Addressing flooding issues, where no one "fix" solution is viable

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How is SIG?

Blue/Green/Gray Infrastructure Project Design, Bid, and Execution. Our comprehensive services encompass the design, bidding, and execution of Blue/Green/Gray infrastructure projects, seamlessly integrating natural and built elements as appropriate.

Stormwater Asset Management. We oversee the strategic planning, assessment, and optimization of stormwater infrastructure to maximize its effectiveness, lifespan, and performance.

Inspections, Operations, and Maintenance. Our services encompass thorough stormwater inspections, meticulous operations, and proactive maintenance to ensure the optimal performance and longevity of stormwater systems.

Monitoring and Controls with Real-Time & Predictive Analytics. Innovative technologies utilize real-time and predictive analytics to optimize performance, mitigate risks, and enable proactive decision-making.

Fixed Cost & Financing via Performance-Based Contracting. Our innovative approach to stormwater management offers fixed-cost solutions and financing options through performance-based contracting, enabling you to achieve your stormwater goals while alleviating risk and optimizing financial efficiency.

stormwater investment group

VILLAGE OF KEY BISCAYNE · ISLAND PARADISE · 1991 · FLORIDA

ABOUT

QUICK FACTS

- Median household income of $151,410
- 7,500 condominium units
- 15,000 residents - 25% growth from 2010-2023
- 1,000+ business and professional licenses
- 1,400 single-family homes or duplexes
- 7,000,000+ visitors per year

Cost
Communications
Engagement
Performance
Time
Disruption

ELEVATING OUR ISLAND PARADISE

Village of Key Biscayne

Resilient Infrastructure and Adaptation Program

The Village is threatened by the very forces of nature that make it an *island paradise*

STORM SURGE

RAINFALL-INDUCED FLOODING

COASTAL EROSION

TIDAL FLOODING

WIND

GROUNDWATER FLOODING

EXTREME HEAT

VULNERABILITIES

Low-lying barrier island with a largely unprotected shoreline

An aging stormwater system in need of upgrades

Exposed electrical and telecommunications infrastructure

Built out with limited space for new infrastructure

Regulations that are incompatible with our resiliency goals

2023
Flooding is already an issue.

2060
It will get worse over time.

JUNE 3-4, 2022 - STORM EVENT

November - 7.5 inches of Rainfall in <24 hours.

The total daily rainfall is not the issue. THE ISSUE is the ***intensity*** of rainfall (inches/hour) !

Average Annual Rainfall = 64.3 inches
Average Number of Days with Runoff = 122

88% of Rainfall Events ≤ 1.00 inches
99% of Rainfall Events ≤ 2.50 inches

Current Stormwater Discharge:

- **17 Outfalls**
- **10 Auger Wells**
- **35 Gravity Drainage Wells**
- **2 Sallow injection Wells**

ZONE DESIGNATION

Starting in Zone 1, which contains the K-8 Community School
- Top priority
- Includes the **heart of the island**, lowest-lying and flood prone area within village
- Construction expected to start in 2025

Performing additional modeling and analysis:
- Prioritizing Zones
- Based on hydrology and hydraulics
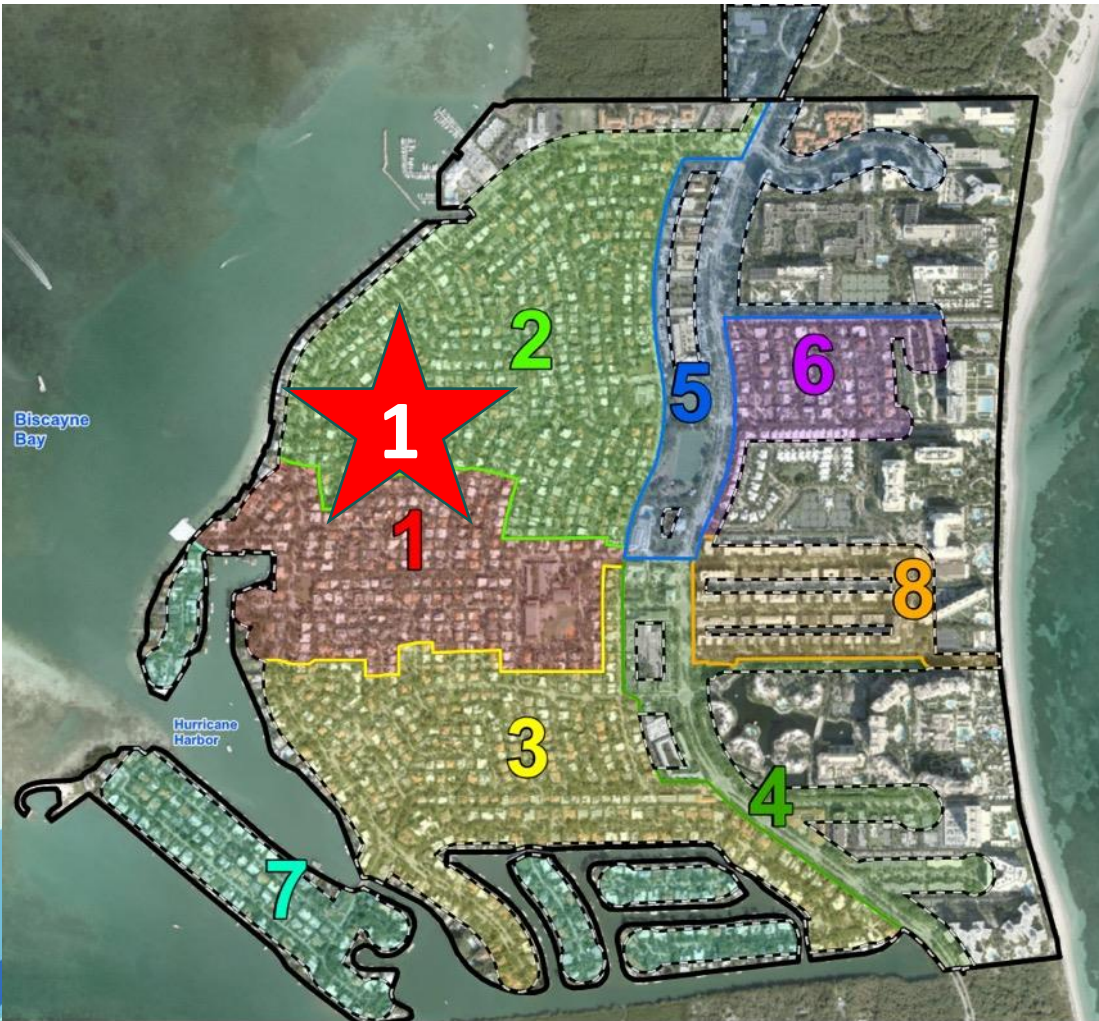
MODEL SUMMARY TABLE

ZONE	REQUIRED DISCHARGE CAPACITY	EXISTING DISCHARGE CAPACITY	% DEFICIT
	(cfs)	(cfs)	
1	248	48	81%
2	441	40	91%
3	348	196	44%
4	140	0	100%
5	179	0	100%
6	106	0	100%
7	180	206	-14%
8	91	0	100%
	1733	490	72%

Four alternative approaches to design a system that combine multiple ways to manage water:

1. Improve existing outfalls in each Zone.

2. Adds pump stations to outfalls with regulated discharge.

3. Discharges within each Zone and master outfall.

4. Move all water North and South but maintain existing outfalls for emergency overflow.

5. Add additional outfall capacity to each Zone.

6. Discharges within each Zone and master outfall, as necessary.

Key Biscayne Pilot Objectives

Florida Department of Environmental Protection (FDEP) Coral Protection and Restoration (CPR) Grant

Pilot Project-

- Effectiveness of two versions of catch basin filters at keeping debris at the street, to facilitate debris removal and prevent debris and litter from entering the K-8 elementary school portion of the stormwater drainage system.
- A secondary objective is the removal efficiency of media filtration filtration.
- Additionally, the pilot project will assess the operational impacts on the stormwater system and the additional challenges and costs for maintaining the treatment approaches.

Technology- Three Best Management Practice (BMP) technologies
- AbTech Industries Ultra-Urban® Filters (UUFs)
- SOP Technologies under-grate filter unit
- SOP Technologies curb inlet screens

* Debris – defined as Trash and Sediment

Key Biscayne Pilot Objectives

Sampling Plan

- QAPP Development and approved by FLDEP
  - 5 Storm Events
  - Sampling 5 different filter locations
  - 75% of the Storm event Hydrograph sampled
  - Discrete time-based grab sampling
  - Flow into catch basin and after filtration sampled
  - Each Filter cleanout debris weighed and analyzed

Key Biscayne Pilot Sample Analysis

Analyte	Method Number
Particle Size Distribution*	Modified SSC Method D3977-97
Total Suspended Solids	SM 2540D
Volatile Suspended Solids	SM 2540D / SM 2540E
Dissolved Solids	SM 2540C
Turbidity	SM 2130B
Total Phosphorus	EPA 365.4
Ortho-Phosphate	EPA 300.0, 365.1, 365.2, 365.4
TKN	EPA Method 351.2
Nitrate-Nitrite	EPA Method 353.2
Florida Petroleum Organics	EPA FL+PRO
Metals** (Total & Dissolved)	EPA 6010B (ICP)
pH	SM 4500H+B
Fecal Coliform	SM 9222D

Pilot – SOP Tech and AbTech Deployment
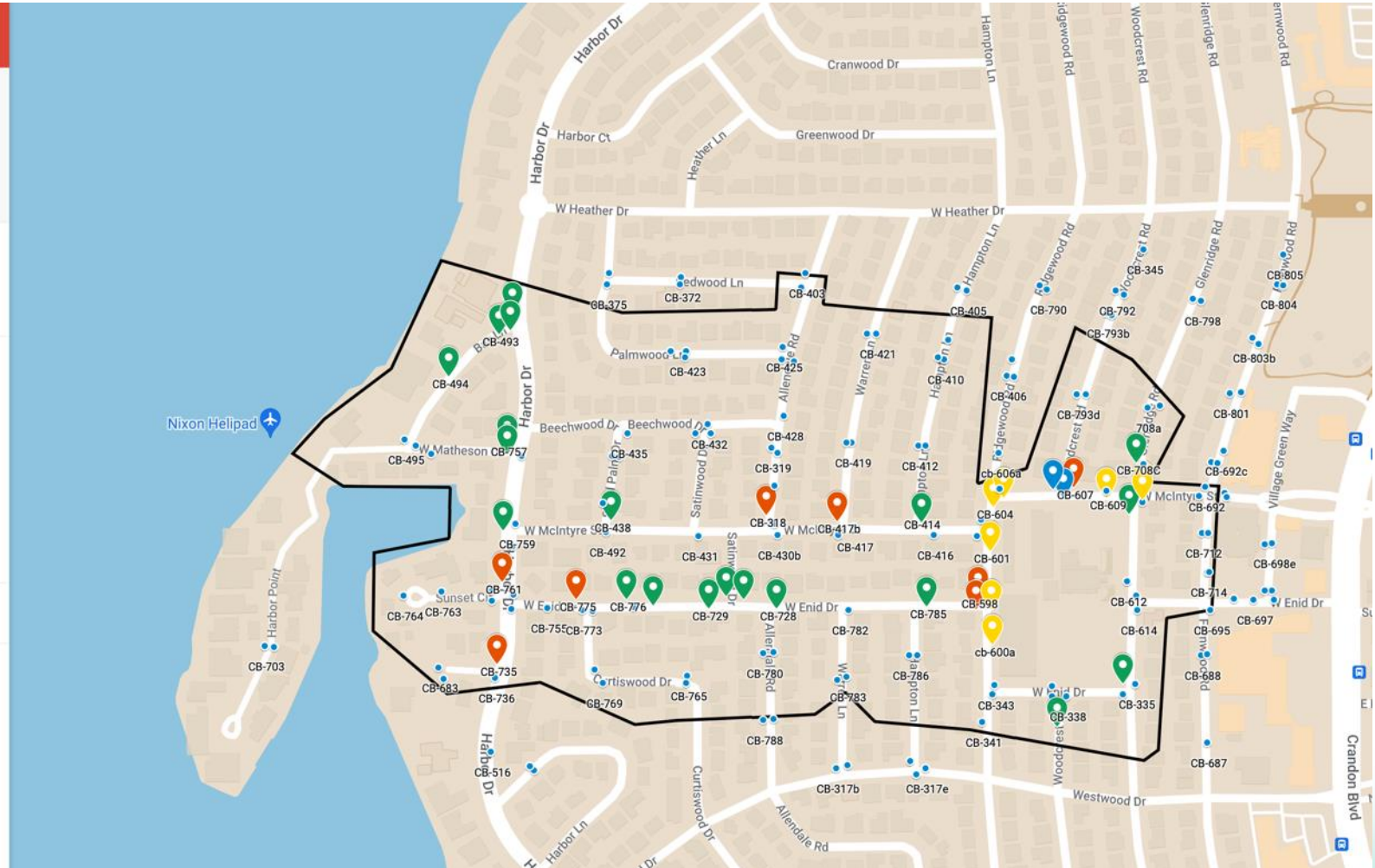
Pilot – AbTech Industries Technology

Pilot – Visuals of August UUF Cleanout

Pilot – August UUF Cleanout

Pilot – Rainfall Summary

				Rainfall Summmary for Pilot Study Period			
Parameter	May	Jun	Jul	Aug	Sep	Oct	Nov
Total (in.)	5.20	7.84	7.46	10.15	12.58	6.06	9.24
Monthly Avg (in.)	0.17	0.26	0.24	0.34	0.42	0.20	0.54
Rainfall Avg (in.)	0.35	0.41	0.39	0.46	0.60	0.51	1.54
# Rain Days	15	19	19	22	21	12	6
Maximum (in.)	1.23	3.04	3.47	3.42	4.43	2.4	7.51
# Days >0.1 in.	7	13	11	14	14	7	4
# Days >1.0 in.	1	2	1	2	3	2	1

Pilot – Visuals of November UUF Cleanout

40.2 lbs of Sediment

Summary of Captured Trash, Debris & Sediment

Contaminant	Range (mg/kg)
Volatile Solids	29.2-85.1
TN	1550-8140
TP	622-1590
% Moisture	35--59.5%
Aluminum	380-1340
Cobalt	0.9-1.7
Copper	14.9-30.5
Iron	1000-2730
Nickel	11.9-48.2
Lead	3.8-9.2
Cadmium	0.25-0.29
FLPRO	143-387

MS4 Load Reduction Assessment Tool

Category	TP (mg/kg)	TN (mg/kg)
Street Sweeping	303	656
Catch Basin Cleaning	339	891
BMP Cleaning	291	1209

Key Biscayne Pilot -Steps moving forward

- Summary of Rainfall Characterization, BMP performance and benefits

- Correlation of intensity, duration and total volume to stormflow water quality

- Model of K-8 Area - rainfall, contaminant concentrations, BMP performance

- Value model analysis to deployment strategy

- Coordination and presentation of findings with Village and their Resilience Team

- Final Report

Balancing Performance and Cost

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