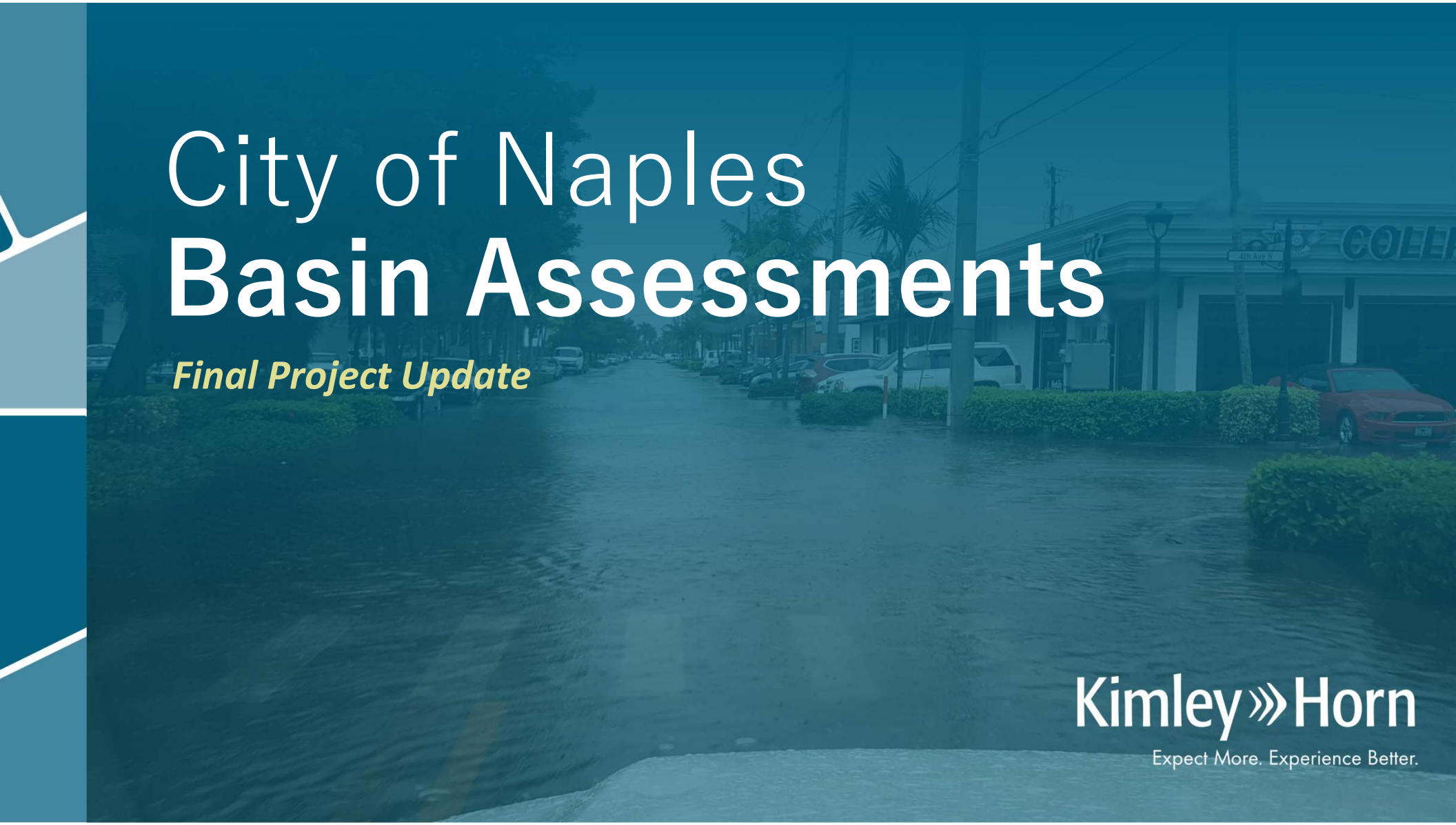


City of Naples
Basin Assessments

Final Project Update

Kimley»Horn

Expect More. Experience Better.

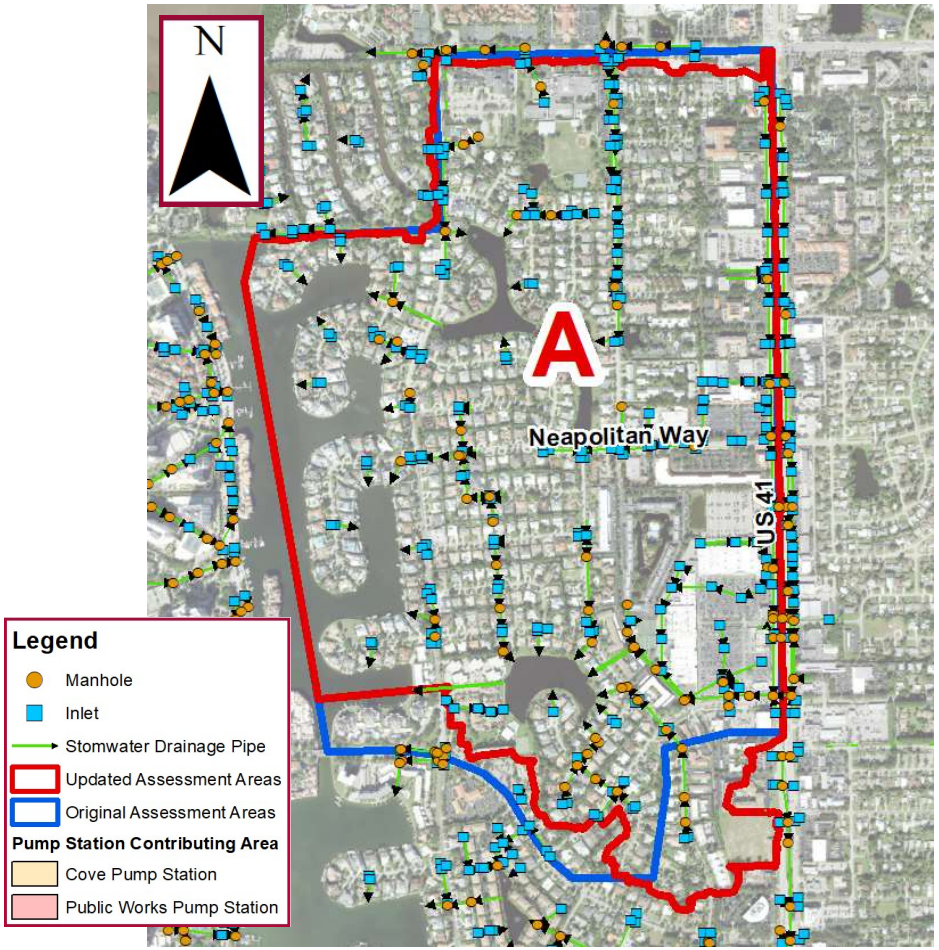
Agenda

- Project Overview and Goals
- Data Collection
- Existing Conditions Model
  - Model Calibration
  - Model Recommendations and Analysis
- Public Coordination
- Alternatives and Future Condition Analysis
- Benefit and Cost Analysis
- Findings and Recommendations

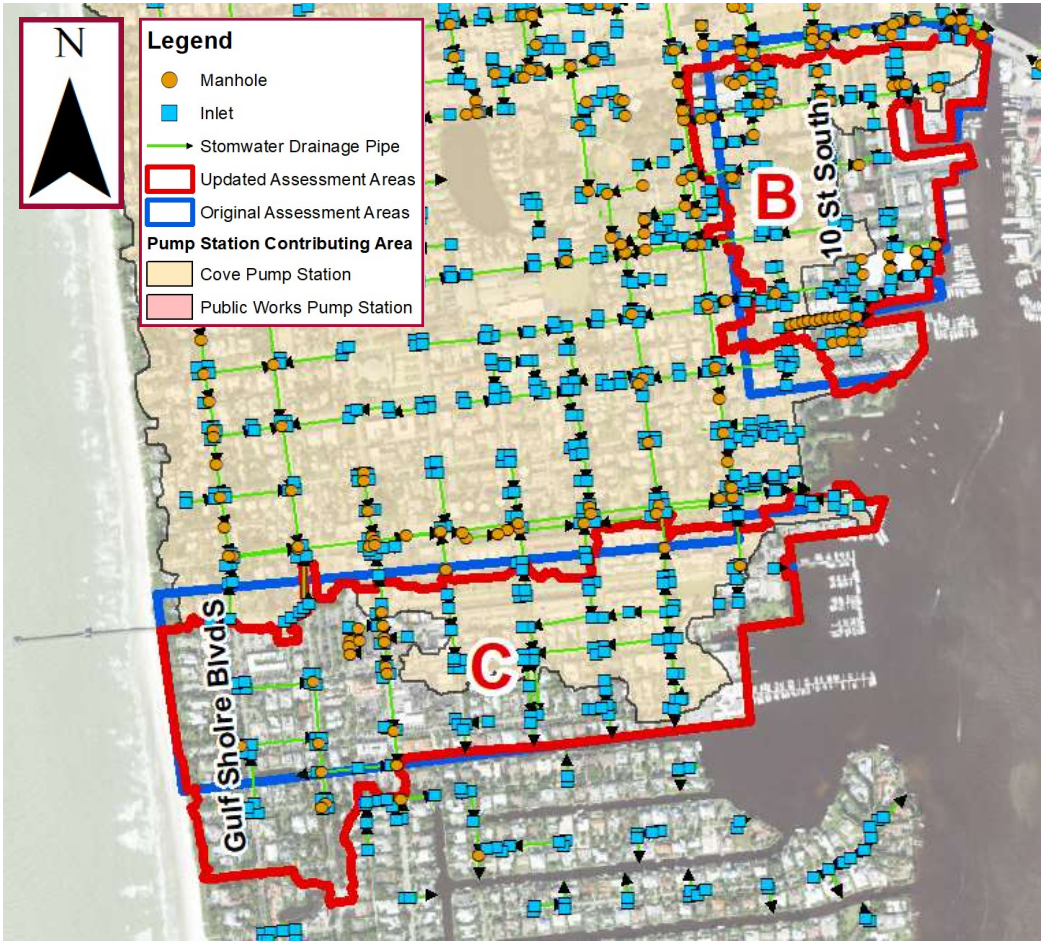
Project Overview

- Five areas of interest across the City of Naples are being studied with the goal to reduce the impacts of flooding during storm events (Assessment Areas A-E)
- The five areas chosen were identified as vulnerable to flooding or water quality issues
- Project kicked off on September 22, 2021

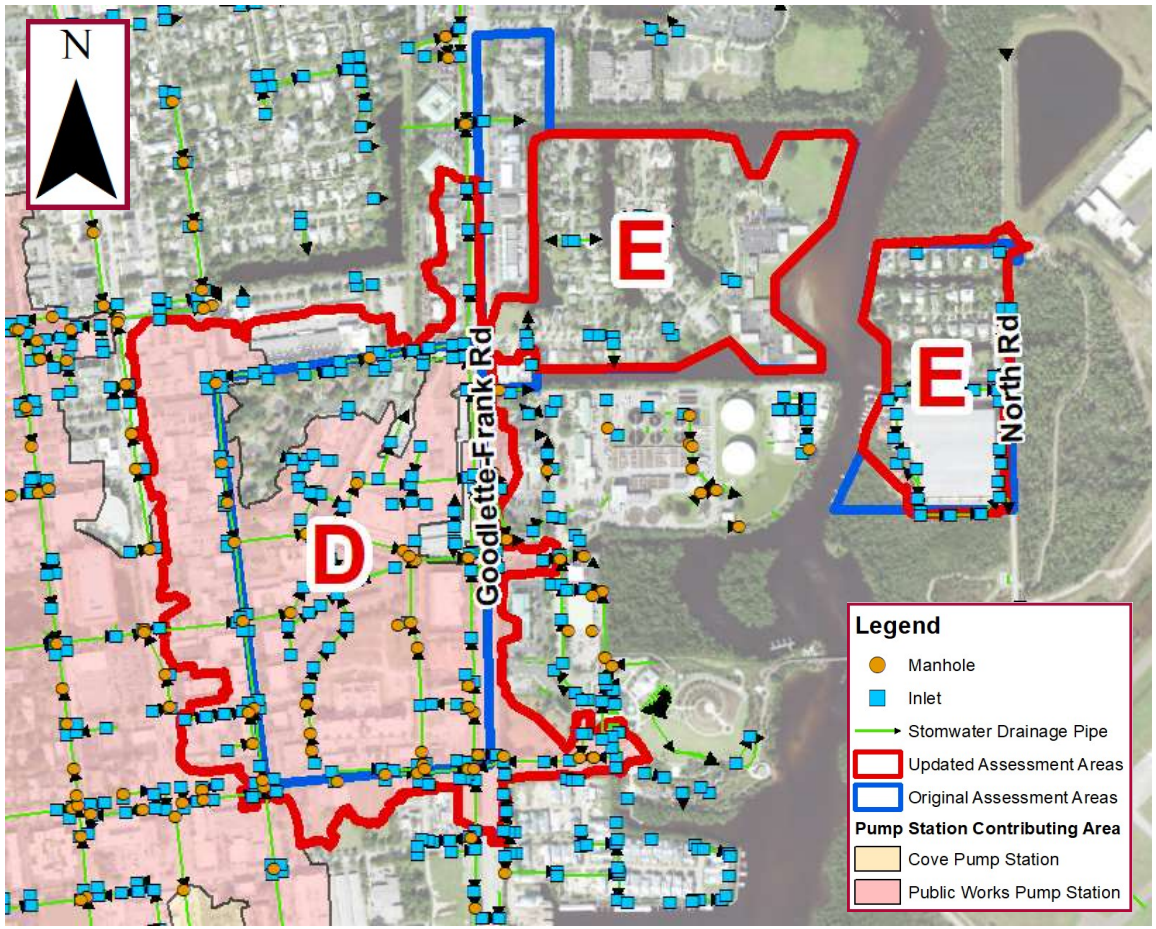
Assessment Area Refinement



Assessment Area Refinement



Assessment Area Refinement

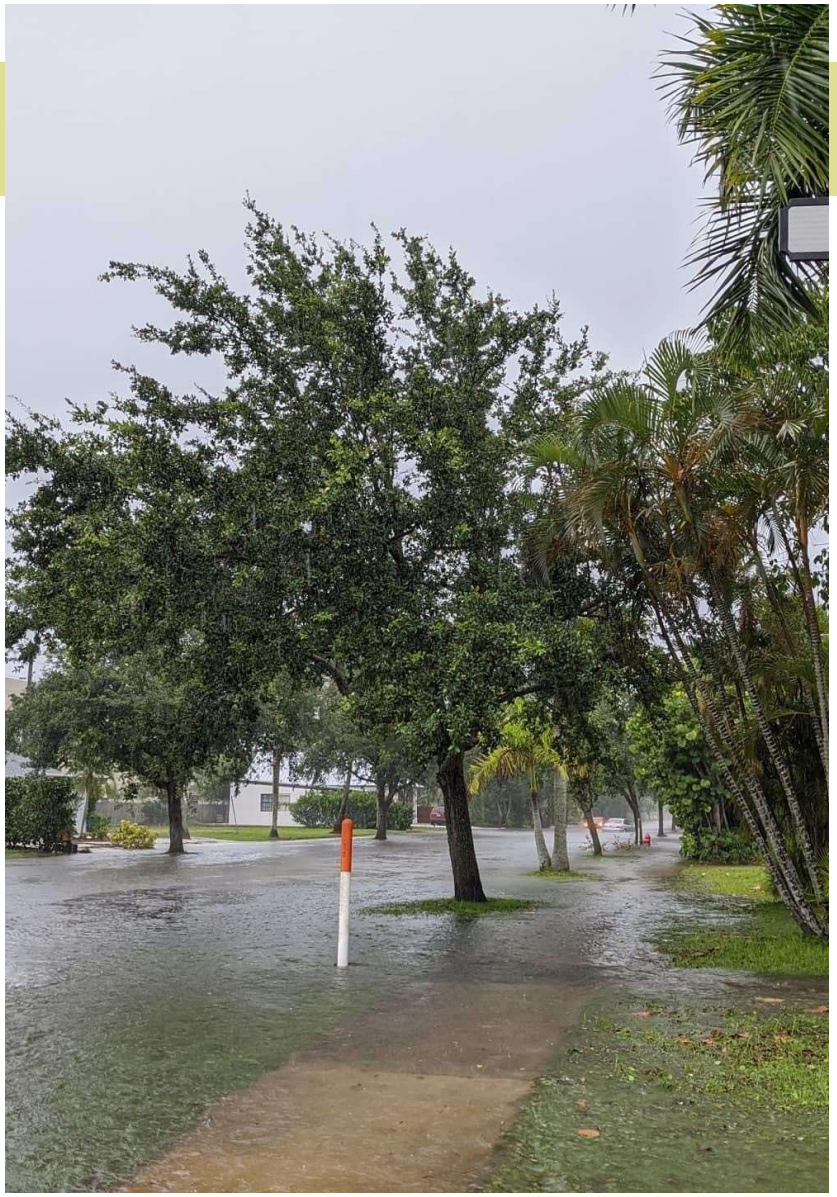


Project Goals

1. Developing a stormwater model that will simulate the impacts of rainfall and sea level rise and help determine the extents of flooding
2. Protection of and improvement to the City's surface and ground water resources
3. Protection of public and private property
4. Protection and restoration of ecology
5. Planning for wise and strategic stormwater management system investments
6. Planning for sustainability and resiliency relating to anticipated climate change

Project Objectives

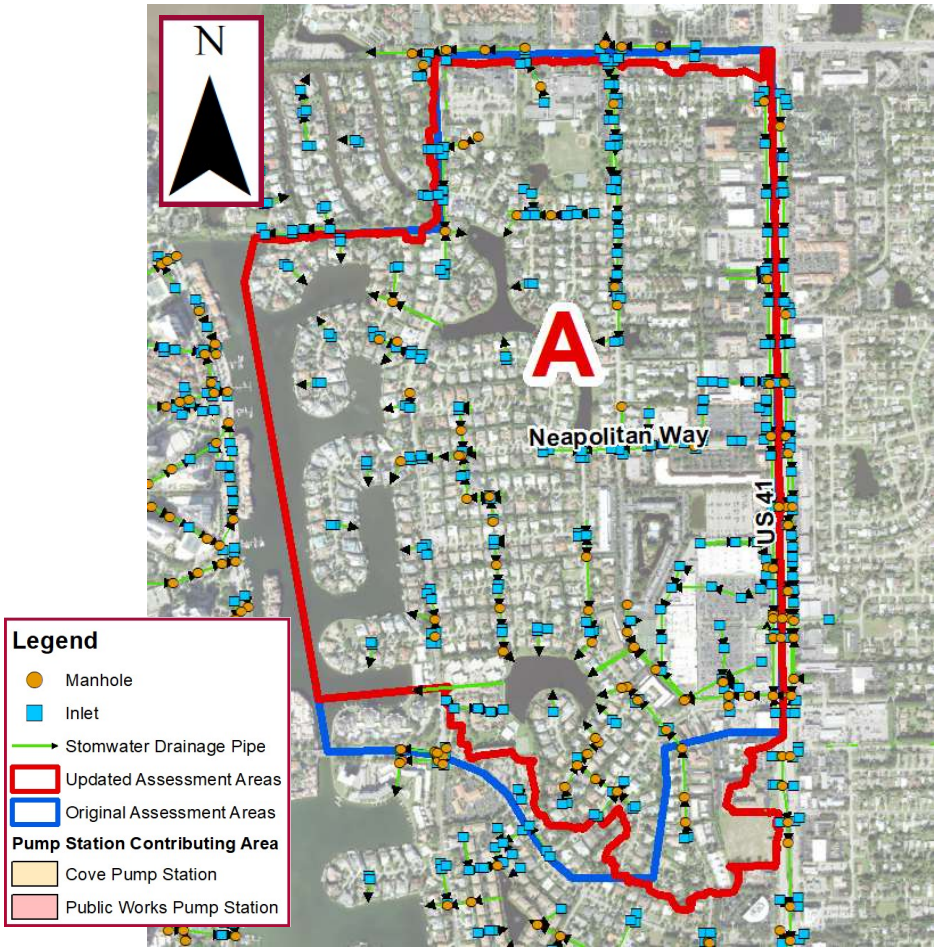
- ✓Identify areas vulnerable to flooding
- ✓Identify possible solutions to improve flood conditions in those vulnerable areas
- ✓Propose anticipated phasing (short-term, medium-term, and long-term) based on analyses performed



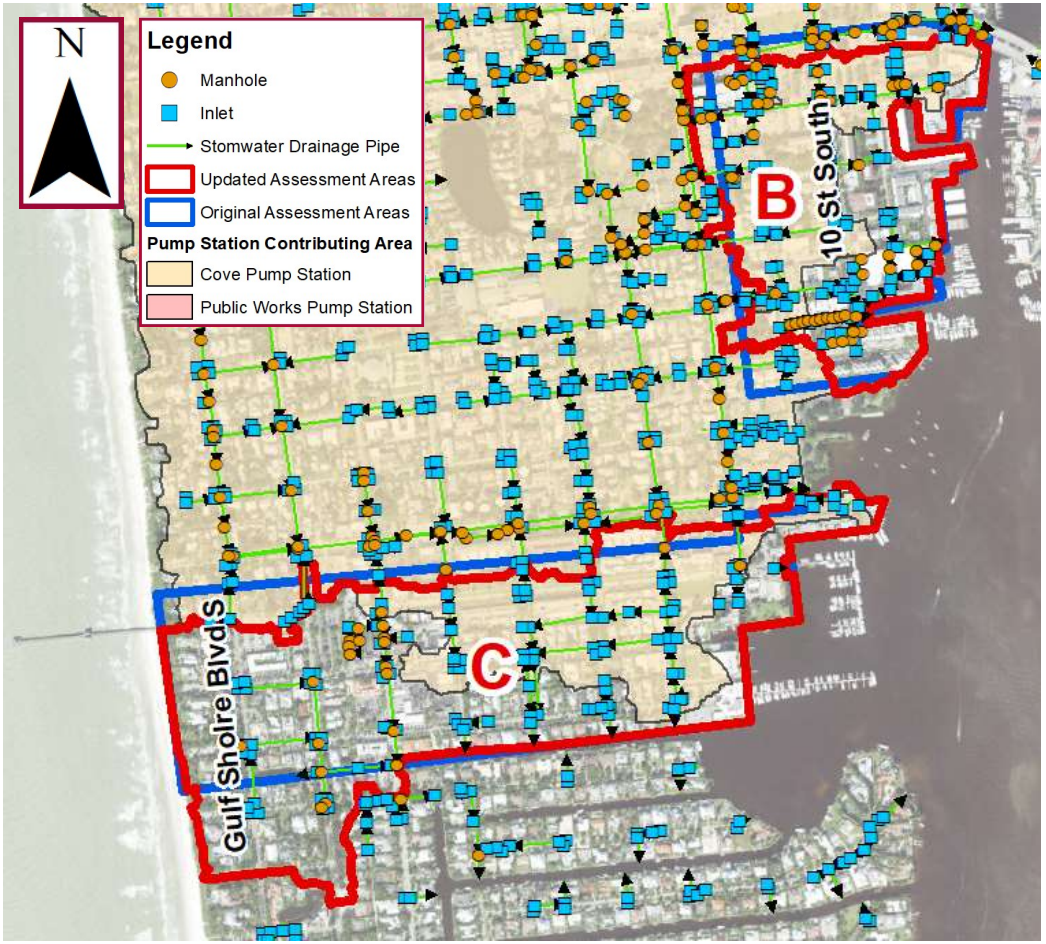
Project Tasks

- Data Collection and Documentation
- Model Recommendations and Analysis
- Existing Conditions Model
  - Model Calibration
- Public Coordination
- Alternatives Analysis
  - Sensitivity Analysis
- Future Conditions Analysis
  - Baseline Future Conditions
  - Long-Range Improvement Alternatives
- Benefit and Cost Analysis
- Capital Improvements Prioritization and Final Report

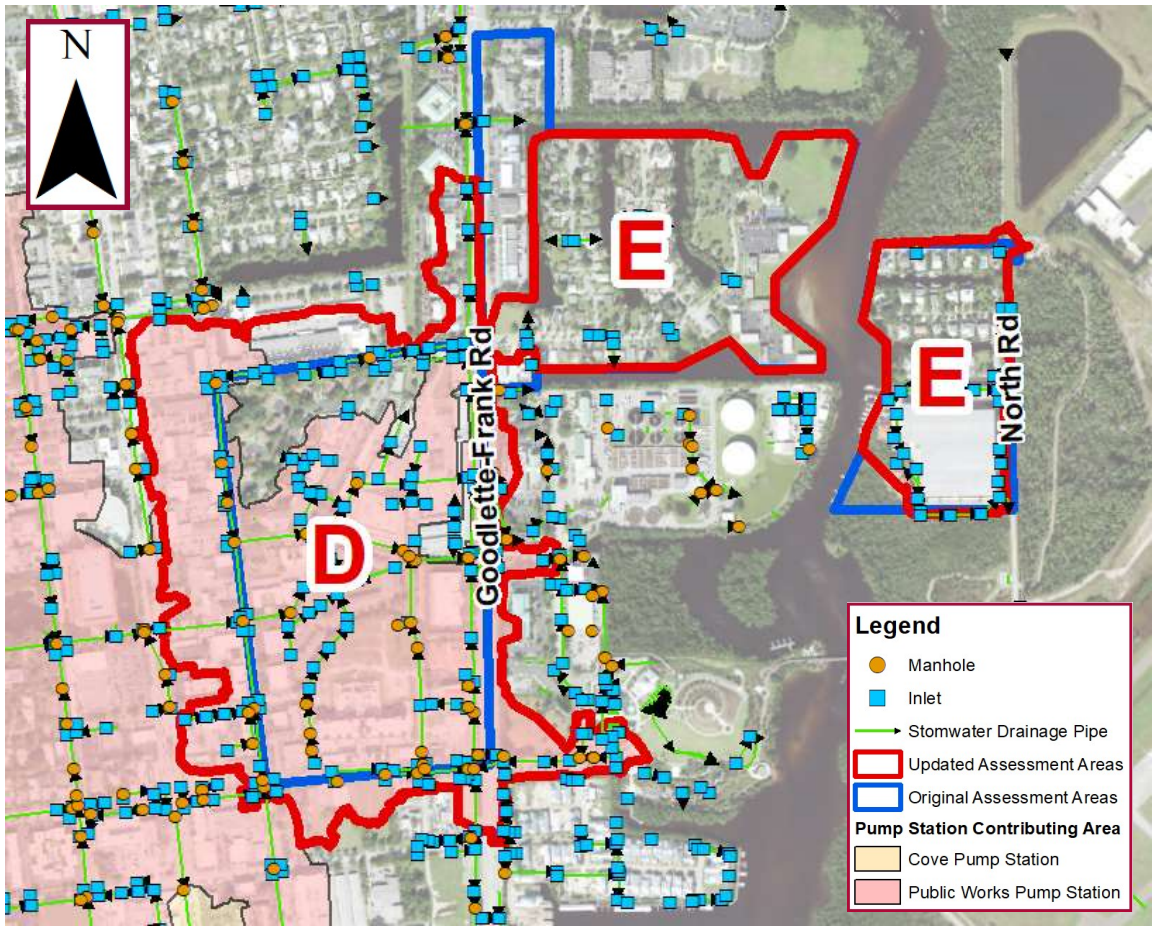
Infrastructure Data Collection



Infrastructure Data Collection

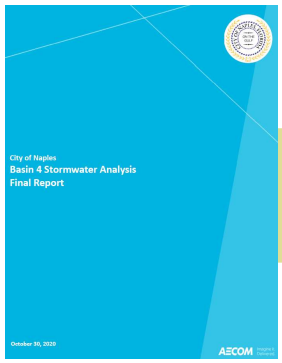


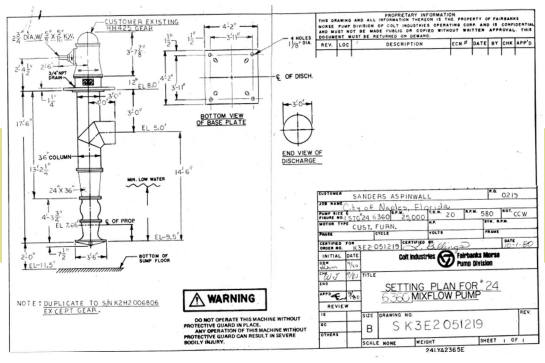
Infrastructure Data Collection

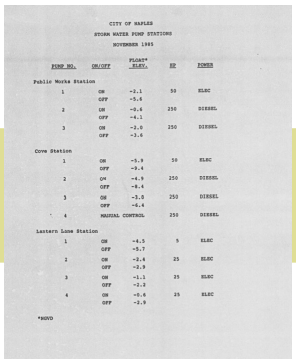


Data Collection

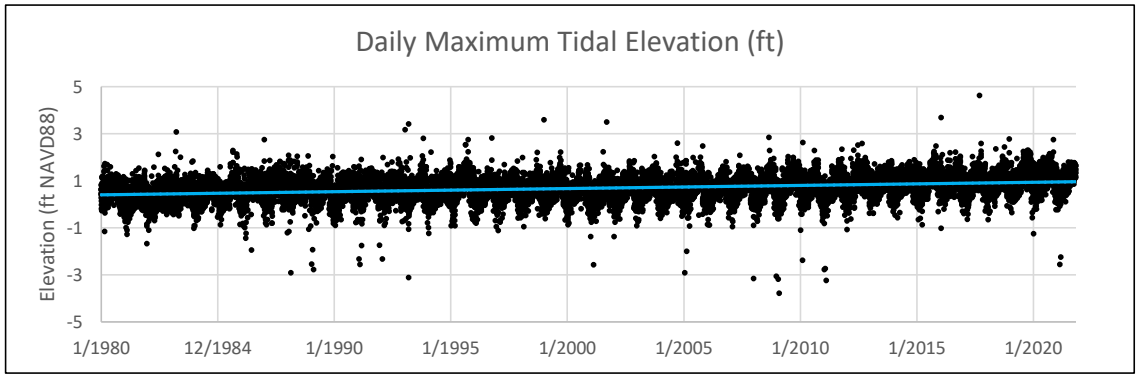
- Field visits
- Survey
  - Lidar data collection
  - Traditional survey methods

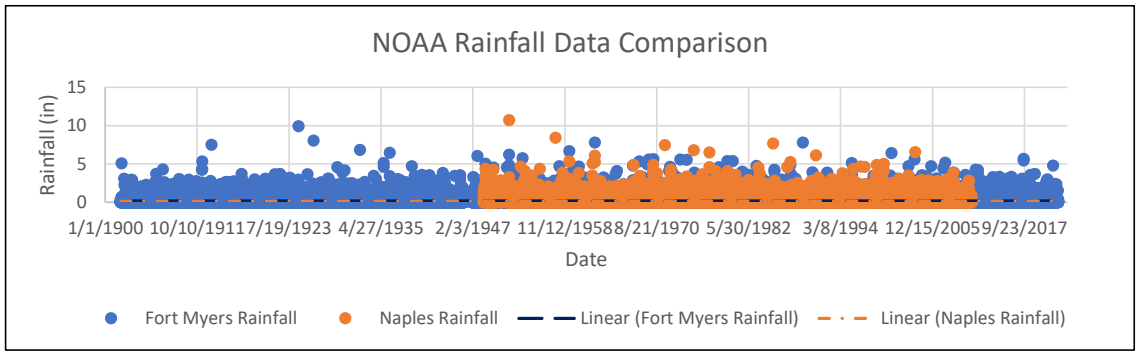






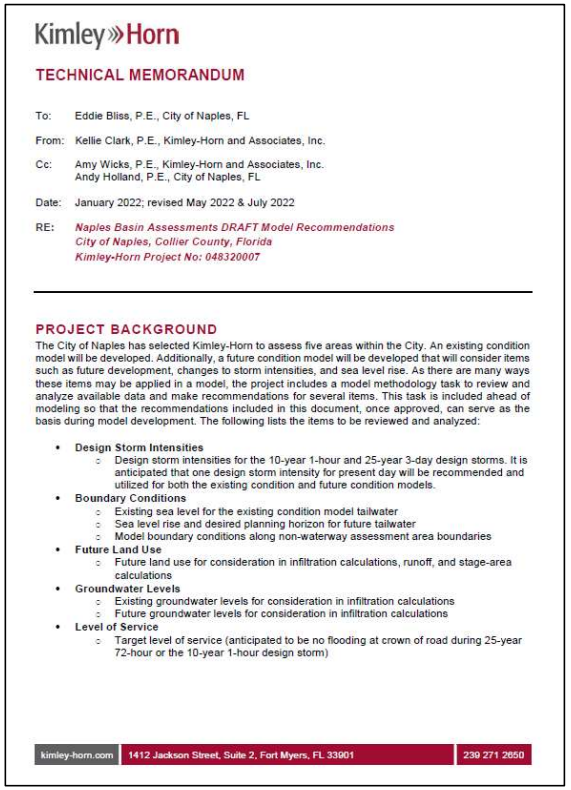
Data Collection





- Desktop review to obtain existing reports, property appraiser data, rainfall data, etc.

Model Recommendations and Analysis



Kimley»Horn

TECHNICAL MEMORANDUM

To: Eddie Bliss, P.E., City of Naples, FL

From: Kellie Clark, P.E., Kimley-Horn and Associates, Inc.

Cc: Amy Wicks, P.E., Kimley-Horn and Associates, Inc.
Andy Holland, P.E., City of Naples, FL

Date: January 2022; revised May 2022 & July 2022

RE: *Naples Basin Assessments DRAFT Model Recommendations*
City of Naples, Collier County, Florida
Kimley-Horn Project No: 048320007

PROJECT BACKGROUND

The City of Naples has selected Kimley-Horn to assess five areas within the City. An existing condition model will be developed. Additionally, a future condition model will be developed that will consider items such as future development, changes to storm intensities, and sea level rise. As there are many ways these items may be applied in a model, the project includes a model methodology task to review and analyze available data and make recommendations for several items. This task is included ahead of modeling so that the recommendations included in this document, once approved, can serve as the basis during model development. The following lists the items to be reviewed and analyzed:

- **Design Storm Intensities**
  - Design storm intensities for the 10-year 1-hour and 25-year 3-day design storms. It is anticipated that one design storm intensity for present day will be recommended and utilized for both the existing condition and future condition models.
- **Boundary Conditions**
  - Existing sea level for the existing condition model tailwater
  - Sea level rise and desired planning horizon for future tailwater
  - Model boundary conditions along non-waterway assessment area boundaries
- **Future Land Use**
  - Future land use for consideration in infiltration calculations, runoff, and stage-area calculations
- **Groundwater Levels**
  - Existing groundwater levels for consideration in infiltration calculations
  - Future groundwater levels for consideration in infiltration calculations
- **Level of Service**
  - Target level of service (anticipated to be no flooding at crown of road during 25-year 72-hour or the 10-year 1-hour design storm)

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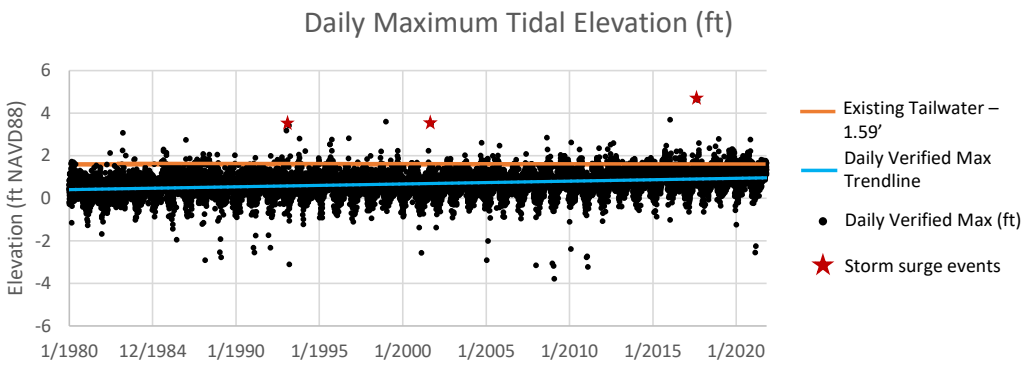
Existing and Future Rainfall

	10-YR 1-HR	25-YR 72-HR
Rainfall Distribution	FDOT 1-HR	SFWMD 72-HR
	NOAA Rainfall Amount (in)	
North Model	3.23	11.5
South Model	3.25	11.6

Model Recommendations and Analysis

Existing Boundary Condition

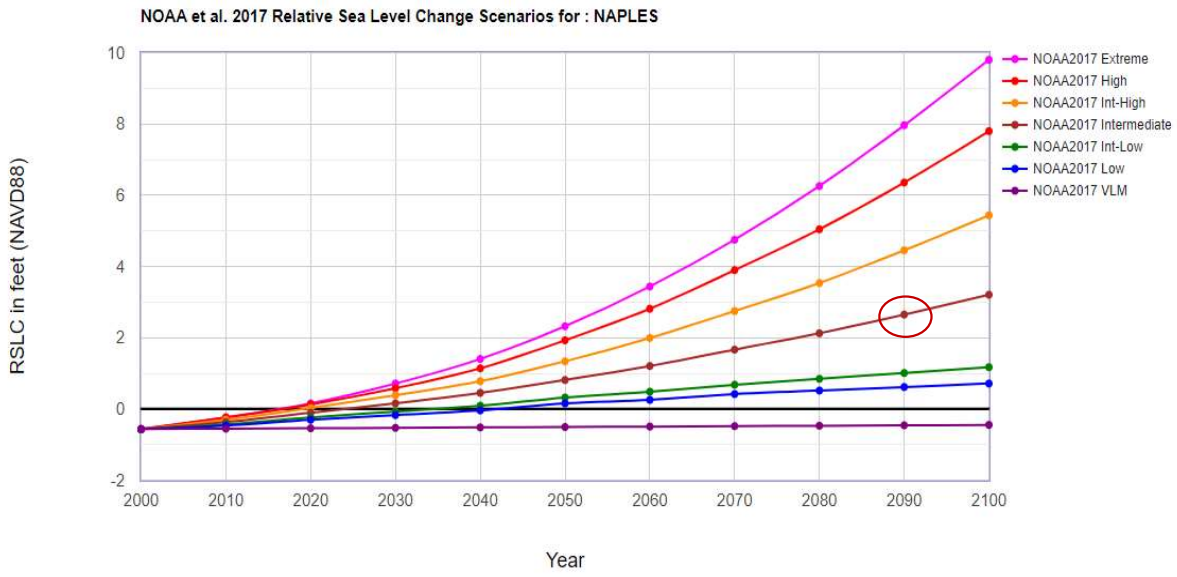


		Tidal Elevation (ft)			Differences (ft)		
Percentile	Percent Chance	First 5 Years	All Data	Last 5 years	Last - First	All - First	Last - All
50%	50%	0.44	0.69	1.01	0.57	0.25	0.32
80%	20%	0.81	1.09	1.39	0.58	0.28	0.30
90%	10%	1.00	1.31	1.59	0.59	0.31	0.28
95%	5%	1.15	1.49	1.76	0.61	0.34	0.27
99%	1%	1.44	1.86	2.14	0.70	0.42	0.28
99.5%	0.5%	1.62	2.04	2.26	0.64	0.42	0.22
99.9%	0.1%	2.24	2.62	2.78	0.54	0.38	0.16
				Average	0.60	0.34	0.26

- 1.59' corresponds to the 90th percentile of tidal elevations recorded at the Naples tidal station in the last 5 years.
- Tides exceeded 1.59' 183 days over the last 5 years or approximately 36 days per year.
- This boundary condition is not intended to represent storm surge.

Model Recommendations and Analysis

Future Boundary Condition



NOAA Intermediate Curve 2020 Estimated Mean Sea Level (MSL) = -0.11 ft

NOAA Intermediate Curve 2090 Estimated MSL = 2.65 ft

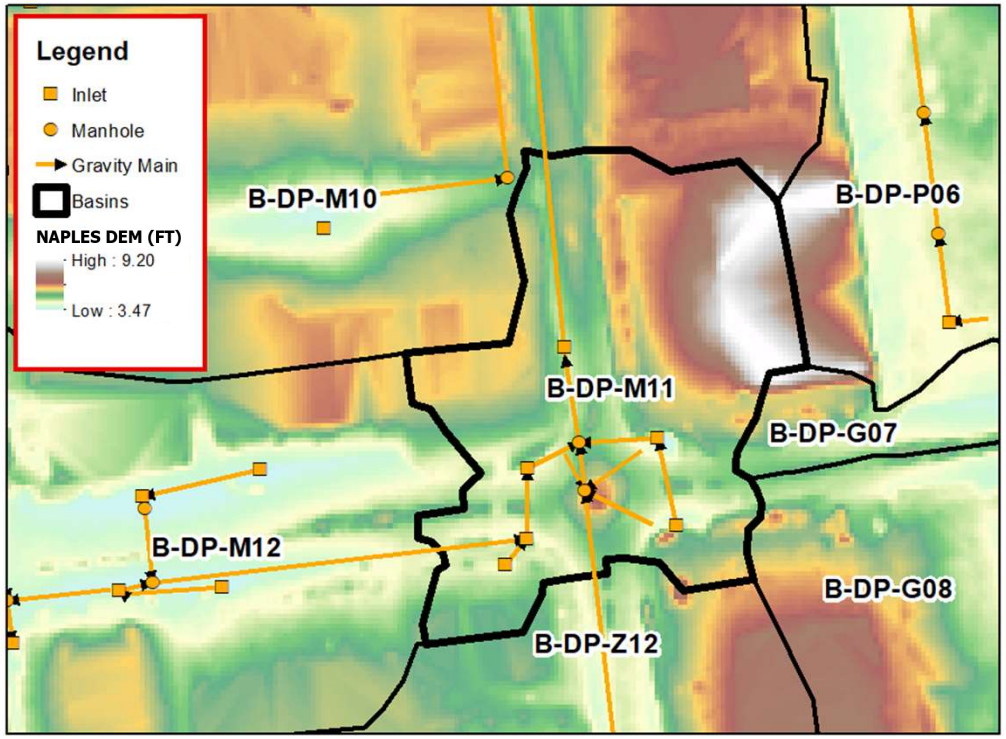
2090 Estimated MSL – 2020 Estimated MSL = Approximate Change in Sea Level
2.65 ft – (-0.11 ft) = 2.76 ft

Existing Tailwater = 1.59 ft

Future Recommended Tailwater = Existing Tailwater + Change in Sea Level
*1.59 ft + 2.76 ft = **4.35 ft (rounded to 4.4 ft)***

Existing Condition Model Development

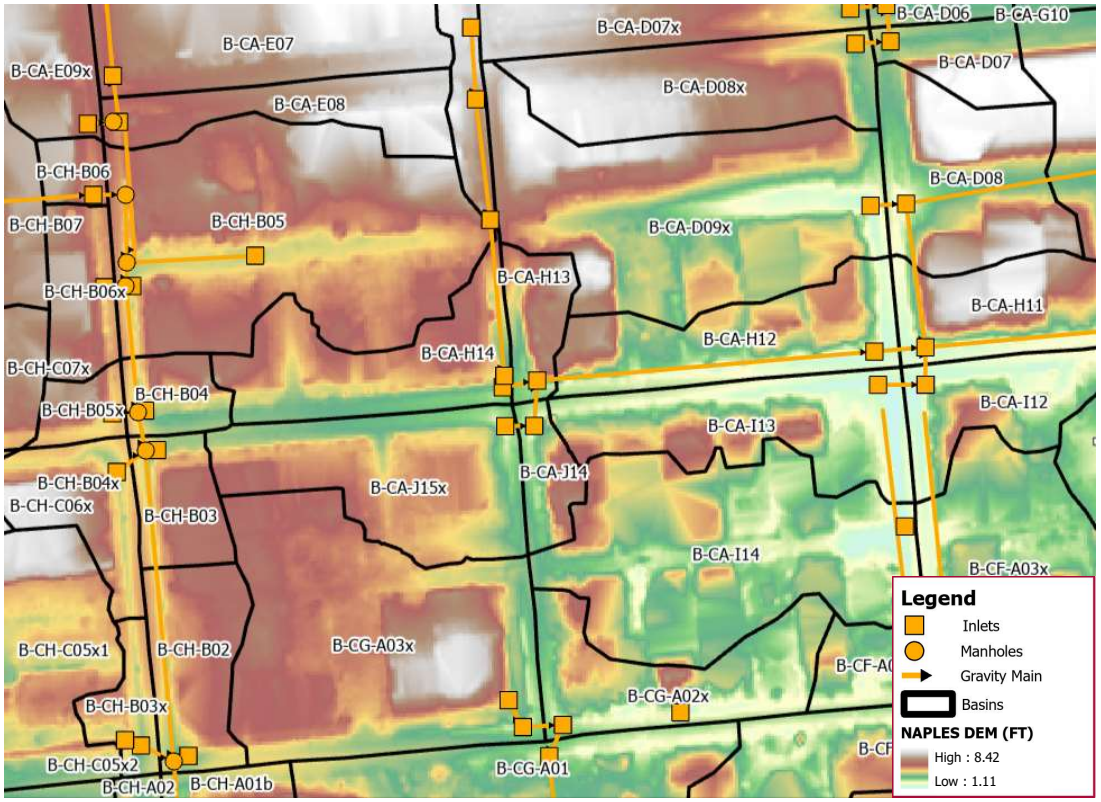
Central Ave & 10th Street S



Basins

- Basins were drawn using elevation data (DEM) and infrastructure data

Existing Condition Model Development



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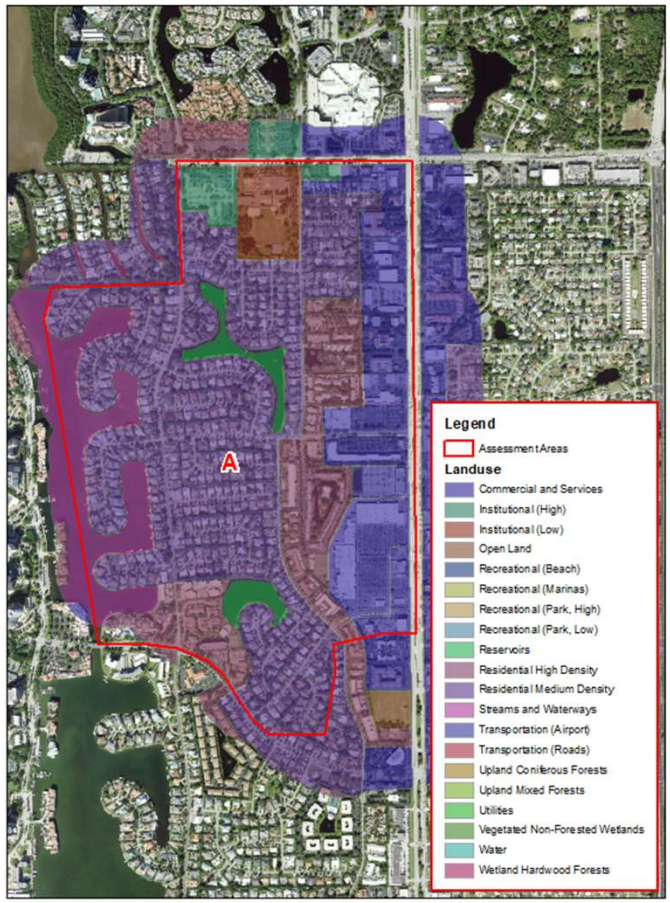
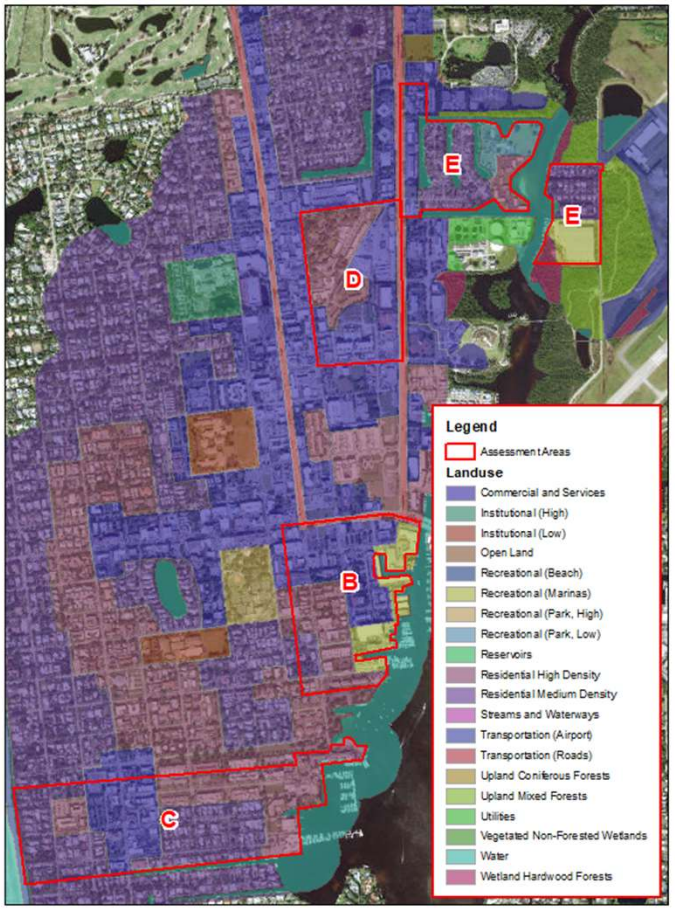
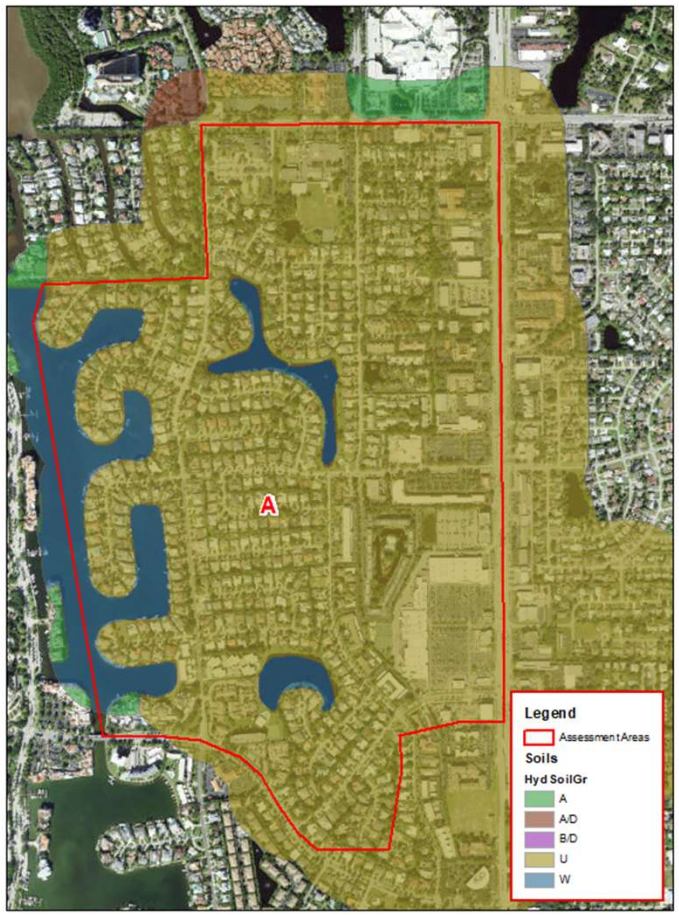


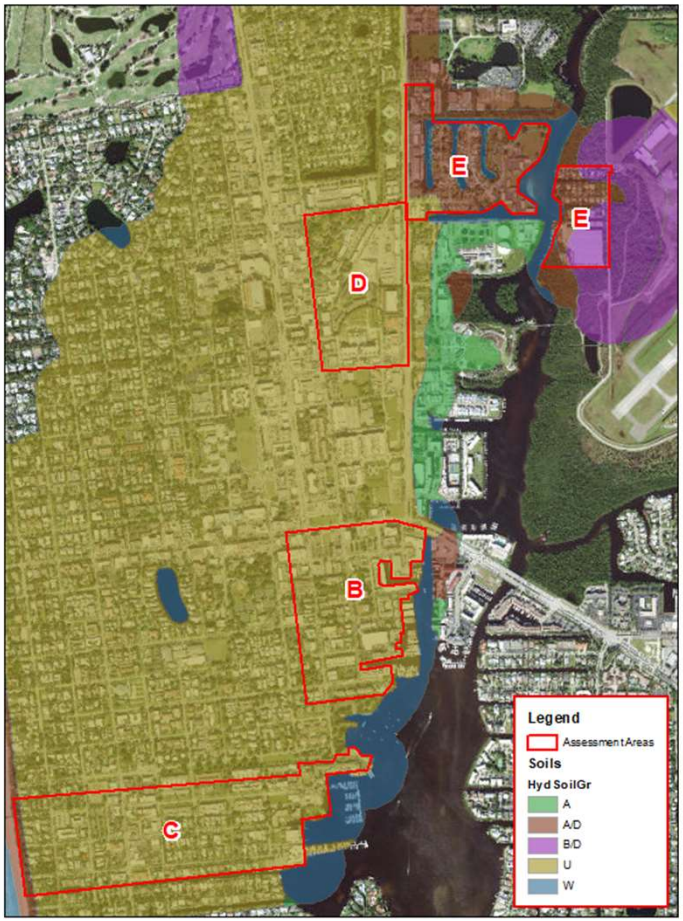


Land Use

- Used in infiltration calculations to estimate runoff

Existing Condition Model Development



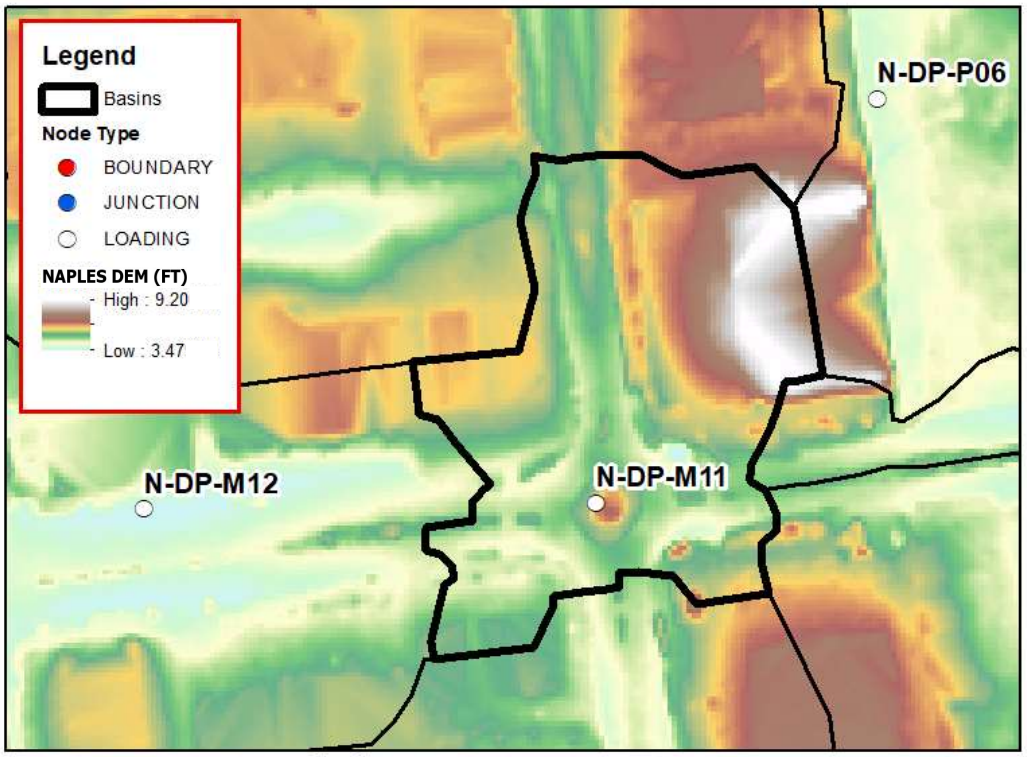


Soils

- Used in infiltration calculations to estimate runoff

Existing Condition Model Development

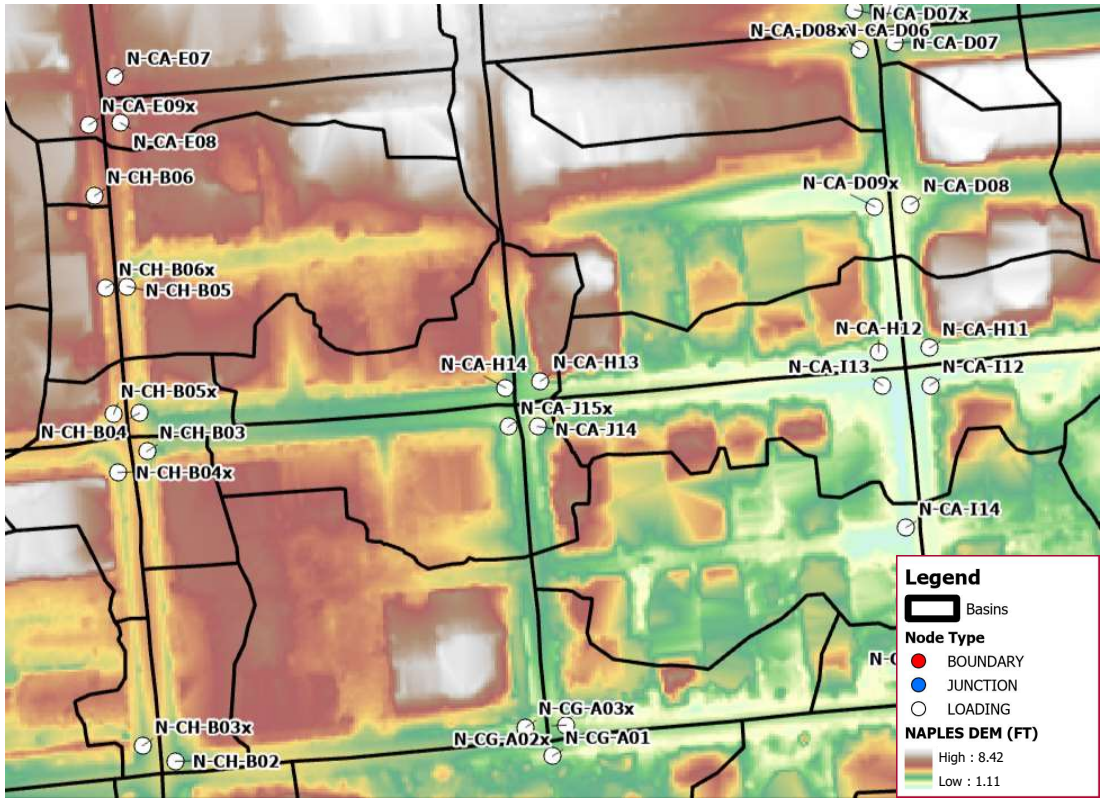
Central Ave & 10th Street S



Nodes

- Represents basin surface storage within the model or represent a modeled connection between structures
- Storage areas calculated based on elevation (DEM)

Existing Condition Model Development



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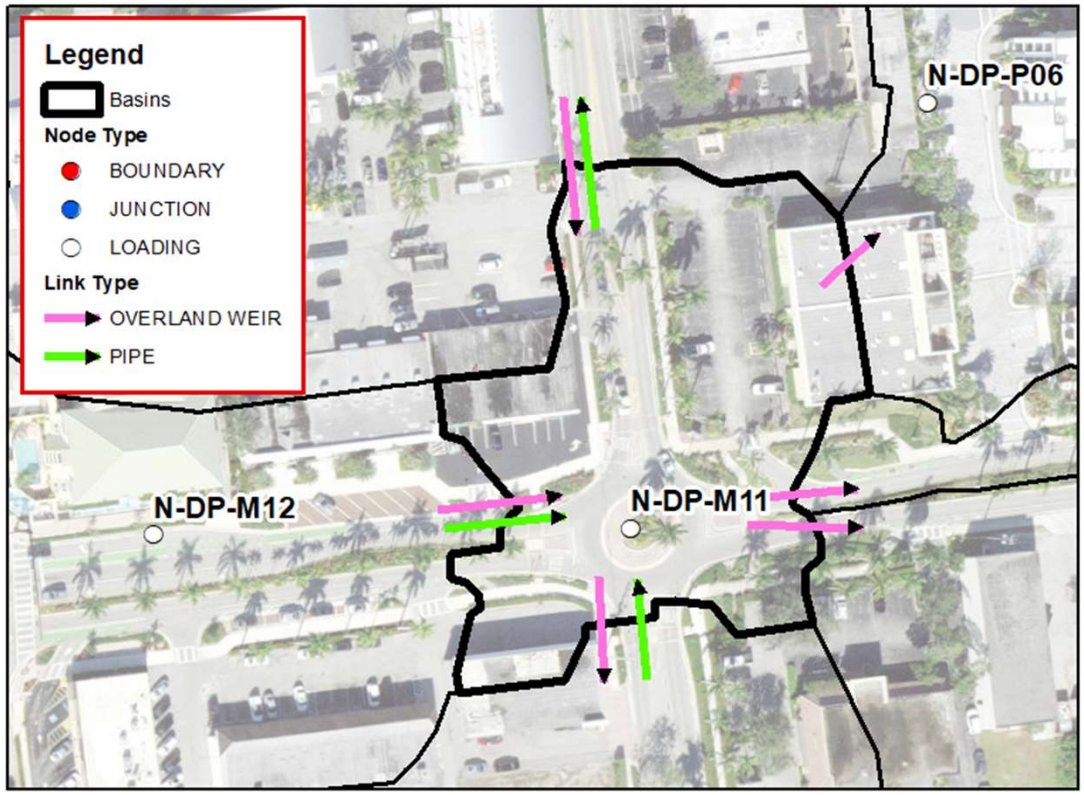
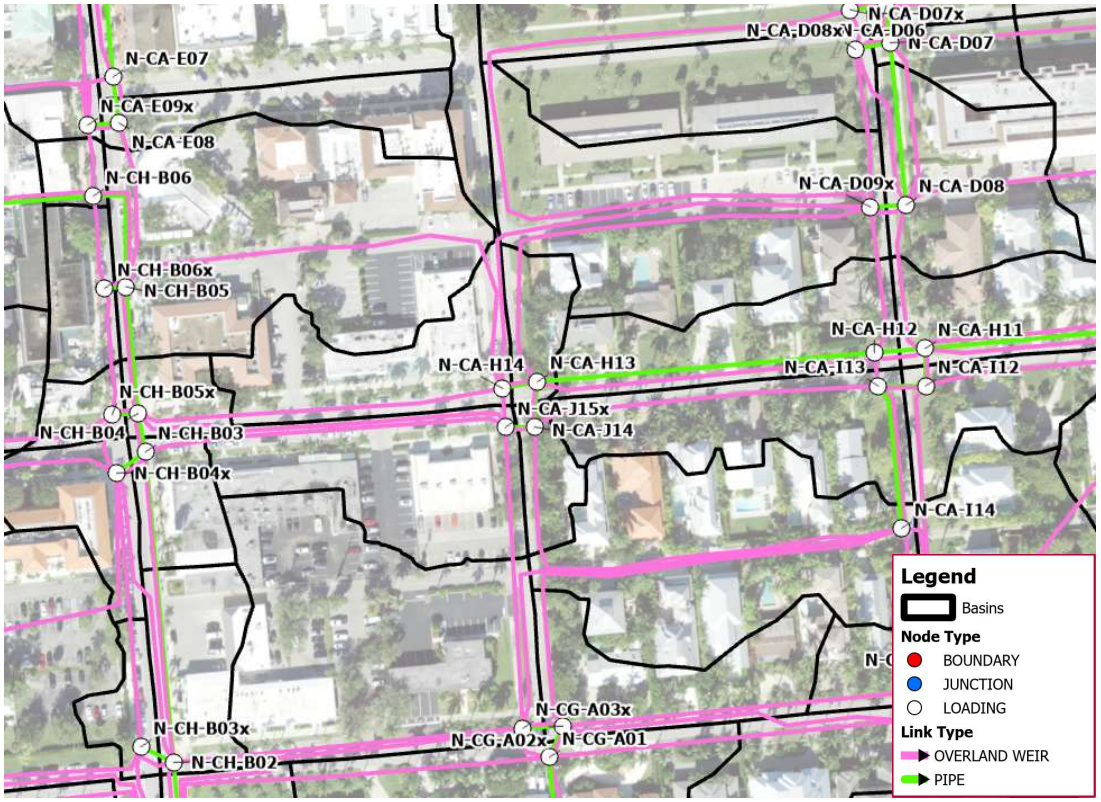


Connectivity

- Pipe and control structure links were created based on geospatial infrastructure data provided by the City of Naples
- Weirs were added to represent overland flow between basin areas
- These connect basins/nodes to allow the model to mimic the natural flow of water through these connections

Existing Condition Model Development



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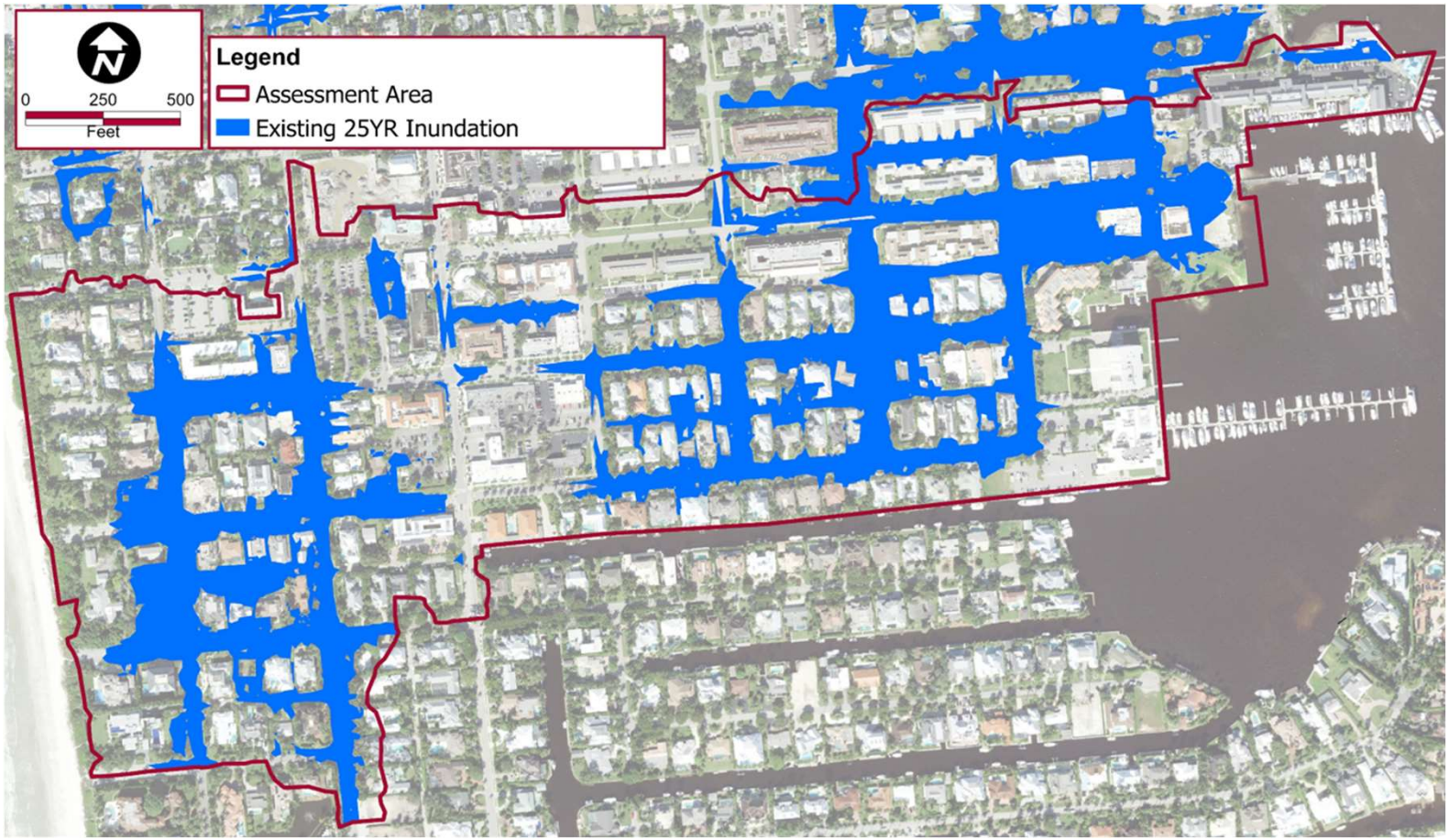
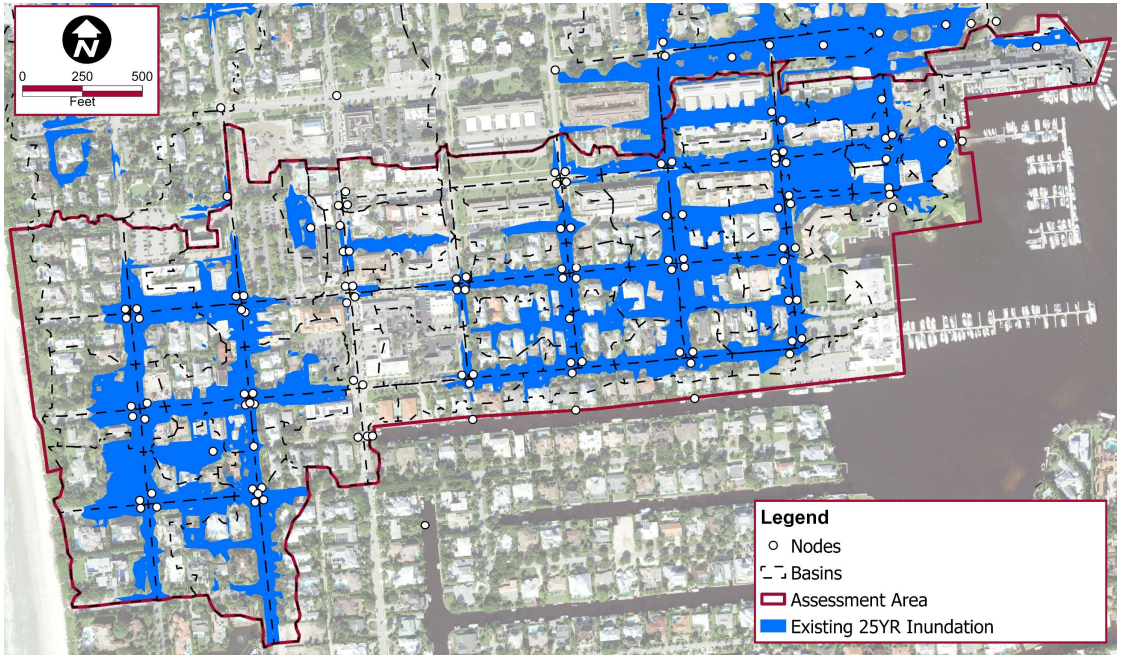
Example Model Results

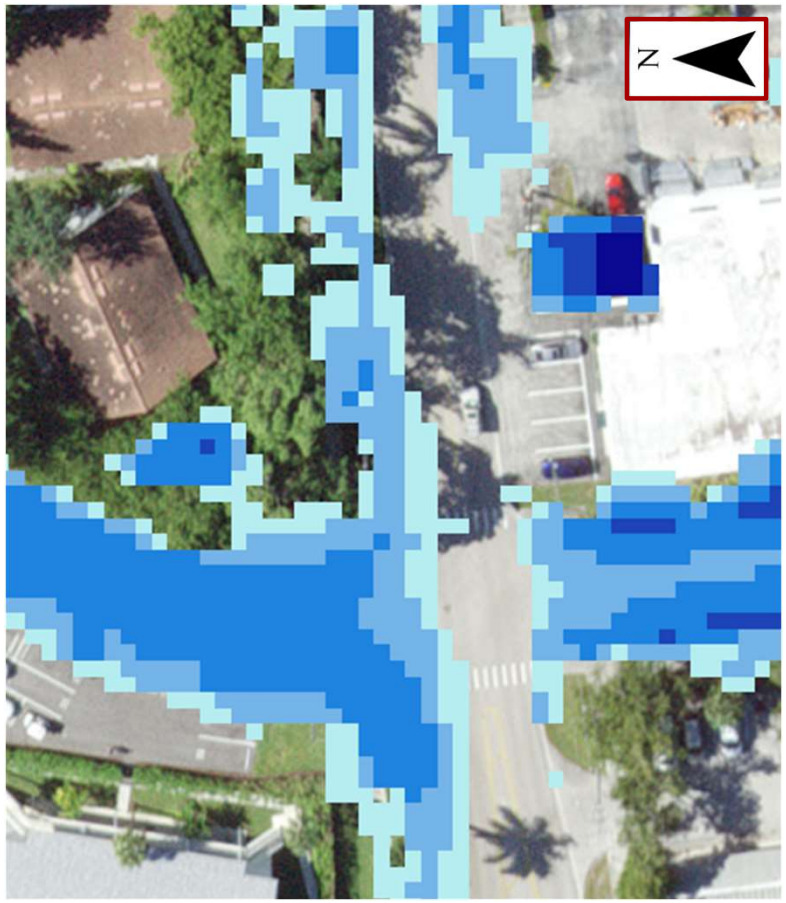


Example Model Results



Sim	Node Name	Existing Maximum Stage [ft]
25 yr 72 hr	N-CH-B06x	4.83
25 yr 72 hr	N-CH-B07	5.93
25 yr 72 hr	N-CH-C04	4.02
25 yr 72 hr	N-CH-C05	4.04
25 yr 72 hr	N-CH-C05x1	4.03
25 yr 72 hr	N-CH-C05x2	4.03
25 yr 72 hr	N-CH-C05x3	4.03
25 yr 72 hr	N-CH-C06	4.04
25 yr 72 hr	N-CH-C06x	4.04
25 yr 72 hr	N-CH-C07x	4.04
25 yr 72 hr	N-CH-D05	4.03
25 yr 72 hr	N-CH-D06	4.03
25 yr 72 hr	N-CH-D08x	4.04
25 yr 72 hr	N-CH-E06	4.04
25 yr 72 hr	N-CH-E07	4.04
25 yr 72 hr	N-CH-F07	4.05
25 yr 72 hr	N-CH-F08	4.05
25 yr 72 hr	N-CH-G07	4.03
25 yr 72 hr	N-CH-G08	4.03
25 yr 72 hr	N-CH-G09	4.02
25 yr 72 hr	N-CH-G10	4.02
25 yr 72 hr	N-CH-G11	4.03
25 yr 72 hr	N-CH-I04	3.99
25 yr 72 hr	N-CH-I05x1	4.02
25 yr 72 hr	N-CH-I05x2	4.01

Verification – 5th Ave N & 11th St N

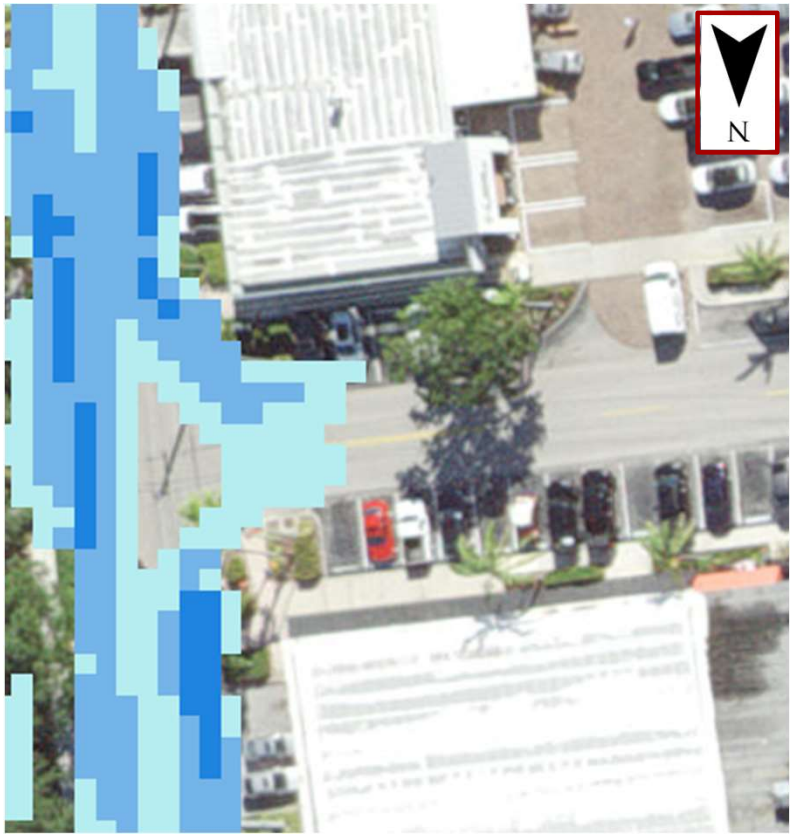


Legend

Calibration Flood Depth

- 1 - 3 in
- 3 - 6 in
- 6 - 12 in
- 12 - 18 in
- 18 - 24 in

Verification – 4th Ave N & 10th St N



Legend

Calibration Flood Depth

- 1 - 3 in
- 3 - 6 in
- 6 - 12 in
- 12 - 18 in
- 18 - 24 in

Verification – 5th Ave N near River Park

Legend

Calibration Flood Depth

- 1 - 3 in
- 3 - 6 in
- 6 - 12 in
- 12 - 18 in
- 18 - 24 in

Calibrated ICPR4 Model

- Results can be referenced as a part of future projects
- Model can be updated for future project analyses
- Model can be used to consider other scenarios or alternatives
- Model can be leveraged to support grant funding on future projects
- Model can be used to support additional CIP planning

Public Coordination – Online

City of Naples Basin Study

Public Survey

Kimley-Horn is conducting a study in five areas within the City of Naples that are vulnerable to flooding from rainfall events. This survey is being provided to collect more information from property owners within those areas. Note that this study and this survey is not related to storm surge events (ex. Hurricane Ian). Please complete the following survey with information from rainfall events not storm surge events.

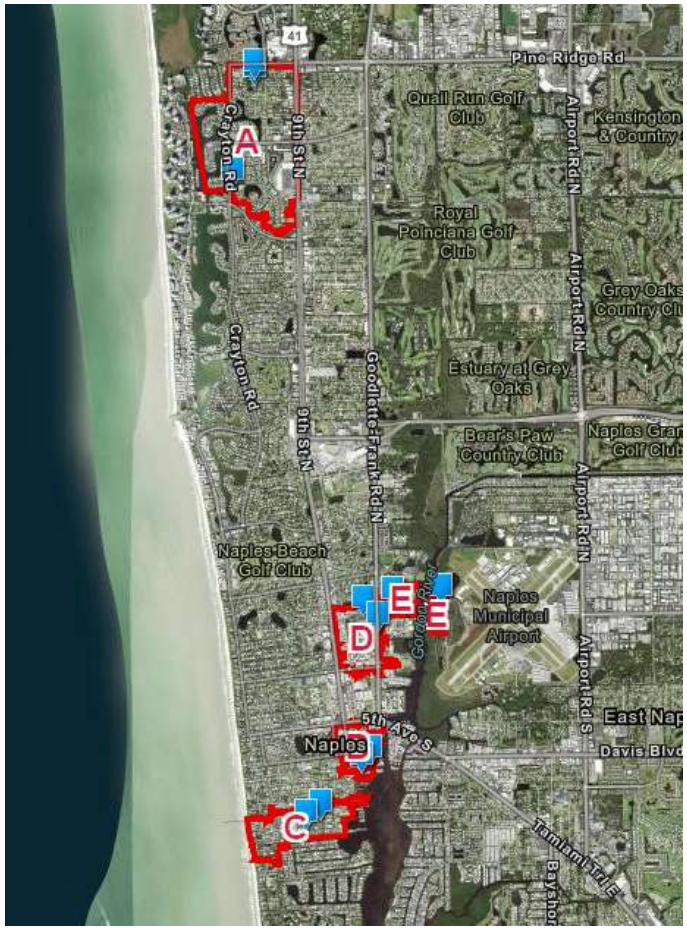
1. Do you own/lease/rent/work at a property within one of the study areas shown on this map: Public Coordinate

- ◯ Own property
- ◯ Lease or rent a property
- ◯ Work at a property
- ◯ No
- ◯ Other (please specify)

2. If you answered yes to the previous question, is this property a business or a home?

- ◯ Busniess
- ◯ Home
- ◯ Other (please specify)

3. What is the address of this property?



Public Coordination – In-person

COMMENT #	COMMENT
1	Road and driveway flooding has been experienced along Myrtle Terrace. There are no stormwater inlets or swales, so every time it rains there is ponding. Another resident said they have not seen any flooding along Myrtle Terrace.
2	There is no flooding at this location.
3	During Hurricane Ian, Swan Lake experienced higher staging than normal. Two feet of flooding occurred in garage structure.
4	There is no flooding at this location during normal rainfall events, and no flooding was experienced during Hurricane Ian.
5	No flooding was observed during normal rainfall events, but during the storm in August 2017, there was flooding in the driveway up to the garage.
6	Improvements were made to Sea Gate Park. Since then, no flooding behind this home has been noted, while backyard flooding was common prior to those improvements. Flooding in the roadway has been seen.
7	There is no road or structure flooding at this location, but the swale does fill with water during a storm.
8	Flooding in the pond has caused inundation in yards.
9	This location experiences standing water in the side yard (0.3') and in the road (0.4') with slime build up along the curb, gutters, and cracks in the pavement. It was discussed this is likely due to the water table elevation during the rainy season.
10	No flooding was observed at this location.
11	This location experiences flooding regularly.
12	This location experiences roadway flooding regularly. Additionally, debris has been reported which prevents the functioning of the drainage systems.

Alternative Analysis Approach

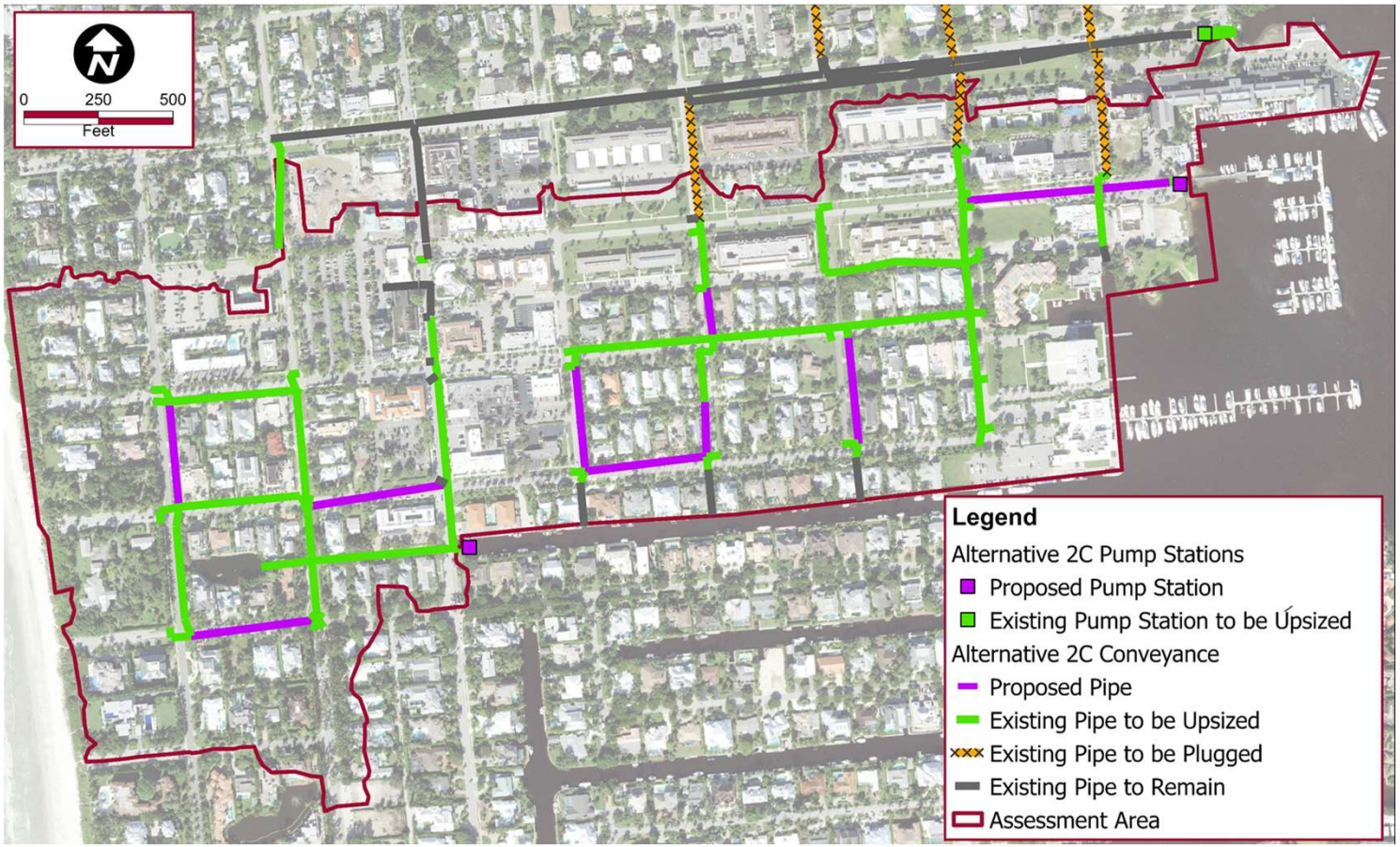
- Multiple Improvement Alternatives were evaluated for each Assessment Area, each with a unique goal or design approach

Scenario	Number Selected/Total Number Modeled	Stormwater Infrastructure	Tailwater Condition
Existing Scenario	N/A	Existing Infrastructure	Existing Tailwater
Alternative Improvements	1/3	Proposed Improvements	Existing Tailwater
Future Baseline	N/A	Existing Infrastructure	Future Tailwater
Future Condition with Alternative Improvements	1/2	Proposed Improvements	Future Tailwater
Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Future Tailwater
Existing Conditions with Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Existing Tailwater

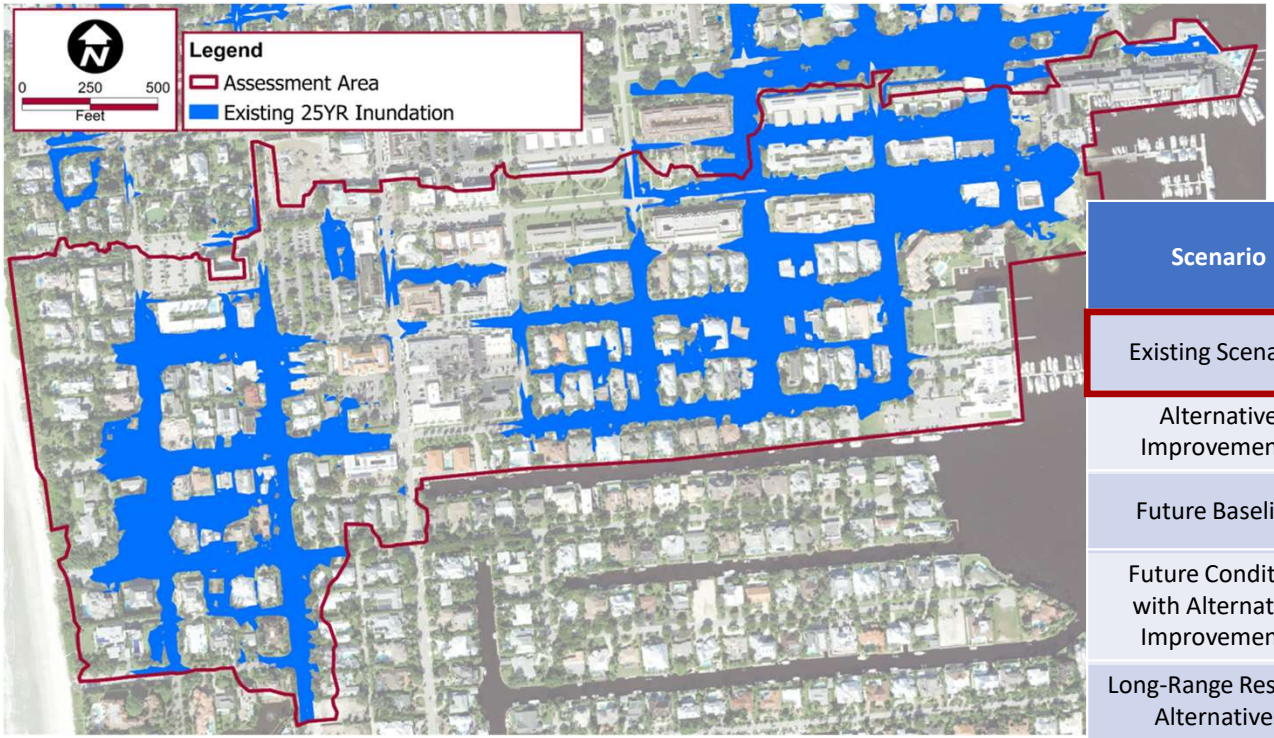
Alternatives Analysis Considerations

- Proposed improvements considered during the alternatives analysis
  - Upsize pipes
  - New pipe connection
  - Upsize pumps
  - New pumps
  - Disconnect existing pipes
  - Check valves
  - Sea walls
  - Raising Roads

Example of Proposed Improvements



Existing Condition Inundation – Area C



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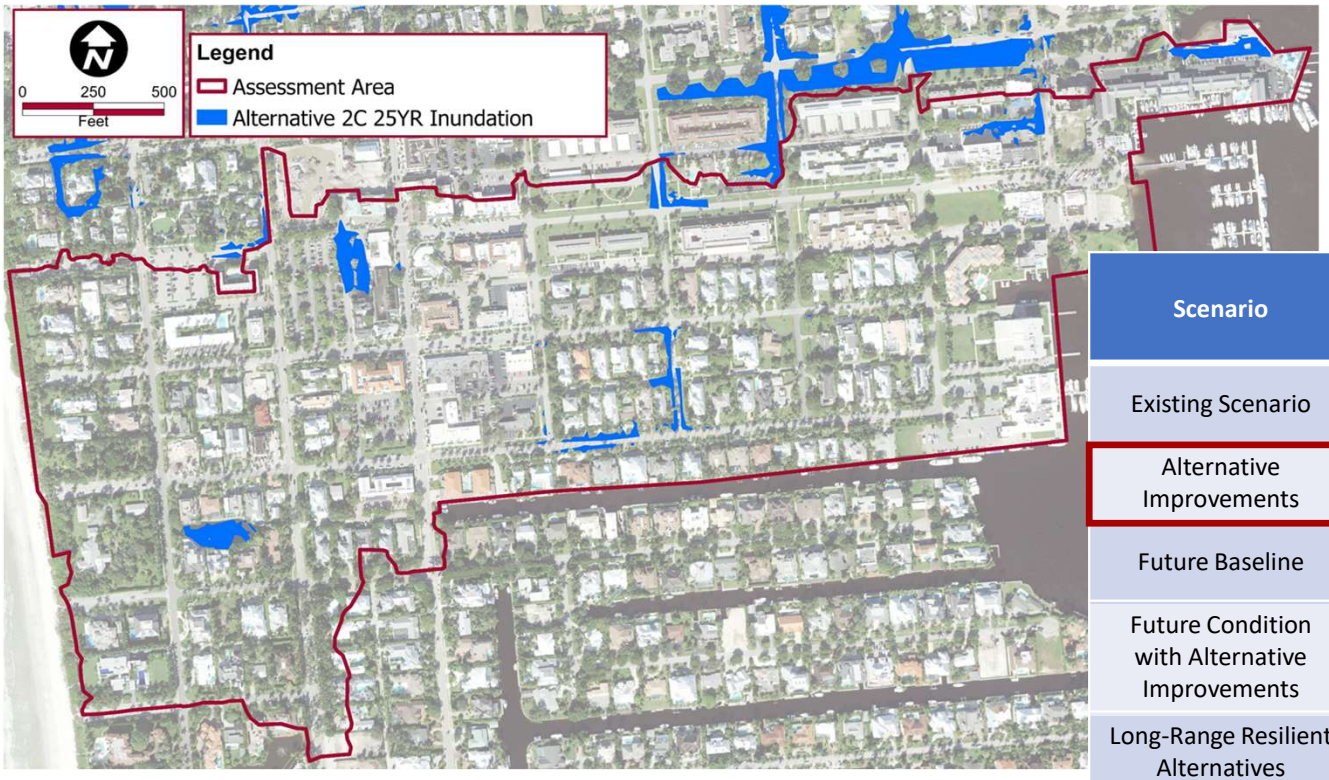
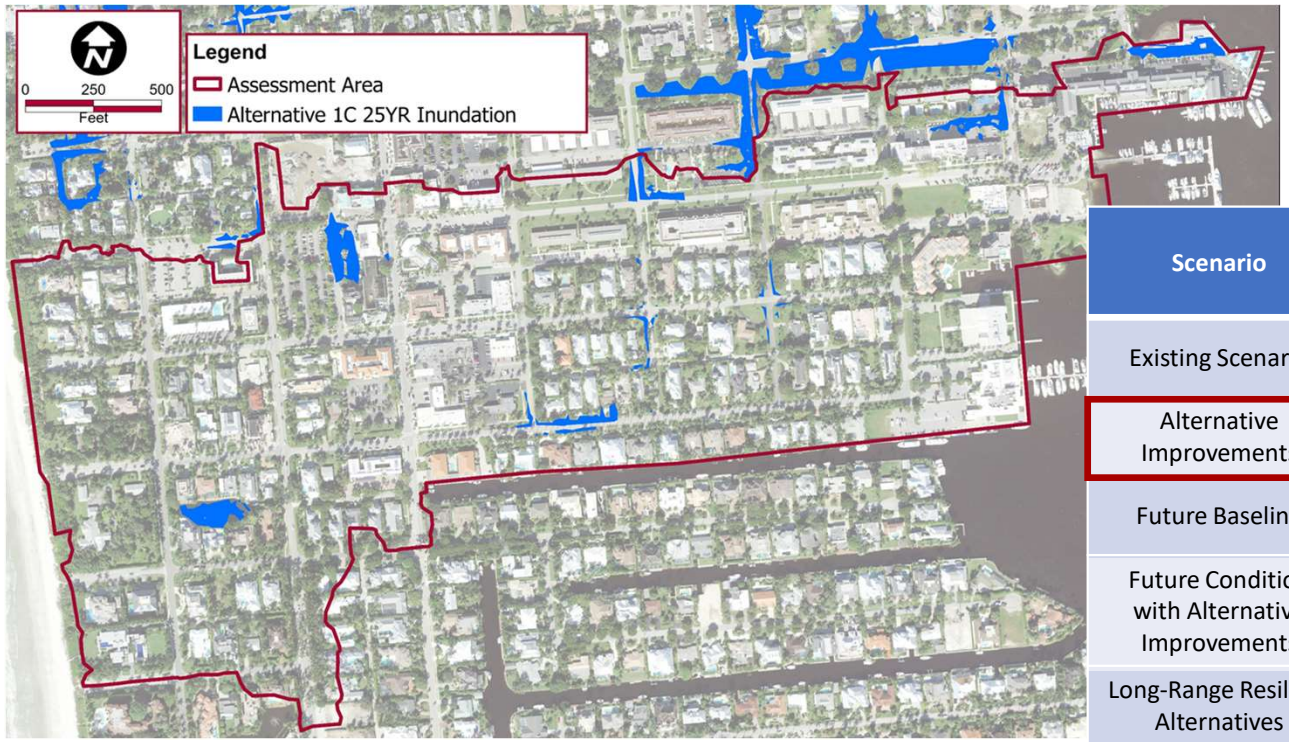
Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Future Tailwater
Existing Conditions with Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Existing Tailwater

Selected Alternative 2C Inundation – Area C



Scenario	Number Selected/Total Number Modeled	Stormwater Infrastructure	Tailwater Condition
Existing Scenario	N/A	Existing Infrastructure	Existing Tailwater
Alternative Improvements	1/3	Proposed Improvements	Existing Tailwater
Future Baseline	N/A	Existing Infrastructure	Future Tailwater
Future Condition with Alternative Improvements	1/2	Proposed Improvements	Future Tailwater
Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Future Tailwater
Existing Conditions with Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Existing Tailwater

Unselected Alternative 1C Inundation – Area C



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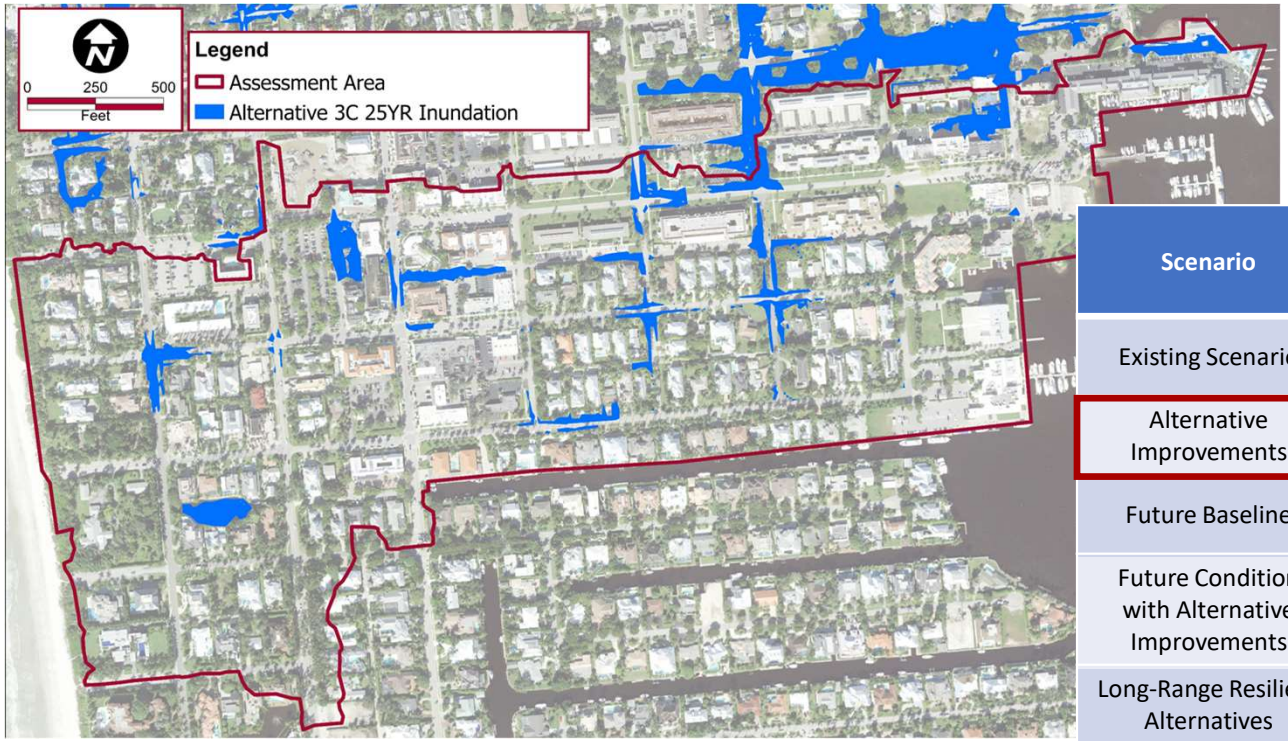
Existing Conditions with Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Existing Tailwater

Unselected Alternative 3C Inundation – Area C



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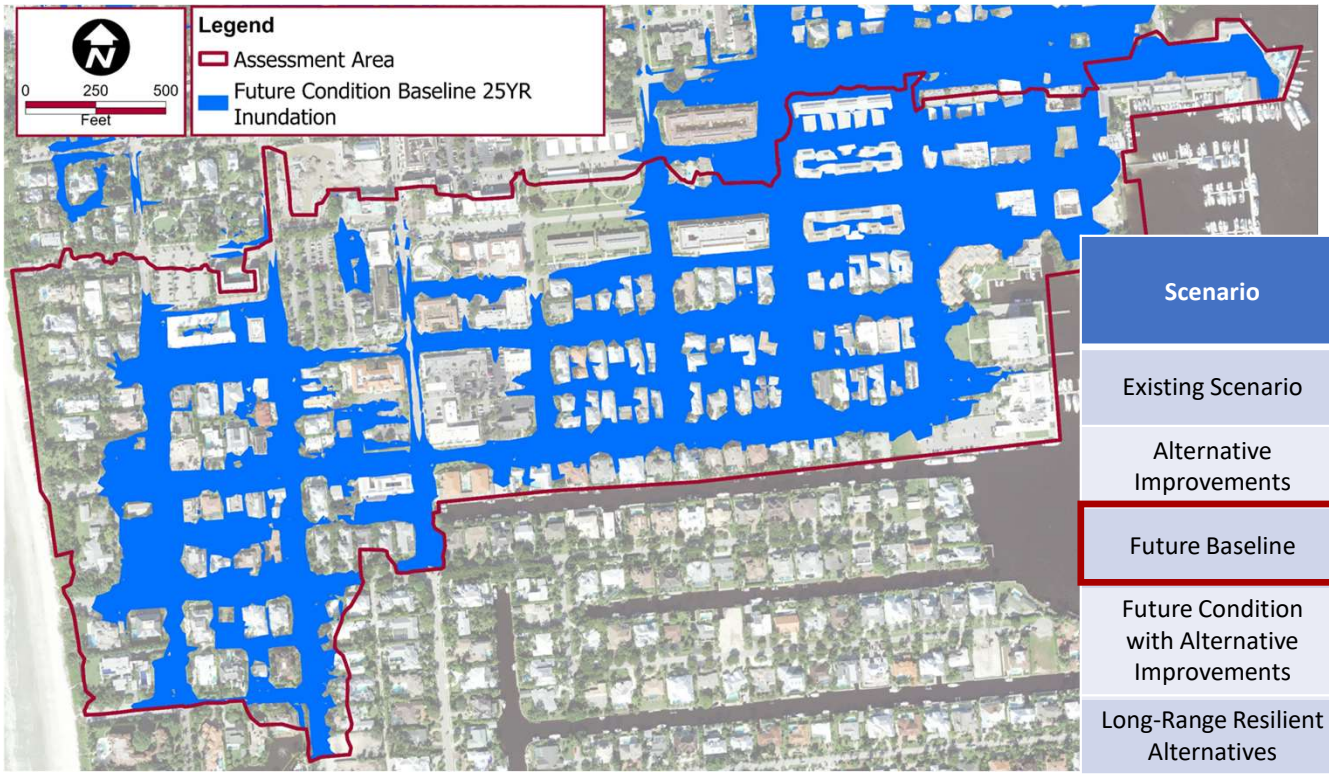
Future Baseline Inundation – Area C



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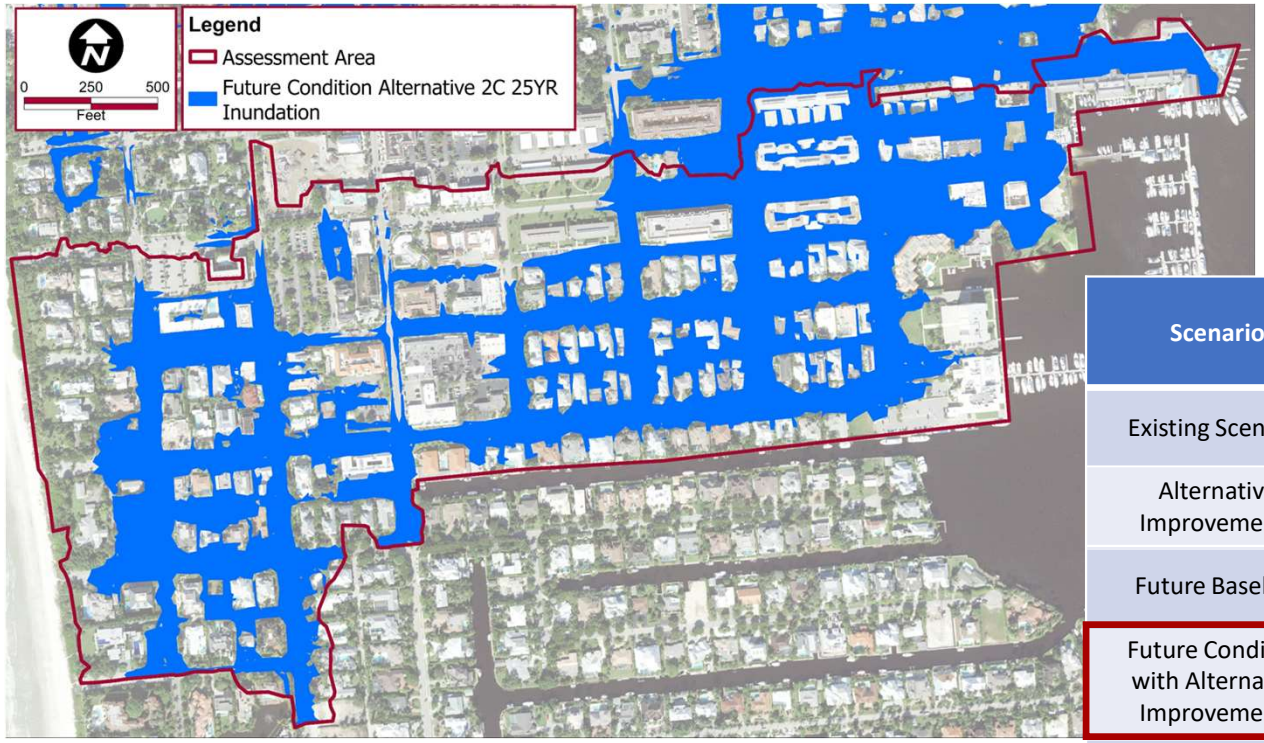
Future Condition Alternative 2C Inundation – Area C



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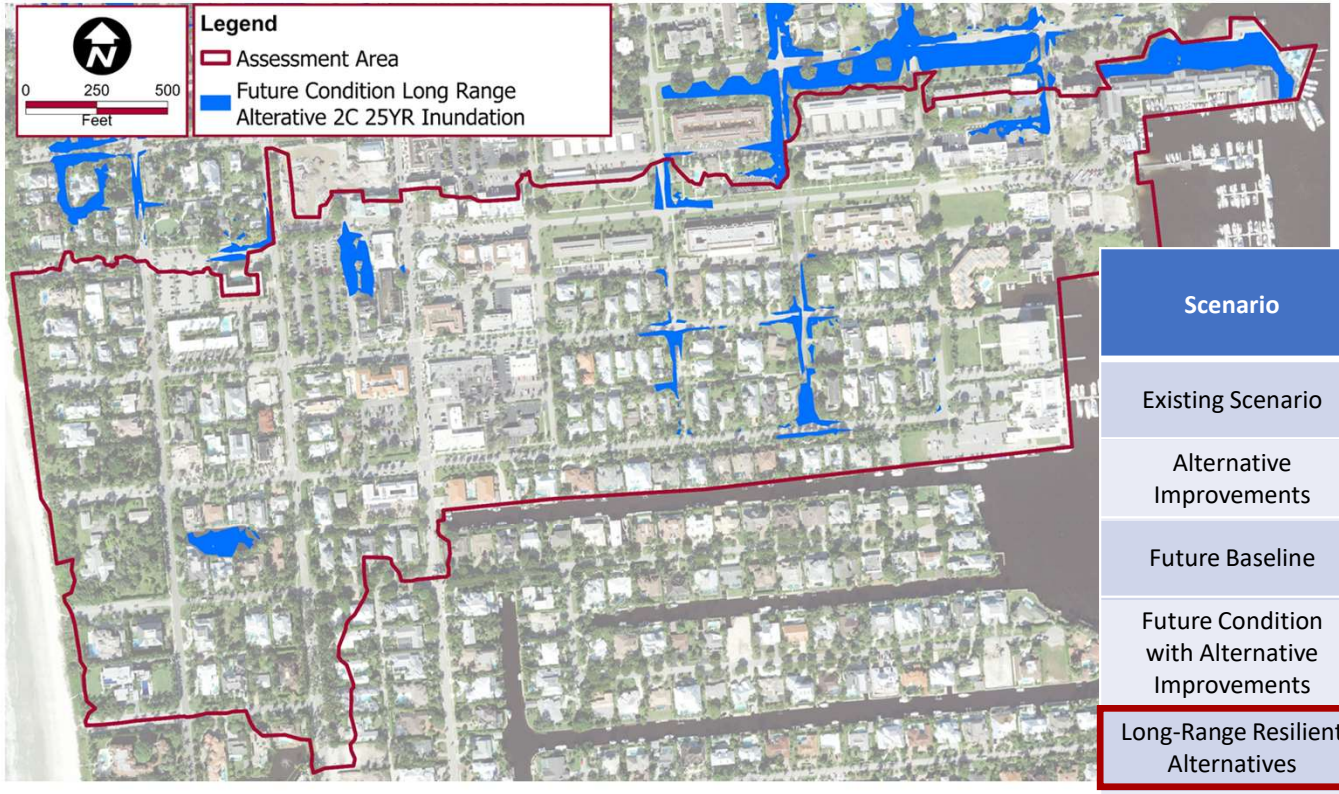
Future Condition Long-Range Alternative Inundation – Area C



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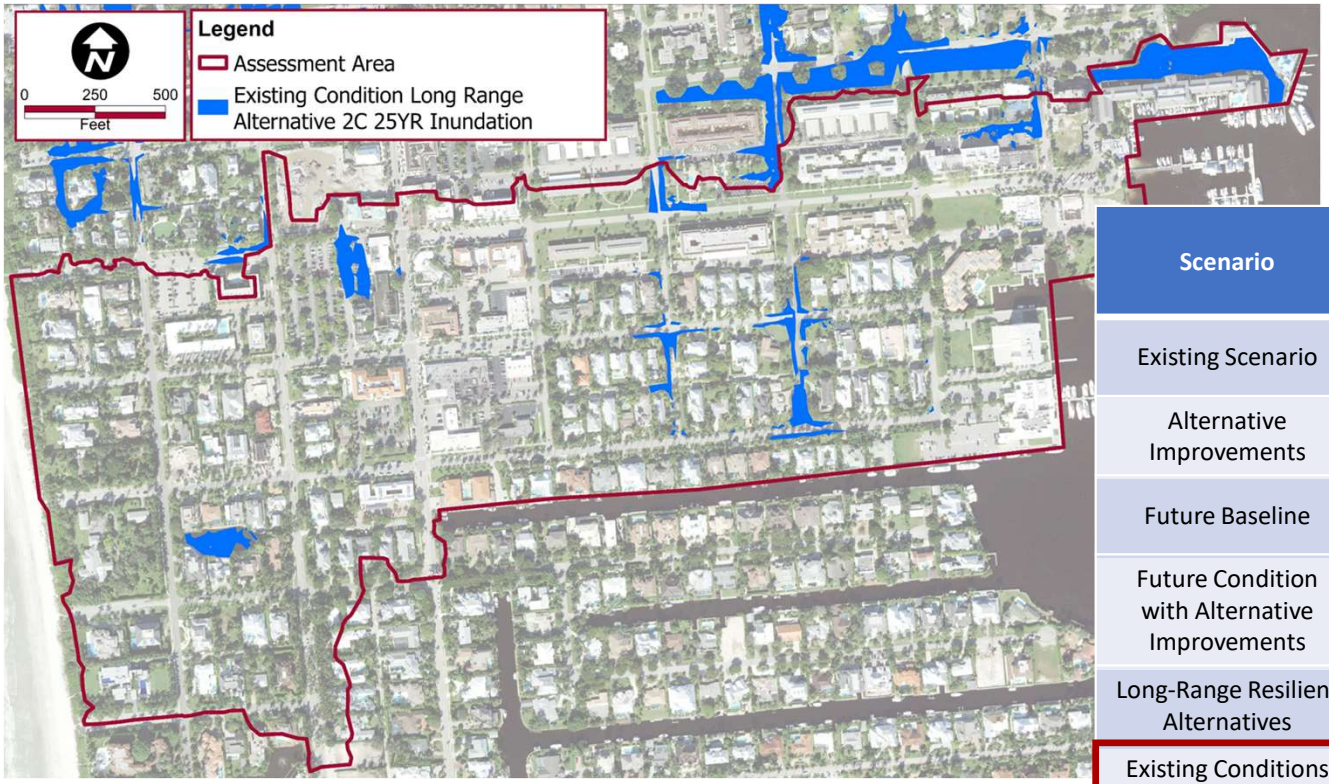
Existing Condition Long-Range Alternative Inundation – Area C



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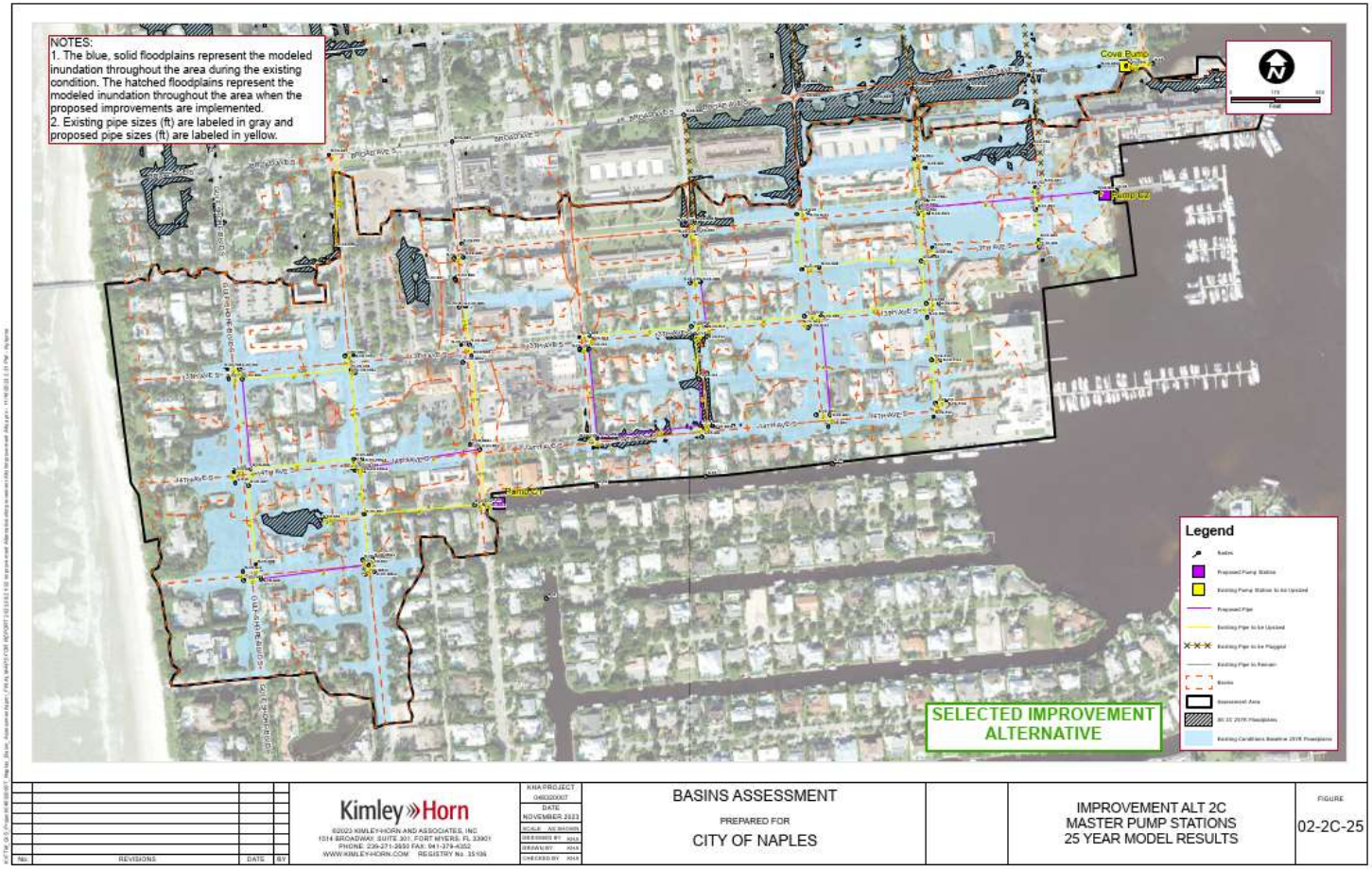
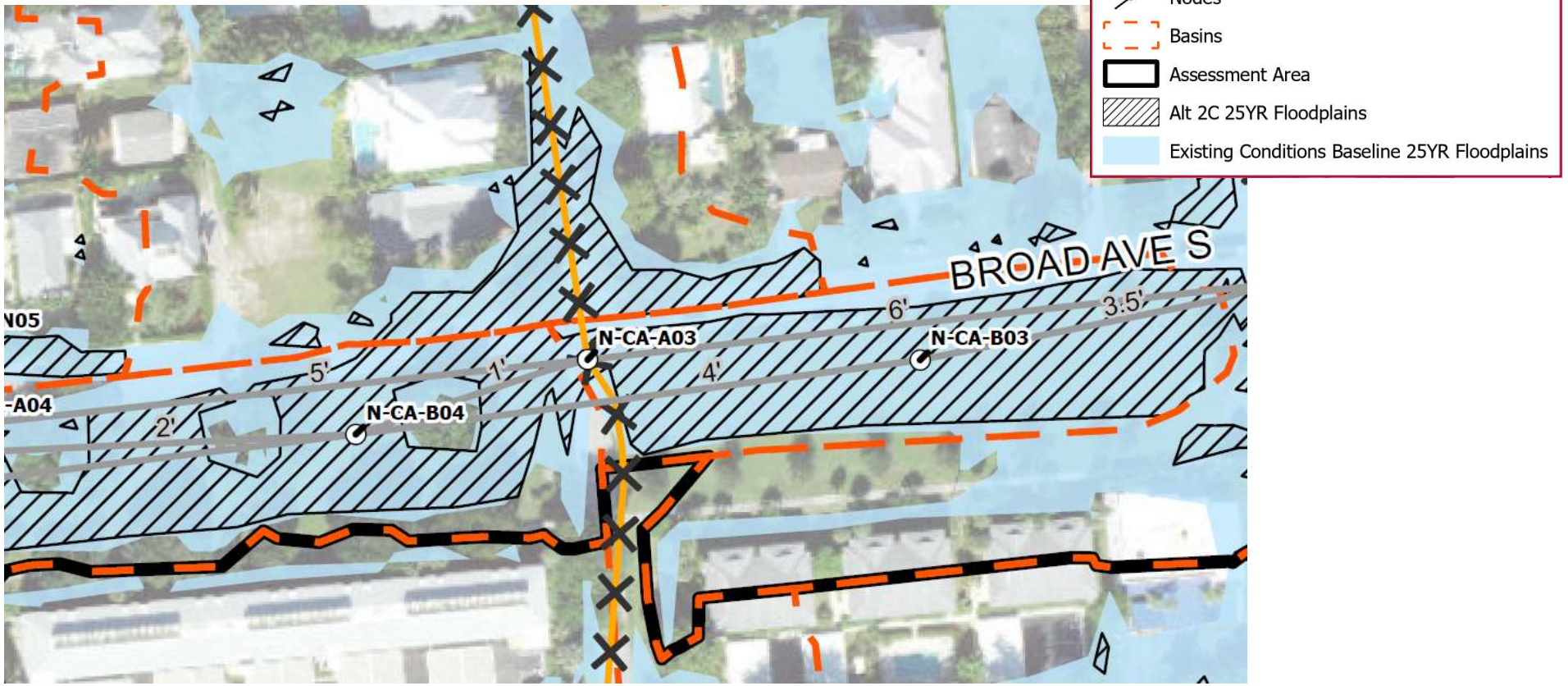
Example of Inundation Maps – Results

- Elements
  - Floodplain Differences
  - Nodes
  - Conveyance Improvements
  - Pump Improvements
- Maps are not to be used for construction – developed to represent modeling information



Example of Inundation Maps – Results

Floodplain Differences

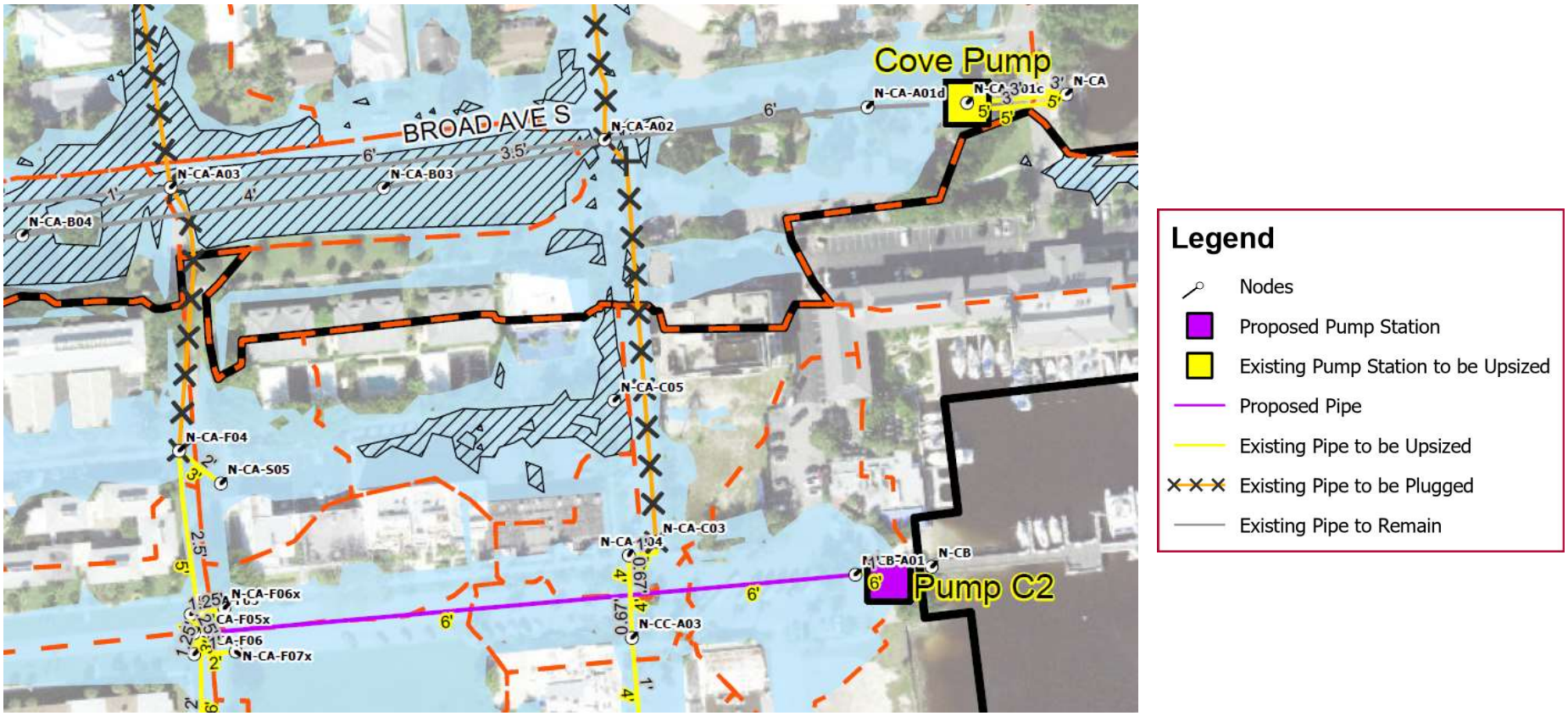


Example of Inundation Maps – Results

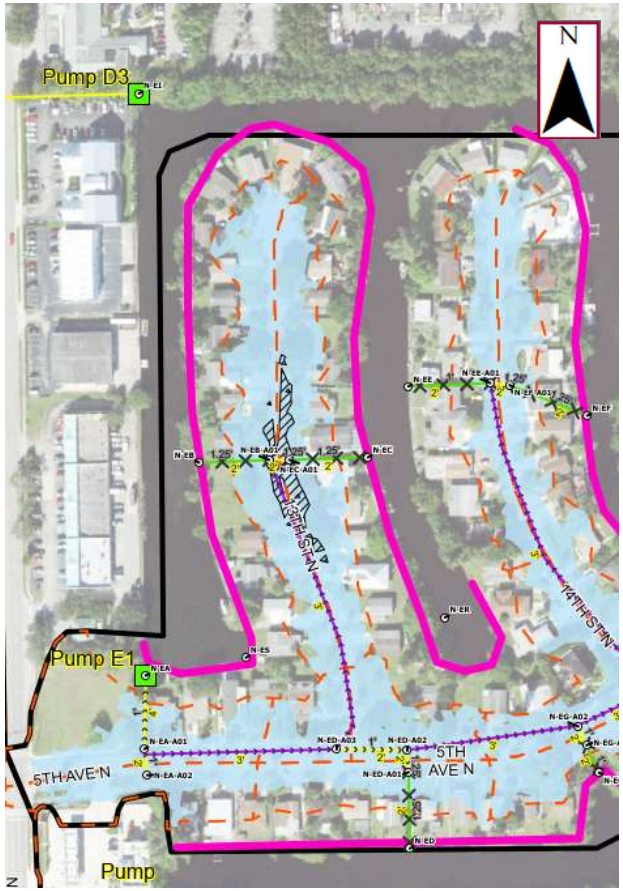
Conveyance and Pump Improvements

Example of Inundation Maps – Results

Conveyance and Pump Improvements

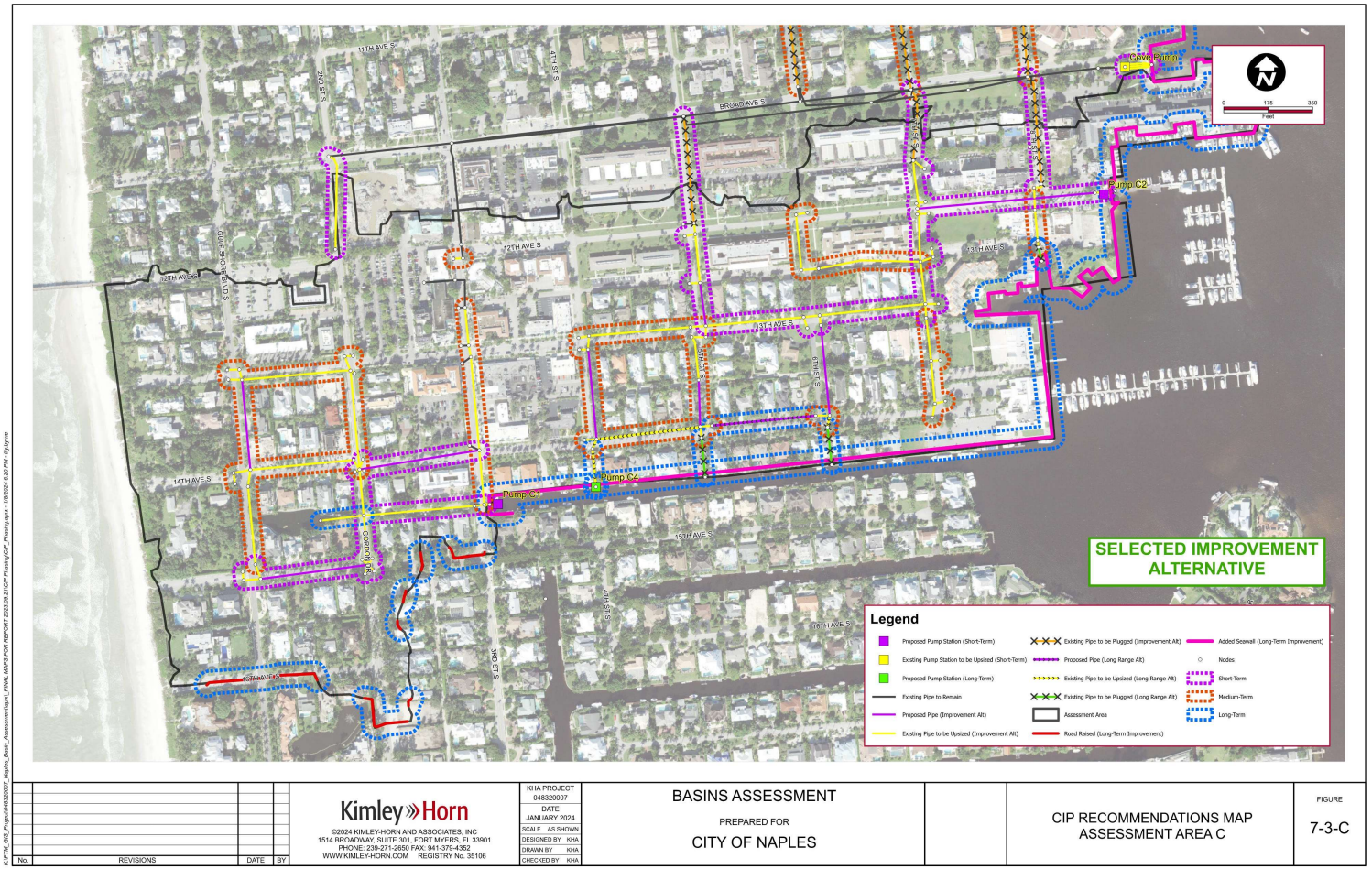


Key Findings from Alternatives Analysis (Existing and Long-Range)



- Maximized flood improvements occur through a combination of upsizing pipes, upsizing existing pumps, new pipe connections, and new pump stations
- When possible, infrastructure was disconnected from existing pump stations and diverted to proposed outfalls.
- In future conditions, pumps are more effective than pipes due to higher sea level.
- In future conditions, seawalls and road raising are needed in areas that are low-lying to prevent inflow from the adjacent waterbodies during high tides.

Example of the CIP Maps



No.	REVISIONS	DATE	BY

Kimley»Horn

1514 BROADWAY, SUITE 301, FORT MYERS, FL 33901
PHONE: 239-271-2650 FAX: 941-379-4352
WWW.KIMLEY-HORN.COM REGISTRY No. 35106

KHA PROJECT	048320007
DATE	JANUARY 2024
SCALE	AS SHOWN
DESIGNED BY	KHA
DRAWN BY	KHA
CHECKED BY	KHA

BASINS ASSESSMENT

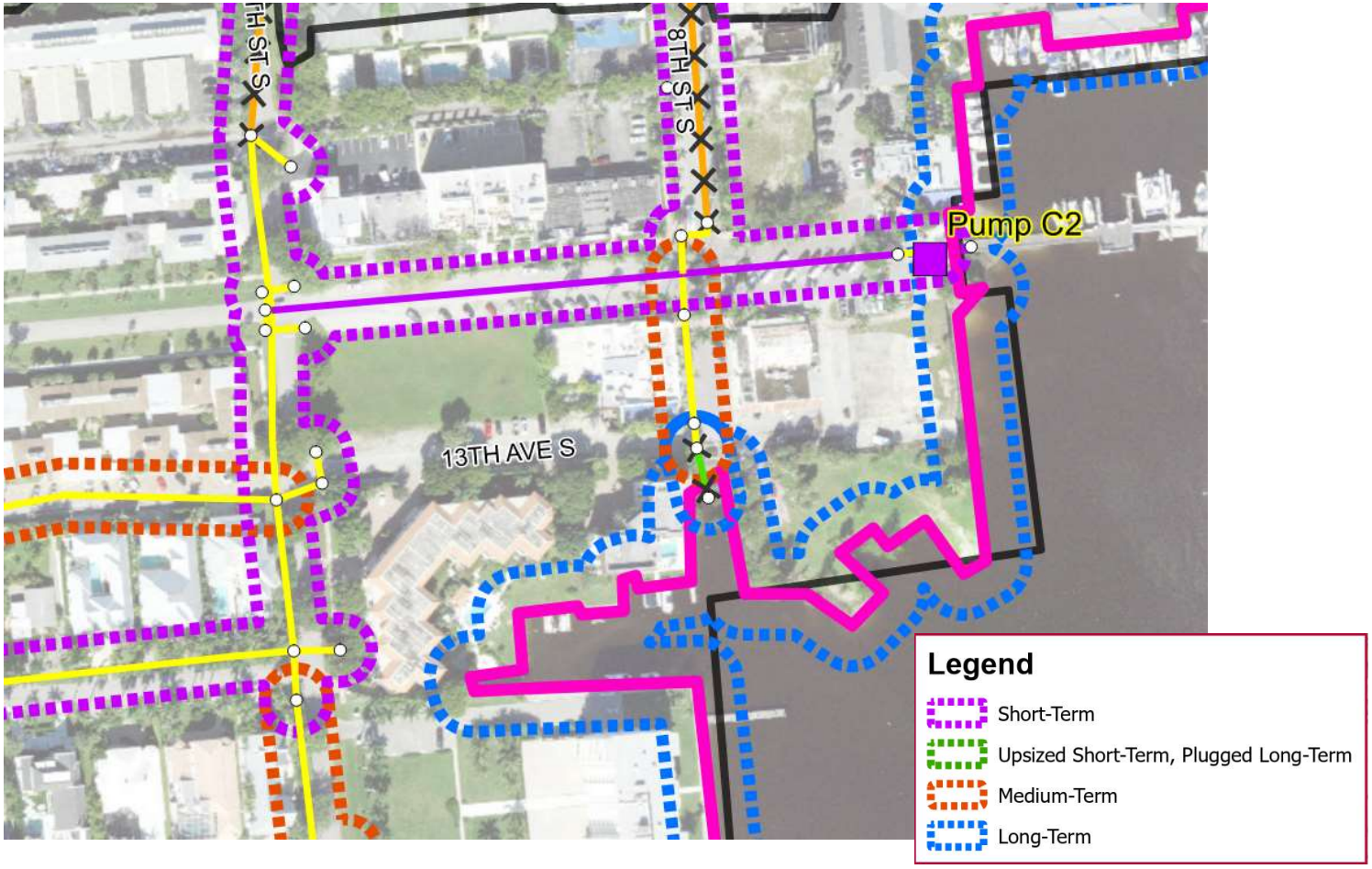
PREPARED FOR

CITY OF NAPLES

CIP RECOMMENDATIONS MAP
ASSESSMENT AREA C

FIGURE
7-3-C

Example of the CIP Maps



Engineer's Opinion of Probable Cost (EOPC)

- EOPC - Used to estimate the cost of all improvements for each Assessment Area
- Prices are based on FDOT Historical Cost Index, City easement costs, and input from manufacturers
- EOPCs include Selected Improvement Alternatives and additional Long-Range Improvements in Future Conditions
- Cost estimates are conservatively high

ENGINEER'S OPINION OF PROBABLE COST
Assessment Area B - Selected Alternatives
January 2024

ITEM	DESCRIPTION	ESTIMATED QUANTITY		UNIT PRICE	AMOUNT
EARTHWORK-CLEAR-GRUB-GRADE					
1	Reconstruction of Disturbed Area (Non-Road)	1848	SY	$ 12.00	$ 22,176.00
2	Reconstruction of Disturbed Area (Paved Road)	16616	SY	$ 45.00	$ 747,720.00
				TOTAL	**$ 769,896.00**
STORM WATER					
3	Plugging/Disconnecting Pipe	2916	LF	$ 500.00	$ 1,458,000.00
4	24" RCP	2194	LF	$ 170.00	$ 372,980.00
5	36" RCP	752	LF	$ 240.00	$ 180,480.00
6	42" RCP	996	LF	$ 390.00	$ 388,440.00
7	48" RCP	1066	LF	$ 450.00	$ 479,700.00
8	54" RCP	2176	LF	$ 500.00	$ 1,088,000.00
9	72" RCP	4338	LF	$ 800.00	$ 3,470,400.00
10	FDOT Type 5 Curb Inlet	12	EA	$ 10,000.00	$ 120,000.00
11	FDOT Type D Inlet	61	EA	$ 9,000.00	$ 549,000.00
12	Manhole	12	EA	$ 8,000.00	$ 96,000.00
13	Pump Station (3 Phase Power Available)	2	EA	$ 9,200,000.00	$ 18,400,000.00
				TOTAL	**$ 26,603,000.00**
				SUBTOTAL	**$ 27,372,896.00**
MISCELLANEOUS					
14	Erosion Control and Dewatering (20% Subtotal)	1	LS	$ 5,474,579.20	$ 5,474,579.20
15	Geotechnical and Survey (5% Subtotal)	1	LS	$ 1,368,644.80	$ 1,368,644.80
16	Maintenance of Traffic (5% Subtotal)	1	LS	$ 1,368,644.80	$ 1,368,644.80
17	Demolition and Site Preparation (10% Subtotal)	1	LS	$ 2,737,289.60	$ 2,737,289.60
18	Mobilization and Demobilization (10% Subtotal)	1	LS	$ 2,737,289.60	$ 2,737,289.60
19	Headwalls and Mitered Ends for Pipes (2% Subtotal)	1	LS	$ 547,457.92	$ 547,457.92
				SUBTOTAL WITH MISCELLANEOUS	**$ 41,606,801.92**
				20% CONTINGENCY	**$ 8,321,360.38**
				TOTAL CONSTRUCTION COST	**$ 49,928,162.30**

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.

Benefit Cost Analysis

- Damage Assessment Modeling
  - Property Damage
  - Commercial Damages
  - Roadway Damages
- Hedonic Modeling
  - Property Value Impacts
  - Property Tax Impacts
- Benefit estimates are conservatively low

BENEFIT
=
DAMAGES AVOIDED
=
DAMAGE UNDER EXISTING CONDITION SCENARIO – DAMAGE UNDER ALTERNATIVE SCENARIO

Property Damage

- Depth-damage functions were used to determine the percentage of damage from each storm scenario
- Flood elevations were compared to approximate finished flood elevations for analysis
- Structural and content damages of each property during each storm scenario
- City of Naples' residential property values were available from 2022

Commercial Damages

- Number of days of business disruption due to flooding was estimated based on model results
- Daily business revenues were estimated from US Census Bureau data
- Loss of revenue was estimated by multiplying days of business disruption by daily revenue

Roadway Damages

- A roadway was considered damaged if it was inundated by any amount during a storm event
- Road segment damages were based on estimated cost to repair the damaged road per linear foot

Class	Cost to Repair / ft (2023 Dollars)
Arterial	$247
Collector	$185
Local	$62

Property Value Impacts

- Decreases in home prices can be driven by experiences of recent flooding events
- Increases in mean road and parcel elevations could result in increases in housing price
- This analysis considered a one-foot increase in mean road and parcel elevation

Property Tax Impacts

- Increases in property values would lead to increases in property taxes
- This analysis multiplied the annual property value impacts by the local tax rates to estimate changes in property tax revenues

Benefit Cost Analysis

50 Year Total Benefits for 10-Year and 25-Year Storms Under Existing and Future Conditions (2023 Dollars in Thousands)

Storm Type	Assessment Area	Existing Conditions	Future Conditions
10-Year	A	$11,563	$20,653
	B	$9,276	$73,391
	C	$12,059	$88,080
	D	$3,320	$41,118
	E	$151	$10,486
	Total	**$36,369**	**$233,728**
25-Year	A	$6,873	$8,919
	B	$6,008	$29,886
	C	$23,086	$35,297
	D	$1,475	$16,531
	E	$49	$4,176
	Total	**$37,491**	**$94,809**
Grand Total	A	$18,436	$29,571
	B	$15,284	$103,277
	C	$35,146	$123,377
	D	$4,794	$57,649
	E	$199	$14,662
	Total	**$73,860**	**$328,536**

Benefit Cost Analysis

- Benefit cost estimates are conservatively low and cost estimates are conservatively high
- Benefit/Cost should be evaluated for individual projects

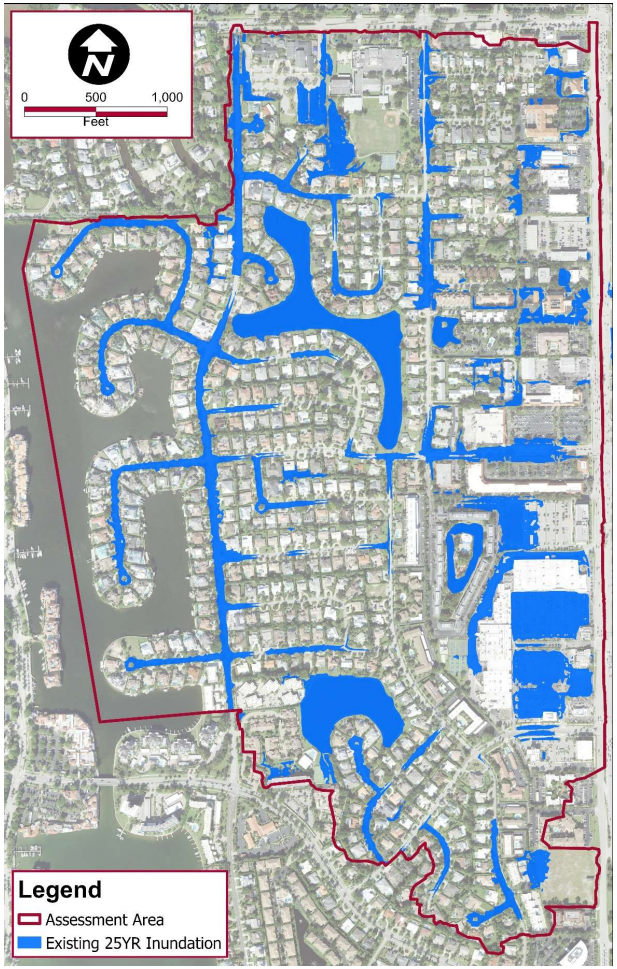
Benefit/Cost Ratio for Selected Improvement Alternatives

Assessment Area	Benefit Associated with Improvement Alternative	Improvement Alternative Cost	Benefit/Cost Ratio
A	$18,436	$19,900	0.93
B	$15,284	$49,900	0.31
C	$35,146	$85,100	0.41
D	$4,794	$32,800	0.15
E	$199	$900	0.22
Total	**$73,860**	$127,700	0.39

Benefit/Cost Ratio for Long-Range Alternatives in Future Conditions

Assessment Area	Benefit Associated with Improvement Alternative	Improvement Alternative Cost	Benefit/Cost Ratio
A	$29,571	$117,400	0.25
B	$103,277	$107,700	0.96
C	$123,377	$129,000	0.96
D	$57,649	$89,300	0.65
E	$14,662	$85,800	0.17
Total	**$328,536**	$529,200	0.62

Area A – Results – Existing Conditions



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Area A – Results – Chosen Alternative

Scenario	Number Selected/Total Number Modeled	Stormwater Infrastructure	Tailwater Condition
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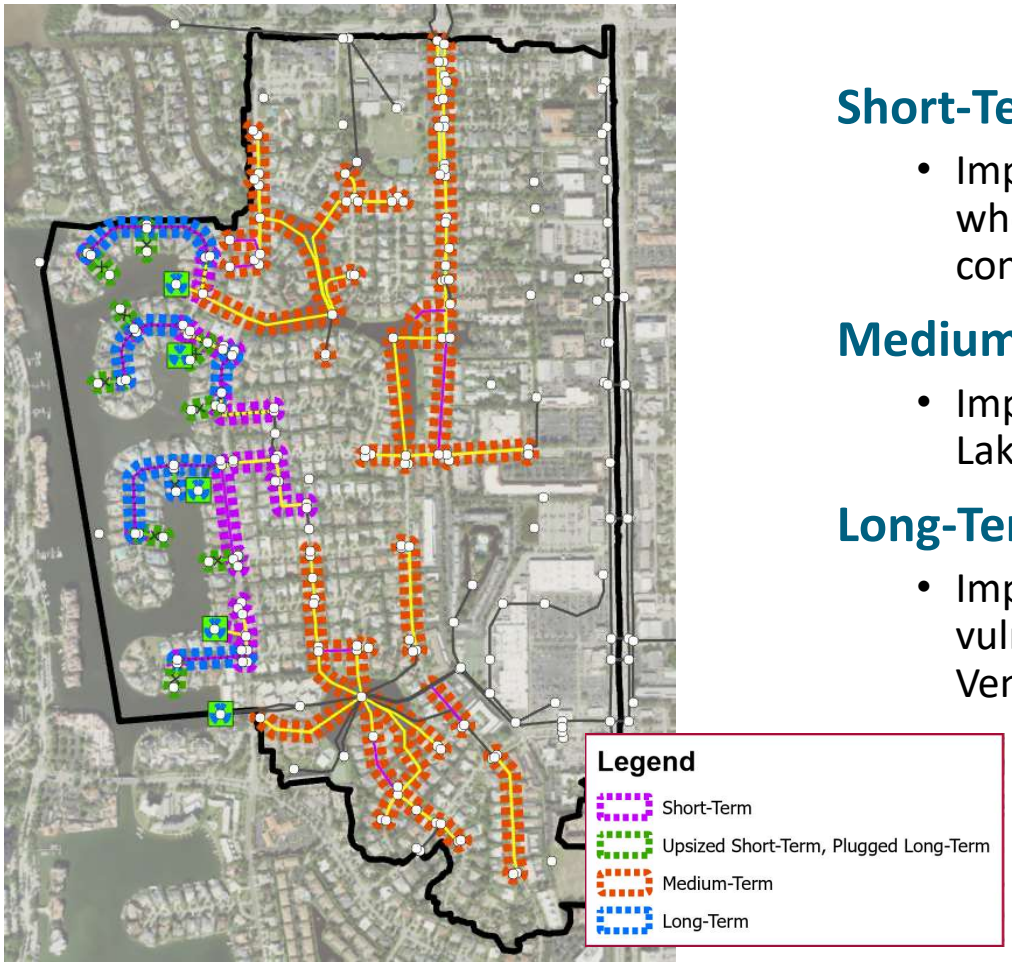
Area A – Findings and Recommendations



Short-Term

- Improvements focused along Crayton Road where flooding is more severe in existing conditions

Medium-Term

- Improvements occur upstream of Devils Lake and Swan Lake

Long-Term

- Improvements focused in areas that will be vulnerable to sea-level rise adjacent to Venetian Bay

Area B – Results – Existing Conditions

Scenario	Number Selected/Total Number Modeled	Stormwater Infrastructure	Tailwater Condition
Existing Scenario	N/A	Existing Infrastructure	Existing Tailwater
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Area B – Results – Chosen Alternative

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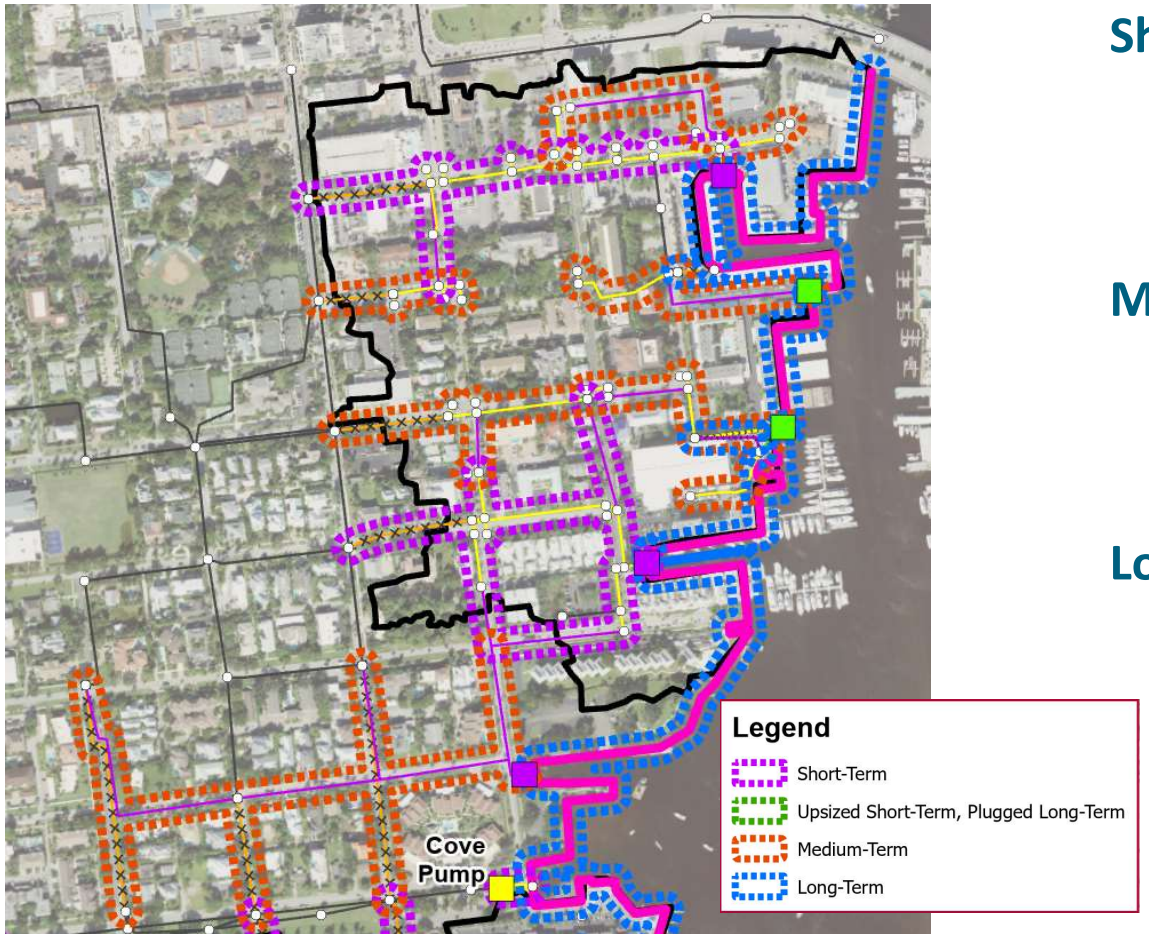
Area B – Findings and Recommendations



Short-Term

- Divert stormwater from the Cove Pump Station to new outfalls
- Evaluate upsizing the Cove Pump Station

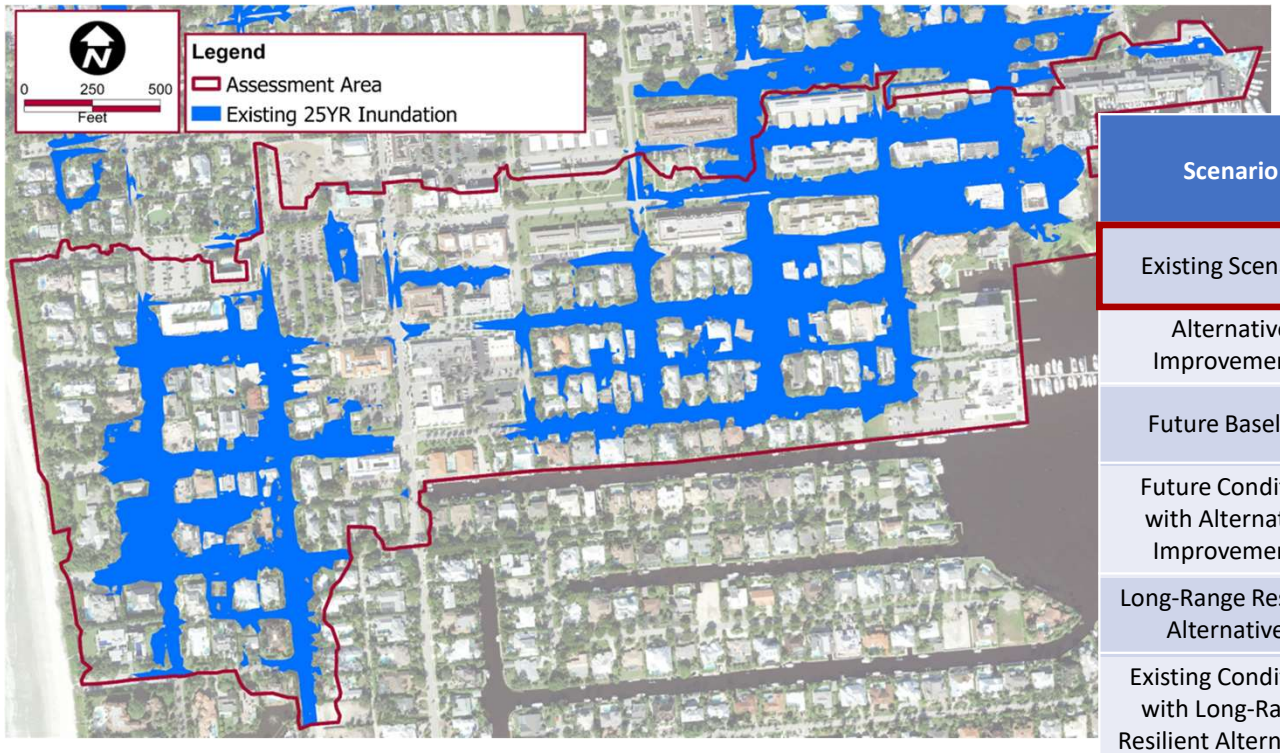
Medium-Term

- Focus on secondary drainage improvements
- Divert water from Cove Pump Station outside of the Study Area

Long-Term

- Construct sea walls in low-lying areas
- Add pump stations and divert any remaining gravity flow to pump stations

Area C – Results – Existing Conditions



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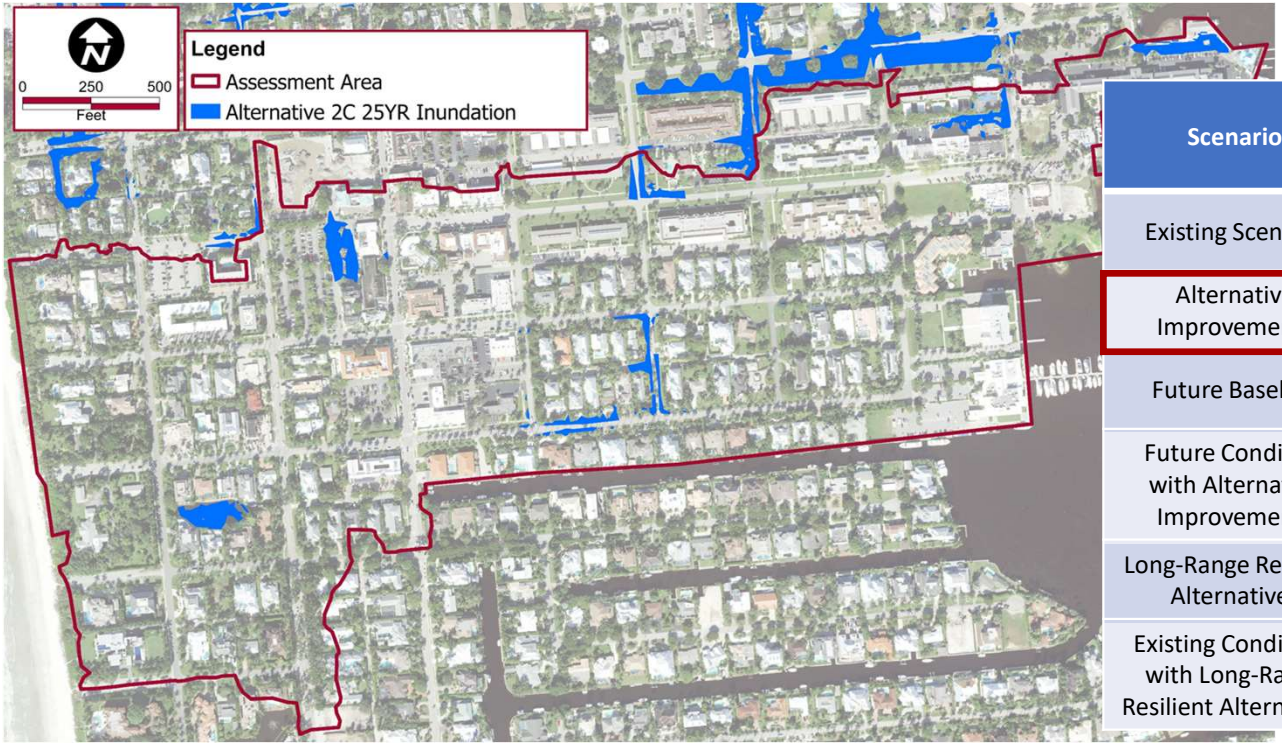
Area C – Results – Chosen Alternative



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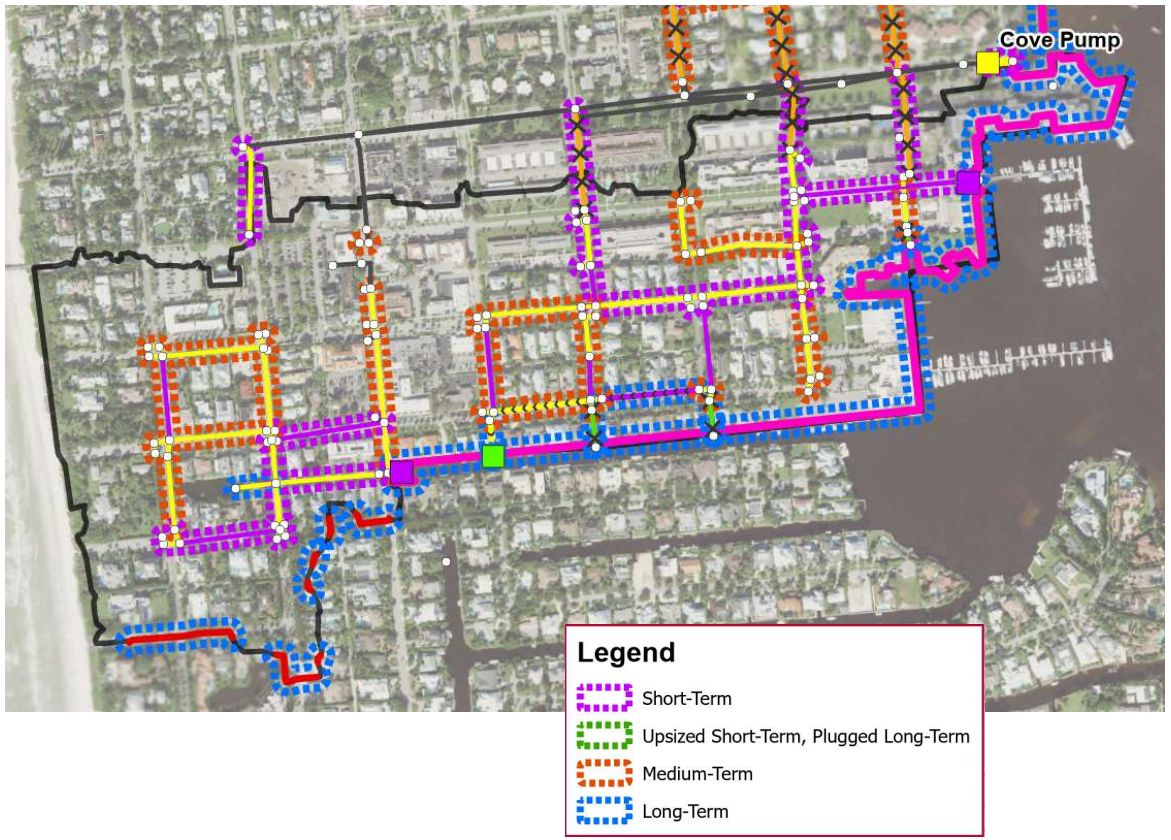
Area C – Findings and Recommendations



Short-Term

- Two proposed pump station and the infrastructure that will divert flow to these pump stations

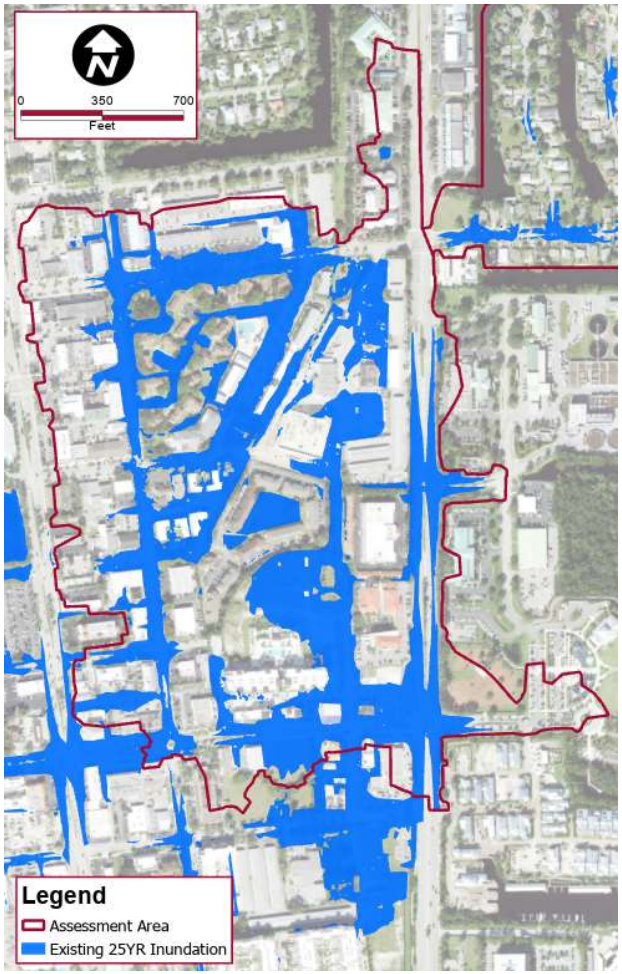
Medium-Term

- Upsize remaining infrastructure connected to pump stations

Long-Term

- Construct sea walls in low-lying areas
- Add pump stations and divert any remaining gravity flow to pump stations

Area D – Results – Existing Conditions



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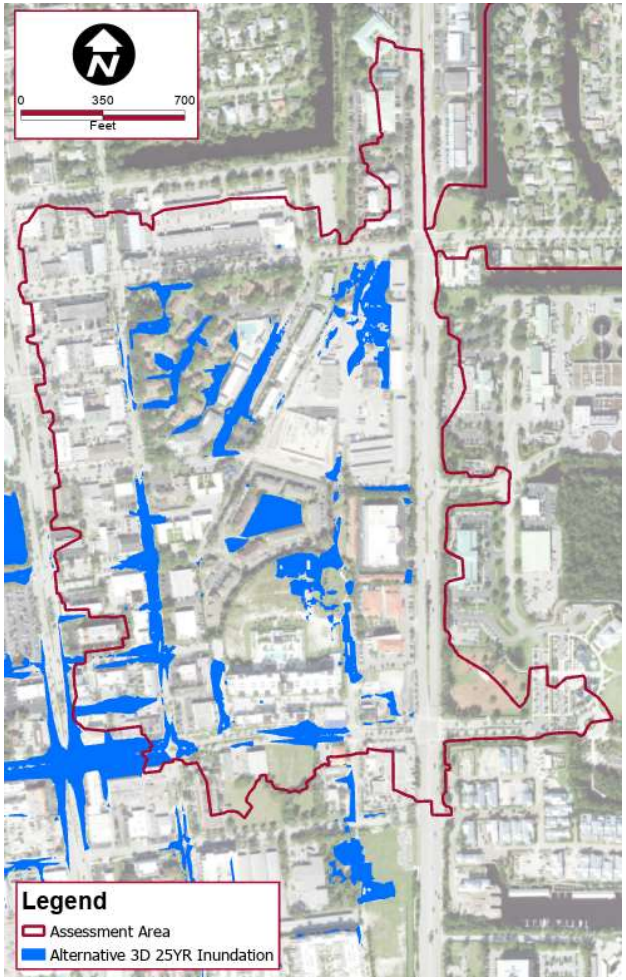
Area D – Results – Chosen Alternative



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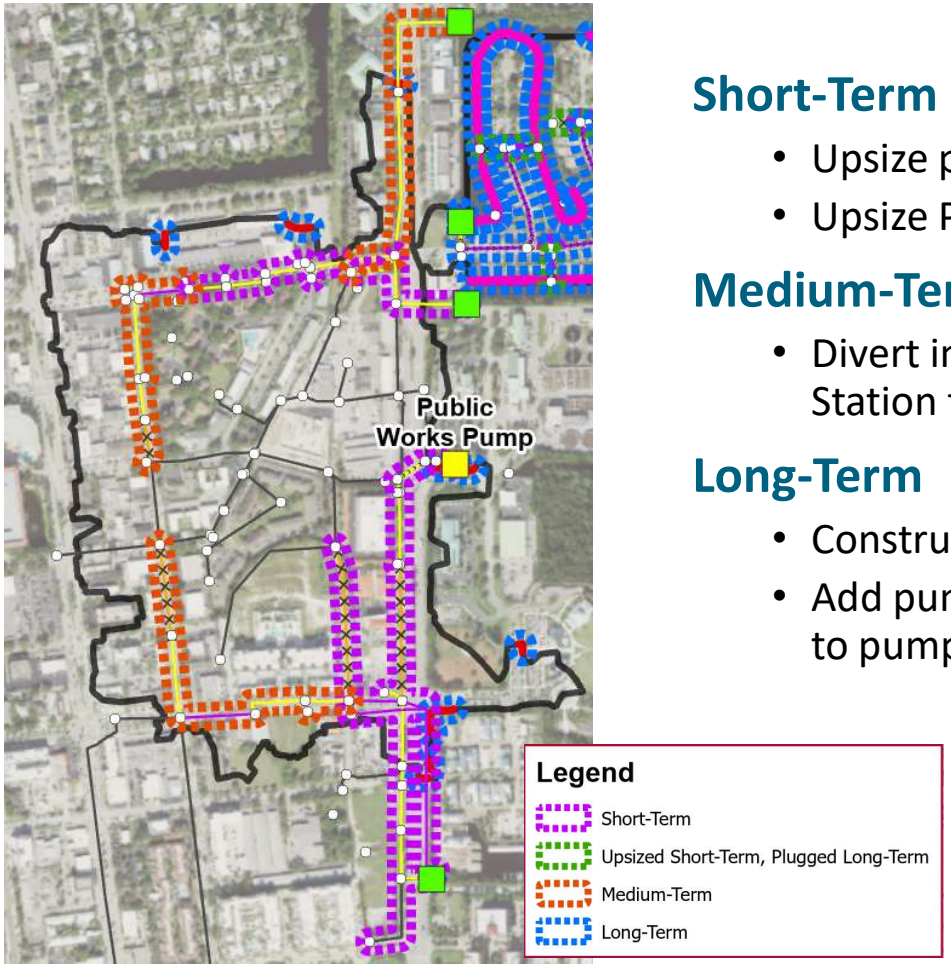
Area D – Findings and Recommendations



Short-Term

- Upsize pipes in vulnerable areas
- Upsize Public Works Pump Station

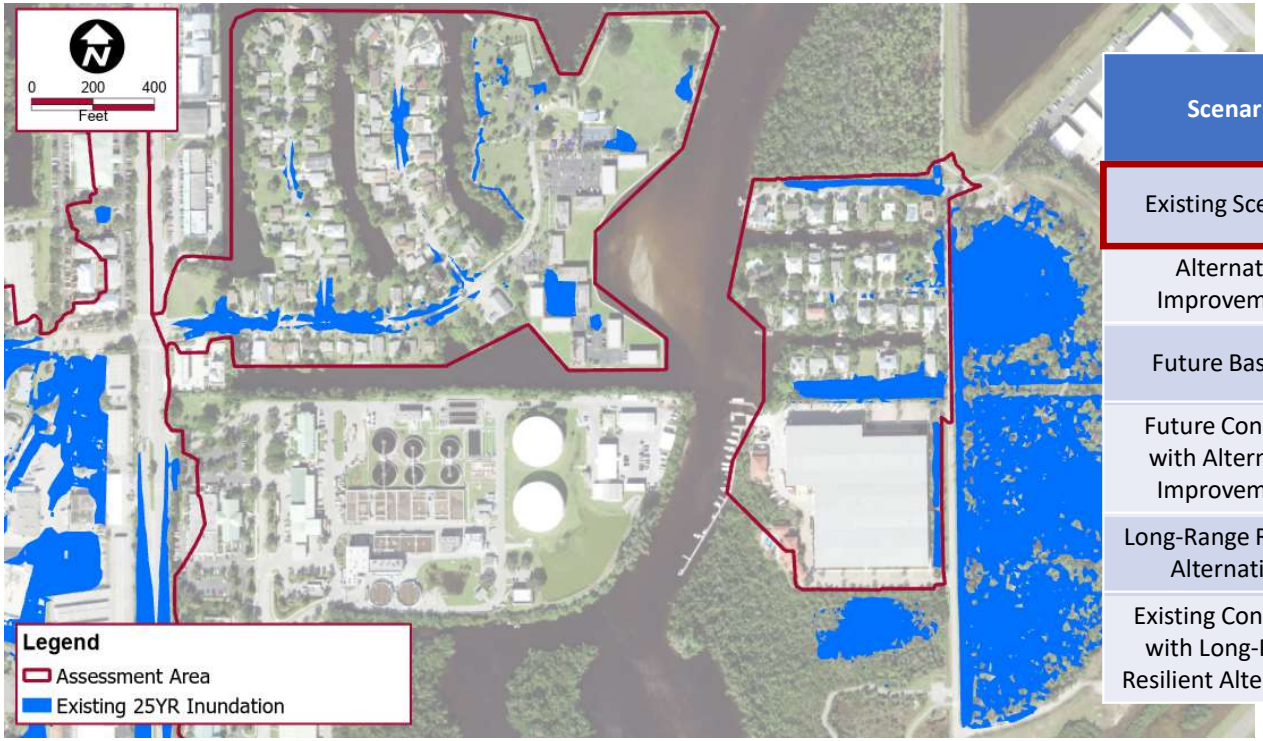
Medium-Term

- Divert infrastructure from the Public Works Pump Station to other outfalls with additional capacity

Long-Term

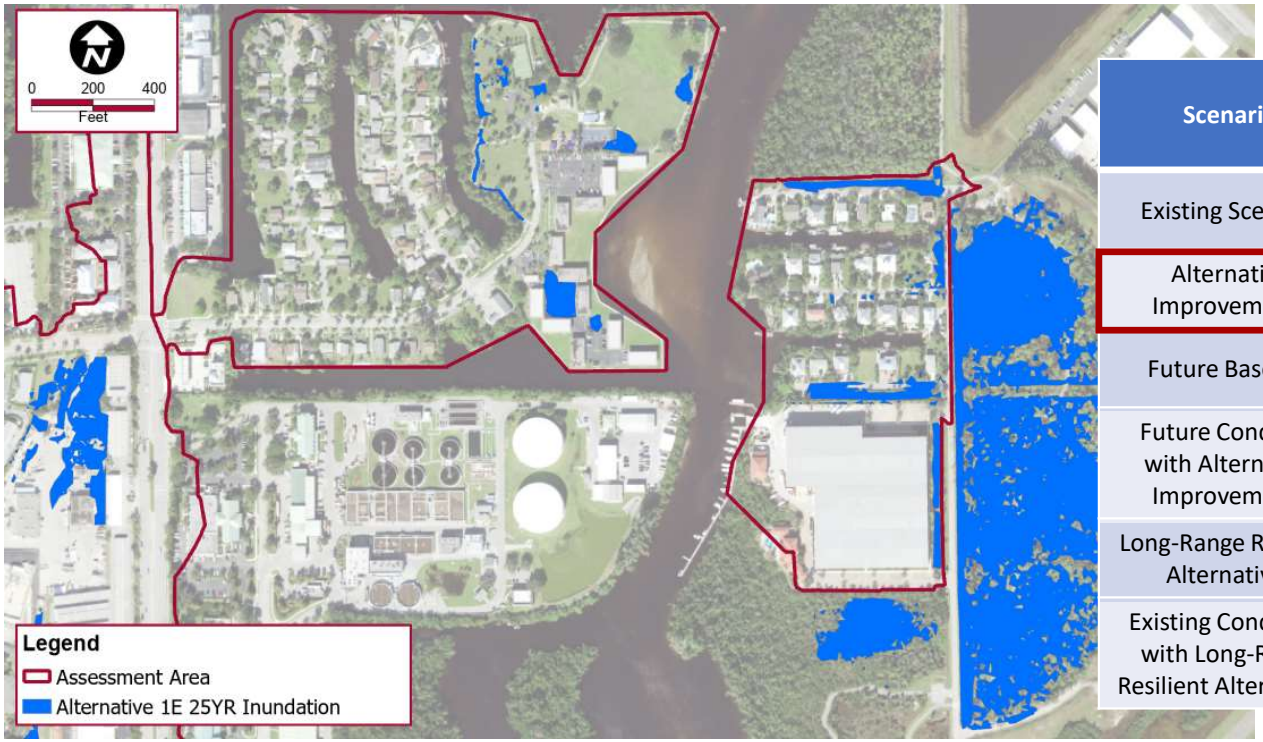
- Construct sea walls in low-lying areas
- Add pump stations and divert any remaining gravity flow to pump stations

Area E – Results – Existing Conditions



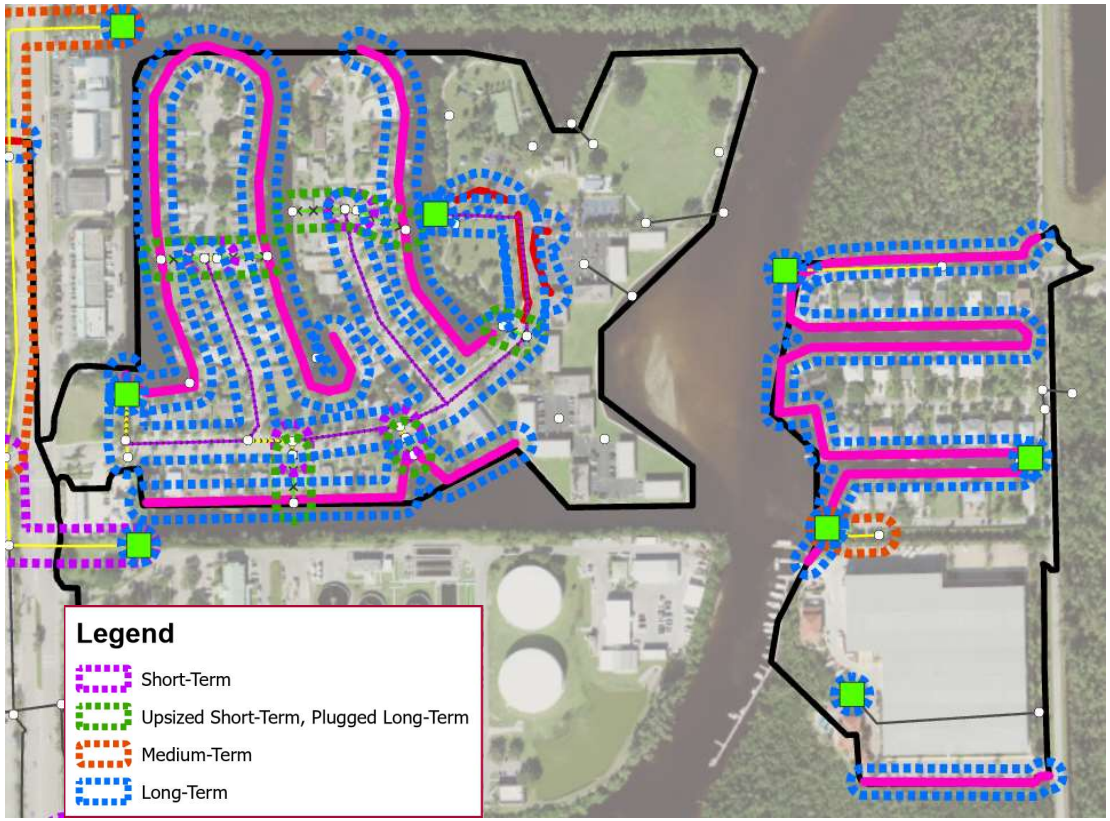
Scenario	Number Selected/Total Number Modeled	Stormwater Infrastructure	Tailwater Condition
Existing Scenario	N/A	Existing Infrastructure	Existing Tailwater
Alternative Improvements	1/3	Proposed Improvements	Existing Tailwater
Future Baseline	N/A	Existing Infrastructure	Future Tailwater
Future Condition with Alternative Improvements	1/2	Proposed Improvements	Future Tailwater
Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Future Tailwater
Existing Conditions with Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Existing Tailwater

Area E – Results – Chosen Alternative



Scenario	Number Selected/Total Number Modeled	Stormwater Infrastructure	Tailwater Condition
Existing Scenario	N/A	Existing Infrastructure	Existing Tailwater
Alternative Improvements	1/3	Proposed Improvements	Existing Tailwater
Future Baseline	N/A	Existing Infrastructure	Future Tailwater
Future Condition with Alternative Improvements	1/2	Proposed Improvements	Future Tailwater
Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Future Tailwater
Existing Conditions with Long-Range Resilient Alternatives	1/2	Long-Range Improvements	Existing Tailwater

Area E – Findings and Recommendations



Short-Term

- Upsize pipes in vulnerable areas

Medium-Term

- Upsize existing outfall structure on east side of study area

Long-Term

- Construct sea walls in low-lying areas
- Add pump stations and divert any remaining gravity flow to pump stations

Funding Opportunities

- Potential funding sources for proposed improvements include but are not limited to:
  - FEMA Flood Mitigation Assistance Grant Program
  - Federal Clean Water Program – Section 319
  - State Water Quality Assistance Grant Program
  - Resilient Florida Grant Program

Final Recommendations

- ✓Develop a more detailed implementation plan and funding strategy leveraging information from this study.
- ✓Implement short-term proposed improvements which include upsizing, adding, and modifying connectivity of existing pipes and pump stations.
- ✓Evaluate proposed projects early in the design process to understand their individual effectiveness and eligibility for grant funding. Collect supplemental data and perform additional analyses during design and permitting as needed.
- ✓Perform feasibility studies of existing and proposed pump stations to determine details of a proposed design.

Questions?

Kimley»Horn

Expect More. Experience Better.