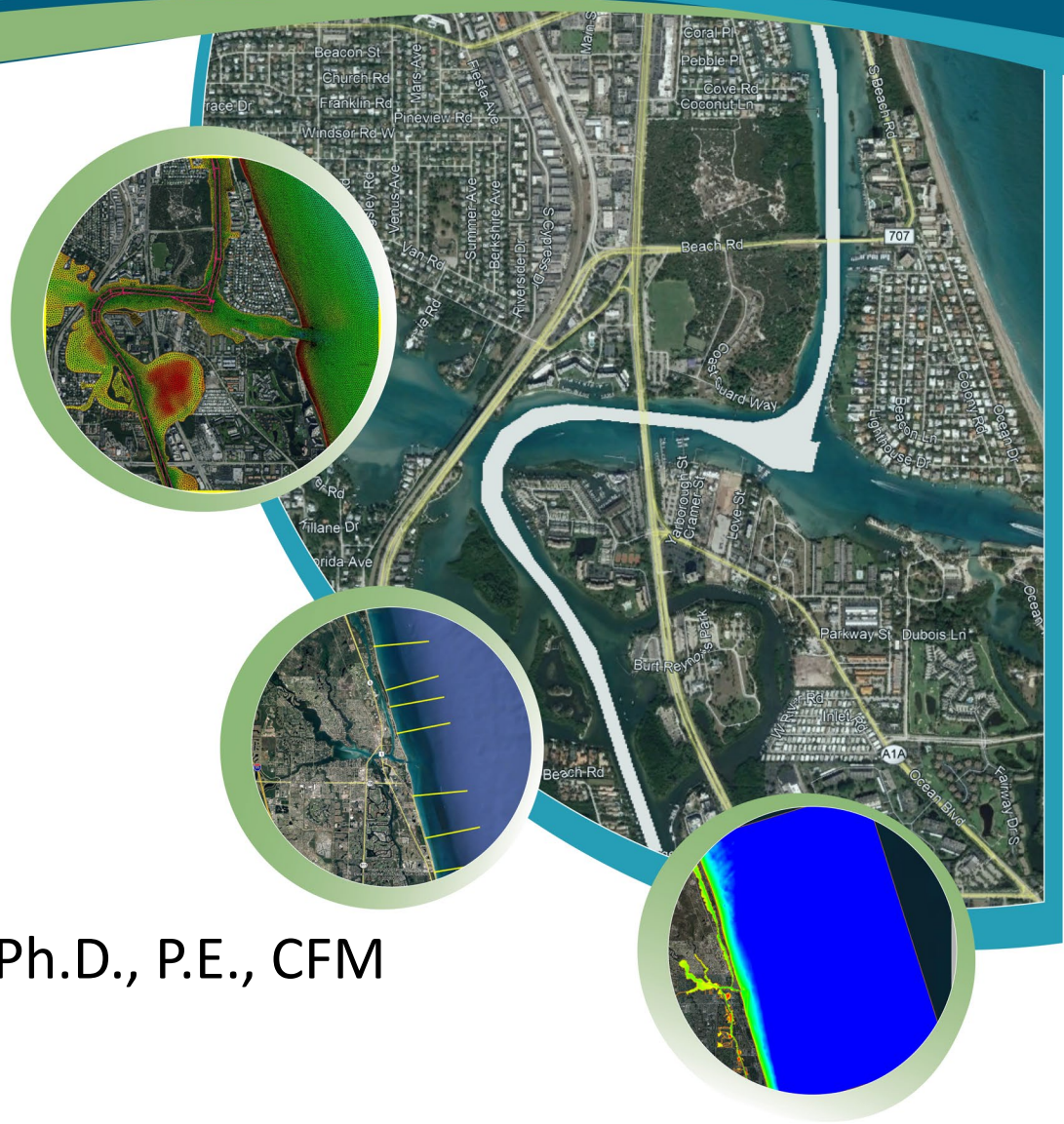
TAYLOR ENGINEERING, INC.

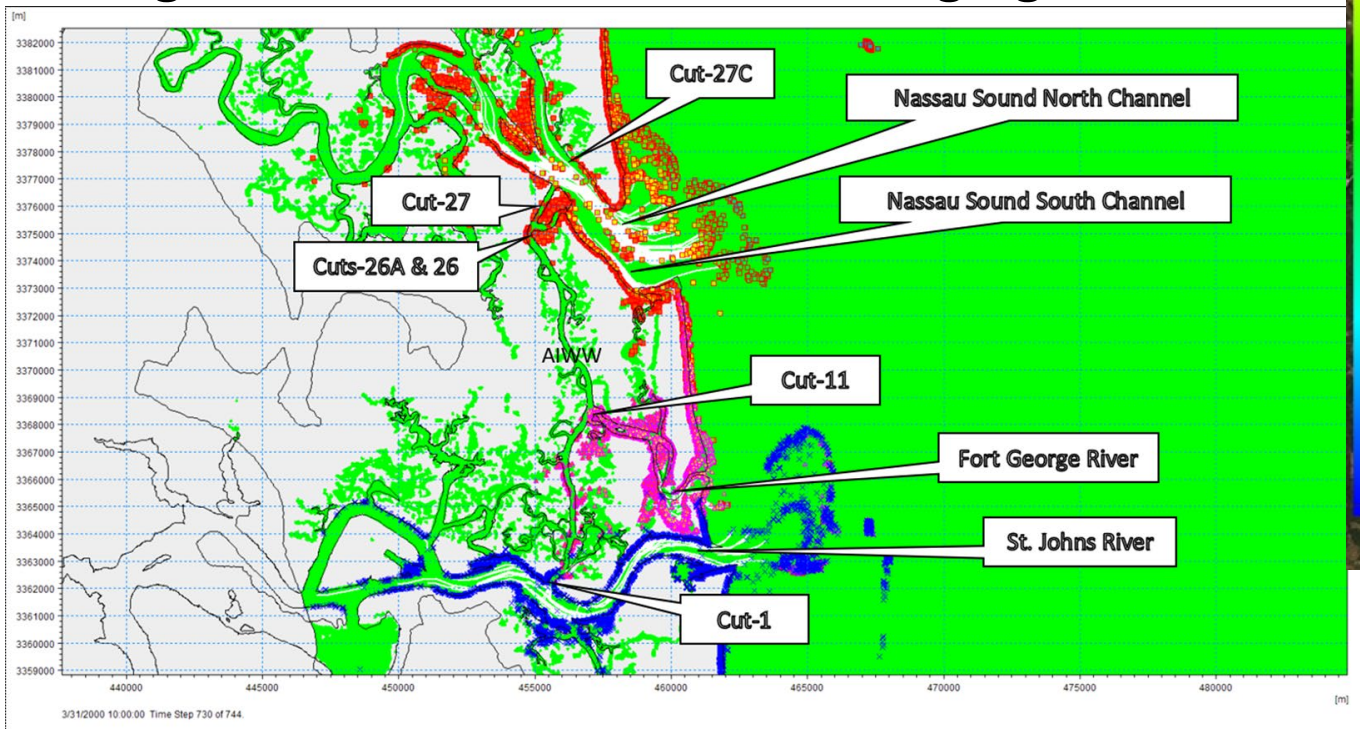
Analysis of Long-Term Shoaling Reduction Alternatives for Dredging Efficiencies in the IWW



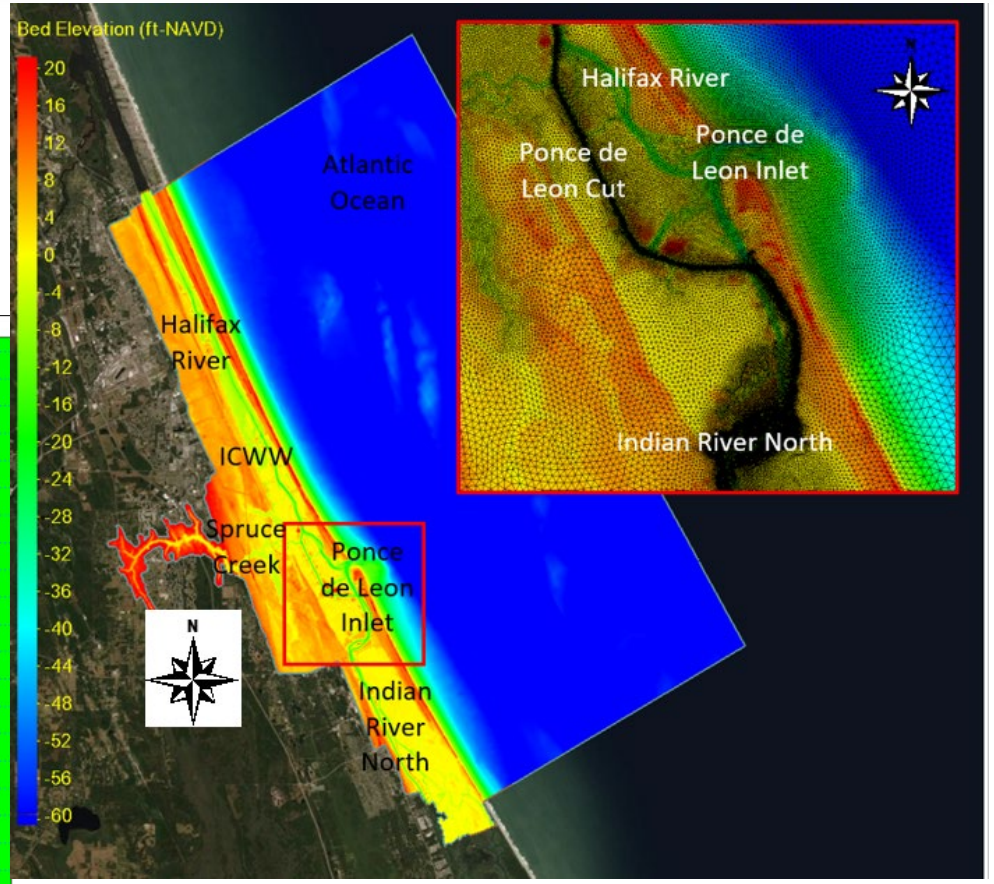
Presented by: Michael B. Kabiling, Ph.D., P.E., CFM
February 6, 2025

Background of FIND Dredging Efficiency Studies

- 2019 – FIND started the dredging efficiency studies
- Alternatives to reduce IWW shoaling and lengthen IWW maintenance dredging intervals



(a) Nassau Sound



(b) Ponce de Leon Inlet

(c) Jupiter Inlet

(d) Bakers Haulover Inlet

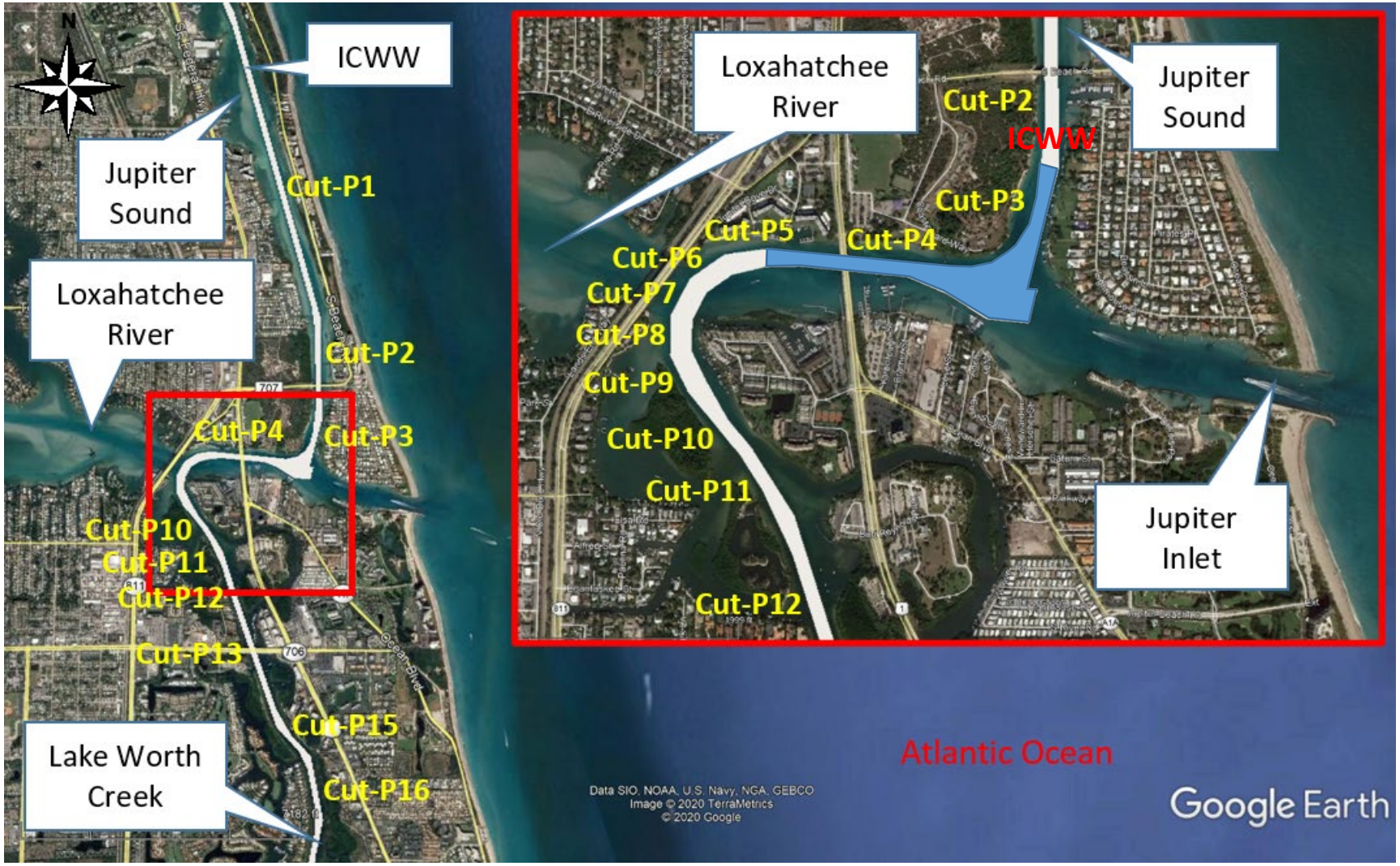
Jupiter Inlet Hydraulics & Sedimentation

Year	History of Total Dredge Volume (cy)
2014	90,000
2017	114,810
2020	95,000
2023	64,951

Average Dredging Interval = 3 years

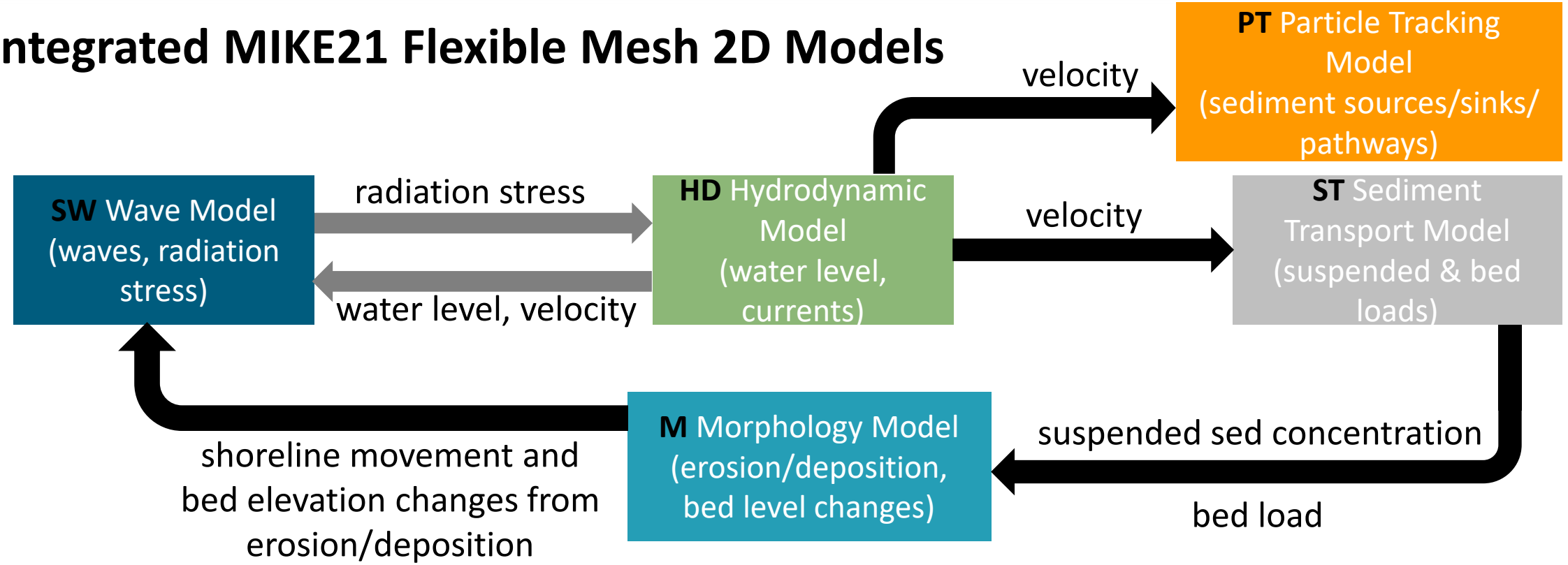
Shoaling Problem

- 48% IWW dredge volume at Cuts-P1 to P10
- Cuts-P3 and P4 account for 65% of the Cuts-P1 to P10 volume



MIKE Integrated & Fully-Dynamic Model

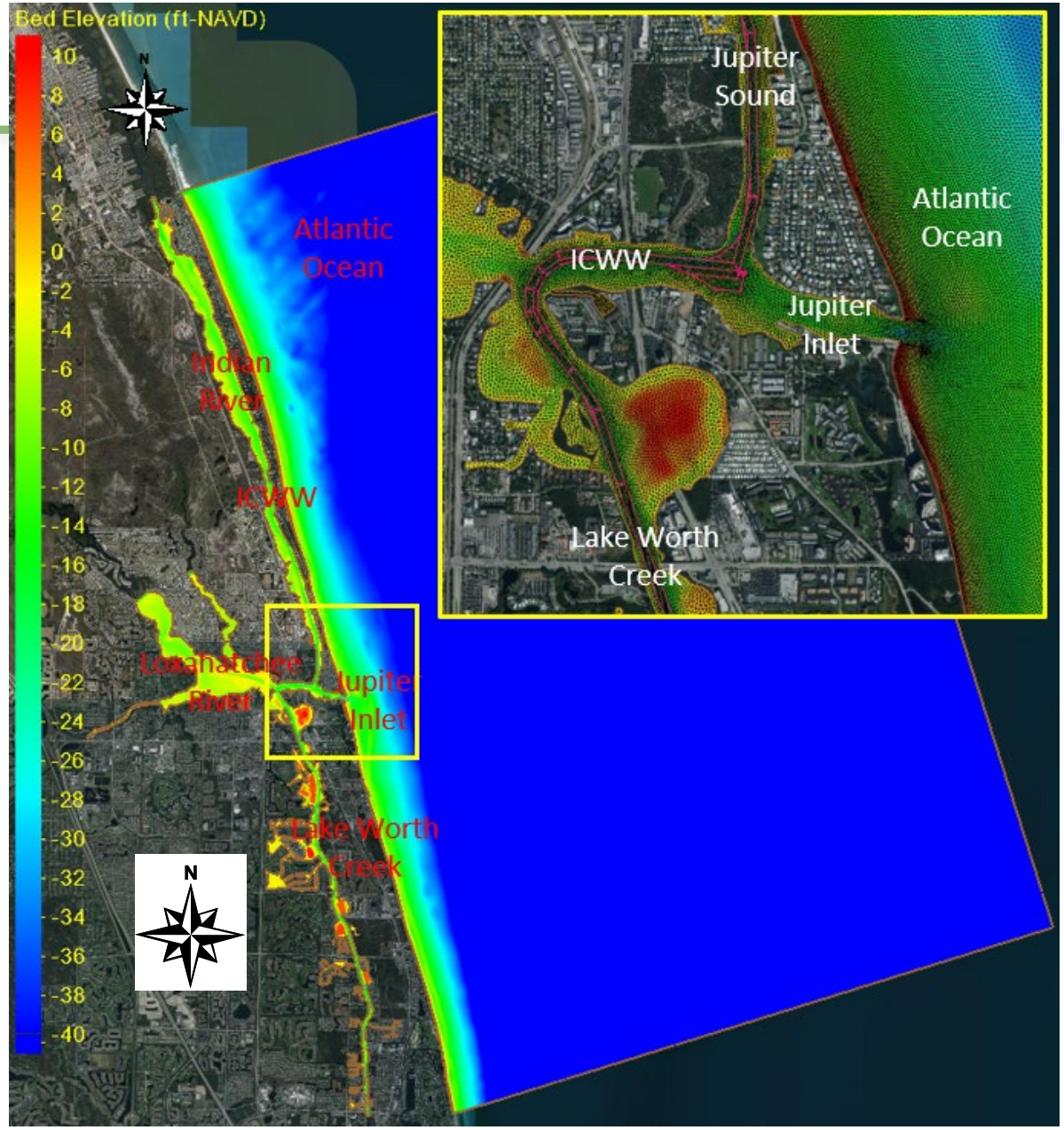
Integrated MIKE21 Flexible Mesh 2D Models



Morphology (M) – uses the ST model computed sediment transport to compute the shoreline changes or bed elevation changes that affect subsequent SW and HD model computations.

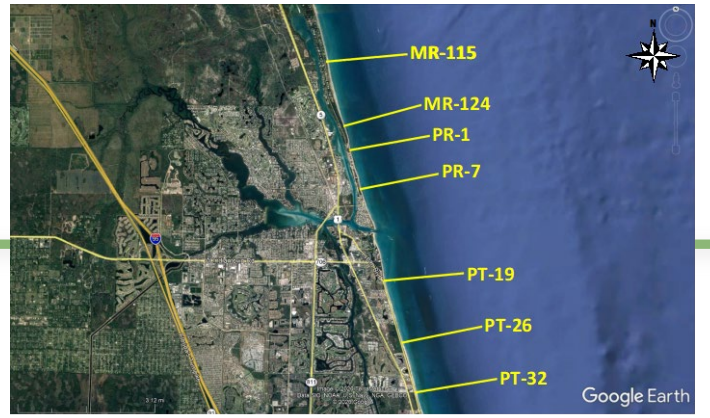
Jupiter Inlet Model Domain and Bed Elevations

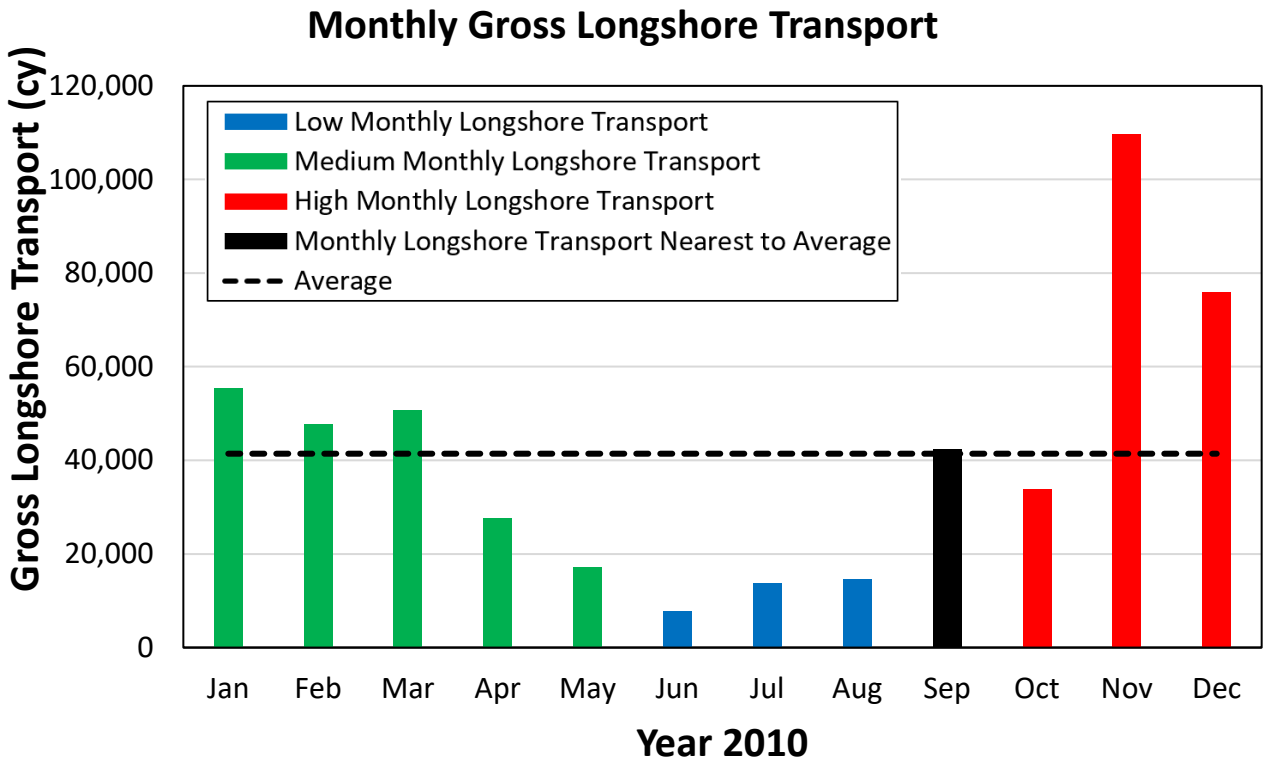
- Jupiter Inlet to approximately 10.0 miles (mi) east (offshore bound), 8.8 mi north (ocean north bound), and 7.1 mi south (ocean south bound).
- Jupiter Inlet – 0.5 mi.
- IWW – more than 16 mi.
- Loxahatchee River – 1.9 mi.
- Loxahatchee River NW Fork – 1.8 mi.
- Loxahatchee River N Fork – 2.1 mi.
- Loxahatchee River SW Fork – 0.7 mi.
- C-18 Canal – 1.4 mi.
- Lake Worth Creek – 7.5 mi.
- In Area of Interest – small elements provided more detailed information.



Representative Hydraulic Conditions

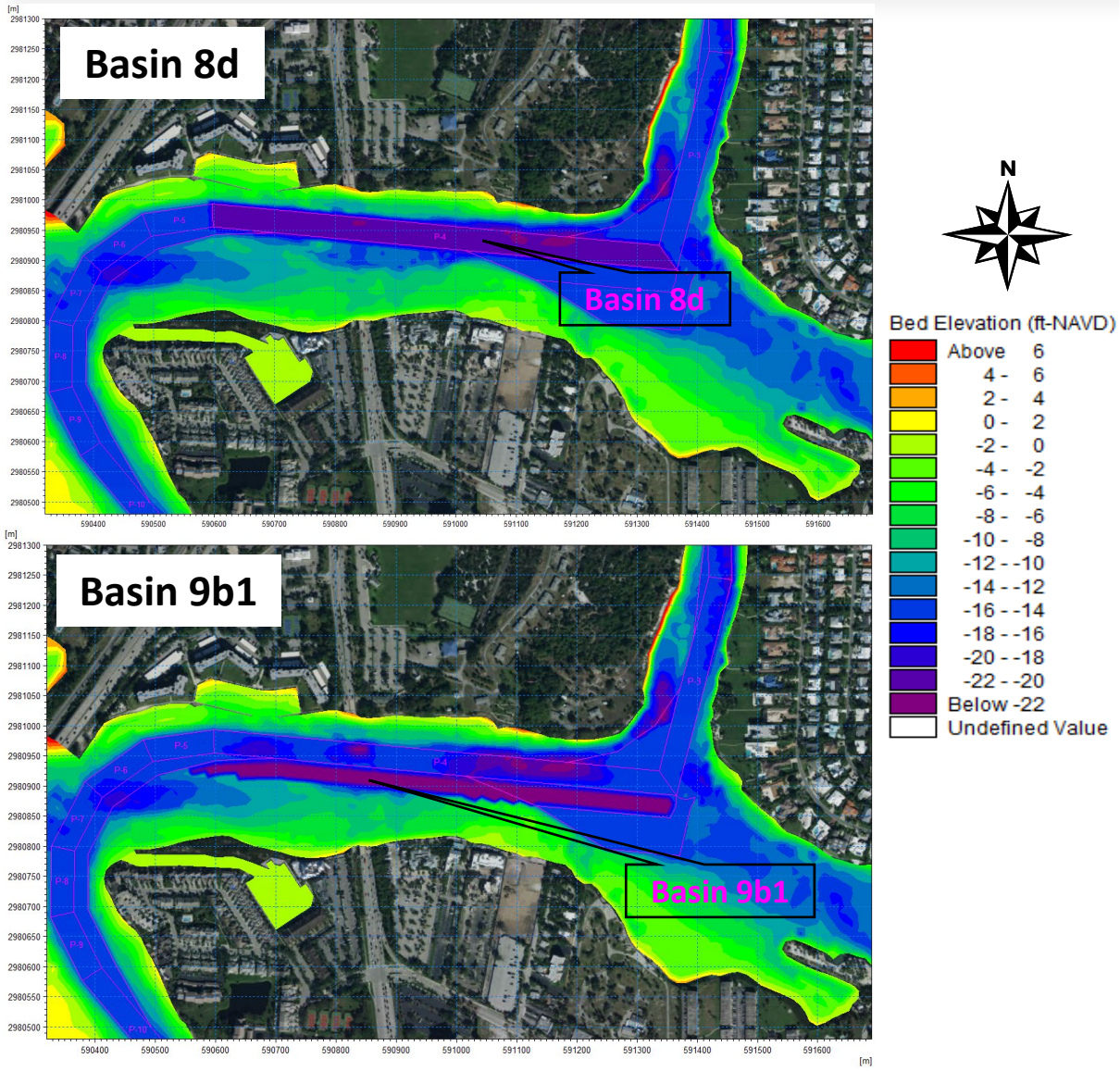
- Reviewed 1980 – 2014 WIS Station 63456 hindcasted wave records.
- Littoral Processes Model estimated annual gross littoral transport at transects.
- Calculated the average annual gross littoral transport.
- Checked for consistency with previous predictions.
- Year 2010 provides annual gross littoral transport nearest to the calculated annual average.
- Selected September 2010 for short-term and Year 2010 for long-term representative hydraulic conditions.





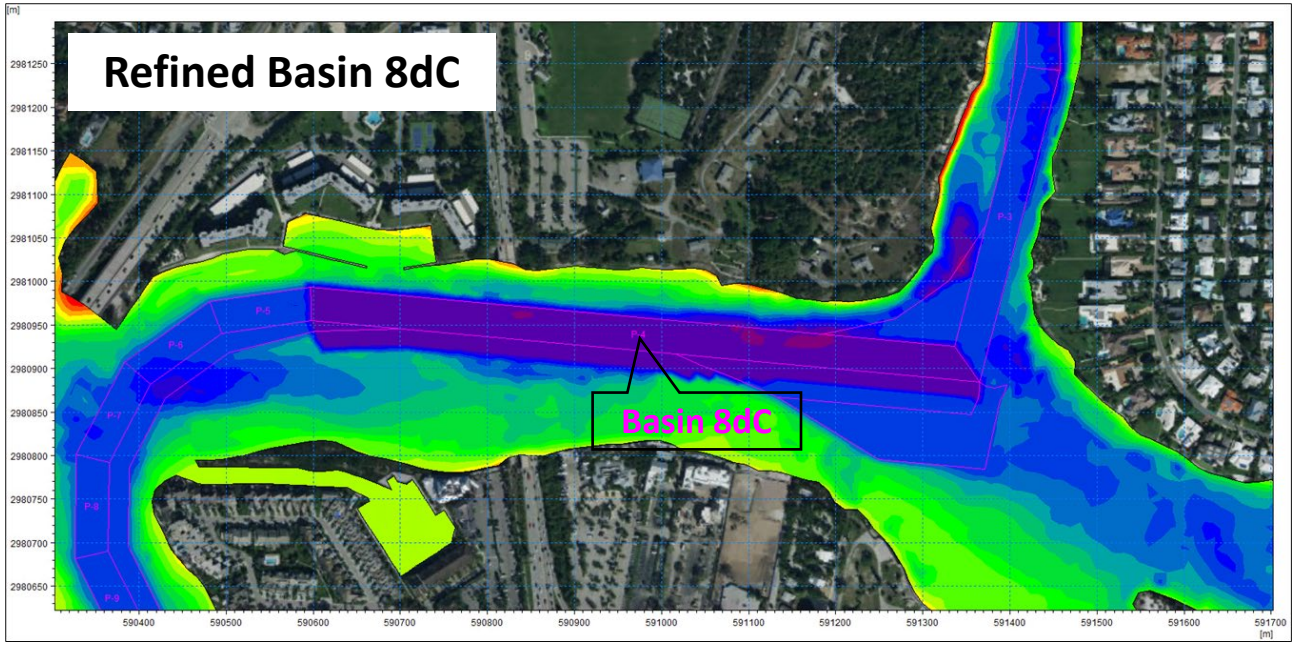
Monthly Gross Littoral Transport at Monument PR-1 Transect for the Year with Average Annual Gross Transport

Short-Term Top Two Alternatives and Refinement

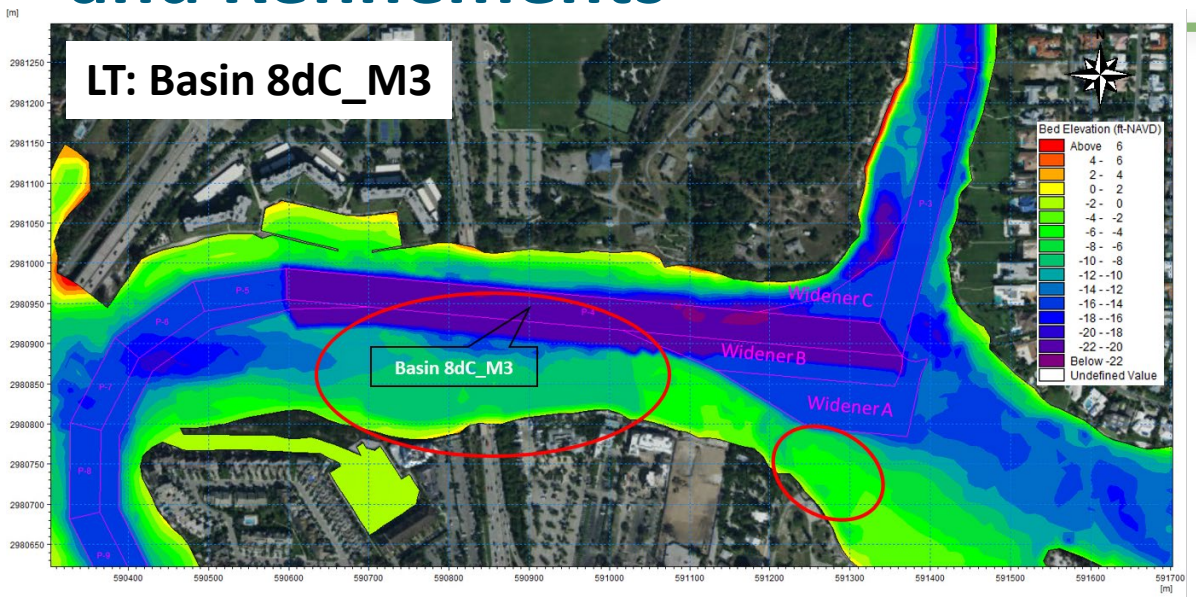


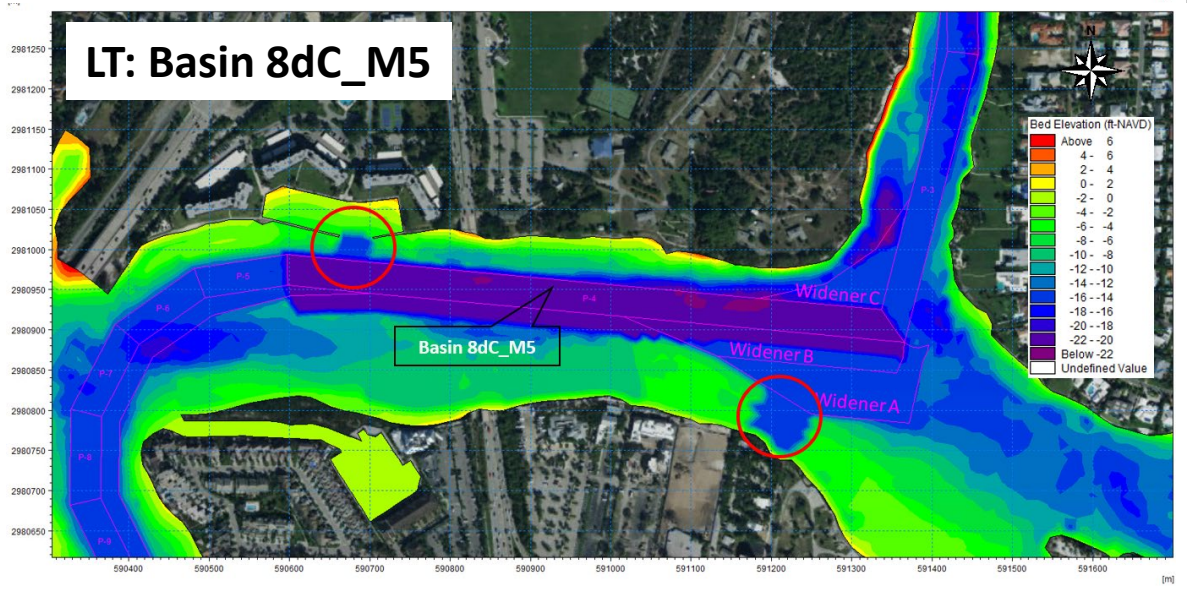
Alterna-tives	Short-Term Analysis New Basin Properties				
	Approx. Length, L (ft)	Approx. Width, W (ft)	Minimum Bed Elevation (ft-NAVD) / (ft-MLLW)	Approx. Area (acres)	Approx. Dredging Volume (cy)
Alt. 8d	2,480	120	-20.1 / -18.0	9.6	48,571
Alt. 9b1	2,650	40 – 130	-22.1 / -20.0	7.5	82,416
Alt. 8dC*	2,530	185	-20.1 / -18.0	13.2	86,618

*Note: * After short-term analysis basin refinement*



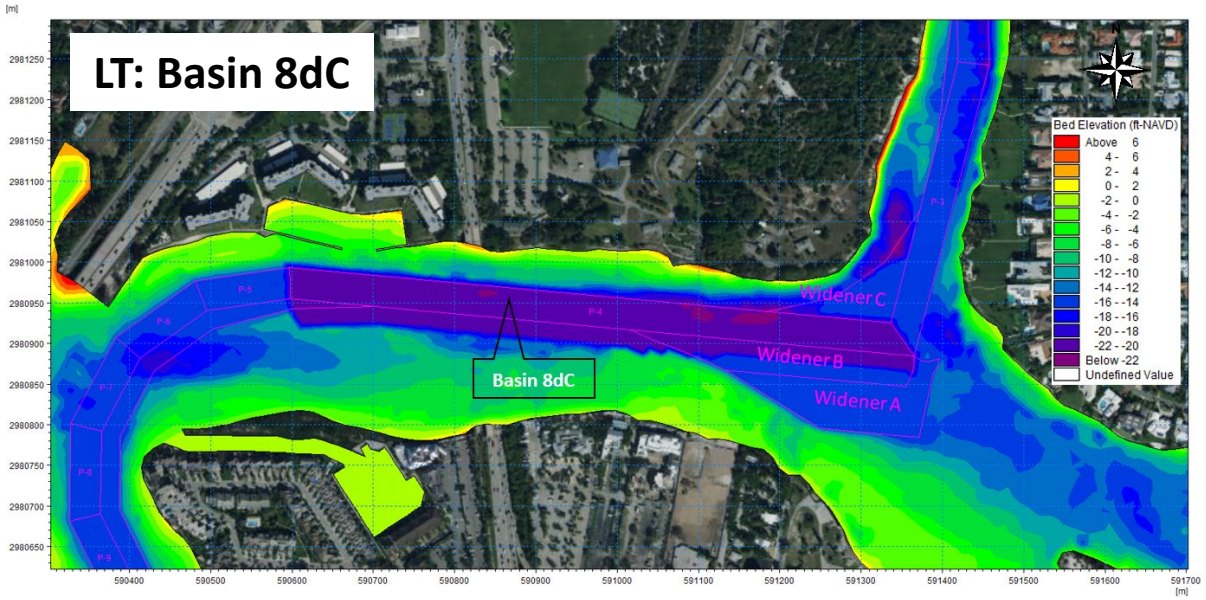
Long-Term Alternatives and Refinements





Alternatives	Long-Term Analysis New Basin Properties				
	Approx. Length, L (ft)	Approx. Width, W (ft)	Minimum Bed Elevation (ft-NAVD) / (ft-MLLW)	Approx. Area (acres)	Approx. Dredging Volume (cy)
8dC	2,530	185	-20.1 / -18.0	13.2	86,618
8dC_M3*	2,530	185	-20.1 / -18.0	22.1	113,691
8dC_M5*	2,530	185	-20.1 / -18.0	24.2	129,611

*Note: *Alt. 8dC_M3 and 8dC_M5 include marina pre-dredging.*



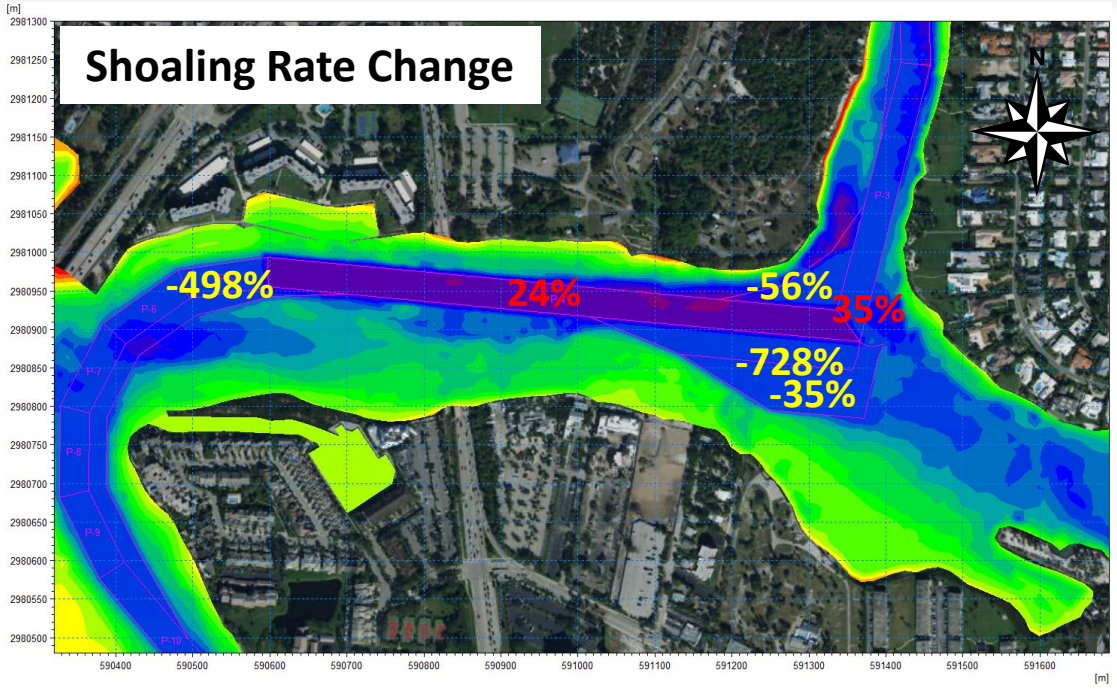
Ranking of Long-Term Alternatives

Alternatives	Basis for Ranking				Overall Ranking
	Performance	Cost Savings	Hydraulic Impact	Marina Sedimenta-tion Impact	
Alternative 8d	4	3.5	1	1	1
Alternative 8dC_M5	1	3.5	3.5	2	2
Alternative 8dC	3	1	2	4	3
Alternative 8dC_M3	2	2	3.5	3	4

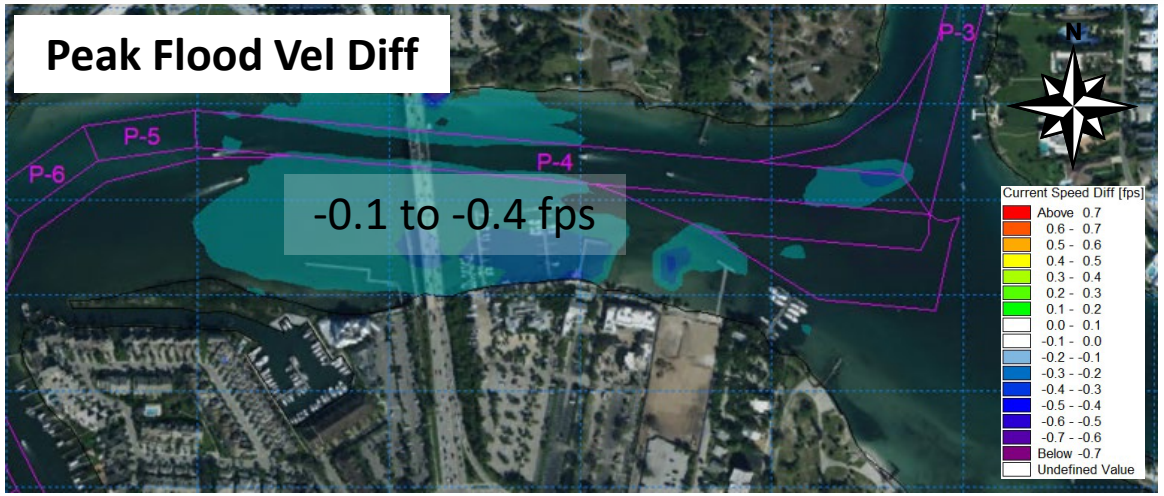
Basis for Ranking:

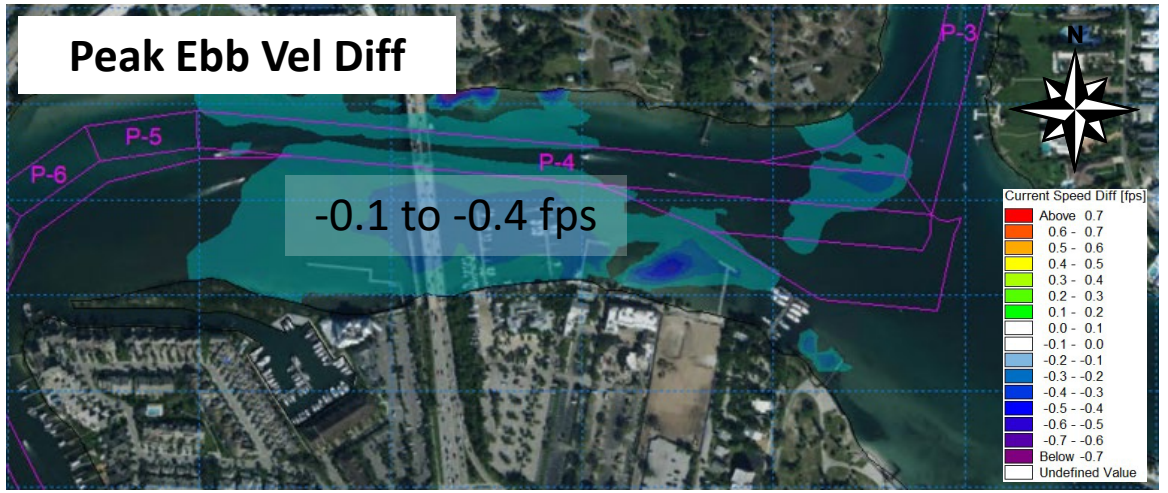
- **Performance** – reduction in IWW Cut-P4 shoaling
- **Cost Savings** – amount of savings relative to Baseline (no new basins)
- **Hydraulic & Marina Sedimentation Impact** – changes in flow velocity and sedimentation in marina areas

RANK 1: Basin Alternative 8d (125,171 cy per Dredge Event)

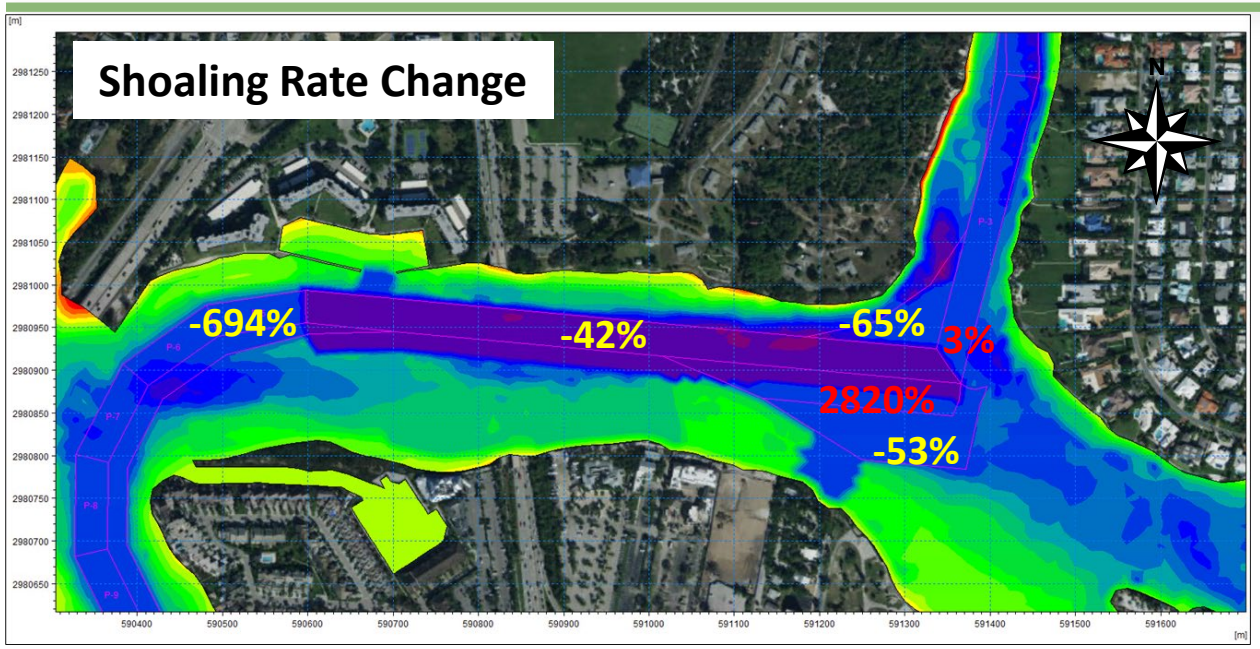


	Baseline	Alternative 8d
Dredging Interval (yr)	**3**	**5**
Cost per Dredging Event	$1,410,000	$1,892,000
Equivalent Annual Cost	$852,000	$709,000
Cost Savings per Year	**n/a**	**$143,000**

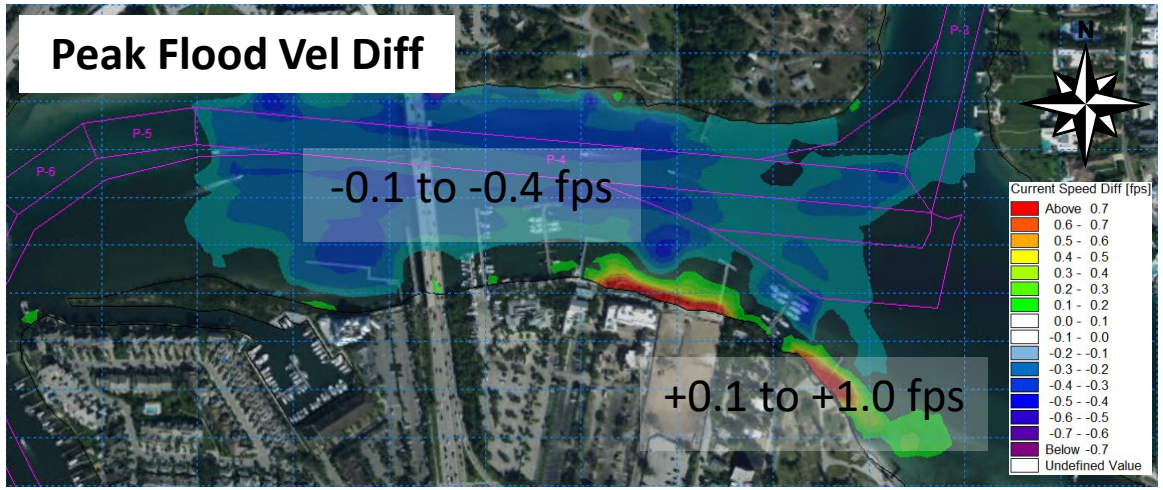


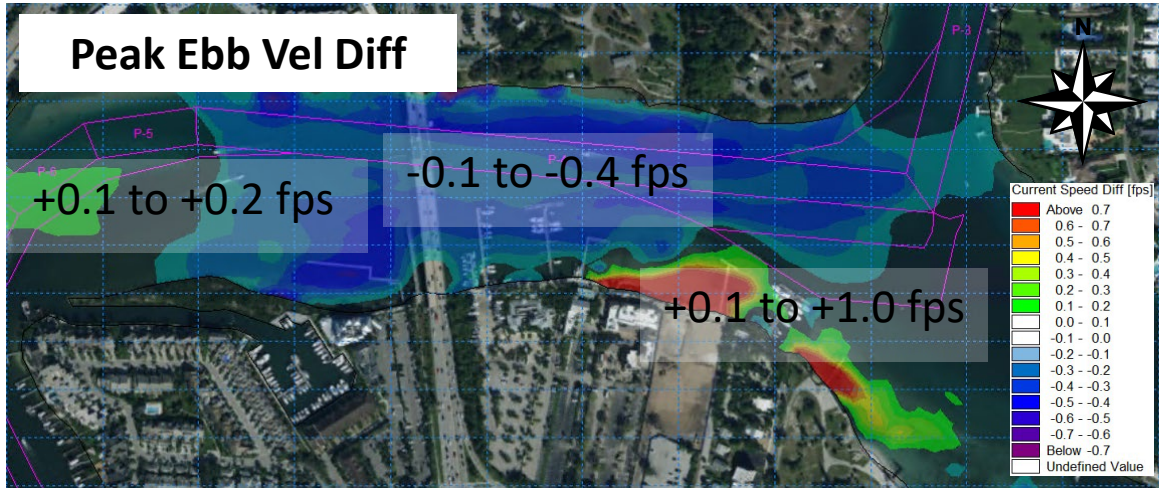


RANK 2: Alternative 8dC_M5 (206,811 cy per Dredge Event)



	Baseline	Alt. 8dC_M5
Dredging Interval (yr)	**3**	**7**
Cost per Dredging Event	$1,410,000	$2,672,000
Equivalent Annual Cost	$852,000	$710,000
Cost Savings per Year	**n/a**	**$142,000**





Details of Equivalent Uniform Annual Cost Estimates (Long-Term)

	Parameter	Baseline	Alt. 8d	Alt. 8dC	Alt. 8dC_M3	Alt. 8dC_M5
A.	**Dredging Frequency (years)**	3	5	7	7	7
B.	Project Life (years)	48	50	49	49	49
C.	Number of Dredging Events	16	10	7	7	7
D.	Quantity (cubic yards per event)	77,200	125,771	163,818	190,891	206,811
E.	Total Yardage (cubic yards)	1,235,200	1,257,710	1,146,726	1,336,237	1,447,677
F.	Yardage Cost (Per Dredging Event)	$645,550	$1,051,703	$1,369,854	$1,596,239	$1,729,363
G.	Mobilization/Demobilization Cost	$580,666	$580,666	$580,666	$580,666	$580,666
H.	Total Dredging Cost (F+G)	$1,226,216	$1,632,369	$1,950,520	$2,176,905	$2,310,029
I.	Permitting Cost (initial $50,000 and $15,000 at every dredging event)	n/a	$15,000	$15,000	$15,000	$15,000
J.	Environmental Study Cost (initial $20,000 and $5,000 per acre at every dredging event)	$0	$0	$0	$0	$0
K.	E&D Cost (initial $110,000 and 5% of Total Dredging Cost at every dredging event)	$61,311	$81,618	$97,526	$108,845	$115,501
L.	Construction Administration Cost (10% of Total Dredging Cost)	$122,622	$163,237	$195,052	$217,691	$231,003
M.	Total Cost (H + I + J + K + L)	$1,410,148	$1,892,224	$2,258,098	$2,518,441	$2,671,533
N.	Total Cost (Rounded to Nearest Thousand)	$1,410,000	$1,892,000	$2,258,000	$2,518,000	$2,672,000
O.	**Equivalent Uniform Annual Cost**	$852,000	$709,000	$600,000	$669,000	$710,000
P.	**Annual Savings**	**n/a**	**$143,000**	**$252,000**	**$183,000**	**$142,000**

Recommendations

1. Proceed with the permitting, engineering, and design of basin for Alternative 8d.
2. The existing US-1 Bridge crosses over Cut-P4. As the Florida Department of Transportation (FDOT) will be replacing the bridge in the near future, any changes to the IWW channel dimensions under the bridge will have to be coordinated with the FDOT.
3. Engineering design for the final channel and basin modifications should evaluate long-term (e.g., year-long) shoaling rate variation for better estimation of the variation of the sediment impoundment performance of channels and basins and to better account for more potential variations of waves and water levels.
4. Future bathymetric surveys should include the areas of proposed basin locations to establish baseline shoaling rates at these locations.

THANK YOU
Questions?

Email to:
mkabiling@taylorengineering.com