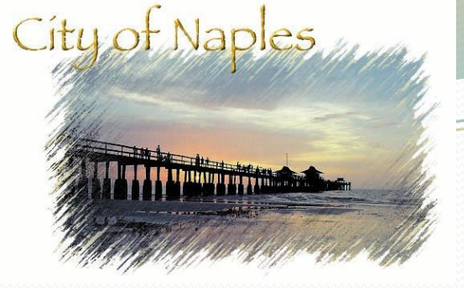

City of Naples
Beach Restoration & Water Quality Improvement Project

Presented By:

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Kelly Blake, PE, Project Manager
Ramon Castella, PE

June 1, 2016

Overview

Naples Beach Restoration & WQ Improvement Project

- Background & Project Need
- Existing Site Conditions
- Project Goals & Objectives
- Analysis
- Design Requirements
- Alternatives
- Cost Estimates
- Evaluation and Alternatives Ranking
- Recommended Alternative (#3)

Background

Naples Beach Restoration & WQ Improvement Project

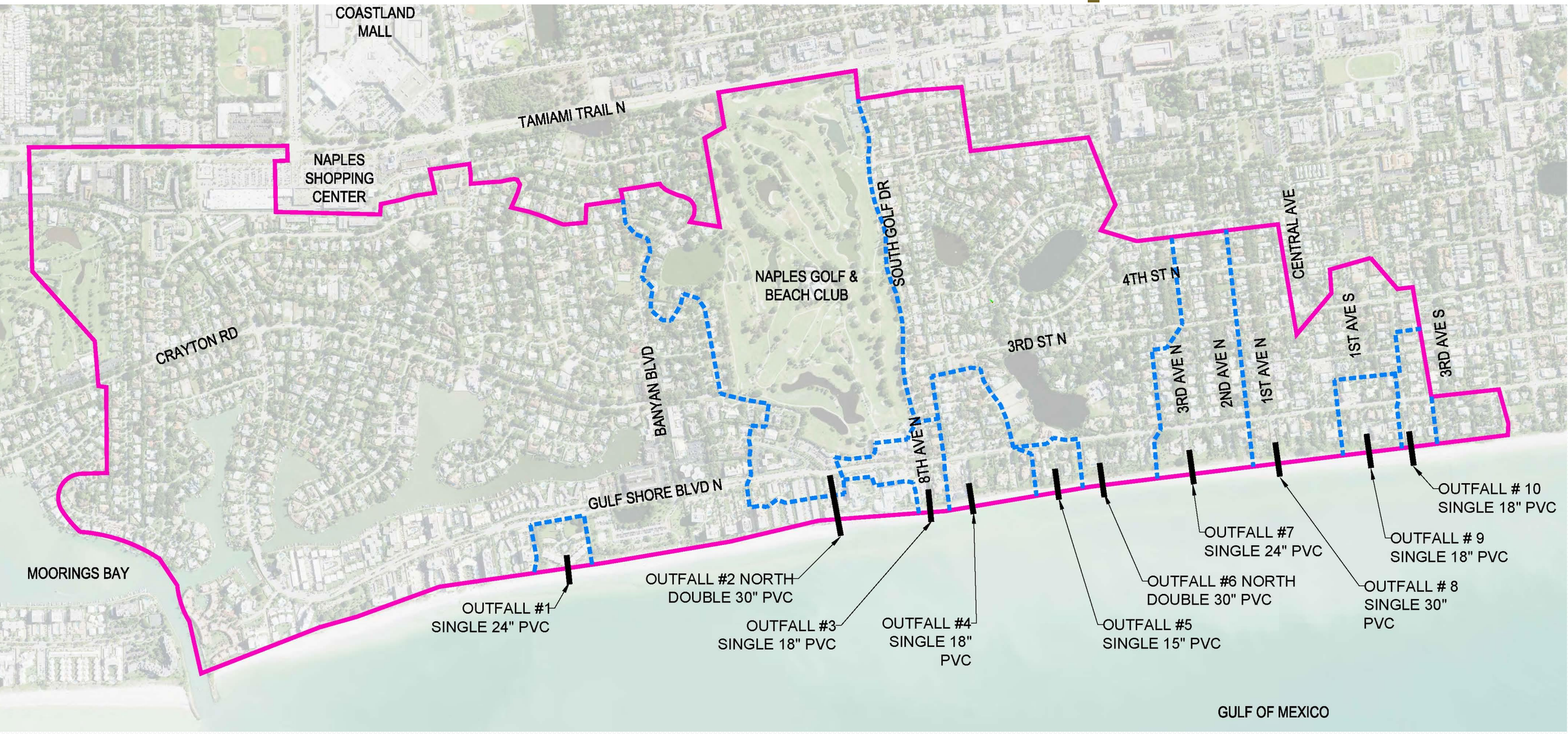
- Proactive Stormwater Management Program ($70M)
- Stormwater User Fees & Incentives
- Stormwater & Fertilizer Ordinances (BMPs & PreTreatment)
- Grass Retention Swales Program & Education
- State DEP Requires Outfall Removal
- City Resolution No. 12-13028 Requires Outfall Removal
- AECOM Stormwater Outfall Removal “Alternatives Evaluation” (2013)
- ECE “Technical Analysis & 30% Design Report” (2015/16)

Project Need

April 2008

- Existing Outfalls Identified as Source of Beach Erosion and Bacteria
- Blocked Discharge from Sand Buildup
- Frequent Maintenance to Secure/Unclog Pipes
- Gulf Shore Blvd Flooding Due to Back-up of Existing Beach Outfalls
- Degrades Aesthetics and Impacts Tourism
- Sea Level Rise Will Increase Occurrence of Flooding

Stormwater Outfalls at Naples Beach



Outfalls: #2, #3, #4, #5 and #6, #7, #8, #9, #10 (City-9)

Site Conditions

Flooding of Gulf Shore Road
(Near 2nd Ave N/Outfall 8, Sept 2015)

Blocked Discharge
(Outfall 9)

Site Conditions

Site Conditions – Water Quality

Goals & Objectives

1. Reduce flooding and improve water quality
2. Reduce adverse impacts to beach & hardbottom resources
3. Eliminate beach erosion from outfall induced scour
4. Improve lateral beach access by removing pipelines/outfalls
5. Meet or exceed existing level of service:
   - ❖ 5-Yr rain event (City of Naples Comprehensive Plan)
   - ❖ 25-Yr rain event (SFWMD)
6. Convey stormwater to pump station, treatment & offshore discharge
7. Community education (project objectives and design)

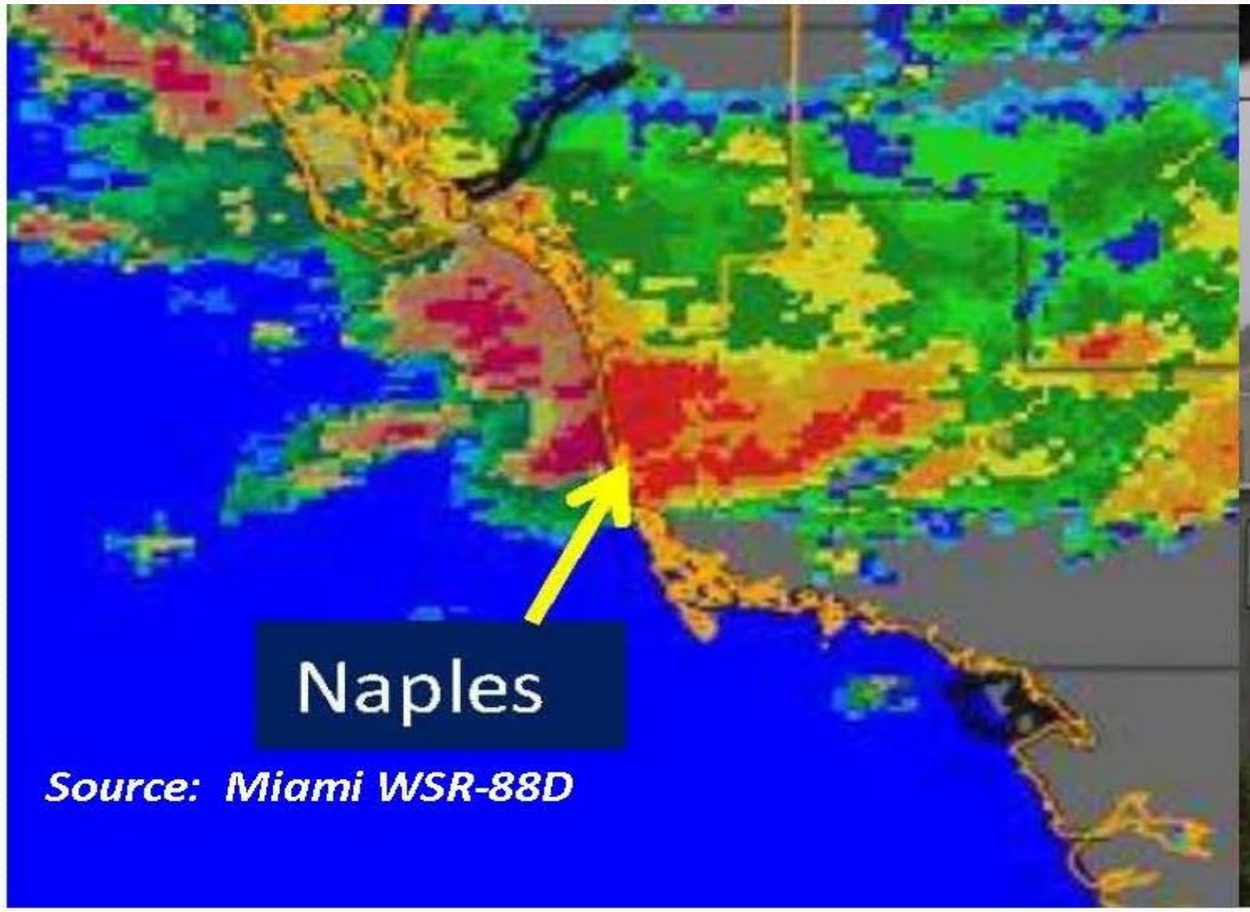
Analysis & Design Requirements

- Naples Beach Rainfall Conditions
- Level of Service (25 Yr Storm Event Discharge)
- S/W Line Consolidation (Peak Discharge) 
- Siting & Sizing Pump Station(s)
- Define & Evaluate Water Quality Conditions & Treatment
- Depth of Closure & Nearshore Hardbottom

Naples Rainfall Days Exceeding 0.5 Inch

Year	Total Days Exceeded					Total # Days
	0.5 in	1 in	2 in	3 in	4 in	
2003	42	20	7	3	1	148
2004	25	12	2	0	0	125
2005	35	18	9	1	1	142
2006	30	20	4	0	0	93
2007	18	9	2	0	0	96
2008	33	15	3	0	0	103
2009	25	6	0	0	0	96
2010	34	11	3	0	0	96
2011	24	13	2	0	0	96
2012	25	12	1	0	0	99
2013	31	14	4	1	0	109
2014	33	9	1	1	1	104
2015	22	6	2	0	0	105
TOTAL	377	165	40	6	3	1,412
AVG	29	13	3	0	0	109
OCCURENCE	26.6%	11.6%	2.8%	0.4%	0.2%	100%

Aug 4, 2014 Rainfall Event



(6 inches in 4 hours)

Beach Erosion Impacts

- **Erosion Fronting Outfalls = 92,200 CY (7 Yrs)**
- **Outfall Induced Impact Estimated at 50+%**
- **Sand Placement Cost (92,200 CY* $35/CY)**
  - **$1.6M (2006-2013)**

Design Level(s) of Service

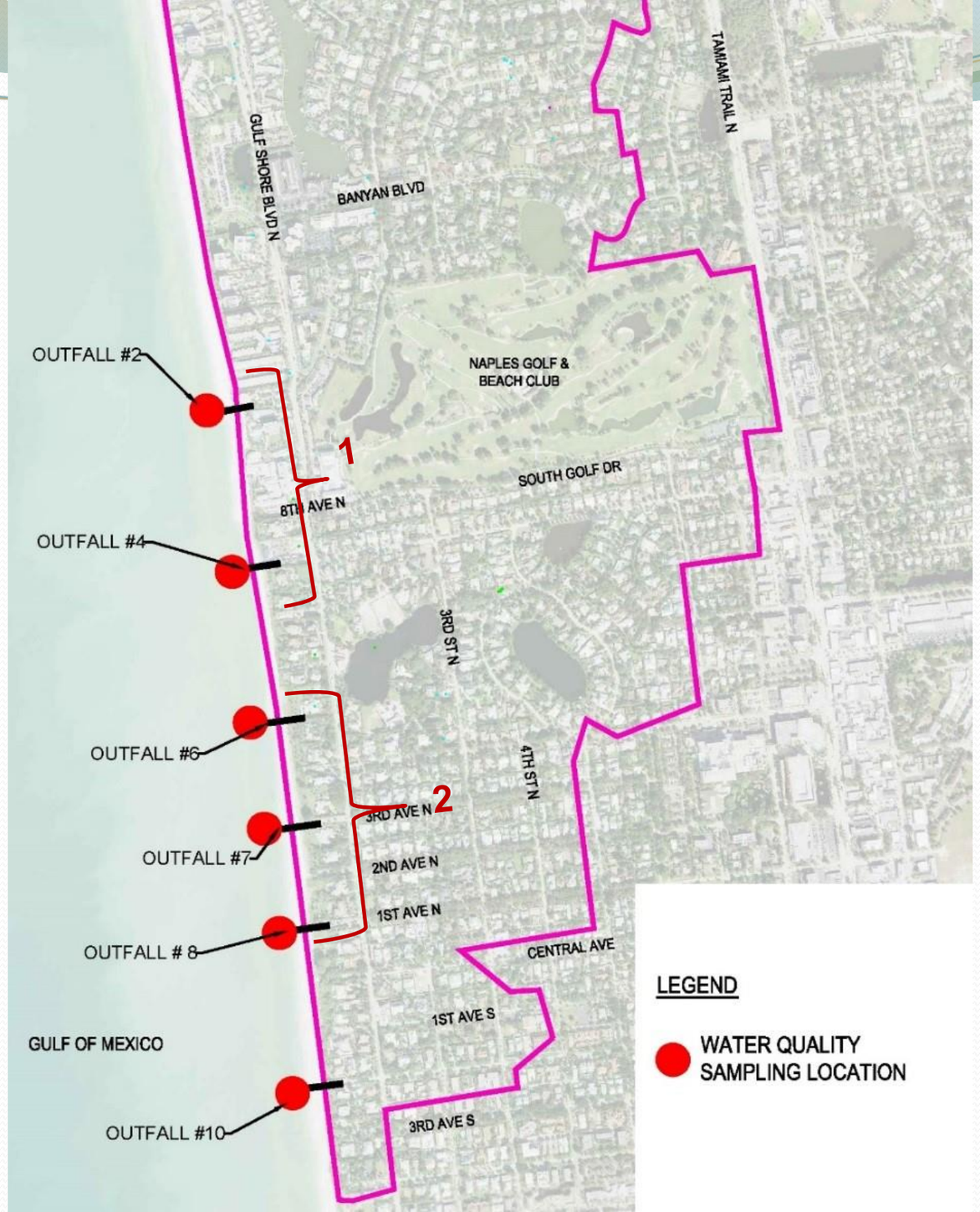
Outfall #	Outfall Location Description	Peak Discharge (cfs)			
		5-Yr/1-Hr Event	5-Yr/1-Day Event	25-Yr/3-Day Event	
2	Naples Beach Hotel & Golf Club	36.8 (19.9)	26.2 (14.2)	84.1 (45.5)	1
3	8th Avenue North	9.6	8.5	2.9	
4	7th Avenue North	9.8	8.0	12.4	
5	6th Avenue North	5.6	5.1	8.2	
6	Alligator Lake Outfall	37.0 (34.2)	37.0 (34.2)	82.3 (76.1)	2
7	3rd Avenue North	19.4	16.4	24.1	
8	1st Avenue North	31.7	28.1	42.6	
9	1st Avenue South	8.2	8.0	11.2	
10	2nd Avenue South	9.6	8.1	11.8	
TOTAL		168 (148)	145 (131)	290 (245)	

Values in parenthesis represent the predicted
Naples Beach Hotel & Golf Club Improvements (Grady Minor, 2015)

WQ Sampling & Testing

Parameters Tested

- Suspended Solids
- Fecal Coliform
- Enterococci
- Nitrogen, Nitrate & Nitrite
- Phosphorous
- Turbidity
- Conductivity & Temperature



Sites for Consolidation & Pump Stations

Largest % of Total Flow:

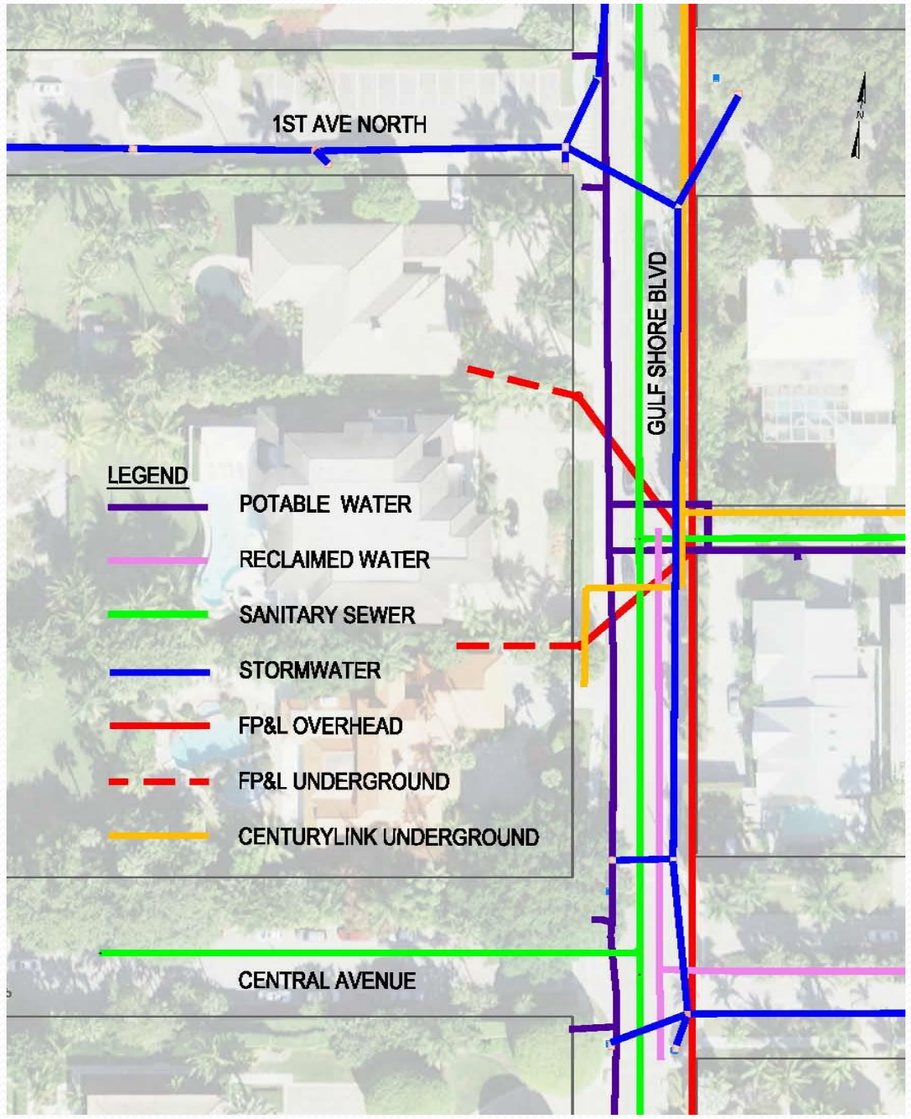
Outfall 2: 19%

Outfall 6: 31%

Outfall 8: 17%

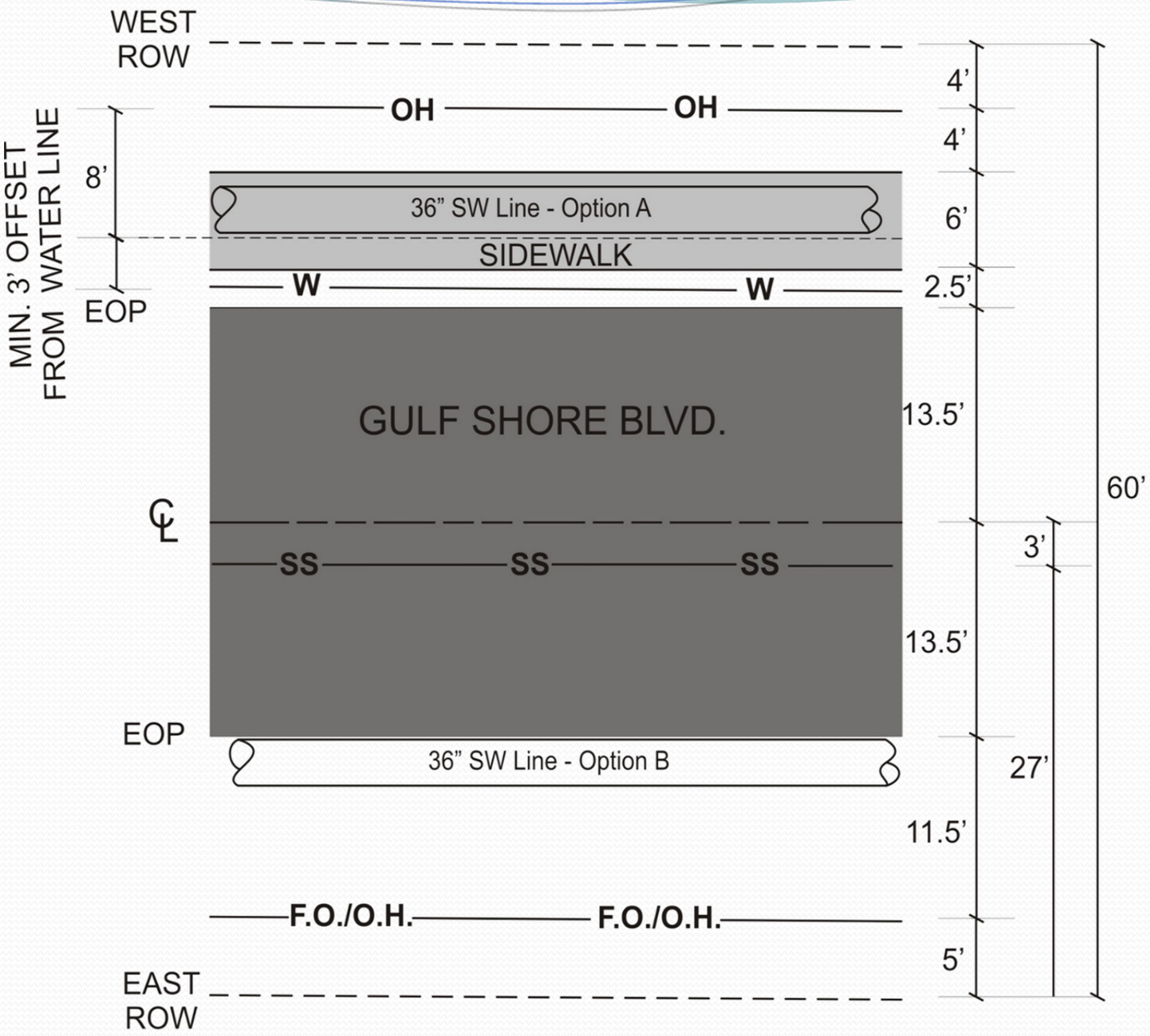
67%

City's Existing Utility Infrastructure & S/W Line Consolidation Options



Pipeline Consolidation along Gulf Shore Blvd

- **Utilities Department prefers consolidation line west ROW to replace the potable watermain**
- **Consolidation line east side concurrent with creating a bike lane**



Conceptual Collection System for Pipeline Consolidation

(Alternative 1)

Conveyance Direction		Outfall Description	Peak Flow for the 5-Yr/1-Day Event (cfs)	Collection System Flow (Peak cfs)	Cumulative Collection System Flow (Peak cfs)
To Outfall 2	2	Naples Beach Hotel and Golf Club	5.7		
To Pump Station 1	2	Naples Beach Hotel and Golf Club (City)	8.5	28.4	28.4
	3	8th Avenue North	8.5	12.9	41.3
	4	7th Avenue North	8.0	12.4	53.6
		Sub-Total (2-4)	*25.1*	*53.6*	
Pump Station 1					61.9
To Pump Station 1	5	6th Avenue North	5.1	8.2	8.2
		Sub-Total (5)	*5.1*	*8.2*	
To Pump Station 2	6	Near Alligator Lake	34.2	76.1	76.1
	7	3rd Avenue North	16.4	24.1	100.2
		Sub-Total (6-7)	*50.6*	*100.2*	
Pump Station 2					165.7
To Pump Station 2	8	2nd Avenue North	28.1	42.6	65.6
	9	1st Avenue South	8.0	11.2	23.0
	10	2nd Avenue South	8.1	11.8	11.8
		Sub-Total (8-10)	*44.2*	*65.6*	
		TOTAL CONSOLIDATED	124.9	165.7	227.6
		TOTAL PEAK RUNOFF (Outfalls 2-10)	130.5		

Conceptual Discharge Plan for Pipeline Consolidation LOS Requirement (25-yr)

Description	Cumulative Collection System Flow	Pump Station Flow Discharged to Gulf	System Overflow
Pump Station 1	61.9	61.9	0.0
Pump Station 2	165.7	94.8	71.0
TOTAL CONSOLIDATED	227.6	156.6	71.0

All values are peak flow rates (cfs)

Pump Station Siting

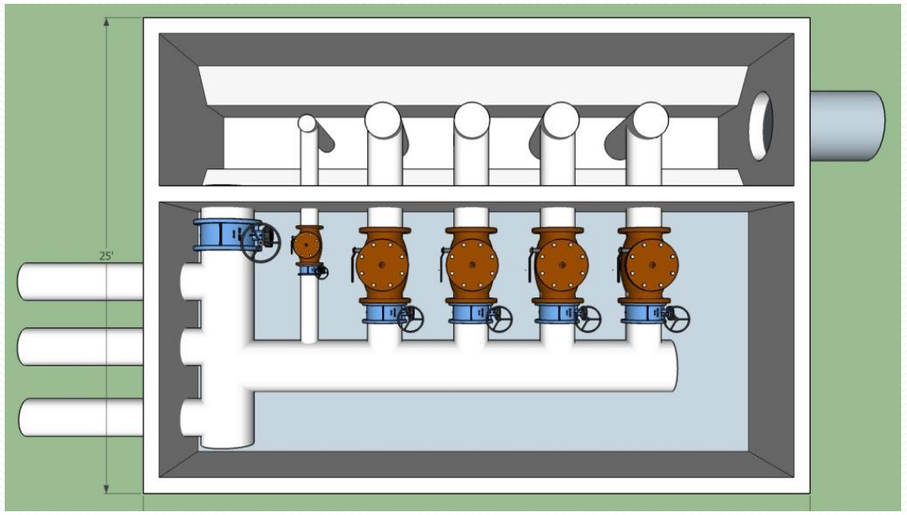
3rd Avenue North

6th Avenue North

Alligator Lake Generator Site

Pump Station Components

- **Below Grade Wet Well & Valve Vault**
- **Elevated Control Panel**
- **Emergency Generator**



Design Requirements Summary

➢ Improve Function of Existing S/W System

- Pump Station will Significantly Improve Drainage & Increase System Efficiency
- Eliminate Stormwater “Staging” for Pipe Flow to Gulf
- Pump Station Below Grade and Adjacent to Beach
- Low Relief Diffuser System to Minimize Impacts
- Overflow Capacity for Extreme Rainfall Events
- Allow for Changes to Components

➢ Minimize/Eliminate Impacts to Water Quality

- Stage Treatment (Filtration, UV Disinfection as required)

➢ Prevent Erosion to Beach - Dune System

- Subsurface Pipeline to Offshore Diffuser
- Eliminate Impacts to Beach-Nearshore System (removing outfalls)

Alternatives

Alternative	Pump Station Location	Total Flow % Consolidated to Pump Station		System Re-Routing	Outfalls to Remain
		5-yr	25-yr		
1	3rd Avenue N	77%	41%	To Moorings Bay & Naples Bay	Outfall 2 (Private Contribution)
2	6th Avenue N ("North System") and 3rd Avenue N ("South System)	96%	69%	-	Outfall 2 (Private Contribution)
3	Vicinity of Naples Beach Hotel & Golf Club ("North System") and 3rd Avenue N ("South System)	100%	77%	-	-

Alternatives: Conceptual Flow Schematics

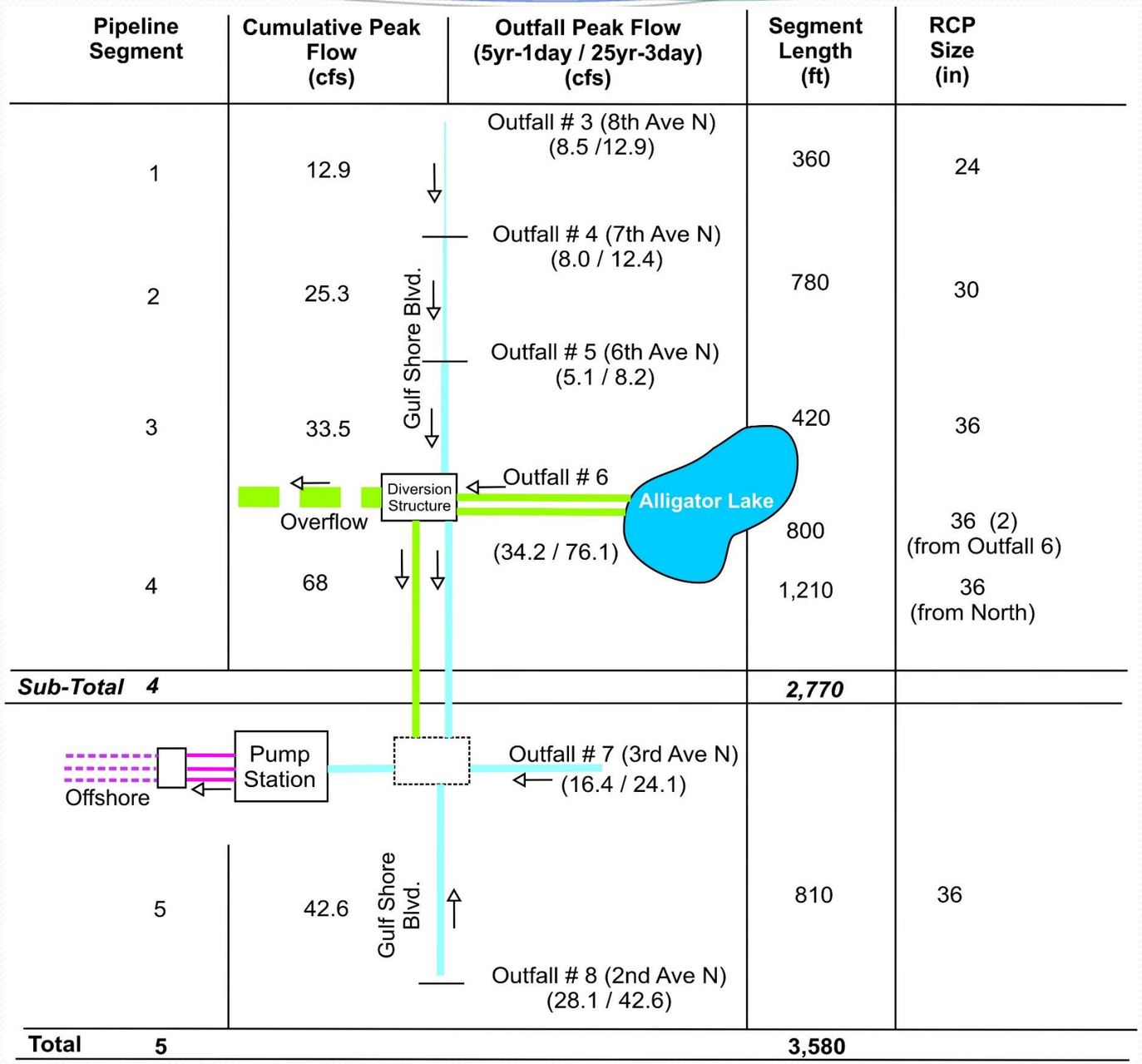
5-yr	77%
25-yr	41%

5-yr	96%
25-yr	69%

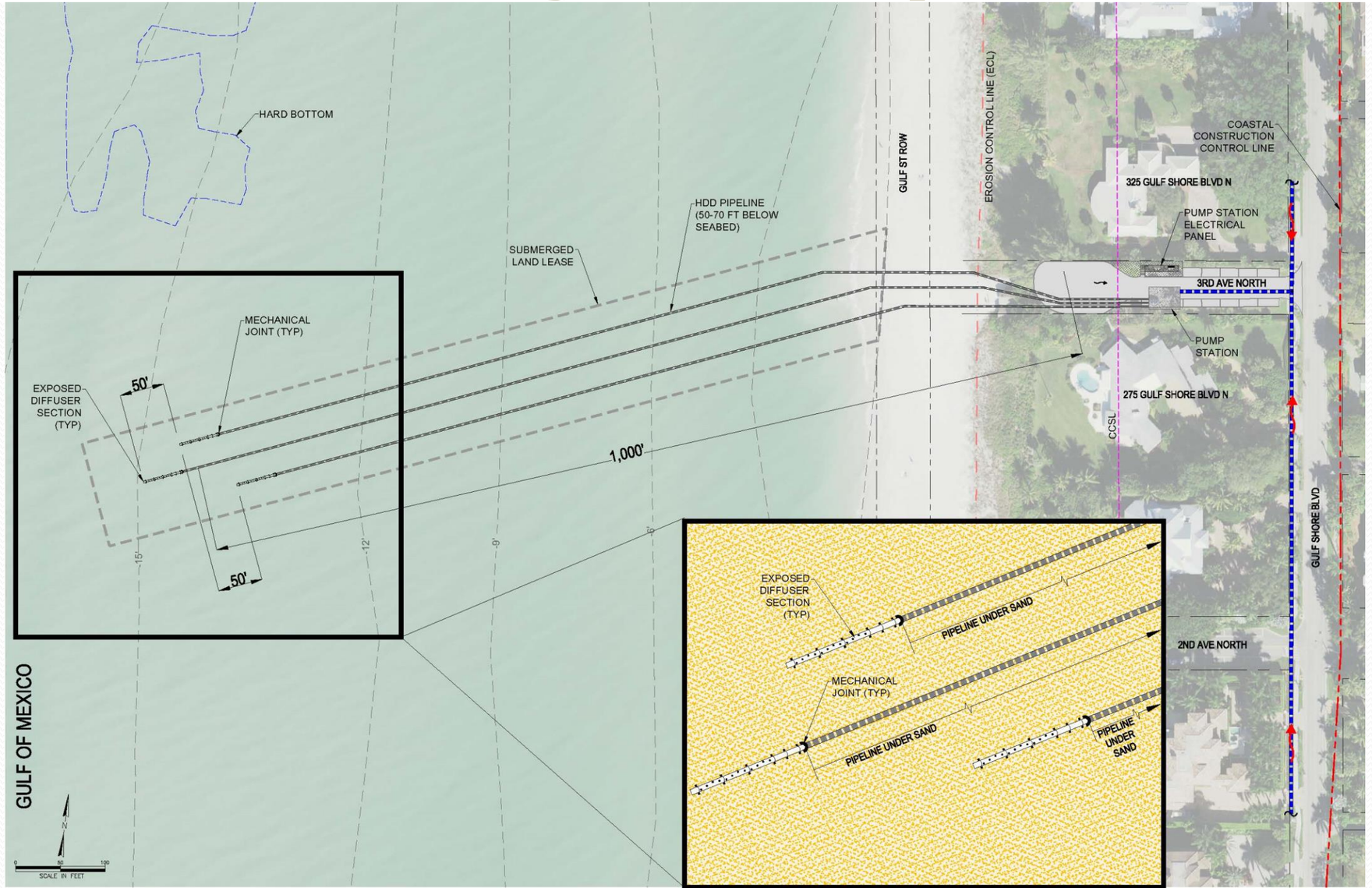
5-yr	100%
25-yr	77%

Alternative 1:
Single Pump Station
3rd Ave North

Pipeline Consolidation Schematic



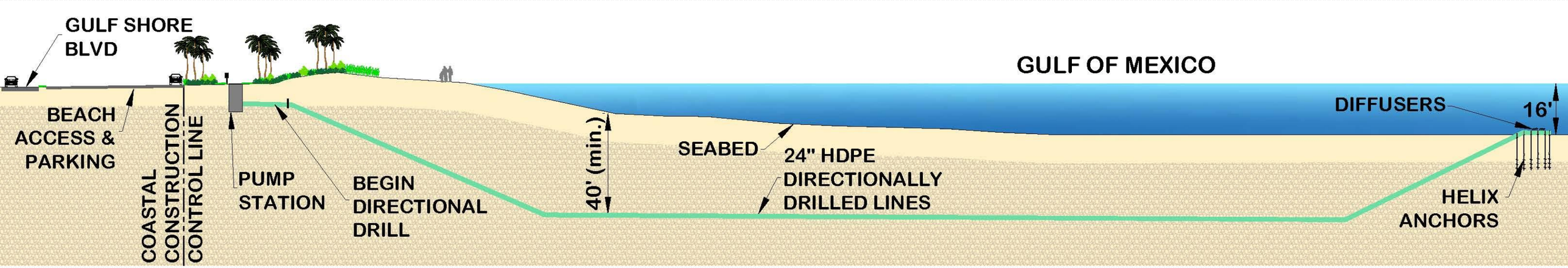
Pump Station, Offshore Discharge & Diffuser System (Alternative 1)



Alt 1 Peak Flow = 100 cfs

Consolidated Stormwater System to Offshore Discharge

Profile View

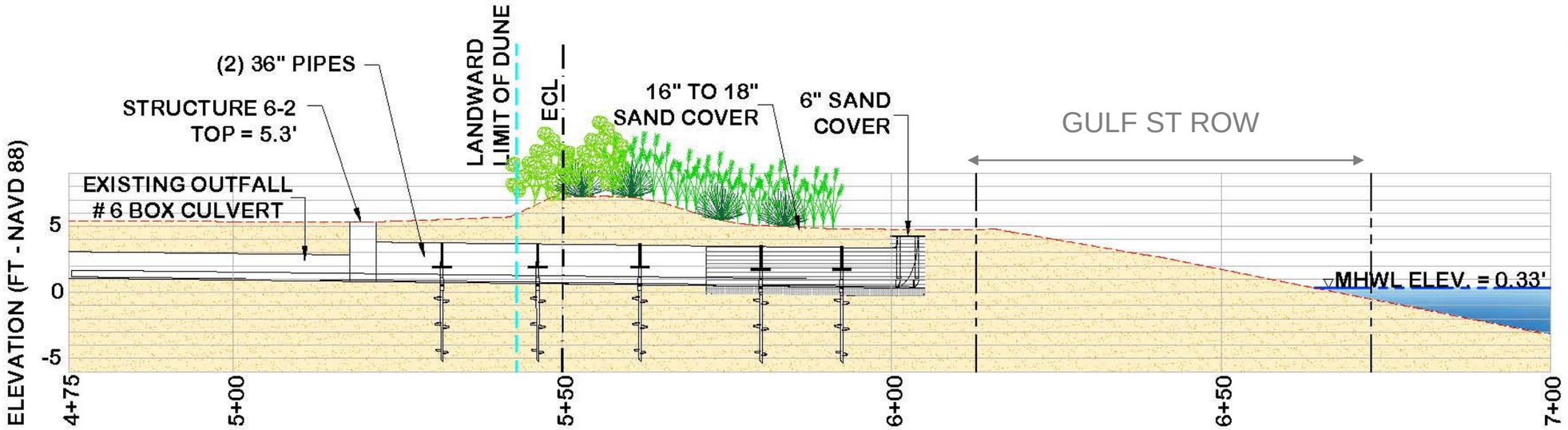


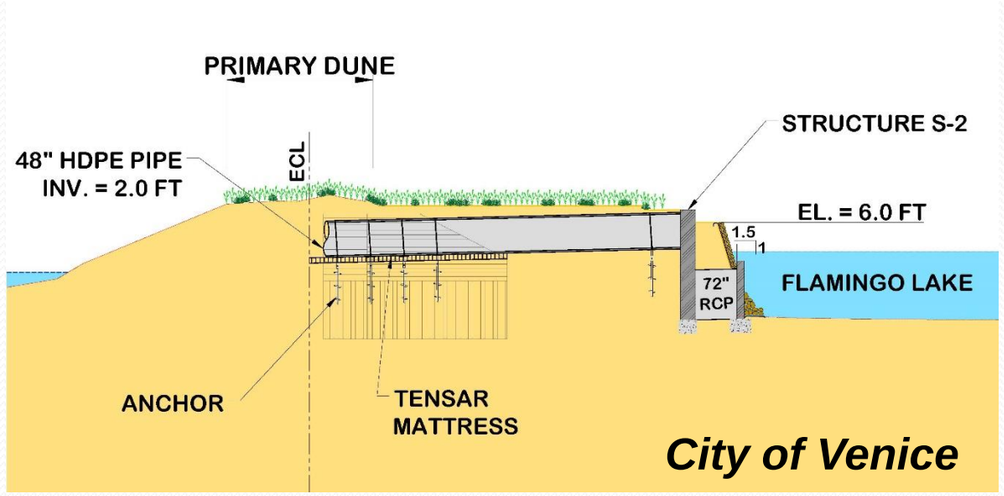
No Dune Impacts

Reduces Environmental Impacts

Diffuser Beyond Depth of Closure

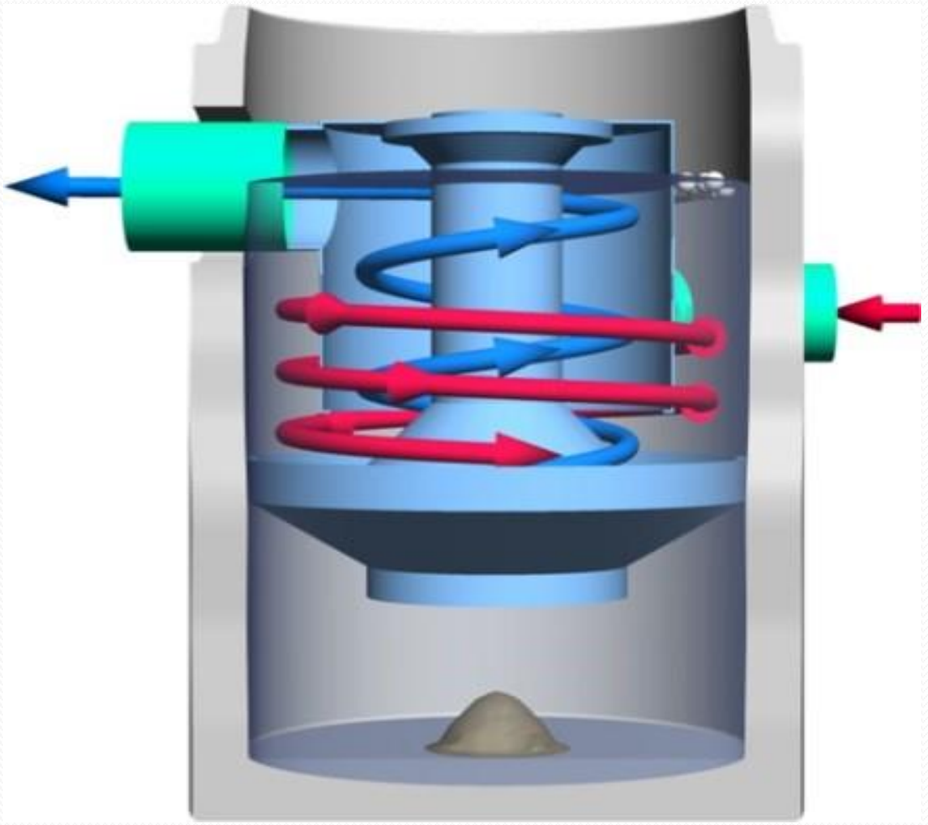
Overflow Line (Modify Outfall #6)



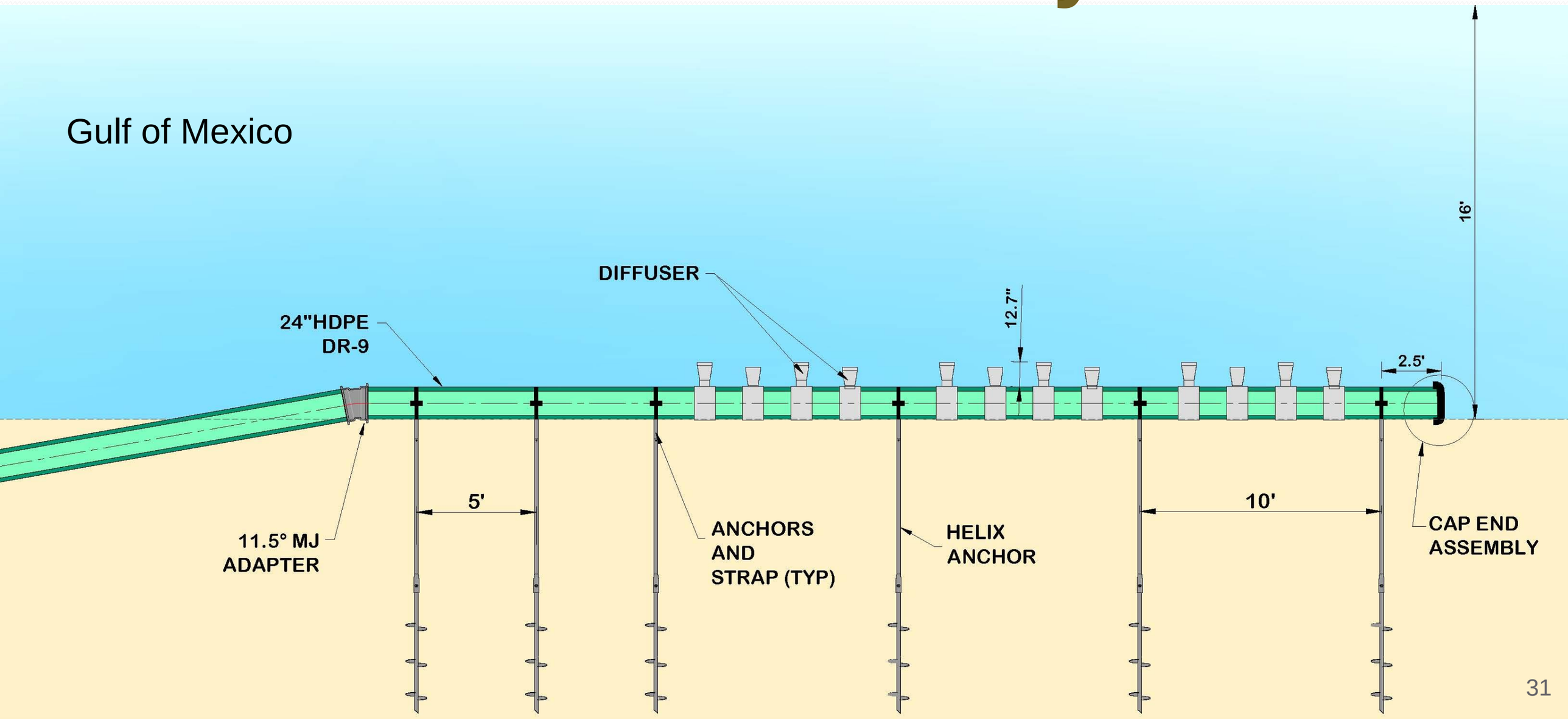


Filtration & Treatment System

- Complete WQ Testing Program
- Determine WQ Treatment Requirements
- Design Suspended Sediment Filtration
- UV Treatment System



Offshore Diffuser System



Cost Comparison

Item	Description	Alternative 1	Alternative 2		Alternative 3	
			North System (Phase I)	South System (Phase II)	North System (Phase I)	South System (Phase II)
1	Mobilization/Demobilization	$578,300	$586,900	$593,300	$496,530	$593,300
2	Pipeline Consolidation	$4,084,000	$1,723,800	$2,507,300	$1,786,000	$2,507,300
3	Pump Station System	$2,403,680	$2,312,200	$2,403,680	$1,809,200	$2,403,680
4	Water Quality Treatment System	$1,115,000	$1,025,000	$1,387,500	$1,025,000	$1,387,500
5	HDD & Diffuser System	$2,794,000	$3,038,000	$1,946,000	$2,882,000	$1,946,000
Sub-Total (Items 1-5)		*$10,974,980*	*$8,685,900*	*$8,837,780*	*$7,998,730*	$8,837,780
Contingency (20%)		$2,195,000	$1,737,200	$1,767,600	$1,599,700	$1,767,600
Sub-Total by System		$13,169,980	$10,423,100	$10,605,380	$9,598,430	$10,605,380
Total		$13,169,980	$21,028,480		$20,203,810	
% of 5-yr / 25-yr Flow Treated		77% / 41%	96% / 69%		100% / 77%	
Effectiveness per Dollar Spent (Construction $ / % Treated)		$17.1M / $32.1M	$21.9M / $30.5		$20.2M / $26.2M	

Alternatives Evaluation & Ranking

- Ranking by City Engr & Natural Resource Depts and Engr Team
- Meetings with Stakeholders
  - Conservancy of SWFL and Waterkeeper Alliance
  - Permitting Agencies (SFWMD, FDEP)
- Sensitivity Analysis
- Ranking Scale

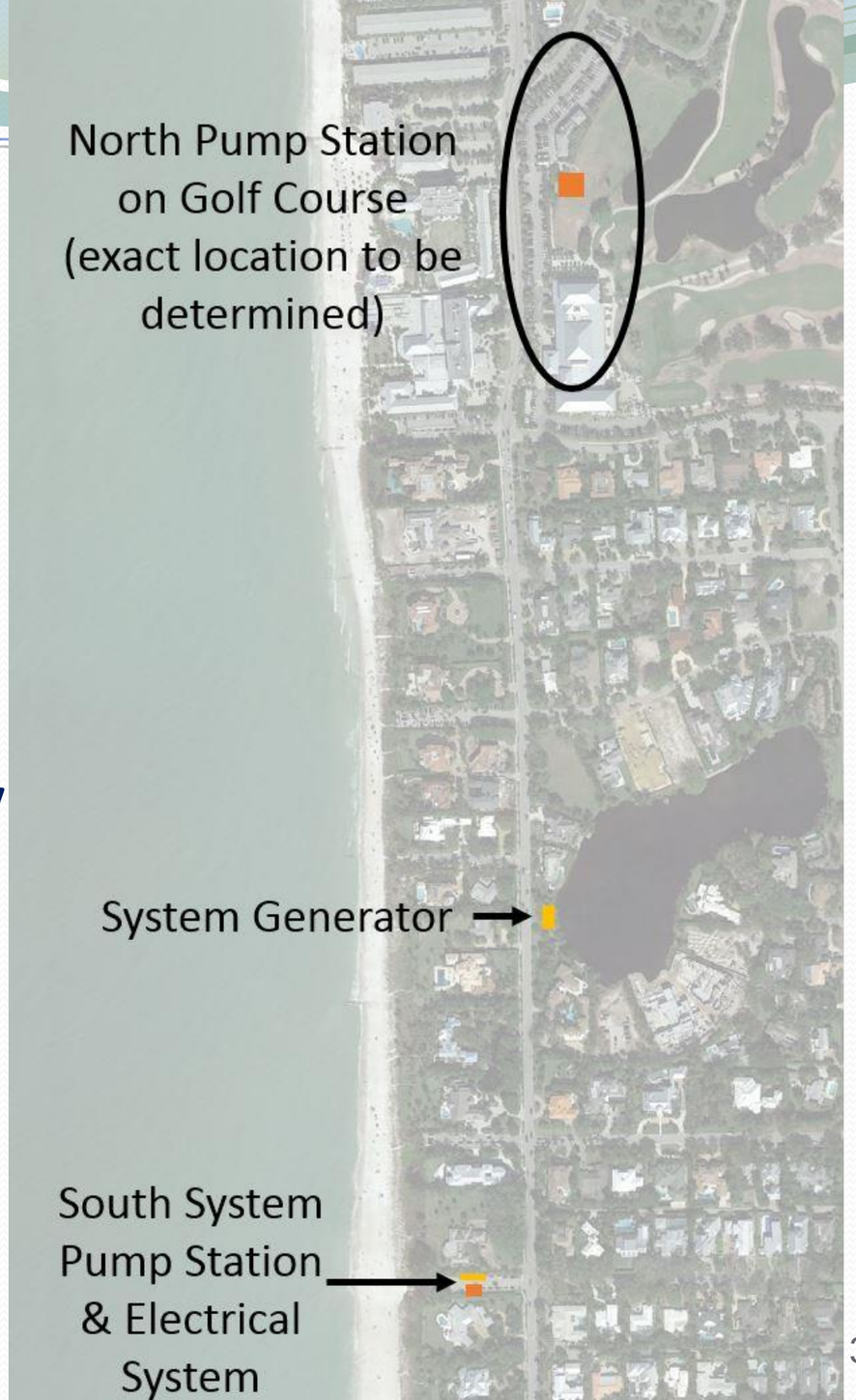
Ranking	Description
-7 / +7	Significant comparative negative/positive project impact
-4 / +4	Medium comparative negative/positive project impact
0	Neutral impact for project

Alternatives Evaluation & Ranking

Evaluation Criteria	Weight	Alternative 1		Alternative 2		Alternative 3	
		Raw	Weighted	Raw	Weighted	Raw	Weighted
Technical	**40%**		**1.15**		**1.08**		**1.63**
Meets Project Objectives	15%	4	0.60	4	0.75	6	0.90
Technical Complexity (Pipeline Consolidation)	5%	-6	-0.30	-5	-0.25	-4	-0.20
Operational Integrity and Reliability (Pump Station)	7.5%	6	0.45	4	0.30	4	0.30
Constructability	7.5%	4	0.30	3	0.23	5	0.38
Scalability	5%	2	0.10	4	0.20	5	0.25
Financial	**30%**		**0.30**		**0.15**		**0.30**
Capital Expenditure (CAPEX)	15%	-1	-0.15	-3	-0.45	-3	-0.45
Effectiveness per Dollar Spent	15%	3	0.45	4	0.60	5	0.75
Non-Technical	**30%**		**1.30**		**1.23**		**1.68**
Social Considerations	7.5%	4	0.30	2	0.15	5	0.38
Environmental Impact	10%	4	0.40	5	0.50	6	0.60
Regulatory Approvals (Permitting)	5%	6	0.30	4	0.20	5	0.25
Health & Safety (Flood Protection, Public Safety, Recreation, etc)	7.5%	4	0.30	5	0.38	6	0.45
	100%		**2.8**		**2.5**		**3.6**

Preferred Alternative

- Alternative 3: Two pump stations
- Removes All City Outfalls (9)
- Routes Outfall 5 to Alligator Lake (Additional WQ Treatment)
- Significantly Improves Nearshore Water Quality
- Highest Effectiveness per Dollar Spent (100% / 77% of flows treated)
- Eliminates Adverse Impacts to Environmental Resources
- Scalable

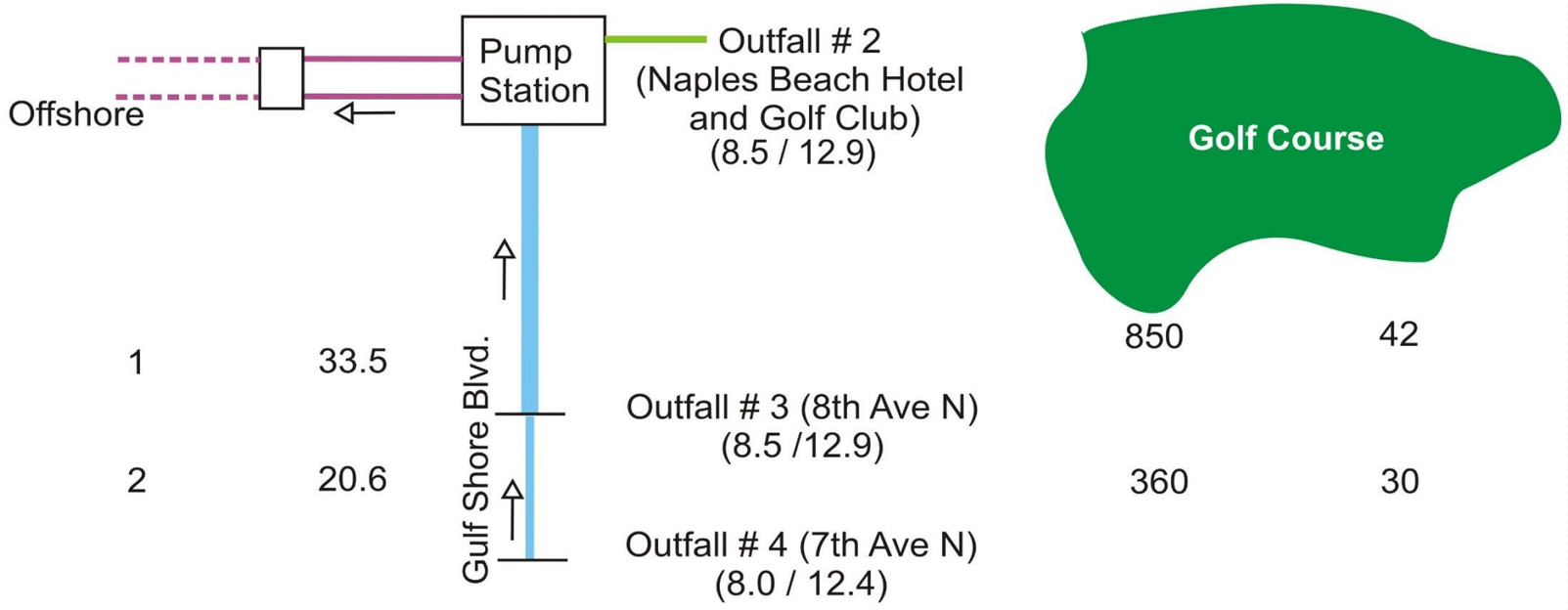


Alternative 3 “North System”

Pipeline Consolidation Schematic

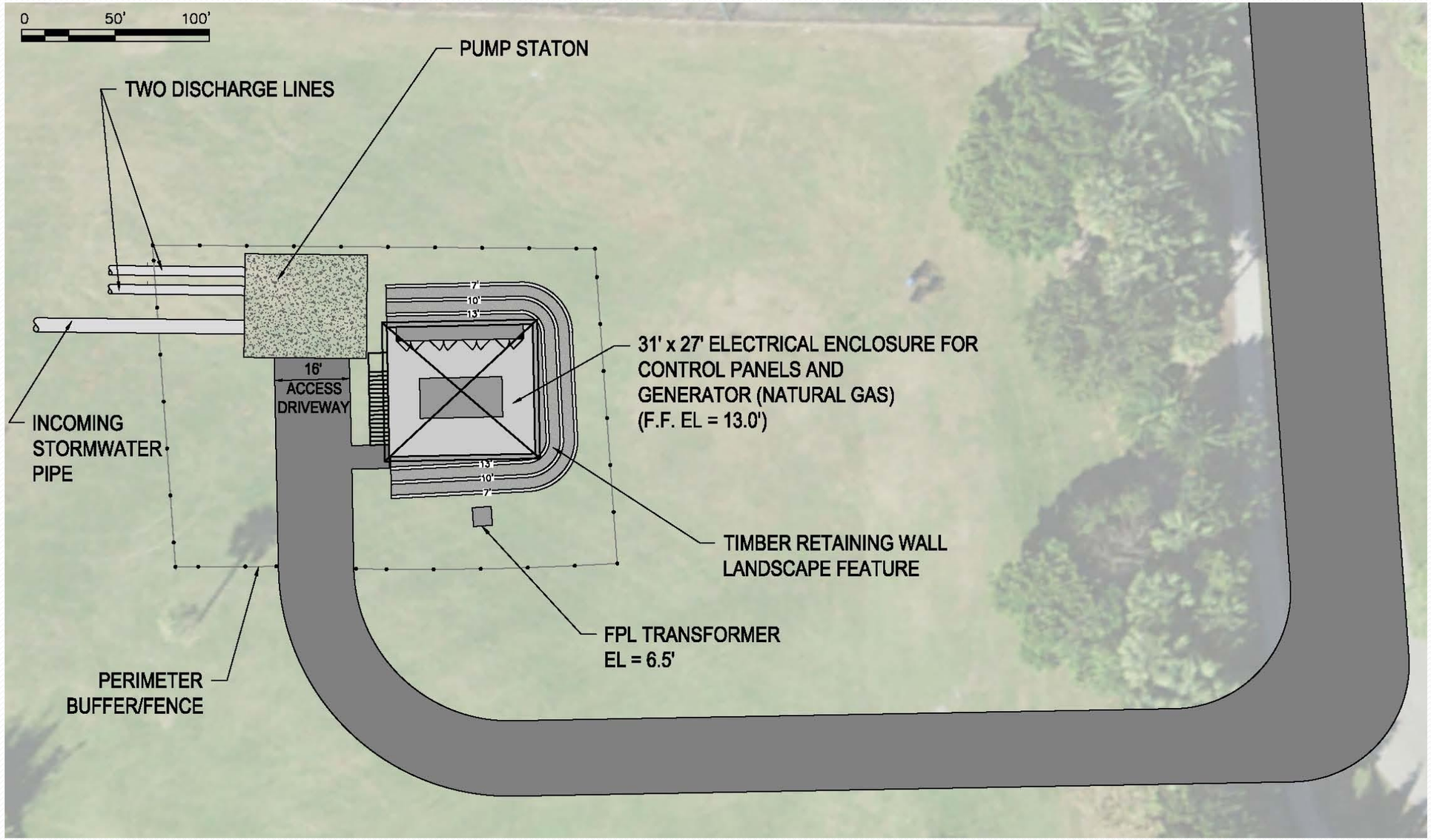
Offshore Discharge (Peak Flow)

- **100% 25-yr**

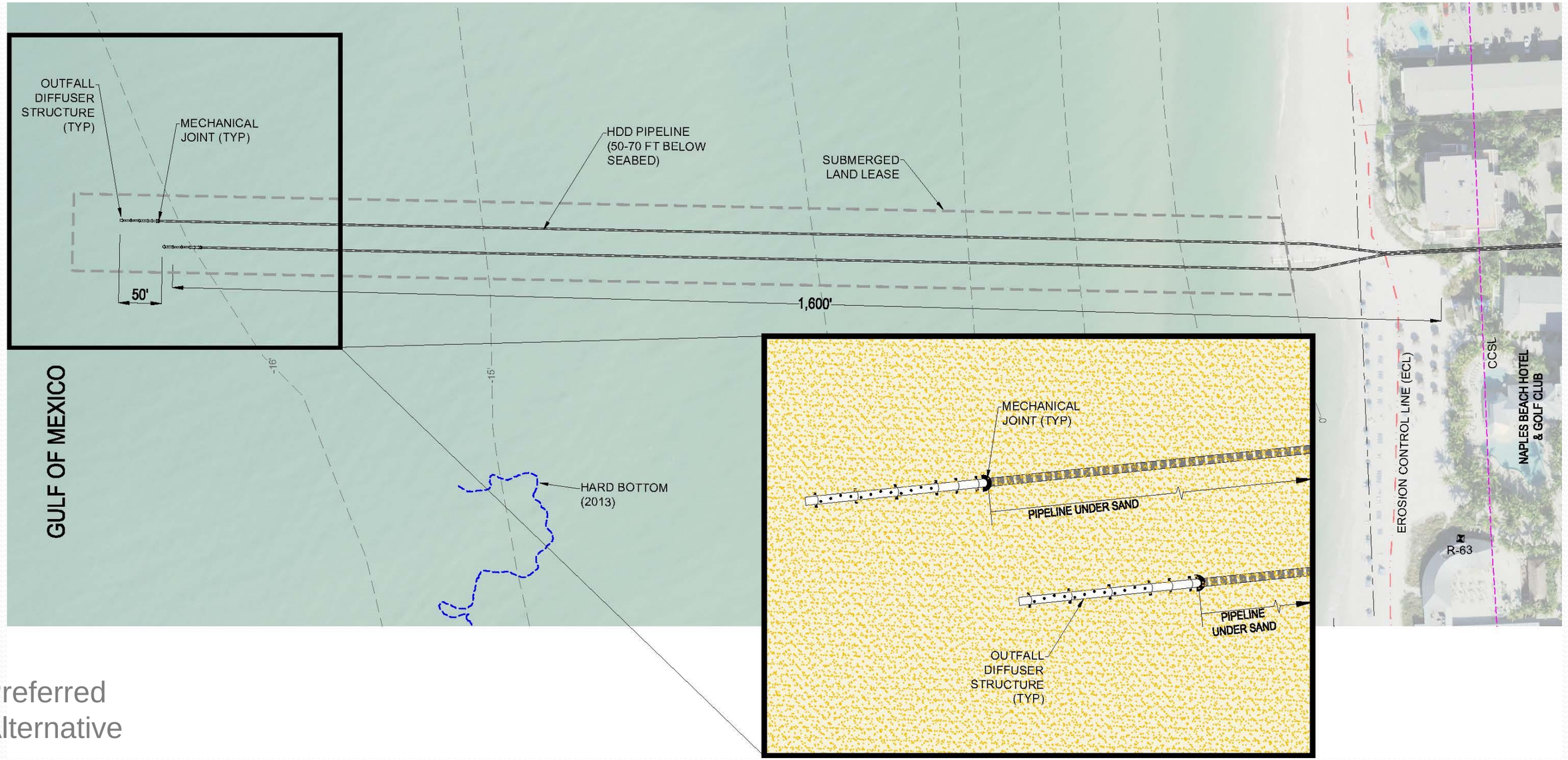


Pipeline Segment	Cumulative Peak Flow (cfs)	Outfall Peak Flow (5yr-1day / 25yr-3day) (cfs)	Segment Length (ft)	RCP Size (in)
1	33.5	Outfall # 3 (8th Ave N) (8.5 /12.9)	850	42
2	20.6	Outfall # 4 (7th Ave N) (8.0 / 12.4)	360	30
Total	**2**		**1,210**	

“North System” Pump Station Design



“North System” Offshore Discharge and Diffuser System



Preferred Alternative

Alternative 3 “South System”

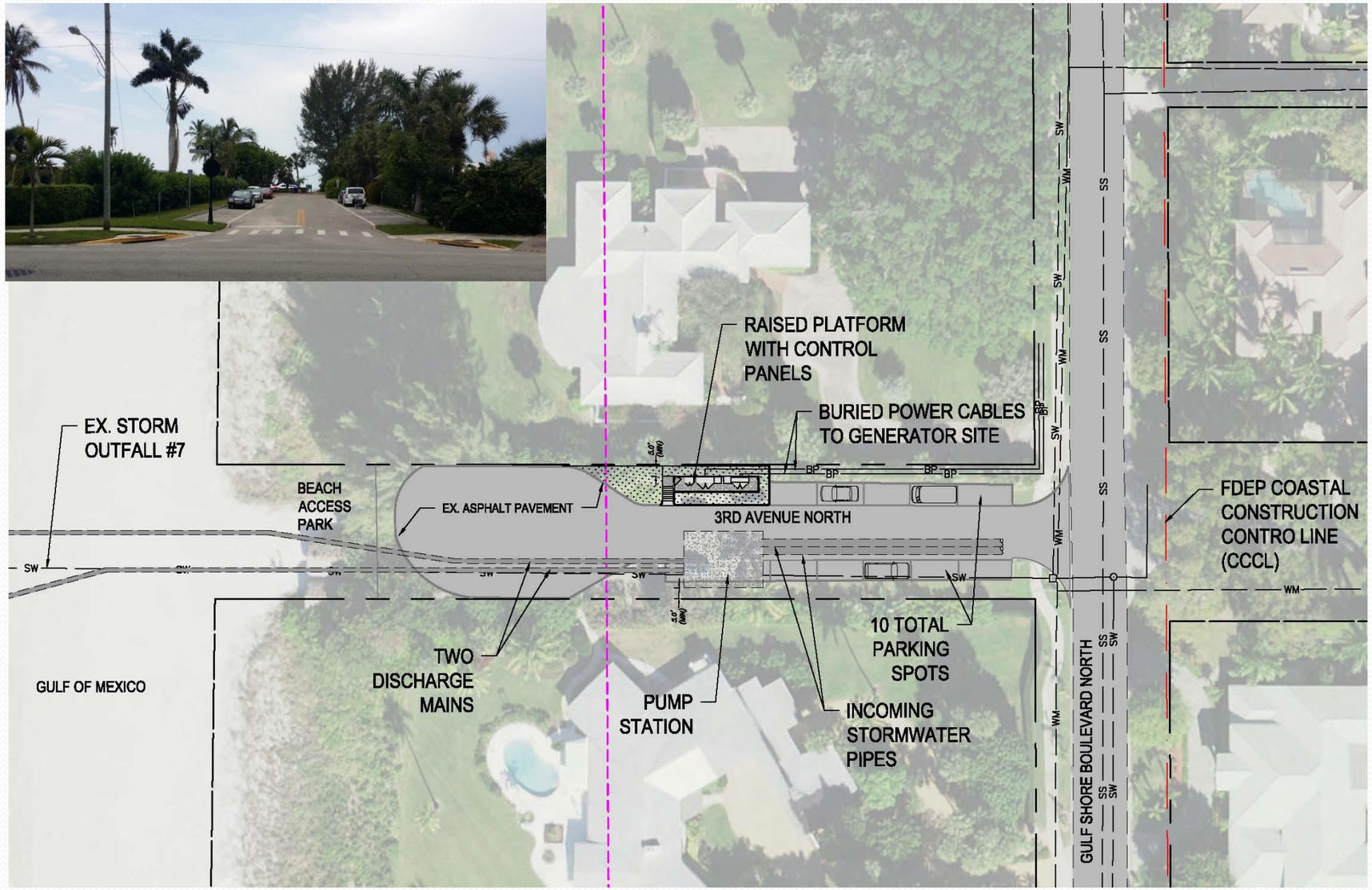
Offshore Discharge (Peak Flow)

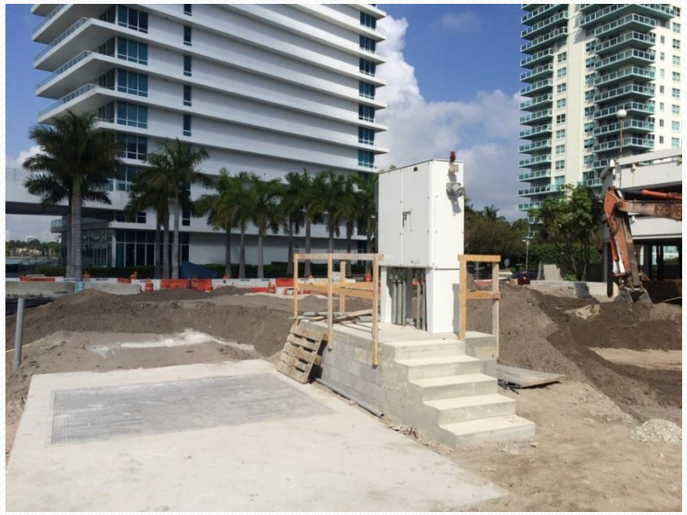
- 100% 5-yr
- 77% 25-yr

Pipeline Consolidation Schematic

Pipeline Segment	Cumulative Peak Flow (cfs)	Outfall Peak Flow (5yr-1day / 25yr-3day) (cfs)	Segment Length (ft)	RCP Size (in)
1	8.2	Outfall # 5 (6th Ave N) (5.1 /8.2)	230	18
2	34.2	Overflow; Diversion Structure; Outfall # 6 (34.2 / 76.1); Alligator Lake	800	36 (2)
Sub-Total	***2***		***1,030***	
3	65.6	Pump Station; Offshore; Outfall # 7 (3rd Ave N) (16.4 / 24.1); Outfall # 8 (1st Ave N) (28.1 / 42.6); Beach Dune	800	36 (2)
4	23.0	Outfall # 9 (1st Ave S) (8.0 / 11.2)	850	36
5	11.8	Outfall # 10 (2nd Ave S) (8.1 / 11.8)	400	24
Sub-Total	***3***		***2,050***	
Total	**5**		**3,080**	

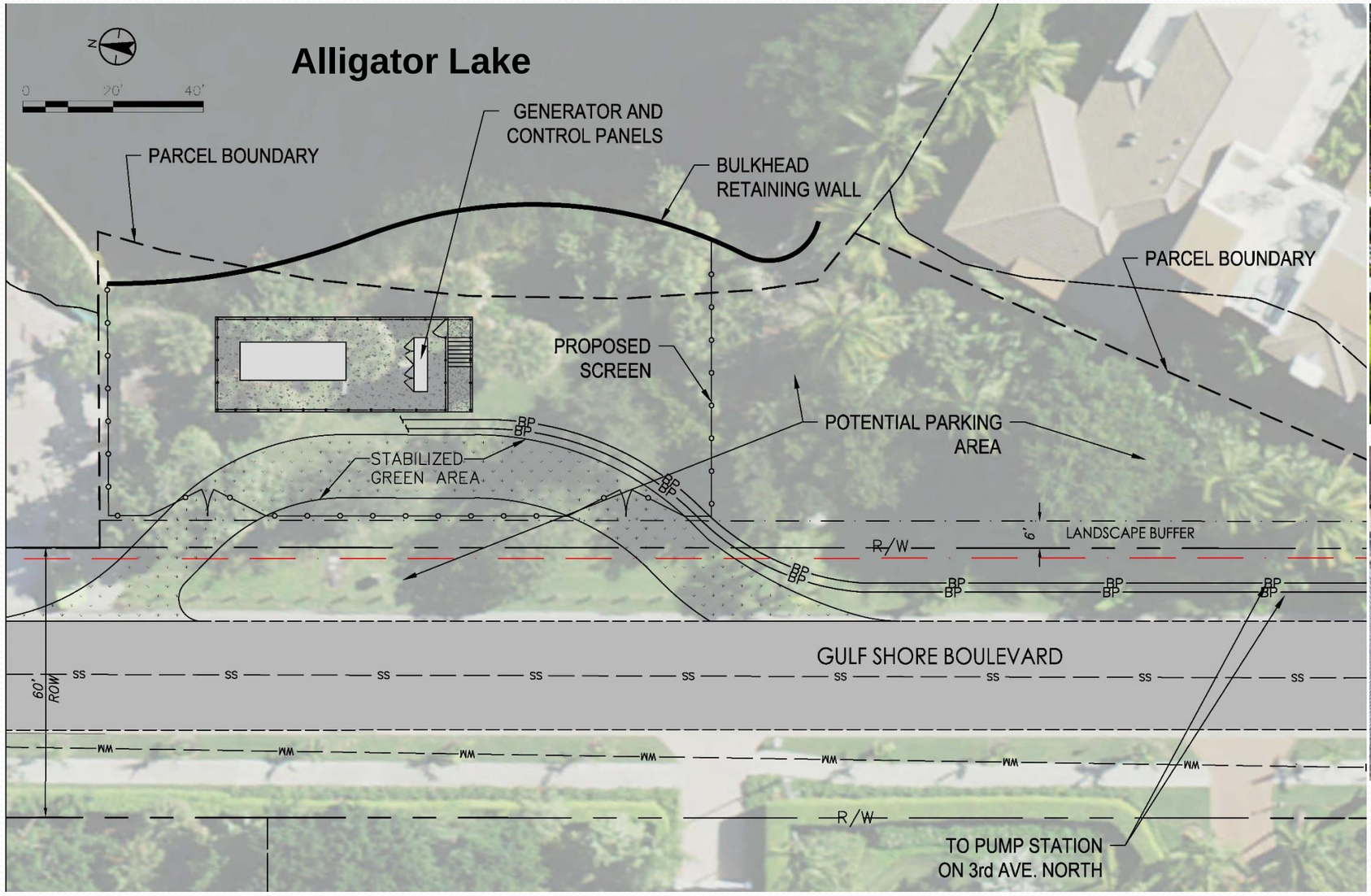
“South System” Pump Station Design





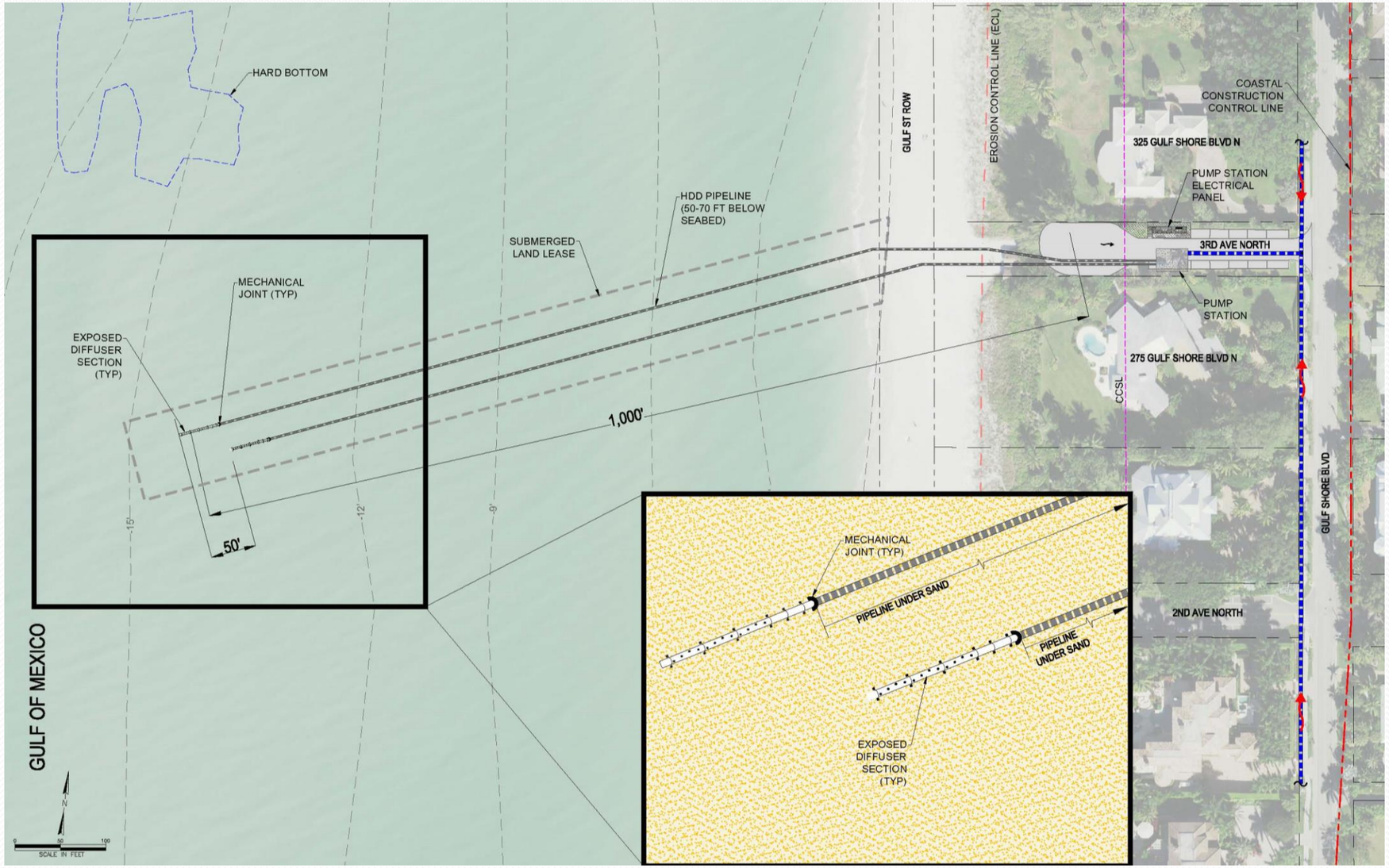
Typical Underground Pump Stations with Elevated Control Panel

“South System” Generator Site



Preferred Alternative

“South System” Offshore Discharge & Diffuser



Preferred Alternative

Cost Estimate & Phases

Item	Description	Alternative 3	
		North System (Phase I)	South System (Phase II)
1	Mobilization/Demobilization	$496,530	$593,300
2	Outfalls Consolidation	$1,786,000	$2,507,300
3	Pump Station System	$1,809,200	$2,403,680
4	Water Quality Treatment System	$1,025,000	$1,387,500
5	HDD & Diffuser System	$2,882,000	$1,946,000
Sub-Total (Items 1-5)		*$7,998,730*	$8,837,780
Contingency (20%)		$1,599,700	$1,767,600
Sub-Total by System		$9,598,430	$10,605,380
Total		$20,203,810	

Preferred Alternative

Consolidation (South System) along back-beach potentially results in $1.8 cost savings

Recommendations & Next Steps

- Continue Stakeholder / Community Coordination
- Complete Water Quality Testing Program
- Additional Data Collection and Modeling
- Supplemental Engineering
- Return to Council with Update — November 2016

- Detailed Design and Permitting

Questions and Discussion