograms)	0	0	0
Catch Basins - Dry Mass Collected	7,070,554		
Amount of TP Removed (Kilograms)	2,673	2,673	5,893
BMP - Dry Mass Collected	0		
Amount of TP Removed (Kilograms)	0	0	0
GRAND TOTAL TP REMOVED (KILOGRAMS) =		2,673	
GRAND TOTAL TP REMOVED (POUNDS) =			5,893

		Subtotal TN Removed (Kilograms)	Subtotal TN Removed (Pounds)
TOTAL NITROGEN			
Street Sweepings - Dry Mass Collected (Kg)	0		
Amount of TN Removed (Kilograms)	0	0	0
Catch Basins - Dry Mass Collected	7,070,554		
Amount of TN Removed (Kilograms)	5,550	5,550	12,239
BMP - Dry Mass Collected	0		
Amount of TN Removed (Kilograms)	0	0	0
GRAND TOTAL TN REMOVED (KILOGRAMS) =		5,550	
GRAND TOTAL TN REMOVED (POUNDS) =			12,239

Figure 63 - The Landings Pond Sediment Removal Load Reduction Assessment Tool

BMP TRAINS 2020 Report US41 & Proctor Wet Detention, Nutrient Separating Baffle Box and Beemats

The BMP Trains 2020 input and output for the US41 and Proctor Conceptual BMPs is presented here:

Existing Conditions (prior to sediment removal)

Site and Catchment Information

Analysis: BMP Analysis

Catchment Name	Composite 1
Rainfall Zone	Florida Zone 4
Annual Mean Rainfall	52.00
Post-Condition Land Use Information	
Land use	User Defined Values
Area (acres)	126.15
Rational Coefficient (0-1)	0.34
Non DCIA Curve Number	82.00
DCIA Percent (0-100)	28.30
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	1.909
Phosphorus EMC (mg/l)	0.291
Runoff Volume (ac-ft/yr)	186.357
Nitrogen Loading (kg/yr)	438.647
Phosphorus Loading (kg/yr)	66.866

Catchment Number: 1 Name: Composite 1

Wet Detention Design

Permanent Pool Volume (ac-ft)	4.230
Permanent Pool Volume (ac-ft) for 31 days residence	15.828
Annual Residence Time (days)	8
Littoral Zone Efficiency Credit	
Wetland Efficiency Credit	

Watershed Characteristics

Catchment Area (acres)	126.15
Contributing Area (acres)	126.150
Non-DCIA Curve Number	82.00
DCIA Percent	28.30
Rainfall Zone	Florida Zone 4
Rainfall (in)	52.00

Surface Water Discharge

Provided TN Treatment Efficiency (%)	29
Provided TP Treatment Efficiency (%)	55

Load Diagram for Wet Detention (stand-alone)

Load	→	Treatment	→	Surface Discharge
N: 438.65 kg/yr		N: 29 %		N: 313.11 kg/yr
P: 66.87 kg/yr		P: 55 %		P: 30.39 kg/yr

↓

Mass Reduction
N: 125.54 kg/yr
P: 36.48 kg/yr

Summary Treatment Report
Nitrogen

Surface Water Discharge

Total N post load	438.65 kg/yr	
Percent N load reduction	29 %	
Provided N discharge load	313.11 kg/yr	690.4 lb/yr
Provided N load removed	125.54 kg/yr	**276.81 lb/yr**

Phosphorus

Surface Water Discharge

Total P post load	66.866 kg/yr	
Percent P load reduction	55 %	
Provided P discharge load	30.387 kg/yr	67 lb/yr
Provided P load removed	36.479 kg/yr	**80.436 lb/yr**

BMP TRAINS 2020 Report
Project: US41 & Proctor Nutrient Separating Baffle Box and Wet Detention with Beemats Floating Wetlands after dredging
Treatment Train
Project: US41 _ Proctor baffle box and wet detention with BEEMATS
Multiple BMP in Series Design Parameters

BMP in Series Number: 1
BMP Type: **Nutrient Separating Baffle Box**

Contributing Catchment Area (acres)	126.150
Provided Nitrogen Treatment Efficiency (%)	19
Provided Phosphorus Treatment Efficiency (%)	15

BMP in Series Number: 2
BMP Type: **Wet Detention with BEEMATS**

Permanent Pool Volume (ac-ft)	8.460
Permanent Pool Volume (ac-ft) for 31 days residence	15.828
Annual Residence Time (days)	17
Littoral Zone Efficiency Credit	
Wetland Efficiency Credit	10

Combined Report of all BMP's

Catchment Area (acres)	126.15
Watershed Non-DCIA Curve Number	82.00

Watershed DCIA Percent	28.30
Rainfall Zone	Florida Zone 4
Calculated Annual Coefficient (0-1)	0.34
Total (accumulated) Retention Depth (in over watershed)	0.000
Overall Provided Nitrogen Treatment Efficiency (%)	52
Overall Provided Phosphorus Treatment Efficiency (%)	69
Overall Nitrogen Load (kg/yr)	208.993
Overall Phosphorus Load (kg/yr)	20.603

Load for Multiple BMP in Series

Load
N: 438.65 kg/yr →
P: 66.87 kg/yr

Treatment
N: 52 %
P: 69 %

→ Surface Discharge
N: 208.99 kg/yr
P: 20.60 kg/yr

↓

Mass Reduction
N: 229.65 kg/yr
P: 46.26 kg/yr

Summary Report
Nitrogen

Surface Water Discharge

Total N post load	438.65 kg/yr	
Percent N load reduction	52 %	
Provided N discharge load	209.12 kg/yr	461.11 lb/yr
Provided N load removed	229.53 kg/yr	**506.1 lb/yr**

Phosphorus

Surface Water Discharge

Total P post load	66.866 kg/yr	
Percent P load reduction	69 %	
Provided P discharge load	20.615 kg/yr	45.46 lb/yr
Provided P load removed	46.251 kg/yr	**101.983 lb/yr**

The existing and proposed treatment efficiency and annual TN and TP removal estimates are presented in Table 9.

Table 9 - The Landings Pond Sediment Removal Treatment Efficiency

	Treatment Efficiency TN	Treatment Efficiency TP	Estimated TN Reduction (lb/yr)	Estimated TP Reduction (lb/yr)
Existing Wet Detention	29%	55%	277	80
Proposed Wet Detention After Sediment Removal	52%	69%	506	102

With the proposed improvements 506 lb/yr of TN and 102 lb/yr of TP will be removed annually with the treatment system.

In addition, approximately 12,239 lb of TN and 5,893 lb of TP are removed as a result of the initial sediment removal during construction.

The estimated cost for the sediment removal, nutrient-separating baffle box and floating Beemats is $328,676.

Faubel Street Priority Management Area Conceptual BMP

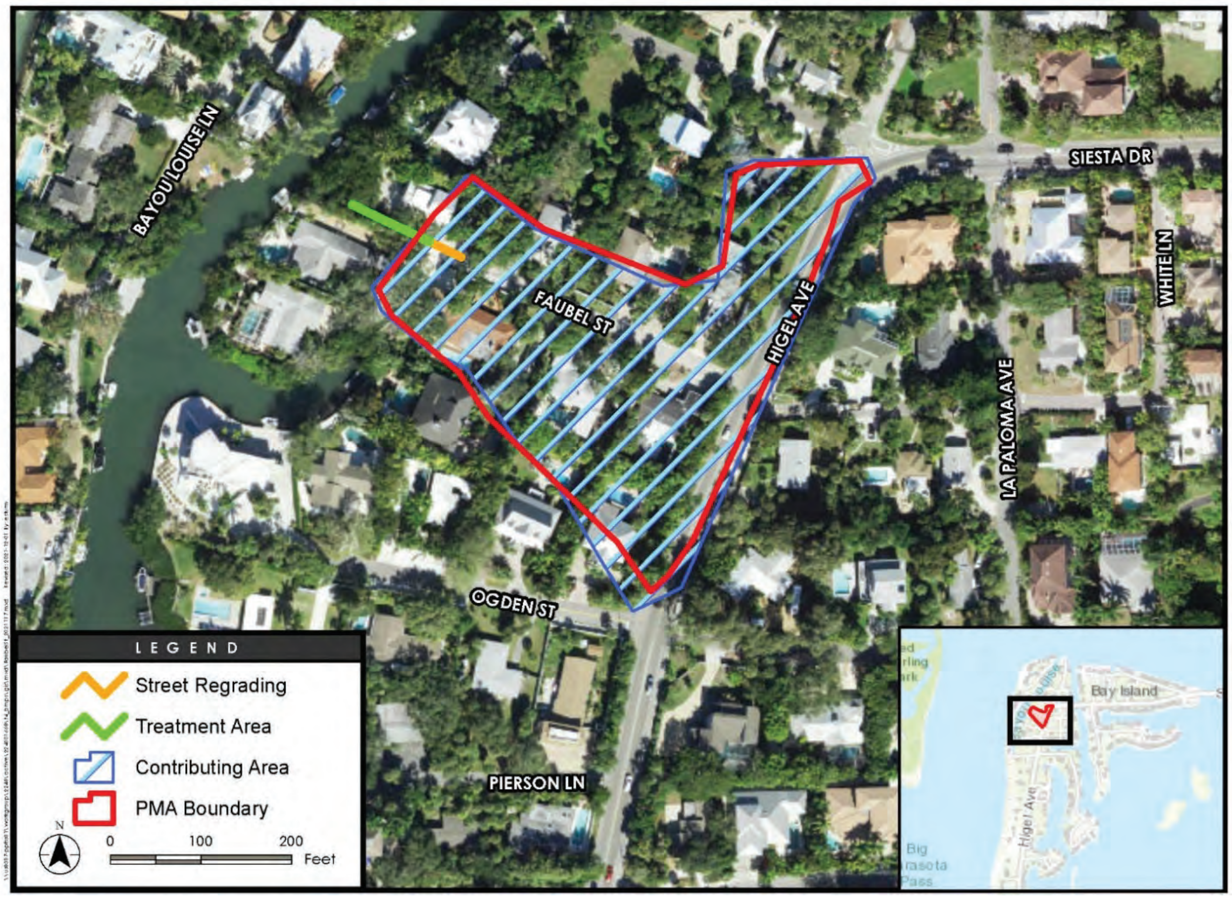


Figure 64 - Faubel Street Area BMPs

Faubel Street is an existing residential street on the north end of Siesta Key in which residents contend with multiple flooding events along their roadway on a regular basis during the wet season. The area needs to have upgrades completed to the stormwater system to ensure that the drainage is treated and discharged – instead of attenuating in the roadway.

The conceptual BMPs include storm structure installation and regrading on the west end of the street as well as rehabilitation for the existing saltwater marsh downstream.

The locations of the regrading area, proposed stormwater structure and wetland plantings is shown on Figure 65.

Figure 65 - Faubel Street Stormwater Improvements

Benefits include:

- **Reduction of 400 linear feet of nuisance street flooding and level of service deficiencies**
- **Reduction of operation and maintenance of roadway and stormwater infrastructure**
- **Reduction of inflow and infiltration of sanitary system infrastructure, and water quality treatment benefits.**

The total cost for the Faubel Street Stormwater Improvements is $37,334.

4.0 Water Quality Level of Service Analysis

Once the conceptual BMPs were finalized with measurable benefits calculated for annual pounds of nitrogen and phosphorus removed, the next step was incorporation of the annual load reductions for each BMP into the SIMPLE model. Janicki Environmental accomplished this by comparing the nutrient loading level of service (LOS) identified in Task 3.6 (Janicki Environmental, 2021c) for Whitaker Bayou, Hudson Bayou and Phillippi Creek to loading estimates from the SIMPLE model developed in Task 3.4 (Janicki Environmental, 2021a), updated with the proposed conceptual BMP projects.

Basin specific loading targets (Janicki Environmental, 2021b) were compared to the mean TN and TP loadings from the most recent 5-year period to the target loadings to determine their achievement of their Strategic LOS (Janicki Environmental, 2021c) (Table 10). Whitaker Bayou is the only basin that is currently meeting its LOS for nutrient loading. Both Hudson Bayou and Phillippi Creek require further reductions to meet their LOS.

Table 10 - Basins meeting or not meeting the Strategic LOS

Basins meeting (green shading) or not meeting (orange shading) the Strategic LOS.				
Basin	**Total Nitrogen (lbs/year)**		**Total Phosphorus (lbs/year)**	
	Target	**Latest 5-year Mean**	**Target**	**Latest 5-year Mean**
Whitaker Bayou	53,387	**47,574**	8,977	**8,295**
Hudson Bayou	22,534	**23,744**	3,936	**4,142**
Phillippi Creek	402,323	**415,410**	64,377	**69,082**

4.1 Methodology

The SIMPLE model's BMP spatial layer (Janicki Environmental, 2021a) was updated with the proposed project's contributing areas, each provided with a unique identifier. The same identifier was used to identify the project's pollution reduction efficiencies calculated via the BMP Trains 2020 analysis. The SIMPLE model was then run for the same period to estimate post-project basin loads with the proposed projects in place.

4.2 Results

The project reductions shown in Tables 11 and 12 are the result of comparing the pre- and post-project loading estimates. The reductions were then used to determine the percent achievement of the corresponding nutrient LOS. The reductions due to the proposed conceptual BMP project's nitrogen load reductions (Table 11) result in Whitaker Bayou continuing to meet its nitrogen LOS at 100%, while the Hudson Bayou and Philippi Creek Basins achieve 37% and 14% of their nitrogen LOS, respectively.

Table 11 - Percent of Nitrogen LOS target met by proposed conceptual BMP reductions

Percent of Nitrogen LOS target met by proposed project reductions.				
BASIN	Total Nitrogen (lbs/yr)			
	Target	2015-2019 Mean	Conceptual BMP Reductions	%Target Reduction
Whitaker Bayou	53,387	47,574	678	100
Hudson Bayou	22,534	23,744	442	37
Phillippi Creek	402,323	415,410	1,778	14

The proposed conceptual BMPs also make progress toward achieving the phosphorus LOS (Table 12). Again, the Whitaker Bayou basin achieves 100% of its phosphorus LOS. Hudson Bayou and Phillippi Creek achieve 62% and 10% of their LOS, respectively.

Table 12 - Percent of Phosphorous LOS Target met by Conceptual CMP Reductions[1]

Percent of Phosphorus LOS target met by conceptual BMP reductions.				
BASIN	Total Phosphorus (lbs/yr)			
	Target	2015-2019 Mean	Conceptual BMP Reductions	%Target Reduction
Whitaker Bayou	8,977	8,295	260	100
Hudson Bayou	3,936	4,142	128	62
Phillippi Creek	64,377	69,082	496	10

[1] future discussion will be required with County to consider the removal of TP from scoring

The progress towards achieving the Strategic LOS only accounts for the stormwater management conceptual BMPs proposed by this project. Additional progress towards meeting the loading targets may be gained through additional non-stormwater recommendations, i.e., septic-to-sewer conversions and wastewater treatment facility upgrades, additional sediment removal, and non-structural recommendations.

5.0 Conclusion

To improve the health of the Sarasota Bay Watershed, conceptual BMPs were identified from a menu of improvement strategies with varying levels of flood protection and pollutant load reduction benefits as determined through the technical ICPR flood modeling and BMP Trains pollutant removal efficiency modeling. The original intent was to propose up to 10 conceptual BMP concepts for the 18 PMAs, however 22 BMPs were developed for 13 PMAs, with a cost totaling $22,780,789.

The Conceptual BMP Cost-Benefit Matrix found in Appendix A, Exhibit 9, contains a list of all Priority Management Areas and the following information for each proposed conceptual BMPs:

- Construction cost estimates
- Flooding LOS deficiency removal
- Pollutant removal efficiency
- Shoreline Restoration benefits

Additionally, several BMPs can be used as a unit cost basis when opportunities arise to replicate the improvement strategy throughout the County, through Programmatic Maintenance. For instance, specific BMPs in the US41 & Highland PMA (a rehabilitation of an existing sand filtration system to be replaced with bio absorption material); the unit costs and cost-benefit results of that BMP can be used to determine applicability of that solution throughout the county. Another example of a BMP that can be replicated throughout the County is the rehabilitation of existing stormwater ponds (sediment removal for capacity). The goal is to ensure that the plan provides site-specific improvement strategies that can be implemented through the County, with the unit costs and cost-benefit of those improvements able to be considered, providing the County with many options for improvements.

Each conceptual BMP was scored using traditional cost per benefit over the 20-year expected life of the BMP according to SWFWMD CFI levels 0-25. A score for resiliency between 0-5 was determined for resilient, somewhat resilient and affected by sea level rise as outlined in the Community Rating System NOAA 2100 Intermediate-High projection for sea level rise. Table 13 contains the individual conceptual BMP scoring as well as the combined score if there is more than one BMP in a Priority Management Area.

Table 13 – Scoring for the Conceptual BMPs

Conceptual BMP Cost-Benefit Scoring									
Priority Management Area	Conceptual BMP	Conceptual Plan Cost Estimate[1]	Shoreline Restoration[2]	TN Removed[2]	TP Removed[2]	Cost per Acre[3]	Flood[4]	Resiliency[5]	TOTAL
Tri Par	DRY RETENTION AREA; NUTRIENT SEPARATING BAFFLE BOX	$ 3,153,810	0	25	25	25	20	5	100
Tri Par	LINEAR TREATMENT AREA; FLOODPLAIN BENCH	$ 633,957	0	25	25	25	0	5	80
	Combined[6]	$ 3,787,767	0	25	25	25	20	5	100
US41 & Highland	CONVERT EXISTING UNDERGROUND TREATMENT MEDIA FROM SAND TO BAM	$ 21,400	0	25	25	15	0	5	70
MLK & Orange	STORM PIPE IMPROVEMENTS	$ 1,242,021	0	5	5	10	20	5	45
US41 & 10th St	CONVERT EXISTING PARKING SPOTS TO PERVIOUS PAVMENT	$ 1,485,640	0	0	5	0	0	0	5
US41 & 10th St	LOW FLOW WEIRS WITH SIDE-BANK FILTRATION	$ 1,212,640	0	25	25	25	0	5	80
US41 & 10th St	SEDIMENT SUMP	$ 274,346	0	15	25	15	0	5	60
	Combined	$ 2,972,626	0	25	25	25	0	5	80
Bee Ridge & Beneva	FOREST LAKES POND SEDIMENT REMOVAL & BEE MATS; NUTRIENT SEPARATING BAFFLE BOX	$ 858,535	0	25	25	25	0	5	80
Bee Ridge & Beneva	LOW FLOW WEIRS WITH SIDE-BANK FILTRATION	$ 1,917,525	0	15	25	25	0	5	70
	Combined	$ 2,776,060	0	25	25	25	0	5	80
Tuttle Circle	TANGLEWOOD CONVERSION OF CANAL TO WET DETENTION WITH BEE MATS	$ 84,259	0	25	25	25	0	3	78
Tuttle Circle	CONVERSION OF BLOSSOM BROOK CANAL TO WET DETENTION IN SERIES	$ 1,882,305	0	25	25	25	0	3	78
Tuttle Circle	PHILLIPPI CREEK DAM REMOVAL; SEDIMENT REMOVAL; SEDIMENT SUMP INSTALLATION	$ 1,046,663	0	25	25	25	0	5	80
	Combined	$ 3,013,227	0	25	25	25	0	5	80
Pinecraft	CONVERT EXISTING WET POND TO DRY POND	$ 267,725	0	25	25	25	0	0	75
Pinecraft	DENITRIFICATION TRENCH - ALOHA MOBILE HOME PARK	$ 125,840	0	25	25	25	0	5	80
Pinecraft	STREAM RESTORATION PHILLIPPI CREEEK	$ 701,393	25	0	0	0	0	5	30
	Combined	$ 1,094,958	25	25	25	25	0	5	105
SMH & US41	NUTRIENT SEPARATING BAFFLE BOX; STORM PIPE & CHECK VALVES	$ 2,463,173	0	5	5	10	5	5	30
Downtown	NUTRIENT SEPARATING BAFFLE BOX & UPFLOW FILTER WITH BAM; DENITRIFICATION TRENCHES	$ 1,104,700	0	0	0	25	0	3	28
Bee Ridge & US41	STORM PIPE IMPROVEMENTS; NUTRIENT SEPARATING BAFFLE BOX	$ 1,475,894	0	5	5	25	15	3	53
Bee Ridge & US41	CONVERT EXISTING PARKING SPOTS TO PERVIOUS PAVEMENT	$ 2,218,339	0	0	0	0	0	5	5
	Combined[6]	$ 3,694,233	0	5	5	25	15	5	55
Stickney Point	STORM PIPE CHECK VALVES	$ 186,115	0	0	0	0	15	5	20
US41 & Proctor	THE LANDINGS POND SEDIMENT REMOVAL & BEE MATS; NUTRIENT SEPARATING BAFFLE BOX	$ 328,676	0	25	25	25	0	3	78
Faubel Street	STORM STRUCTURE INSTALLATION; SALT WATER MARSH REHABILITATION	$ 37,334	0	0	0	25	15	0	40

1) Conceptual Plan Cost Estimate does not include O&M costs; O&M can be found on Project Sheets

2) Methodology adapted from proposed SWFWMD FY2023 CFI - Water Quality Projects

3) Methodology adapted from proposed SWFWMD FY2023 CFI - Natural Systems Restoration

4) Methodology adapted from proposed SWFWMD FY2023 CFI - Flood Protectio

5) Determined whether project will be inundated by 2100 projected SLR

6) Score for combined BMP concepts assigned to highest individual group

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Appendices

Appendix A – Exhibits 1 through 9

Appendix B - Conceptual BMP Project Sheets

Appendix C - The Sarasota County Sediment Management Project 1: Phillippi Creek Barrier Removal Feasibility Study Final Report by Weiler Engineering Corporation, dated January 2019.

Appendix D - Harbor Acres Alternatives Analysis Report by Kimley Horn and Associates, dated 2021.

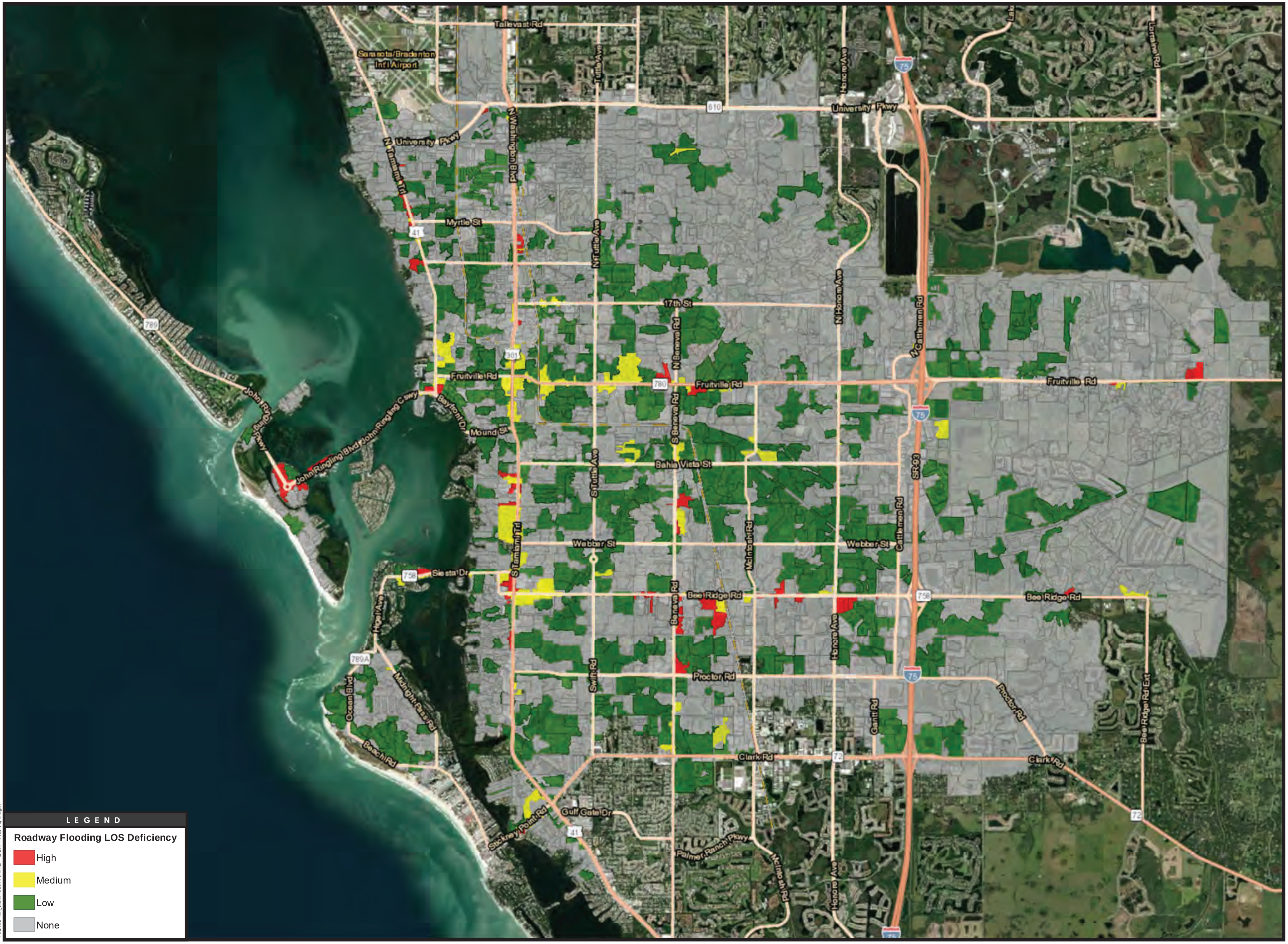
Appendix E - Whitaker Bayou Analysis Report by Stantec Consulting Services Inc., dated 2020.

Appendix F - The Cost Benefit Analysis for Stormwater Projects Report by Stantec Consulting Services Inc., dated 2018.

Appendix G - The Future Conditions Floodplain Analysis Report by Jones Edmunds, dated 2019.

Appendix A

Exhibits



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Sarasota Bay Watershed Exhibit 1

Roadway Flooding LOS Deficiency Ranking

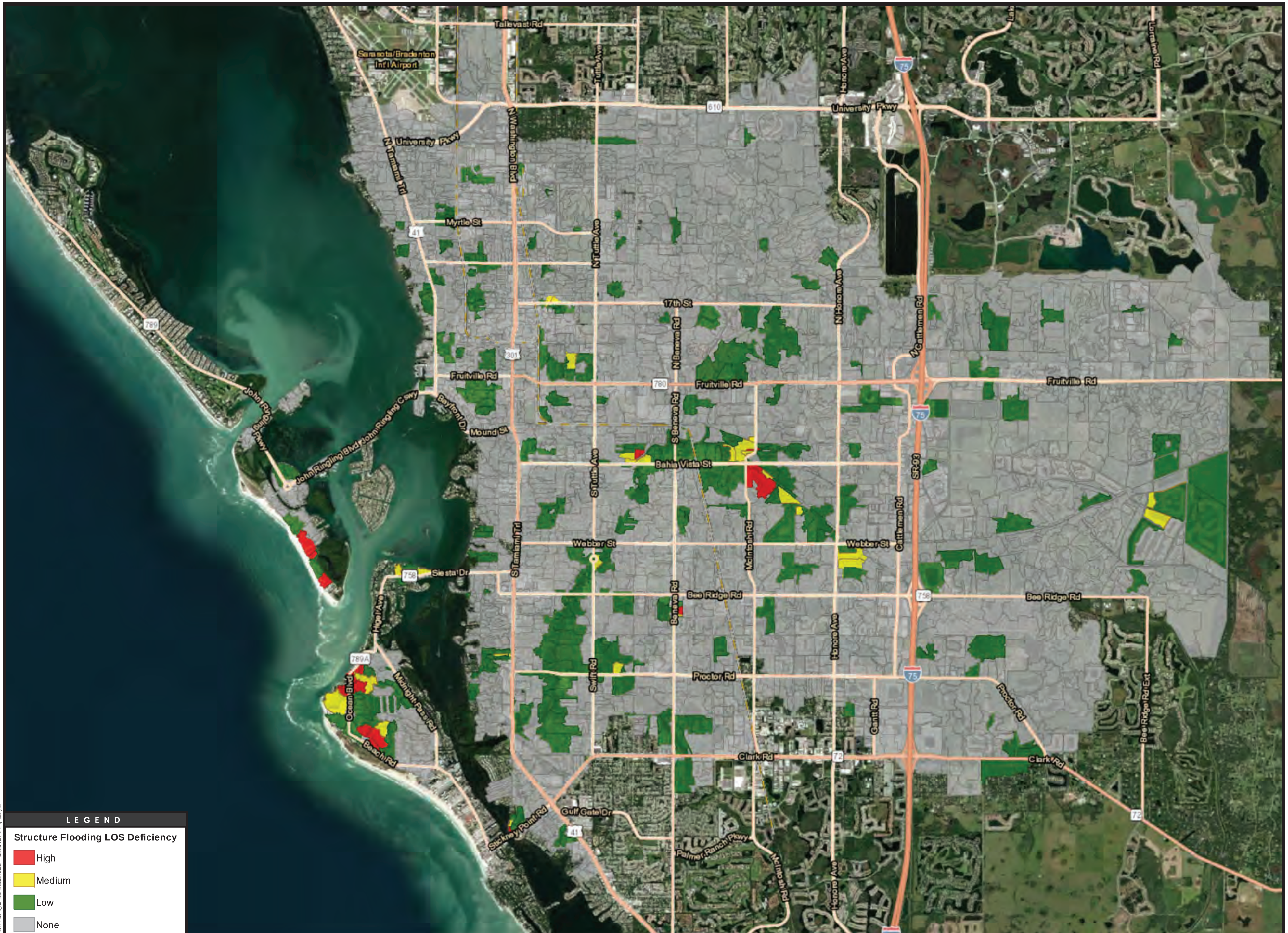
May 2021

Stantec Consulting Services Inc.
6900 Professional Pkwy E.
Sarasota, FL 34240
tel 941.907.6900
fax 941.907.6910

N

0 5,000 10,000 Feet

Prepared by: M.A.D. 05/12/21
Technical Review by: N.A.A. 05/12/21
Independent Review by: B.Q. 05/12/21



Sarasota Bay Watershed Exhibit 2

Structure Flooding LOS Deficiency Ranking

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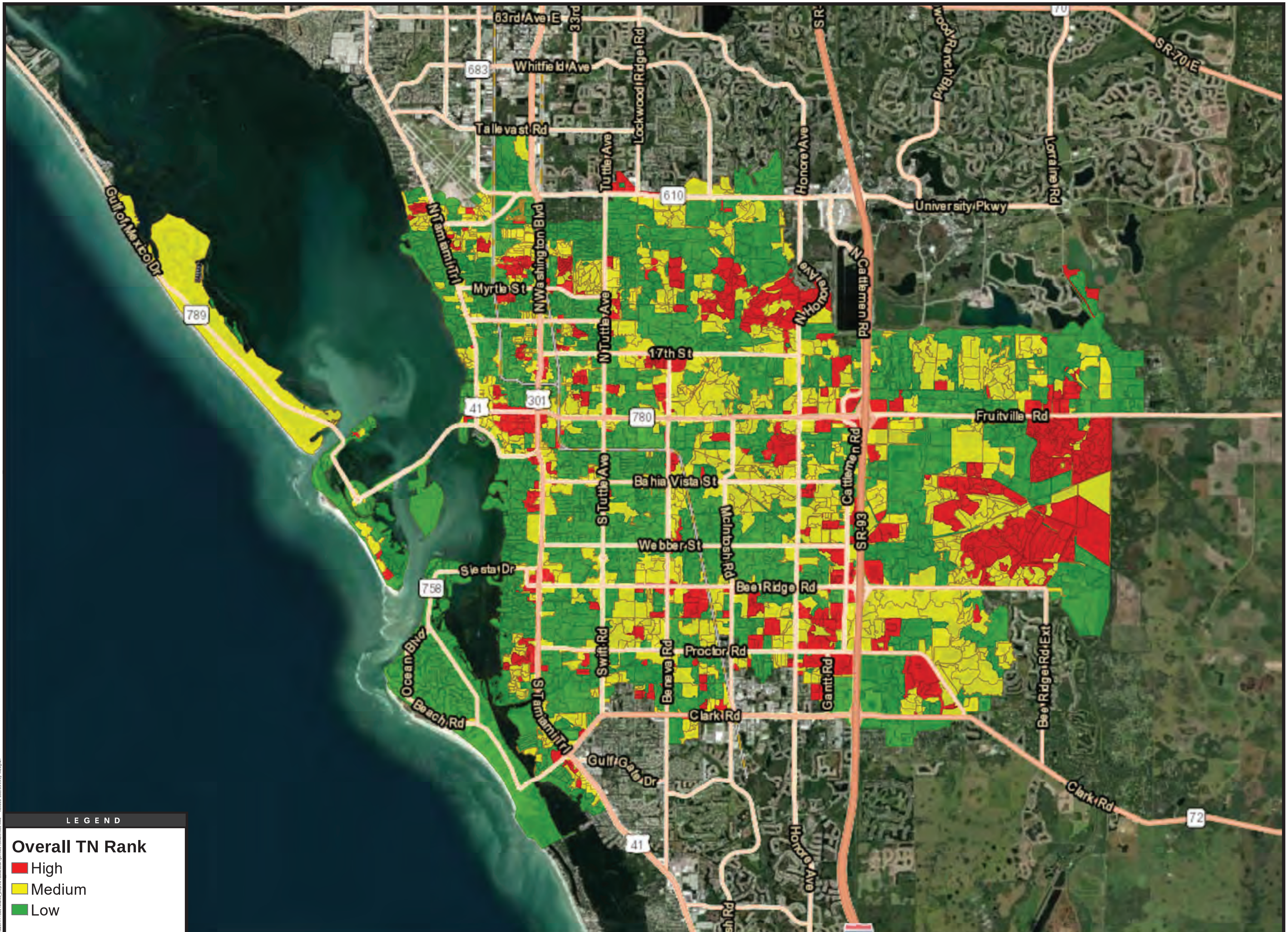
Technical Review by: N.A.A. 05/13/21
Independent Review by: B.Q. 05/13/21



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Sarasota Bay Watershed Exhibit 3

Overall TN Loading Ranking

May 2021

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N

0 5,000 10,000 Feet

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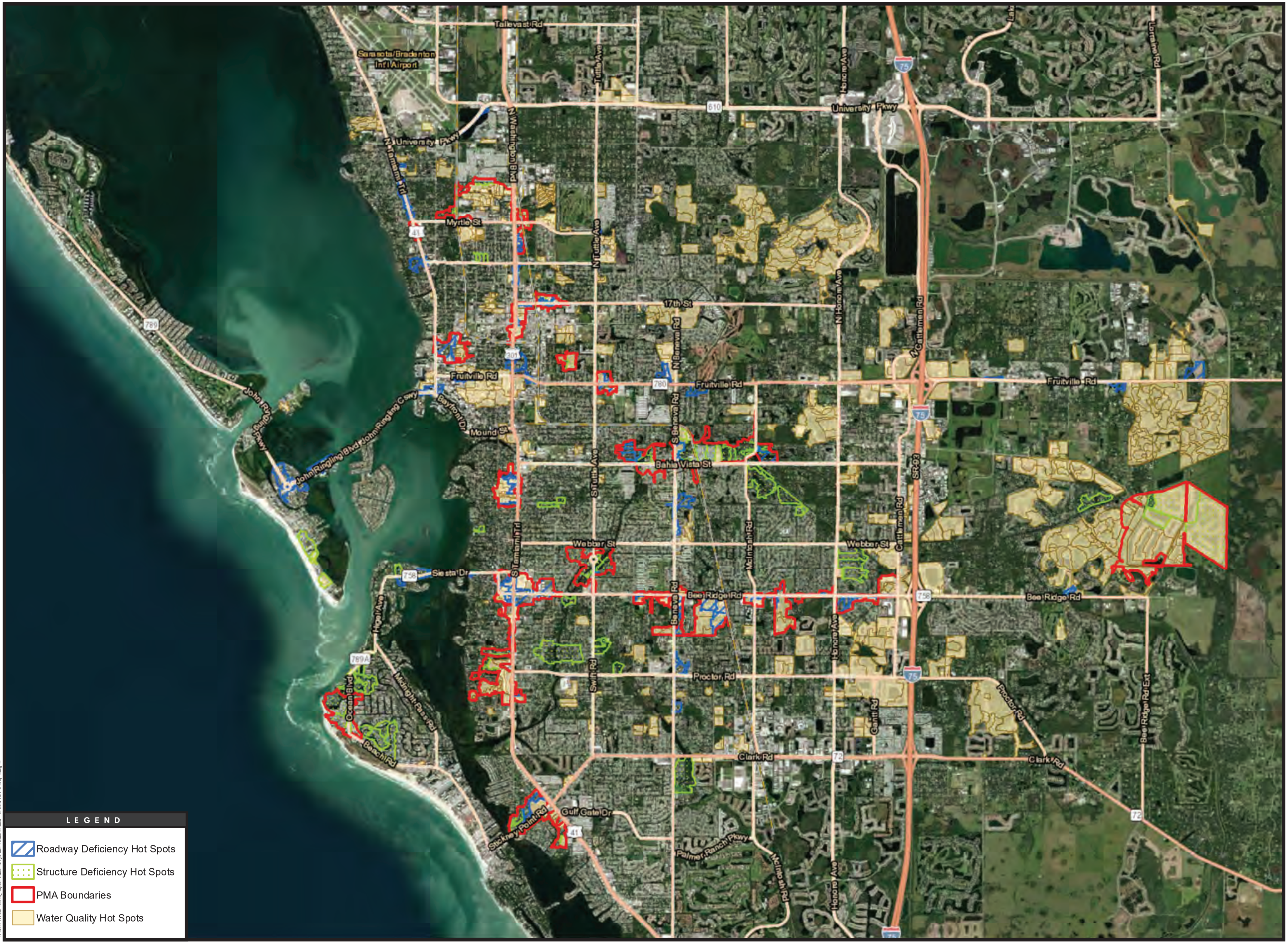
Independent Review by: B.Q. 05/13/2021



Sarasota Bay Watershed Exhibit 4

Priority Management Areas Overlay Analysis

May 2021

Stantec

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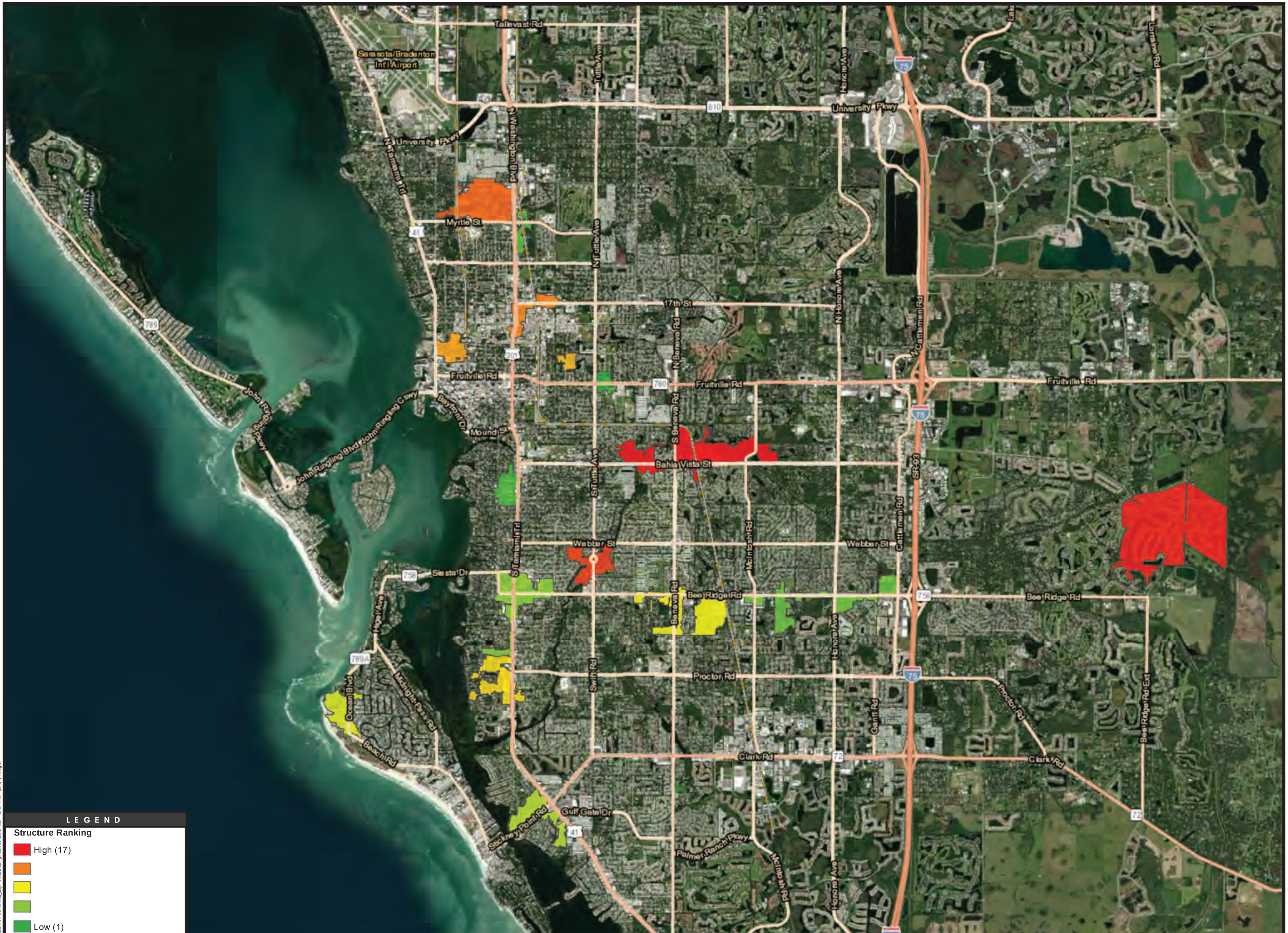
Independent Review by: B.Q. 05/13/21



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Sarasota Bay Watershed Exhibit 5

Structure Flooding LOS Deficiency Prioritization

May 2021

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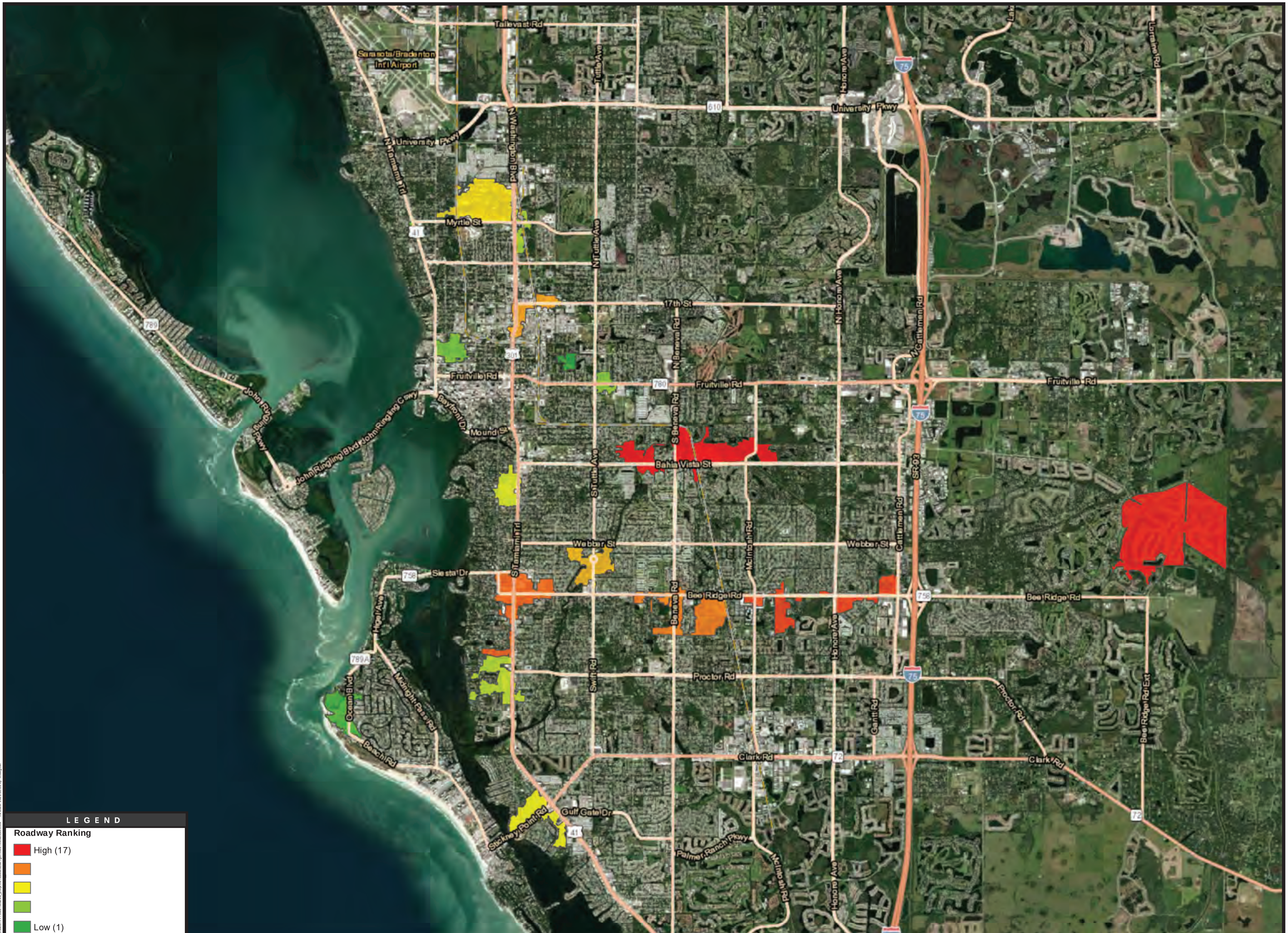
Technical Review by: N.A.A. 05/13/21
Independent Review by: B.Q. 05/13/21



Sarasota Bay Watershed Exhibit 6

Roadway Flooding LOS Deficiency Prioritization

May 2021

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N

0 5,000 10,000 Feet

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Technical Review by: N.A.A. 05/13/21
Independent Review by: B.Q. 05/13/21

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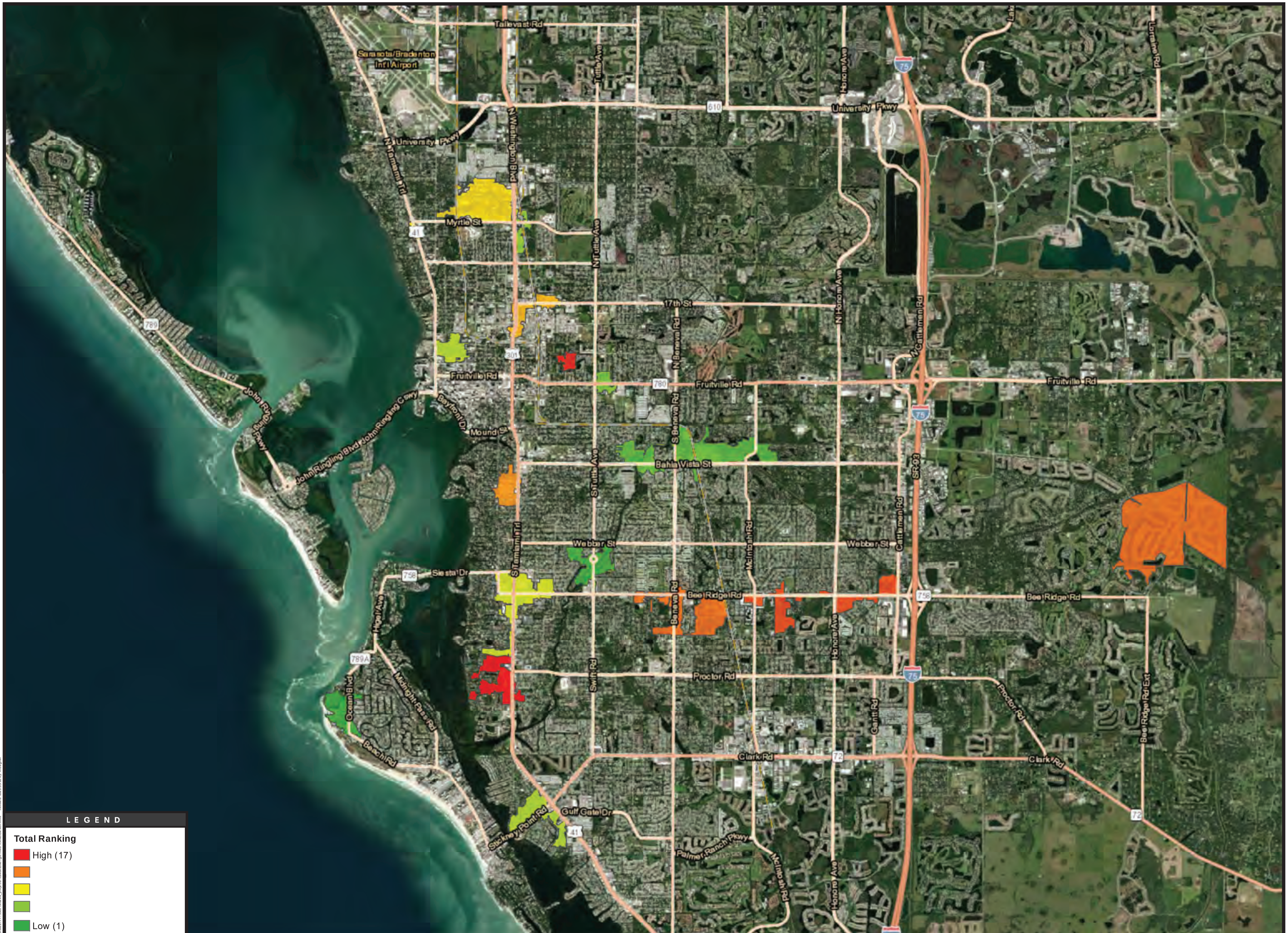
2. Source data: Sarasota Bay Watershed Analysis Output
3. Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors



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Sarasota Bay Watershed Exhibit 7

Water Quality Hot Spots Prioritization

May 2021

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N

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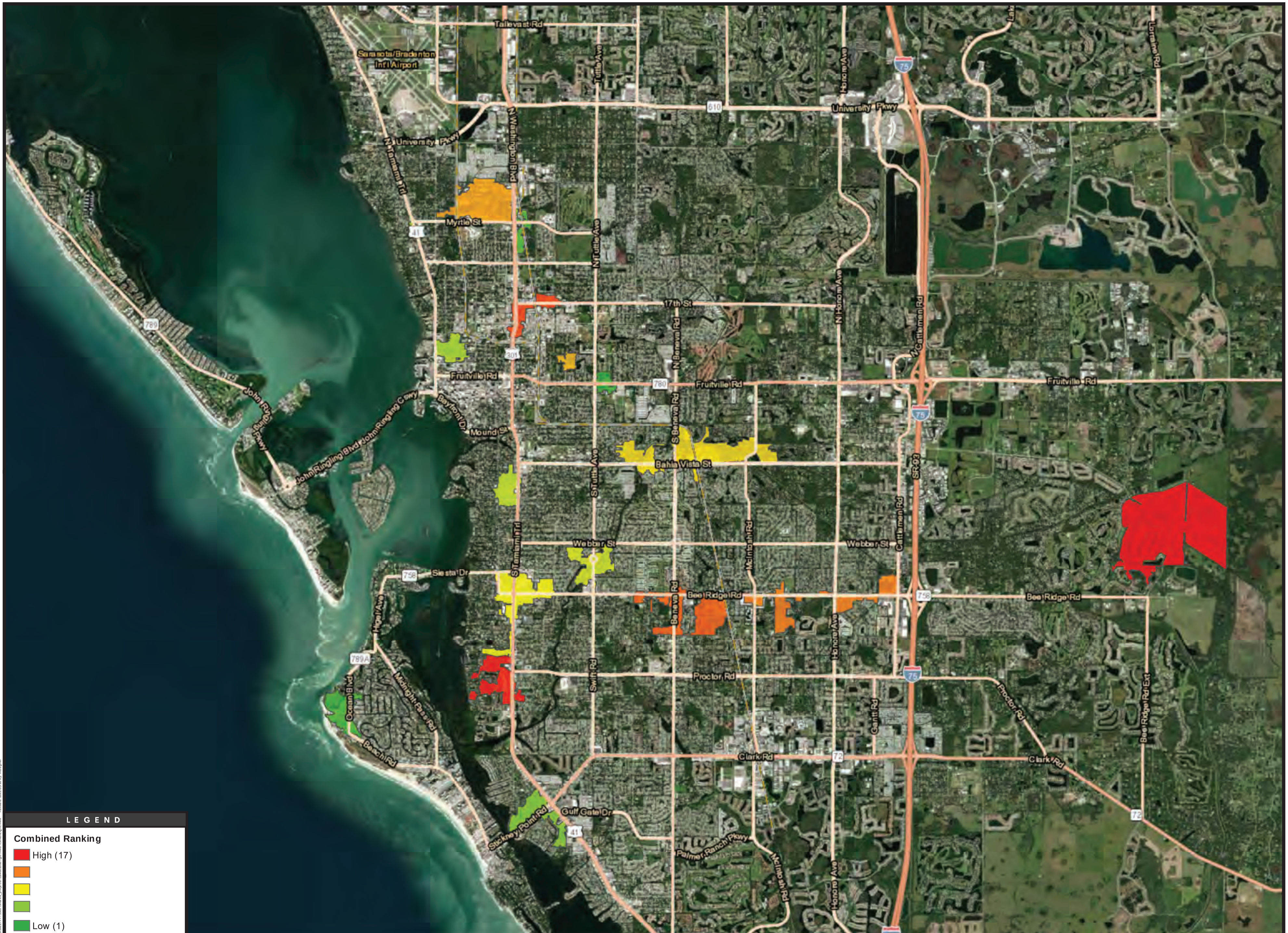
Prepared by: M.A.D. 05/18/21
Technical Review by: N.A.A. 05/13/21
Independent Review by: B.Q. 05/13/21



Sarasota Bay Watershed Exhibit 8

Combined Priority Management Areas Prioiritization

May 2021

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N

0 5,000 10,000 Feet

Prepared by: M.A.D. 05/18/21
Technical Review by: N.A.A. 05/13/21
Independent Review by: B.Q. 05/13/2021

Appendix A - Exhibit 9

Conceptual BMP Cost-Benefit Matrix

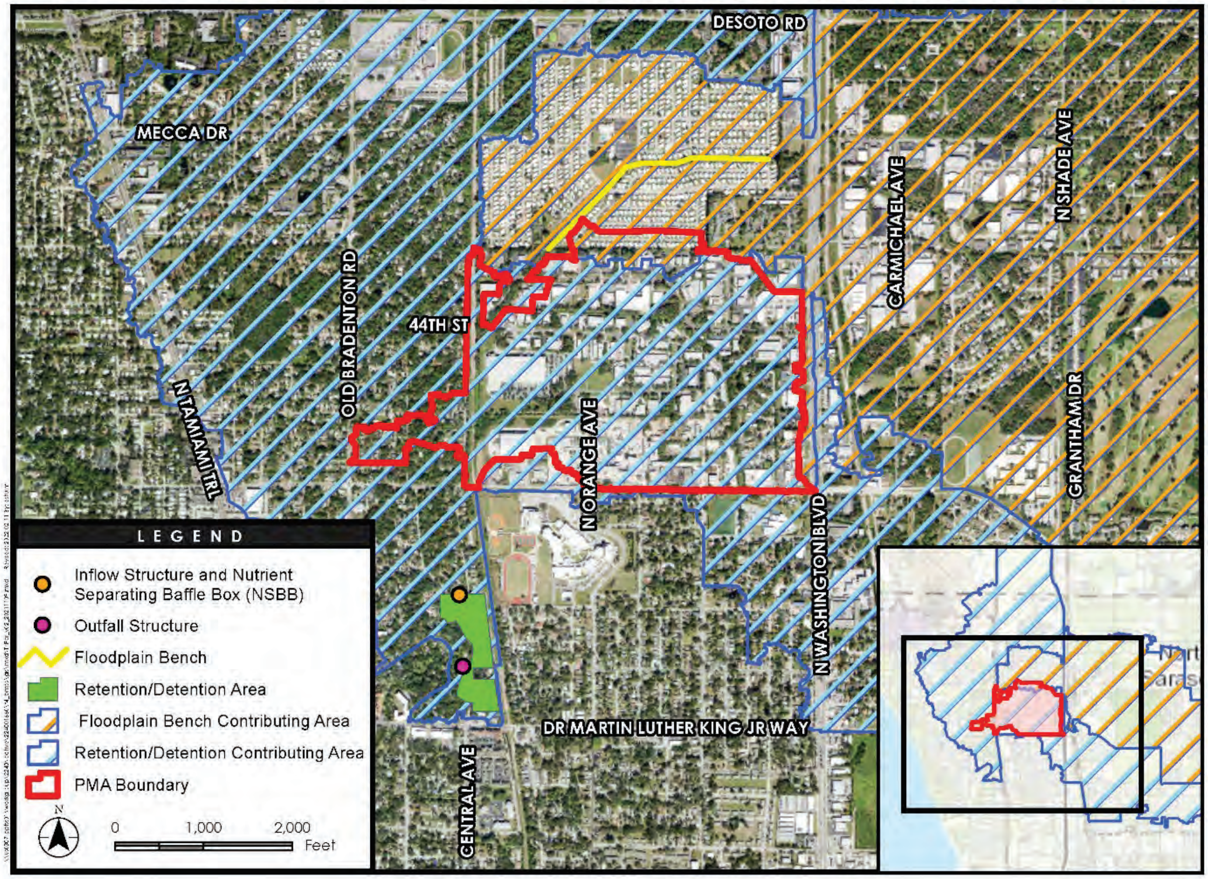
Project Management Area	Conceptual BMP	Conceptual Plan Cost Estimate[1]	Initial TN Removed during construction (lbs)	TN Removed (lbs/yr)	Cost TN ($/lb/yr)	Initial TP Removed during construction (lbs)	TP Removed (lbs/yr)	Cost TP ($/lb/yr)	Contributing Area (ac)	Linear Feet Road Removed from 100Yr Flood Risk	Structures Removed From 100Yr Flood Risk	Linear Feet Stream Restoration	Flood Cost Benefit Ratio[2]	Cost Per Acre	Cost Per Linear Foot Shoreline Restoration	TN Removed (Cost/lb./20yr)[3]	TP Removed (Cost/lb./20yr)
Tri Par	DRY RETENTION AREA; NUTRIENT SEPARATING BAFFLE BOX	$ 3,153,810	N/A	5,465	$ 577	N/A	912	$ 3,458	3,502	N/A	12	N/A		$ 901	N/A	$ 28.85	$ 172.91
Tri Par	LINEAR TREATMENT AREA; FLOODPLAIN BENCH	$ 633,957	N/A	1,154	$ 549	N/A	251	$ 2,526	1,281	1,018	N/A	N/A		$ 494.89	N/A	$ 27.47	$ 126.29
	Combined	$ 3,787,767	N/A	6,619	$ 572	N/A	1,163	$ 3,257	4,783	1,018	12	N/A	1.08	$ 791.92	N/A	$ 28.61	$ 162.84
US41 & Highland	CONVERT EXISTING UNDERGROUND TREATMENT MEDIA FROM SAND TO BAM	$ 21,400	N/A	14.9	$ 1,436	N/A	2.7	$ 7,926	3	N/A	N/A	N/A	N/A	$ 6,993.46	N/A	$ 71.81	$ 396.30
MLK & Orange	STORM PIPE IMPROVEMENTS; NUTRIENT SEPARATING BAFFLE BOX	$ 1,242,021	N/A	105.7	$ 11,750	N/A	13.2	$ 94,092	22	292	5	N/A	0.94	$ 56,123.84	N/A	$ 587.52	$ 4,704.62
US41 & 10th St	CONVERT EXISTING PARKING SPOTS TO PERVIOUS PAVMENT	$ 1,485,640	N/A	49.82	$ 29,820	N/A	6.56	$ 226,470	3.5	N/A	N/A	N/A	N/A	$ 425,684.81	N/A	$ 1,491.01	$ 11,323.48
US41 & 10th St	LOW FLOW WEIRS WITH SIDE-BANK FILTRATION	$ 1,212,640	N/A	619.9	$ 1,956	N/A	149.5	$ 8,111	239	N/A	N/A	N/A	N/A	$ 5,073.81	N/A	$ 97.81	$ 405.57
US41 & 10th St	SEDIMENT SUMP	$ 274,346	1,380	40.77	$ 6,729	665	58.75	$ 4,670	41	N/A	N/A	N/A	N/A	$ 6,620.33	N/A	$ 124.96	$ 149.10
	Combined	$ 2,972,626	1,380	710.49	$ 4,184	665	215	$ 13,838	284	N/A	N/A	N/A	N/A	$ 10,469.57	N/A	$ 209.20	$ 691.92
Bee Ridge & Beneva	FOREST LAKES POND SEDIMENT REMOVAL & BEE MATS; NUTRIENT SEPARATING BAFFLE BOX	$ 858,535	87,110	526	$ 1,632	41,946	126	$ 6,814	140	N/A	N/A	N/A	N/A	$ 6,149.96	N/A	$ 81.61	$ 340.69
Bee Ridge & Beneva	LOW FLOW WEIRS WITH SIDE-BANK FILTRATION	$ 1,917,525	N/A	382.2	$ 5,017	N/A	102.9	$ 18,635	89	N/A	N/A	N/A	N/A	$ 21,618.09	N/A	$ 250.85	$ 931.74
	Combined	$ 2,776,060	87,110	908.2	$ 3,057	41,946	228.9	$ 12,128	228	N/A	N/A	N/A	N/A	$ 12,159.70	N/A	$ 152.83	$ 606.39
Tuttle Circle	TANGLEWOOD CONVERSION OF CANAL TO WET DETENTION WITH BEE MATS	$ 84,259	N/A	249	$ 338	N/A	67	$ 1,258	104	N/A	N/A	N/A	N/A	$ 814.10	N/A	$ 16.92	$ 62.88
Tuttle Circle	CONVERSION OF BLOSSOM BROOK CANAL TO WET DETENTION IN SERIES	$ 1,882,305	N/A	1,865	$ 1,009	N/A	434	$ 4,337	549	N/A	N/A	N/A	N/A	$ 3,427.36	N/A	$ 50.46	$ 216.86
Tuttle Circle	PHILLIPPI CREEK DAM REMOVAL; SEDIMENT REMOVAL; SEDIMENT SUMP INSTALLATION	$ 1,046,663	36,107	160	$ 6,542	17,387	64	$ 16,354	31,210	N/A	N/A	N/A	N/A	$ 33.54	N/A	$ 26.63	$ 56.07
	Combined	$ 3,013,227	36,107	2,274	$ 1,325	17,387	565	$ 5,333	31,863	N/A	N/A	N/A	N/A	$ 94.57	N/A	$ 66.25	$ 266.66
Pinecraft	CONVERT EXISTING WET POND TO DRY POND	$ 267,725	N/A	185.5	$ 1,443	N/A	33.7	$ 7,944	34	N/A	N/A	N/A	N/A	$ 7,851.17	N/A	$ 72.16	$ 397.22
Pinecraft	DENITRIFICATION TRENCH - ALOHA MOBILE HOME PARK	$ 125,840	N/A	297.9	$ 422	N/A	38.9	$ 3,235	12	N/A	N/A	N/A	N/A	$ 10,646.36	N/A	$ 21.12	$ 161.75
Pinecraft	STREAM RESTORATION PHILLIPPI CREEEK	$ 701,393	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,000	N/A	N/A	$ 351	N/A	N/A
	Combined	$ 1,094,958	N/A	483.4	$ 2,265	N/A	72.6	$ 15,082	46	N/A	N/A	2,000	N/A	N/A	N/A	$ 113.26	$ 754.10
SMH & US41	NUTRIENT SEPARATING BAFFLE BOX; STORM PIPES & CHECK VALVES	$ 2,463,173	N/A	111.5	$ 22,091	N/A	14.3	$ 172,250	154	5,500	41	N/A	0.5	$ 16,007.10	N/A	$ 1,104.56	$ 8,612.49
Downtown	NUTRIENT SEPARATING BAFFLE BOX & UPFLOW FILTER WITH BAM; DENITRIFICATION TRENCHES	$ 1,104,700	N/A	60.5	$ 18,260	N/A	10	$ 110,470	27	N/A	N/A	N/A	N/A	$ 41,483.29	N/A	$ 912.98	$ 5,523.50
Bee Ridge & US41	STORM PIPE IMPROVEMENTS; NUTRIENT SEPARATING BAFFLE BOX	$ 1,475,894	N/A	147.1	$ 10,033	N/A	18.4	$ 80,212	89	220	0	N/A	0.22	$ 16,540.34	N/A	$ 501.66	$ 4,010.58
Bee Ridge & US41	CONVERT EXISTING PARKING SPOTS TO PERVIOUS PAVEMENT	$ 2,218,339	N/A	57.1	$ 38,850	N/A	7.5	$ 295,779	5.2	N/A	N/A	N/A	N/A	$ 428,250.77	N/A	$ 1,942.50	$ 14,788.93
	Combined	$ 3,694,233	N/A	204.2	$ 18,091	N/A	25.9	$ 142,634	94	N/A	N/A	N/A	0.22	$ 39,129.68	N/A	$ 904.56	$ 7,131.72
Stickney Point	STORM PIPE CHECK VALVES	$ 186,115	N/A	N/A	N/A	N/A	N/A	N/A	N/A	225	0	N/A	0.21	N/A	N/A	N/A	N/A
US41 & Proctor	THE LANDINGS POND SEDIMENT REMOVAL & BEE MATS; NUTRIENT SEPARATING BAFFLE BOX	$ 328,676	12,239	506	$ 650	5,893	102	$ 3,222	126	N/A	N/A	N/A	N/A	$ 2,605.44	N/A	$ 14.70	$ 41.43
Faubel Street	STORM STRUCTURE INSTALLATION; SALT WATER MARSH REHABILITATION	$ 37,334	N/A	N/A	N/A	N/A	N/A	N/A	2.8	400	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		$ 22,722,289	$ 136,836	11,997.89		65,891	2,412			7,435	58	2,000					

Notes:
1) Conceptual Plan Cost Estimate does not include O&M costs
2) Methodology provided in the Sarasota County document "A Proposed Cost-Benefit Analysis for Stormwater Projects: Manual For Costs and Benefit for Flood and Water Quality Project"
3) SWFWMD FY2023 CFI applications
4) Sediment Sump BMP and Sediment Removal Project TN and TP initial removed is included in the total TN and TP removed during the lifespan of the BMP (20 years)
5) For Tri-par, if the Linear treatment area is constructed, the Dry Retention area pollutant load removal may be lower due to the upstream BMPs.

Appendix B

Conceptual BMP Project Sheets

Tri-Par – Whitaker Bayou



Project Management Area

The Tri-Par Area has historic long-standing flooding located within Whitaker Bayou basin at two main confluences (Canal/Trib A and Trib A/B) The area includes high nutrient loading due to the age and intensity of land-use (commercial/industrial).

Conceptual BMP

- Linear treatment system channel retrofit with floodplain bench and weirs for storage and pollutant removal.
- Large dry retention area to provide floodplain storage
- Nutrient separating baffle box at retention area inflow will capture sediment, vegetation, and trash

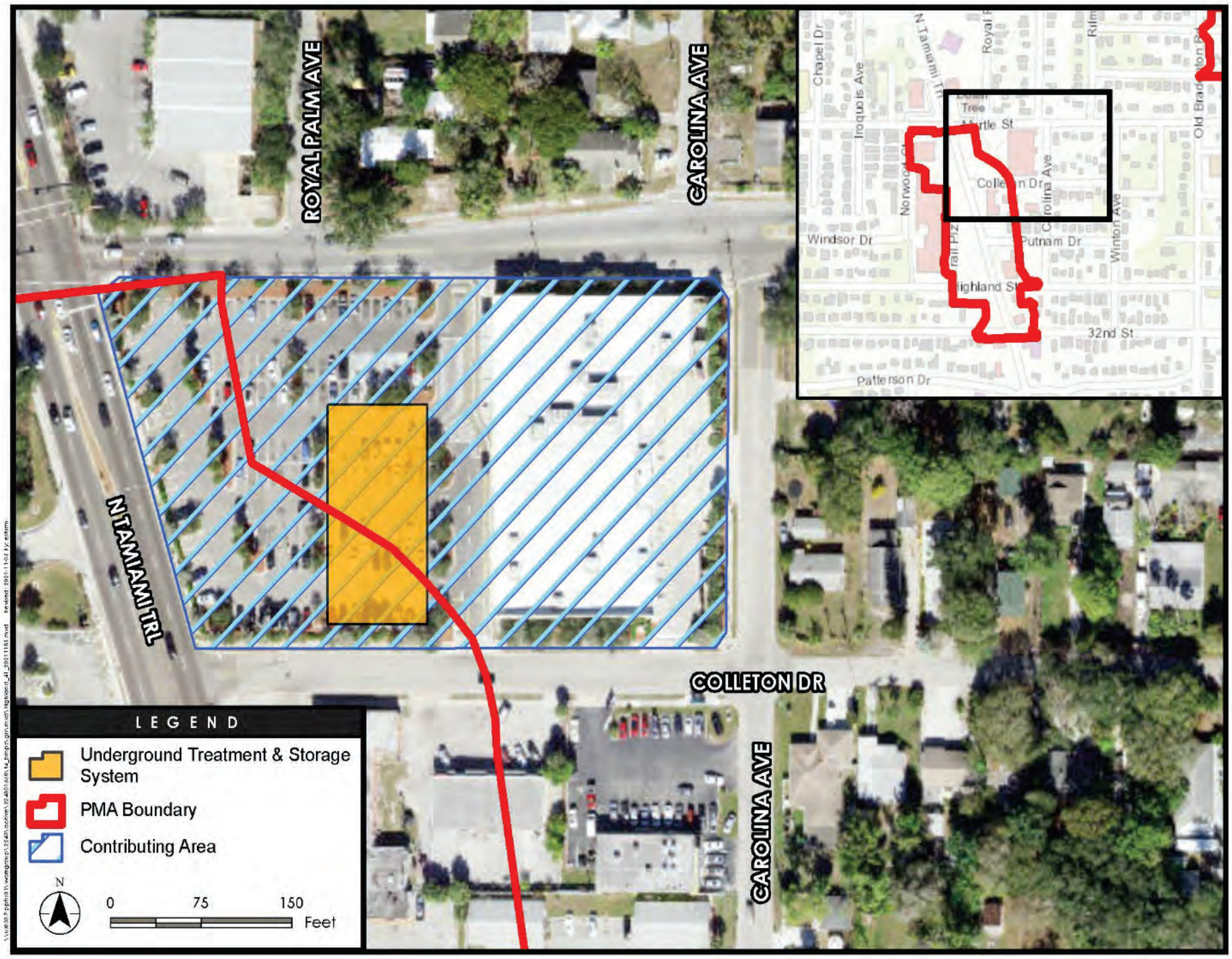
Score 100 Cost $3,787,767

Benefits

- Annual TN removal 6,619 lbs
- $28/lb TN removed over 20 year life expectancy of BMP
- 12 structures removed from 100yr storm risk
- 1018 linear feet of roadway removed from LOS Deficiency including 416 feet of evacuation route
- Flood Cost-Benefit Ratio = 1.08
- Resilient in NOAA 2100 future condition

PROJECT MANAGEMENT AREA: TRI-PAR				
CONCEPTUAL PLAN COST ESTIMATE - DRY RETENTION AREA; NUTRIENT SEPARATING BAFFLE BOX				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Nutrient Separating Baffle Box - 48" Pipe	EA	1	126000	126000
Storm Pipe - 48" RCP	LF	80	$ 230	$ 18,400
Concrete weir - form and pour in place	CY	104	$ 900	$ 93,600
Regular Excavation	CY	19360	$ 7	$ 135,520
Subsoil Excavation	CY	48,400	$ 6	$ 290,400
Sod	SY	13,300	$ 2	$ 26,600
Silt Fence	LF	3,800	$ 2	$ 7,600
Floating Turbidity Barrier	LF	300	$ 9	$ 2,700
Materials Subtotal				**$ 700,820**
Temporary Traffic Control (5%)				$ 35,041
Staging Area (5%)				$ 35,041
Mobilization (10%)				$ 70,082
Contingency (30%)				$ 210,246
Construction Total				**$ 1,051,230**
Property Acquisition				**$ 2,012,580**
Design and Permitting				**$ 90,000**
Annual Operations & Maintenance Cost				**$ 5,500**
CONCEPTUAL PLAN COST - DRY RETENTION AREA; NSBB				**$ 3,159,310**
CONCEPTUAL PLAN COST ESTIMATE - LINEAR TREATMENT AREA / FLOODPLAIN BENCH				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Storm Pipe - 18" RCP	LF	120	$ 90	$ 10,800
Storm Structure - MES - 18"	EA	6	$ 1,810	$ 10,860
Concrete weir - form and pour in place	CY	22	$ 900	$ 19,800
Regular Excavation	CY	6,000	$ 7	$ 42,000
Subsoil Excavation	CY	45,000	$ 6	$ 270,000
Sod	SY	6,900	$ 2	$ 13,800
Silt Fence	LF	6600	$ 2	$ 13,200
Floating Turbidity Barrier	LF	2	$ 9	$ 18
Wetland plantings	AC	0.36	$ 6,000	$ 2,160
Materials Subtotal				**$ 382,638**
Temporary Traffic Control (5%)				$ 19,132
Staging Area (5%)				$ 19,132
Mobilization (10%)				$ 38,264
Contingency (30%)				$ 114,791
Construction Total				**$ 573,957**
Design and Permitting				**$ 60,000**
Annual Operations & Maintenance Cost				**$ 2,000**
CONCEPTUAL PLAN COST - LINEAR TREATMENT AREA / FLOODPLAIN BENCH				**$ 635,957**
Note: Percentages based on Materials Subtotal				

US-41 and Highland – Coastal



Project Management Area

Older, highly impervious corridor representative of US41 development throughout watershed with little treatment and high nutrient loading. This section has a roadway Flood LOS deficiency.

Conceptual BMP

- Opportunity to convert commonly found existing sand filters in urban commercial development to biosorption activated media (BAM) for increased nutrient removal.
- Modification of existing underground treatment facility can be replicated with similar cost efficiency.

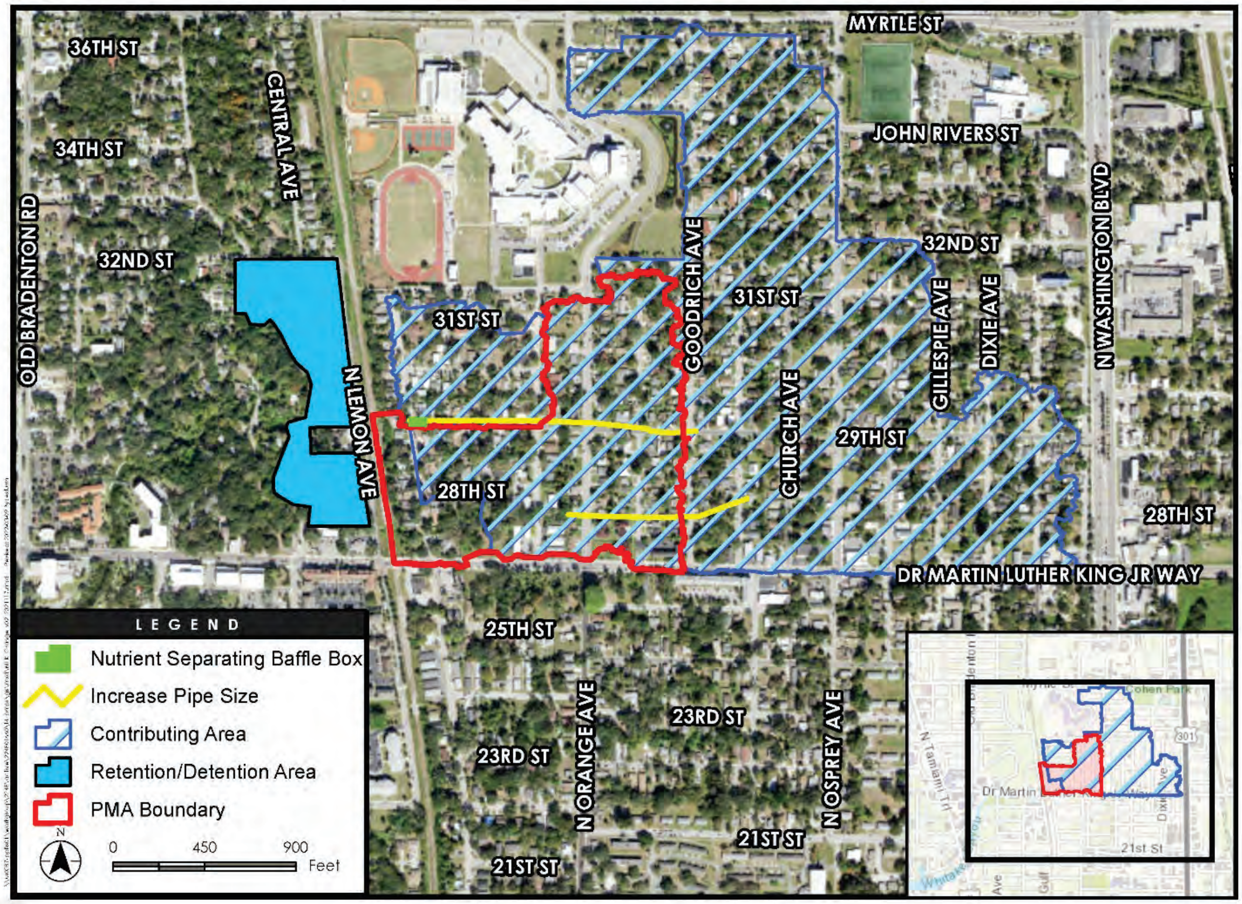
Score 70 Cost $21,400

Benefits

- More than 4 times more TN removal with BAM vs. current sand filter media
- 14.9 lb/yr TN removed annually
- $72/yr TN removed over 20 year life expectancy of filter system
- Provides Stormwater Environmental Utility with unit cost of retrofitting existing stormwater infrastructure with more efficient media for nitrogen removal
- Resilient in NOAA 2100 future condition

PROJECT MANAGEMENT AREA: US-41 & HIGHLAND				
CONCEPTUAL PLAN COST ESTIMATE - CONVERT EXISTING UNDERGROUND TREATMENT MEDIA FROM SAND TO BAM				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Remove existing sand media (special excavation)	LS	1	$ 11,000	$ 11,000
Biosorption Activated Media	CY	8	$ 200	$ 1,600
Materials Subtotal				**$ 12,600**
Temporary Traffic Control (5%)				$ 630
Staging Area (5%)				$ 630
Mobilization (10%)				$ 1,260
Contingency (30%)				$ 3,780
Construction Total				**$ 6,300**
Design and Permitting				**$ 2,500**
Annual Operations & Maintenance Cost				**$ 1,000**
CONCEPTUAL PLAN COST				**$ 22,400**
Note: Percentages based on Materials Subtotal				

Martin Luther King Jr. Way and Orange Ave. – Whitaker Bayou



Project Management Area

Contributing area to Whitaker Bayou Tributary C with history of structure flooding (~60) and no water quality management systems. Nutrient loading is primarily due to the age and intensity of land-use as well as land-use types (residential).

Conceptual BMP

- Upsize capacity of existing 2400 linear feet of stormwater pipes shown in yellow
- Nutrient Separating Baffle Box will capture sediment, vegetation, and trash at large outfall before discharging to Whitaker Bayou

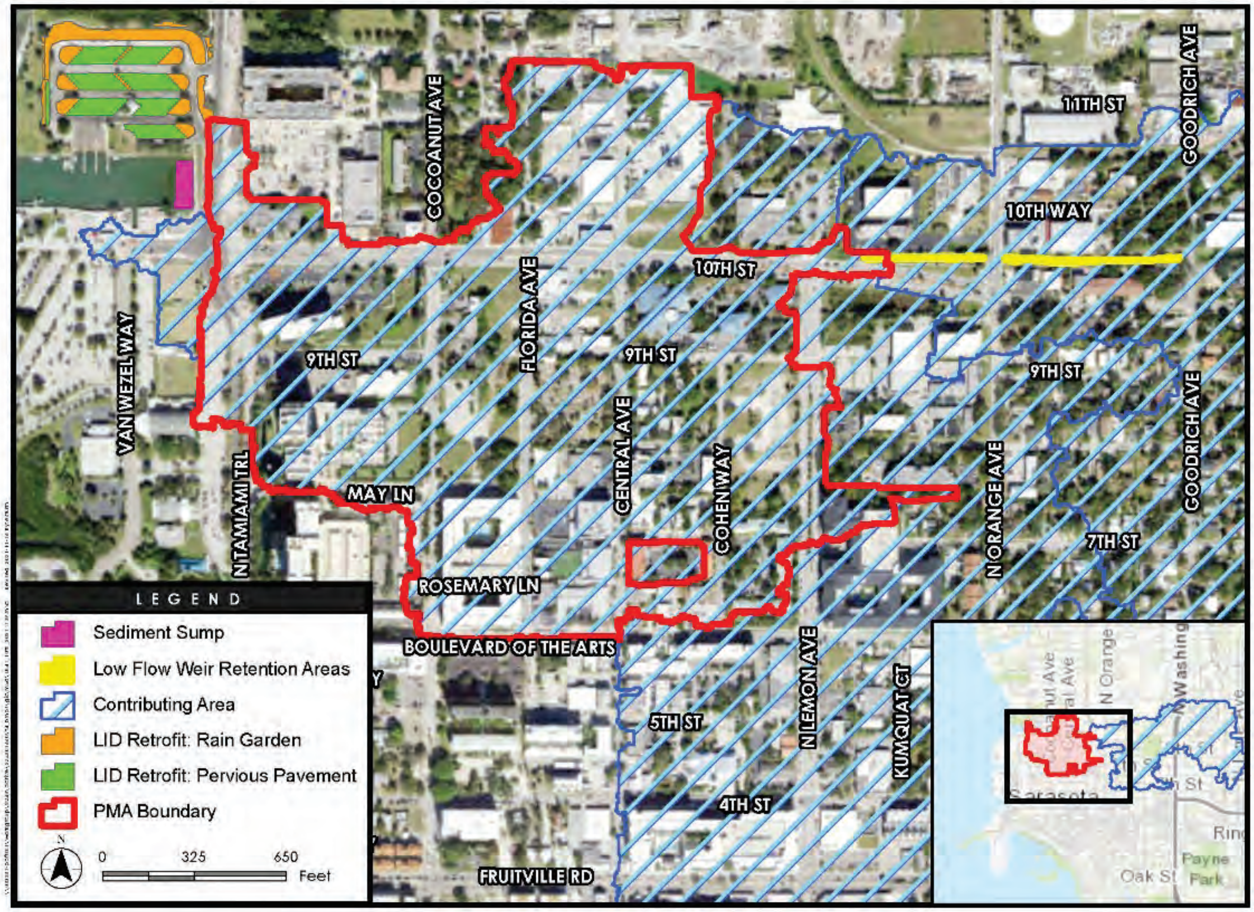
Score 45 **Cost** $1,242,021

Benefits

- Annual TN Removal 105.7 lb/yr
- $588/lb TN reduction over the 20 year expected life of the project
- 5 structures removed from 100yr storm risk
- 292 linear feet of roadway removed from LOS Deficiency
- Benefit-Cost Ratio = 0.94

PROJECT MANAGEMENT AREA: MARTIN LUTHER KING JR & ORANGE AVE				
CONCEPTUAL PLAN COST ESTIMATE - STORM PIPE IMPROVEMENTS				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Nutrient Separating Baffle Box - 54" Pipe	EA	1	$ 130,000	$ 130,000
Storm Pipe - 42" RCP	LF	2,390	$ 148	$ 353,720
Storm Structures	EA	14	$ 8,200	$ 114,800
Storm Structure - MES - 42"	EA	2	$ 5,500	$ 11,000
Subsoil Excavation	CY	8000	$ 6	$ 48,000
Clearing and Grubbing	AC	0.20	$ 18,800	$ 3,760
Silt Fence	LF	5019	$ 2	$ 10,038
Floating Turbidity Barrier	LF	100	$ 9	$ 900
Inlet Protection	EA	30	$ 140	$ 4,200
Roadway Restoration	LS	1	$ 125,000	$ 125,000
Materials Subtotal				**$ 801,418**
Temporary Traffic Control (2.5%)				$ 20,035
Mobilization (10%)				$ 80,142
Contingency (30%)				$ 240,425
Construction Total				**$ 340,603**
Design and Permitting				**$ 100,000**
Annual Operations & Maintenance Cost				**$ 1,000**
CONCEPTUAL PLAN COST				**$ 1,243,021**
Note: Percentages based on Materials Subtotal				

US-41 and 10th Street – Coastal



Project Management Area

A large part of the intensely urbanized downtown core drains directly into the bay at the 10th St. boat ramp. Largely untreated stormwater with a few BMPs is found in this area. There are flood LOS deficiencies in part of the roadways.

Conceptual BMP

- A sediment sump (pink) will capture sediment and nutrients prior to discharge into the Bay.
- Existing open conveyance will be improved with low flow weirs and side-bank BAM filter
- LID retrofit of existing impervious parking area

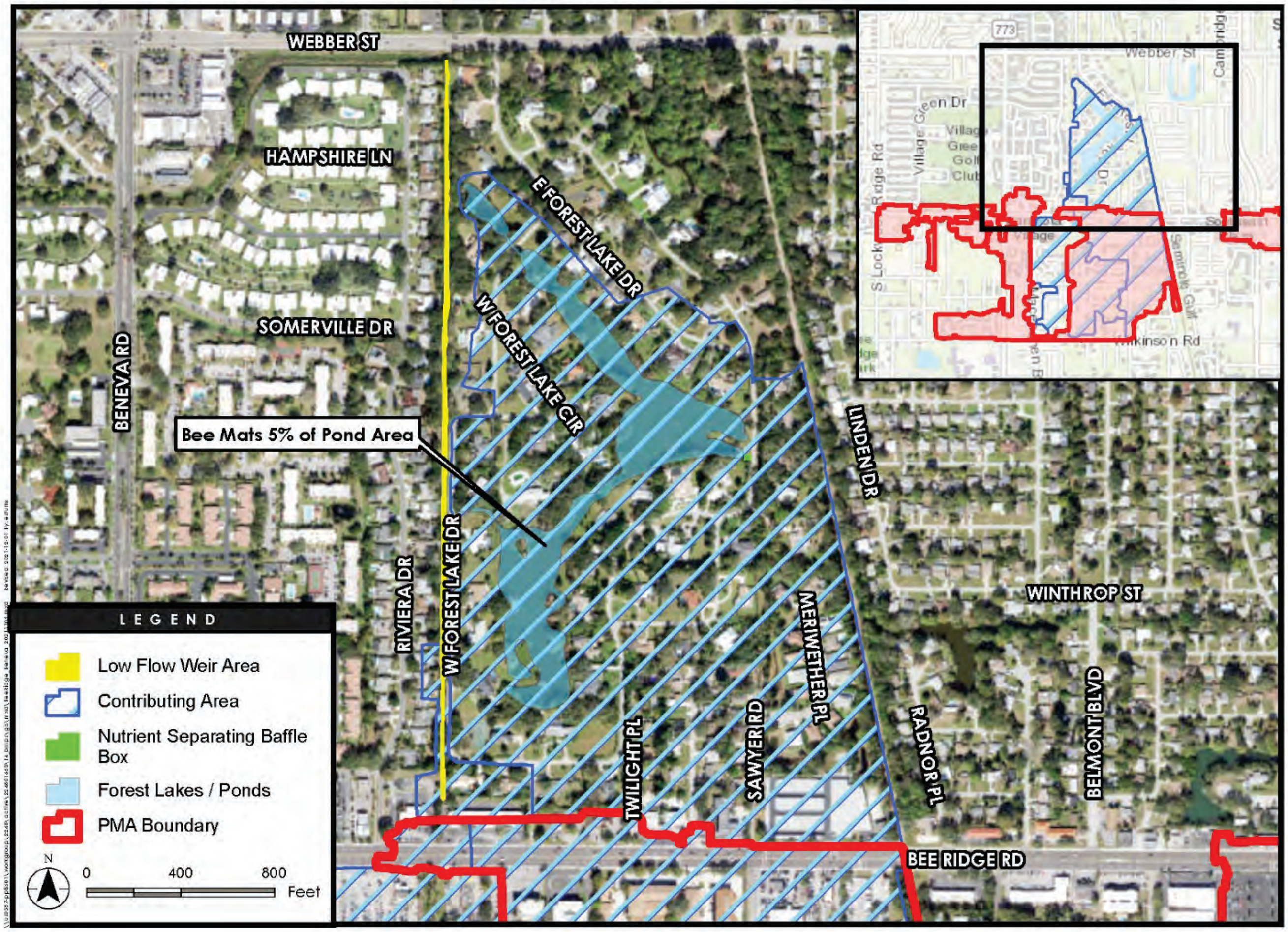
Score 80 — Cost $2,972,626

Benefits

- Annual TN Removal = 710 lb/yr
- $209/lb TN over 20 year expected life of the three combined BMPs
- Resilient in NOAA 2100 future condition
- No feasible flood protection project was identified for this area due to lack of available land.

PROJECT MANAGEMENT AREA: US 41 & 10TH STREET				
CONCEPTUAL PLAN COST ESTIMATE - CONVERT EXISTING PARKING SPOTS TO PERVIOUS PAVEMENT				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Clearing and Grubbing	AC	2	$ 18,800	$ 30,080
Pervious Concrete - 6" layer	SY	7744	$ 75	$ 580,800
Bedding Stone	TN	2,672	$ 130	$ 347,360
Silt Fence	LF	1,500	$ 2	$ 3,000
Inlet Protection	EA	18	$ 140	$ 2,520
Materials Subtotal				**$ 963,760**
Temporary Traffic Control (5%)				$ 48,188
Staging Area (5%)				$ 48,188
Mobilization (10%)				$ 96,376
Contingency (30%)				$ 289,128
Construction Total				**$ 1,445,640**
Design and Permitting				**$ 40,000**
Annual Operations & Maintenance Cost				**$ 2,500**
CONCEPTUAL PLAN COST				**$ 1,488,140**
CONCEPTUAL PLAN COST ESTIMATE - LOW FLOW WEIRS WITH SIDE-BANK FILTRATION				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Regular Excavation	CY	1,620	$ 7	$ 11,340
Embankment	CY	310	$ 9	$ 2,790
Underdrain-6"	LF	2,080	$ 90	$ 187,200
Bedding Stone	TN	310	$ 130	$ 40,300
Biosorption Activated Media	CY	1000	$ 200	$ 200,000
Concrete weir - form and pour in place	CY	20	$ 900	$ 18,000
Rip Rap	TN	43	$ 120	$ 5,186
Sod	SY	1850	$ 2	$ 3,700
Silt Fence	LF	2,400	$ 2	$ 4,800
Floating Turbidity Barrier	LF	120	$ 9	$ 1,080
Materials Subtotal				**$ 463,056**
Temporary Traffic Control (5%)				$ 23,153
Staging Area (5%)				$ 23,153
Mobilization (10%)				$ 46,306
Contingency (30%)				$ 138,917
Construction Total				**$ 694,584**
Design and Permitting				**$ 55,000**
Annual Operations & Maintenance Cost				**$ 2,500**
CONCEPTUAL PLAN COST				**$ 1,215,140**
CONCEPTUAL PLAN COST ESTIMATE - SEDIMENT SUMP				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Sheet Pile	LF	194	$ 800	$ 155,200
Rip-Rap	TN	16	$ 120	$ 1,920
Subsoil Excavation	CY	767	$ 6	$ 4,602
floating turbidity barrier	LF	500	$ 9	$ 4,500
Materials Subtotal				**$ 166,222**
Temporary Traffic Control (5%)				$ 3,324
Staging Area (5%)				$ 8,311
Mobilization (10%)				$ 16,622
Contingency (30%)				$ 49,867
Construction Total				**$ 244,346**
Design and Permitting				**$ 30,000**
Annual Operations & Maintenance Cost				**$ 1,750**
CONCEPTUAL PLAN COST				**$ 276,096**
Note: Percentages based on Materials Subtotal				

Bee Ridge Rd. and Beneva Rd. – Phillippi Creek



Project Management Area

Bee Ridge Road is an evacuation route with existing street flooding. The stormwater ponds in the Forest Lakes subdivision have experienced significant sediment loading throughout the years.

Conceptual BMP

- Low flow weirs and side-bank filtration with BAM to maximize removal in existing linear system (yellow)
- Nutrient separating baffle box will reduce sediment, vegetation, and trash from entering the ponds
- Sediment removal program to restore existing stormwater facility to permitted capability
- Floating wetlands will remove nutrients in ponds

Score 80 | **Cost $2,776,060**

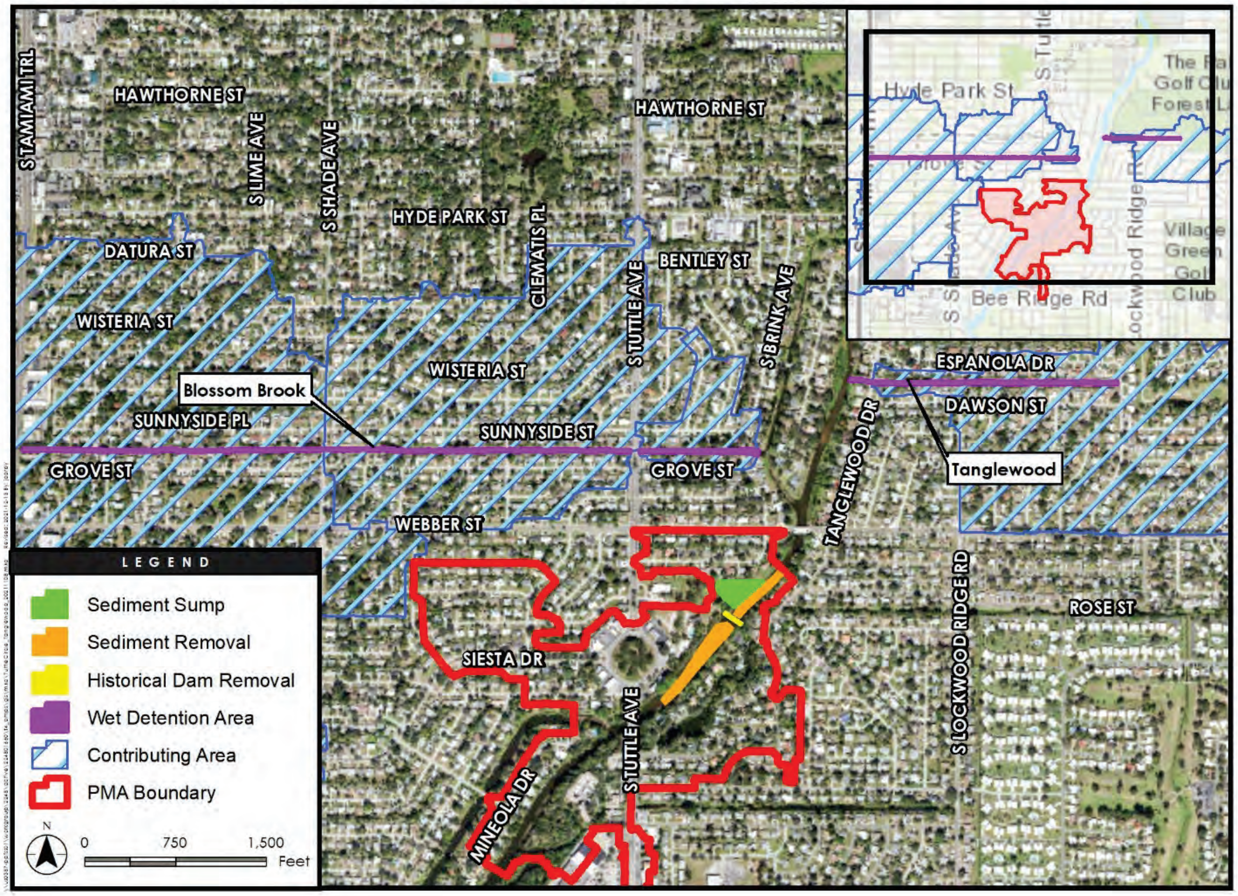
Benefits

- Annual TN Removal = 908 lb/yr
- $153/lb TN removed over 20 year life expectancy of improvements
- Reduced sedimentation
- Resilient in NOAA 2100 future condition
- No flood reduction concept feasible

PROJECT MANAGEMENT AREA: BEE RIDGE ROAD AND BENEVA ROAD				
CONCEPTUAL PLAN COST ESTIMATE - FOREST LAKES POND SEDIMENT REMOVAL & BEE MATS; NUTRIENT SEPARATING BAFFLE BOX				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Nutrient Separating Baffle Box - 48" Pipe	EA	1	$ 126,000.00	$ 126,000
Storm Pipe - 48" RCP	LF	16	$ 230	$ 3,680
Subsoil Excavation	CY	48,400	$ 6	$ 290,400
Floating Bee Mats	SY	2400	$ 47	$ 112,800
Silt Fence	LF	1,000	$ 2	$ 2,000
Floating Turbidity Barrier	LF	90	$ 9	$ 810
Materials Subtotal				**$ 535,690**
Temporary Traffic Control (5%)				$ 26,785
Staging Area (5%)				$ 26,785
Mobilization (10%)				$ 53,569
Contingency (30%)				$ 160,707
Construction Total				**$ 803,535**
Design and Permitting				**$ 55,000**
Annual Operations & Maintenance Cost				**$ 3,500**
CONCEPTUAL PLAN COST				**$ 862,035**

CONCEPTUAL PLAN COST ESTIMATE - RIVIERA DR LOW FLOW WEIRS WITH SIDE-BANK FILTRATION				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Regular Excavation	CY	3800	$ 7	$ 26,600
Embankment	CY	780	$ 9	$ 7,020
underdrain pipe - 6"	LF	6,000	$ 90	$ 540,000
Bedding Stone	TN	1211	$ 130	$ 157,430
Biosorption Activated Media	CY	2,220	$ 200	$ 444,000
Concrete weir - form and pour in place	CY	40	$ 900	$ 36,000
Rip-Rap	TN	80	$ 120	$ 9,600
Sod	SY	4000	$ 2	$ 8,000
silt fence	LF	6,800	$ 2	$ 13,600
floating turbidity barrier	LF	300	$ 9	$ 2,700
Materials Subtotal				**$ 1,218,350**
Temporary Traffic Control (5%)				$ 60,918
Staging Area (5%)				$ 60,918
Mobilization (10%)				$ 121,835
Contingency (30%)				$ 365,505
Construction Total				**$ 1,827,525**
Design and Permitting				**$ 90,000**
Annual Operations & Maintenance Cost				**$ 4,000**
CONCEPTUAL PLAN COST				**$ 1,921,525**
Note: Percentages based on Materials Subtotal				

Tuttle Circle – Phillippi Creek



Project Management Area

This area was ditched and drained for historical agricultural use with a salinity dam placed in Phillippi Creek. In the 1950's, it was converted to single family residential and today has significant sediment build up and direct discharge of stormwater without treatment to tidal systems resulting in significant nutrient loading to the Creek.

Conceptual BMP

- Removal of historic dam (yellow), accumulated sediment (orange) and installation of a sediment sump (green) to capture future sediment at a central point for maintenance
- Improve quality of drainage ditches with in-line wet detention and side-bank filtration to maximize efficiency (purple); install floating wetlands in ditch

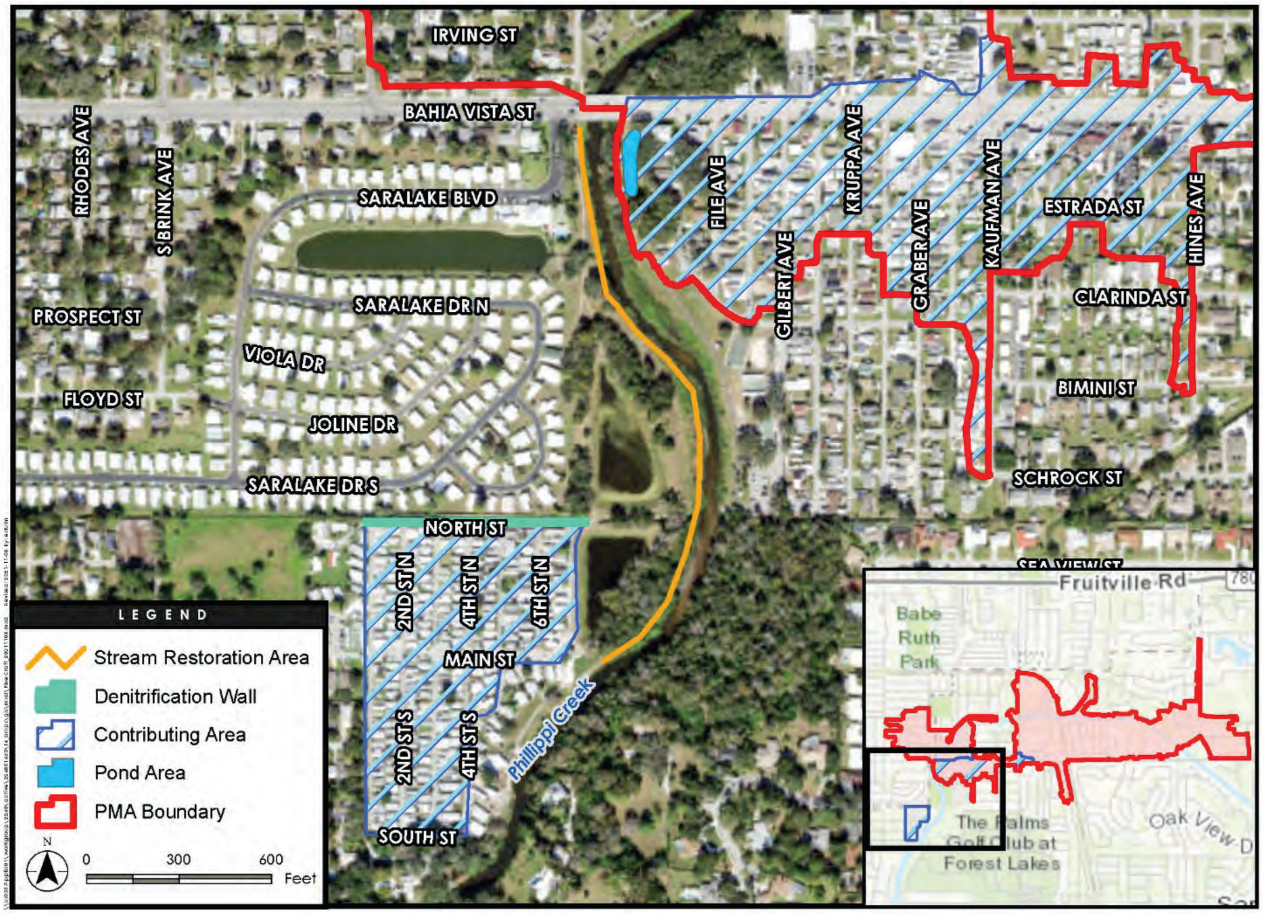
Score 80 **Cost $3,013,227**

Benefits

- Annual TN Removal 2,274 lbs
- $66/lb TN removed over 20 year life expectancy
- Improve natural systems in Phillippi Creek
- Reduce sediment accumulation within the natural creek system
- Portions of the BMPs will be somewhat affected by the NOAA 2100 sea level rise projection but can be slightly modified with minimal cost.

PROJECT MANAGEMENT AREA: TUTTLE CIRCLE				
CONCEPTUAL PLAN COST ESTIMATE - TANGLEWOOD CONVERSIN OF CANAL TO WET DETENTION WITH BEE MATS				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Subsoil Excavation	CY	1,100	$ 6	$ 6,600
Concrete weir - form and pour in place	CY	24	$ 900	$ 21,600
Rip Rap	TN	45	$ 120	$ 5,400
Floating Bee Mats	SY	8	$ 47	$ 376
Silt Fence	LF	750	$ 2	$ 1,500
Floating Turbidity Barrier	LF	90	$ 9	$ 810
Sod	SY	250	$ 2	$ 500
Materials Subtotal				**$ 36,786**
Temporary Traffic Control (2.5%)				$ 920
Staging Area (5%)				$ 1,839
Mobilization (10%)				$ 3,679
Contingency (30%)				$ 11,036
Construction Subtotal				**$ 54,259**
Design and Permitting				**$ 30,000**
Annual Operations & Maintenance Cost				**$ 1,000**
CONCEPTUAL PLAN COST				**$ 85,259**
CONCEPTUAL PLAN COST ESTIMATE - CONVERSION OF BLOSSOM BROOK CANAL TO WET DETENTION IN SERIES WITH SIDEBANK FILTRATION				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Subsoil Excavation	CY	1,950	$ 6	$ 11,700
Regular Excavation	CY	4,250	$ 7	$ 29,750
Embankment	CY	800	$ 9	$ 7,200
Underdrain-6"	LF	5,460	$ 90	$ 491,400
Bedding Stone	TN	1,242	$ 130	$ 161,460
Biosorption Activated Media	CY	2,630	$ 200	$ 526,000
Sod	SY	4850	$ 2	$ 9,700
Concrete weir - form and pour in place	CY	24	$ 900	$ 21,600
Rip Rap	TN	67	$ 120	$ 8,040
Silt Fence	LF	11,000	$ 2	$ 22,000
Floating Turbidity Barrier	LF	180	$ 9	$ 1,620
Materials Subtotal				**$ 1,249,020**
Temporary Traffic Control (2.5%)				$ 31,226
Staging Area (5%)				$ 62,451
Mobilization (10%)				$ 124,902
Contingency (30%)				$ 374,706
Construction Total				**$ 1,842,305**
Design and Permitting				**$ 40,000**
Annual Operations & Maintenance Cost				**$ 4,000**
CONCEPTUAL PLAN COST				**$ 1,886,305**
CONCEPTUAL PLAN COST ESTIMATE - PHILLIPPI CREEK DAM REMOVAL; SEDIMENT REMOVAL; SEDIMENT SUMP INSTALLATION				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Subsoil Excavation	CY	9,644	$ 6	$ 57,864
Channel Excavation	CY	10,418	$ 46	$ 479,228
Sod	SY	4855.55556	$ 2	$ 9,711
Embankment	CY	5,000	$ 9	$ 45,000
Floating Turbidity Barrier	LF	600	$ 9	$ 5,400
Clearing and Grubbing	AC	2	$ 18,800	$ 32,900
Silt Fence	LF	850	$ 2	$ 1,700
Compost Material	CY	367	$ 18	$ 6,606
Remove Existing Bulkhead	LF	177	$ 350	$ 61,950
Wetland plantings	AC	0	$ 6,000	$ 2,700
Materials Subtotal				**$ 645,195**
Temporary Traffic Control (2.5%)				$ 16,130
Staging Area (5%)				$ 32,260
Mobilization (10%)				$ 64,520
Contingency (30%)				$ 193,559
Construction Total				**$ 951,663**
Design and Permitting				**$ 95,000**
Annual Operations & Maintenance Cost				**$ 1,750**
CONCEPTUAL PLAN COST				**$ 1,048,413**
Note: Percentages based on Materials Subtotal				

Pinecraft – Phillippi Creek



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Project Management Area

This is the historic headwaters of Phillippi Creek where tidal influence becomes negligible. Significant sediment deposition occurs at Beneva Road Bridge and the Trestle Bridge. Large dense development exists along both sides of the creek with little stormwater treatment.

Conceptual BMP

- Convert existing wet pond to dry pond with media for higher pollutant removal
- Denitrification wall to intercept groundwater impacted by septic systems in Aloha Mobile Home Park
- Stream restoration along Phillippi Creek
- Sediment removal along creek system

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Score 105 Cost $1,094,958

Benefits

- Annual TN Removal 484 lb/yr
- $113/lb TN removed annually assuming 20 year project life expectancy
- 2000 linear feet of shoreline restoration at a cost of $350 / LF
- Stabilized creek banks will reduce erosion to create more natural system
- Resilient in NOAA 2100 future condition

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PROJECT MANAGEMENT AREA: PINECRAFT				
CONCEPTUAL PLAN COST ESTIMATE - CONVERT EXISTING WET POND TO DRY POND				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Embankment	CY	500	$ 9	$ 4,500
Regular Excavation	CY	250	$ 7	$ 1,750
Storm Structure - Junction Box	EA	1	$ 5,100	$ 5,100
Storm Pipe - 18" RCP	LF	80	$ 90	$ 7,200
Biosorption Activated Media	CY	610	$ 200	$ 122,000
Sod	SY	1,800	$ 2	$ 3,600
Rip Rap	TN	10	$ 120	$ 1,200
Silt Fence	LF	680	$ 2	$ 1,360
Floating Turbidity Barrier	LF	100	$ 9	$ 900
Materials Subtotal				**$ 147,610**
Temporary Traffic Control (2.5%)				$ 3,690
Staging Area (5%)				$ 7,381
Mobilization (10%)				$ 14,761
Contingency (30%)				$ 44,283
Construction Total				**$ 217,725**
Design and Permitting				**$ 50,000**
Annual Operations & Maintenance Cost				**$ 1,000**
CONCEPTUAL PLAN COST				**$ 268,725**
CONCEPTUAL PLAN COST ESTIMATE - DENITRIFICATION TRENCH - ALOHA MOBILE HOME PARK				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Regular Excavation	CY	400	$ 7	$ 2,800
Biosorption Activated Media	CY	220	$ 200	$ 44,000
Silt Fence	LF	1400	$ 2	$ 2,800
Floating Turbidity Barrier	LF	40	$ 9	$ 360
Sod	SY	300	$ 2	$ 600
Materials Subtotal				**$ 50,560**
Temporary Traffic Control (5%)				$ 2,528
Staging Area (5%)				$ 2,528
Mobilization (10%)				$ 5,056
Contingency (30%)				$ 15,168
Construction Total				**$ 75,840**
Design and Permitting				**$ 50,000**
Annual Operations & Maintenance Cost				**$ 1,000**
CONCEPTUAL PLAN COST				**$ 126,840**
CONCEPTUAL PLAN COST ESTIMATE - STREAM RESTORATION				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Regular Excavation	CY	3,548	$ 7	$ 24,836
Clearing and Grubbing	AC	1	$ 18,800	$ 21,056
Channel Excavation	CY	2027	$ 46	$ 93,242
Headwater Channel Construction	LF	320	$ 120	$ 38,400
Wetland plantings	AC	0	$ 6,000	$ 1,020
Wood Toe Protection with Soil Lifts	LF	279	$ 200	$ 55,800
Riparian Revegetation	AC	3.8	$ 5,000	$ 19,000
Invasive Vegetation Removal	AC	4	$ 3,000	$ 12,000
Access Trail	LF	5,000	$ 30	$ 150,000
Floating Turbidity Barrier	LF	600	$ 9	$ 5,400
Silt Fence	LF	4700	$ 2	$ 9,400
Materials Subtotal				**$ 384,262**
Temporary Traffic Control (5%)				$ 19,213
Staging Area (5%)				$ 19,213
Mobilization (10%)				$ 38,426
Contingency (30%)				$ 115,279
Construction Total				**$ 576,393**
Design and Permitting				**$ 125,000**
Annual Operations & Maintenance Cost				**$ 5,000**
CONCEPTUAL PLAN COST				**$ 706,393**
Note: Percentages based on Materials Subtotal				

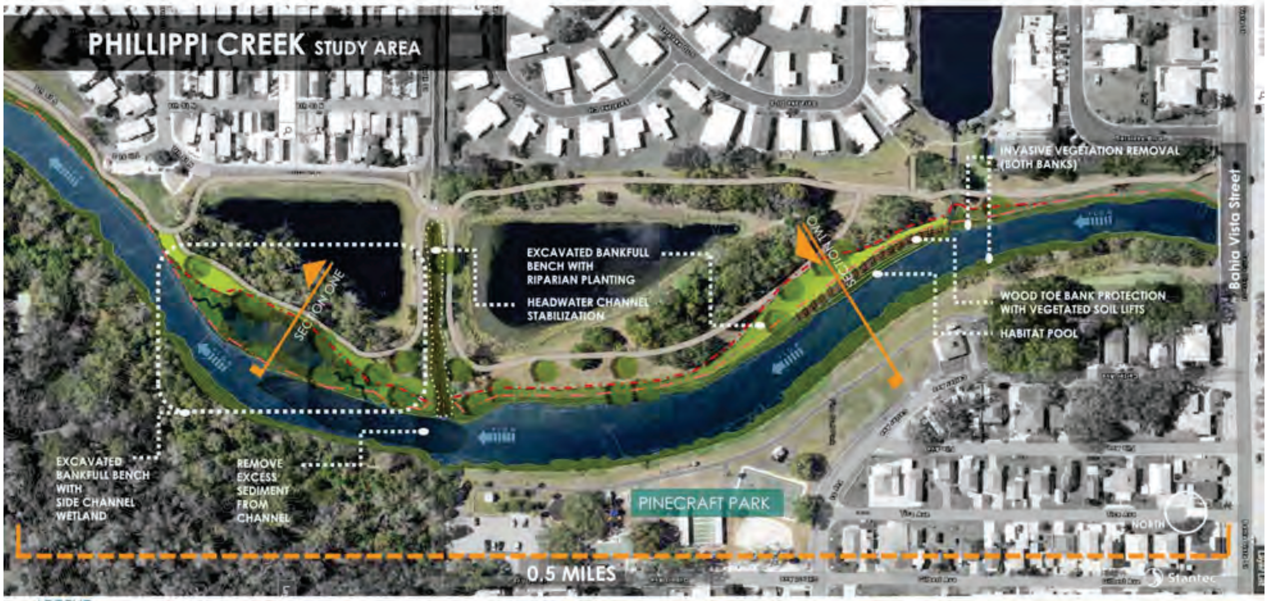
Pinecraft – Phillippi Creek Concept Stream Restoration Plan

The segment of Phillippi Creek downstream of the Bahia Vista Street bridge and extending to approximately 600 feet downstream of the Pinecraft Park presents the opportunity to implement stream restoration techniques aimed at improving water quality, enhancing a variety of habitat functions, and improving accessibility to the public. This reach is located at the interface between riverine and tidal influences and exhibits indicators of channel instability and aquatic habitat impairment typical of riverine responses to urban development within the watershed, encroachment of adjacent developments, and historic channelization activities. This segment of creek is characterized as an entrenched, single stage channel without adequate floodplain connectivity, and steep unstable banks dominated by shallow rooted non-native grasses and invasive vegetation. Visual observations noted signs of mass wasting and toe erosion that contribute to decreases in aquatic habitat diversity and elevated sediment loading to the downstream channel and ultimately Sarasota Bay.

This preliminary concept focuses on utilizing available adjacent land within the limited channel right-of-way to improve floodplain connectivity, implementation of bioengineered stabilization to promote long term and resilient bank protection, and replacement of exotic vegetation with native plantings. The proposed laying back of the channel side slopes and creating a bankfull bench will provide increase in flood flow conveyance capacity while improving water quality by reducing erosion potential, providing in-line treatment, and depositional areas for sediment/entrained pollutants. The bankfull benches will be revegetated with appropriate native plants which improve shear strength of the creek bank soils by establishment of deep root masses.

The wood toe protection structure utilizes locally salvaged woody debris that serves to provide long term bank stabilization, acts as a hydraulic energy dissipater, and a supports biological habitat and carbon sources. Typical historic maintenance operations generally focused on removal of woody debris as they were seen as potentially threats to infrastructure. However, absence of woody debris in channels results in the lack of the naturally occurring aquatic habitats critical to a healthy ecosystem. The process of utilizing woody debris in a manner that is embedded into the creek bed or bank such that the wood stays submerged beneath the low water elevation can help to address both the maintenance concerns and habitat improvement goals of restoration projects. The new channel bank above the wood toe will be stabilized with bioengineered soil wraps vegetated with live cuttings (also known as Vegetation Reinforced Soil Slope – VRSS). The use of native live cuttings provides resilient slope stability that gets stronger with time as the root masses mature.

The Headwater channel stabilization structure is a naturalized way to utilize on-site woody debris that would otherwise require haul-off and disposal in a method that provides effective channel grade and bank protection in steep and/or incised channels. The structure can be incredibly effective in channels dominated by sand and/or fine-grained creek beds that have experience erosion or downcutting due to changes in hydrology or lowering of baselevel. The creek bed and banks are reconstructed using a mixture of various size classes of woody debris mixed with native soil, which emulates the naturally occurring subbase in natural channels. The matrix of wood in the subbase provides a “rebar” like effect in improve subsurface soil structure resistant to erosion and scour, which providing improved aquatic habitat.

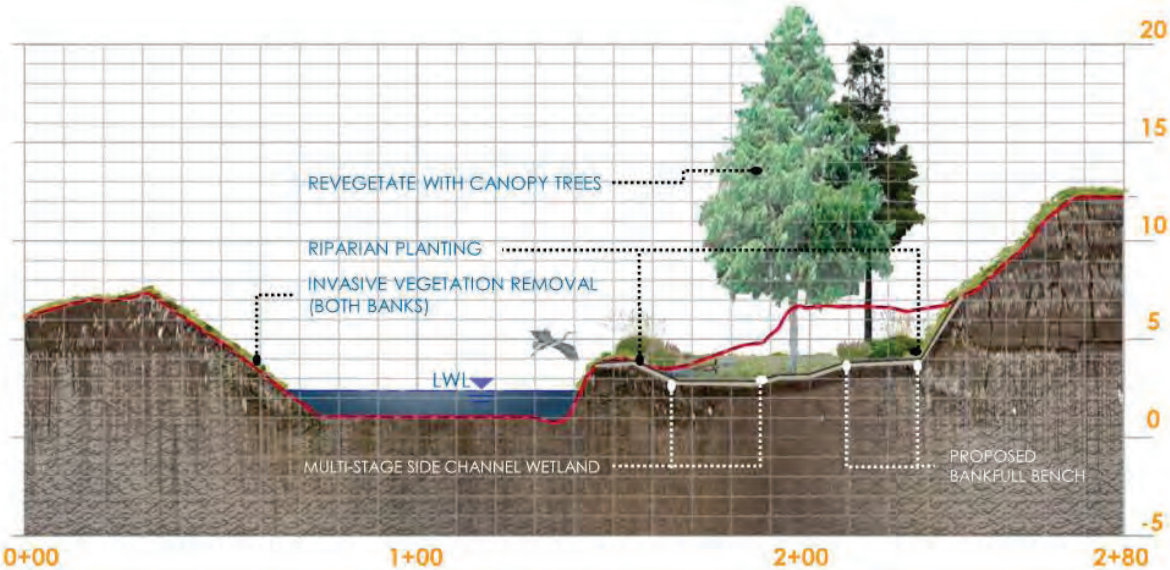


LEGEND

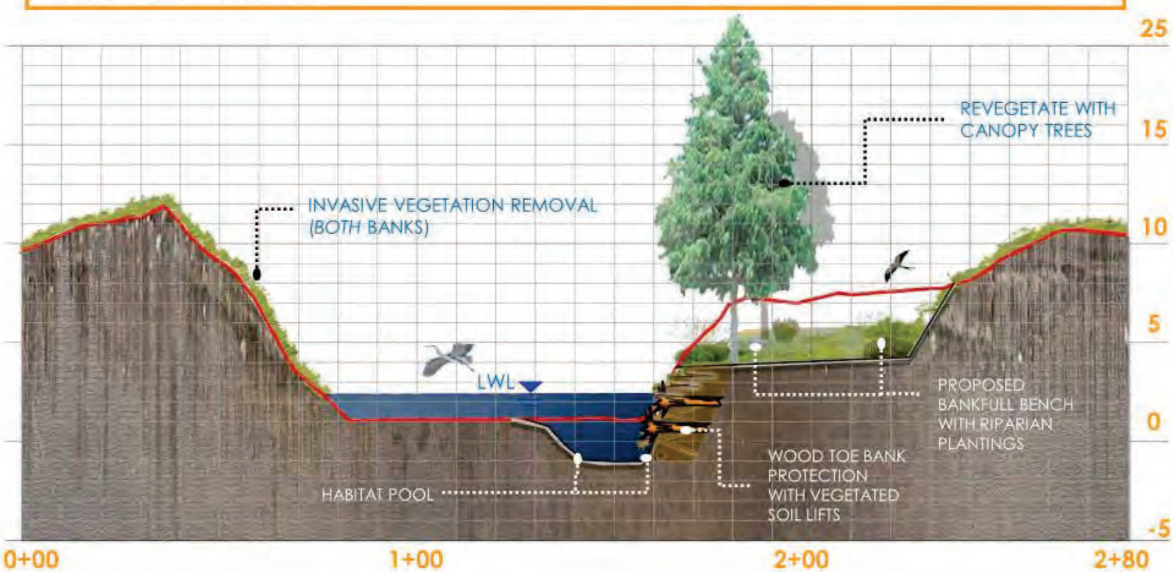
- EXISTING BANKFULL LIMITS
- PROPOSED EXCAVATED BANKFULL BENCH LIMITS
- EXCESS SEDIMENT REMOVAL AREA
- REVEGETATED AREA
- HEADWATER CHANNEL STABILIZATION
- PROPOSED TREES
- MULTI-USE PATHWAYS

Phillippi Creek Concept Restoration Plan

The Phillippi Creek reach downstream of the Bahia Vista Street bridge and extending to approximately 600' downstream of the Pinecraft Park presents the opportunity to implement stream restoration techniques aimed at improving water quality, enhancing a variety of habitat functions, and improving accessibility to the public. This reach is located at the interface between riverine and tidal influences and exhibits symptoms of channel instability and aquatic habitat impairment typical of riverine responses to urban development in the upstream watershed, encroachment of adjacent developments, and historic channelization activities.

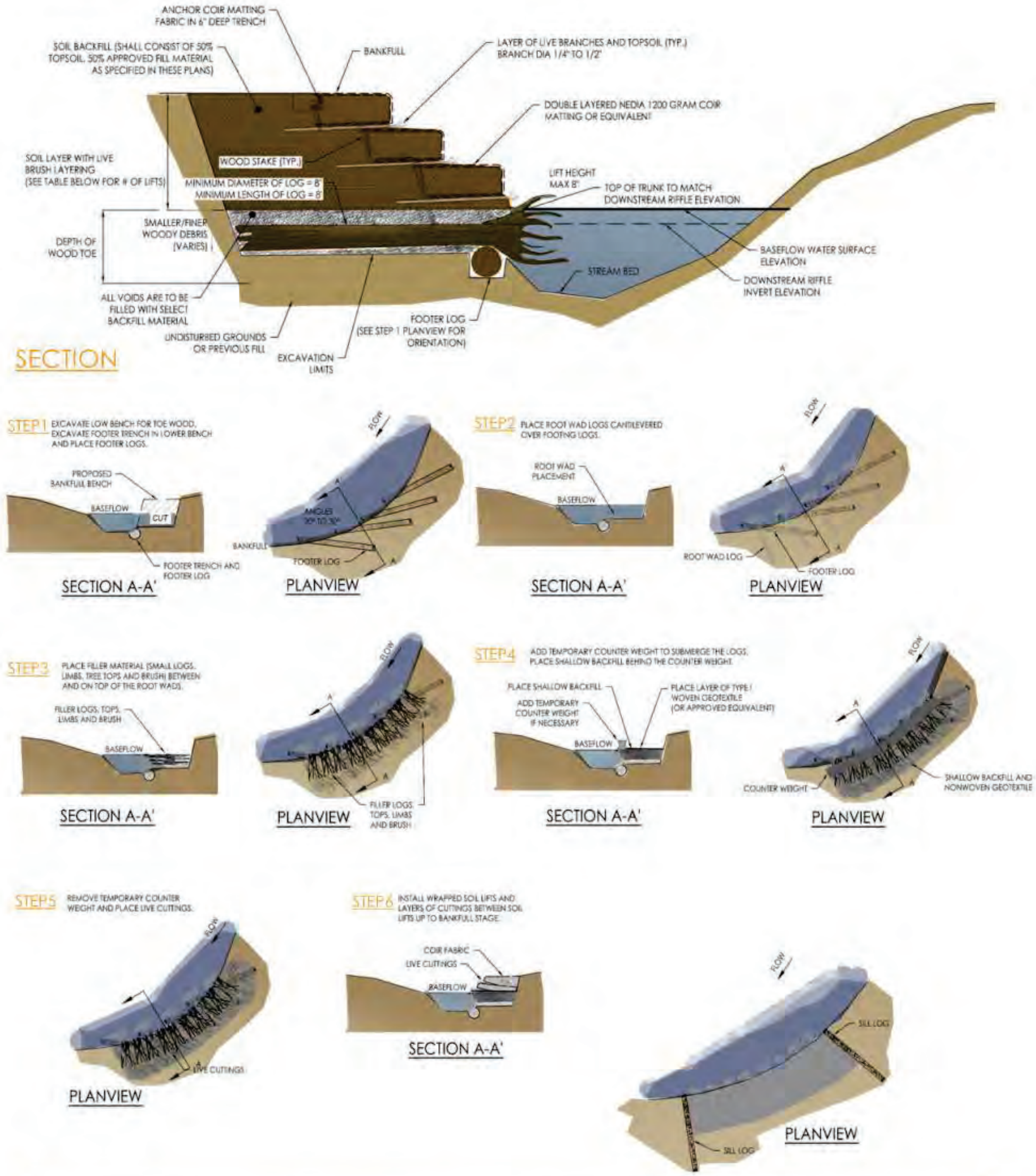


SECTION ONE: The proposed laying bank of the channel side slopes, and adjacent multi-stage wetland provides a diversity of aquatic and riparian habitat, while allowing for settling of entrained sediment and nutrients during high flow. Establishment of native vegetation will improve soil structure stability and restore a variety of terrestrial habitat.



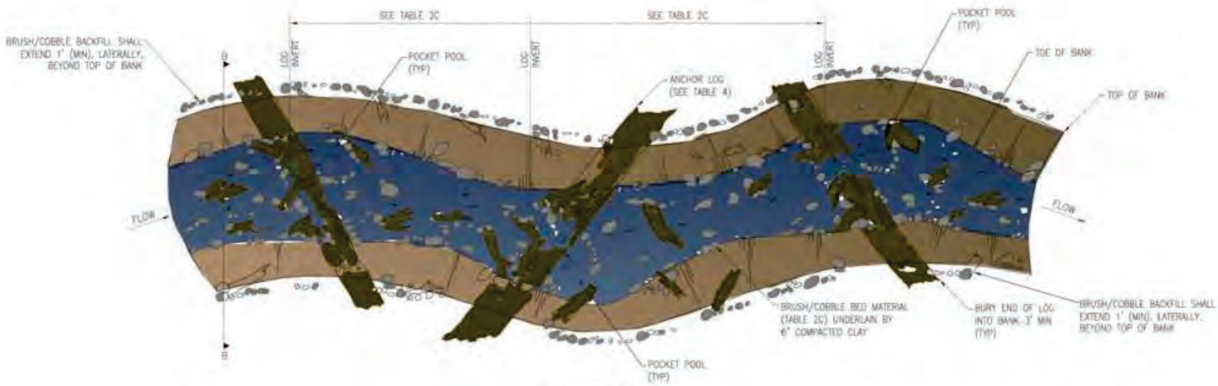
SECTION TWO: The wood toe bioengineered bank protection structure consists of locally salvaged logs and woody debris placed along the unstable right bank. The roughness of the woody debris reduces near-bank shear stress, provides aquatic habitat enhancement, and conducive subbase medium for vegetation establishment. Vegetated soil lifts create a resilient upper bank and the bankfull bench allows for increase in floodplain connectivity and support of native riparian vegetation community.

Stantec

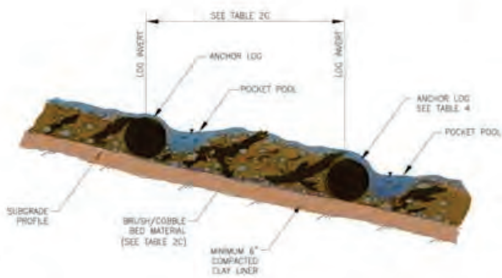


WOOD TOE PROTECTION WITH VEGETATED SOIL LIFTS DETAILS:
Phillippi Creek Concept Restoration

Stantec

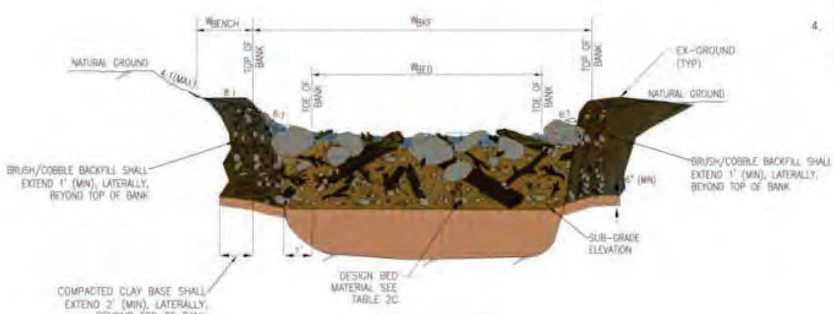


HEADWATER CHANNEL
PLAN
NOT TO SCALE



HEADWATER CHANNEL
PROFILE
NOT TO SCALE

NOTES:
1. HEADWATER CHANNEL IS TO OCCUR IN ALL REACHES SHOWN ON THE PLANS. THE LAYOUT SHALL FOLLOW THE PROPOSED ALIGNMENT BUT THE CONTRACTOR IS TO MAKE SPECIAL CARE NOT TO DISTURB MATURE TREES IF THEY CAN BE AVOIDED. THE FINAL ALIGNMENT NEAR SENSITIVE AREAS IS TO BE FIELD FIT TO MINIMIZE DISTURBANCE, AS DIRECTED BY THE ONSITE ENGINEER.
2. IN LOCATIONS WHERE THE PROPOSED CHANNEL IS BEING RAISED AND RECONNECTED WITH THE ADJACENT FLOODPLAIN, THE EXISTING CHANNEL IS TO BE FILLED WITH CLAY, COMPACTED IN 6" LIFTS, UP TO PROPOSED SUBGRADE ELEVATION.
3. IN THE EVENT WHEN AN 18" DIA LOG IS NOT AVAILABLE A COMBINATION OF TWO (2) 12" LOGS MAY BE SUBSTITUTED FOR THE LIGHT TREATMENT SPECIFIED IN TABLE 2C.
4. INSTALL MATERIAL BASED ON DEPTHS SPECIFIED IN TABLE 2C. MATERIAL DEPTHS IN PLAN AND PROFILE SHEETS ARE FOR DISPLAY PURPOSES ONLY.

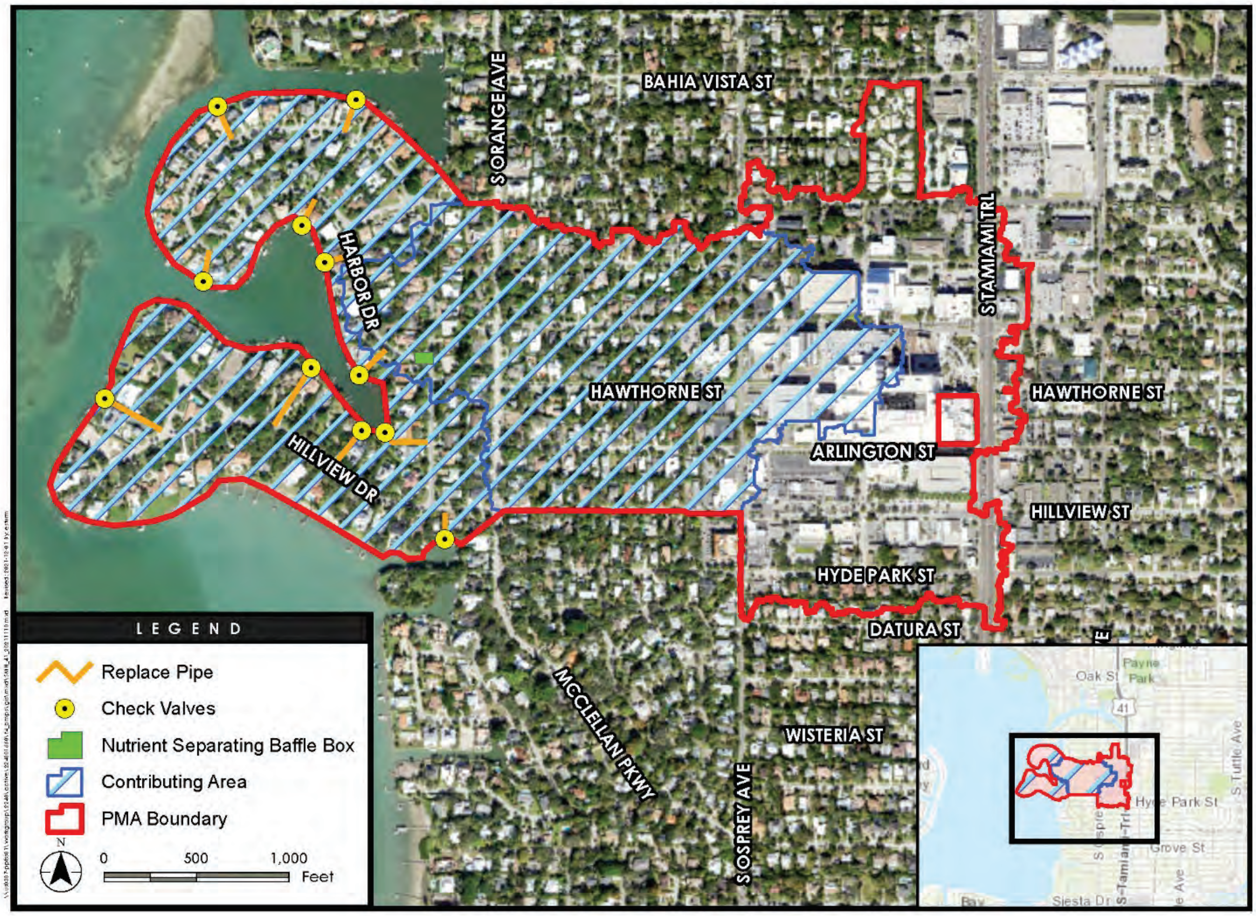


HEADWATER CHANNEL
SECTION B-B

HEADWATER CHANNEL DETAILS: Phillippi Creek Concept Restoration

Stantec

Sarasota Memorial Hospital and US-41 – Coastal



Project Management Area

Existing street flooding in the Harbor Acres subdivision is a function of tidal influence as well as being downstream from a dense commercial development with minimal stormwater infrastructure. The drainage within this subbasin drains from the natural ridge (US-41) to the bay through the existing neighborhoods.

Conceptual BMP Description

- Nutrient Separating Baffle Box will capture sediment, vegetation, and trash at large outfall before it enters the bay
- Outfall pipes will be enlarged resulting in reduced street flooding and removing structures from the horizontal floodplain.
- One-way check valves installed at end of outfall pipes will reduce tidal nuisance flooding.

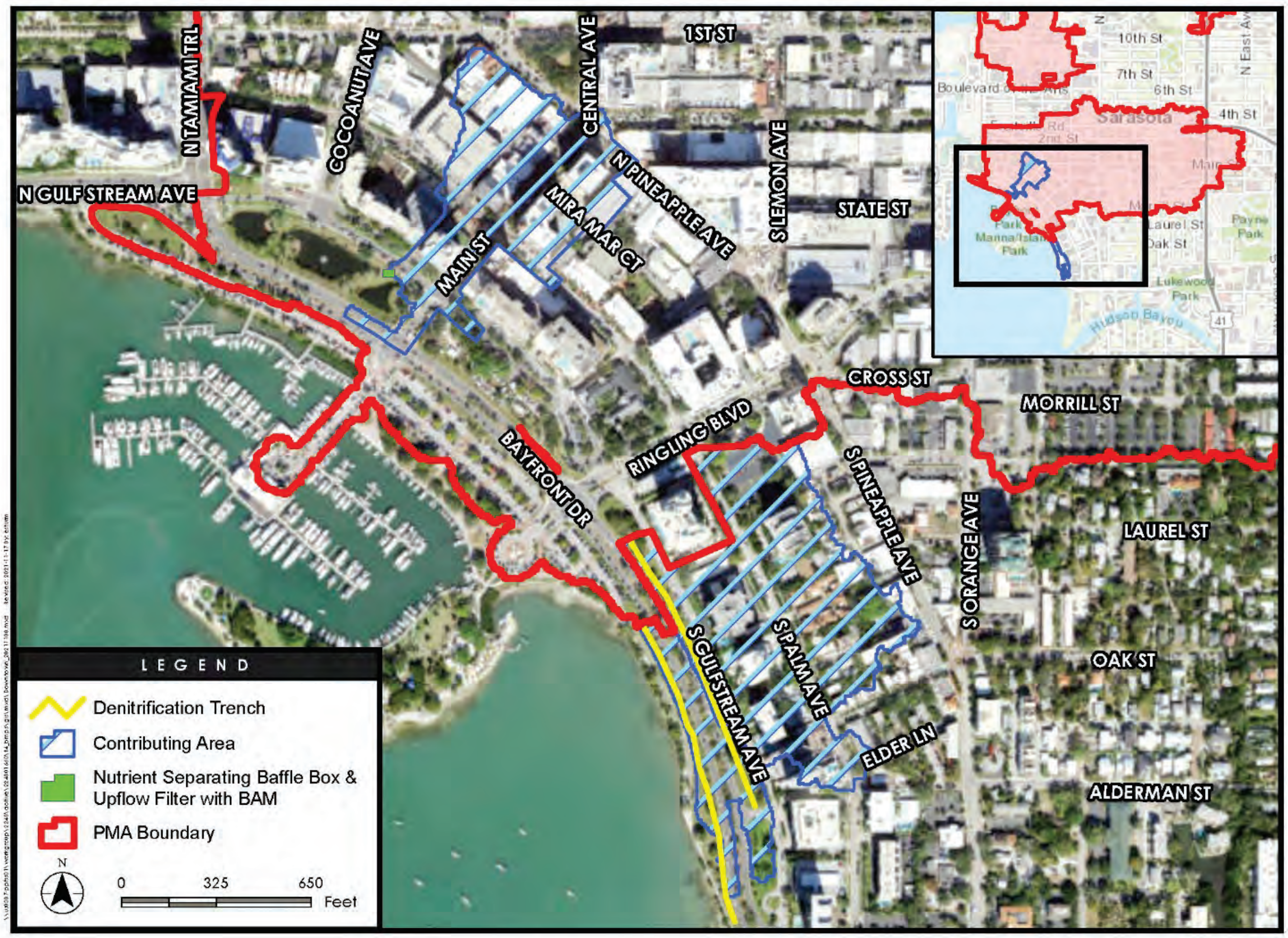
Score 30 Cost $2,463,173

Benefits

- Annual TN Removal 111.5 lb/yr
- $1,104/lb TN reduction estimated annually over the 20 year expected life of the project
- Elimination 5500 LF of roadway level of service deficiencies (100 year flooding 12” or less for local streets) within Harbor Acres
- Reduction of residential structure flooding from 53 flooded structures to 12 within Harbor Acres.
- Benefit-Cost Ratio 0.50
- Resilient in NOAA 2100 future condition

PROJECT MANAGEMENT AREA: SARASOTA MEMORIAL HOSPITAL & US 41				
CONCEPTUAL PLAN COST ESTIMATE - NUTRIENT SEPARATING BAFFLE BOX; STORM PIPE & CHECK VALVES				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Nutrient Separating Baffle Box - 36" Pipe	EA	1	$122,000.00	$122,000
One-Way check valve - 12" pipe	EA	1	$4,000.00	$4,000
One-Way check valve - 18" pipe	EA	1	$9,000.00	$9,000
One-Way check valve - 24" pipe	EA	3	$14,000.00	$42,000
One-Way check valve - 30" pipe	EA	1	$18,000.00	$18,000
One-Way check valve - 36" pipe	EA	4	$22,000.00	$88,000
One-Way check valve - 42" pipe	EA	1	$32,000.00	$32,000
One-Way check valve - 54" pipe	EA	2	$56,000.00	$112,000
One-Way check valve - 60" pipe	EA	1	$74,000.00	$74,000
Storm Pipe - 12" RCP	LF	140	$97.00	$13,580
Storm Pipe - 14" x 23" ERCP	LF	175	$95.00	$16,625
Storm Pipe - 19" x 30" ERCP	LF	769	$109.00	$83,821
Storm Pipe - 24" x 38" ERCP	LF	517	$157.00	$81,169
Storm Pipe - 34" x 53" ERCP	LF	1,576	$255.00	$401,880
Storm Pipe - 29" x 45" ERCP	LF	220	$184.50	$40,590
Storm Pipe - 43" x 68" ERCP	LF	410	$320.00	$131,200
Storm Pipe - 48" x 76" ERCP	LF	250	$456.00	$114,000
Adjust Storm Structure	EA	11	$750.00	$8,250
Landscape/Wall/Infrastructure Replacement Allowance	EA	11	$20,000.00	$220,000
Silt Fence	LF	0	$2.00	$-
Materials Subtotal				**$1,612,115**
Temporary Traffic Control (5%)				$80,606
Staging Area (5%)				$80,606
Contingency (30%)				$483,635
Construction Total				**$2,418,173**
Design and Permitting				**$45,000**
Annual Operations & Maintenance Cost				**$5,500**
CONCEPTUAL PLAN COST				**$2,468,673**
Note: Percentages based on Materials Subtotal. Property acquisition costs (if needed) are not included				

Downtown – Coastal



Project Management Area

Highly urbanized, mostly impervious area in City of Sarasota that drains directly to Sarasota Bay through more than 20 outfalls. Challenging location due to little available land for traditional stormwater BMP's but ideal for Low Impact Development techniques. Existing ponds are tidally influenced. There is a linear open space buffer that exists between downtown and the bay, however, the open space is used often for civic and public events.

Conceptual BMP

- Capture first flush of pollution through a nutrient separating baffle box with up-flow filter
- Denitrification trenches with media to remove nutrients from entering the Bay from target outfalls

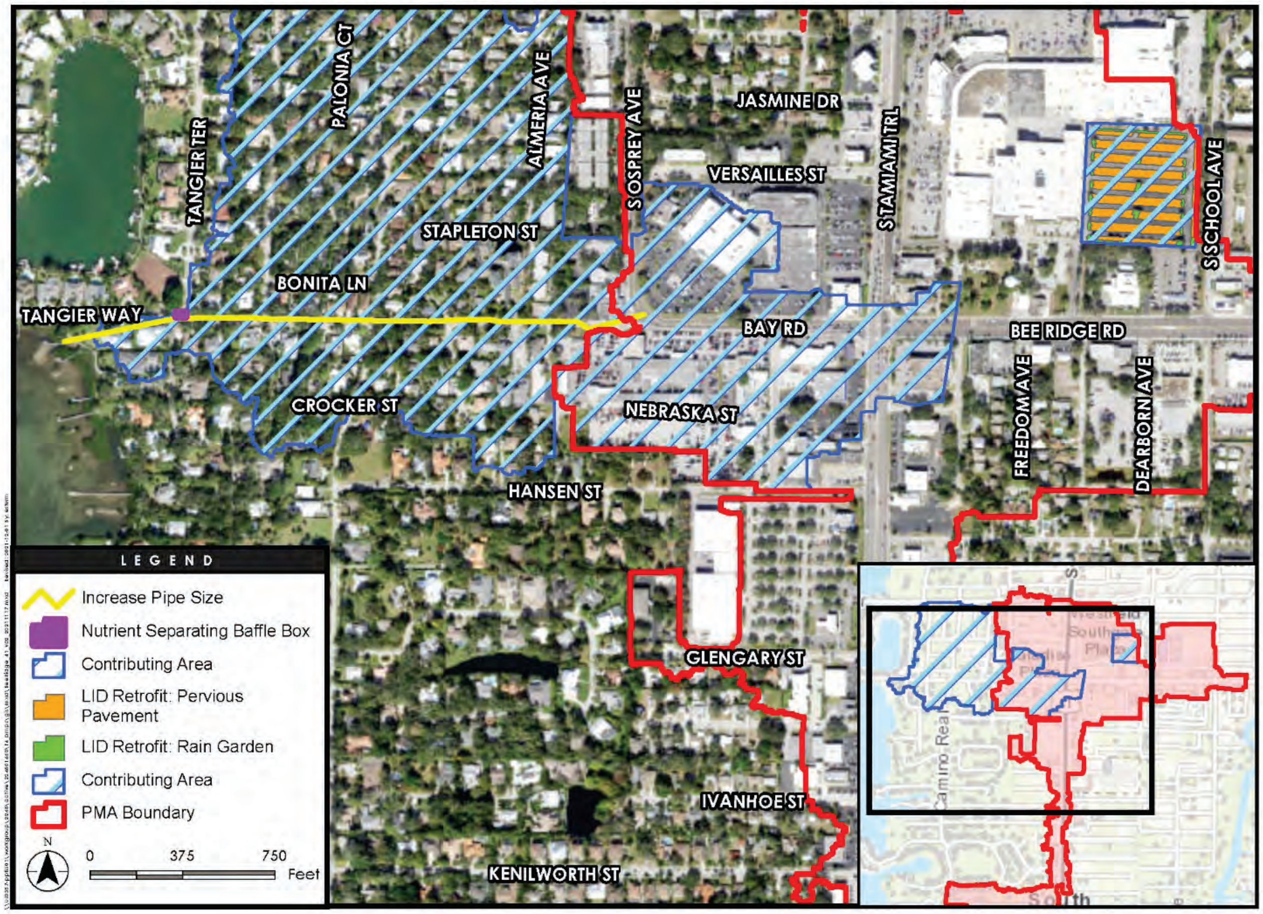
Score 28 Cost $1,104,700

Benefits

- Annual TN Removal 60.5 lb/yr
- $913/lb TN removed annually over the 20 year life expectancy
- BMPs located underground so they won't impact available open space
- Baffle box will be resilient in 2100 sea level rise projection, but denitrification trench outfall may be submerged

PROJECT MANAGEMENT AREA: DOWNTOWN				
CONCEPTUAL PLAN COST ESTIMATE - NUTRIENT SEPARATING BAFFLE BOX WITH UPFLOW FILTER AND BAM; DENITRIFICATION TRENCHES				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Nutrient Separating Baffle Box - 36" Pipe	EA	1	$ 122,000	$ 122,000
Regular Excavation	CY	1,950	$ 7	$ 13,650
Adjust Storm Structure	EA	6	$ 750	$ 4,500
Underdrain-18"	LF	2,110	$ 110	$ 232,100
Biosorption Activated Media	CY	1,400	$ 200	$ 280,000
Silt Fence	LF	5,000	$ 2	$ 10,000
Sod	SY	16,900	$ 2	$ 33,800
Adjust Storm Structure	EA	5	$ 750	$ 3,750
Materials Subtotal				**$ 699,800**
Temporary Traffic Control (5%)				$ 34,990
Staging Area (5%)				$ 34,990
Mobilization (10%)				$ 69,980
Contingency (30%)				$ 209,940
Construction Total				**$ 1,049,700**
Design and Permitting				**$ 55,000**
Annual Operations & Maintenance Cost				**$ 2,500**
CONCEPTUAL PLAN COST				**$ 1,107,200**
Note: Percentages based on Materials Subtotal				

Bee Ridge Rd. and US-41 – Coastal



Project Management Area

Bee Ridge Road is an evacuation route with existing street flooding. The neighborhoods were built in the 1940's-1960's without extensive stormwater BMP's. The system outfalls have been improved over the years (strainers to catch vegetation), but the improvements are not adequate to remove nutrients from the high pollutant loading area.

Conceptual BMP

- 2,340 linear feet of pipe increased (yellow)
- Modification of existing stormwater strainer box
- Nutrient Separating Baffle Box (purple)
- 2.45 acres of impervious parking retrofitted with pervious concrete

Score 55 **Cost** $3,694,233

Benefits

- Annual TN Removal 204 lb/yr
- $502/lb annual TN removed over 20 year life expectancy of baffle box
- 220 linear feet of roadway removed from LOS Deficiency
- Cost-Benefit Ratio = 0.22
- Portions of the project will be somewhat affected by the NOAA 2100 sea level rise projection but can be slightly modified with minimal cost

PROJECT MANAGEMENT AREA: BEE RIDGE & US 41				
CONCEPTUAL PLAN COST ESTIMATE - STORM PIPE IMPROVEMENTS; NUTRIENT SEPARATING BAFFLE BOX				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Clearing and Grubbing	AC	1	$ 18,800	$ 20,304
Nutrient Separating Baffle Box - 54" Pipe	EA	1	$ 130,000	$ 130,000
Storm Pipe - 36" RCP	LF	260	$ 175	$ 45,500
Storm Pipe - 34" x 53" ERCP	LF	590	$ 255	$ 150,450
Storm Pipe - 38" x 60" ERCP	LF	1,040	$ 300	$ 312,000
Storm Pipe - 43" x 68"" RCP	LF	450	$ 320	$ 144,000
Storm Structure - MES - 43" X 68"	EA	1	$ 15,600	$ 15,600
Sod	SY	16,900	$ 2	$ 33,800
Floating Turbidity Barrier	LF	60	$ 9	$ 540
Silt Fence	LF	4680	$ 2	$ 9,360
Inlet Protection	EA	22	$ 140	$ 3,080
Roadway Restoration	LS	1	$ 85,000	$ 85,000
Adjust Storm Structure	EA	22	$ 750	$ 16,500
Materials Subtotal				**$ 966,134**
Temporary Traffic Control (5%)				$ 48,307
Mobilization (10%)				$ 96,613
Contingency (30%)				$ 289,840
Construction Total				**$ 1,400,894**
Design and Permitting				**$ 75,000**
Annual Operations & Maintenance Cost				**$ 2,500**
CONCEPTUAL PLAN COST				**$ 1,478,394**
CONCEPTUAL PLAN COST ESTIMATE - CONVERT EXISTING PARKING SPOTS TO PERVIOUS PAVEMENT				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Clearing and Grubbing	AC	2	$ 18,800	$ 46,060
Pervious Concrete - 6" layer	SY	11,900	$ 75	$ 892,500
Bedding Stone	TN	4100	$ 130	$ 533,000
Silt Fence	LF	1800	$ 2	$ 3,600
Inlet Protection	EA	12	$ 140	$ 1,680
Materials Subtotal				**$ 1,476,840**
Temporary Traffic Control (2.5%)				$ 36,921
Staging Area (5%)				$ 73,842
Mobilization (10%)				$ 147,684
Contingency (30%)				$ 443,052
Construction Total				**$ 2,178,339**
Design and Permitting				**$ 40,000**
Annual Operations & Maintenance Cost				**$ 2,500**
CONCEPTUAL PLAN COST				**$ 2,220,839**
Note: Percentages based on Materials Subtotal				

Stickney Point – Coastal

Project Management Area

This neighborhood experiences street flooding associated with stormwater runoff and tidal influences. The areas have minimal stormwater treatment with most of the drainage discharging directly into the waterway. There is high pollutant loading from the contributing area and potential for Low Impact Development in redevelopment.

Conceptual BMP

- Increase outfall pipe size and install one-way storm pipe check valves (yellow/orange)
- Install concrete flume to channel water to outfall pipe (blue)

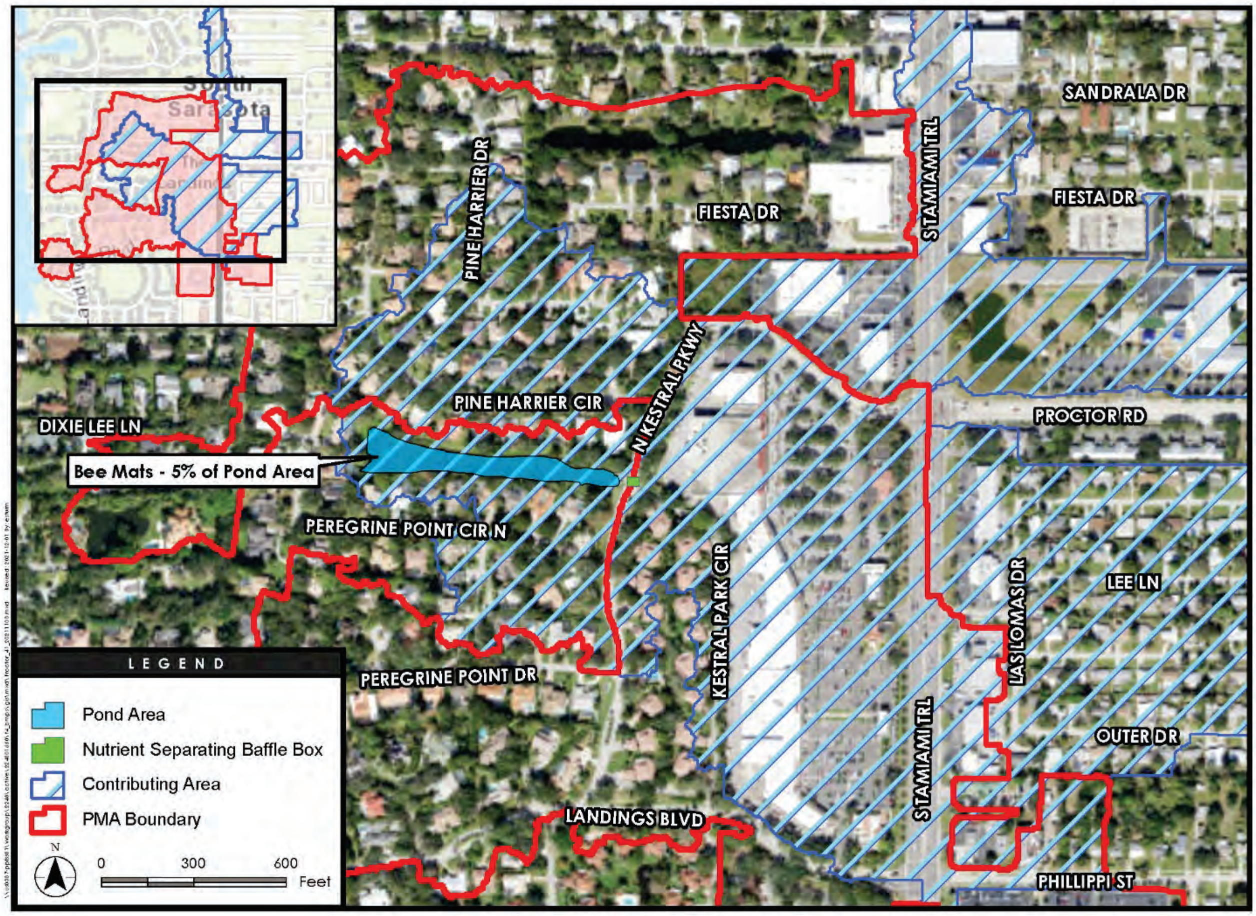
Score 20 (flood only) Cost $186,115

Benefits

- 225 linear feet of roadway removed from LOS Deficiency
- Cost-Benefit Ratio = 0.21
- Reduction of high tide flooding events
- Nutrient reduction possible with redevelopment opportunity
- Public-private partnership to incentivize LID in redevelopment at 41 and Stickney Point
- Resilient in NOAA 2100 future condition

PROJECT MANAGEMENT AREA: STICKNEY POINT				
CONCEPTUAL PLAN COST ESTIMATE - STORM PIPE & CHECK VALVES				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
One-Way check valve - 36" pipe	EA	2	$ 22,000	$ 44,000
Storm Pipe - 36" RCP	LF	300	$ 175	$ 52,500
Adjust Storm Structure	EA	5	$ 750	$ 3,750
Concrete Flume	LF	16	$ 30	$ 480
Silt Fence	LF	620	$ 2	$ 1,240
Roadway Restoration	LS	1	$ 5,000	$ 5,000
Sod	SY	220	$ 2	$ 440
Materials Subtotal				**$ 107,410**
Temporary Traffic Control (5%)				$ 5,371
Staging Area (5%)				$ 5,371
Mobilization (10%)				$ 10,741
Contingency (30%)				$ 32,223
Construction Total				**$ 161,115**
Design and Permitting				**$ 25,000**
Annual Operations & Maintenance Cost				**$ 3,500**
CONCEPTUAL PLAN COST				**$ 189,615**
Note: Percentages based on Materials Subtotal				

US-41 and Proctor Road – Coastal



Project Management Area

This drainage flows through The Landings pond system with little BMPs to outfall directly into the Bay resulting in high nutrient loading. US-41 has experienced flooding in the past. The area is primarily developed residential, although there is a commercial corridor along the arterial roadways .

Conceptual BMP

- Sediment removal program to restore existing pond to permitted capability
- Nutrient Separating Baffle Box to capture sediment, trash, and vegetation before entering the pond
- Floating Bee Mats

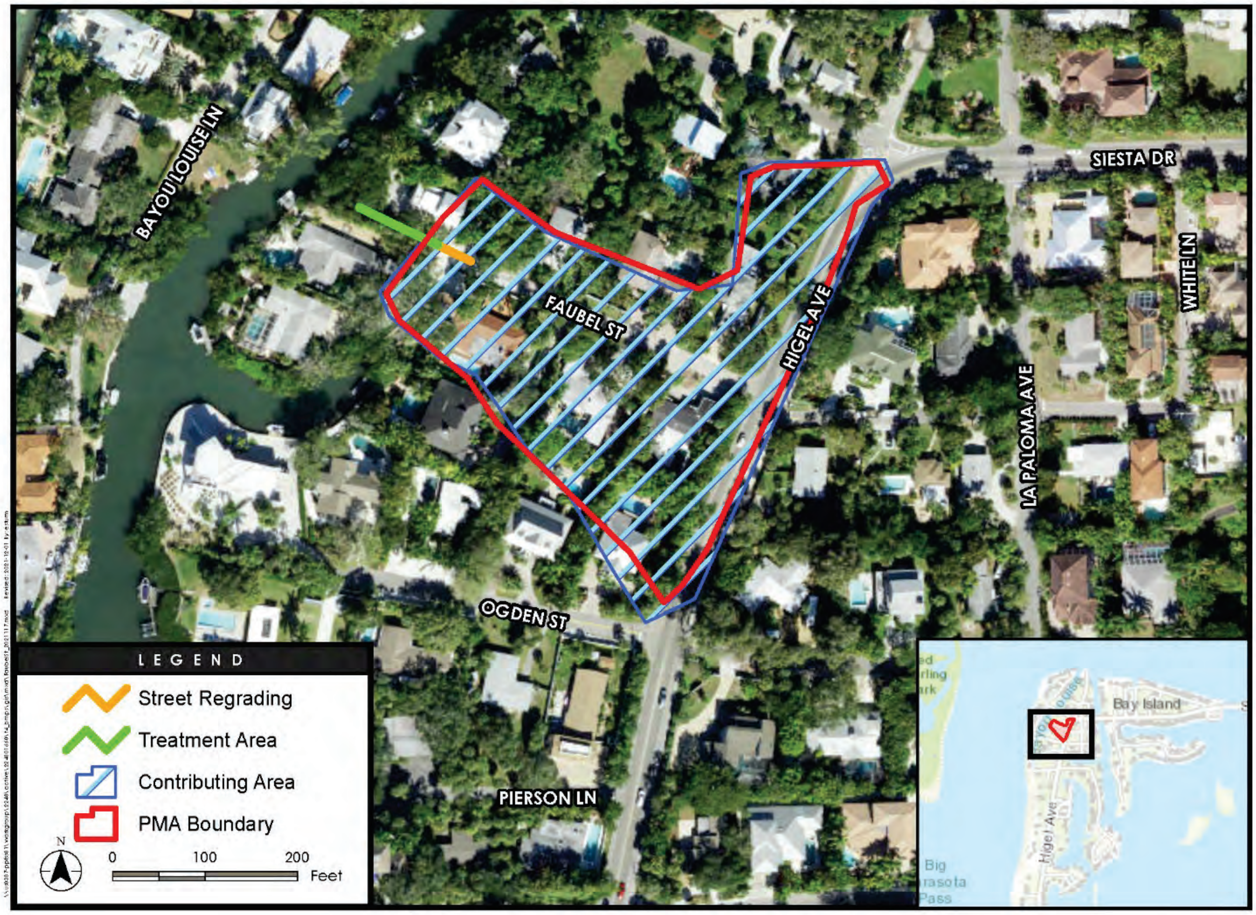
Score 78 Cost $328,676

Benefits

- Annual TN Removal 506 lb/yr
- $14.70/lb annual TN removed during 20 year expected life of BMP
- Developed cost/benefit for pond restoration that can be transferred to other pond project planning
- Somewhat resilient in NOAA 2100 future condition

PROJECT MANAGEMENT AREA: US41 & PROCTOR ROAD				
CONCEPTUAL PLAN COST ESTIMATE - THE LANDINGS POND SEDIMENT REMOVAL & BEE MATS; NUTRIENT SEPARATING BAFFLE BOX				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Nutrient Separating Baffle Box - 48" Pipe	EA	1	$ 126,000	$ 126,000
Storm Pipe - 48" RCP	LF	20	$ 230	$ 4,600
Subsoil Excavation	CY	6,800	$ 6	$ 40,800
Floating Bee Mats	SY	340	$ 47	$ 15,980
Silt Fence	LF	1000	$ 2	$ 2,000
Floating Turbidity Barrier	LF	60	$ 9	$ 540
Rip Rap	TN	50	$ 120	$ 6,000
Materials Subtotal				**$ 195,920**
Temporary Traffic Control (5%)				$ 9,796
Staging Area (10%)				$ 19,592
Mobilization (10%)				$ 19,592
Contingency (30%)				$ 58,776
Construction Total				**$ 303,676**
Design and Permitting				**$ 25,000**
Annual Operations & Maintenance Cost				**$ 3,500**
CONCEPTUAL PLAN COST				**$ 332,176**
Note: Percentages based on Materials Subtotal				

Faubel Street – Coastal



Project Management Area

Northern end of Siesta Key in the City of Sarasota experiences regular flooding on the roadway during the wet season. The area needs to have upgrades completed to the stormwater system to ensure that the drainage is treated and discharged – instead of attenuating in the roadway and infiltrating the sanitary system infrastructure.

Conceptual BMP

- Regrading of roadway to allow stormwater to flow through a saltwater marsh area before outfall into the Bay

Score 40 (flood only) Cost $37,334

- Elimination of 400 LF of nuisance street flooding and level of service deficiencies
- Reduction of operation & maintenance of roadway / stormwater infrastructure
- Reduction of inflow and infiltration of sanitary system infrastructure

PROJECT MANAGEMENT AREA: FAUBEL STREET - SIESTA KEY				
CONCEPTUAL PLAN COST ESTIMATE - STORM STRUCTURE INSTALLATION; SALT WATER MARSH REHABILITATION				
DESCRIPTION	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Clearing and Grubbing	LS	1	$ 4,000	$ 4,000
Embankment	LS	1	$ 1,500	$ 1,500
Storm Structures	EA	1	$ 8,200	$ 8,200
Storm Pipe - 18" RCP	LF	20	$ 90	$ 1,800
Storm Structure - MES - 18"	EA	1	$ 1,810	$ 1,810
Wetland plantings	AC	0.25	$ 6,000	$ 1,500
Materials Subtotal				**$ 18,810**
Temporary Traffic Control				$ 1,000
Mobilization (10%)				$ 1,881
Contingency (30%)				$ 5,643
Construction Total				**$ 27,334**
Design and Permitting				**$ 10,000**
Annual Operations & Maintenance Cost				**$ 1,000**
CONCEPTUAL PLAN COST				**$ 38,334**
Note: Percentages based on Materials Subtotal				

Appendix C

The Sarasota County Sediment Management Project 1: Phillippi Creek Barrier Removal Feasibility Study Final Report by Weiler Engineering Corporation, dated January 2019.

Project 1: Phillippi Creek Barrier Removal Feasibility Study

(Task 4 – Final Report)

For

Sarasota County
Sediment Management

Owner:
Sarasota County
1001 Sarasota Center Blvd.
Sarasota, FL 34240

Work Assignment: WA666
Contract 2016-168

Prepared by

WEILER ENGINEERING CORPORATION EB# 6656

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WEC JOB NO. 17097.001

January 2019

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Executive Summary

Approximately 3.6 miles upstream of the mouth of Phillippi Creek lies a historic barrier that was once used as a salinity gate for agricultural purposes. As the agricultural land was converted to residential, the barrier became obsolete and the stop logs were removed, allowing water to flow freely through the area. However, approximately 100 feet of the barrier wall extending from the NW side of Phillippi Creek and six standalone piles that supported the stop logs remain. The remaining concrete structure is causing suspended sediment from upstream sources to deposit both upstream and downstream of the structure. The County has implemented BMPs upstream in an attempt to decrease the amount of suspended sediment entering the bays, most notably instream sediment sumps RB3 and RB5. Both sumps are located at the confluence of two streams in order to maximize the amount of area served. As outlined in the Task 3 Analysis Report, the flows near RB5 (sampling stations RBW-BEN and RBW-F) had a much lower concentration of TSS compared to near the barrier (RBW-SALIN). A portion of the watershed approximately 2,000 acres in size contributes runoff to Phillippi Creek at the location of the barrier without passing through either upstream sediment sump location. Erosion within this area is likely the cause of the elevated TSS counts.

Sarasota County (County), with cooperative funding from Southwest Florida Water Management District (District) has opted to investigate the feasibility of removing the barrier structure. An analysis (Task 3) was completed, which examined the current state of the water quality, environmental conditions, hydrology, and other considerations, and the impact of the barrier on each. A bathymetric survey was completed and the Phillippi Creek Watershed Model (ECM) was updated to accurately depict the barrier and surrounding site conditions to establish a Revised Phillippi Creek Watershed Model (RECM).

This phase of the report (Task 4) analyzed the alternatives for removing the barrier to determine the post construction impacts in the same areas examined during the Task 3 analysis, along with alternatives to facilitate construction of the barrier removal and available funding options.

The three recommended alternatives proposed for construction include: (1) removing the barrier completely along with removing the sediment that has accumulated upstream and downstream of the barrier to restore flow back to the natural conditions, (2) completing all the activities described in alternative 1 with the addition of the construction of a sediment sump to isolate the accumulated sediment into one location that can be easily maintained by the County, and (3) alternative 2, except the potential sediment sump area would be used as a planted littoral zone to restore the natural habitat of this area. Constructability and cost estimates are included within this report, for review.

Effects on Water Quality and Environmental Conditions

During the Task 3 analysis, the existing water quality of Phillippi Creek was established using data collected from existing water quality stations upstream and downstream of the barrier. It was determined that the barrier may contribute to the degradation of upstream water quality, thus the removal of the barrier should benefit Phillippi Creek. The water quality characteristics analyzed were dissolved oxygen, total nitrogen, total phosphorus, chlorophyll a, and total suspended solids. The data was compared for samples taken on the same day, minimizing the number of variables affecting the results. Over the time period analyzed, each water quality indicator was found to have deteriorated from the upstream sampling points to the sampling point downstream of the barrier. Analyzing the available data, the water quality characteristics of the major influent flows into Phillippi Creek between the upstream and downstream, it was determined that the deterioration of water quality within the observed region of Phillippi Creek was not caused by effluent flows. The data analysis performed shows no direct causation between the decrease in water quality and the presence of the barrier, but it does show that there is a decrease in water quality not due to a polluted influent flow.

Several relevant indicators of environmental conditions and health were analyzed during Task 3 including: bottom hardness, invasive species, and oyster bed habitats. The areas upstream and downstream of the barrier have a uniquely high bottom hardness compared to the surrounding areas of the creek. Since the only unique factor in this area of Phillippi Creek is the barrier, it can be inferred that the barrier is likely causing this phenomenon and its removal should have a positive impact on the bottom hardness, restoring it to a level similar to the surrounding areas.

There are several invasive species, both aquatic and terrestrial in the creek and along the creek banks. Removing the barrier will expand the surface area of free-flowing water and free-flowing conditions aid in the spread of many of these species, thus invasive species removal prior to barrier removal is essential. Removal of such species and restoration of the creek embankment will provide a natural habitat for the creek's ecosystem.

After review of the existing water quality conditions it was determined that the removal of the barrier should have no impact on the oyster populations in the creek. Optimal salinity for oysters is 17-29 ppt, and the salinity at the barrier is about 2 ppt; identifying that the salinity gradient in the creek under existing conditions is not ideal for oyster habitat growth. The farthest upstream oyster habitat is located 1.86 miles south of the existing barrier, hydrology calculations herein show that the flow rates dissipates with the proposed construction alternatives approximately 1.3 miles downstream of the barrier, supporting the claim that the proposed construction will have no effect on the oyster habitat in the creek. See Table 4 herein for additional information.

Hydrology and Flood Protection (ICPR)

There are three recommended alternatives for removing the barrier suggested within this report, including: (1) Removal of the barrier and the upstream and downstream sediment that has accumulated due to the restriction in flow caused by the barrier; (2) Alternative 1 plus the construction of a sediment sump on an adjacent vacant marsh parcel; and (3) Alternative 1 plus the construction of a planted littoral zone in the location of the Alternative 2 sediment sump. Additional detail is provided herein regarding the importance of sediment removal and construction of a sediment sump to improve the creek's ecosystem. For this section, these alternatives were used in the ICPR modeling to determine the feasibility of each option. The ICPR models were named "PCM" for "Post Construction Model" with the addition of a number coinciding with the construction alternative they represent.

Revised Pre-Development and Post-Development

As part of Task 3, the RECM was created to accurately model the conditions between Tuttle Ave. and Webber St. Survey data were used to input cross sections that account for sediment buildup within this region of the creek. Figures 1, 2, and 3 represent the updated channel cross sections utilized in the post-construction design models (PCM 1, PCM 2, and PCM 3, respectively). Figures 4-6 represent the node-link layouts for the ICPR models (ECM, RECM, and PCM models).

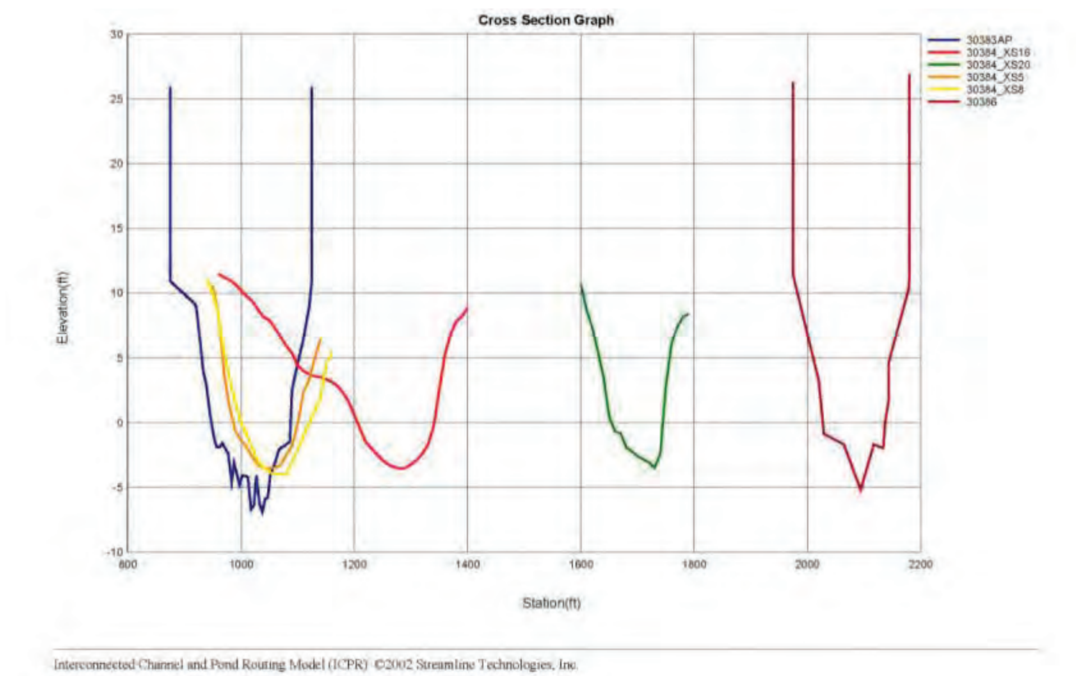


Figure 1: ICPR PCM 1 Cross Section Graph

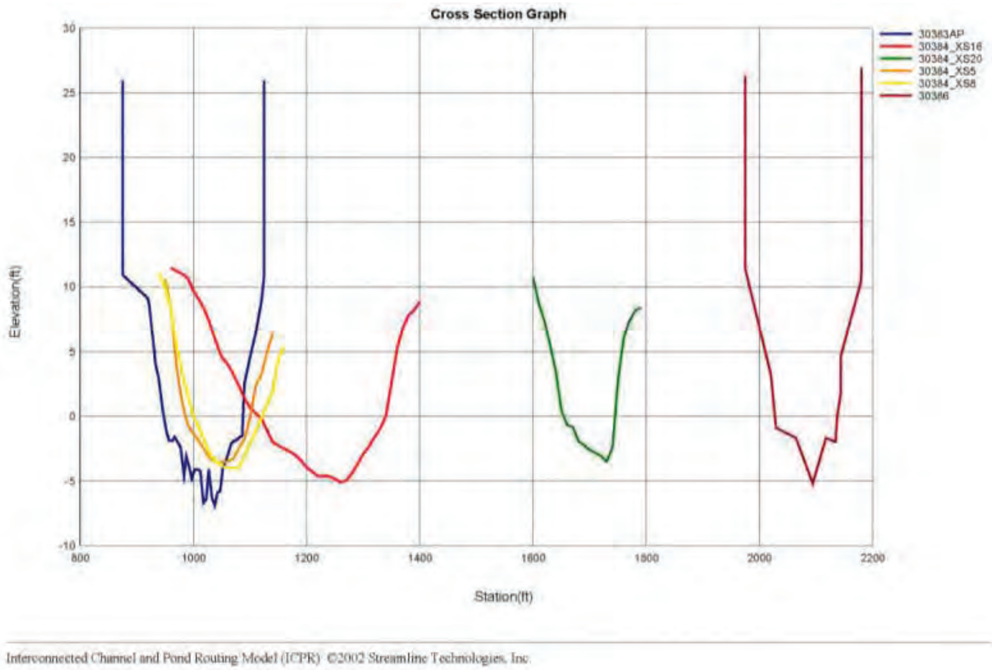


Figure 2: ICPR PCM 2 Cross Section Graph

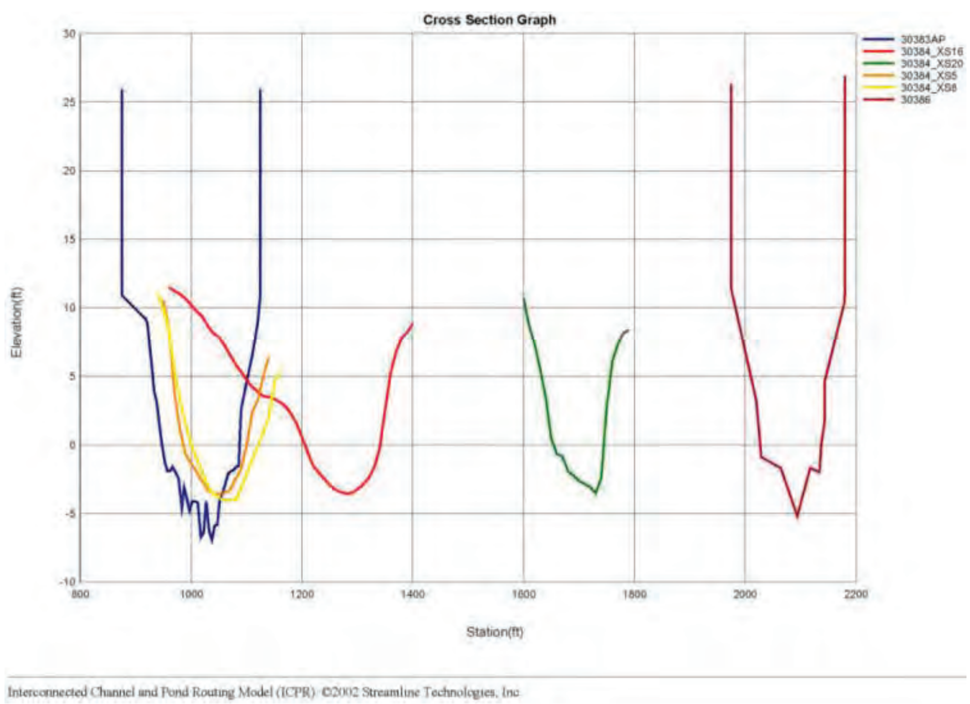


Figure 3: ICPR PCM 3 Cross Section Graph

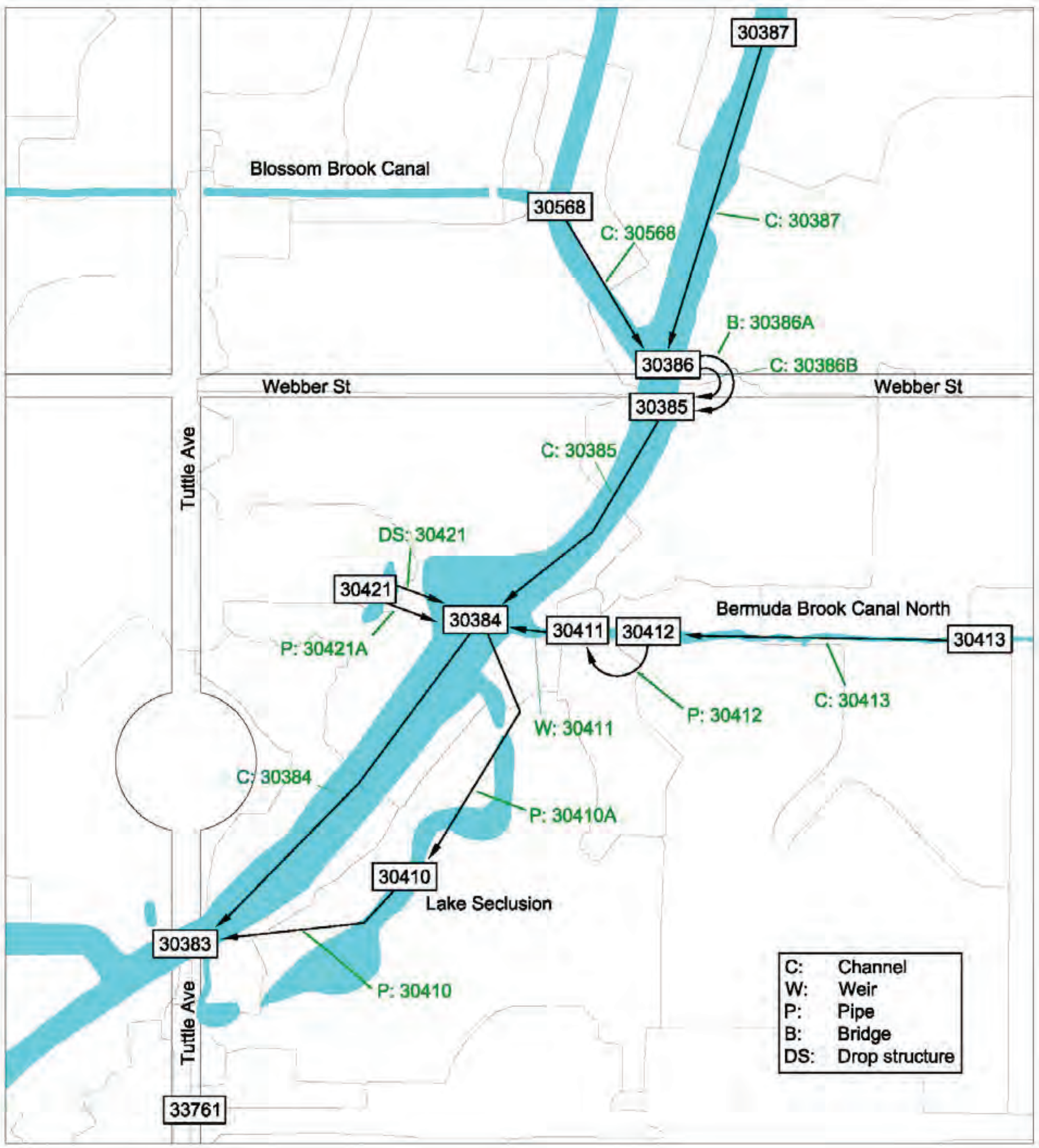


Figure 4: ECM Node-Link Schematic

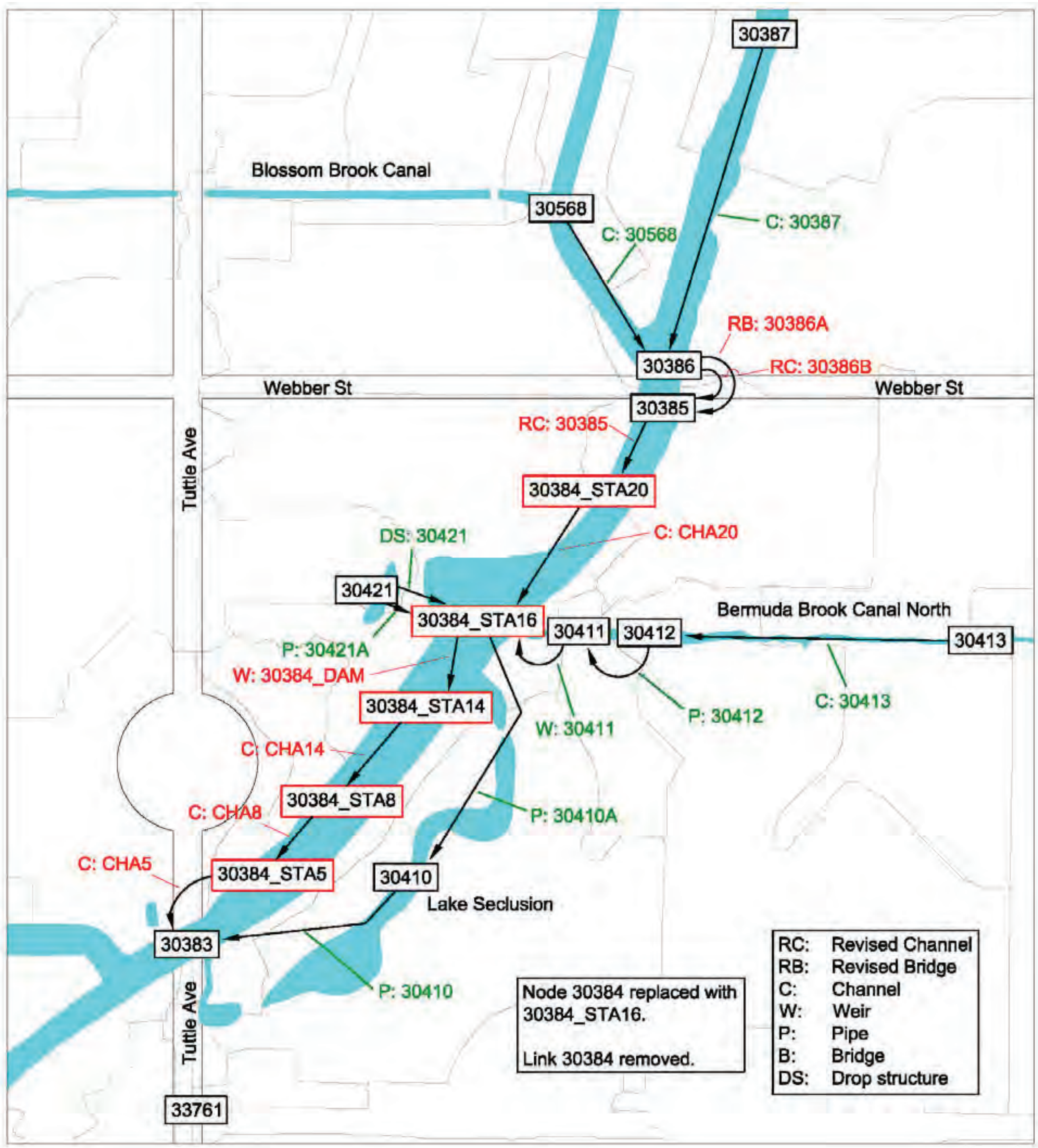


Figure 5: RECM Node-Link Schematic

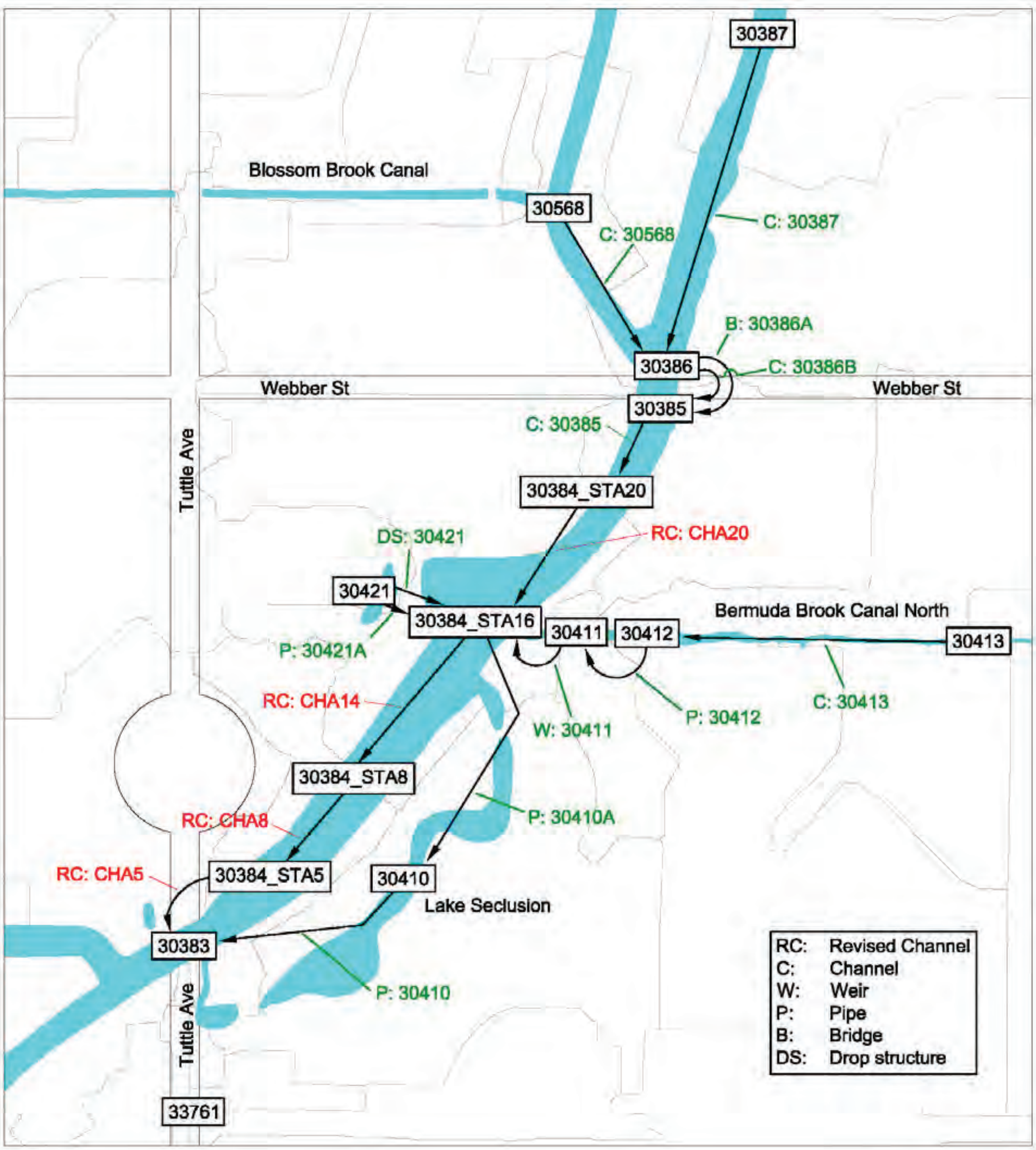


Figure 6: PCM 1-3 Node-Link Schematic

Post Construction – ICPR Results

The three PCM models were run for the 100 year-24 hour storm event and compared to the RECM and ECM output for the same event. There are two important outputs that the model provides that were reviewed for this study, the maximum stage (ft) and the maximum flow rate (cfs). Maximum stage is used to assure that any construction impacts do not result in flooding, where maximum flow rate is utilized to ensure such construction does not alter the ecological and natural properties of the creek. The results from each model (PCM 1-3) are in Appendix E along with the results from the RECM and ECM. Tables 1-3 show the Link maximum results for the PCM 1-3 models, respectively. Values for 30384_CHA20, DAM, CHA14, CHA8, and CHA5 in the ECM result columns are represented by the channel 30384 results.

Sarasota County Sediment Management								
Project 1- Phillippi Creek Barrier Removal Feasibility Study								
Link Name	**100yr-24hr**							
	Max Stage (NAVD)				Max Flow (cfs)			
	ECM	RECM	PCM 1	Difference (PCM 1-RECM)	ECM	RECM	PCM 1	Difference (PCM 1-RECM)
30568	10.92	11.66	11.44	-0.22	1246.19	1188.76	1452.85	264.09
30387	11.06	11.79	11.57	-0.22	4619.30	4573.19	5201.25	628.06
30386B	10.88	11.65	11.42	-0.23	5665.25	5479.00	7847.34	2368.34
30385	10.87	11.61	11.37	-0.24	5671.20	6192.01	8853.42	2661.41
30384_CHA20	10.82	11.53	11.27	-0.26	5758.67	41935.13	24518.33	-17416.80
30384_DAM	10.82	11.23	-	-	5758.67	5259.01	-	-
30384_CHA14	10.82	10.62	10.75	0.13	5758.67	5126.23	6825.88	1699.65
30384_CHA8	10.82	10.51	10.61	0.10	5758.67	5111.54	5589.68	478.14
30384_CHA5	10.82	10.41	10.49	0.08	5758.67	5108.91	5517.47	408.56
30411	11.02	11.35	11.00	-0.35	921.80	921.80	921.80	0.00
30410	10.80	11.16	10.71	-0.45	371.80	780.07	467.28	-312.79
30383	10.62	10.39	10.48	0.09	6131.55	5887.77	5940.45	52.68

Table 1: ICPR Link Maximum Conditions Results (ECM, RECM, PCM 1)

Sarasota County Sediment Management								
Project 1- Phillippi Creek Barrier Removal Feasibility Study								
Link Name	**100yr-24hr**							
	Max Stage (NAVD)				Max Flow (cfs)			
	ECM	RECM	PCM 2	Difference (PCM 2-RECM)	ECM	RECM	PCM 2	Difference (PCM 2-RECM)
30568	10.92	11.66	11.50	-0.16	1246.19	1188.76	1155.62	-33.14
30387	11.06	11.79	11.63	-0.16	4619.30	4573.19	4561.38	-11.81
30386B	10.88	11.65	11.48	-0.17	5665.25	5479.00	5387.35	-91.65
30385	10.87	11.61	11.43	-0.18	5671.20	6192.01	5390.36	-801.65
30384_CHA20	10.82	11.53	11.34	-0.19	5758.67	41935.13	5454.01	-36481.12
30384_DAM	10.82	11.23	-	-	5758.67	5259.01	-	-
30384_CHA14	10.82	10.62	10.71	0.09	5758.67	5126.23	5497.33	371.10
30384_CHA8	10.82	10.51	10.57	0.06	5758.67	5111.54	5497.13	385.59
30384_CHA5	10.82	10.41	10.46	0.05	5758.67	5108.91	5496.21	387.30
30411	11.02	11.35	10.93	-0.42	921.80	921.80	921.80	0.00
30410	10.80	11.16	10.68	-0.48	371.80	780.07	437.69	-342.38
30383	10.62	10.39	10.44	0.05	6131.55	5887.77	5933.20	45.43

Table 2: ICPR Link Maximum Conditions Results (ECM, RECM, PCM 2)

Sarasota County Sediment Management								
Project 1- Phillippi Creek Barrier Removal Feasibility Study								
Link Name	**100yr-24hr**							
	Max Stage (NAVD)				Max Flow (cfs)			
	ECM	RECM	PCM 3	Difference (PCM 3-RECM)	ECM	RECM	PCM 3	Difference (PCM 3-RECM)
30568	10.92	11.66	11.43	-0.23	1246.19	1188.76	1458.61	269.85
30387	11.06	11.79	11.56	-0.23	4619.30	4573.19	5235.12	661.93
30386B	10.88	11.65	11.41	-0.24	5665.25	5479.00	7896.55	2417.55
30385	10.87	11.61	11.36	-0.25	5671.20	6192.01	8922.94	2730.93
30384_CHA20	10.82	11.53	11.26	-0.27	5758.67	41935.13	24515.24	-17419.89
30384_DAM	10.82	11.23	-	-	5758.67	5259.01	-	-
30384_CHA14	10.82	10.62	10.79	0.17	5758.67	5126.23	6873.32	1747.09
30384_CHA8	10.82	10.51	10.65	0.14	5758.67	5111.54	5622.88	511.34
30384_CHA5	10.82	10.41	10.54	0.13	5758.67	5108.91	5542.93	434.02
30411	11.02	11.35	11.03	-0.32	921.80	921.80	921.80	0.00
30410	10.80	11.16	10.75	-0.45	371.80	780.07	467.27	-312.80
30383	10.62	10.39	10.53	0.14	6131.55	5887.77	5966.88	79.11

Table 3: ICPR Link Maximum Conditions Results (ECM, RECM, PCM 3)

The removal of the barrier from the model and the input of revised cross sections based on the proposed sediment removal created both increases and decreases in the stage within the watershed. Stage decreases primarily exist downstream of the barrier location and stage increases primarily exist upstream of the barrier location, according to the PCM models. The greatest stage increase was 0.10 feet at node 30384_STA8 for PCM 1. For the PCM 2 model, the greatest stage increase was 0.06 feet at node 30384_STA8. For the PCM 3 model, the greatest stage increase was 0.14 feet at node 30384_STA8. See Appendix E for the 100-year floodplain maps, which illustrate the changes in peak stage. Based on the floodplain maps it appears that properties within the 100-year floodplain may be removed with the proposed construction, however, this should be further investigated by the County during the design phase. The full maximum stage results for all five models analyzed in Task 3 and Task 4 can be found in Appendix E.

The flow fluctuated most notably in link 30384_CHA20 between the RECM and the PCM models. In the RECM, the flow through this link was 41935.13 cfs. In the PCM 2, the flow was 5454.01 cfs, and in PCM 1 and PCM 3 the flows were in between the two. High flow rates can cause scouring along the channel banks. Though the peak flows reported are instantaneous flow rates that occur for less than 15 minutes, it can be concluded that removing the barrier reduces the likelihood of scouring through link 30384_CHA20 in all three PCM models.

In Task 3 it was reported that the nearest living oyster habitat in Phillippi Creek exists approximately 1.86 miles downstream of the existing barrier. As part of Task 4, the flow rates for the PCM models were analyzed to see how the oyster habitat might be affected. The average flow rates from hours 0-48 of the ICPR models were calculated for several links between the existing barrier and the nearest oyster habitat. The results show an increase in flow rate just downstream of the barrier after removal that completely dissipates just downstream of Tuttle Ave. in link 30382. These results show that removal of the barrier will likely cause no shift in the salinity gradient of Phillippi Creek or change in velocity at the nearest oyster habitat. See Table 4 for the results.

Link	Distance Downstream of Existing Barrier (miles)	Average Flow Rate (cfs)			
		RECM	PCM 1	PCM 2	PCM 3
30384_CHA8	0.1	3136.6	3384.2	3370.5	3382.4
30382	0.4	2783.9	2782.8	2772.1	2782.1
30110	1.3	4018.5	4017.8	4005.0	4018.0
30106	1.7	4032.1	4031.3	4018.5	4031.5

Table 4: Average Flow Rate of Downstream Channels

While no change in salinity or velocity is expected in the location of the oyster habitats, the observed increase in flow rate immediately downstream of the existing barrier could affect the oyster habitats. According to the ICPR output, the flow rate increases downstream of the existing barrier in each of the Post Construction models. Even though the flow rates return to normal levels in a relatively short distance, the increase in flow rate in the region downstream of the barrier could resuspend the deposited sediment of the sediment island. Any resuspended sediment is at risk of travelling downstream and depositing on or near the oyster habitats. This supports the case for removing all built up sediment near the barrier if the barrier is to be removed.

Sediment Analysis/Removal

The project area between the Tuttle Ave. and Webber St. bridges has experienced a large amount of sedimentation within the creek. Sediment has accumulated behind the upstream side of the barrier wall and is now covered in dense vegetation. A sediment island exists a couple hundred feet downstream of the barrier where the creek widens and the water flow decreases. The creek bottom is noticeably high throughout this area downstream of the barrier to Tuttle Ave. See Appendix A for the bathymetric survey of Phillippi Creek between Tuttle Ave. and Webber St. Sedimentation on both sides of the barrier is caused by the restricted flow through the area; as a result, suspended sediment levels are high compared to upstream levels over the time period analyzed. High levels of suspended solids block sunlight from reaching the channel bottom and decrease oxygen levels through absorbing heat, thus raising the water temperature. If the increased levels of sedimentation continue to accumulate, the channel morphology will change. Upon analyzing the bathymetric survey, it appears the primary channel flow is currently navigating to one side of the sediment island. Based on stations 12+00, 13+00, and 14+00 of the survey, the SE side of the creek has a higher bottom than the NW side. If the process causing this continues then the bank along the NW side of the creek is in danger of receding, while the properties along the SE side will become farther from the creek through sediment deposition. Figure 7 illustrates the path of the stated flow. Note that the portion of flow perpendicular to the banks is the deepest portion of the creek (See station 15+00 of the bathymetric survey, Appendix A).

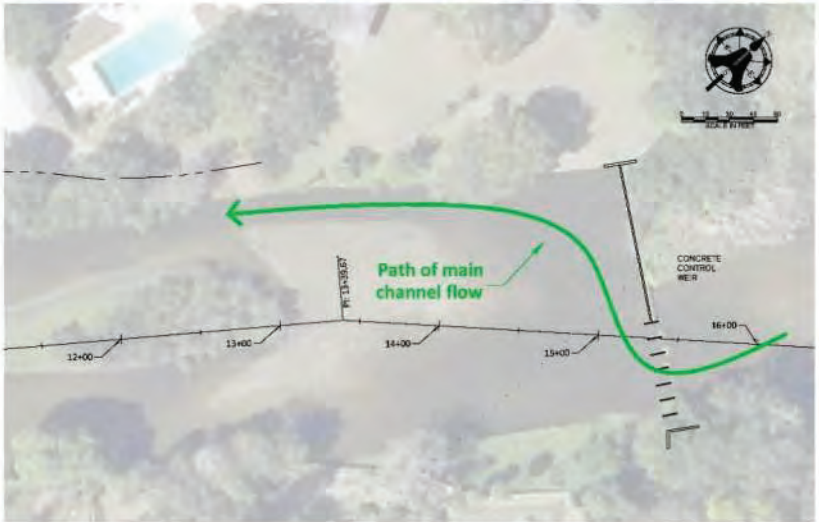


Figure 7: Path of Main Channel Flow Downstream of Barrier

Removal of the sediment buildup is proposed upstream and downstream of the barrier along with the restoration of the creek banks to prevent future erosion. It is recommended that the sediment island downstream of the barrier be removed along with the barrier structure so that the creek can return to its natural path. The sediment buildup behind the barrier wall should also be removed, to avoid further accumulation downstream upon removal of the barrier wall. Analysis and construction cost estimates have been completed for the sediment removal in Phillippi Creek from Sta 6+00 to Sta 18+00 of the survey and are contained herein. This area spans upstream of the proposed sump area to downstream of the sediment island.

The potential natural resource benefit created by the sediment deposits must also be accounted for when determining whether to remove the deposits or not. The sediment island is approximately 0.4 acres above the Annual Lowest Tide of -0.8 ft (NAVD 88, Sarasota Bay tidal station data 2018) and 0.0 acres above the Mean High Water Line of 1.6 (NAVD 88). The effect of the sediment deposits that could be considered a benefit is the creation of terrestrial habitat, although the terrestrial habitat gain is directly linked to aquatic habitat loss. This area is smaller than the area above the Annual Lowest Tide to be restored as part of Design Alternative 3, so both aquatic and terrestrial habitat will be restored as part of Design 3. Design 1 offers no terrestrial habitat restoration and Design 2 offer minimal restoration at this elevation. Figure 8 is a picture taken during a site visit on November 7, 2017. Several White Ibis can be seen on the sediment island in the picture. While the sediment deposits do sometimes create a natural resource benefit, the benefits from removing the sediment likely outweigh the benefit of leaving them.

Figure 8: Sediment Deposit Island with White Ibis Presence

Mean High Water Line (MHWL)

A vertical baseline is required when comparing existing and proposed cross-sectional areas of the creek. The MHWL was estimated using linear interpolation between two points with known MHWL, one upstream of this section of Phillippi Creek and one downstream. These locations are illustrated in Figure 9.

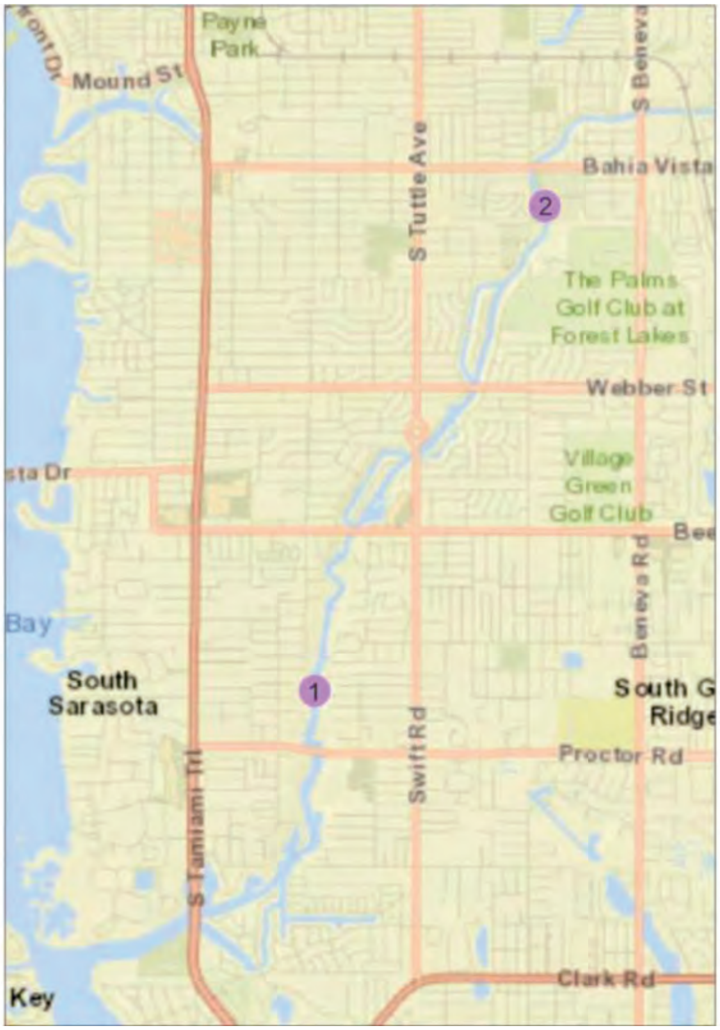


Figure 9: Stations Map

Station 1 - ERP 41304: Phillippi Cove Dredging
Station 2 - Pinecraft Park

The water level for Pinecraft Park came from the Pinecraft Park Habitat Restoration Project (ERP 41178) (2014) and the other location from the Phillippi Cove Dredging Project (ERP 41304) (2012). Linear interpolation between these two points produced a MHWL at Sta 5+00 from the survey of 1.565 ft and a MHWL at Sta 24+00 from the survey of 1.626 ft. The MHWL values for all other stations fall between these two values.

Existing vs Proposed Cross Sections

Proposed cross sections were drawn in Autocad and overlaid to compare the existing versus the proposed conditions. The chosen sediment removal constraints were a -4 ft NAVD creek bottom and 1:10 side slopes. The side slopes were taken to an elevation of +2 ft NAVD on each side (except where seawalls exist), which is just over the calculated MHWL at all locations. A bottom of -4 ft NAVD was used to be consistent with the elevation of the creek bottom in the 2008 "Phillippi Creek - Tuttle to Hyde Park Feasibility Study" and is the natural creek bottom based on the bathymetry data. The recommended side slope for bodies of active water lined with fine sand is 5° or 1:11.4 (Yell, 1995). This shallow slope keeps the creek bed stable, preventing erosion. A 1:10 side slope was used based on this data and other projects with similar profiles. All creek cross sections are in Appendix C, and along with each cross section is the area beneath the MHWL for existing conditions and post-sediment removal conditions.

Quantifying Sediment Removal

If the County elects to remove the sediment in the creek upstream of the barrier, whether a sump or littoral zone will be constructed or not, it is recommended that the existing pond area be surveyed because the sediment removal will extend into this area. The bathymetric survey presented in Appendix A does not include this area, therefore Lidar data were used to complete the cross sectional profile 16+00, 17+00, and 18+00, and the estimated sediment removal in this area was assumed based on these data. Table 5 quantifies the amount of sediment to be removed between the stations.

Creek Section	Station	Sediment Removal (ft^2)	Fill (ft^2)	Volume of Sediment Removed (cyd) (Scenario 1)*	Volume of Sediment Removed (cyd) (Scenario 2)**
6-7	6+00	152.34	83.32	555	177
	7+00	147.51	120.72		
7-8	7+00	147.51	120.72	577	104
	8+00	164.10	134.77		
8-9	8+00	164.10	134.77	596	194
	9+00	157.57	82.12		
9-10	9+00	157.57	82.12	581	277
	10+00	156.12	81.94		
10-11	10+00	156.12	81.94	690	376
	11+00	216.52	87.84		
11-12	11+00	216.52	87.84	947	440
	12+00	295.04	186.36		
12-13	12+00	295.04	186.36	1260	780
	13+00	385.16	72.88		
13-14	13+00	385.16	72.88	1162	805
	14+00	242.24	119.97		
14-15	14+00	242.24	119.97	474	18
	15+00	13.91	126.45		
15-Barrier	15+00	13.91	126.45	443	326
	Barrier	465.00	0.00		

Creek Section	Station	Sediment Removal (ft^2)	Fill (ft^2)	Volume of Sediment Removed (cyd) (Scenario 1)*	Volume of Sediment Removed (cyd) (Scenario 2)**
Barrier-16	Barrier	465.00	0.00	895	865
	16+00	501.24	31.94		
16-17	16+00	501.24	31.94	1319	1148
	17+00	211.07	60.70		
17-18	17+00	211.07	60.70	915	658
	18+00	282.86	77.95		
			Total	10414	6167

*Scenario 1: Existing creek sediment is found NOT suitable for use in restructuring the creek bottom

**Scenario 2: Existing creek sediment is found suitable for use in restructuring the creek bottom

Table 5: Sediment Removal

The creek was divided into 100 ft segments between the surveyed stations. To quantify the volume of the sediment removed for each segment, the areas of the sediment material for the cross sections bordering each segment were averaged and multiplied by the 100 ft length of the segment. The barrier is between Sta 15+00 and Sta 16+00, therefore a segment length of 50 ft was used for the "15-Barrier" and "Barrier-16" segments.

Sediment Drying/Dewatering Zone

The sediment removal activities will require an area designated for sediment dewatering/drying. This area was chosen to be the open space just west of the barrier at latitude 27.306455, longitude -82.512033. Figure 18 in Appendix C illustrates this area. The figure shows an area of approximately 6200 ft^2 of space as the drying zone, and more adjacent land is available if needed. The property, located at 3145 Southgate Circle and site of the Southgate Community Center, is owned by the South Gate Community Association. The Community Association members will need to grant permission for the use of their property prior to construction through a temporary construction easement. The members might be amenable to the easement as the removal of the barrier and sediment should increase the ease of recreational use of the creek.

Alternative 2 – Proposed Sediment Sump

A portion of a parcel upstream of the barrier along the NW creek bank is vacant and acts as a floodplain for the creek. This area has been identified as a potential location for an instream sediment sump along with a small portion of the Southgate Community Center parcel. The role of an in-stream sediment sump is to slow the velocity of a flowing water body, and thus allow suspended sediments to settle in a controlled location. The proposed sump location is sufficiently large for a sump; this means lowering the creek bottom only a couple feet would significantly increase the size of the channel's cross section, which will lead to effective, controlled sedimentation. Figure 10 is a picture of this location taken during a site visit on November 7, 2017.

Figure 10: Proposed Sediment Sump Location

The preliminary sediment sump design has the sump bottom set at -6.5 ft. This is 2.5 ft lower than proposed creek bottom. In the preliminary design, the side of the proposed sump along the NW side of the creek has a 1:4 vertical to horizontal slope. Due to the geometry of this area and how it connects to the creek, a 1:4 slope should be stable and not experience scouring. The remaining portion of the proposed sump exists in the center of the creek body and will have a 1:10 side slope, following the proposed sediment removal guidelines. Figure 11 shows the existing conditions at the proposed sediment sump area, including elevation contours. Figure 12 represents a plan view of the preliminary sediment sump design (note the parcel boundaries). Also proposed is the planting of native emergent plants on the 1:4 sloped banks of the sediment sump to prevent erosion and promote nutrient uptake. The plants are proposed in the transitional zone from +1 ft NAVD to +4 ft NAVD.

Figure 11: Existing Conditions - Sediment Sump Area

Under ideal conditions, the space below -4 ft is where sediment will collect and should be cleaned out once the volume of space reaches 50% capacity with sediment. If allowed to fill more than 50%, sediment collected in the sump is at risk of becoming resuspended and distributed downstream.

The effectiveness of the proposed sediment sump design must be demonstrated for the option to be considered viable. The physical process of sedimentation happens when the flow velocity is low enough to allow the sediment particles to settle within the water column. Sediment sumps work because they increase the cross-sectional area of the water body. According to the volumetric flow rate equation ($Q = A*V$), increasing the cross-sectional area decreases the velocity for a constant flow rate.

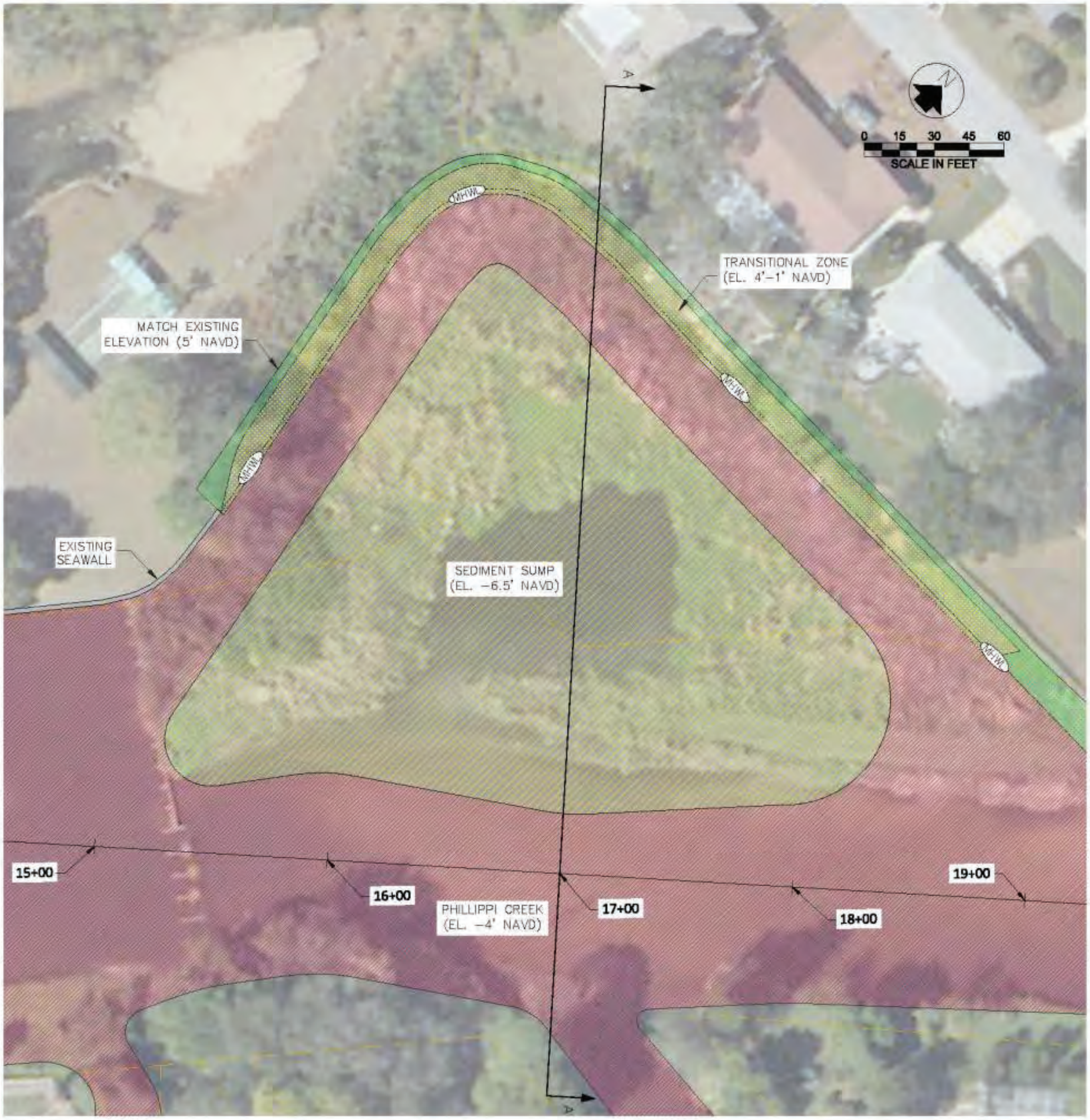


Figure 12: Preliminary Sediment Sump Design - Plan

The Hjulstrom Curve is a simple method used for determining deposition and erosion velocities. This method requires only the sediment particle grain size to obtain the deposition and erosion velocities. See Figure 13 for the Hjulstrom Curve labeled for a fine sediment particle of 2 mm (a metric graph was used). According to the graph, the deposition velocity threshold for a sediment particle of grain size 2 mm is approximately 1.5 cm/sec, or 0.049 ft/sec. The Hjulstrom Curve is considered to be inadequate for accurately modeling sediment transport because of uncertainty in the erosion velocity curve and the lack of depth variance (Hjulstrøm, 1939). This analysis is not concerned with the erosion velocity and according to the note on the Figure 13 graph, this curve is approximated for a flow depth of 1 meter, which is appropriate for Phillippi Creek in this region. Therefore, the Hjulstrom Curve method would be a valid approach to estimating the deposition velocity. The Shields method was also used and is considered a more accurate method for modeling sediment transport, and using this method yielded a bed shear velocity of 0.054 ft/sec (See Appendix D for equations) (Cao, 2006).

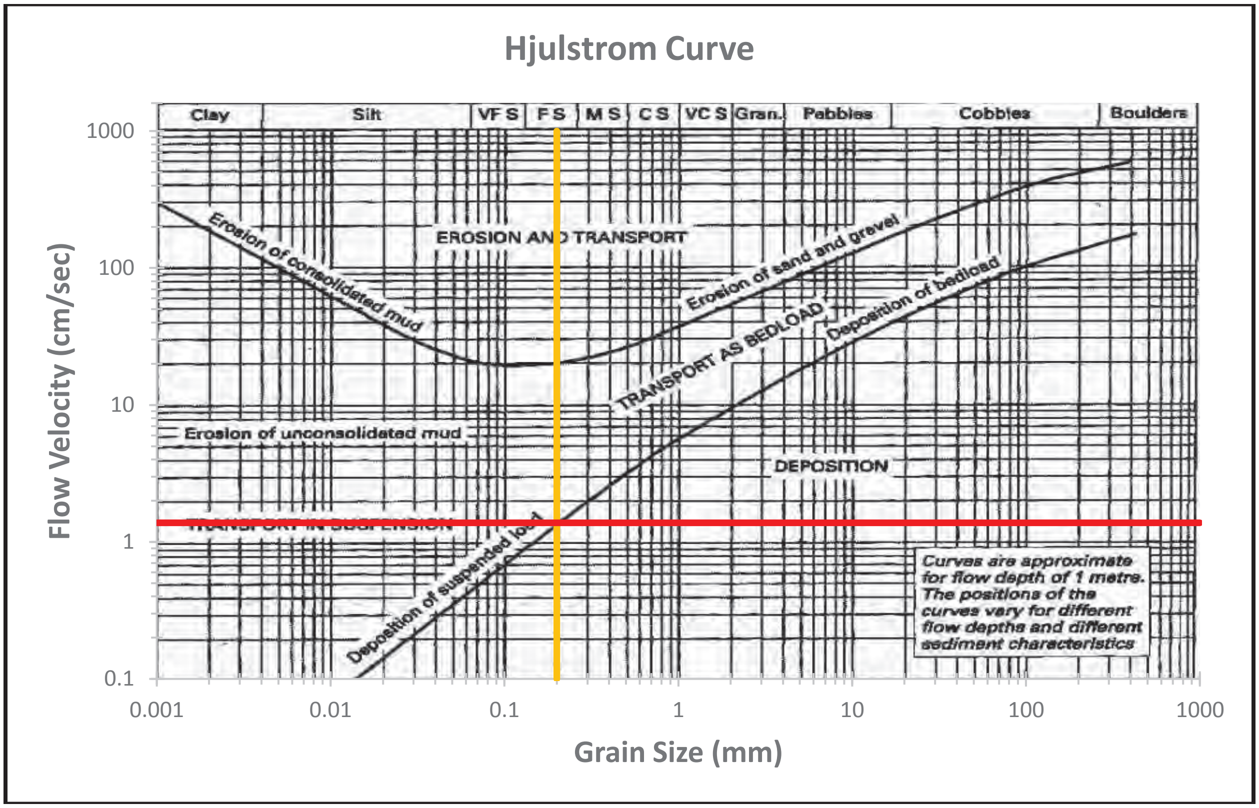


Figure 13: Hjulstrom Curve

These calculated velocities are very low and may be lower than what can naturally be expected in Phillippi Creek near the existing barrier. Approximately 2200 ft^2 of the proposed cross-sectional area at Sta 17+00 of the creek is below MHWL. For a velocity as low as 0.054 ft/sec to occur, the flow rate would be approximately 120 ft^3/sec or lower. This is an estimate based on the cross-sectional area not being independent of flow rate in this open channel scenario – under realistic conditions, the amount of water flowing affects the elevation of the water surface, which affects the cross-sectional area. This location does not offer the benefit of a downstream weir to slow the flow rate, which in-stream sediment sumps generally rely on. The County should investigate during the design phase the normal flow rates of the creek in this location in order to determine if an in-stream sediment sump is a viable option. If data is collected on the stream velocity and coinciding water surface elevation, flow rates can be calculated using the existing conditions cross sections present in the Task 3 report. Once a normal flow rate is established, the value can be used with the proposed cross sections to calculate the post sump construction stream velocity and compare to the required settling velocity previously described. This method assumes water surface elevation is a constant. Available USGS stream gage data is inadequate for determining the normal flow rate at this location, and ICPR is inadequate because the program only models storm event conditions, under which the sump is not expected to operate normally.

Additional Sediment Removal for Proposed Sediment Sump

Constructing an in-stream sediment sump will require additional sediment removal. Table 6 outlines the estimated amount of removal required for sump construction. The "Total *Additional* removal" is the amount of sediment that would need to be excavated in addition to the sediment removal already proposed in Table 6. If the removal activities described in Table 6 does not occur and the sump will still be constructed, then the amount of sediment to be removed for sump construction is the "Total".

Creek Section	Station	Sediment Removal (ft^2)	Fill (ft^2)	Volume of Sediment Removed (cyd) (Scenario 1)*	Volume of Sediment Removed (cyd) (Scenario 2)**
Barrier-16	Barrier	465.00	0.00	1717	1686
	16+00	1389.01	33.07		
16-17	16+00	1389.01	33.07	5829	5655
	17+00	1758.40	60.70		
17-18	17+00	1758.40	60.70	5231	4974
	18+00	1066.21	77.95		
			Total	12776	12315
			Total *Additional* dredging	9648	9644

*Scenario 1: Existing creek sediment is found NOT suitable for use in restructuring the creek bottom

**Scenario 2: Existing creek sediment is found suitable for use in restructuring the creek bottom

Table 6: Proposed Sump Sediment Removal

Alternative 3 – Littoral Zone

In addition to the sediment sump option, another design was created as an alternative use for the area designated for the sump. This design utilizes the area as a littoral zone, which would create an environmentally low-impact area that could provide nutrient uptake. By definition, this area already serves as part of Phillippi Creek's littoral zone, but this design serves to enhance the area. Emergent plants help prevent erosion and provide a habitat for diverse aquatic life. The plants selected for use must be resistant to low levels of salinity. As shown in the Task 3 Report, the salinity at RBW-SALIN over the observed time period was 2.36 ppt. Freshwater is characterized by salinity levels below 0.5 ppt. Figure 14 shows the proposed littoral zone and Figure 15 shows cross section A-A as seen on Figures 12 and 14, which shows the existing creek cross section at Station 17+00 and the cross sections for the sediment sump and littoral zone design alternatives. Although this alternative does not provide an opportunity for collecting the sediment that is dispersed in the creek at this location, it provides the greatest opportunity to restore the natural conditions of the creek and the adjacent wetland marsh.

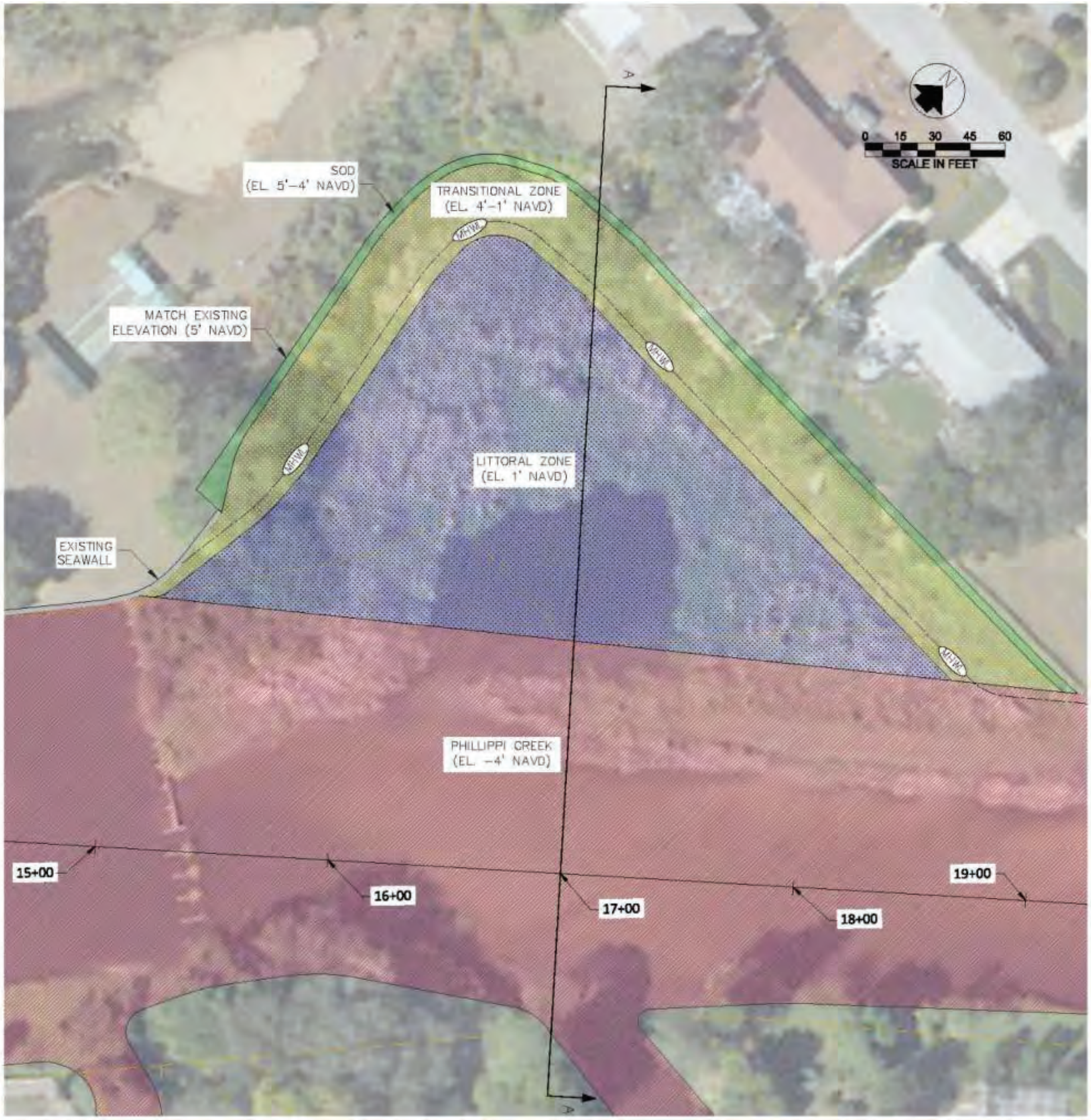


Figure 14: Alternative 3 (Littoral Zone)

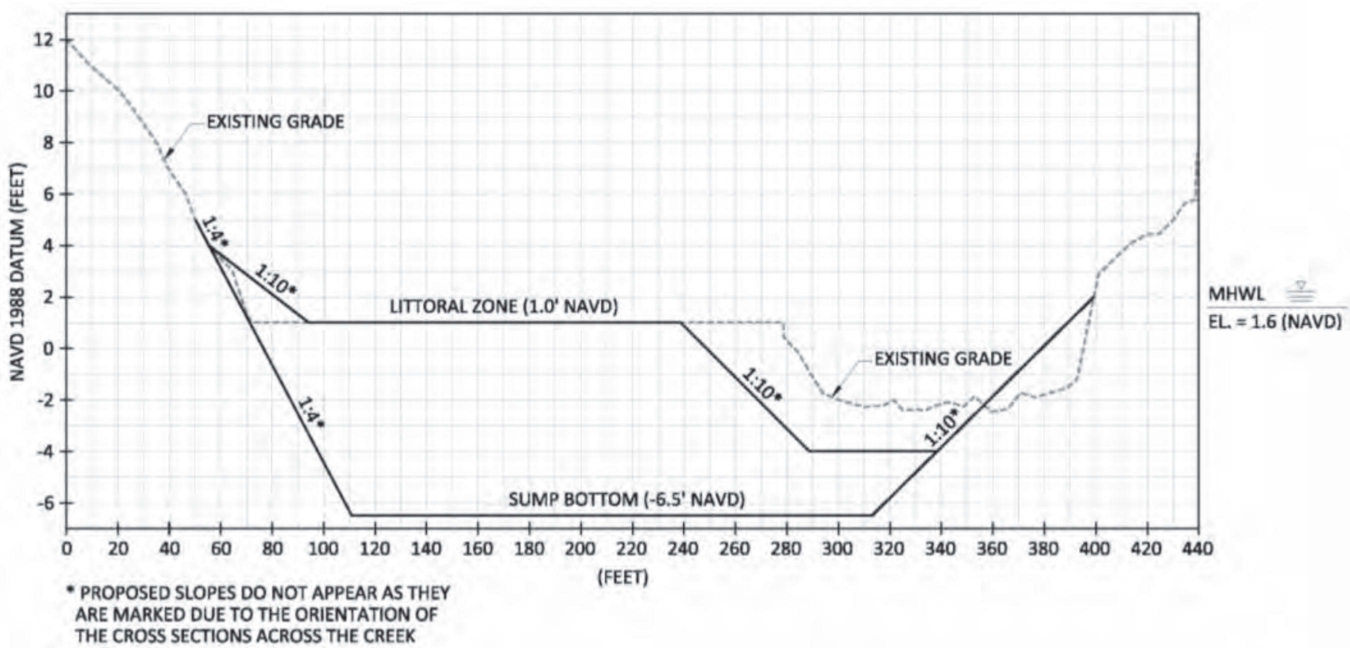


Figure 15: Cross Section A-A

Permitting

In the completion of the barrier removal there will be a series of permits required for construction. This section details each permit and their associated requirements for construction completion.

Southwest Florida Water Management District (DISTRICT)/Florida Department of Environmental Protection (DEPARTMENT)- Environmental Resource Permit (ERP)

The SWFWMD and the FDEP have an operating agreement that was issued in 1998. The operating agreement clarifies the limits of regulation and agency responsibility for processing the statewide ERP required for projects based on their proposed impacts and overall project development. Section II.A. details the DEPARTMENT's responsibilities and states in Section II.A.i. "*Docking facilities, boardwalks, shore protection structures and piers, including the adjacent docking and boating related development and navigational dredging. … The DEPARTMENT shall also review and take final action on permit applications for docking, boating related, boardwalk, shore protection or pier projects which include existing project related commercial or residential development that does not have a previously issued DISTRICT permit under Part IV, Chapter 373, F.S., and which do not propose new project related commercial or residential development."* Due to the environmental impact and that this project is not part of a larger development plan the DEPARTMENT should be the issuing agency for the ERP required for the barrier removal and associated dredging activities. However, a pre-application meeting with the DISTRICT will be required to delegate the appropriate agency.

The requirement for processing the ERP will include detailed construction plans with dredge and fill locations clearly defined and a detailed report of the environmental and hydrological impacts. Such information will include a wetland survey, any necessary mitigation required for wetland impacts, and a hydrology analysis to ensure post construction flow rates and staging do not cause adverse impacts to the floodplain. Typical permit processing for similar projects can take 6-12 months depending on department reviews.

Army Corps of Engineers (ACOE)- Nationwide Permit (NWP)

Due to the fact that the barrier is located in a navigable waterway an NWP through the ACOE will be required. In 2017, ACOE opted out of the Statewide Individual ERP permit and implemented a separate permitting process rather than the Joint Application with the DISTRICT/DEPARTMENT which was utilized in past years. The proposed barrier removal will fall under two different categories of the Nationwide permit Section B.27. Aquatic Habitat Restoration, Enhancement, and Establishment Activities for the dredging activities required to remove the sediment that has accumulate both upstream and downstream of the barrier, and Section B.53.Removal of Low-Head Dams for the removal of the remaining ±100 linear feet of the barrier. In order to process, permit coordination with Corps district office will be required to determine consistency with the NWP rules and requirements. The NWP will require no adverse impacts to species inhabiting navigable waters, no adverse effects to the aquatic system due to accelerating the passage of water, compliance with applicable FEMA-approved floodplain management requirements, and application of soil erosion and sediment controls. NWP often requires coordination with outside agencies such as: FWC, NMFS, and the Navy; typical permit processing timeline can be 8-18 months depending on coordination requirements.

All regulatory requirements should be reviewed with each agency through pre-application meetings during the design/plans process, in order to adequately meet all the regulations and expedite the permitting process.

Federal Emergency Management Agency (FEMA)

Phillippi Creek is a FEMA regulated waterway and coordination with the agency should be completed during the design phase of any proposed construction altering the existing creek conditions.

Construction Cost Estimates

The cost estimate for sediment removal and sediment sump construction were determined using the construction estimates provided by the County for the RB-3 and RB-5 sumps. Using the estimates as a basis, the total proposed site area was divided by the RB-3 and RB-5 site areas, to develop relative ratios used in computing the amount of material necessary for construction. Once the material quantity was determined, the unit cost was calculated by using the County's current running construction costs, the FDOT's 12-month moving statewide averages and Area 10 12-month moving averages, and construction costs observed by WEC.

Itemized cost estimates for the implementation of each construction option are located in Appendix H.

Alternative 1: Removal of the Barrier and Sediment Accumulated Upstream and Down Stream

Alternative 1 includes the removal of the barrier and removal of the built-up sediment upstream and downstream of the barrier. The region designated for sediment removal extends from Station 6+00 to Station 18+00 of the survey. Costs were calculated assuming the soil from the existing sediment deposits is not suitable for the restructuring of the creek banks. A deduction in cost was calculated to illustrate the change in cost if the sediment is found suitable for restructuring the creek banks. The deduction was made to the "Channel Excavation" item in the amount of the "Embankment" quantity. This method includes the consideration of the labor involved in restructuring the creek banks. The total estimated construction cost for Alternative 1 is $882,297.67.

Alternative 2: Removal of the Barrier, Sediment Accumulated Upstream and Down Stream, and Construction of Sediment Sump

Alternative 2 includes the removal of the barrier, removal of the built-up sediment upstream and downstream of the barrier, and construction of an instream sediment sump. The region designated for sediment removal extends from Station 6+00 to Station 18+00 of the survey and the proposed sediment sump is located on the property of the West Coast Church of the Cross. This option assumes change in ownership of this land to the County. Alternative 2 includes changes in item quantities and new items relevant to the construction of the sediment sump. Costs were calculated assuming the soil from the existing sediment deposits is not suitable for the restructuring of the creek banks. A deduction in cost was calculated to illustrate the change in cost if the sediment is found suitable for restructuring the creek banks. The deduction was made to the "Channel Excavation" item in the amount of the "Embankment" quantity. This method includes the consideration of the labor involved in restructuring the creek banks. The total estimated construction cost for Alternative 2 is $1,246,820.99.

Alternative 3: Removal of the Barrier, Sediment Accumulated Upstream and Down Stream, and Construction/Restoration of Natural Habitat

Alternative 3 is the same as Alternative 2, except the sediment sump area will be utilized as a littoral zone. Alternative 3 involves restructuring the littoral zone through embankment to create a gentler slope into the littoral zone, preparation of the littoral zone soil, and emergent plant cover over the flat littoral shelf set at +1 ft NAVD. The existing area designated for a sediment sump or littoral zone enhancement hosts some emergent plants, but much of the area has no plant cover. Costs were calculated assuming the soil from the existing sediment deposits is not suitable for the restructuring of the creek banks. A deduction in cost was calculated to illustrate the change in cost if the sediment is found suitable for restructuring the banks. The quantity for "Embankment" is greater than the quantity for "Channel Excavation" for this design alternative, thus, the deduction quantity is equal to the total amount of "Channel Excavation" specified. The total estimated construction cost for Alternative 3 is $1,156,779.05.

Construction Alternatives

The cost estimates for the three design alternatives were made with the most desirable construction method in mind: the use of the South Gate Community Center's property for construction staging and sediment drying through a temporary easement. The County requires the analysis of alternatives in the event that the Southgate Community Center property is not available for construction staging, sediment dewatering, or both.

If the property is unavailable for both construction staging and dewatering, the following option was investigated: utilizing a barge with all the necessary equipment from the mouth of Phillippi Creek up to the project site, loading the barge with sediment and the barrier structure, and transporting the material downstream to be unloaded and disposed of. This option would not only be exceedingly costly, it does not appear feasible in terms of construction, water depths, and bridge locations. The bridges that span Phillippi Creek, specifically S Tuttle Avenue, do not offer enough clearance for a barge loaded with the necessary equipment to pass under. Due to sediment buildup in the creek, a barge would require high tide to navigate to the project site, and high tide would lead to even less clearance under the bridges. Because of this, this construction alternative is not considered a valid option.

In the event the South Gate Community Association only agrees to allow construction staging on their property, an alternative location for sediment drying has been identified. Parcel ID 0059-04-0046 is owned by the County and exists between the two portions of the West Coast Church of the Cross property. This parcel would be available for the project if the County acquires the portion of the West Coast Church of the Cross property where the proposed sediment sump is located. The parcel houses a County stormwater pond and the portion East of the pond has slopes as steep as 1:3 (vertical to horizontal), according to Lidar data. The pond and steep slopes greatly diminish the amount of available space for sediment drying, causing this option to be considered infeasible. See Figure 16 for an illustration of this option.

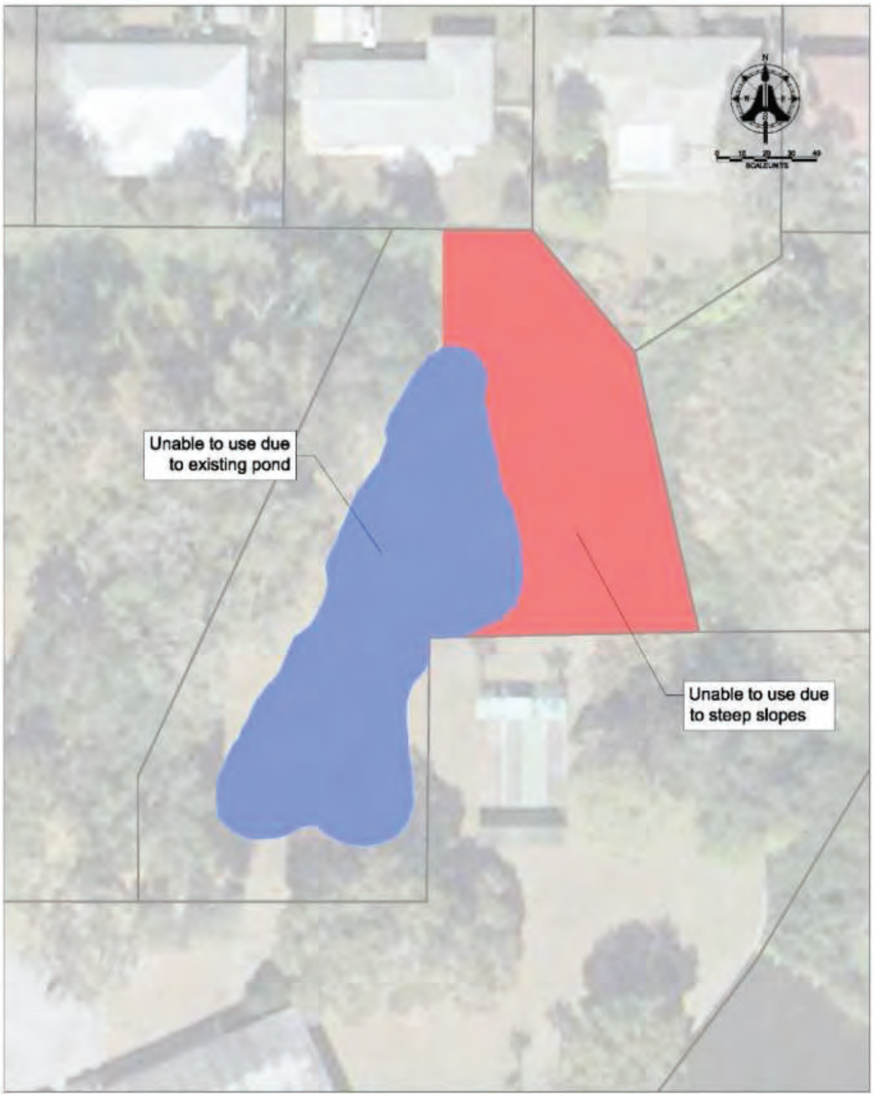


Figure 16: County Parcel 0059-04-0046

Funding Opportunities

District Cooperative Funding Initiative (CFI)

The District CFI program funds projects that have resource benefits related to natural systems, flood protection, and water quality. Based upon the feasibility of the structure removal, the following benefits may be provided by the proposed project:

- Submerged Land Restoration
    - Removing accumulated sediment and the barrier will restore the channel profile to its natural state
    - Unusual bottom hardness caused by the presence of the barrier should return to natural levels with its removal
- Hydrologic Restoration
    - Removing accumulated sediment and the barrier should allow the creek flow rates to return to natural levels
    - No negative impact on the downstream oyster habitats is expected, as shown through ICPR modeling and existing downstream location of the oyster beds
- Shoreline Restoration
    - Restoring the creek banks to their natural, shallower sloped profile should prevent future erosion and create a stable ecosystem for native vegetation
    - Removal of invasive plant species and proposed planting of bank stabilizing vegetation will assist in the overall bank stabilization of the creek, preventing future erosion
- Water Quality Benefits
    - Restoring the creek banks to their natural, shallower sloped profile should prevent future erosion, creating a decrease into total suspended solids (TSS) in the creek
    - The proposed sediment sump should collect suspended solids from upstream in a controlled location for removal
- Floodplain Benefits
    - Decrease in maximum stage within the watershed during the 100 year-24 hour storm event shown through ICPR modeling

Applying for CFI program funding requires the following: a detailed description of how the project will create the specified benefits, a cost benefit analysis of the project, an outline of any complementary efforts completed to date, and plans with details of the proposed construction and thorough timeline.

Fish and Wildlife Commission

The Florida Fish and Wildlife Conservation Commission offers grants through the "Florida State Wildlife Grants Program," federally funded by the State and Tribal Wildlife Grants Program. Funds are appropriated annually, with the 2018 deadline having passed on July 13. The program supports projects that target needs identified in the "State Wildlife Action Plan." Items listed as conservation threats to coastal tidal rivers or streams in the "State Wildlife Action Plan" are addressed by this project, mainly channel modification/shipping lanes, and invasive plants.

To be considered for funding, the "Florida State Wildlife Grants Program Application Form" must be submitted. As part of the application, the target habitat and the objective must be identified, and the potential benefit and project approach/methodology must be expressed. Projects with a duration of greater than three years may not be considered for funding.

Sarasota Bay Estuary Program

The Sarasota Bay Estuary Program (SBEP) Bay Partners Grant Program offers funding for local projects that focus on habitat or water quality improvement, or environmental education. This project qualifies as a habitat improvement project and could also qualify as a water quality improvement project, specifically Design Alternatives 2 and 3. These projects also coincide with SBEP's "Phillippi Creek Shoreline" restoration plan, part of the SBEP "Five-Year Habitat Restoration Plan FY 2016 – FY 2020."

Funds are appropriated annually and the window for application submission for 2018-2019 closed on March 1, 2018. Applications are scored based on four categories: Project Description, Environmental Benefits, Community Benefits, and Budget Proposal.

Federal Clean Water Act Grants

The FDEP administers grant money from the EPA through the Federal Clean Water Act (319 Grants) for projects that will help reduce nonpoint source pollution within watersheds. Funds are appropriated annually, with project proposals due in the spring and fund allocation by September of that year. This funding source should be pursued only if Design Alternative 2 is selected, as 319 Grants focus solely on water quality and pollution reduction is only shown through construction of the sediment sump.

Measurable Benefits

A measurable benefits analysis is needed to determine which CFI funding source Design Alternative 1, 2, or 3 would qualify for. This involves utilizing the CFI ranking tables for each of the proposed funding alternatives to determine if the project provides high, medium, or low impacts as defined in the tables. Table 7 provides a detail for each of the funding alternatives what ranking it qualifies under and how the ranking was determined. The "$/Ac Restored" and "$/foot of shoreline restoration" values reflect only the portion of the design that contributes to restoration. Certain elements of Design 2 and Design 3 contribute to the overall project cost, but not toward restoration. Figure 17 identifies the areas of proposed restoration used in each scoring. The "Shoreline Restoration Area" shown on Figure 17 is the post-construction area above the Annual Low Tide of -0.8 ft (NAVD 88) within the Top of Bank line.

		Design 1	Design 2 (Sump)	Design 3 (Littoral Zone)
Natural Systems Restoration	Project Cost	$882,297.67	$1,246,820.99	$1,156,779.05
	Acres Restored	5.3	5.3	6.2
	$/Ac Restored	$166,471.26	$166,471.26	$186,577.26
	Linear Ft of Shoreline Restored	2,430.4	2,430.4	2,430.4
	$/foot of shoreline restoration	$363.03	$363.03	$363.03
	Combination of Elements Ranking	**LOW**	**LOW**	**LOW**
	Shoreline Restoration Ranking	**LOW**	**LOW**	**LOW**
Flood Protection BMPs	Sum of all Benefit/Cost Ratios	1.88	1.88	1.88
	Total Cost of Mitigation for all Structures	$2,865,240	$2,865,240	$2,865,240
	Benefit/Cost Ratio is greater than or equal to 1.	**HIGH**	**HIGH**	**HIGH**
Water Quality	TSS Target Pollutant- Cost/lb TSS $20 or less	N/A- no reduction	$7.00/lb **MEDIUM**	N/A- no reduction
	TP Target Pollutant- Cost/lb TP $4,715 or less	N/A- no reduction	$19,481.58/lb **LOW**	N/A- no reduction
	TN Target Pollutant- Cost/lb TN $646	N/A- no reduction	$7,792.62/lb **LOW**	N/A- no reduction

Table 7: Measurable Benefit Ranking

Figure 17: Delineation of Natural Systems Restoration Areas

Natural Systems

The natural systems restoration rankings were determined using the estimated project cost for each design option, the amount of area restored, and the length of shoreline restored. The area restored is the total area within the top of bank line from station 6+00 through station 18+00 of the survey, as this is the extent of the area where sediment removal is proposed. The quantities shown in Table 7 for Natural Systems "Acres Restored" is the Creek Restoration and Shoreline Restoration Areas shown in Figure 17 added together. The linear length of shoreline is the length of the shoreline on each side of the creek from station 6+00 through station 18+00 of the survey added together. This area represents the submerged land restoration and shoreline restoration portions of the project. The shoreline will be restored through the removal of invasive plant species and bank stabilization to prevent erosion and the submerged land restoration will be accomplished through sediment removal and the restructuring of the creek banks to a 1:10 slope. Due to the stabilization of the banks, a relatively small decrease in TSS is expected. The expected TSS decrease caused by the prevention of erosion within the project area is considered small relative to the amount of sediment entering the project area from upstream, as approximately 31,000 acres of the watershed contributes runoff to the project area. Native emergent plants are proposed as part of Design 2 and Design 3 for environmental enhancement and to promote nutrient uptake. Removing the barrier should also restore the bottom hardness of this portion of the creek to a level similar to the surrounding areas. The characteristics of this project result in low natural systems restoration rankings.

Flood Protection

The analysis for the flood protection ranking was completed using the FEMA BCA Toolkit 5.3.0 which provides a Benefit Cost Ratio (BCR) for each structure analyzed. Utilizing Lidar data and the maximum stages from ICPR, it was determined that many residential houses may have an opportunity where they could be removed from the RECM 100-year floodplain. These structures are on Bougainvillea St, Cronley Pl, Alta Vista St, Irving St, Webber St, and Tanglewood Dr. The total sum of all the BCR from the BCA Toolkit was 1.88, indicating a high ranking. The total mitigation cost of acquisition of all structures is approximately $2,865,824; over double the cost of the proposed project with the sump construction of $1,246,821.

Water Quality

The biggest component in improving water quality for the system is with the construction of the sediment sump. Calculations for the TSS portion of the nutrient reduction section are based on the amount of TSS collected in the existing upstream sediment sump RB3. Total Nitrogen (TN) and Total Phosphorus (TP) reductions were also calculated based on the amount of TSS collected. These nutrients are known to attach to suspended solids, thus a reduction in TSS leads to an expected reduction in TN and TP. The County supplied lb/lb ratios of each nutrient to TSS. See Appendix I for the nutrient reduction calculations.

The restructuring and stabilization of the creek banks as part of each design alternative should also benefit water quality. This action should reduce erosion, leading to lower TSS downstream. Designs 2 and 3 have proposed emergent plantings, which should lead to nutrient uptake in addition to reducing erosion. The removal of the barrier should also eliminate the opportunity for water to stagnate in certain areas through restoring normal flow conditions.

Recommendations

It is recommended that the County pursue design alternative 3: removal of the historic agricultural barrier, removal of accumulated sediment upstream and downstream of the barrier location, and restoration of the existing wetland marsh to natural conditions. Table 8 summarizes each alternatives' benefit and objectives in improving the creek ecosystem.

Parameter	Design Alternative 1	Design Alternative 2	Design Alternative 3
Project Cost	$882,297.67	$1,246,820.99	$1,156,779.05
Submerged Land Restoration	✓	✓	✓
Shoreline Restoration	✓	✓	✓
Velocity Reduction	✓	✓	✓
Sediment Deposition	x	✓	x
Nutrient Reduction	x	Potentially	Potentially
Floodplain Reduction	Potentially	Potentially	Potentially

Table 8: Alternative Benefit Summary

Removing the barrier will have a minimal effect on the environmental conditions, as free flowing conditions already exist in the location of the barrier. The increase in nutrient levels and suspended solids observed in the Task 3 water quality analysis could be due to the presence of the barrier. Therefore, removing the barrier should improve the water quality characteristics closer to what is observed farther upstream.

Removing the accumulated sediment and restructuring the creek banks will restore the creek to its natural state and reverse the effects in the channel morphology downstream of the barrier. Constructing the instream sediment sump offers a potential benefit in the water quality of the creek, allowing a location for unwanted suspended sediment to accumulate and be removed. This may lower turbidity levels and may also prevent future undesirable changes in the channel morphology. However, it is uncertain that flow velocities will be low enough for consistent sediment deposition due to the lack of a downstream weir, but the channel cross section will increase dramatically in the sump location, allowing for sediment deposition. Restoration of the natural wetland conditions with the littoral zone construction does not require additional investigation into the flow velocities and provides a habitat for diverse aquatic life as well as reducing bank erosion.

Each design alternative has various benefits and funding opportunities with minimal impact on the hydrologic conditions within the Phillippi Creek Watershed.

Reference

Cao, Zhixian & Pender, G & Meng, Jian. (2006). Explicit Formulation of the Shields Diagram for Incipient Motion of Sediment. Journal of Hydraulic Engineering-asce - J HYDRAUL ENG-ASCE. 132. 10.1061/(ASCE)0733-9429(2006)132:10(1097).

Eilers, David T. (2013). West-Central Florida Tidal Stream Assessment Summary. Final Report to the Sarasota Bay Estuary Program, December 2013.

Hjulstrøm, F., 1939, Transportation of debris by moving water, in Trask, P.D., ed., Recent Marine Sediments; A Symposium: Tulsa, Oklahoma, American Association of Petroleum Geologists, p. 5-31.

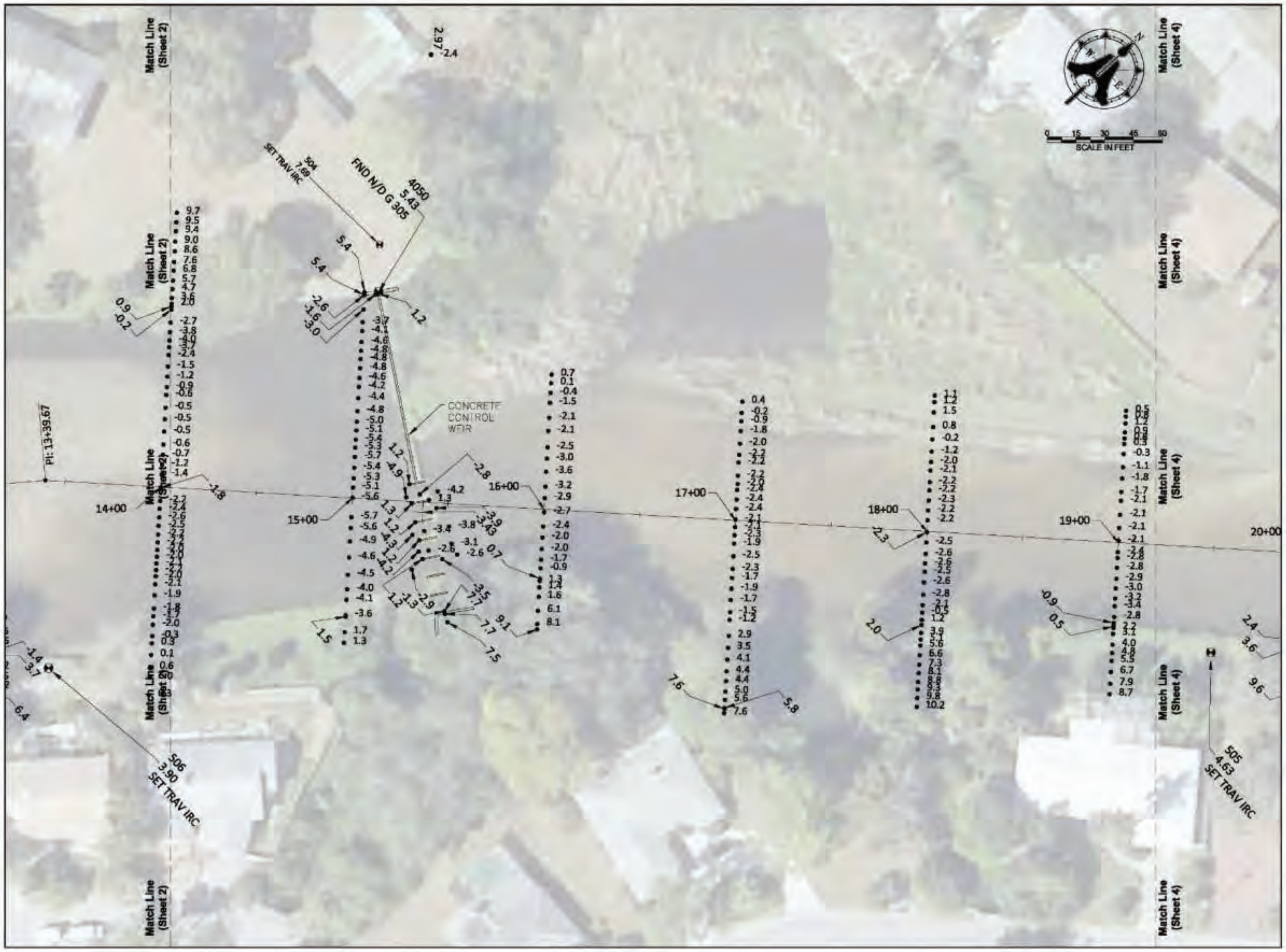
Yell, Dennis, and Riddell, John. (1995). ICE Design and Practice Guide: Dredging. London, UK: Thomas Telford Publications.

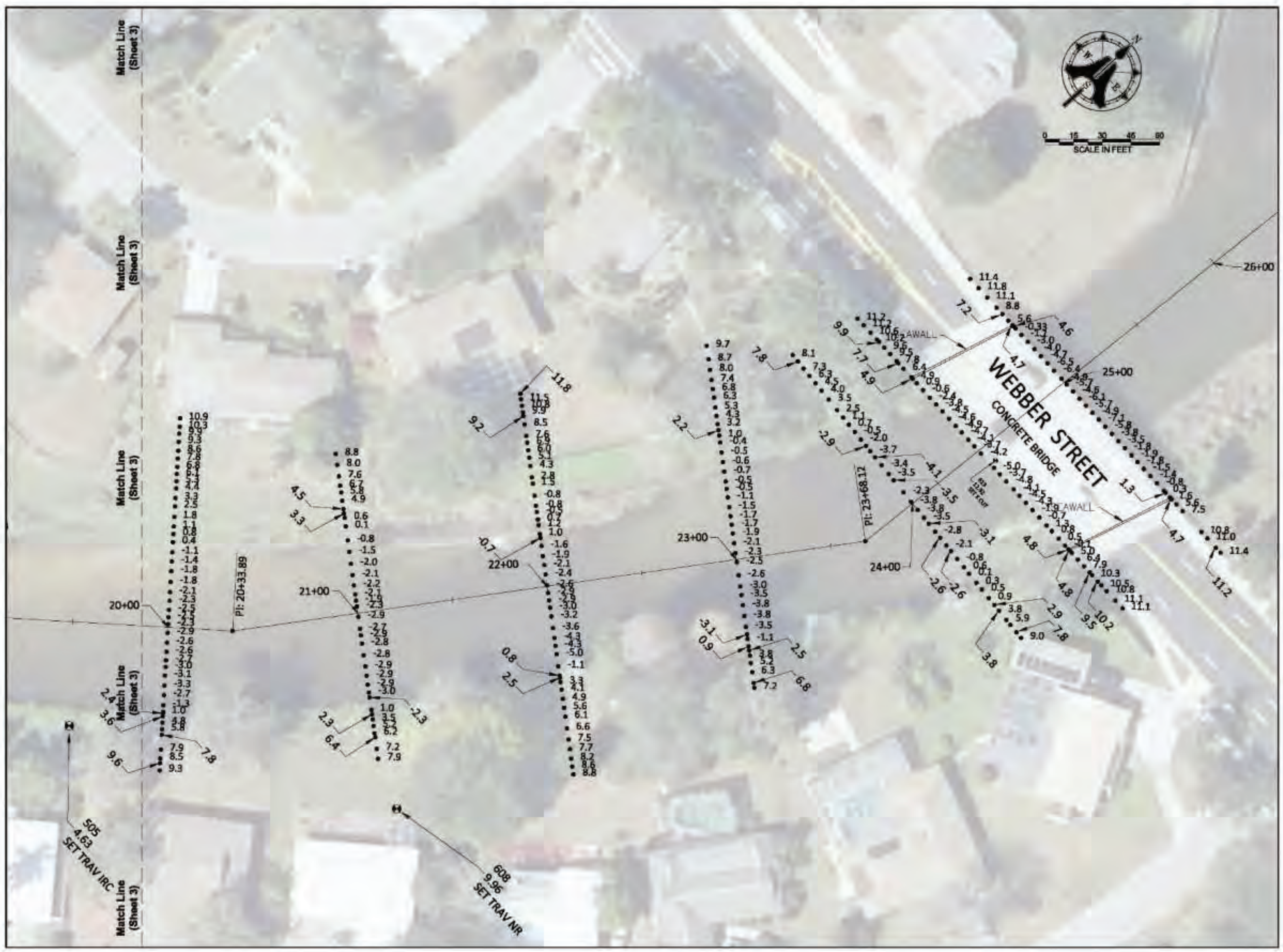
Florida Administrative Codes pertaining to water quality:

Dissolved Oxygen Saturation: 62-302.533
Total Nitrogen: 62-302.531
Total Phosphorus: 62-302.531
Chlorophyll a: 62-303.351

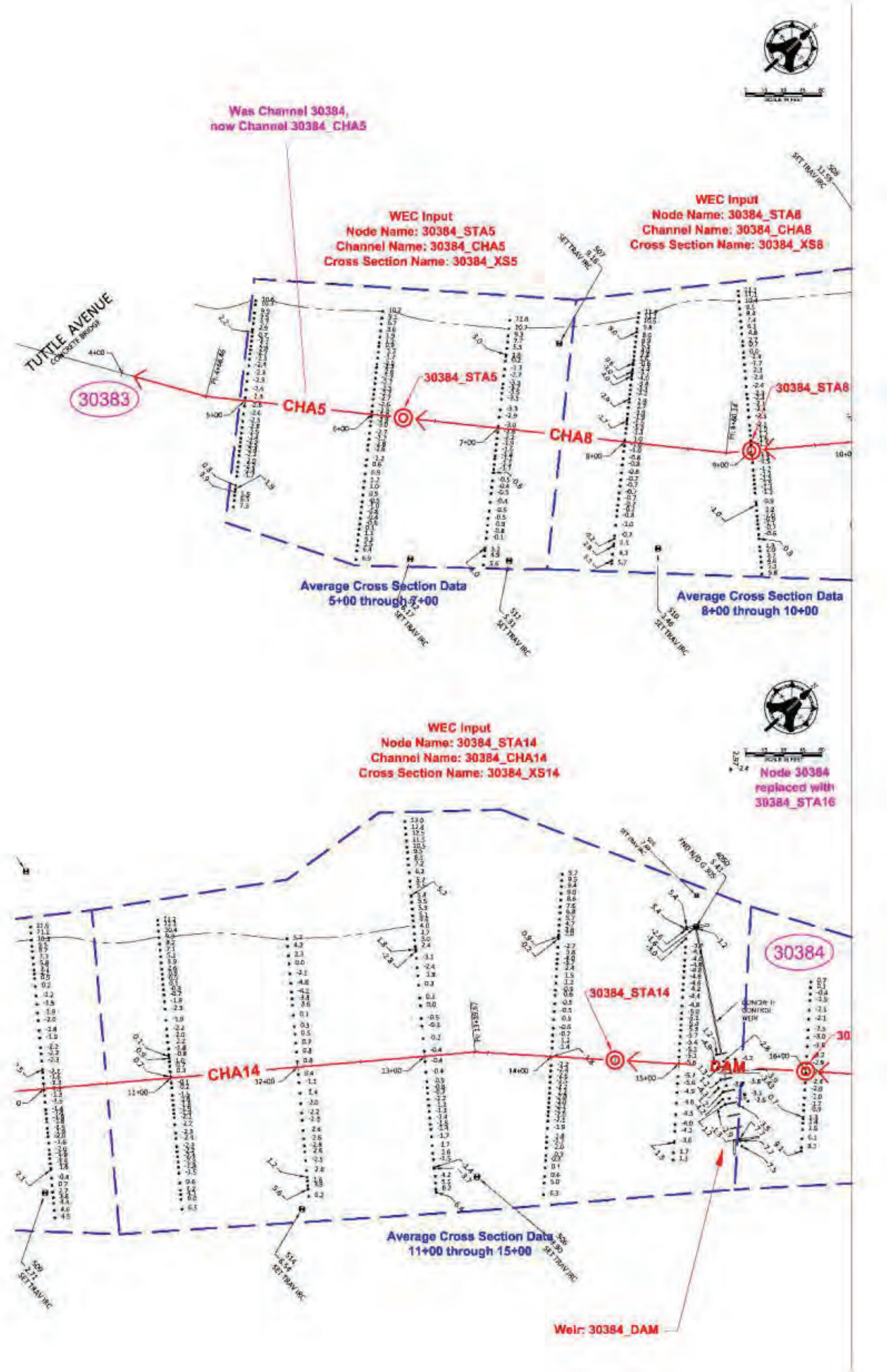
Appendix A: Bathymetric Survey

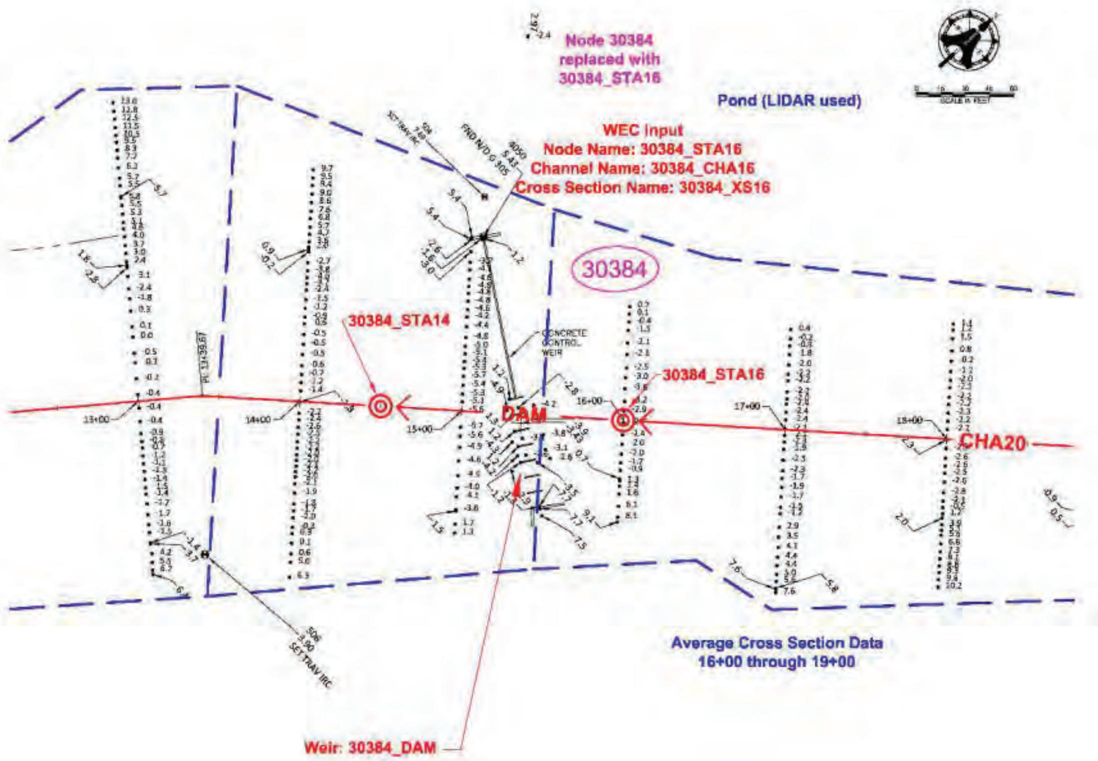

Match Line (Sheet 1)
Match Line (Sheet 3)
SCALE IN FEET
0 15 30 45 60
507 9.16 SET TRAV IRC
508 11.58 SET TRAV IRC
509 2.71 SET TRAV IRC
510 3.46 SET TRAV IRC
514 6.54 SET TRAV IRC
8+00
9+00
10+00
11+00
12+00
13+00
14+00
PI: 8+80.14
PI: 13+39.67

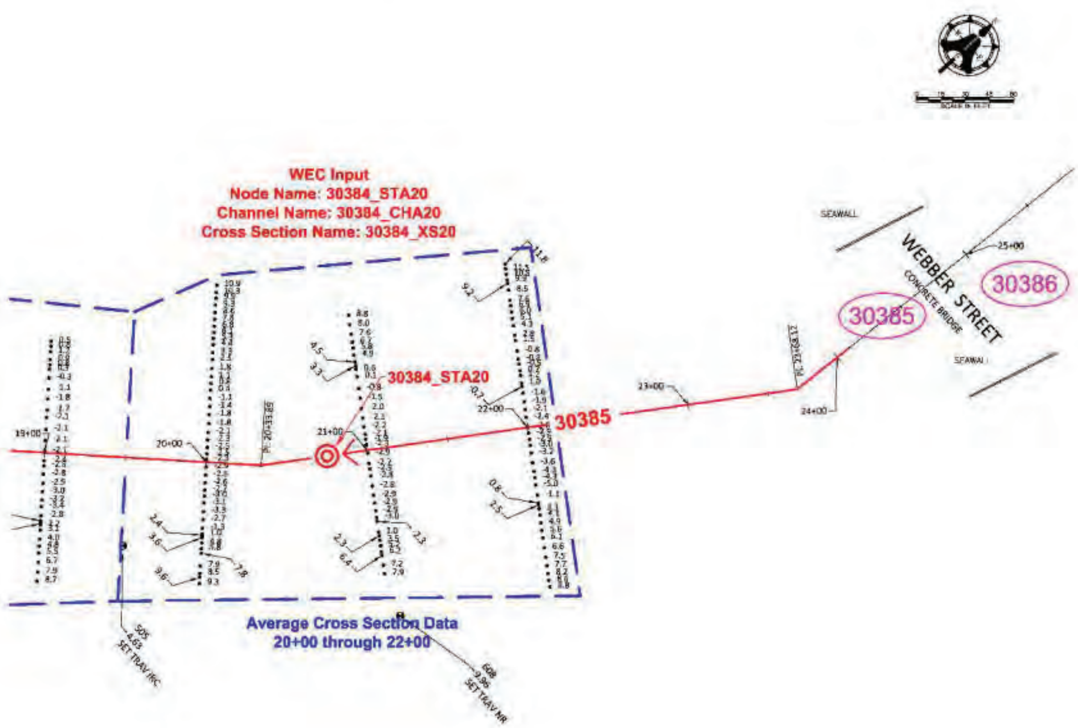

Match Line (Sheet 2)
Match Line (Sheet 4)
PI: 13+39.67
14+00
15+00
16+00
17+00
18+00
19+00
20+00
CONCRETE CONTROL WEIR
4050
5.43
FND N/D G 305
504
7.69
SET TRAV IRC
506
3.90
SET TRAV IRC
505
4.63
SET TRAV IRC
2.97
SCALE IN FEET
0
15
30
45
60


WEBBER STREET
CONCRETE BRIDGE
SCALE IN FEET
Match Line (Sheet 3)
20+00
21+00
22+00
23+00
24+00
25+00
26+00
PI: 20+33.89
PI: 23+68.12
505
4.63
SET TRAV IRC
608
9.96
SET TRAV NR

Appendix B: Survey with Revised ICPR Overlay

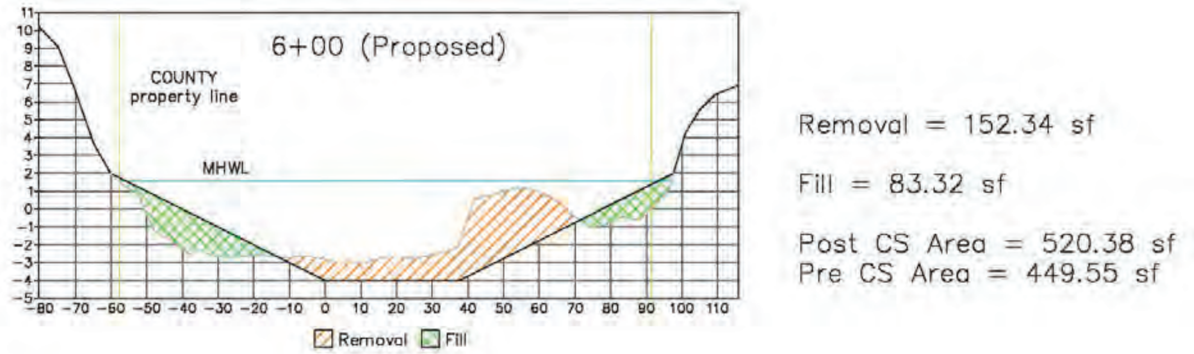


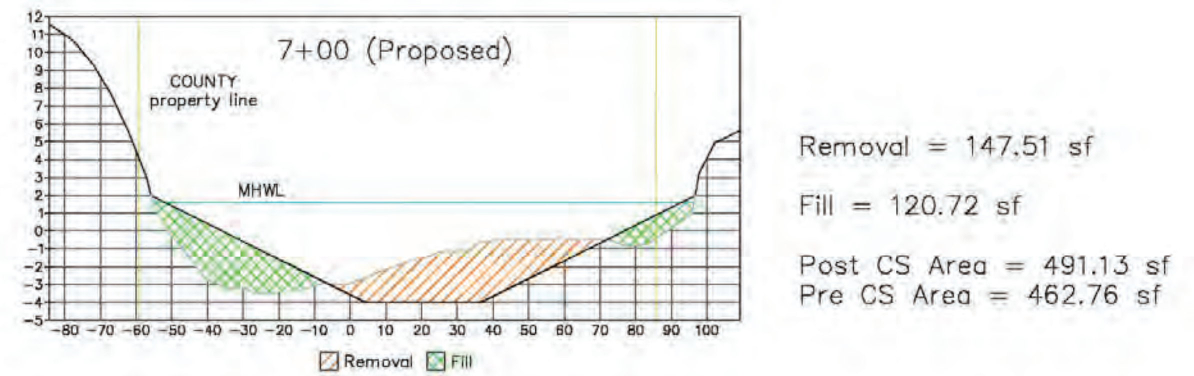

Node 30384
replaced with
30384_STA16
Pond (LIDAR used)
WEC Input
Node Name: 30384_STA16
Channel Name: 30384_CHA16
Cross Section Name: 30384_XS16
30384
30384_STA14
30384_STA16
DAM
CHA20
Average Cross Section Data
16+00 through 19+00
Weir: 30384_DAM

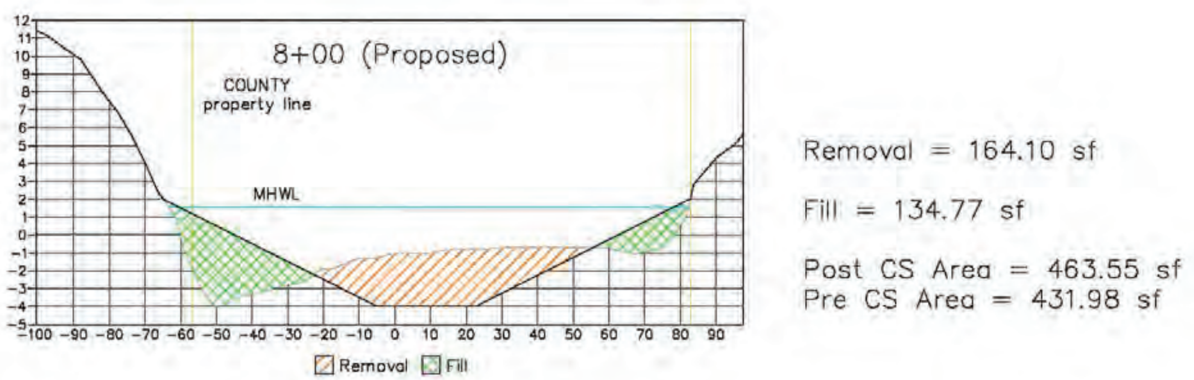

WEC Input
Node Name: 30384_STA20
Channel Name: 30384_CHA20
Cross Section Name: 30384_XS20
30384_STA20
30385
30386
WEBBER STREET
Average Cross Section Data
20+00 through 22+00

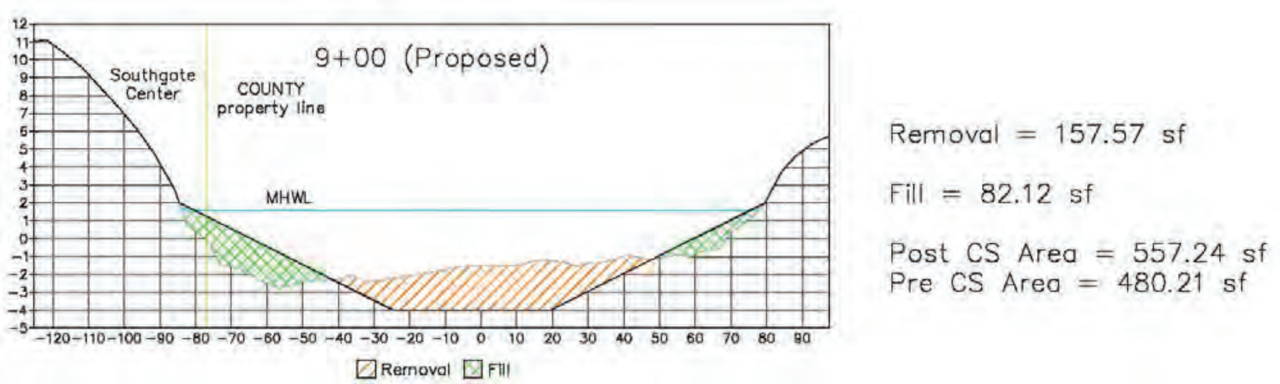
Appendix C: Sediment Removal

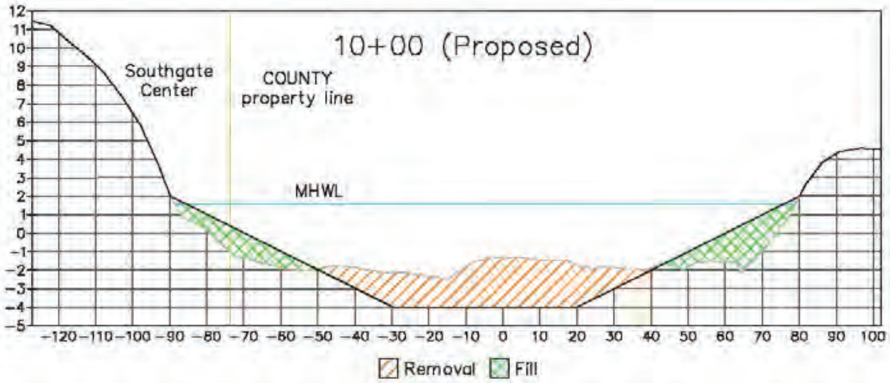
All cross sections oriented facing upstream unless otherwise noted.







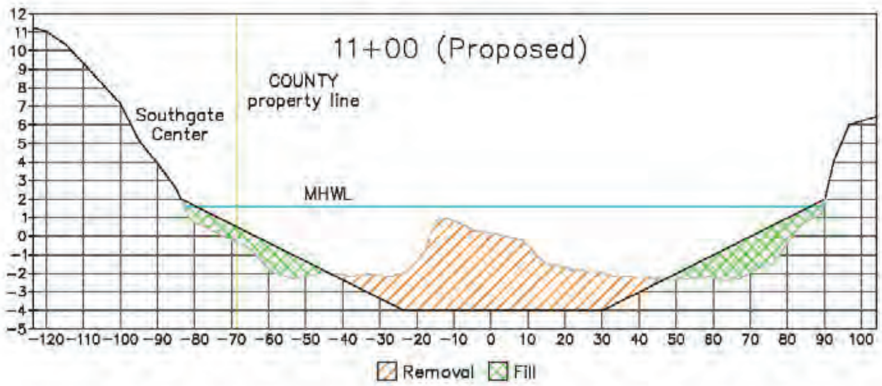




Removal = 156.12 sf

Fill = 81.94 sf

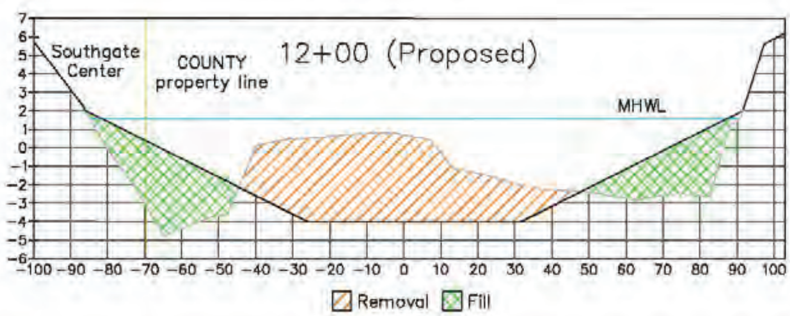
Post CS Area = 588.60 sf
Pre CS Area = 513.84 sf



Removal = 216.52 sf

Fill = 87.84 sf

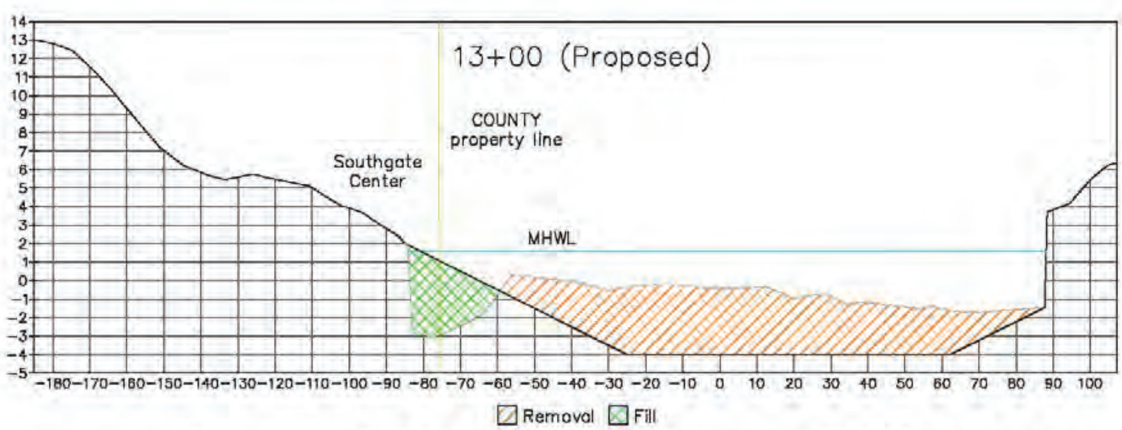
Post CS Area = 612.21 sf
Pre CS Area = 482.09 sf



Removal = 295.04 sf

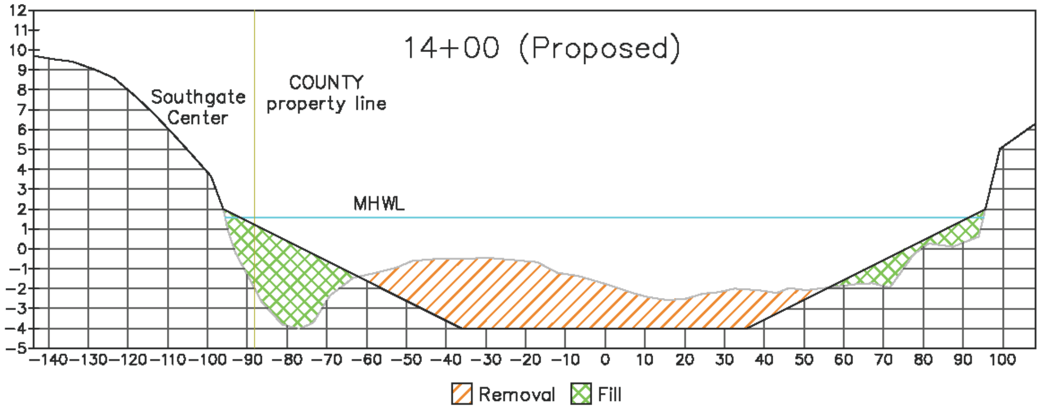
Fill = 186.36 sf

Post CS Area = 633.15 sf
Pre CS Area = 523.68 sf



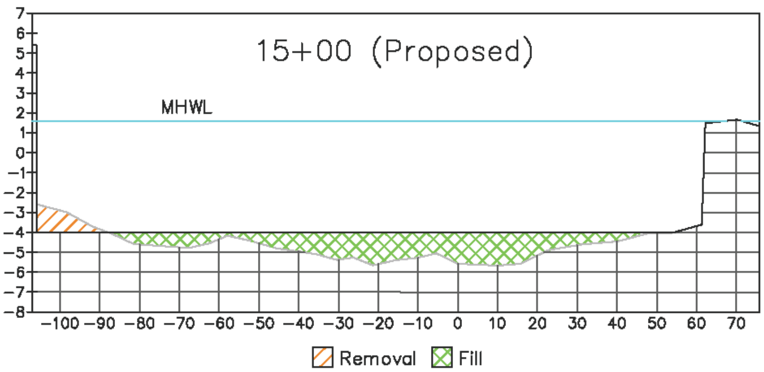
Removal = 385.16 sf
Fill = 72.88 sf

Post CS Area = 754.02 sf
Pre CS Area = 441.28 sf



Removal = 242.24 sf
Fill = 119.97 sf

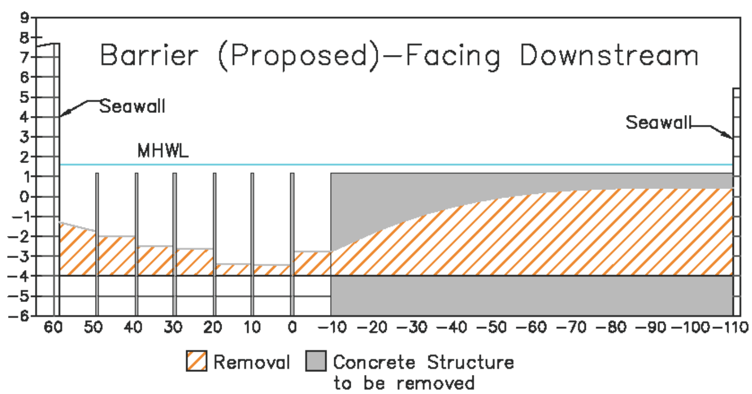
Post CS Area = 714.51 sf
Pre CS Area = 590.63 sf



Removal = 13.91 sf

Fill = 126.45 sf

Post CS Area = 937.72 sf
Pre CS Area = 1049.42 sf

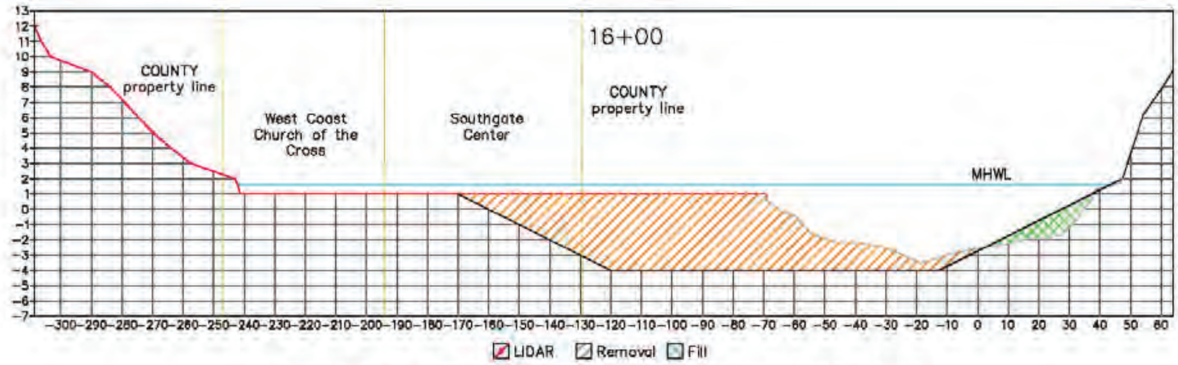


Removal = 465 sf

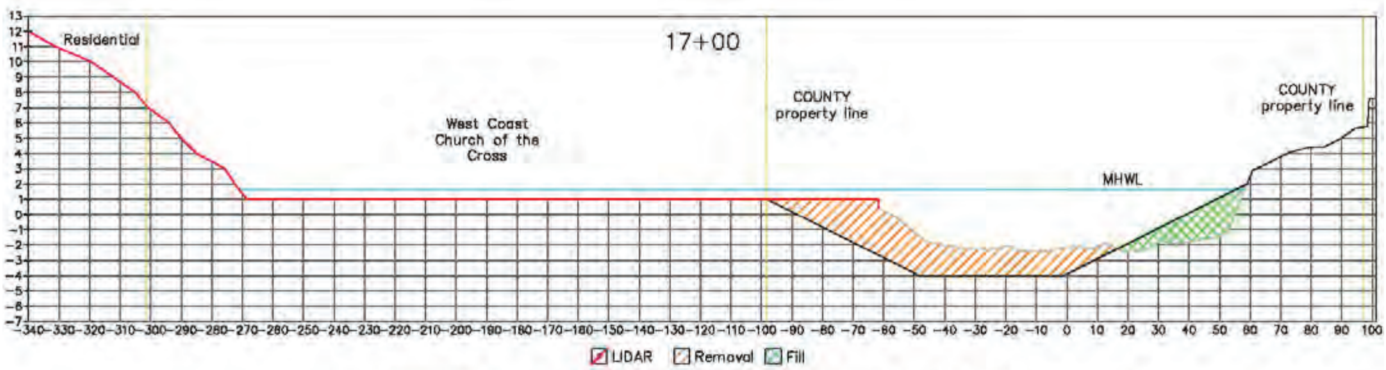
Buildup behind wall estimated

Fill = 0 sf

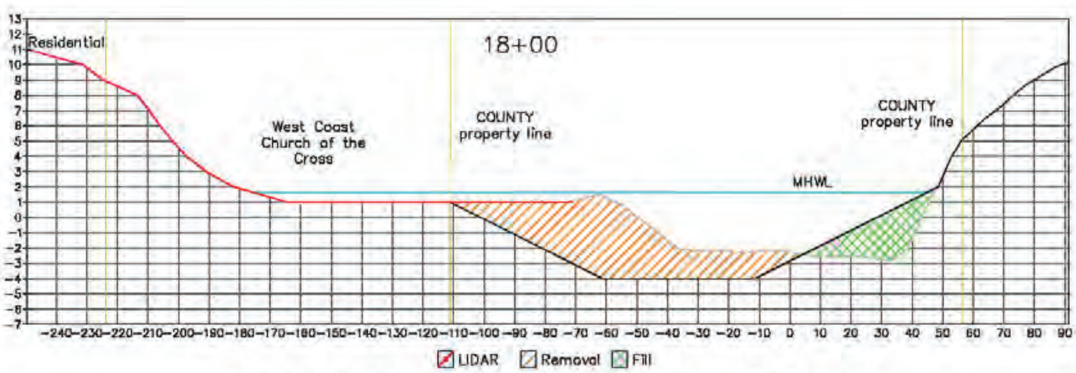
Post CS Area = 947.84 sf
Pre CS Area = 310.40 sf



Removal = 501.24 sf   Post CS Area = 955.74 sf
Fill = 31.94 sf   Pre CS Area = 485.91 sf



Removal = 211.07 sf   Post CS Area = 679.41 sf
Fill = 60.70 sf   Pre CS Area = 527.86 sf



Removal = 282.86 sf   Post CS Area = 627.78 sf
Fill = 77.95 sf   Pre CS Area = 422.19 sf

Figure 18: Sediment Drying Zone

Appendix D: Proposed Sediment Sump

Shields Method for Sediment Transport - Variables		
s	=	specific gravity of sediment
g	=	acceleration due to gravity
d	=	sediment particle diameter
v	=	kinematic viscosity of fluid
R	=	particle Reynolds number
θ_c	=	critical shields parameter for incipient motion
u	=	bed shear velocity

$$s = 2.65$$
$$g = 32.2\ \frac{ft}{sec^2}$$
$$d = 0.2\ mm = 0.000656\ ft$$
$$v_{70\,℉} = 1.052\ x\ 10^{-5}\ \frac{ft^2}{sec}$$

$$R = \frac{d\sqrt{sgd}}{v}$$
$$R = \frac{0.000656\ ft\sqrt{2.65 * 32.2\ \frac{ft}{sec^2} * 0.000656\ ft}}{1.052\ x\ 10^{-5}\ \frac{ft^2}{sec}}$$
$$R = \frac{0.000656\ ft\sqrt{0.056\ \frac{ft^2}{sec^2}}}{1.052\ x\ 10^{-5}\ \frac{ft^2}{sec}}$$
$$R = \frac{0.000656\ ft * 0.237\ \frac{ft}{sec}}{1.052\ x\ 10^{-5}\ \frac{ft^2}{sec}}$$
$$R = \frac{1.55\ x\ 10^{-4}\ \frac{ft^2}{sec}}{1.052\ x\ 10^{-5}\ \frac{ft^2}{sec}}$$
$$R = 14.73$$

$$ln\theta_C = -0.6769 lnR + 0.3542\ln[1 + (0.0223R)^{2.8358}] - 1.1296$$
$$ln\theta_C = -0.6769\ln(14.73) + 0.3542\ln[1 + (0.0223 * 14.73)^{2.8358}] - 1.1296$$
$$ln\theta_C = -2.94$$
$$\theta_C = e^{-2.94}$$
$$\theta_C = 0.053$$
$$\theta_C = \frac{u^2}{sgd}$$
$$u = \sqrt{\theta_C sgd}$$
$$u = \sqrt{0.053 * 2.65 * 32.2\ \frac{ft}{sec^2} * 0.000656\ ft}$$
$$u = 0.054\ \frac{ft}{sec}$$

Appendix E: Watershed Maximum Stage Comparison (NAVD)

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
097860	34.96	34.96	34.96	34.96	34.96
099340	41.77	41.77	41.77	41.77	41.77
30000	1.42	1.42	1.42	1.42	1.42
30001	2.76	2.69	2.73	2.70	2.74
30002	3.13	3.05	3.10	3.06	3.11
30003	3.50	3.41	3.46	3.42	3.47
30004	3.69	3.59	3.65	3.61	3.66
30005	3.75	3.65	3.71	3.66	3.72
30008	4.35	4.22	4.30	4.24	4.32
30010	5.01	4.87	4.96	4.89	4.97
30012	5.46	5.30	5.40	5.33	5.42
30014	5.92	5.75	5.85	5.79	5.87
30016	6.24	6.06	6.16	6.10	6.18
30018	6.49	6.31	6.41	6.35	6.43
30020	3.70	3.61	3.67	3.62	3.68
30021	3.72	3.62	3.68	3.64	3.69
30022	6.76	6.76	6.76	6.76	6.76
30023	11.22	11.22	11.22	11.22	11.22
30030	4.66	4.54	4.62	4.55	4.63
30031	4.70	4.58	4.66	4.59	4.67
30032	4.75	4.62	4.71	4.64	4.72
30034	7.63	7.58	7.63	7.57	7.63
30035	7.63	7.58	7.63	7.58	7.63
30036	10.27	10.27	10.27	10.27	10.27
30037	10.78	10.78	10.78	10.78	10.78
30038	10.91	10.91	10.91	10.91	10.91
30039	10.94	10.94	10.94	10.94	10.94
30041A	12.53	12.53	12.53	12.53	12.53
30042	13.47	13.47	13.47	13.47	13.47
30044	13.58	13.58	13.58	13.58	13.58
30046	13.58	13.58	13.58	13.58	13.58
30050	13.97	13.97	13.97	13.97	13.97
30052	14.72	14.72	14.72	14.72	14.72
30054	15.49	15.49	15.49	15.49	15.49
30055	13.98	13.98	13.98	13.98	13.98
30056	15.69	15.69	15.69	15.69	15.69
30058	17.30	17.30	17.30	17.30	17.30
30060	7.82	7.74	7.81	7.73	7.81
30061	12.01	11.94	12.00	11.93	12.00
30062	14.92	14.91	14.92	14.91	14.92
30063	15.25	15.25	15.25	15.25	15.25
30064	15.54	15.54	15.54	15.54	15.54
30065	15.82	15.82	15.82	15.82	15.82
30066	15.99	15.99	15.99	15.99	15.99
30067	16.08	16.08	16.08	16.08	16.08
30068	16.00	16.00	16.00	16.00	16.00

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30068A	15.99	15.99	15.99	15.99	15.99
30070	7.30	7.30	7.30	7.30	7.30
30071	12.72	12.72	12.72	12.72	12.72
30072	14.96	14.96	14.96	14.96	14.96
30073	7.76	7.76	7.76	7.76	7.76
30074	16.50	16.50	16.50	16.50	16.50
30076	5.98	5.82	5.91	5.85	5.93
30077	7.30	7.14	7.13	7.18	7.13
30078	8.71	8.55	8.54	8.59	8.54
30079	11.00	11.00	11.00	11.00	11.00
30080	12.55	12.55	12.55	12.55	12.55
30081	12.81	12.81	12.81	12.81	12.81
30082	13.15	13.15	13.15	13.15	13.15
30083	13.52	13.52	13.52	13.52	13.52
30084	13.93	13.93	13.93	13.93	13.93
30085	14.37	14.37	14.37	14.37	14.37
30086	14.75	14.75	14.75	14.75	14.75
30087	13.68	13.68	13.68	13.68	13.68
30090	17.19	17.19	17.19	17.19	17.19
30091	10.39	10.40	10.40	10.40	10.40
30092	12.12	12.12	12.12	12.12	12.12
30093	15.18	15.18	15.18	15.18	15.18
30094	15.20	15.20	15.20	15.20	15.20
30094A	15.23	15.23	15.23	15.23	15.23
30096	19.90	19.90	19.90	19.90	19.90
30097	20.86	20.86	20.86	20.86	20.86
30098	22.33	22.33	22.33	22.33	22.33
30099	23.39	23.39	23.39	23.39	23.39
30100	23.46	23.46	23.46	23.46	23.46
30100A	23.49	23.49	23.49	23.49	23.49
30105	7.04	6.85	6.95	6.89	6.98
30106	7.82	7.62	7.72	7.66	7.75
30107	8.05	7.84	7.94	7.88	7.97
30110	8.61	8.40	8.50	8.45	8.53
30111	8.78	8.58	8.67	8.62	8.70
30112	9.12	8.91	9.00	8.95	9.03
30113	9.42	9.20	9.29	9.25	9.32
30114	9.51	9.29	9.37	9.34	9.41
30116	15.57	15.57	15.57	15.57	15.57
30117	17.03	17.03	17.03	17.03	17.03
30119	20.24	20.24	20.24	20.24	20.24
30121	20.94	20.94	20.94	20.94	20.94
30124	13.90	13.90	13.90	13.90	13.90
30125	15.07	15.07	15.07	15.07	15.07
30126	18.71	18.71	18.71	18.71	18.71
30128	20.21	20.21	20.21	20.21	20.21
30129	21.30	21.30	21.30	21.30	21.30
30130	21.30	21.30	21.30	21.30	21.30
30130A	21.30	21.30	21.30	21.30	21.30
30131	21.30	21.30	21.30	21.30	21.30

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30134	10.80	10.69	10.79	10.68	10.79
30135	19.76	19.74	19.76	19.73	19.76
30136	19.89	19.88	19.89	19.87	19.89
30137	20.06	20.04	20.06	20.04	20.06
30138	20.72	20.71	20.72	20.70	20.72
30139	20.91	20.90	20.91	20.90	20.91
30140	22.03	22.02	22.03	22.02	22.03
30144	21.10	21.09	21.10	21.08	21.10
30145	22.49	22.49	22.49	22.49	22.49
30147	21.69	21.68	21.69	21.68	21.69
30148	22.37	22.37	22.37	22.37	22.37
30149	11.68	11.60	11.67	11.59	11.67
30150	5.09	4.97	5.07	4.98	5.08
30151	9.43	9.43	9.43	9.43	9.43
30152	10.22	10.22	10.22	10.22	10.22
30153	10.64	10.64	10.64	10.64	10.64
30154	11.38	11.38	11.38	11.38	11.38
30155	12.12	12.12	12.12	12.12	12.12
30156	13.44	13.44	13.44	13.44	13.44
30157	14.14	14.14	14.14	14.14	14.14
30158	14.14	14.14	14.14	14.14	14.14
30160	24.24	24.24	24.24	24.24	24.24
30161	24.11	24.11	24.11	24.11	24.11
30162	23.69	23.69	23.69	23.69	23.69
30201	19.07	19.07	19.07	19.07	19.07
30202	19.07	19.07	19.07	19.07	19.07
30204	22.01	22.01	22.01	22.01	22.01
30206	19.08	19.08	19.08	19.08	19.08
30209	19.08	19.08	19.08	19.08	19.08
30220	19.08	19.08	19.08	19.08	19.08
30221	19.14	19.14	19.14	19.14	19.14
30230	19.08	19.08	19.08	19.08	19.08
30231	19.08	19.08	19.08	19.08	19.08
30232	19.09	19.09	19.09	19.09	19.09
30235	19.08	19.08	19.08	19.08	19.08
30236	19.10	19.10	19.10	19.10	19.10
30238	26.62	26.62	26.62	26.62	26.62
30239	27.30	27.30	27.30	27.30	27.30
30241A	19.72	19.72	19.72	19.72	19.72
30242	19.71	19.71	19.71	19.71	19.71
30243	21.34	21.34	21.34	21.34	21.34
30244	21.35	21.35	21.35	21.35	21.35
30245	22.89	22.89	22.89	22.89	22.89
30246	22.30	22.30	22.30	22.30	22.30
30246A	22.30	22.30	22.30	22.30	22.30
30247	22.88	22.88	22.88	22.88	22.88
30248	19.08	19.08	19.08	19.08	19.08
30249	19.70	19.70	19.70	19.70	19.70
30251	19.69	19.69	19.69	19.69	19.69
30251A	19.69	19.69	19.69	19.69	19.69

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30252	19.70	19.70	19.70	19.70	19.70
30253	19.68	19.68	19.68	19.68	19.68
30253A	19.69	19.69	19.69	19.69	19.69
30254	19.68	19.68	19.68	19.68	19.68
30254A	19.68	19.68	19.68	19.68	19.68
30255	19.75	19.75	19.75	19.75	19.75
30255A	19.69	19.69	19.69	19.69	19.69
30255B	19.68	19.68	19.68	19.68	19.68
30256	19.67	19.67	19.67	19.67	19.67
30257	19.67	19.67	19.67	19.67	19.67
30258	19.67	19.67	19.67	19.67	19.67
30258A	19.67	19.67	19.67	19.67	19.67
30258B	19.67	19.67	19.67	19.67	19.67
30259	19.67	19.67	19.67	19.67	19.67
30260	22.65	22.65	22.65	22.65	22.65
30261	22.80	22.80	22.80	22.80	22.80
30262	22.81	22.81	22.81	22.81	22.81
30263	19.68	19.68	19.68	19.68	19.68
30264	20.10	20.10	20.10	20.10	20.10
30265	22.82	22.82	22.82	22.82	22.82
30267	21.19	21.19	21.19	21.19	21.19
30270	31.40	31.40	31.40	31.40	31.40
30271	28.09	28.09	28.09	28.09	28.09
30272	19.72	19.72	19.72	19.72	19.72
30273	31.26	31.26	31.26	31.26	31.26
30275	31.23	31.23	31.23	31.23	31.23
30276	31.27	31.27	31.27	31.27	31.27
30277	31.85	31.85	31.85	31.85	31.85
30281	19.70	19.70	19.70	19.70	19.70
30282	24.00	24.00	24.00	24.00	24.00
30283	24.10	24.10	24.10	24.10	24.10
30284	27.06	27.06	27.06	27.06	27.06
30285	27.93	27.93	27.93	27.93	27.93
30286	28.69	28.69	28.69	28.69	28.69
30288	28.57	28.57	28.57	28.57	28.57
30289	30.31	30.31	30.31	30.31	30.31
30290	29.01	29.01	29.01	29.01	29.01
30291	30.99	30.99	30.99	30.99	30.99
30292	27.80	27.80	27.80	27.80	27.80
30293	31.29	31.29	31.29	31.29	31.29
30294	30.42	30.42	30.42	30.42	30.42
30295	28.52	28.52	28.52	28.52	28.52
30296	29.51	29.51	29.51	29.51	29.51
30297	30.34	30.34	30.34	30.34	30.34
30299	28.54	28.54	28.54	28.54	28.54
30301	8.96	8.77	8.87	8.81	8.89
30302	9.11	8.97	9.05	9.00	9.06
30303	9.13	8.98	9.07	9.02	9.08
30304	13.83	13.83	13.83	13.83	13.83
30305	9.97	9.91	9.96	9.92	9.96

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30306	11.26	11.25	11.26	11.25	11.26
30307	13.44	13.44	13.44	13.44	13.44
30308	13.59	13.59	13.59	13.59	13.59
30309	17.61	17.61	17.61	17.61	17.61
30310	18.93	18.93	18.93	18.93	18.93
30312	17.88	17.87	17.87	17.87	17.87
30313	17.91	17.91	17.91	17.91	17.91
30315	18.18	18.18	18.18	18.18	18.18
30318	18.33	18.33	18.33	18.33	18.33
30322	18.40	18.39	18.39	18.39	18.39
30323	18.37	18.37	18.37	18.37	18.37
30324	20.79	20.79	20.79	20.79	20.79
30325	21.41	21.41	21.41	21.41	21.41
30326	22.83	22.83	22.83	22.83	22.83
30327	18.21	18.21	18.21	18.21	18.21
30331	25.23	25.23	25.23	25.23	25.23
30332	23.09	23.09	23.09	23.09	23.09
30333	23.10	23.10	23.10	23.10	23.10
30335	23.08	23.08	23.08	23.08	23.08
30337	28.64	28.64	28.64	28.64	28.64
30338	20.88	20.88	20.88	20.88	20.88
30339	25.49	25.49	25.49	25.49	25.49
30340	24.79	24.79	24.79	24.79	24.79
30342	29.51	29.51	29.51	29.51	29.51
30343	22.52	22.52	22.52	22.52	22.52
30344	21.14	21.14	21.14	21.14	21.14
30347	27.85	27.85	27.85	27.85	27.85
30348	29.65	29.65	29.65	29.65	29.65
30349	29.55	29.55	29.55	29.55	29.55
30350	30.31	30.31	30.31	30.31	30.31
30356	29.58	29.58	29.58	29.58	29.58
30357	31.33	31.33	31.33	31.33	31.33
30362	31.45	31.45	31.45	31.45	31.45
30363	30.49	30.49	30.49	30.49	30.49
30366	32.41	32.41	32.41	32.41	32.41
30367	32.80	32.80	32.80	32.80	32.80
30368	31.13	31.13	31.13	31.13	31.13
30369	33.24	33.24	33.24	33.24	33.24
30371	32.48	32.48	32.48	32.48	32.48
30372	32.95	32.95	32.95	32.95	32.95
30374	33.03	33.03	33.03	33.03	33.03
30380	9.75	9.59	9.67	9.64	9.71
30381	9.90	9.73	9.81	9.78	9.85
30382	10.07	9.90	9.97	9.94	10.01
30383	10.63	10.39	10.48	10.44	10.53
30384	10.82	-	-	-	-
30384_STA14	-	10.62	-	-	-
30384_STA16	-	11.23	10.75	10.71	10.79
30384_STA20	-	11.53	11.27	11.34	11.26
30384_STA5	-	10.41	10.50	10.46	10.54

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30384_STA8	-	10.51	10.61	10.57	10.65
30385	10.87	11.61	11.37	11.43	11.36
30386	10.88	11.65	11.42	11.48	11.41
30387	11.06	11.79	11.57	11.63	11.56
30388	11.24	11.94	11.72	11.78	11.71
30391	11.52	12.16	11.96	12.02	11.95
30393	11.84	12.43	12.25	12.30	12.24
30395	12.02	12.59	12.42	12.46	12.41
30396	12.03	12.60	12.49	12.52	12.50
30397	12.17	12.60	12.58	12.59	12.58
30399	12.64	13.01	12.99	13.00	12.99
30400	13.16	13.40	13.39	13.40	13.39
30401	13.50	13.69	13.68	13.69	13.68
30402	13.94	14.11	14.10	14.10	14.10
30403	14.23	14.39	14.38	14.38	14.38
30404	14.86	14.98	14.97	14.98	14.97
30405	9.76	9.60	9.68	9.65	9.72
30406	9.79	9.63	9.71	9.67	9.74
30407	10.03	9.86	9.94	9.91	9.98
30408	10.05	9.88	9.96	9.92	9.99
30410	10.80	11.16	10.71	10.68	10.75
30411	11.02	11.35	11.00	10.93	11.03
30412	11.52	11.68	11.54	11.41	11.54
30413	12.64	12.64	12.64	12.64	12.64
30414	14.56	14.56	14.56	14.56	14.56
30415	14.83	14.83	14.83	14.83	14.83
30416	15.68	15.68	15.68	15.68	15.68
30417	16.61	16.61	16.61	16.61	16.61
30418	17.14	17.14	17.14	17.14	17.14
30419	18.82	18.82	18.82	18.82	18.82
30421	12.25	12.27	12.25	12.24	12.25
30422	20.06	20.06	20.06	20.06	20.06
30423	20.90	20.90	20.90	20.90	20.90
30424	20.91	20.91	20.91	20.91	20.91
30425	14.14	14.14	14.14	14.14	14.14
30426	14.14	14.14	14.14	14.14	14.14
30427	14.14	14.14	14.14	14.14	14.14
30428	9.91	9.75	9.84	9.79	9.87
30429	9.91	9.75	9.84	9.79	9.87
30431	16.67	16.67	16.67	16.67	16.67
30432	20.59	20.59	20.59	20.59	20.59
30434	21.56	21.56	21.56	21.56	21.56
30436	22.84	22.84	22.84	22.84	22.84
30437	25.35	25.35	25.35	25.35	25.35
30438	25.37	25.37	25.37	25.37	25.37
30439	25.38	25.38	25.38	25.38	25.38
30440	25.39	25.39	25.39	25.39	25.39
30441	25.41	25.41	25.41	25.41	25.41
30442	25.48	25.48	25.48	25.48	25.48
30443	25.71	25.71	25.71	25.71	25.71

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30444	22.91	22.91	22.91	22.91	22.91
30445	22.34	22.34	22.34	22.34	22.34
30446	22.29	22.29	22.29	22.29	22.29
30447	22.29	22.29	22.29	22.29	22.29
30448	23.31	23.31	23.31	23.31	23.31
30449	23.64	23.64	23.64	23.64	23.64
30450	24.53	24.53	24.53	24.53	24.53
30451	24.98	24.98	24.98	24.98	24.98
30452	25.36	25.36	25.36	25.36	25.36
30453	25.36	25.36	25.36	25.36	25.36
30454	25.42	25.42	25.42	25.42	25.42
30455	25.40	25.40	25.40	25.40	25.40
30456	25.37	25.37	25.37	25.37	25.37
30457	25.89	25.89	25.89	25.89	25.89
30458	26.80	26.80	26.80	26.80	26.80
30459	27.47	27.47	27.47	27.47	27.47
30460	27.65	27.65	27.65	27.65	27.65
30461	27.83	27.83	27.83	27.83	27.83
30462	26.70	26.70	26.70	26.70	26.70
30463	26.83	26.83	26.83	26.83	26.83
30464	27.48	27.48	27.48	27.48	27.48
30465	27.39	27.39	27.39	27.39	27.39
30466	27.87	27.87	27.87	27.87	27.87
30467	25.45	25.45	25.45	25.45	25.45
30468	25.54	25.54	25.54	25.54	25.54
30469	26.35	26.35	26.35	26.35	26.35
30470	26.44	26.44	26.44	26.44	26.44
30473	26.57	26.57	26.57	26.57	26.57
30474	26.66	26.66	26.66	26.66	26.66
30475	26.85	26.85	26.85	26.85	26.85
30476	26.84	26.84	26.84	26.84	26.84
30477	26.57	26.57	26.57	26.57	26.57
30478	26.57	26.57	26.57	26.57	26.57
30479	26.88	26.88	26.88	26.88	26.88
30480	26.57	26.57	26.57	26.57	26.57
30482	27.08	27.08	27.08	27.08	27.08
30483	27.02	27.02	27.02	27.02	27.02
30484	27.68	27.68	27.68	27.68	27.68
30485	27.41	27.41	27.41	27.41	27.41
30486	27.68	27.68	27.68	27.68	27.68
30487	27.68	27.68	27.68	27.68	27.68
30488	27.75	27.75	27.75	27.75	27.75
30489	27.73	27.73	27.73	27.73	27.73
30490	27.92	27.92	27.92	27.92	27.92
30491	27.99	27.99	27.99	27.99	27.99
30492	28.60	28.60	28.60	28.60	28.60
30493	29.08	29.08	29.08	29.08	29.08
30494	29.42	29.42	29.42	29.42	29.42
30495	29.09	29.09	29.09	29.09	29.09
30496	29.20	29.20	29.20	29.20	29.20

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30497	29.61	29.61	29.61	29.61	29.61
30498	29.67	29.67	29.67	29.67	29.67
30499	30.55	30.55	30.55	30.55	30.55
30500	29.67	29.67	29.67	29.67	29.67
30501	29.54	29.54	29.54	29.54	29.54
30502	30.45	30.45	30.45	30.45	30.45
30503	28.74	28.74	28.74	28.74	28.74
30508	19.22	19.22	19.22	19.22	19.22
30509	19.55	19.55	19.55	19.55	19.55
30510	20.97	20.97	20.97	20.97	20.97
30511	22.11	22.11	22.11	22.11	22.11
30513	19.06	19.06	19.06	19.05	19.06
30514	19.37	19.38	19.37	19.37	19.37
30515	20.79	20.79	20.79	20.79	20.79
30516	21.20	21.20	21.20	21.20	21.20
30517	23.01	23.01	23.01	23.01	23.01
30518	26.10	26.10	26.10	26.10	26.10
30519	28.93	28.93	28.93	28.93	28.93
30520	29.94	29.94	29.94	29.94	29.94
30521	30.19	30.19	30.19	30.19	30.19
30522	30.38	30.38	30.38	30.38	30.38
30523	30.67	30.67	30.67	30.67	30.67
30524	30.75	30.75	30.75	30.75	30.75
30525	30.75	30.75	30.75	30.75	30.75
30526	29.07	29.07	29.07	29.07	29.07
30527	31.02	31.02	31.02	31.02	31.02
30528	32.95	32.95	32.95	32.95	32.95
30529	33.03	33.03	33.03	33.03	33.03
30530	19.73	19.73	19.73	19.73	19.73
30531	20.06	20.07	20.06	20.06	20.06
30532	19.42	19.42	19.42	19.42	19.42
30533	19.40	19.41	19.40	19.40	19.40
30535	22.47	22.47	22.47	22.47	22.47
30536	23.11	23.11	23.11	23.11	23.11
30537	25.37	25.37	25.37	25.37	25.37
30538	26.76	26.76	26.76	26.76	26.76
30539	28.17	28.17	28.17	28.17	28.17
30540	28.69	28.69	28.69	28.69	28.69
30541	28.81	28.81	28.81	28.81	28.81
30542	28.90	28.90	28.90	28.90	28.90
30543	29.63	29.63	29.63	29.63	29.63
30550	25.93	25.93	25.93	25.93	25.93
30552	28.67	28.67	28.67	28.67	28.67
30553	30.87	30.87	30.87	30.87	30.87
30554	31.08	31.08	31.08	31.08	31.08
30555	33.66	33.66	33.66	33.66	33.66
30556	33.25	33.25	33.25	33.25	33.25
30557	33.50	33.50	33.50	33.50	33.50
30558	25.94	25.94	25.94	25.94	25.94
30559	26.36	26.36	26.36	26.36	26.36

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30560	29.90	29.90	29.90	29.90	29.90
30561	30.66	30.66	30.66	30.66	30.66
30562	31.87	31.87	31.87	31.87	31.87
30563	33.11	33.11	33.11	33.11	33.11
30564	34.05	34.05	34.05	34.05	34.05
30565	33.27	33.27	33.27	33.27	33.27
30566	33.85	33.85	33.85	33.85	33.85
30567	33.70	33.70	33.70	33.70	33.70
30568	10.92	11.66	11.44	11.50	11.43
30569	10.95	11.68	11.46	11.52	11.45
30570	11.16	11.88	11.66	11.72	11.65
30571	11.21	11.92	11.70	11.76	11.69
30572	26.86	26.86	26.86	26.86	26.86
30573	11.15	11.79	11.57	11.65	11.56
30574	11.19	11.81	11.59	11.67	11.57
30575	11.89	12.20	12.05	12.18	12.00
30576	12.19	12.44	12.26	12.43	12.26
30577	13.31	13.36	13.33	13.36	13.33
30578	13.67	13.71	13.68	13.72	13.68
30579	13.90	13.94	13.91	13.94	13.91
30580	14.07	14.10	14.08	14.10	14.08
30581	14.18	14.21	14.19	14.21	14.19
30582	15.08	15.09	15.08	15.09	15.08
30583	16.08	16.08	16.08	16.08	16.08
30584	16.33	16.33	16.33	16.33	16.33
30585	17.33	17.33	17.33	17.33	17.33
30586	17.59	17.59	17.59	17.59	17.59
30588	14.28	14.30	14.29	14.31	14.29
30590	19.82	19.82	19.82	19.82	19.82
30591	18.31	18.32	18.32	18.32	18.32
30592	18.13	18.14	18.13	18.14	18.13
30593	16.28	16.29	16.29	16.29	16.29
30595	16.58	16.59	16.59	16.59	16.59
30597	16.77	16.78	16.78	16.78	16.78
30599	17.02	17.02	17.02	17.02	17.02
30601	17.02	17.02	17.02	17.02	17.02
30603	16.22	16.23	16.23	16.23	16.23
30604	16.80	16.80	16.80	16.80	16.80
30605	18.43	18.43	18.43	18.43	18.43
30606	19.24	19.24	19.24	19.24	19.24
30607	20.46	20.46	20.46	20.46	20.46
30608	20.89	20.89	20.89	20.89	20.89
30609	21.39	21.39	21.39	21.39	21.39
30610	22.54	22.54	22.54	22.54	22.54
30611	22.59	22.59	22.59	22.59	22.59
30612	21.41	21.41	21.41	21.41	21.41
30613	22.79	22.79	22.79	22.79	22.79
30614	11.06	11.80	11.57	11.63	11.56
30615	11.70	11.80	11.70	11.70	11.70
30616	13.73	13.73	13.73	13.73	13.73

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30617	17.65	17.65	17.65	17.65	17.65
30618	18.72	18.72	18.72	18.72	18.72
30619	11.43	12.00	11.79	11.87	11.78
30620	11.52	12.03	11.82	11.91	11.80
30621	11.52	12.03	11.82	11.91	11.80
30622	12.60	12.77	12.65	12.78	12.66
30623	13.08	13.14	13.10	13.15	13.10
30624	13.40	13.43	13.41	13.43	13.41
30626	15.15	15.15	15.15	15.15	15.15
30627	12.18	12.49	12.29	12.50	12.29
30628	18.71	18.71	18.71	18.71	18.71
30629	12.15	12.31	12.20	12.29	12.20
30630	12.39	12.44	12.41	12.44	12.41
30631	12.91	12.92	12.91	12.92	12.91
30632	13.07	13.08	13.08	13.08	13.08
30633	13.42	13.42	13.42	13.42	13.42
30634	14.02	14.02	14.02	14.02	14.02
30635	14.06	14.06	14.06	14.07	14.06
30636	14.11	14.12	14.11	14.12	14.11
30637	16.65	16.65	16.65	16.65	16.65
30638	16.66	16.66	16.66	16.66	16.66
30639	16.69	16.69	16.69	16.69	16.69
30640	16.75	16.75	16.75	16.75	16.75
30641	16.81	16.81	16.81	16.81	16.81
30642	16.84	16.84	16.84	16.84	16.84
30643	17.01	17.01	17.01	17.01	17.01
30644	14.31	14.31	14.31	14.31	14.31
30645	17.71	17.71	17.71	17.71	17.71
30646	17.74	17.74	17.74	17.74	17.74
30647	17.89	17.89	17.89	17.89	17.89
30648	17.85	17.85	17.85	17.85	17.85
30649	16.96	16.96	16.96	16.96	16.96
30650	17.03	17.03	17.03	17.03	17.03
30651	11.84	12.43	12.25	12.30	12.25
30652	12.29	12.49	12.36	12.40	12.35
30653	11.95	12.58	12.41	12.45	12.40
30654	15.71	15.74	15.72	15.74	15.72
30655	11.96	12.58	12.41	12.46	12.40
30656	14.07	14.07	14.07	14.07	14.07
30657	12.82	12.81	12.81	12.81	12.81
30658	14.94	14.93	14.93	14.93	14.93
30659	19.07	19.07	19.07	19.07	19.07
30660	12.02	12.59	12.42	12.46	12.41
30661	12.03	12.60	12.49	12.52	12.50
30662	12.09	12.60	12.43	12.47	12.42
30663	12.03	12.60	12.50	12.52	12.50
30664	25.16	25.16	25.16	25.16	25.16
30665	22.12	22.12	22.12	22.12	22.12
30666	20.06	20.06	20.06	20.06	20.06
30667	14.86	14.98	14.97	14.98	14.97

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30668	14.56	14.64	14.63	14.64	14.63
30669	14.83	14.96	14.95	14.96	14.95
30670A	15.45	15.45	15.45	15.45	15.45
30670C	13.14	13.14	13.14	13.14	13.14
30670F	12.57	12.60	12.58	12.60	12.58
30670G	12.32	12.53	12.53	12.53	12.53
30671A	13.99	14.03	14.01	14.03	14.01
30671B	12.32	12.54	12.53	12.53	12.53
30672	12.02	12.76	12.73	12.75	12.73
30673A	13.61	13.74	13.73	13.73	13.73
30673B	13.56	13.74	13.73	13.73	13.73
30673C	11.77	12.77	12.74	12.75	12.73
30674A	13.56	13.73	13.73	13.73	13.73
30674B	13.56	13.73	13.73	13.73	13.72
30674C	13.55	13.73	13.72	13.73	13.72
30674D	13.56	13.73	13.73	13.73	13.73
30674E	11.10	12.77	12.74	12.76	12.74
30675	11.10	12.77	12.74	12.76	12.74
30676	11.10	12.77	12.74	12.76	12.74
30677	11.14	12.77	12.74	12.76	12.74
30677A	11.09	12.77	12.74	12.76	12.74
30678	11.02	12.77	12.74	12.76	12.74
30678A	11.02	12.77	12.74	12.76	12.74
30679A	13.55	13.73	13.72	13.73	13.72
30679B	13.55	13.73	13.72	13.73	13.72
30679C	11.78	12.77	12.74	12.76	12.74
30679D	11.03	12.77	12.74	12.76	12.74
30680	8.90	9.18	9.13	9.15	9.13
30684	8.78	9.13	8.79	8.80	8.79
30690	8.77	9.13	8.78	8.79	8.78
30691AU	8.76	9.14	8.77	8.78	8.77
30691B	9.42	10.12	9.98	10.06	9.97
30691C	10.01	11.84	11.78	11.81	11.77
30691D	10.98	12.77	12.74	12.76	12.74
30691ED	10.98	12.77	12.74	12.76	12.74
30691EU	11.61	12.89	12.84	12.87	12.84
30691F	13.74	13.74	13.74	13.74	13.74
30691G	13.55	13.73	13.72	13.73	13.72
30692A	16.69	16.69	16.69	16.69	16.69
30692B	14.75	14.75	14.75	14.75	14.75
30692C	12.59	12.61	12.59	12.61	12.59
30693A	13.23	13.23	13.23	13.23	13.23
30693B	9.14	9.14	9.14	9.14	9.14
30694A	13.46	13.46	13.46	13.46	13.46
30694B	12.58	12.60	12.58	12.60	12.58
30694C	9.09	9.13	9.09	9.09	9.09
30695	8.85	9.13	8.85	8.85	8.85
30696A	12.64	12.64	12.64	12.64	12.64
30696B	13.66	13.66	13.66	13.66	13.66
30696C	8.77	9.13	8.78	8.79	8.78

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30697A	14.06	14.06	14.06	14.06	14.06
30697C	8.77	9.13	8.78	8.79	8.78
30698	8.77	9.13	8.78	8.79	8.78
30699	8.77	9.13	8.78	8.79	8.78
30700	13.55	13.73	13.72	13.73	13.72
30702	13.68	13.85	13.84	13.84	13.84
30704	13.99	14.13	14.12	14.12	14.12
30706	14.87	14.87	14.87	14.87	14.87
30708	15.45	15.46	15.45	15.46	15.45
30709	16.91	16.96	16.96	16.96	16.96
30710	16.94	16.99	16.99	16.99	16.99
30712	17.27	17.32	17.31	17.32	17.31
30713	17.33	17.37	17.36	17.37	17.36
30714	17.49	17.53	17.52	17.53	17.52
30715	17.73	17.76	17.75	17.76	17.75
30716	17.97	18.00	17.99	18.00	17.99
30717	18.23	18.25	18.24	18.25	18.24
30720	19.52	19.52	19.52	19.52	19.52
30721	19.66	19.66	19.66	19.66	19.66
30722	20.34	20.34	20.34	20.34	20.34
30723	20.94	20.94	20.94	20.94	20.94
30724	18.73	18.73	18.73	18.73	18.73
30725	13.97	13.97	13.97	13.97	13.97
30726	13.69	13.85	13.84	13.85	13.84
30727	15.45	15.45	15.45	15.45	15.45
30728	15.59	15.60	15.59	15.60	15.59
30729	15.94	15.94	15.94	15.94	15.94
30730	17.08	17.08	17.08	17.08	17.08
30732	18.22	18.22	18.22	18.22	18.22
30733	19.63	19.63	19.63	19.63	19.63
30734	22.12	22.12	22.12	22.12	22.12
30735	23.81	23.81	23.81	23.81	23.81
30736	19.87	19.87	19.87	19.87	19.87
30737	17.55	17.55	17.55	17.55	17.55
30738	19.13	19.13	19.13	19.13	19.13
30739	18.26	18.26	18.26	18.26	18.26
30740	17.55	17.55	17.55	17.55	17.55
30741	16.48	16.48	16.48	16.48	16.48
30742	15.31	15.32	15.31	15.32	15.31
30743	15.67	15.68	15.67	15.68	15.67
30744	16.09	16.09	16.09	16.09	16.09
30745	16.76	16.76	16.76	16.76	16.76
30746	18.69	18.69	18.69	18.69	18.69
30747	19.17	19.17	19.17	19.17	19.17
30748	19.59	19.59	19.59	19.59	19.59
30749	20.04	20.04	20.04	20.04	20.04
30750	20.63	20.63	20.63	20.63	20.63
30751	21.21	21.21	21.21	21.21	21.21
30752	21.78	21.78	21.78	21.78	21.78
30753	22.47	22.47	22.47	22.47	22.47

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30754	23.10	23.10	23.10	23.10	23.10
30755	23.28	23.28	23.28	23.28	23.28
30756	23.60	23.60	23.60	23.60	23.60
30757	25.19	25.19	25.19	25.19	25.19
30759	26.43	26.43	26.43	26.43	26.43
30761	27.35	27.35	27.35	27.35	27.35
30762	27.62	27.62	27.62	27.62	27.62
30763	27.66	27.66	27.66	27.66	27.66
30765	29.63	29.63	29.63	29.63	29.63
30767	23.09	23.09	23.09	23.09	23.09
30768	25.45	25.45	25.45	25.45	25.45
30769	23.94	23.94	23.94	23.94	23.94
30770	29.02	29.02	29.02	29.02	29.02
30775	19.13	19.13	19.13	19.13	19.13
30777	25.31	25.31	25.31	25.31	25.31
30779	23.09	23.09	23.09	23.09	23.09
30780	22.96	22.96	22.96	22.96	22.96
30781	24.84	24.84	24.84	24.84	24.84
30782	21.82	21.82	21.82	21.82	21.82
30783	18.80	18.80	18.80	18.80	18.80
30784	19.97	19.97	19.97	19.97	19.97
30785	17.86	17.89	17.88	17.89	17.88
30786	18.94	18.94	18.94	18.94	18.94
30787	22.79	22.79	22.79	22.79	22.79
30788	22.88	22.88	22.88	22.88	22.88
30790	20.65	20.65	20.65	20.65	20.65
30792	26.31	26.31	26.31	26.31	26.31
30793	28.87	28.87	28.87	28.87	28.87
30795	30.03	30.03	30.03	30.03	30.03
30800	20.93	20.93	20.93	20.93	20.93
30801	20.94	20.94	20.94	20.94	20.94
30802	20.95	20.95	20.95	20.95	20.95
30803	21.08	21.08	21.08	21.08	21.08
30804	21.47	21.47	21.47	21.47	21.47
30805	22.42	22.42	22.42	22.42	22.42
30806	23.06	23.06	23.06	23.06	23.06
30807	23.08	23.08	23.08	23.08	23.08
30808	23.89	23.89	23.89	23.89	23.89
30811	24.34	24.34	24.34	24.34	24.34
30814	24.45	24.45	24.45	24.45	24.45
30815	24.51	24.51	24.51	24.51	24.51
30816	24.52	24.52	24.52	24.52	24.52
30817	21.54	21.54	21.54	21.54	21.54
30818	21.55	21.55	21.55	21.55	21.55
30820	24.83	24.83	24.83	24.83	24.83
30821	20.88	20.88	20.88	20.88	20.88
30822	20.87	20.87	20.87	20.87	20.87
30823	20.69	20.69	20.69	20.69	20.69
30824	20.69	20.69	20.69	20.69	20.69
30825	24.17	24.17	24.17	24.17	24.17

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30826	20.87	20.87	20.87	20.87	20.87
30827	20.87	20.87	20.87	20.87	20.87
30828	20.88	20.88	20.88	20.88	20.88
30830	23.43	23.43	23.43	23.43	23.43
30831	24.09	24.09	24.09	24.09	24.09
30832	24.34	24.34	24.34	24.34	24.34
30833	26.13	26.13	26.13	26.13	26.13
30834	26.15	26.15	26.15	26.15	26.15
30835	24.34	24.34	24.34	24.34	24.34
30836	24.44	24.44	24.44	24.44	24.44
30837	24.53	24.53	24.53	24.53	24.53
30838	24.43	24.43	24.43	24.43	24.43
30840	23.09	23.09	23.09	23.09	23.09
30841	24.71	24.71	24.71	24.71	24.71
30842	24.82	24.82	24.82	24.82	24.82
30843	24.82	24.82	24.82	24.82	24.82
30844	24.84	24.84	24.84	24.84	24.84
30845	25.45	25.45	25.45	25.45	25.45
30846	25.72	25.72	25.72	25.72	25.72
30847	27.15	27.15	27.15	27.15	27.15
30848	27.15	27.15	27.15	27.15	27.15
30849	27.16	27.16	27.16	27.16	27.16
30850	24.71	24.71	24.71	24.71	24.71
30852	25.11	25.11	25.11	25.11	25.11
30853	25.57	25.57	25.57	25.57	25.57
30854	24.93	24.93	24.93	24.93	24.93
30855	25.00	25.00	25.00	25.00	25.00
30856	27.07	27.07	27.07	27.07	27.07
30857	27.42	27.42	27.42	27.42	27.42
30858	26.32	26.32	26.32	26.32	26.32
30859	25.78	25.78	25.78	25.78	25.78
30860	26.65	26.65	26.65	26.65	26.65
30861	26.96	26.96	26.96	26.96	26.96
30862	26.97	26.97	26.97	26.97	26.97
30863	27.69	27.69	27.69	27.69	27.69
30864	27.69	27.69	27.69	27.69	27.69
30865	27.71	27.71	27.71	27.71	27.71
30867	26.33	26.33	26.33	26.33	26.33
30868	25.01	25.01	25.01	25.01	25.01
30870	21.54	21.54	21.54	21.54	21.54
30871	21.67	21.67	21.67	21.67	21.67
30872	21.80	21.80	21.80	21.80	21.80
30873	21.93	21.93	21.93	21.93	21.93
30874	23.02	23.02	23.02	23.02	23.02
30875	23.45	23.45	23.45	23.45	23.45
30876	24.38	24.38	24.38	24.38	24.38
30877	23.19	23.19	23.19	23.19	23.19
30878	25.56	25.56	25.56	25.56	25.56
30879	26.32	26.32	26.32	26.32	26.32
30880	26.33	26.33	26.33	26.33	26.33

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30881	26.34	26.34	26.34	26.34	26.34
30882	26.55	26.55	26.55	26.55	26.55
30883	26.59	26.59	26.59	26.59	26.59
30886	24.55	24.55	24.55	24.55	24.55
30887	24.57	24.57	24.57	24.57	24.57
30890	24.66	24.66	24.66	24.66	24.66
30891	24.67	24.67	24.67	24.67	24.67
30892	24.66	24.66	24.66	24.66	24.66
30893	24.67	24.67	24.67	24.67	24.67
30894	25.13	25.13	25.13	25.13	25.13
30895	25.24	25.24	25.24	25.24	25.24
30896	26.40	26.40	26.40	26.40	26.40
30897	26.47	26.47	26.47	26.47	26.47
30898	28.62	28.62	28.62	28.62	28.62
30900	24.55	24.55	24.55	24.55	24.55
30901	24.57	24.57	24.57	24.57	24.57
30902	26.70	26.70	26.70	26.70	26.70
30903	24.57	24.57	24.57	24.57	24.57
30904	24.58	24.58	24.58	24.58	24.58
30905	24.66	24.66	24.66	24.66	24.66
30906	29.25	29.25	29.25	29.25	29.25
30907	24.66	24.66	24.66	24.66	24.66
30908	26.75	26.75	26.75	26.75	26.75
30909	26.86	26.86	26.86	26.86	26.86
30910	27.17	27.17	27.17	27.17	27.17
30911	27.39	27.39	27.39	27.39	27.39
30912	28.24	28.24	28.24	28.24	28.24
30913	26.24	26.24	26.24	26.24	26.24
30915	28.54	28.54	28.54	28.54	28.54
30916	28.58	28.58	28.58	28.58	28.58
30917	29.36	29.36	29.36	29.36	29.36
30918	29.97	29.97	29.97	29.97	29.97
30919	29.97	29.97	29.97	29.97	29.97
30943	24.58	24.58	24.58	24.58	24.58
30944	24.58	24.58	24.58	24.58	24.58
30945	25.43	25.43	25.43	25.43	25.43
30946	25.55	25.55	25.55	25.55	25.55
30947	24.58	24.58	24.58	24.58	24.58
30948	26.99	26.99	26.99	26.99	26.99
30949	25.58	25.58	25.58	25.58	25.58
30950	24.53	24.53	24.53	24.53	24.53
30951	24.53	24.53	24.53	24.53	24.53
30952	24.58	24.58	24.58	24.58	24.58
30953	24.58	24.58	24.58	24.58	24.58
30954	24.61	24.61	24.61	24.61	24.61
30955	24.75	24.75	24.75	24.75	24.75
30956	24.77	24.77	24.77	24.77	24.77
30957	24.77	24.77	24.77	24.77	24.77
30958	24.80	24.80	24.80	24.80	24.80
30959	24.80	24.80	24.80	24.80	24.80

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
30960	24.80	24.80	24.80	24.80	24.80
30961	24.81	24.81	24.81	24.81	24.81
30962	24.82	24.82	24.82	24.82	24.82
30963	24.77	24.77	24.77	24.77	24.77
30964	24.78	24.78	24.78	24.78	24.78
30965	24.79	24.79	24.79	24.79	24.79
30966	24.91	24.91	24.91	24.91	24.91
30967	24.79	24.79	24.79	24.79	24.79
30969	25.56	25.56	25.56	25.56	25.56
30971	25.39	25.39	25.39	25.39	25.39
30972	26.06	26.06	26.06	26.06	26.06
30973	26.44	26.44	26.44	26.44	26.44
30974	26.25	26.25	26.25	26.25	26.25
30975	24.80	24.80	24.80	24.80	24.80
30976	24.80	24.80	24.80	24.80	24.80
30977	24.87	24.87	24.87	24.87	24.87
30978	27.68	27.68	27.68	27.68	27.68
30979	26.69	26.69	26.69	26.69	26.69
30980	27.69	27.69	27.69	27.69	27.69
30981	26.25	26.25	26.25	26.25	26.25
30982	26.23	26.23	26.23	26.23	26.23
30983	26.18	26.18	26.18	26.18	26.18
30984	24.90	24.90	24.90	24.90	24.90
30985	26.01	26.01	26.01	26.01	26.01
30986	25.78	25.78	25.78	25.78	25.78
30989	25.18	25.18	25.18	25.18	25.18
30990	24.86	24.86	24.86	24.86	24.86
30991	24.91	24.91	24.91	24.91	24.91
30993	24.85	24.85	24.85	24.85	24.85
30995	25.01	25.01	25.01	25.01	25.01
30996	26.86	26.86	26.86	26.86	26.86
30997	25.15	25.15	25.15	25.15	25.15
30998	27.42	27.42	27.42	27.42	27.42
30999	25.36	25.36	25.36	25.36	25.36
31000	24.34	24.34	24.34	24.34	24.34
31001	24.41	24.41	24.41	24.41	24.41
31002	24.43	24.44	24.44	24.44	24.44
31003	25.08	25.08	25.08	25.08	25.08
31004	25.71	25.71	25.71	25.71	25.71
31007	25.77	25.77	25.77	25.77	25.77
31008	26.15	26.15	26.15	26.15	26.15
31009	26.19	26.19	26.19	26.19	26.19
31010	26.26	26.26	26.26	26.26	26.26
31011	26.35	26.35	26.35	26.35	26.35
31012	26.43	26.43	26.43	26.43	26.43
31013	26.53	26.53	26.53	26.53	26.53
31014	26.23	26.23	26.23	26.23	26.23
31015	25.72	25.72	25.72	25.72	25.72
31016	25.79	25.79	25.79	25.79	25.79
31018	25.78	25.78	25.78	25.78	25.78

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31019	25.76	25.76	25.76	25.76	25.76
31020	25.80	25.80	25.80	25.80	25.80
31022	25.85	25.85	25.85	25.85	25.85
31023	25.89	25.89	25.89	25.89	25.89
31024	25.88	25.88	25.88	25.88	25.88
31025	27.23	27.23	27.23	27.23	27.23
31026	26.21	26.21	26.21	26.21	26.21
31027	26.91	26.91	26.91	26.91	26.91
31028	26.23	26.23	26.23	26.23	26.23
31029	27.21	27.21	27.21	27.21	27.21
31030	26.20	26.20	26.20	26.20	26.20
31040	24.55	24.55	24.55	24.55	24.55
31041	24.62	24.62	24.62	24.62	24.62
31042	24.66	24.66	24.66	24.66	24.66
31044	24.82	24.82	24.82	24.82	24.82
31045	24.84	24.84	24.84	24.84	24.84
31046	24.88	24.88	24.88	24.88	24.88
31047	26.26	26.26	26.26	26.26	26.26
31048	26.35	26.35	26.35	26.35	26.35
31049	26.56	26.56	26.56	26.56	26.56
31051	24.53	24.53	24.53	24.53	24.53
31052	26.99	26.99	26.99	26.99	26.99
31053	26.18	26.18	26.18	26.18	26.18
31054	29.35	29.35	29.35	29.35	29.35
31055	27.04	27.04	27.04	27.04	27.04
31056	27.86	27.86	27.86	27.86	27.86
31057	28.67	28.67	28.67	28.67	28.67
31059	31.13	31.13	31.13	31.13	31.13
31060	30.92	30.92	30.92	30.92	30.92
31061	26.20	26.20	26.20	26.20	26.20
31062	28.98	28.98	28.98	28.98	28.98
31063	30.35	30.35	30.35	30.35	30.35
31070	29.34	29.34	29.34	29.34	29.34
31072	29.36	29.36	29.36	29.36	29.36
31073	29.39	29.39	29.39	29.39	29.39
31074	29.43	29.43	29.43	29.43	29.43
31076	29.71	29.71	29.71	29.71	29.71
31077	30.78	30.78	30.78	30.78	30.78
31100	15.15	15.27	15.26	15.27	15.26
31101	15.21	15.32	15.31	15.32	15.31
31102	15.36	15.48	15.46	15.47	15.46
31103	15.43	15.54	15.53	15.54	15.53
31104	15.85	15.93	15.92	15.93	15.92
31105	16.06	16.14	16.13	16.14	16.13
31106	16.70	16.76	16.75	16.76	16.75
31107	17.06	17.11	17.10	17.11	17.10
31108	17.73	17.76	17.75	17.76	17.75
31110	17.75	17.77	17.77	17.77	17.77
31113	17.80	17.83	17.82	17.83	17.82
31114	17.82	17.84	17.84	17.84	17.84

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31116	17.99	17.99	17.99	17.99	17.99
31117	18.11	18.11	18.11	18.11	18.11
31118	20.61	20.61	20.61	20.61	20.61
31119	20.96	20.96	20.96	20.96	20.96
31120	21.28	21.28	21.28	21.28	21.28
31122	23.47	23.47	23.47	23.47	23.47
31123	27.98	27.98	27.98	27.98	27.98
31125	15.41	15.52	15.51	15.51	15.51
31126	15.67	15.71	15.71	15.71	15.71
31127	16.06	16.14	16.13	16.14	16.13
31128	15.54	15.54	15.54	15.54	15.54
31129	16.47	16.47	16.47	16.47	16.47
31130	18.33	18.33	18.33	18.33	18.33
31131	15.65	15.65	15.65	15.65	15.65
31132	19.42	19.42	19.42	19.42	19.42
31133	19.50	19.50	19.50	19.50	19.50
31134	15.47	15.55	15.54	15.55	15.54
31135	19.00	19.00	19.00	19.00	19.00
31137	17.75	17.78	17.77	17.78	17.77
31138	17.75	17.78	17.78	17.78	17.78
31139	17.76	17.79	17.78	17.79	17.78
31140	18.53	18.53	18.53	18.53	18.53
31142	17.75	17.78	17.77	17.78	17.77
31144	18.70	18.70	18.70	18.70	18.70
31145	21.94	21.94	21.94	21.94	21.94
31146	22.98	22.98	22.98	22.98	22.98
31148	22.70	22.70	22.70	22.70	22.70
31150	19.68	19.68	19.68	19.68	19.68
31151	19.67	19.67	19.67	19.67	19.67
31152	19.87	19.87	19.87	19.87	19.87
31155	17.84	17.87	17.86	17.87	17.86
31156	18.00	18.00	18.00	18.00	18.00
31158	17.84	17.87	17.86	17.87	17.86
31160	20.65	20.65	20.65	20.65	20.65
31161	21.23	21.23	21.23	21.23	21.23
31163	20.51	20.51	20.51	20.51	20.51
31164	23.85	23.85	23.85	23.85	23.85
31166	19.54	19.54	19.54	19.54	19.54
31167	19.92	19.92	19.92	19.92	19.92
31169	17.77	17.80	17.79	17.80	17.79
31170	17.80	17.83	17.82	17.83	17.82
31172	20.96	20.96	20.96	20.96	20.96
31173	25.69	25.69	25.69	25.69	25.69
31175	27.38	27.38	27.38	27.38	27.38
31177	27.51	27.51	27.51	27.51	27.51
31178	28.06	28.06	28.06	28.06	28.06
31179	28.26	28.26	28.26	28.26	28.26
31180	28.45	28.45	28.45	28.45	28.45
31182	27.94	27.94	27.94	27.94	27.94
31185	23.17	23.17	23.17	23.17	23.17

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31186	23.72	23.72	23.72	23.72	23.72
31202	16.54	16.59	16.58	16.59	16.58
31204	16.54	16.59	16.58	16.59	16.58
31206	16.55	16.60	16.59	16.60	16.59
31208	16.54	16.59	16.58	16.59	16.58
31210	16.54	16.59	16.58	16.59	16.58
31215	16.71	16.75	16.74	16.75	16.74
31216	16.70	16.74	16.73	16.74	16.73
31218	16.65	16.69	16.69	16.69	16.69
31222	16.63	16.67	16.66	16.67	16.66
31224	16.55	16.60	16.59	16.60	16.59
31226	16.55	16.60	16.59	16.60	16.59
31228	17.71	17.71	17.71	17.71	17.71
31228A	17.93	17.93	17.93	17.93	17.93
31228B	18.01	18.01	18.01	18.01	18.01
31228C	18.12	18.12	18.12	18.12	18.12
31230	18.38	18.38	18.38	18.38	18.38
31230A	18.48	18.48	18.48	18.48	18.48
31230B	18.54	18.54	18.54	18.54	18.54
31230C	18.58	18.58	18.58	18.58	18.58
31232	18.70	18.70	18.70	18.70	18.70
31232A	18.74	18.74	18.74	18.74	18.74
31232B	19.25	19.25	19.25	19.25	19.25
31238	20.48	20.48	20.48	20.48	20.48
31240	19.69	19.69	19.69	19.69	19.69
31242	20.88	20.88	20.88	20.88	20.88
31244	23.63	23.63	23.63	23.63	23.63
31245	24.05	24.05	24.05	24.05	24.05
31246	23.98	23.98	23.98	23.98	23.98
31247	25.79	25.79	25.79	25.79	25.79
31248	23.68	23.68	23.68	23.68	23.68
31249	24.33	24.33	24.33	24.33	24.33
31250	16.70	16.74	16.73	16.74	16.73
31252	16.70	16.74	16.74	16.74	16.74
31254	16.70	16.74	16.74	16.74	16.74
31256	18.24	18.24	18.24	18.24	18.24
31258	19.87	19.87	19.87	19.87	19.87
31260	20.55	20.55	20.55	20.55	20.55
31262	20.79	20.79	20.79	20.79	20.79
31264	21.58	21.58	21.58	21.58	21.58
31270	16.84	16.84	16.84	16.84	16.84
31272	17.45	17.45	17.45	17.45	17.45
31274	18.27	18.27	18.27	18.27	18.27
31276	18.32	18.32	18.32	18.32	18.32
31278	18.76	18.76	18.76	18.76	18.76
31280	19.52	19.52	19.52	19.52	19.52
31281	21.78	21.78	21.78	21.78	21.78
31282	23.68	23.68	23.68	23.68	23.68
31283	25.50	25.50	25.50	25.50	25.50
31284	25.50	25.50	25.50	25.50	25.50

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31285	25.50	25.50	25.50	25.50	25.50
31289	23.53	23.53	23.53	23.53	23.53
31290	18.34	18.34	18.34	18.34	18.34
31292	18.85	18.85	18.85	18.85	18.85
31294	19.11	19.11	19.11	19.11	19.11
31296	19.37	19.37	19.37	19.37	19.37
31300	21.98	21.98	21.98	21.98	21.98
31301	22.55	22.55	22.55	22.55	22.55
31302	22.75	22.75	22.75	22.75	22.75
31303	22.94	22.94	22.94	22.94	22.94
31304	23.43	23.43	23.43	23.43	23.43
31305	23.48	23.48	23.48	23.48	23.48
31306	23.88	23.88	23.88	23.88	23.88
31307	24.26	24.26	24.26	24.26	24.26
31308	24.57	24.57	24.57	24.57	24.57
31309	24.90	24.90	24.90	24.90	24.90
31310	24.99	24.99	24.99	24.99	24.99
31311	25.11	25.11	25.11	25.11	25.11
31312	25.41	25.41	25.41	25.41	25.41
31314	25.92	25.92	25.92	25.92	25.92
31315	26.08	26.08	26.08	26.08	26.08
31316	26.23	26.23	26.23	26.23	26.23
31317	28.39	28.39	28.39	28.39	28.39
31318	28.45	28.45	28.45	28.45	28.45
31319	28.72	28.72	28.72	28.72	28.72
31320	28.84	28.84	28.84	28.84	28.84
31321	28.91	28.91	28.91	28.91	28.91
31322	29.40	29.40	29.40	29.40	29.40
31325	29.73	29.73	29.73	29.73	29.73
31326	29.90	29.90	29.90	29.90	29.90
31327	30.11	30.11	30.11	30.11	30.11
31328	30.11	30.11	30.11	30.11	30.11
31329	30.11	30.11	30.11	30.11	30.11
31330	30.12	30.12	30.12	30.12	30.12
31332	30.14	30.14	30.14	30.14	30.14
31334	30.15	30.15	30.15	30.15	30.15
31336	30.19	30.19	30.19	30.19	30.19
31337	30.35	30.35	30.35	30.35	30.35
31338	30.37	30.37	30.37	30.37	30.37
31339	30.75	30.75	30.75	30.75	30.75
31340	31.20	31.20	31.20	31.20	31.20
31343	32.04	32.04	32.04	32.04	32.04
31344	32.91	32.91	32.91	32.91	32.91
31346	32.96	32.96	32.96	32.96	32.96
31347	33.00	33.00	33.00	33.00	33.00
31348	33.00	33.00	33.00	33.00	33.00
31349	21.98	21.98	21.98	21.98	21.98
31350	22.85	22.85	22.85	22.85	22.85
31351	23.54	23.54	23.54	23.54	23.54
31352	25.05	25.05	25.05	25.05	25.05

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31353	25.06	25.06	25.06	25.06	25.06
31354	25.29	25.29	25.29	25.29	25.29
31355	27.31	27.31	27.31	27.31	27.31
31358	24.69	24.69	24.69	24.69	24.69
31359	24.75	24.75	24.75	24.75	24.75
31360	24.90	24.90	24.90	24.90	24.90
31361	25.36	25.36	25.36	25.36	25.36
31362	25.39	25.39	25.39	25.39	25.39
31363	25.83	25.83	25.83	25.83	25.83
31364	25.84	25.84	25.84	25.84	25.84
31365	25.88	25.88	25.88	25.88	25.88
31366	26.74	26.74	26.74	26.74	26.74
31367	26.74	26.74	26.74	26.74	26.74
31368	27.48	27.48	27.48	27.48	27.48
31369	27.57	27.57	27.57	27.57	27.57
31370	27.58	27.58	27.58	27.58	27.58
31371	28.28	28.28	28.28	28.28	28.28
31372	28.29	28.29	28.29	28.29	28.29
31373	28.43	28.43	28.43	28.43	28.43
31374	28.45	28.45	28.45	28.45	28.45
31378	25.84	25.84	25.84	25.84	25.84
31379	25.85	25.85	25.85	25.85	25.85
31381	25.85	25.85	25.85	25.85	25.85
31382	26.11	26.11	26.11	26.11	26.11
31383	27.21	27.21	27.21	27.21	27.21
31385	28.21	28.21	28.21	28.21	28.21
31387	27.57	27.57	27.57	27.57	27.57
31390	25.27	25.27	25.27	25.27	25.27
31391	25.30	25.30	25.30	25.30	25.30
31392	27.29	27.29	27.29	27.29	27.29
31393	27.66	27.66	27.66	27.66	27.66
31394	28.29	28.29	28.29	28.29	28.29
31396	28.59	28.59	28.59	28.59	28.59
31398	25.90	25.90	25.90	25.90	25.90
31400	25.88	25.88	25.88	25.88	25.88
31402	25.91	25.91	25.91	25.91	25.91
31404	27.40	27.40	27.40	27.40	27.40
31405	28.03	28.03	28.03	28.03	28.03
31406	29.95	29.95	29.95	29.95	29.95
31407	30.18	30.18	30.18	30.18	30.18
31408	30.51	30.51	30.51	30.51	30.51
31410	27.96	27.96	27.96	27.96	27.96
31411	28.55	28.55	28.55	28.55	28.55
31413	25.96	25.96	25.96	25.96	25.96
31415	28.68	28.68	28.68	28.68	28.68
31416	28.79	28.79	28.79	28.79	28.79
31417	28.88	28.88	28.88	28.88	28.88
31418	28.96	28.96	28.96	28.96	28.96
31419	28.99	28.99	28.99	28.99	28.99
31420	29.27	29.27	29.27	29.27	29.27

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31421	29.51	29.51	29.51	29.51	29.51
31422	29.84	29.84	29.84	29.84	29.84
31423	28.45	28.45	28.45	28.45	28.45
31424	28.91	28.91	28.91	28.91	28.91
31430	28.44	28.44	28.44	28.44	28.44
31432	30.27	30.27	30.27	30.27	30.27
31433	30.30	30.30	30.30	30.30	30.30
31434	31.35	31.35	31.35	31.35	31.35
31435	34.43	34.43	34.43	34.43	34.43
31436	34.43	34.43	34.43	34.43	34.43
31438	34.44	34.44	34.44	34.44	34.44
31440	28.47	28.47	28.47	28.47	28.47
31442	32.00	32.00	32.00	32.00	32.00
31444	29.49	29.49	29.49	29.49	29.49
31445	32.08	32.08	32.08	32.08	32.08
31446	30.88	30.88	30.88	30.88	30.88
31450	31.17	31.17	31.17	31.17	31.17
31451	34.25	34.25	34.25	34.25	34.25
31455	28.84	28.84	28.84	28.84	28.84
31456	29.25	29.25	29.25	29.25	29.25
31458	29.27	29.27	29.27	29.27	29.27
31460	31.20	31.20	31.20	31.20	31.20
31462	30.73	30.73	30.73	30.73	30.73
31463	31.47	31.47	31.47	31.47	31.47
31464	30.95	30.95	30.95	30.95	30.95
31468	31.90	31.90	31.90	31.90	31.90
31469	32.34	32.34	32.34	32.34	32.34
31470	29.73	29.73	29.73	29.73	29.73
31473	32.65	32.65	32.65	32.65	32.65
31500	30.13	30.13	30.13	30.13	30.13
31501	30.20	30.20	30.20	30.20	30.20
31502	30.62	30.62	30.62	30.62	30.62
31503	31.57	31.57	31.57	31.57	31.57
31504	31.62	31.62	31.62	31.62	31.62
31506	31.74	31.74	31.74	31.74	31.74
31508	31.68	31.68	31.68	31.68	31.68
31509	31.73	31.73	31.73	31.73	31.73
31510	31.97	31.97	31.97	31.97	31.97
31511	31.70	31.70	31.70	31.70	31.70
31512	31.71	31.71	31.71	31.71	31.71
31513	31.96	31.96	31.96	31.96	31.96
31514	31.79	31.79	31.79	31.79	31.79
31515	31.77	31.77	31.77	31.77	31.77
31516	31.98	31.98	31.98	31.98	31.98
31518	30.11	30.11	30.11	30.11	30.11
31519	30.11	30.11	30.11	30.11	30.11
31520	30.11	30.11	30.11	30.11	30.11
31521	30.11	30.11	30.11	30.11	30.11
31522	30.11	30.11	30.11	30.11	30.11
31524	31.25	31.25	31.25	31.25	31.25

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31525	31.25	31.25	31.25	31.25	31.25
31526	31.07	31.07	31.07	31.07	31.07
31527	31.26	31.26	31.26	31.26	31.26
31528	31.29	31.29	31.29	31.29	31.29
31532	31.04	31.04	31.04	31.04	31.04
31533	31.25	31.25	31.25	31.25	31.25
31537	30.16	30.16	30.16	30.16	30.16
31538	30.71	30.71	30.71	30.71	30.71
31539	30.92	30.92	30.92	30.92	30.92
31540	30.99	30.99	30.99	30.99	30.99
31541	33.19	33.19	33.19	33.19	33.19
31542	31.84	31.84	31.84	31.84	31.84
31543	33.20	33.20	33.20	33.20	33.20
31544	33.19	33.19	33.19	33.19	33.19
31545	31.06	31.06	31.06	31.06	31.06
31546	32.10	32.10	32.10	32.10	32.10
31547	30.77	30.77	30.77	30.77	30.77
31548	31.53	31.53	31.53	31.53	31.53
31550	32.04	32.04	32.04	32.04	32.04
31552	31.95	31.95	31.95	31.95	31.95
31553	32.40	32.40	32.40	32.40	32.40
31554	32.61	32.61	32.61	32.61	32.61
31555	33.02	33.02	33.02	33.02	33.02
31602	15.80	15.89	15.88	15.88	15.87
31603	16.08	16.16	16.15	16.16	16.15
31605	16.08	16.16	16.15	16.16	16.15
31607	16.09	16.17	16.16	16.17	16.16
31608	16.09	16.17	16.16	16.17	16.16
31609	16.09	16.17	16.16	16.17	16.16
31610	16.09	16.17	16.16	16.17	16.16
31612	16.10	16.18	16.17	16.18	16.17
31613	16.44	16.49	16.49	16.49	16.49
31614	16.43	16.48	16.47	16.48	16.47
31615	16.44	16.49	16.48	16.49	16.48
31616	16.45	16.50	16.49	16.50	16.49
31617	16.47	16.51	16.51	16.51	16.51
31618	16.52	16.56	16.56	16.56	16.56
31619	16.55	16.60	16.59	16.60	16.59
31620	17.52	17.55	17.55	17.55	17.55
31622	17.58	17.60	17.60	17.60	17.60
31623	17.58	17.60	17.60	17.60	17.60
31624	21.61	21.61	21.61	21.61	21.61
31625	17.58	17.60	17.60	17.60	17.60
31627A	27.12	27.12	27.12	27.12	27.12
31627B	27.11	27.11	27.11	27.11	27.11
31630	16.08	16.16	16.15	16.16	16.15
31640	16.08	16.16	16.15	16.16	16.15
31641	16.08	16.16	16.15	16.16	16.15
31642	16.09	16.17	16.16	16.17	16.16
31643	16.09	16.17	16.16	16.17	16.16

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31644	16.17	16.25	16.24	16.25	16.24
31645	18.44	18.44	18.44	18.44	18.44
31646	18.49	18.49	18.49	18.49	18.49
31647	19.02	19.02	19.02	19.02	19.02
31648	20.41	20.41	20.41	20.41	20.41
31649	20.62	20.62	20.62	20.62	20.62
31650	21.80	21.80	21.80	21.80	21.80
31651	22.11	22.11	22.11	22.11	22.11
31652	22.45	22.45	22.45	22.45	22.45
31653	22.47	22.47	22.47	22.47	22.47
31654	22.48	22.48	22.48	22.48	22.48
31655	22.50	22.50	22.50	22.50	22.50
31656	22.48	22.48	22.48	22.48	22.48
31661	16.09	16.17	16.16	16.17	16.16
31663	16.09	16.17	16.16	16.17	16.16
31665	16.09	16.17	16.16	16.17	16.16
31666	16.29	16.29	16.29	16.29	16.29
31668	16.31	16.31	16.31	16.31	16.31
31671	16.53	16.53	16.53	16.53	16.53
31672	18.10	18.10	18.10	18.10	18.10
31673	22.91	22.91	22.91	22.91	22.91
31674	24.45	24.45	24.45	24.45	24.45
31682	16.09	16.17	16.16	16.17	16.16
31684	16.85	16.85	16.85	16.85	16.85
31690	16.09	16.17	16.16	16.17	16.16
31692	16.10	16.18	16.17	16.18	16.17
31701	16.09	16.18	16.17	16.17	16.16
31702	16.09	16.17	16.16	16.17	16.16
31704	16.10	16.17	16.16	16.17	16.16
31707	23.33	23.33	23.33	23.33	23.33
31708	29.60	29.60	29.60	29.60	29.60
31709	28.42	28.42	28.42	28.42	28.42
31710	29.61	29.61	29.61	29.61	29.61
31711	29.61	29.61	29.61	29.61	29.61
31712	30.13	30.13	30.13	30.13	30.13
31720	24.28	24.28	24.28	24.28	24.28
31720A	24.04	24.04	24.04	24.04	24.04
31721	22.37	22.37	22.37	22.37	22.37
31722	25.42	25.42	25.42	25.42	25.42
31724	31.29	31.29	31.29	31.29	31.29
31725	31.62	31.62	31.62	31.62	31.62
31727	16.10	16.18	16.17	16.18	16.17
31728	16.10	16.18	16.17	16.18	16.17
31730	16.10	16.18	16.17	16.18	16.17
31731	16.12	16.20	16.19	16.20	16.19
31732	16.10	16.18	16.17	16.18	16.17
31733	16.13	16.22	16.21	16.21	16.20
31734	17.70	17.70	17.70	17.70	17.70
31736	16.45	16.50	16.49	16.50	16.49
31737	16.43	16.48	16.47	16.48	16.47

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31738	16.46	16.51	16.51	16.51	16.50
31742	16.52	16.57	16.56	16.57	16.56
31743	16.52	16.57	16.56	16.57	16.56
31744	17.56	17.56	17.56	17.56	17.56
31745	18.38	18.38	18.38	18.38	18.38
31745A	18.38	18.38	18.38	18.38	18.38
31746	18.55	18.55	18.55	18.55	18.55
31748	18.57	18.57	18.57	18.57	18.57
31749	17.77	17.77	17.77	17.77	17.77
31749A	18.57	18.57	18.57	18.57	18.57
31750	21.14	21.14	21.14	21.14	21.14
31750A	20.48	20.48	20.48	20.48	20.48
31751	22.04	22.04	22.04	22.04	22.04
31751A	22.04	22.04	22.04	22.04	22.04
31752	23.62	23.62	23.62	23.62	23.62
31753	34.12	34.12	34.12	34.12	34.12
31754	18.19	18.19	18.19	18.19	18.19
31755	18.38	18.38	18.38	18.38	18.38
31756	19.13	19.13	19.13	19.13	19.13
31762	17.52	17.55	17.54	17.55	17.54
31763	17.51	17.54	17.54	17.54	17.54
31764	16.52	16.57	16.56	16.57	16.56
31765	18.34	18.34	18.34	18.34	18.34
31766	19.09	19.09	19.09	19.09	19.09
31767	18.38	18.38	18.38	18.38	18.38
31770	17.52	17.55	17.55	17.55	17.55
31772	17.52	17.55	17.55	17.55	17.55
31774	18.76	18.76	18.76	18.76	18.76
31775	21.99	21.99	21.99	21.99	21.99
31777	23.22	23.22	23.22	23.22	23.22
31780	15.04	15.16	15.15	15.16	15.15
31781	15.13	15.25	15.24	15.25	15.24
31784	15.38	15.50	15.48	15.49	15.48
31786	15.55	15.66	15.64	15.65	15.64
31787	15.80	15.89	15.88	15.88	15.87
31788	15.91	15.99	15.98	15.99	15.98
31789	15.94	16.02	16.01	16.02	16.01
31790	16.03	16.11	16.10	16.10	16.10
31791	16.31	16.38	16.37	16.38	16.37
31792	16.42	16.48	16.47	16.48	16.47
31793	16.54	16.59	16.58	16.59	16.58
31794	16.68	16.72	16.72	16.72	16.72
31795	16.84	16.88	16.88	16.88	16.88
31798	17.22	17.25	17.24	17.25	17.24
31799	17.38	17.40	17.40	17.40	17.40
31799AP	17.45	17.47	17.47	17.47	17.47
31801	17.61	17.64	17.63	17.64	17.63
31802	17.76	17.78	17.77	17.78	17.77
31803	17.85	17.87	17.87	17.87	17.87
31804	18.27	18.29	18.29	18.29	18.29

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31805	18.41	18.42	18.42	18.42	18.42
31806	18.52	18.53	18.53	18.53	18.53
31807	18.27	18.29	18.29	18.29	18.29
31808	17.71	17.73	17.72	17.73	17.72
31810	15.04	15.17	15.16	15.16	15.16
31811	15.41	15.41	15.41	15.41	15.41
31812	15.40	15.52	15.50	15.51	15.50
31813	15.38	15.50	15.48	15.49	15.48
31814	15.49	15.60	15.59	15.60	15.59
31815	16.07	16.15	16.14	16.15	16.14
31816	16.07	16.15	16.14	16.15	16.14
31817	16.04	16.12	16.11	16.12	16.11
31818	16.07	16.15	16.14	16.15	16.14
31819	16.43	16.48	16.47	16.48	16.47
31821	17.06	17.07	17.07	17.07	17.07
31822	17.92	17.92	17.92	17.92	17.92
31823	17.92	17.92	17.92	17.92	17.92
31824	17.93	17.93	17.93	17.93	17.93
31825	17.93	17.93	17.93	17.93	17.93
31826	17.11	17.11	17.11	17.11	17.11
31830	16.43	16.49	16.48	16.48	16.48
31832	16.52	16.56	16.56	16.56	16.56
31833	16.52	16.56	16.56	16.56	16.56
31834	16.56	16.60	16.60	16.60	16.60
31836	16.09	16.17	16.16	16.17	16.16
31837	16.08	16.16	16.15	16.16	16.15
31838	16.44	16.49	16.48	16.49	16.48
31839	16.53	16.58	16.57	16.57	16.57
31840	16.55	16.60	16.60	16.60	16.60
31844	16.63	16.67	16.66	16.67	16.66
31845	16.58	16.62	16.61	16.62	16.61
31846	16.61	16.66	16.65	16.66	16.65
31847	16.88	16.91	16.91	16.91	16.91
31849	16.71	16.74	16.74	16.74	16.74
31850	16.71	16.75	16.74	16.75	16.74
31852	17.08	17.11	17.10	17.11	17.10
31853	16.99	17.02	17.01	17.02	17.01
31855	17.38	17.40	17.40	17.40	17.40
31857	17.61	17.63	17.63	17.63	17.63
31860	17.32	17.34	17.34	17.34	17.34
31861	17.33	17.36	17.36	17.36	17.35
31862	17.37	17.40	17.39	17.40	17.39
31863	18.59	18.59	18.59	18.59	18.59
31864	19.39	19.39	19.39	19.39	19.39
31865	21.31	21.31	21.31	21.31	21.31
31866	21.60	21.60	21.60	21.60	21.60
31868	22.51	22.51	22.51	22.51	22.51
31869	22.53	22.53	22.53	22.53	22.53
31870	22.67	22.67	22.67	22.67	22.67
31871	22.82	22.82	22.82	22.82	22.82

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31872	25.90	25.90	25.90	25.90	25.90
31873	26.41	26.41	26.41	26.41	26.41
31874	26.57	26.57	26.57	26.57	26.57
31875	28.24	28.24	28.24	28.24	28.24
31876	28.71	28.71	28.71	28.71	28.71
31877	29.21	29.21	29.21	29.21	29.21
31878	30.01	30.01	30.01	30.01	30.01
31896	31.80	31.80	31.80	31.80	31.80
31897	32.51	32.51	32.51	32.51	32.51
31898	32.82	32.82	32.82	32.82	32.82
31899	33.15	33.15	33.15	33.15	33.15
31915	34.65	34.65	34.65	34.65	34.65
31920	23.34	23.34	23.34	23.34	23.34
31921	25.03	25.03	25.03	25.03	25.03
31922	25.87	25.87	25.87	25.87	25.87
31923	26.57	26.57	26.57	26.57	26.57
31924	26.68	26.68	26.68	26.68	26.68
31925	26.85	26.85	26.85	26.85	26.85
31926	26.87	26.87	26.87	26.87	26.87
31928	28.19	28.19	28.19	28.19	28.19
31930	28.98	28.98	28.98	28.98	28.98
31931	31.02	31.02	31.02	31.02	31.02
31932	31.04	31.04	31.04	31.04	31.04
31933	31.04	31.04	31.04	31.04	31.04
31933A	31.48	31.48	31.48	31.48	31.48
31934	31.49	31.49	31.49	31.49	31.49
31935	31.98	31.98	31.98	31.98	31.98
31936	31.99	31.99	31.99	31.99	31.99
31937	32.12	32.12	32.12	32.12	32.12
31938	32.26	32.26	32.26	32.26	32.26
31939	32.40	32.40	32.40	32.40	32.40
31940	32.41	32.41	32.41	32.41	32.41
31941	32.56	32.56	32.56	32.56	32.56
31942	32.84	32.84	32.84	32.84	32.84
31943	33.41	33.41	33.41	33.41	33.41
31944	33.46	33.46	33.46	33.46	33.46
31945	33.66	33.66	33.66	33.66	33.66
31947	33.69	33.69	33.69	33.69	33.69
31948	33.70	33.70	33.70	33.70	33.70
31949	33.70	33.70	33.70	33.70	33.70
31950	33.70	33.70	33.70	33.70	33.70
31951	33.69	33.69	33.69	33.69	33.69
31952	33.70	33.70	33.70	33.70	33.70
31953	33.74	33.74	33.74	33.74	33.74
31954	34.11	34.11	34.11	34.11	34.11
31955	34.11	34.11	34.11	34.11	34.11
31956	34.50	34.50	34.50	34.50	34.50
31957	34.45	34.45	34.45	34.45	34.45
31958	34.47	34.47	34.47	34.47	34.47
31958A	34.45	34.45	34.45	34.45	34.45

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
31959A	34.51	34.51	34.51	34.51	34.51
31960	19.62	19.62	19.62	19.62	19.62
31961	19.79	19.79	19.79	19.79	19.79
31964	20.57	20.57	20.57	20.57	20.57
31969	21.20	21.20	21.20	21.20	21.20
31970	26.72	26.72	26.72	26.72	26.72
31971	27.62	27.62	27.62	27.62	27.62
31972	29.75	29.75	29.75	29.75	29.75
31973	31.02	31.02	31.02	31.02	31.02
31974	31.21	31.21	31.21	31.21	31.21
31975	34.05	34.05	34.05	34.05	34.05
31976	33.76	33.76	33.76	33.76	33.76
31977	34.10	34.10	34.10	34.10	34.10
31978	34.25	34.25	34.25	34.25	34.25
31979	34.55	34.55	34.55	34.55	34.55
31980	33.42	33.42	33.42	33.42	33.42
31981	33.42	33.42	33.42	33.42	33.42
31982	33.43	33.43	33.43	33.43	33.43
31983	33.43	33.43	33.43	33.43	33.43
31985	33.69	33.69	33.69	33.69	33.69
31986	33.86	33.86	33.86	33.86	33.86
31987	33.86	33.86	33.86	33.86	33.86
31988	34.30	34.30	34.30	34.30	34.30
31989	34.50	34.50	34.50	34.50	34.50
31990	34.59	34.59	34.59	34.59	34.59
31991	34.58	34.58	34.58	34.58	34.58
31992	34.52	34.52	34.52	34.52	34.52
31995	26.34	26.34	26.34	26.34	26.34
31996	26.36	26.36	26.36	26.36	26.36
31997	27.57	27.57	27.57	27.57	27.57
31998	27.78	27.78	27.78	27.78	27.78
31999	26.43	26.43	26.43	26.43	26.43
32000	28.71	28.71	28.71	28.71	28.71
32001	28.68	28.68	28.68	28.68	28.68
32002	28.70	28.70	28.70	28.70	28.70
32003	28.97	28.97	28.97	28.97	28.97
32006	17.38	17.40	17.40	17.40	17.40
32007	17.32	17.35	17.34	17.35	17.34
32008	17.81	17.81	17.81	17.81	17.81
32009	18.62	18.62	18.62	18.62	18.62
32010	26.87	26.87	26.87	26.87	26.87
32011	29.15	29.15	29.15	29.15	29.15
32012	25.60	25.60	25.60	25.60	25.60
32013	28.84	28.84	28.84	28.84	28.84
32014	28.82	28.82	28.82	28.82	28.82
32015	28.81	28.81	28.81	28.81	28.81
32016	28.81	28.81	28.81	28.81	28.81
32017	29.19	29.19	29.19	29.19	29.19
32020	33.70	33.70	33.70	33.70	33.70
32021	34.56	34.56	34.56	34.56	34.56

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32022	34.58	34.58	34.58	34.58	34.58
32023	34.58	34.58	34.58	34.58	34.58
32025	34.70	34.70	34.70	34.70	34.70
32026	34.72	34.72	34.72	34.72	34.72
32031	33.70	33.70	33.70	33.70	33.70
32033	34.01	34.01	34.01	34.01	34.01
32034	34.21	34.21	34.21	34.21	34.21
32035	34.38	34.38	34.38	34.38	34.38
32037	34.46	34.46	34.46	34.46	34.46
32039	34.94	34.94	34.94	34.94	34.94
32040	17.61	17.64	17.63	17.64	17.63
32041	17.61	17.63	17.63	17.63	17.63
32042	17.60	17.63	17.62	17.63	17.62
32043	17.61	17.63	17.63	17.63	17.63
32044	17.61	17.63	17.63	17.63	17.63
32045	18.20	18.20	18.20	18.20	18.20
32046	19.25	19.25	19.25	19.25	19.25
32047	17.59	17.62	17.61	17.62	17.61
32048	17.59	17.62	17.61	17.62	17.61
32049	17.59	17.62	17.61	17.62	17.61
32050	26.65	26.65	26.65	26.65	26.65
32051	25.62	25.62	25.62	25.62	25.62
32053	17.61	17.63	17.63	17.63	17.63
32055	17.62	17.64	17.64	17.64	17.64
32056	18.80	18.80	18.80	18.80	18.80
32057	22.30	22.30	22.30	22.30	22.30
32058	17.68	17.70	17.70	17.70	17.70
32059	17.68	17.70	17.70	17.70	17.70
32060	17.69	17.71	17.71	17.71	17.71
32061	19.01	19.01	19.01	19.01	19.01
32063	24.32	24.32	24.32	24.32	24.32
32064	25.30	25.30	25.30	25.30	25.30
32065	25.28	25.28	25.28	25.28	25.28
32066	17.68	17.70	17.70	17.70	17.70
32067	17.67	17.70	17.69	17.70	17.69
32068	19.04	19.04	19.04	19.04	19.04
32069	21.49	21.49	21.49	21.49	21.49
32070	20.25	20.25	20.25	20.25	20.25
32071	21.55	21.55	21.55	21.55	21.55
32072	21.63	21.63	21.63	21.63	21.63
32073	22.65	22.65	22.65	22.65	22.65
32074	23.19	23.19	23.19	23.19	23.19
32075	23.18	23.18	23.18	23.18	23.18
32076	23.05	23.05	23.05	23.05	23.05
32077	23.07	23.07	23.07	23.07	23.07
32078	22.32	22.32	22.32	22.32	22.32
32079	23.69	23.69	23.69	23.69	23.69
32080	25.60	25.60	25.60	25.60	25.60
32081	23.07	23.07	23.07	23.07	23.07
32084	26.90	26.90	26.90	26.90	26.90

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32086	27.40	27.40	27.40	27.40	27.40
32087	27.25	27.25	27.25	27.25	27.25
32088	17.70	17.72	17.71	17.72	17.71
32089	17.70	17.72	17.72	17.72	17.71
32090	17.70	17.72	17.72	17.72	17.72
32091	17.70	17.72	17.72	17.72	17.72
32092	17.70	17.72	17.72	17.72	17.72
32093	17.72	17.74	17.73	17.74	17.73
32093A	17.72	17.74	17.74	17.74	17.73
32094	19.19	19.19	19.19	19.19	19.19
32095	19.19	19.19	19.19	19.19	19.19
32095A	19.30	19.30	19.30	19.30	19.30
32096	19.45	19.45	19.45	19.45	19.45
32096A	19.15	19.15	19.15	19.15	19.15
32097	19.21	19.21	19.21	19.21	19.21
32098	18.29	18.30	18.30	18.30	18.30
32101	19.15	19.16	19.16	19.16	19.15
32102	19.42	19.42	19.42	19.42	19.42
32103	19.44	19.45	19.44	19.45	19.44
32104	19.46	19.47	19.46	19.47	19.46
32105	19.52	19.53	19.53	19.53	19.53
32108	19.56	19.56	19.56	19.56	19.56
32109	19.57	19.57	19.57	19.57	19.57
32110	19.58	19.59	19.59	19.59	19.59
32111	19.69	19.70	19.70	19.70	19.70
32112	19.73	19.74	19.74	19.74	19.74
32113	19.78	19.79	19.79	19.79	19.79
32115	19.79	19.80	19.80	19.80	19.80
32117	19.79	19.80	19.80	19.80	19.80
32117A	19.79	19.80	19.80	19.80	19.80
32117B	19.94	19.94	19.94	19.94	19.94
32117C	24.45	24.45	24.45	24.45	24.45
32117D	19.95	19.95	19.95	19.95	19.95
32120	21.21	21.21	21.21	21.21	21.21
32121	20.71	20.71	20.71	20.71	20.71
32122	20.73	20.73	20.73	20.73	20.73
32123	20.77	20.77	20.77	20.77	20.77
32123A	20.77	20.77	20.77	20.77	20.77
32125	20.98	20.99	20.99	20.99	20.99
32125A	20.96	20.96	20.96	20.96	20.96
32125B	20.96	20.96	20.96	20.96	20.96
32126	21.13	21.13	21.13	21.13	21.13
32127	21.36	21.36	21.36	21.36	21.36
32128	21.39	21.39	21.39	21.39	21.39
32129	21.64	21.64	21.64	21.64	21.64
32130	26.37	26.37	26.37	26.37	26.37
32130A	24.79	24.79	24.79	24.79	24.79
32130C	24.66	24.66	24.66	24.66	24.66
32130D	26.29	26.29	26.29	26.29	26.29
32131	24.86	24.86	24.86	24.86	24.86

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32131A	24.87	24.87	24.87	24.87	24.87
32131B	30.34	30.34	30.34	30.34	30.34
32132	25.38	25.38	25.38	25.38	25.38
32132A	27.82	27.82	27.82	27.82	27.82
32133	25.88	25.88	25.88	25.88	25.88
32134	26.07	26.07	26.07	26.07	26.07
32135	26.56	26.56	26.56	26.56	26.56
32136	26.71	26.71	26.71	26.71	26.71
32137	26.76	26.76	26.76	26.76	26.76
32138	27.12	27.12	27.12	27.12	27.12
32140	27.36	27.36	27.36	27.36	27.36
32141	27.69	27.69	27.69	27.69	27.69
32142	27.79	27.79	27.79	27.79	27.79
32143	28.57	28.57	28.57	28.57	28.57
32144	29.31	29.31	29.31	29.31	29.31
32144A	29.35	29.35	29.35	29.35	29.35
32145	29.71	29.71	29.71	29.71	29.71
32146	30.17	30.17	30.17	30.17	30.17
32147	30.41	30.41	30.41	30.41	30.41
32148	30.42	30.42	30.42	30.42	30.42
32149	30.43	30.43	30.43	30.43	30.43
32150	30.79	30.79	30.79	30.79	30.79
32151	31.49	31.49	31.49	31.49	31.49
32152	32.05	32.05	32.05	32.05	32.05
32152A	33.36	33.36	33.36	33.36	33.36
32153	32.18	32.18	32.18	32.18	32.18
32153A	32.18	32.18	32.18	32.18	32.18
32154	32.18	32.18	32.18	32.18	32.18
32155	33.76	33.76	33.76	33.76	33.76
32155A	33.70	33.70	33.70	33.70	33.70
32156	33.82	33.82	33.82	33.82	33.82
32157	33.88	33.88	33.88	33.88	33.88
32158	34.04	34.04	34.04	34.04	34.04
32170	24.94	24.94	24.94	24.94	24.94
32171	25.09	25.09	25.09	25.09	25.09
32172	25.26	25.26	25.26	25.26	25.26
32173	19.08	19.09	19.08	19.09	19.08
32174	21.15	21.15	21.15	21.15	21.15
32177	23.34	23.34	23.34	23.34	23.34
32178	24.04	24.04	24.04	24.04	24.04
32179	25.02	25.02	25.02	25.02	25.02
32180	19.56	19.57	19.57	19.57	19.57
32181	20.10	20.10	20.10	20.10	20.10
32183	19.57	19.57	19.57	19.57	19.57
32184	19.54	19.55	19.55	19.55	19.55
32185	19.57	19.57	19.57	19.57	19.57
32188	19.57	19.58	19.57	19.58	19.57
32190	19.57	19.57	19.57	19.57	19.57
32191	19.57	19.58	19.58	19.58	19.58
32192	19.57	19.58	19.58	19.58	19.58

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32193	19.57	19.57	19.57	19.57	19.57
32194	19.57	19.57	19.57	19.57	19.57
32195	19.57	19.58	19.58	19.58	19.58
32197	19.59	19.60	19.60	19.60	19.60
32198	19.60	19.61	19.61	19.61	19.61
32199	20.00	20.00	20.00	20.00	20.00
32205	19.70	19.71	19.71	19.71	19.71
32206	19.78	19.79	19.78	19.79	19.78
32207	19.78	19.79	19.78	19.79	19.78
32208	19.92	19.92	19.92	19.92	19.92
32209	22.62	22.62	22.62	22.62	22.62
32210	20.55	20.55	20.55	20.55	20.55
32211	21.78	21.78	21.78	21.78	21.78
32212	20.01	20.01	20.01	20.01	20.01
32214	23.95	23.95	23.95	23.95	23.95
32220	19.78	19.79	19.78	19.79	19.78
32221	19.78	19.79	19.78	19.79	19.78
32222	19.78	19.79	19.78	19.79	19.78
32224	19.78	19.79	19.79	19.79	19.79
32226	19.78	19.79	19.79	19.79	19.79
32227	19.78	19.79	19.79	19.79	19.79
32227A	20.77	20.78	20.78	20.78	20.78
32228	21.13	21.13	21.13	21.13	21.13
32228A	21.36	21.37	21.36	21.37	21.36
32228B	21.13	21.13	21.13	21.13	21.13
32228C	21.13	21.13	21.13	21.13	21.13
32230	21.39	21.39	21.39	21.39	21.39
32231	21.39	21.39	21.39	21.39	21.39
32235	28.22	28.22	28.22	28.22	28.22
32236	28.27	28.27	28.27	28.27	28.27
32237	28.32	28.32	28.32	28.32	28.32
32238	28.32	28.32	28.32	28.32	28.32
32240	27.11	27.11	27.11	27.11	27.11
32241	27.37	27.37	27.37	27.37	27.37
32242	28.16	28.16	28.16	28.16	28.16
32243	28.16	28.16	28.16	28.16	28.16
32244	28.16	28.16	28.16	28.16	28.16
32245	28.16	28.16	28.16	28.16	28.16
32246	28.16	28.16	28.16	28.16	28.16
32247	28.16	28.16	28.16	28.16	28.16
32248	28.17	28.17	28.17	28.17	28.17
32249	28.17	28.17	28.17	28.17	28.17
32250	28.23	28.23	28.23	28.23	28.23
32251	29.00	29.00	29.00	29.00	29.00
32253	30.26	30.26	30.26	30.26	30.26
32254	30.43	30.43	30.43	30.43	30.43
32257	29.98	29.98	29.98	29.98	29.98
32258	29.64	29.64	29.64	29.64	29.64
32260	32.06	32.06	32.06	32.06	32.06
32261	35.88	35.88	35.88	35.88	35.88

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32262	36.89	36.89	36.89	36.89	36.89
32264	30.41	30.41	30.41	30.41	30.41
32265	30.45	30.45	30.45	30.45	30.45
32266	30.51	30.51	30.51	30.51	30.51
32267	30.71	30.71	30.71	30.71	30.71
32268	30.77	30.77	30.77	30.77	30.77
32270	36.50	36.50	36.50	36.50	36.50
32271	32.64	32.64	32.64	32.64	32.64
32272	32.78	32.78	32.78	32.78	32.78
32273	32.92	32.92	32.92	32.92	32.92
32274	30.80	30.80	30.80	30.80	30.80
32276	30.79	30.79	30.79	30.79	30.79
32277	31.70	31.70	31.70	31.70	31.70
32278	32.00	32.00	32.00	32.00	32.00
32280	33.33	33.33	33.33	33.33	33.33
32283	31.69	31.69	31.69	31.69	31.69
32284	31.70	31.70	31.70	31.70	31.70
32285	31.74	31.74	31.74	31.74	31.74
32286	31.78	31.78	31.78	31.78	31.78
32287	31.86	31.86	31.86	31.86	31.86
32288	31.89	31.89	31.89	31.89	31.89
32289	31.97	31.97	31.97	31.97	31.97
32290	32.54	32.54	32.54	32.54	32.54
32291	31.76	31.76	31.76	31.76	31.76
32292	31.88	31.88	31.88	31.88	31.88
32293	32.49	32.49	32.49	32.49	32.49
32295	33.33	33.33	33.33	33.33	33.33
32298	32.05	32.05	32.05	32.05	32.05
32299	32.08	32.08	32.08	32.08	32.08
32301	32.13	32.13	32.13	32.13	32.13
32302	32.36	32.36	32.36	32.36	32.36
32303	32.74	32.74	32.74	32.74	32.74
32306	32.96	32.96	32.96	32.96	32.96
32308	34.31	34.31	34.31	34.31	34.31
32309	34.26	34.26	34.26	34.26	34.26
32312	32.40	32.40	32.40	32.40	32.40
32313	32.56	32.56	32.56	32.56	32.56
32315	34.61	34.61	34.61	34.61	34.61
32317	36.69	36.69	36.69	36.69	36.69
32318	33.76	33.76	33.76	33.76	33.76
32319	34.31	34.31	34.31	34.31	34.31
32320	34.01	34.01	34.01	34.01	34.01
32322	37.13	37.13	37.13	37.13	37.13
32324	34.58	34.58	34.58	34.58	34.58
32327	34.83	34.83	34.83	34.83	34.83
32329	34.83	34.83	34.83	34.83	34.83
32330	34.69	34.69	34.69	34.69	34.69
32331	34.89	34.89	34.89	34.89	34.89
32332	34.81	34.81	34.81	34.81	34.81
32335	34.42	34.42	34.42	34.42	34.42

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32400	19.77	19.78	19.78	19.78	19.78
32401A	19.75	19.76	19.75	19.76	19.75
32401B	19.77	19.77	19.77	19.77	19.77
32402	19.79	19.80	19.80	19.80	19.80
32403	19.81	19.81	19.81	19.81	19.81
32405	19.93	19.93	19.93	19.93	19.93
32406	19.95	19.96	19.96	19.96	19.96
32407	19.95	19.96	19.96	19.96	19.96
32408	20.44	20.44	20.44	20.44	20.44
32409	20.46	20.46	20.46	20.46	20.46
32410	21.06	21.06	21.06	21.06	21.06
32411	21.59	21.59	21.59	21.59	21.59
32412	21.61	21.61	21.61	21.61	21.61
32414	24.72	24.72	24.72	24.72	24.72
32415	25.93	25.93	25.93	25.93	25.93
32418	21.31	21.31	21.31	21.31	21.31
32421	22.16	22.16	22.16	22.16	22.16
32424	19.94	19.94	19.94	19.94	19.94
32425	19.94	19.94	19.94	19.94	19.94
32426	19.94	19.95	19.94	19.95	19.94
32427	19.95	19.95	19.95	19.95	19.95
32428	20.03	20.03	20.03	20.03	20.03
32429	22.07	22.07	22.07	22.07	22.07
32430	23.43	23.43	23.43	23.43	23.43
32432	27.11	27.11	27.11	27.11	27.11
32433	27.19	27.19	27.19	27.19	27.19
32434	19.60	19.60	19.60	19.60	19.60
32435	20.85	20.85	20.85	20.85	20.85
32436	21.39	21.39	21.39	21.39	21.39
32437	22.05	22.05	22.05	22.05	22.05
32440	22.66	22.66	22.66	22.66	22.66
32441	23.60	23.60	23.60	23.60	23.60
32442	24.15	24.15	24.15	24.15	24.15
32443	27.27	27.27	27.27	27.27	27.27
32444	29.19	29.19	29.19	29.19	29.19
32446	20.70	20.70	20.70	20.70	20.70
32447	20.24	20.24	20.24	20.24	20.24
32450	23.92	23.92	23.92	23.92	23.92
32452	21.38	21.38	21.38	21.38	21.38
32455	20.15	20.16	20.15	20.16	20.15
32456	22.11	22.11	22.11	22.11	22.11
32458	19.95	19.96	19.96	19.96	19.96
32460	21.48	21.48	21.48	21.48	21.48
32464	27.17	27.17	27.17	27.17	27.17
32470	29.06	29.06	29.06	29.06	29.06
32471	28.29	28.29	28.29	28.29	28.29
32472	26.22	26.22	26.22	26.22	26.22
32473	28.37	28.37	28.37	28.37	28.37
32474	24.87	24.87	24.87	24.87	24.87
32474A	26.22	26.22	26.22	26.22	26.22

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32474B	26.92	26.92	26.92	26.92	26.92
32474C	26.23	26.23	26.23	26.23	26.23
32474MH	24.86	24.86	24.86	24.86	24.86
32475	30.05	30.05	30.05	30.05	30.05
32482	27.73	27.73	27.73	27.73	27.73
32483	27.16	27.16	27.16	27.16	27.16
32500	19.79	19.80	19.79	19.80	19.79
32501	19.80	19.81	19.81	19.81	19.81
32502	20.04	20.05	20.05	20.05	20.05
32503	20.05	20.06	20.05	20.06	20.05
32504	20.06	20.06	20.06	20.06	20.06
32505	20.06	20.06	20.06	20.06	20.06
32506	20.06	20.07	20.07	20.07	20.07
32507	20.06	20.06	20.06	20.06	20.06
32508	20.06	20.06	20.06	20.06	20.06
32509	20.07	20.07	20.07	20.07	20.07
32510	20.77	20.77	20.77	20.77	20.77
32511	20.07	20.07	20.07	20.07	20.07
32512	20.07	20.07	20.07	20.07	20.07
32513	20.07	20.07	20.07	20.07	20.07
32518	26.80	26.80	26.80	26.80	26.80
32530	20.06	20.07	20.06	20.07	20.06
32531	20.06	20.07	20.06	20.07	20.06
32532	20.06	20.07	20.06	20.07	20.06
32533	20.06	20.07	20.06	20.07	20.06
32534	20.07	20.07	20.07	20.07	20.07
32535	20.07	20.07	20.07	20.07	20.07
32537	27.60	27.60	27.60	27.60	27.60
32538	20.72	20.72	20.72	20.72	20.72
32540	20.06	20.06	20.06	20.06	20.06
32549	21.54	21.54	21.54	21.54	21.54
32550	22.85	22.85	22.85	22.85	22.85
32552	27.35	27.35	27.35	27.35	27.35
32553	27.42	27.42	27.42	27.42	27.42
32555	22.85	22.85	22.85	22.85	22.85
32559	25.39	25.39	25.39	25.39	25.39
32560	25.41	25.41	25.41	25.41	25.41
32561	25.50	25.50	25.50	25.50	25.50
32575	30.82	30.82	30.82	30.82	30.82
32576	31.83	31.83	31.83	31.83	31.83
32577	31.98	31.98	31.98	31.98	31.98
32578	32.10	32.10	32.10	32.10	32.10
32579	32.06	32.06	32.06	32.06	32.06
32601	21.42	21.42	21.42	21.42	21.42
32602	21.60	21.60	21.60	21.60	21.60
32604	22.55	22.55	22.55	22.55	22.55
32605	21.68	21.68	21.68	21.68	21.68
32606	21.86	21.86	21.86	21.86	21.86
32606A	21.90	21.90	21.90	21.90	21.90
32607	21.95	21.95	21.95	21.95	21.95

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32608	21.95	21.95	21.95	21.95	21.95
32609	21.96	21.96	21.96	21.96	21.96
32610	22.03	22.03	22.03	22.03	22.03
32611	22.09	22.09	22.09	22.09	22.09
32612	22.10	22.10	22.10	22.10	22.10
32614	22.12	22.12	22.12	22.12	22.12
32615	22.15	22.15	22.15	22.15	22.15
32616	22.28	22.28	22.28	22.28	22.28
32619	22.37	22.37	22.37	22.37	22.37
32620	23.91	23.91	23.91	23.91	23.91
32621	23.98	23.98	23.98	23.98	23.98
32622	24.42	24.42	24.42	24.42	24.42
32623	24.52	24.52	24.52	24.52	24.52
32624	24.53	24.53	24.53	24.53	24.53
32625	25.07	25.07	25.07	25.07	25.07
32626	25.92	25.92	25.92	25.92	25.92
32627	25.92	25.92	25.92	25.92	25.92
32628	24.57	24.57	24.57	24.57	24.57
32629	23.29	23.29	23.29	23.29	23.29
32630	22.05	22.05	22.05	22.05	22.05
32631	22.23	22.23	22.23	22.23	22.23
32632	22.60	22.60	22.60	22.60	22.60
32633	23.59	23.59	23.59	23.59	23.59
32635	27.50	27.50	27.50	27.50	27.50
32636	27.66	27.66	27.66	27.66	27.66
32637	27.54	27.54	27.54	27.54	27.54
32640	27.82	27.82	27.82	27.82	27.82
32642	29.10	29.10	29.10	29.10	29.10
32643	29.36	29.36	29.36	29.36	29.36
32645	29.85	29.85	29.85	29.85	29.85
32646	29.84	29.84	29.84	29.84	29.84
32647	30.05	30.05	30.05	30.05	30.05
32648	30.09	30.09	30.09	30.09	30.09
32656	30.46	30.46	30.46	30.46	30.46
32660	25.42	25.42	25.42	25.42	25.42
32661	27.25	27.25	27.25	27.25	27.25
32661A	23.76	23.76	23.76	23.76	23.76
32662	28.60	28.60	28.60	28.60	28.60
32665	27.74	27.74	27.74	27.74	27.74
32666	28.01	28.01	28.01	28.01	28.01
32667	28.49	28.49	28.49	28.49	28.49
32668	28.59	28.59	28.59	28.59	28.59
32670	29.19	29.19	29.19	29.19	29.19
32672	28.10	28.10	28.10	28.10	28.10
32673	28.33	28.33	28.33	28.33	28.33
32674	28.78	28.78	28.78	28.78	28.78
32675	28.89	28.89	28.89	28.89	28.89
32677	28.13	28.13	28.13	28.13	28.13
32678	28.76	28.76	28.76	28.76	28.76
32680	27.80	27.80	27.80	27.80	27.80

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32681	27.15	27.15	27.15	27.15	27.15
32685	22.31	22.31	22.31	22.31	22.31
32685A	22.33	22.33	22.33	22.33	22.33
32686	22.45	22.45	22.45	22.45	22.45
32687	22.46	22.47	22.47	22.47	22.47
32688	22.48	22.48	22.48	22.48	22.48
32690	22.49	22.49	22.49	22.49	22.49
32691	22.49	22.49	22.49	22.49	22.49
32692	26.93	26.93	26.93	26.93	26.93
32693	26.50	26.50	26.50	26.50	26.50
32695	22.49	22.49	22.49	22.49	22.49
32696	23.50	23.50	23.50	23.50	23.50
32697	23.31	23.31	23.31	23.31	23.31
32698	24.14	24.14	24.14	24.14	24.14
32699	22.94	22.94	22.94	22.94	22.94
32700	21.97	21.97	21.97	21.97	21.97
32701	21.95	21.95	21.95	21.95	21.95
32702	21.97	21.97	21.97	21.97	21.97
32703	21.99	21.99	21.99	21.99	21.99
32704	26.63	26.63	26.63	26.63	26.63
32705	26.71	26.71	26.71	26.71	26.71
32706	26.74	26.74	26.74	26.74	26.74
32707	26.75	26.75	26.75	26.75	26.75
32708	26.76	26.76	26.76	26.76	26.76
32711	28.37	28.37	28.37	28.37	28.37
32712	28.41	28.41	28.41	28.41	28.41
32713	28.41	28.41	28.41	28.41	28.41
32714	28.40	28.40	28.40	28.40	28.40
32715	27.64	27.64	27.64	27.64	27.64
32716	27.64	27.64	27.64	27.64	27.64
32718	27.64	27.64	27.64	27.64	27.64
32719	27.74	27.74	27.74	27.74	27.74
32720	27.74	27.74	27.74	27.74	27.74
32721	27.74	27.74	27.74	27.74	27.74
32725	22.08	22.08	22.08	22.08	22.08
32726	22.04	22.04	22.04	22.04	22.04
32728	26.71	26.71	26.71	26.71	26.71
32729	26.71	26.71	26.71	26.71	26.71
32732	22.30	22.30	22.30	22.30	22.30
32734	22.67	22.67	22.67	22.67	22.67
32736	23.07	23.07	23.07	23.07	23.07
32737	23.08	23.08	23.08	23.08	23.08
32738	23.47	23.47	23.47	23.47	23.47
32740	22.36	22.36	22.36	22.36	22.36
32741	22.44	22.44	22.44	22.44	22.44
32742	25.11	25.11	25.11	25.11	25.11
32743	24.61	24.61	24.61	24.61	24.61
32744	25.38	25.38	25.38	25.38	25.38
32745	26.36	26.36	26.36	26.36	26.36
32747	22.79	22.79	22.79	22.79	22.79

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32748	23.47	23.47	23.47	23.47	23.47
32749	24.59	24.59	24.59	24.59	24.59
32752	21.62	21.62	21.62	21.62	21.62
32754	25.18	25.18	25.18	25.18	25.18
32755	28.54	28.54	28.54	28.54	28.54
32756	24.90	24.90	24.90	24.90	24.90
32758	25.70	25.70	25.70	25.70	25.70
32760	22.09	22.09	22.09	22.09	22.09
32761	23.51	23.51	23.51	23.51	23.51
32765	24.34	24.34	24.34	24.34	24.34
32768	23.95	23.95	23.95	23.95	23.95
32770	23.39	23.39	23.39	23.39	23.39
32773	19.61	19.62	19.62	19.62	19.62
32774	22.36	22.36	22.36	22.36	22.36
32775	19.62	19.62	19.62	19.62	19.62
32776	20.65	20.65	20.65	20.65	20.65
32777	22.29	22.29	22.29	22.29	22.29
32778	22.86	22.86	22.86	22.86	22.86
32779	22.88	22.88	22.88	22.88	22.88
32780	23.04	23.04	23.04	23.04	23.04
32781	23.07	23.07	23.07	23.07	23.07
32782	23.56	23.56	23.56	23.56	23.56
32783	26.08	26.08	26.08	26.08	26.08
32784	26.13	26.13	26.13	26.13	26.13
32785	28.93	28.93	28.93	28.93	28.93
32787	27.75	27.75	27.75	27.75	27.75
32789	27.47	27.47	27.47	27.47	27.47
32794	26.31	26.31	26.31	26.31	26.31
32795	26.47	26.47	26.47	26.47	26.47
32796	26.47	26.47	26.47	26.47	26.47
32797	26.49	26.49	26.49	26.49	26.49
32798	26.50	26.50	26.50	26.50	26.50
32801	18.29	18.30	18.30	18.30	18.30
32802	18.18	18.20	18.19	18.20	18.19
32803	18.31	18.32	18.31	18.32	18.31
32805	20.89	20.89	20.89	20.89	20.89
32806	20.97	20.97	20.97	20.97	20.97
32807	22.08	22.08	22.08	22.08	22.08
32808	22.18	22.18	22.18	22.18	22.18
32809	22.52	22.53	22.53	22.53	22.53
32810	25.18	25.18	25.18	25.18	25.18
32811	26.65	26.65	26.65	26.65	26.65
32812	27.14	27.14	27.14	27.14	27.14
32812A	26.78	26.78	26.78	26.78	26.78
32813	30.39	30.39	30.39	30.39	30.39
32814	30.39	30.39	30.39	30.39	30.39
32815	30.39	30.39	30.39	30.39	30.39
32816	30.49	30.49	30.49	30.49	30.49
32817	33.18	33.18	33.18	33.18	33.18
32818	34.27	34.27	34.27	34.27	34.27

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32819	33.96	33.96	33.96	33.96	33.96
32820	33.78	33.78	33.78	33.78	33.78
32821	18.53	18.54	18.53	18.54	18.53
32822	18.31	18.32	18.31	18.32	18.31
32823	18.46	18.46	18.46	18.46	18.46
32824	19.15	19.15	19.15	19.15	19.15
32825	19.15	19.16	19.15	19.16	19.15
32826	19.19	19.19	19.19	19.19	19.19
32828	19.19	19.19	19.19	19.19	19.19
32830	18.83	18.83	18.83	18.83	18.83
32831	20.42	20.42	20.42	20.42	20.42
32832	20.52	20.52	20.52	20.52	20.52
32833	20.58	20.58	20.58	20.58	20.58
32834	20.70	20.70	20.70	20.70	20.70
32835	21.17	21.17	21.17	21.17	21.17
32836	22.43	22.43	22.43	22.43	22.43
32837	22.97	22.97	22.97	22.97	22.97
32838	23.46	23.46	23.46	23.46	23.46
32839	23.68	23.68	23.68	23.68	23.68
32840	23.86	23.86	23.86	23.86	23.86
32842	24.07	24.07	24.07	24.07	24.07
32844	24.04	24.04	24.04	24.04	24.04
32845	20.62	20.62	20.62	20.62	20.62
32847	19.93	19.93	19.93	19.93	19.93
32849	21.55	21.55	21.55	21.55	21.55
32850	22.01	22.01	22.01	22.01	22.01
32850A	21.01	21.01	21.01	21.01	21.01
32851	23.68	23.68	23.68	23.68	23.68
32851A	22.96	22.96	22.96	22.96	22.96
32852	23.90	23.90	23.90	23.90	23.90
32852A	23.68	23.68	23.68	23.68	23.68
32853	24.56	24.56	24.56	24.56	24.56
32854	24.79	24.79	24.79	24.79	24.79
32855	24.63	24.63	24.63	24.63	24.63
32856	23.88	23.88	23.88	23.88	23.88
32857	23.56	23.56	23.56	23.56	23.56
32858	23.22	23.22	23.22	23.22	23.22
32859	22.75	22.75	22.75	22.75	22.75
32861	22.01	22.01	22.01	22.01	22.01
32862	22.06	22.06	22.06	22.06	22.06
32863	21.56	21.56	21.56	21.56	21.56
32864	23.64	23.64	23.64	23.64	23.64
32865	24.40	24.40	24.40	24.40	24.40
32866	24.43	24.43	24.43	24.43	24.43
32870	25.37	25.37	25.37	25.37	25.37
32871	25.75	25.75	25.75	25.75	25.75
32872	25.75	25.75	25.75	25.75	25.75
32873	26.47	26.47	26.47	26.47	26.47
32874	26.98	26.98	26.98	26.98	26.98
32875	25.91	25.91	25.91	25.91	25.91

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32876	26.26	26.26	26.26	26.26	26.26
32879	29.67	29.67	29.67	29.67	29.67
32880	33.14	33.14	33.14	33.14	33.14
32881	34.95	34.95	34.95	34.95	34.95
32882	35.15	35.15	35.15	35.15	35.15
32883	35.24	35.24	35.24	35.24	35.24
32884	35.37	35.37	35.37	35.37	35.37
32885	36.26	36.26	36.26	36.26	36.26
32886	36.26	36.26	36.26	36.26	36.26
32887	35.80	35.80	35.80	35.80	35.80
32888	36.27	36.27	36.27	36.27	36.27
32889	37.16	37.16	37.16	37.16	37.16
32890	27.63	27.63	27.63	27.63	27.63
32891	28.94	28.94	28.94	28.94	28.94
32892	31.18	31.18	31.18	31.18	31.18
32894	31.20	31.20	31.20	31.20	31.20
32901	24.17	24.17	24.17	24.17	24.17
32902	24.19	24.19	24.19	24.19	24.19
32903	25.06	25.06	25.06	25.06	25.06
32904	25.54	25.54	25.54	25.54	25.54
32905	29.03	29.03	29.03	29.03	29.03
32910	23.00	23.00	23.00	23.00	23.00
32911	23.83	23.83	23.83	23.83	23.83
32912	22.42	22.42	22.42	22.42	22.42
32913	23.37	23.37	23.37	23.37	23.37
32914	25.00	25.00	25.00	25.00	25.00
32915	20.55	20.55	20.55	20.55	20.55
32916	28.70	28.70	28.70	28.70	28.70
32920	27.14	27.14	27.14	27.14	27.14
32921	27.86	27.86	27.86	27.86	27.86
32922	27.88	27.88	27.88	27.88	27.88
32924	30.41	30.41	30.41	30.41	30.41
32925	30.39	30.39	30.39	30.39	30.39
32930	27.14	27.14	27.14	27.14	27.14
32931	29.33	29.33	29.33	29.33	29.33
32932	30.01	30.01	30.01	30.01	30.01
32933	30.28	30.28	30.28	30.28	30.28
32934	30.28	30.28	30.28	30.28	30.28
32935	30.28	30.28	30.28	30.28	30.28
32936	30.28	30.28	30.28	30.28	30.28
32937	32.01	32.01	32.01	32.01	32.01
32938	32.12	32.12	32.12	32.12	32.12
32939	32.85	32.85	32.85	32.85	32.85
32940	34.47	34.47	34.47	34.47	34.47
32941	34.47	34.47	34.47	34.47	34.47
32942	36.17	36.17	36.17	36.17	36.17
32943	36.71	36.71	36.71	36.71	36.71
32944	37.01	37.01	37.01	37.01	37.01
32945	37.07	37.07	37.07	37.07	37.07
32950	30.15	30.15	30.15	30.15	30.15

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
32951	30.74	30.74	30.74	30.74	30.74
32952	31.46	31.46	31.46	31.46	31.46
32953	32.18	32.18	32.18	32.18	32.18
32954	33.95	33.95	33.95	33.95	33.95
32955	34.34	34.34	34.34	34.34	34.34
32956	34.70	34.70	34.70	34.70	34.70
32957	34.72	34.72	34.72	34.72	34.72
32959	32.84	32.84	32.84	32.84	32.84
33001	19.10	19.11	19.11	19.11	19.11
33002	19.38	19.39	19.39	19.39	19.39
33003	19.85	19.85	19.85	19.85	19.85
33006	20.32	20.32	20.32	20.32	20.32
33007	20.83	20.83	20.83	20.83	20.83
33008	21.29	21.29	21.29	21.29	21.29
33009	21.57	21.57	21.57	21.57	21.57
33010	21.71	21.71	21.71	21.71	21.71
33011	22.02	22.02	22.02	22.02	22.02
33012	22.18	22.18	22.18	22.18	22.18
33013	22.30	22.31	22.31	22.31	22.31
33014	22.64	22.64	22.64	22.64	22.64
33015	22.92	22.92	22.92	22.92	22.92
33016	23.18	23.18	23.18	23.18	23.18
33017	23.55	23.55	23.55	23.55	23.55
33018	23.82	23.82	23.82	23.82	23.82
33019	24.03	24.03	24.03	24.03	24.03
33020	24.05	24.05	24.05	24.05	24.05
33023	24.29	24.29	24.29	24.29	24.29
33024	24.54	24.54	24.54	24.54	24.54
33025	24.61	24.61	24.61	24.61	24.61
33026	24.70	24.70	24.70	24.70	24.70
33027	24.88	24.88	24.88	24.88	24.88
33028	24.89	24.89	24.89	24.89	24.89
33029	24.90	24.90	24.90	24.90	24.90
33030	24.93	24.93	24.93	24.93	24.93
33031	25.12	25.12	25.12	25.12	25.12
33033	25.99	25.99	25.99	25.99	25.99
33035	25.16	25.16	25.16	25.16	25.16
33040	20.37	20.37	20.37	20.37	20.37
33041	21.45	21.45	21.45	21.45	21.45
33042	20.37	20.37	20.37	20.37	20.37
33043	20.39	20.39	20.39	20.39	20.39
33044	20.95	20.95	20.95	20.95	20.95
33046	20.32	20.33	20.32	20.33	20.32
33047	20.35	20.36	20.36	20.36	20.36
33048	20.35	20.36	20.36	20.36	20.36
33049	22.11	22.11	22.11	22.11	22.11
33049A	20.45	20.46	20.45	20.46	20.45
33050	20.86	20.86	20.86	20.86	20.86
33051	22.22	22.22	22.22	22.22	22.22
33052	22.22	22.22	22.22	22.22	22.22

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33055	22.12	22.12	22.12	22.12	22.12
33056	22.16	22.16	22.16	22.16	22.16
33057	22.16	22.16	22.16	22.16	22.16
33060	21.59	21.59	21.59	21.59	21.59
33061	23.30	23.30	23.30	23.30	23.30
33064	23.38	23.38	23.38	23.38	23.38
33065	23.43	23.43	23.43	23.43	23.43
33066	23.48	23.48	23.48	23.48	23.48
33067	23.49	23.49	23.49	23.49	23.49
33068	28.59	28.59	28.59	28.59	28.59
33069	30.33	30.33	30.33	30.33	30.33
33070	32.43	32.43	32.43	32.43	32.43
33071	23.67	23.67	23.67	23.67	23.67
33072	24.02	24.02	24.02	24.02	24.02
33073	22.15	22.15	22.15	22.15	22.15
33074	22.15	22.15	22.15	22.15	22.15
33075	24.28	24.28	24.28	24.28	24.28
33076	22.98	22.98	22.98	22.98	22.98
33077	23.01	23.01	23.01	23.01	23.01
33078	24.86	24.86	24.86	24.86	24.86
33079	26.36	26.36	26.36	26.36	26.36
33082	22.31	22.31	22.31	22.31	22.31
33083	22.33	22.33	22.33	22.33	22.33
33084	22.45	22.45	22.45	22.45	22.45
33085	24.84	24.84	24.84	24.84	24.84
33086	24.83	24.83	24.83	24.83	24.83
33087	22.67	22.67	22.67	22.67	22.67
33088	22.64	22.64	22.64	22.64	22.64
33090	23.56	23.56	23.56	23.56	23.56
33091	23.62	23.62	23.62	23.62	23.62
33092	23.80	23.80	23.80	23.80	23.80
33093	24.16	24.16	24.16	24.16	24.16
33095	28.03	28.03	28.03	28.03	28.03
33096	28.46	28.46	28.46	28.46	28.46
33097	31.35	31.35	31.35	31.35	31.35
33098	31.48	31.48	31.48	31.48	31.48
33099	32.44	32.44	32.44	32.44	32.44
33101	22.30	22.30	22.30	22.30	22.30
33102	23.59	23.59	23.59	23.59	23.59
33103	23.83	23.83	23.83	23.83	23.83
33105	24.35	24.35	24.35	24.35	24.35
33106	24.43	24.43	24.43	24.43	24.43
33107	24.81	24.81	24.81	24.81	24.81
33108	25.51	25.51	25.51	25.51	25.51
33109	25.97	25.97	25.97	25.97	25.97
33110	26.53	26.53	26.53	26.53	26.53
33111	27.20	27.20	27.20	27.20	27.20
33112	27.36	27.36	27.36	27.36	27.36
33113	27.49	27.49	27.49	27.49	27.49
33114	27.58	27.58	27.58	27.58	27.58

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33116	27.86	27.86	27.86	27.86	27.86
33118	28.20	28.20	28.20	28.20	28.20
33119	31.69	31.69	31.69	31.69	31.69
33120	29.60	29.60	29.60	29.60	29.60
33121	30.00	30.00	30.00	30.00	30.00
33123	30.09	30.09	30.09	30.09	30.09
33123A	30.02	30.02	30.02	30.02	30.02
33124	30.25	30.25	30.25	30.25	30.25
33125	30.30	30.30	30.30	30.30	30.30
33128	30.45	30.45	30.45	30.45	30.45
33129	33.10	33.10	33.10	33.10	33.10
33130	34.02	34.02	34.02	34.02	34.02
33131	34.17	34.17	34.17	34.17	34.17
33132	34.25	34.25	34.25	34.25	34.25
33135	22.32	22.32	22.32	22.32	22.32
33136	24.30	24.30	24.30	24.30	24.30
33137	24.38	24.38	24.38	24.38	24.38
33138	27.25	27.25	27.25	27.25	27.25
33139	27.51	27.51	27.51	27.51	27.51
33140	24.42	24.42	24.42	24.42	24.42
33141	24.46	24.46	24.46	24.46	24.46
33142	25.28	25.28	25.28	25.28	25.28
33143	27.83	27.83	27.83	27.83	27.83
33146	25.60	25.60	25.60	25.60	25.60
33147	26.04	26.04	26.04	26.04	26.04
33148	26.51	26.51	26.51	26.51	26.51
33150	27.38	27.38	27.38	27.38	27.38
33151	27.40	27.40	27.40	27.40	27.40
33152	28.08	28.08	28.08	28.08	28.08
33153	29.27	29.27	29.27	29.27	29.27
33154	29.96	29.96	29.96	29.96	29.96
33155	30.92	30.92	30.92	30.92	30.92
33156	28.57	28.57	28.57	28.57	28.57
33157	31.61	31.61	31.61	31.61	31.61
33158	31.88	31.88	31.88	31.88	31.88
33159	31.34	31.34	31.34	31.34	31.34
33160	32.61	32.61	32.61	32.61	32.61
33161	33.78	33.78	33.78	33.78	33.78
33163	29.15	29.15	29.15	29.15	29.15
33164	29.03	29.03	29.03	29.03	29.03
33165	29.61	29.61	29.61	29.61	29.61
33167	32.71	32.71	32.71	32.71	32.71
33168	34.54	34.54	34.54	34.54	34.54
33169	30.24	30.24	30.24	30.24	30.24
33170	32.14	32.14	32.14	32.14	32.14
33171	32.56	32.56	32.56	32.56	32.56
33172	32.87	32.87	32.87	32.87	32.87
33173	32.89	32.89	32.89	32.89	32.89
33174	32.94	32.94	32.94	32.94	32.94
33175	32.77	32.77	32.77	32.77	32.77

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33176	32.14	32.14	32.14	32.14	32.14
33177	32.20	32.20	32.20	32.20	32.20
33178	33.34	33.34	33.34	33.34	33.34
33179	33.34	33.34	33.34	33.34	33.34
33180	23.02	23.02	23.02	23.02	23.02
33181	23.27	23.27	23.27	23.27	23.27
33182	23.88	23.88	23.88	23.88	23.88
33183	25.72	25.72	25.72	25.72	25.72
33184	26.50	26.50	26.50	26.50	26.50
33185	27.66	27.66	27.66	27.66	27.66
33186	29.63	29.63	29.63	29.63	29.63
33188	23.64	23.64	23.64	23.64	23.64
33189	23.65	23.65	23.65	23.65	23.65
33190	27.62	27.62	27.62	27.62	27.62
33191	29.42	29.42	29.42	29.42	29.42
33192	32.10	32.10	32.10	32.10	32.10
33193	32.44	32.44	32.44	32.44	32.44
33194	32.43	32.43	32.43	32.43	32.43
33197	23.65	23.65	23.65	23.65	23.65
33198	23.65	23.65	23.65	23.65	23.65
33199	23.94	23.94	23.94	23.94	23.94
33200	24.04	24.04	24.04	24.04	24.04
33201	24.81	24.81	24.81	24.81	24.81
33202	24.92	24.92	24.92	24.92	24.92
33203	25.18	25.18	25.18	25.18	25.18
33204	25.79	25.79	25.79	25.79	25.79
33205	26.23	26.23	26.23	26.23	26.23
33206	26.97	26.97	26.97	26.97	26.97
33207	27.03	27.03	27.03	27.03	27.03
33208	27.50	27.50	27.50	27.50	27.50
33209	27.67	27.67	27.67	27.67	27.67
33210	28.40	28.40	28.40	28.40	28.40
33211	28.52	28.52	28.52	28.52	28.52
33212	29.08	29.08	29.08	29.08	29.08
33213	31.10	31.10	31.10	31.10	31.10
33215	23.95	23.95	23.95	23.95	23.95
33216	24.11	24.11	24.11	24.11	24.11
33217	25.56	25.56	25.56	25.56	25.56
33218	28.38	28.38	28.38	28.38	28.38
33219	29.60	29.60	29.60	29.60	29.60
33221	29.46	29.46	29.46	29.46	29.46
33223	23.60	23.60	23.60	23.60	23.60
33224	23.60	23.60	23.60	23.60	23.60
33225	23.60	23.60	23.60	23.60	23.60
33226	23.60	23.60	23.60	23.60	23.60
33227	24.06	24.06	24.06	24.06	24.06
33228	28.33	28.33	28.33	28.33	28.33
33229	28.92	28.92	28.92	28.92	28.92
33230	29.44	29.44	29.44	29.44	29.44
33231	32.21	32.21	32.21	32.21	32.21

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33232	33.48	33.48	33.48	33.48	33.48
33235	23.97	23.97	23.97	23.97	23.97
33236	24.70	24.70	24.70	24.70	24.70
33237	27.86	27.86	27.86	27.86	27.86
33238	28.77	28.77	28.77	28.77	28.77
33239	28.83	28.83	28.83	28.83	28.83
33240	24.81	24.81	24.81	24.81	24.81
33241	28.82	28.82	28.82	28.82	28.82
33242	23.91	23.91	23.91	23.91	23.91
33243	28.81	28.81	28.81	28.81	28.81
33244	29.84	29.84	29.84	29.84	29.84
33245	29.89	29.89	29.89	29.89	29.89
33246	31.06	31.06	31.06	31.06	31.06
33247	25.50	25.50	25.50	25.50	25.50
33248	28.88	28.88	28.88	28.88	28.88
33250	24.54	24.54	24.54	24.54	24.54
33251	24.54	24.54	24.54	24.54	24.54
33252	24.55	24.55	24.55	24.55	24.55
33253	24.56	24.56	24.56	24.56	24.56
33254	24.56	24.56	24.56	24.56	24.56
33257	26.04	26.04	26.04	26.04	26.04
33258	30.17	30.17	30.17	30.17	30.17
33259	31.76	31.76	31.76	31.76	31.76
33259A	32.45	32.45	32.45	32.45	32.45
33259B	31.64	31.64	31.64	31.64	31.64
33260	24.53	24.53	24.53	24.53	24.53
33261	31.09	31.09	31.09	31.09	31.09
33261A	31.20	31.20	31.20	31.20	31.20
33262	24.53	24.53	24.53	24.53	24.53
33265	24.50	24.50	24.50	24.50	24.50
33266	24.13	24.13	24.13	24.13	24.13
33267	24.13	24.13	24.13	24.13	24.13
33268	24.13	24.13	24.13	24.13	24.13
33269	24.53	24.53	24.53	24.53	24.53
33272	28.24	28.24	28.24	28.24	28.24
33273	30.38	30.38	30.38	30.38	30.38
33275	24.64	24.64	24.64	24.64	24.64
33276	25.21	25.21	25.21	25.21	25.21
33277	25.21	25.21	25.21	25.21	25.21
33278	25.22	25.22	25.22	25.22	25.22
33283	24.94	24.94	24.94	24.94	24.94
33284	24.88	24.88	24.88	24.88	24.88
33285	25.21	25.21	25.21	25.21	25.21
33287	24.84	24.84	24.84	24.84	24.84
33301	24.88	24.88	24.88	24.88	24.88
33302	24.75	24.75	24.75	24.75	24.75
33303	24.76	24.76	24.76	24.76	24.76
33304	24.76	24.76	24.76	24.76	24.76
33305	24.77	24.77	24.77	24.77	24.77
33307	24.77	24.77	24.77	24.77	24.77

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33308	24.77	24.77	24.77	24.77	24.77
33309	27.66	27.66	27.66	27.66	27.66
33312	27.67	27.67	27.67	27.67	27.67
33313	28.28	28.28	28.28	28.28	28.28
33314	24.75	24.75	24.75	24.75	24.75
33315	30.54	30.54	30.54	30.54	30.54
33317	26.93	26.93	26.93	26.93	26.93
33318	24.62	24.62	24.62	24.62	24.62
33319	24.70	24.70	24.70	24.70	24.70
33320	27.69	27.69	27.69	27.69	27.69
33323	26.06	26.06	26.06	26.06	26.06
33325	26.11	26.11	26.11	26.11	26.11
33326	26.12	26.12	26.12	26.12	26.12
33328	26.82	26.82	26.82	26.82	26.82
33330	26.83	26.83	26.83	26.83	26.83
33331	27.53	27.53	27.53	27.53	27.53
33332	27.12	27.12	27.12	27.12	27.12
33334	27.22	27.22	27.22	27.22	27.22
33335	27.29	27.29	27.29	27.29	27.29
33346	28.36	28.36	28.36	28.36	28.36
33347	28.36	28.36	28.36	28.36	28.36
33348	28.42	28.42	28.42	28.42	28.42
33352	31.38	31.38	31.38	31.38	31.38
33353	31.92	31.92	31.92	31.92	31.92
33353A	32.26	32.26	32.26	32.26	32.26
33353B	32.84	32.84	32.84	32.84	32.84
33353C	32.87	32.87	32.87	32.87	32.87
33354	32.18	32.18	32.18	32.18	32.18
33355	32.35	32.35	32.35	32.35	32.35
33358	28.36	28.36	28.36	28.36	28.36
33362	37.17	37.17	37.17	37.17	37.17
33366	25.70	25.70	25.70	25.70	25.70
33367	26.57	26.57	26.57	26.57	26.57
33368	27.84	27.84	27.84	27.84	27.84
33369	28.29	28.29	28.29	28.29	28.29
33370	29.19	29.19	29.19	29.19	29.19
33371	30.23	30.23	30.23	30.23	30.23
33372	30.40	30.40	30.40	30.40	30.40
33373	30.99	30.99	30.99	30.99	30.99
33374	31.25	31.25	31.25	31.25	31.25
33375	31.29	31.29	31.29	31.29	31.29
33376	32.93	32.93	32.93	32.93	32.93
33377	32.93	32.93	32.93	32.93	32.93
33378	33.06	33.06	33.06	33.06	33.06
33379	33.59	33.59	33.59	33.59	33.59
33380	34.36	34.36	34.36	34.36	34.36
33381	34.54	34.54	34.54	34.54	34.54
33382	34.56	34.56	34.56	34.56	34.56
33383	34.90	34.90	34.90	34.90	34.90
33384	36.72	36.72	36.72	36.72	36.72

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33385	36.85	36.85	36.85	36.85	36.85
33386	37.09	37.09	37.09	37.09	37.09
33387	37.18	37.18	37.18	37.18	37.18
33388	37.63	37.63	37.63	37.63	37.63
33389	38.94	38.94	38.94	38.94	38.94
33390	41.22	41.22	41.22	41.22	41.22
33391	41.60	41.60	41.60	41.60	41.60
33392	41.63	41.63	41.63	41.63	41.63
33394	43.97	43.97	43.97	43.97	43.97
33395	42.28	42.28	42.28	42.28	42.28
33403	30.39	30.39	30.39	30.39	30.39
33404	30.26	30.26	30.26	30.26	30.26
33405	30.40	30.40	30.40	30.40	30.40
33406	31.77	31.77	31.77	31.77	31.77
33407	33.95	33.95	33.95	33.95	33.95
33409	33.45	33.45	33.45	33.45	33.45
33410	33.73	33.73	33.73	33.73	33.73
33411	35.75	35.75	35.75	35.75	35.75
33412	35.92	35.92	35.92	35.92	35.92
33413	36.61	36.61	36.61	36.61	36.61
33414	36.76	36.76	36.76	36.76	36.76
33415	37.78	37.78	37.78	37.78	37.78
33416	39.40	39.40	39.40	39.40	39.40
33417	40.65	40.65	40.65	40.65	40.65
33419	36.99	36.99	36.99	36.99	36.99
33421	40.52	40.52	40.52	40.52	40.52
33422	44.07	44.07	44.07	44.07	44.07
33430	25.98	25.98	25.98	25.98	25.98
33431	27.55	27.55	27.55	27.55	27.55
33432	27.76	27.76	27.76	27.76	27.76
33433	27.90	27.90	27.90	27.90	27.90
33437	31.45	31.45	31.45	31.45	31.45
33438	33.44	33.44	33.44	33.44	33.44
33439	34.56	34.56	34.56	34.56	34.56
33440	34.58	34.58	34.58	34.58	34.58
33441	35.88	35.88	35.88	35.88	35.88
33442	35.90	35.90	35.90	35.90	35.90
33443	37.60	37.60	37.60	37.60	37.60
33444	33.78	33.78	33.78	33.78	33.78
33446	38.98	38.98	38.98	38.98	38.98
33448	31.19	31.19	31.19	31.19	31.19
33449	31.30	31.30	31.30	31.30	31.30
33451	31.33	31.33	31.33	31.33	31.33
33458	31.47	31.47	31.47	31.47	31.47
33460	28.93	28.93	28.93	28.93	28.93
33461	31.33	31.33	31.33	31.33	31.33
33475	31.59	31.59	31.59	31.59	31.59
33480	26.05	26.05	26.05	26.05	26.05
33481	29.68	29.68	29.68	29.68	29.68
33482	30.26	30.26	30.26	30.26	30.26

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33500	17.77	17.77	17.77	17.77	17.77
33501	17.69	17.72	17.71	17.72	17.71
33501AP	17.67	17.69	17.69	17.69	17.69
33501EX	17.64	17.66	17.66	17.66	17.66
33502	17.79	17.81	17.81	17.81	17.80
33503	18.18	18.19	18.19	18.19	18.19
33504	18.18	18.19	18.19	18.19	18.19
33505	18.82	18.83	18.83	18.83	18.83
33506	19.14	19.14	19.14	19.14	19.14
33507	19.84	19.84	19.84	19.84	19.84
33508	20.06	20.07	20.07	20.07	20.07
33509	20.08	20.08	20.08	20.08	20.08
33510	20.37	20.37	20.37	20.37	20.37
33511	20.82	20.82	20.82	20.82	20.82
33513	22.42	22.42	22.42	22.42	22.42
33514	21.24	21.24	21.24	21.24	21.24
33515	21.63	21.63	21.63	21.63	21.63
33516	21.71	21.72	21.72	21.72	21.71
33517	22.59	22.59	22.59	22.59	22.59
33519	21.80	21.80	21.80	21.80	21.80
33522	22.66	22.67	22.67	22.67	22.67
33524	23.22	23.22	23.22	23.22	23.22
33525	23.57	23.57	23.57	23.57	23.57
33526	24.85	24.85	24.85	24.85	24.85
33529	26.01	26.01	26.01	26.01	26.01
33530	26.68	26.68	26.68	26.68	26.68
33531	27.02	27.02	27.02	27.02	27.02
33532	27.69	27.69	27.69	27.69	27.69
33533	28.39	28.39	28.39	28.39	28.39
33534	20.84	20.84	20.84	20.84	20.84
33535	20.84	20.84	20.84	20.84	20.84
33536	28.56	28.56	28.56	28.56	28.56
33537	28.61	28.61	28.61	28.61	28.61
33538	28.64	28.64	28.64	28.64	28.64
33539	28.84	28.84	28.84	28.84	28.84
33540	29.86	29.86	29.86	29.86	29.86
33542	30.63	30.63	30.63	30.63	30.63
33544	30.72	30.72	30.72	30.72	30.72
33545	30.80	30.80	30.80	30.80	30.80
33546	31.60	31.60	31.60	31.60	31.60
33547	31.01	31.01	31.01	31.01	31.01
33548	31.63	31.63	31.63	31.63	31.63
33549	31.64	31.64	31.64	31.64	31.64
33550	31.64	31.64	31.64	31.64	31.64
33551	31.69	31.69	31.69	31.69	31.69
33552	31.72	31.72	31.72	31.72	31.72
33553	31.78	31.78	31.78	31.78	31.78
33554	31.86	31.86	31.86	31.86	31.86
33555	31.93	31.93	31.93	31.93	31.93
33556	32.81	32.81	32.81	32.81	32.81

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33557	32.79	32.79	32.79	32.79	32.79
33558	33.43	33.43	33.43	33.43	33.43
33559	34.14	34.14	34.14	34.14	34.14
33560	28.59	28.59	28.59	28.59	28.59
33561	28.62	28.62	28.62	28.62	28.62
33562	28.72	28.72	28.72	28.72	28.72
33564	29.45	29.45	29.45	29.45	29.45
33565	29.89	29.89	29.89	29.89	29.89
33566	30.54	30.54	30.54	30.54	30.54
33567	31.04	31.04	31.04	31.04	31.04
33568	31.04	31.04	31.04	31.04	31.04
33569	31.90	31.90	31.90	31.90	31.90
33570	32.39	32.39	32.39	32.39	32.39
33571	32.57	32.57	32.57	32.57	32.57
33571A	34.63	34.63	34.63	34.63	34.63
33572	35.79	35.79	35.79	35.79	35.79
33575	31.91	31.91	31.91	31.91	31.91
33576	34.05	34.05	34.05	34.05	34.05
33577	35.53	35.53	35.53	35.53	35.53
33577A	34.72	34.72	34.72	34.72	34.72
33580	17.70	17.72	17.72	17.72	17.72
33581	17.70	17.72	17.72	17.72	17.72
33582	18.86	18.86	18.86	18.86	18.86
33583	21.06	21.06	21.06	21.06	21.06
33584	21.07	21.07	21.07	21.07	21.07
33585	22.36	22.36	22.36	22.36	22.36
33586	18.87	18.87	18.87	18.87	18.87
33587	20.13	20.13	20.13	20.13	20.13
33588	18.30	18.31	18.30	18.31	18.30
33589	18.30	18.31	18.30	18.31	18.30
33590	20.51	20.51	20.51	20.51	20.51
33591	19.84	19.85	19.85	19.85	19.85
33592	19.84	19.84	19.84	19.84	19.84
33593	20.71	20.71	20.71	20.71	20.71
33595	22.42	22.42	22.42	22.42	22.42
33596	21.72	21.72	21.72	21.72	21.72
33598	21.76	21.76	21.76	21.76	21.76
33599	24.39	24.39	24.39	24.39	24.39
33602	22.75	22.75	22.75	22.75	22.75
33603	22.92	22.92	22.92	22.92	22.92
33605	24.98	24.98	24.98	24.98	24.98
33608	22.71	22.71	22.71	22.71	22.71
33609	23.86	23.86	23.86	23.86	23.86
33610	23.88	23.88	23.88	23.88	23.88
33611	30.77	30.77	30.77	30.77	30.77
33614	23.22	23.22	23.22	23.22	23.22
33618	24.86	24.86	24.86	24.86	24.86
33619	24.87	24.87	24.87	24.87	24.87
33620	25.23	25.23	25.23	25.23	25.23
33621	25.88	25.88	25.88	25.88	25.88

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33622	28.07	28.07	28.07	28.07	28.07
33623	31.41	31.41	31.41	31.41	31.41
33624	26.88	26.88	26.88	26.88	26.88
33625	27.50	27.50	27.50	27.50	27.50
33626	28.00	28.00	28.00	28.00	28.00
33627	28.81	28.81	28.81	28.81	28.81
33628	31.44	31.44	31.44	31.44	31.44
33629	32.40	32.40	32.40	32.40	32.40
33632	34.74	34.74	34.74	34.74	34.74
33633	35.36	35.36	35.36	35.36	35.36
33634	35.68	35.68	35.68	35.68	35.68
33635	36.52	36.52	36.52	36.52	36.52
33637	35.51	35.51	35.51	35.51	35.51
33638	35.52	35.52	35.52	35.52	35.52
33640	36.26	36.26	36.26	36.26	36.26
33642	32.66	32.66	32.66	32.66	32.66
33643	32.73	32.73	32.73	32.73	32.73
33644	25.84	25.84	25.84	25.84	25.84
33644A	24.93	24.93	24.93	24.93	24.93
33645	25.04	25.04	25.04	25.04	25.04
33647	27.39	27.39	27.39	27.39	27.39
33648	27.75	27.75	27.75	27.75	27.75
33649	27.69	27.69	27.69	27.69	27.69
33650	29.61	29.61	29.61	29.61	29.61
33650A	29.89	29.89	29.89	29.89	29.89
33650B	29.21	29.21	29.21	29.21	29.21
33650C	30.04	30.04	30.04	30.04	30.04
33650D	26.69	26.69	26.69	26.69	26.69
33651	27.03	27.03	27.03	27.03	27.03
33652	28.40	28.40	28.40	28.40	28.40
33653	28.46	28.46	28.46	28.46	28.46
33654	28.56	28.56	28.56	28.56	28.56
33655	31.16	31.16	31.16	31.16	31.16
33656	31.18	31.18	31.18	31.18	31.18
33658	31.20	31.20	31.20	31.20	31.20
33659	31.43	31.43	31.43	31.43	31.43
33660	32.21	32.21	32.21	32.21	32.21
33661	32.21	32.21	32.21	32.21	32.21
33663	31.21	31.21	31.21	31.21	31.21
33664	35.70	35.70	35.70	35.70	35.70
33665	28.70	28.70	28.70	28.70	28.70
33667	29.19	29.19	29.19	29.19	29.19
33668	31.46	31.46	31.46	31.46	31.46
33669	31.46	31.46	31.46	31.46	31.46
33670	31.69	31.69	31.69	31.69	31.69
33671	31.69	31.69	31.69	31.69	31.69
33672	36.49	36.49	36.49	36.49	36.49
33674	30.78	30.78	30.78	30.78	30.78
33674A	31.82	31.82	31.82	31.82	31.82
33675	31.93	31.93	31.93	31.93	31.93

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33675A	32.94	32.94	32.94	32.94	32.94
33676	33.66	33.66	33.66	33.66	33.66
33677	33.66	33.66	33.66	33.66	33.66
33678	33.66	33.66	33.66	33.66	33.66
33679	34.54	34.54	34.54	34.54	34.54
33680	34.43	34.43	34.43	34.43	34.43
33681	32.32	32.32	32.32	32.32	32.32
33682	30.93	30.93	30.93	30.93	30.93
33683	30.82	30.82	30.82	30.82	30.82
33683A	30.81	30.81	30.81	30.81	30.81
33684	30.85	30.85	30.85	30.85	30.85
33685	31.14	31.14	31.14	31.14	31.14
33686	31.58	31.58	31.58	31.58	31.58
33687	31.65	31.65	31.65	31.65	31.65
33688	31.65	31.65	31.65	31.65	31.65
33689	32.88	32.88	32.88	32.88	32.88
33690	32.84	32.84	32.84	32.84	32.84
33691	32.84	32.84	32.84	32.84	32.84
33692	32.84	32.84	32.84	32.84	32.84
33693	32.06	32.06	32.06	32.06	32.06
33694	32.50	32.50	32.50	32.50	32.50
33695	33.69	33.69	33.69	33.69	33.69
33696	33.92	33.92	33.92	33.92	33.92
33697	37.92	37.92	37.92	37.92	37.92
33698	33.72	33.72	33.72	33.72	33.72
33699	32.59	32.59	32.59	32.59	32.59
33699A	31.82	31.82	31.82	31.82	31.82
33700	25.73	25.73	25.73	25.73	25.73
33701	25.39	25.39	25.39	25.39	25.39
33702	25.39	25.39	25.39	25.39	25.39
33703	25.41	25.41	25.41	25.41	25.41
33704	25.36	25.36	25.36	25.36	25.36
33705	25.48	25.48	25.48	25.48	25.48
33706	25.37	25.37	25.37	25.37	25.37
33707	25.37	25.37	25.37	25.37	25.37
33708	25.37	25.37	25.37	25.37	25.37
33709	25.37	25.37	25.37	25.37	25.37
33710	25.36	25.36	25.36	25.36	25.36
33711	25.36	25.36	25.36	25.36	25.36
33712	25.33	25.33	25.33	25.33	25.33
33713	24.70	24.70	24.70	24.70	24.70
33714	24.66	24.66	24.66	24.66	24.66
33715	25.83	25.83	25.83	25.83	25.83
33720	25.38	25.38	25.38	25.38	25.38
33721	25.92	25.92	25.92	25.92	25.92
33722	25.78	25.78	25.78	25.78	25.78
33723	24.69	24.69	24.69	24.69	24.69
33724	24.24	24.24	24.24	24.24	24.24
33725	24.70	24.70	24.70	24.70	24.70
33726	24.94	24.94	24.94	24.94	24.94

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
33727	25.21	25.21	25.21	25.21	25.21
33750	9.91	9.83	9.85	9.82	9.86
33751	9.91	9.81	9.83	9.80	9.86
33752	9.91	9.78	9.82	9.79	9.86
33753	9.90	9.74	9.82	9.79	9.86
33754	9.90	9.74	9.82	9.79	9.86
33755	9.90	9.74	9.82	9.79	9.86
33756	9.90	9.74	9.82	9.79	9.86
33757	9.90	9.74	9.82	9.79	9.86
33758	9.90	9.74	9.82	9.78	9.86
33759	9.90	9.74	9.82	9.78	9.86
33760	9.90	9.74	9.82	9.79	9.86
33761	9.90	9.74	9.82	9.78	9.86
33762	9.90	9.74	9.82	9.78	9.85
33763	9.90	9.74	9.82	9.78	9.85
33764	9.91	9.75	9.81	9.79	9.86
33765	9.91	9.75	9.82	9.79	9.86
34000	27.21	27.21	27.21	27.21	27.21
34001	30.26	30.26	30.26	30.26	30.26
34002	27.58	27.58	27.58	27.58	27.58
34003	28.14	28.14	28.14	28.14	28.14
34004	27.63	27.63	27.63	27.63	27.63
34005	33.03	33.03	33.03	33.03	33.03
34006	29.88	29.88	29.88	29.88	29.88
34007	27.20	27.20	27.20	27.20	27.20
34008	27.18	27.18	27.18	27.18	27.18
34009	28.23	28.23	28.23	28.23	28.23
34010	27.50	27.50	27.50	27.50	27.50
34011	29.81	29.81	29.81	29.81	29.81
34012	28.52	28.52	28.52	28.52	28.52
34013	29.88	29.88	29.88	29.88	29.88
34014	25.37	25.37	25.37	25.37	25.37
34015	25.40	25.40	25.40	25.40	25.40
34016	25.51	25.51	25.51	25.51	25.51
34017	27.73	27.73	27.73	27.73	27.73
34018	26.88	26.88	26.88	26.88	26.88
34019	26.90	26.90	26.90	26.90	26.90
34020	27.52	27.52	27.52	27.52	27.52
34021	29.02	29.02	29.02	29.02	29.02
34022	29.69	29.69	29.69	29.69	29.69
34023	33.16	33.16	33.16	33.16	33.16
34024	30.52	30.52	30.52	30.52	30.52
34025	35.85	35.85	35.85	35.85	35.85
34026	27.26	27.26	27.26	27.26	27.26
34027	27.36	27.36	27.36	27.36	27.36
34028	28.31	28.31	28.31	28.31	28.31
34029	28.30	28.30	28.30	28.30	28.30
34030	30.66	30.66	30.66	30.66	30.66
34031	30.80	30.80	30.80	30.80	30.80
34032	30.83	30.83	30.83	30.83	30.83

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
34033	32.97	32.97	32.97	32.97	32.97
34034	25.64	25.64	25.64	25.64	25.64
34035	25.79	25.79	25.79	25.79	25.79
34036	25.99	25.99	25.99	25.99	25.99
34037	26.27	26.27	26.27	26.27	26.27
34038	27.73	27.73	27.73	27.73	27.73
34039	29.72	29.72	29.72	29.72	29.72
34040	30.80	30.80	30.80	30.80	30.80
34041	30.84	30.84	30.84	30.84	30.84
34042	31.13	31.13	31.13	31.13	31.13
34043	31.18	31.18	31.18	31.18	31.18
34044	32.60	32.60	32.60	32.60	32.60
34045	33.84	33.84	33.84	33.84	33.84
34046	32.60	32.60	32.60	32.60	32.60
34047	31.26	31.26	31.26	31.26	31.26
34048	31.46	31.46	31.46	31.46	31.46
34049	27.52	27.52	27.52	27.52	27.52
34050	31.34	31.34	31.34	31.34	31.34
34051	31.65	31.65	31.65	31.65	31.65
34052	32.95	32.95	32.95	32.95	32.95
34053	27.51	27.51	27.51	27.51	27.51
34054	27.51	27.51	27.51	27.51	27.51
34055	27.52	27.52	27.52	27.52	27.52
34056	31.47	31.47	31.47	31.47	31.47
34057	27.52	27.52	27.52	27.52	27.52
34058	29.18	29.18	29.18	29.18	29.18
34059	29.22	29.22	29.22	29.22	29.22
34060	29.15	29.15	29.15	29.15	29.15
34061	29.48	29.48	29.48	29.48	29.48
34062	29.17	29.17	29.17	29.17	29.17
34063	27.37	27.37	27.37	27.37	27.37
34064	27.51	27.51	27.51	27.51	27.51
34065	28.71	28.71	28.71	28.71	28.71
34066	28.75	28.75	28.75	28.75	28.75
34067	26.07	26.07	26.07	26.07	26.07
34068	28.67	28.67	28.67	28.67	28.67
34069	29.71	29.71	29.71	29.71	29.71
34070	29.30	29.30	29.30	29.30	29.30
34071	30.39	30.39	30.39	30.39	30.39
34072	30.67	30.67	30.67	30.67	30.67
34073	30.69	30.69	30.69	30.69	30.69
34074	30.73	30.73	30.73	30.73	30.73
34075	30.52	30.52	30.52	30.52	30.52
34076	31.12	31.12	31.12	31.12	31.12
34077	34.81	34.81	34.81	34.81	34.81
34078	27.70	27.70	27.70	27.70	27.70
34079	27.70	27.70	27.70	27.70	27.70
34080	27.70	27.70	27.70	27.70	27.70
34081	27.70	27.70	27.70	27.70	27.70
34082	27.63	27.63	27.63	27.63	27.63

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
34083	28.22	28.22	28.22	28.22	28.22
34084	28.20	28.20	28.20	28.20	28.20
34085	30.38	30.38	30.38	30.38	30.38
34086	30.44	30.44	30.44	30.44	30.44
34087	28.29	28.29	28.29	28.29	28.29
34088	28.95	28.95	28.95	28.95	28.95
34089	29.59	29.59	29.59	29.59	29.59
34090	32.30	32.30	32.30	32.30	32.30
34091	29.21	29.21	29.21	29.21	29.21
34092	29.21	29.21	29.21	29.21	29.21
34093	31.37	31.37	31.37	31.37	31.37
34094	31.25	31.25	31.25	31.25	31.25
34095	29.24	29.24	29.24	29.24	29.24
34096	29.49	29.49	29.49	29.49	29.49
34098	30.80	30.80	30.80	30.80	30.80
34101	32.82	32.82	32.82	32.82	32.82
34115	35.02	35.02	35.02	35.02	35.02
34220	17.71	17.73	17.72	17.73	17.72
34222	17.72	17.74	17.74	17.74	17.74
34225	18.26	18.27	18.27	18.27	18.27
34229	18.29	18.29	18.29	18.29	18.29
34230	18.33	18.34	18.33	18.34	18.33
34235	17.72	17.74	17.74	17.74	17.74
34250	35.44	35.44	35.44	35.44	35.44
34252	35.34	35.34	35.34	35.34	35.34
34254	35.05	35.05	35.05	35.05	35.05
34256	34.76	34.76	34.76	34.76	34.76
34258	33.92	33.92	33.92	33.92	33.92
34260	35.00	35.00	35.00	35.00	35.00
34300	30.78	30.78	30.78	30.78	30.78
34302	31.35	31.35	31.35	31.35	31.35
34304	31.35	31.35	31.35	31.35	31.35
34306	31.91	31.91	31.91	31.91	31.91
34320	31.31	31.31	31.31	31.31	31.31
34320A	31.30	31.30	31.30	31.30	31.30
34321	31.30	31.30	31.30	31.30	31.30
34322	31.30	31.30	31.30	31.30	31.30
34340	30.44	30.44	30.44	30.44	30.44
34342	30.17	30.17	30.17	30.17	30.17
34344	30.09	30.09	30.09	30.09	30.09
35000	24.77	24.77	24.77	24.77	24.77
35005	24.77	24.77	24.77	24.77	24.77
35010	24.77	24.77	24.77	24.77	24.77
35015	24.77	24.77	24.77	24.77	24.77
35020	24.77	24.77	24.77	24.77	24.77
35025	24.77	24.77	24.77	24.77	24.77
35030	24.77	24.77	24.77	24.77	24.77
35035	24.77	24.77	24.77	24.77	24.77
35040	24.77	24.77	24.77	24.77	24.77
35050	27.25	27.25	27.25	27.25	27.25

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
35060	29.01	29.01	29.01	29.01	29.01
35509	23.17	23.17	23.17	23.17	23.17
35510	25.19	25.19	25.19	25.19	25.19
35512	27.02	27.02	27.02	27.02	27.02
35513	27.19	27.19	27.19	27.19	27.19
35522	21.15	21.15	21.15	21.15	21.15
35523	21.25	21.25	21.25	21.25	21.25
35523A	21.86	21.86	21.86	21.86	21.86
35524	21.16	21.16	21.16	21.16	21.16
35525	23.31	23.31	23.31	23.31	23.31
35526A	25.25	25.25	25.25	25.25	25.25
35526B	25.14	25.14	25.14	25.14	25.14
35527	25.33	25.33	25.33	25.33	25.33
35528	25.33	25.33	25.33	25.33	25.33
35528A	25.34	25.34	25.34	25.34	25.34
35528B	25.42	25.42	25.42	25.42	25.42
35528C	25.48	25.48	25.48	25.48	25.48
35528D	25.42	25.42	25.42	25.42	25.42
35529	25.34	25.34	25.34	25.34	25.34
35529A	25.38	25.38	25.38	25.38	25.38
35530	25.58	25.58	25.58	25.58	25.58
35531	28.31	28.31	28.31	28.31	28.31
35532	27.26	27.26	27.26	27.26	27.26
35532A	28.26	28.26	28.26	28.26	28.26
35533	29.42	29.42	29.42	29.42	29.42
35534	31.20	31.20	31.20	31.20	31.20
35535	28.39	28.39	28.39	28.39	28.39
35536	31.73	31.73	31.73	31.73	31.73
35537	31.46	31.46	31.46	31.46	31.46
35538	32.16	32.16	32.16	32.16	32.16
35539	32.59	32.59	32.59	32.59	32.59
35540	33.38	33.38	33.38	33.38	33.38
35541	30.70	30.70	30.70	30.70	30.70
35542	21.16	21.16	21.16	21.16	21.16
35543	21.16	21.16	21.16	21.16	21.16
35544	21.16	21.16	21.16	21.16	21.16
35544A	21.16	21.16	21.16	21.16	21.16
35544B	25.61	25.61	25.61	25.61	25.61
35545	21.16	21.16	21.16	21.16	21.16
35546	22.92	22.92	22.92	22.92	22.92
35547	26.58	26.58	26.58	26.58	26.58
35548	26.58	26.58	26.58	26.58	26.58
35549	27.75	27.75	27.75	27.75	27.75
35550	27.77	27.77	27.77	27.77	27.77
35550A	26.46	26.46	26.46	26.46	26.46
35551	27.08	27.08	27.08	27.08	27.08
35552	27.17	27.17	27.17	27.17	27.17
35553	27.69	27.69	27.69	27.69	27.69
35553B	27.21	27.21	27.21	27.21	27.21
35554	28.50	28.50	28.50	28.50	28.50

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
35554A	27.29	27.29	27.29	27.29	27.29
35555	27.69	27.69	27.69	27.69	27.69
35555A	31.16	31.16	31.16	31.16	31.16
35556	32.13	32.13	32.13	32.13	32.13
35556A	31.18	31.18	31.18	31.18	31.18
35557	31.93	31.93	31.93	31.93	31.93
35558	32.66	32.66	32.66	32.66	32.66
35558A	31.92	31.92	31.92	31.92	31.92
35559	32.87	32.87	32.87	32.87	32.87
35560	33.46	33.46	33.46	33.46	33.46
35561	31.51	31.51	31.51	31.51	31.51
35562	32.88	32.88	32.88	32.88	32.88
35563	33.72	33.72	33.72	33.72	33.72
35563A	33.72	33.72	33.72	33.72	33.72
35564	33.58	33.58	33.58	33.58	33.58
35565	32.05	32.05	32.05	32.05	32.05
35566	34.11	34.11	34.11	34.11	34.11
35566A	32.17	32.17	32.17	32.17	32.17
35567	32.27	32.27	32.27	32.27	32.27
35568	32.27	32.27	32.27	32.27	32.27
35570	31.15	31.15	31.15	31.15	31.15
35571	36.06	36.06	36.06	36.06	36.06
35572	33.89	33.89	33.89	33.89	33.89
35575	35.47	35.47	35.47	35.47	35.47
35577	33.82	33.82	33.82	33.82	33.82
35578	33.83	33.83	33.83	33.83	33.83
35579	33.82	33.82	33.82	33.82	33.82
35581	33.01	33.01	33.01	33.01	33.01
35592	33.88	33.88	33.88	33.88	33.88
35594	34.53	34.53	34.53	34.53	34.53
35595	34.04	34.04	34.04	34.04	34.04
35596	34.70	34.70	34.70	34.70	34.70
35597	34.95	34.95	34.95	34.95	34.95
35598	34.70	34.70	34.70	34.70	34.70
35599	35.53	35.53	35.53	35.53	35.53
35599A	34.71	34.71	34.71	34.71	34.71
35600	33.50	33.50	33.50	33.50	33.50
35600A	38.39	38.39	38.39	38.39	38.39
35601	30.62	30.62	30.62	30.62	30.62
35610	25.56	25.56	25.56	25.56	25.56
35611	28.98	28.98	28.98	28.98	28.98
35612	29.17	29.17	29.17	29.17	29.17
35614	29.62	29.62	29.62	29.62	29.62
35615	29.83	29.83	29.83	29.83	29.83
35617	30.62	30.62	30.62	30.62	30.62
35620	17.33	17.36	17.36	17.36	17.36
35621	17.33	17.36	17.36	17.36	17.36
35622	17.34	17.36	17.36	17.36	17.36
35623	17.34	17.36	17.36	17.36	17.36
35624	17.61	17.64	17.63	17.64	17.63

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
35625	17.61	17.64	17.63	17.64	17.63
35626	17.61	17.64	17.63	17.64	17.63
35627	17.61	17.64	17.63	17.64	17.63
35628	17.61	17.64	17.63	17.64	17.63
35629	17.61	17.64	17.63	17.64	17.63
35630	16.13	16.22	16.21	16.21	16.20
35631	16.51	16.51	16.51	16.51	16.51
35632	17.28	17.28	17.28	17.28	17.28
35633	16.43	16.47	16.47	16.47	16.47
35640	20.77	20.77	20.77	20.77	20.77
35641	20.77	20.77	20.77	20.77	20.77
35641A	20.84	20.84	20.84	20.84	20.84
35641B	20.94	20.94	20.94	20.94	20.94
35642	21.30	21.30	21.30	21.30	21.30
35643	22.74	22.74	22.74	22.74	22.74
35644	21.03	21.03	21.03	21.03	21.03
35644A	21.04	21.04	21.04	21.04	21.04
35645	24.88	24.88	24.88	24.88	24.88
35646	24.88	24.88	24.88	24.88	24.88
35650	29.96	29.96	29.96	29.96	29.96
35651	29.97	29.96	29.97	29.97	29.97
35652	29.97	29.96	29.97	29.97	29.97
35653	30.08	30.08	30.08	30.08	30.08
35655	33.95	33.95	33.95	33.95	33.95
35656	33.95	33.95	33.95	33.95	33.95
35657	33.95	33.95	33.95	33.95	33.95
35660	34.27	34.27	34.27	34.27	34.27
35661	34.29	34.29	34.29	34.29	34.29
35662	34.32	34.32	34.32	34.32	34.32
35665A	20.77	20.77	20.77	20.77	20.77
35665B	20.77	20.77	20.77	20.77	20.77
35665C	20.77	20.77	20.77	20.77	20.77
35665D	20.77	20.77	20.77	20.77	20.77
35665E	21.61	21.61	21.61	21.61	21.61
35665F	24.96	24.96	24.96	24.96	24.96
35665G	25.30	25.30	25.30	25.30	25.30
35665H	26.01	26.01	26.01	26.01	26.01
35670	23.16	23.16	23.16	23.16	23.16
35671	23.16	23.16	23.16	23.16	23.16
35672	23.16	23.16	23.16	23.16	23.16
35673	23.16	23.16	23.16	23.16	23.16
35674	24.88	24.88	24.88	24.88	24.88
35680	22.47	22.47	22.47	22.47	22.47
35684	24.06	24.06	24.06	24.06	24.06
35690	22.88	22.88	22.88	22.88	22.88
35691	23.31	23.31	23.31	23.31	23.31
35693	23.87	23.87	23.87	23.87	23.87
35694	23.83	23.83	23.83	23.83	23.83
35695	23.15	23.15	23.15	23.15	23.15
35696	24.78	24.78	24.78	24.78	24.78

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
35697	24.77	24.77	24.77	24.77	24.77
35698	25.14	25.14	25.14	25.14	25.14
35700	21.95	21.95	21.95	21.95	21.95
35710	19.73	19.74	19.74	19.74	19.74
35712	19.73	19.74	19.74	19.74	19.74
35713	19.73	19.74	19.74	19.74	19.74
35715	19.73	19.74	19.74	19.74	19.74
35716	19.73	19.74	19.74	19.74	19.74
35717	19.73	19.74	19.74	19.74	19.74
35719	19.73	19.74	19.74	19.74	19.74
35720	21.77	21.77	21.77	21.77	21.77
35721	23.11	23.11	23.11	23.11	23.11
35722	23.11	23.11	23.11	23.11	23.11
35723	27.75	27.75	27.75	27.75	27.75
35724	23.12	23.12	23.12	23.12	23.12
35725	23.12	23.12	23.12	23.12	23.12
35726	23.13	23.13	23.13	23.13	23.13
35727	23.51	23.51	23.51	23.51	23.51
35728	23.97	23.97	23.97	23.97	23.97
35729	24.22	24.22	24.22	24.22	24.22
35730	25.36	25.36	25.36	25.36	25.36
35731	24.01	24.01	24.01	24.01	24.01
35732	24.06	24.06	24.06	24.06	24.06
35733	24.78	24.78	24.78	24.78	24.78
35734	25.37	25.37	25.37	25.37	25.37
35735	26.76	26.76	26.76	26.76	26.76
35740	24.30	24.30	24.30	24.30	24.30
35741	24.59	24.59	24.59	24.59	24.59
35742	25.84	25.84	25.84	25.84	25.84
35743	26.59	26.59	26.59	26.59	26.59
35744	24.64	24.64	24.64	24.64	24.64
35745	24.67	24.67	24.67	24.67	24.67
35746	19.04	19.04	19.04	19.04	19.04
35747	18.27	18.29	18.29	18.29	18.29
35750	19.20	19.21	19.20	19.21	19.20
35751	21.09	21.09	21.09	21.09	21.09
35752	20.37	20.38	20.38	20.38	20.38
35753	20.38	20.38	20.38	20.38	20.38
35754	20.70	20.70	20.70	20.70	20.70
35755	20.38	20.39	20.38	20.39	20.38
35756	21.44	21.44	21.44	21.44	21.44
35800	29.09	29.09	29.09	29.09	29.09
35805	28.08	28.08	28.08	28.08	28.08
35810	28.70	28.70	28.70	28.70	28.70
35815	29.87	29.87	29.87	29.87	29.87
35820	29.89	29.89	29.89	29.89	29.89
35825	28.75	28.75	28.75	28.75	28.75
35830	29.88	29.88	29.88	29.88	29.88
35835	30.01	30.01	30.01	30.01	30.01
35840	30.18	30.18	30.18	30.18	30.18

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
35845	30.71	30.71	30.71	30.71	30.71
35850	30.18	30.18	30.18	30.18	30.18
35855	29.00	29.00	29.00	29.00	29.00
35860	30.02	30.02	30.02	30.02	30.02
35865	29.82	29.82	29.82	29.82	29.82
35870	30.25	30.25	30.25	30.25	30.25
35875	31.67	31.67	31.67	31.67	31.67
35880	30.83	30.83	30.83	30.83	30.83
35885	31.54	31.54	31.54	31.54	31.54
35890	31.14	31.14	31.14	31.14	31.14
35895	31.19	31.19	31.19	31.19	31.19
35900	31.55	31.55	31.55	31.55	31.55
35905	30.74	30.74	30.74	30.74	30.74
35910	30.36	30.36	30.36	30.36	30.36
35915	30.80	30.80	30.80	30.80	30.80
35920	36.09	36.09	36.09	36.09	36.09
35930	35.83	35.83	35.83	35.83	35.83
35935	26.92	26.92	26.92	26.92	26.92
35940	26.88	26.88	26.88	26.88	26.88
35945	25.63	25.63	25.63	25.63	25.63
35950	25.63	25.63	25.63	25.63	25.63
35955	27.42	27.42	27.42	27.42	27.42
35960	26.18	26.18	26.18	26.18	26.18
35965	29.45	29.45	29.45	29.45	29.45
35970	29.12	29.12	29.12	29.12	29.12
35975	25.63	25.63	25.63	25.63	25.63
35980	25.81	25.81	25.81	25.81	25.81
35985	27.81	27.81	27.81	27.81	27.81
35990	26.29	26.29	26.29	26.29	26.29
36000	23.86	23.86	23.86	23.86	23.86
36005	25.79	25.79	25.79	25.79	25.79
36010	26.26	26.26	26.26	26.26	26.26
36015	28.19	28.19	28.19	28.19	28.19
36020	26.48	26.48	26.48	26.48	26.48
36025	28.57	28.57	28.57	28.57	28.57
36030	26.59	26.59	26.59	26.59	26.59
36035	28.65	28.65	28.65	28.65	28.65
36040	26.81	26.81	26.81	26.81	26.81
36045	28.73	28.73	28.73	28.73	28.73
36050	29.25	29.25	29.25	29.25	29.25
36055	29.33	29.33	29.33	29.33	29.33
36060	30.20	30.20	30.20	30.20	30.20
36065	31.77	31.77	31.77	31.77	31.77
36075	28.56	28.56	28.56	28.56	28.56
36080	26.15	26.15	26.15	26.15	26.15
36085	28.56	28.56	28.56	28.56	28.56
36090	26.32	26.32	26.32	26.32	26.32
36095	28.57	28.57	28.57	28.57	28.57
36100	29.51	29.51	29.51	29.51	29.51
36105	28.57	28.57	28.57	28.57	28.57

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
36110	31.81	31.81	31.81	31.81	31.81
36115	34.11	34.11	34.11	34.11	34.11
36120	29.71	29.71	29.71	29.71	29.71
36125	29.58	29.58	29.58	29.58	29.58
36130	30.57	30.57	30.57	30.57	30.57
36135	30.58	30.58	30.58	30.58	30.58
36140	30.62	30.62	30.62	30.62	30.62
36145	31.79	31.79	31.79	31.79	31.79
36150	16.72	16.76	16.76	16.76	16.76
36155	17.25	17.29	17.28	17.29	17.28
36158	17.51	17.54	17.54	17.54	17.54
36160	19.09	19.09	19.09	19.09	19.09
36175	18.42	18.42	18.42	18.42	18.42
36185	19.27	19.27	19.27	19.27	19.27
36190	18.90	18.90	18.90	18.90	18.90
36195	18.90	18.90	18.90	18.90	18.90
36200	25.94	25.94	25.94	25.94	25.94
36205	20.02	20.02	20.02	20.02	20.02
36210	21.91	21.91	21.91	21.91	21.91
36215	20.02	20.02	20.02	20.02	20.02
36220	22.90	22.90	22.90	22.90	22.90
36225	22.66	22.66	22.66	22.66	22.66
36230	17.30	17.33	17.32	17.33	17.32
36235	17.05	17.07	17.07	17.07	17.07
36240	16.99	17.02	17.02	17.02	17.02
36245	17.01	17.04	17.03	17.04	17.03
36250	17.44	17.45	17.45	17.45	17.45
36255	16.99	17.02	17.02	17.02	17.02
36260	17.73	17.73	17.73	17.73	17.73
36263	17.45	17.47	17.47	17.47	17.47
36265	18.43	18.43	18.43	18.43	18.43
36270	18.88	18.88	18.88	18.88	18.88
36275	18.98	18.98	18.98	18.98	18.98
36280	19.11	19.11	19.11	19.11	19.11
36285	19.27	19.27	19.27	19.27	19.27
36295	20.15	20.15	20.15	20.15	20.15
36300	20.69	20.69	20.69	20.69	20.69
36305	20.20	20.20	20.20	20.20	20.20
36310	20.20	20.20	20.20	20.20	20.20
36315	20.53	20.53	20.53	20.53	20.53
36320	20.70	20.70	20.70	20.70	20.70
36325	20.64	20.64	20.64	20.64	20.64
36330	20.64	20.64	20.64	20.64	20.64
36335	21.54	21.54	21.54	21.54	21.54
36340	20.82	20.82	20.82	20.82	20.82
36350	21.32	21.32	21.32	21.32	21.32
36352	21.55	21.55	21.55	21.55	21.55
36355	21.71	21.71	21.71	21.71	21.71
36360	22.41	22.41	22.41	22.41	22.41
36365	22.30	22.30	22.30	22.30	22.30

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
36370	22.55	22.55	22.55	22.55	22.55
36375	22.31	22.31	22.31	22.31	22.31
36380	21.63	21.63	21.63	21.63	21.63
36385	22.46	22.46	22.46	22.46	22.46
36390	21.64	21.64	21.64	21.64	21.64
36395	23.02	23.02	23.02	23.02	23.02
36400	28.38	28.38	28.38	28.38	28.38
36405	30.94	30.94	30.94	30.94	30.94
36410	31.24	31.24	31.24	31.24	31.24
36415	31.25	31.25	31.25	31.25	31.25
36420	31.50	31.50	31.50	31.50	31.50
36430	31.50	31.50	31.50	31.50	31.50
36435	31.27	31.27	31.27	31.27	31.27
36445	31.29	31.29	31.29	31.29	31.29
36450	16.99	17.02	17.02	17.02	17.02
36500	24.53	24.53	24.53	24.53	24.53
36510	24.53	24.53	24.53	24.53	24.53
36520	26.73	26.73	26.73	26.73	26.73
36530	30.02	30.02	30.02	30.02	30.02
36540	30.21	30.21	30.21	30.21	30.21
36550	29.38	29.38	29.38	29.38	29.38
36560	25.41	25.41	25.41	25.41	25.41
36570	30.21	30.21	30.21	30.21	30.21
36580	28.57	28.57	28.57	28.57	28.57
36590	28.57	28.57	28.57	28.57	28.57
36600	28.79	28.79	28.79	28.79	28.79
36610	32.15	32.15	32.15	32.15	32.15
36620	32.29	32.29	32.29	32.29	32.29
36630	32.43	32.43	32.43	32.43	32.43
36640	34.86	34.86	34.86	34.86	34.86
36650	34.86	34.86	34.86	34.86	34.86
36660	34.30	34.30	34.30	34.30	34.30
36670	33.95	33.95	33.95	33.95	33.95
36680	34.92	34.92	34.92	34.92	34.92
36690	33.96	33.96	33.96	33.96	33.96
36700	34.04	34.04	34.04	34.04	34.04
36710	34.61	34.61	34.61	34.61	34.61
36720	34.09	34.09	34.09	34.09	34.09
36730	34.49	34.49	34.49	34.49	34.49
36740	34.39	34.39	34.39	34.39	34.39
36750	34.38	34.38	34.38	34.38	34.38
36760	34.37	34.37	34.37	34.37	34.37
36770	34.42	34.42	34.42	34.42	34.42
36780	34.42	34.42	34.42	34.42	34.42
36790	34.71	34.71	34.71	34.71	34.71
36800	34.92	34.92	34.92	34.92	34.92
36810	33.59	33.59	33.59	33.59	33.59
36820	34.41	34.41	34.41	34.41	34.41
36830	33.63	33.63	33.63	33.63	33.63
36840	33.60	33.60	33.60	33.60	33.60

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
36850	34.59	34.59	34.59	34.59	34.59
36860	34.54	34.54	34.54	34.54	34.54
36870	34.46	34.46	34.46	34.46	34.46
36880	33.61	33.61	33.61	33.61	33.61
36890	29.61	29.61	29.61	29.61	29.61
36900	28.57	28.57	28.57	28.57	28.57
36910	34.19	34.19	34.19	34.19	34.19
36930	34.18	34.18	34.18	34.18	34.18
36940	33.68	33.68	33.68	33.68	33.68
36950	34.16	34.16	34.16	34.16	34.16
36960	37.09	37.09	37.09	37.09	37.09
36970	37.14	37.14	37.14	37.14	37.14
36980	33.50	33.50	33.50	33.50	33.50
37000	27.12	27.12	27.12	27.12	27.12
37010	27.15	27.15	27.15	27.15	27.15
37020	27.15	27.15	27.15	27.15	27.15
37030	27.46	27.46	27.46	27.46	27.46
37040	27.55	27.55	27.55	27.55	27.55
37050	27.97	27.97	27.97	27.97	27.97
37060	28.34	28.34	28.34	28.34	28.34
37070	27.55	27.55	27.55	27.55	27.55
37080	24.56	24.56	24.56	24.56	24.56
37090	24.56	24.56	24.56	24.56	24.56
37100	34.67	34.67	34.67	34.67	34.67
37110	33.16	33.16	33.16	33.16	33.16
37120	30.36	30.36	30.36	30.36	30.36
37130	31.53	31.53	31.53	31.53	31.53
37140	31.47	31.47	31.47	31.47	31.47
37150	29.61	29.61	29.61	29.61	29.61
37200	12.19	12.19	12.19	12.19	12.19
37205	12.24	12.24	12.24	12.24	12.24
37210	12.52	12.52	12.52	12.52	12.52
37215	13.47	13.47	13.47	13.47	13.47
37220	14.23	14.23	14.23	14.23	14.23
37225	14.85	14.85	14.85	14.85	14.85
37230	13.73	13.73	13.73	13.73	13.73
37235	9.91	9.91	9.91	9.91	9.91
37240	11.97	11.97	11.97	11.97	11.97
37245	22.17	22.17	22.17	22.17	22.17
37250	20.65	20.65	20.65	20.65	20.65
37255	21.58	21.58	21.58	21.58	21.58
37260	22.14	22.14	22.14	22.14	22.14
37265	21.31	21.31	21.31	21.31	21.31
37270	23.27	23.27	23.27	23.27	23.27
37275	16.52	16.52	16.52	16.52	16.52
37280	16.12	16.12	16.12	16.12	16.12
37285	23.21	23.21	23.21	23.21	23.21
37290	24.05	24.05	24.05	24.05	24.05
37295	19.86	19.86	19.86	19.86	19.86
37300	15.86	15.86	15.86	15.86	15.86

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
37305	21.41	21.41	21.41	21.41	21.41
37310	20.12	20.12	20.12	20.12	20.12
37315	19.72	19.72	19.72	19.72	19.72
37320	21.53	21.53	21.53	21.53	21.53
37325	26.44	26.44	26.44	26.44	26.44
37330	26.77	26.77	26.77	26.77	26.77
37335	29.14	29.14	29.14	29.14	29.14
37340	32.36	32.36	32.36	32.36	32.36
37345	31.37	31.37	31.37	31.37	31.37
37347	28.79	28.79	28.79	28.79	28.79
37350	31.30	31.30	31.30	31.30	31.30
37355	32.43	32.43	32.43	32.43	32.43
37360	31.63	31.63	31.63	31.63	31.63
37365	31.54	31.54	31.54	31.54	31.54
37370	33.14	33.14	33.14	33.14	33.14
37375	31.29	31.29	31.29	31.29	31.29
37380	31.85	31.85	31.85	31.85	31.85
37385	18.39	18.39	18.39	18.39	18.39
37390	29.71	29.71	29.71	29.71	29.71
37395	29.67	29.67	29.67	29.67	29.67
37400	31.11	31.11	31.11	31.11	31.11
37405	30.38	30.38	30.38	30.38	30.38
37410	30.19	30.19	30.19	30.19	30.19
37415	30.19	30.19	30.19	30.19	30.19
37420	31.12	31.12	31.12	31.12	31.12
37425	31.75	31.75	31.75	31.75	31.75
37430	33.29	33.29	33.29	33.29	33.29
37435	33.26	33.26	33.26	33.26	33.26
37440	24.34	24.34	24.34	24.34	24.34
37445	27.48	27.48	27.48	27.48	27.48
37450	24.31	24.31	24.31	24.31	24.31
37455	28.16	28.16	28.16	28.16	28.16
37460	19.49	19.49	19.49	19.49	19.49
37465	16.51	16.52	16.51	16.52	16.51
37470	18.33	18.33	18.33	18.33	18.33
37475	17.62	17.62	17.62	17.62	17.62
37480	18.76	18.76	18.76	18.76	18.76
37485	26.49	26.49	26.49	26.49	26.49
37490	29.71	29.71	29.71	29.71	29.71
37495	29.89	29.89	29.89	29.89	29.89
37500	30.03	30.03	30.03	30.03	30.03
37505	26.75	26.75	26.75	26.75	26.75
37510	29.68	29.68	29.68	29.68	29.68
37515	29.58	29.58	29.58	29.58	29.58
37520	26.75	26.75	26.75	26.75	26.75
37525	27.12	27.12	27.12	27.12	27.12
37530	27.06	27.06	27.06	27.06	27.06
37535	29.63	29.63	29.63	29.63	29.63
37540	20.91	20.91	20.91	20.91	20.91
37545	21.66	21.66	21.66	21.66	21.66

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
37550	20.56	20.56	20.56	20.56	20.56
37555	22.08	22.08	22.08	22.08	22.08
37560	25.85	25.85	25.85	25.85	25.85
37565	21.14	21.14	21.14	21.14	21.14
37570	22.85	22.85	22.85	22.85	22.85
37575	31.14	31.14	31.14	31.14	31.14
37580	37.85	37.85	37.85	37.85	37.85
37583	30.10	30.10	30.10	30.10	30.10
37585	30.16	30.16	30.16	30.16	30.16
37590	31.04	31.04	31.04	31.04	31.04
37595	31.49	31.49	31.49	31.49	31.49
37600	32.82	32.82	32.82	32.82	32.82
37605	32.91	32.91	32.91	32.91	32.91
37610	33.13	33.13	33.13	33.13	33.13
37615	33.14	33.14	33.14	33.14	33.14
37620	17.73	17.76	17.75	17.76	17.75
37625	21.15	21.15	21.15	21.15	21.15
37630	17.74	17.77	17.76	17.77	17.76
37635	17.75	17.77	17.77	17.77	17.77
37640	17.76	17.79	17.78	17.79	17.78
37645	17.76	17.79	17.78	17.79	17.78
37650	18.21	18.21	18.21	18.21	18.21
37655	23.44	23.44	23.44	23.44	23.44
37660	26.24	26.24	26.24	26.24	26.24
37665	22.43	22.43	22.43	22.43	22.43
37670	19.33	19.33	19.33	19.33	19.33
37675	30.67	30.67	30.67	30.67	30.67
37680	24.58	24.58	24.58	24.58	24.58
37685	26.10	26.10	26.10	26.10	26.10
37690	24.19	24.19	24.19	24.19	24.19
37695	24.67	24.67	24.67	24.67	24.67
37700	29.34	29.34	29.34	29.34	29.34
37705	26.40	26.40	26.40	26.40	26.40
37710	25.23	25.23	25.23	25.23	25.23
37715	25.41	25.41	25.41	25.41	25.41
37720	29.39	29.39	29.39	29.39	29.39
37725	30.92	30.92	30.92	30.92	30.92
37730	30.89	30.89	30.89	30.89	30.89
37735	25.92	25.92	25.92	25.92	25.92
37740	30.44	30.44	30.44	30.44	30.44
37745	21.46	21.46	21.46	21.46	21.46
37750	31.17	31.17	31.17	31.17	31.17
37755	32.61	32.61	32.61	32.61	32.61
37760	32.68	32.68	32.68	32.68	32.68
37765	34.25	34.25	34.25	34.25	34.25
37770	34.30	34.30	34.30	34.30	34.30
37775	34.54	34.54	34.54	34.54	34.54
37780	34.49	34.49	34.49	34.49	34.49
37785	34.57	34.57	34.57	34.57	34.57
37790	34.63	34.63	34.63	34.63	34.63

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
37795	33.98	33.98	33.98	33.98	33.98
37800	36.98	36.98	36.98	36.98	36.98
37805	36.68	36.68	36.68	36.68	36.68
37810	37.77	37.77	37.77	37.77	37.77
37815	36.80	36.80	36.80	36.80	36.80
37820	19.84	19.84	19.84	19.84	19.84
37825	24.18	24.18	24.18	24.18	24.18
37830	21.68	21.68	21.68	21.68	21.68
37835	21.49	21.49	21.49	21.49	21.49
37840	18.56	18.56	18.56	18.56	18.56
37845	24.66	24.66	24.66	24.66	24.66
37850	29.64	29.64	29.64	29.64	29.64
37855	25.32	25.32	25.32	25.32	25.32
37860	26.83	26.83	26.83	26.83	26.83
37865	30.15	30.15	30.15	30.15	30.15
37870	30.68	30.68	30.68	30.68	30.68
37875	31.19	31.19	31.19	31.19	31.19
37880	23.96	23.96	23.96	23.96	23.96
37885	24.08	24.08	24.08	24.08	24.08
37890	24.09	24.09	24.09	24.09	24.09
37895	28.44	28.44	28.44	28.44	28.44
37900	29.51	29.51	29.51	29.51	29.51
37905	21.67	21.67	21.67	21.67	21.67
37910	21.89	21.89	21.89	21.89	21.89
37915	16.04	16.12	16.11	16.12	16.11
37920	16.82	16.82	16.82	16.82	16.82
37925	19.62	19.62	19.62	19.62	19.62
37930	27.69	27.69	27.69	27.69	27.69
37935	26.54	26.54	26.54	26.54	26.54
37940	24.93	24.93	24.93	24.93	24.93
37945	21.96	21.96	21.96	21.96	21.96
37950	23.18	23.18	23.18	23.18	23.18
37955	25.70	25.70	25.70	25.70	25.70
37960	26.52	26.52	26.52	26.52	26.52
37965	28.20	28.20	28.20	28.20	28.20
37970	28.20	28.20	28.20	28.20	28.20
37975	28.20	28.20	28.20	28.20	28.20
37980	27.91	27.91	27.91	27.91	27.91
37985	26.72	26.72	26.72	26.72	26.72
37990	28.51	28.51	28.51	28.51	28.51
37995	28.54	28.54	28.54	28.54	28.54
38000	34.60	34.60	34.60	34.60	34.60
38005	34.60	34.60	34.60	34.60	34.60
38010	35.93	35.93	35.93	35.93	35.93
38015	20.84	20.85	20.85	20.85	20.84
38020	22.20	22.20	22.20	22.20	22.20
38025	22.34	22.34	22.34	22.34	22.34
38030	22.94	22.94	22.94	22.94	22.94
38035	23.16	23.16	23.16	23.16	23.16
38040	23.16	23.16	23.16	23.16	23.16

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
38045	22.15	22.15	22.15	22.15	22.15
38050	22.86	22.86	22.86	22.86	22.86
38055	21.73	21.73	21.73	21.73	21.73
38060	23.38	23.38	23.38	23.38	23.38
38065	24.14	24.14	24.14	24.14	24.14
38070	27.65	27.65	27.65	27.65	27.65
38075	25.91	25.91	25.91	25.91	25.91
38080	24.52	24.52	24.52	24.52	24.52
38085	29.96	29.96	29.96	29.96	29.96
38090	30.21	30.21	30.21	30.21	30.21
38095	25.22	25.22	25.22	25.22	25.22
38100	25.21	25.21	25.21	25.21	25.21
38105	34.27	34.27	34.27	34.27	34.27
38110	31.02	31.02	31.02	31.02	31.02
38115	33.45	33.45	33.45	33.45	33.45
38120	34.90	34.90	34.90	34.90	34.90
38125	39.53	39.53	39.53	39.53	39.53
38130	36.26	36.26	36.26	36.26	36.26
38135	22.95	22.95	22.95	22.95	22.95
38140	30.71	30.71	30.71	30.71	30.71
38145	36.66	36.66	36.66	36.66	36.66
38150	30.09	30.09	30.09	30.09	30.09
38155	30.61	30.61	30.61	30.61	30.61
38160	23.91	23.91	23.91	23.91	23.91
38165	16.75	16.75	16.75	16.75	16.75
38170	15.94	15.94	15.94	15.94	15.94
38175P	33.28	33.28	33.28	33.28	33.28
38180	17.74	17.77	17.76	17.77	17.76
38185	11.11	12.77	12.74	12.75	12.73
38190	21.30	21.30	21.30	21.30	21.30
38195	26.70	26.70	26.70	26.70	26.70
38200	26.43	26.43	26.43	26.43	26.43
38205	27.84	27.84	27.84	27.84	27.84
38210	28.58	28.58	28.58	28.58	28.58
38215	29.63	29.63	29.63	29.63	29.63
38220	29.77	29.77	29.77	29.77	29.77
38295	32.06	32.06	32.06	32.06	32.06
38300	32.28	32.28	32.28	32.28	32.28
38305	32.39	32.39	32.39	32.39	32.39
38310	32.43	32.43	32.43	32.43	32.43
38315	33.23	33.23	33.23	33.23	33.23
38320	33.97	33.97	33.97	33.97	33.97
38325	34.30	34.30	34.30	34.30	34.30
38330	34.46	34.46	34.46	34.46	34.46
38335	34.49	34.49	34.49	34.49	34.49
38340	34.55	34.55	34.55	34.55	34.55
38345	19.95	19.95	19.95	19.95	19.95
38350	20.53	20.53	20.53	20.53	20.53
38355	22.87	22.87	22.87	22.87	22.87
38360	23.64	23.64	23.64	23.64	23.64

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
38365	22.57	22.57	22.57	22.57	22.57
38370	23.81	23.81	23.81	23.81	23.81
38380	23.08	23.08	23.08	23.08	23.08
38385	26.67	26.67	26.67	26.67	26.67
38390	28.25	28.25	28.25	28.25	28.25
38395	31.03	31.03	31.03	31.03	31.03
38400	18.27	18.28	18.28	18.28	18.28
38405	19.71	19.71	19.71	19.71	19.71
38410	19.71	19.71	19.71	19.71	19.71
38415	19.72	19.72	19.72	19.72	19.72
38420	19.72	19.72	19.72	19.72	19.72
38425	31.28	31.28	31.28	31.28	31.28
38430	29.12	29.12	29.12	29.12	29.12
38435	29.77	29.77	29.77	29.77	29.77
38440	29.81	29.81	29.81	29.81	29.81
38445	29.89	29.89	29.89	29.89	29.89
38450	30.30	30.30	30.30	30.30	30.30
38455	30.45	30.45	30.45	30.45	30.45
38460	30.44	30.44	30.44	30.44	30.44
38465	31.27	31.27	31.27	31.27	31.27
38470	29.20	29.20	29.20	29.20	29.20
38475	30.17	30.17	30.17	30.17	30.17
38480	9.11	9.13	9.11	9.11	9.11
38485	9.01	9.13	9.01	9.01	9.01
38490	8.81	9.13	8.81	8.82	8.81
38495	8.77	9.13	8.78	8.79	8.78
38500	8.33	8.62	8.33	8.33	8.33
38505	13.04	13.04	13.04	13.04	13.04
38510	13.36	13.36	13.36	13.36	13.36
38515	14.09	14.09	14.09	14.09	14.09
38520	14.41	14.41	14.41	14.41	14.41
38525	13.68	13.68	13.68	13.68	13.68
38530	13.73	13.73	13.73	13.73	13.73
38535	13.84	13.84	13.84	13.84	13.84
38540	13.96	13.96	13.96	13.96	13.96
38545	12.75	12.75	12.75	12.75	12.75
38550	21.33	21.33	21.33	21.33	21.33
38555	31.57	31.57	31.57	31.57	31.57
38560	31.80	31.80	31.80	31.80	31.80
38565	32.78	32.78	32.78	32.78	32.78
38570	28.01	28.01	28.01	28.01	28.01
38575	28.14	28.14	28.14	28.14	28.14
38580	29.51	29.51	29.51	29.51	29.51
38585	30.02	30.02	30.02	30.02	30.02
38590	19.67	19.67	19.67	19.67	19.67
38595	17.31	17.31	17.31	17.31	17.31
38600	31.76	31.76	31.76	31.76	31.76
38605	31.69	31.69	31.69	31.69	31.69
38610	28.15	28.15	28.15	28.15	28.15
38615	35.19	35.19	35.19	35.19	35.19

Node	ECM (ft)	RECM (ft)	PCM 1 (ft)	PCM 2 (ft)	PCM 3 (ft)
38620	25.72	25.72	25.72	25.72	25.72
38625	31.18	31.18	31.18	31.18	31.18
38630	22.00	21.99	22.00	21.99	22.00
38645	26.21	26.21	26.21	26.21	26.21
38650	24.72	24.72	24.72	24.72	24.72
39000	17.54	17.54	17.54	17.54	17.54
39010	20.57	20.57	20.57	20.57	20.57
39050	13.69	13.69	13.69	13.69	13.69
39055	27.16	27.16	27.16	27.16	27.16
39060	30.89	30.89	30.89	30.89	30.89
39065	31.12	31.12	31.12	31.12	31.12
39070	30.43	30.43	30.43	30.43	30.43
39075	29.57	29.57	29.57	29.57	29.57
39080	25.78	25.78	25.78	25.78	25.78
39085	22.22	22.22	22.22	22.22	22.22
39090	40.78	40.78	40.78	40.78	40.78
39095	21.86	21.86	21.86	21.86	21.86
39105	9.81	9.83	9.82	9.83	9.82
39110	7.22	7.22	7.21	7.22	7.21
39115	9.21	9.21	9.21	9.21	9.21
39120	17.10	17.10	17.10	17.10	17.10
39125	34.57	34.57	34.57	34.57	34.57
40127	15.45	15.45	15.45	15.45	15.45
40188	16.36	16.36	16.36	16.36	16.36
40298	13.53	13.53	13.53	13.53	13.53
40622	15.22	15.22	15.22	15.22	15.22
40645	15.39	15.39	15.39	15.39	15.39
40666	22.90	22.90	22.90	22.90	22.90
61400	33.52	33.52	33.52	33.52	33.52
61615	34.25	34.25	34.25	34.25	34.25
61760	34.64	34.64	34.64	34.64	34.64
61810	34.15	34.15	34.15	34.15	34.15
62600	35.54	35.54	35.54	35.54	35.54
62900	37.30	37.30	37.30	37.30	37.30
62940	34.48	34.48	34.48	34.48	34.48
64072	34.60	34.60	34.60	34.60	34.60
64073	34.63	34.63	34.63	34.63	34.63
80790	34.92	34.92	34.92	34.92	34.92
80931	34.66	34.66	34.66	34.66	34.66
MH1	12.58	12.60	12.59	12.60	12.59
MH2	12.57	12.60	12.58	12.60	12.58
MH3	12.57	12.60	12.58	12.60	12.58
MH6	12.58	12.60	12.59	12.60	12.59
MH7	12.58	12.60	12.59	12.60	12.59
MH8	12.57	12.60	12.58	12.60	12.58
MH9	12.57	12.60	12.58	12.60	12.58
PSF	13.50	13.69	13.67	13.68	13.67
PUMP	8.16	8.33	8.16	8.16	8.16

Appendix F: ICPR Input

MODEL UPDATE SUMMARY WORKSHEET
Created by DBF Comparator

Basin: ______ Bayshed: ______

Project Name: PJ1_ECMvRECM Sec/Twn/Ran: ______

Modification Type: ______ New Construction
______ Modification of Existing Conditions

Modification Date: 7/17/2018 SEU Staff: ______

NAME	BASIN	NODE	PIPE	CHAN	WEIR	X-SECT	DRP STR	BRIDGE
30384_CHA5				Addition				
30384_CHA8				Addition				
30384_CHA14				Addition				
30384_CHA20				Addition				
30384_DAM					Addition			
30385				Modification				
30384				Deletion				
30384_STA5		Addition						
30384_STA8		Addition						
30384_STA14		Addition						
30384		Modification						
30384_STA20		Addition						
30384_XS5						Addition		
30384_XS8						Addition		
30384_XS14						Addition		
30384_XS16						Addition		
30384_XS20						Addition		
30384_XSDAM						Addition		
30383AP						Modification		

NOTES:

SKETCH

- Nodes -

CHOOSE ONE

X Addition
___ Modification
___ Deletion

EXISTING
Name:
Group:
Comment:

Init Stage (ft):
Warn Stage (ft):

Stage (ft)	Area (ac)

REVISED
Name: 30384_STA5
Group: MIDPHILL
Comment:

Init Stage (ft): 1.42
Warn Stage (ft): 6.42

Stage (ft)	Area (ac)
No data	

CHOOSE ONE

X Addition
___ Modification
___ Deletion

EXISTING
Name:
Group:
Comment:

Init Stage (ft):
Warn Stage (ft):

Stage (ft)	Area (ac)

REVISED
Name: 30384_STA8
Group: MIDPHILL
Comment:

Init Stage (ft): 1.42
Warn Stage (ft): 6.42

Stage (ft)	Area (ac)
6	0.02
7	0.11
8	0.16
9	0.21
10	0.29
11	0.34
12	0.39
14.14	0.5
14.64	0.79
15.14	1.1
16.14	1.49
16.64	1.74
17.14	1.82
17.78	1.83
32.78	1.83

CHOOSE ONE

X Addition
___ Modification
___ Deletion

EXISTING
Name:
Group:
Comment:

Init Stage (ft):
Warn Stage (ft):

Stage (ft)	Area (ac)

REVISED
Name: 30384_STA14
Group: MIDPHILL
Comment:

Init Stage (ft): 1.42
Warn Stage (ft): 6.42

Stage (ft)	Area (ac)
No data	

CHOOSE ONE

___ Addition

X Modification

___ Deletion

EXISTING

Name: 30384
Group: MIDPHILL
Comment:

Init Stage (ft): 1.42
Warn Stage (ft): 6.42

Stage (ft)	Area (ac)
-3.38	0.01
0.13	0.01
0.14	0.01
0.64	0.82
1.64	0.92
2.14	0.95
2.64	0.98
3.14	1.02
3.64	1.05
4.14	1.09
5.14	1.21
5.64	1.27
6.14	1.31
6.64	1.38
7.14	1.47
8.14	1.82
8.64	1.94
9.14	2.19
9.64	2.51
10.64	3.58
11.14	4.47
11.64	5.37
13.14	8.68
14.14	10.07
14.64	10.78
15.14	11.66
15.64	12.48
16.64	13.62
17.14	14.12
17.64	14.54
18.24	14.57
33.24	14.57

REVISED

Name: 30384_STA16
Group: MIDPHILL
Comment:

Init Stage (ft): 1.42
Warn Stage (ft): 6.42

Stage (ft)	Area (ac)
13.14	2.38
14.14	3.77
14.64	4.48
15.14	5.36
15.64	6.18
16.64	7.32
17.14	7.82
17.64	8.24
18.24	8.27
33.24	8.27

CHOOSE ONE

X Addition

___ Modification

EXISTING

Name:
Group:
Comment:

Init Stage (ft):
Warn Stage (ft):

REVISED

Name: 30384_STA20
Group: MIDPHILL
Comment:

Init Stage (ft): 1.42
Warn Stage (ft): 6.42

___ Deletion

Stage (ft)	Area (ac)

Stage (ft)	Area (ac)
No data	

------------------------ **Cross Sections** ------------------------

CHOOSE ONE

X Addition

___ Modification

___ Deletion

EXISTING

Name:
Group:
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n

REVISED

Name: 30384_XS5
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
950	10.58	0.08
960	8.42	0.08
970	3.78	0.08
980	0.11	0.04
990	-2.5	0.04
1000	-2.76	0.04
1010	-2.76	0.04
1020	-2.71	0.04
1030	-2.69	0.04
1040	-2.59	0.04
1050	-2.27	0.04
1060	-2.04	0.04
1070	-1.14	0.04
1080	-0.49	0.04
1090	-0.46	0.04
1100	0.13	0.04
1110	1.65	0.08
1120	2.4	0.08
1130	5	0.08
1140	6.45	0.08

CHOOSE ONE

X Addition

___ Modification

___ Deletion

EXISTING

Name:
Group:
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n

REVISED

Name: 30384_XS8
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
940	11.03	0.08
950	9.89	0.08
960	8.28	0.08
970	5.47	0.08
980	2.68	0.08
990	0.38	0.04
1000	-1.54	0.04
1010	-2.79	0.04
1020	-2.48	0.04
1030	-2.44	0.04
1040	-2.1	0.04

1050	-1.62	0.04
1060	-1.28	0.04
1070	-1.31	0.04
1080	-1.26	0.04
1090	-1.31	0.04
1100	-1.17	0.04
1110	-1.2	0.04
1120	-1.06	0.04
1130	-0.54	0.04
1140	1.55	0.08
1150	4.5	0.08
1160	5.32	0.08

CHOOSE ONE

X Addition

___ Modification

___ Deletion

EXISTING

Name:
Group:
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n

REVISED

Name: 30384_XS14
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
920	12.82	0.08
930	11.57	0.08
940	10.26	0.08
950	9.36	0.08
960	9.06	0.08
970	8.78	0.08
980	8.12	0.08
990	6.62	0.08
1000	3.01	0.08
1010	0.37	0.04
1020	-2.5	0.04
1030	-2.78	0.04
1040	-2.57	0.04
1050	-2.14	0.04
1060	-1.72	0.04
1070	-1.82	0.04
1080	-1.72	0.04
1090	-1.42	0.04
1100	-1.75	0.04
1110	-2.21	0.04
1120	-2.59	0.04
1130	-2.48	0.04
1140	-2.6	0.04
1150	-2.57	0.04
1160	-2.47	0.04
1170	-1.1	0.04
1180	-0.41	0.04
1190	1.61	0.08
1200	5.5	0.08

CHOOSE ONE

X Addition

___ Modification

___ Deletion

EXISTING			**REVISED**		
Name:			Name:	30384_XS16	
Group:			Group:	MIDPHILL	
Comment:			Comment:		
X-sta (ft)	Y-ele.(ft)	Manning's n	X-sta (ft)	Y-ele.(ft)	Manning's n
			950	11.66	0.08
			960	11.49	0.08
			970	11.34	0.08
			980	11.12	0.08
			990	10.82	0.08
			1000	9.37	0.08
			1010	8.68	0.08
			1020	7.46	0.08
			1030	6.36	0.08
			1040	5.53	0.08
			1050	4.99	0.08
			1060	4.13	0.08
			1070	3.93	0.08
			1080	3.69	0.08
			1090	3.27	0.08
			1100	2.99	0.08
			1110	2.82	0.08
			1120	2.72	0.08
			1130	2.67	0.08
			1140	2.57	0.08
			1150	2.43	0.08
			1160	2.27	0.08
			1170	2.09	0.08
			1180	1.8	0.08
			1190	1.46	0.04
			1200	1.22	0.04
			1210	1	0.04
			1220	1	0.04
			1230	1.06	0.04
			1240	0.22	0.04
			1250	-1.1	0.04
			1260	-1.79	0.04
			1270	-2.31	0.04
			1280	-2.78	0.04
			1290	-2.63	0.04
			1300	-2.36	0.04
			1310	-2.37	0.04
			1320	-2.27	0.04
			1330	-1.88	0.04
			1340	-0.21	0.04
			1350	2.6	0.04
			1360	6.16	0.08
			1370	7.62	0.08
			1380	8.25	0.08
			1390	8.53	0.08

1400	8.96	0.08

CHOOSE ONE

X Addition
___ Modification
___ Deletion

EXISTING			REVISED		
Name:			Name:	30384_XS20	
Group:			Group:	MIDPHILL	
Comment:			Comment:		
X-sta (ft)	Y-ele.(ft)	Manning's n	X-sta (ft)	Y-ele.(ft)	Manning's n
			1600	10.7	0.08
			1610	8.7	0.08
			1620	7.33	0.08
			1630	5.52	0.08
			1640	3.45	0.08
			1650	0.45	0.04
			1660	-0.67	0.04
			1670	-0.81	0.04
			1680	-1.92	0.04
			1690	-2.22	0.04
			1700	-2.61	0.04
			1710	-2.83	0.04
			1720	-3.07	0.04
			1730	-3.5	0.04
			1740	-2.42	0.04
			1750	2.83	0.08
			1760	6.12	0.08
			1770	7.36	0.08
			1780	8.16	0.08
			1790	8.4	0.08

CHOOSE ONE

X Addition
___ Modification
___ Deletion

EXISTING			REVISED		
Name:			Name:	30384_XSDAM	
Group:			Group:	MIDPHILL	
Comment:			Comment:		
X-sta (ft)	Y-ele.(ft)	Manning's n	X-sta (ft)	Y-ele.(ft)	Manning's n
			1060	1.18	0.04
			1161	1.19	0.045
			1161	-2.76	0.045
			1171	-2.76	0.045
			1171	1.27	0.045
			1172	1.27	0.045
			1172	-3.39	0.045
			1181	-3.39	0.045
			1181	1.2	0.045
			1182	1.2	0.045
			1182	-2.62	0.045
			1191	-2.62	0.045
			1191	1.2	0.045
			1192	1.2	0.045

1192	-2.5	0.045
1201	-2.5	0.045
1201	1.2	0.045
1202	1.2	0.045
1202	-2	0.045
1211	-2	0.045
1211	1.2	0.045
1212	1.2	0.045
1212	-1.28	0.045
1221	-1.28	0.045
1221	7.72	0.045

CHOOSE ONE

___ Addition

X Modification

___ Deletion

EXISTING

Name: 30383AP
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
874.9	25.92	0.08
875	13.92	0.08
875.1	10.92	0.08
900	9.92	0.08
914	9.82	0.08
928	9.62	0.08
939	0.02	0.08
970	-4.98	0.035
1000	-6.58	0.035
1022	-7.18	0.035
1050	-0.78	0.035
1063	7.52	0.04
1079	8.02	0.06
1120	8.92	0.06
1124.9	10.92	0.06
1125	13.92	0.06
1125.1	25.92	0.06

REVISED

Name: 30383AP
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
874.9	25.92	0.08
875	13.92	0.08
875.1	10.92	0.08
912.5	9.4	0.08
917.6	9.2	0.08
921	8.9	0.08
931	4.9	0.08
932.5	4.1	0.08
938.4	3	0.08
945.5	0.5	0.04
952.2	-1.2	0.04
957.1	-1.9	0.04
962	-1.9	0.04
966.4	-1.6	0.04
972	-2	0.04
977.3	-2.4	0.04
983.2	-4.6	0.04
987.3	-3.1	0.04
992.2	-3.9	0.04
997	-4.8	0.04
1002.2	-4.1	0.04
1007.1	-4.1	0.04
1012.1	-4.2	0.04
1017.5	-6.7	0.04
1022.5	-6.4	0.04
1027	-4.1	0.04
1032.7	-6.3	0.04
1037.5	-6.9	0.04
1042.3	-5.9	0.04
1047	-5.8	0.04
1051.6	-4	0.04
1056.5	-3.5	0.04

1061.4	-2.9	0.04
1066.9	-2.1	0.04
1071.9	-1.9	0.04
1076.3	-1.8	0.04
1081.8	-1.6	0.04
1085.8	-1.5	0.04
1090	2.55	0.04
1100	4.63	0.08
1110	6.47	0.08
1120	8.92	0.08
1124.9	10.92	0.08
1125	13.92	0.08
1125.1	25.92	0.08

- Channels -

CHOOSE ONE

X Addition

___ Modification

___ Deletion

EXISTING			REVISED		
Name:			Name:	30384_CHA5	
Group:			Group:	MIDPHILL	
From Node:			From Node:	30384_STA5	
To Node:			To Node:	30383	
Length (ft):			Length (ft):	300	
Count:			Count:	1	
	Upstream	Downstream		Upstream	Downstream
Geometry:			Geometry:	Irregular	Irregular
Invert (ft):			Invert (ft):	-2.76	-7.18
TclpInitZ (ft):			TclpInitZ (ft):	97.92	97.92
Manning's n:			Manning's n:		
Tclip (ft):			Tclip (ft):		
Bclip (ft):			Bclip (ft):		
Main Xsec:			Main Xsec:	30384_XS5	30383AP
AxEl1 (ft):			AxEl1 (ft):	0	0
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):			AxEl2 (ft):	0	0
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:			Equation:	Average Conveyance	
Flow:			Flow:	Both	
Eddy Contrac Coef:			Eddy Contrac Coef:	0.1	
Eddy Expans Coef:			Eddy Expans Coef:	0.3	
Entrance Loss Coef:			Entrance Loss Coef:	0	
Exit Loss Coef:			Exit Loss Coef:	0	
Outlet Cntrl Spec:			Outlet Cntrl Spec:	Use dc or tw	

EXISTING			REVISED		
Inlet Cntrl Spec:			Inlet Cntrl Spec:	Use dn	
Stabilizer Option:			Stabilizer Option:	No Stabilization	

CHOOSE ONE

X Addition

___ Modification

___ Deletion

EXISTING			REVISED		
Name:			Name:	30384_CHA8	
Group:			Group:	MIDPHILL	
From Node:			From Node:	30384_STA8	
To Node:			To Node:	30384_STA5	
Length (ft):			Length (ft):	300	
Count:			Count:	1	
	Upstream	Downstream		Upstream	Downstream
Geometry:			Geometry:	Irregular	Irregular
Invert (ft):			Invert (ft):	-2.79	-2.76
TclpInitZ (ft):			TclpInitZ (ft):	97.92	97.922
Manning's n:			Manning's n:		
Tclip (ft):			Tclip (ft):		
Bclip (ft):			Bclip (ft):		
Main Xsec:			Main Xsec:	30384_XS8	30384_XS5
AxEl1 (ft):			AxEl1 (ft):	0	0
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):			AxEl2 (ft):	0	0
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:			Equation:	Average Conveyance	
Flow:			Flow:	Both	
Eddy Contrac Coef:			Eddy Contrac Coef:	0.1	
Eddy Expans Coef:			Eddy Expans Coef:	0.3	
Entrance Loss Coef:			Entrance Loss Coef:	0	
Exit Loss Coef:			Exit Loss Coef:	0	
Outlet Cntrl Spec:			Outlet Cntrl Spec:	Use dc or tw	
Inlet Cntrl Spec:			Inlet Cntrl Spec:	Use dc	
Stabilizer Option:			Stabilizer Option:	No Stabilization	

CHOOSE ONE

X Addition

EXISTING	REVISED	
Name:	Name:	30384_CHA14
Group:	Group:	MIDPHILL
From Node:	From Node:	30384_STA14
To Node:	To Node:	30384_STA8

	EXISTING			REVISED		
___ Modification	Length (ft):			Length (ft):	500	
___ Deletion	Count:			Count:	1	
		Upstream	Downstream		Upstream	Downstream
	Geometry:			Geometry:	Irregular	Irregular
	Invert (ft):			Invert (ft):	-2.78	-2.79
	TclpInitZ (ft):			TclpInitZ (ft):	97.92	97.92
	Manning's n:			Manning's n:		
	Tclip (ft):			Tclip (ft):		
	Bclip (ft):			Bclip (ft):		
	Main Xsec:			Main Xsec:	30384_XS14	30384_XS8
	AxEl1 (ft):			AxEl1 (ft):	0	0
	Aux Xsec1:			Aux Xsec1:		
	AxEl2 (ft):			AxEl2 (ft):	0	0
	Aux Xsec2:			Aux Xsec2:		
	Twidth (ft):			Twidth (ft):		
	Depth (ft):			Depth (ft):		
	Bwidth (ft):			Bwidth (ft):		
	LSdSlp (h/v):			LSdSlp (h/v):		
	RSdSlp (h/v):			RSdSlp (h/v):		
	Equation:			Equation:	Average Conveyance	
	Flow:			Flow:	Both	
	Eddy Contrac Coef:			Eddy Contrac Coef:	0.1	
	Eddy Expans Coef:			Eddy Expans Coef:	0.3	
	Entrance Loss Coef:			Entrance Loss Coef:	0	
	Exit Loss Coef:			Exit Loss Coef:	0	
	Outlet Cntrl Spec:			Outlet Cntrl Spec:	Use dc or tw	
	Inlet Cntrl Spec:			Inlet Cntrl Spec:	Use dc	
	Stabilizer Option:			Stabilizer Option:	No Stabilization	

CHOOSE ONE	EXISTING			REVISED		
	Name:			Name:	30384_CHA20	
	Group:			Group:	MIDPHILL	
X Addition	From Node:			From Node:	30384_STA20	
	To Node:			To Node:	30384_STA16	
___ Modification	Length (ft):			Length (ft):	500	
	Count:			Count:	1	
___ Deletion						
		Upstream	Downstream		Upstream	Downstream
	Geometry:			Geometry:	Irregular	Irregular
	Invert (ft):			Invert (ft):	-3.5	-2.78
	TclpInitZ (ft):			TclpInitZ (ft):	97.92	97.92
	Manning's n:			Manning's n:		
	Tclip (ft):			Tclip (ft):		
	Bclip (ft):			Bclip (ft):		
	Main Xsec:			Main Xsec:	30384_XS20	30384_XS16

AxEl1 (ft):			AxEl1 (ft):	0	0
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):			AxEl2 (ft):	0	0
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:			Equation:	Average Conveyance	
Flow:			Flow:	Both	
Eddy Contrac Coef:			Eddy Contrac Coef:	0.1	
Eddy Expans Coef:			Eddy Expans Coef:	0.3	
Entrance Loss Coef:			Entrance Loss Coef:	0	
Exit Loss Coef:			Exit Loss Coef:	0	
Outlet Cntrl Spec:			Outlet Cntrl Spec:	Use dc or tw	
Inlet Cntrl Spec:			Inlet Cntrl Spec:	Use dc	
Stabilizer Option:			Stabilizer Option:	No Stabilization	

CHOOSE ONE

___ Addition

X Modification

___ Deletion

	EXISTING			**REVISED**	
Name:	30385		Name:	30385	
Group:	MIDPHILL		Group:	MIDPHILL	
From Node:	30385		From Node:	30385	
To Node:	30384		To Node:	30384_STA20	
Length (ft):	764		Length (ft):	150	
Count:	1		Count:	1	
	Upstream	Downstream		Upstream	Downstream
Geometry:	Irregular	Irregular	Geometry:	Irregular	Irregular
Invert (ft):	-7.08	-3.38	Invert (ft):	-7.08	-3.5
TclpInitZ (ft):	9997.92	9997.92	TclpInitZ (ft):	97.92	97.92
Manning's n:			Manning's n:		
Tclip (ft):			Tclip (ft):		
Bclip (ft):			Bclip (ft):		
Main Xsec:	30386EX	30384	Main Xsec:	30386EX	30384_XS20
AxEl1 (ft):	0	0	AxEl1 (ft):	0	0
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):	0	0	AxEl2 (ft):	0	0
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:	Average Conveyance		Equation:	Average Conveyance	
Flow:	Both		Flow:	Both	

Eddy Contrac Coef:	0.1	Eddy Contrac Coef:	0.1
Eddy Expans Coef:	0.3	Eddy Expans Coef:	0.3
Entrance Loss Coef:	0	Entrance Loss Coef:	0
Exit Loss Coef:	0	Exit Loss Coef:	0
Outlet Cntrl Spec:	Use dc or tw	Outlet Cntrl Spec:	Use dc or tw
Inlet Cntrl Spec:	Use dn	Inlet Cntrl Spec:	Use dn
Stabilizer Option:	No Stabilization	Stabilizer Option:	No Stabilization

CHOOSE ONE

___ Addition

___ Modification

X Deletion

	EXISTING			**REVISED**	
Name:	30384		Name:		
Group:	MIDPHILL		Group:		
From Node:	30384		From Node:		
To Node:	30383		To Node:		
Length (ft):	900		Length (ft):		
Count:	1		Count:		
	Upstream	Downstream		Upstream	Downstream
Geometry:	Irregular	Irregular	Geometry:		
Invert (ft):	-3.38	-7.18	Invert (ft):		
TclpInitZ (ft):	9997.92	9997.92	TclpInitZ (ft):		
Manning's n:			Manning's n:		
Tclip (ft):			Tclip (ft):		
Bclip (ft):			Bclip (ft):		
Main Xsec:	30384	30383AP	Main Xsec:		
AxEl1 (ft):	0	0	AxEl1 (ft):		
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):	0	0	AxEl2 (ft):		
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:	Average Conveyance		Equation:		
Flow:	Both		Flow:		
Eddy Contrac Coef:	0.1		Eddy Contrac Coef:		
Eddy Expans Coef:	0.3		Eddy Expans Coef:		
Entrance Loss Coef:	0		Entrance Loss Coef:		
Exit Loss Coef:	0		Exit Loss Coef:		
Outlet Cntrl Spec:	Use dc or tw		Outlet Cntrl Spec:		
Inlet Cntrl Spec:	Use dn		Inlet Cntrl Spec:		
Stabilizer Option:	No Stabilization		Stabilizer Option:		

- Irregular Weirs -

CHOOSE ONE

X Addition

___ Modification

___ Deletion

EXISTING		REVISED	
Name:		Name:	30384_DAM
Group:		Group:	MIDPHILL
From Node:		From Node:	30384_STA16
To Node:		To Node:	**30384_STA14**
Count:		Count:	1
Type:		Type:	Vertical: Mavis Equation
Xsec Name:		Xsec Name:	30384_XSDAM
Invert (ft):		Invert (ft):	-3.39
Control Elev (ft):		Control Elev (ft):	1.2
Struct Opening Dim (ft):		Struct Opening Dim (ft):	9999
Bottom Clip (in):		Bottom Clip (in):	0
Top Clip (in):		Top Clip (in):	0
Weir Discharge Coef:		Weir Discharge Coef:	3.2
Orifice Discharge Coef:		Orifice Discharge Coef:	0.6

MODEL UPDATE SUMMARY WORKSHEET
Created by DBF Comparator

Basin: ____________ Bayshed: ____________

Project Name: PJ1_RECMvPCM 1 Sec/Twn/Ran: ____________

Modification Type: ____ New Construction
____ Modification of Existing Conditions

Modification Date: 7/17/2018 SEU Staff: ____________

NAME	BASIN	NODE	PIPE	CHAN	WEIR	X-SECT	DRP STR	BRIDGE
30384_CHA5				Modification				
30384_CHA8				Modification				
30384_CHA14				Modification				
30384_CHA20				Modification				
30384_DAM					Deletion			
30384_XS5						Modification		
30384_XS8						Modification		
30384_XS14						Deletion		
30384_XS16						Modification		
30384_XSDAM						Deletion		
30384_STA14		Deletion						

NOTES:

SKETCH

- **Cross Sections** -

CHOOSE ONE

____ Addition
X Modification
____ Deletion

EXISTING
Name: 30384_XS5
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
950	10.58	0.08
960	8.42	0.08
970	3.78	0.08

REVISED
Name: 30384_XS5
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
950	10.58	0.08
960	8.42	0.08
970	3.79	0.08

980	0.11	0.04	980	1.08	0.08
990	-2.5	0.04	990	-0.7	0.04
1000	-2.76	0.04	1000	-1.35	0.04
1010	-2.76	0.04	1010	-1.96	0.04
1020	-2.71	0.04	1020	-2.64	0.04
1030	-2.69	0.04	1030	-3.3	0.04
1040	-2.59	0.04	1040	-3.53	0.04
1050	-2.27	0.04	1050	-3.54	0.04
1060	-2.04	0.04	1060	-3.48	0.04
1070	-1.14	0.04	1070	-3.28	0.04
1080	-0.49	0.04	1080	-2.48	0.04
1090	-0.46	0.04	1090	-1.78	0.04
1100	0.13	0.04	1100	-0.03	0.04
1110	1.65	0.08	1110	2.36	0.08
1120	2.4	0.08	1120	3.28	0.08
1130	5	0.08	1130	5	0.08
1140	6.45	0.08	1140	6.45	0.08

CHOOSE ONE

____ Addition

X ____ Modification

____ Deletion

EXISTING			**REVISED**		
Name:	30384_XS8		Name:	30384_XS8	
Group:	MIDPHILL		Group:	MIDPHILL	
Comment:			Comment:		
X-sta (ft)	Y-ele.(ft)	Manning's n	X-sta (ft)	Y-ele.(ft)	Manning's n
940	11.03	0.08	940	11.03	0.08
950	9.89	0.08	950	9.89	0.08
960	8.28	0.08	960	8.28	0.08
970	5.47	0.08	970	5.47	0.08
980	2.68	0.08	980	3.35	0.08
990	0.38	0.04	990	1.55	0.08
1000	-1.54	0.04	1000	0.03	0.04
1010	-2.79	0.04	1010	-0.97	0.04
1020	-2.48	0.04	1020	-1.97	0.04
1030	-2.44	0.04	1030	-2.97	0.04
1040	-2.1	0.04	1040	-3.5	0.04
1050	-1.62	0.04	1050	-3.83	0.04
1060	-1.28	0.04	1060	-4	0.04
1070	-1.31	0.04	1070	-4	0.04
1080	-1.26	0.04	1080	-3.99	0.04
1090	-1.31	0.04	1090	-3.07	0.04
1100	-1.17	0.04	1100	-2.07	0.04
1110	-1.2	0.04	1110	-1.07	0.04
1120	-1.06	0.04	1120	-0.07	0.04
1130	-0.54	0.04	1130	0.93	0.04
1140	1.55	0.08	1140	1.98	0.08
1150	4.5	0.08	1150	4.5	0.08
1160	5.32	0.08	1160	5.32	0.08

CHOOSE ONE

____ Addition

____ Modification

X Deletion

EXISTING

Name: 30384_XS14
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
920	12.82	0.08
930	11.57	0.08
940	10.26	0.08
950	9.36	0.08
960	9.06	0.08
970	8.78	0.08
980	8.12	0.08
990	6.62	0.08
1000	3.01	0.08
1010	0.37	0.04
1020	-2.5	0.04
1030	-2.78	0.04
1040	-2.57	0.04
1050	-2.14	0.04
1060	-1.72	0.04
1070	-1.82	0.04
1080	-1.72	0.04
1090	-1.42	0.04
1100	-1.75	0.04
1110	-2.21	0.04
1120	-2.59	0.04
1130	-2.48	0.04
1140	-2.6	0.04
1150	-2.57	0.04
1160	-2.47	0.04
1170	-1.1	0.04
1180	-0.41	0.04
1190	1.61	0.08
1200	5.5	0.08

REVISED

Name:
Group:
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n

CHOOSE ONE

____ Addition

X Modification

____ Deletion

EXISTING

Name: 30384_XS16
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
950	11.66	0.08
960	11.49	0.08
970	11.34	0.08
980	11.12	0.08
990	10.82	0.08
1000	9.37	0.08

REVISED

Name: 30384_XS16
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
960	11.49	0.08
970	11.23	0.08
980	11.01	0.08
990	10.67	0.08
1000	10.22	0.08
1010	9.75	0.08

1010	8.68	0.08	1020	9.37	0.08
1020	7.46	0.08	1030	8.69	0.08
1030	6.36	0.08	1040	8.14	0.08
1040	5.53	0.08	1050	7.89	0.08
1050	4.99	0.08	1060	7.28	0.08
1060	4.13	0.08	1070	6.59	0.08
1070	3.93	0.08	1080	5.89	0.08
1080	3.69	0.08	1090	5.36	0.08
1090	3.27	0.08	1100	4.75	0.08
1100	2.99	0.08	1110	4.25	0.08
1110	2.82	0.08	1120	3.9	0.08
1120	2.72	0.08	1130	3.58	0.08
1130	2.67	0.08	1140	3.5	0.08
1140	2.57	0.08	1150	3.36	0.08
1150	2.43	0.08	1160	3.14	0.08
1160	2.27	0.08	1170	2.84	0.08
1170	2.09	0.08	1180	2.31	0.08
1180	1.8	0.08	1190	1.6	0.08
1190	1.46	0.04	1200	0.59	0.04
1200	1.22	0.04	1210	-0.49	0.04
1210	1	0.04	1220	-1.49	0.04
1220	1	0.04	1230	-1.99	0.04
1230	1.06	0.04	1240	-2.45	0.04
1240	0.22	0.04	1250	-2.92	0.04
1250	-1.1	0.04	1260	-3.24	0.04
1260	-1.79	0.04	1270	-3.44	0.04
1270	-2.31	0.04	1280	-3.53	0.04
1280	-2.78	0.04	1290	-3.51	0.04
1290	-2.63	0.04	1300	-3.22	0.04
1300	-2.36	0.04	1310	-2.89	0.04
1310	-2.37	0.04	1320	-2.42	0.04
1320	-2.27	0.04	1330	-1.66	0.04
1330	-1.88	0.04	1340	-0.31	0.04
1340	-0.21	0.04	1350	2.62	0.08
1350	2.6	0.04	1360	5.27	0.08
1360	6.16	0.08	1370	6.86	0.08
1370	7.62	0.08	1380	7.81	0.08
1380	8.25	0.08	1390	8.22	0.08
1390	8.53	0.08	1400	8.87	0.08
1400	8.96	0.08			

CHOOSE ONE

____ Addition

____ Modification

_X_ Deletion

EXISTING			**REVISED**		
Name:	30384_XSDAM		Name:		
Group:	MIDPHILL		Group:		
Comment:			Comment:		
X-sta (ft)	Y-ele.(ft)	Manning's n	X-sta (ft)	Y-ele.(ft)	Manning's n
1060	1.18	0.04			
1161	1.19	0.045			
1161	-2.76	0.045			

1171	-2.76	0.045
1171	1.27	0.045
1172	1.27	0.045
1172	-3.39	0.045
1181	-3.39	0.045
1181	1.2	0.045
1182	1.2	0.045
1182	-2.62	0.045
1191	-2.62	0.045
1191	1.2	0.045
1192	1.2	0.045
1192	-2.5	0.045
1201	-2.5	0.045
1201	1.2	0.045
1202	1.2	0.045
1202	-2	0.045
1211	-2	0.045
1211	1.2	0.045
1212	1.2	0.045
1212	-1.28	0.045
1221	-1.28	0.045
1221	7.72	0.045

- Channels -

CHOOSE ONE

____ Addition

X Modification

____ Deletion

	EXISTING			**REVISED**	
Name:	30384_CHA5		Name:	30384_CHA5	
Group:	MIDPHILL		Group:	MIDPHILL	
From Node:	30384_STA5		From Node:	30384_STA5	
To Node:	30383		To Node:	30383	
Length (ft):	300		Length (ft):	300	
Count:	1		Count:	1	
	Upstream	Downstream		Upstream	Downstream
Geometry:	Irregular	Irregular	Geometry:	Irregular	Irregular
Invert (ft):	-2.76	-7.18	Invert (ft):	-3.54	-7.18
TclpInitZ (ft):	97.92	97.92	TclpInitZ (ft):	97.92	97.92
Manning's n:			Manning's n:		
Tclip (ft):			Tclip (ft):		
Bclip (ft):			Bclip (ft):		
Main Xsec:	30384_XS5	30383AP	Main Xsec:	30384_XS5	30383AP
AxEl1 (ft):	0	0	AxEl1 (ft):	0	0
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):	0	0	AxEl2 (ft):	0	0
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:	Average Conveyance		Equation:	Average Conveyance	

Flow:	Both	Flow:	Both
Eddy Contrac Coef:	0.1	Eddy Contrac Coef:	0.1
Eddy Expans Coef:	0.3	Eddy Expans Coef:	0.3
Entrance Loss Coef:	0	Entrance Loss Coef:	0
Exit Loss Coef:	0	Exit Loss Coef:	0
Outlet Cntrl Spec:	Use dc or tw	Outlet Cntrl Spec:	Use dc or tw
Inlet Cntrl Spec:	Use dn	Inlet Cntrl Spec:	Use dn
Stabilizer Option:	No Stabilization	Stabilizer Option:	No Stabilization

CHOOSE ONE

___ Addition

X Modification

___ Deletion

	EXISTING			**REVISED**	
Name:	30384_CHA8		Name:	30384_CHA8	
Group:	MIDPHILL		Group:	MIDPHILL	
From Node:	30384_STA8		From Node:	30384_STA8	
To Node:	30384_STA5		To Node:	30384_STA5	
Length (ft):	300		Length (ft):	300	
Count:	1		Count:	1	
	Upstream	Downstream		Upstream	Downstream
Geometry:	Irregular	Irregular	Geometry:	Irregular	Irregular
Invert (ft):	-2.79	-2.76	Invert (ft):	-4	-3.54
TclpInitZ (ft):	97.92	97.922	TclpInitZ (ft):	97.92	97.922
Manning's n:			Manning's n:		
Tclip (ft):			Tclip (ft):		
Bclip (ft):			Bclip (ft):		
Main Xsec:	30384_XS8	30384_XS5	Main Xsec:	30384_XS8	30384_XS5
AxEl1 (ft):	0	0	AxEl1 (ft):	0	0
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):	0	0	AxEl2 (ft):	0	0
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:	Average Conveyance		Equation:	Average Conveyance	
Flow:	Both		Flow:	Both	
Eddy Contrac Coef:	0.1		Eddy Contrac Coef:	0.1	
Eddy Expans Coef:	0.3		Eddy Expans Coef:	0.3	
Entrance Loss Coef:	0		Entrance Loss Coef:	0	
Exit Loss Coef:	0		Exit Loss Coef:	0	
Outlet Cntrl Spec:	Use dc or tw		Outlet Cntrl Spec:	Use dc or tw	

Inlet Cntrl Spec:	Use dc		Inlet Cntrl Spec:	Use dc	
Stabilizer Option:	No Stabilization		Stabilizer Option:	No Stabilization	

CHOOSE ONE

___ Addition

X Modification

___ Deletion

	EXISTING			**REVISED**	
Name:	30384_CHA14		Name:	30384_CHA14	
Group:	MIDPHILL		Group:	MIDPHILL	
From Node:	30384_STA14		From Node:	30384_STA14	
To Node:	30384_STA8		To Node:	30384_STA8	
Length (ft):	500		Length (ft):	500	
Count:	1		Count:	1	
	Upstream	Downstream		Upstream	Downstream
Geometry:	Irregular	Irregular	Geometry:	Irregular	Irregular
Invert (ft):	-2.78	-2.79	Invert (ft):	-4	-4
TclpInitZ (ft):	97.92	97.92	TclpInitZ (ft):	97.92	97.92
Manning's n:			Manning's n:		
Tclip (ft):			Tclip (ft):		
Bclip (ft):			Bclip (ft):		
Main Xsec:	30384_XS14	30384_XS8	Main Xsec:	30384_XS14	30384_XS8
AxEl1 (ft):	0	0	AxEl1 (ft):	0	0
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):	0	0	AxEl2 (ft):	0	0
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:	Average Conveyance		Equation:	Average Conveyance	
Flow:	Both		Flow:	Both	
Eddy Contrac Coef:	0.1		Eddy Contrac Coef:	0.1	
Eddy Expans Coef:	0.3		Eddy Expans Coef:	0.3	
Entrance Loss Coef:	0		Entrance Loss Coef:	0	
Exit Loss Coef:	0		Exit Loss Coef:	0	
Outlet Cntrl Spec:	Use dc or tw		Outlet Cntrl Spec:	Use dc or tw	
Inlet Cntrl Spec:	Use dc		Inlet Cntrl Spec:	Use dc	
Stabilizer Option:	No Stabilization		Stabilizer Option:	No Stabilization	

CHOOSE ONE

___ Addition

	EXISTING		**REVISED**
Name:	30384_CHA20	Name:	30384_CHA20
Group:	MIDPHILL	Group:	MIDPHILL
From Node:	30384_STA20	From Node:	30384_STA20

X Modification

___ Deletion

	Existing Upstream	Existing Downstream		Revised Upstream	Revised Downstream
To Node:	30384_STA16		To Node:	30384_STA16	
Length (ft):	500		Length (ft):	500	
Count:	1		Count:	1	
	Upstream	Downstream		Upstream	Downstream
Geometry:	Irregular	Irregular	Geometry:	Irregular	Irregular
Invert (ft):	-3.5	-2.78	Invert (ft):	-3.5	-3.53
TclpInitZ (ft):	97.92	97.92	TclpInitZ (ft):	97.92	97.92
Manning's n:			Manning's n:		
Tclip (ft):			Tclip (ft):		
Bclip (ft):			Bclip (ft):		
Main Xsec:	30384_XS20	30384_XS16	Main Xsec:	30384_XS20	30384_XS16
AxEl1 (ft):	0	0	AxEl1 (ft):	0	0
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):	0	0	AxEl2 (ft):	0	0
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:	Average Conveyance		Equation:	Average Conveyance	
Flow:	Both		Flow:	Both	
Eddy Contrac Coef:	0.1		Eddy Contrac Coef:	0.1	
Eddy Expans Coef:	0.3		Eddy Expans Coef:	0.3	
Entrance Loss Coef:	0		Entrance Loss Coef:	0	
Exit Loss Coef:	0		Exit Loss Coef:	0	
Outlet Cntrl Spec:	Use dc or tw		Outlet Cntrl Spec:	Use dc or tw	
Inlet Cntrl Spec:	Use dc		Inlet Cntrl Spec:	Use dc	
Stabilizer Option:	No Stabilization		Stabilizer Option:	No Stabilization	

- Irregular Weirs -

CHOOSE ONE

___ Addition

___ Modification

X Deletion

	EXISTING		**REVISED**
Name:	30384_DAM	Name:	
Group:	MIDPHILL	Group:	
From Node:	30384_STA16	From Node:	
To Node:	**30384_STA14**	To Node:	
Count:	1	Count:	
Type:	Vertical: Mavis Equation	Type:	
Xsec Name:	30384_XSDAM	Xsec Name:	
Invert (ft):	-3.39	Invert (ft):	
Control Elev (ft):	1.2	Control Elev (ft):	
Struct Opening Dim (ft):	9999	Struct Opening Dim (ft):	
Bottom Clip (in):	0	Bottom Clip (in):	
Top Clip (in):	0	Top Clip (in):	

Weir Discharge Coef:	3.2	Weir Discharge Coef:	
Orifice Discharge Coef:	0.6	Orifice Discharge Coef:	

MODEL UPDATE SUMMARY WORKSHEET
Created by DBF Comparator

Basin: ______________ Bayshed: ______________

Project Name: PJ1_PCM 1vPCM 2 Sec/Twn/Ran: ______________

Modification Type: ____ New Construction
____ Modification of Existing Conditions

Modification Date: 7/17/2018 SEU Staff: ______________

NAME	BASIN	NODE	PIPE	CHAN	WEIR	X-SECT	DRP STR	BRIDGE
30384_CHA20				Modification				
30384_XS16						Modification		

NOTES:

SKETCH

- **Cross Sections** -

CHOOSE ONE

___ Addition

X Modification

___ Deletion

EXISTING

Name: 30384_XS16
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
960	11.49	0.08
970	11.23	0.08
980	11.01	0.08

REVISED

Name: 30384_XS16
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
960	11.49	0.08
970	11.23	0.08
980	11.01	0.08

990	10.67	0.08	990	10.67	0.08
1000	10.22	0.08	1000	9.66	0.08
1010	9.75	0.08	1010	9	0.08
1020	9.37	0.08	1020	8.17	0.08
1030	8.69	0.08	1030	7.04	0.08
1040	8.14	0.08	1040	5.7	0.08
1050	7.89	0.08	1050	4.9	0.08
1060	7.28	0.08	1060	4.25	0.08
1070	6.59	0.08	1070	3.28	0.08
1080	5.89	0.08	1080	2.37	0.08
1090	5.36	0.08	1090	1.4	0.08
1100	4.4	0.08	1100	0.65	0.04
1110	3.98	0.08	1110	0.23	0.04
1120	3.72	0.08	1120	-0.18	0.04
1130	3.58	0.08	1130	-1.09	0.04
1140	3.5	0.08	1140	-2.01	0.04
1150	3.36	0.08	1150	-2.27	0.04
1160	3.14	0.08	1160	-2.49	0.04
1170	2.84	0.08	1170	-2.72	0.04
1180	2.31	0.08	1180	-3	0.04
1190	1.6	0.08	1190	-3.43	0.04
1200	0.59	0.04	1200	-3.94	0.04
1210	-0.49	0.04	1210	-4.3	0.04
1220	-1.49	0.04	1220	-4.63	0.04
1230	-1.99	0.04	1230	-4.63	0.04
1240	-2.45	0.04	1240	-4.61	0.04
1250	-2.92	0.04	1250	-4.83	0.04
1260	-3.24	0.04	1260	-5.11	0.04
1270	-3.44	0.04	1270	-4.96	0.04
1280	-3.53	0.04	1280	-4.4	0.04
1290	-3.51	0.04	1290	-3.67	0.04
1300	-3.22	0.04	1300	-2.9	0.04
1310	-2.89	0.04	1310	-2.32	0.04
1320	-2.42	0.04	1320	-1.6	0.04
1330	-1.66	0.04	1330	-0.93	0.04
1340	-0.31	0.04	1340	0.04	0.04
1350	2.62	0.08	1350	2.7	0.04
1360	5.27	0.08	1360	5.31	0.08
1370	6.86	0.08	1370	6.86	0.08
1380	7.81	0.08	1380	7.81	0.08
1390	8.22	0.08	1390	8.23	0.08
1400	8.87	0.08	1400	8.87	0.08

- Channels -

CHOOSE ONE	EXISTING		REVISED	
	Name:	30384_CHA20	Name:	30384_CHA20
	Group:	MIDPHILL	Group:	MIDPHILL
____ Addition	From Node:	30384_STA20	From Node:	30384_STA20
	To Node:	30384_STA16	To Node:	30384_STA16
X Modification	Length (ft):	500	Length (ft):	500

___ Deletion

	Count: 1			Count: 1	
	Upstream	Downstream		Upstream	Downstream
Geometry:	Irregular	Irregular	Geometry:	Irregular	Irregular
Invert (ft):	-3.5	-3.53	Invert (ft):	-3.5	-5.11
TclpInitZ (ft):	97.92	97.92	TclpInitZ (ft):	97.92	97.92
Manning's n:			Manning's n:		
Tclip (ft):			Tclip (ft):		
Bclip (ft):			Bclip (ft):		
Main Xsec:	30384_XS20	30384_XS16	Main Xsec:	30384_XS20	30384_XS16
AxEl1 (ft):	0	0	AxEl1 (ft):	0	0
Aux Xsec1:			Aux Xsec1:		
AxEl2 (ft):	0	0	AxEl2 (ft):	0	0
Aux Xsec2:			Aux Xsec2:		
Twidth (ft):			Twidth (ft):		
Depth (ft):			Depth (ft):		
Bwidth (ft):			Bwidth (ft):		
LSdSlp (h/v):			LSdSlp (h/v):		
RSdSlp (h/v):			RSdSlp (h/v):		
Equation:	Average Conveyance		Equation:	Average Conveyance	
Flow:	Both		Flow:	Both	
Eddy Contrac Coef:	0.1		Eddy Contrac Coef:	0.1	
Eddy Expans Coef:	0.3		Eddy Expans Coef:	0.3	
Entrance Loss Coef:	0		Entrance Loss Coef:	0	
Exit Loss Coef:	0		Exit Loss Coef:	0	
Outlet Cntrl Spec:	Use dc or tw		Outlet Cntrl Spec:	Use dc or tw	
Inlet Cntrl Spec:	Use dc		Inlet Cntrl Spec:	Use dc	
Stabilizer Option:	No Stabilization		Stabilizer Option:	No Stabilization	

MODEL UPDATE SUMMARY WORKSHEET
Created by DBF Comparator

Basin: ______ Bayshed: ______

Project Name: PJ1_PCM 1 v PCM 3 Sec/Twn/Ran: ______

Modification Type: ____ New Construction
____ Modification of Existing Conditions

Modification Date: 7/17/2018 SEU Staff: ______

NAME	BASIN	NODE	PIPE	CHAN	WEIR	X-SECT	DRP STR	BRIDGE
30384_XS16						Modification		

NOTES:

SKETCH

- **Cross Sections** -

CHOOSE ONE

___ Addition

X Modification

___ Deletion

EXISTING

Name: 30384_XS16
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
960	11.49	0.08
970	11.23	0.08
980	11.01	0.08

REVISED

Name: 30384_XS16
Group: MIDPHILL
Comment:

X-sta (ft)	Y-ele.(ft)	Manning's n
960	11.49	0.08
970	11.23	0.08
980	11.01	0.08

990	10.67	0.08	990	10.67	0.08
1000	10.22	0.08	1000	10.22	0.08
1010	9.75	0.08	1010	9.75	0.08
1020	9.37	0.08	1020	9.37	0.08
1030	8.69	0.08	1030	8.69	0.08
1040	8.14	0.08	1040	8.14	0.08
1050	7.89	0.08	1050	7.89	0.08
1060	7.28	0.08	1060	7.28	0.08
1070	6.59	0.08	1070	6.59	0.08
1080	5.89	0.08	1080	5.89	0.08
1090	5.36	0.08	1090	5.36	0.08
1100	4.4	0.08	1100	4.75	0.08
1110	3.98	0.08	1110	4.25	0.08
1120	3.72	0.08	1120	3.9	0.08
1130	3.58	0.08	1130	3.58	0.08
1140	3.5	0.08	1140	3.5	0.08
1150	3.36	0.08	1150	3.36	0.08
1160	3.14	0.08	1160	3.14	0.08
1170	2.84	0.08	1170	2.84	0.08
1180	2.31	0.08	1180	2.31	0.08
1190	1.6	0.08	1190	1.6	0.08
1200	0.59	0.04	1200	0.59	0.04
1210	-0.49	0.04	1210	-0.49	0.04
1220	-1.49	0.04	1220	-1.49	0.04
1230	-1.99	0.04	1230	-1.99	0.04
1240	-2.45	0.04	1240	-2.45	0.04
1250	-2.92	0.04	1250	-2.92	0.04
1260	-3.24	0.04	1260	-3.24	0.04
1270	-3.44	0.04	1270	-3.44	0.04
1280	-3.53	0.04	1280	-3.53	0.04
1290	-3.51	0.04	1290	-3.51	0.04
1300	-3.22	0.04	1300	-3.22	0.04
1310	-2.89	0.04	1310	-2.89	0.04
1320	-2.42	0.04	1320	-2.42	0.04
1330	-1.66	0.04	1330	-1.66	0.04
1340	-0.31	0.04	1340	-0.31	0.04
1350	2.62	0.08	1350	2.62	0.08
1360	5.27	0.08	1360	5.27	0.08
1370	6.86	0.08	1370	6.86	0.08
1380	7.81	0.08	1380	7.81	0.08
1390	8.22	0.08	1390	8.22	0.08
1400	8.87	0.08	1400	8.87	0.08

Appendix G: Estimate of Engineer's Probable BMP Cost

Design Alternative 1

Item No.	Description	Unit	Unit Price	Unit Price Source	Quantity	Amount
5-7-3	Construction Stakeout	HR	$90.15	F. Derr and Co.	45	$4,056.75
5-7-7	Record drawings	LS	$20,000.00	WEC	1	$20,000.00
102-1-3	Mobilization (10%)	EA	$45,311.50	WEC	1	$45,311.50
101-2-1S	Project Sign	EA	$1,500.00	FDOT	1	$1,500.00
104-10-3	Sediment barrier	LF	$1.24	FDOT	850	$1,054.00
104-11	Turbidity barrier, floating	LF	$11.61	FDOT	600	$6,966.00
104-15	Soil tracking prevention device	EA	$2,824.13	FDOT	1	$2,824.13
104-30S	Prevention, control, abatement of erosion & water pollution	LS	$100,000.00	WEC	1	$100,000.00
104-31-15	Dust abatement water	MG	$1,000.00	WEC	10	$10,000.00
110-1	Clearing and grubbing	AC	$10,752.56	FDOT	1.5	$16,128.84
120-5	Channel Excavation	CY	$10.19	FDOT	10414	$106,118.66
120-6	Embankment	CY	$6.95	FDOT	4247	$29,516.65
146-1	Special bank treatment 1	SF	$15.00	WEC	5000	$75,000.00
162-1-11	Prepared soil layer, finish soil layer, littoral shelf, 6"	SY	$15.00	WEC	1200	$18,000.00
110-73	Remove existing bulkhead	LF	$350.00	WEC	177	$61,950.00
570-1-2	Performance Turf - Sod	SY	$3.00	FDOT	4300	$12,900.00
	Additional items					
	Rehabilitate shuffleboard courts		$4,000.00		1	$4,000.00
	Geotechnical Analysis		$3,600.00		1	$3,600.00
	Design and Permitting		$85,000.00		1	$85,000.00
	Temporary Easement acquisition			unknown		
	CEI	15% total	$ 74,763.98		1	$74,763.98
					Subtotal	$678,690.51
					30% contingency	**$882,297.67**

Deduct (Excavated sediment found suitable for bank restructuring)

120-5	Channel Excavation	CY	$10.19	FDOT	4247	$43,276.93

Design Alternative 2

Item No.	Description	Unit	Unit Price	Unit Price Source	Quantity	Amount
5-7-3	Construction Stakeout	HR	$90.15	F. Derr and Co.	60	$5,409.00
5-7-7	Record drawings	LS	$20,000.00	WEC	1	$20,000.00
102-1-3	Mobilization (10%)	EA	$65,717.63	WEC	1	$65,717.63
101-2-1S	Project Sign	EA	$1,500.00	FDOT	1	$1,500.00
104-10-3	Sediment barrier	LF	$1.24	FDOT	850	$1,054.00
104-11	Turbidity barrier, floating	LF	$11.61	FDOT	600	$6,966.00
104-15	Soil tracking prevention device	EA	$2,824.13	FDOT	1	$2,824.13
104-30S	Prevention, control, abatement of erosion & water pollution	LS	$150,000.00	WEC	1	$150,000.00
104-31-15	Dust abatement water	MG	$1,000.00	WEC	15	$15,000.00
110-1	Clearing and grubbing	AC	$10,752.56	FDOT	1.75	$18,816.98
120-5	Channel Excavation	CY	$10.19	FDOT	20062	$204,431.78
120-6	Embankment	CY	$6.95	FDOT	4251	$29,544.45
BS-1	#250 Sand	CY	$25.04	F. Derr and Co.	750	$18,780.00
146-1	Special bank treatment 1	SF	$15.00	WEC	5000	$75,000.00
162-1-11	Prepared soil layer, finish soil layer, littoral shelf, 6"	SY	$15.00	WEC	2200	$33,000.00
110-73	Remove existing bulkhead	LF	$350.00	WEC	177	$61,950.00
570-1-2	Performance Turf - Sod	SY	$3.00	FDOT	4300	$12,900.00
580-1-1	Emergent plants	LS	$8,500.00	FDOT	1	$8,500.00
	Additional items					
	Rehabilitate shuffleboard courts		$4,000.00		1	$4,000.00
	Geotechnical Analysis		$3,600.00		1	$3,600.00
	Design and Permitting		$95,000.00		1	$95,000.00
	Temporary Easement acquisition			unknown		
	CEI	15% total	$125,099.10		1	$125,099.10
					Subtotal	$959,093.07
					30% contingency	**$1,246,820.99**

Deduct (Excavated sediment found suitable for bank restructuring)

120-5	Channel Excavation	CY	$10.19	FDOT	4251	$43,317.69

Design Alternative 3

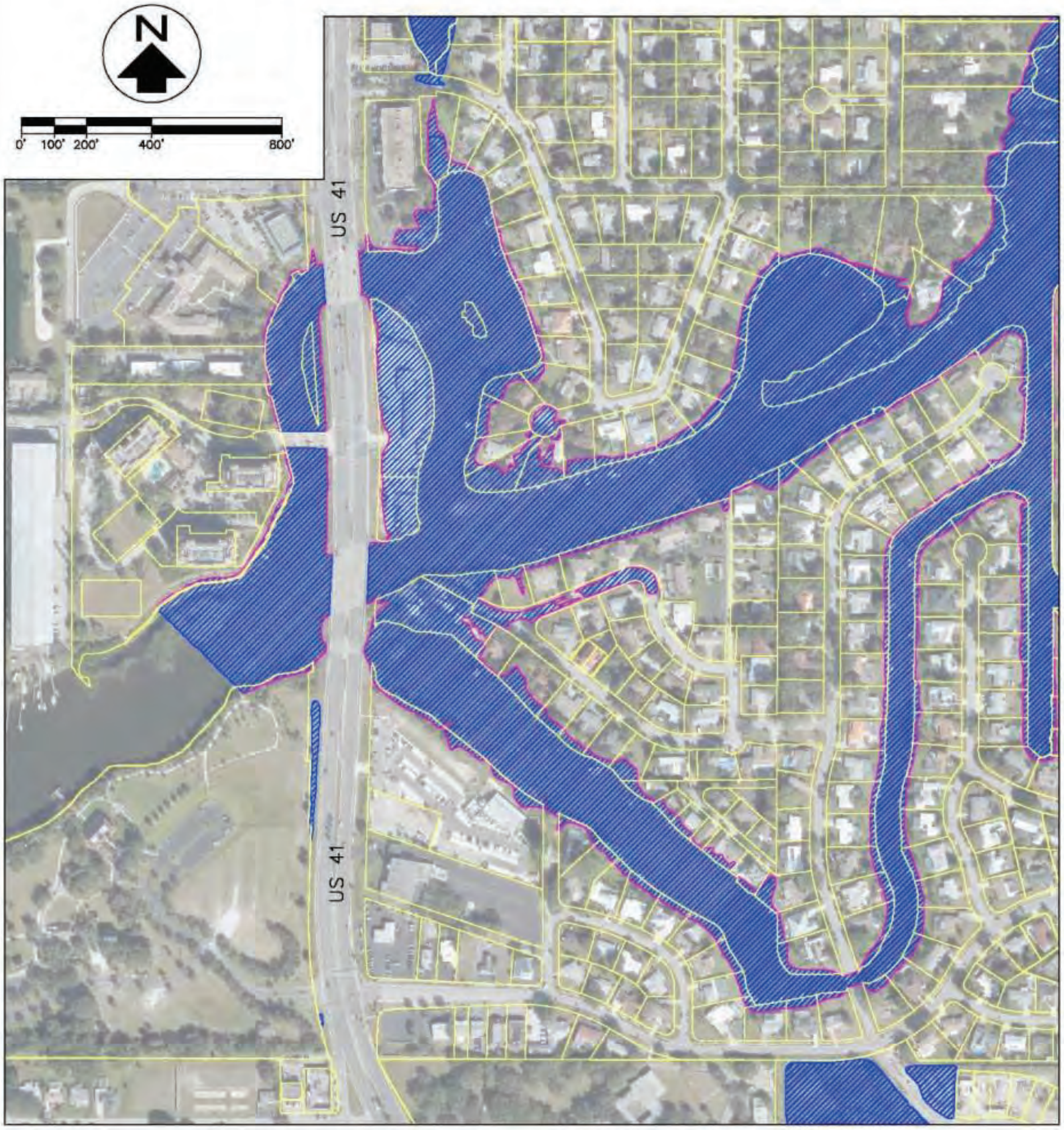
Item No.	Description	Unit	Unit Price	Unit Price Source	Quantity	Amount
5-7-3	Construction Stakeout	HR	$90.15	F. Derr and Co.	45	$4,056.75
5-7-7	Record drawings	LS	$20,000.00	WEC	1	$20,000.00
102-1-3	Mobilization (10%)	EA	$60,200.00	WEC	1	$60,200.00
101-2-1S	Project Sign	EA	$1,500.00	FDOT	1	$1,500.00
104-10-3	Sediment barrier	LF	$1.24	FDOT	850	$1,054.00
104-11	Turbidity barrier, floating	LF	$11.61	FDOT	600	$6,966.00
104-15	Soil tracking prevention device	EA	$2,824.13	FDOT	1	$2,824.13
104-30S	Prevention, control, abatement of erosion & water pollution	LS	$100,000.00	WEC	1	$100,000.00
104-31-15	Dust abatement water	MG	$1,000.00	WEC	10	$10,000.00
110-1	Clearing and grubbing	AC	$10,752.56	FDOT	1.5	$16,128.84
120-5	Channel Excavation	CY	$10.19	FDOT	10414	$106,118.66
120-6	Embankment	CY	$6.95	FDOT	18547	$128,901.65
146-1	Special bank treatment 1	SF	$15.00	WEC	5000	$75,000.00
162-1-11	Prepared soil layer, finish soil layer, littoral shelf, 6"	SY	$15.00	WEC	4500	$67,500.00
110-73	Remove existing bulkhead	LF	$350.00	WEC	177	$61,950.00
570-1-2	Performance Turf - Sod	SY	$3.00	FDOT	4300	$12,900.00
580-1-1	Emergent plants	LS	$22,800.00	FDOT	1	$22,800.00
	Additional items					
	Rehabilitate shuffleboard courts		$4,000.00		1	$4,000.00
	Geotechnical Analysis		$3,600.00		1	$3,600.00
	Design and Permitting		$85,000.00		1	$85,000.00
	Temporary Easement acquisition			unknown		
	CEI	15% total	$ 99,330.00		1	$99,330.00
					Subtotal	$889,830.04
					30% contingency	**$1,156,779.05**

Deduct (Excavated sediment found suitable for bank restructuring)

120-5	Channel Excavation	CY	$10.19	FDOT	10414	$106,118.66

Appendix H: 100-Year Floodplain Property Graphics

PCM 1



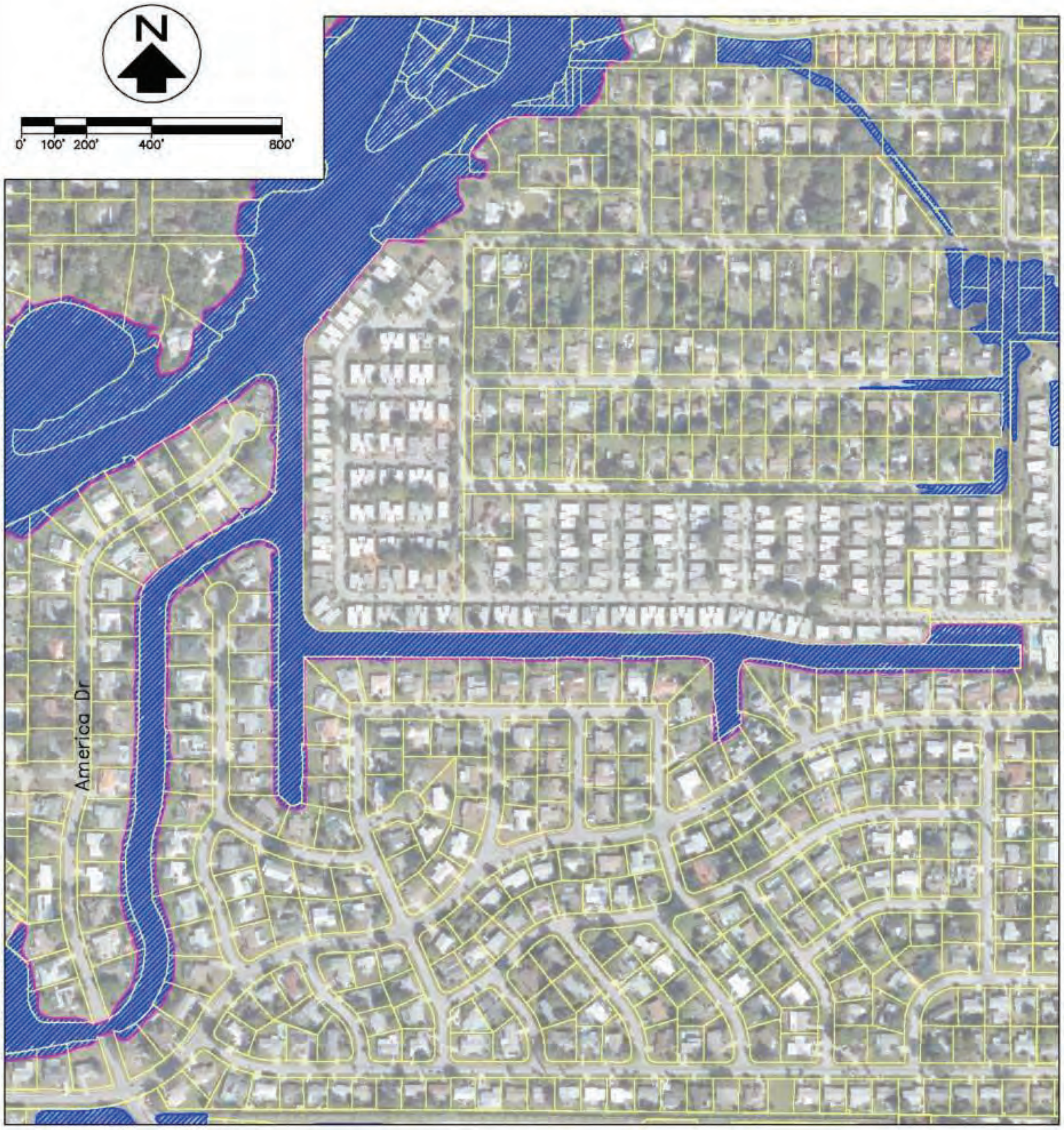
RECM 100yr floodplain

PCM – Area now included in the 100yr floodplain

PCM – Area now removed from the 100yr floodplain

Page 1 of 11

PCM 1

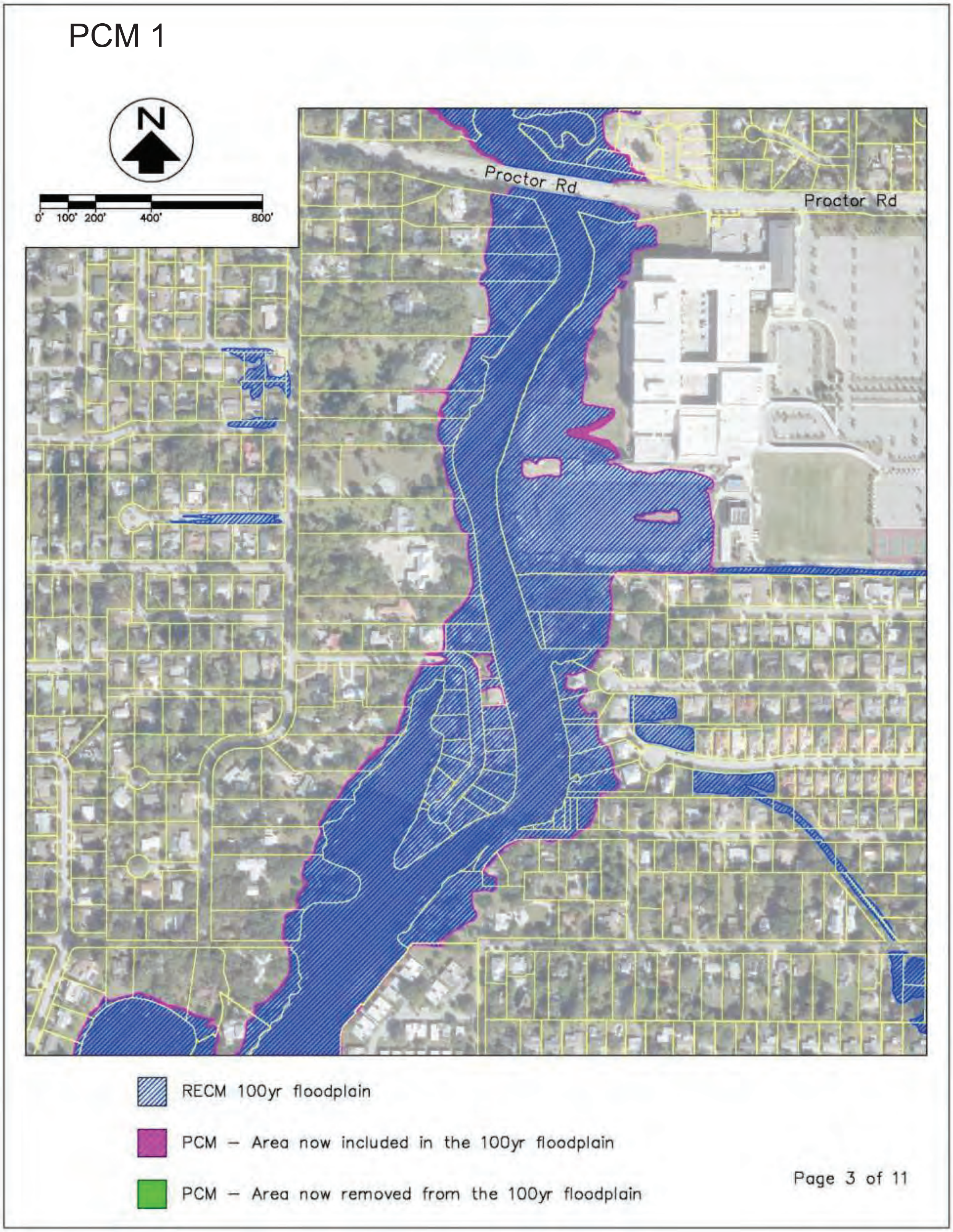


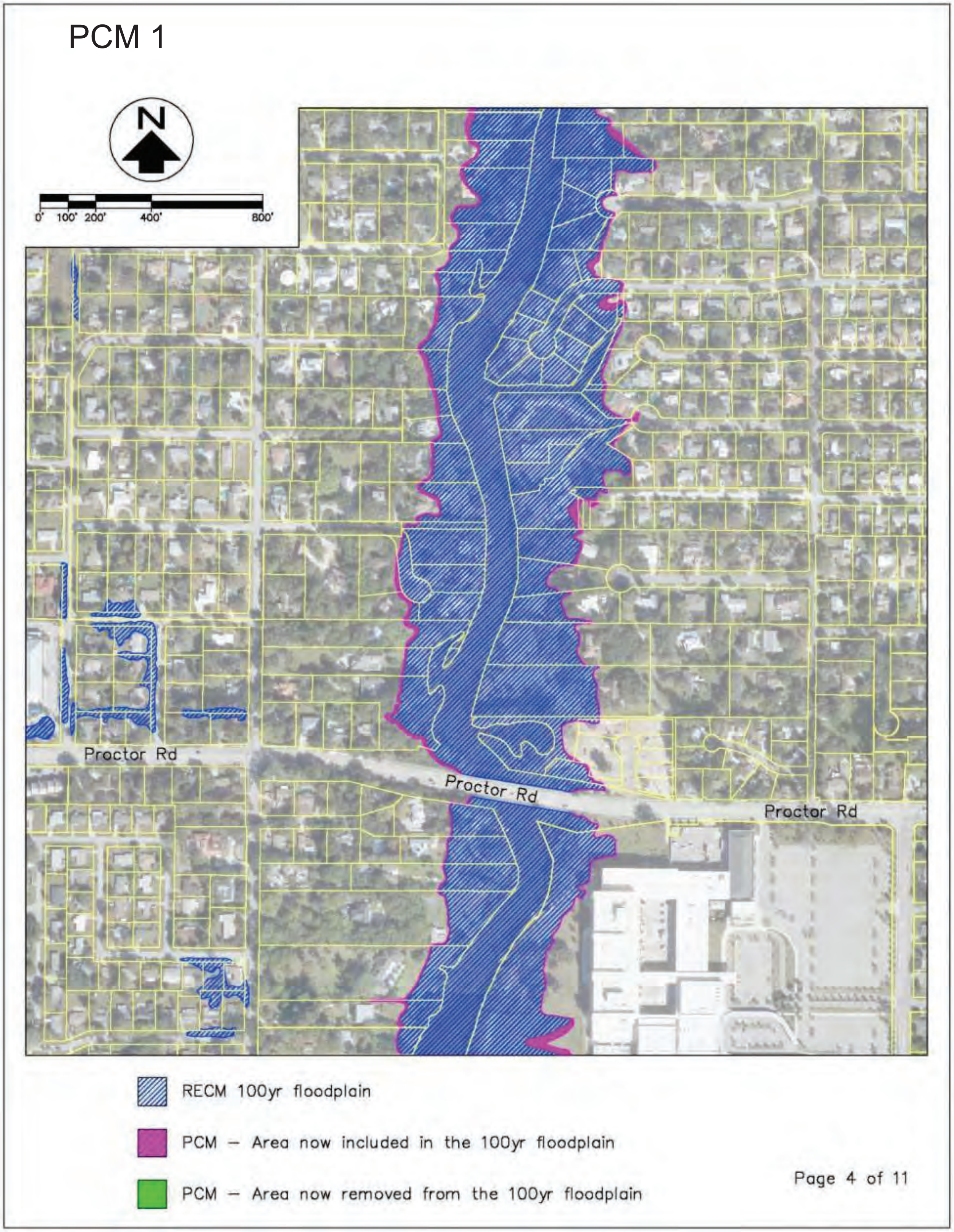
RECM 100yr floodplain

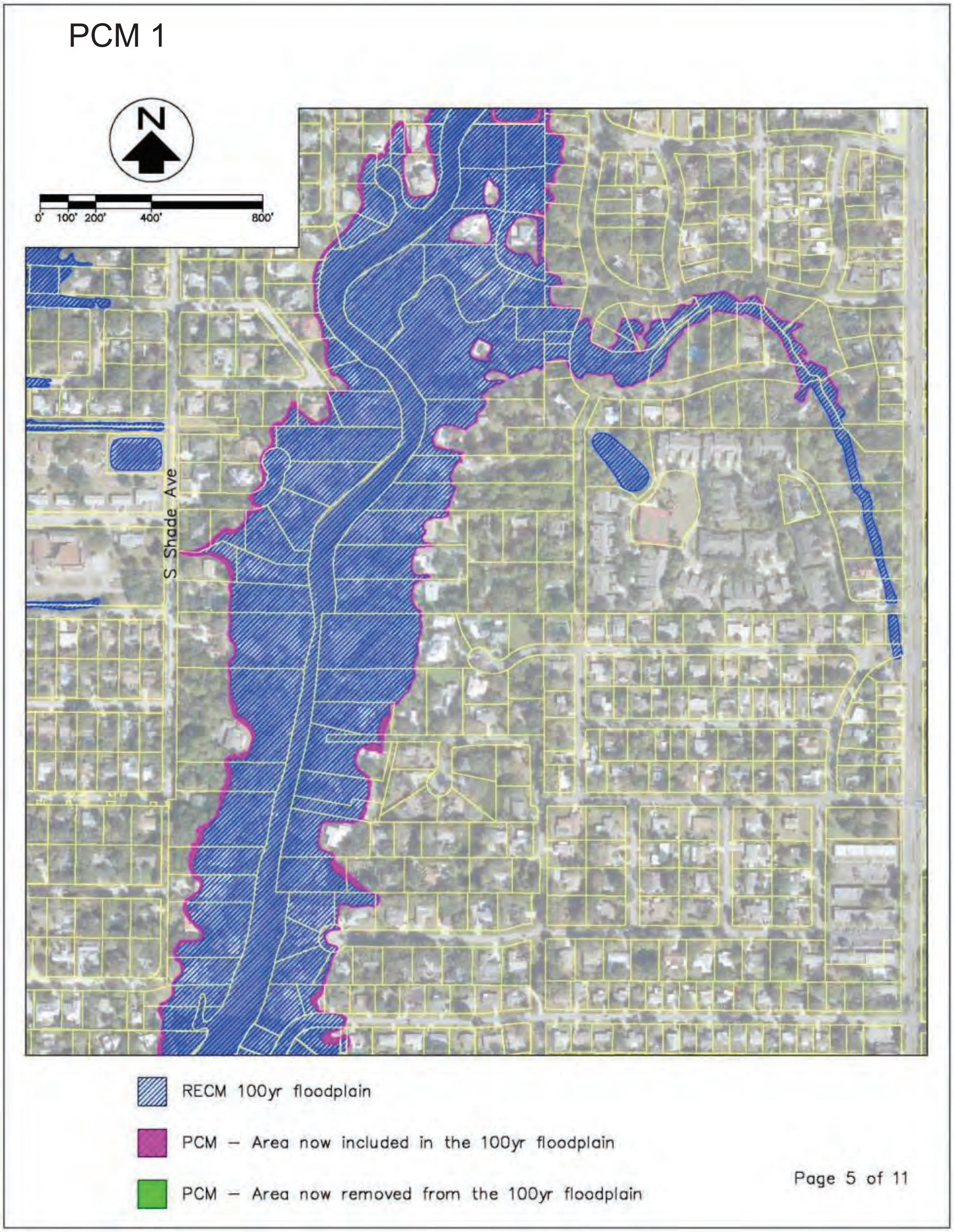
PCM – Area now included in the 100yr floodplain

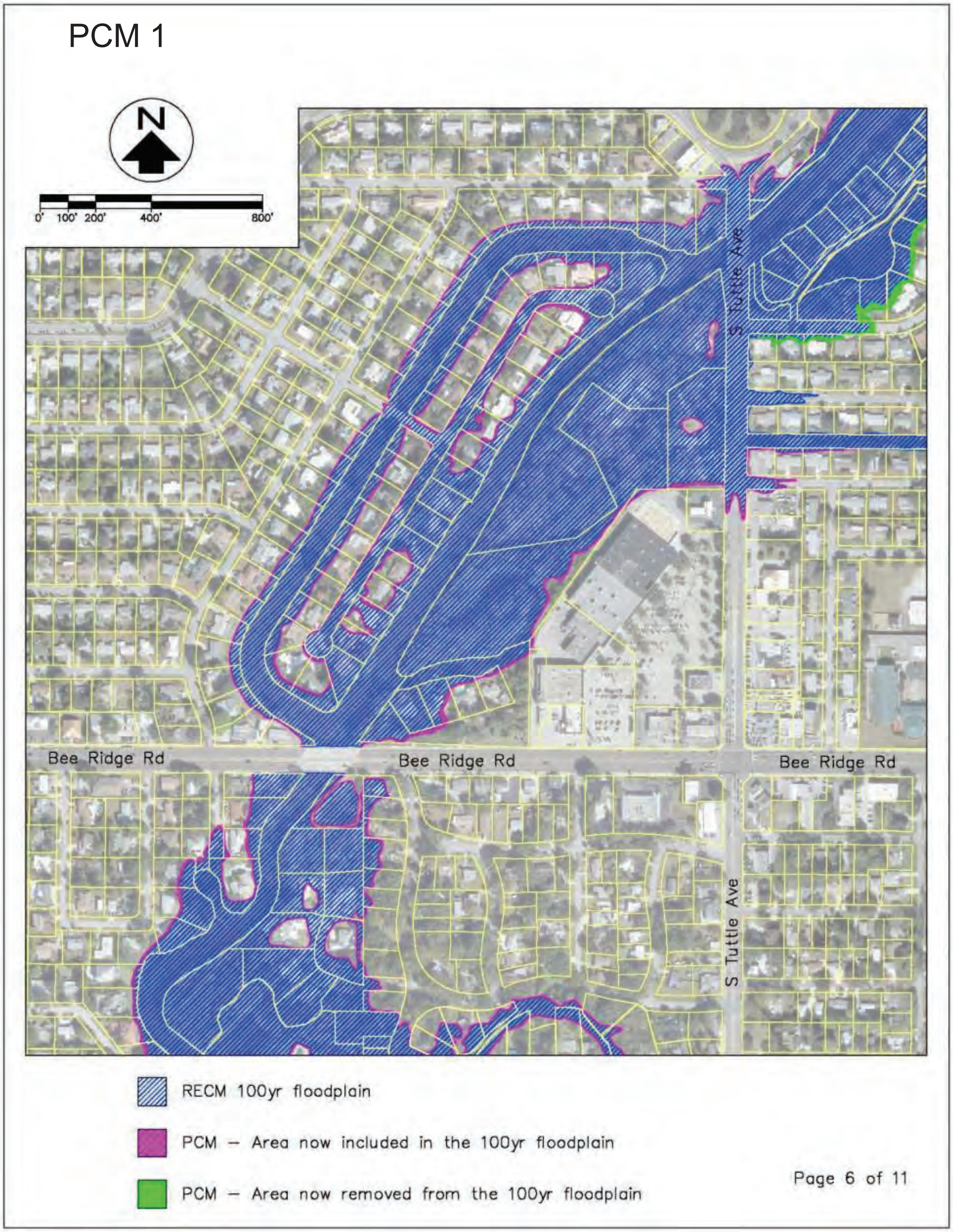
PCM – Area now removed from the 100yr floodplain

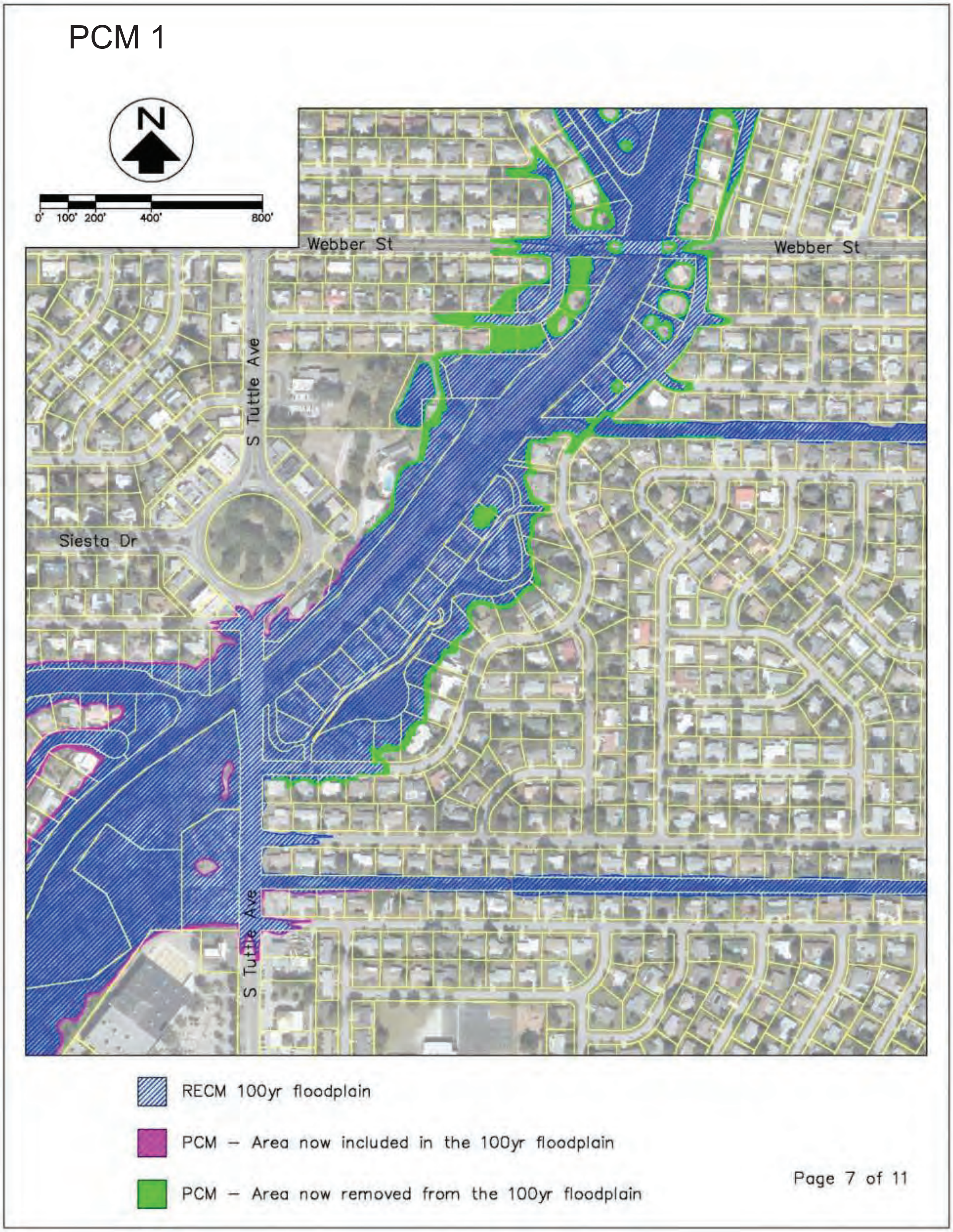
Page 2 of 11

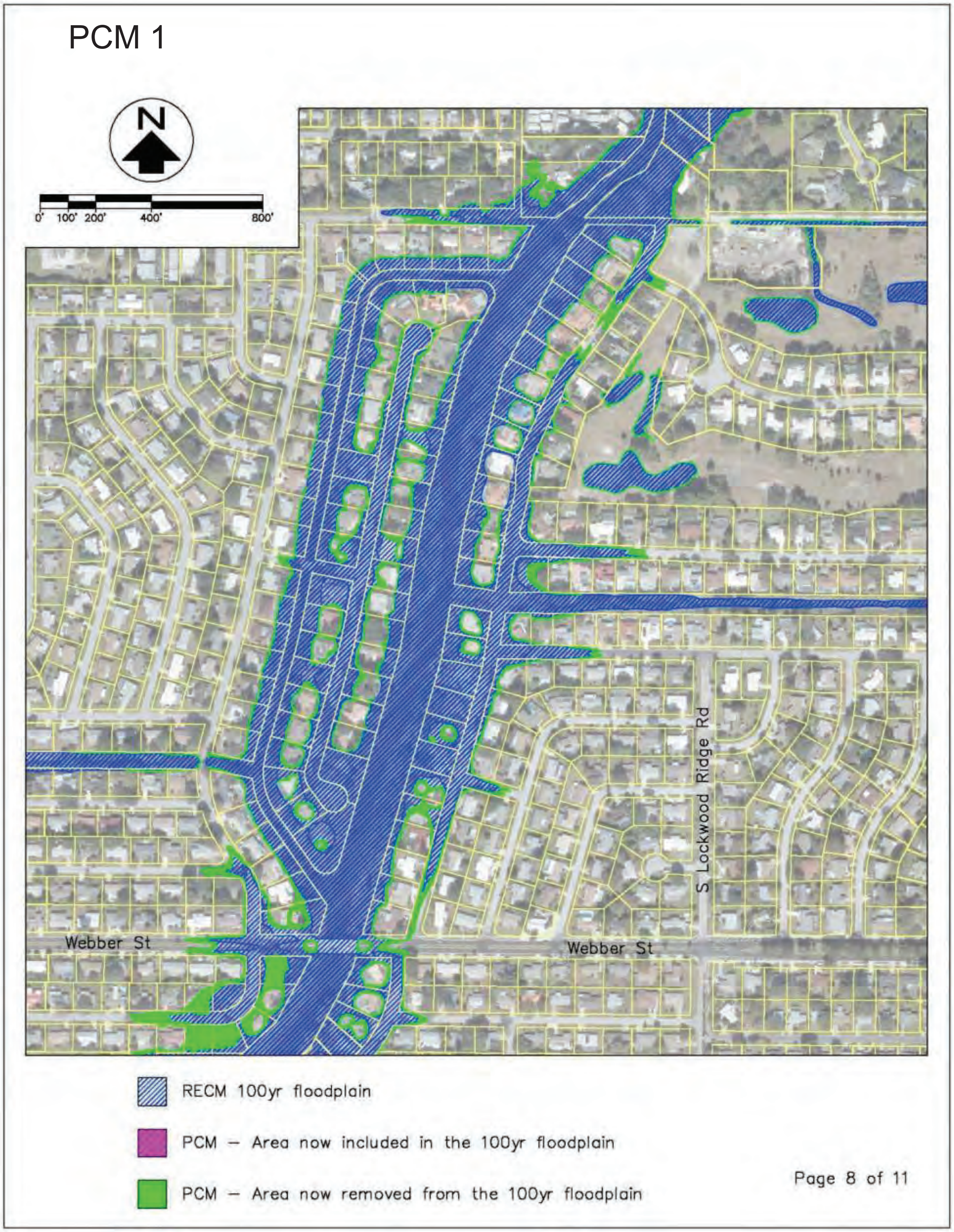

PCM 1
N
0' 100' 200' 400' 800'
Proctor Rd
Proctor Rd
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 3 of 11

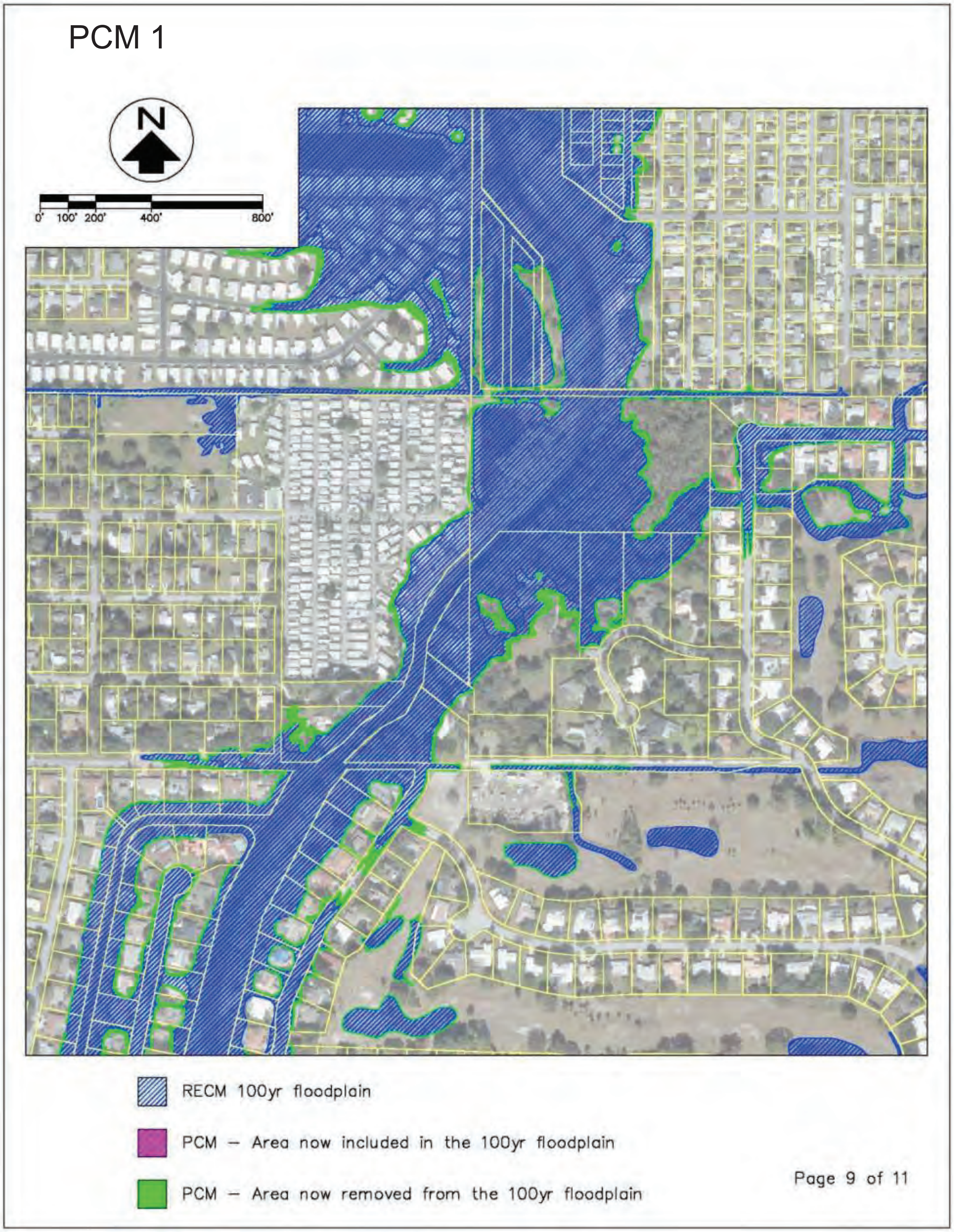

PCM 1
N
0' 100' 200' 400' 800'
Proctor Rd
Proctor Rd
Proctor Rd
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 4 of 11

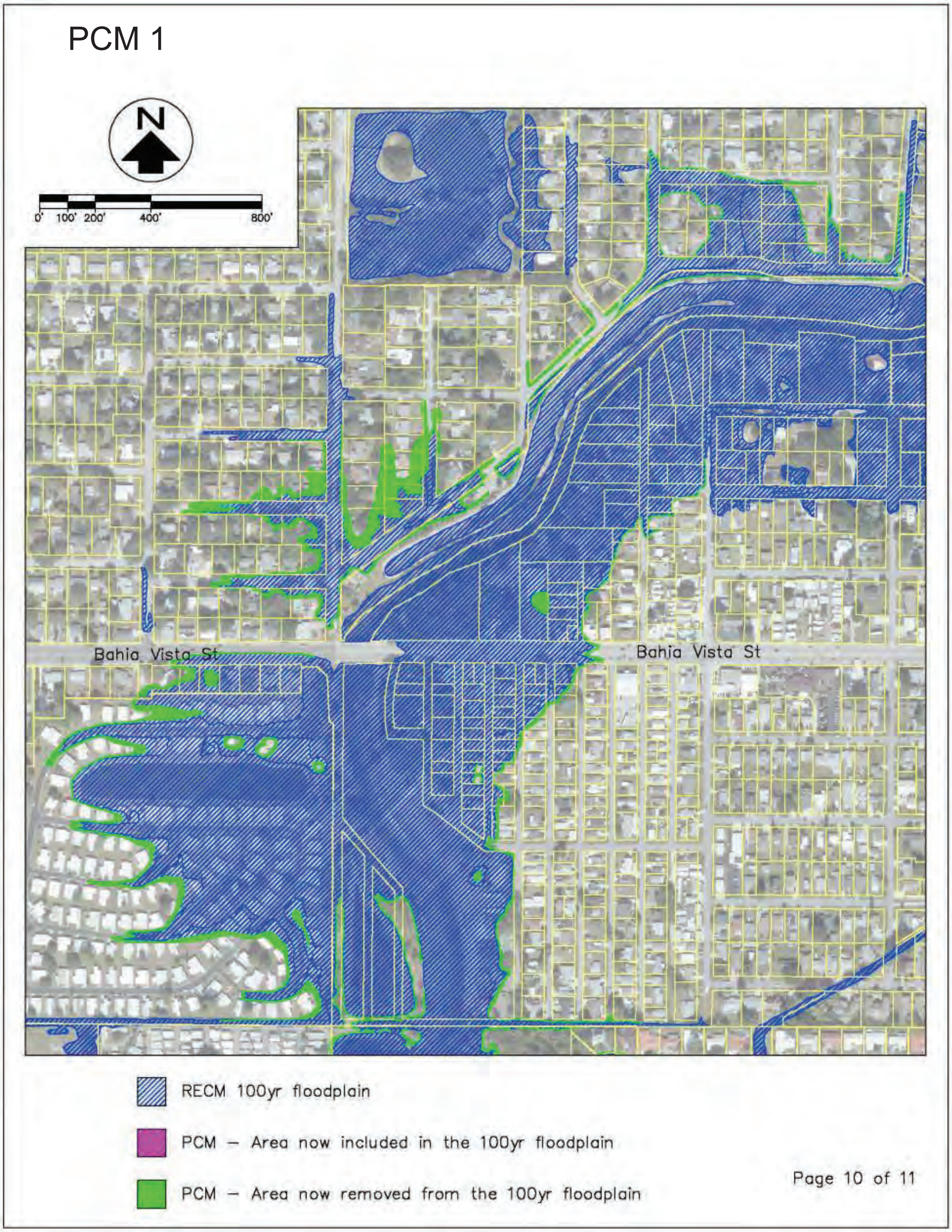

PCM 1
N
0' 100' 200' 400' 800'
S Shade Ave
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 5 of 11

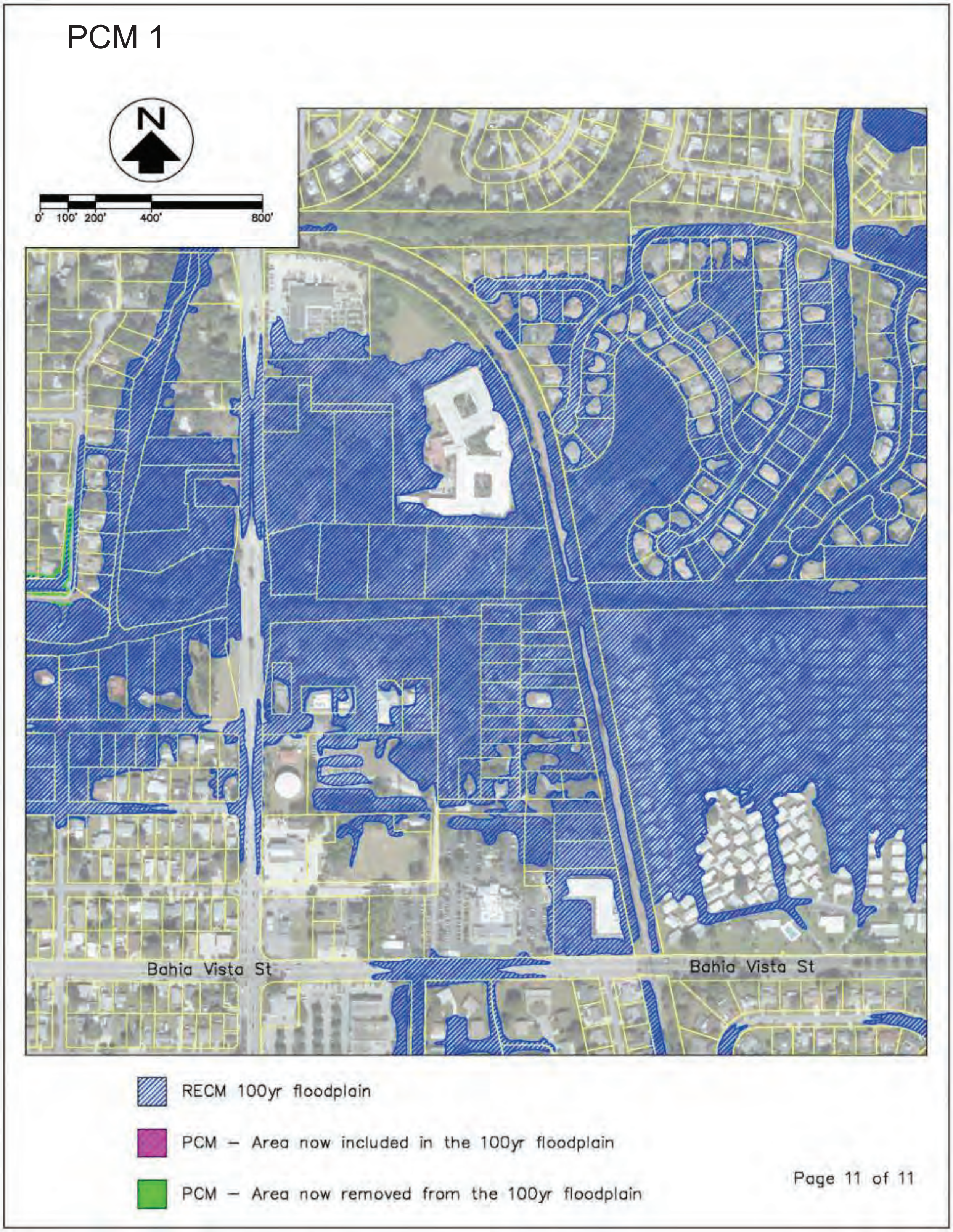

PCM 1
N
0' 100' 200' 400' 800'
Bee Ridge Rd
Bee Ridge Rd
Bee Ridge Rd
S Tuttle Ave
S Tuttle Ave
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 6 of 11

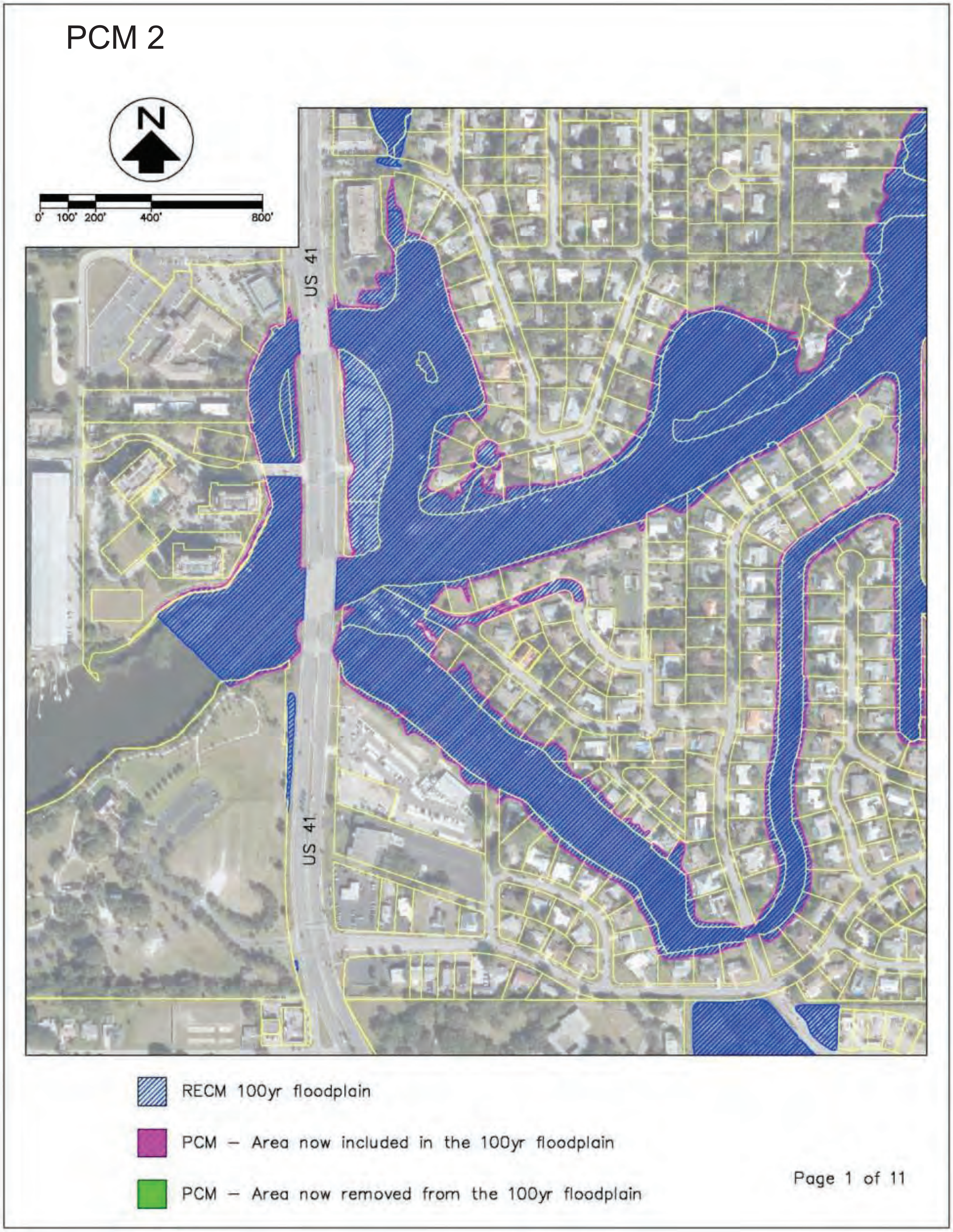

PCM 1
N
0' 100' 200' 400' 800'
Webber St
Webber St
S Tuttle Ave
Siesta Dr
S Tuttle Ave
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 7 of 11

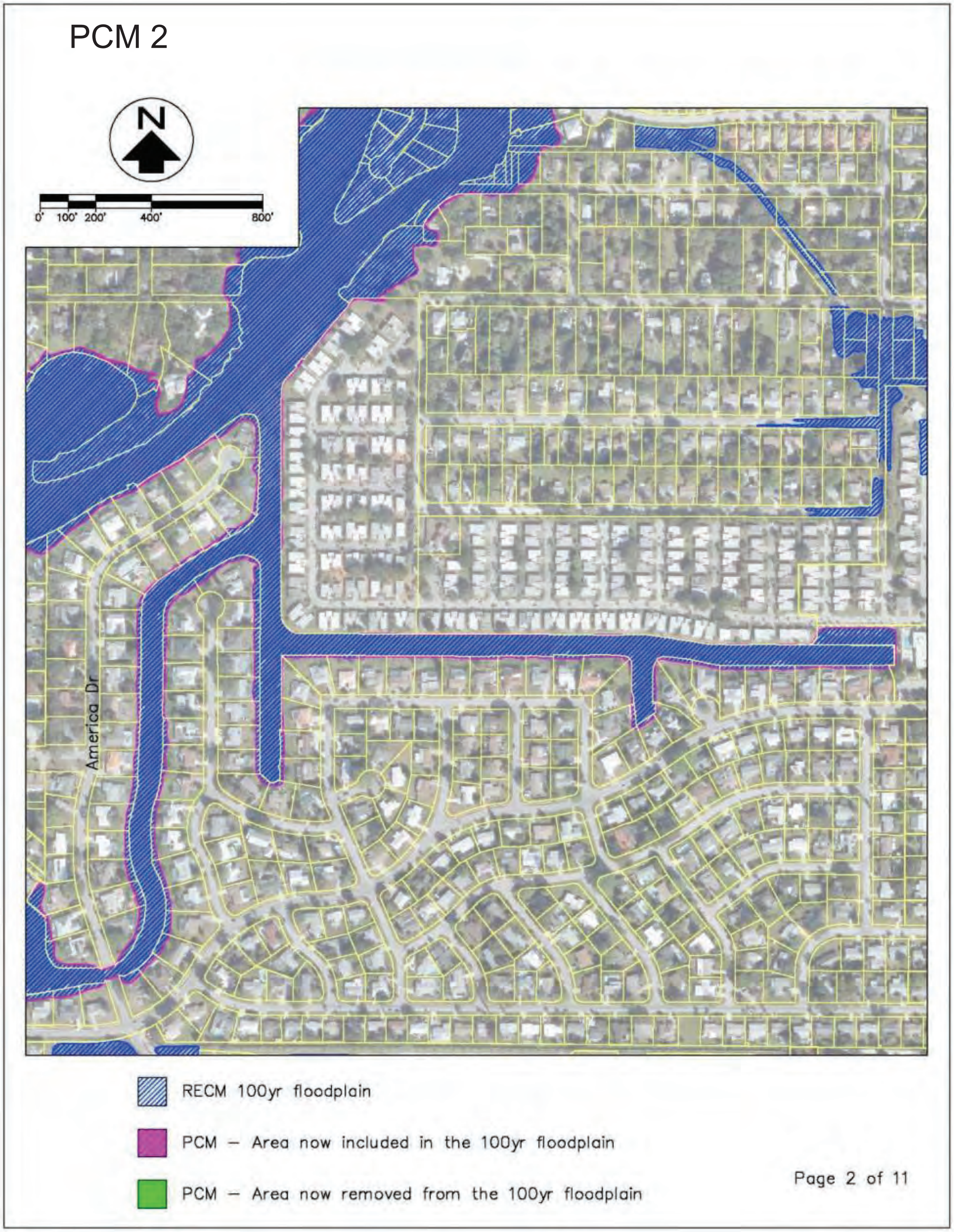

PCM 1
N
0' 100' 200' 400' 800'
Webber St
Webber St
S Lockwood Ridge Rd
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 8 of 11

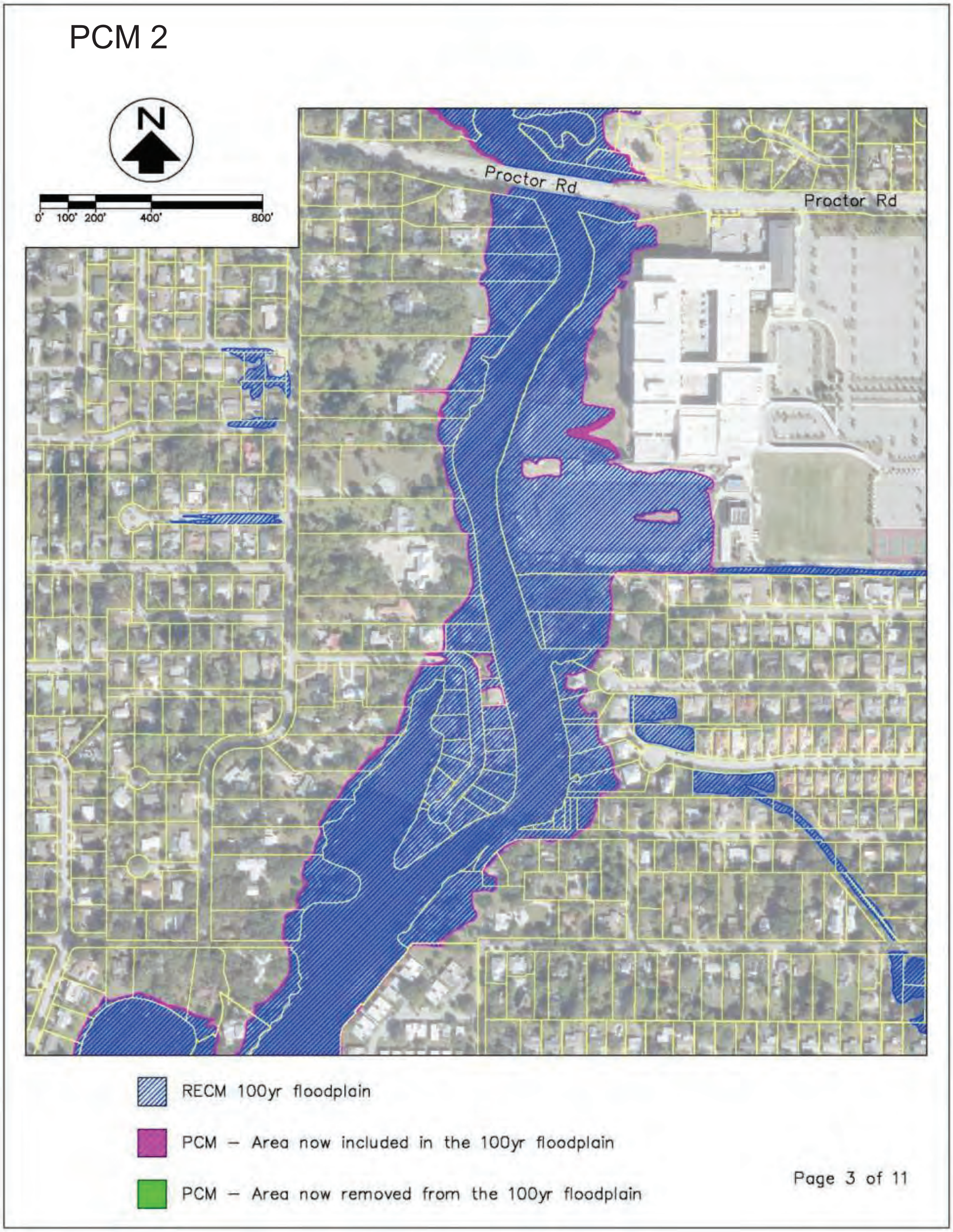

PCM 1
N
0' 100' 200' 400' 800'
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 9 of 11

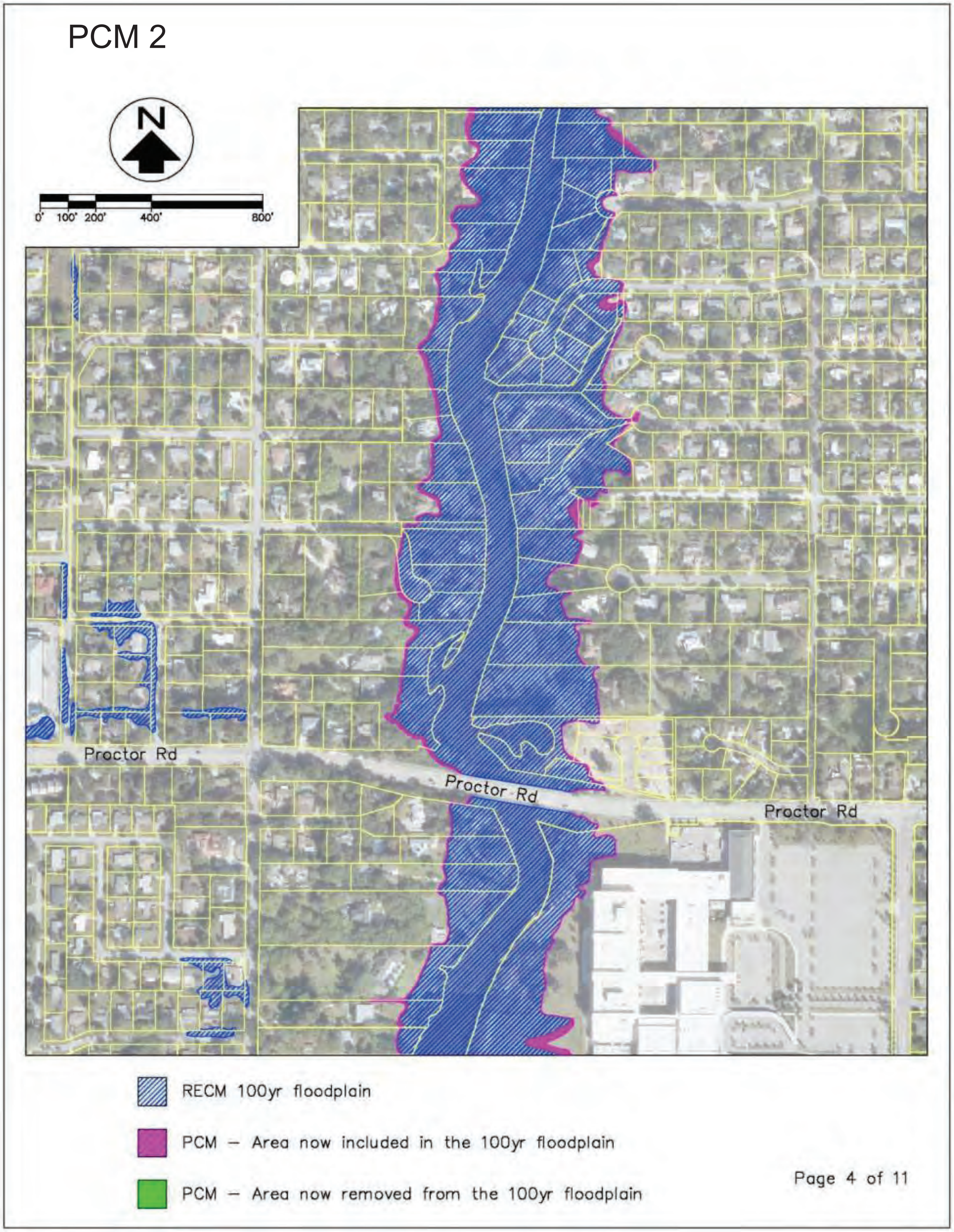

PCM 1
N
0' 100' 200' 400' 800'
Bahia Vista St
Bahia Vista St
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 10 of 11

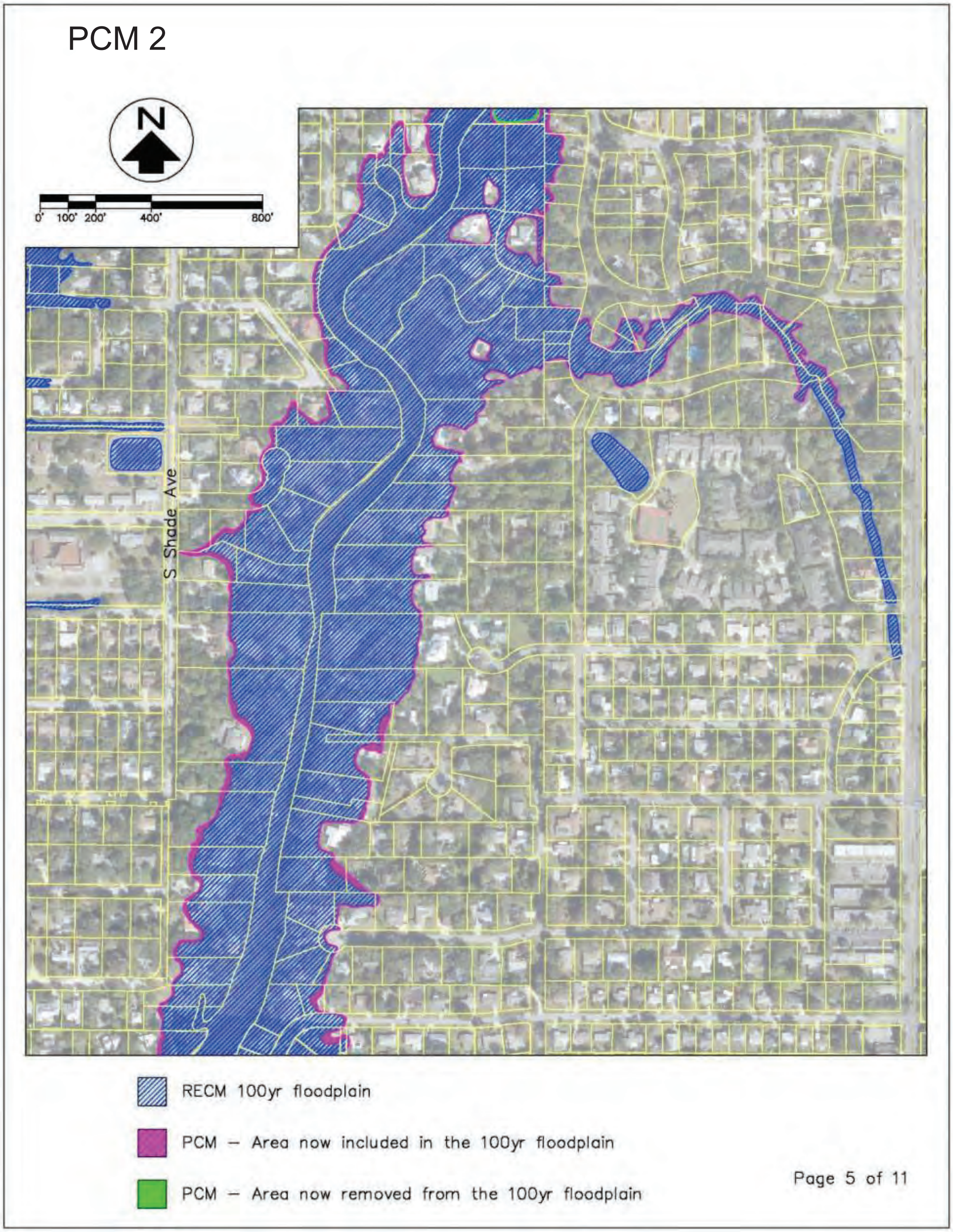

PCM 1
N
0' 100' 200' 400' 800'
Bahia Vista St
Bahia Vista St
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 11 of 11

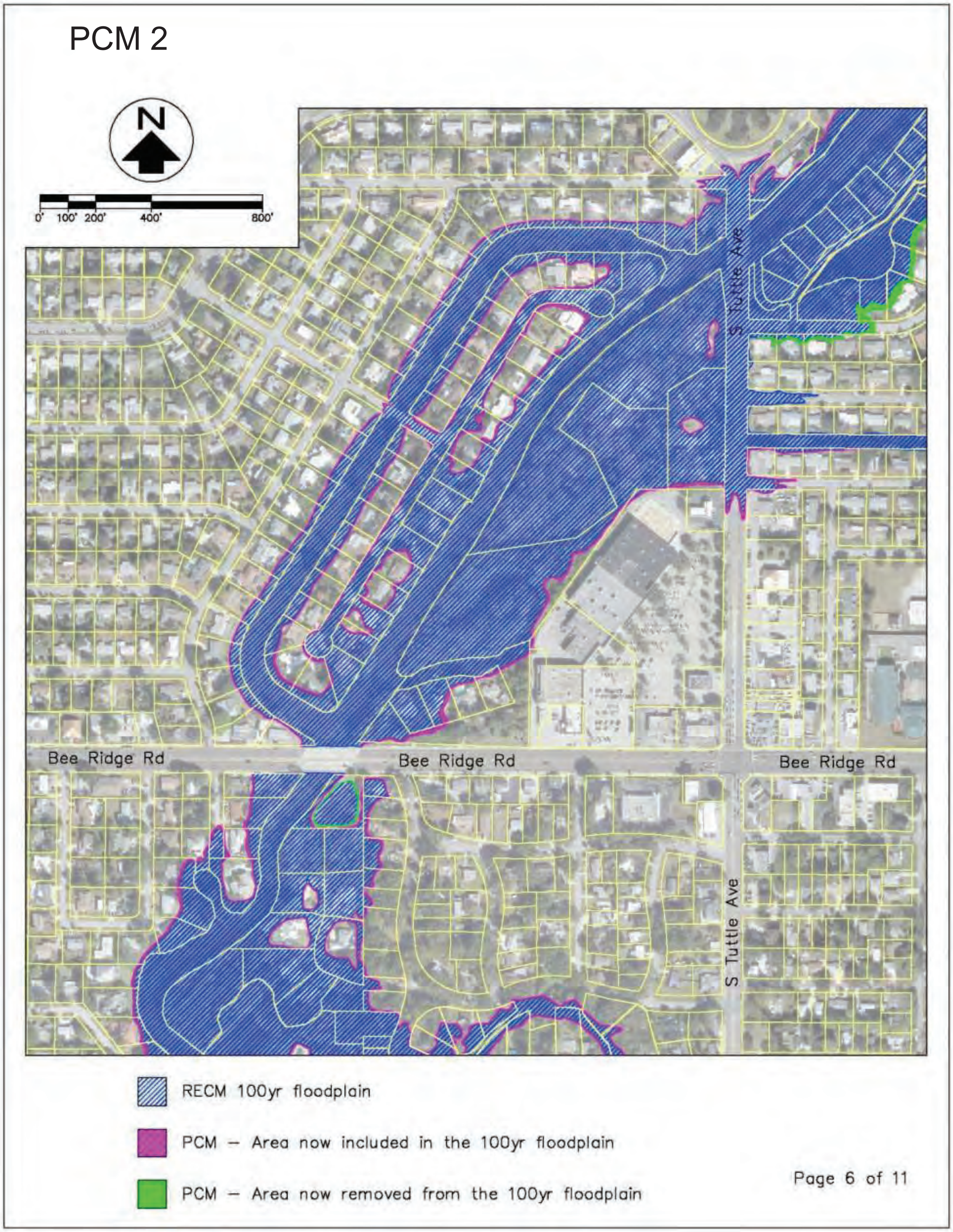

PCM 2
N
0' 100' 200' 400' 800'
US 41
US 41
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 1 of 11

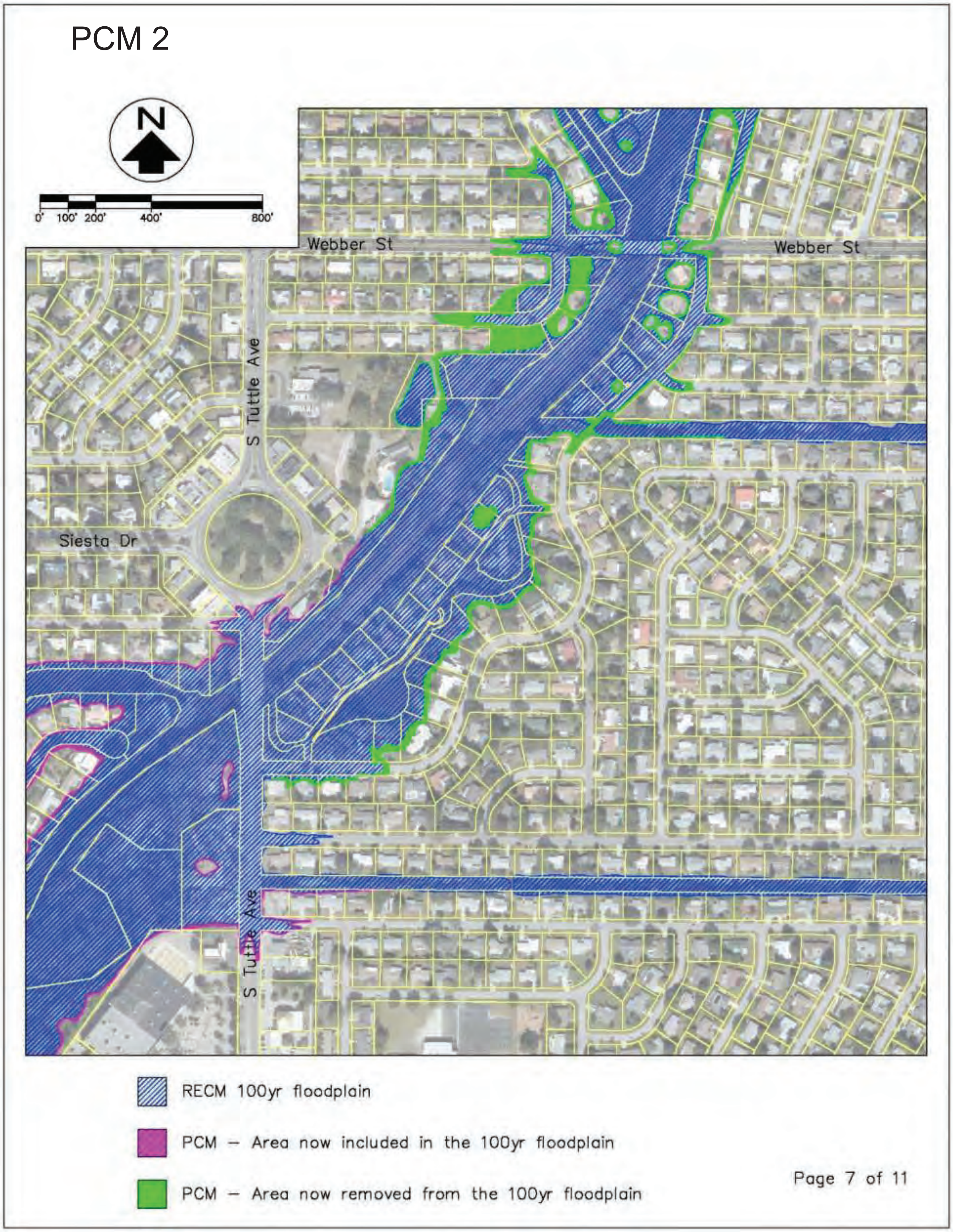

PCM 2
N
0'
100'
200'
400'
800'
America Dr
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 2 of 11

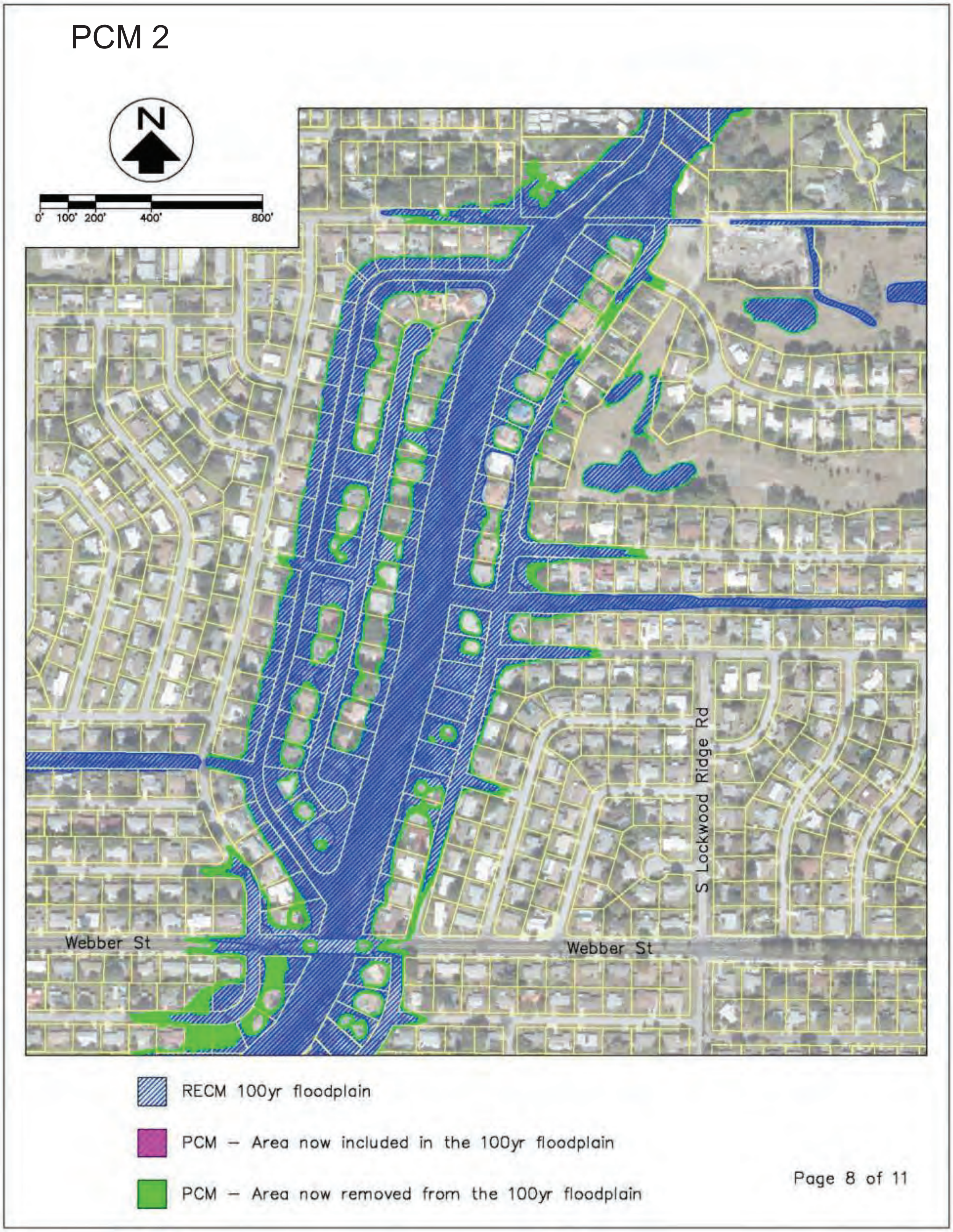

PCM 2
N
0' 100' 200' 400' 800'
Proctor Rd
Proctor Rd
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 3 of 11

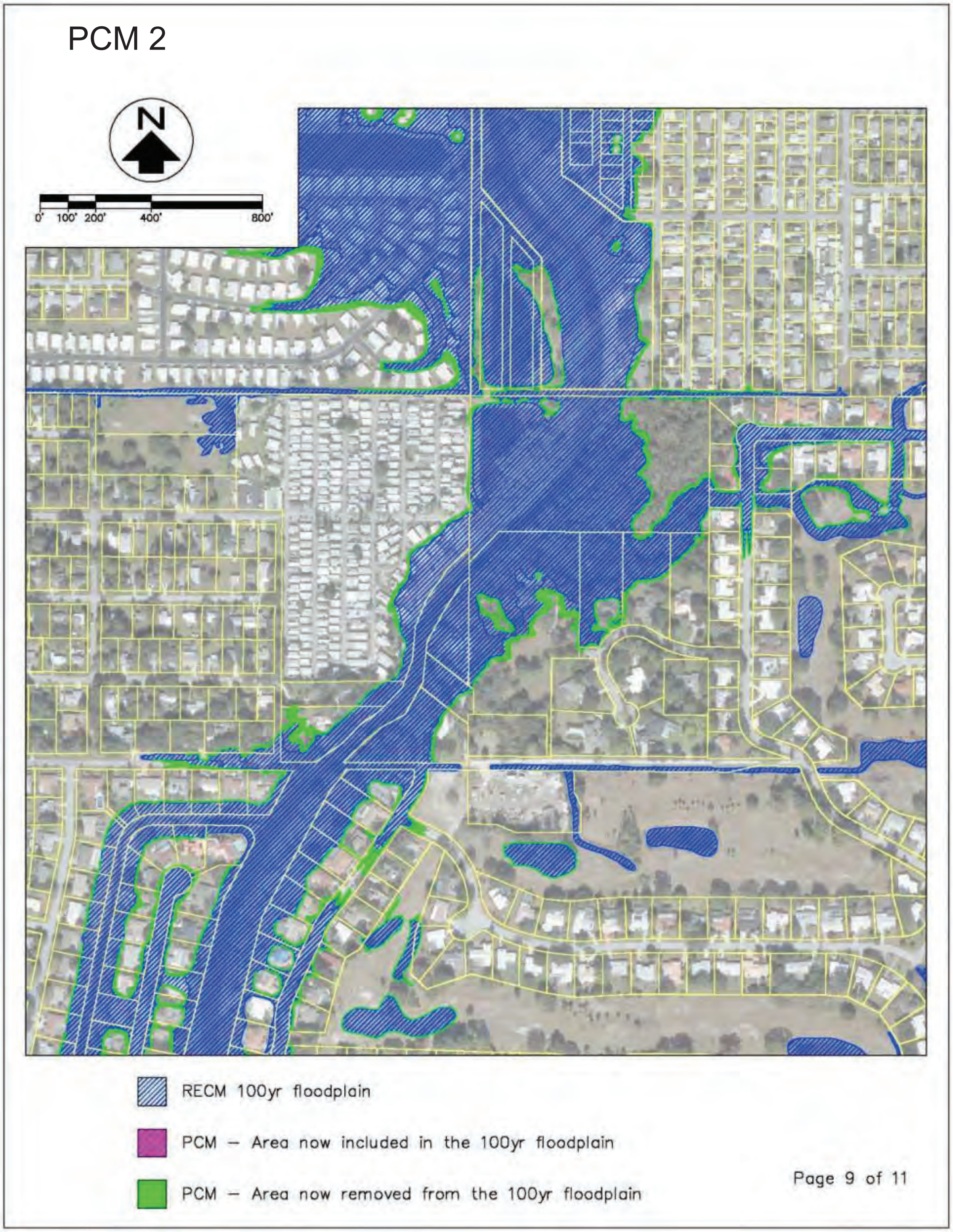

PCM 2
N
0' 100' 200' 400' 800'
Proctor Rd
Proctor Rd
Proctor Rd
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 4 of 11

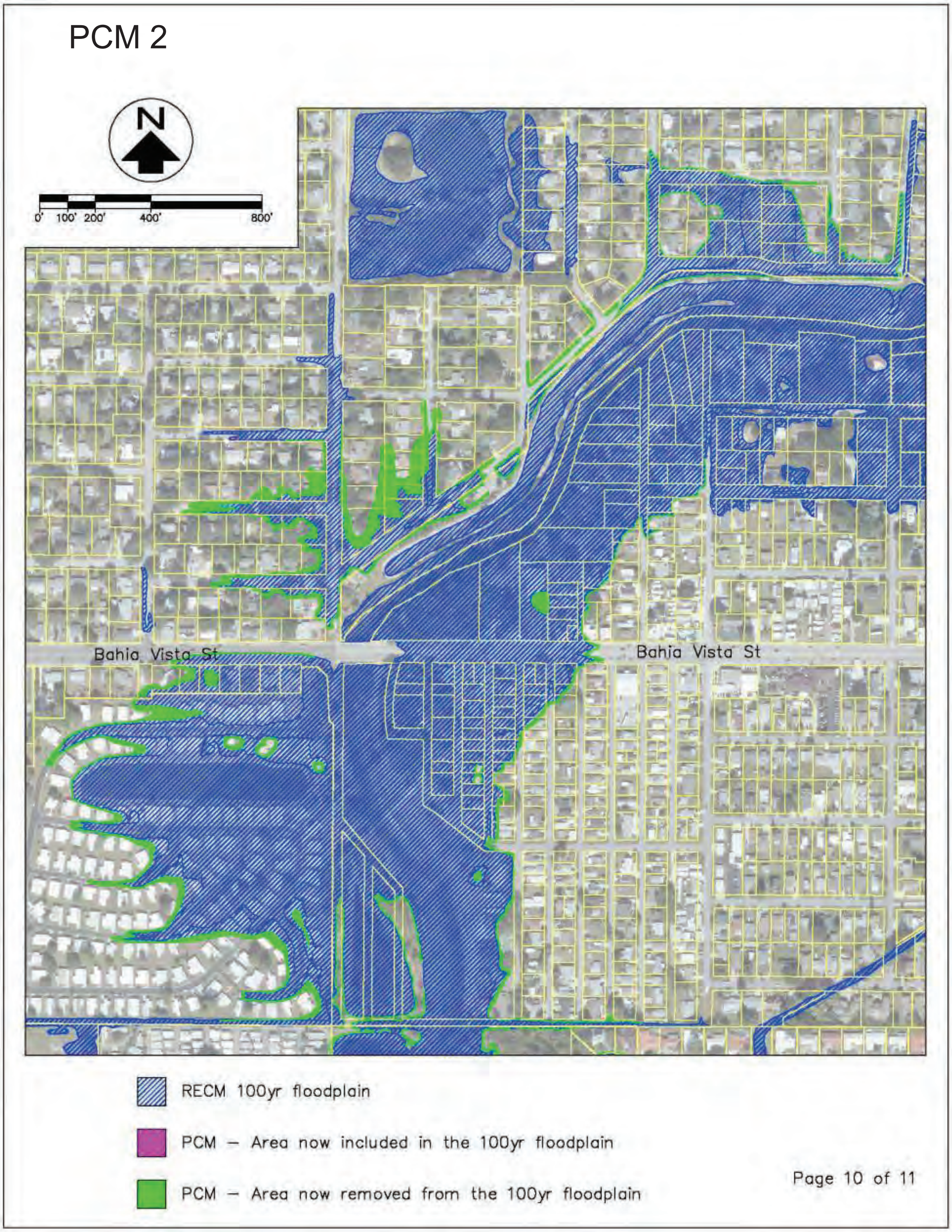

PCM 2
N
0' 100' 200' 400' 800'
S Shade Ave
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 5 of 11

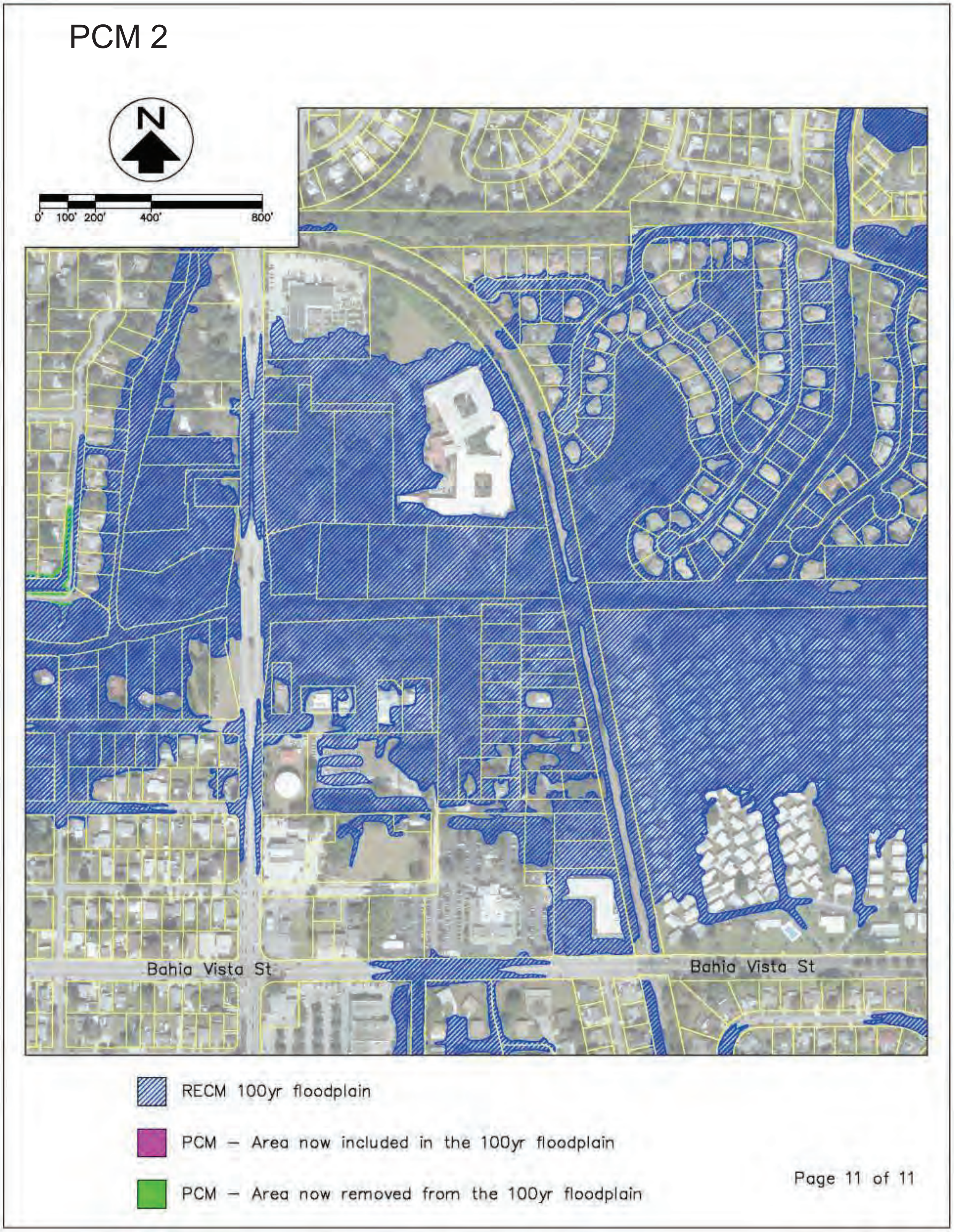

PCM 2
N
0' 100' 200' 400' 800'
S Tuttle Ave
Bee Ridge Rd
Bee Ridge Rd
Bee Ridge Rd
S Tuttle Ave
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 6 of 11

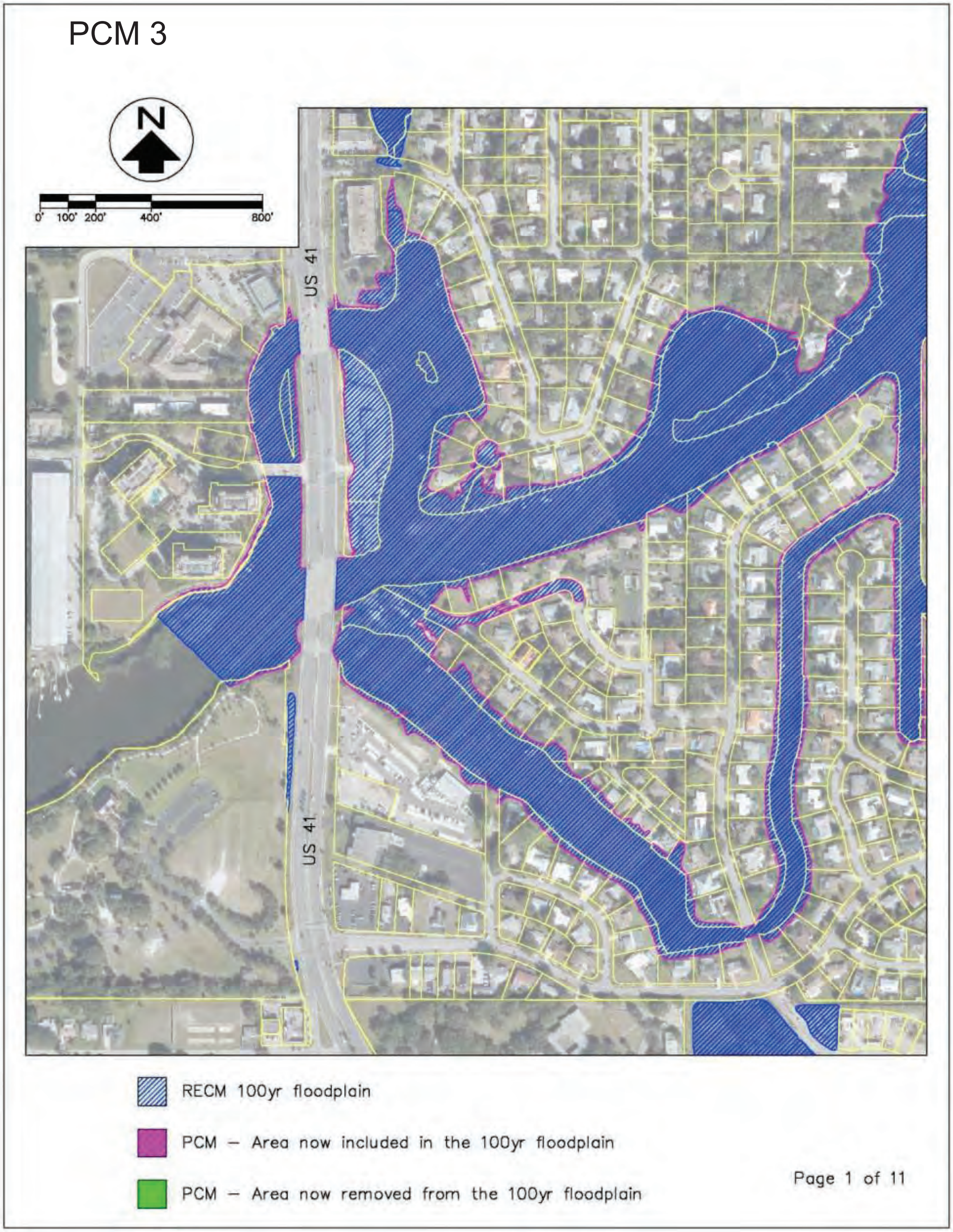

PCM 2
N
0' 100' 200' 400' 800'
Webber St
Webber St
S Tuttle Ave
Siesta Dr
S Tuttle Ave
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 7 of 11


PCM 2
N
0' 100' 200' 400' 800'
Webber St
Webber St
S Lockwood Ridge Rd
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 8 of 11


PCM 2
N
0' 100' 200' 400' 800'
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 9 of 11

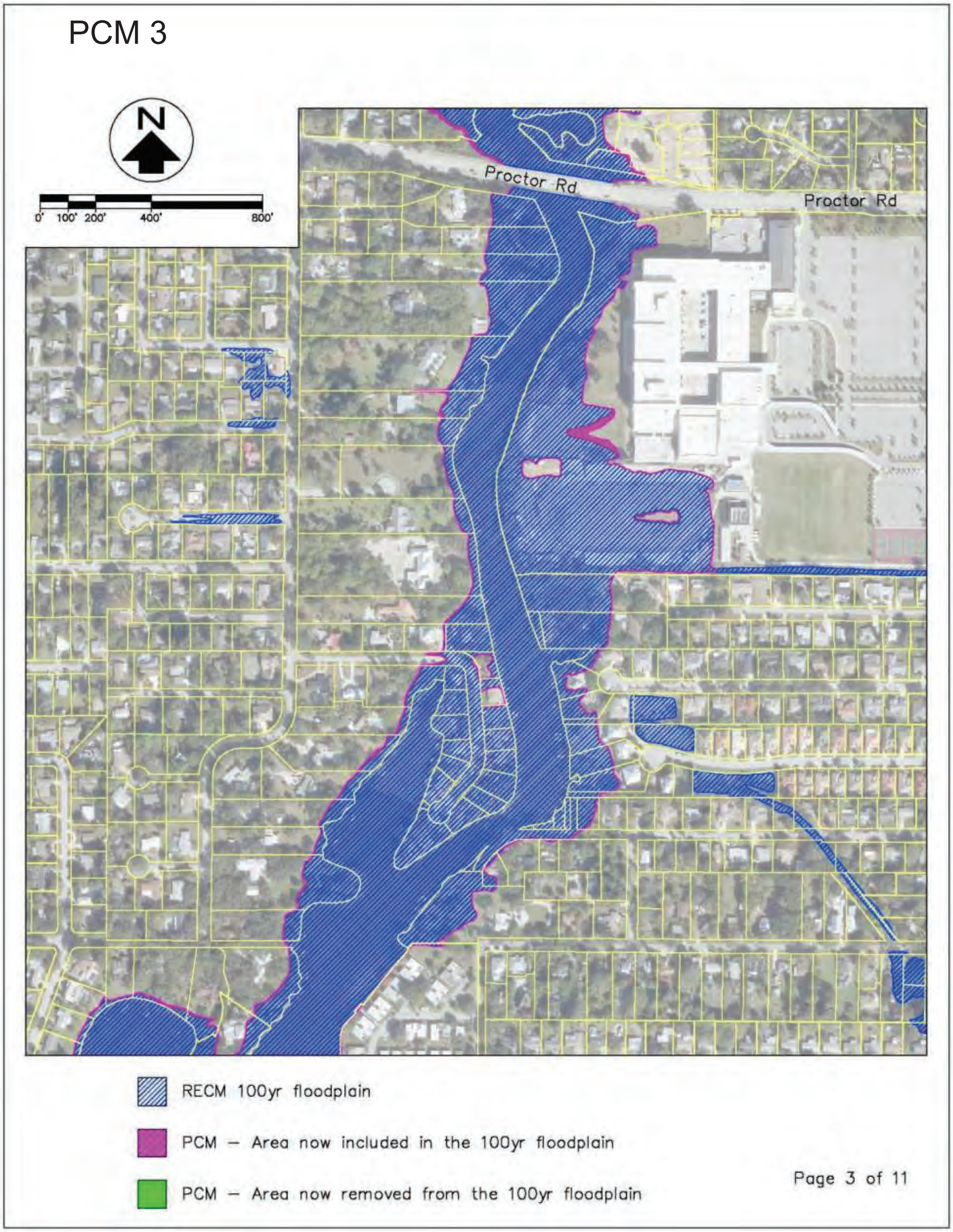

PCM 2
N
0' 100' 200' 400' 800'
Bahia Vista St
Bahia Vista St
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 10 of 11


PCM 2
N
0' 100' 200' 400' 800'
Bahia Vista St
Bahia Vista St
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 11 of 11

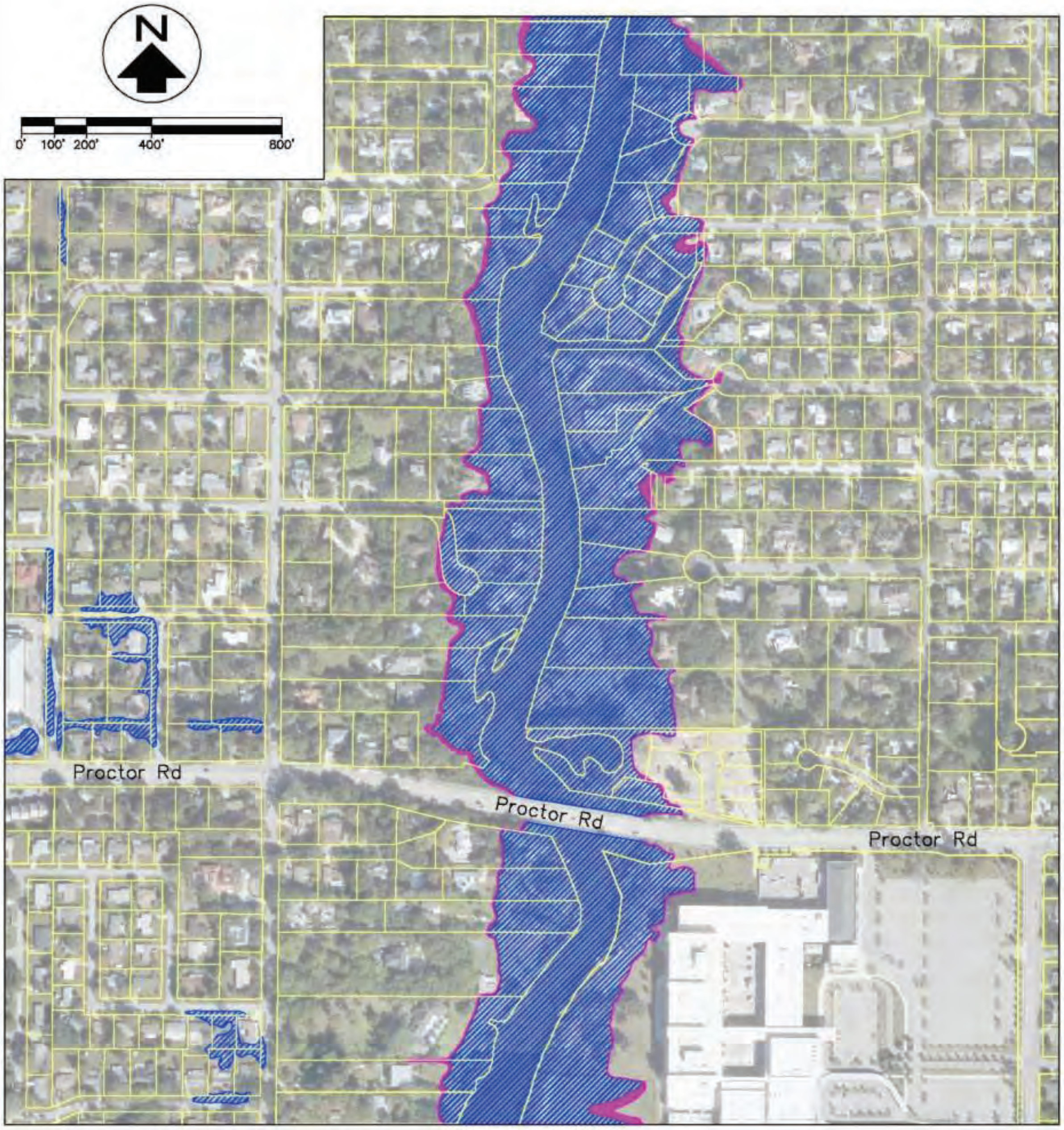

PCM 3
N
0' 100' 200' 400' 800'
US 41
US 41
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 1 of 11

PCM 3

Page 2 of 11


PCM 3
N
0' 100' 200' 400' 800'
Proctor Rd
Proctor Rd
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 3 of 11

PCM 3



RECM 100yr floodplain

PCM – Area now included in the 100yr floodplain

PCM – Area now removed from the 100yr floodplain

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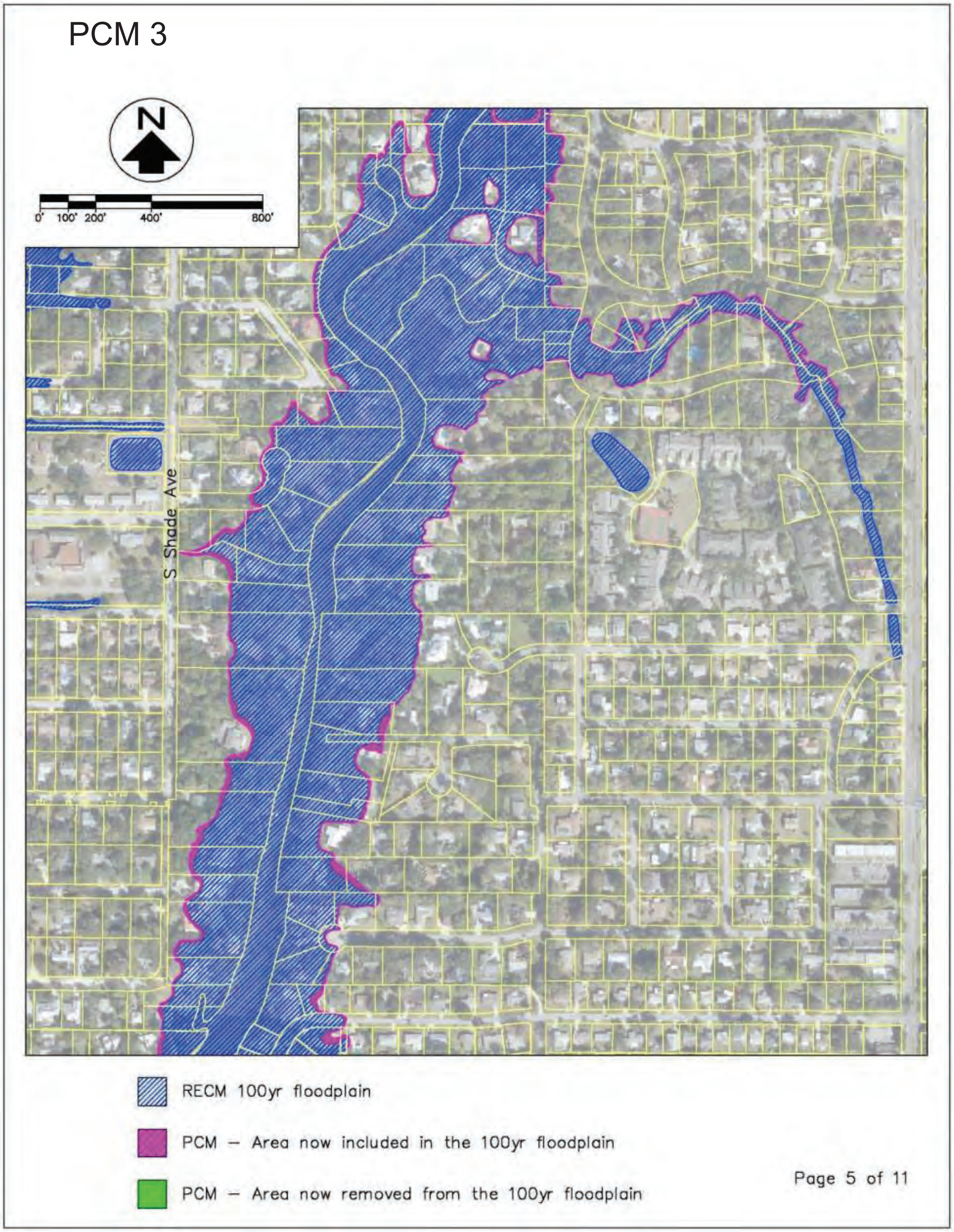
PCM 3
N
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S Shade Ave
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
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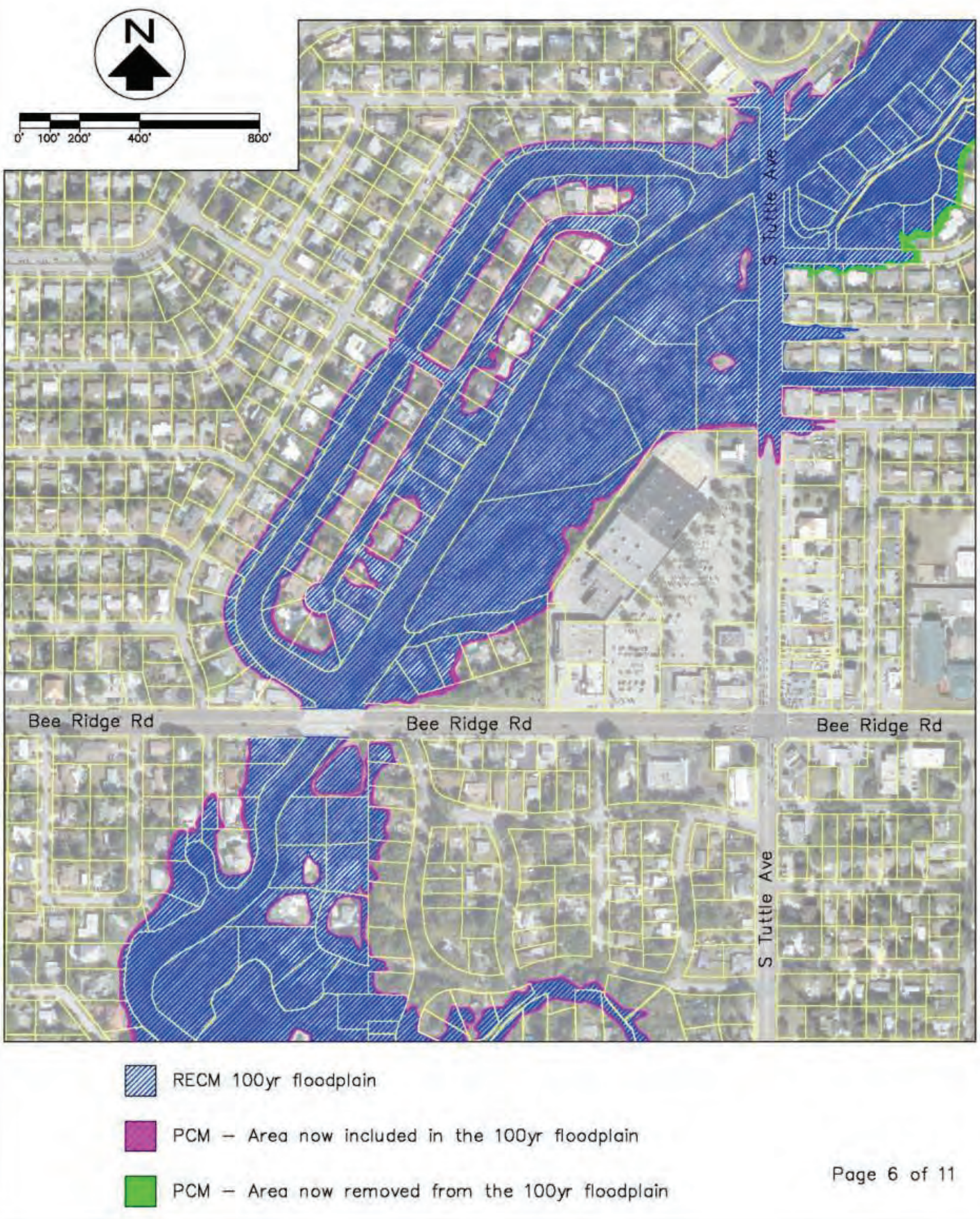
PCM 3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Bee Ridge Rd
Bee Ridge Rd
S Tuttle Ave
S Tuttle Ave
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PCM – Area now removed from the 100yr floodplain
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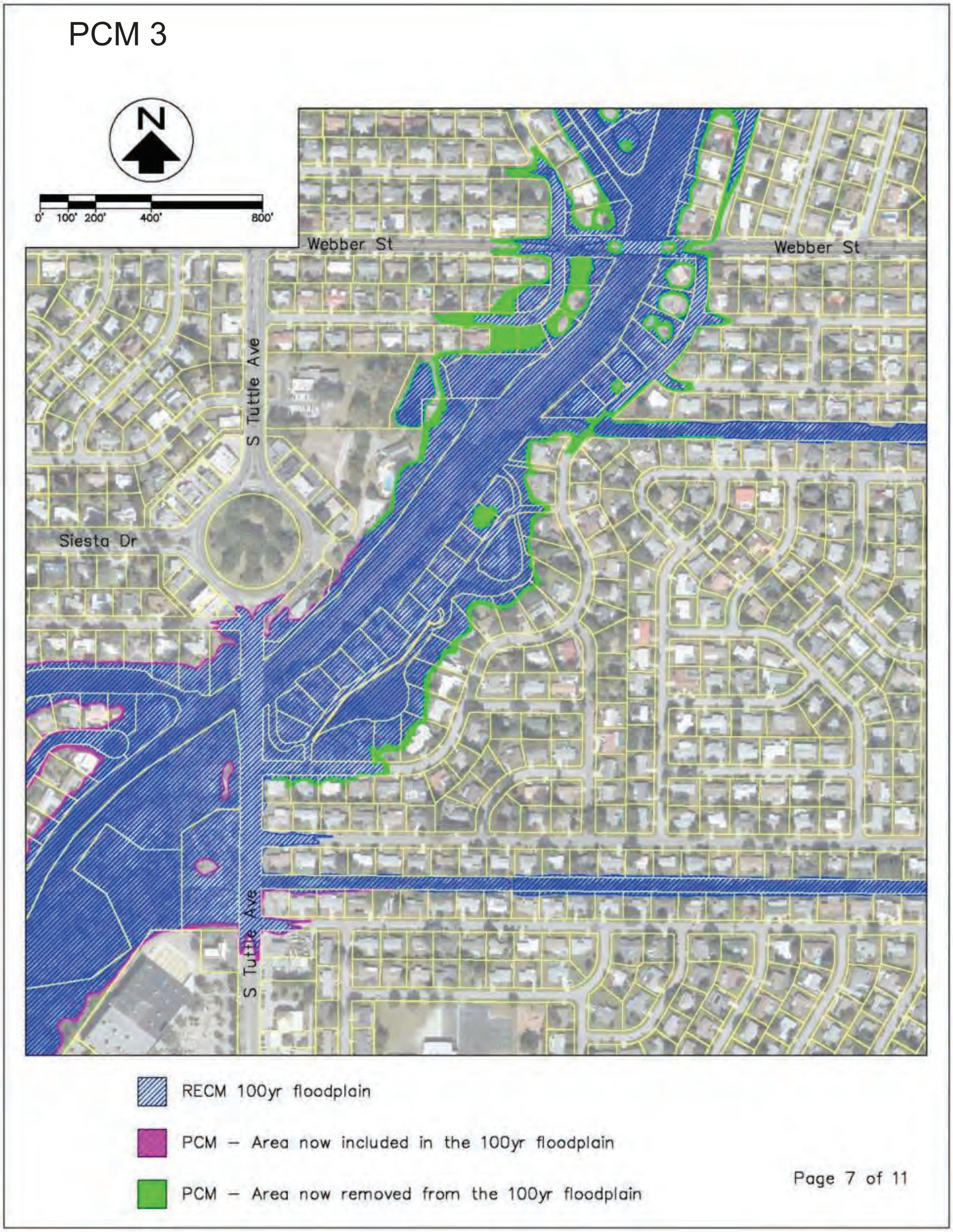
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N
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Webber St
Webber St
S Tuttle Ave
Siesta Dr
S Tuttle Ave
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
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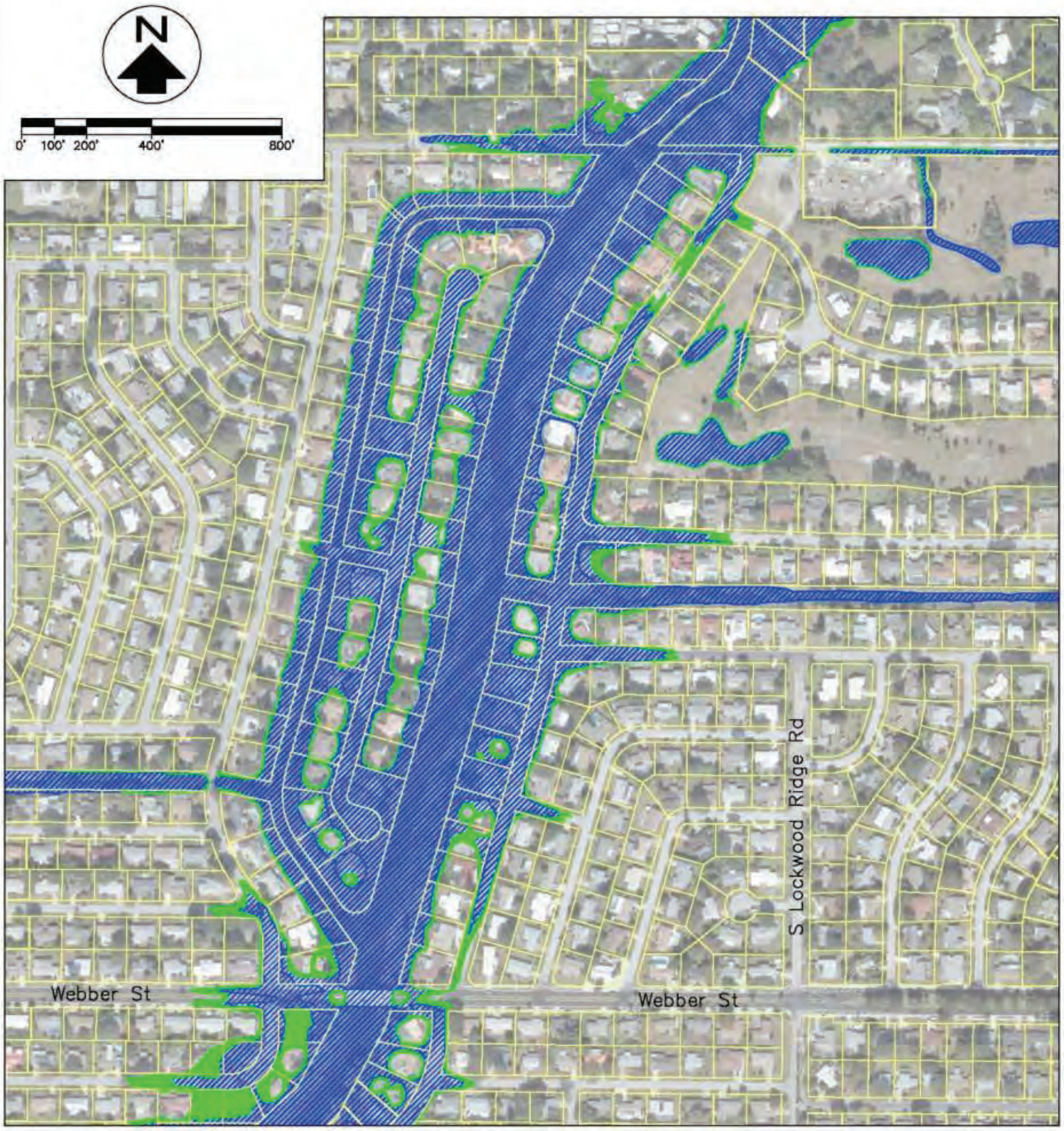
PCM 3



RECM 100yr floodplain

PCM – Area now included in the 100yr floodplain

PCM – Area now removed from the 100yr floodplain

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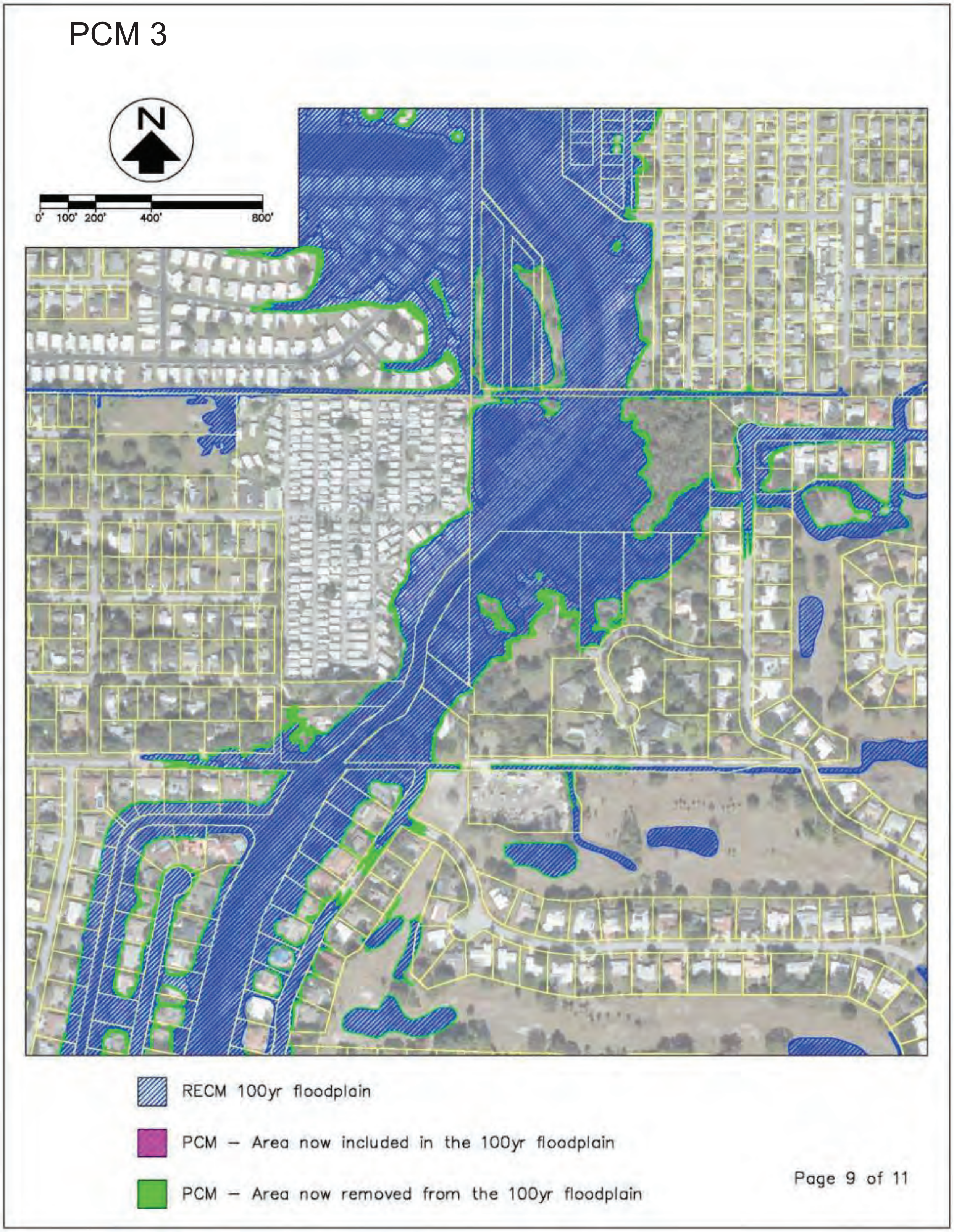
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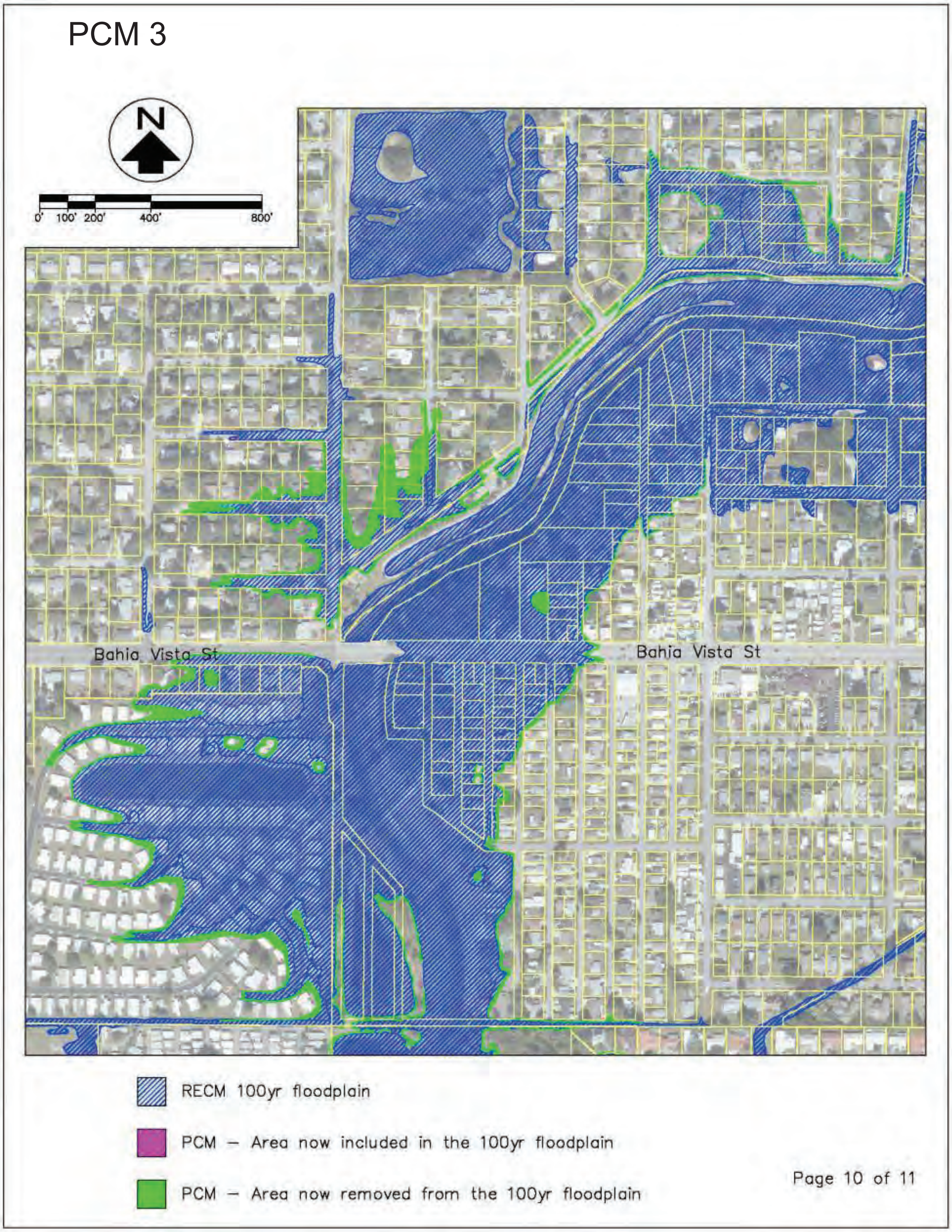
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
Page 9 of 11


PCM 3
N
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Bahia Vista St
Bahia Vista St
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
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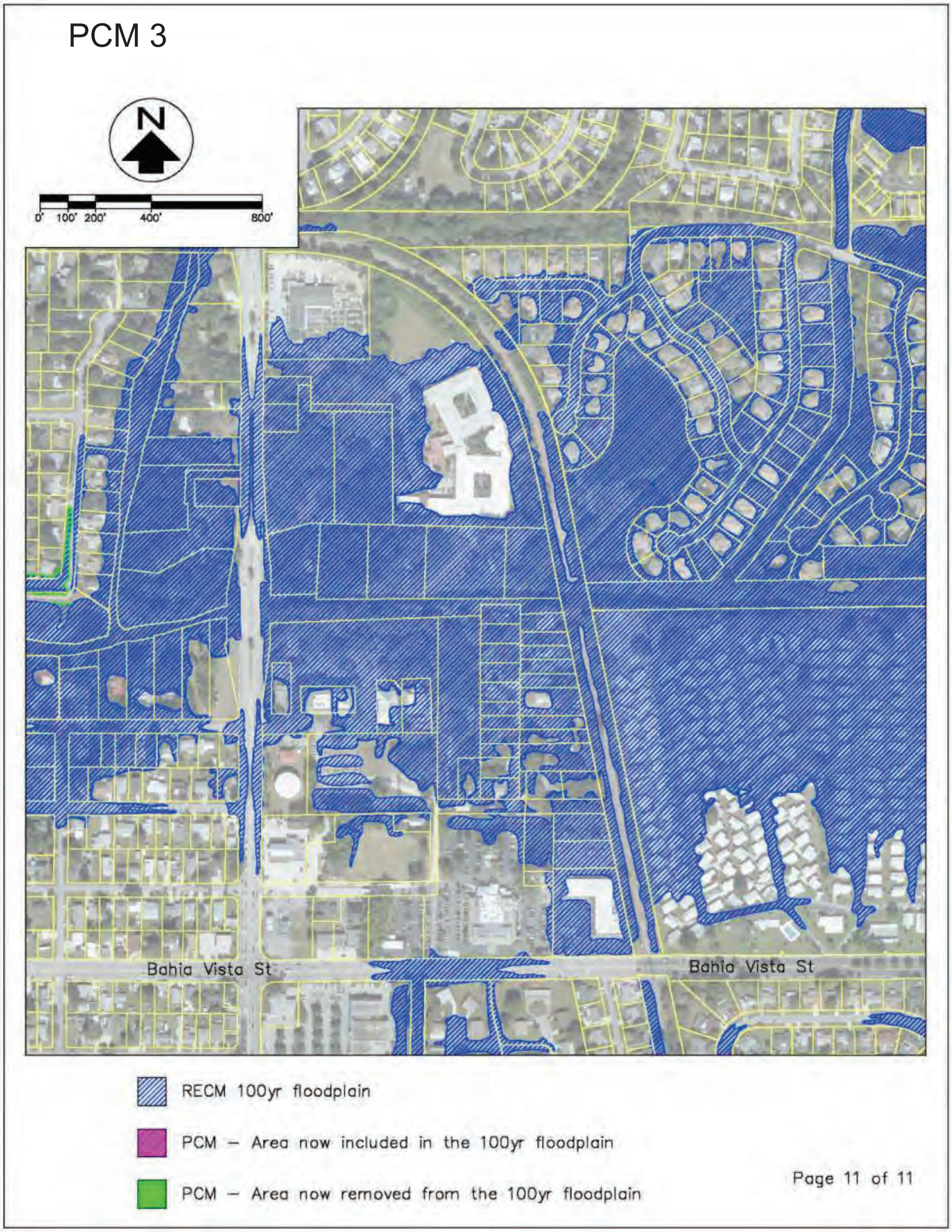
PCM 3
N
0' 100' 200' 400' 800'
Bahia Vista St
Bahia Vista St
RECM 100yr floodplain
PCM – Area now included in the 100yr floodplain
PCM – Area now removed from the 100yr floodplain
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Appendix I: Water Quality Calculations

TSS Reduction Calculation

$$RB3\ contributing\ area = Approx.5850\ ac$$
$$RB5\ contributing\ area = Approx.29120\ ac$$
$$Alternative\ 2\ Sump = Approx.31210\ ac$$

$$RB3\ Sediment\ Removal = 149{,}454\frac{lb\ TSS\ removed}{yr}^{1}$$
$$Assumed\ Sediment\ Sump\ efficiency = 80\%$$
$$\frac{149{,}454\ \frac{lb\ TSS\ removed}{yr}}{0.8} = 186{,}818\ \frac{lb\ TSS}{yr}$$
$$186{,}818\ \frac{lb\ TSS}{yr} \div 5850\ ac = 31.93\ \frac{lb\ TSS}{yr*ac}$$

$$31210\ ac*31.93\ \frac{lb\ TSS}{yr*ac} = 996{,}535\ \frac{lb\ TSS}{yr}$$
$$29120\ ac*31.93\ \frac{lb\ TSS}{yr*ac} = 929{,}802\ \frac{lb\ TSS}{yr}$$
$$929{,}802\ \frac{lb\ TSS}{yr} - 149{,}454\frac{lb\ TSS\ removed}{yr} = 780{,}348\ \frac{lb\ TSS}{yr} = RB5\ influent$$
$$780{,}348\ \frac{lb\ TSS}{yr}*0.8 = 624{,}278\ \frac{lb\ TSS\ removed}{yr} = RB5\ Sediment\ Removal$$
$$\left(996{,}535\ \frac{lb\ TSS}{yr} - 624{,}278\ \frac{lb\ TSS\ removed}{yr} - 149{,}454\frac{lb\ TSS\ removed}{yr}\right)*0.8 = 178{,}242\ \frac{lb\ TSS\ removed}{yr}$$
$$Alternative\ 2\ Sump\ Removal = 178{,}242\ \frac{lb\ TSS\ removed}{yr}$$

$$\frac{\$1{,}246{,}821}{178{,}242\ \frac{lb\ TSS\ removed}{yr}} = \frac{\$7.00}{\frac{lb\ TSS\ removed}{yr}}$$

TP Reduction Calculation

$$178{,}242\ \frac{lb\ TSS\ removed}{yr}*0.00036\ \frac{lb\ TP}{lb\ TSS}^{1} = 64\ \frac{lb\ TP\ removed}{yr}$$

TN Reduction Calculation

$$178{,}242\ \frac{lb\ TSS\ removed}{yr}*0.00090\ \frac{lb\ TN}{lb\ TSS}^{1} = 160\ \frac{lb\ TP\ removed}{yr}$$

[1] Data received from the County

Appendix D

The Harbor Acres Alternatives Analysis Report by Kimley Horn and Associates, dated 2021.

FINAL REPORT

HARBOR ACRES ALTERNATIVES ANALYSIS

Prepared for:

Sarasota County
1001 Sarasota Center Blvd.
Sarasota, FL 34240

Kimley»Horn

FINAL REPORT

HARBOR ACRES ALTERNATIVES ANALYSIS

Prepared for:

Sarasota County
1001 Sarasota Center Blvd.
Sarasota, FL 34240

Prepared by:

Kimley-Horn and Associates, Inc.

KELLIE CLARK, P.E.

STATE OF FLORIDA,
PROFESSIONAL ENGINEER,
LICENSE NO.77642

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY KELLIE CLARK, P.E. ON THE DATE INDICATED HERE.

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

THIS IS TO CERTIFY THAT THE ENCLOSED ENGINEERING CALCULATIONS WERE PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION.

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INTRODUCTION

The Harbor Acres development is approximately 61.5 acres and is located within the City of Sarasota. The development is bounded to the west, south, and north by Sarasota Bay and to the east by South Orange Avenue. Harbor Acres was originally designed in the 1940s and home sizes were anticipated to be around 3,000 sf. Since that time, multiple residential structures have been demolished and redeveloped with larger waterfront homes with a significant increase in impervious area. The properties have been elevated to meet current Florida Building Code and City of Sarasota code requirements. According to Sarasota County, flooding issues have been reported within the Harbor Acres community by residents. Kimley-Horn and Associates, Inc. was hired by Sarasota County to perform a study of the drainage system within the community including historical conditions, current conditions, and future buildout conditions, as well as an alternative analysis to evaluate potential solutions to resolve or reduce flooding and evaluate how potential solutions will perform in future conditions. Historical conditions refer to the original buildout of the development in the 1940s including historical topography, tailwater conditions, impervious area, and inlet and drainage pipe location and dimensions. The current conditions refer to the mix of original and redeveloped parcels as of 2017 and the changes to the topography and tailwater conditions. For current conditions, the inlets and drainage pipe locations and dimensions are consistent with the historical conditions. The future buildout conditions refer to the assumption that all parcels will be redeveloped with an increase in impervious area and modifications to the topography to meet the Florida Building Code and the projected changes in tailwater conditions for 2050. Throughout this report the study performed by Kimley-Horn is referred to as "the study" or "this study".

It should be noted that a portion of the Harbor Acres development was previously modeled as a part of the Coastal Fringe Phase 3 (CF3) Watershed Management Plan (WMP) completed and accepted by Sarasota County in 2015. Harbor Drive, Hawthorne Street, and South Orange Avenue were all previously identified within the CF3 WMP as failing to meet neighborhood level of service, or roadway flooding of 12 inches or less during a 100-year 24-hour storm event.

The purpose of this study is to determine the impacts increased impervious area on the existing stormwater system as well as provide alternatives to achieve three different levels of service under current conditions, and review the impacts of sea level rise (changing tailwater conditions) on each of those alternatives. The historical conditions were modeled to establish the original design conditions in the 1940s and the future buildout conditions model was created to understand the effects of the increase impervious and topographical modifications due to the re-development to larger homes within the community. Alternatives were determined using the current conditions model and were also modeled under future buildout conditions to determine impacts of sea level rise on level of service in the future. Additionally, cost-benefits were evaluated for proposed alternatives by considering capital costs, maintenance costs, life-cycle alternative, and impacts to upstream areas for each level of service.

BACKGROUND

Three (3) baseline models (the historic, the current, and the future buildout conditions models) were developed during this study and the Mean-Annual (2.33-year)/24-hour, 25-year/24-hour, and 100-year/24-hour storm events were used in the evaluation. Two (2) additional sets of models were developed (using the current and the future buildout conditions baseline models) to include proposed alternatives under each scenario. The historic conditions were intended to establish the performance of the stormwater system under the original design scenario (1940s). The current conditions model was intended to represent the existing conditions of the stormwater system and its performance and to better define the extents of the flooding issues currently affecting the community. The future buildout conditions model was developed to predict the potential performance of the current stormwater system in a future scenario that includes sea level rise conditions (for year 2050) and continued increase of building footprints and other impervious areas. The three conditions were developed using available data and assumptions, no model calibration was included in this analysis.

Once the performance of the stormwater system was established for current conditions, six (6) different alternatives were developed using the current conditions model to identify potential solutions or mitigation to the flooding affecting the Harbor Acres development. Three (3) of these alternatives were selected by the County and were incorporated into the future buildout conditions. The future buildout conditions with the alternatives served to predict how the stormwater system will perform in the future with the proposed improvements.

Per the County's direction, the ICPR3 Modeling software was used (same as CF3 model). The 2007 LiDAR obtained from Sarasota County was best available topographic information and was used as the topography for all the models and alternatives. For historic and future buildout conditions, modifications were incorporated to the Digital Elevation Map (DEM) of the LiDAR to best represent each scenario (discussed in following sections). Per the County's request, this project was completed in NAVD88.

Aerials from 1948 were used to establish the historical conditions model. The aerials were obtained from Sarasota County. To establish the inland boundary conditions and supplement the model to include areas upstream of Harbor Acres, the CFR3 model was used. In addition, the stormwater infrastructure within the Harbor Acres development was obtained from survey completed in February 2017 provided by the County (NAVD88) and survey completed in May 2017 by Hyatt Surveying (NAVD88). This stormwater infrastructure was used for all the base models under the historical, current, and future buildout conditions. For the analyzed alternatives, proposed improvements as identified for each alternative were incorporated into the model (under current and future buildout conditions).

The tailwater conditions for the historic and future buildout conditions scenarios were based on the sea level information for each condition and by utilizing the data from the St. Petersburg NOAA tidal station #8726520. The tailwater for the current conditions model was set based on further evaluation of this NOAA station #8726083 and presented to the County for concurrence. Additional details for the parameters applied on each scenario are provided in the model development section of this report.

Several assumptions were made to create the historic, current, and future buildout conditions models, and these were based upon assumptions agreed upon with the County as well as best available information. Meeting minutes of discussions with the County are included within Appendix B of this report.

Assumptions made during the baseline models' development are listed below:

All Models

- The lots bordering Sarasota Bay and S Orange Avenue were delineated as type B lots, and all internal lots were assumed to be type A lots. Type A lots are lots that drains to the front (to the street) of the lot for the public storm drainage system. Type B lots drains to the front (to the street) and to the back of the lot (split drain). This assumption is reasonable given the current lot elevations.

Historical Conditions Model

- For the impervious calculations, all lots within the Harbor Acres Development were assumed to be 100% developed with a 3,000 square foot home.
- For the impervious calculations, lots did not include impervious area for a patio or a pool.
- For the impervious calculations, driveways were assumed to be 2.75% of the total lot area.
- Current day design rainfall distribution, amount, and intensity was assumed to be applicable. This allowed for more straightforward comparison related to increased development and sea level rise.
- The elevation of area surrounding existing homes was assumed to be the average grade of the area surrounding current homes.

Current Conditions Model

- For the impervious calculations, the building footprint layer acquired from Sarasota County was used to determine the amount of impervious area in current conditions.
- For the impervious calculations, all lots were assumed to have an 1,800 square foot pool or patio.
- For the impervious calculations, driveways were assumed to be 11% of the parcel area.

Future Buildout Model

- For the impervious calculations, all lots within the Harbor Acres Development were assumed to be 100% developed with a 12,000 square foot home. Lots greater than 30,000 square feet were assumed to have a single-story home with a footprint of 12,000 square feet. Lots less than 30,000 square feet were assumed to have a two-story home with a footprint of 6,000 square feet.
- For the impervious calculations, all lots were assumed to have an 1,800 square foot pool or patio.
- For the impervious calculations, driveways were assumed to be 11% of the parcel area.
- Current day design rainfall distribution, amount, and intensity was assumed to be applicable. This allowed for more straightforward comparison related to increased development and sea level rise.
- The elevation of area surrounding existing homes was assumed to be the average grade of the area surrounding current homes.

MODEL DEVELOPMENT

For this study, Kimley-Horn developed hydrologic and hydraulic models using ICPR version 3. The below report sections describe the parameters used to create each of the models considered during this study.

Hydrology

Terrain

Three terrain surfaces were used during this project. For the current conditions model and the associated alternatives scenarios for the current condition the 2007 LiDAR was used as the base data. Current building footprints obtained from the County, were incorporated into the surface at an elevation higher than anticipated maximum stages. This was done so no flow unrealistically occurred through the footprint of a home.

For historic conditions, the 2007 terrain surface was used as the base, but the building footprints were modified assuming that the historic building footprints were 3,000 square feet. Because the historic homes were different shapes than the existing homes, it was necessary to also modify the area around the homes. In cases where there was a current home on the lot, these homes were removed from the DEM by buffering the current home footprint. An average elevation was acquired for the area between the current home footprint and the buffer. This average elevation was then applied to the current home to effectively remove the home from the DEM. The historic homes were then added to the DEM to complete the historic conditions surface. The same methodology was applied to obtain the projected building footprint.

For the future buildout conditions, the 2007 terrain surface was modified to reflect building footprints of 12,000 square feet in all lots. In cases where a 12,000 square foot footprint did not fit on the lots (lots less than 30,000 square feet), a two-story home with a 6,000 square foot footprint was used.

Basin Delineation

Kimley-Horn performed basin delineation for the historic, current and future buildout conditions using the 2007 LiDAR and Aerial Photography provided by Sarasota County. Basin divides were generated using averages to the center of homes of the lots and high points in the roadway from LiDAR. The generated basin divides were reviewed to create the final model basins based on review of the 2007 LiDAR, aerial photographs, and engineering judgment.

- Basins were delineated at a local scale, with a subbasin delineated for each group of stormwater inlets serving one side of a road. As such, basin divides fall on both along homes or backs of lots and along the center of roadways.
- An average distance to current homes (which represent both smaller historic homes and larger buildout homes) was determined. This distance represents how far back on the lot the buildings were. Historic homes were assumed to be set this far back from the front of the property and the basin boundary was drawn along the center of the building footprints. Basins were smoothed along home locations to the average distance.

Rainfall

For the current conditions, Kimley-Horn modeled the Mean-Annual (2.33-year)/24-hour, 25-year/24-hour, and 100-year/24-hour storm events in ICPR using the Natural Resources Conservation Services (NRCS) Type-II Florida-Modified Rainfall Distribution. Rainfall volumes for these storms were derived from rainfall isohyetal maps provided in *SWFWMD Environmental Resource Permit Applicant's Handbook Volume II.* The same rainfall parameters were used in the historic and future buildout conditions models.

Runoff

The NRCS method of calculating runoff was used for all models based on the requirement in *SWFWMD Environmental Resource Permit Applicant's Handbook Volume II.* The unit hydrograph peaking factor for all subbasins was set to 256 in accordance with SWFWMD guidance documents. Curve numbers were determined to be 98 for impervious and 80 for pervious based on hydrologic soil group, cover type, and hydrologic condition. Hydrologic soil group was determined to act as type D based on a type A/D classification from NRCS soil mapping and water table elevations in this area. The cover type and hydrologic condition for the site was determined to be a combination of impervious and good condition lawn based on aerial photography. Impervious coverage for historic, current, and future buildout conditions were determined based on aerial photography, engineering judgement, and information from Sarasota County (as applicable). Relevant aspects for the impervious coverage obtained from engineering judgement and/or information provided by the County are shown below:

- Historic Conditions: All lots within the Harbor Acres Development are 100% developed with a 3,000 square foot home with 2.75% of the lot assumed impervious for the driveway. No additional impervious area for pools or patios.
- Current Conditions: Existing home footprints within the Harbor Acres Development were acquired from Sarasota County and used to determine impervious area. For the driveway, 11% of the lot was assumed impervious. An additional 1,800 square feet of impervious was included for pools or patios.
- Future Buildout Conditions: All lots within the Harbor Acres Development are 100% developed with a 12,000 square foot home. Lots greater than 30,000 square feet were assigned a single-story home with a footprint of 12,000 feet while lots less than 30,000 square feet were assigned a two-story home with a footprint of 6,000 square feet. For the driveway, 11% of the lot was assumed impervious. An additional 1,800 square feet of impervious was included for pools or patios.

Impervious area was also added for driveways and pools/patios for all three conditions. Driveways for current conditions were determined to be approximately 11% of the parcel area for each house based on a sample of driveway sizes measured off of the aerial in GIS, and this percentage was also applied during the future buildout conditions. The driveways for historic conditions were determined to be 25% of the current driveway impervious (2.75% of the lot area) size because the assigned house size for historic conditions is 25% of the size of the current conditions house. Pools or patios of 1,800 square feet were assigned to each current condition house based on the average of a sample of pool/patio areas measured from the aerial in GIS. A pool/patio of 1,800 square feet was also applied for the future buildout conditions calculation, while during historic conditions no pool or patio were considered.

The time of concentration (T_C) for each subbasin was calculated as the combination of sheet flow and shallow concentrated flow over paved and unpaved surfaces. The Manning's roughness coefficients were derived from the TR-55 (NRCS, 1986). A coefficient of 0.011 was used for paved surfaces and a coefficient of 0.15 was used for unpaved surfaces. Travel distances were determined using the provided Sarasota County Aerials and GIS. Slopes were determined from the 2007 LiDAR. The minimum slope used in calculations was 0.001 ft/ft. The 2-year, 24-hour rainfall depth was referenced from the rainfall isohyetal maps provided in *SWFWMD Environmental Resource Permit Applicant's Handbook Volume II*. The maximum T_C used was 30 minutes. The calculated T_C values were the same for the historic, current, and future buildout conditions model.

Hydraulics

Conveyance Structures

The stormwater network included in the ICPR model was defined using the survey data received from Sarasota County and from Hyatt Surveying, as well as the CF3 model. The stormwater network assessed during this evaluation included all the contributing areas within the Harbor Acres development. This network consists of pipes and inlets with a main discharge waterbody (Sarasota Bay). Seventeen (17) outfall pipes were identified within the study area. Two (2) out of the seventeen outfall pipes are elliptical, while the other fifteen are circular pipes. Outfall pipes upstream invert elevations range between 6.4 feet and -2.08 feet. The outfall downstream invert elevations range between 1.9 feet and -4.21 feet. Circular outfall pipes' diameters range from 12" to 48", and elliptical pipes range from 14" x 23" to 29" x 45". Outfall pipe material varies from PVC, CMP, and concrete.

Thirty more pipes interconnected to the outfalls were part of this evaluation. Thirteen (13) pipes have survey from the County and at least three (3) of those thirteen (13) pipes also have survey from Hyatt. Thirteen more pipes have only Hyatt survey. In the case of varying pipe elevations between surveys, the higher invert elevation was selected for the model. In some cases where no survey was available, Environmental Resources Permit (ERP) information was used. Pipes made of concrete, CPP, terra cotta, and CMP were assumed to have Manning's roughness coefficients of 0.012, 0.024, 0.013, and 0.024 respectively. The CF3 model was mostly used to define the contributing areas to the Harbor Acres, but that are not part of the development.

Fifty-eight (58) nodes representing manholes, inlets or junction boxes were included in the model. Twenty-four (24) out of the fifty-eight (58) have at least one basin connected to them. All inlets found within the development were modeled as weirs and weir sizes were based on survey.

Storage

Basin stage-storage for the historic, current, and future buildout conditions was based on the pertaining surface generated for each task. ArcHydro tools were used to obtain the stage-storage relationship for each basin.

Overland Weirs

Overland weirs for historic, current and future buildout conditions were defined by utilizing the pertaining modified surfaces. ArcGIS was used to extract the station/elevation points along historic and future buildout basin boundaries to capture high points, low points, and grade changes. For the historic and future buildout conditions, the overland weirs were delineated along the center of the placed houses. For the current conditions, overland weirs were defined along the main terrain surface ridges as defined in the 2007 LiDAR.

Boundary Conditions

The Harbor Acres neighborhood and all upstream contributing area was modeled; therefore, only one boundary condition at the outfall was required. Kimley-Horn evaluated and obtained the current tailwater based on an evaluation of NOAA tidal station #8726083 data. The tailwater elevation of 1.95' (NAVD 88) for current conditions was presented to the County and concurrence was obtained. The tailwater elevation for historic conditions was determined to be 1.54' (NAVD 88). This was determined by using the CRS recommended U.S. Army Corps of Engineers "Sea-Level Change Calculator" to back calculate from the current conditions tailwater elevation to the 1940s. Data from St. Petersburg NOAA tidal station #8726520 during 1947 to 1957 was used to determine the historic MHHW in St. Petersburg. This was compared to the MHHW from St. Petersburg NOAA tidal station #8726520 from 2007 to 2017. The difference between the MHHW for historic and current conditions at the St. Petersburg gauge was used to select a NOAA curve to back calculate the historic conditions for Sarasota. The intermediate low curve for the St. Petersburg NOAA tidal station #8726520. Tailwater for future buildout conditions was projected for the year 2050 utilizing the NOAA Tidal Data for station #8726520 and Sea Level Rise Calculator utilizing the intermediate high curve for calculations. The resulting tailwater for Node NH3050 was 2.99' (1.95' + 1.04'). All modeled scenarios consider a constant tailwater at the Sarasota Bay for the entire simulation.

Initial Stages

Initial stages for all the modeled scenarios were set to static wet conditions for each node and were updated for each scenario to consider the pertaining scenario tailwater elevations.

ALTERNATIVES

As part of alternatives analysis, different alternatives were analyzed to help achieve a specific Level of Service (LOS) in the Harbor Acres Community. Utilizing the current and future buildout conditions models as the base, the alternatives were incorporated in the current and future buildout scenarios and the resulting Level of Service (LOS) was documented.

The alternatives analysis (task 5) performed on the current conditions scenario included the analysis of six (6) alternatives to achieve a desired LOS associated to the 100-year 24 hour storm event. The current conditions model was used as the base and was modified to evaluate alternatives to provide different LOS., alternatives were evaluated and classified as follows:

- Three (3) alternatives that reduce the flood water levels on local roads to be no greater than 12 inches
- Two (2) alternatives that reduce the flood water levels on the local roads to be no greater than 6 inches
- One (1) alternative that reduces the flood water levels on local roads to be no greater than 0 inches.

Improvements considered during this study were:

- Adding inlets
- Upsizing pipes
- Adding pump station(s)
- Purchasing homes to create additional storage

Model updates were performed to incorporate the proposed improvements.

As part of the future buildout conditions, three (3) alternatives from the alternative analysis were selected by the County and were incorporated in the future buildout conditions scenario. The resulting LOS was established for each alternative under the future buildout conditions scenario.

A description of the alternatives for both scenarios (current and future buildout) are included in the following paragraphs. Appendix C shows the peak stages obtained for the current conditions and the future buildout conditions, as well as the corresponding Level of Service (in inches).

Current Conditions - Alternatives

Level of Service of 12 inches of Standing Water on Local Roads

The three (3) alternatives that were determined to reduce the water levels on the road to be no greater than 12 inches were named as alternative 1, alternative 2 and alternative 3 and are described as follows:

- Alternative 1: Considered increasing the pipes' size, the addition of pipes to the network and the addition and/or size increase of inlets within the Harbor Acres community.

- Alternative 2: Considered the changes determined during Alternative 1 but included additional storage within some critical basins (Basins HA03 and HA05). Basins, overland weirs and pertaining cross sections affected by the storage addition were revised accordingly. Considering the level of analysis, this model was edited at Basins HA03 and HA05 to reflect (mainly) the outfall and not the internal drainage elements. This was done assuming that the internal inlets and pipes will be adequately designed during a final design phase.

- Alternative 3: Considered the changes determined during Alternative 1 but included additional modifications for a pump system at one of the most critical basins (Basin HA05). It also considered modifications to (some) inlets invert/control elevations.

Level of Service of 6" Standing Water on Local Roads

The two (2) alternatives that were determined to reduce the water levels on the road to be no greater than 6" were named as alternative 4 and alternative 5 and are described as follows:

- Alternative 4: Considered the changes determined on Alternative 2 but included additional increase of pipes' size and the addition and/or size increase of inlets.
- Alternative 5: Considered additional storage in all basins (within the study area), increase of pipe sizes, and the addition and/or size increase of inlets. Basins, overland weirs and pertaining cross sections affected by the storage addition were revised accordingly. Considering the level of analysis, this model was edited to reflect mainly the outfall and not the internal drainage elements.

This was done assuming that the internal inlets and pipes will be adequately design during a final design phase.

Level of Service of 0” Standing Water on Local Roads

One (1) alternative was identified to reduce the water levels on the road to be no greater than 0”. This alternative was named as alternative 6 and is described as follows:

- Alternative 6: Considered the changes determined on Alternative 5, but included additional increase of pipes’ size, and the addition and/or size increase of inlets.

To model the alternatives, modifications were made to the current conditions model.

For the alternative analysis, additional storage was considered for some of the basins. Stage-storage for those basins was modified to reflect the particular lot changes. A constant additional storage area of 90% of the lot size was used from the approximate pond bottom to the top of the storage. The stage area relationships were determined by subtracting the storage determined during the current and future buildout conditions for a particular lot (under its base conditions) from the total storage area of the basin and then adding the estimated additional storage associated to the particular lot. The storage top of bank area was estimated based on the total area of the lot selected (90% of the lot size).

Overland weirs were also modified for those alternatives including additional storage. Specifically, the portion of the overland weir that is within the modified parcel(s) were updated to reflect the changes on the lot(s).

Future Buildout Conditions - Alternatives

The alternatives the County selected from the alternative analysis to be modeled under the future buildout conditions scenario were: alternative 1, alternative 2, and alternative 5. The numbering schema used during the alternative analysis to identify each alternative was maintained during the future buildout with alternatives (e.g. ICPR Models: FBC_Alternative_1, FBC_Alternative_2 and FBC_Alternative_5). This was done for comparison and reference purposes. In terms of model network, descriptions provided under the Current Conditions - Alternatives section apply for the future buildout alternatives 1, 2 and 5. However, model differences between the current and future buildout conditions baseline models prevails.

A graphical representation of the analyzed alternatives is included in Appendix A.

Summary of Model Parameters (Comparison)

The following table summarizes the main model parameters highlights and/or differences between the modeled scenarios.

Parameters	Historic Conditions	Current Conditions	Alternative Analysis	Future Buildout Conditions
Basin Divides	For the basin delineation it was assumed that lots bordering Sarasota Bay and S Orange Avenue are type B lots, and all internal lots are type A lots. For type B lots, the average distance to the back of each group of houses was determined and then used to create the basin divides though lots. Type A lots were divided by lot lines. Roadway crossing were determined by identifying roadway high points from 2007 LiDAR.			
Areas	All basin areas were calculated using ArcGIS.	All basin areas were calculated using ArcGIS.	All basin areas were calculated using ArcGIS. However, for alternatives where additional storage was considered, the portion of the lot(s) that were added to accommodate such storage was considered in the total basin area.	All basin areas were calculated using ArcGIS.
Curve Number/Impervious Areas	All lots within the Harbor Acres Development were considered 100% developed with a 3,000 square foot home. Lots did not include neither patio nor pool, and driveways were assumed to be 2.75% of the total lot area.	The existing building footprints were used for the impervious calculations. All lots were assumed to have an 1,800 square foot pool or patio, and driveways were assumed to be 11% of the parcel area.	Same as current conditions, but for alternatives with additional storage considers the area added from the particular lot(s) and the structure removal.	All lots within the Harbor Acres Development were considered 100% developed with a 12,000 square foot home. All lots were assumed to have an 1,800 square foot pool or patio, and driveways were assumed to be 11% of the parcel area.

Stage Storage	Building footprints of 3,000 square feet were burned into the 2007 LiDAR to effectively remove the building area from the stage area. The modified surface was used with ArcHydro tools to obtain stage area for historical conditions.	Current building footprints obtained from the County were burned into the 2007 LiDAR to effectively remove the building area from the stage area. The modified surface was used with ArcHydro tools to obtain stage area for current conditions.	Stage Area was obtained from the current conditions model and was modified for alternatives with proposed additional storage. The top of bank area was estimated based on the 90% total area of the lot selected. Current conditions storage associated to the particular lots were removed from the total basin area and the proposed storage was added accordingly.	Building footprints of 12,000 square feet were burned into the 2007 LiDAR to effectively remove the building area from the stage area. The modified surface was used with ArcHydro tools to obtain stage area for future buildout conditions. For alternatives considering additional storage, the methodology used during the alternative analysis was applied.
Overland Weirs	The modified surface used for the historic conditions stage storage calculations was used to develop overland weirs. Points were taken along all basin boundaries capturing high points, low points, and grade changes. As this follows the basin boundaries, mostly the building footprints were considered on its definition.	The modified surface used for current conditions stage storage calculations was used to develop overland weirs. Points were taken along the main terrain ridges to capture high points, low points, and grade changes. These do not necessarily match the basin boundary in all its length.	The process used to define the overland weirs in the current conditions was applied. However, alternatives where additional storage was considered, the portion of the overland weirs that represent the parcel(s) that were modified to accommodate the additional storage were modified accordingly.	The modified surface used for future buildout conditions stage storage calculations was used to develop overland weirs. Points were taken along all basin boundaries to capture high points, low points, and grade changes. For the alternatives where additional storage is proposed, same methodology as the one used during the alternative analysis was applied. As this follows the basin boundaries, mostly the building footprints were considered on its definition.

Tailwater	Tailwater was determined by using the CRS recommended U.S. Army Corps of Engineers "Sea-Level Change Calculator". It was back calculated from the current conditions tailwater elevation to the 1940s. Data from St. Petersburg NOAA tidal station #8726520 was used. The resulting historic tailwater elevation was 1.54' (NAVD 88).	The tailwater for the Kimley-Horn evaluated and obtained the current tailwater using NOAA tidal station #8726083 The resulting current tailwater elevation was 1.95' (NAVD 88).	Same tailwater as current conditions.	Tailwater for future buildout conditions was projected for the year 2050 utilizing the NOAA Tidal Data for station #8726520 and Sea Level Rise Calculator utilizing the intermediate high curve for calculations. The resulting historic tailwater elevation was 2.99' (NAVD 88).

COST BENEFIT ANALYSIS

A cost benefit analysis was developed for each of the proposed alternatives evaluated during the alternative analysis. This cost benefit analysis includes capital costs, maintenance costs, Level of Service (LOS), life cycle of the alternatives (without surpassing year 2050),and impacts to upstream areas.

The capital costs were determined considering the probable construction cost of each alternative. Stormwater infrastructure construction, demolition, excavation, land acquisition, and ancillary costs were considered for the probable construction cost estimate. The cost for each item was assigned using the Florida Department of Transportations (FDOT) Item Average Unit Cost Table (as presented on the FDOT website for the time range 2019/01/01 to 2019/12/31) and projects with similar characteristics. For items without FDOT values, an estimated unit price was assumed based on available construction information. A detailed probable construction cost estimate for each alternative is included in Appendix D. Rankings for the final cost benefit matrix were based on the costs determined in these EOPCs.

The rankings for maintenance were determined based on the level of difficulty of maintaining the system. Alternatives with pumps included were ranked to include the highest maintenance, followed by stormwater ponds, and finally addition of pipe infrastructure.

Level of Service rankings were based on the results for the Alternatives Level of Service Analysis. Alternatives that achieved a higher level of service, for example 0”, were ranked better than alternatives achieving 6” for the level of service.

Similar to level of service, the life cycle of the alternatives was based on the effectiveness of each alternatives under the future buildout conditions scenario. Because not all of the alternatives were modeled under the future buildout conditions, these were assumed to be equal in ranking to the current level of service. The actual level of service was not calculated, but the overall effectiveness is assumed to be the same in relation to the other alternatives.

The impacts to upstream areas were ranked based on a review of the reduction in stages in areas outside of the Harbor Acres Development.

Appendix E includes a cost benefit matrix that has been created and summarizes the cost analysis findings of for all six (6) alternatives considered evaluated during the alternative analysis. It should be noted that to draw conclusions from the provided cost benefit matrix, priority ranking should be assigned to each category in order to capture which parameters are most important to the project success.

In addition to the cost benefit matrix, the cost-benefit ratio was also calculated for Alternatives 1, 2, and 5. This was done by determining cost of damages and displacement, lost wages or income, and road detours.

The cost of damages included costs for building damages, content damages, automobile damages, and exterior property damages. The building damages were calculated by determining the assessed property value of each building in the vertical floodplain and then multiplying that by the building damage multiplier of 0.12. A building was determined to be in the vertical floodplain if the finished floor elevation (FFE) was less than the flood elevation for a given storm. The next few paragraphs describe the process used to determine the FFE of the buildings.

Of the 59 homes with possible flooding, 25 elevation certificates were provided to determine FFE. There were five different elevation categories on each certificate including top of bottom floor, top of next higher floor, bottom of lowest structural member, attached garage, and lowest elevation of machinery. However, these categories were not all populated on each certificate, so a specific methodology was used to determine which of those provided elevations was the FFE. If the bottom of lowest structural member elevation was provided, then that was assumed to be the FFE. If that elevation was not provided and the top of next higher floor elevation was 8 ft or more higher than the top of bottom floor elevation or if the top of next higher floor was not provided, then the top of bottom floor elevation was assumed to be the FFE. If the difference between the top of next higher floor and bottom floor elevation was less than 8 ft, then the top of next higher floor elevation was assumed to be the FFE.

For the homes within the floodplain but without elevation certificates, an assumption needed to be made regarding if these homes flooded. First, the DEM and available elevation data were reviewed. When the homes built prior to 2008 were reviewed against the 2007 DEM (at the roadway centerlines and the building footprints), there was no correlation between the DEM and the FFE. Based on this review, there was no evidence to believe a relationship can be assumed between the DEM elevations and the FFE. Additionally, because all available data indicates FFE higher than flood elevations, and without elevation data to determine whether a home is flooded, it was assumed that no buildings flood under any conditions and building damage costs were not included in the cost-benefit analysis. This assumption reviewed by the County and accepted as a valid assumption prior to proceeding with the cost-benefit analysis.

Both content damage and automobile damages are calculated as a multiplier of structure flooding. Since there were no homes in the vertical floodplain, there were no content damage costs or automobile damage costs.

The exterior property damages were calculated by multiplying the landscape/hardscape cost of $2,000 by the number of homes in the horizontal floodplain. GIS was used to map the floodplains and determine the number of homes that intersected with them and were in the horizontal floodplain. Each of the alternatives and storms incurred costs for exterior property damages.

Displacement costs included those for flooded structures and for structures in the horizontal floodplain. Displacement costs for flooded structures were calculated by multiplying the number of homes in the vertical floodplain by displacement duration of 14 days by the per diem cost for displacement of $250. This cost was $0 because there were no flooded homes. The displacement cost for structures in the horizontal floodplain was calculated by multiplying the number of homes in the horizontal floodplain by displacement duration of two days by the per diem cost for displacement of $250. There were displacement costs for structures in the horizontal floodplain for each alternative and storm.

The lost wages due to residential flooding as well as lost business income and lost wages due to closed business were calculated. The lost wages due to residential flooding were calculated by multiplying the average household income of $61,683 by the fraction of work hours missed in a day/total work hours in a year of 8/2080 by the number of homes in the horizontal floodplain by the displacement duration of two days plus this same calculation for the number of homes in the vertical floodplain with a displacement duration of 14 days. There was a cost associated with lost wages due to residential flooding because there were homes in the horizontal floodplain in each storm and alternative.

Lost business income was calculated by finding the sum of the number of commercial structures in the horizontal floodplain multiplied by the displacement duration of two days and the number of commercial structures in the vertical floodplain multiplied by the displacement duration of 14 days and multiplying this sum by the average daily commercial revenue of $5,101. Lost wages due to closed business was calculated by finding the sum of the number of commercial structures in the horizontal floodplain multiplied by the displacement duration of two days and the number of commercial structures in the vertical floodplain multiplied by the displacement duration of 14 days and multiplying this sum by the average number of employees per business of 10 by the number of work hours lost in a day of 8 by the average Sarasota County payroll rate of $17.39/hour. Since there were no commercial structures flooded, there was no cost for lost business income or lost wages due to closed business.

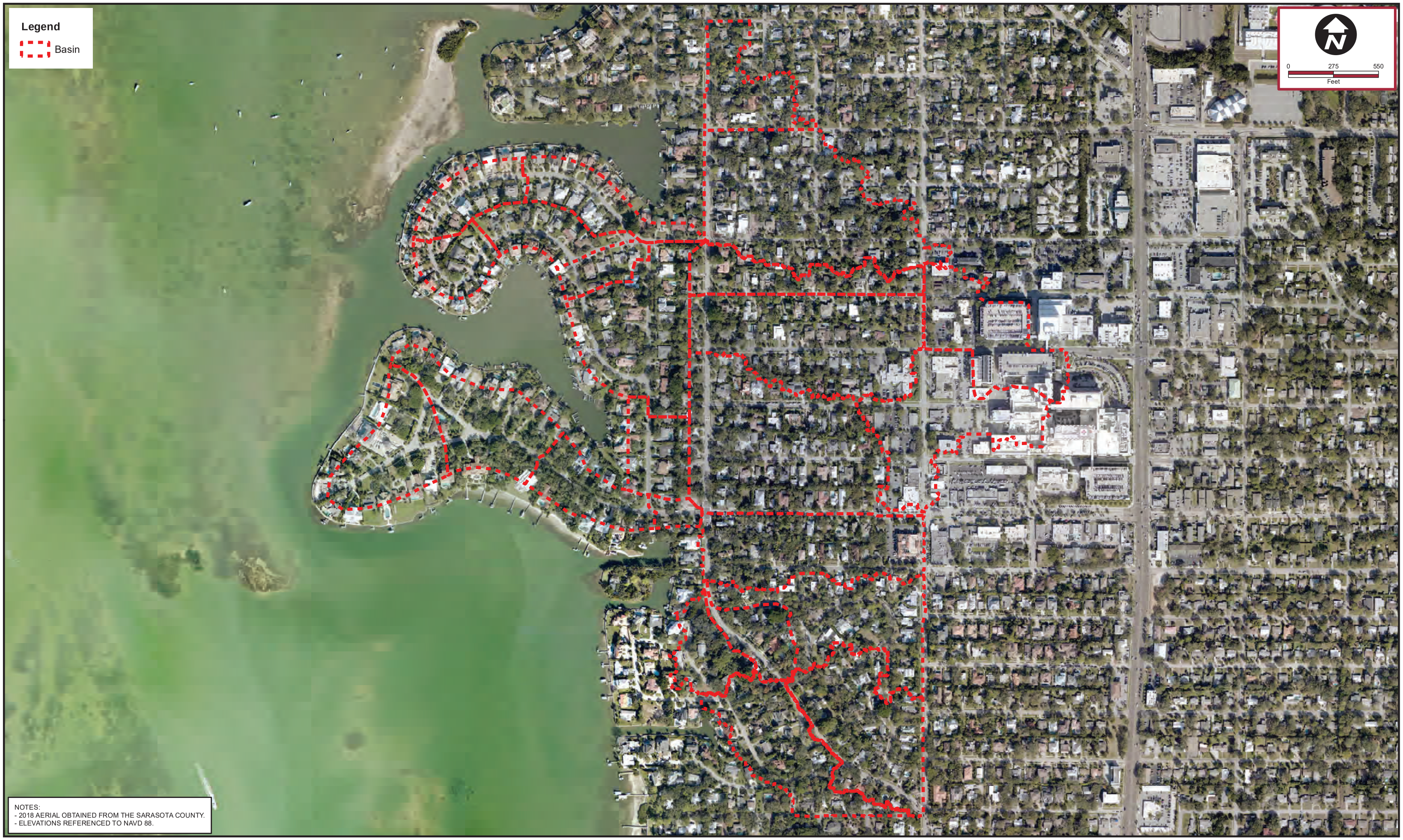
Road detour and public works costs were calculated by cost of manpower, materials, and duration of events, but there were no costs associated with this because no road detours or maintenance needed to take place.

Flood insurance costs were calculated by multiplying the total assessed property for each storm by 1%, but there were no homes in the vertical flood plain, so there were no flood insurance costs.

These costs were calculated for the current conditions as well as each of the three alternatives. The difference between the current conditions cost and the costs for each of the alternatives, were the avoided damages. The avoided damages was divided by the anticipated cost of construction to calculate the cost-benefit ratios. A higher cost-benefit ratio indicates a project that provide more benefit for its relative cost. A summary of the cost-benefit ratios is shown in the table below, and more detail can be seen in Appendix F.

Alternative	Avoided Damages	Anticipated Construction Cost	Cost-Benefit Ratio
Alternative 1	$1,033,000	$2,024,624	0.51
Alternative 2	$1,124,000	$7,411,250	0.15
Alternative 3	$1,223,000	$34,912,199	0.04

Appendix A: Exhibits



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KHA PROJECT
048048123

DATE
MARCH 2020

SCALE
AS SHOWN

HARBOR ACRES
ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM PROJECT LOCATION

EXHIBIT
1

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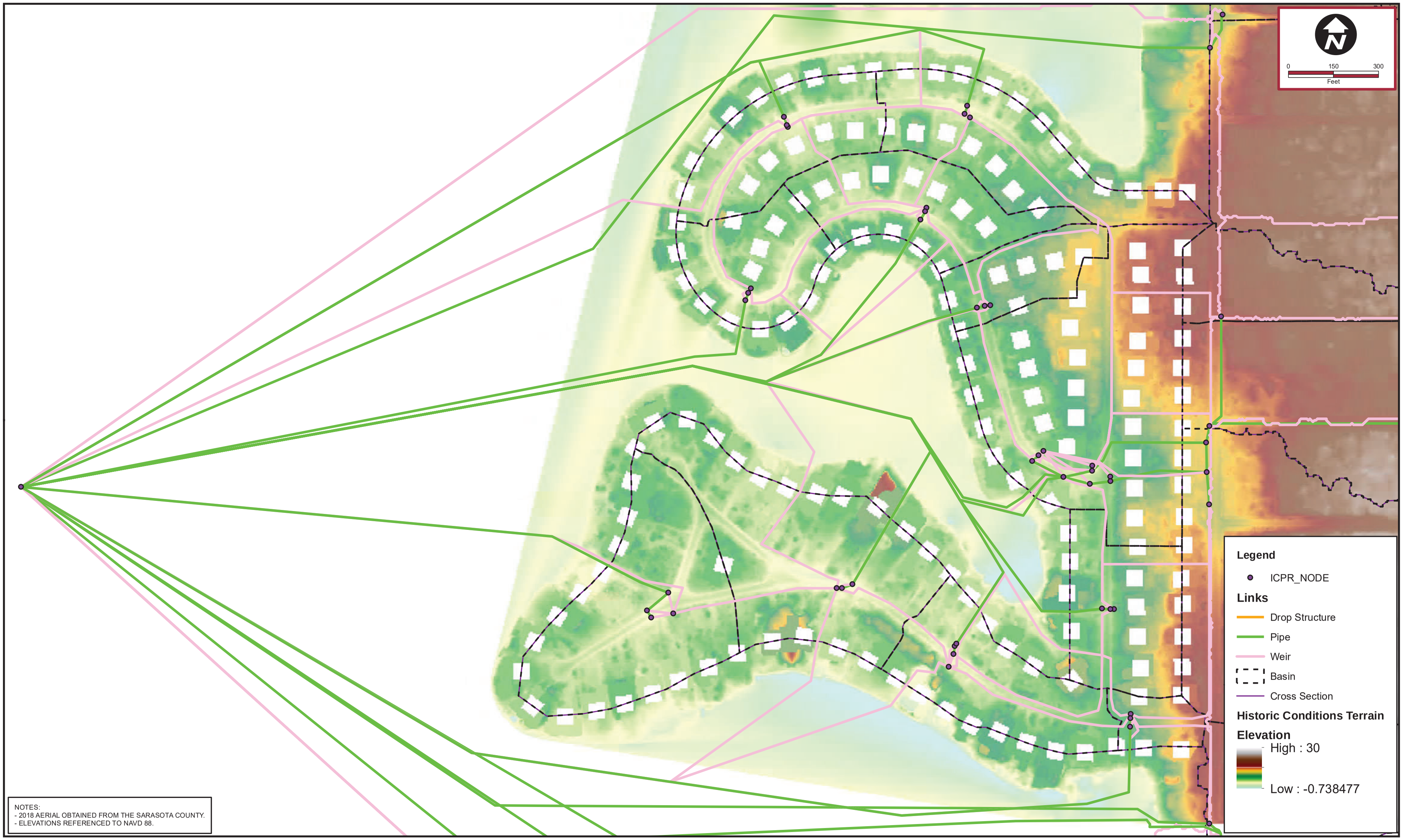

NOTES:
- 2018 AERIAL OBTAINED FROM THE SARASOTA COUNTY.
- ELEVATIONS REFERENCED TO NAVD 88.

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ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM HISTORIC CONDITIONS

EXHIBIT 2

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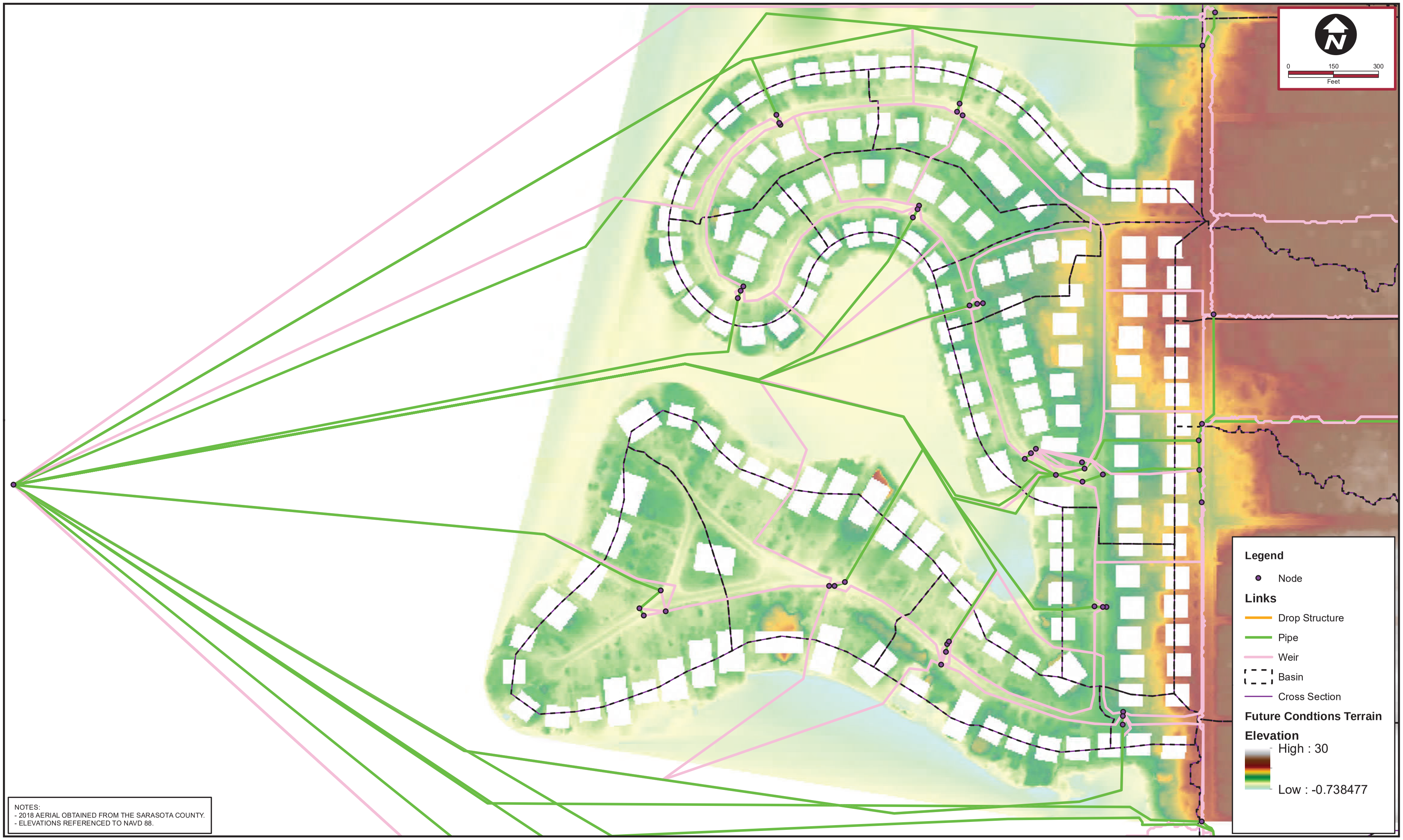
ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM CURRENT CONDITIONS

EXHIBIT
3

K:\FTM_Civil\048048123 - Harbor Acres Alternative\GIS\mxds\Final_Report_Exhibits\03_HarborAcres_Current.mxd - 3/17/2020 5:36:10 PM - melissa.perez



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HARBOR ACRES
ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM FUTURE CONDITIONS

EXHIBIT
4

Pipe	From	To	Current Conditions						Alternative 1					
			Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)	Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)
RHA054A-P	NHA054	NHA055	100	1	48	48	-2.86	-2.07	100	1	48	48	-2.86	-2.07
RHA041A-P	NHA041	NHA042	30	1	12	12	2.63	2.27	30	1	30	19	2.05	1.69
RHA051A-P	NHA051	NHA052	30	1	12	12	1.44	1.31	30	1	45	29	0.02	-0.3
RHA042A-P	NHA042	NH3050	275	1	12	12	2	0.02	275	1	30	19	1.42	-0.56
RHA111A-P	NHA111	NHA112	30	1	18	12	3.6	3.54	30	1	18	12	3.6	3.54
RHA112A-P	NHA112	NH3050	140	1	12	12	3.28	0.05	140	1	12	12	3.28	0.05
RHA031A-P	NHA031	NHA032	40	1	12	12	0.59	0.49	40	1	30	19	0.01	-0.09
RHA021A-P	NHA021	NHA022	50.9	1	18	18	-0.31	-0.28	50.9	1	45	29	-1.23	-1.2
RHA022A-P	NHA022	NH3050	380	1	12	12	-0.28	-0.86	380	2	45	29	-1.7	-2.28
RHA011A-P	NHA011	NHA012	30	1	18	12	0.86	0.38	30	1	38	24	-0.14	-0.62
RHA012A-P	NHA012	NHA013	90	1	15	15	0.29	-1.03	90	1	38	24	-0.46	-1.78
RHA013A-P	NHA013	NH3050	365	1	15	15	-1.08	-1.46	365	2	45	29	-2.25	-2.63
RHA101A-P	NHA101	NHA102	24	1	12	12	0.33	0.15	24	1	38	24	-0.67	-0.85
RHA102A-P	NHA102	NH3050	190	1	12	12	0.28	-0.84	190	1	38	24	-0.72	-1.84
RHA091A-P	NHA091	NHA092	30	1	12	12	1.09	1.29	30	1	30	19	0.51	0.71
RHA092A-P	NHA092	NH3050	190	1	12	12	1.29	-1.3	190	1	30	19	0.71	-1.88
RHA081A-P	NHA081	NHA082	22	1	12	12	-0.21	0.28	22	1	30	19	-0.78	-0.86
RHA082A-P	NHA082	NH3050	175	1	12	12	0	0.03	175	1	38	24	-0.99	-1.17
RHA071A-P	NHA071	NHA072	32	1	23	14	1.24	1.12	32	1	45	29	-0.01	-0.13
RHA072A-P	NHA072	NH3050	150	1	23	14	1.07	-1.67	150	1	45	29	-0.18	-2.92
RHA061A-P	NHA061	NHA062	25	1	12	12	1.88	1.82	25	1	23	14	1.71	1.65
RHA062A-P	NHA062	NH3050	150	1	12	12	1.76	-0.85	150	1	23	14	1.59	-1.02
RHA055A-P2	NHA055	NH3050	230	1	48	48	-2.08	-4.21	230	1	48	48	-2.08	-4.21
RHA055A-P	NHA055	NH3050	200	1	48	48	-2.08	-3.53	200	1	48	48	-2.08	-3.53
RHA052-P	NHA052	NHA055	60	1	18	18	-0.28	-0.28	---	---	---	---	---	---
RHA053A-P	NHA053	NHA054	75	1	48	48	-2.22	-2.2	75	1	48	48	-2.22	-2.2
RHA056A-P	NHA056	NHA055	140	1	48	48	-2.85	-2.85	140	1	76	48	-2.85	-2.85
RHA033A-P	NHA033	NH3050	250	1	12	12	0.47	-0.2	250	1	83	53	-3	-3.61
RHA032A-P	NHA032	NHA033	5	1	12	12	0.51	0.47	5	1	45	29	-0.91	-0.95
RHA057A-P	NHA057	NHA056	8	1	12	12	0.22	0.22	8	1	38	24	-0.78	-0.78
RHA0500A-P	NHA0500	NH3050	---	---	---	---	---	---	220	1	53	34	-0.5	-3.53
RHA501A-P	NHA052	NH3050	---	---	---	---	---	---	205	2	76	48	-2	-3.95

Inlet	From	To	Current Conditions					Alternative 1				
			Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)	Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)
RHA04-W4	NHA04	NHA041	1	18	31.2	3.74	3.74	1	18	31.2	3.74	3.74
RHA04-W5	NHA04	NHA042	1	18	31.2	3.66	3.66	1	18	31.2	3.66	3.66
RHA05-W8	NHA05	NHA051	1	18	28.8	3.15	3.15	3	18	28.8	3.15	3.15
RHA11-W3	NHA11	NHA111	1	18	31.2	5.45	5.45	1	18	31.2	5.45	5.45
RHA11-W4	NHA11	NHA112	1	18	31.2	5.39	5.39	1	18	31.2	5.39	5.39
RHA03-W4	NHA03	NHA031	1	30	18	2.24	2.24	1	30	18	2.24	2.24
RHA03-W5	NHA03	NHA032	1	30	18	2.31	2.31	1	30	18	2.31	2.31
RHA02-W4	NHA02	NHA021	1	30	18	1.87	1.87	2	30	18	1.87	1.87
RHA02-W5	NHA02	NHA022	1	30	18	1.67	1.67	1	30	18	1.67	1.67
RHA01-W2	NHA01	NHA011	1	30	18	2.14	2.14	1	30	18	2.14	2.14
RHA01-W3	NHA01	NHA012	1	18	28.8	1.98	1.98	1	18	28.8	1.98	1.98
RHA01-W4	NHA01	NHA013	1	18	28.8	1.98	1.98	2	18	28.8	1.98	1.98
RHA10-W5	NHA10	NHA101	1	16.8	30	2.07	2.07	1	16.8	30	2.07	2.07
RHA10-W6	NHA10	NHA102	1	16.8	30	2.1	2.1	1	16.8	30	2.1	2.1
RHA09-W2	NHA09	NHA091	1	32.4	7.2	2.69	2.69	1	32.4	7.2	2.69	2.69
RHA09-W3	NHA09	NHA092	1	31.2	4.8	2.59	2.59	1	31.2	4.8	2.59	2.59
RHA08-W3	NHA08	NHA081	1	16.8	30	1.87	1.87	1	16.8	30	1.87	1.87
RHA08-W4	NHA08	NHA082	1	24	24	1.96	1.96	1	24	24	1.96	1.96
RHA07-W5	NHA07	NHA071	1	14	23	2.72	2.72	1	14	23	2.72	2.72
RHA07-W6	NHA07	NHA072	1	14	23	2.57	2.57	1	14	23	2.57	2.57
RHA06-W4	NHA06	NHA061	1	16.8	30	3.47	3.47	2	16.8	30	3.47	3.47
RHA06-W5	NHA06	NHA062	1	16.8	30	3.56	3.56	1	16.8	30	3.56	3.56
RHA05-W3	NHA05	NHA052	1	30	30	2.9	2.9	3	30	30	2.9	2.9
RHA05-W4	NHA05	NHA057	1	18	31.2	3.23	3.23	1	18	31.2	3.23	3.23
RHA05-W5	NHA05	NHA055	1	72	6	3.84	3.84	1	72	6	3.84	3.84
RHA05-W6	NHA05	NHA054	1	18	28.8	3.3	3.3	2	18	28.8	3.3	3.3
RHA05-W7	NHA05	NHA053	1	18	28.8	3.89	3.89	1	18	28.8	3.89	3.89
RHA09-W5	NHA09	NHA092	1	18	31.2	2.59	2.59	1	18	31.2	2.59	2.59
RHA09-W4	NHA09	NHA091	1	18	31.2	2.69	2.69	1	18	31.2	2.69	2.69
RHA05W-500	NHA05	NHA0500	---	---	---	---	---	3	18	28.8	2.9	2.9

NOTES:
- 2018 AERIAL OBTAINED FROM THE SARASOTA COUNTY.
- ELEVATIONS REFERENCED TO NAVD 88.

No.	REVISIONS	DATE	BY

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KHA PROJECT
048048123

DATE
MARCH 2020

SCALE
AS SHOWN

HARBOR ACRES
ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM
ALTERNATIVE 1

EXHIBIT
5

K:\FTM_Civil\048048123 - Harbor Acres Alternative\GIS\mxds\Proposed_Conditions\20200303_Exhibits\05_HarborAcres_Alternative_1_V01.mxd - 3/17/2020 5:43:28 PM - melissa.perez

Pipe	Current Conditions								Alternative 2							
	From	To	Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)	From	To	Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)
RHA054A-P	NHA054	NHA055	100	1	48	48	-2.86	-2.07	NHA054	NHA05	150	1	48	48	-2.86	-3.2
RHA041A-P	NHA041	NHA042	30	1	12	12	2.63	2.27	NHA041	NHA042	30	1	30	19	2.05	1.69
RHA051A-P	NHA051	NHA052	30	1	12	12	1.44	1.31	---	---	---	---	---	---	---	---
RHA042A-P	NHA042	NH3050	275	1	12	12	2	0.02	NHA042	NH3050	275	1	30	19	1.42	-0.56
RHA111A-P	NHA111	NHA112	30	1	18	12	3.6	3.54	NHA111	NHA112	30	1	18	12	3.6	3.54
RHA112A-P	NHA112	NH3050	140	1	12	12	3.28	0.05	NHA112	NH3050	140	1	12	12	3.28	0.05
RHA031A-P	NHA031	NHA032	40	1	12	12	0.59	0.49	---	---	---	---	---	---	---	---
RHA021A-P	NHA021	NHA022	50.9	1	18	18	-0.31	-0.28	NHA021	NHA022	50.9	1	45	29	-1.23	-1.2
RHA022A-P	NHA022	NH3050	380	1	12	12	-0.28	-0.86	NHA022	NH3050	380	2	45	29	-1.7	-2.28
RHA011A-P	NHA011	NHA012	30	1	18	12	0.86	0.38	NHA011	NHA012	30	1	38	24	-0.14	-0.62
RHA012A-P	NHA012	NHA013	90	1	15	15	0.29	-1.03	NHA012	NHA013	90	1	38	24	-0.46	-1.78
RHA013A-P	NHA013	NH3050	365	1	15	15	-1.08	-1.46	NHA013	NH3050	365	2	45	29	-2.25	-2.63
RHA101A-P	NHA101	NHA102	24	1	12	12	0.33	0.15	NHA101	NHA102	24	1	38	24	-0.67	-0.85
RHA102A-P	NHA102	NH3050	190	1	12	12	0.28	-0.84	NHA102	NH3050	190	1	38	24	-0.72	-1.84
RHA091A-P	NHA091	NHA092	30	1	12	12	1.09	1.29	NHA091	NHA092	30	1	30	19	0.51	0.71
RHA092A-P	NHA092	NH3050	190	1	12	12	1.29	-1.3	NHA092	NH3050	190	1	30	19	0.71	-1.88
RHA081A-P	NHA081	NHA082	22	1	12	12	-0.21	0.28	NHA081	NHA082	22	1	30	19	-0.78	-0.86
RHA082A-P	NHA082	NH3050	175	1	12	12	0	0.03	NHA082	NH3050	175	1	38	24	-0.99	-1.17
RHA071A-P	NHA071	NHA072	32	1	23	14	1.24	1.12	NHA071	NHA072	32	1	45	29	-0.01	-0.13
RHA072A-P	NHA072	NH3050	150	1	23	14	1.07	-1.67	NHA072	NH3050	150	1	45	29	-0.18	-2.92
RHA061A-P	NHA061	NHA062	25	1	12	12	1.88	1.82	NHA061	NHA062	25	1	23	14	1.71	1.65
RHA062A-P	NHA062	NH3050	150	1	12	12	1.76	-0.85	NHA062	NH3050	150	1	23	14	1.59	-1.02
RHA055A-P2	NHA055	NH3050	230	1	48	48	-2.08	-4.21	---	---	---	---	---	---	---	---
RHA055A-P	NHA055	NH3050	200	1	48	48	-2.08	-3.53	NHA05	NH3050	50	2	68	43	-3.2	-3.53
RHA052-P	NHA052	NHA055	60	1	18	18	-0.28	-0.28	---	---	---	---	---	---	---	---
RHA053A-P	NHA053	NHA054	75	1	48	48	-2.22	-2.2	NHA053	NHA054	75	1	48	48	-2.22	-2.2
RHA056A-P	NHA056	NHA055	140	1	48	48	-2.85	-2.85	NHA056	NHA05	190	1	76	48	-2.85	-3.2
RHA033A-P	NHA033	NH3050	250	1	12	12	0.47	-0.2	NHA03	NH3050	50	1	68	24	-0.58	-1.19
RHA032A-P	NHA032	NHA033	5	1	12	12	0.51	0.47	---	---	---	---	---	---	---	---
RHA057A-P	NHA057	NHA056	8	1	12	12	0.22	0.22	---	---	---	---	---	---	---	---
RHA0500A-P	NHA0500	NH3050	---	---	---	---	---	---	---	---	---	---	---	---	---	---
RHA501A-P	NHA052	NH3050	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Inlet	From	To	Current Conditions					Alternative 2				
			Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)	Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)
RHA03-W1	NHA03	NH3050	1	9999	9999	3.6	3.6	1	9999	9999	3.1	3.1
RHA05-W1	NHA05	NH3050	1	9999	9999	3.88	3.88	1	9999	9999	2.9	2.9
RHA04-W4	NHA04	NHA041	1	18	31.2	3.74	3.74	1	18	31.2	3.74	3.74
RHA04-W5	NHA04	NHA042	1	18	31.2	3.66	3.66	1	18	31.2	3.66	3.66
RHA05-W8	NHA05	NHA051	1	18	28.8	3.15	3.15	---	---	---	---	---
RHA11-W3	NHA11	NHA111	1	18	31.2	5.45	5.45	1	18	31.2	5.45	5.45
RHA11-W4	NHA11	NHA112	1	18	31.2	5.39	5.39	1	18	31.2	5.39	5.39
RHA03-W4	NHA03	NHA031	1	30	18	2.24	2.24	---	---	---	---	---
RHA03-W5	NHA03	NHA032	1	30	18	2.31	2.31	---	---	---	---	---
RHA02-W4	NHA02	NHA021	1	30	18	1.87	1.87	2	30	18	1.87	1.87
RHA02-W5	NHA02	NHA022	1	30	18	1.67	1.67	1	30	18	1.67	1.67
RHA01-W2	NHA01	NHA011	1	30	18	2.14	2.14	1	30	18	2.14	2.14
RHA01-W3	NHA01	NHA012	1	18	28.8	1.98	1.98	1	18	28.8	1.98	1.98
RHA01-W4	NHA01	NHA013	1	18	28.8	1.98	1.98	2	18	28.8	1.98	1.98
RHA10-W5	NHA10	NHA101	1	16.8	30	2.07	2.07	1	16.8	30	2.07	2.07
RHA10-W6	NHA10	NHA102	1	16.8	30	2.1	2.1	1	16.8	30	2.1	2.1
RHA09-W2	NHA09	NHA091	1	32.4	7.2	2.69	2.69	1	32.4	7.2	2.69	2.69
RHA09-W3	NHA09	NHA092	1	31.2	4.8	2.59	2.59	1	31.2	4.8	2.59	2.59
RHA08-W3	NHA08	NHA081	1	16.8	30	1.87	1.87	1	16.8	30	1.87	1.87
RHA08-W4	NHA08	NHA082	1	24	24	1.96	1.96	1	24	24	1.96	1.96
RHA07-W5	NHA07	NHA071	1	14	23	2.72	2.72	1	14	23	2.72	2.72
RHA07-W6	NHA07	NHA072	1	14	23	2.57	2.57	1	14	23	2.57	2.57
RHA06-W4	NHA06	NHA061	1	16.8	30	3.47	3.47	2	16.8	30	3.47	3.47
RHA06-W5	NHA06	NHA062	1	16.8	30	3.56	3.56	1	16.8	30	3.56	3.56
RHA05-W3	NHA05	NHA052	1	30	30	2.9	2.9	---	---	---	---	---
RHA05-W4	NHA05	NHA057	1	18	31.2	3.23	3.23	---	---	---	---	---
RHA05-W5	NHA05	NHA055	1	72	6	3.84	3.84	---	---	---	---	---
RHA05-W6	NHA05	NHA054	1	18	28.8	3.3	3.3	---	---	---	---	---
RHA05-W7	NHA05	NHA053	1	18	28.8	3.89	3.89	---	---	---	---	---
RHA09-W5	NHA09	NHA092	1	18	31.2	2.59	2.59	1	18	31.2	2.59	2.59
RHA09-W4	NHA09	NHA091	1	18	31.2	2.69	2.69	1	18	31.2	2.69	2.69
RHA05W-500	NHA05	NHA0500	---	---	---	---	---	---	---	---	---	---

No.	REVISIONS	DATE	BY

Kimley»Horn

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KHA PROJECT 048048123

DATE MARCH 2020

SCALE AS SHOWN

HARBOR ACRES
ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM ALTERNATIVE 2

EXHIBIT 6

Pipe	From	To	Current Conditions Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)	Alternative 3 Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)
RHA054A-P	NHA054	NHA055	100	1	48	48	-2.86	-2.07	100	1	48	48	-2.86	-2.07
RHA041A-P	NHA041	NHA042	30	1	12	12	2.63	2.27	30	1	30	19	2.05	1.69
RHA051A-P	NHA051	NHA052	30	1	12	12	1.44	1.31	30	1	45	29	0.02	-0.30
RHA042A-P	NHA042	NH3050	275	1	12	12	2.00	0.02	275	1	30	19	1.42	-0.56
RHA111A-P	NHA111	NHA112	30	1	18	12	3.60	3.54	30	1	18	12	3.60	3.54
RHA112A-P	NHA112	NH3050	140	1	12	12	3.28	0.05	140	1	12	12	3.28	0.05
RHA031A-P	NHA031	NHA032	40	1	12	12	0.59	0.49	40	1	30	19	0.01	-0.09
RHA021A-P	NHA021	NHA022	50.9	1	18	18	-0.31	-0.28	50.9	1	45	29	-1.23	-1.20
RHA022A-P	NHA022	NH3050	380	1	12	12	-0.28	-0.86	380	2	45	29	-1.70	-2.28
RHA011A-P	NHA011	NHA012	30	1	18	12	0.86	0.38	30	1	38	24	-0.14	-0.62
RHA012A-P	NHA012	NHA013	90	1	15	15	0.29	-1.03	90	1	38	24	-0.46	-1.78
RHA013A-P	NHA013	NH3050	365	1	15	15	-1.08	-1.46	365	2	45	29	-2.25	-2.63
RHA101A-P	NHA101	NHA102	24	1	12	12	0.33	0.15	24	1	38	24	-0.67	-0.85
RHA102A-P	NHA102	NH3050	190	1	12	12	0.28	-0.84	190	1	38	24	-0.72	-1.84
RHA091A-P	NHA091	NHA092	30	1	12	12	1.09	1.29	30	1	30	19	0.51	0.71
RHA092A-P	NHA092	NH3050	190	1	12	12	1.29	-1.30	190	1	30	19	0.71	-1.88
RHA081A-P	NHA081	NHA082	22	1	12	12	-0.21	0.28	22	1	30	19	-0.78	-0.86
RHA082A-P	NHA082	NH3050	175	1	12	12	0.00	0.03	175	1	38	24	-0.99	-1.17
RHA071A-P	NHA071	NHA072	32	1	23	14	1.24	1.12	32	1	45	29	-0.01	-0.13
RHA072A-P	NHA072	NH3050	150	1	23	14	1.07	-1.67	150	1	45	29	-0.18	-2.92
RHA061A-P	NHA061	NHA062	25	1	12	12	1.88	1.82	25	1	23	14	1.71	1.65
RHA062A-P	NHA062	NH3050	150	1	12	12	1.76	-0.85	150	1	23	14	1.59	-1.02
RHA055A-P2	NHA055	NH3050	230	1	48	48	-2.08	-4.21	---	---	---	---	---	---
RHA055A-P	NHA055	NH3050	200	1	48	48	-2.08	-3.53	---	---	---	---	---	---
RHA052-P	NHA052	NHA055	60	1	18	18	-0.28	-0.28	60	1	45	29	-1.20	-1.20
RHA053A-P	NHA053	NHA054	75	1	48	48	-2.22	-2.20	75	1	48	48	-2.22	-2.20
RHA056A-P	NHA056	NHA055	140	1	48	48	-2.85	-2.85	140	1	76	48	-2.85	-2.85
RHA033A-P	NHA033	NH3050	250	1	12	12	0.47	-0.20	250	1	83	53	-3.00	-3.61
RHA032A-P	NHA032	NHA033	5	1	12	12	0.51	0.47	5	1	45	29	-0.91	-0.95
RHA057A-P	NHA057	NHA056	8	1	12	12	0.22	0.22	8	1	38	24	-0.78	-0.78
RHA0500A-P	NHA0500	NH3050	---	---	---	---	---	---	220	1	53	34	-0.50	-3.53
RHA501A-P	NHA052	NH3050	---	---	---	---	---	---	205	2	76	48	-2.00	-3.95
Pipe05	NHA055	Pump05a	---	---	---	---	---	---	40	1	83	53	-2.50	-3.00

Inlet	From	To	Current Conditions Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)	Alternative 3 Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)
RHA04-W4	NHA04	NHA041	1	18	31.2	3.74	3.74	1	18	31.2	3.74	3.74
RHA04-W5	NHA04	NHA042	1	18	31.2	3.66	3.66	1	18	31.2	3.66	3.66
RHA05-W8	NHA05	NHA051	1	18	28.8	3.15	3.15	3	18	28.8	3	3
RHA11-W3	NHA11	NHA111	1	18	31.2	5.45	5.45	1	18	31.2	5.45	5.45
RHA11-W4	NHA11	NHA112	1	18	31.2	5.39	5.39	1	18	31.2	5.39	5.39
RHA03-W4	NHA03	NHA031	1	30	18	2.24	2.24	1	30	18	2.24	2.24
RHA03-W5	NHA03	NHA032	1	30	18	2.31	2.31	1	30	18	2.31	2.31
RHA02-W4	NHA02	NHA021	1	30	18	1.87	1.87	2	30	18	1.87	1.87
RHA02-W5	NHA02	NHA022	1	30	18	1.67	1.67	1	30	18	1.67	1.67
RHA01-W2	NHA01	NHA011	1	30	18	2.14	2.14	1	30	18	2.14	2.14
RHA01-W3	NHA01	NHA012	1	18	28.8	1.98	1.98	1	18	28.8	1.98	1.98
RHA01-W4	NHA01	NHA013	1	18	28.8	1.98	1.98	2	18	28.8	1.98	1.98
RHA10-W5	NHA10	NHA101	1	16.8	30	2.07	2.07	1	16.8	30	2.07	2.07
RHA10-W6	NHA10	NHA102	1	16.8	30	2.1	2.1	1	16.8	30	2.1	2.1
RHA09-W2	NHA09	NHA091	1	32.4	7.2	2.69	2.69	1	32.4	7.2	2.69	2.69
RHA09-W3	NHA09	NHA092	1	31.2	4.8	2.59	2.59	1	31.2	4.8	2.59	2.59
RHA08-W3	NHA08	NHA081	1	16.8	30	1.87	1.87	1	16.8	30	1.87	1.87
RHA08-W4	NHA08	NHA082	1	24	24	1.96	1.96	1	24	24	1.96	1.96
RHA07-W5	NHA07	NHA071	1	14	23	2.72	2.72	1	14	23	2.72	2.72
RHA07-W6	NHA07	NHA072	1	14	23	2.57	2.57	1	14	23	2.57	2.57
RHA06-W4	NHA06	NHA061	1	16.8	30	3.47	3.47	2	16.8	30	3.47	3.47
RHA06-W5	NHA06	NHA062	1	16.8	30	3.56	3.56	1	16.8	30	3.56	3.56
RHA05-W3	NHA05	NHA052	1	30	30	2.9	2.9	3	30	30	2.9	2.9
RHA05-W4	NHA05	NHA057	1	18	31.2	3.23	3.23	1	18	31.2	3.23	3.23
RHA05-W5	NHA05	NHA055	1	72	6	3.84	3.84	1	72	6	3.59	3.59
RHA05-W6	NHA05	NHA054	1	18	28.8	3.3	3.3	2	18	28.8	3.3	3.3
RHA05-W7	NHA05	NHA053	1	18	28.8	3.89	3.89	1	18	28.8	3.89	3.89
RHA09-W5	NHA09	NHA092	1	18	31.2	2.59	2.59	1	18	31.2	2.59	2.59
RHA09-W4	NHA09	NHA091	1	18	31.2	2.69	2.69	1	18	31.2	2.69	2.69
RHA05W-500	NHA05	NHA0500	---	---	---	---	---	3	18	28.8	2.9	2.9

Notes:
- Model 3 considers a pump system at Basin H05. It was represented in the model as a Rating Curve (Pump05 from Node Pump05a to Node NH3050) with an operating table associated to it. The operating table was defined with data obtained for the Xylem PL7121/905 3~ 510N4 pump.

NOTES:
- 2018 AERIAL OBTAINED FROM THE SARASOTA COUNTY.
- ELEVATIONS REFERENCED TO NAVD 88.

No.	REVISIONS	DATE	BY

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KHA PROJECT 048048123
DATE MARCH 2020
SCALE AS SHOWN

HARBOR ACRES
ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM ALTERNATIVE 3

EXHIBIT
7

K:\FTM_Civil\048048123 - Harbor Acres Alternative\GIS\mxds\Proposed_Conditions\20200303_Exhibits\07_HarborAcres_Alternative_3_V01.mxd - 3/17/2020 5:52:53 PM - melissa.perez

Pipe	Current Conditions								Alternative 4							
	From	To	Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)	From	To	Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)
RHA054A-P	NHA054	NHA055	100	1	48	48	-2.86	-2.07	NHA054	NHA05	150	1	48	48	-2.86	-3.2
RHA041A-P	NHA041	NHA042	30	1	12	12	2.63	2.27	NHA041	NHA042	30	1	38	24	1.63	1.27
RHA051A-P	NHA051	NHA052	30	1	12	12	1.44	1.31	---	---	---	---	---	---	---	---
RHA042A-P	NHA042	NH3050	275	1	12	12	2	0.02	NHA042	NH3050	275	1	45	29	0.58	-2.4
RHA111A-P	NHA111	NHA112	30	1	18	12	3.6	3.54	NHA111	NHA112	30	1	18	12	3.6	3.54
RHA112A-P	NHA112	NH3050	140	1	12	12	3.28	0.05	NHA112	NH3050	140	1	12	12	3.28	0.05
RHA031A-P	NHA031	NHA032	40	1	12	12	0.59	0.49	---	---	---	---	---	---	---	---
RHA021A-P	NHA021	NHA022	50.9	1	18	18	-0.31	-0.28	NHA021	NHA022	50.9	1	53	34	-1.65	-2
RHA022A-P	NHA022	NH3050	380	1	12	12	-0.28	-0.86	NHA022	NH3050	380	1	83	53	-3.8	-4.2
RHA011A-P	NHA011	NHA012	30	1	18	12	0.86	0.38	NHA011	NHA012	30	1	38	24	-0.14	-0.62
RHA012A-P	NHA012	NHA013	90	1	15	15	0.29	-1.03	NHA012	NHA013	90	1	76	48	-2.46	-3.5
RHA013A-P	NHA013	NH3050	365	1	15	15	-1.08	-1.46	NHA013	NH3050	365	1	68	43	-3.5	-4
RHA101A-P	NHA101	NHA102	24	1	12	12	0.33	0.15	NHA101	NHA102	24	1	38	24	-0.67	-0.85
RHA102A-P	NHA102	NH3050	190	1	12	12	0.28	-0.84	NHA102	NH3050	190	1	45	29	-1.14	-2.26
RHA091A-P	NHA091	NHA092	30	1	12	12	1.09	1.29	NHA091	NHA092	30	1	38	24	0.51	0.71
RHA092A-P	NHA092	NH3050	190	1	12	12	1.29	-1.3	NHA092	NH3050	190	1	38	24	0.71	-2.3
RHA081A-P	NHA081	NHA082	22	1	12	12	-0.21	0.28	NHA081	NHA082	22	1	45	29	-1.63	-1.7
RHA082A-P	NHA082	NH3050	175	1	12	12	0	0.03	NHA082	NH3050	175	1	45	29	-1.7	-2
RHA071A-P	NHA071	NHA072	32	1	23	14	1.24	1.12	NHA071	NHA072	32	1	45	29	-0.01	-0.13
RHA072A-P	NHA072	NH3050	150	1	23	14	1.07	-1.67	NHA072	NH3050	150	1	45	29	-0.18	-2.92
RHA061A-P	NHA061	NHA062	25	1	12	12	1.88	1.82	NHA061	NHA062	25	1	23	14	1.71	1.65
RHA062A-P	NHA062	NH3050	150	1	12	12	1.76	-0.85	NHA062	NH3050	150	1	30	19	1.18	-1.43
RHA055A-P2	NHA055	NH3050	230	1	48	48	-2.08	-4.21	---	---	---	---	---	---	---	---
RHA055A-P	NHA055	NH3050	200	1	48	48	-2.08	-3.53	NHA05	NH3050	50	2	68	43	-3.2	-3.53
RHA052-P	NHA052	NHA055	60	1	18	18	-0.28	-0.28	---	---	---	---	---	---	---	---
RHA053A-P	NHA053	NHA054	75	1	48	48	-2.22	-2.2	NHA053	NHA054	75	1	48	48	-2.22	-2.2
RHA056A-P	NHA056	NHA055	140	1	48	48	-2.85	-2.85	NHA056	NHA05	190	1	76	48	-2.85	-3.2
RHA033A-P	NHA033	NH3050	250	1	12	12	0.47	-0.2	NHA03	NH3050	50	1	38	24	-0.58	-1.19
RHA032A-P	NHA032	NHA033	5	1	12	12	0.51	0.47	---	---	---	---	---	---	---	---
RHA057A-P	NHA057	NHA056	8	1	12	12	0.22	0.22	---	---	---	---	---	---	---	---

Inlet	From	To	Current Conditions					Alternative 4				
			Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)	Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)
RHA03-W1	NHA03	NH3050	1	9999	9999	3.6	3.6	1	9999	9999	3.1	3.1
RHA05-W1	NHA05	NH3050	1	9999	9999	3.88	3.88	1	9999	9999	2.9	2.9
RHA04-W4	NHA04	NHA041	1	18	31.2	3.74	3.74	2	18	31.2	3.74	3.74
RHA04-W5	NHA04	NHA042	1	18	31.2	3.66	3.66	2	18	31.2	3.66	3.66
RHA05-W8	NHA05	NHA051	1	18	28.8	3.15	3.15	---	---	---	---	---
RHA11-W3	NHA11	NHA111	1	18	31.2	5.45	5.45	1	18	31.2	5.45	5.45
RHA11-W4	NHA11	NHA112	1	18	31.2	5.39	5.39	1	18	31.2	5.39	5.39
RHA03-W4	NHA03	NHA031	1	30	18	2.24	2.24	---	---	---	---	---
RHA03-W5	NHA03	NHA032	1	30	18	2.31	2.31	---	---	---	---	---
RHA02-W4	NHA02	NHA021	1	30	18	1.87	1.87	3	30	18	1.87	1.87
RHA02-W5	NHA02	NHA022	1	30	18	1.67	1.67	3	30	18	1.67	1.67
RHA01-W2	NHA01	NHA011	1	30	18	2.14	2.14	1	30	18	2.14	2.14
RHA01-W3	NHA01	NHA012	1	18	28.8	1.98	1.98	2	18	28.8	1.98	1.98
RHA01-W4	NHA01	NHA013	1	18	28.8	1.98	1.98	2	18	28.8	1.98	1.98
RHA10-W5	NHA10	NHA101	1	16.8	30	2.07	2.07	2	16.8	30	2.07	2.07
RHA10-W6	NHA10	NHA102	1	16.8	30	2.1	2.1	2	16.8	30	2.1	2.1
RHA09-W2	NHA09	NHA091	1	32.4	7.2	2.69	2.69	1	32.4	7.2	2.69	2.69
RHA09-W3	NHA09	NHA092	1	31.2	4.8	2.59	2.59	1	31.2	4.8	2.59	2.59
RHA08-W3	NHA08	NHA081	1	16.8	30	1.87	1.87	2	16.8	30	1.87	1.87
RHA08-W4	NHA08	NHA082	1	24	24	1.96	1.96	1	24	24	1.96	1.96
RHA07-W5	NHA07	NHA071	1	14	23	2.72	2.72	2	14	23	2.72	2.72
RHA07-W6	NHA07	NHA072	1	14	23	2.57	2.57	2	14	23	2.57	2.57
RHA06-W4	NHA06	NHA061	1	16.8	30	3.47	3.47	2	16.8	30	3.47	3.47
RHA06-W5	NHA06	NHA062	1	16.8	30	3.56	3.56	1	16.8	30	3.56	3.56
RHA05-W3	NHA05	NHA052	1	30	30	2.9	2.9	---	---	---	---	---
RHA05-W4	NHA05	NHA057	1	18	31.2	3.23	3.23	---	---	---	---	---
RHA05-W5	NHA05	NHA055	1	72	6	3.84	3.84	---	---	---	---	---
RHA05-W6	NHA05	NHA054	1	18	28.8	3.3	3.3	---	---	---	---	---
RHA05-W7	NHA05	NHA053	1	18	28.8	3.89	3.89	---	---	---	---	---
RHA09-W5	NHA09	NHA092	1	18	31.2	2.59	2.59	1	18	31.2	2.59	2.59
RHA09-W4	NHA09	NHA091	1	18	31.2	2.69	2.69	1	18	31.2	2.69	2.69

NOTES:
- 2018 AERIAL OBTAINED FROM THE SARASOTA COUNTY.
- ELEVATIONS REFERENCED TO NAVD 88.

No.	REVISIONS	DATE	BY

Kimley»Horn

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KHA PROJECT 048048123

DATE MARCH 2020

SCALE AS SHOWN

HARBOR ACRES
ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM
ALTERNATIVE 4

EXHIBIT
8

K:\FTM_Civil\048048123 - Harbor Acres Alternative\GIS\mxds\Proposed_Conditions\20200303_Exhibits\08_HarborAcres_Alternative_4_V01.mxd - 3/17/2020 5:48:34 PM - melissa.perez

Pipe	Current Conditions								Alternative 5							
	From	To	Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)	From	To	Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)
RHA054A-P	NHA054	NHA055	100	1	48	48	-2.86	-2.07	NHA054	NHA05	150	1	48	48	-2.86	-3.2
RHA041A-P	NHA041	NHA042	30	1	12	12	2.63	2.27	---	---	---	---	---	---	---	---
RHA051A-P	NHA051	NHA052	30	1	12	12	1.44	1.31	---	---	---	---	---	---	---	---
RHA042A-P	NHA042	NH3050	275	1	12	12	2	0.02	NHA04	NH3050	275	1	30	19	1	0
RHA111A-P	NHA111	NHA112	30	1	18	12	3.6	3.54	NHA111	NHA112	30	1	18	12	3.6	3.54
RHA112A-P	NHA112	NH3050	140	1	12	12	3.28	0.05	NHA112	NH3050	140	1	12	12	3.28	0.05
RHA031A-P	NHA031	NHA032	40	1	12	12	0.59	0.49	---	---	---	---	---	---	---	---
RHA021A-P	NHA021	NHA022	50.9	1	18	18	-0.31	-0.28	---	---	---	---	---	---	---	---
RHA022A-P	NHA022	NH3050	380	1	12	12	-0.28	-0.86	NHA02	NH3050	50	1	68	43	-2.96	-3.44
RHA011A-P	NHA011	NHA012	30	1	18	12	0.86	0.38	---	---	---	---	---	---	---	---
RHA012A-P	NHA012	NHA013	90	1	15	15	0.29	-1.03	---	---	---	---	---	---	---	---
RHA013A-P	NHA013	NH3050	365	1	15	15	-1.08	-1.46	NHA01	NH3050	60	1	53	34	-2.58	-3.04
RHA101A-P	NHA101	NHA102	24	1	12	12	0.33	0.15	---	---	---	---	---	---	---	---
RHA102A-P	NHA102	NH3050	190	1	12	12	0.28	-0.84	NHA10	NH3050	40	1	38	24	-0.31	-1.43
RHA091A-P	NHA091	NHA092	30	1	12	12	1.09	1.29	---	---	---	---	---	---	---	---
RHA092A-P	NHA092	NH3050	190	1	12	12	1.29	-1.3	NHA09	NH3050	50	1	30	19	-1.09	-1.89
RHA081A-P	NHA081	NHA082	22	1	12	12	-0.21	0.28	---	---	---	---	---	---	---	---
RHA082A-P	NHA082	NH3050	175	1	12	12	0	0.03	NHA08	NH3050	50	1	38	24	-1.29	-1.59
RHA071A-P	NHA071	NHA072	32	1	23	14	1.24	1.12	---	---	---	---	---	---	---	---
RHA072A-P	NHA072	NH3050	150	1	23	14	1.07	-1.67	NHA07	NH3050	60	1	30	19	-1	-1.67
RHA061A-P	NHA061	NHA062	25	1	12	12	1.88	1.82	---	---	---	---	---	---	---	---
RHA062A-P	NHA062	NH3050	150	1	12	12	1.76	-0.85	NHA06	NH3050	210	1	18	12	1.5	-0.5
RHA055A-P2	NHA055	NH3050	230	1	48	48	-2.08	-4.21	---	---	---	---	---	---	---	---
RHA055A-P	NHA055	NH3050	200	1	48	48	-2.08	-3.53	NHA05	NH3050	50	2	68	43	-3.2	-3.53
RHA052-P	NHA052	NHA055	60	1	18	18	-0.28	-0.28	---	---	---	---	---	---	---	---
RHA053A-P	NHA053	NHA054	75	1	48	48	-2.22	-2.2	NHA053	NHA054	75	1	48	48	-2.22	-2.6
RHA056A-P	NHA056	NHA055	140	1	48	48	-2.85	-2.85	NHA056	NHA05	190	1	76	48	-2.85	-3.2
RHA033A-P	NHA033	NH3050	250	1	12	12	0.47	-0.2	NHA03	NH3050	50	1	38	24	-0.58	-1.19
RHA032A-P	NHA032	NHA033	5	1	12	12	0.51	0.47	---	---	---	---	---	---	---	---
RHA057A-P	NHA057	NHA056	8	1	12	12	0.22	0.22	---	---	---	---	---	---	---	---

Inlet	From	To	Current Conditions					Alternative 5				
			Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)	Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)
RHA01-W1	NHA01	NH3050	1	9999	9999	3.61	3.61	1	9999	9999	2.75	2.75
RHA02-W1	NHA02	NH3050	1	9999	9999	3.83	3.83	1	9999	9999	2.5	2.5
RHA03-W1	NHA03	NH3050	1	9999	9999	3.6	3.6	1	9999	9999	3.1	3.1
RHA04-W2	NHA04	NH3050	1	9999	9999	4.38	4.38	1	9999	9999	4.38	4.38
RHA05-W1	NHA05	NH3050	1	9999	9999	3.88	3.88	1	9999	9999	2.3	2.3
RHA06-W1	NHA06	NH3050	1	9999	9999	5.06	5.06	1	9999	9999	5.06	5.06
RHA07-W1	NHA07	NH3050	1	9999	9999	4.56	4.56	1	9999	9999	3.5	3.5
RHA08-W1	NHA08	NH3050	1	9999	9999	3.92	3.92	1	9999	9999	3.92	3.92
RHA09-W1	NHA09	NH3050	1	9999	9999	3.83	3.83	1	9999	9999	3.83	3.83
RHA10-W1	NHA10	NH3050	1	9999	9999	3.74	3.74	1	9999	9999	3.74	3.74
RHA11-W1	NHA11	NH3050	1	9999	9999	5.42	5.42	1	9999	9999	5.42	5.42
RHA04-W4	NHA04	NHA041	1	18	31.2	3.74	3.74	---	---	---	---	---
RHA04-W5	NHA04	NHA042	1	18	31.2	3.66	3.66	---	---	---	---	---
RHA05-W8	NHA05	NHA051	1	18	28.8	3.15	3.15	---	---	---	---	---
RHA11-W3	NHA11	NHA111	1	18	31.2	5.45	5.45	1	18	31.2	5.45	5.45
RHA11-W4	NHA11	NHA112	1	18	31.2	5.39	5.39	1	18	31.2	5.39	5.39
RHA03-W4	NHA03	NHA031	1	30	18	2.24	2.24	---	---	---	---	---
RHA03-W5	NHA03	NHA032	1	30	18	2.31	2.31	---	---	---	---	---
RHA02-W4	NHA02	NHA021	1	30	18	1.87	1.87	---	---	---	---	---
RHA02-W5	NHA02	NHA022	1	30	18	1.67	1.67	---	---	---	---	
RHA01-W2	NHA01	NHA011	1	30	18	2.14	2.14	---	---	---	---	---
RHA01-W3	NHA01	NHA012	1	18	28.8	1.98	1.98	---	---	---	---	---
RHA01-W4	NHA01	NHA013	1	18	28.8	1.98	1.98	---	---	---	---	---
RHA10-W5	NHA10	NHA101	1	16.8	30	2.07	2.07	---	---	---	---	---
RHA10-W6	NHA10	NHA102	1	16.8	30	2.1	2.1	---	---	---	---	---
RHA09-W2	NHA09	NHA091	1	32.4	7.2	2.69	2.69	---	---	---	---	---
RHA09-W3	NHA09	NHA092	1	31.2	4.8	2.59	2.59	---	---	---	---	---
RHA08-W3	NHA08	NHA081	1	16.8	30	1.87	1.87	---	---	---	---	---
RHA08-W4	NHA08	NHA082	1	24	24	1.96	1.96	---	---	---	---	---
RHA07-W5	NHA07	NHA071	1	14	23	2.72	2.72	---	---	---	---	---
RHA07-W6	NHA07	NHA072	1	14	23	2.57	2.57	---	---	---	---	---
RHA06-W4	NHA06	NHA061	1	16.8	30	3.47	3.47	---	---	---	---	---
RHA06-W5	NHA06	NHA062	1	16.8	30	3.56	3.56	---	---	---	---	---
RHA05-W3	NHA05	NHA052	1	30	30	2.9	2.9	---	---	---	---	---
RHA05-W4	NHA05	NHA057	1	18	31.2	3.23	3.23	---	---	---	---	---
RHA05-W5	NHA05	NHA055	1	72	6	3.84	3.84	---	---	---	---	---
RHA05-W6	NHA05	NHA054	1	18	28.8	3.3	3.3	---	---	---	---	---
RHA05-W7	NHA05	NHA053	1	18	28.8	3.89	3.89	---	---	---	---	---
RHA09-W5	NHA09	NHA092	1	18	31.2	2.59	2.59	---	---	---	---	---
RHA09-W4	NHA09	NHA091	1	18	31.2	2.69	2.69	---	---	---	---	---

NOTES:
- 2018 AERIAL OBTAINED FROM THE SARASOTA COUNTY.
- ELEVATIONS REFERENCED TO NAVD 88.

No.	REVISIONS	DATE	BY

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KHA PROJECT
048048123

DATE
MARCH 2020

SCALE
AS SHOWN

HARBOR ACRES
ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM
ALTERNATIVE 5

EXHIBIT
9

Pipe	Current Conditions								Alternative 6							
	From	To	Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)	From	To	Length (ft)	Count	Span (in)	Rise (in)	US Invert (ft)	DS Invert (ft)
RHA054A-P	NHA054	NHA055	100	1	48	48	-2.86	-2.07	NHA054	NHA05	150	1	76	48	-2.86	-3.2
RHA041A-P	NHA041	NHA042	30	1	12	12	2.63	2.27	---	---	---	---	---	---	---	---
RHA051A-P	NHA051	NHA052	30	1	12	12	1.44	1.31	---	---	---	---	---	---	---	---
RHA042A-P	NHA042	NH3050	275	1	12	12	2	0.02	NHA04	NH3050	275	1	45	29	0.58	-2.4
RHA111A-P	NHA111	NHA112	30	1	18	12	3.6	3.54	NHA111	NHA112	30	1	18	12	3.6	3.54
RHA112A-P	NHA112	NH3050	140	1	12	12	3.28	0.05	NHA112	NH3050	140	1	12	12	3.28	0.05
RHA031A-P	NHA031	NHA032	40	1	12	12	0.59	0.49	---	---	---	---	---	---	---	---
RHA021A-P	NHA021	NHA022	50.9	1	18	18	-0.31	-0.28	---	---	---	---	---	---	---	---
RHA022A-P	NHA022	NH3050	380	1	12	12	-0.28	-0.86	NHA02	NH3050	50	1	91	58	-3.8	-4.2
RHA011A-P	NHA011	NHA012	30	1	18	12	0.86	0.38	---	---	---	---	---	---	---	---
RHA012A-P	NHA012	NHA013	90	1	15	15	0.29	-1.03	---	---	---	---	---	---	---	---
RHA013A-P	NHA013	NH3050	365	1	15	15	-1.08	-1.46	NHA01	NH3050	60	1	83	53	-3.5	-4
RHA101A-P	NHA101	NHA102	24	1	12	12	0.33	0.15	---	---	---	---	---	---	---	---
RHA102A-P	NHA102	NH3050	190	1	12	12	0.28	-0.84	NHA10	NH3050	40	1	53	34	-1.14	-2.26
RHA091A-P	NHA091	NHA092	30	1	12	12	1.09	1.29	---	---	---	---	---	---	---	---
RHA092A-P	NHA092	NH3050	190	1	12	12	1.29	-1.3	NHA09	NH3050	50	1	38	24	-1.5	-2.3
RHA081A-P	NHA081	NHA082	22	1	12	12	-0.21	0.28	---	---	---	---	---	---	---	---
RHA082A-P	NHA082	NH3050	175	1	12	12	0	0.03	NHA08	NH3050	50	1	45	29	-1.7	-2
RHA071A-P	NHA071	NHA072	32	1	23	14	1.24	1.12	---	---	---	---	---	---	---	---
RHA072A-P	NHA072	NH3050	150	1	23	14	1.07	-1.67	NHA07	NH3050	60	1	45	29	-0.18	-2.92
RHA061A-P	NHA061	NHA062	25	1	12	12	1.88	1.82	---	---	---	---	---	---	---	---
RHA062A-P	NHA062	NH3050	150	1	12	12	1.76	-0.85	NHA06	NH3050	210	1	30	19	1.18	-1.43
RHA055A-P2	NHA055	NH3050	230	1	48	48	-2.08	-4.21	---	---	---	---	---	---	---	---
RHA055A-P	NHA055	NH3050	200	1	48	48	-2.08	-3.53	NHA05	NH3050	50	2	76	48	-3.7	-4.1
RHA052-P	NHA052	NHA055	60	1	18	18	-0.28	-0.28	---	---	---	---	---	---	---	---
RHA053A-P	NHA053	NHA054	75	1	48	48	-2.22	-2.2	NHA053	NHA054	75	1	76	48	-2.22	-2.6
RHA056A-P	NHA056	NHA055	140	1	48	48	-2.85	-2.85	NHA056	NHA05	190	1	83	53	-3.27	-3.7
RHA033A-P	NHA033	NH3050	250	1	12	12	0.47	-0.2	NHA03	NH3050	50	1	83	53	-3	-3.61
RHA032A-P	NHA032	NHA033	5	1	12	12	0.51	0.47	---	---	---	---	---	---	---	---
RHA057A-P	NHA057	NHA056	8	1	12	12	0.22	0.22	---	---	---	---	---	---	---	---

Inlet	From	To	Current Conditions					Alternative 6				
			Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)	Count	Span (in)	Rise (in)	Invert (ft)	Control Elev. (ft)
RHA01-W1	NHA01	NH3050	1	9999	9999	3.61	3.61	1	9999	9999	2.75	2.75
RHA02-W1	NHA02	NH3050	1	9999	9999	3.83	3.83	1	9999	9999	2.5	2.5
RHA03-W1	NHA03	NH3050	1	9999	9999	3.6	3.6	1	9999	9999	3.1	3.1
RHA04-W2	NHA04	NH3050	1	9999	9999	4.38	4.38	1	9999	9999	4.38	4.38
RHA05-W1	NHA05	NH3050	1	9999	9999	3.88	3.88	1	9999	9999	2.3	2.3
RHA06-W1	NHA06	NH3050	1	9999	9999	5.06	5.06	1	9999	9999	5.06	5.06
RHA07-W1	NHA07	NH3050	1	9999	9999	4.56	4.56	1	9999	9999	3.5	3.5
RHA08-W1	NHA08	NH3050	1	9999	9999	3.92	3.92	1	9999	9999	3.92	3.92
RHA09-W1	NHA09	NH3050	1	9999	9999	3.83	3.83	1	9999	9999	3.83	3.83
RHA10-W1	NHA10	NH3050	1	9999	9999	3.74	3.74	1	9999	9999	3.74	3.74
RHA11-W1	NHA11	NH3050	1	9999	9999	5.42	5.42	1	9999	9999	5.42	5.42
RHA04-W4	NHA04	NHA041	1	18	31.2	3.74	3.74	---	---	---	---	---
RHA04-W5	NHA04	NHA042	1	18	31.2	3.66	3.66	---	---	---	---	---
RHA05-W8	NHA05	NHA051	1	18	28.8	3.15	3.15	---	---	---	---	---
RHA11-W3	NHA11	NHA111	1	18	31.2	5.45	5.45	1	18	31.2	5.45	5.45
RHA11-W4	NHA11	NHA112	1	18	31.2	5.39	5.39	1	18	31.2	5.39	5.39
RHA03-W4	NHA03	NHA031	1	30	18	2.24	2.24	---	---	---	---	---
RHA03-W5	NHA03	NHA032	1	30	18	2.31	2.31	---	---	---	---	---
RHA02-W4	NHA02	NHA021	1	30	18	1.87	1.87	---	---	---	---	---
RHA02-W5	NHA02	NHA022	1	30	18	1.67	1.67	---	---	---	---	---
RHA01-W2	NHA01	NHA011	1	30	18	2.14	2.14	---	---	---	---	---
RHA01-W3	NHA01	NHA012	1	18	28.8	1.98	1.98	---	---	---	---	---
RHA01-W4	NHA01	NHA013	1	18	28.8	1.98	1.98	---	---	---	---	---
RHA10-W5	NHA10	NHA101	1	16.8	30	2.07	2.07	---	---	---	---	---
RHA10-W6	NHA10	NHA102	1	16.8	30	2.1	2.1	---	---	---	---	---
RHA09-W2	NHA09	NHA091	1	32.4	7.2	2.69	2.69	---	---	---	---	---
RHA09-W3	NHA09	NHA092	1	31.2	4.8	2.59	2.59	---	---	---	---	---
RHA08-W3	NHA08	NHA081	1	16.8	30	1.87	1.87	---	---	---	---	---
RHA08-W4	NHA08	NHA082	1	24	24	1.96	1.96	---	---	---	---	---
RHA07-W5	NHA07	NHA071	1	14	23	2.72	2.72	---	---	---	---	---
RHA07-W6	NHA07	NHA072	1	14	23	2.57	2.57	---	---	---	---	---
RHA06-W4	NHA06	NHA061	1	16.8	30	3.47	3.47	---	---	---	---	---
RHA06-W5	NHA06	NHA062	1	16.8	30	3.56	3.56	---	---	---	---	---
RHA05-W3	NHA05	NHA052	1	30	30	2.9	2.9	---	---	---	---	---
RHA05-W4	NHA05	NHA057	1	18	31.2	3.23	3.23	---	---	---	---	---
RHA05-W5	NHA05	NHA055	1	72	6	3.84	3.84	---	---	---	---	---
RHA05-W6	NHA05	NHA054	1	18	28.8	3.3	3.3	---	---	---	---	---
RHA05-W7	NHA05	NHA053	1	18	28.8	3.89	3.89	---	---	---	---	---
RHA09-W5	NHA09	NHA092	1	18	31.2	2.59	2.59	---	---	---	---	---
RHA09-W4	NHA09	NHA091	1	18	31.2	2.69	2.69	---	---	---	---	---

NOTES:
- 2018 AERIAL OBTAINED FROM THE SARASOTA COUNTY.
- ELEVATIONS REFERENCED TO NAVD 88.

No.	REVISIONS	DATE	BY

Kimley»Horn

1412 JACKSON STREET, SUITE 2, FORT MYERS, FL 33901
Phone: 239-271-2650 FAX: 941-379-4352
WWW.KIMLEY-HORN.COM CA 00000696

KHA PROJECT 048048123
DATE MARCH 2020
SCALE AS SHOWN

HARBOR ACRES
ALTERNATIVE ANALYSIS
SARASOTA COUNTY, FLORIDA

STORMWATER DRAINAGE SYSTEM ALTERNATIVE 6

EXHIBIT
10

K:\FTM_Civil\048048123 - Harbor Acres Alternative\GIS\mxds\Proposed_Conditions\20200303_Exhibits\10_HarborAcres_Alternative_6_V01.mxd - 3/17/2020 5:50:19 PM - melissa.perez

Appendix B: Meeting Minutes

Meeting Minutes

Meeting with Sarasota County
Harbor Acres Alternative – Kimley-Horn Project Number 048048123.1

January 27, 2017

Ben Quartermaine, Sarasota County	**Michael DelRossi, City of Sarasota**
Molly Williams, Sarasota County	**Douglas Jeffcoat, City of Sarasota**
Kellie Clark, Kimley-Horn	**Amy Wicks, Kimley-Horn**

General Information

- Sarasota County explained that they are currently surveying the project area. They are not working off a benchmark but instead using a hand held. Survey may be 0.1' off. County will send survey to Kimley-Horn once they are done. Likely sometime the week of January 30.
- Survey will be in NAVD 88. County requires the project completed in NAVD 88.
- Sarasota County agrees that Kimley-Horn can wait to start the data collection task until Kimley-Horn receives the County survey. Kimley-Horn indicated while it will affect the data collection deliverable date, other project milestone dates should not be affected by the delay.

Kimley-Horn Needs from County:

- LiDAR and 1948 Aerials – Kimley-Horn to request through Sarasota County Mapping.
- Flooding complaints – County will pull information and send to Kimley-Horn. This will include pictures of flooding and complaints after events.
- Model of the area including Harbor Acres – Kimley-Horn to follow up with Robert for the latest and greatest. It should be the Sarasota Bay Coastal Phase 3 Model.

Utilities Work in Harbor Acres:

- Sarasota County explained County Utilities is doing work in Harbor Acres at very end including resurfacing. In addition, new work is anticipated to include a County project that will modify the inlets to a hybrid box with open throats that will still have the ability to capture organics before they are discharged.

Conditions to be Addressed:

- At historic conditions – was the system adequate? What was the level of service?
- At current conditions – is the system adequate? What is the level of service?
- At future conditions – is the system adequate? What is the level of service?

Methodology:

- Sea level rise will be considered by setting tailwater conditions based on sea level information for each condition.
- The full contributing area to Harbor Acres will be considered**.**
- Kimely-Horn asked if modeling will be done in ICPR 3 or ICPR 4. Sarasota County said to use whatever model version the Sarasota Bay Coastal Phase 3 Model is in.

Alternatives that may be Considered:

- New system including conveyance and inlets
- Pumps
- Elevate road to elevation 5' or 6' since homes are now at elevation 12'
- Cost analysis of alternatives

Sarasota County explained to the City of Sarasota that because the stormwater utility does not fund CIP projects, the cost will be borne by the properties in the contributing basin.

Coordination:

- Deliverables will be provided to the County and the County will provide them to the City.
- The City can provide comments on deliverables.
- The City will be invited to any meetings the project team has.

Sarasota County verified this is a lump sum contract.

Appendix C: LOS for Current and Future Conditions

Results for Current, Current with Alternatives, Future and Future with Alternatives Conditions

Harbor Acres, Sarasota

Basin Name	Minimum Edge of Pavement (ft)	Water Surface Elevation (ft)								Level of Service (in)							
		Current Conditions	Future Conditions	Alternative 1		Alternative 2		Alternative 5		Current Conditions	Future Conditions	Alternative 1		Alternative 2		Alternative 5	
				Current Conditions	Future Conditions	Current Conditions	Future Conditions	Current Conditions	Future Conditions			Current Conditions	Future Conditions	Current Conditions	Future Conditions	Current Conditions	Future Conditions
HA01	1.98	4.0	4.1	2.8	3.6	2.8	3.6	2.3	3.0	25	25	10	19	10	19	4	12
HA02	1.67	4.1	4.1	2.7	3.6	2.7	3.5	2.1	3.0	29	29	12	23	12	22	5	16
HA03	2.24	4.0	4.1	3.2	3.7	2.6	3.2	2.6	3.2	22	22	11	17	4	12	4	12
HA04	3.66	4.8	4.9	4.6	4.4	4.6	4.4	3.7	4.4	14	14	11	9	11	9	1	9
HA05	2.9	4.8	4.5	3.9	4.1	3.2	3.1	2.8	3.1	23	20	11	14	3	3	0	3
HA06	3.47	4.8	4.7	4.5	4.6	4.5	4.6	3.8	4.6	16	15	12	13	12	13	3	13
HA07	2.57	4.2	4.1	3.3	3.7	3.3	3.7	2.7	3.6	20	18	8	13	8	13	1	12
HA08	1.87	4.2	4.1	2.7	3.3	2.7	3.3	2.3	3.2	28	26	10	18	10	18	5	16
HA09	2.59	4.2	4.1	3.5	3.8	3.5	3.8	2.9	3.6	19	18	11	14	11	14	4	12
HA10	2.07	4.2	4.1	3.1	3.8	3.1	3.8	2.4	3.4	26	24	12	21	12	21	4	16
HA11	5.39	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	0	0	0	0	0	0	0	0

Notes:

1. Minimum Edge of Pavement was determined using the minimum weir elevation (at inlets) reported for each basin (in Current Conditions Model).

2. Minimum Edge of Pavement Elevations reported at Basins HA02 and HA08 (in Current Conditions Model) are lower than the Boundary Condition Stage (1.95').

Appendix D: Engineers Opinion of Probable Cost

Kimley»Horn

ITEM	DESCRIPTION	ESTIMATED QUANTITY		UNIT PRICE	AMOUNT
PRELIMINARY ENGINEER'S OPINION OF PROBABLE COST OF CONSTRUCTION SITE WORK FOR					
HARBOR ACRES DEVELOPMENT - PROPOSED ALTERNATIVE 1					
CONSTRUCTION					
I. STORMWATER/DRAINAGE					
1	Pipe Grout in Place	10	CY	$ 140.00	$ 1,400.00
2	Pipe Culv, RCP, Elliptical, 23" x 14"	175	LF	$ 135.00	$ 23,625.00
3	Pipe Culv, RCP, Elliptical, 30" x 19"	587	LF	$ 152.00	$ 89,224.00
4	Pipe Culv, RCP, Elliptical, 38" x 24"	517	LF	$ 170.00	$ 87,890.00
5	Pipe Culv, RCP, Elliptical, 45" x 29"	1,758	LF	$ 215.00	$ 377,948.50
6	Pipe Culv, RCP, Elliptical, 53" x 34"	220	LF	$ 230.00	$ 50,600.00
7	Pipe Culv, RCP, Elliptical, 76" x 48"	550	LF	$ 236.00	$ 129,800.00
8	Pipe Culv, RCP, Elliptical, 83" x 53"*	250	LF	$ 400.00	$ 100,000.00
12	FDOT Large Inlet (Estimated with Type H Inlet Cost)	27	EA	$ 4,400.00	$ 118,800.00
13	Junction Box Drainage	2	EA	$ 3,280.00	$ 6,560.00
				STORMWATER/DRAINAGE TOTAL	$ 985,847.50
II. SITE WORK					
1	Clearing and Grubbing	4.7	AC	$ 10,500.00	$ 49,350.00
				SITE WORK TOTAL	$ 49,350.00
III. PAVEMENT COSNTRUCTION					
1	2" Type SP 12.5 Asphalt	134	TN	$ 115.00	$ 15,366.88
2	8" Limerock Base (Min. LBR 100)	1,188	SY	$ 12.00	$ 14,256.00
3	12" Type B Stabilized Subgrade (Min. LBR 40)	1,188	SY	$ 4.00	$ 4,752.00
4	Curb Type Valley Gutter	840	LF	$ 20.00	$ 16,800.00
5	Driveway Removal and Restoration, and Mailbox Relocation	652	SF	$ 9.00	$ 5,868.00
6	Existing Curb Removal	840	LF	$ 10.00	$ 8,400.00
7	Existing Asphalt Pavement Removal	1,188	SY	$ 10.00	$ 11,880.00
				PAVEMENT CONSTRUCTION TOTAL	$ 77,322.88
IV. LANDSCAPE					
1	Landscape and Irrigation Repair	3	EA	$ 1,000.00	$ 3,000.00
2	Sod	22,748	SY	$ 2.50	$ 56,870.00
				LANDSCAPE TOTAL	$ 59,870.00
V. OTHER					
1	Erosion Control	1	LS	$ 37,633.73	$ 37,633.73
2	Maintenance of Traffic	1	LS	$ 25,089.15	$ 25,089.15
3	Mobilization/Demobilization	1	LS	$ 62,722.89	$ 62,722.89
				OTHER TOTAL COST	$ 125,445.77
CONSTRUCTION SUMMARY					
I. STORMWATER/DRAINAGE					$ 985,847.50
II. SITE WORK					$ 49,350.00
III. PAVEMENT COSNTRUCTION					$ 77,322.88
IV. LANDSCAPE					$ 59,870.00
V. OTHER					$ 125,445.77
				HARBOR ACRES PROPOSED ALTERNATIVE 1 PROJECT CONSTRUCTION SUBTOTAL	$ 1,297,836.15
				CONTINGENCY (30% OF CONSTRUCTION SUBTOTAL)	$ 389,350.84
				HARBOR ACRES PROPOSED ALTERNATIVE 1 PROJECT CONSTRUCTION TOTAL	$ 1,687,186.99
PROJECT SUMMARY					
				HARBOR ACRES PROPOSED ALTERNATIVE 1 PROJECT CONSTRUCTION TOTAL	$ 1,687,186.99
				ENGINEERING/PERMITTING/CONSTRUCTION MANAGEMENT	$ 337,437.40
				HARBOR ACRES PROPOSED ALTERNATIVE 1 PROJECT TOTAL	$ 2,024,624.39

NOTES

Costs presented above are based on the Florida Departement of Transportation (FDOT)

** Estimated cost*

Disclaimer: The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

PRELIMINARY ENGINEER'S OPINION OF PROBABLE COST OF CONSTRUCTION SITE WORK FOR					
HARBOR ACRES DEVELOPMENT - PROPOSED ALTERNATIVE 2					
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**		**UNIT PRICE**	**AMOUNT**
CONSTRUCTION					
I. STORMWATER/DRAINAGE					
1	Pipe Grout in Place	220	CY	$ 140.00	$ 30,800.00
2	Pipe Culv, RCP, Circular, 18"	83	LF	$ 74.00	$ 6,142.00
3	Pipe Culv, RCP, Elliptical, 23" x 14"	175	LF	$ 135.00	$ 23,625.00
4	Pipe Culv, RCP, Elliptical, 30" x 19"	547	LF	$ 152.00	$ 83,144.00
5	Pipe Culv, RCP, Elliptical, 38" x 24"	559	LF	$ 170.00	$ 95,030.00
6	Pipe Culv, RCP, Elliptical, 45" x 29"	1,723	LF	$ 215.00	$ 370,423.50
7	Pipe Culv, RCP, Elliptical, 68" x 43"	100	LF	$ 362.00	$ 36,200.00
8	Pipe Culv, RCP, Elliptical, 76" x 48"	190	LF	$ 236.00	$ 44,840.00
9	Pipe Culv, RCP, Round, 48"	150	LF	$ 211.00	$ 31,650.00
13	FDOT Large Inlet (Estimated with Type H Inlet Cost)	27	EA	$ 4,400.00	$ 118,800.00
14	Vertical Weir	2	EA	$ 32,000.00	$ 64,000.00
15	Junction Box Drainage	2	EA	$ 3,280.00	$ 6,560.00
				STORMWATER/DRAINAGE TOTAL	$ 911,214.50
II. SITE WORK					
1	Regular Excavation	22,049	CY	$ 6.00	$ 132,294.00
2	Fine Grading	1.3	AC	$ 4,800.00	$ 6,240.00
3	Onsite Structures Demolition	15,488	SF	$ 10.00	$ 154,880.00
4	Clearing and Grubbing	5.3	AC	$ 10,500.00	$ 55,650.00
5	Haul Excess Material Export?	22,049	CY	$ 10.00	$ 220,490.00
				SITE WORK TOTAL	$ 569,554.00
III. PAVEMENT COSNTRUCTION					
1	2" Type SP 12.5 Asphalt	139	TN	$ 115.00	$ 15,985.00
2	8" Limerock Base (Min. LBR 100)	1,236	SY	$ 12.00	$ 14,832.00
3	12" Type B Stabilized Subgrade (Min. LBR 40)	1,236	SY	$ 4.00	$ 4,944.00
4	Curb Type Valley Gutter	840	LF	$ 20.00	$ 16,800.00
5	Driveway Removal and Restoration, and Mailbox Relocation	652.0	SF	$ 9.00	$ 5,868.00
6	Existing Curb Removal	840	LF	$ 10.00	$ 8,400.00
7	Existing Asphalt Pavement Removal	1,236	SY	$ 10.00	$ 12,360.00
				PAVEMENT CONSTRUCTION TOTAL	$ 79,189.00
IV. LANDSCAPE					
1	Landscape and Irrigation Repair	3	EA	$ 1,000.00	$ 3,000.00
2	Sod	25,652	SY	$ 2.50	$ 64,130.00
				LANDSCAPE TOTAL	$ 67,130.00
V. OTHER					
1	Erosion Control	1	LS	$ 52,229.51	$ 52,229.51
2	Maintenance of Traffic	1	LS	$ 34,819.67	$ 34,819.67
3	Mobilization/Demobilization	1	LS	$ 87,049.18	$ 87,049.18
				OTHER TOTAL COST	$ 174,098.36
CONSTRUCTION SUMMARY					
I. STORMWATER/DRAINAGE					$ 911,214.50
II. SITE WORK					$ 569,554.00
III. PAVEMENT COSNTRUCTION					$ 79,189.00
IV. LANDSCAPE					$ 67,130.00
V. OTHER					$ 174,098.36
				HARBOR ACRES PROPOSED ALTERNATIVE 2 PROJECT CONSTRUCTION SUBTOTAL	$ 1,801,185.86
				CONTINGENCY (30% OF CONSTRUCTION SUBTOTAL)	$ 540,355.76
				HARBOR ACRES PROPOSED ALTERNATIVE 2 PROJECT CONSTRUCTION TOTAL	$ 2,341,541.62
LAND ACQUISITION					
1	Parcel Account #2037110019 / HA03	1	EA	$ 1,805,800.00	$ 1,805,800.00
2	Parcel Account #2037110025 / HA05	1	EA	$ 2,795,600.00	$ 2,795,600.00
				LAND ACQUISITION TOTAL	$ 4,601,400.00
PROJECT SUMMARY					
				HARBOR ACRES PROPOSED ALTERNATIVE 2 PROJECT CONSTRUCTION TOTAL	$ 2,341,541.62
				ENGINEERING/PERMITTING/CONSTRUCTION MANAGEMENT	$ 468,308.32
				LAND ACQUISITION	$ 4,601,400.00
				HARBOR ACRES PROPOSED ALTERNATIVE 2 PROJECT TOTAL	$ 7,411,249.95

NOTES

Costs presented above are based on the Florida Departement of Transportation (FDOT)

** Estimated cost*

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Kimley»Horn

PRELIMINARY ENGINEER'S OPINION OF PROBABLE COST OF CONSTRUCTION SITE WORK FOR						
HARBOR ACRES DEVELOPMENT - PROPOSED ALTERNATIVE 3						
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**		**UNIT PRICE**	**AMOUNT**	
CONSTRUCTION						
I. STORMWATER/DRAINAGE						
1	Pipe Culv, RCP, Elliptical, 23" x 14"	175	LF	$ 135.00	$	23,625.00
2	Pipe Culv, RCP, Elliptical, 30" x 19"	587	LF	$ 152.00	$	89,224.00
3	Pipe Culv, RCP, Elliptical, 38" x 24"	517	LF	$ 170.00	$	87,890.00
4	Pipe Culv, RCP, Elliptical, 45" x 29"	1,818	LF	$ 215.00	$	390,848.50
5	Pipe Culv, RCP, Elliptical, 53" x 34"	220	LF	$ 230.00	$	50,600.00
6	Pipe Culv, RCP, Elliptical, 76" x 48"	550	LF	$ 236.00	$	129,800.00
7	Pipe Culv, RCP, Elliptical, 83" x 53"*	290	LF	$ 400.00	$	116,000.00
8	Modify Existing Inlet	1	EA	$ 1,000.00	$	1,000.00
9	FDOT Large Inlet (Estimated with Type H Inlet Cost)	26	EA	$ 4,400.00	$	114,400.00
10	Junction Box Drainage	2	EA	$ 3,280.00	$	6,560.00
				STORMWATER/DRAINAGE TOTAL	$	1,009,947.50
II. PUMP STATION						
1	Pump Station	4	EA	$ 3,000,000.00	$	12,000,000.00
				PUMP STATION TOTAL	$	12,000,000.00
III. SITE WORK						
1	Clearing and Grubbing	6.3	AC	$ 10,500.00	$	66,150.00
				SITE WORK TOTAL	$	66,150.00
IV. PAVEMENT COSNTRUCTION						
1	2" Type SP 12.5 Asphalt	134	TN	$ 115.00	$	15,366.88
2	8" Limerock Base (Min. LBR 100)	1,188	SY	$ 12.00	$	14,256.00
3	12" Type B Stabilized Subgrade (Min. LBR 40)	1,188	SY	$ 4.00	$	4,752.00
4	Curb Type Valley Gutter	900	LF	$ 20.00	$	18,000.00
5	Driveway Removal and Restoration, and Mailbox Relocation	652.0	SF	$ 9.00	$	5,868.00
6	Existing Curb Removal	900	LF	$ 10.00	$	9,000.00
7	Existing Asphalt Pavement Removal	1,188	SY	$ 10.00	$	11,880.00
				PAVEMENT CONSTRUCTION TOTAL	$	79,122.88
V. LANDSCAPE						
1	Landscape and Irrigation Repair	3	EA	$ 1,000.00	$	3,000.00
2	Sod	30,492	SY	$ 2.50	$	76,230.00
				LANDSCAPE TOTAL	$	79,230.00
VI. OTHER						
1	Erosion Control	1	LS	$ 424,825.86	$	424,825.86
2	Maintenance of Traffic	1	LS	$ 283,217.24	$	283,217.24
3	Mobilization/Demobilization	1	LS	$ 708,043.10	$	708,043.10
				OTHER TOTAL COST	$	1,416,086.19
CONSTRUCTION SUMMARY						
I. STORMWATER/DRAINAGE					$	1,009,947.50
II. PUMP STATION					$	12,000,000.00
III. SITE WORK					$	66,150.00
IV. PAVEMENT COSNTRUCTION					$	79,122.88
V. LANDSCAPE					$	79,230.00
VI. OTHER					$	1,416,086.19
				HARBOR ACRES PROPOSED ALTERNATIVE 3PROJECT CONSTRUCTION SUBTOTAL	$	14,650,536.57
				CONTINGENCY (30% OF CONSTRUCTION SUBTOTAL)	$	4,395,160.97
				HARBOR ACRES PROPOSED ALTERNATIVE 3 PROJECT CONSTRUCTION TOTAL	$	19,045,697.53
PROJECT SUMMARY						
				HARBOR ACRES PROPOSED ALTERNATIVE 3 PROJECT CONSTRUCTION TOTAL	$	19,045,697.53
				ENGINEERING/PERMITTING/CONSTRUCTION MANAGEMENT	$	3,809,139.51
				HARBOR ACRES PROPOSED ALTERNATIVE 3 PROJECT TOTAL	$	22,854,837.04

NOTES

Costs presented above are based on the Florida Departement of Transportation (FDOT)

** Estimated cost*

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Kimley»Horn

ITEM	DESCRIPTION	ESTIMATED QUANTITY		UNIT PRICE	AMOUNT
PRELIMINARY ENGINEER'S OPINION OF PROBABLE COST OF CONSTRUCTION SITE WORK FOR					
HARBOR ACRES DEVELOPMENT - PROPOSED ALTERNATIVE 4					
CONSTRUCTION					
I. STORMWATER/DRAINAGE					
1	Pipe Grout in Place	220	CY	$ 140.00	$ 30,800.00
2	Pipe Culv, RCP, Circular, 18"	83	LF	$ 74.00	$ 6,142.00
3	Pipe Culv, RCP, Elliptical, 23" x 14"	25	LF	$ 135.00	$ 3,375.00
4	Pipe Culv, RCP, Elliptical, 30" x 19"	150	LF	$ 152.00	$ 22,800.00
5	Pipe Culv, RCP, Elliptical, 38" x 24"	354	LF	$ 170.00	$ 60,180.00
6	Pipe Culv, RCP, Elliptical, 45" x 29"	844	LF	$ 215.00	$ 181,460.00
7	Pipe Culv, RCP, Elliptical, 53" x 34"	51	LF	$ 230.00	$ 11,707.00
8	Pipe Culv, RCP, Elliptical, 68" x 43"	465	LF	$ 362.00	$ 168,330.00
9	Pipe Culv, RCP, Elliptical, 76" x 48"	280	LF	$ 236.00	$ 66,080.00
10	Pipe Culv, RCP, Elliptical, 83" x 53"*	380	LF	$ 400.00	$ 152,000.00
11	Pipe Culv, RCP, Round, 48"	150	LF	$ 211.00	$ 31,650.00
15	FDOT Large Inlet (Estimated with Type H Inlet Cost)	26	EA	$ 4,400.00	$ 114,400.00
16	Vertical Weir	2	EA	$ 32,000.00	$ 64,000.00
				STORMWATER/DRAINAGE TOTAL	$ 912,924.00
II. SITE WORK					
1	Regular Excavation	22,049	CY	$ 6.00	$ 132,294.00
2	Fine Grading	1.3	AC	$ 4,800.00	$ 6,240.00
3	Onsite Structures Demolition	15,488	SF	$ 10.00	$ 154,880.00
4	Clearing and Grubbing	4.4	AC	$ 10,500.00	$ 46,200.00
5	Haul Excess Material Export?	22,049	CY	$ 10.00	$ 220,490.00
				SITE WORK TOTAL	$ 560,104.00
III. PAVEMENT COSNTRUCTION					
1	2" Type SP 12.5 Asphalt	137	TN	$ 115.00	$ 15,783.75
2	8" Limerock Base (Min. LBR 100)	1,220	SY	$ 12.00	$ 14,640.00
3	12" Type B Stabilized Subgrade (Min. LBR 40)	1,220	SY	$ 4.00	$ 4,880.00
4	Curb Type Valley Gutter	840	LF	$ 20.00	$ 16,800.00
5	Driveway Removal and Restoration, and Mailbox Relocation	652.0	SF	$ 9.00	$ 5,868.00
6	Existing Curb Removal	840	LF	$ 10.00	$ 8,400.00
7	Existing Asphalt Pavement Removal	1,220	SY	$ 10.00	$ 12,200.00
				PAVEMENT CONSTRUCTION TOTAL	$ 78,571.75
IV. LANDSCAPE					
1	Landscape and Irrigation Repair	3	EA	$ 1,000.00	$ 3,000.00
2	Sod	21,296	SY	$ 2.50	$ 53,240.00
				LANDSCAPE TOTAL	$ 56,240.00
V. OTHER					
1	Erosion Control	1	LS	$ 51,611.66	$ 51,611.66
2	Maintenance of Traffic	1	LS	$ 34,407.77	$ 34,407.77
3	Mobilization/Demobilization	1	LS	$ 86,019.43	$ 86,019.43
				OTHER TOTAL COST	$ 172,038.85
CONSTRUCTION SUMMARY					
I. STORMWATER/DRAINAGE					$ 912,924.00
II. SITE WORK					$ 560,104.00
III. PAVEMENT COSNTRUCTION					$ 78,571.75
IV. LANDSCAPE					$ 56,240.00
V. OTHER					$ 172,038.85
				HARBOR ACRES PROPOSED ALTERNATIVE 4 PROJECT CONSTRUCTION SUBTOTAL	$ 1,779,878.60
				CONTINGENCY (30% OF CONSTRUCTION SUBTOTAL)	$ 533,963.58
				HARBOR ACRES PROPOSED ALTERNATIVE 4 PROJECT CONSTRUCTION TOTAL	$ 2,313,842.18
LAND ACQUISITION					
1	Parcel Account #2037110019 / HA03	1	EA	$ 1,805,800.00	$ 1,805,800.00
2	Parcel Account #2037110025 / HA05	1	EA	$ 2,795,600.00	$ 2,795,600.00
				LAND ACQUISITION TOTAL	$ 4,601,400.00
PROJECT SUMMARY					
				HARBOR ACRES PROPOSED ALTERNATIVE 4 PROJECT CONSTRUCTION TOTAL	$ 2,313,842.18
				ENGINEERING/PERMITTING/CONSTRUCTION MANAGEMENT	$ 462,768.44
				LAND ACQUISITION	$ 4,601,400.00
				HARBOR ACRES PROPOSED ALTERNATIVE 4 PROJECT TOTAL	$ 7,378,010.62

NOTES

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** Estimated cost*

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PRELIMINARY ENGINEER'S OPINION OF PROBABLE COST OF CONSTRUCTION SITE WORK FOR

HARBOR ACRES DEVELOPMENT - PROPOSED ALTERNATIVE 5

ITEM	DESCRIPTION	ESTIMATED QUANTITY		UNIT PRICE	AMOUNT
I. STORMWATER/DRAINAGE					
1	Pipe Grout in Place	250	CY	$ 140.00	$ 35,000.00
2	Pipe Culv, RCP, Circular, 18"	214	LF	$ 74.00	$ 15,836.00
3	Pipe Culv, RCP, Circular, 24"	141	LF	$ 94.00	$ 13,244.60
4	Pipe Culv, RCP, Elliptical, 18" x 12"	210	LF	$ 95.00	$ 19,950.00
5	Pipe Culv, RCP, Elliptical, 23" x 14"	30	LF	$ 135.00	$ 4,050.00
6	Pipe Culv, RCP, Elliptical, 30" x 19"	417	LF	$ 152.00	$ 63,384.00
7	Pipe Culv, RCP, Elliptical, 38" x 24"	530	LF	$ 170.00	$ 90,100.00
8	Pipe Culv, RCP, Elliptical, 53" x 34"	190	LF	$ 230.00	$ 43,700.00
9	Pipe Culv, RCP, Elliptical, 68" x 43"	150	LF	$ 362.00	$ 54,300.00
10	Pipe Culv, RCP, Elliptical, 76" x 48"	190	LF	$ 236.00	$ 44,840.00
11	Pipe Culv, RCP, Round, 48"	225	LF	$ 211.00	$ 47,475.00
15	FDOT Large Inlet (Estimated with Type H Inlet Cost)	29	EA	$ 4,400.00	$ 127,600.00
16	Vertical Weir	8	EA	$ 32,000.00	$ 256,000.00
17	Junction Box Drainage	2	EA	$ 3,280.00	$ 6,560.00
				STORMWATER/DRAINAGE TOTAL	$ 822,039.60
II. SITE WORK					
1	Regular Excavation	92,129	CY	$ 6.00	$ 552,774.00
2	Fine Grading	5.3	AC	$ 4,800.00	$ 25,440.00
3	Onsite Structures Demolition	78,065	SF	$ 10.00	$ 780,650.00
4	Clearing and Grubbing	7.4	AC	$ 10,500.00	$ 77,700.00
5	Haul Excess Material Export?	92,129	CY	$ 10.00	$ 921,290.00
				SITE WORK TOTAL	$ 2,357,854.00
III. PAVEMENT COSNTRUCTION					
1	2" Type SP 12.5 Asphalt	156	TN	$ 115.00	$ 17,911.25
2	8" Limerock Base (Min. LBR 100)	1,384	SY	$ 12.00	$ 16,608.00
3	12" Type B Stabilized Subgrade (Min. LBR 40)	1,384	SY	$ 4.00	$ 5,536.00
4	Curb Type Valley Gutter	960	LF	$ 20.00	$ 19,200.00
5	Driveway Removal and Restoration, and Mailbox Relocation	1,991	SF	$ 9.00	$ 17,919.00
6	Existing Curb Removal	960	LF	$ 10.00	$ 9,600.00
7	Existing Asphalt Pavement Removal	1,384	SY	$ 10.00	$ 13,840.00
				PAVEMENT CONSTRUCTION TOTAL	$ 100,614.25
IV. LANDSCAPE					
1	Landscape and Irrigation Repair	11	EA	$ 1,000.00	$ 11,000.00
2	Sod	35,816	SY	$ 2.50	$ 89,540.00
				LANDSCAPE TOTAL	$ 100,540.00
V. OTHER					
1	Erosion Control	1	LS	$ 108,531.64	$ 108,531.64
2	Maintenance of Traffic	1	LS	$ 72,354.42	$ 72,354.42
3	Mobilization/Demobilization	1	LS	$ 180,886.06	$ 180,886.06
				OTHER TOTAL COST	$ 361,772.12
CONSTRUCTION SUMMARY					
I. STORMWATER/DRAINAGE					$ 822,039.60
II. SITE WORK					$ 2,357,854.00
III. PAVEMENT COSNTRUCTION					$ 100,614.25
IV. LANDSCAPE					$ 100,540.00
V. OTHER					$ 361,772.12
				HARBOR ACRES PROPOSED ALTERNATIVE 5 PROJECT CONSTRUCTION SUBTOTAL	$ 3,742,819.97
				CONTINGENCY (30% OF CONSTRUCTION SUBTOTAL)	$ 1,122,845.99
				HARBOR ACRES PROPOSED ALTERNATIVE 5 PROJECT CONSTRUCTION TOTAL	$ 4,865,665.96
LAND ACQUISITION					
1	Parcel Account #2037130013 / HA01	1	EA	$ 7,650,000.00	$ 7,650,000.00
2	Parcel Account #2037110016 / HA02	1	EA	$ 3,350,000.00	$ 3,350,000.00
3	Parcel Account #2037110019 / HA03	1	EA	$ 1,805,800.00	$ 1,805,800.00
4	Parcel Account #2037110013 / HA04	1	EA	$ 877,500.00	$ 877,500.00
5	Parcel Account #2037110025 / HA05	1	EA	$ 2,795,600.00	$ 2,795,600.00
6	Parcel Account #2037060026 / HA06	1	EA	$ 1,111,100.00	$ 1,111,100.00
7	Parcel Account #2037060040 / HA07	1	EA	$ 2,674,900.00	$ 2,674,900.00
8	Parcel Account #2037050009 / HA08	1	EA	$ 2,921,400.00	$ 2,921,400.00
9	Parcel Account #2037040010 / HA09	1	EA	$ 4,578,000.00	$ 4,578,000.00
10	Parcel Account #2037030029 / HA10	1	EA	$ 1,309,100.00	$ 1,309,100.00
				LAND ACQUISITION TOTAL	$ 29,073,400.00
PROJECT SUMMARY					
				HARBOR ACRES PROPOSED ALTERNATIVE 5 PROJECT CONSTRUCTION TOTAL	$ 4,865,665.96
				ENGINEERING/PERMITTING/CONSTRUCTION MANAGEMENT	$ 973,133.19
				LAND ACQUISITION	$ 29,073,400.00
				HARBOR ACRES PROPOSED ALTERNATIVE 5 PROJECT TOTAL	$ 34,912,199.15

NOTES

Costs presented above are based on the Florida Departement of Transportation (FDOT)

** Estimated cost*

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PRELIMINARY ENGINEER'S OPINION OF PROBABLE COST OF CONSTRUCTION SITE WORK FOR								
HARBOR ACRES DEVELOPMENT - PROPOSED ALTERNATIVE 6								
ITEM	**DESCRIPTION**	**ESTIMATED QUANTITY**		**UNIT PRICE**		**AMOUNT**		
CONSTRUCTION								
I. STORMWATER/DRAINAGE								
1	Pipe Grout in Place	250	CY	$	140.00	$	35,000.00	
2	Pipe Culv, RCP, Circular, 18"	214	LF	$	74.00	$	15,836.00	
3	Pipe Culv, RCP, Circular, 24"	141	LF	$	94.00	$	13,244.60	
4	Pipe Culv, RCP, Elliptical, 23" x 14"	30	LF	$	135.00	$	4,050.00	
5	Pipe Culv, RCP, Elliptical, 30" x 19"	210	LF	$	152.00	$	31,920.00	
6	Pipe Culv, RCP, Elliptical, 38" x 24"	50	LF	$	170.00	$	8,500.00	
7	Pipe Culv, RCP, Elliptical, 45" x 29"	385	LF	$	215.00	$	82,775.00	
8	Pipe Culv, RCP, Elliptical, 53" x 34"	430	LF	$	230.00	$	98,900.00	
9	Pipe Culv, RCP, Elliptical, 76" x 48"	325	LF	$	236.00	$	76,700.00	
10	Pipe Culv, RCP, Elliptical, 83" x 53"*	430	LF	$	400.00	$	172,000.00	
11	Pipe Culv, RCP, Elliptical, 91" x 58"	50	LF	$	1,220.00	$	61,000.00	
15	FDOT Large Inlet (Estimated with Type H Inlet Cost)	29	EA	$	4,400.00	$	127,600.00	
16	Vertical Weir	8	EA	$	32,000.00	$	256,000.00	
17	Junction Box Drainage	2	EA	$	3,280.00	$	6,560.00	
				STORMWATER/DRAINAGE TOTAL		$	990,085.60	
II. SITE WORK								
1	Regular Excavation	92,129	CY	$	6.00	$	552,774.00	
2	Fine Grading	5.3	AC	$	4,800.00	$	25,440.00	
3	Onsite Structures Demolition	78,065	SF	$	10.00	$	780,650.00	
4	Clearing and Grubbing	7.4	AC	$	10,500.00	$	77,700.00	
5	Haul Excess Material Export?	92,129	CY	$	10.00	$	921,290.00	
				SITE WORK TOTAL		$	2,357,854.00	
III. PAVEMENT COSNTRUCTION								
1	2" Type SP 12.5 Asphalt	156	TN	$	115.00	$	17,911.25	
2	8" Limerock Base (Min. LBR 100)	1,384	SY	$	12.00	$	16,608.00	
3	12" Type B Stabilized Subgrade (Min. LBR 40)	1,384	SY	$	4.00	$	5,536.00	
4	Curb Type Valley Gutter	960	LF	$	20.00	$	19,200.00	
5	Driveway Removal and Restoration, and Mailbox Relocation	1,991	SF	$	9.00	$	17,919.00	
6	Existing Curb Removal	960	LF	$	10.00	$	9,600.00	
7	Existing Asphalt Pavement Removal	1,384	SY	$	10.00	$	13,840.00	
				PAVEMENT CONSTRUCTION TOTAL		$	100,614.25	
IV. LANDSCAPE								
1	Landscape and Irrigation Repair	11	EA	$	1,000.00	$	11,000.00	
2	Sod	35,816	SY	$	2.50	$	89,540.00	
				LANDSCAPE TOTAL		$	100,540.00	
V. OTHER								
1	Erosion Control	1	LS	$	113,925.91	$	113,925.91	
2	Maintenance of Traffic	1	LS	$	75,950.61	$	75,950.61	
3	Mobilization/Demobilization	1	LS	$	189,876.52	$	189,876.52	
				OTHER TOTAL COST		$	379,753.04	
CONSTRUCTION SUMMARY								
I. STORMWATER/DRAINAGE						$	990,085.60	
II. SITE WORK						$	2,357,854.00	
III. PAVEMENT COSNTRUCTION						$	100,614.25	
IV. LANDSCAPE						$	100,540.00	
V. OTHER						$	379,753.04	
				HARBOR ACRES PROPOSED ALTERNATIVE 6 PROJECT CONSTRUCTION SUBTOTAL		$	3,928,846.89	
				CONTINGENCY (30% OF CONSTRUCTION SUBTOTAL)		$	1,178,654.07	
				HARBOR ACRES PROPOSED ALTERNATIVE 6 PROJECT CONSTRUCTION TOTAL		$	5,107,500.96	
LAND ACQUISITION								
1	Parcel Account #2037130013 / HA01	1	EA	$	7,650,000.00	$	7,650,000.00	
2	Parcel Account #2037110016 / HA02	1	EA	$	3,350,000.00	$	3,350,000.00	
3	Parcel Account #2037110019 / HA03	1	EA	$	1,805,800.00	$	1,805,800.00	
4	Parcel Account #2037110013 / HA04	1	EA	$	877,500.00	$	877,500.00	
5	Parcel Account #2037110025 / HA05	1	EA	$	2,795,600.00	$	2,795,600.00	
6	Parcel Account #2037060026 / HA06	1	EA	$	1,111,100.00	$	1,111,100.00	
7	Parcel Account #2037060040 / HA07	1	EA	$	2,674,900.00	$	2,674,900.00	
8	Parcel Account #2037050009 / HA08	1	EA	$	2,921,400.00	$	2,921,400.00	
9	Parcel Account #2037040010 / HA09	1	EA	$	4,578,000.00	$	4,578,000.00	
10	Parcel Account #2037030029 / HA10	1	EA	$	1,309,100.00	$	1,309,100.00	
				LAND ACQUISITION TOTAL		$	29,073,400.00	
PROJECT SUMMARY								
				HARBOR ACRES PROPOSED ALTERNATIVE 6 PROJECT CONSTRUCTION TOTAL		$	5,107,500.96	
				ENGINEERING/PERMITTING/CONSTRUCTION MANAGEMENT		$	1,021,500.19	
				LAND ACQUISITION		$	29,073,400.00	
				HARBOR ACRES PROPOSED ALTERNATIVE 6 PROJECT TOTAL		$	35,202,401.15	

NOTES

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** Estimated cost*

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Appendix E: Cost Benefit Matrix

Harbor Acres Cost Benefit Matrix

	Capital Costs	Maintenance Costs	Loss of Service	Life Cycle of Alternative	Impact to Upstream Areas	Total*
Priority Weighting (Optional)						
Alternative 1	6	6	4	4	3	23
Alternative 2	4	5	4	4	2	19
Alternative 3	3	4	4	4	5	20
Alternative 4	5	5	5	5	2	22
Alternative 5	2	5	5	5	4	21
Alternative 6	1	5	6	6	6	24
TOTAL*	21	30	28	28	22	

*Total is based on rankings provided. Priority weighting can be added and multiplied by each alternative rank for use in decision making.
Note: The highest ranked option is assigned a 6 (to result in a higher score) and the lowest ranked option is assigned a 1.

Appendix F: Cost Benefit Analysis Table

Harbor Acres Cost-Benefit Analysis - Current Conditions

Expected Damages for 30 - year Project Life =	$	1,342,000
Anticipated Water Quality Constuction and Design Costs =	$	-
Anticipated Flood Control Constuction and Design Costs =	$	-
Anticipated Construction and Design Cost for Project =	$	-
Cost Benefit Ratio =		-

Expected Damages by Component

Component		2 - Year Event	5 - Year Event	10 - Year Event	25 - Year Event	50 - Year Event	100 - Year Event
Building Damages	BD	$ -	$ -	$ -	$ -	$ -	$ -
Content Damages	CD	$ -	$ -	$ -	$ -	$ -	$ -
Automobile Damages	AD	$ -	$ -	$ -	$ -	$ -	$ -
Exterior Property Damages	PD	$ 52,000	$ 78,000	$ 98,000	$ 104,000	$ 104,000	$ 106,000
Displacement Costs for Flooded Structures	DISF	$ -	$ -	$ -	$ -	$ -	$ -
Displacement Costs for Structures in the Horizontal Floodplain	DIS	$ 13,000	$ 19,500	$ 24,500	$ 26,000	$ 26,000	$ 26,500
Lost Wages due to Residential Flooding	LW	$ 12,337	$ 18,505	$ 23,250	$ 24,673	$ 24,673	$ 25,148
Lost Business Income	LBI	$ -	$ -	$ -	$ -	$ -	$ -
Lost Wages due to Closed Business	LWB	$ -	$ -	$ -	$ -	$ -	$ -
Road Detour Costs	RD	$ -	$ -	$ -	$ -	$ -	$ -
Public Works Costs	PW	$ -	$ -	$ -	$ -	$ -	$ -
Flood Insurance Costs	FI	$ -	$ -	$ -	$ -	$ -	$ -
Total Expected Damages		**$ 77,337**	**$ 116,005**	**$ 145,750**	**$ 154,673**	**$ 154,673**	**$ 157,648**

Annualized Damages

Storm Event		Expected Damages for Storm Event	Probability of Occurance During Any Year	Expected Annual Damages For Storm Event
2 - Year Event		$ 77,337	50.0%	$ 38,668
5 - Year Event		$ 116,005	20.0%	$ 23,201
10 - Year Event		$ 145,750	10.0%	$ 14,575
25 - Year Event		$ 154,673	4.0%	$ 6,187
50 - Year Event		$ 154,673	2.0%	$ 3,093
100 - Year Event		$ 157,648	1.0%	$ 1,576
Total Expected Annual Cost (A)				**$ 87,301**

Present Worth Analysis	
Total Expected Annual Cost (A)	$ 87,301
Interest **(I)**	5.00%
Project Life **(n)**	30
$P = A \{[(1 + I)^n - 1] / [I \times (1 + I)^n]\}$	
Expected Damages for 30 - year Project Life (P)	**$ 1,342,000**

Harbor Acres Cost-Benefit Analysis - Alternative 1

Avoided Damages for 30 - year Project Life =	$	1,033,000
Anticipated Water Quality Constuction and Design Costs =	$	-
Anticipated Flood Control Constuction and Design Costs =	$	2,024,624
Anticipated Construction and Design Cost for Project =	$	2,024,624
Cost Benefit Ratio =		0.51

Avoided Damages by Component

Component		2 - Year Event	5 - Year Event	10 - Year Event	25 - Year Event	50 - Year Event	100 - Year Event
Building Damages	BD	$ -	$ -	$ -	$ -	$ -	$ -
Content Damages	CD	$ -	$ -	$ -	$ -	$ -	$ -
Automobile Damages	AD	$ -	$ -	$ -	$ -	$ -	$ -
Exterior Property Damages	PD	$ 42,000	$ 66,000	$ 86,000	$ 92,000	$ 92,000	$ 82,000
Displacement Costs for Flooded Structures	DISF	$ -	$ -	$ -	$ -	$ -	$ -
Displacement Costs for Structures in the Horizontal Floodplain	DIS	$ 10,500	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 6,000
Lost Wages due to Residential Flooding	LW	$ 9,964	$ 15,658	$ 20,403	$ 21,826	$ 21,826	$ 19,454
Lost Business Income	LBI	$ -	$ -	$ -	$ -	$ -	$ -
Lost Wages due to Closed Business	LWB	$ -	$ -	$ -	$ -	$ -	$ -
Road Detour Costs	RD	$ -	$ -	$ -	$ -	$ -	$ -
Public Works Costs	PW	$ -	$ -	$ -	$ -	$ -	$ -
Flood Insurance Costs	FI	$ -	$ -	$ -	$ -	$ -	$ -
Total Avoided Damages		**$ 62,464**	**$ 84,658**	**$ 109,403**	**$ 116,826**	**$ 116,826**	**$ 107,454**

Annualized Damages

Storm Event		Avoided Damages for Storm Event	Probability of Occurance During Any Year	Avoided Annual Damages For Storm Event
2 - Year Event		$ 62,464	50.0%	$ 31,232
5 - Year Event		$ 84,658	20.0%	$ 16,932
10 - Year Event		$ 109,403	10.0%	$ 10,940
25 - Year Event		$ 116,826	4.0%	$ 4,673
50 - Year Event		$ 116,826	2.0%	$ 2,337
100 - Year Event		$ 107,454	1.0%	$ 1,075
Total Avoided Annual Cost (A)				**$ 67,188**

Present Worth Analysis	
Total Avoided Annual Cost (A)	$ 67,188
Interest **(I)**	5.00%
Project Life **(n)**	30
$P = A \{[(1 + I)^n - 1] / [I \times (1 + I)^n]\}$	
Avoided Damages for 30 - year Project Life (P)	**$ 1,033,000**

Harbor Acres Cost-Benefit Analysis - Alternative 2

Avoided Damages for 30 - year Project Life =	$	1,124,000
Anticipated Water Quality Constuction and Design Costs =	$	-
Anticipated Flood Control Constuction and Design Costs =	$	7,411,250
Anticipated Construction and Design Cost for Project =	$	7,411,250
Cost Benefit Ratio =		0.15

Avoided Damages by Component

Component		2 - Year Event	5 - Year Event	10 - Year Event	25 - Year Event	50 - Year Event	100 - Year Event
Building Damages	BD	$ -	$ -	$ -	$ -	$ -	$ -
Content Damages	CD	$ -	$ -	$ -	$ -	$ -	$ -
Automobile Damages	AD	$ -	$ -	$ -	$ -	$ -	$ -
Exterior Property Damages	PD	$ 42,000	$ 66,000	$ 86,000	$ 92,000	$ 92,000	$ 86,000
Displacement Costs for Flooded Structures	DISF	$ -	$ -	$ -	$ -	$ -	$ -
Displacement Costs for Structures in the Horizontal Floodplain	DIS	$ 10,500	$ 16,500	$ 21,500	$ 23,000	$ 23,000	$ 21,500
Lost Wages due to Residential Flooding	LW	$ 9,964	$ 15,658	$ 20,403	$ 21,826	$ 21,826	$ 20,403
Lost Business Income	LBI	$ -	$ -	$ -	$ -	$ -	$ -
Lost Wages due to Closed Business	LWB	$ -	$ -	$ -	$ -	$ -	$ -
Road Detour Costs	RD	$ -	$ -	$ -	$ -	$ -	$ -
Public Works Costs	PW	$ -	$ -	$ -	$ -	$ -	$ -
Flood Insurance Costs	FI	$ -	$ -	$ -	$ -	$ -	$ -
Total Avoided Damages		**$ 62,464**	**$ 98,158**	**$ 127,903**	**$ 136,826**	**$ 136,826**	**$ 127,903**

Annualized Damages

Storm Event		Avoided Damages for Storm Event	Probability of Occurance During Any Year	Avoided Annual Damages For Storm Event
2 - Year Event		$ 62,464	50.0%	$ 31,232
5 - Year Event		$ 98,158	20.0%	$ 19,632
10 - Year Event		$ 127,903	10.0%	$ 12,790
25 - Year Event		$ 136,826	4.0%	$ 5,473
50 - Year Event		$ 136,826	2.0%	$ 2,737
100 - Year Event		$ 127,903	1.0%	$ 1,279
Total Avoided Annual Cost (A)				**$ 73,143**

Present Worth Analysis	
Total Avoided Annual Cost (A)	$ 73,143
Interest **(I)**	5.00%
Project Life **(n)**	30
$P = A \{[(1 + I)^n - 1] / [I \times (1 + I)^n]\}$	
Avoided Damages for 30 - year Project Life (P)	**$ 1,124,000**

Harbor Acres Cost-Benefit Analysis - Alternative 5

Avoided Damages for 30 - year Project Life =	$	1,223,000
Anticipated Water Quality Constuction and Design Costs =	$	-
Anticipated Flood Control Constuction and Design Costs =	$	34,912,199
Anticipated Construction and Design Cost for Project =	$	34,912,199
Cost Benefit Ratio =		0.04

Avoided Damages by Component

Component		2 - Year Event	5 - Year Event	10 - Year Event	25 - Year Event	50 - Year Event	100 - Year Event
Building Damages	BD	$ -	$ -	$ -	$ -	$ -	$ -
Content Damages	CD	$ -	$ -	$ -	$ -	$ -	$ -
Automobile Damages	AD	$ -	$ -	$ -	$ -	$ -	$ -
Exterior Property Damages	PD	$ 46,000	$ 72,000	$ 92,000	$ 98,000	$ 98,000	$ 100,000
Displacement Costs for Flooded Structures	DISF	$ -	$ -	$ -	$ -	$ -	$ -
Displacement Costs for Structures in the Horizontal Floodplain	DIS	$ 11,500	$ 18,000	$ 23,000	$ 24,500	$ 24,500	$ 25,000
Lost Wages due to Residential Flooding	LW	$ 10,913	$ 17,081	$ 21,826	$ 23,250	$ 23,250	$ 23,724
Lost Business Income	LBI	$ -	$ -	$ -	$ -	$ -	$ -
Lost Wages due to Closed Business	LWB	$ -	$ -	$ -	$ -	$ -	$ -
Road Detour Costs	RD	$ -	$ -	$ -	$ -	$ -	$ -
Public Works Costs	PW	$ -	$ -	$ -	$ -	$ -	$ -
Flood Insurance Costs	FI	$ -	$ -	$ -	$ -	$ -	$ -
Total Avoided Damages		**$ 68,413**	**$ 107,081**	**$ 136,826**	**$ 145,750**	**$ 145,750**	**$ 148,724**

Annualized Damages

Storm Event		Avoided Damages for Storm Event	Probability of Occurance During Any Year	Expected Avoided Damages For Storm Event
2 - Year Event		$ 68,413	50.0%	$ 34,207
5 - Year Event		$ 107,081	20.0%	$ 21,416
10 - Year Event		$ 136,826	10.0%	$ 13,683
25 - Year Event		$ 145,750	4.0%	$ 5,830
50 - Year Event		$ 147,000	2.0%	$ 2,940
100 - Year Event		$ 148,724	1.0%	$ 1,487
Total Avoided Annual Cost (A)				**$ 79,563**

Present Worth Analysis	
Total Avoided Annual Cost (A)	$ 79,563
Interest **(I)**	5.00%
Project Life **(n)**	30
$P = A\{[(1+I)^n - 1] / [I \times (1+I)^n]\}$	
Avoided Damages for 30 - year Project Life (P)	**$ 1,223,000**

Harbor Acres Cost-Benefit Analysis - Input Summary

Fixed Input (Update Annually)					
	Value	Unit		Value	Unit
Builiding Damage Multipyer	0.12		Displacment Duration	2	Days
Content Damage Multiplyer	0.86		Flooded Stucture Displacement Duration	14	Days
Average Automobile Cost	$22,000		Average Household Income	$61,683	Annual
Number of Cars per Household	2		IRS per Mile Cost	$0.575	
Automobile Damage Multiplyer	0.075		Average Daily Commercial Revenue	$5,101	Daily
Landscape / Hardscape Cost	$2,000		Average Employees per Business	10	
Per Diem Cost	$250	Daily	Average Sarasota County Payroll	$17.39	Hourly Rate

Current Conditions Project Specific Input - From Data Entry Sheets							
		2 - Year Event	5 - Year Event	10 - Year Event	25 - Year Event	50 - Year Event	100 - Year Event
Assessed Property Value	AV	$0	$0	$0	$0	$0	$0
Number of Residential Flooded Structures	FS	0	0	0	0	0	0
Number of Residential Structures in the Horizontal Floodplain	HFP	26	39	49	52	52	53
Number of Commercial Flooded Structures	CFS	0	0	0	0	0	0
Number of Commercial Structures in the Horizontal Floodplain	CHFP	0	0	0	0	0	0

Alternative 1 Project Specific Input - From Data Entry Sheets							
		2 - Year Event	5 - Year Event	10 - Year Event	25 - Year Event	50 - Year Event	100 - Year Event
Assessed Property Value	AV	$0	$0	$0	$0	$0	$0
Number of Residential Flooded Structures	FS	0	0	0	0	0	0
Number of Residential Structures in the Horizontal Floodplain	HFP	5	6	6	6	6	12
Number of Commercial Flooded Structures	CFS	0	0	0	0	0	0
Number of Commercial Structures in the Horizontal Floodplain	CHFP	0	0	0	0	0	0

Alternative 2 Project Specific Input - From Data Entry Sheets							
		2 - Year Event	5 - Year Event	10 - Year Event	25 - Year Event	50 - Year Event	100 - Year Event
Assessed Property Value	AV	$0	$0	$0	$0	$0	$0
Number of Residential Flooded Structures	FS	0	0	0	0	0	0
Number of Residential Structures in the Horizontal Floodplain	HFP	5	6	6	6	6	10
Number of Commercial Flooded Structures	CFS	0	0	0	0	0	0
Number of Commercial Structures in the Horizontal Floodplain	CHFP	0	0	0	0	0	0

Alternative 5 Project Specific Input - From Data Entry Sheets							
		2 - Year Event	5 - Year Event	10 - Year Event	25 - Year Event	50 - Year Event	100 - Year Event
Assessed Property Value	AV	$0	$0	$0	$0	$0	$0
Number of Residential Flooded Structures	FS	0	0	0	0	0	0
Number of Residential Structures in the Horizontal Floodplain	HFP	3	3	3	3	3	3
Number of Commercial Flooded Structures	CFS	0	0	0	0	0	0
Number of Commercial Structures in the Horizontal Floodplain	CHFP	0	0	0	0	0	0

Current Conditions Data Entry

							2-Year Event			5-Year Event			10-Year Event			25-Year Event			50-Year Event			100-Year Event		
ID	Just Property Value	Assessed Value	Building	Property PID	Address Number	Address Street	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain
1	$ 8,380,600.00	$ 2,487,882.00	$ 18,100.00	2037120007	1317	Vista Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
2	$ 2,082,600.00	$ 1,582,600.00	$ 429,700.00	2037120010	1329	Vista Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
3	$ 3,652,800.00	$ 3,652,800.00	$ 1,955,200.00	2037120011	1333	Vista Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
4	$ 1,757,200.00	$ 1,757,200.00	$ -	2037120012	1337	Vista Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
5	$ 7,708,700.00	$ 6,145,690.00	$ 5,347,300.00	2037110015	1423	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
6	$ 2,337,100.00	$ 2,337,100.00	$ 332,900.00	2037110016	1435	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
7	$ 1,994,900.00	$ 1,994,900.00	$ 394,600.00	2037110017	1449	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
8	$ 1,517,800.00	$ 1,517,800.00	$ -	2037110018	1465	Hillview Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
9	$ 1,622,600.00	$ 686,916.00	$ 137,700.00	2037110019	1481	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
10	$ 2,871,200.00	$ 2,871,200.00	$ 1,431,600.00	2037140018	1505	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
14	$ 6,703,500.00	$ 4,340,305.00	$ 1,541,800.00	2037130009	1212	Hillview Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
15	$ 4,865,200.00	$ 896,652.00	$ 304,800.00	2037130007	1226	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
16	$ 11,276,700.00	$ 4,502,809.00	$ 1,218,200.00	2037130004	1274	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
18	$ 11,456,300.00	$ 4,969,388.00	$ 2,093,400.00	2037130001	1410	Hillview Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
20	$ 8,044,400.00	$ 7,937,252.00	$ 3,536,300.00	2037140012	1486	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
22	$ 1,209,000.00	$ 787,507.00	$ 129,600.00	2037140005	1560	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
23	$ 981,400.00	$ 481,400.00	$ 7,500.00	2037140004	1570	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
24	$ 1,747,500.00	$ 1,747,500.00	$ 378,900.00	2037110022	1708	Flower Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
25	$ 2,188,700.00	$ 1,621,881.00	$ 796,600.00	2037110023	1630	Flower Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
26	$ 1,736,400.00	$ 1,736,400.00	$ 257,800.00	2037110024	1572	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
27	$ 2,702,700.00	$ 1,135,934.00	$ 481,500.00	2037110025	1550	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
28	$ 3,771,900.00	$ 3,771,900.00	$ 1,944,500.00	2037060034	1526	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
29	$ 2,009,300.00	$ 1,086,965.00	$ 494,000.00	2037060035	1500	Harbor Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
30	$ 2,327,400.00	$ 1,930,529.00	$ 782,600.00	2037060036	1444	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
32	$ 2,799,000.00	$ 2,799,000.00	$ 1,362,500.00	2037060045	1386	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
33	$ 3,037,100.00	$ 3,037,100.00	$ 1,447,500.00	2037050008	1382	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
36	$ 4,544,000.00	$ 811,339.00	$ 175,800.00	2037050011	1376	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
37	$ 5,994,400.00	$ 5,040,645.00	$ 1,562,100.00	2037050013	1372	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1
38	$ 6,522,300.00	$ 4,366,384.00	$ 2,127,300.00	2037040005	1370	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
39	$ 6,886,900.00	$ 5,507,195.00	$ 2,465,200.00	2037040007	1366	Harbor Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
40	$ 4,758,700.00	$ 928,655.00	$ 303,200.00	2037040010	1360	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
41	$ 4,582,400.00	$ 4,582,400.00	$ 2,820,100.00	2037030020	1356	Harbor Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
42	$ 1,960,600.00	$ 884,079.00	$ 567,200.00	2037030021	1354	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
43	$ 2,401,200.00	$ 2,004,159.00	$ 1,068,200.00	2037030022	1352	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
44	$ 2,007,000.00	$ 1,055,858.00	$ 600,100.00	2037030024	1348	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1
45	$ 1,793,900.00	$ 1,650,408.00	$ 393,000.00	2037030025	1346	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
46	$ -	$ -	$ -	2037030026		no info online	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
47	$ 1,812,300.00	$ 1,419,972.00	$ 486,100.00	2037030028	1340	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
48	$ 1,231,600.00	$ 837,716.00	$ 515,700.00	2037030014	1351	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
49	$ 2,093,100.00	$ 2,093,100.00	$ 1,272,300.00	2037030012	1347	Harbor Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
50	$ 1,661,700.00	$ 1,644,404.00	$ 840,000.00	2037030013	1349	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
51	$ 712,200.00	$ 261,023.00	$ 8,000.00	2037030015	1355	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
52	$ 2,037,500.00	$ 2,037,500.00	$ 1,292,000.00	2037030016	1357	Harbor Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
53	$ 985,100.00	$ 985,100.00	$ 242,100.00	2037030017	1359	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
54	$ 2,024,500.00	$ 2,024,500.00	$ 1,214,700.00	2037040001	1361	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
56	$ 725,400.00	$ 725,400.00	$ -	2037040003	1369	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
58	$ 1,083,800.00	$ 767,929.00	$270,100	2037050003	1381	Harbor Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
59	$ 889,800.00	$ 338,110.00	$ 172,100.00	2037030001	1387	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
60	$ 867,900.00	$ 250,101.00	$ 160,400.00	2037030002	1389	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
62	$ 882,400.00	$ 274,296.00	$ 129,200.00	2037030004	1393	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
63	$ 1,197,300.00	$ 556,502.00	$ 347,700.00	2037030005	1395	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
64	$ 2,011,800.00	$ 1,881,676.00	$ 1,185,900.00	2037060029	1433	Harbor Dr	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1
65	$ 843,600.00	$ 287,051.00	$ 149,000.00	2037060031	1519	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
66	$ 741,800.00	$ 306,910.00	$ 128,900.00	2037060032	1535	Harbor Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
69	$ 2,583,100.00	$ 1,422,302.00	$ 925,200.00	2037120009	1325	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	$ 1,917,000.00	$ 1,917,000.00	$ 372,100.00	2037110021	1800	Flower Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	$ 2,124,900.00	$ 2,124,900.00	$ 794,600.00	2037140022	1808	Flower Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	$ -	$ -	$ -	2037130010		no info online	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	$ 164,035,200.00	$ 111,339,022.00	$ 47,321,000.00				0	0	26	0	0	39	0	0	49	0	0	52	0	0	52	0	0	53

Alternative 1 Data Entry

ID	Just Property Value	Assessed Value	Building	Property PID	Address Number	Address Street	2-Year Event			5-Year Event			10-Year Event			25-Year Event			50-Year Event			100-Year Event		
							Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain
1	$ 8,380,600.00	$ 2,487,882.00	$ 18,100.00	2037120007	1317	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	$ 2,082,600.00	$ 1,582,600.00	$ 429,700.00	2037120010	1329	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	$ 3,652,800.00	$ 3,652,800.00	$ 1,955,200.00	2037120011	1333	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	$ 1,757,200.00	$ 1,757,200.00	$ -	2037120012	1337	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	$ 7,708,700.00	$ 6,145,690.00	$ 5,347,300.00	2037110015	1423	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	$ 2,337,100.00	$ 2,337,100.00	$ 332,900.00	2037110016	1435	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	$ 1,994,900.00	$ 1,994,900.00	$ 394,600.00	2037110017	1449	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	$ 1,517,800.00	$ 1,517,800.00	$ -	2037110018	1465	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	$ 1,622,600.00	$ 686,916.00	$ 137,700.00	2037110019	1481	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	$ 2,871,200.00	$ 2,871,200.00	$ 1,431,600.00	2037140018	1505	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	$ 1,332,500.00	$ 1,332,500.00	$ 144,600.00	2037140019	1515	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	$ 2,538,800.00	$ 2,067,537.00	$ 986,500.00	2037140021	1545	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	$ 17,617,400.00	$ 16,524,291.00	$ 8,703,000.00	2037120001	1253	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
14	$ 6,703,500.00	$ 4,340,305.00	$ 1,541,800.00	2037130009	1212	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	$ 4,865,200.00	$ 896,652.00	$ 304,800.00	2037130007	1226	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	$ 11,276,700.00	$ 4,502,809.00	$ 1,218,200.00	2037130004	1274	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
17	$ 8,174,500.00	$ 8,174,500.00	$ 2,784,400.00	2037130003	1310	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	$ 11,456,300.00	$ 4,969,388.00	$ 2,093,400.00	2037130001	1410	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	$ 5,218,400.00	$ 932,000.00	$ 76,900.00	2037140015	1430	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	$ 8,044,400.00	$ 7,937,252.00	$ 3,536,300.00	2037140012	1486	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
21	$ 8,659,600.00	$ 1,877,467.00	$ 14,500.00	2037140010	1500	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
22	$ 1,209,000.00	$ 787,507.00	$ 129,600.00	2037140005	1560	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
23	$ 981,400.00	$ 481,400.00	$ 7,500.00	2037140004	1570	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
24	$ 1,747,500.00	$ 1,747,500.00	$ 378,900.00	2037110022	1708	Flower Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
25	$ 2,188,700.00	$ 1,621,881.00	$ 796,600.00	2037110023	1630	Flower Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
26	$ 1,736,400.00	$ 1,736,400.00	$ 257,800.00	2037110024	1572	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
27	$ 2,702,700.00	$ 1,135,934.00	$ 481,500.00	2037110025	1550	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	$ 3,771,900.00	$ 3,771,900.00	$ 1,944,500.00	2037060034	1526	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
29	$ 2,009,300.00	$ 1,086,965.00	$ 494,000.00	2037060035	1500	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	$ 2,327,400.00	$ 1,930,529.00	$ 782,600.00	2037060036	1444	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	$ 2,687,800.00	$ 1,926,025.00	$ 1,382,400.00	2037060044	1388	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	$ 2,799,000.00	$ 2,799,000.00	$ 1,362,500.00	2037060045	1386	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	$ 3,037,100.00	$ 3,037,100.00	$ 1,447,500.00	2037050008	1382	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	$ 2,869,200.00	$ 2,869,200.00	$ 1,007,400.00	2037050009	1380	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	$ 4,086,700.00	$ 3,586,147.00	$ 1,358,100.00	2037050010	1378	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	$ 4,544,000.00	$ 811,339.00	$ 175,800.00	2037050011	1376	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	$ 5,994,400.00	$ 5,040,645.00	$ 1,562,100.00	2037050013	1372	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	$ 6,522,300.00	$ 4,366,384.00	$ 2,127,300.00	2037040005	1370	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	$ 6,886,900.00	$ 5,507,195.00	$ 2,465,200.00	2037040007	1366	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	$ 4,758,700.00	$ 928,655.00	$ 303,200.00	2037040010	1360	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	$ 4,582,400.00	$ 4,582,400.00	$ 2,820,100.00	2037030020	1356	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	$ 1,960,600.00	$ 884,079.00	$ 567,200.00	2037030021	1354	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	$ 2,401,200.00	$ 2,004,159.00	$ 1,068,200.00	2037030022	1352	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	$ 2,007,000.00	$ 1,055,858.00	$ 600,100.00	2037030024	1348	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	$ 1,793,900.00	$ 1,650,408.00	$ 393,000.00	2037030025	1346	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	$ -	$ -	$ -	2037030026		no info online	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	$ 1,812,300.00	$ 1,419,972.00	$ 486,100.00	2037030028	1340	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	$ 1,231,600.00	$ 837,716.00	$ 515,700.00	2037030014	1351	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	$ 2,093,100.00	$ 2,093,100.00	$ 1,272,300.00	2037030012	1347	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	$ 1,661,700.00	$ 1,644,404.00	$ 840,000.00	2037030013	1349	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	$ 712,200.00	$ 261,023.00	$ 8,000.00	2037030015	1355	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	$ 2,037,500.00	$ 2,037,500.00	$ 1,292,000.00	2037030016	1357	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	$ 985,100.00	$ 985,100.00	$ 242,100.00	2037030017	1359	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
54	$ 2,024,500.00	$ 2,024,500.00	$ 1,214,700.00	2037040001	1361	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
55	$ 2,337,100.00	$ 2,103,603.00	$ 1,523,200.00	2037040002	1365	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	$ 725,400.00	$ 725,400.00	$ -	2037040003	1369	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	$ 849,200.00	$ 454,631.00	$ 145,500.00	2037050002	1379	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	$ 1,083,800.00	$ 767,929.00	$270,100	2037050003	1381	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	$ 889,800.00	$ 338,110.00	$ 172,100.00	2037030001	1387	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	$ 867,900.00	$ 250,101.00	$ 160,400.00	2037030002	1389	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	$ 1,356,100.00	$ 1,165,899.00	$ 615,900.00	2037030003	1391	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	$ 882,400.00	$ 274,296.00	$ 129,200.00	2037030004	1393	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	$ 1,197,300.00	$ 556,502.00	$ 347,700.00	2037030005	1395	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	$ 2,011,800.00	$ 1,881,676.00	$ 1,185,900.00	2037060029	1433	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	$ 843,600.00	$ 287,051.00	$ 149,000.00	2037060031	1519	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	$ 741,800.00	$ 306,910.00	$ 128,900.00	2037060032	1535	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	$ 1,054,000.00	$ 1,046,540.00	$ 259,000.00	2037110028	1561	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	$ 222,816,500.00	$ 155,399,362.00	$ 66,322,400.00				0	0	5	0	0	6	0	0	6	0	0	6	0	0	6	0	0	12

Alternative 2 Data Entry

							2-Year Event			5-Year Event			10-Year Event			25-Year Event			50-Year Event			100-Year Event		
ID	Just Property Value	Assessed Value	Building	Property PID	Address Number	Address Street	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain
1	$ 8,380,600.00	$ 2,487,882.00	$ 18,100.00	2037120007	1317	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	$ 2,082,600.00	$ 1,582,600.00	$ 429,700.00	2037120010	1329	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	$ 3,652,800.00	$ 3,652,800.00	$ 1,955,200.00	2037120011	1333	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	$ 1,757,200.00	$ 1,757,200.00	$ -	2037120012	1337	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	$ 7,708,700.00	$ 6,145,690.00	$ 5,347,300.00	2037110015	1423	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	$ 2,337,100.00	$ 2,337,100.00	$ 332,900.00	2037110016	1435	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	$ 1,994,900.00	$ 1,994,900.00	$ 394,600.00	2037110017	1449	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	$ 1,517,800.00	$ 1,517,800.00	$ -	2037110018	1465	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	$ 1,622,600.00	$ 686,916.00	$ 137,700.00	2037110019	1481	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	$ 2,871,200.00	$ 2,871,200.00	$ 1,431,600.00	2037140018	1505	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	$ 1,332,500.00	$ 1,332,500.00	$ 144,600.00	2037140019	1515	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	$ 2,538,800.00	$ 2,067,537.00	$ 986,500.00	2037140021	1545	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	$ 17,617,400.00	$ 16,524,291.00	$ 8,703,000.00	2037120001	1253	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
14	$ 6,703,500.00	$ 4,340,305.00	$ 1,541,800.00	2037130009	1212	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	$ 4,865,200.00	$ 896,652.00	$ 304,800.00	2037130007	1226	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	$ 11,276,700.00	$ 4,502,809.00	$ 1,218,200.00	2037130004	1274	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
17	$ 8,174,500.00	$ 8,174,500.00	$ 2,784,400.00	2037130003	1310	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	$ 11,456,300.00	$ 4,969,388.00	$ 2,093,400.00	2037130001	1410	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	$ 5,218,400.00	$ 932,000.00	$ 76,900.00	2037140015	1430	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	$ 8,044,400.00	$ 7,937,252.00	$ 3,536,300.00	2037140012	1486	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
21	$ 8,659,600.00	$ 1,877,467.00	$ 14,500.00	2037140010	1500	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	$ 1,209,000.00	$ 787,507.00	$ 129,600.00	2037140005	1560	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
23	$ 981,400.00	$ 481,400.00	$ 7,500.00	2037140004	1570	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
24	$ 1,747,500.00	$ 1,747,500.00	$ 378,900.00	2037110022	1708	Flower Dr	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
25	$ 2,188,700.00	$ 1,621,881.00	$ 796,600.00	2037110023	1630	Flower Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
26	$ 1,736,400.00	$ 1,736,400.00	$ 257,800.00	2037110024	1572	Harbor Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
27	$ 2,702,700.00	$ 1,135,934.00	$ 481,500.00	2037110025	1550	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	$ 3,771,900.00	$ 3,771,900.00	$ 1,944,500.00	2037060034	1526	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	$ 2,009,300.00	$ 1,086,965.00	$ 494,000.00	2037060035	1500	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	$ 2,327,400.00	$ 1,930,529.00	$ 782,600.00	2037060036	1444	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	$ 2,687,800.00	$ 1,926,025.00	$ 1,382,400.00	2037060044	1388	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	$ 2,799,000.00	$ 2,799,000.00	$ 1,362,500.00	2037060045	1386	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	$ 3,037,100.00	$ 3,037,100.00	$ 1,447,500.00	2037050008	1382	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	$ 2,869,200.00	$ 2,869,200.00	$ 1,007,400.00	2037050009	1380	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	$ 4,086,700.00	$ 3,586,147.00	$ 1,358,100.00	2037050010	1378	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	$ 4,544,000.00	$ 811,339.00	$ 175,800.00	2037050011	1376	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	$ 5,994,400.00	$ 5,040,645.00	$ 1,562,100.00	2037050013	1372	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	$ 6,522,300.00	$ 4,366,384.00	$ 2,127,300.00	2037040005	1370	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	$ 6,886,900.00	$ 5,507,195.00	$ 2,465,200.00	2037040007	1366	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	$ 4,758,700.00	$ 928,655.00	$ 303,200.00	2037040010	1360	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	$ 4,582,400.00	$ 4,582,400.00	$ 2,820,100.00	2037030020	1356	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	$ 1,960,600.00	$ 884,079.00	$ 567,200.00	2037030021	1354	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	$ 2,401,200.00	$ 2,004,159.00	$ 1,068,200.00	2037030022	1352	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	$ 2,007,000.00	$ 1,055,858.00	$ 600,100.00	2037030024	1348	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	$ 1,793,900.00	$ 1,650,408.00	$ 393,000.00	2037030025	1346	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	$ -	$ -	$ -	2037-03-0026		no info online	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	$ 1,812,300.00	$ 1,419,972.00	$ 486,100.00	2037030028	1340	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	$ 1,231,600.00	$ 837,716.00	$ 515,700.00	2037030014	1351	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	$ 2,093,100.00	$ 2,093,100.00	$ 1,272,300.00	2037030012	1347	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	$ 1,661,700.00	$ 1,644,404.00	$ 840,000.00	2037030013	1349	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	$ 712,200.00	$ 261,023.00	$ 8,000.00	2037030015	1355	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	$ 2,037,500.00	$ 2,037,500.00	$ 1,292,000.00	2037030016	1357	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	$ 985,100.00	$ 985,100.00	$ 242,100.00	2037030017	1359	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
54	$ 2,024,500.00	$ 2,024,500.00	$ 1,214,700.00	2037040001	1361	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
55	$ 2,337,100.00	$ 2,103,603.00	$ 1,523,200.00	2037040002	1365	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	$ 725,400.00	$ 725,400.00	$ -	2037040003	1369	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	$ 849,200.00	$ 454,631.00	$ 145,500.00	2037050002	1379	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	$ 1,083,800.00	$ 767,929.00	$270,100	2037050003	1381	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	$ 889,800.00	$ 338,110.00	$ 172,100.00	2037030001	1387	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	$ 867,900.00	$ 250,101.00	$ 160,400.00	2037030002	1389	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	$ 1,356,100.00	$ 1,165,899.00	$ 615,900.00	2037030003	1391	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	$ 882,400.00	$ 274,296.00	$ 129,200.00	2037030004	1393	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	$ 1,197,300.00	$ 556,502.00	$ 347,700.00	2037030005	1395	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	$ 2,011,800.00	$ 1,881,676.00	$ 1,185,900.00	2037060029	1433	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	$ 843,600.00	$ 287,051.00	$ 149,000.00	2037060031	1519	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	$ 741,800.00	$ 306,910.00	$ 128,900.00	2037060032	1535	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	$ 1,054,000.00	$ 1,046,540.00	$ 259,000.00	2037110028	1561	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	$ 222,816,500.00	$ 155,399,362.00	$ 66,322,400.00				0	0	5	0	0	6	0	0	6	0	0	6	0	0	6	0	0	10

Alternative 5 Data Entry

							2-Year Event			5-Year Event			10-Year Event			25-Year Event			50-Year Event			100-Year Event		
ID	Just Property Value	Assessed Value	Building	Property PID	Address Number	Address Street	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain	Assessed Builidng Value	Flooded Structure	In Horizontal Floodplain
1	$ 8,380,600.00	$ 2,487,882.00	$ 18,100.00	2037120007	1317	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	$ 2,082,600.00	$ 1,582,600.00	$ 429,700.00	2037120010	1329	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	$ 3,652,800.00	$ 3,652,800.00	$ 1,955,200.00	2037120011	1333	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	$ 1,757,200.00	$ 1,757,200.00	$ -	2037120012	1337	Vista Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	$ 7,708,700.00	$ 6,145,690.00	$ 5,347,300.00	2037110015	1423	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	$ 2,337,100.00	$ 2,337,100.00	$ 332,900.00	2037110016	1435	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	$ 1,994,900.00	$ 1,994,900.00	$ 394,600.00	2037110017	1449	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	$ 1,517,800.00	$ 1,517,800.00	$ -	2037110018	1465	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	$ 1,622,600.00	$ 686,916.00	$ 137,700.00	2037110019	1481	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	$ 2,871,200.00	$ 2,871,200.00	$ 1,431,600.00	2037140018	1505	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	$ 1,332,500.00	$ 1,332,500.00	$ 144,600.00	2037140019	1515	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	$ 2,538,800.00	$ 2,067,537.00	$ 986,500.00	2037140021	1545	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	$ 17,617,400.00	$ 16,524,291.00	$ 8,703,000.00	2037120001	1253	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	$ 6,703,500.00	$ 4,340,305.00	$ 1,541,800.00	2037130009	1212	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	$ 4,865,200.00	$ 896,652.00	$ 304,800.00	2037130007	1226	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	$ 11,276,700.00	$ 4,502,809.00	$ 1,218,200.00	2037130004	1274	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	$ 8,174,500.00	$ 8,174,500.00	$ 2,784,400.00	2037130003	1310	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	$ 11,456,300.00	$ 4,969,388.00	$ 2,093,400.00	2037130001	1410	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	$ 5,218,400.00	$ 932,000.00	$ 76,900.00	2037140015	1430	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	$ 8,044,400.00	$ 7,937,252.00	$ 3,536,300.00	2037140012	1486	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
21	$ 8,659,600.00	$ 1,877,467.00	$ 14,500.00	2037140010	1500	Hillview Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	$ 1,209,000.00	$ 787,507.00	$ 129,600.00	2037140005	1560	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
23	$ 981,400.00	$ 481,400.00	$ 7,500.00	2037140004	1570	Hillview Dr	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
24	$ 1,747,500.00	$ 1,747,500.00	$ 378,900.00	2037110022	1708	Flower Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	$ 2,188,700.00	$ 1,621,881.00	$ 796,600.00	2037110023	1630	Flower Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	$ 1,736,400.00	$ 1,736,400.00	$ 257,800.00	2037110024	1572	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	$ 2,702,700.00	$ 1,135,934.00	$ 481,500.00	2037110025	1550	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	$ 3,771,900.00	$ 3,771,900.00	$ 1,944,500.00	2037060034	1526	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	$ 2,009,300.00	$ 1,086,965.00	$ 494,000.00	2037060035	1500	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	$ 2,327,400.00	$ 1,930,529.00	$ 782,600.00	2037060036	1444	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	$ 2,687,800.00	$ 1,926,025.00	$ 1,382,400.00	2037060044	1388	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	$ 2,799,000.00	$ 2,799,000.00	$ 1,362,500.00	2037060045	1386	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	$ 3,037,100.00	$ 3,037,100.00	$ 1,447,500.00	2037050008	1382	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	$ 2,869,200.00	$ 2,869,200.00	$ 1,007,400.00	2037050009	1380	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	$ 4,086,700.00	$ 3,586,147.00	$ 1,358,100.00	2037050010	1378	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	$ 4,544,000.00	$ 811,339.00	$ 175,800.00	2037050011	1376	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	$ 5,994,400.00	$ 5,040,645.00	$ 1,562,100.00	2037050013	1372	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	$ 6,522,300.00	$ 4,366,384.00	$ 2,127,300.00	2037040005	1370	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	$ 6,886,900.00	$ 5,507,195.00	$ 2,465,200.00	2037040007	1366	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	$ 4,758,700.00	$ 928,655.00	$ 303,200.00	2037040010	1360	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	$ 4,582,400.00	$ 4,582,400.00	$ 2,820,100.00	2037030020	1356	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	$ 1,960,600.00	$ 884,079.00	$ 567,200.00	2037030021	1354	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	$ 2,401,200.00	$ 2,004,159.00	$ 1,068,200.00	2037030022	1352	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	$ 2,007,000.00	$ 1,055,858.00	$ 600,100.00	2037030024	1348	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	$ 1,793,900.00	$ 1,650,408.00	$ 393,000.00	2037030025	1346	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	$ -	$ -	$ -	2037030026		no info online	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	$ 1,812,300.00	$ 1,419,972.00	$ 486,100.00	2037030028	1340	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	$ 1,231,600.00	$ 837,716.00	$ 515,700.00	2037030014	1351	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	$ 2,093,100.00	$ 2,093,100.00	$ 1,272,300.00	2037030012	1347	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	$ 1,661,700.00	$ 1,644,404.00	$ 840,000.00	2037030013	1349	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	$ 712,200.00	$ 261,023.00	$ 8,000.00	2037030015	1355	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	$ 2,037,500.00	$ 2,037,500.00	$ 1,292,000.00	2037030016	1357	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	$ 985,100.00	$ 985,100.00	$ 242,100.00	2037030017	1359	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	$ 2,024,500.00	$ 2,024,500.00	$ 1,214,700.00	2037040001	1361	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	$ 2,337,100.00	$ 2,103,603.00	$ 1,523,200.00	2037040002	1365	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	$ 725,400.00	$ 725,400.00	$ -	2037040003	1369	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	$ 849,200.00	$ 454,631.00	$ 145,500.00	2037050002	1379	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	$ 1,083,800.00	$ 767,929.00	$270,100	2037050003	1381	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	$ 889,800.00	$ 338,110.00	$ 172,100.00	2037030001	1387	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	$ 867,900.00	$ 250,101.00	$ 160,400.00	2037030002	1389	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	$ 1,356,100.00	$ 1,165,899.00	$ 615,900.00	2037030003	1391	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	$ 882,400.00	$ 274,296.00	$ 129,200.00	2037030004	1393	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	$ 1,197,300.00	$ 556,502.00	$ 347,700.00	2037030005	1395	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	$ 2,011,800.00	$ 1,881,676.00	$ 1,185,900.00	2037060029	1433	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	$ 843,600.00	$ 287,051.00	$ 149,000.00	2037060031	1519	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	$ 741,800.00	$ 306,910.00	$ 128,900.00	2037060032	1535	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	$ 1,054,000.00	$ 1,046,540.00	$ 259,000.00	2037110028	1561	Harbor Dr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	$ 222,816,500.00	$ 155,399,362.00	$ 66,322,400.00				0	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	0	3

Appendix E

Whitaker Bayou Analysis Report by Stantec Consulting Services Inc., dated 2020.

Appendix F

The Cost Benefit Analysis for Stormwater Projects Report by Stantec Consulting Services Inc., dated 2018.

Stantec

A Proposed Cost-Benefit Analysis for Stormwater Projects

MANUAL FOR COSTS AND BENEFITS FOR FLOOD AND WATER QUALITY PROJECTS

November 9, 2018

Prepared for:

Sarasota County Stormwater Division

Prepared by:

Stantec Consulting Services Inc.

Sign-off Sheet

This document entitled A Proposed Cost Benefit Analysis for Stormwater Projects was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Sarasota County Stormwater Division (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ____

(signature)

Molly Williams, PE

Reviewed by ____

(signature)

Scott McKenna, PE

Approved by ____

(signature)

Kelly Smith, PE

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LIST OF TABLES

LIST OF APPENDICIES

EXECUTIVE SUMMARY

Based on the Cost Benefit Analysis adopted by the Board of County Commissioners on December 5, 2000, the Sarasota County Stormwater Division applies a cost benefit analysis to proposed capital projects to determine if the project will provide stormwater management improvements for a cost-effective investment. The County contracted with Stantec to update the white paper titled *Projecting Damages Associated with Flooding: A Proposed Cost-Effective Analysis for Stormwater Projects* as presented to the Board of County Commissioners in an Interoffice Memorandum dated December 5, 2000.

In certain instances, even if a project's costs exceed the tangible benefits of flood control, the County may determine the project provides public value supported by numerous intangible benefits such as health, safety, and community support. These intangibles should be given consideration on a case by case basis when deciding whether to go forward with a project.

To update the Sarasota County specific multipliers for building and content damage, Stantec analyzed nearly 800 FEMA claims (historic flood damage costs) for Sarasota County that were made during rain events. The available claim data ranges from 1978 to 2016 and provide a statistically valid sample to analyze. The analysis showed that the average Sarasota County building damage claim was 12% of the building value and the median claim was 6% of the building value. Analysis of the content damage claims showed that the average claim was between 82% and 87% of the building damage claims.

Revisions included using the most current available data (2015) to update the average automobile cost, number of cars per household, landscape / hardscape cost, per diem cost for displacement from structures, the average household income, and the published 2018 IRS per mile cost for the detours. These values are fixed costs that will need to be updated as more current data becomes available.

The Lost Business Income and Lost Wages due to Closed Business were separated from the Lost Wages for increased accuracy in calculating lost business revenue caused by flooding. Data from the United States Census Bureau - American Fact Finder website was used to derive the average daily commercial revenue for Sarasota County; the average number of employees per business in Sarasota County; and the average wages in Sarasota County.

Each project under evaluation will require the following project specific data:

1. AV - assessed property values
2. FS - number of flooded residential structures
3. HFP - number of residential structures within the horizontal floodplain
4. CFS - number of flooded commercial structures
5. CHFP - number of commercial structures within the horizontal floodplain
6. RD - road detour costs
7. PW - public works costs
8. FI - flood insurance costs

In addition to the updates, the cost-benefit analysis has been expended to include water quality benefits. The methodology follows the Southwest Florida Water Management District criteria used to evaluate cooperative grant funding projects.

The water quality benefit calculations will require the following project specific data:

1. Total area treated (acres)
2. Total nitrogen (N) removed / year (lbs)
3. Total phosphorus (P) removed / year (lbs)
4. Total suspended solids (TSS) removed / year (lbs)

Intangible benefits including public perception and political climate along with benefits such as health, safety, and community support continue to be considered for proposed projects.

1.0 PROJECTING DAMAGES ASSOCIATED WITH FLOODING

1.1 INTRODUCTION

Stantec was contracted to update the white paper titled Projecting Damages Associated with Flooding: A Proposed Cost-Effective Analysis for Stormwater Projects as presented in an Interoffice Memorandum dated December 5, 2000 submitted to the Sarasota County Board of County Commissioners for their information. The document is included as Appendix A.

Based on information in the original memo developed in 2000, the Cost Benefit analysis was updated for current costs and conditions. Projecting avoided damages by reducing structure and street flooding will allow the Stormwater Division to determine if proposed Capital Improvement Program (CIP) projects are cost-effective by comparing the cost of the proposed project to the amount of damages avoided by flood level reductions attributed to the project. The County has contracted with Stantec to update the Cost Benefit Analysis using available FEMA repetitive loss data, for current economic conditions, and expand the analysis to include Water Quality Benefits.

The County continues to strive towards providing the Level of Service (LOS) for flood protection adopted by the Board of County Commissioners. The Stormwater CIP is predicated on LOS criteria established in the Comprehensive Plan. Primarily, the criteria prohibits the flooding of any habitable structure, residential or commercial. Recognizing that roadways remaining passable during the design rain event is a reasonable and realistic expectation of the citizens, the LOS also sets allowable roadway flooding depths for various classifications of roadways. This LOS provides a higher level of security and comfort to the general population and especially those in need of emergency services.

1.2 COMPONENTS OF AVOIDED DAMAGE CALCULATIONS

Review of the original cost-effective analysis, several factors must be considered when projecting costs that are associated with flood events. **Table 1-1** shows the components than have been incorporated. Methodologies to determine the tangible damage for each of these components will be discussed in the following sections.

Table 1-1: Factors considered on projecting cost calculations.

Abbreviation	Component	Description
BD	Building Damage	Structural Damage associates with flooded structures.
CD	Content Damage	Damage associated with contents of flooded structures.
AD	Automobile Damage	Damage to flooded vehicles.
PD	Exterior Property Damage	Damage to landscape / hardscape and flooded lots.
DISF	Displacement Costs for Flooded Structures	Per diem cost associated with uninhabitable structures.
DIS	Displacement Costs for Structures in the Horizontal Floodplain	Per Diem cost associated with non-accessible structures, but structure not flooded.
LW	Lost Wages due to Residential Flooding	Costs associated with time off from work due to residential flooding.
LBI	Lost Business Income	Costs associated with loss of commercial business income due to flooding.
LWB	Lost Wages due to Closed Business	Costs associated with employee time off from work due to business flooding.
RD	Road Detour Costs	Costs associated with detouring traffic due impassable to street flooding.
PW	Public Works Costs	Cost incurred by public entity to maintain traffic detours and public safety because of flooding events.
FI	Flood Insurance Costs	Avoided flood insurance premiums if a structure is removed from the Special Flood Hazard Area (SFHA).

1.3 EVALUATION OF FLOOD INSURANCE CLAIMS IN SARASOTA COUNTY

FEMA's statistics are based on nation-wide data from flood insurance claims. Nationwide data does not accurately represent flood damages for southwest Florida. Evaluation of flood claims in Sarasota County account for one-story homes with no basement or second story and residential properties with ground level storage sheds. Content damage or structure damage incurred by single-story structures would be higher than those with multiple levels.

To evaluate historic flood damage costs in Sarasota County, Stantec analyzed nearly 800 FEMA claims for Sarasota County that were made during rain events. The available claim data ranges from 1978 to 2016 and is a statistically valid sample to analyze. Flood claims evaluated for the following:

1. Structural Damage Claim amount as a percentage of the Building Value of the Home.
2. Content Damage Claim amount as a percentage of the Structural Damage Claim.

The analysis showed that the average Structural Damage Claim was 12% of the building value of the home and the median claim was 6%.

Analysis of the Content Damage Claims showed that the average claim was between 82% and 87% of the Structural Damage Claim. Summary of the FEMA flood claim data for Sarasota County in included in Appendix B and the summary for the City of Sarasota flood claim data is included in Appendix C.

1.3.1 Damage Calculations by Component

A component summary sheet is included as Appendix D. Additional information is included below:

1.3.1.1 Building Damages (BD)

BD = 0.12 * AV * 1.25

0.12 = Sarasota County specific multiplier for building damage
AV = Assessed value of property (building only)
1.25 = Multiplier for assessed value

1.3.1.2 Content Damages (CD)

CD = 0.86 * BD

0.86 = Sarasota County specific multiplier for content damage
BD = Building Damages

1.3.1.3 Automobile Damages (AD)

AD = $25,000 * 2 * 0.075 * #FS

$25,000 = Replacement value of a car

2 = Number of cars per residence
0.075 = Average damage expected as a percent of the value of a car.
#FS = Number of flooded structures.

In calculating potential automobile damage, consideration should be given to garage/carport elevation (rather than habitable finished floor elevation).

Average cost of a car in Sarasota County was derived from information on the following website:

https://www.numbeo.com/cost-of-living/in/Sarasota

Transportation		Range	
Volkswagen Golf 1.4 90 KW Trendline (Or Equivalent New Car)	18,525.00 $	15,000.00	22,050.00
Toyota Corolla 1.6l 97kW Comfort (Or Equivalent New Car)	24,050.33 $	18,151.00	35,000.00

The information from the Numbeo website is included as Appendix E.

1.3.1.4 Exterior Property Damages (PD)

PD = $2,000 * # HFPL

$2,000 = Expected damage to landscaping / hardscaping or exterior of property
HFPL = Number of lots in the horizontal floodplain

All properties within the horizontal limits of the event floodplain are subject to Exterior Property Damages. Exterior Property Damages includes cost of restoration of landscaping and hardscape include costs such as debris removal, yard work, possible loss of mature trees, restoration of paver and other impervious surfaces, and improvements to onsite drainage. Costs specifically associated with Exterior Property Damages were not readily available but were estimated at $2,000 per flooded property.

1.3.1.5 Displacement Costs for Flooded Structures (DISF)

DISF = $250/day * # Fdays * # FS

$250 = Per diem costs to be displaced from residence
Fdays = 14 days for flooded structures to restore residence to habitable state
FS = Number of flooded structures

The residents of flooded structures are displaced for the duration of standing floodwaters and for a period after the waters recede for cleanup of their homes. A conservative estimate of 14 days at a cost of $250 per day was used. It should be noted that displacement costs are for a time period where the structure may not be accessible due to flood waters and time required for initial clean up. The displacement cost does not reflect the time for full restoration of the structure as the structure may be habitable while reconstruction is in progress.

1.3.1.6 Displacement Costs for Structures in the Floodplain (DIS)

DIS = $250/day * #Ddays * # HFP

$250 = Per diem costs to be displaced from residence (inaccessible)
Ddays = 2 days for displaced residents
HFP = Number of structures in horizontal floodplain

The residents of structures in the horizontal limits of the floodplain are displaced for the duration of standing floodwaters. An estimate of 2 days at a cost of $250 per day was used.

1.3.1.7 Lost Wages due to Residential Flooding (LW)

LW = $56,286 * 8 / 2080 *[(# HFP * # Ddays) + (# FS * #Fdays)]

$56,286 = Average household income
8 = Work hours per day
2080 = Work hours per year
# HFP = Number of structures in the horizontal floodplain
# Ddays = 2 days for displaced residents
# FS = Number of flooded structures
# Fdays = 14 days for flooded structures to restore residence to habitable state

The Lost Wages calculation is based on the most current Median Household Income (2015) for Sarasota County as reported by DATA USA at the following website:

https://datausa.io/profile/geo/sarasota-county-fl/

Basic data from the DATA USA website is included as Appendix F. It is understood that there are areas of Sarasota County where salaries may be higher or lower than average, but actual salaries are not known without requesting information from individuals in the project area.

Lost wages represent the economic impact on residents when they miss work due to flooding.

1.3.1.8 Lost Business Income (LBI)

LBI = $5,104 *[(#CHFP * #Ddays) + (#CFS * #Fdays)]

$5,104 = Average daily commercial revenue for Sarasota County firms with paid employees
#CHFP = Number of commercial displaced structures in the horizontal floodplain
#Ddays = 2 days lost due to commercial displaced structures
#CFS = Number of commercial flooded structures
#Fdays = 14 days lost due to commercial flooded structures

The Lost Business Income calculation is based on the most current Average Annual Revenue (2012) published in 2015 for Sarasota County derived from the data reported by American Fact Finder at the following website:

https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

Geographic area name	2012 NAICS code	Meaning of 2012 NAICS code	Meaning of Gender code	Meaning of Ethnicity code	Meaning of Race code	Year	Number of firms with or without paid employees	Sales, receipts, or value of shipments of firms with or without paid employees ($1,000)	Data Used for Average Daily Commercial Revenue: Number of firms with paid employees	Data Used for Average Daily Commercial Revenue: Sales, receipts, or value of shipments of firms with paid employees ($1,000)
Sarasota County, Florida	00	Total for all sectors	All firms	All firms	All firms	2012	43,592	21,968,226	10,918	20,339,106

Lost Business Income represents lost opportunity for commercial business or industrial sites that are flooded. Basic data from the American Fact Finder website is included as Appendix G.

1.3.1.9 Lost Wages due to Closed Business (LWB)

LWB = 10 * 8 * $19.35 *[(#CHFP * #Ddays) + (#CFS * #Fdays)]

10 = Average employees per business
8 = Work hours per day
$19.35 = Average Sarasota County payroll (hourly rate)
#CHFP = Number of commercial displaced structures in the horizontal floodplain
#Ddays = 2 Days lost due to commercial displaced structures
#CFS = Number of commercial flooded structures
#Fdays = 14 Days lost due to commercial flooded structures

The Lost Wages due to Closed Business calculation is based on the most current statistics published for Sarasota County. The Average Sarasota County Payroll Hourly Rate was derived from the data reported by American Fact Finder at the following website:

https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

Geographic area name	2012 NAICS code	Meaning of 2012 NAICS code	Year	Data Used for Average Hourly Wages and Average Employees per Business: Number of establishments	Paid employees for pay period including March 12 (number)	First-quarter payroll ($1,000)	Annual payroll ($1,000)
Sarasota County, Florida	00	Total for all sectors	2015	13,405	137,827	1,335,703	5,547,522

It should be noted that not all residents who work in Sarasota County live in Sarasota County and that income values used for Lost Wages due to Residential Flooding are based on Sarasota County Average Household Income. Lost Wages due to Closed Business represents lost opportunity for employees of commercial business or industrial sites that are flooded. Basic data from the American Fact Finder website is included as Appendix G.

1.3.1.10 Road Detour Costs (RD)

RD = RDI + RDV

RDI, Income lost due to road detour
RDI = (Detour Length / Avg. Speed) * Avg. Hourly Salary * AADT * # Days
RDV, Vehicle/Mileage costs due to road detours
RDV = Detour Length * AADT * # of Days * $/mile

Table 1-2: Elements of Road Detour Cost (RD).

Value	Description	Source
Detour Length	Length of Detour in miles	GIS Detour Route
Avg. Speed	20 miles per hour	Assumed Value
Avg. Hourly Salary (Household)	$27.06/hour	Data USA: https://datausa.io/profile/geo/sarasota-county-fl/
AADT	Annual Average Daily Traffic	Traffic Operations
# Ddays	Number of Days Detour is in Effect	Maximo Data
$/Mile	$0.545 per mile	IRS Notice 18-03

Each flooded roadway segment is to be evaluated to determine the most feasible detour route to minimize the traffic affected by the detour. The $0.545 per mile rate is the IRS standard for 2018. This rate would be adjusted annually as the IRS adjusts the published rate. The IRS Notice 18-03 2018 Standard Mileage Rates is included as Appendix H.

1.3.1.11 Public Works Costs (PW)

Public Works Costs include setting the detours, maintenance of the detours, emergency maintenance during the storm event, reconstruction of roadways damaged due to standing flood waters, manpower to answer phones and inspect complaints resulting from the storm event. For a specific project, the cost ranges from $2,000 to $100,000 depending on the duration of the flooding, the length and number of roadway segments, and structures affected by the flooding.

1.3.1.12 Flood Insurance Costs (FI)

Mortgage companies require homeowners in FEMA's Special Flood Hazard Area to carry flood insurance during the life of the mortgage. Rates are dependent on the age of the structure and how far the finished floor elevation is below the 100-year flood elevation. If a structure is removed from the vertical floodplain they receive the benefit of avoiding the mandatory flood insurance costs. The homeowner may decide to keep flood insurance, but the rate will be lower. The average rate of flood insurance for a structure within the floodplain is 1% of the value of the home annually.

FI = Avg SV * 0.01 * # FS

Avg SV = Average value of structures in horizontal floodplain
0.01 = 1% of the value of structures
#FS = Number of flooded structures

1.3.2 Annualized Damages

To determine a present worth cost of avoided damages if a project were built today, the estimated damages for each interval rainfall event were calculated and multiplied by the probability that the event will happen in any given year. For example, a 100-year rainfall event has a 1% (0.01) probability of occurring in a given year; 2% for the 50-year rainfall event; 4% for the 25-year event; and 10% for the 10-year rainfall event. The Stormwater Division's standard scope for Basin Master Plans does not include modeling of the 50-year rain event. Therefore, recognizing that 50-year event would have tangible damages, the cost was estimated by subtracting the 25-year damages from the 100-year damages, dividing by 3 and adding to the 25-year damages. An analysis of projects where the 50-year flood event information was available and found this to be an accurate representation of the 50-year damages.

Avoided Flood Insurance costs are included as an annualized cost, since the expenses are not related to the probability of a rainfall event. Residential structures that would be removed from the 100-year floodplain will be required to pay these annual premiums if they have a mortgage on their home. The sum of the annualized avoided damages is then calculated to determine a present worth value.

1.3.3 Present Worth Analysis

The Present Worth of the Total Expected Annual Damages is calculated:

P = A [(1 + i)n – 1] / [i * (1 + i)n] where

P = Present worth
A = Total expected annual damages
i = Interest rate = 5%, the average rate of return on municipal bonds
n = 30-year Project Life per County Stormwater Ordinance

1.3.4 Summary of Avoided Damage Analysis

The present worth value should be considered a guide when evaluating the cost-effectiveness of a project. It should be noted this method is sensitive to assessed value of homes as well as the volume of traffic on flooded roadways. While this value represents an educated guess of the economic impact resulting from project, there are invariably other intangible benefits associated with a project that may need to be considered, such as quality of life benefits.

1.3.5 Acquisitions and Elevations

FEMA has issued a memorandum regarding the Cost Effectiveness Determinations for Acquisitions and Elevations in Special Flood Hazard Areas and has determined that "the acquisition or elevation of a structure located in the 100-year floodplain (as delineated on the Flood Insurance Rate Map or based on best available data) that costs less than or equal to the amount of benefits…is considered cost effective." The determined benefit for an acquisition is $276,000 and the determined benefit for an elevation project is $175,000. In the past, Sarasota County has not considered acquisition as a mitigation strategy for reducing flood risk. With the implementation of the Basin Master Plans and the construction of Flood Control projects throughout the County that have reduced the flood risk due to riverine rainfall events, the County should consider acquisition as an option to reduce future flood risk.

1.3.6 Intangible Factors

Currently, a weighting system for intangible benefits has not been developed and has not performed a sensitivity analysis of projects to determine how weights would affect a cost-effective analysis. Due to the high degree of judgement that would be needed, it is reasonable to acknowledge the intangible factors without assigning a dollar figure to be included in any type of economic analysis. Some examples of these intangible factors include, but are not limited to:

- Health Factors, such as ability to use septic systems
- Safety Factors, such as access by Emergency Vehicles
- Community Support for a Project
- Public Perception of a Stormwater Problem
- Board Policy for Addressing Stormwater Needs

In certain instances, even if a project's costs exceed the tangible benefits of flood control, it may still be a worthwhile project if it has numerous intangible benefits such as health, safety, and community support. These intangibles should be given consideration on a case by case basis when deciding whether to go forward with a project.

2.0 QUANTIFYING WATER QUALITY BENEFITS

2.1 INTRODUCTION TO WATER QUALITY IMPROVEMENT COST EFFECTIVENESS

Funding agencies, such as the Southwest Florida Water Management District (SWFWMD), have begun to evaluate water quality improvement projects based on the cost of the project and the expected cost per pound of pollutant removed and/or the cost per acre of implementing the project. The water quality cost-benefit matrix developed by SWFWMD for project evaluation is currently the most relevant such analysis for evaluating projects proposed in Sarasota County.

Cost Effectiveness (CE) is calculated as follows:

CE = (Total cost of project*/20 years)/ (pound of pollutant reduced/year) = $/lb reduction

*Total project cost includes design costs. SWFWMD water quality benefits are based on a 20-year project life for the purpose of cooperative funding.

2.1.1 The SWFWMD Cost Effectiveness Matrix

The SWFWMD cost effectiveness matrix currently in use to rank water quality improvement projects was developed by District staff in approximately 2013-2014. A new study to formalize and update cost benefit criteria was contracted by the District with The Balmoral Group, but the results of that study, completed in October 2017, have not yet been adopted by the District and it has not yet been decided if the study will be adopted for use in SWFWMD's Cooperative Funding Initiative (CFI) program. It is also unknown whether the data used by District staff were normalized for a particular years' dollars based on the Consumer Price Index (CPI), or if the current SWFWMD-developed matrix values will be updated using the CPI or updated with new project numbers as the years progress. If the Balmoral study is adopted, it is unknown if or how often the dollar values from the study will be updated. A copy of the email communication with SWFWMD is provided as Appendix I. **Tables 2.1 and 2.2** below detail cost effectiveness ranking criteria currently in use for projects proposed for SWFWMD cooperative funding.

Table 2.1 – Current (March 2018) SWFWMD High, Medium and Low-ranking criteria for Urban/Suburban project types.

Urban/Suburban Projects	High Rank	Medium Rank	Low Rank
Water Quality BMP Implementation (TN target pollutant)	Cost/lb TN $224 or less and Cost/acre $8,050 or less	High rank for Cost/lb and Low rank for Cost/acre or Low rank for Cost/lb and High rank for Cost/acre	Cost/lb TN more than $224 and Cost/acre more than $8,050

Urban/Suburban Projects	High Rank	Medium Rank	Low Rank
Water Quality BMP Implementation (TP target pollutant)	Cost/lb TP $896 or less and Cost/acre $8,050 or less	High rank for Cost/lb and Low rank for Cost/acre or Low rank for Cost/lb and High rank for Cost/acre	Cost/lb TP more than $896 and Cost/acre more than $8,050
Water Quality BMP Implementation (TSS target pollutant)	Cost/lb TSS $12 or less and Cost/acre $8,050 or less	High rank for Cost/lb and Low rank for Cost/acre or Low rank for Cost/lb and High rank for Cost/acre	Cost/lb TSS more than $12 and Cost/acre more than $8,050

Table 2-2 – Current (March 2018) SWFWMD High, Medium and Low-ranking criteria for Coastal/LID project types.

Coastal/LID Projects	High Rank	Medium Rank	Low Rank
Water Quality BMP Implementation (TN target pollutant)	Cost/lb TN $646 or less and Cost/acre $46,947 or less	High rank for Cost/lb and Low rank for Cost/acre or Low rank for Cost/lb and High rank for Cost/acre	Cost/lb TN more than $646 and Cost/acre more than $46,947
Water Quality BMP Implementation (TP target pollutant)	Cost/lb TP $4,715 or less and Cost/acre $46,947 or less	High rank for Cost/lb and Low rank for Cost/acre or Low rank for Cost/lb and High rank for Cost/acre	Cost/lb TP more than $4,715 and Cost/acre more than $46,947
Water Quality BMP Implementation (TSS target pollutant)	Cost/lb TSS $20 or less and Cost/acre $46,947 or less	High rank for Cost/lb and Low rank for Cost/acre or Low rank for Cost/lb and High rank for Cost/acre	Cost/lb TSS more than $20 and Cost/acre more than $46,947

2.1.2 SWFWMD Cost Effectiveness Study – The Balmoral Group

The SWFWMD funded study conducted by The Balmoral Group in 2017 and the factors considered in the development of the water quality cost-benefit matrix developed by the study, which may or may not be adopted by SWFWMD, to rank proposed projects for possible funding will be discussed. While not yet adopted by SWFWMD, the information is presented here because the Balmoral report findings might be adopted at any time and, if adopted, would be used for future projects.

The cost-effectiveness chart developed by The Balmoral Group used the total, actual project cost (including design costs) divided by 20 years and compared the estimated load reductions expected for TN, TP or TSS in the same calculation shown above. Costs for past projects were adjusted to 2017 dollars, which should be kept in mind as the years progress. It is unknown whether if or how often SWFWMD will update the costs used in this ranking matrix, if it is adopted for use.

The matrix divides cost effectiveness into Urban/Suburban groupings and the distance from the coast used to distinguish which group a project falls under was determined to be 1,500 meters (4,921 feet), based on how far inland proximity to the coast significantly increases property values. However, the report does recommend that site specific information be considered before automatically applying the 1,500-meter distance criteria.

The process that The Balmoral Group used in determining the thresholds for high or low-cost effectiveness was developed by collecting data from projects conducted by SWFWMD as well as projects conducted by other agencies. To be included in the evaluation, each project needed to have information regarding a load reduction estimate for TN, TP or TSS, a total actual project cost, known project location and a description of Best Management Practices (BMPs) implemented for the project. A total of 67 SWFWMD projects (internal) and 71 (external) projects from other agencies were used for the final economic analysis. Ultimately, only SWFWMD (internal) projects were used to develop the high, medium and low-ranking cost benefit ranges in the Balmoral report because the external data showed significantly smaller values for cost effectiveness than the SWFWMD data.

The ranges developed by The Balmoral Group for ranking projects are presented here in **Tables 2-3 and 2-4** in case they are adopted by SWFWMD for future use; however, these numbers have not been entered into the cost calculator and ***SHOULD NOT BE USED AT THIS TIME*** because they have not been officially adopted by SWFWMD. Cost effectiveness on a per acre basis was not included in the Balmoral report.

Table 2-3: The Balmoral Group PROPOSED (NOT ADOPTED) High, Medium and Low-ranking criteria for water quality improvement projects for General (non-coastal) project types. Based on cost of past projects for cost/lb of pollutant removed for 20 years.

General (non-coastal) Projects	High Rank	Medium Rank	Low Rank
Water Quality BMP Implementation (TN target pollutant)	Cost/lb TN is < $113	Cost/lb TN ≥$113 and ≤$240	Cost/lb TN >$240
Water Quality BMP Implementation (TP target pollutant)	Cost/lb TP < $791	Cost/lb TP ≥$791 and ≤$2,055	Cost/lb TP >$2,055
Water Quality BMP Implementation (TSS target pollutant)	Cost/lb TSS < $3	Cost/lb TSS ≥$3 and ≤$6	Cost/lb TSS >$6

Table 2-4: The Balmoral Group PROPOSED (NOT ADOPTED) High, Medium and Low-ranking criteria for water quality improvement projects for Coastal project types. Based on cost of past projects for cost/lb of pollutant removed for 20 years.

Coastal Projects	High Rank	Medium Rank	Low Rank
Water Quality BMP Implementation (TN target pollutant)	Cost/lb TN <$547	Cost/lb TN ≥$547 and ≤$1,543	Cost/lb TN >$1,543
Water Quality BMP Implementation (TP target pollutant)	Cost/lb TP <$2,188	Cost/lb TP ≥$2,188 and ≤$4,152	Cost/lb TP >$4,152
Water Quality BMP Implementation (TSS target pollutant)	Cost/lb TSS <$4	Cost/lb TSS ≥$4 and ≤$13	Cost/lb TSS >$13

2.1.2.1 Developing the Cost per Pound Removed or Cost per Acre Treated

There are many examples of projects available, both in design and implemented, for which cost per pound of pollutant removed/per acre treated has been estimated for various project types. However, the actual estimate and actual realization of benefits will be very site specific and must be developed on a case-by-case basis for each new project, and it is recommended that estimates be very conservative, partially due to SWFWMD CFI contract language, wherein repayment may be required if projected benefits are not achieved.

It is advisable to compare Sarasota County project removal estimates developed for a specific project to similar BMP projects in similar land use areas, soil types and climatological regions in Florida. Comparison to projects outside Florida or in regions with different BMPs, land use, soil, climatological and other characteristics may result in estimates that are vastly different than what may be realized in Sarasota County due to these and other factors.

Many of the example projects from Brevard County related to the Indian River Lagoon were considered in the Balmoral report, and the external (non-SWFWMD) project data was determined to be significantly different than cost effectiveness data within the SWFWMD largely due to the Brevard County projects. Again, load removal estimates should be developed separately for each project based on site specific data and should be comparable to other projects conducted within the SWFWMD in order to be considered competitive for SWFWMD funding.

2.1.3 Tangible Benefits Associated with Water Quality Improvements

There are a number of tangible benefits associated with water quality improvements, including:

- Reducing regulatory costs by reducing pollutant loading in impaired water bodies with assigned Total Maximum Daily Loads (TMDLs)
- Prevention of TMDL establishment through preventative measures, also reducing regulatory costs
- Improving water clarity and therefore supporting water-based tourism
- Maintaining healthy fisheries to increase recreational spending in the county
- Averting or reducing health issues associated with water-based recreation, as high nutrient levels can lead to algal blooms and promotion of other organisms that may be harmful to human health
- Reducing maintenance cost of nuisance and exotic plant species, many of which increase in the presence of high nutrients (e.g. cattails)
- Reducing wastewater overflows that occur during flood events

2.1.4 Intangible Benefits Associated with Water Quality Improvements

- Improving wildlife habitat
- Improving the visual aesthetics of water resources as water clarity typical improves when TN, TP, and TSS are reduced
- Improving odors associated with water resources, as high levels of nutrients can cause algal blooms, which can lead to significant odor problems (especially with blue-green algae)
- Improved safety for recreational users when water clarity is improved

APPENDIX A – INTEROFFICE MEMORANDUM DATED DECEMBER 5, 2000

SARASOTA COUNTY GOVERNMENT
PUBLIC WORKS
STORMWATER DIVISION

INTEROFFICE MEMORANDUM

TO: Board of County Commissioners
James L. Ley, County Administrator

THROUGH: Stephen D. Cork, Executive Director, Public Works J Goodsell for

FROM: Francisco B. Domingo, P.E., Acting General Manager, FBD
Public Works Planning

SUBJECT: **Cost Effective Analysis for Stormwater Projects**

DATE: ~~November 8~~ December 5, 2000

BACKGROUND:

During the January 26, 2000 Board Workshop concerning Stormwater Management, staff proposed to utilize a Cost Effective Analysis as a tool in the evaluation of proposed improvement project. On July 31, 2000, a Board report including a white paper on the subject was forwarded to the Board for additional information. Staff indicated that a presentation and discussion of the methodology would be presented at a future Board meeting.

REPORT:

The most recent version of the white paper is attached for your review. No substantive changes were made to the paper since it was given to the Board in late July. Staff will present the formula and explain the elements of it as a discussion item. Staff will also provide specific applications as examples in the presentation.

When utilized in a basin approach, the numbers give staff an indication of anticiapted damages associated with flood events. With that, staff can formulate capital programs with cost value in mind. The key is to put projects in place that produce the most "bang for the buck."

In addition to more easily measured quantifiable factors, project analyses will continue to consider more intangible benefits such as:

- Water Quality Enhancement
- Health Factors (impact on wells, septic systems, etc.)
- Safety Factors (access for emergency services)
- Community Acceptance

This formula combined with the above intangible benefits, was developed to refine existing project analyses and to help formulate decisions concerning future projects.

RECOMMENDATION:

Staff recommends the adoption of this benefit analysis as the decision making tool for future projects.

cc: David R. Bullock, Deputy County Administrator

PROJECTING DAMAGES ASSOCIATED WITH FLOODING
A Proposed Cost-Effective Analysis for Stormwater Projects

SARASOTA COUNTY
STORMWATER ENVIRONMENTAL UTILITY

Introduction

The Sarasota County Stormwater Division has developed a method of projecting damages associated with flood events consistent with methodologies used by other agencies such as the Army Corps of Engineers (ACOE) and the Federal Emergency Management Agency (FEMA). Projecting avoided damages by reducing structure and street flooding will allow Stormwater staff to determine if proposed CIP projects are cost-effective by comparing the cost of the proposed project to the amount of damages avoided by flood level reductions. This methodology has been utilized by staff and presented to the ACOE for the Whitaker Bayou Basin. The ACOE has reviewed and preliminarily approved this methodology.

The County continues to strive towards providing the Level of Service (LOS) for flood protection adopted by the Board of County Commissioners. The Stormwater Capital Improvement Program is predicated on LOS criteria established in the Comprehensive Plan. Primarily, the criteria prohibits the flooding of any habitable structure, residential or commercial. Recognizing that roadways remaining passable during the design rain event is a reasonable and realistic expectation of the citizens, the LOS also sets allowable roadway flooding depths for various classifications of roadways. This LOS provides a higher level of security and comfort to the general population and especially those in need of emergency services.

Components of Avoided Damage Calculations

Several factors must be considered when projecting costs that are associated with flood events. Based on formulas from ACOE and FEMA, the following components have been incorporated:

Connotation	Component	Description
BD	Building Damage	Structural damage associated with flooded residences.
CD	Content Damage	Damage associated with contents of flooded residences.
AD	Automobile Damage	Damage to flooded automobiles.
PD	Exterior Property Damage	Damage to landscaping of flooded lots.
DISF	Displacement Costs for Flooded Structures	Per diem cost associated with uninhabitable residences.
DIS	Displacement Costs for Structures in the Horizontal Floodplain	Per diem costs associated with non-accessible homes, but structure does not flood.
LBI	Lost Wages or Business Income	Costs associated with time off from work and/or lost of commercial business due to flooding.
RD	Road Detour Costs	Costs associated with detouring due to street flooding.
PW	Public Works Cost	Costs incurred by Public Works Department as a result of flooding events.
FI	Flood Insurance Costs	Flood insurance premiums that would be avoided if a structure is removed from the floodplain.

Methodologies to determine the tangible damage for each of these components will be discussed in the following sections.

Evaluation of Flood Insurance Claims in Sarasota County

Both FEMA and ACOE use actuarial tables to determine building damage and content damage based on depth of flooding in the structure. The FEMA method uses a stair-step scale to calculate building damages based on depth of flooding. Their scale starts at 7% of the appraised value of a home for one foot of flooding. ACOE uses a complex computer program that includes formulas for integration of the area under a logarithmic curve based on data developed by ACOE to calculate damages. The statistics used to develop FEMA's and ACOE's formulas are most likely based on nation-wide statistics from flood insurance claims. Staff wanted to be sure that nationwide data accurately represented flood damages for southwest Florida for several reasons including the fact that most homes are one-story homes with no basement or second story. Intuitively it seems that content damage or structure damage incurred by single-story structures would be higher than those with multiple levels.

To verify flood damages in Sarasota County, staff analyzed over 300 FEMA claims for Sarasota County that were made during the extreme rain events of 1992, 1995 and 1997. At some point, all FEMA claims made in Sarasota County can be included in the analysis. But this data provides a starting point, and also a statistically valid sample to analyze. Although there were several more claims made to FEMA during the three referenced rainfall events, 333 claims contained the data needed for inclusion in the analysis. Staff evaluated flood claims for the following:

1. Structural Damage Claim amount as a percentage of the Appraised Value of the Home.
2. Content Damage Claim amount as a percentage of the Structural Damage Claim.

The analysis showed that the average Structural Damage Claim was 16% of the appraised value of the home and the median claim was 9%. The population distribution of the claims showed that the majority of the claims made were between 0 and 10%.

Analysis of the Content Damage Claims showed that the average claim was 86% of the Structural Damage Claim, but the standard deviation of the data set was high. The population distribution showed that there was a normal distribution of the data around the average. Therefore, Stormwater staff computed a 95% Confidence Interval to check the validity of the data and found based on statistics, 95% of the time, the average content claim will range between 71 and 100 percent of the structural damage claim. This is a relatively small confidence interval and staff feels confident that the 86% figure is a reliable indicator of Content Damage as compared to Structural Damage.

Damage Calculations by Component

Building Damages (BD)

$$BD = df * AV * 1.25$$

Detour Length = Length of Detour in miles
Avg Speed = 20 miles per hour (assumed)
Avg Hourly Salary = $20/hour (assumed)
AADT = Annual Average Daily Traffic
# of Days = Number of Days Detour is in Effect – assume 2 days
$/Mile = $0.30 per mile

Staff evaluates each segment of flooded roadway to determine the most feasible detour route and what traffic will be affected by the detour. Because of the low traffic counts on local roadways, this formula will not favor projects to address local roadway level of service.

Public Works Costs (PW)

Public Works Costs include setting the detours, maintenance of the detours, emergency maintenance during the storm event, manpower to answer phones and inspect complaints resulting form the storm event. Typically this cost ranges from $2,000 to $100,000 depending on the number of roadway segments and structures affected by the flooding. More research into this value is warranted.

Flood Insurance Costs (FI)

Mortgage companies require homeowners in the vertical floodplain (the finished floor elevation is lower than the 100-year flood elevation) to carry flood insurance during the life of the mortgage. If a structure is removed from the vertical floodplain they receive the benefit of avoiding the mandatory flood insurance costs. The homeowner may decide to keep flood insurance but the rate will be lower. Initial research shows the rate of flood insurance for a structure within the floodplain is 1% of the value of the home annually. Further research into this number is warranted for verification of accuracy.

FI = Avg Value of Structure in Floodplain * 0.01* # of Flooded Structures

Annualized Damages

To determine a present worth cost of avoided damages if a project were built today, the estimated damages for each interval rainfall event were calculated and multiplied by the probability that the event will happen in any given year. For example, a 100-year rainfall event has a 1% (0.01) probability of occurring in a given year; 2% for the 50-year rainfall event; 4% for the 25 year event; and 10% for the 10-year rainfall event. The Stormwater Division's standard scope for Basin Master Plans does not include modeling of the 50-year rain event. Therefore, recognizing that 50-year event would have tangible damages, the cost was estimated by subtracting the 25-year damages from the 100-year damages, dividing by 3 and adding to the 25-year damages. Staff did an analysis of projects where the 50-year flood event information was available and found this to be an accurate representation of the 50-year damages.

Avoided Flood Insurance costs are included as an annualized cost, since the expenses are not related to the probability of a rainfall event. Residential structures that would be removed from the 100-year floodplain will be required to pay these annual premiums if they have a mortgage on their home. The sum of the annualized avoided damages is then calculated to determine a present worth value.

Present Worth Analysis

The Present Worth of the Total Expected Annual Damages is calculated:

$P = A \{ [(1 + I)^n - 1] / [I \times (1 + I)^n] \}$ where

P, Present Worth
A, Total Expected Annual Damages
I, Interest Rate = 5%, the average rate of return on municipal bonds
N, Project Life in years = 50 years, same as ACOE

Summary of Avoided Damage Analysis

Stormwater staff cautions that this present worth value should be considered a guide when evaluating the cost-effectiveness of a project. It should be noted this method is sensitive to assessed value of homes as well as the volume of traffic on flooded roadways. While this value represents an educated guess of the economic impact resulting from a project, there are invariably other intangible benefits associated with a project that may need to be considered, such as water quality and quality of life benefits. Staff proposes to present results of the Cost Effective Analysis by presenting the Estimated Avoided Damages from a Project in comparison to the Estimated Cost.

Intangible Factors

Currently staff does not have a weighting system for intangible benefits and has not performed a sensitivity analysis of projects to determine how weights would affect a cost-effective analysis. Due to the high degree of judgement that would be needed, it is reasonable to acknowledge the intangible factors without assigning a dollar figure to be included in any type of economic analysis. Some examples of these intangible factors include, but are not limited to:

- Water Quality Benefits
- Health Factors, such as ability to use septic systems
- Safety Factors, such as access by Emergency Vehicles
- Community Support for a Project
- Public Perception of a Stormwater Problem
- Board Policy for Addressing Stormwater Needs

Staff feels that in certain instances even if a project's costs exceed the tangible benefits of flood control, it may still be a worthwhile project if it has numerous intangible benefits such as improving water quality, health and safety, and community support. These intangibles should be given consideration on a case by case basis when deciding whether to go forward with a project.

df = Depth Factor:
9% for up to 1 foot of flooding (used for the 10, 25, 50 year Events)
16% for 1 to 2 feet of flooding (used for the 100-year Event)
see FEMA tables for above two feet of flooding.
AV = Assessed Value of Property (including building and lot)
1.25 = Multiplier for Appraised Value

Staff completed a detailed analysis of damages due to structure flooding in the Whitaker Bayou for the 25, 50 and 100-year return storm event based on depth of flooding in the structure. Then staff completed a general analysis multiplying the value of all structures by 0.16 for the 100-year event when significant flooding is expected and 0.09 for the 25 and 50-year events when flood levels would be lower. The two analyses were within 10% of each other. Stormwater staff considers the general analysis to be indicative of expected damages. Engineers evaluating damages can use their judgement if a detailed analysis or general analysis should be completed.

Content Damages (CD)

CD = 0.86 * BD

0.86 = Sarasota County specific multiplier
BD = Building Damages

Automobile Damages (AD)

AD = $10,000 * 1.5 * 0.075 * #FS

10,000 = Assumed Replacement Value of a Car
1.5 = Number of Cars per Residence
0.075 = Average damage expected as a percent of the value of a car.
#FS = Number of Flooded Structures.

This formula is consistent with the ACOE method. In calculating potential automobile damage, consideration should be given to garage/carport elevation (rather than habitable finished floor elevation).

Exterior Property Damages (PD)

PD = $1,000 * #HFP

1,000 = Expected Damage to Landscaping or Exterior of Property
#HFP = Number of Lots in the Horizontal Floodplain

All properties within the horizontal limits of the event floodplain are subject to Exterior Property Damages. The Exterior Property Damages were estimated at $1000 per flooded property consistent with the FEMA methodology.

Displacement Costs for Flooded Structures (DISF)

DISF = $100/day * 14 days * #FS

$100 = Per Diem costs to be displaced from residence
14 days = Number of days to restore residence to habitable state.
#FS = Number of Flooded structures.

The residents of flooded structures are displaced for the duration of standing floodwaters and for a period after the waters recede for clean up of their homes. A conservative estimate of 14 days at a cost of $100 per day was used and reflects FEMA methodology.

Displacement Costs for Structures in the Floodplain (DIS)

DIS = $100/day * 2 days * #HFP

$100 = Per Diem costs to be displaced from residence (inaccessible)
2 = Number of days residence is inaccessible
#HFP = Number of structures in Horizontal Floodplain.

The residents of structures in the horizontal limits of the floodplain are displaced for the duration of standing floodwaters. An estimate of 2 days at a cost of $100 per day was used.

Lost Wages or Business Income (LBI)

Lost wages represent the economic impact on residents when they miss work due to flooding.

LW = $40,000 * 1.5 * 8 / 2080 *(#HSF * #Days + #FS * #Days)

$40,000 = Average Annual Income
1.5 = Number of Employed Residents per Home
#Days = Number of Work Days Lost due to Flooding;
= 7 for flooded structures
= 2 for displaced residents
8 = Work Hours per Day
2,080 = Work Hours per Year
#HSF = Number of Structures in the Horizontal Floodplain
#FS = Number of Flooded Structures

Lost Business Income represents lost opportunity for commercial business or industrial sites that are flooded. Staff is currently working through this scenario in the Catfish Creek Basin by contacting the businesses to determine how flooding impacts them.

Road Detour Costs (RD)

RDI = Income lost due to Road Detour
RDI = Detour Length * Avg Speed * Avg Hourly Salary * AADT * # of Days

RDV = Vehicle/Milage Costs due to Road Detours
RDV = Detour Length * $/mile * AADT * # of Days

Detour Length = Length of Detour in miles
Avg Speed = 20 miles per hour (assumed)
Avg Hourly Salary = $20/hour (assumed)
AADT = Annual Average Daily Traffic
# of Days = Number of Days Detour is in Effect – assume 2 days
$/Mile = $0.30 per mile

Staff evaluates each segment of flooded roadway to determine the most feasible detour route and what traffic will be affected by the detour. Because of the low traffic counts on local roadways, this formula will not favor projects to address local roadway level of service.

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Flood Insurance Costs (FI)

Mortgage companies require homeowners in the vertical floodplain (the finished floor elevation is lower than the 100-year flood elevation) to carry flood insurance during the life of the mortgage. If a structure is removed from the vertical floodplain they receive the benefit of avoiding the mandatory flood insurance costs. The homeowner may decide to keep flood insurance but the rate will be lower. Initial research shows the rate of flood insurance for a structure within the floodplain is 1% of the value of the home annually. Further research into this number is warranted for verification of accuracy.

FI = Avg Value of Structure in Floodplain * 0.01* # of Flooded Structures

<u>Annualized Damages</u>

To determine a present worth cost of avoided damages if a project were built today, the estimated damages for each interval rainfall event were calculated and multiplied by the probability that the event will happen in any given year. For example, a 100-year rainfall event has a 1% (0.01) probability of occurring in a given year; 2% for the 50-year rainfall event; 4% for the 25 year event; and 10% for the 10-year rainfall event. The Stormwater Division's standard scope for Basin Master Plans does not include modeling of the 50-year rain event. Therefore, recognizing that 50-year event would have tangible damages, the cost was estimated by subtracting the 25-year damages from the 100-year damages, dividing by 3 and adding to the 25-year damages. Staff did an analysis of projects where the 50-year flood event information was available and found this to be an accurate representation of the 50-year damages.

Avoided Flood Insurance costs are included as an annualized cost, since the expenses are not related to the probability of a rainfall event. Residential structures that would be removed from the 100-year floodplain will be required to pay these annual premiums if they have a mortgage on their home. The sum of the annualized avoided damages is then calculated to determine a present worth value.

Present Worth Analysis

The Present Worth of the Total Expected Annual Damages is calculated:

$P = A \{ [(1 + I)^n - 1] / [I \times (1 + I)^n] \}$ where

P, Present Worth
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I, Interest Rate = 5%, the average rate of return on municipal bonds
N, Project Life in years = 50 years, same as ACOE

Summary of Avoided Damage Analysis

Stormwater staff cautions that this present worth value should be considered a guide when evaluating the cost-effectiveness of a project. It should be noted this method is sensitive to assessed value of homes as well as the volume of traffic on flooded roadways. While this value represents an educated guess of the economic impact resulting from a project, there are invariably other intangible benefits associated with a project that may need to be considered, such as water quality and quality of life benefits. Staff proposes to present results of the Cost Effective Analysis by presenting the Estimated Avoided Damages from a Project in comparison to the Estimated Cost.

Intangible Factors

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- Water Quality Benefits
- Health Factors, such as ability to use septic systems
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- Community Support for a Project
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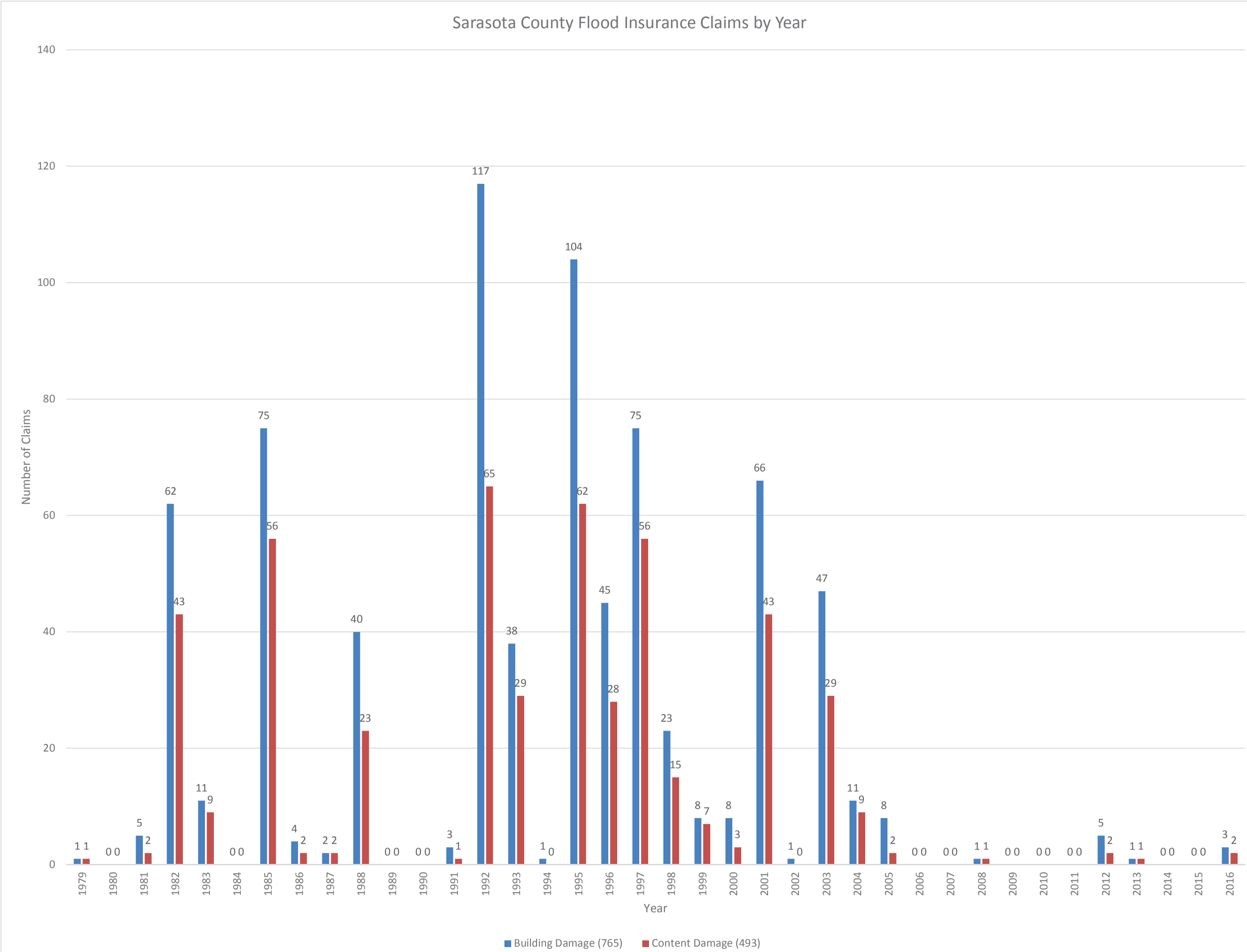
- Board Policy for Addressing Stormwater Needs

Staff feels that in certain instances even if a project's costs exceed the tangible benefits of flood control, it may still be a worthwhile project if it has numerous intangible benefits such as improving water quality, health and safety, and community support. These intangibles should be given consideration on a case by case basis when deciding whether to go forward with a project.

APPENDIX B – SARASOTA COUNTY FLOOD CLAIMS

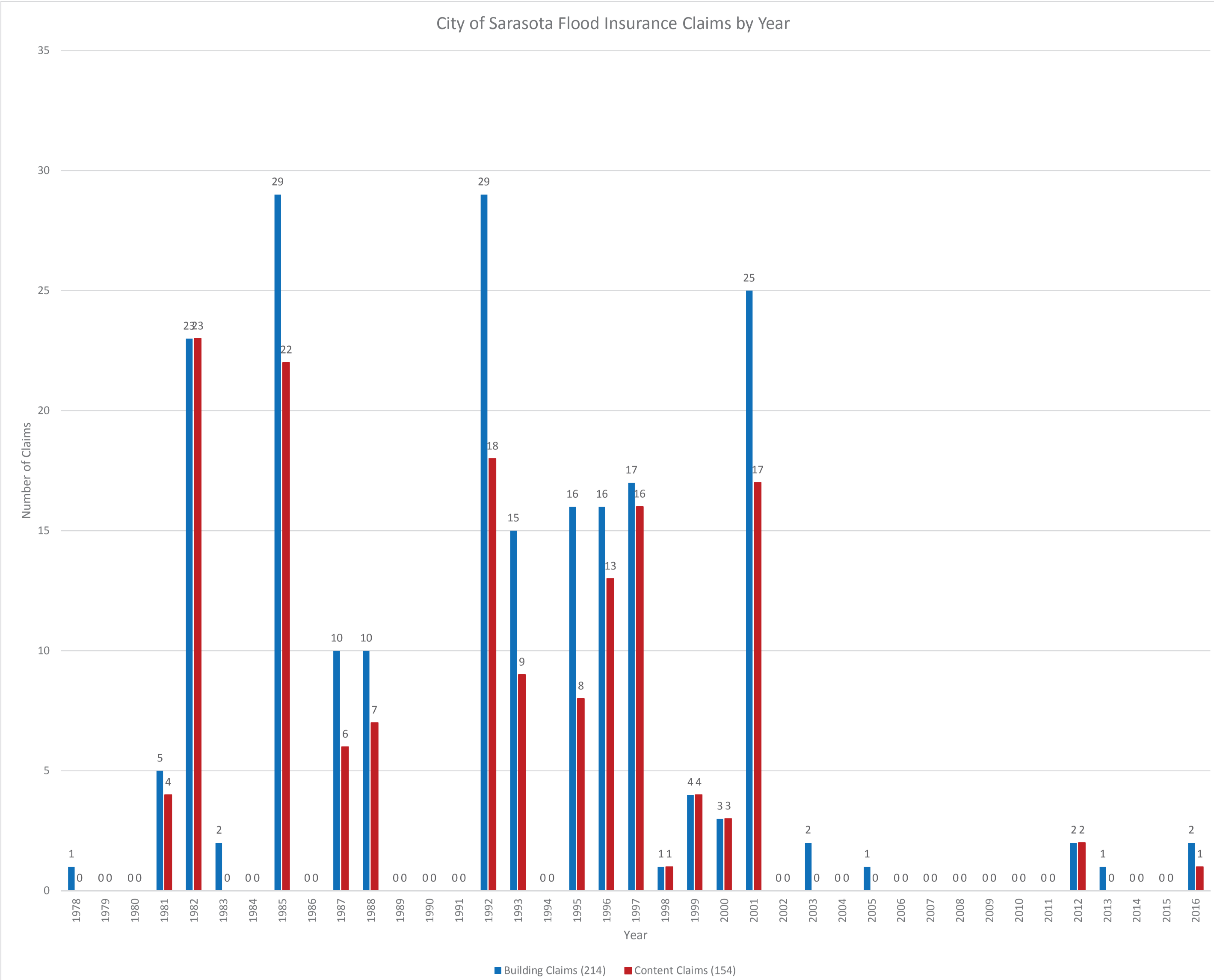


Year	Building Claims	Content Claims	Primary Month
1979	1	1	Apr
1980	0	0	
1981	5	2	Aug
1982	62	43	June
1983	11	9	Mar
1984	0	0	
1985	75	56	Aug
1986	4	2	Dec
1987	2	2	July
1988	40	23	Sep / Nov
1989	0	0	
1990	0	0	
1991	3	1	Mar
1992	117	65	June
1993	38	29	Mar
1994	1	0	July
1995	104	62	July
1996	45	28	Oct
1997	75	56	Nov
1998	23	15	Mar
1999	8	7	Jan
2000	8	3	Sep
2001	66	43	Sep
2002	1	0	Jan
2003	47	29	June
2004	11	9	Sep
2005	8	2	July
2006	0	0	
2007	0	0	
2008	1	1	Aug
2009	0	0	
2010	0	0	
2011	0	0	
2012	5	2	June
2013	1	1	Sep
2014	0	0	
2015	0	0	
2016	3	2	Aug
	765	493	

12.1%	Average Building Damage
6.2%	Median Building Damage

82.3%	Average Content Damage / Building Damage
42.7%	Median Content Damage / Building Damage

APPENDIX C – CITY OF SARASOTA FLOOD CLAIMS



Year	Building Claims	Content Claims	Primary Month
1978	1	0	
1979	0	0	
1980	0	0	
1981	5	4	Aug
1982	23	23	June
1983	2	0	Mar
1984	0	0	
1985	29	22	Aug
1986	0	0	
1987	10	6	July
1988	10	7	Sep / Nov
1989	0	0	
1990	0	0	
1991	0	0	
1992	29	18	June
1993	15	9	Mar
1994	0	0	
1995	16	8	July
1996	16	13	Oct
1997	17	16	Nov
1998	1	1	Mar
1999	4	4	Jan
2000	3	3	Sep
2001	25	17	Sep
2002	0	0	
2003	2	0	June
2004	0	0	
2005	1	0	July
2006	0	0	
2007	0	0	
2008	0	0	
2009	0	0	
2010	0	0	
2011	0	0	
2012	2	2	June
2013	1	0	Sep
2014	0	0	
2015	0	0	
2016	2	1	Aug
	214	154	

11.2%	Average Building Damage
6.0%	Median Building Damage

87.0%	Average Content Damage / Building Damage
15.9%	Median Content Damage / Building Damage

APPENDIX D – COMPONENT SUMMARY SHEET

Abbreviation	Component	Description
BD	Building Damage	Structural Damage associates with flooded structures.
Equation:	BD = 0.12 * AV * 1.25	
0.12	= Sarasota County specific multiplier for building damage	
AV	= Assessed Value of Property (building only)	
1.25	= Multiplier for Appraised Value	
CD	Content Damage	Damage associated with contents of flooded structures.
Equation:	CD = 0.86 * BD	
0.86	= Sarasota County specific multiplier for content damage	
BD	= Building Damages	
AD	Automobile Damage	Damage to flooded vehicles.
Equation:	AD = $25,000 * 2 * 0.075 * #FS	
$25,000	= Replacement value of a car	
2	= Number of cars per residence	
0.075	= Average damage expected as a percent of the value of a car.	
#FS	= Number of flooded structures	
PD	Exterior Property Damage	Damage to landscape / hardscape and flooded lots.
Equation:	PD = $2,000 * # HFPL	
$2,000	= Expected damage to landscaping / hardscaping or exterior of property	
# HFPL	= Number of Lots in the Horizontal Floodplain	
DISF	Displacement Costs for Flooded Structures	Per diem cost associated with uninhabitable structures.
Equation:	DISF = $250/day * # Fdays * # FS	
$250	= Per diem costs to be displaced from residence	
# Fdays	= 14 days for flooded structures to restore residence to habitable state	
# FS	= Number of flooded structures	
DIS	Displacement Costs for Structures in the Horizontal Floodplain	Per Diem cost associated with non-accessible structures, but structure not flooded.
Equation:	DIS = $250/day * #Ddays * # HFP	
$250	= Per diem costs to be displaced from residence (inaccessible)	
# Ddays	= 2 days for displaced residents	
# HFP	= Number of structures in horizontal floodplain	
LW	Lost Wages due to Residential Flooding	Costs associated with time off from work due to residential flooding.
Equation:	LW = $56,286 * 8 / 2080 *[(# HFP * # Ddays) + (# FS * #Fdays)]	
$56,286	= Average Household Income (2015)	
8	= Work hours per day	
2080	= Work hours per year	
# HFP	= Number of structures in the horizontal floodplain	
# Ddays	= 2 days for displaced residents	
# FS	= Number of flooded structures	
# Fdays	= 14 days for flooded structures to restore residence to habitable state	

Abbreviation	Component	Description
LBI	Lost Business Income	Costs associated with loss of commercial business income due to flooding.
Equation:	LBI = $5,104 *[(#CHFP * #Ddays) + (#CFS * #Fdays)]	
$5,104	= Average daily commercial revenue for Sarasota County firms with paid employees	
#CHFP	= Number of commercial displaced structures in the horizontal floodplain	
#Ddays	= 2 days Lost due to commercial displaced structures	
#CFS	= Number of commercial flooded structures	
#Fdays	= 14 Days Lost due to commercial flooded structures	
LWB	Lost Wages due to Closed Business	Costs associated with employee time off from work due to business flooding.
Equation:	LWB = 10 * 8 * $19.35 *[(#CHFP * #Ddays) + (#CFS * #Fdays)]	
10	= Average employees per business	
8	= Work hours per day	
$19.35	= Average Sarasota County payroll (hourly rate)	
#CHFP	= Number of commercial displaced structures in the horizontal floodplain	
#Ddays	= 2 days Lost due to commercial displaced structures	
#CFS	= Number of commercial flooded structures	
#Fdays	= 14 Days Lost due to commercial flooded structures	
RD	Road Detour Costs	Costs associated with detouring traffic due impassable to street flooding.
Equation:	RD = RDI + RDV	
RDI	= Income lost due to road detour	
	= Detour Length* Avg. Speed* Avg. Hourly Salary* AADT *# Ddays	
RDV	= Vehicle / Mileage costs due to road detours	
	= Detour Length * AADT * # of Ddays * $/mile	
PW	Public Works Costs	Cost incurred by public entity to maintain traffic detours and public safety because of flooding events.
Cost ranges from $2,000 to $50,000 depending on the duration of the flooding, the number of roadway segments, and structures affected by the flooding.		
FI	Flood Insurance Costs	Avoided flood insurance premiums if a structure is removed from the Special Flood Hazard Area (SFHA).
Equation:	FI = Avg SV * 0.01 * # FS	
Avg SV	= Average value of structures in horizontal floodplain	
0.01	= 1% of the value of structures	
# FS	= Number of flooded structures	

APPENDIX E – NUMBEO INFORMATION

Cost of Living in Sarasota

Restaurants	[Edit]	Range
Meal, Inexpensive Restaurant	12.00 $	9.00 - 15.00
Meal for 2 People, Mid-range Restaurant, Three-course	40.00 $	30.00 - 45.00
McMeal at McDonalds (or Equivalent Combo Meal)	6.50 $	4.00 - 8.00
Domestic Beer (1 pint draught)	4.50 $	4.00 - 5.00
Imported Beer (11.2 oz small bottle)	6.00 $	5.00 - 6.00
Cappuccino (regular)	3.79 $	2.50 - 5.00
Coke/Pepsi (11.2 oz small bottle)	1.43 $	1.00 - 2.50
Water (11.2 oz small bottle)	1.15 $	1.00 - 1.50
Markets	[Edit]	
Milk (regular), (1 gallon)	3.79 $	3.59 - 4.00
Loaf of Fresh White Bread (1 lb)	2.63 $	2.00 - 3.00
Rice (white), (1 lb)	3.50 $	2.00 - 4.00
Eggs (regular) (12)	1.81 $	1.50 - 2.50
Local Cheese (1 lb)	10.50 $	5.00 - 14.00
Chicken Breasts (Boneless, Skinless), (1 lb)	5.37 $	3.50 - 6.00
Beef Round (1 lb) (or Equivalent Back Leg Red Meat)	6.98 $	5.00 - 8.00
Apples (1 lb)	3.00 $	2.00 - 4.00
Banana (1 lb)	1.40 $	0.55 - 2.00
Oranges (1 lb)	3.00 $	2.00 - 3.00
Tomato (1 lb)	2.00 $	1.50 - 3.00
Potato (1 lb)	1.50 $	1.00 - 2.00
Onion (1 lb)	2.00 $	1.50 - 2.00
Lettuce (1 head)	2.50 $	1.50 - 3.00
Water (1.5 liter bottle)	1.33 $	0.50 - 2.00
Bottle of Wine (Mid-Range)	19.50 $	15.00 - 24.00
Domestic Beer (0.5 liter bottle)	3.00 $	2.00 - 4.00
Imported Beer (11.2 oz small bottle)	4.50 $	3.00 - 6.00
Pack of Cigarettes (Marlboro)	6.89 $	6.79 - 7.00
Transportation	[Edit]	
One-way Ticket (Local Transport)	1.25 $	1.25 - 1.25
Monthly Pass (Regular Price)	40.00 $	30.00 - 50.00
Taxi Start (Normal Tariff)	3.00 $	
Taxi 1 mile (Normal Tariff)	2.50 $	2.00 - 3.00
Taxi 1hour Waiting (Normal Tariff)	?	
Gasoline (1 gallon)	2.35 $	2.16 - 2.59
Volkswagen Golf 1.4 90 KW Trendline (Or Equivalent New Car)	18,525.00 $	15,000.00 - 22,050.00
Toyota Corolla 1.6l 97kW Comfort (Or Equivalent New Car)	24,050.33 $	18,151.00 - 35,000.00
Utilities (Monthly)	[Edit]	
Basic (Electricity, Heating, Cooling, Water, Garbage) for 915 sq ft Apartment	152.85 $	101.66 - 228.73
1 min. of Prepaid Mobile Tariff Local (No Discounts or Plans)	0.10 $	0.10 - 0.10
Internet (60 Mbps or More, Unlimited Data, Cable/ADSL)	63.33 $	40.00 - 85.00
Sports And Leisure	[Edit]	
Fitness Club, Monthly Fee for 1 Adult	28.43 $	10.00 - 60.00
Tennis Court Rent (1 Hour on Weekend)	21.50 $	15.00 - 30.00

Cinema, International Release, 1 Seat	9.00 $	8.00 -	14.00
Childcare	[Edit]		
Preschool (or Kindergarten), Full Day, Private, Monthly for 1 Child	1,300.00 $	1,200.00 -	1,500.00
International Primary School, Yearly for 1 Child	18,000.00 $	15,000.00 -	24,000.00
Clothing And Shoes	[Edit]		
1 Pair of Jeans (Levis 501 Or Similar)	34.83 $	28.99 -	45.00
1 Summer Dress in a Chain Store (Zara, H&M, ...)	35.00 $	30.00 -	49.00
1 Pair of Nike Running Shoes (Mid-Range)	71.43 $	50.00 -	120.00
1 Pair of Men Leather Business Shoes	88.33 $	65.00 -	120.00
Rent Per Month	[Edit]		
Apartment (1 bedroom) in City Centre	1,166.67 $	900.00 -	1,800.00
Apartment (1 bedroom) Outside of Centre	991.67 $	800.00 -	1,200.00
Apartment (3 bedrooms) in City Centre	2,058.33 $	1,250.00 -	3,000.00
Apartment (3 bedrooms) Outside of Centre	1,700.00 $	1,200.00 -	2,100.00
Buy Apartment Price	[Edit]		
Price per Square Feet to Buy Apartment in City Centre	320.04 $	311.66 -	424.25
Price per Square Feet to Buy Apartment Outside of Centre	132.96 $	111.00 -	171.00
Salaries And Financing	[Edit]		
Average Monthly Net Salary (After Tax)	2,605.56 $		
Mortgage Interest Rate in Percentages (%), Yearly, for 20 Years Fixed-Rate	3.90	3.56 -	4.54

Prices in Sarasota, Florida

These data are based on 343 entries in the past 18 months from 45 different contributors.
Last update: April 2018

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Sources and References:
No sources and references provided yet.
Add new source here:
URL:
Description:
Add

Sign up for our newsletter:
Your email address:
Submit

Nearby cities:

Cost of Living in Bradenton, Florida	13.20 miles
Cost of Living in Venice, Florida	18.96 miles
Cost of Living in Saint Petersburg, Florida	37.69 miles
Cost of Living in Clearwater, Florida	55.60 miles
Cost of Living in Tampa, Florida	61.08 miles
Cost of Living in New Port Richey, Florida	73.66 miles
Cost of Living in Fort Myers, Florida	75.95 miles
Cost of Living in Zephyrhills, Florida	79.31 miles
Cost of Living in Spring Hill, Florida	93.86 miles
Cost of Living in Naples, Florida	116.61 miles

Leave a comment:
Your name: Sign In
Your email address (optional):
Your comment (no HTML):

Post comment

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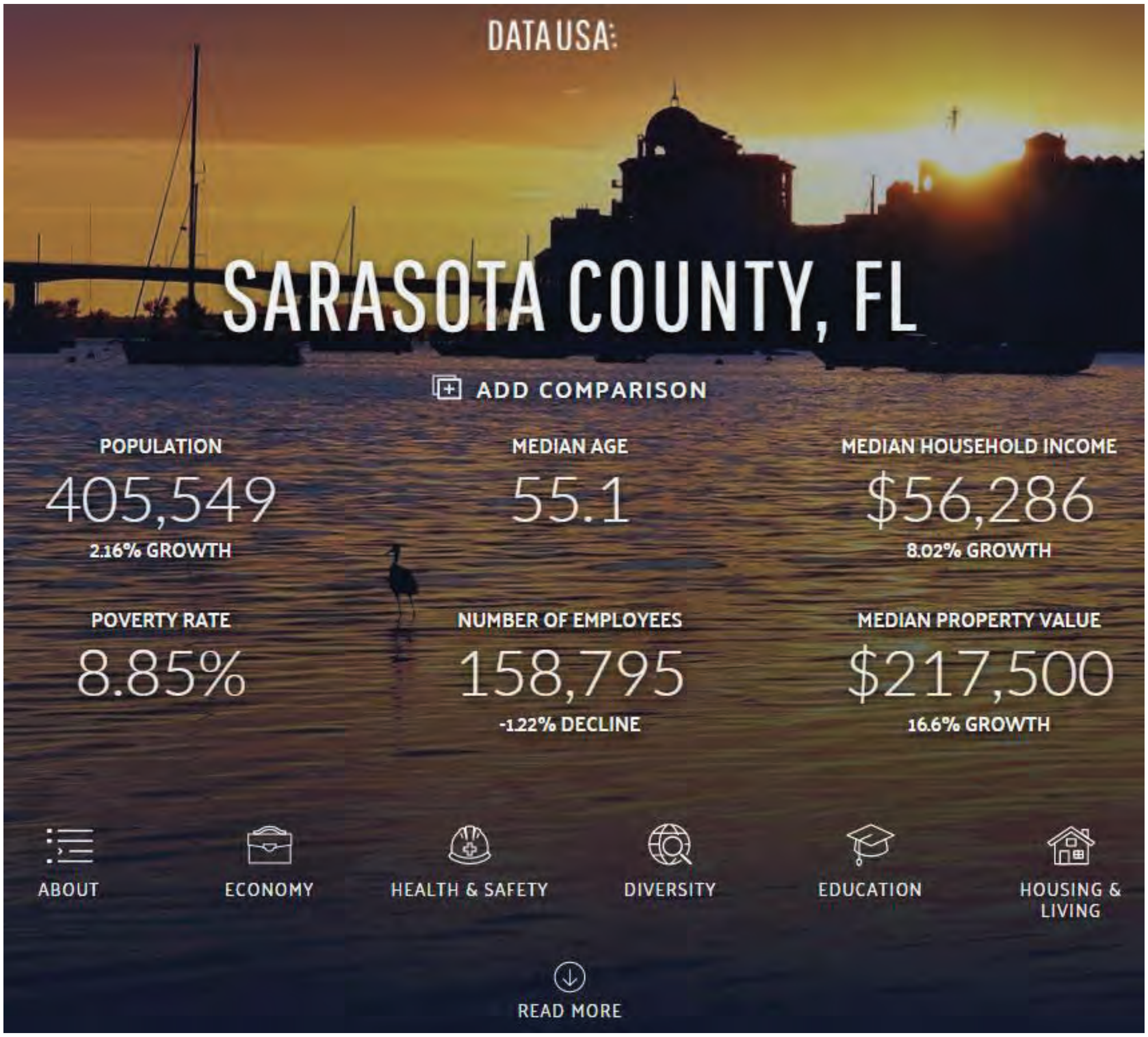
APPENDIX F – DATA USA INFORMATION

https://datausa.io/profile/geo/sarasota-county-fl/



https://datausa.io/profile/geo/sarasota-county-fl/#category_wages

Household Income

Please note that the buckets used in this visualization were not evenly distributed by ACS when publishing the data.

$56,286
MEDIAN HOUSEHOLD INCOME
± $2,523

177,807
NUMBER OF HOUSEHOLDS
± 3,612

In 2015, the median household income of the 177,807 households in Sarasota County, FL grew to $56,286 from the previous year's value of $52,109.

The following chart displays the households in Sarasota County, FL distributed between a series of income buckets compared to the national averages for each bucket. The largest share of households have an income in the $75-$100k range.

Dataset: ACS 1-year Estimate
Source: Census Bureau

Car Ownership

2 cars
AVERAGE NUMBER

The following chart displays the households in Sarasota County, FL distributed between a series of car ownership buckets compared to the national averages for each bucket. The largest share of households in Sarasota County, FL have 2 cars, followed by 1 car.

Dataset: ACS 1-year Estimate
Source: Census Bureau

APPENDIX G – AMERICAN FACT FINDER INFORMATION

https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

United States Census Bureau

AMERICAN FactFinder

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SB1200CSA01

Statistics for All U.S. Firms by Industry, Gender, Ethnicity, and Race for the U.S., States, Metro Areas, Counties, and Places: 2012
2012 Survey of Business Owners

Table View

Actions: Modify Table | Bookmark/Save | Print | Download | Create a Map

This table is displayed with default industry codes.
Not all rows may be displayed below.
Click Back to Search to select other industry codes using the search options on the left.

The table contains a total of **4,020,463** data rows.

Release Date : 12/15/2015

[NOTE: Includes firms with paid employees and firms with no paid employees. Data are based on the 2012 Economic Census, and the estimates of business ownership by gender, ethnicity, race, and veteran status are fr
one race and therefore is included in each race selected. Firms with more than one domestic establishment are counted in each geographic area and industry in which they operate, but only once in the U.S. and state tota

Versions of this table are available for the following years:
2012
2007

1 - 100 of 358

Geographic area name	2012 NAICS code	Meaning of 2012 NAICS code	Meaning of Gender code	Meaning of Ethnicity code	Meaning of Race code	Year	Number of firms with or without paid employees	Sales, receipts, or value of shipments of firms with or without paid employees ($1,000)	Number of firms with paid employees	Sales, receipts, or value of shipments of firms with paid employees ($1,000)
Sarasota County, Florida	00	Total for all sectors	All firms	All firms	All firms	2012	43,592	21,968,226	10,918	20,339,106

United States Census Bureau

AMERICAN FactFinder

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CB1500A11

Geography Area Series: County Business Patterns
2015 Business Patterns

Table View

BACK TO COMMUNITY FACTS

Actions: Modify Table | Bookmark/Save | Print | Download | Create a Map

View Geography Notes | View Table Notes

This table is displayed with default industry codes.
Not all rows may be displayed below.
Click Back to Search to select other industry codes using the search options on the left.

The table contains a total of 3,169,793 data rows.

Release Date : 04/20/2017

NOTE: Data based on the 2015 County Business Patterns. CBP html tables and download files can be found at the County Business Patterns Website.
For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.
Data in this table represent those available when this report was created; data may not be available for all NAICS industries or geographies. Excludes most government employees, railroad employees, and self-employed persons.

Versions of this table are available for the following years:
2015

1 - 21 of 21

Geographic area name	2012 NAICS code	Meaning of 2012 NAICS code	Year	Number of establishments	Paid employees for pay period including March 12 (number)	First-quarter payroll ($1,000)	Annual payroll ($1,000)
Sarasota County, Florida	00	Total for all sectors	2015	13,405	137,827	1,335,703	5,547,522

APPENDIX H – INTERNAL REVENUE SERVICE NOTICE 2018 STANDARD MILEAGE RATES

2018 Standard Mileage Rates

Notice 2018-03

SECTION 1. PURPOSE

This notice provides the optional 2018 standard mileage rates for taxpayers to use in computing the deductible costs of operating an automobile for business, charitable, medical, or moving expense purposes. This notice also provides the amount taxpayers must use in calculating reductions to basis for depreciation taken under the business standard mileage rate, and the maximum standard automobile cost that may be used in computing the allowance under a fixed and variable rate (FAVR) plan.

SECTION 2. BACKGROUND

Rev. Proc. 2010-51, 2010-51 I.R.B. 883, provides rules for computing the deductible costs of operating an automobile for business, charitable, medical, or moving expense purposes, and for substantiating, under § 274(d) of the Internal Revenue Code and § 1.274-5 of the Income Tax Regulations, the amount of ordinary and necessary business expenses of local transportation or travel away from home. Taxpayers using the standard mileage rates must comply with Rev. Proc. 2010-51. However, a taxpayer is not required to use the substantiation methods described in Rev. Proc. 2010-51, but instead may substantiate using actual allowable expense amounts if the taxpayer maintains adequate records or other sufficient evidence.

An independent contractor conducts an annual study for the Internal Revenue Service of the fixed and variable costs of operating an automobile to determine the standard mileage rates for business, medical, and moving use reflected in this notice. The standard mileage rate for charitable use is set by § 170(i).

SECTION 3. STANDARD MILEAGE RATES

The standard mileage rate for transportation or travel expenses is 54.5 cents per mile for all miles of business use (business standard mileage rate). See section 4 of Rev. Proc. 2010-51.

The standard mileage rate is 14 cents per mile for use of an automobile in rendering gratuitous services to a charitable organization under § 170. See section 5 of Rev. Proc. 2010-51.

The standard mileage rate is 18 cents per mile for use of an automobile (1) for medical care described in § 213, or (2) as part of a move for which the expenses are deductible under § 217. See section 5 of Rev. Proc. 2010-51.

SECTION 4. BASIS REDUCTION AMOUNT

For automobiles a taxpayer uses for business purposes, the portion of the business standard mileage rate treated as depreciation is 22 cents per mile for 2014, 24 cents per mile for 2015, 24 cents per mile for 2016, 25 cents per mile for 2017, and 25 cents per mile for 2018. See section 4.04 of Rev. Proc. 2010-51.

SECTION 5. MAXIMUM STANDARD AUTOMOBILE COST

For purposes of computing the allowance under a FAVR plan, the standard automobile cost may not exceed $27,300 for automobiles (excluding trucks and vans) or $31,000 for trucks and vans. See section 6.02(6) of Rev. Proc. 2010-51.

SECTION 6. EFFECTIVE DATE

This notice is effective for (1) deductible transportation expenses paid or incurred on or after January 1, 2018, and (2) mileage allowances or reimbursements paid to an employee or to a charitable volunteer (a) on or after January 1, 2018, and (b) for transportation expenses the employee or charitable volunteer pays or incurs on or after January 1, 2018.

SECTION 7. EFFECT ON OTHER DOCUMENTS

Notice 2016-79 is superseded.

DRAFTING INFORMATION

The principal author of this notice is Bernard P. Harvey of the Office of Associate Chief Counsel (Income Tax and Accounting). For further information on this notice contact Bernard P. Harvey on (202) 317-7005 (not a toll-free call).

APPENDIX I – EMAIL COMMUNICATION WITH SWFWMD

From: Nicole R. Mytyk <nicole.mytyk@swfwmd.state.fl.us>
Sent: Thursday, February 22, 2018 2:49 PM
Subject: RE: Cost Effective Analysis - sample reports
To: Brunty, Jennifer <jennifer.brunty@stantec.com>

Pounds per year but the cost effectiveness is calculated for 20 years (considered the life of the project).

Nicole Mytyk – SWIM Program, SWFWMD

From: Brunty, Jennifer [mailto:Jennifer.Brunty@stantec.com]
Sent: Thursday, February 22, 2018 2:36 PM
To: Nicole R. Mytyk <Nicole.Mytyk@swfwmd.state.fl.us>
Subject: RE: Cost Effective Analysis - sample reports

Me again with one more question – is the pollutant removal rate pounds per year or pounds per life of the project?

Jennifer L. Brunty, PhD, PMP
Senior Environmental Scientist

Direct: (941) 907-6900
Mobile: (941) 779-5925

Stantec Consulting Services Inc.
6900 Professional Parkway East
Sarasota FL 34240-8414 US

Stantec

From: Nicole R. Mytyk [mailto:Nicole.Mytyk@swfwmd.state.fl.us]
Sent: Thursday, February 22, 2018 9:37 AM
To: Brunty, Jennifer <Jennifer.Brunty@stantec.com>
Subject: RE: Cost Effective Analysis - sample reports

Decisions on both questions are unknown at this time.
The metrics were based on past District projects and the Balmoral study was to look at all available info (explained in various reports) to verify the numbers and provide suggestions. At this time none have been adopted. That may or may not change in the future, so for now our metrics have stayed the same. The report was finished around October of last year.

Nicole Mytyk – SWIM Program, SWFWMD

From: Brunty, Jennifer [mailto:Jennifer.Brunty@stantec.com]
Sent: Thursday, February 22, 2018 9:34 AM
To: Nicole R. Mytyk <Nicole.Mytyk@swfwmd.state.fl.us>
Subject: RE: Cost Effective Analysis - sample reports

Thanks – I was using the chart you had pasted into the Janaury 25th email and thought it came out of the Balmoral report but I see it's a little different. I'm trying to write a paragraph for the county so they can understand where the numbers SWFWMD is using came from.

Where did the numbers in the chart used in the past come from? Was it based on District staff doing calculations on past District projects? That's what I vaguely remember but I was never involved in that. What year was the chart created (seems like 2013-14 if I remember right)? I ask because the Balmoral report looks like it was normalized for 2017 dollars and I don't know what dollars or any normalization was done for the chart currently in use. Overall, I'm trying to determine if the dollars will be updated as the years progress, or if that is unknown I'll just say it's unknown right now and leave it at that. The years the dollars came fro would be something for the county to keep in mind as they do budgets.

Are there plans to use the Balmoral report in the future?

Thanks again for your help!

Jennifer L. Brunty, PhD, PMP
Senior Environmental Scientist

Direct: (941) 907-6900
Mobile: (941) 779-5925

Stantec Consulting Services Inc.
6900 Professional Parkway East
Sarasota FL 34240-8414 US

Stantec

From: Nicole R. Mytyk [mailto:Nicole.Mytyk@swfwmd.state.fl.us]
Sent: Thursday, February 22, 2018 9:23 AM
To: Brunty, Jennifer <Jennifer.Brunty@stantec.com>
Subject: RE: Cost Effective Analysis - sample reports

Hi Jennifer! We are not adopting any of the Balmoral study at this time. I provided it to show our current metrics listed in Table 6. This may change in the future, but as of 2018 that was how we evaluated projects for FY2019.

See the note in my first email: "The WQ Metrics is an evaluation we completed on our metrics this past year. Table 6 (furthest right column) has our current metrics."

Nicole Mytyk – SWIM Program, SWFWMD

From: Brunty, Jennifer [mailto:Jennifer.Brunty@stantec.com]
Sent: Thursday, February 22, 2018 8:55 AM
To: Nicole R. Mytyk <Nicole.Mytyk@swfwmd.state.fl.us>
Subject: RE: Cost Effective Analysis - sample reports

Good morning – A question about the Balmoral study. The costs were adjusted to 2017 dollars. Do you know if there are plans to update the costs periodically using the consumer price index? I just want to make a note about that in the report for Sarasota County.

Thanks!

APPENDIX J –SARASOTA COUNTY BOARD MEETING MINUTES DATED DECEMBER 5, 2000-HIGLIGHTED

MINUTES
BOARD OF COUNTY COMMISSIONERS

SARASOTA COUNTY ADMINISTRATION CENTER
1660 RINGLING BOULEVARD
COUNTY COMMISSION CHAMBERS
SARASOTA, FLORIDA

9:00 a.m.

Nora Patterson, Chair, District 4
David R. Mills, Vice Chairman, District 2
Paul Mercier, District 1
Shannon Staub, District 3
Jon Thaxton, District 5

Also present were:

James Ley, County Administrator
David Bullock, Deputy County Administrator
Jorge L. Fernandez, County Attorney
Stephen DeMarsh, Assistant County Attorney
Peter Ramsden, Clerk of the Circuit Court Finance Director
Tricia Granger, Deputy Clerk

INVOCATION
Johnnie Mae Reid

PLEDGE OF ALLEGIANCE
Commissioner Staub

PROCLAMATIONS
Circus Sarasota Season - December 26, 2000 - January 27, 2001
Civil Air Patrol Week - December 1-7, 2000

PERFORMANCE RECOGNIZED AS OUTSTANDING (PRO) AWARDS
Gary Krauss, Community Services - Individual Accomplishment
Diane M. Thibodeau and Dianne M. Shipley, Health & Human Services - Team Merit

RECOGNITION OF RETIREMENTS
John H. Albritton, Emergency Services - 31 years
Les McKinney, Public Works - 37 years

PRESENTATION
Commr. Mills presented Sarasota Herald Tribune Staff Writer Chad Binette an editorial cartoon commemorating the current Presidential election campaign ballot recounts.

PRESENTATION OF CERTIFICATES
Citizens Academy Class Graduation
(1-0961)

26. COMMISSION REPORTS

A. ADVISORY COUNCILS/ORGANIZATIONS
Commr. Staub introduced STAR (Students Taking Active Role in Government) members observing the meeting.
(1-1060)

ELECTION OF BOARD OF COUNTY COMMISSION 2001 OFFICERS AND BOARD COMMITTEE APPOINTMENTS

Commr. Staub moved to elect Commr. Mills as Chairman for calendar year 2001. The motion, seconded by Commr. Thaxton, carried without objection.

Chairman. Mills moved to elect Commr. Patterson as Vice Chairman for calendar year 2001. The motion, seconded by Commr. Staub, carried without objection.

Chairman Mills moved to elect Commr. Staub as Chairman Pro-Tem for calendar year 2001. The motion, seconded by Commr. Thaxton, carried without objection.

RECESS: 9:40 a.m. - 9:45 a.m.
(1-1147)

Interim Chair Patterson passed the gavel and Chairman Mills noted consideration of the Board Committee Appointments, and subsequent to comments and discussion, the annual appointments of individual Commissioners as representatives for 2001 were confirmed, as follows:

Organizations/Agencies/Boards:

Southwest Florida Regional Planning Council (SWFRPC)

Two members:	Commr. Staub Commr. Thaxton
One alternate:	Commr. Mercier

Tourist Development Council (TDC)

One member:	Commr. Mills
One alternate:	Commr. Patterson

Peace River/Manasota Regional Water Supply Authority

One member:	Commr. Staub
One alternate:	Commr. Thaxton

Value Adjustment Board

Three members:	Commr. Staub Commr. Mercier Commr. Thaxton

Economic Development Board

One member:	Commr. Mills
One alternate:	Commr. Mercier

National Estuary Program Policy Committee

One member:	Commr. Thaxton
One alternate:	Commr. Patterson

West Coast Inland Navigation District (WCIND)

One member:	Commr. Patterson
One alternate:	Commr. Staub

ELECTION OF BOARD OF COUNTY COMMISSION 2001 OFFICERS AND BOARD COMMITTEE APPOINTMENTS - Continued

<u>Organizations/Agencies/Boards:</u>	
Metropolitan Planning Organization	
Three members:	Commr. Staub
	Commr. Mills
	Commr. Patterson
Two alternates:	Commr. Mercier
	Commr. Thaxton
Transportation Disadvantaged Board	
One member:	Commr. Mercier
One alternate:	Commr. Mills
Juvenile Justice	
One member:	Commr. Mercier
One alternate:	Commr. Patterson
Public Safety Council	
One member:	Commr. Mercier
One alternate:	Commr. Thaxton
Utilities Acquisition	
One member:	Commr. Patterson
Charlotte Harbor National Estuary Program	
One member:	Commr. Thaxton
One alternate:	Commr. Mercier
Trail Corridor Committee	
One member:	Commr. Mills
Community Action Agency Board	
One member:	Commr. Mercier
One alternate:	Commr. Mills
Council of Governments	
One member:	Commr. Mills
One alternate:	Commr. Patterson
School Readiness Coalition	
One member:	Commr. Staub
One alternate:	Commr. Mercier
Sarasota County Community Alliance (SCCA)	
Department of Children and Families (DCF)	
One member:	Commr. Mercier
One alternate:	Commr. Mills
G. Pierce Woods Closure Committee	
One member:	Commr. Staub
One alternate:	Commr. Mills

CONSENT MOTION
A motion was made by Commr. Staub, seconded by Commr. Thaxton, and carried by a 5-0 vote to approve Items 1-11 as follows, with the exception of Items 2 and 3, considered later this meeting.

1. **RESOLUTIONS/GRANTS**

A. Adopted Resolution No. 2000-278 authorizing the approval for grant application submissions to the Florida Department of Community Affairs (FDCA) for the Emergency Management Preparedness and Assistance Competitive Grant Program;

B. Authorized execution and submissions of the grant applications by the County Administrator or his designee.

2. **ENVIRONMENTAL SERVICES**

See consideration of the Certification of Financial Responsibility for the Venice Gardens Water Treatment Plant deep injection well, later this meeting.

3. **ENVIRONMENTAL SERVICES**

See consideration of the recommended priority list for County projects to be submitted for Southwest Florida Water Management District Manasota Basin Board Cooperative Funding, later this meeting.

4. **CONTRACTS**

Approved Contract No. 2001-061, Change Order No. 2 to Contract No. 2000-214, with Stately Contractors, Inc., for the construction of the Newtown Water Distribution and Wastewater Collection System, Phase 3, in an amount not to exceed $188,686.01; and to reduce the Contract retainage to 2.5 percent (%).

5. **PUBLIC WORKS**

A. Approved a Non-Exclusive Permanent Utility Easement to Florida Power and Light Company for the purpose of relocating existing facilities to accommodate the Cattlemen Road Project - Phase I;

B. Approved a Non-Exclusive Access Easement to Florida Power and Light Company for the purpose of relocating existing facilities to accommodate the Cattlemen Road Project - Phase I.

6. **CONTRACTS**

Approved Contract No. 2001-062, Supplemental Agreement No. 4 to Contract No. 97-358, with Hole, Montes & Associates, Inc., to provide additional engineering services for the Clark Road Stormwater Improvement Project, in the amount of $21,470.00.

7. **ORDINANCES**

Authorized advertising of a public hearing to consider a proposed Ordinance to establish the Boleyn Road Non-Maintained Secondary Road Improvement District.

8. **RESOLUTIONS**

A. Adopted Resolution No. 2000-279 authorizing the execution and submittal of Contract No. 2000-331, a Joint Participation Agreement (JPA), with the Florida Department of Transportation (FDOT), for a Federal Transportation Administration (FTA) Section 5310 Capital Equipment Grant, in the amount of $136,800.00, and $17,100.00 of FDOT matching funds; authorizing the execution and filing of the Application for Federal Assistance for the Grant Program; and rescinding Resolution No. 2000-186, approved by the Board on September 12, 2000.

8. **RESOLUTIONS** - Continued

B. Adopted Resolution No. 2000-280, authorizing the execution and submittal of Contract No. 2000-330, a Joint Participation Agreement (JPA), with the Florida Department of Transportation (FDOT), for a Federal Transportation Administration (FTA) Section 5311 Non-Urbanized Grant, in the amount of $54,100.00; authorizing execution and filing of the Application for Federal Assistance for the Grant Program; authorizing the execution and filing of the FY2000 Federal Transit Administration's certifications and Assurances, and rescinding Resolution No. 2000-185, approved by the Board on September 12, 2000.

9. **RESOLUTIONS**

Adopted Resolution No. 2000-281 authorizing the execution and submittal of Contract No. 99-358, a Joint Participation Agreement with the Florida Department of Transportation (FDOT) permitting FDOT to provide up to $715,277.00 in transit operating assistance to the SCAT (Sarasota County Area Transit) bus system, and rescinding Resolution No. 2000-220, approved by the Board on September 26, 2000.

10. **WARRANTS**

Approved the warrants dated November 27 through December 1, 2000, in the amount of $5,801,910.76, as detailed in the voucher packages filed in the Finance Department.

11. **MINUTES**

Approved the Minutes of meetings dated September 28 and October 11, 2000.

(1-1913)

2. **ENVIRONMENTAL SERVICES** - Continued

Following clarification of Staff's report by County Administrator James Ley pertaining to funding requirements, Chairman Mills moved to authorize execution of the Certification of Financial Responsibility for the Venice Gardens Water Treatment Plant deep injection well, for submission to the Florida Department of Environmental Protection (FDEP). The motion, seconded by Commr. Staub, carried without objection.

3. **ENVIRONMENTAL SERVICES** - Continued

Following inquiry, Environmental Services Utilities Planning Section Supervisor John Knowles reviewed the process for the development of the priority listing for County projects to be submitted for Southwest Florida Water Management District (SWFWMD) Manasota Basin Board Cooperative Funding.

Subsequent to discussion on the development process, the Catfish Creek Stormwater Improvement Project, and anticipated funding, Chairman Mills moved to approve the priority listing for County projects to be submitted. The motion, seconded by Commr. Patterson, carried without objection.

(1-2254)

26. **COMMISSION REPORTS** - Continued

B. **ORGANIZATIONS**

Chairman Mills noted the attendance of Ms. Cathy Layton and congratulated her on her recent appointment to the Charter Review Board by Governor Jeb Bush.

12. CONTRACTS/RESOLUTIONS
Following comments from Chairman Mills on consideration of the requests for tax exemption status for historical property, Community Services Historical Resources Specialist Lorrie Muldowney provided background information on Ordinance requirements and an overview of criteria for consideration and approval of the requests.

Ms. Muldowney presented the proposed Resolution to grant tax exemption status for property known as the Crisp Building located at 1970 Main Street, Sarasota, and Contract, a Historic Preservation Property Tax Exemption Covenant, with the Kauffman Family Partnership I (Owner) for the purpose of qualifying the Owner for an ad valorem tax exemption for qualified improvements made to the property for a ten-year period commencing January 1, 2001 through December 31, 2011.

Commr. Staub moved to adopt Resolution No. 2000-282, approving the tax exemption status for the Crisp Building. The motion, seconded by Commr. Mercier, carried by a 5-0 vote.

Commr. Staub moved to approve Contract No. 2001-063, a Historic Preservation Property Tax Exemption Covenant, with the Kauffman Family Partnership I, for the Crisp Building. The motion, seconded by Commr. Mercier, carried by a 5-0 vote.
(1-2585)

Ms. Muldowney presented an overview of the proposed Resolution to grant tax exemption status for property known as the Leonard Reid House located at 1435 7th Street, Sarasota, and Contract, a Historic Preservation Property Tax Exemption Covenant, with Donald Wallace (Owner) for the purpose of qualifying the Owner for an ad valorem tax exemption for qualified improvements made to the property for a ten-year period commencing January 1, 2001 through December 31, 2011.

Commr. Thaxton declared a conflict and filed the appropriate documentation.

Commr. Patterson moved to adopt Resolution No. 2000-283, approving the tax exemption status for the Leonard Reid House. The motion, seconded by Commr. Mercier, carried by a 4-0 vote, with Commr. Thaxton abstaining.

Commr. Patterson moved to approve Contract No. 2001-064, a Historic Preservation Property Tax Exemption Covenant, with David Wallace for the Leonard Reid House. The motion, seconded by Commr. Mercier, carried by a 4-0 vote, with Commr. Thaxton abstaining.
(1-2718)

Ms. Muldowney presented an overview of the proposed Resolution to grant tax exemption status for property known as the Hood Building located at 1373-1385 5th Street, Sarasota, and Contract, a Historic Preservation Property Tax Exemption Covenant, with Daniel P. and Judith C. Ball (Owners) for the purpose of qualifying the Owner for an ad valorem tax exemption for qualified improvements made to the property for a ten-year period commencing January 1, 2001 through December 31, 2011.

Commr. Thaxton moved to adopt Resolution No. 2000-284, approving the tax exemption status for the Hood Building. The motion, seconded by Commr. Staub, carried by a 5-0 vote.

12. **CONTRACTS/RESOLUTIONS - Continued**

Commr. Thaxton moved to approve Contract No. 2001-065, a Historic Preservation Property Tax Exemption Covenant, with Daniel P. and Judith C. Ball for the Hood Building. The motion, seconded by Commr. Staub, carried by a 5-0 vote.
(1-2795)

Ms. Muldowney presented an overview of the proposed Resolution to grant tax exemption status for property known as the Kicklighter House located at 1205 Cocoanut Avenue, Sarasota, and Contract, a Historic Preservation Property Tax Exemption Covenant, with Katherine Kelly (Owner) for the purpose of qualifying the Owner for an ad valorem tax exemption for qualified improvements made to the property for a ten-year period commencing January 1, 2001 through December 31, 2011.

Commr. Mercier moved to adopt Resolution No. 2000-285, approving the tax exemption status for the Kicklighter House. The motion, seconded by Commr. Staub, carried by a 5-0 vote.

Commr. Mercier moved to approve Contract No. 2001-066, a Historic Preservation Property Tax Exemption Covenant, with Katherine Kelly for the Kicklighter House. The motion, seconded by Commr. Staub, carried by a 5-0 vote.
(1-2872)

Ms. Muldowney presented an overview of the proposed Resolution to grant tax exemption status for property known as the Alice Watters Beebe House located at 1265 Tree Bay Lane, Sarasota, and a Contract, a Historic Preservation Property Tax Exemption Covenant, with Harold and Mary Michaels (Owners) for the purpose of qualifying the Owner for an ad valorem tax exemption for qualified improvements made to the property for a ten-year period commencing January 1, 2001 through December 31, 2011.

Commr. Staub moved to adopt Resolution No. 2000-286, approving the tax exemption status for the Alice Watters Beebe House. The motion, seconded by Commr. Patterson, carried by a 5-0 vote.

Commr. Staub moved to approve Contract No. 2001-067, a Historic Preservation Property Tax Exemption Covenant, with Harold and Mary Michaels for the Alice Watters Beebe House. The motion, seconded by Commr. Patterson, carried by a 5-0 vote.
(1-2980)

13. **RESOLUTIONS**

Following comments, Ms. Mikki Hartig, Agent for Geraldine and Walter Schwab, Owner/Petitioner, presented an overview of Historic Designation Petition No. 00-CoD-04, for the Alvah Jordan Home and Guest House located at 218 E. Pocono Trail, Nokomis, discussed the improvements to the property, and reviewed the criteria for consideration of the petition.

Community Services Historical Resources Specialist Lorrie Muldowney presented an overview of the Petition and noted the recommendation for approval by the Historic Preservation Board, pursuant to Ordinance No. 97-133.

Subsequent to comments, Commr. Staub moved to adopt Resolution No. 2000-287, approving Historic Designation Petition No. 00-CoD-04. The motion, seconded by Commr. Mercier, carried by a 5-0 vote.
(2-0006)

14. RESOLUTIONS

Ms. Ginger Daniel, Agent for Lisa S. Jones, Owner/Petitioner, presented an overview of Historic Designation Petition No. 00-CoD-03, a petition, for the George A. and Ethel Freeman House located at 4010 Roberts Point Road, Sarasota, reviewed the improvements to the property, and supported approval.

Community Services Historical Resources Specialist Lorrie Muldowney presented an overview of the Petition and reviewed the historic designation process. Discussion ensued on the criteria for application for tax exemptions.

Chairman Mills requested and County Administrator James Ley confirmed that the historic designation process will be clarified in future reports.

Subsequent to comments, Commr. Patterson moved to adopt Resolution No. 2000-288, approving Historic Designation Petition No. 00-CoD-04. The motion, seconded by Commr. Staub, carried by a 5-0 vote.

RECESS: 10:52 a.m. - 11:00 a.m.
(2-0355)

15. PUBLIC WORKS

Following comments from Chairman Mills on a request to speak, Public Works Project Development and Environment (PD&E) Section Supervisor Robert Fakhri, presented an overview of the design concepts and alignment recommendations for McIntosh Road from Sawyer Loop Road to Hicks Street, and advised of Staff's recommendation for proposed Alignment No. 5 Discussions were held with Mr. Fakhri and Public Works Construction Services General Manager Tom Wilcox on the following:

- modifications to traffic signal locations
- Wilkinson Road intersection
- proposed stormwater pond locations
- anticipated speed limit on the roadway
- ingress/egress to Old McIntosh Road.

Following comments, Commr. Staub moved to approve the design concepts and Alignment Recommendation No. 5 outlined in Staff's report. The motion, seconded by Commr. Thaxton, carried by a 5-0 vote.
(2-1323)

16. ADVISORY COUNCILS

The Board considered the appointment of seven (7) individuals to serve two-year terms on the Water and Sewer Advisory Committee, effective through December 2003.

Commr. Thaxton moved to reappoint Patrick Arbolino, Robert Fedel, John Finnimore, Michael Pender, and Leonard Smally. The motion, seconded by Commr. Staub, carried by a 5-0 vote.

Commr. Staub nominated Judith Johnson. Commr. Thaxton seconded the nomination. Commr. Staub nominated William Taft. Commr. Patterson nominated Harold Simon. Commr. Mercier seconded the nomination.

16. **ADVISORY COUNCILS - Continued**
Following discussion on the nominations, Chairman Mills noted the unanimous appointments of Judith Johnson and William Taft to serve two-year terms on the Water and Sewer Advisory Committee effective through December 2003.
(2-1480)

17. **ADVISORY COUNCILS**
The Board considered the appointments of four (4) individuals to the Keep Sarasota Beautiful Advisory Board as follows:
One (1) individual to fill an unexpired three-year term effective through March 2001;
One (1) individual to fill an unexpired three-year term effective through November 2001;
Two (2) individuals to fill three-year term effective through November 2003.

Commr. Staub moved to reappoint Donald Fleming and Tommy Meyer to three-year terms effective through November 2003. The motion, seconded by Commr. Thaxton, carried by a 5-0 vote.

Commr. Staub nominated John Johnston to fill an unexpired three-year term effective through March 2001 and Mark Royall to fill an unexpired three-year term effective through November 2001.

Chairman Mills closed the nominations without objection, and noted the unanimous appointments of John Johnston to fill an unexpired three-year year term effective through March 2001, and Mark Royall to fill an unexpired three-year term effective through November 2001, on the Keep Sarasota Beautiful Advisory Board.
(2-1560)

18. **BUDGETS**
Administrative Services Fiscal Planning and Budget Coordinator Juanita Still presented an overview and slide presentation on the Capital Improvement Program (CIP) FY2000, Fourth Quarter Status Report and noted the distribution of revised copies for Section E.

Discussions were held with County Administrator James Ley and Emergency Services Fire Chief Brian Gorski on the Waterworks/10th Street project included on Page E-2 of Staff's report.

Ms. Still responded to inquiries on the following projects:

- Englewood Sports Complex - Page E-6
- Van Wezel Remodeling - Page A-1
- Jacaranda Library - Page D-2.

Chairman Mills inquired and Ms. Still commented on allocations for the acquisition of properties for the North Library and noted that the information is the final report for FY1999-2000.
(2-2065)

19. **HOUSING/RESOLUTIONS**
Following comments on the remaining agenda items to be considered, Growth Management Office of Housing and Community Development Director Donald Hadsell presented an overview of the revised Housing Credit Guidelines and a proposed Resolution to authorize conceptual site plan review for specified affordable housing projects.

19. **HOUSING/RESOLUTIONS** - Continued

Subsequent to comments, Commr. Staub moved to approve the revised Housing Credit Guidelines and to adopt Resolution No. 2000-289, authorizing conceptual site plan review for specified affordable housing projects. The motion, seconded by Commr. Thaxton, carried by a 5-0 vote.

RECESS: 11:55 a.m. - 1:30 p.m.
(2-2281)

26. **COMMISSION REPORTS** - Continued

C. **BCC**

Chairman Mills reviewed revisions to the Open to the Public portion of Board meetings and noted the afternoon schedule.

29. **OPEN TO THE PUBLIC**

A. **ENVIRONMENTAL SERVICES**

Mr. Edward Harding commented on the disposal of solid waste through composting methods and options for wastewater/septic systems maintenance.

B. **ELECTIONS/POLICIES AND PROCEDURES**

Mr. John Flaherty commented on campaign contributions, speaker time limits, and compliance with County ordinances and State Statutes.

C. **COMMUNITY SERVICES/ORGANIZATIONS**

Mr. Robert Friedman commented on the Little League Baseball program and existing lease with the County.

D. **COMMUNITY SERVICES/ORGANIZATIONS**

Mr. Kurt Rohde commented on the history of Little League program and the existing lease with the County.

Following discussion, County Attorney Jorge Fernandez commented on Staff's review of the lease. Upon inquiry, Deputy County Administrator David Bullock commented on Staff options for resolution of the issue.

Discussion ensued with Mr. Rohde on the efforts of the Little League organization to resolve the issues.

E. **COMMUNITY SERVICES/ORGANIZATIONS**

Ms. Toneen Slimick commented on the Little League Baseball program and existing lease with the County.

Following comments, County Attorney Jorge Fernandez commented on the legal rights of the parties, advised that the courts have the final authority to determine individual rights, and discussed the terms of the lease. Individual comments followed.
(3-0433)

20. **ENVIRONMENTAL SERVICES**

Environmental Services General Manager Warren Wagner presented a status report on potable water and public supply water management. Discussions were held on the following:

- supply versus demand
- daily production and costs
- planning activities.

Environmental Services Administration and Finance Manager David Cook presented a status report on current and future conservation efforts. Discussions were held on the following:

- irrigation customers and large users
- code enforcement reporting hotline

Mr. Cook reviewed Staff's recommendation to amend Ordinance No. 2000-015 and requested authorization to advertise proposed amendments to the Ordinance. Mr. Cook noted the time frame for planning activities with County business centers and commented on variances granted by the Southwest Florida Water Management District (SWFWMD).

Environmental Services Public Communications and Outreach Coordinator Amie Haer commented on watering days/restrictions included in the Ordinance No. 2000-015 versus current SWFWMD restrictions.

Following comments from County Administrator James Ley on the enforcement process, Commr. Staub moved to authorize advertising of a public hearing to consider proposed Ordinance No. 2000-082, amending Ordinance No. 2000-015. The motion was seconded by Commr. Patterson. Subsequent to individual comments, the motion carried by a 5-0 vote.

(3-1981)

26. **COMMISSION REPORTS** - Continued

D. **BCC**

Following comments, Commr. Mercier moved to proceed with the public hearing on Coastal Setback Variance Petition No. 79-03-00-290, at this time. The motion, seconded by Commr. Staub, carried by a 5-0 vote.

(3-2030)

30. **RESOLUTIONS**

Public hearing continued from November 8, 2000, to consider a proposed Resolution, Coastal Setback Variance Petition No. 79-03-00-290, a petition by Edward C. and Elizabeth J. Bavaria, represented by Ms. Kristina V. Tignor, P.E., for the construction of a 75-foot long, shore-parallel vinyl bulkhead adjacent to and landward of a proposed 6-foot wide and 75-foot long rock revetment structure with two 40-foot long, shore-perpendicular, vinyl bulkhead returns at each end of the proposed revetment/bulkhead structure, and for the placement of beach compatible sand fill behind the bulkhead. All proposed construction is to be located a maximum of 55 feet waterward of the Barrier Island Pass Twenty-Year Hazard Line at property fronting the waters of Big Sarasota Pass at 4083 Shell Road, Siesta Key.

30. RESOLUTIONS - Continued
Following comments from Chairman Mills on the public hearing on November 8, 2000, Commr. Patterson inquired, and County Attorney Jorge Fernandez opined that no conflict exists for Commr. Patterson to consider the petition.

Having been duly sworn, Development Services Resource Protection Services Senior Engineer Rob LaDue commented on previous Board review of the petition, noted that the Petitioner has submitted a draft plan for review, and discussed the proposed public access. Mr. LaDue submitted a copy of an interoffice memorandum for the Office of the County Attorney dated December 4, 2000, and discussion ensued with Mr. LaDue and County Attorney Fernandez on the requirements of the County Code pertaining to public access.

Mr. LaDue's presentation continued with review of existing shore protection structures on neighboring properties, the proposed conceptual plan, and existing revetments. Mr. LaDue submitted a document entitled "Comparison Report of Prior and Pending Coastal Setback Variance Petitions" and a letter of support from Attorney William Merrill.
(4-0088)

Attorney Brenda Patten, representing Edward and Elizabeth Bavaria and duly sworn, commented on property owned by the petitioners, reviewed previous and existing property conditions, and discussed previous Board direction noting support of neighboring property owners.

Upon inquiry, County Attorney Fernandez noted that the Board is limited to act on only the current petition and action taken will not "bind" the Board to future approvals for surrounding properties.

Agent Kristina Tignor, duly sworn, commented on the time frame for the petition, the intent of the surrounding property owners, the proposed conceptual plan, and a code enforcement case on neighboring property, and reviewed the comparison report submitted by Staff.

Attorney Patten commented on the requested variance and pedestrian easements/public access.
(4-1050)

Upon inquiry, County Attorney Fernandez noted that the County will not incur any liability exposure for the proposed public access.

The following individuals, duly sworn, commented on the proposed variance petition:

Mr. Steven King
Attorney William Merrill

During speaker presentations, Mr. LaDue responded to inquiries pertaining to additional variance requests pending for neighboring properties and the time frame for Board consideration.

RECESS: 4:12 p.m. - 4:20 p.m.
(4-1523)

30. RESOLUTIONS - Continued

Upon inquiry, Mr. LaDue discussed erosion issues pertaining to a "straight line versus bowed line" revetment, the time frame for construction of the structure, and previous variances constructed in the area.

Commr. Staub moved to close the public hearing. The motion, seconded by Commr. Patterson, carried without objection.

(4-1720)

Following discussion on the proposed revetment line, Commr. Thaxton moved to adopt Resolution No. 2000-290, approving Coastal Setback Variance Petition No. 79-03-00-290. The motion was seconded by Commr. Staub. Subsequent to discussion on future variance requests, Commr. Staub moved to reopen the public hearing. The motion, seconded by Commr. Patterson, carried without objection.

Upon inquiry, Ms. Tignor noted agreement with Board discussion pertaining to variance petitions for neighboring property. Commr. Staub moved to close the public hearing. The motion, seconded by Commr. Thaxton, carried without objection.

Following individual comments, the motion to adopt Resolution No. 2000-290 carried by a 5-0 vote.

Discussion ensued on the time frame for consideration of variance petitions for neighboring properties. (See item later this meeting.)

(4-2302)

31. PUBLIC WORKS

Chairman Mills noted that consideration of the Metropolitan Planning Organization (MPO) discussion of the coordination and project priorities will be continued to the meeting scheduled for December 6, 2000.

30. RESOLUTIONS - Continued

Upon inquiry by Attorney William Merrill, Assistant County Attorney Stephen DeMarsh commented on Board options for documenting action taken this date and consideration of future petitions.

(4-2375)

21. PUBLIC WORKS

Public Works Stormwater Planning Section Supervisor Theresa Connor presented the Cost Effective Analysis for Stormwater Projects report and noted Staff's recommendation for adoption of the Benefit Analysis as outlined in the report. Ms. Connor discussed expenses incurred by private utilities for damages during a storm event, stormwater fees, and level of service, and reviewed the proposed use of the analysis report.

Commr. Thaxton moved to adopt the Benefit Analysis as outlined in Staff's report. The motion, seconded by Commr. Patterson, carried by a 5-0 vote.

Commr. Patterson inquired, and Ms. Connor noted the status of the Hatchett Creek Stormwater project.

(4-3375)

22. CLERK'S REPORT

A. CLERK OF CIRCUIT COURT
The Filed for Record List was noted.

23. COUNTY ADMINISTRATOR'S REPORT

A. BCC
County Administrator James Ley noted distribution of literature for the Board Retreat scheduled for December 7, 2000, and for the Convocation of Governments meeting scheduled for December 14, 2000. Discussion ensued on the format for the December 7th meeting.

24. COUNTY ATTORNEY'S REPORT

A. PLATS
County Attorney Jorge Fernandez presented, and Commr. Staub moved to approve the Final Plat of Venice Palms, Phase II. The motion, seconded by Commr. Thaxton, carried by a 5-0 vote.
(5-0069)

25. COMMITTEE REPORTS

A. ORGANIZATIONS

- Commr. Mercier noted that he will be serving on the canvassing board for Holiday Park and thanked Staff for their assistance to date.
- Commr. Staub discussed issues reviewed at the West Coast Inland Navigation District (WCIND) meeting pertaining to project funding.

  Commr. Patterson moved to authorize correspondence to Congressman Miller requesting support for Federal funds for the Midnight Pass Study and Lemon Bay project. The motion, seconded by Commr. Staub, carried by a 5-0 vote.

- Chairman Mills noted attendance at the anniversary celebration of the Pinellas Trail Program, and noted an upcoming meeting of the Metropolitan Planning Organization.

(5-0386)

26. COMMISSION REPORTS - Continued

D. BCC
Commr. Thaxton commended Staff for their efforts in providing information to the new commissioners and their service to the County.

E. GROWTH MANAGEMENT
Commr. Patterson commented on the Dearborn Community Redevelopment Area and funding alternatives. Following comments, Commr. Patterson moved to direct Staff to review options for lighting and financing options for the area. The motion, seconded by Commr. Staub, carried without objection.
(5-0566)

26. **COMMISSION REPORTS - Continued**

F. **ADMINISTRATION**
Commr. Patterson commented on available non-emergency numbers, and following comments, County Administrator James Ley noted that Staff will review the issue to provide public information for non-emergencies.
(5-066)

G. **BCC**
Commr. Staub commented on the installation of Constitutional Officers on January 2, 2000, and County Administrator James Ley noted that he will review options for holding the ceremonies at the Administration building.

H. **ORDINANCES/POLICIES AND PROCEDURES**
Commr. Staub noted receipt of a request for Mr. William King for additional speaking time at the public hearing scheduled for December 6, 2000, pertaining to connection to available central wastewater utility. Individual comments followed.

I. **STATE AGENCIES**
Subsequent to comments, Commr. Staub requested that Staff contact the Florida Department of Transportation (FDOT) and request the removal of a directional sign on State Road 70 directing traffic to Fruitville Road.

J. **ORGANIZATIONS**
Commr. Staub commented on the presentation to Mr. Chad Binette earlier this meeting and commended Englewood Sun Herald Warren Richardson on his service.
(5-0839)

K. **ORGANIZATIONS**
Chairman Mills noted receipt of the "Best Small City Award" and invited Board members to attend the presentation on December 12, 2000 to be held at the Van Wezel Auditorium.

L. **PUBLIC WORKS**
Following inquiry from Chairman Mills, Commr. Staub provided a status report on the Jacaranda lighting project.

M. **LEGISLATION**
Following comments from Chairman Mills, Administration Intergovernmental Relations Policy Coordinator William Broughton noted the distribution of an interoffice memorandum outlining legislative priorities to be presented at the Legislative Delegation on December 8, 2000.

27. **BCC**
The Board reviewed the County Commission "Board Assignments Report" dated November 30, 2000.

28. **BCC**
The Board reviewed the County Commissioners Meeting Schedule and 2001 Board calendar. Chairman Mills requested Board review of the 2001 calendar.

29. **OPEN TO THE PUBLIC** - No one appeared at this time.

MEETING ADJOURNED: 5:35 p.m.
(5-0978)

MINUTES APPROVED: 12/19/2000

BY: [signature] Chairman

ATTEST: Paula J. Christman
Deputy Clerk

Appendix G

The Future Conditions Floodplain Analysis Report by Jones Edmunds, dated 2019.

SARASOTA COUNTY
FUTURE CONDITIONS FLOODPLAIN ANALYSES

Sarasota County | January 2019

SARASOTA COUNTY
FUTURE CONDITIONS FLOODPLAIN ANALYSES

Prepared for:

Sarasota County

1001 Sarasota Center Boulevard

Sarasota, Florida 34240

Prepared by:

Jones Edmunds & Associates, Inc.

7230 Kyle Ct

Sarasota, FL 34240

Jones Edmunds Project No.: 19006-058-01

January 2019

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APPENDIX

1 INTRODUCTION

1.1 PURPOSE

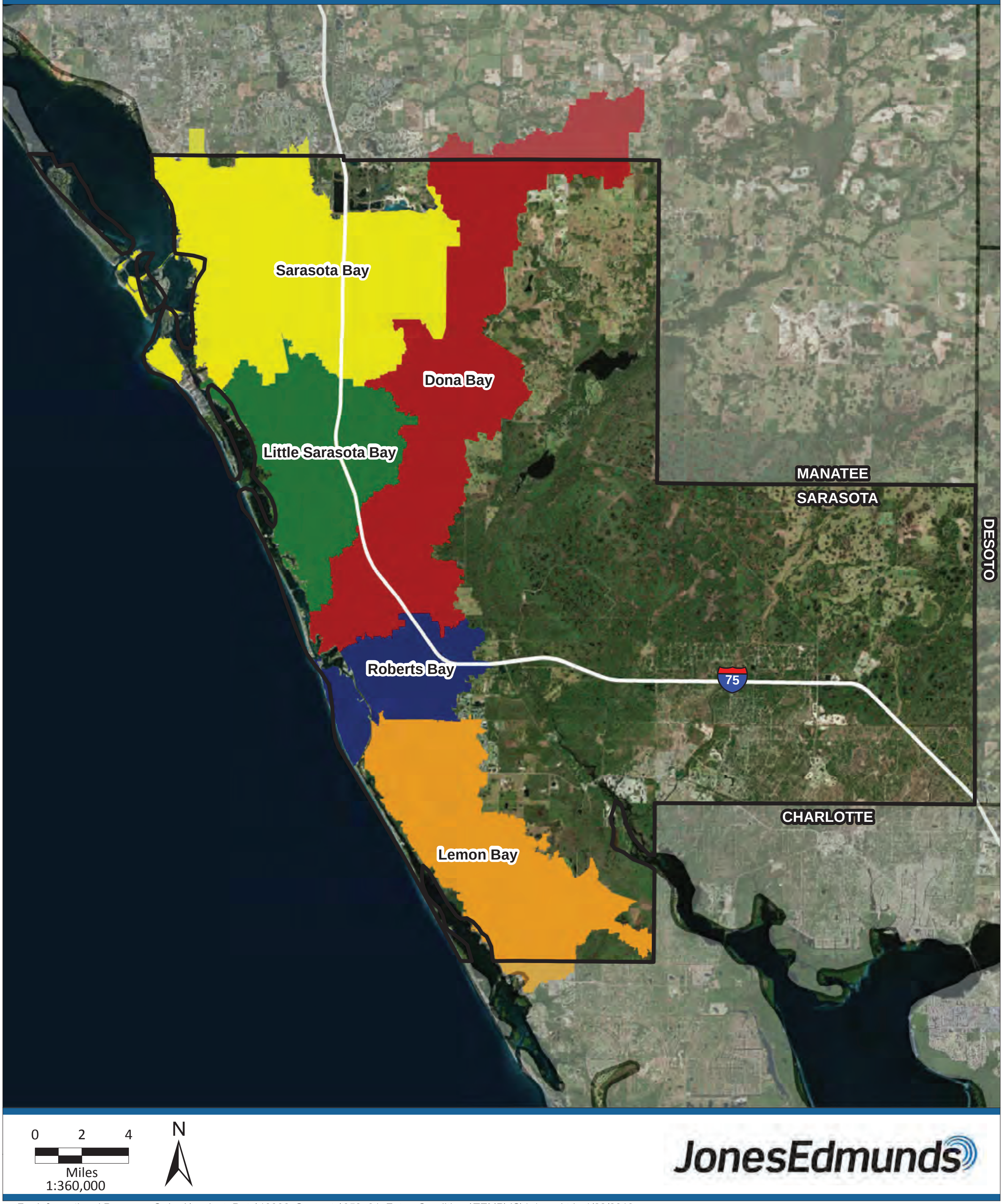
The National Oceanic and Atmospheric Administration (NOAA) estimates that sea-level rise (SLR) will impact coastal communities in the next 25 years. Planning for SLR impacts and future development conditions will aid communities in becoming more resilient to climate changes. The purpose of this analysis is to produce mapping information to depict the changes regarding the extent of flood hazards in response to changes in future hydrologic conditions and projected SLR scenarios of 2, 4, 6.17, 8, and 10 feet in five watersheds in Sarasota County. The watersheds include recently updated models for Phillippi Creek, Lemon Bay, Dona Bay, Roberts Bay, and Little Sarasota Bay (Figure 1-1). The 6.17 feet represents the NOAA 2017 projection that corresponds to the intermediate-high relative sea-level change for 2100.

For the watershed models to be effectively used to evaluate future conditions and SLR, the five watersheds were merged with the adjacent coastal models. The combined models allow for determination of coastal tailwater effects on inland portions.

Figure 1-1

Sarasota County Watersheds

Sarasota County Future Conditions Floodplain Analyses



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2 EXISTING CONDITIONS

To effectively model the coastal influences due to SLR and future hydrologic changes, the geographic information systems (GIS) data for the five watersheds were merged with their respective coastal models. These coastal models included:

- Coastal Fringe Phase I – Robert Bay.
- Coastal Fringe Phase II – Lemon Bay.
- Coastal Fringe Phase III – Sarasota Bay, Little Sarasota Bay, and Dona Bay.
- Coastal Fringe Lyons Bay.
- Island of Venice.
- Whitaker Bayou.
- Hudson Bayou.

2.1 LEMON BAY

The Lemon Bay watershed boundaries were revised to be consistent with Roberts Bay and Coastal Fringe Phase II boundaries. Hydraulic connections between the watersheds were updated accordingly. Basin areas, stage areas, weir inverts, and cross-sections were revised where necessary due to the boundary changes. The two geodatabases were then merged. The combined geodatabase was used to export the model information to Interconnected Pond Routing Version 3 (ICPR3) and to simulate the 100-year/24-hour design storm. The results from the combined model were compared to the results from the individual models. Differences in node stages were observed in areas along the boundary between the previous watershed models. These differences were expected since the models are hydraulically connected and node elevations are now dynamically calculated between the watersheds.

2.2 ROBERTS BAY

The Island of Venice watershed drains to Roberts Bay and the Gulf of Mexico. The model was developed in 2009, and elevation data were based on the National Geodetic Vertical Datum of 1929 (NGVD 29). Before merging the model with the Roberts Bay watershed, the Island of Venice data were converted to the County's current Geographic Watershed Information Systems (GWIS) format to be consistent with the Roberts Bay watershed data format. In additional, elevation data in the Island of Venice watershed were converted to the North American Vertical Datum of 1988 (NAVD 88). The two model geodatabases were combined and exported to ICPR3 to simulate the 100-year/24-hour design storm. The results were compared with the previous individual model results to ensure that the conversion was reasonable.

Additional boundaries along the Roberts Bay watershed were revised to be consistent with the Lemon Bay, Dona Bay, and Coastal Fringe Phase III watersheds. Hydraulic connections between the watersheds were updated accordingly. Basin areas, stage areas, weir inverts, and cross-sections were revised where necessary.

Once the boundaries were revised to be consistent, the Island of Venice/Roberts Bay watershed was combined with the Dona Bay portion of Coastal Fringe Phase III to form a single Roberts Bay watershed. The combined geodatabase was exported to ICPR3 and the 100-year/24-hour design storm was simulated. Due to its large size, the combined Roberts

Bay model took approximately 1 week to run. To optimize the run time of the model, several adjustments were made, such as thinning the cross-section and stage area data. However, the data thinning did not improve the run-time significantly. Unlike other watershed models for Sarasota County, the Roberts Bay model contains areas as small as 0.00001 acre-foot (ac-ft) in the stage-storage data. This may lead to some instabilities in the model or make the model take longer to converge on a solution and increase the run time. By changing the minimum storage values to 0.01 ac-ft (consistent with other models for this area), the model run-time improved significantly. The results from the combined model were compared against the results from the individual models and, as expected, the differences in node stages were observed in areas where the model is now dynamic between the watersheds.

2.3 DONA BAY

The Dona Bay watershed shares its boundary with the Little Sarasota Bay, Phillippi Creek, Roberts Bay, and Coastal Fringe Lyons Bay watersheds.

The Coastal Fringe Lyons Bay watershed was originally developed using elevations referenced to the NGVD 29 datum. The watershed geodatabase was also recently converted to GWIS. Reviewing the data revealed discrepancies between the model and geodatabase. Therefore, the geodatabase was rectified to match the ICPR3 model inputs. Elevation data were also converted to NAVD 88 to be consistent with the County's other watershed models.

Several issues were identified in the Coastal Fringe Lyons Bay watershed model, and the County recognizes that the model will require additional work (not included in this scope) to accurately represent existing conditions in that watershed. For this study, many basins were aggregated and hydraulic parameters were revised based on Light Detection and Ranging (LiDAR) information to reasonably represent the main channel system that drains into Lyons Bay. Since the basins were changed for the purpose of this study, the hydrologic parameters (i.e., Curve Number [CN] and Time-of-Concentration [TC]) were also revised using the Natural Resource Conservation Service CN and Technical Release-55 methodologies.

The Dona Bay watershed boundaries were revised to be consistent with Little Sarasota Bay, Phillippi Creek, Roberts Bay, and the new Coastal Fringe Lyons Bay geodatabases. Hydraulic connections between the watersheds were revised. Basin areas, stage areas, weir inverts, and cross-sections were updated as necessary.

The Coastal Fringe Lyons Bay geodatabase was then merged with the Dona Bay geodatabase. The combined geodatabase was exported to ICPR3 and the 100-year/24-hour design storm was simulated. The results from the combined model were checked against the results of the individual watershed models and, as expected, the differences in node stages were observed in areas where the model is now dynamic between the watersheds.

2.4 LITTLE SARASOTA BAY

The Little Sarasota Bay watershed boundaries were revised to be consistent with Dona Bay, Phillippi Creek, Coastal Fringe Phase I, and Coastal Fringe Phase III watersheds. Hydraulic connections between the watersheds were revised accordingly. Basin areas, stage areas, weir inverts, and cross-sections were updated where appropriate. The Coastal Fringe

Phase III watershed was then merged with the Little Sarasota Bay watershed. The combined geodatabase was then exported to ICPR3 and the 100-year/24-hour design storm was simulated. The results from the combined model were checked against the individual models and, as expected, the differences in node stages were observed in areas where the model is now dynamic between the watersheds.

2.5 SARASOTA BAY

The Sarasota Bay watershed combined model includes Phillippi Creek, Hudson Bayou, Whitaker Bayou, Coastal Fringe Phase III, and the majority of Coastal Fringe Phase I. Before merging with the Sarasota Bay watershed, the Hudson Bayou and Whitaker Bayou models were converted to NAVD 88. Boundaries and hydraulic connections between the watersheds were revised to be consistent with each other. Basin areas, stage areas, weir inverts, and cross-sections were updated as necessary. The combined geodatabase was then exported to ICPR3 and the 100-year/24-hour design storm was simulated. The results from the combined model were checked against the individual models and, as expected, the differences in node stages were observed in areas where the model is now dynamic between the watersheds.

3 FUTURE CONDITIONS

3.1 BACKGROUND

Two factors used for developing the future conditions floodplain map for this Study are future development in the watershed and SLR.

3.1.1 FUTURE DEVELOPMENT IN THE WATERSHED

As Sarasota County recovers from the recent economic downturn, the next 5 years indicate an increased growth rate with almost 24,000 new residents projected from 2015 to 2020, at an average annual increase of approximately 1.2 percent per year. Long-term projections indicate that the County could reach nearly a half-million residents by 2040.

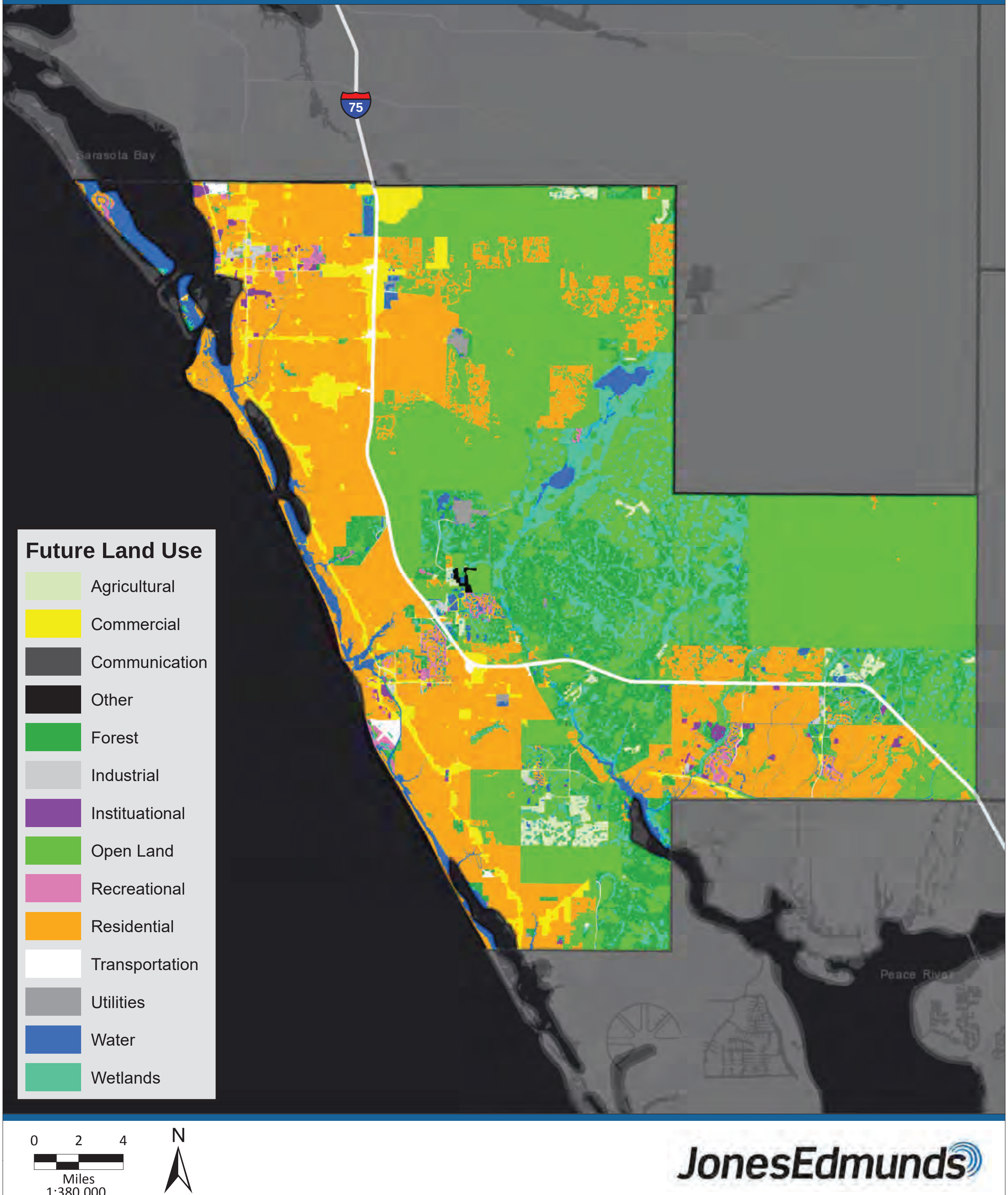
Changes in future development will influence the peak discharge of floods by modifying how rainfall is stored on and/or run off the land into tributaries. In undeveloped areas such as forests and grasslands, rainfall is collected and stored on vegetation, in the soil column, and in surface depressions. When this storage capacity is filled, runoff flows slowly over land or as subsurface flow. In contrast, urban areas have less capacity to store rainfall, since much of the urban land surface is covered by roads and buildings. Construction of these roads and buildings often involves removing vegetation, soil, and depressions from the land surface. The permeable soil is replaced by impermeable surfaces such as roads, roofs, parking lots, and sidewalks that store little water, reduce infiltration of water into the ground, and accelerate runoff to ditches and streams. In suburban areas, where lawns and other permeable landscaping may be common, rainfall can saturate thin, compressed soils and produce overland flow that runs off quickly. Dense networks of ditches and culverts in cities reduce the distance that runoff must travel over land or through subsurface flow-paths to reach streams and rivers.

Since land use can greatly affect the runoff potential, mapping of future floodplains must consider future land uses. Figure 3-1 illustrates the future land use designations for Sarasota County.

Figure 3-1

Sarasota County Future Land Use

Sarasota County Future Conditions Floodplain Analyses



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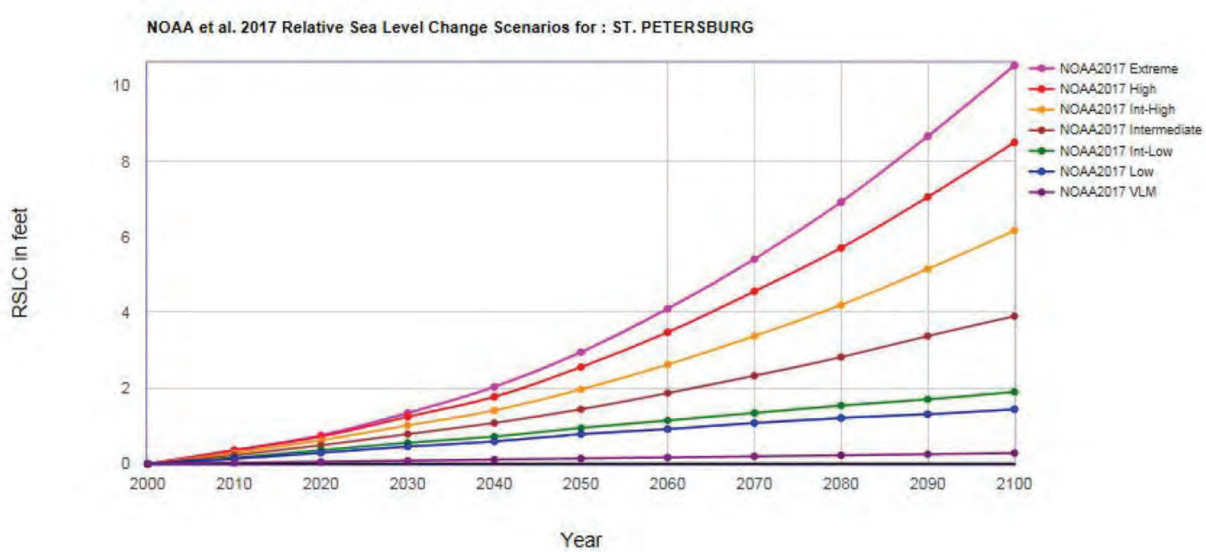
3.1.2 CLIMATE CHANGE AND SEA LEVEL RISE

Global sea level has been rising over the past century, and the rate has increased in recent decades. The two major causes of global sea level rise (SLR) are thermal expansion caused by warming of the ocean and the increased melting of land-based ice, such as glaciers and ice sheets.

As sea level rises, low-lying coastal areas will be increasingly prone to coastal and inland flooding. Storm surge and wave heights during hurricanes will increase as coastal water depths increase with sea level rise, amplifying the damage potential of hurricanes. Because stormwater drainage systems rely mainly on gravity, sea level rise may reduce their effectiveness and potentially exacerbated inland flooding during rain events, especially in low-lying interior floodplains. Climate change can potentially increase the impact and frequency of flooding events.

Error! Reference source not found. illustrates the Relative Sea Level Change (RSLC) S cenarios for St. Petersburg, Florida, as calculated using the NOAA projections and regional corrections (NOAA, 2017).

Figure 3-2 Relative Sea Level Change Projections – Gauge: 8726520, St. Petersburg, FL



3.2 METHODOLOGIES

The future land use layers for Sarasota County, Manatee County, and City of Sarasota were combined into a single layer. Several future land use categories were revised to match existing land use categories to develop composite CNs for each watershed. In some cases, existing CN values may be higher than values calculated for future conditions. Several reasons may account for this, including that some CN values may have been manually adjusted in the individual watershed to better calibrate the model. Therefore, in cases where the existing CN is higher than the calculated CN based on future conditions, the existing CN was retained for use in the future floodplain analyses.

The Community Rating System encourages communities to model, at a minimum, the projected intermediate-high RSLC for 2100. According to the recent NOAA 2017 projections, this value is currently 6.17 feet. Since these values are subject to change and vary by planning horizon, the model evaluated variable RSLC values of 2, 4, 6.17, 8, and 10 feet. In the model, the RSLC is the new tailwater condition on which the analysis is based. In each of the tailwater scenarios, the initial conditions were revised for all nodes that were affected by the tailwater including all hydraulically connected nodes. Each scenario was modeled using the 100-year/24-hour design storm for the watersheds. Level-pool inundation areas were developed for each of the modeled RSLC scenarios. The inundation areas were mapped using GIS by assigning flood elevations to the basins and comparing those elevations to the County's LiDAR. Figure 3-2, Figure 3-3, Figure 3-4, Figure 3-5, and Figure 3-6 show the inundation areas for each watershed resulting from these scenarios. Appendix A contains large-size figures for these watersheds.

Figure 3-3

Future Conditions Inundation - Lemon Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

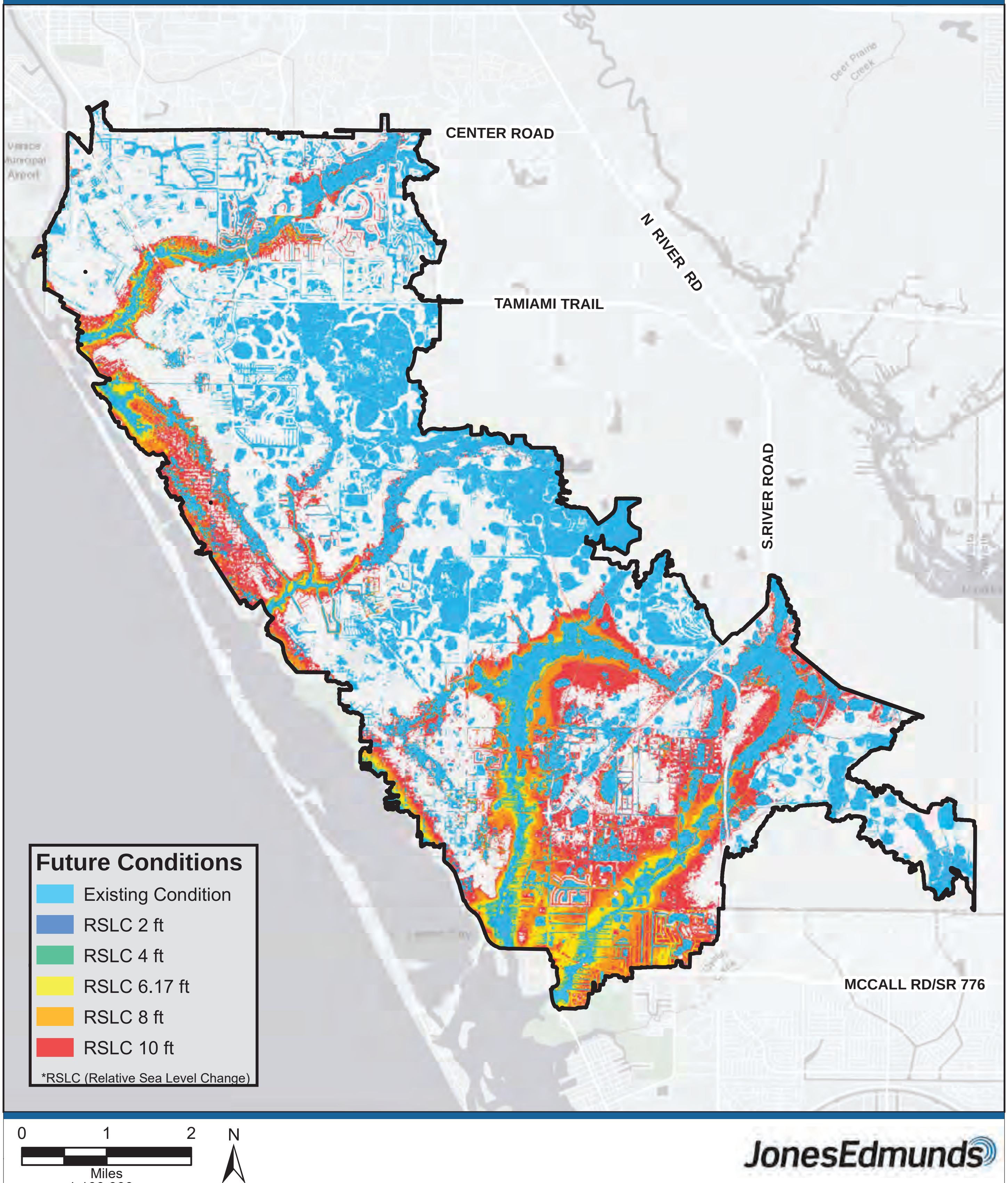


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Figure 3-4

Future Conditions Inundation - Roberts Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

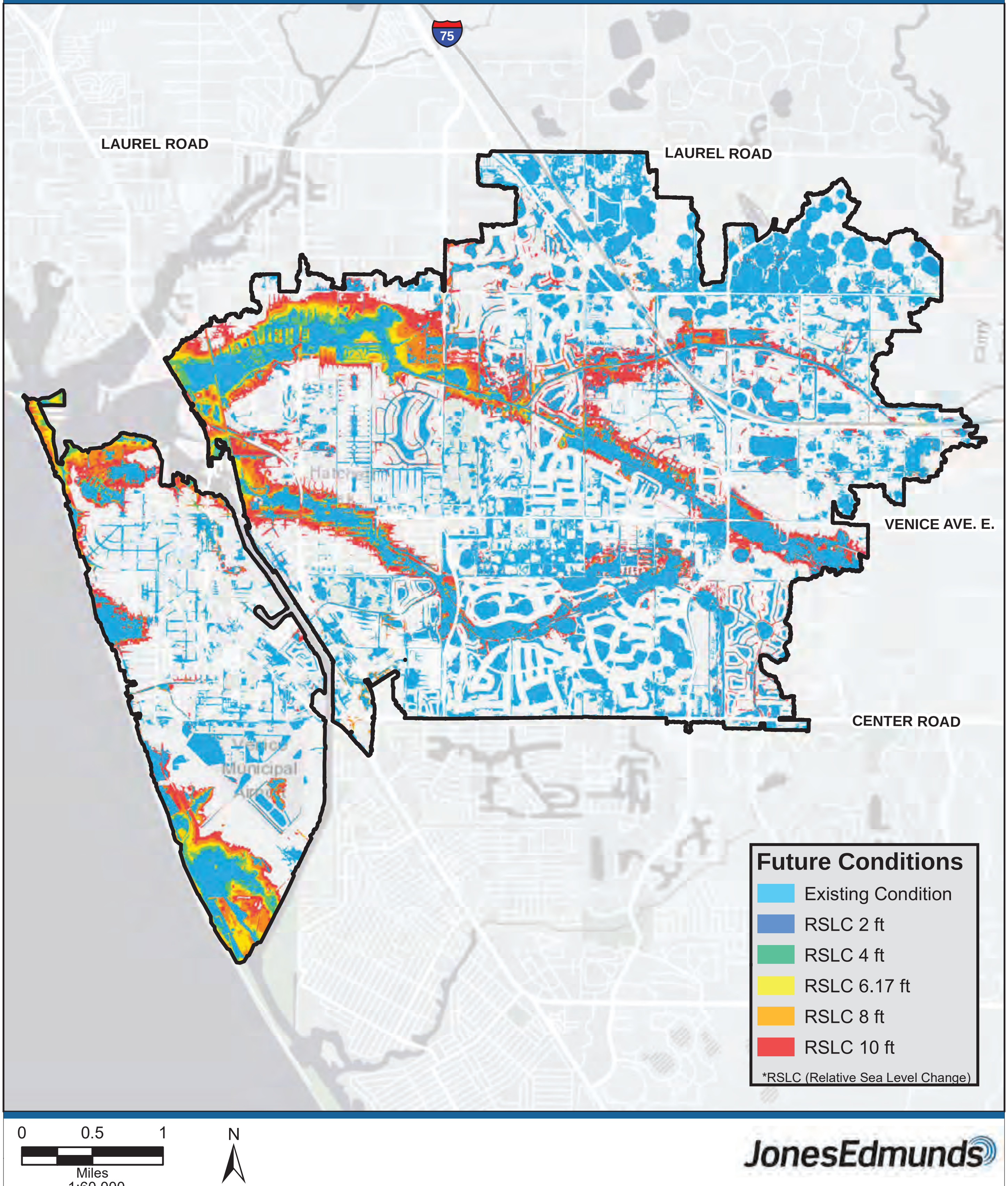

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Figure 3-5

Future Conditions Inundation - Dona Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

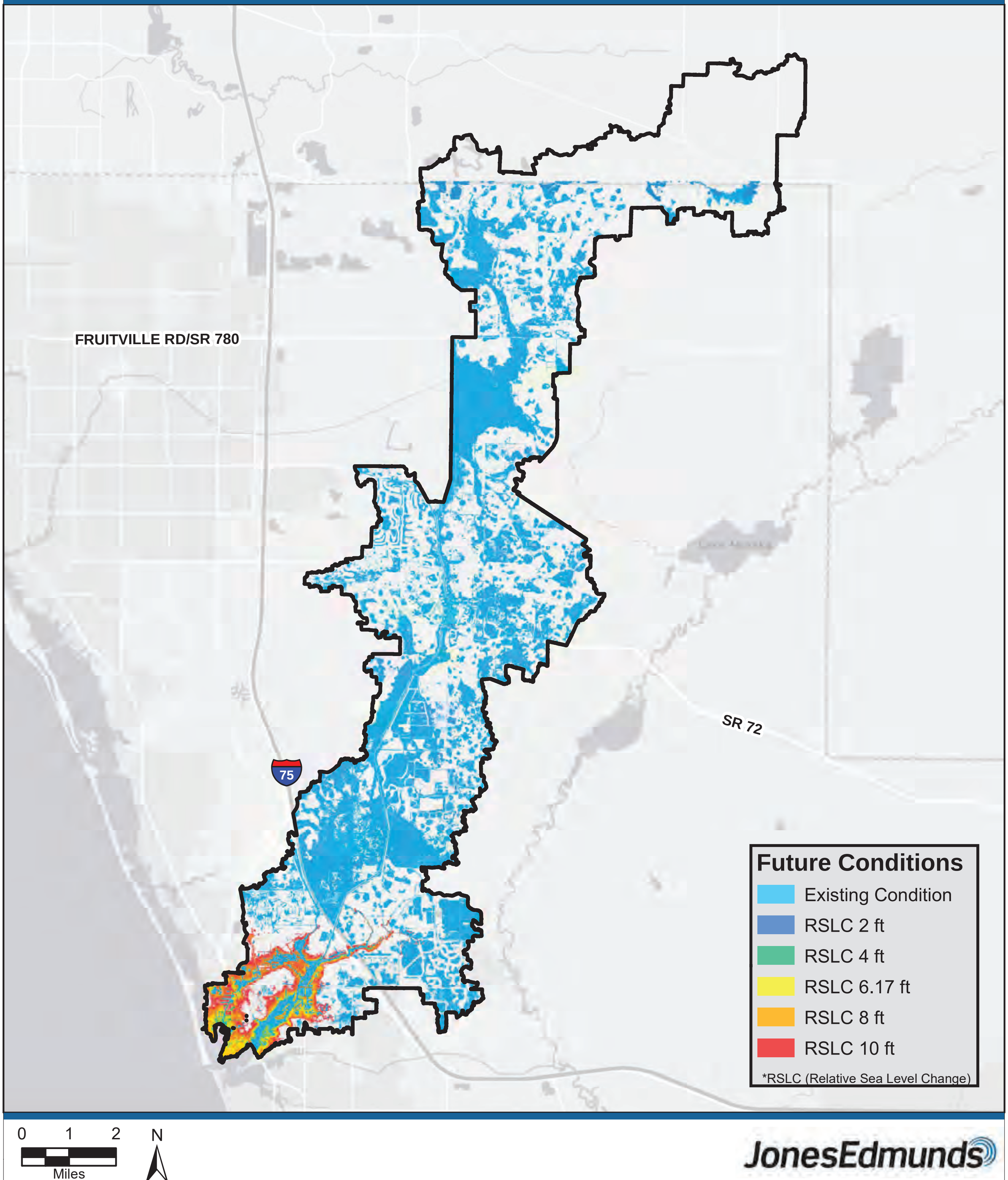

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Figure 3-6

Future Conditions Inundation - Little Sarasota Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

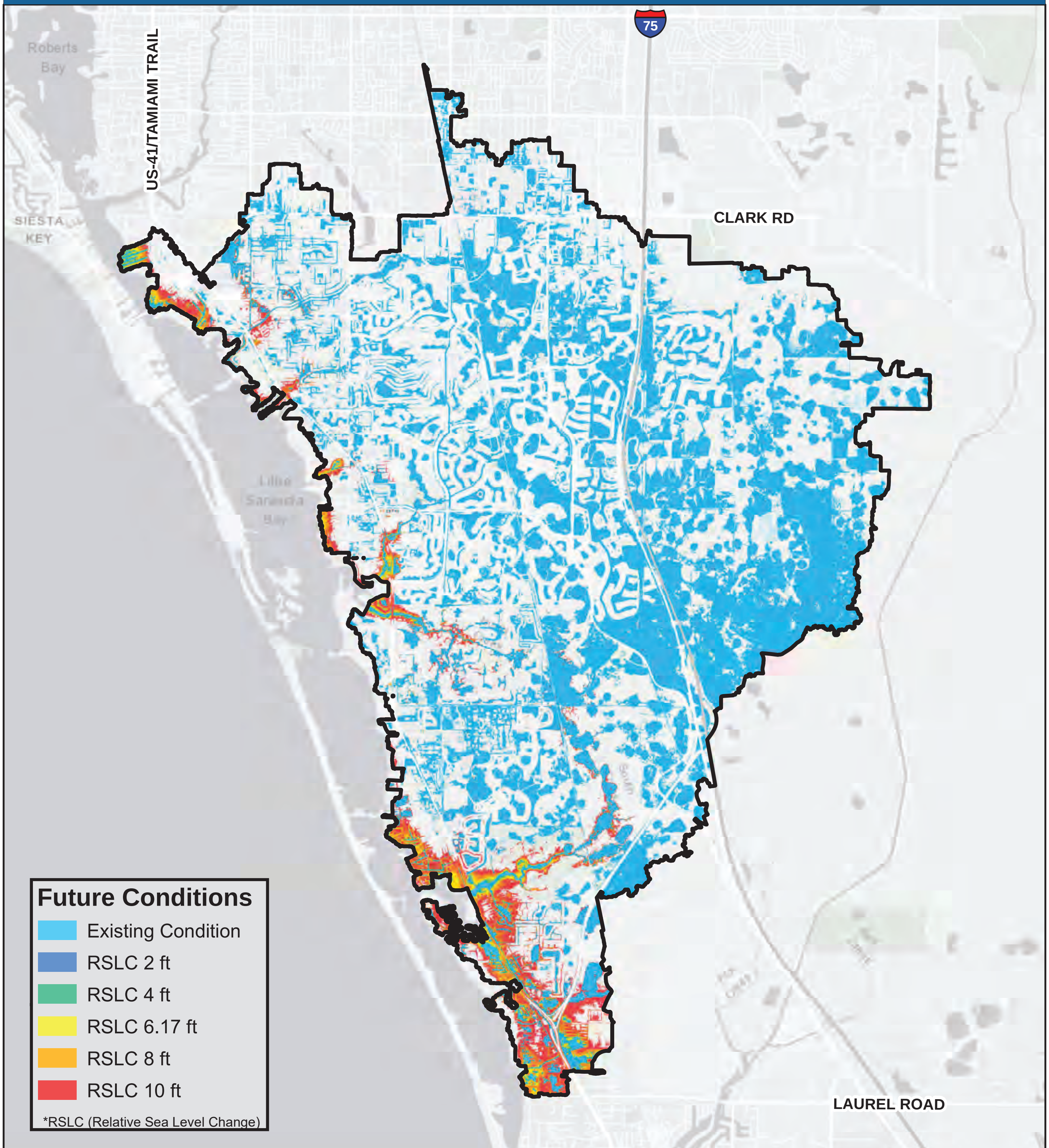

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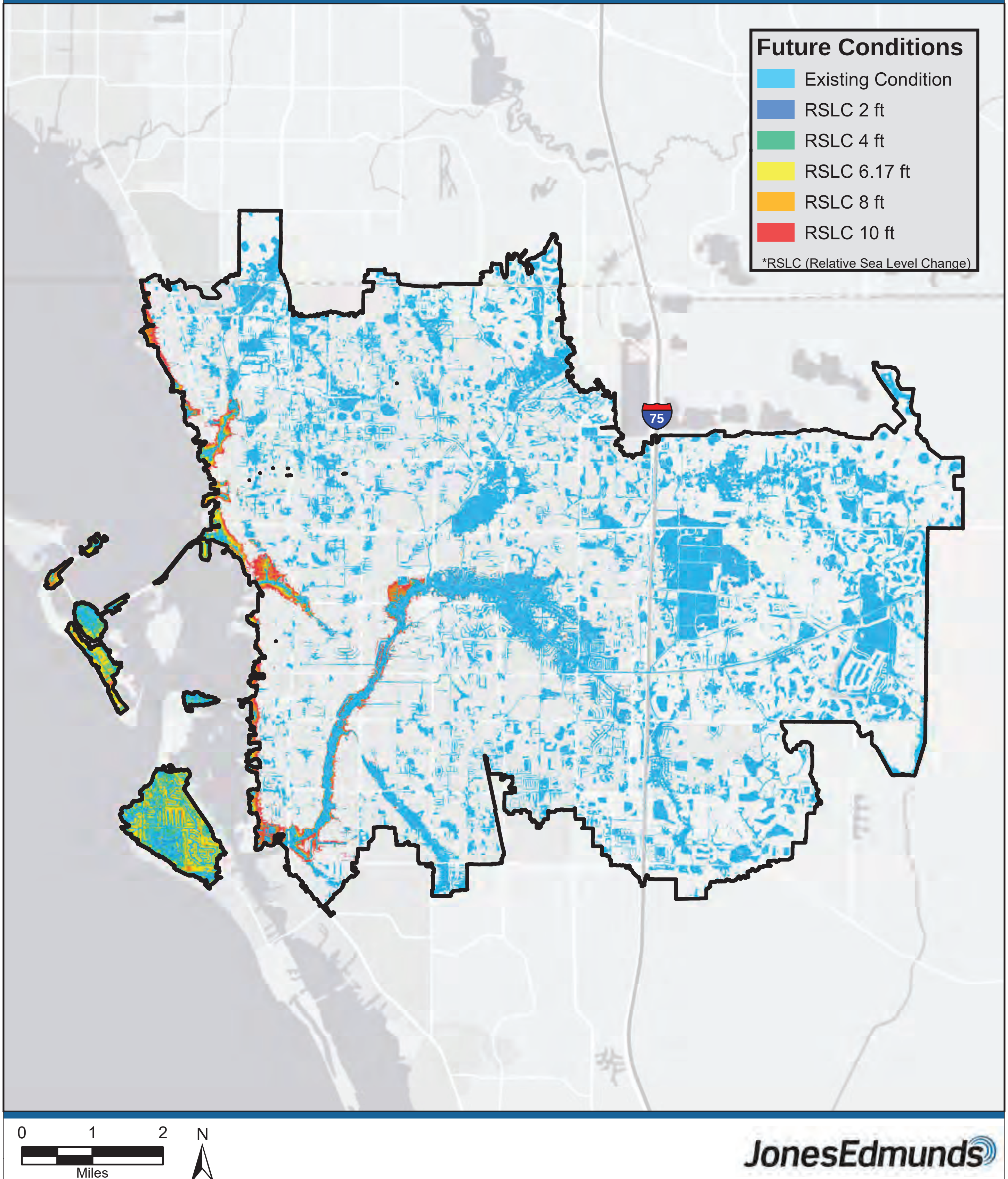
Figure 3-7

Future Conditions Inundation - Sarasota Bay Watershed

Sarasota County Future Conditions Floodplain Analyses

Sarasota County



JonesEdmunds

For Informational Purposes Only J:\project_Data\19006_Sarasota\058_01_FutureConditions\TEMP\JS\3-7.mxd tdo 1/22/2019

Appendix A

Full-Size Watershed Figures