The Drive to Stay Dry

North Bay Village's Resiliency Journey

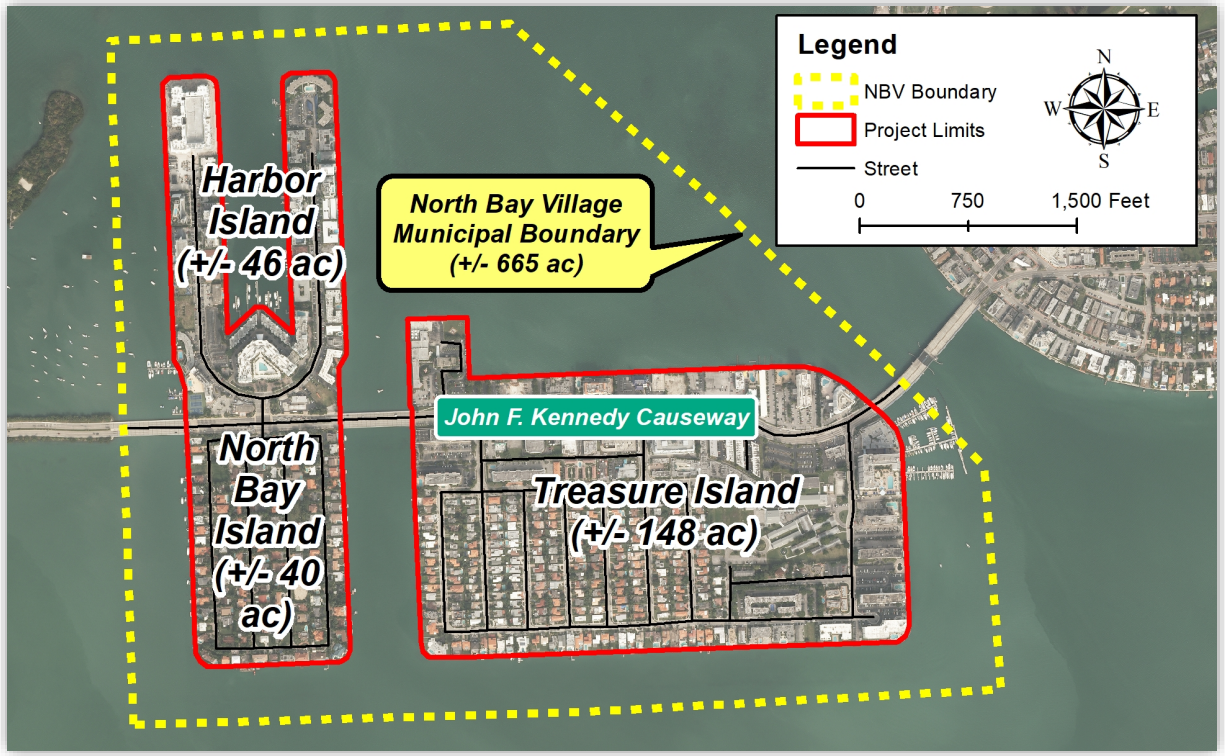
June 16, 2022

NORTH BAY VILLAGE
EST. 1945

bcc engineering

PROJECT LOCATION OVERVIEW

- The Village retained BCC Engineering LLC. (BCC) to develop the Village's first Stormwater Master Plan (SWMP).
- Address flooding and resilience for the Village's three (3) islands:
  - Harbor Island
  - North Bay Island
  - Treasure Island

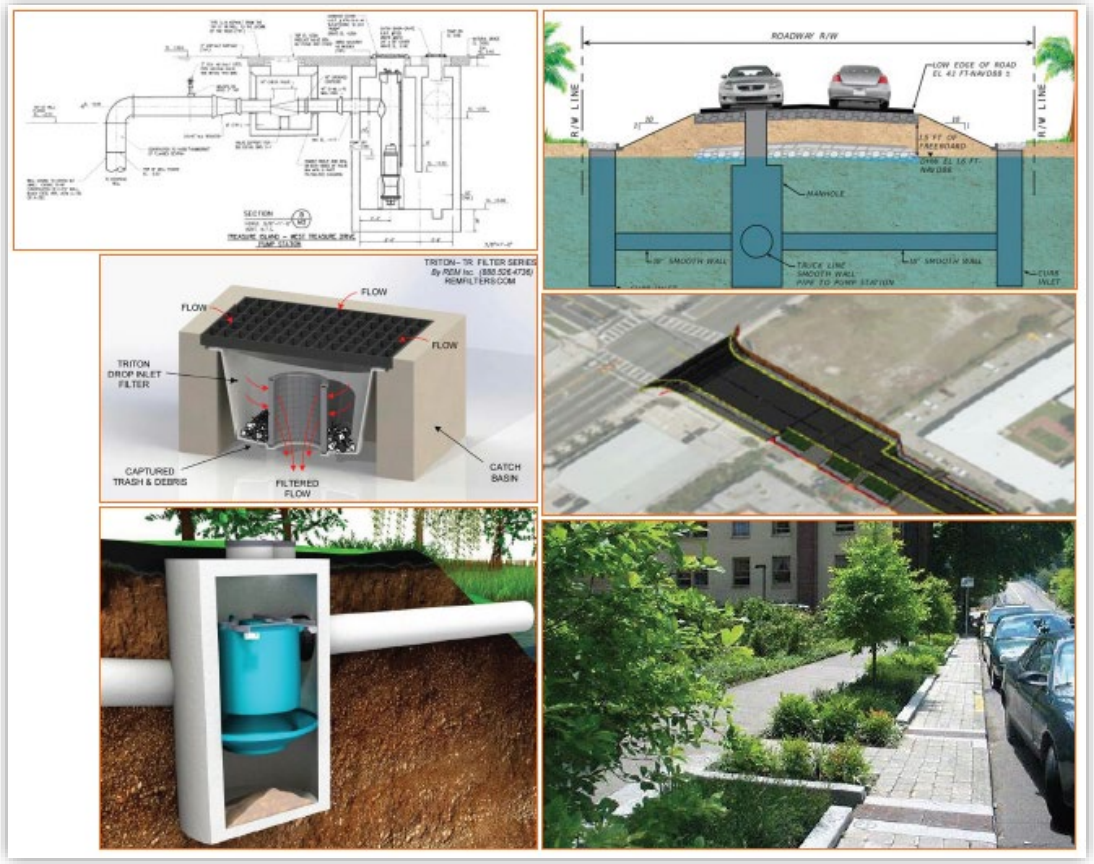


STORMWATER ISSUES AND CONCERNS

- Sea-Level/Groundwater Rise
- Deteriorating Stormwater Infrastructure
- Increased Rainfall Amounts & Frequency
- Stronger Hurricanes
- Higher Storm Surges
- Aging & Low-Lying Seawalls
- Sunny-Day Flooding
  - Tidal Flooding
  - King Tide Flooding

SWMP PURPOSE AND OBJECTIVES

- Provide the Village with short- and long-term stormwater Capital Improvement Plans (CIPs) to implement high priority projects in a systematic, objective and cost-effective manner
- Assist the Village in developing an Adaptive Management Plan for Climate Change, and mitigate projected sea-level and groundwater rise
- Help the Village secure grants for flood protection and resilience to prepare for future conditions
- Help improve the Village's FEMA Community Rating Score (CRS) to reduce resident's flood insurance rates



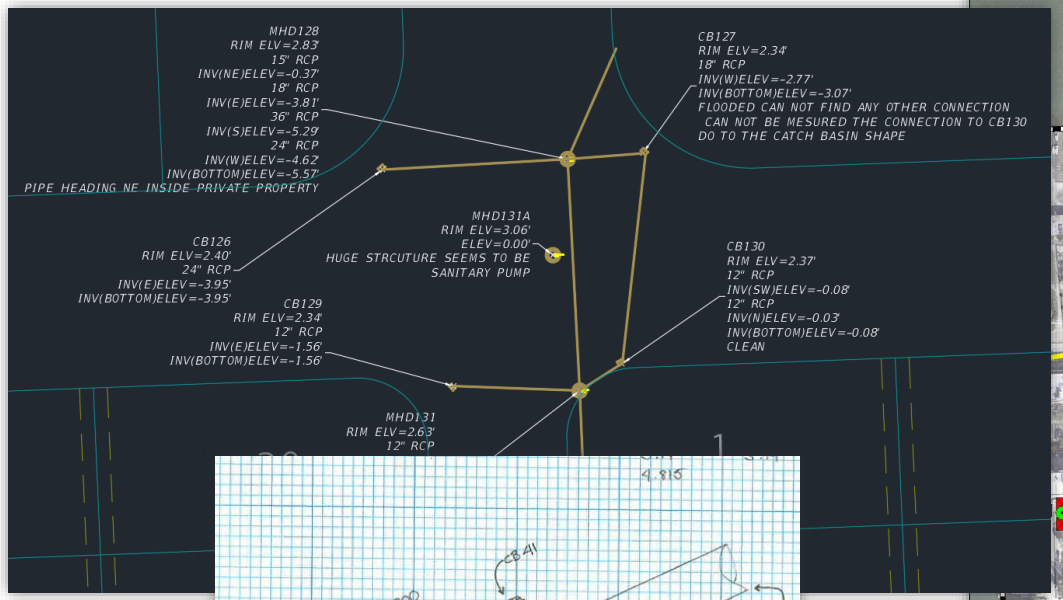
SWMP SCOPE OF WORK

- Task 1 – Project Coordination and Progress Meetings
- Task 2 – Data Collection and Evaluation
- Task 3 – Public Involvement and Engagement
- Task 4 – Existing Conditions H&H Model Development and WQ Modeling
- Task 5 – Future Conditions H&H Modeling w/o Projects
- Task 6 – Identification/Ranking of Sub-basins for Existing/Future Conditions w/o Projects
- Task 7 – Capital Improvement Plan (CIP) Development and Funding
- Task 8 – Comprehensive Stormwater Master Plan Report

DRAINAGE INFRASTRUCTURE SURVEY

- 68 Manholes
- 118 Catch Basins
- 3.69 Miles of Culverts
- 36 Outfalls
- 21 Backflow Preventers
- 2 Pump Stations
- 2 Drainage Wells

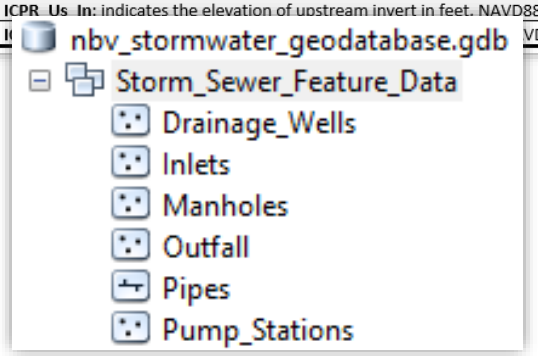
DRAINAGE INFRASTRUCTURE SURVEY

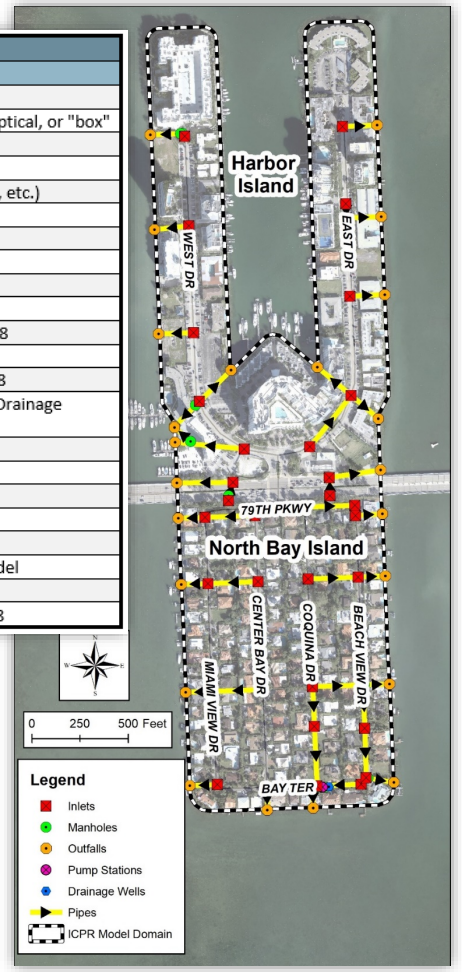


DRAINAGE INFRASTRUCTURE DATABASE

- Developed comprehensive drainage infrastructure GIS geodatabase
- Defined extensive attribute tables that document critical and pertinent stormwater system data
- Allows the Village to meet future needs for documenting maintenance operations, conducting stormwater assessments, and implementing drainage improvements

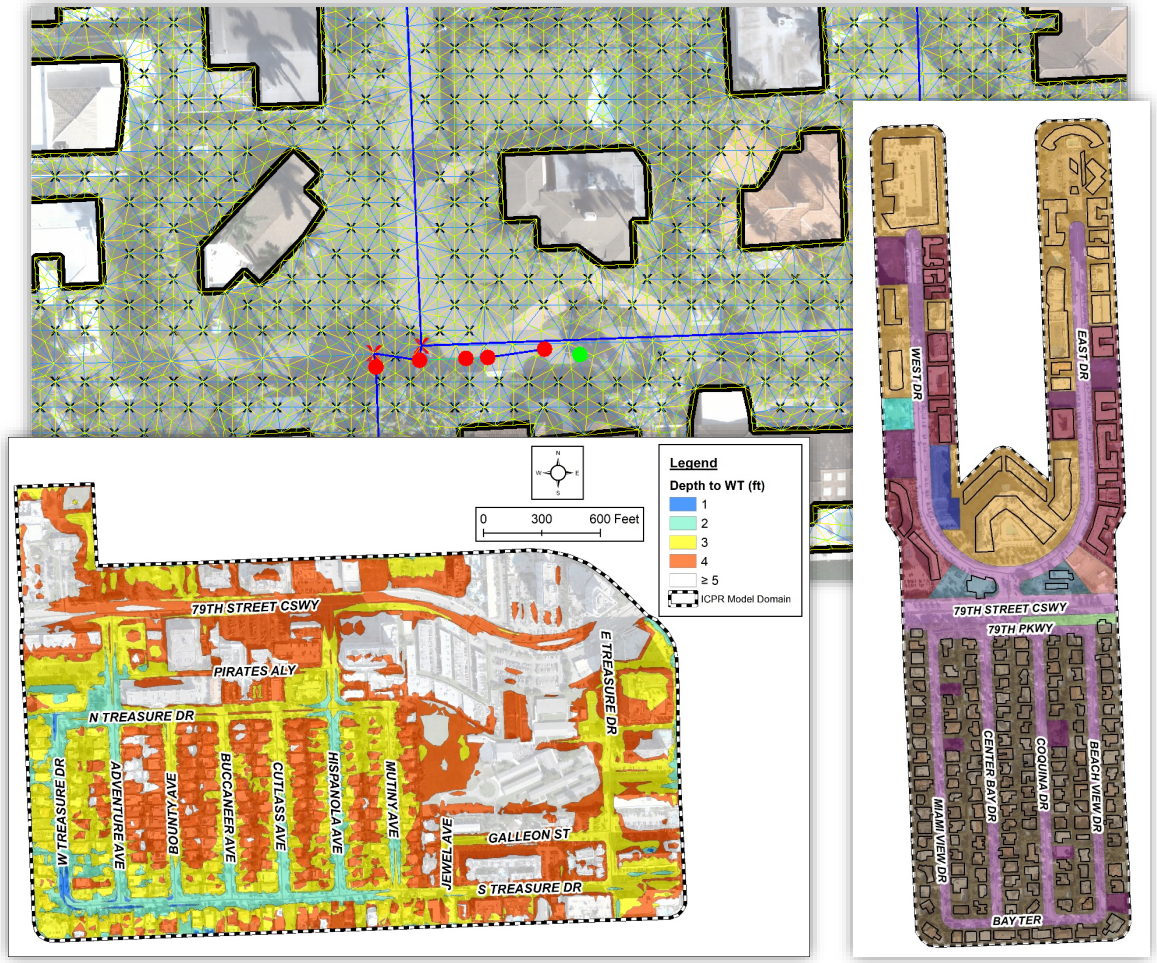
Summary of Pipe Attributes	
Description	***Attributes***
Line Feature Class (NAD 1983 HARN State Plane Florida East FIPS 0901, Linear Unit: Feet)	**Length:** indicates the length of the pipe in feet
	Type: indicates the shape of the associated pipe, generally "circular", "elliptical, or "box"
	Width: defines width dimension of pipe denoted in feet
	Height: defines height dimension of pipe denoted in feet
	Material: indicates the composition type of the pipe (i.e., concrete, metal, etc.)
	N_Invert: defines the north invert elevation of pipe in feet, NAVD88
	S_Invert: defines the south invert elevation of pipe in feet, NAVD88
	E_Invert: defines the east invert elevation of pipe in feet, NAVD88
	W_Invert: defines the west invert elevation of pipe in feet, NAVD88
	NE_Invert: defines the northeast invert elevation of pipe in feet, NAVD88
	NW_Invert: defines the northwest invert elevation of pipe in feet, NAVD88
	SE_Invert: defines the southeast invert elevation of pipe in feet, NAVD88
	SW_Invert: defines the southwest invert elevation of pipe in feet, NAVD88
	Source: indicates the original data source for specific data line (i.e., 2021 Drainage Infrastructure Survey, etc.)
	Notes: contains other pertinent information
	Pipe_Cond: describes condition of pipe (i.e., unknown, etc.)
	Count: identifies the number of pipe(s)
	ICPR_Name: indicates the name of associated node in ICPR model
	ICPR_Us_No: indicates the name of upstream node of pipe in ICPR model
	ICPR_Ds_No: indicates the name of downstream node of pipe in ICPR model
	ICPR_Us_In: indicates the elevation of upstream invert in feet, NAVD88





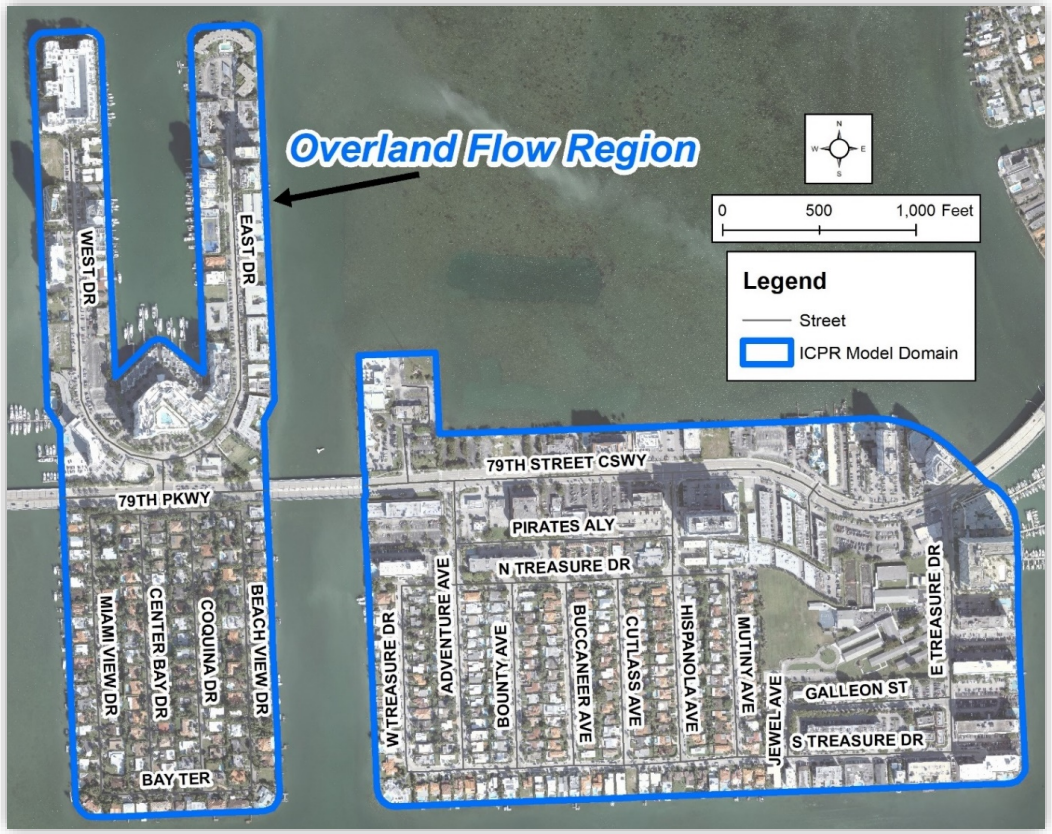
EXISTING CONDITIONS H&H MODEL

- Developed fully-integrated 1D/2D model using ICPRv4 software
- Benefits of 2D model approach:
  - Basin delineations are not needed
  - Time of concentration (t_c) calculations are not required
  - Overland flow/inter-basin weirs are not needed
  - More realistic surface flow patterns and velocities
  - Inherently accounts for surface storage
  - More detailed model results



H&H MODEL INPUT PARAMETERS

Overland Flow Region

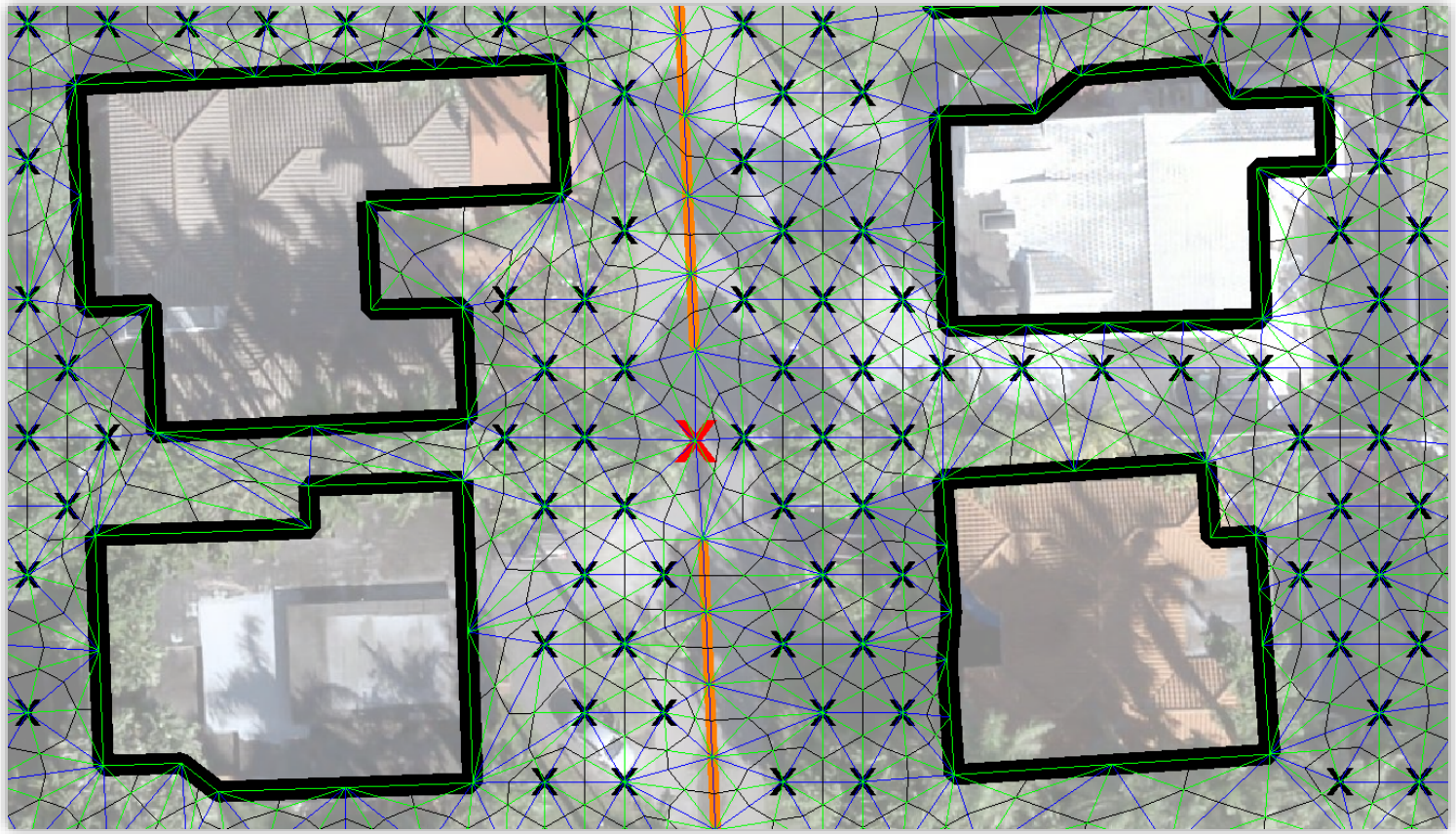


Node-Link Connectivity

H&H MODEL INPUT PARAMETERS

2D Overland Flow Mesh Generation

- Required Model Elements:
  - Breakpoints
  - Breaklines
  - 1D Interface Nodes
  - Boundary Stage Lines
  - Pond Control Volumes
  - 2D Weir Features
  - Extrusion Zones
  - Overland Flow Region
  - Map Layers/Surface
  - Cell Size(s)
  - Triangulation Area/Angle



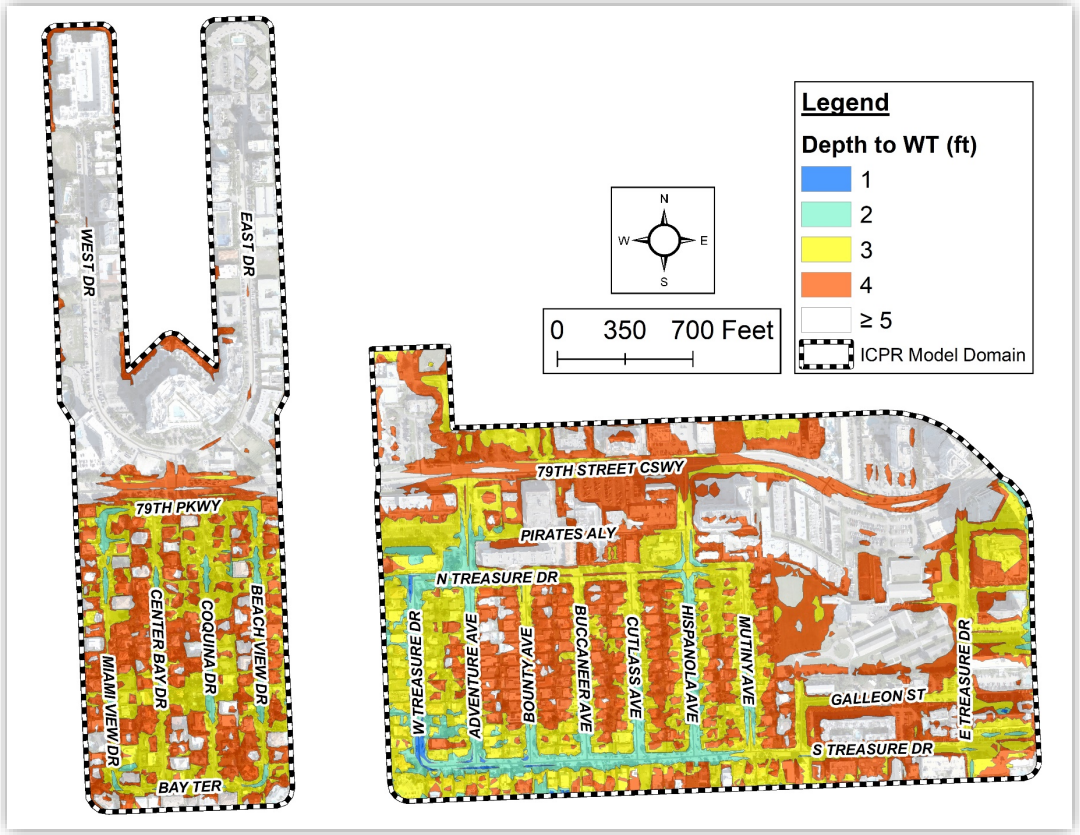
H&H MODEL INPUT PARAMETERS

Soil Storage Capability

Cumulative Soil Storage Information for Coastal Environments		
Depth to W.T. [1]	*Uncompacted S (in.)*	*Compacted S (in.)*
1	0.60	0.45
2	2.50	1.88
3	6.60	4.95
4	10.90	8.18

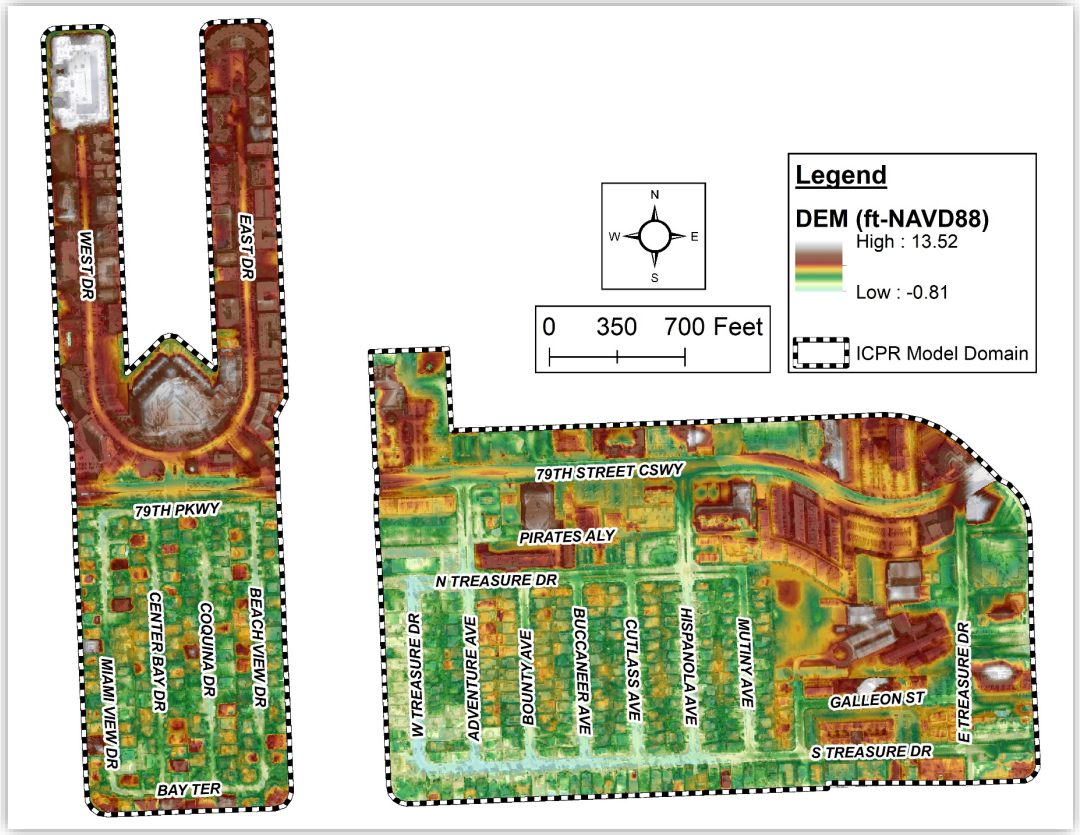
[1] ***Typically, the Seasonal High-Water Table. Site-specific situations to be considered.***

Soil Zones

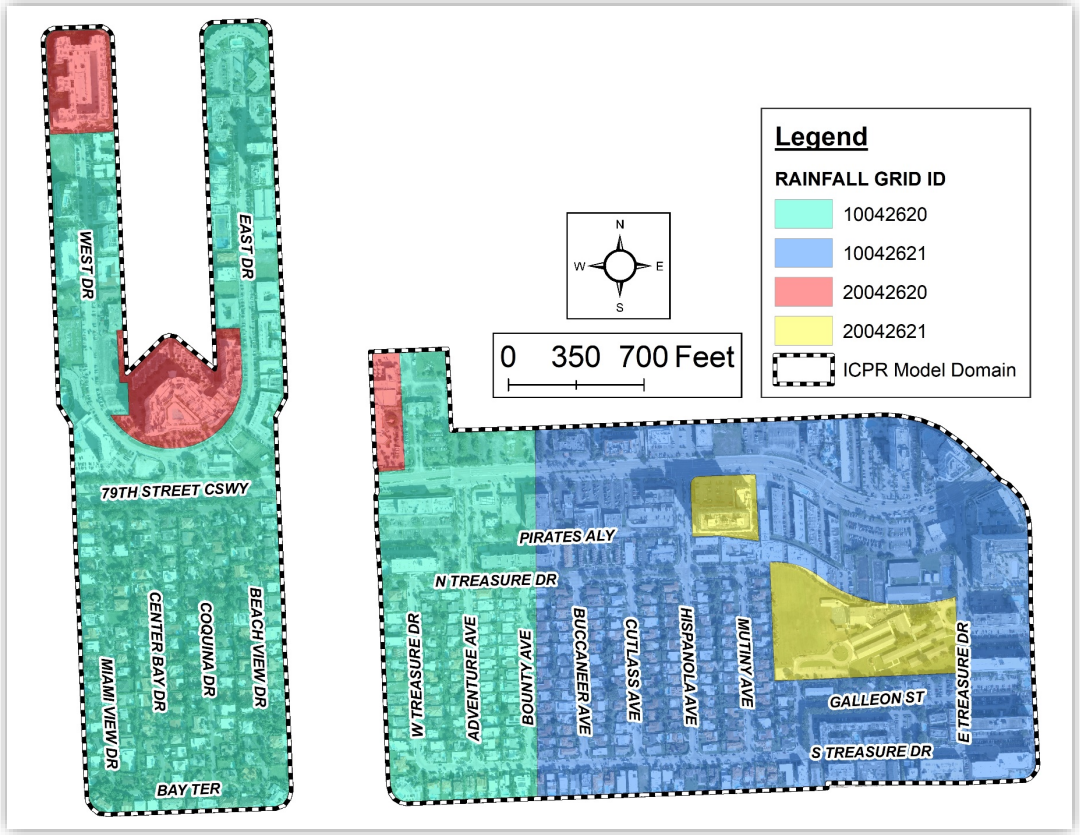


H&H MODEL INPUT PARAMETERS

Topography

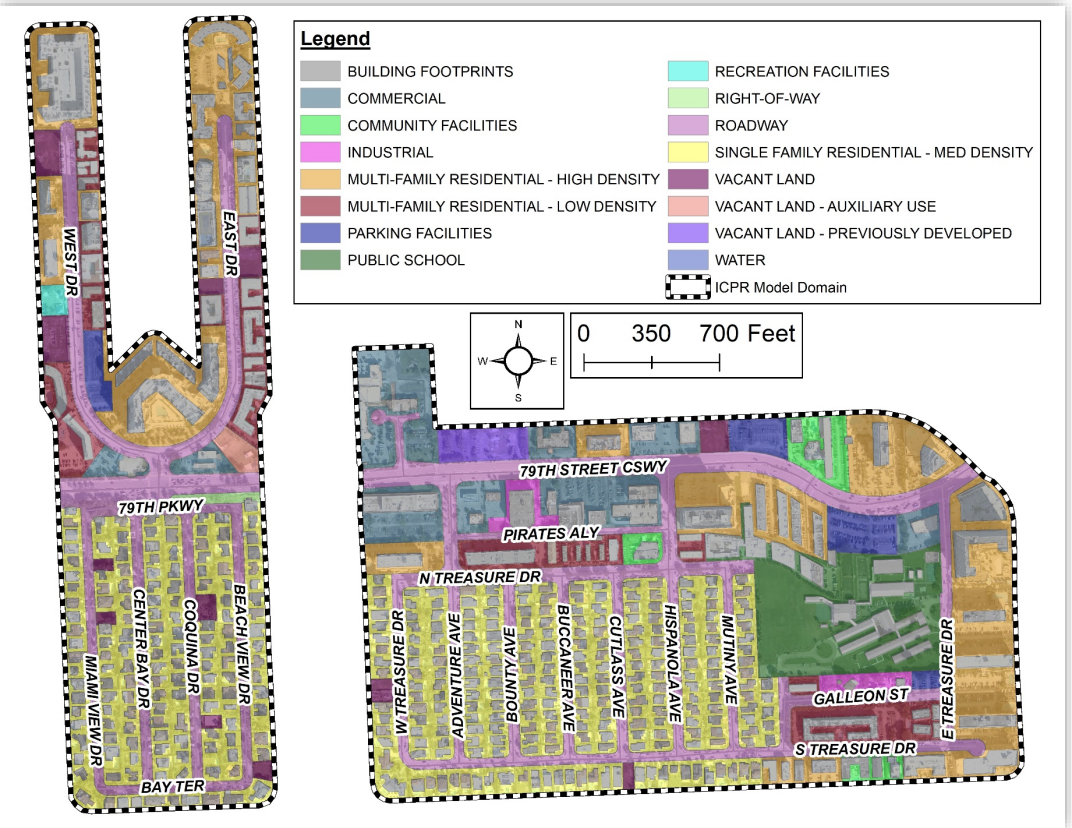


Rainfall Zones

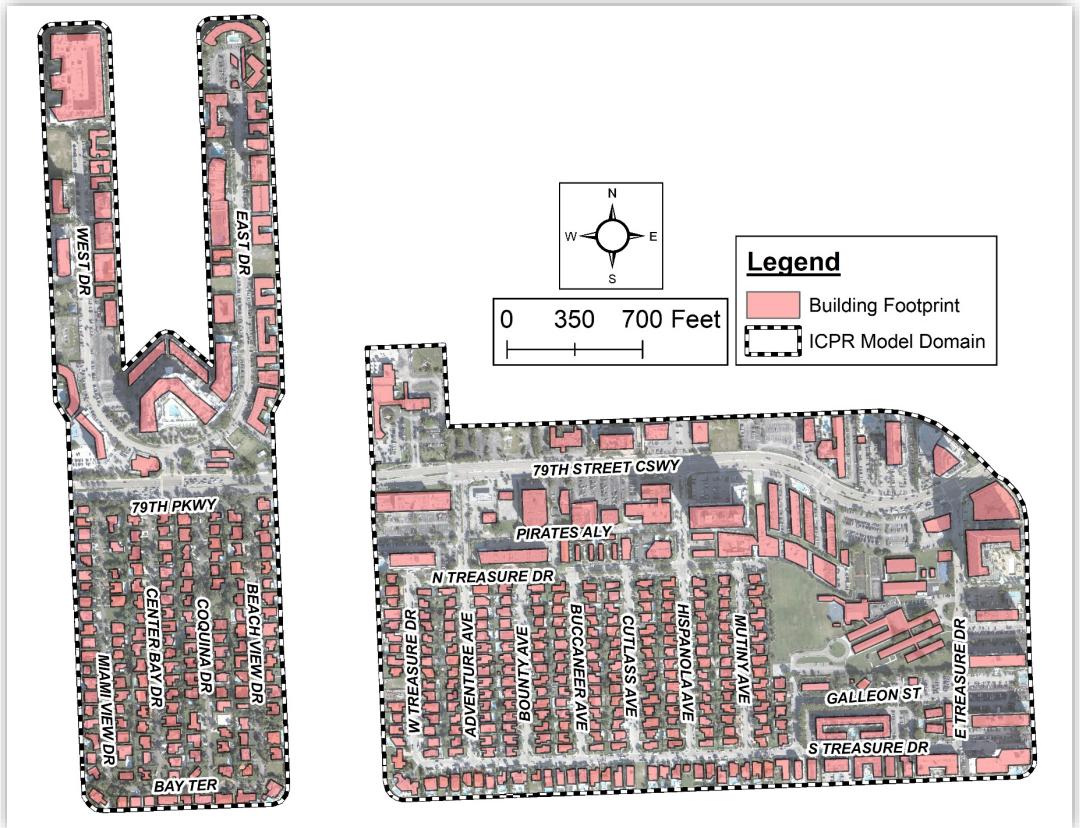


H&H MODEL INPUT PARAMETERS

Land Cover Zones

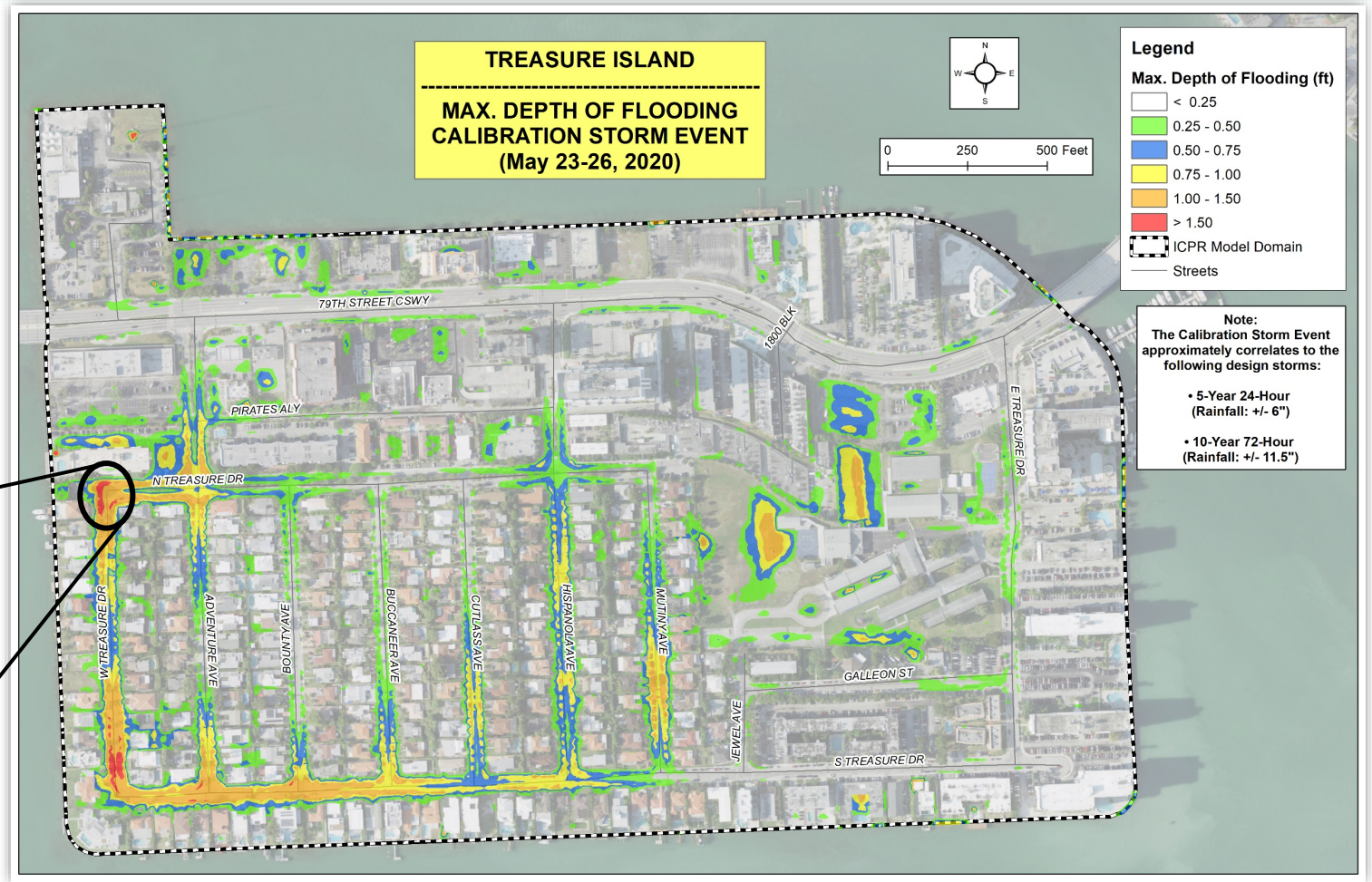


Extrusion Zones



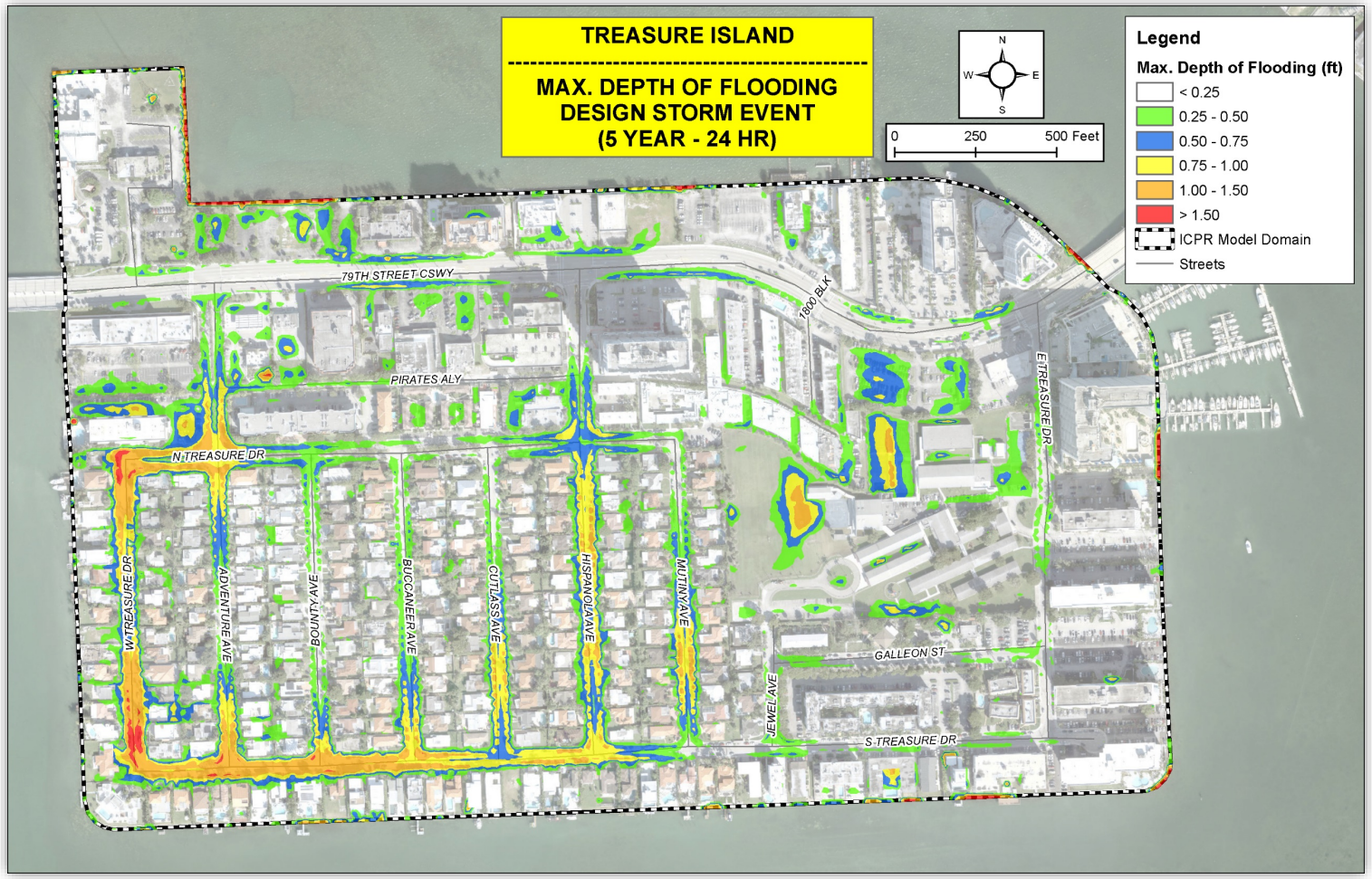
VALIDATION DEPTH OF FLOODING MAPS

- Calibrated and validated model using an observed rainfall event:
  - May 23rd to 27th, 2020 – Total Rainfall Depth = 9.9” to 11.5”
  - 5-yr, 24-hr or 10-yr, 72-hr storm



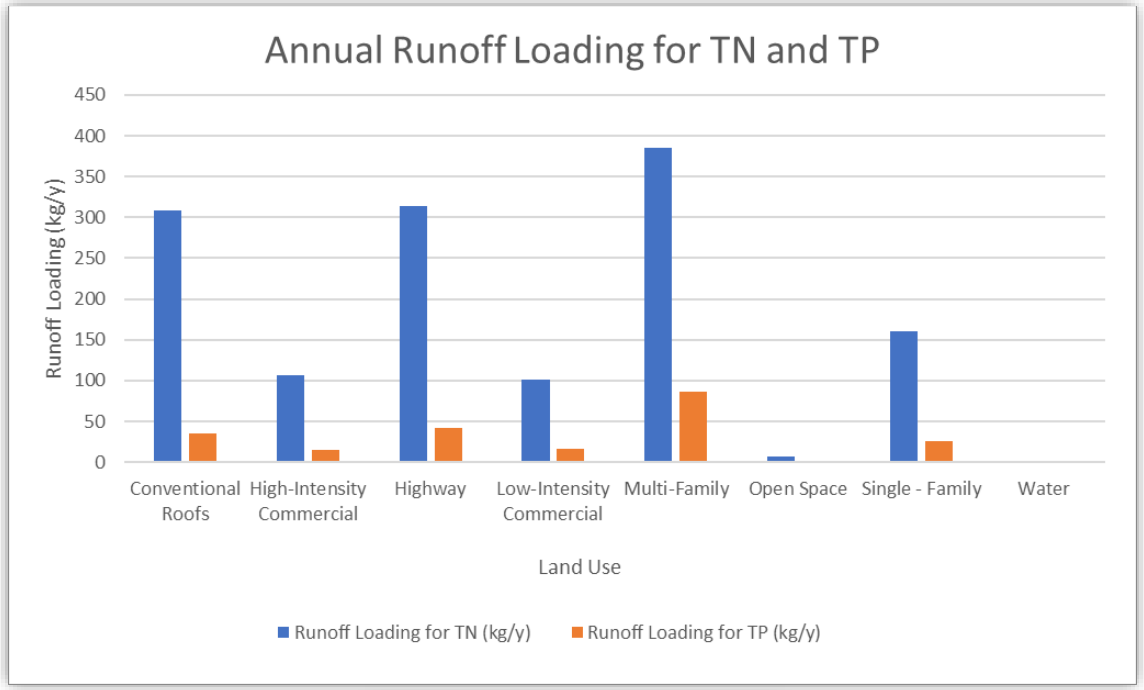
DESIGN STORM DEPTH OF FLOODING MAPS

- Ran design rainfall events and developed flood maps for:
  - 5-year, 24-hour
  - 10-year, 24-hour
  - 25-year, 72-hour
  - 100-year, 72-hour



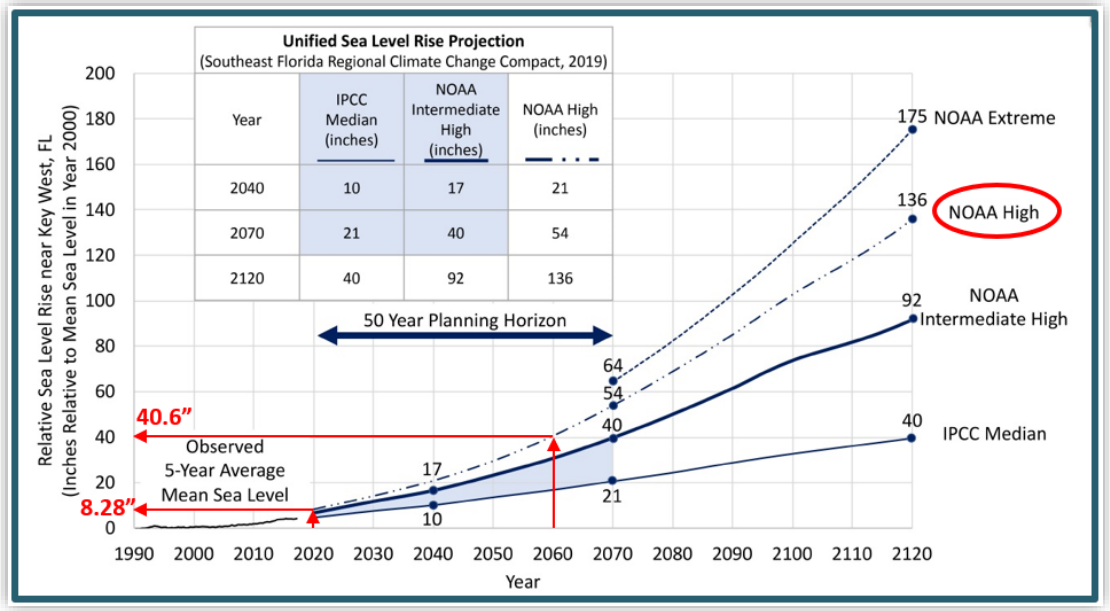
EXISTING CONDITIONS WQ MODELING

- Estimated the Village's current stormwater pollutant loading in terms of Nitrogen (N) and Phosphorous (P)
- Utilized University of Central Florida's (UCF) BMP Trains software
- Established baseline for determining water quality benefits, in terms of pollutant reduction, for short- and long-term improvement projects



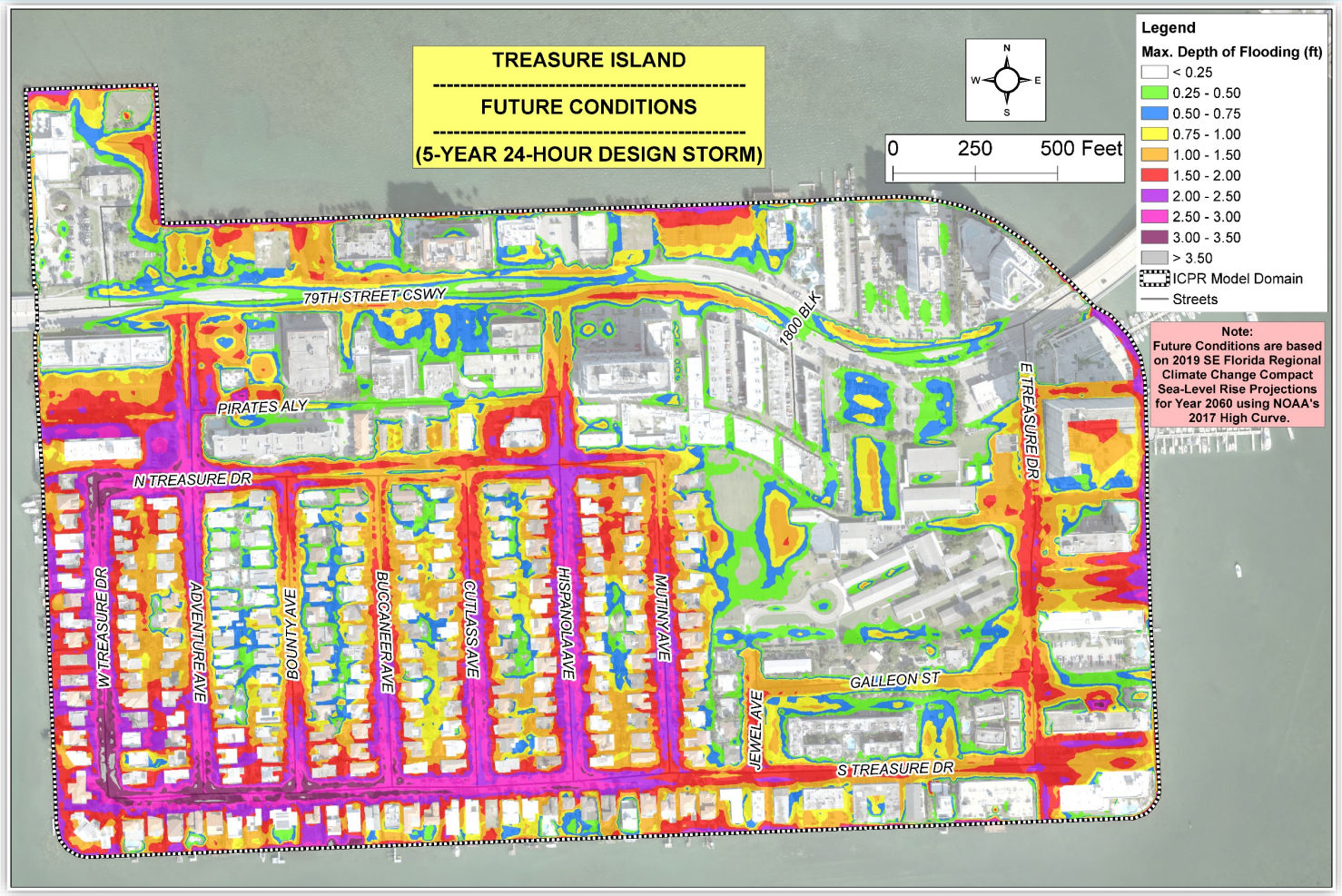
FUTURE CONDITIONS H&H MODELING W/O PROJECTS

- Defined 2060 planning horizon for future conditions using NOAA High Projection Curve
- Determined projected sea-level/groundwater rise and increases in rainfall amounts
- Revised H&H model parameters to reflect future and fully 'built-out' conditions
- Performed design storm and 'no rainfall' simulations to develop future depth of flooding maps



Change Factor (CF) Values and Future Condition Rainfall Depth			
Design Storm Event	**Existing Condition Rainfall Depth (in.)**	**50th Percentile (Median) Change Factor (CF) Value**	**Future Condition Rainfall Depth (in.)**
5-YR 24-HR	6.97	1.08	7.53
10-YR 24-HR	8.44	1.10	9.28
25-YR 72-HR	13.00	1.11	14.43
100-YR 72-HR	17.50	1.17	20.48

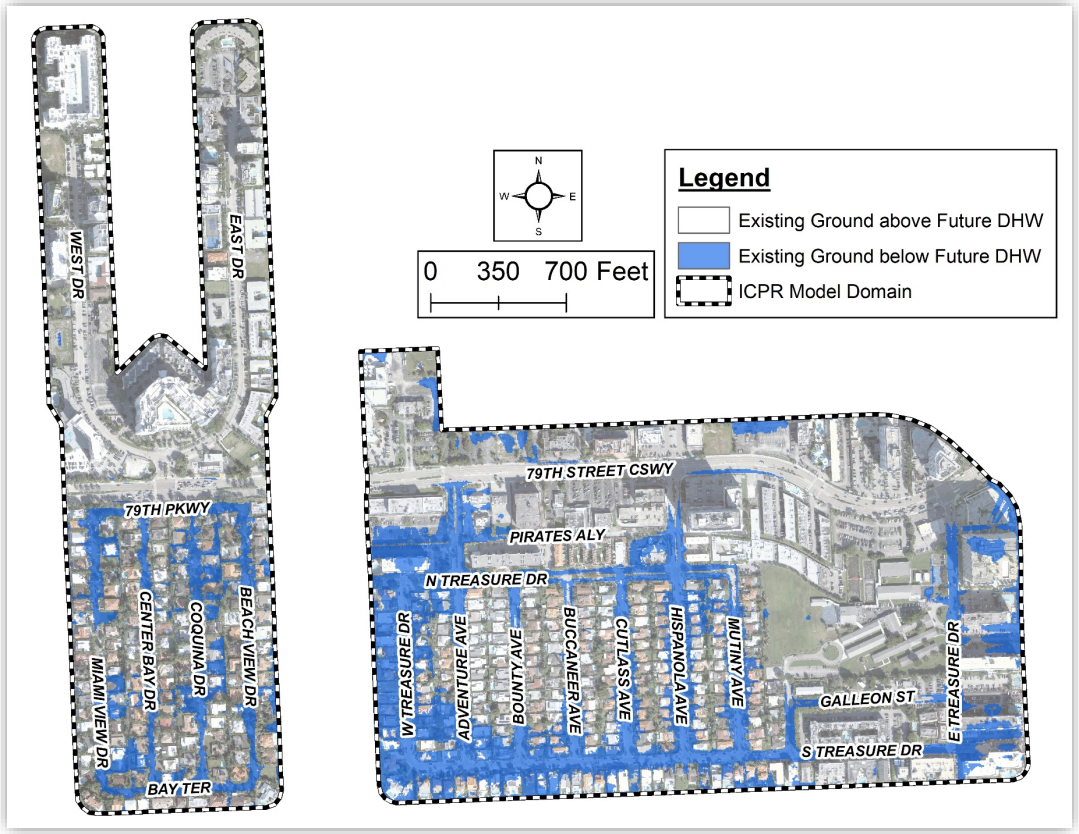
FUTURE CONDITIONS H&H MODELING W/O PROJECTS



FUTURE CONDITIONS H&H MODELING W/O PROJECTS

Tidal Overtopping of Seawalls

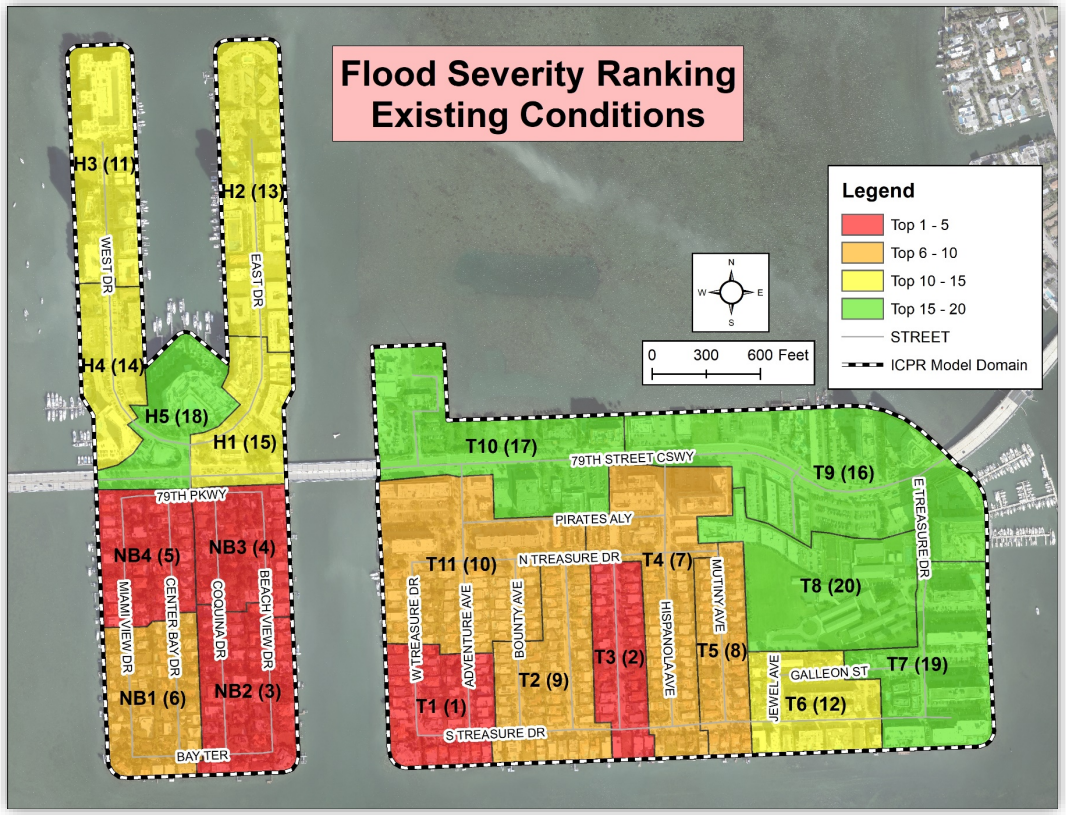
Areas above/below Future DHW

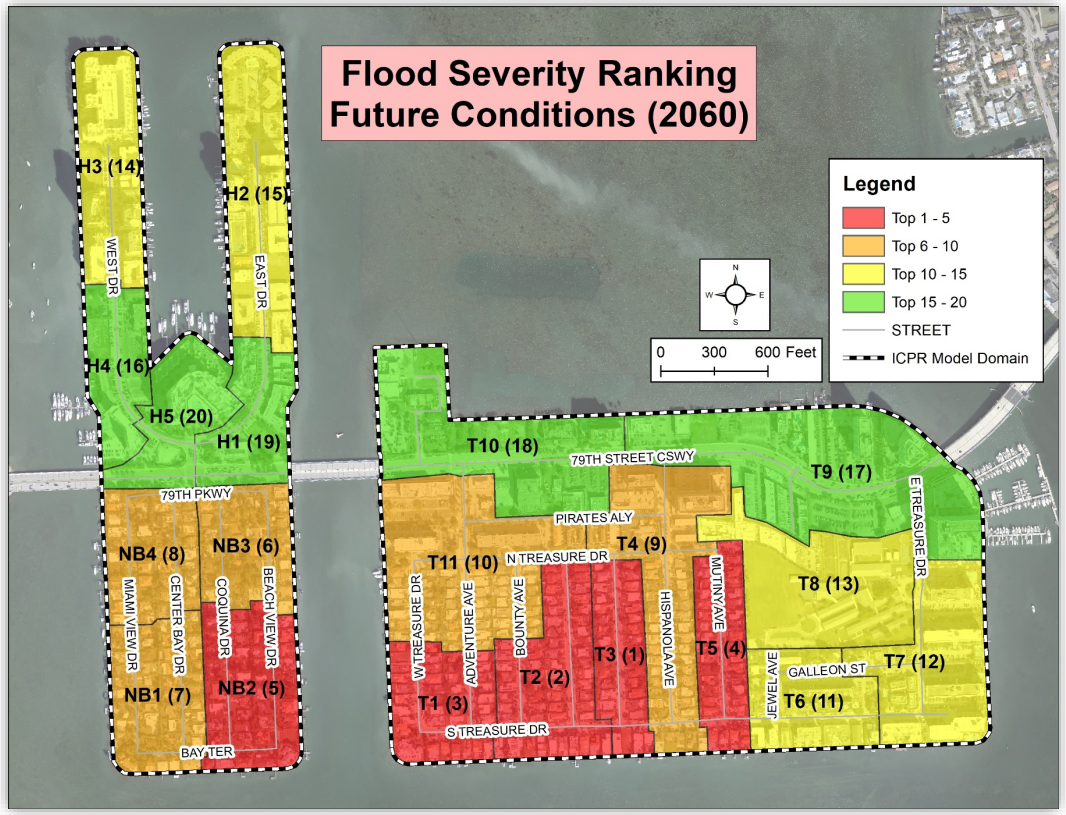


IDENTIFICATION/RANKING OF BASINS FOR EXISTING/FUTURE CONDITIONS W/O PROJECTS

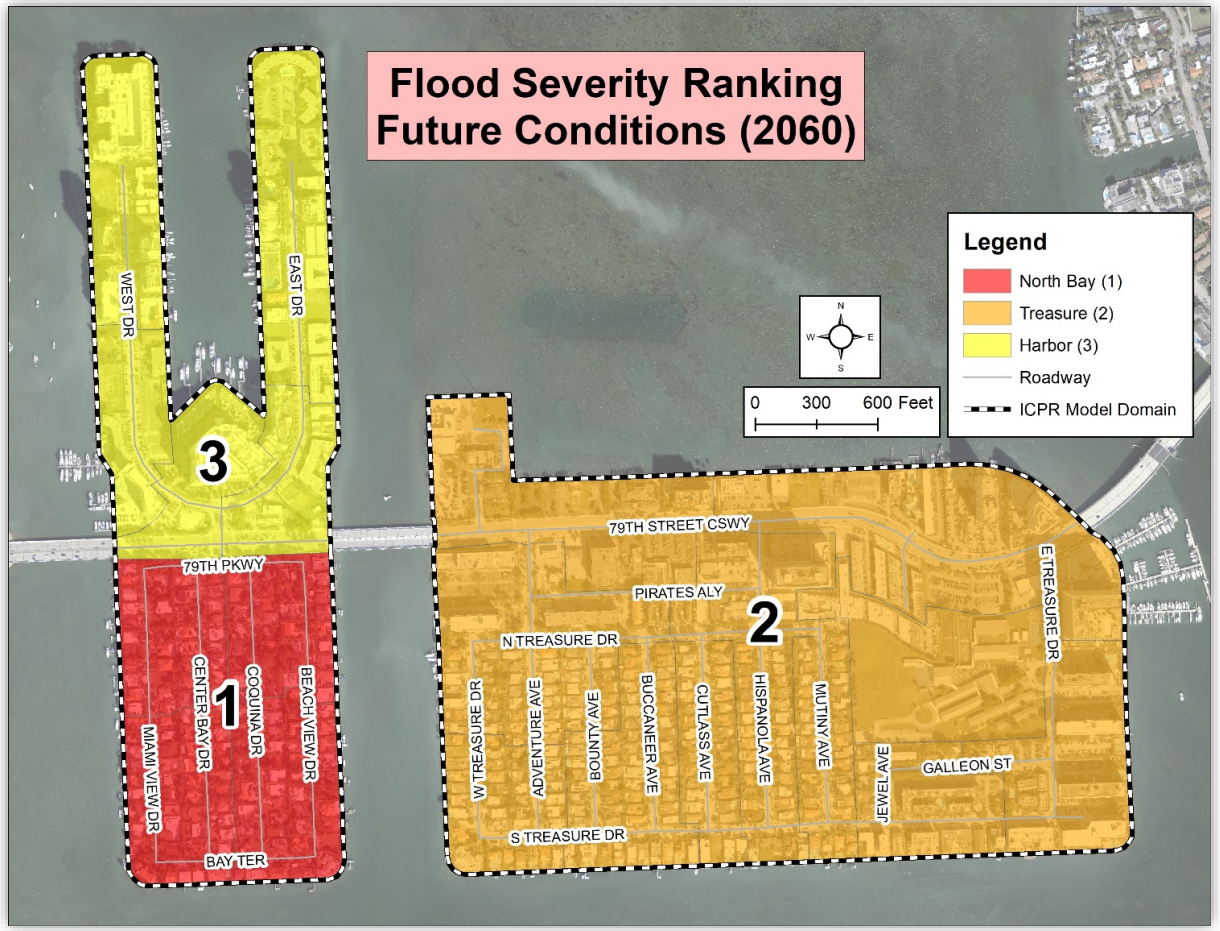
- Delineated 20 sub-basins for the entire Village based on stormwater infrastructure, topography and area
- Computed Flooding Problem Severity Score (FPSS) for each sub-basin
  - Flood Protection Level of Service (FPLOS) indicators
  - Weighting Factors (WF)
  - Amount of Flooding Exceedance (E)
- Ranked sub-basin for existing and future conditions based on flood severity

IDENTIFICATION/RANKING OF BASINS FOR EXISTING/FUTURE CONDITIONS W/O PROJECTS



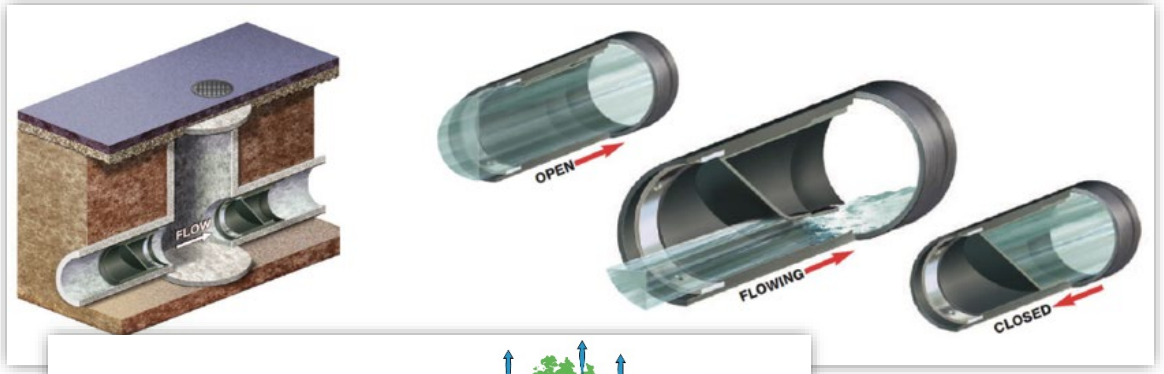


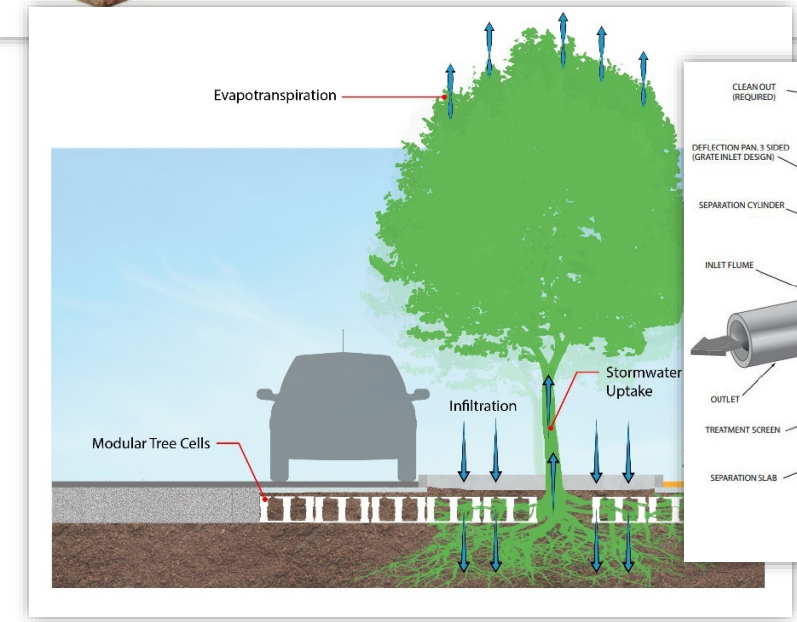
IDENTIFICATION/RANKING OF BASINS FOR EXISTING/FUTURE CONDITIONS W/O PROJECTS

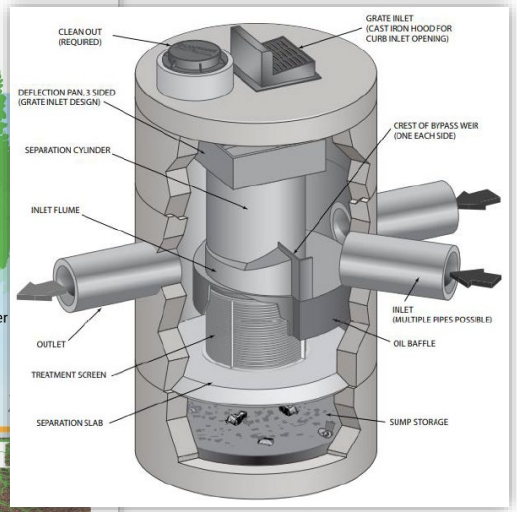


CAPITAL IMPROVEMENT PLAN DEVELOPMENT

- Evaluated available stormwater BMPs, LID strategies and GI technologies for implementation.
- Formulated stormwater improvements projects to address existing/future FPLOS deficiencies and mitigate flooding conditions.
- Developed concept schematics to highlight and quantify proposed drainage infrastructure components.
- Established phasing approach for implementation of improvements.

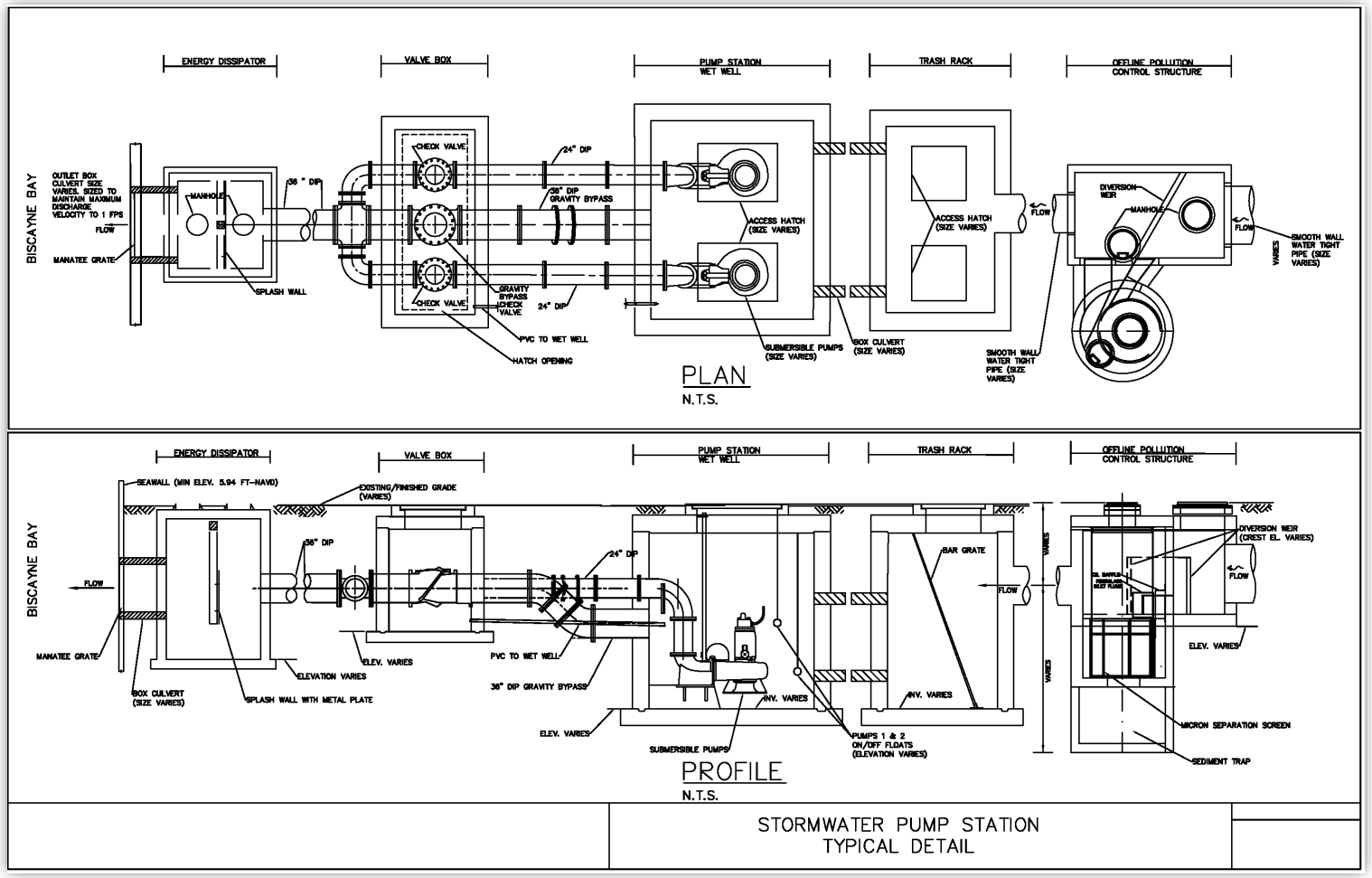






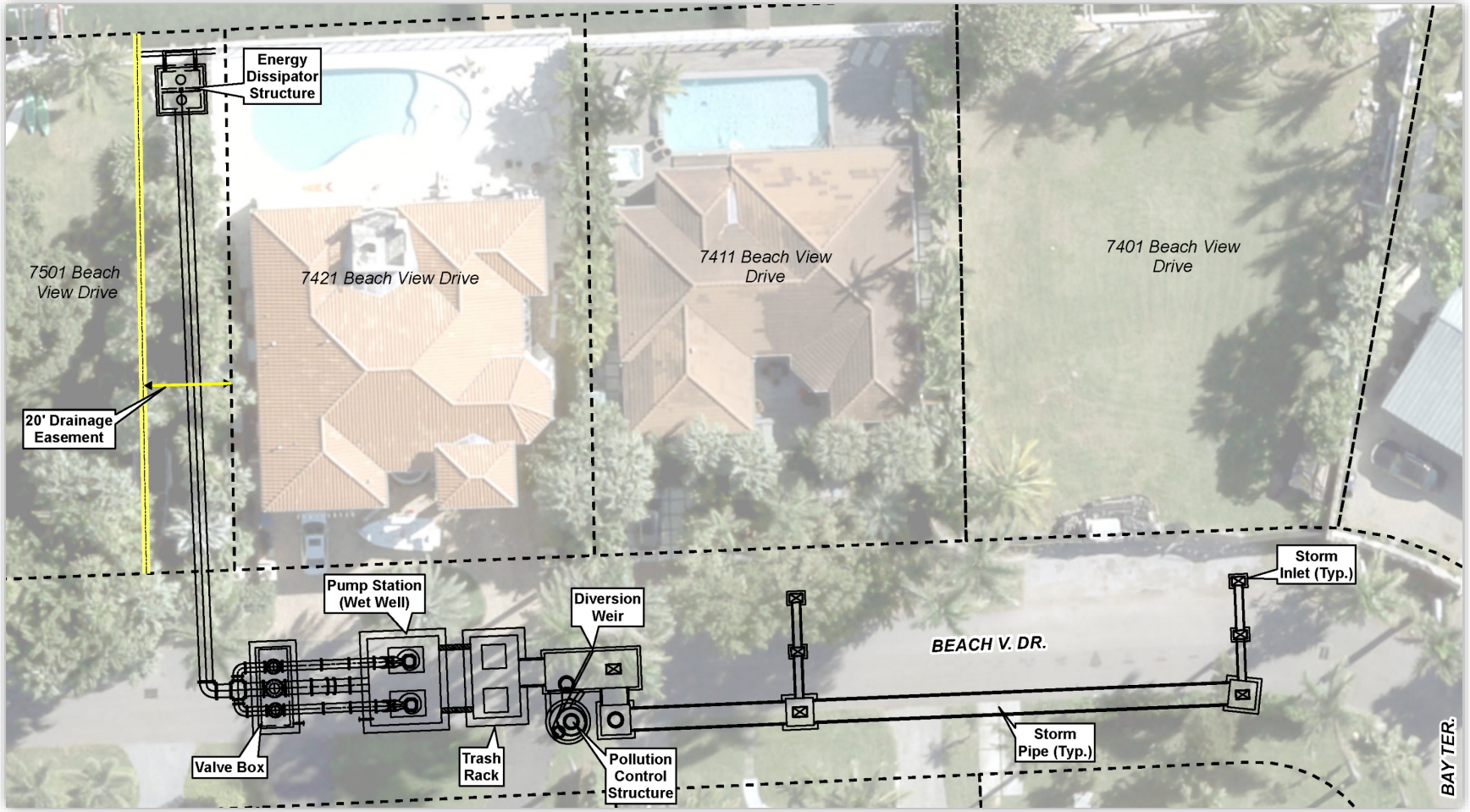
NORTH BAY VILLAGE
EST. 1945

CAPITAL IMPROVEMENT PLAN DEVELOPMENT



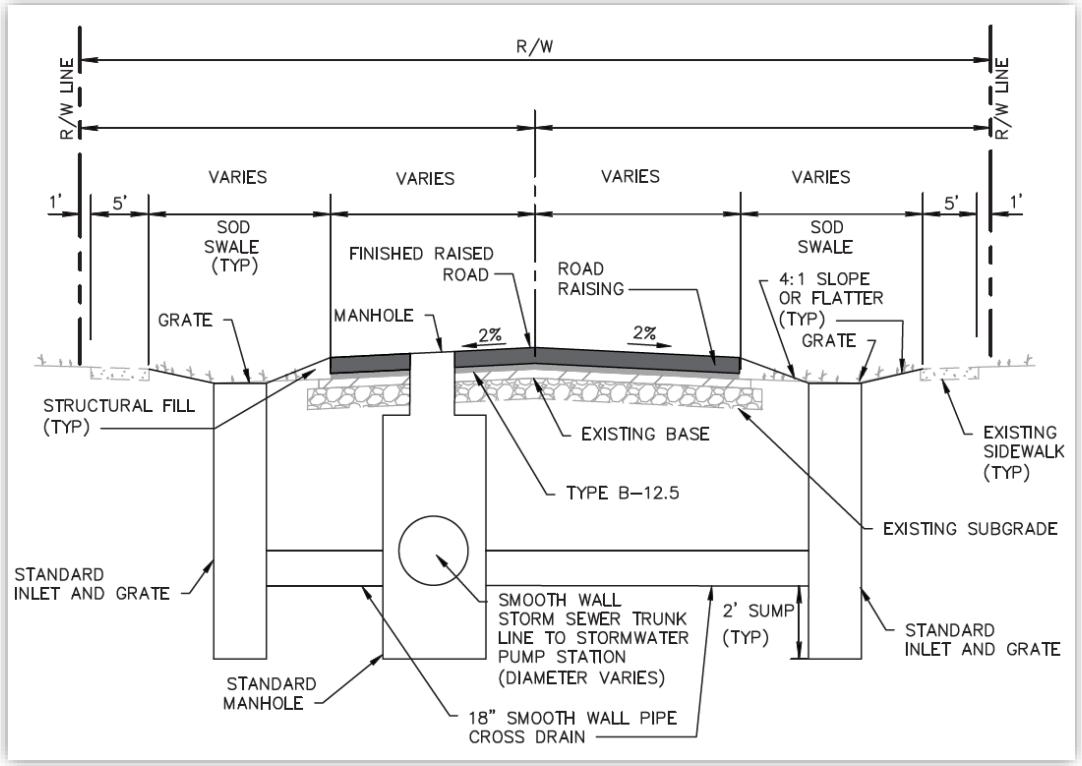
bcc engineering

CAPITAL IMPROVEMENT PLAN DEVELOPMENT

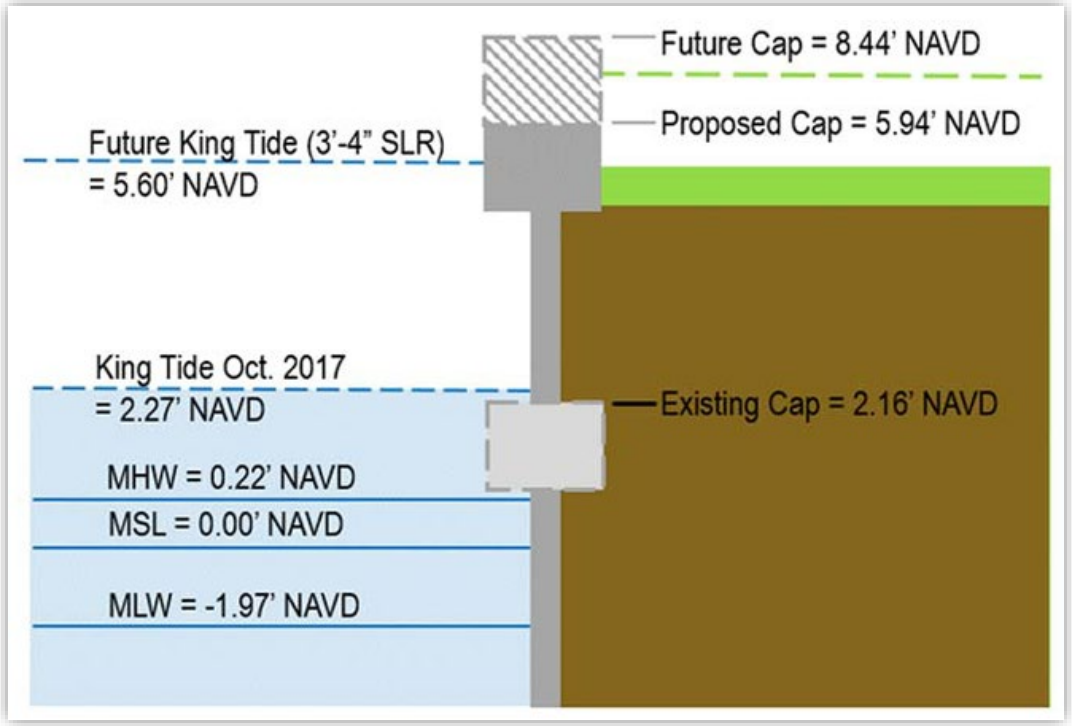


CAPITAL IMPROVEMENT PLAN DEVELOPMENT

Roadway Raising



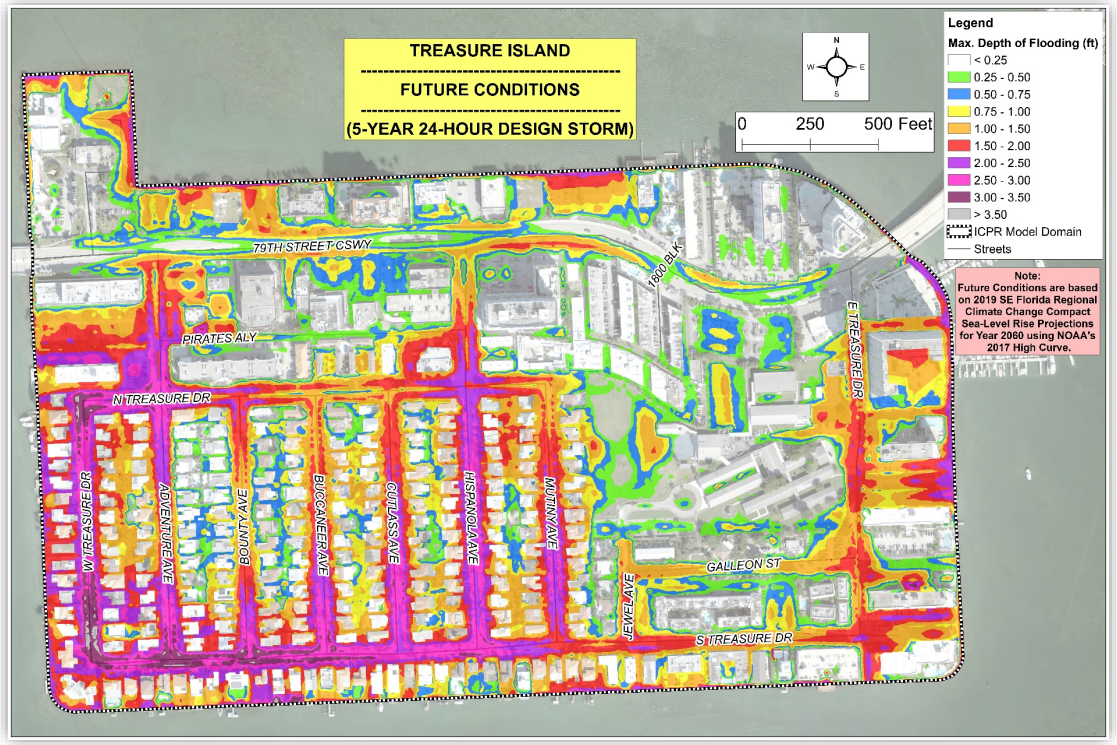
Private Seawall Raising

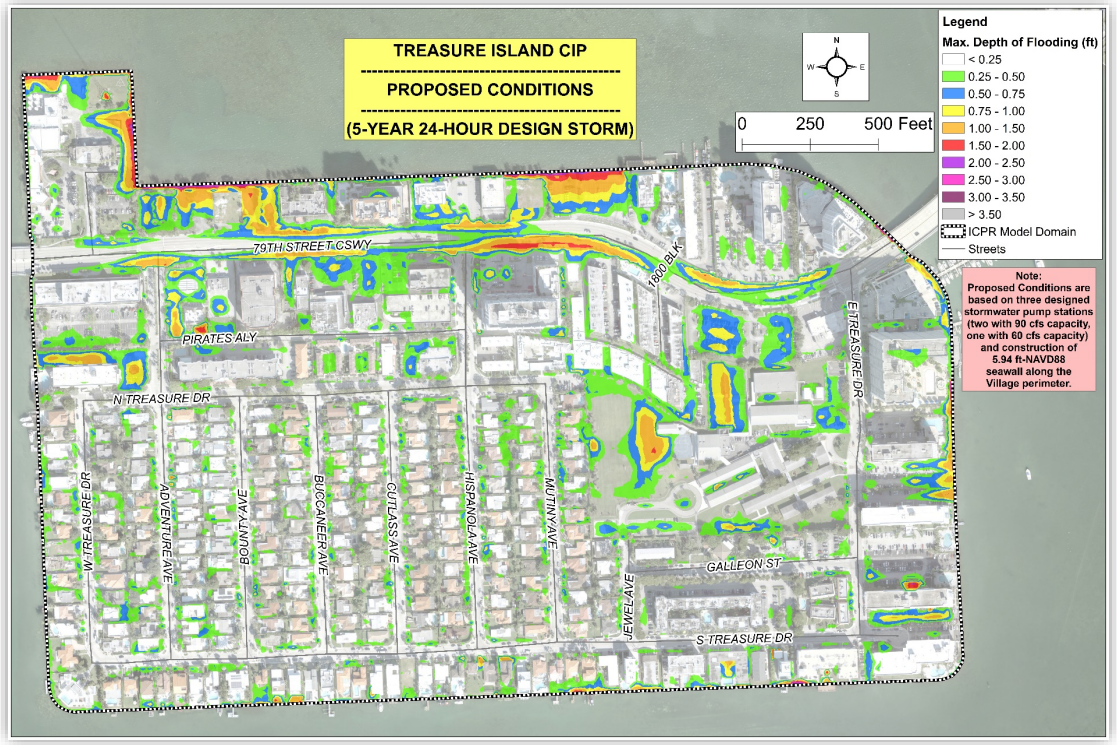


CAPITAL IMPROVEMENT PLAN DEVELOPMENT

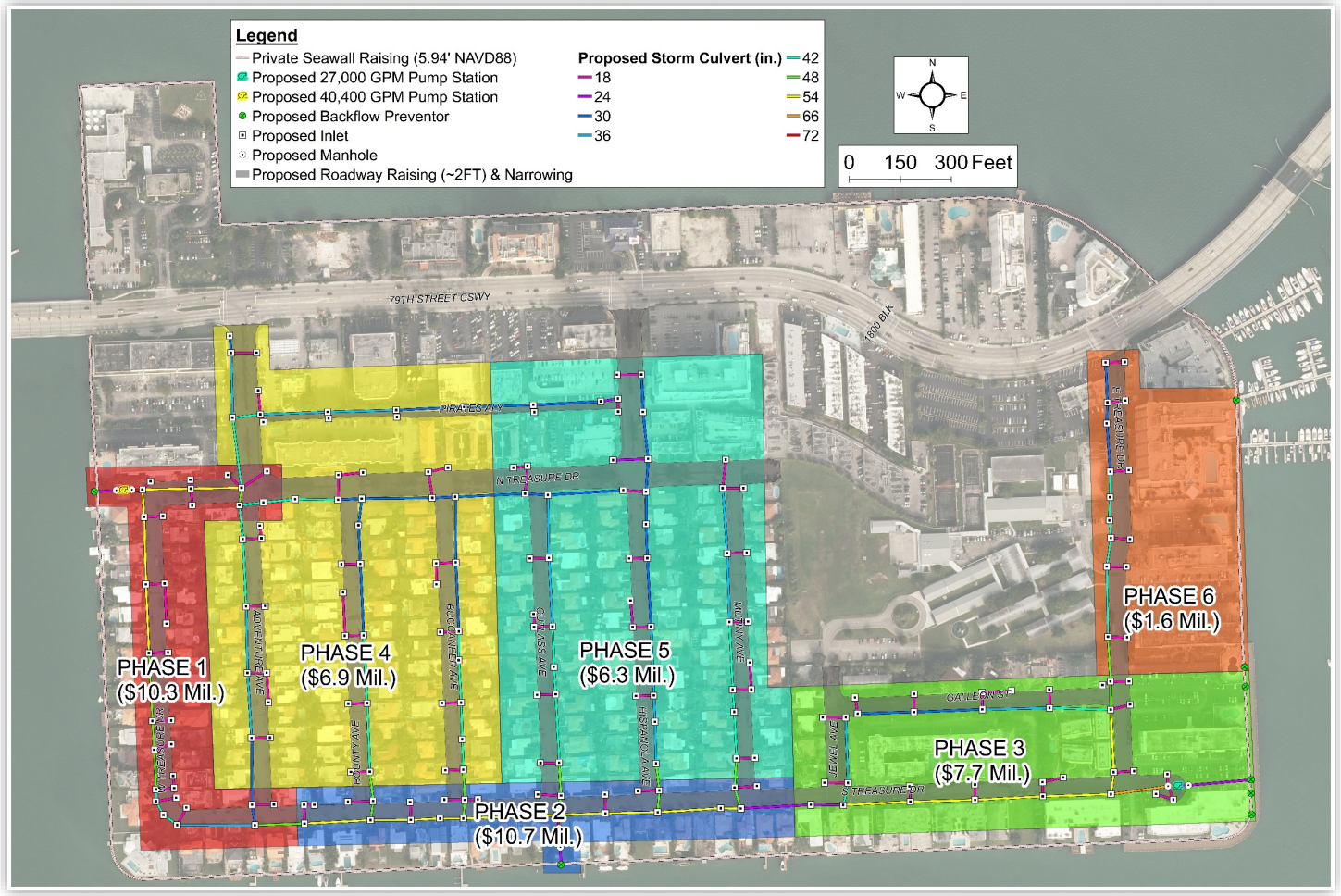
- Total Cost for implementing all proposed stormwater improvements on Treasure Island is estimated to be $43.5 million.

CAPITAL IMPROVEMENT PLAN DEVELOPMENT





CAPITAL IMPROVEMENT PLAN DEVELOPMENT

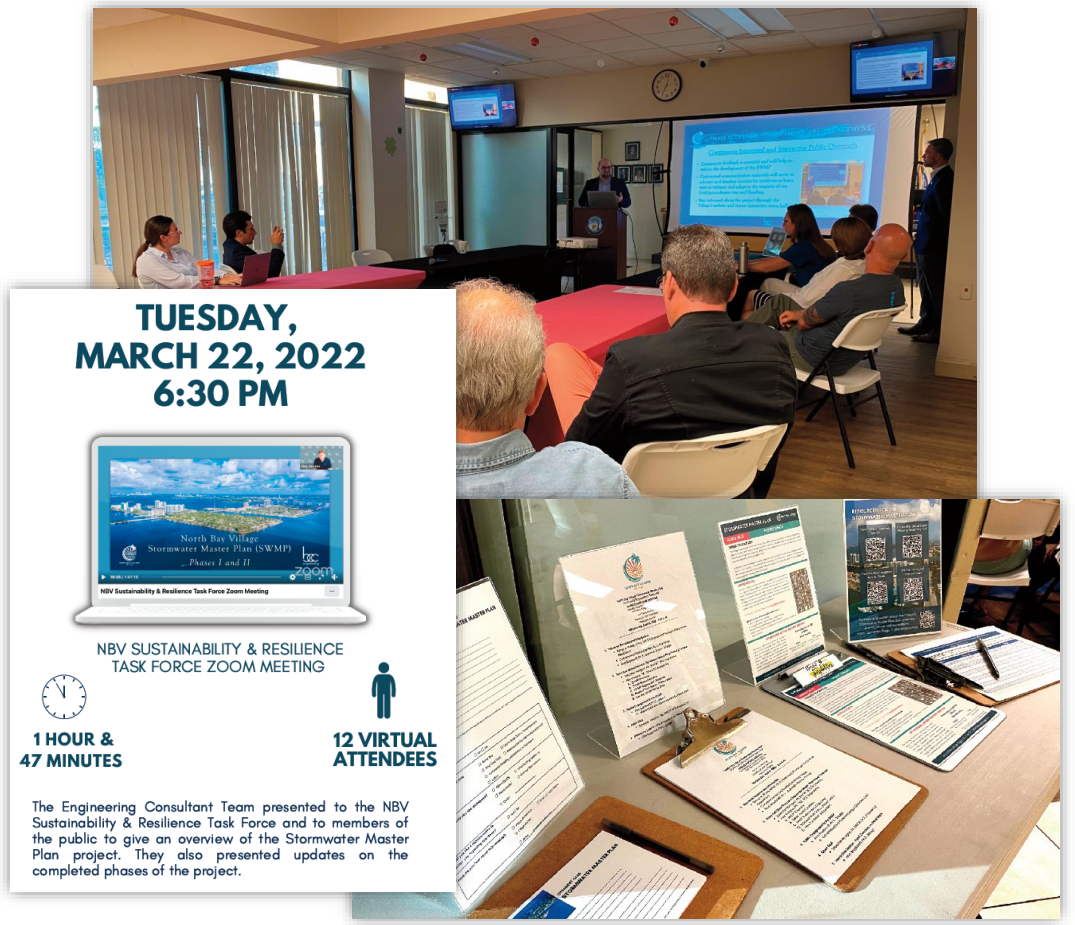


CAPITAL IMPROVEMENT PLAN DEVELOPMENT

CIP Construction Cost Estimate			
Phase	**Treasure Island**	**North Bay Island**	**Harbor Island**
1	$10.3 million	$4.4 million	$2.8 million
2	$10.7 million	$4.3 million	$0.7 million
3	$7.7 million	$2.2 million	$0.6 million
4	$6.9 million	$2.4 million	-
5	$6.3 million	-	-
6	$1.6 million	-	-
SUB-TOTAL	**$43.5 million**	**$13.3 million**	**$4.1 million**
TOTAL		**$60.9 million**	

PUBLIC INVOLVEMENT AND ENGAGEMENT

- Community feedback is essential and helped in the development of the SWMP
- Customized communication materials serve as relevant and timeless content for residents to learn ways to mitigate and adapt to the impacts of sea-level rise and flooding
- Residents can stay informed about the project through the Village's website and future interactive workshops



PUBLIC INVOLVEMENT AND ENGAGEMENT

North Bay Village
HEART OF THE BAY

Flooding Map Activity

The Flooding Map Activity is intended to help the project team better identify flooding problem areas that the Village is experiencing.

Severity of Flooding

YELLOW

A little bit of flooding

Minor flooding: No property damage, but possibly some public threat or inconvenience.

ORANGE

Ankle-deep

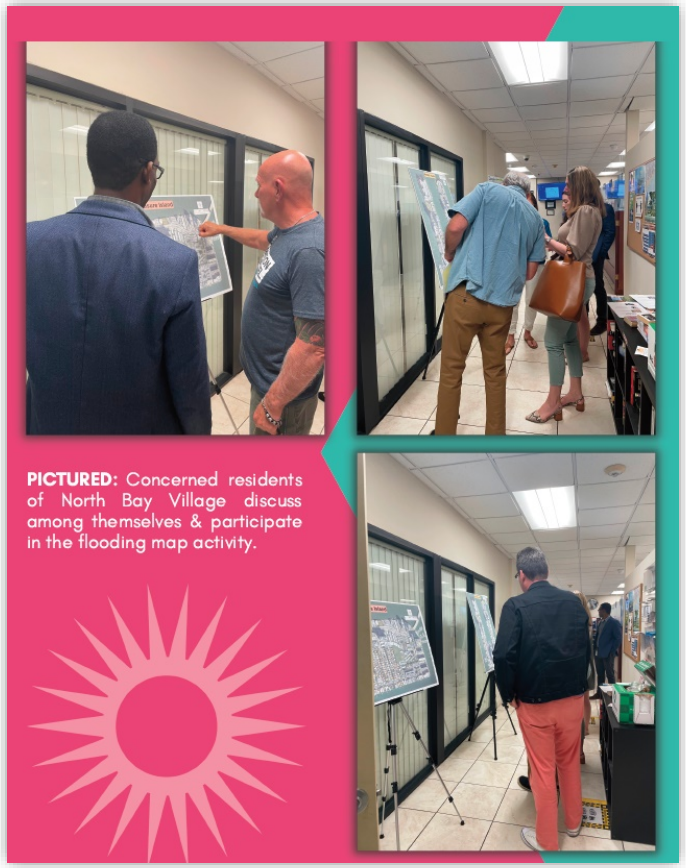
Moderate flooding: Some inundation of roadways making them difficult to navigate or nearly impassible. Flooding near structures and minimal damage.

RED

Knee-deep

Major flooding: Extensive inundation of some roadways and structures with significant damage to property.

PICTURED: Commissioner Rachel Streitfeld and local residents of the Village placing colored dots during the Flooding Map Activity to indicate prominent flooding areas.



PICTURED: Concerned residents of North Bay Village discuss among themselves & participate in the flooding map activity.

Thank you.

Any Questions?

bcc engineering