Bakers Haulover Inlet Management

2019 National Conference on Beach Preservation Technology – St. Augustine, Florida

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Presentation Outline

- Inlet Management Plan – Developing & Updating IMP
- Bakers Haulover Inlet (Location, history)
- Beach Management Challenges
- Sediment Budget
- Alternatives
- Next steps towards IMP

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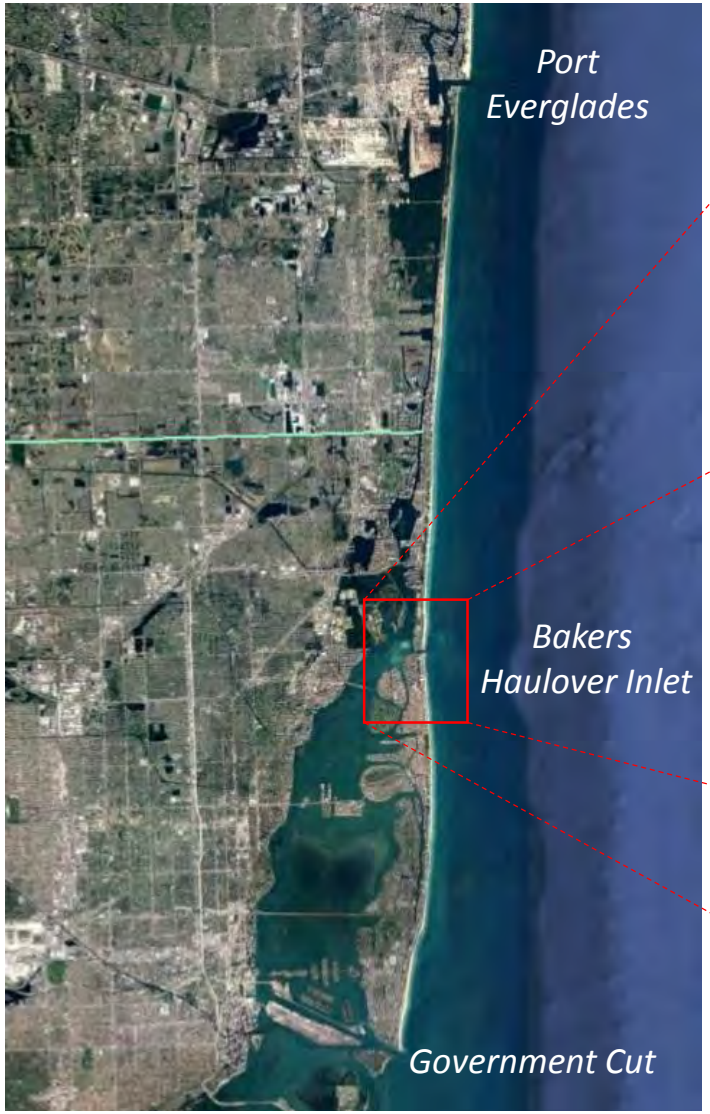
Bakers Haulover Inlet – Location Map



Inlet Management Plan – Florida Statutes

Section 161.142, F.S. –

- The Legislature finds it is in the public interest to replicate the natural drift of sand which is interrupted or altered by inlets to be replaced and for each level of government to undertake all reasonable efforts to maximize inlet sand bypassing to ensure that beach-quality sand is placed on adjacent eroding beaches. Such activities cannot make up for the historical sand deficits caused by inlets but shall be designed to balance the sediment budget of the inlet and adjacent beaches and extend the life of proximate beach-restoration projects so that periodic nourishment is needed less frequently.

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Inlet Management Plan

- All FDEP Inlet Management Plans

https://floridadep.gov/water/beaches-inlets-ports/content/strategic-planning-and-coordination#imp

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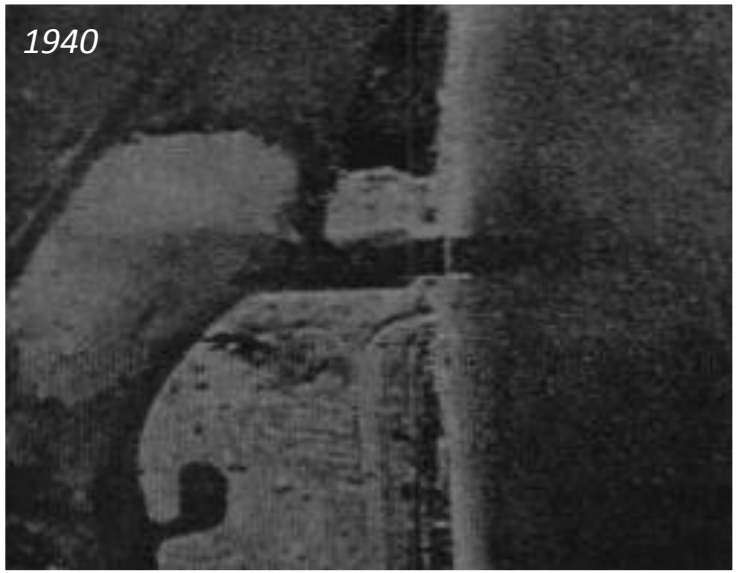
Bakers Haulover Inlet - History

Year	BHI modifications
1925	The BHI was constructed along with two short rock rubble jetties.
1926	All protective structures along BHI were destroyed by a hurricane.
1927	Permits were issued for the reconstruction of BHI which provided for the construction of two sheet pile jetties.
1936	The integrity of the coastal structures (bulkheads and groins) was compromised due to corrosion and abrasion. Damaged produced by a severe storm resulted in the replacement of the bulkhead south of the inlet (parallel to the shore). The groins were not repaired.
1940	The south jetty was repaired after a sand fill scape in 1939.
1950-1952	The bridge over the inlet was moved 200 ft to the west. The old bridge (20 ft of vertical clearance) was removed in 1952.
1963	The north jetty was reconstructed.
1964	BHI was widened by relocating and reconstructing the south jetty.
1974	South jetty extension with curved end completed.
1986	North jetty sand tightening and extension with northward end completed.



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Bakers Haulover Inlet – Dredging events

Year	Source	Placement	Quantity (cy)
1955 -1959	BHI	R19-R26 Haulover Beach Park	418,214
1961	BHI Flood Shoal	R19-R25 Haulover Beach Park	32,038
1966	BHI Flood Shoal	R19-R25 Haulover Beach Park	25,102
1969	BHI Flood Shoal	R19-R25 Haulover Beach Park	24,300
1975	ICWW, channel widened along east side	R19-R25 Haulover Beach Park	58,874
1980	BHI Flood Shoal	R19-R26 Haulover Beach Park	43,163
1984	BHI Flood Shoal	R19-R26 Haulover Beach Park	35,000
1990	BHI and ICWW	R7-R9 Sunny Isles	32,000
1994	BHI	R19-R26 Haulover Beach Park	24,560
1998	Flood Shoal, Entrance Channel, ICWW and ICWW Approaches	R28-R31 Bal Harbour	282,852
2003	BHI Ebb Shoal	R27-R31 Bal Harbour	188,000
2006	BHI Flood Shoal and ICWW	R27-R31 Bal Harbour	30,000
2010	BHI Flood Shoal and ICWW	Bal Harbour	33,080
2014	BHI Flood Shoal and ICWW	R28-R29 Bal Harbour	49,592
	BHI Ebb Shoal	R27-R31 Bal Harbour	235,733
2017	BHI Flood Shoal and ICWW	R28-R29 Bal Harbour	37,281

1997 – IMP Adoption

Intracoastal Waterway – Extensive Maintenance

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Beach Management Challenges

- Dr. Dean FSBPA Jan 2008:
  - inlets may be the cause of as much as 80 to 85% of the beach erosion along Florida's East Coast
  - improved sand management at inlets could potentially reduce annual beach nourishment needs by as much as 1.4 million cubic yards of sand
- Lack of economical source (offshore sand)

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Beach Management Challenges

- SAND study (2014): 21,417,300 cy required over the next 50 years from Port Everglades to Government Cut
- Bakers Haulover Inlet Ebb Shoal: 300,000 cy every 10 years reducing Bal Harbour sediment requirement from 60,000 cy/yr to 30,000 cy/yr
- Miami Beach – Truck Haul Beach Nourishment Costs $55 - $65 per cy
- Downdrift communities – benefit from improved inlet management
- FDEP SBMP 2018: BHI - Place all beach compatible maintenance dredging material on adjacent beaches in areas of greatest need; update the sediment budget and the inlet management plan.
- 22,400 cy/yr lost to the inlet: $1.34 M/yr

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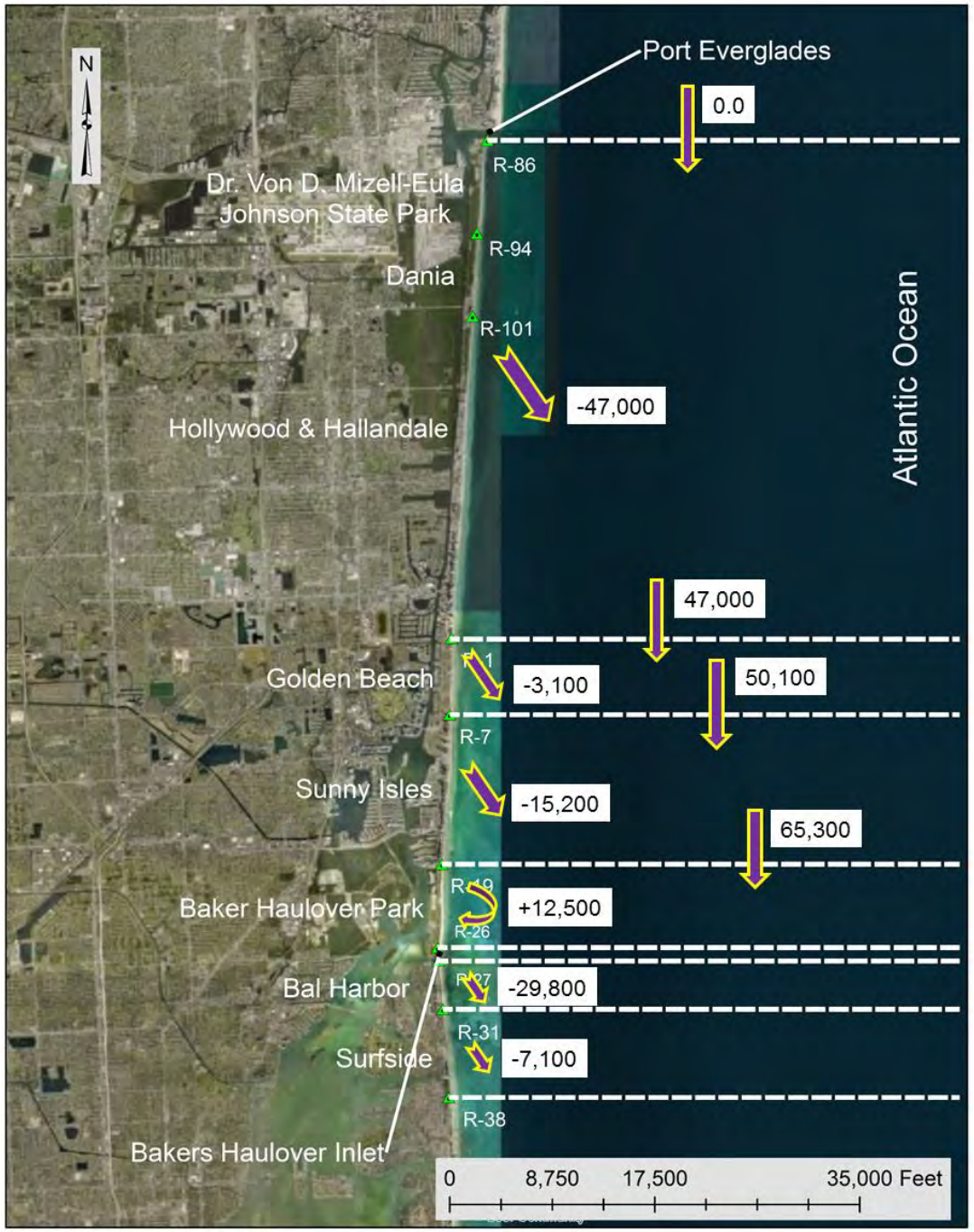

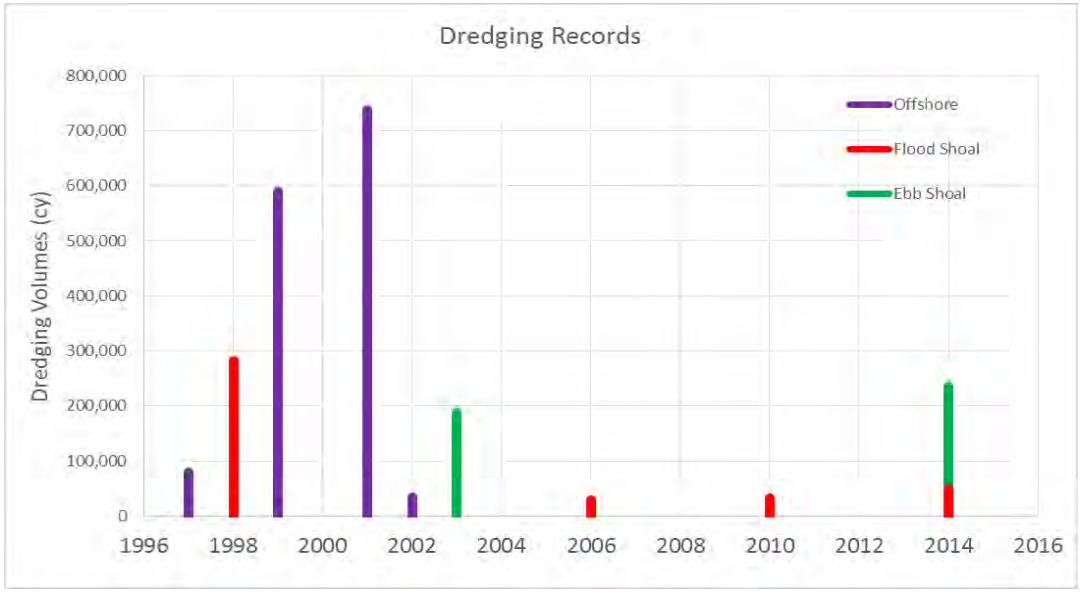

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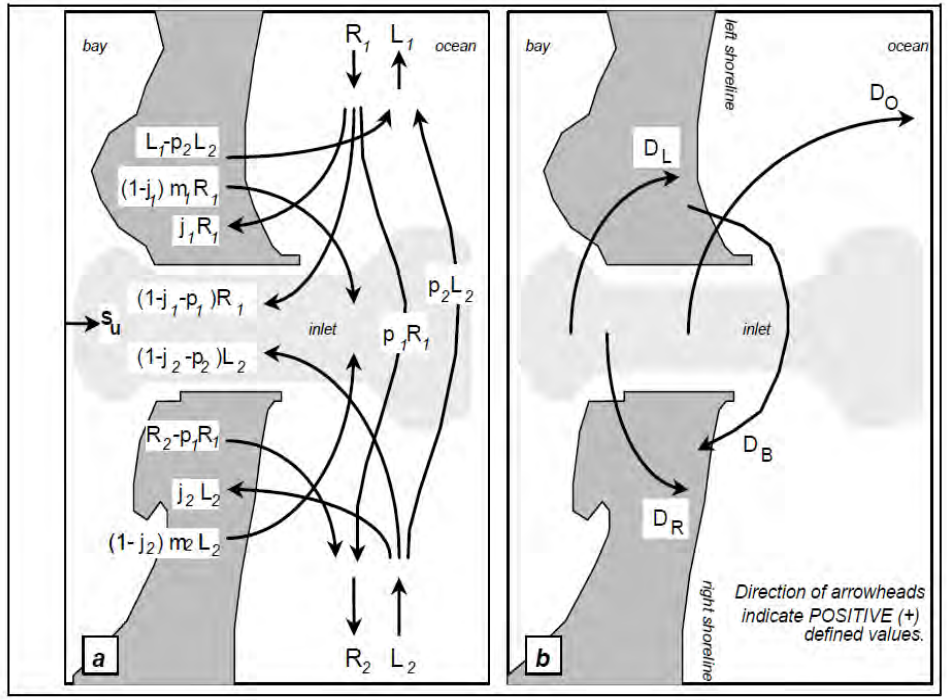
Sediment Budget Update for the Existing Conditions

- "Family of Solutions" method (Bodge, 1999)

Input Variable	Unit	Lower Value	Upper Value
Net transport, Q	cy/yr	50,000	95,000
Ratio of north/south transport, r	-	0.16	0.35
Net volume changes of the south shoreline, ΔV_R	cy/yr	-36,900	
Net volume changes of the north shoreline, ΔV_L	cy/yr	+12,500	
Mechanical transfer of sand from the inlet and placed on south shoreline, D_R	cy/yr	36,300	
Mechanical transfer of sand from the inlet and placed on north shoreline, D_R	cy/yr	0	
Mechanical dredging and out-system disposal from the inlet, D_0	cy/yr	0	
Transport of littoral material into the inlet from upland sources, S_u	cy/yr	3,200	
North jetty impermeability, j_1	-	0.1	1
North jetty impermeability, j_1	-	0.4	1



Coastal Engineering Manual

Sediment Budget Update for the Existing Conditions

Date	Southerly-directed transport rate (cy/yr)	Northerly-directed transport rate (cy/yr)	Net transport rate, Q (cy/yr)	Ratio of north/south transport
2007	110,800	17,400	93,400	0.16
2008	109,200	38,000	71,200	0.35
2009	73,700	22,000	51,700	0.30
2010	91,100	30,600	60,500	0.34
2011	102,400	16,200	86,200	0.16
2012	108,600	31,400	77,200	0.29
2013	93,200	31,000	62,200	0.33
2014	95,500	19,200	76,300	0.20
2015	97,100	22,600	74,500	0.23
2016	96,800	23,200	73,600	0.24
Average	**97,800**	**25,200**	**72,700**	**0.26**

- Littoral drift (longshore sediment transport rates)
- DHI Spectral Wave Model (MIKE 21 SW)
- LITDRIFT (DHI)
- Estimated Longshore Transport Rates from 2007 to 2016

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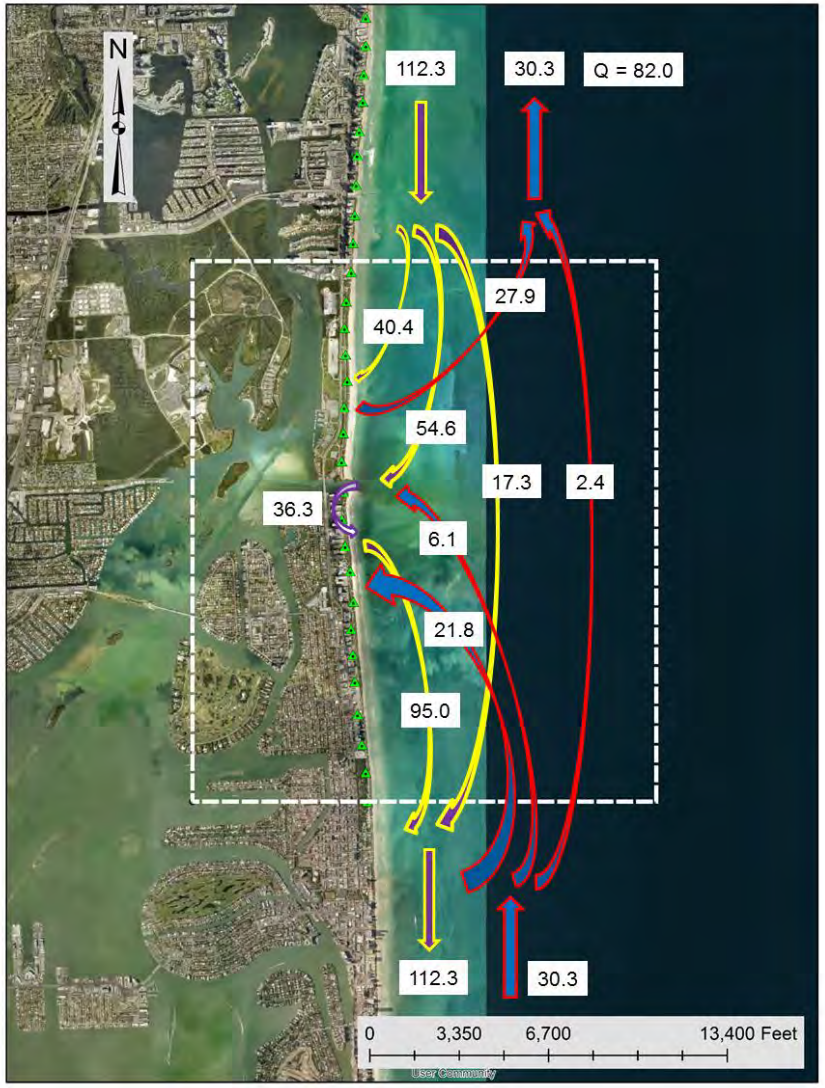
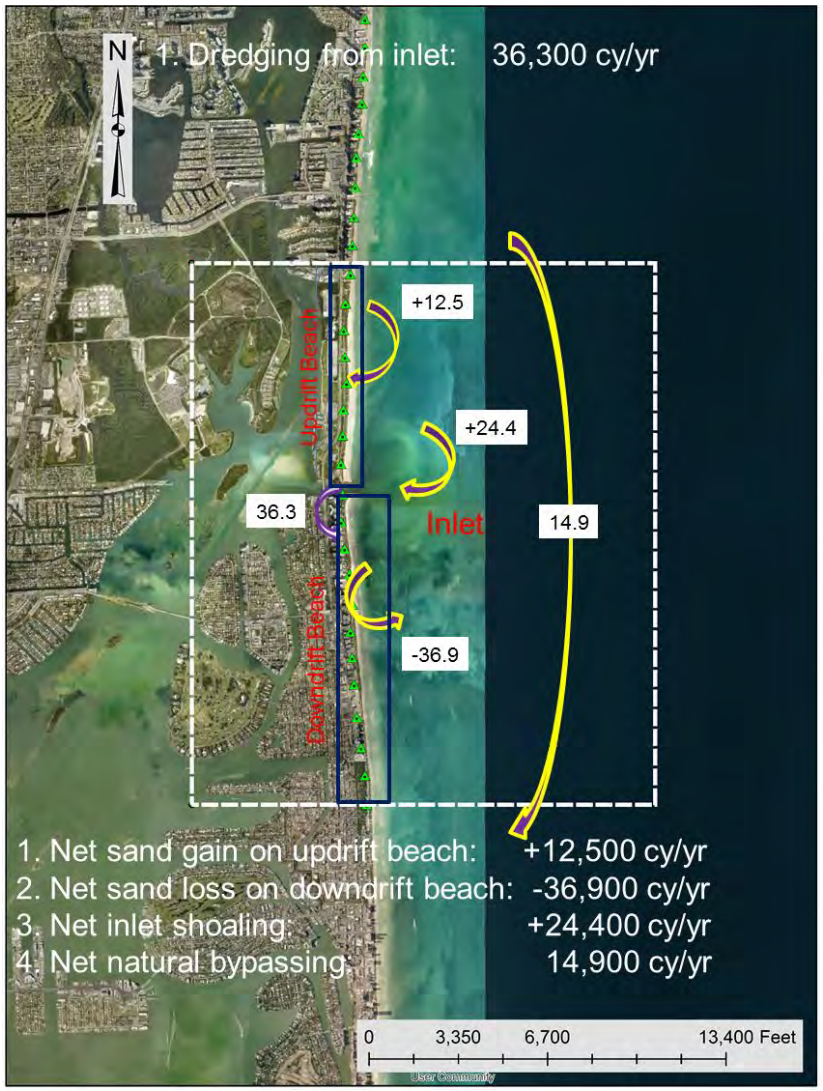
Sediment Budget Update for the Existing Conditions





Variable	Solution (Median)
Net transport, Q, (cy/yr)	**82,000**
Southerly-directed transport, R, (cy/yr)	**112,300**
Northerly-directed transport, L, (cy/yr)	**-30,300**
North jetty impermeability, j_1	**0.36**
South jetty impermeability, j_2	**0.72**
Net beach volume changes at north shoreline (Haulover Park beach)	**+12,500**
Net beach volume changes at south shoreline (Bal Harbour and Surfside beach)	**-36,900**
Net natural bypassing, (cy/yr)	**14,900**
Inlet shoaling from north, (cy/yr)	**54,600**
Inlet shoaling from south, (cy/yr)	**6,100**

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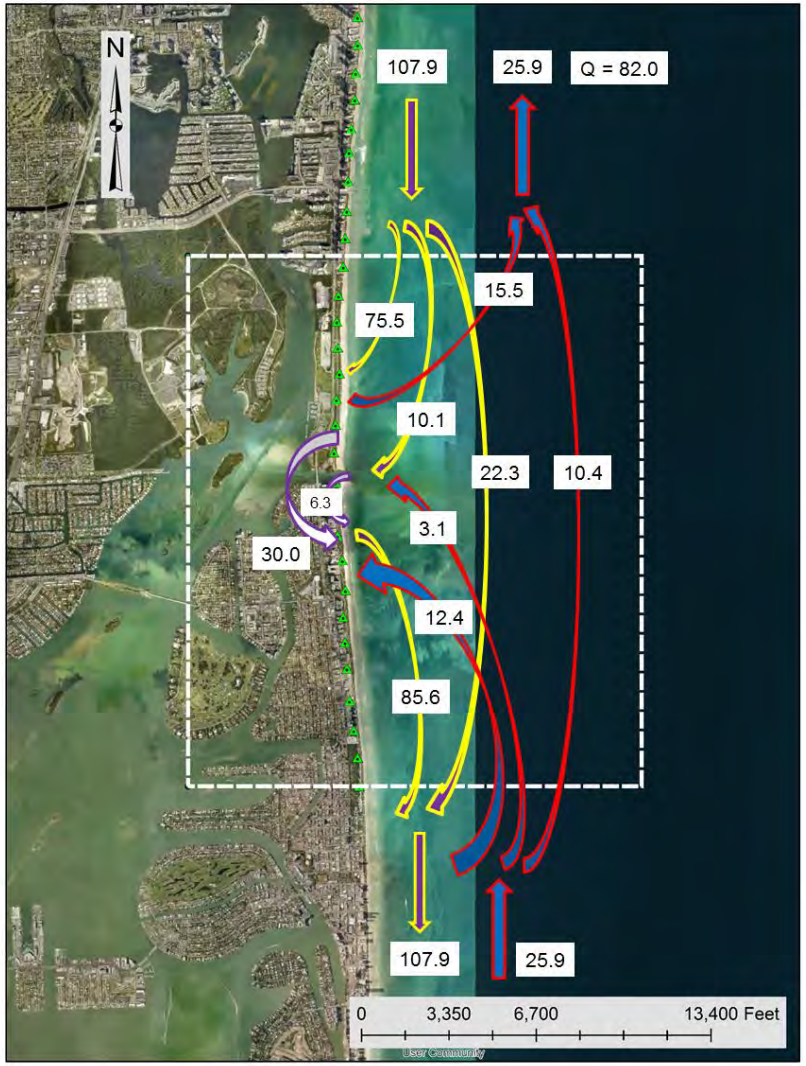
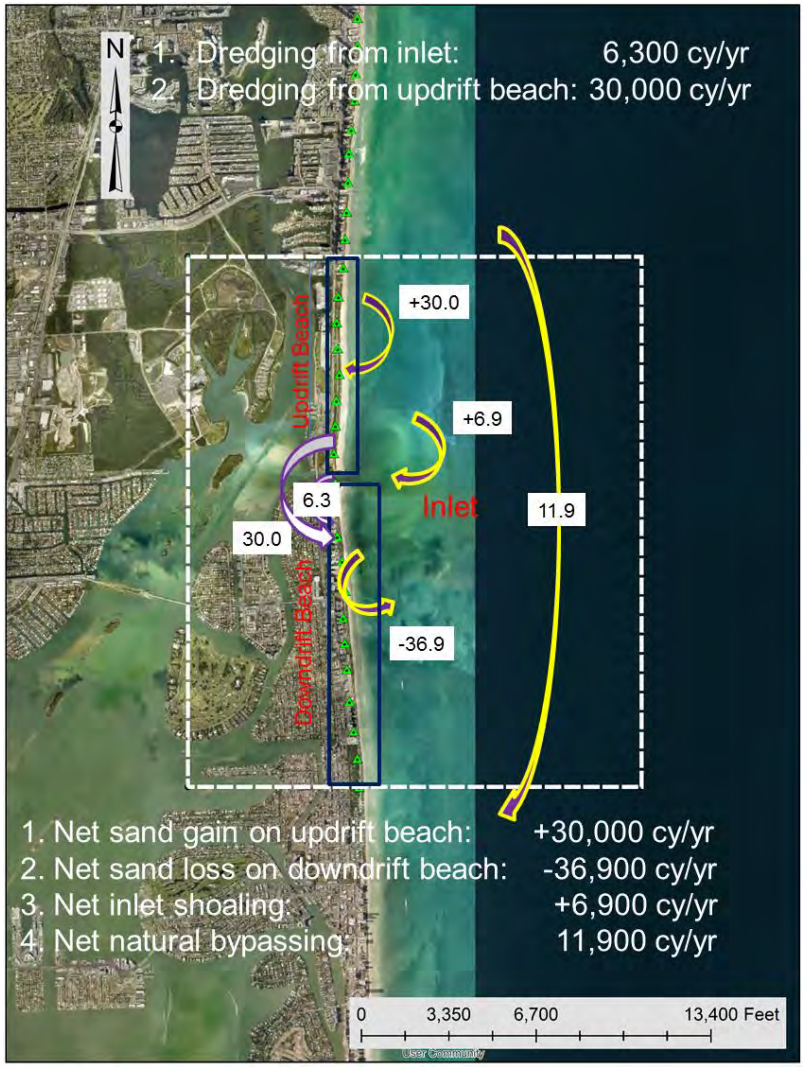
Sediment Budget Update for Proposed North Jetty Extension Project (164 ft)





Variable	Solution (Median)
Net transport, Q, (cy/yr)	**82,000**
Southerly-directed transport, R, (cy/yr)	**107,900**
Northerly-directed transport, L, (cy/yr)	**-25,900**
North jetty impermeability, j_1	**0.70**
South jetty impermeability, j_2	**0.48**
Net beach volume changes at north shoreline (Haulover Park beach)	**+30,000**
Net beach volume changes at south shoreline (Bal Harbour and Surfside beach)	**-36,900**
Net natural bypassing, (cy/yr)	**11,900**
Inlet shoaling from north, (cy/yr)	**10,100**
Inlet shoaling from south, (cy/yr)	**3,100**

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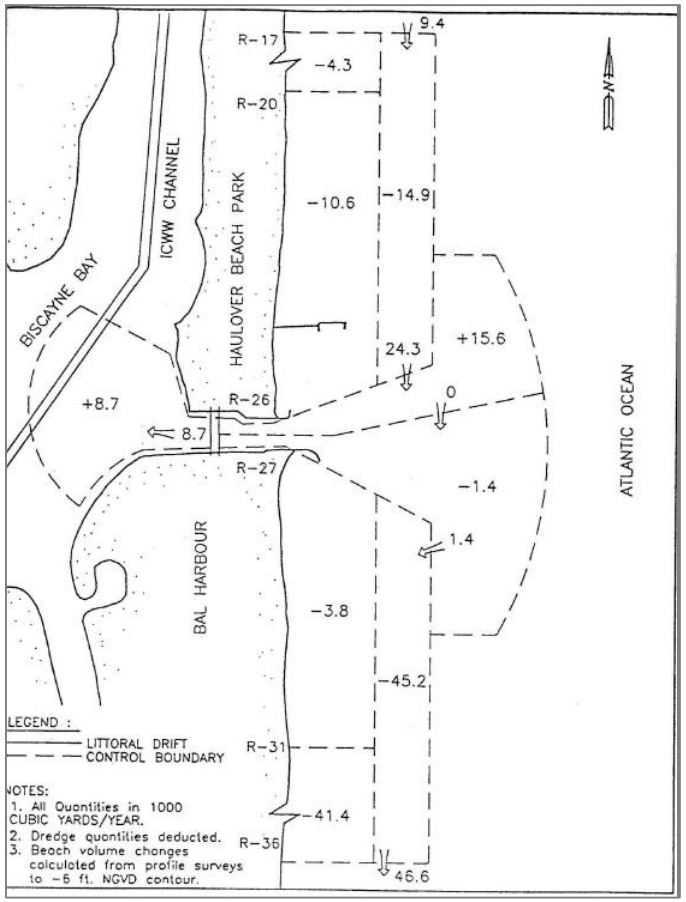
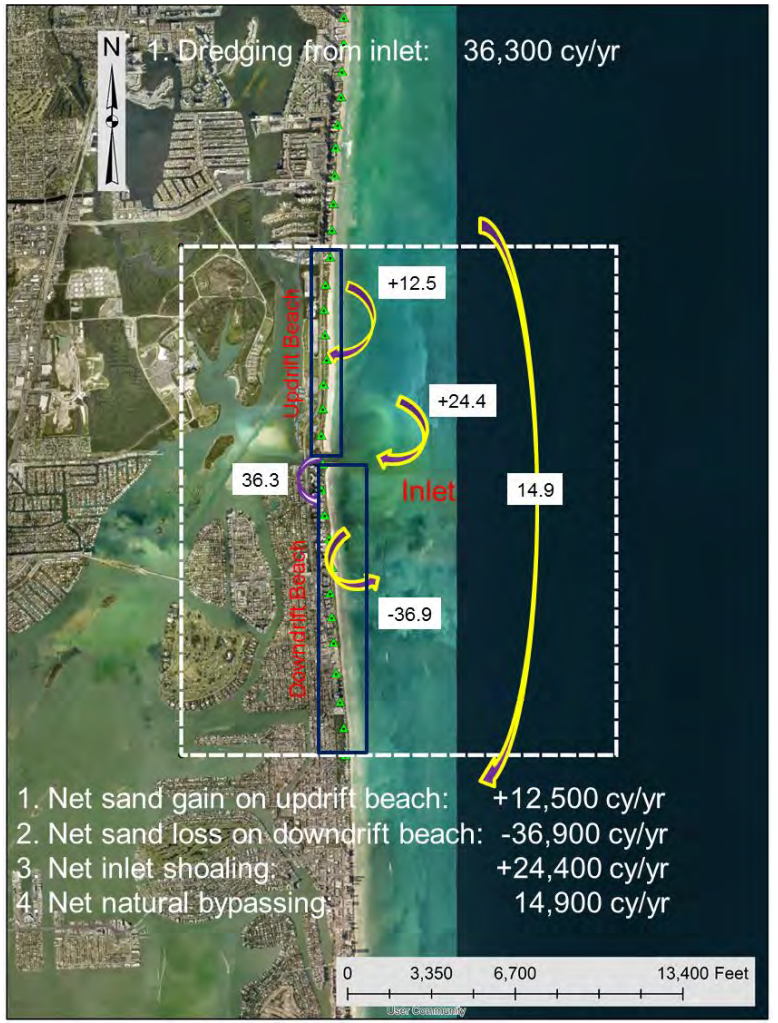
Comparison to 1995 Sediment Budget Update



Location	1995 Sediment Budget	Present Study
Net beach volume changes at north shoreline, (cy/yr)	-14,900	12,500
Net beach volume changes at south shoreline, (cy/yr)	-45,200	-36,900
Inlet shoaling (cy/yr)	24,300	60,700
Net natural bypassing, (cy/yr)	0.0	14,900



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Scenarios

A. No action (LRR, 2016)
B. No action – modified (ebb shoal every 10 years and flood shoal every 3 years)
C. North jetty extension plus beach borrow area (dredge)
    i. Excavation/nourishment every 4 years
    ii. Excavation/nourishment every 6 years
    iii. Excavation/nourishment every 8 years
D. North jetty extension plus sand trap borrow area
    i. Excavation/nourishment every 5 years
E. North jetty extension plus beach borrow area (truck haul)
    i. Excavation/nourishment every 4 years
    ii. Excavation/nourishment every 6 years
    iii. Excavation/nourishment every 8 years

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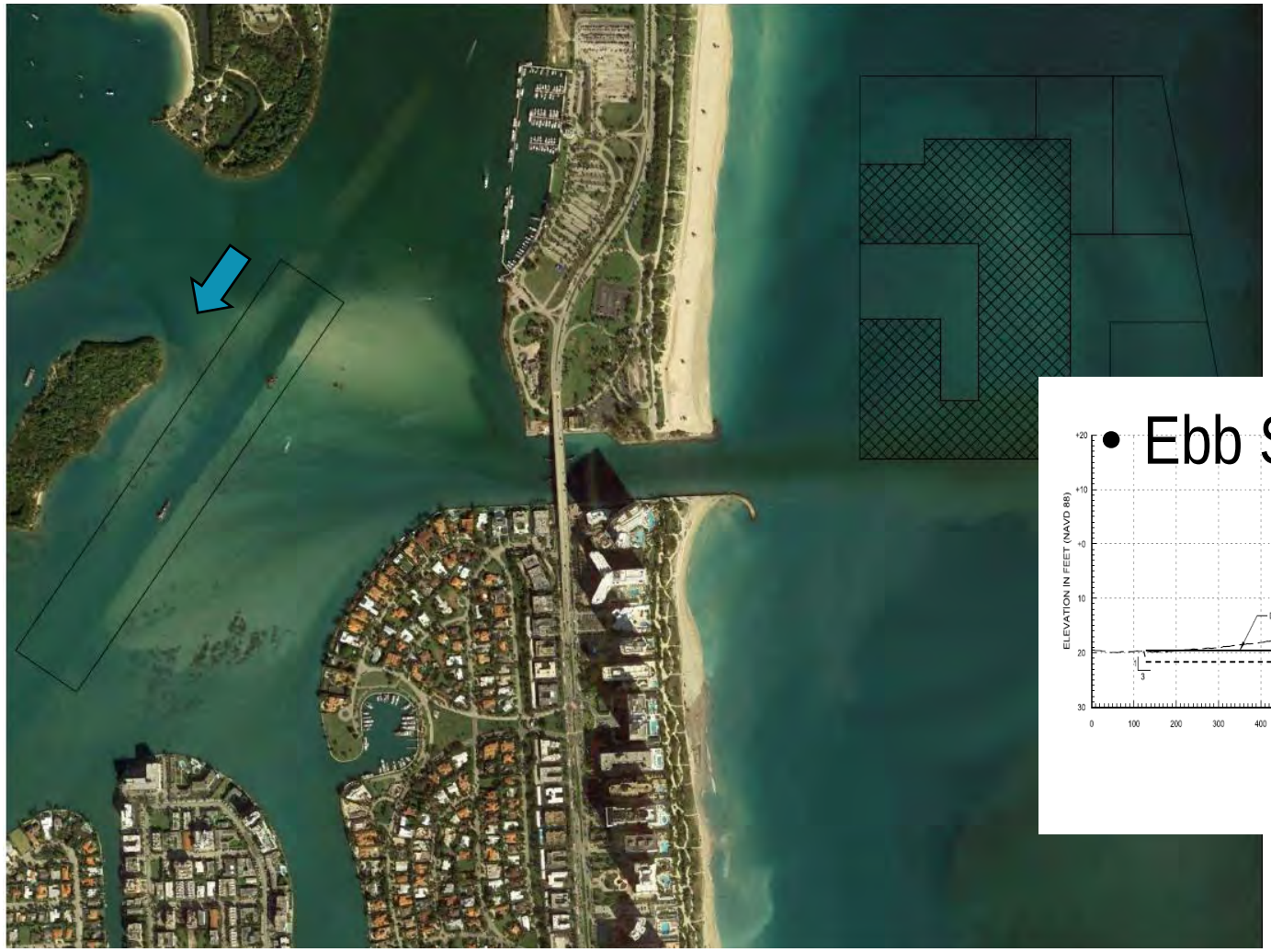
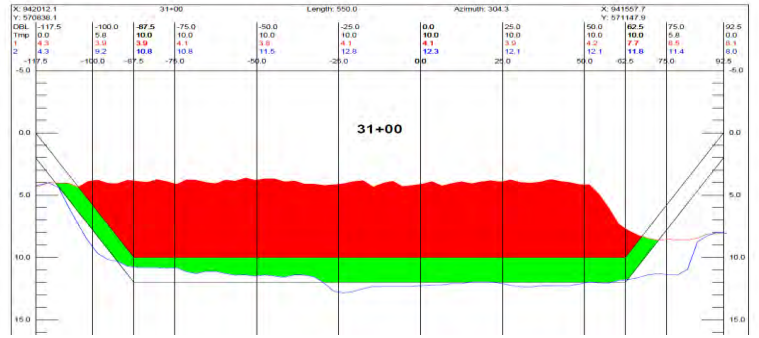
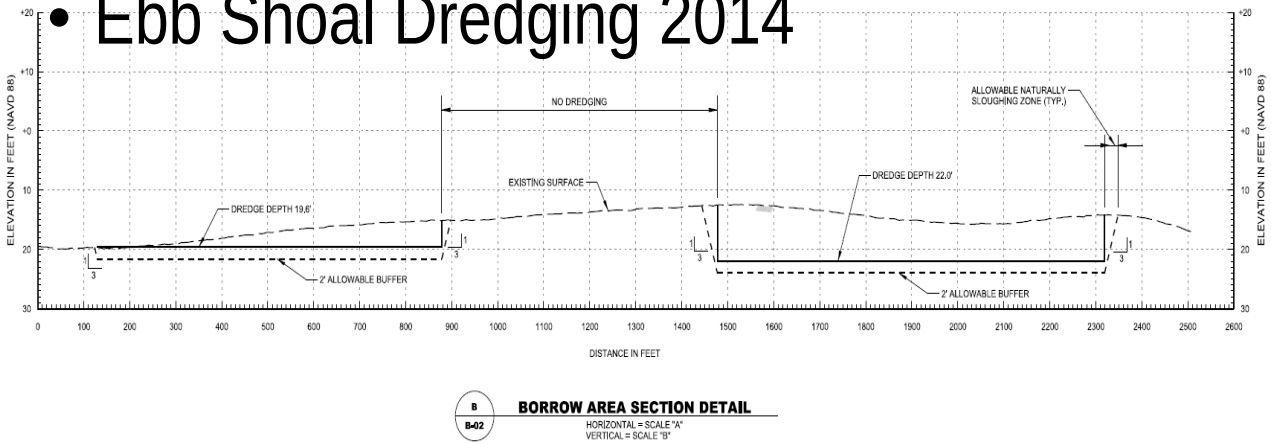
Periodic Dredging of Flood and Ebb Shoals



- Flood Shoal Dredging 2004



- Ebb Shoal Dredging 2014



B
B-02
BORROW AREA SECTION DETAIL
HORIZONTAL = SCALE "A"
VERTICAL = SCALE "B"

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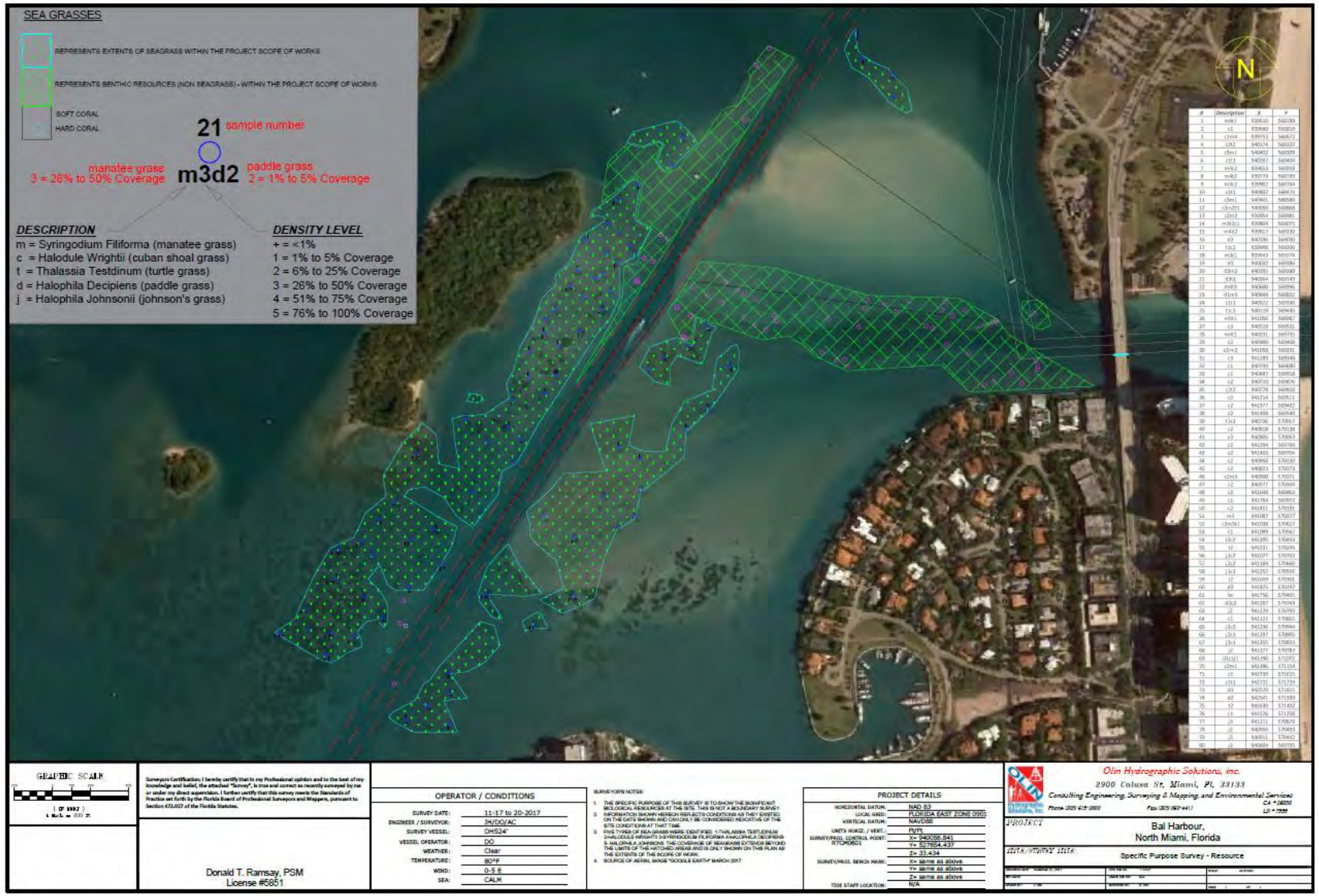
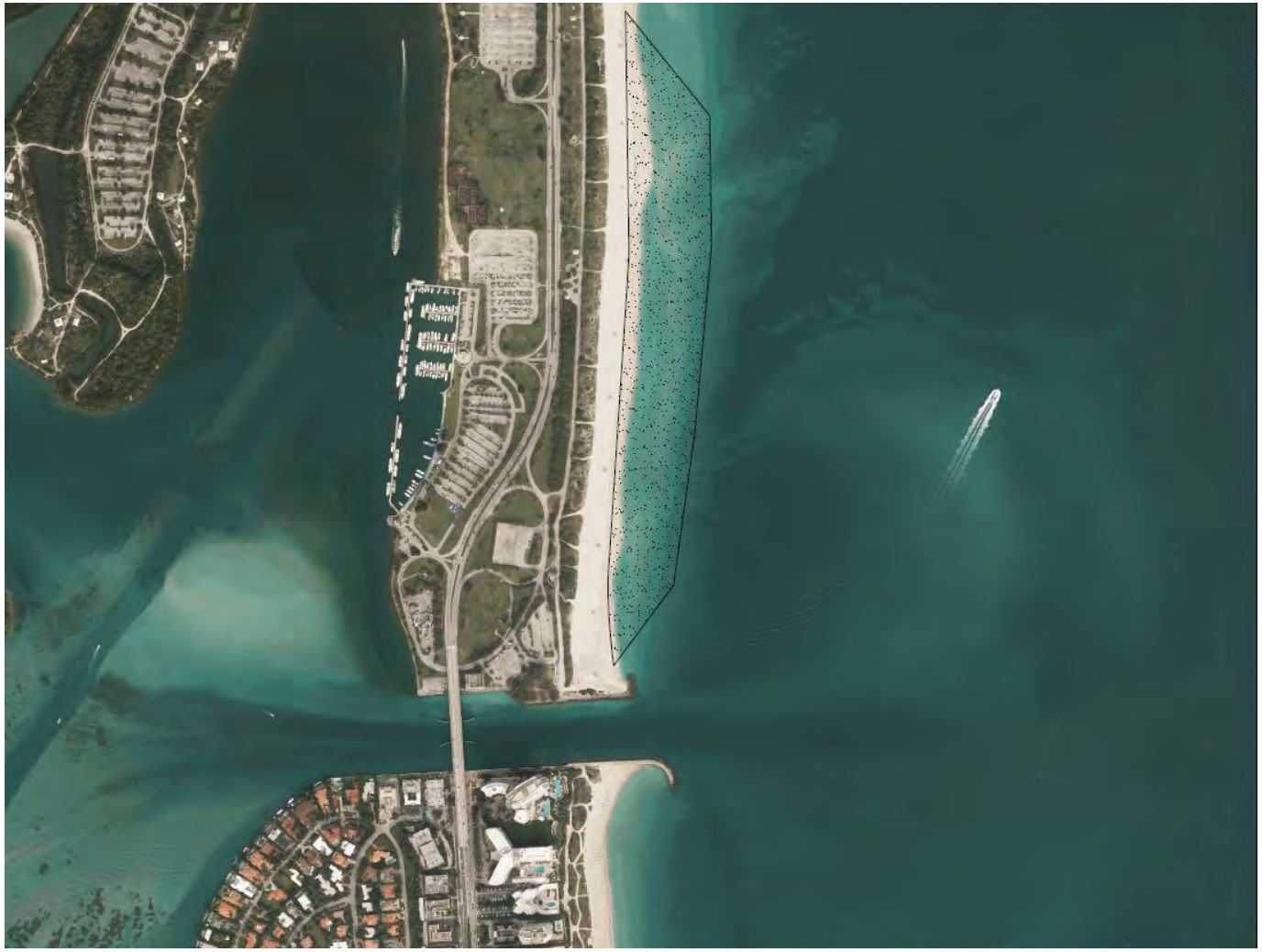
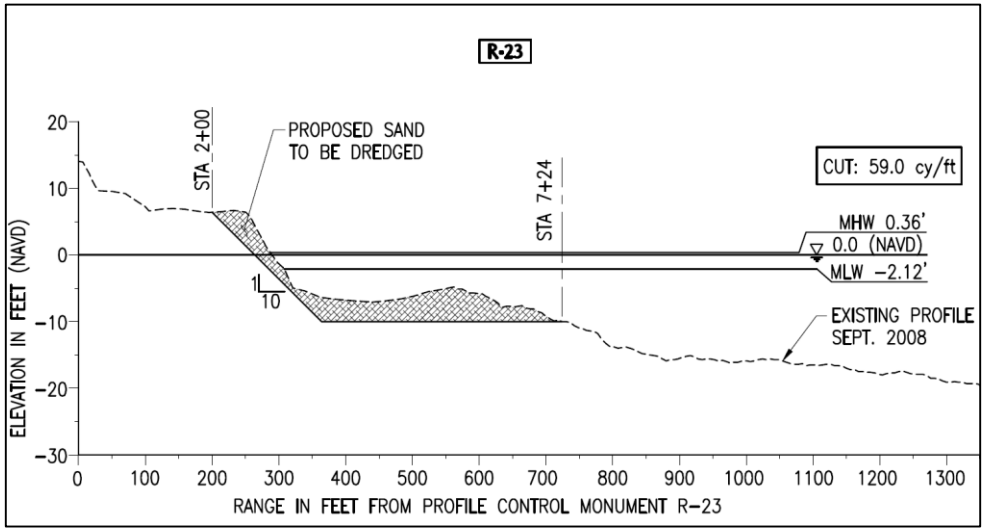
Periodic Dredging of Flood and Ebb Shoals

- Resource Survey November 2017
- Seagrasses and benthic resources



Beach Borrow Area – Alternative 1 (Bal Harbour Design)





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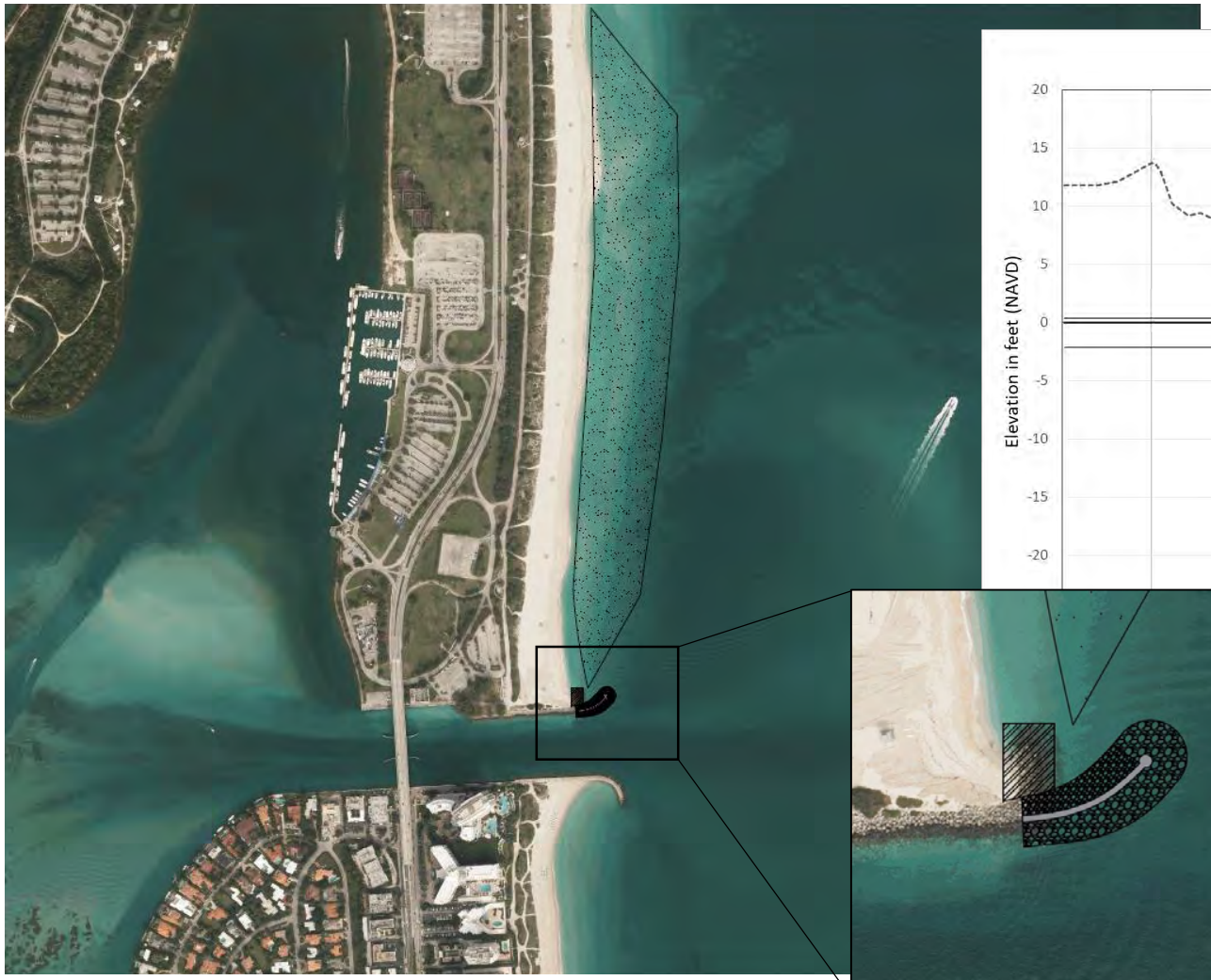
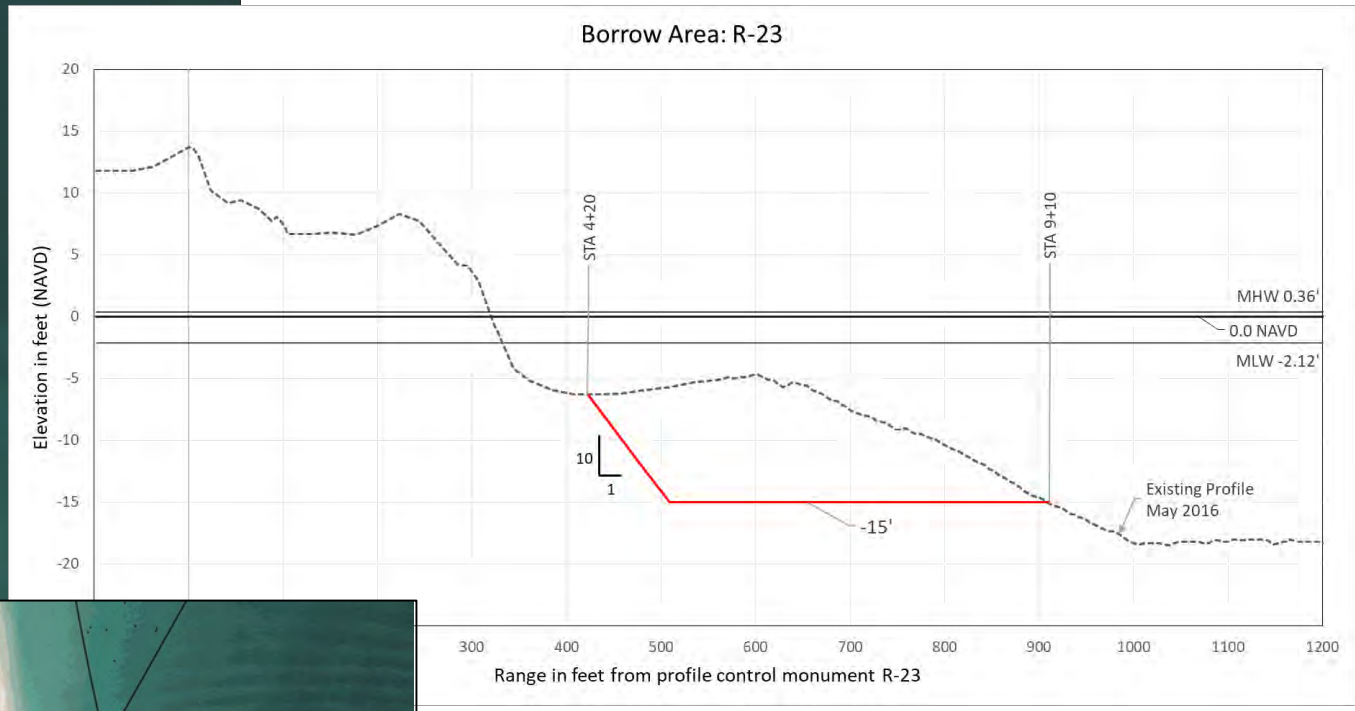
Beach Borrow Area - Alternative 3 – Deeper BBA and North Jetty Extension





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Sediment Trap and North Jetty Extension

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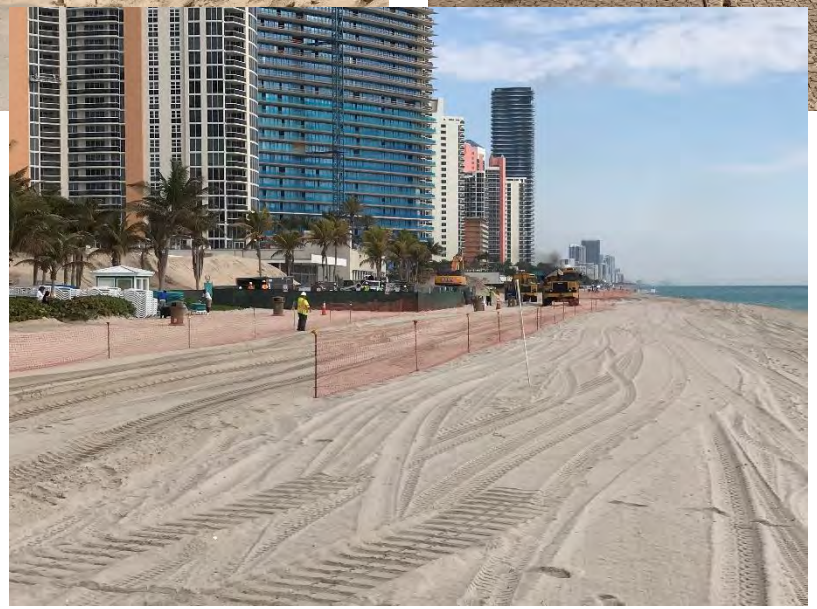
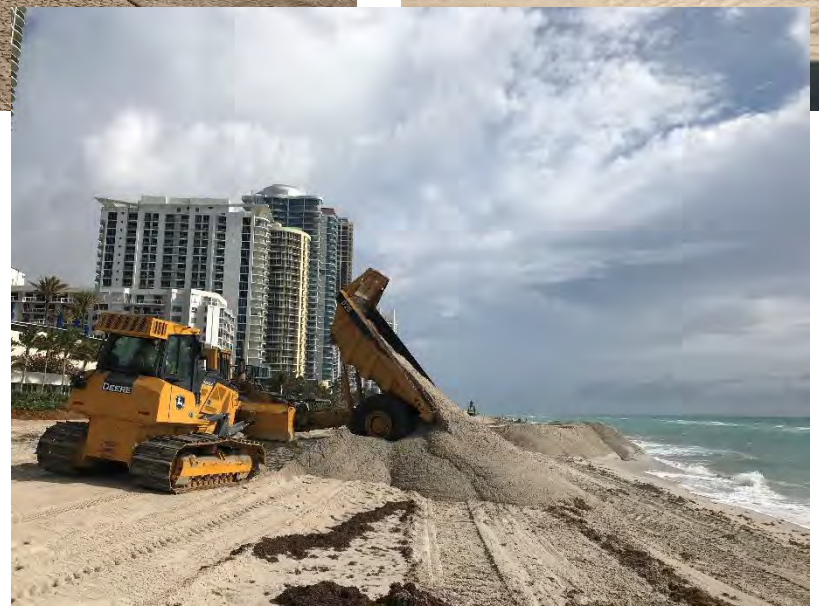
Truck Haul





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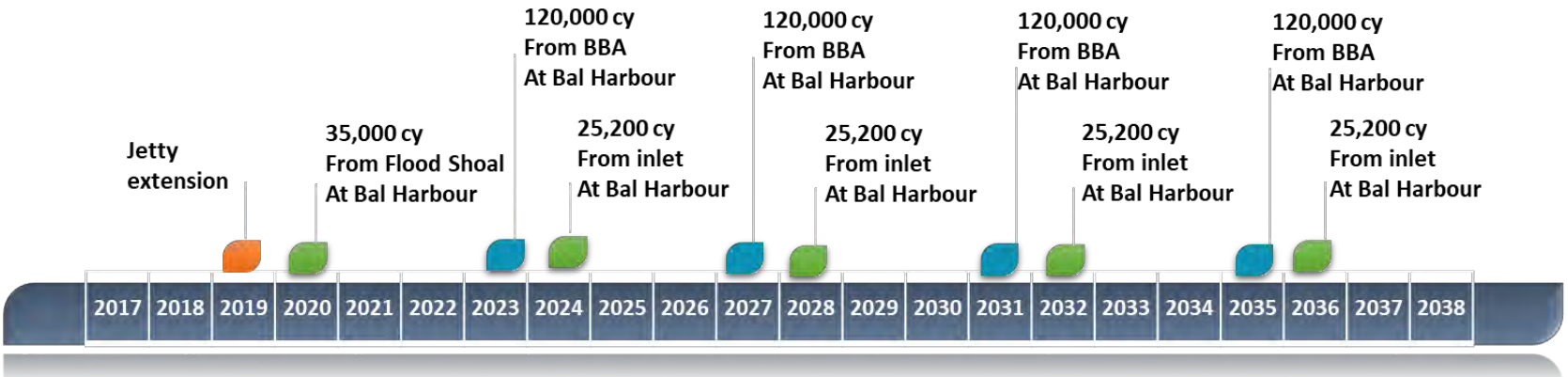
Analysis of Economics – Scenarios

	A		B		C1		C2		E1		E2	
	Source	Quantity (cy)	Source	Quantity (cy)	Source	Quantity (cy)	Source	Quantity (cy)	Source	Quantity (cy)	Source	Quantity (cy)
2018												
2019	SL10-T41	330,000			Jetty construction		Jetty construction		Jetty construction		Jetty construction	
2020	Flood Shoal	35,000	Flood Shoal	35,000	Flood Shoal	35,000	Flood Shoal	35,000	Flood Shoal	35,000	Flood Shoal	35,000
2021												
2022												
2023	Flood Shoal	35,000	Flood Shoal	35,000	BBA	120,000			BBA	120,000		
2024			Ebb Shoal	300,000	Inlet	25,200	Inlet	25,200	Inlet	25,200	Inlet	25,200
2025							BBA	180,000			BBA	180,000
2026	Flood Shoal	35,000	Flood Shoal	35,000								
2027					BBA	120,000			BBA	120,000		
2028					Inlet	25,200	Inlet	25,200	Inlet	25,200	Inlet	25,200
2029	Flood Shoal	35,000	Flood Shoal	35,000								
2030												
2031					BBA	120,000	BBA	180,000	BBA	120,000	BBA	180,000
2032	Flood Shoal	35,000	Flood Shoal	35,000	Inlet	25,200	Inlet	25,200	Inlet	25,200	Inlet	25,200
2033												
2034			Ebb Shoal	300,000								
2035	Flood Shoal	35,000	Flood Shoal	35,000	BBA	120,000			BBA	120,000		
2036					Inlet	25,200	Inlet	25,200	Inlet	25,200	Inlet	25,200
2037							BBA	180,000			BBA	180,000
2038	Flood Shoal	35,000	Flood Shoal	35,000								
Total		**575,000**		**845,000**		**615,800**		**675,800**		**615,800**		**675,800**

Scenario C1 timeline



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Technical Advisory Committee (TAC)

- Florida DEP
- Miami-Dade County DERM
- U.S. Army Corps of Engineers
- Florida Inland Navigation District (FIND) - (consultant Taylor Engineering)
- City of Sunny Isles Beach – (consultant APTIM)
- Village of Bal Harbour - (consultant Coastal Systems International)
- Town of Surfside - (consultant Calvin Giordano Associates)

Build Consensus - stakeholders

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Recommendations & Next Steps

- A 164 feet extension of the north jetty is recommended to trap the sand to be by-passed from the beach north of the inlet (updrift) to Bal Harbour beach (downdrift).
- A bypassing interval of four to six years is recommended.
- The design for subsequent intervals will be adjusted based on a Performance Monitoring program to be established in environmental permits.
- Refinement of the cost estimates is recommended through the environmental permitting and engineering design process, followed by a SWOT analysis.
- FDEP to complete updated inlet management plan (IMP) by end of 2019.

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