Packery Channel, Baseline Physical Process Monitoring Overview and Status

Nicholas Kraus
Corps of Engineers, Coastal and Hydraulics Laboratory (Inlet designer)

Deidre Williams
Texas A&M University – Corpus Christi (Monitoring)

Lauren Augustin
Texas A&M University, College Station (Modeling)

Carl Anderson
Corps of Engineers, Galveston District (Packery Channel Project Manager)

Andrew Smith
Corps of Engineers, (Project site inspector)

October 17, 2006

May 06, before north jetty completion

Chronology

4 Aug 05

1. Oct 03. Construction began.
2. Dec 03- Ap 04. Dredged and placed 110,000 cu yd of sand along southern shoreline to Whitecap (end of seawall).
3. Jul 05. Channel opened by H. Emily.
4. Aug-Sep 05. Storm surge associated with Rita and Katrina impacted area.
5. Jul-Dec 05. Narrow channel remains open.
6. Jan-Feb 06. Dredging of channel, partial placement at south end of seawall.
7. Mar 06. S. Jetty complete to 1,400 ft.
8. Oct 06. N. Jetty complete to 1,400 ft.

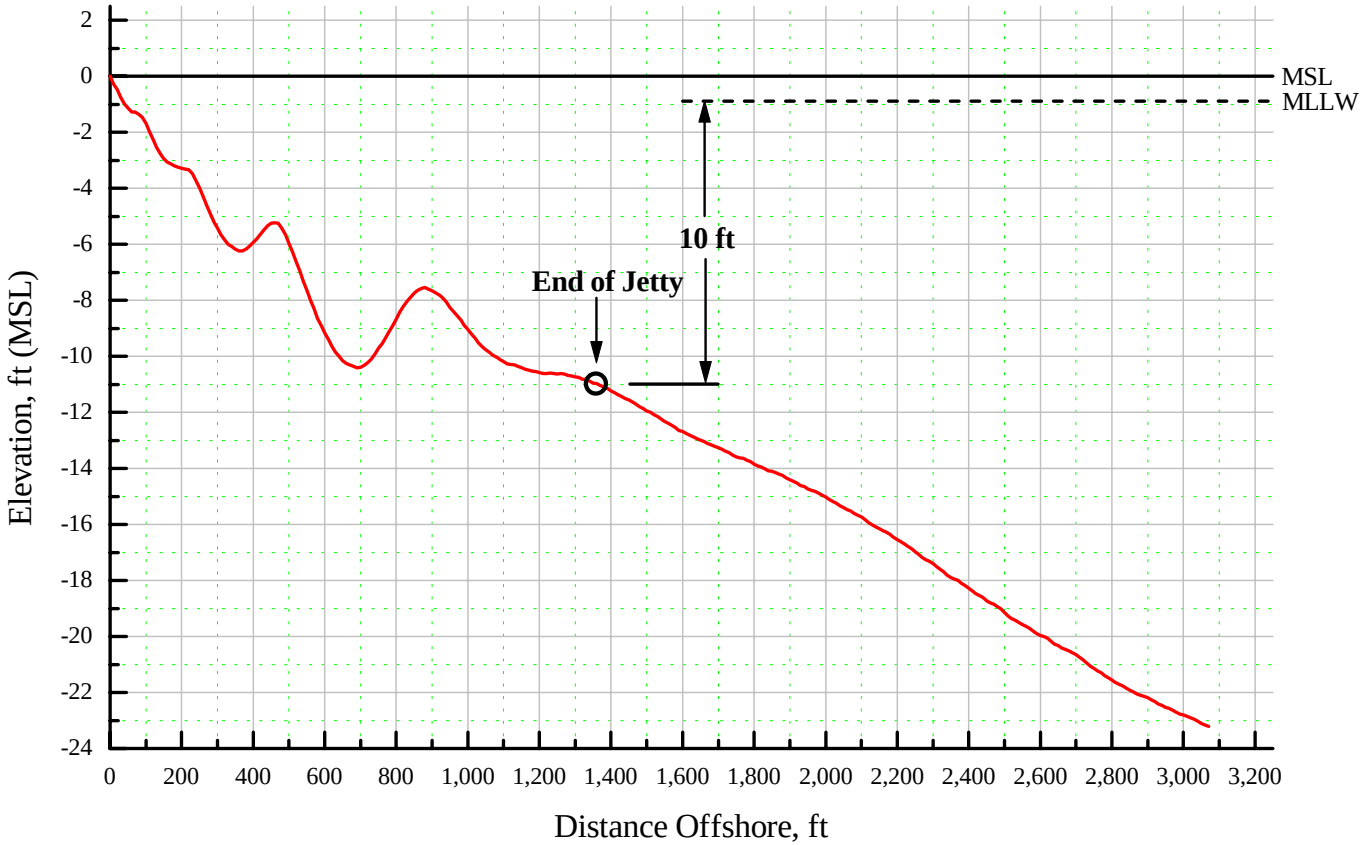
Overview of Presentation

1. Packery Channel design overview
2. Monitoring program, example results
3. Key findings from monitoring to date
4. Preliminary modeling
5. Comments to City

Acknowledgement: Almost all aerial photographs shown in this presentation were taken by Lanmon Aerial Photography, Inc., Corpus Christi, Texas

1. Packery Channel Design

- Documented in Kraus & Heilman (1997) and in Brown & Militello (1997) http://goliath.cbi.tamucc.edu/TexasInletsOnline/



Packery Channel Design

Comparison of Selected Inlets along Texas Coast

Table 3. Approximate geometry of five Texas Gulf Coast passes.					
Pass	**Jetty Length, ft (perpendicular to shoreline)**	**Estimated Depth at Jetty Tip, ft**	**Distance Between Jetties, ft**	**Depth of Entrance Channel, ft**	**Width to Depth Ratio**
Colorado River	East Jetty: 1,400 West Jetty: 600	13	1,300	16	81
Aransas Pass	North Jetty: 11,000 South Jetty: 9,000	30	1,300	47	28
Fish Pass	870	8	400	8, 4[9]	50, 100
Packery Channel (Proposed)	1,400	11	300	11	27
Mansfield Pass	1,350[10]	15	1,000	16	63

Packery Channel Design

Packery Channel expected to be stable, relatively easy to maintain, and cause moderate shoreline change because:

1. A historic hurricane overwash pass and historic entrance to Corpus Christi Bay.
2. Designed to have low jetty width to channel depth ratio (hydraulically efficient).
3. Located in Gulf of Mexico near zero net littoral sand drift.
4. Located in southeast corner of bay; benefits from current produced by wind fronts from north.

Packery Channel 14 months after September, 1967, Hurricane Beulah

2. Monitoring Program

Supported by Corps Galveston District for 3 years @ ~ $200,000/year
Augmented by the Corps' national Coastal Inlets Research Program

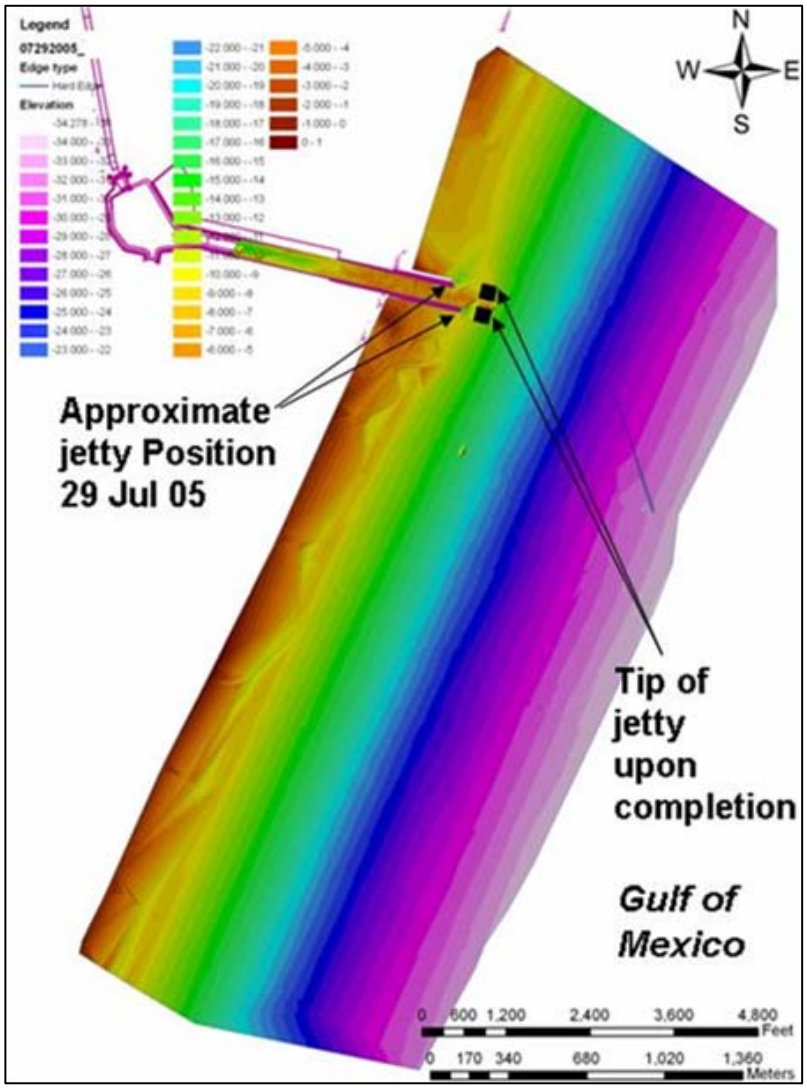
1. **Survey Nearshore and Channel**
   - **Beach profile**
   - **Shoreline position**
   - **Ebb shoal**
   - **Channel**
   - **Sediment grain-size analysis**

2. **Measure Current and Numerically Model Circulation**
   - **Packery Channel**
   - **GIWW at JFK**
   - **Begin numerical model development**

3. **Obtain and Interpret Aerial Photography**

4. **Manage and Disseminate Data**
   Texas Inlets Online (all data posted – publicly available)

“Ebb Shoal Surveys”



Ebb Shoal Survey 29 Jul 05

1. One week after Hurricane Emily forced Packery Channel open.

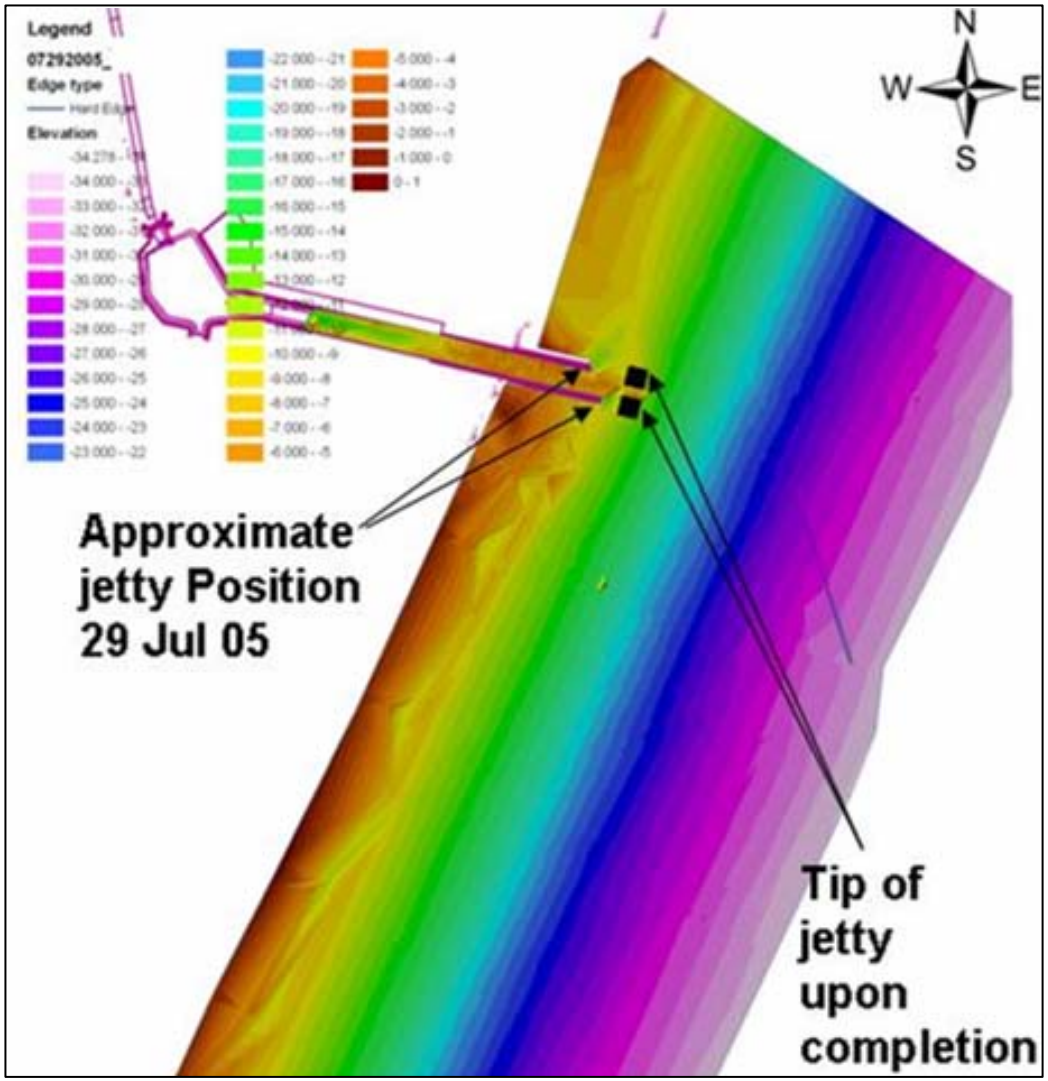
2. South jetty ≈75% complete and north jetty ≈ 50% complete at that time.

3. Inner Channel depths 12-13 ft NAVD88 (MSL=+0.48 ft).

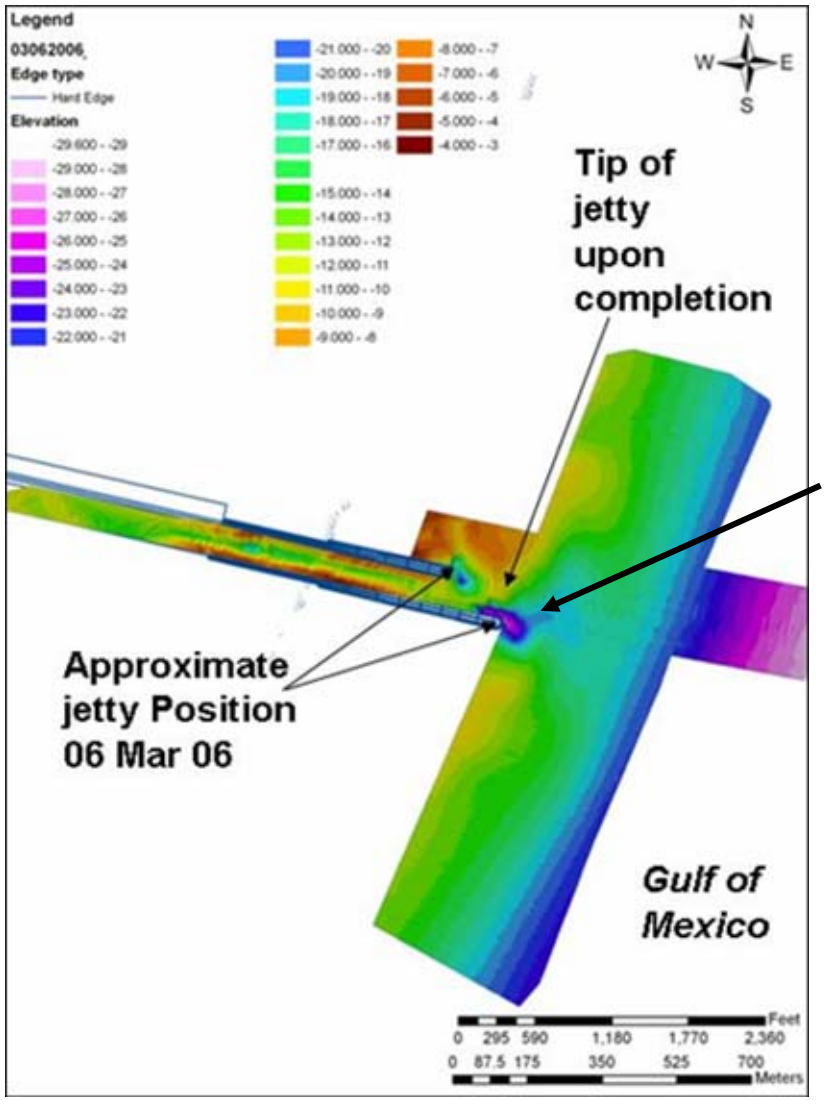
4. Storm surge opened the channel mouth, producing channel mouth depths of 4-8 ft NAVD88.

5. Depths at projected jetty length are 12-13 ft NAVD88.

29 Jul 05
Almost Pre-Construction



06 Mar 06


Legend
03062006
Edge type
Hard Edge
Elevation
-29.600 - -29
-29.000 - -28
-28.000 - -27
-27.000 - -26
-26.000 - -25
-25.000 - -24
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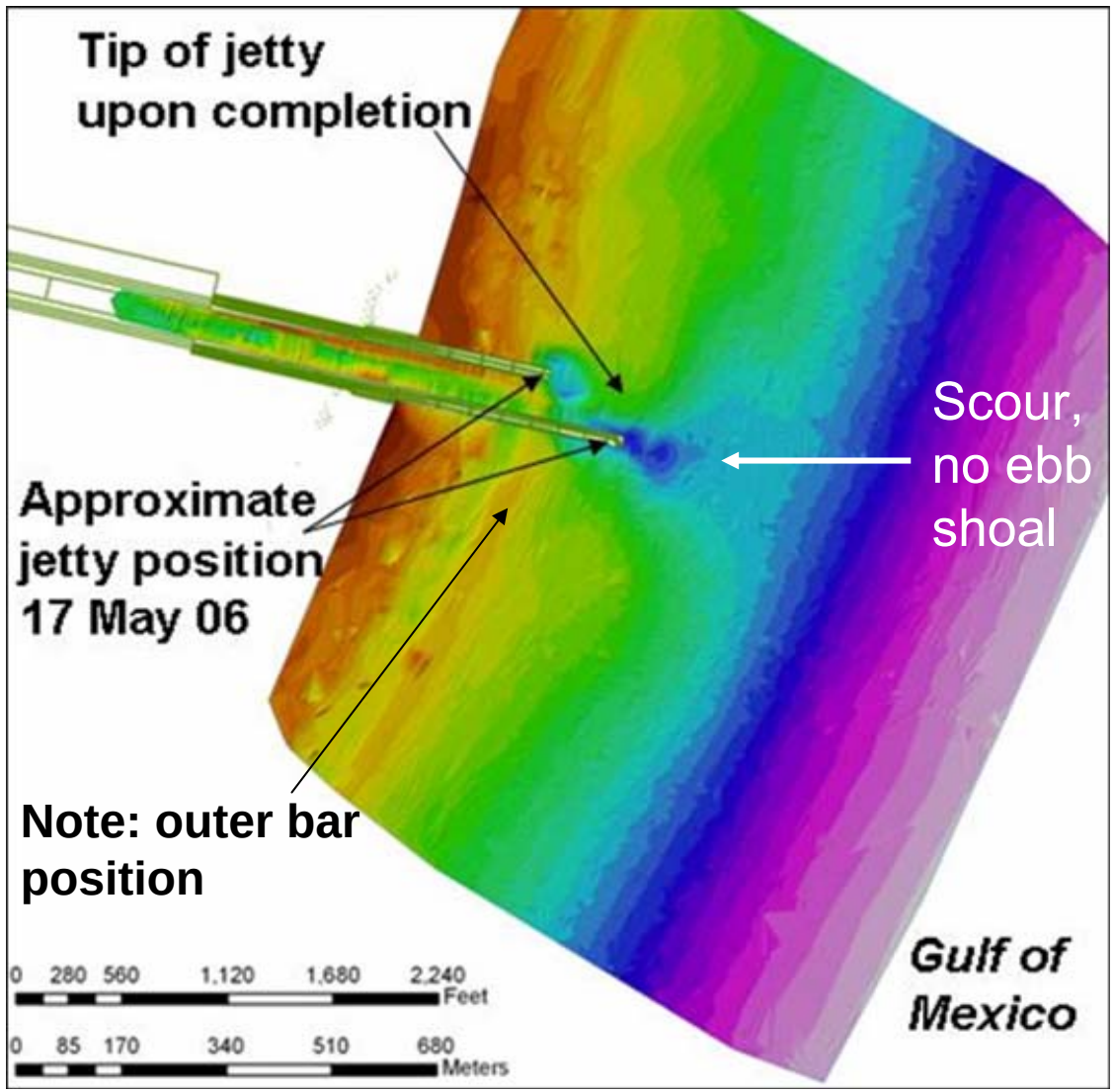
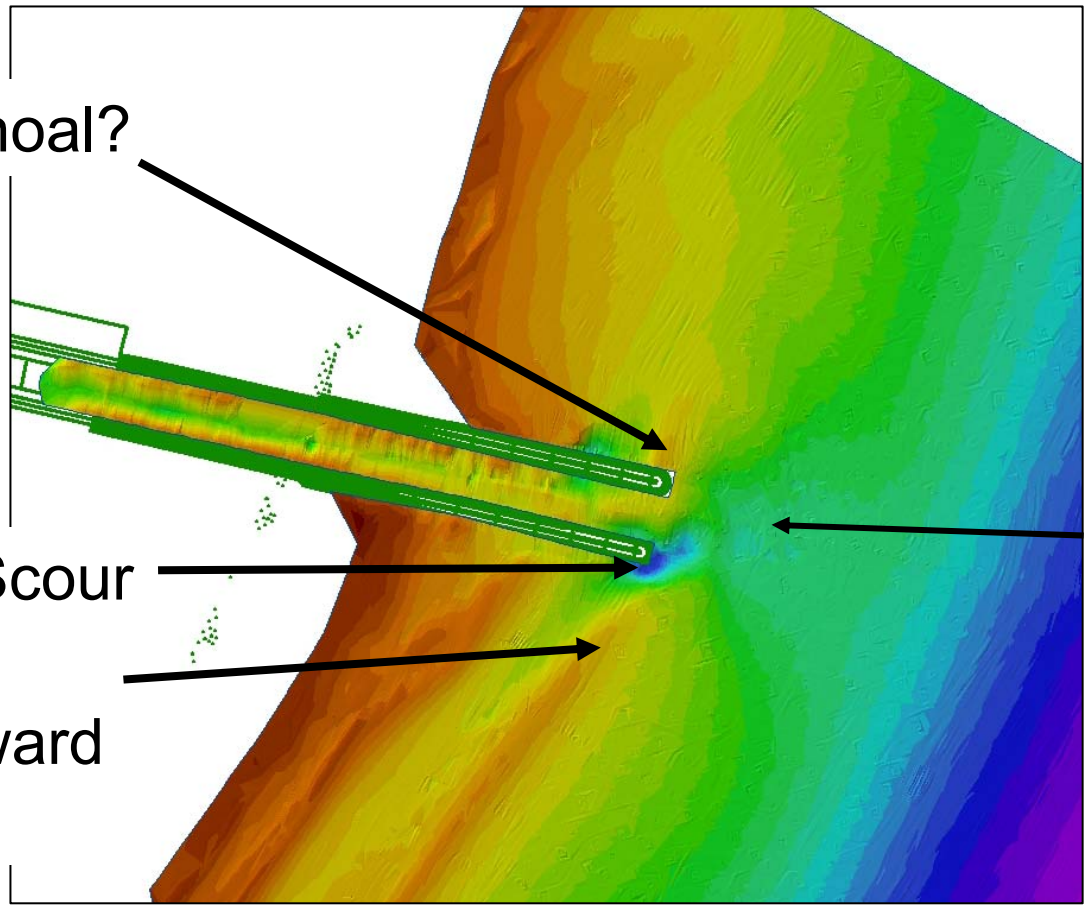
-9.000 - -8
-8.000 - -7
-7.000 - -6
-6.000 - -5
-5.000 - -4
-4.000 - -3
N
W
E
S
Tip of jetty upon completion
Scour, no ebb shoal
Approximate jetty Position 06 Mar 06
Gulf of Mexico
Feet
0 295 590 1,180 1,770 2,360
0 87.5 175 350 525 700
Meters

17 May 06


Tip of jetty upon completion
Approximate jetty position 17 May 06
Note: outer bar position
Scour, no ebb shoal
Gulf of Mexico
0 280 560 1,120 1,680 2,240
Feet
0 85 170 340 510 680
Meters

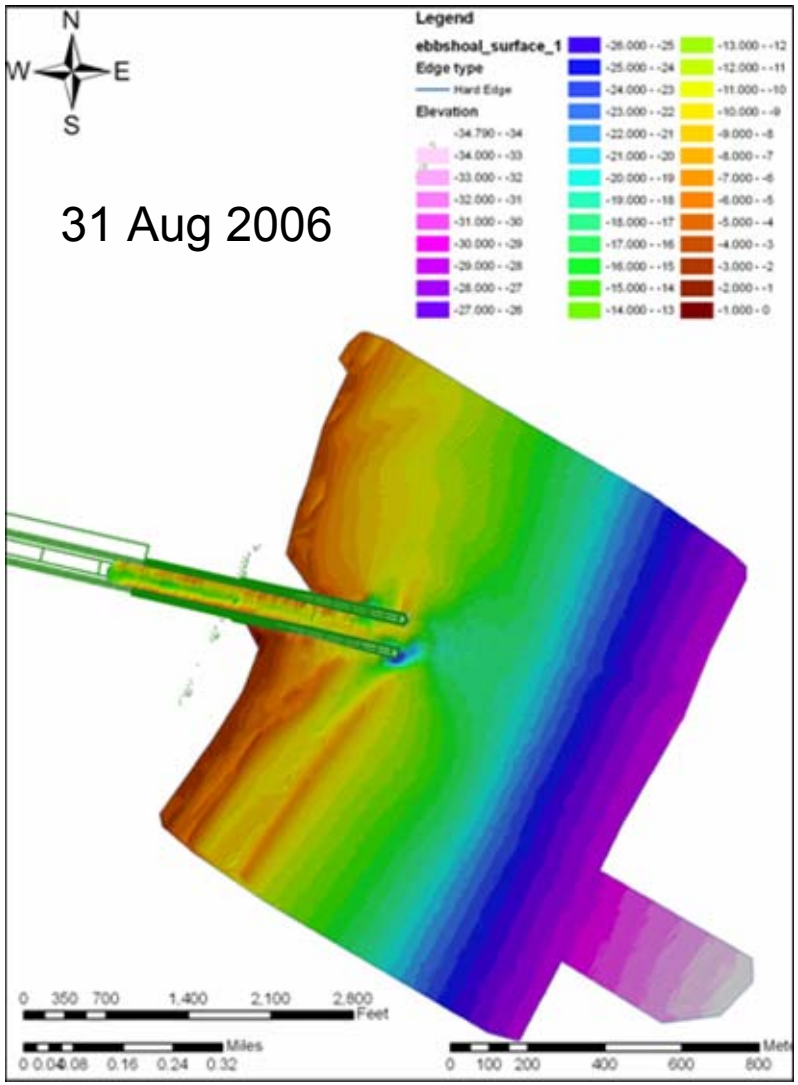
31 Aug 06 – close-up



Inner Channel depths 12 to 13 ft NAVD88 (MSL=+0.48 ft).

Channel shoaling (< 7 ft NAVD88) adjacent to jetties.

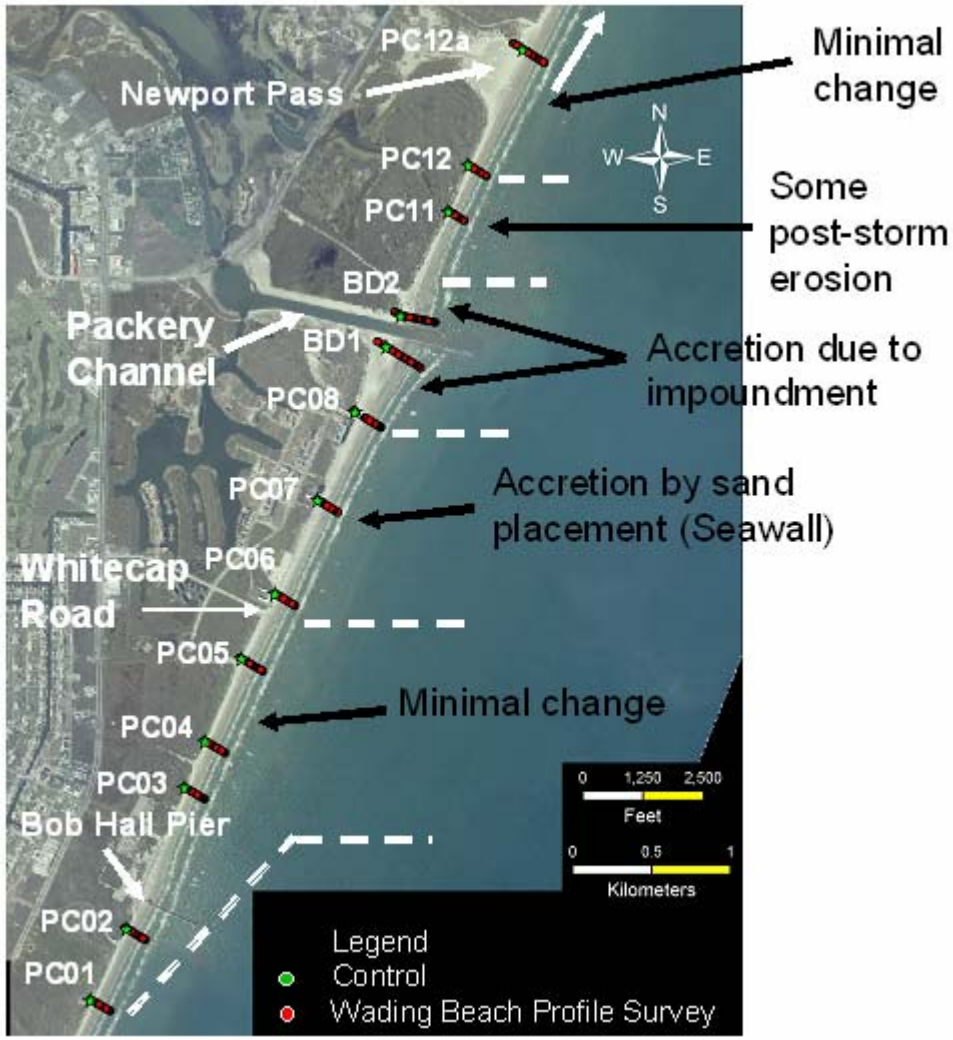
Key Findings from Monitoring



Ebb Shoal

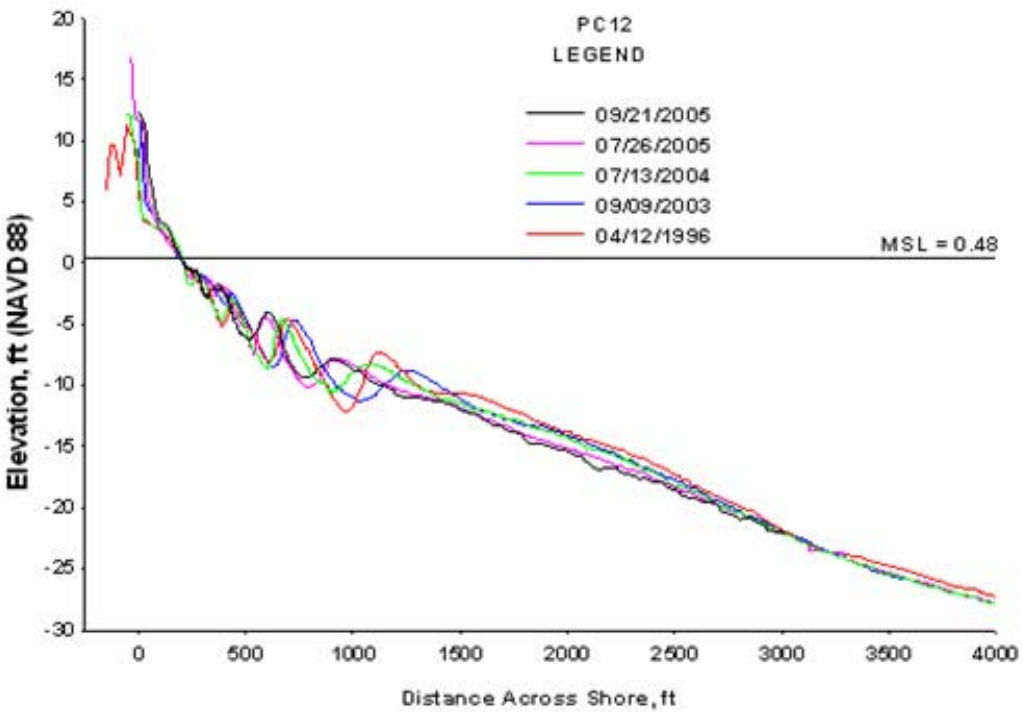
1. At present, no ebb shoal.
2. Channel shoaling between jetties is restricted to central section along north and south jetties.
3. Channel shoaling between jetties increased by incomplete northern jetty and landward gap in armoring.
4. Depth at inlet mouth increased from Jul 05 to Mar 06 and then began to decrease through Aug 06. Depths are approaching those observed in the baseline survey.

Beach Profile Surveys
(Also, available from 1970s & 1996)



1. Slight accretion adjacent to jetties by impoundment.
2. Accretion along seawall by placement.
3. Minimal change at northern and southern extremes.
4. Some sustained post-storm erosion in small region north of inlet (PC11).

Beach Profile Survey
South end of Newport Pass (north of inlet)

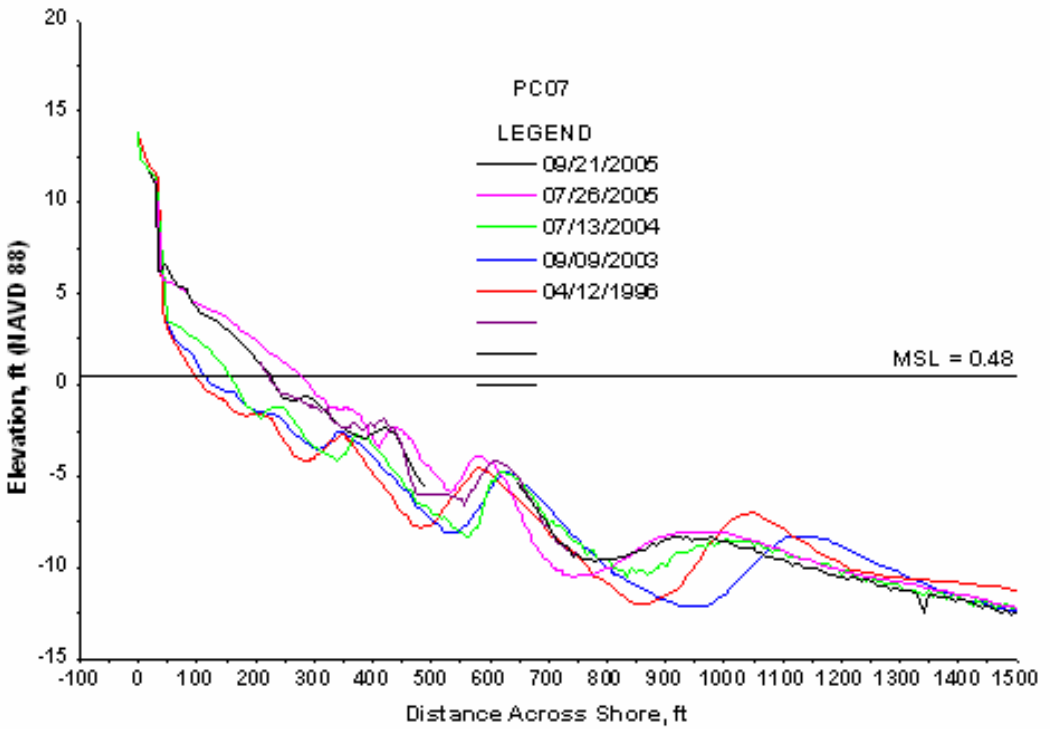


1. Minimal change in berm and beach width observed north (Newport Pass to Fish Pass) and south (just south of seawall to Nueces Kleberg County Line) of the inlet.

2. Typically three sand bars.

3. Depth of Closure 16-20 ft NAVD88.

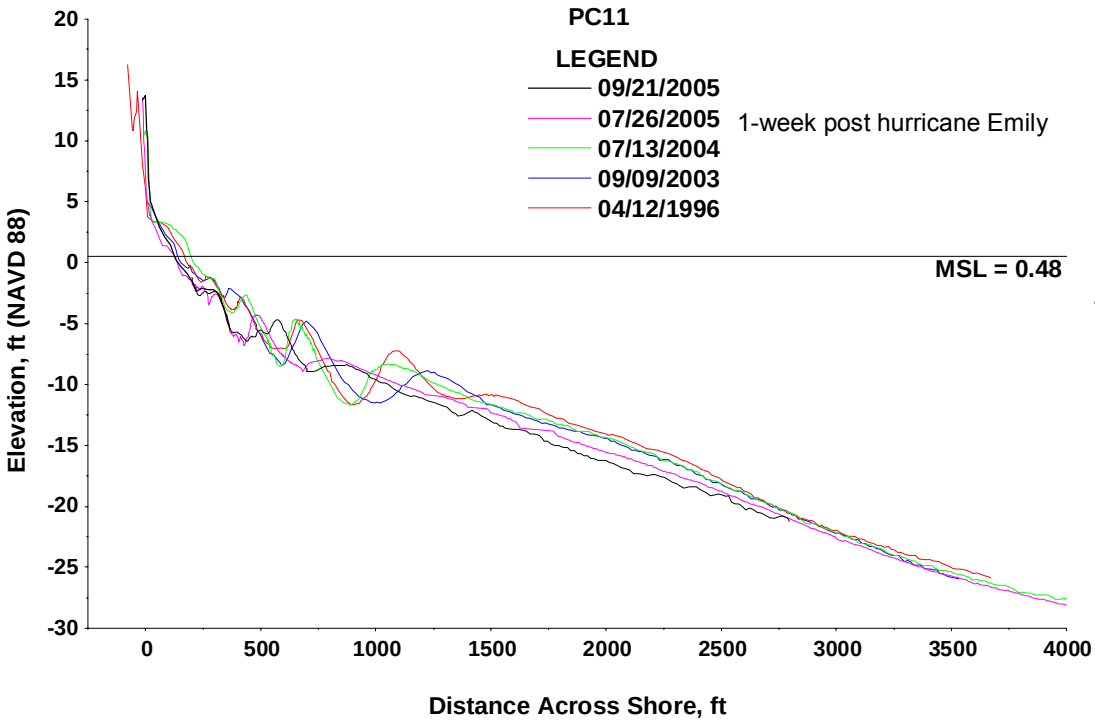
Beach Profile Survey
Midway on Seawall (Holiday Inn)



1. Net accretion maintained from BD1 (adjacent to south jetty) south to PC06 (south end of seawall).

2. Some erosion observed during active hurricane season from Jul to Sep 05.

Beach Profile Survey
Mid-way between north jetty & Newport Pass



1. Accretion from Aug 03 to Jul 04.
2. Some erosion observed during active hurricane season (Jul to Sep 05).

Shoreline Position

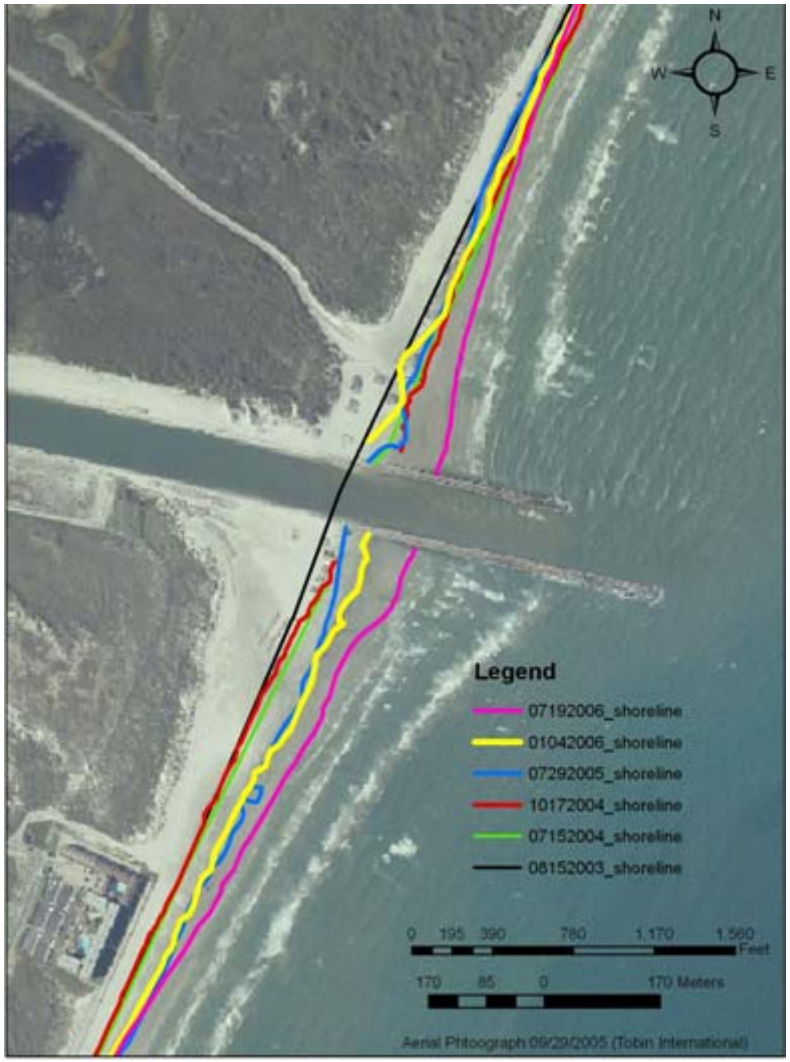
1. Shoreline position change dynamic adjacent to inlet and in front of seawall.

2. Shoreline defined as berm crest (1.5-2 ft NAVD88).

1. Shoreline position change decreases within 1/2 mile of inlet to the north and south.

2. Shoreline advancing within dynamic region adjacent to the inlet.

Shoreline Position

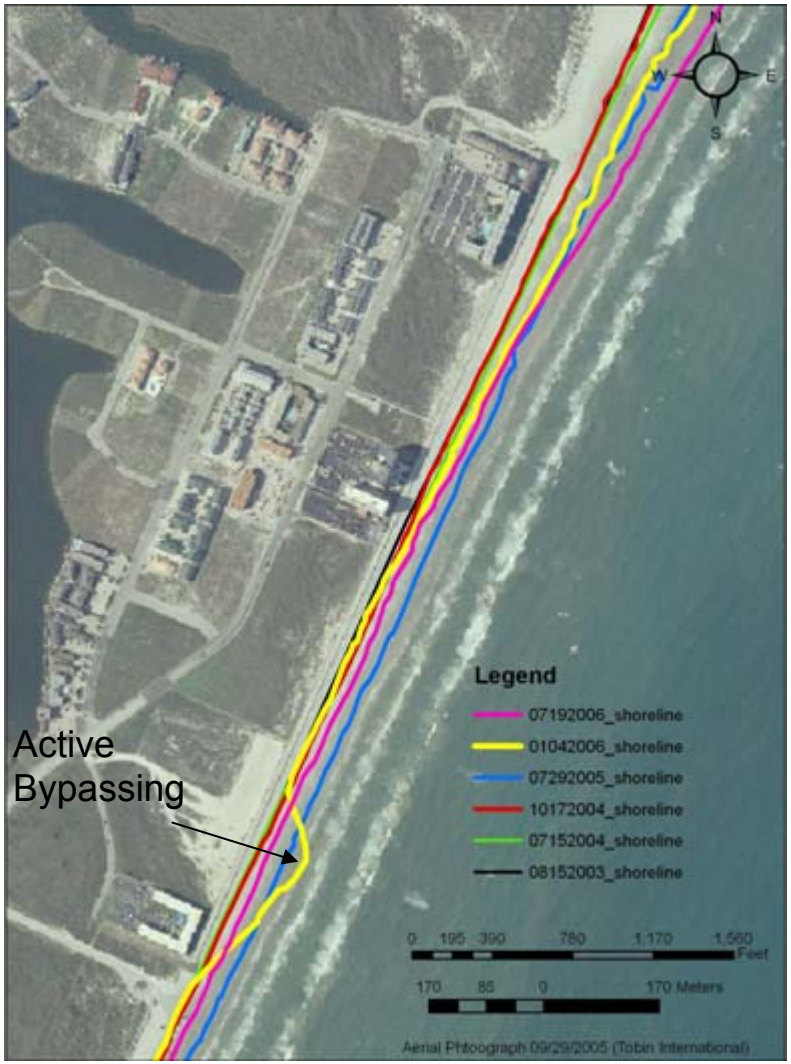


1. Shoreline advance adjacent to jetties:
   ≈ 380 ft on north side
   > 400 ft on south side
   (15 Aug 03 survey as baseline)

2. South side shows gradual advance over time.

3. North side more erratic prior to Jul 06 due to losses sustained through gap in north jetty during storm surges.

Shoreline Position



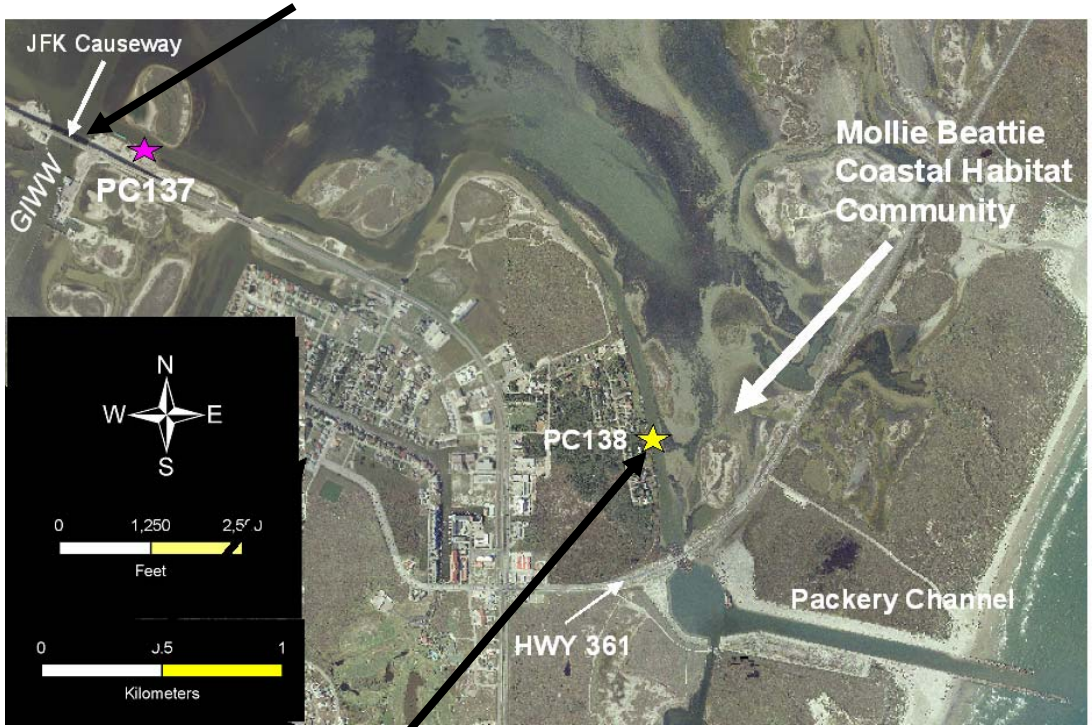
1. Shoreline advance on the order of 60 ft (south end) to - 200 ft (north end) in front of the seawall as of 07/19/2006.

2. Post-Hurricane Emily survey (29 Jul 06)

3. Active period of sand placement (4 Jan 06 -- yellow line)

Current in Packery Channel

JFK150
Center of GIWW under the JFK Bridge

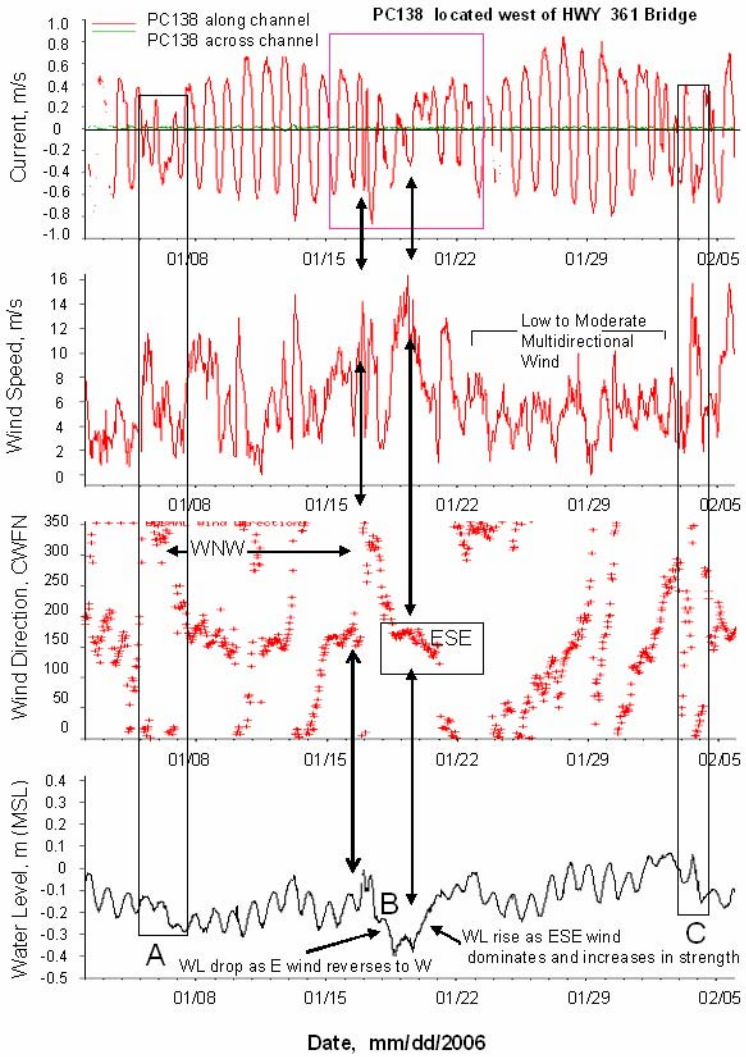


PC138
North of HWY 361 Bridge

Measurements

1. Real-time measurement of current speed and direction.
2. Online access to current data.
3. GIWW and in Channel

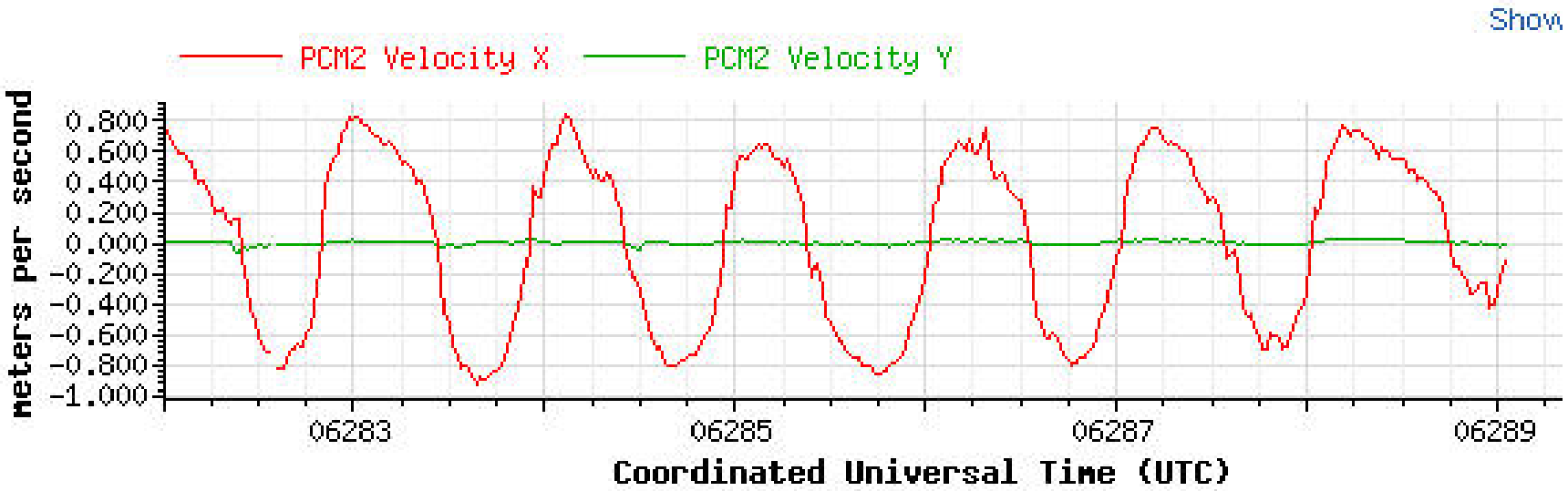
Current



PC138

1. Tidal signal is strong.
2. Ebb flow is enhanced by strong W and NW wind during frontal passage.
3. Flood flow is enhanced by strong ESE winds which dominate in the region, so current is flood biased.
4. Values in range predicted in the 1997 report.

Current
Last week, plotted on web site



http://lighthouse.tamucc.edu/qc/138/today,-7d/

Key Findings from Monitoring

	Average $V_{x,flood}$ [m/s]	Average $V_{x,ebb}$ [m/s]	Max $V_{x,flood}$ [m/s]	Max $V_{x,ebb}$ [m/s]
Sep-05	0.466	-0.479	1.556	-0.964
Oct-05	0.290	-0.288	0.829	-0.847
Nov-05	0.193	-0.224	0.720	-0.673
Dec-05	0.261	-0.270	0.937	-0.709
Jan-06	0.378	-0.427	0.879	-0.918
Feb-06	0.401	-0.462	0.907	-0.921
Mar-06	0.410	-0.445	0.975	-0.933
Apr-06	0.416	-0.447	0.920	-0.849
May-06	0.409	-0.454	0.809	-0.898

Current Record PC138
Sep 05 to May 06

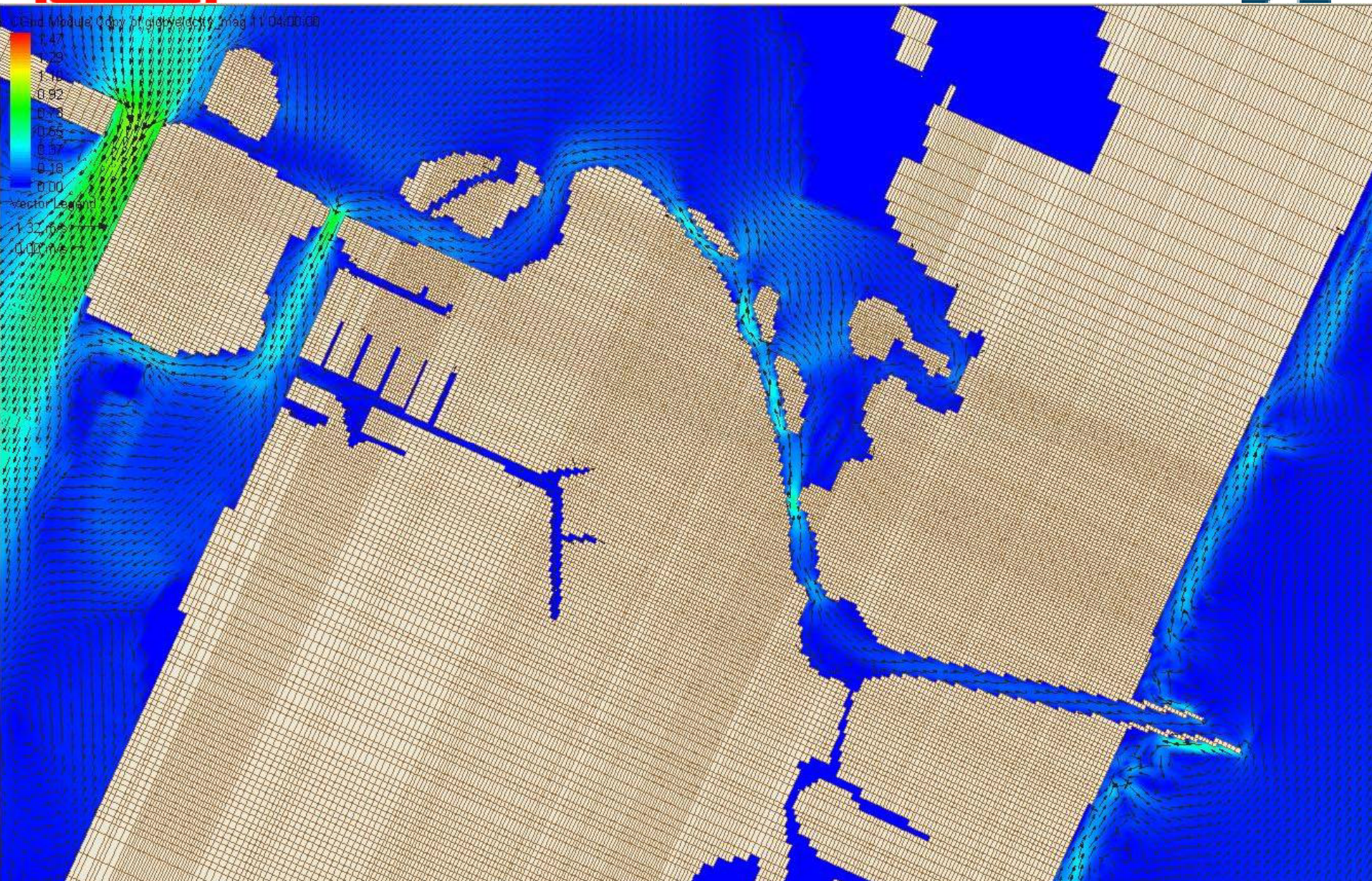
1. Max. flood velocity = 1.6 m/s.
   Avg. flood velocity = 0.36 m/s

2. Max ebb velocity = 1 m/s
   Avg. ebb velocity = 0.39 m/s

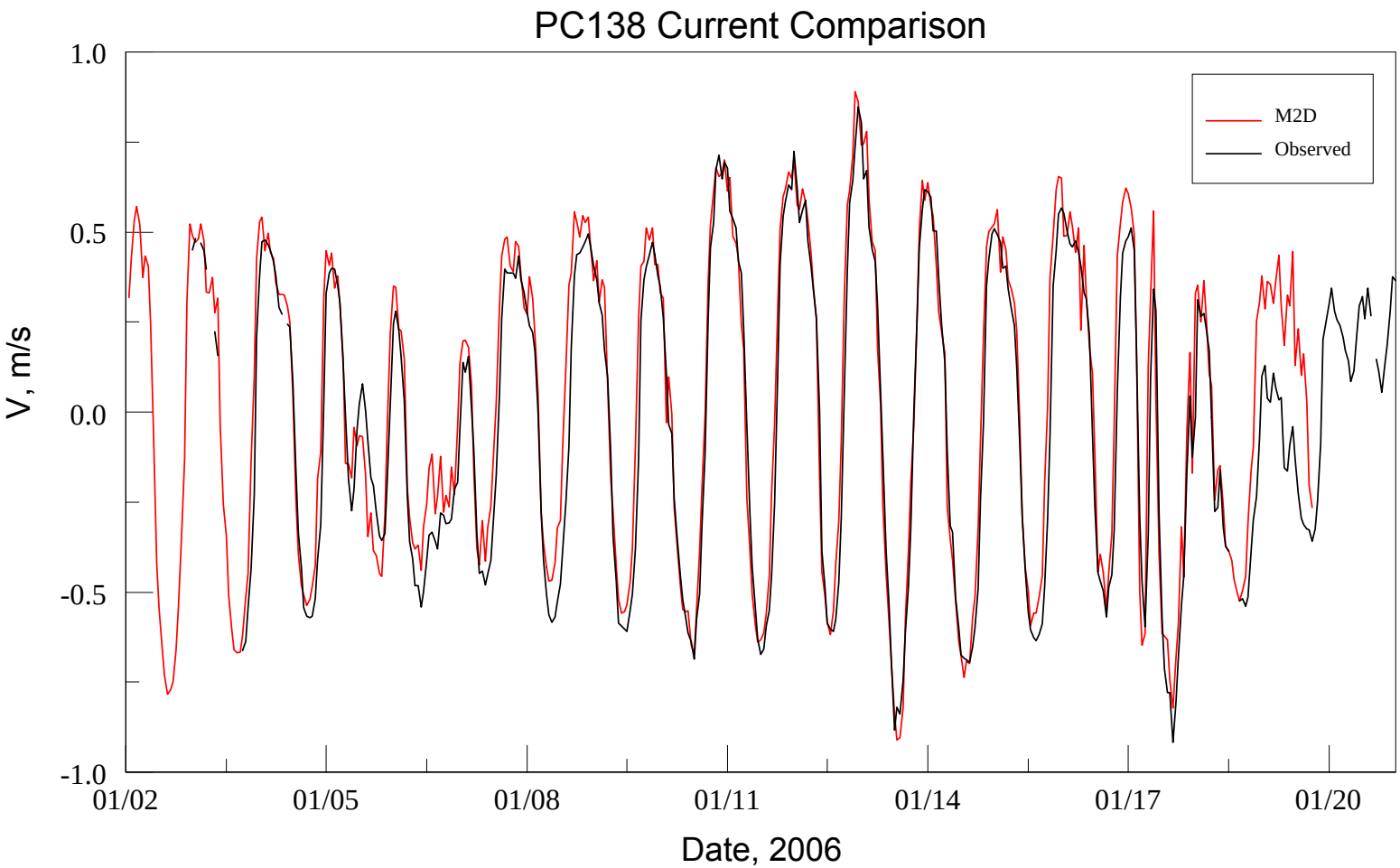
3. September velocities representative of hurricane influence.

4. Agreement with model predictions:
   1.0 m/s during typical conditions
   1.5 m/s during storms
   (Brown and Militello 1997)

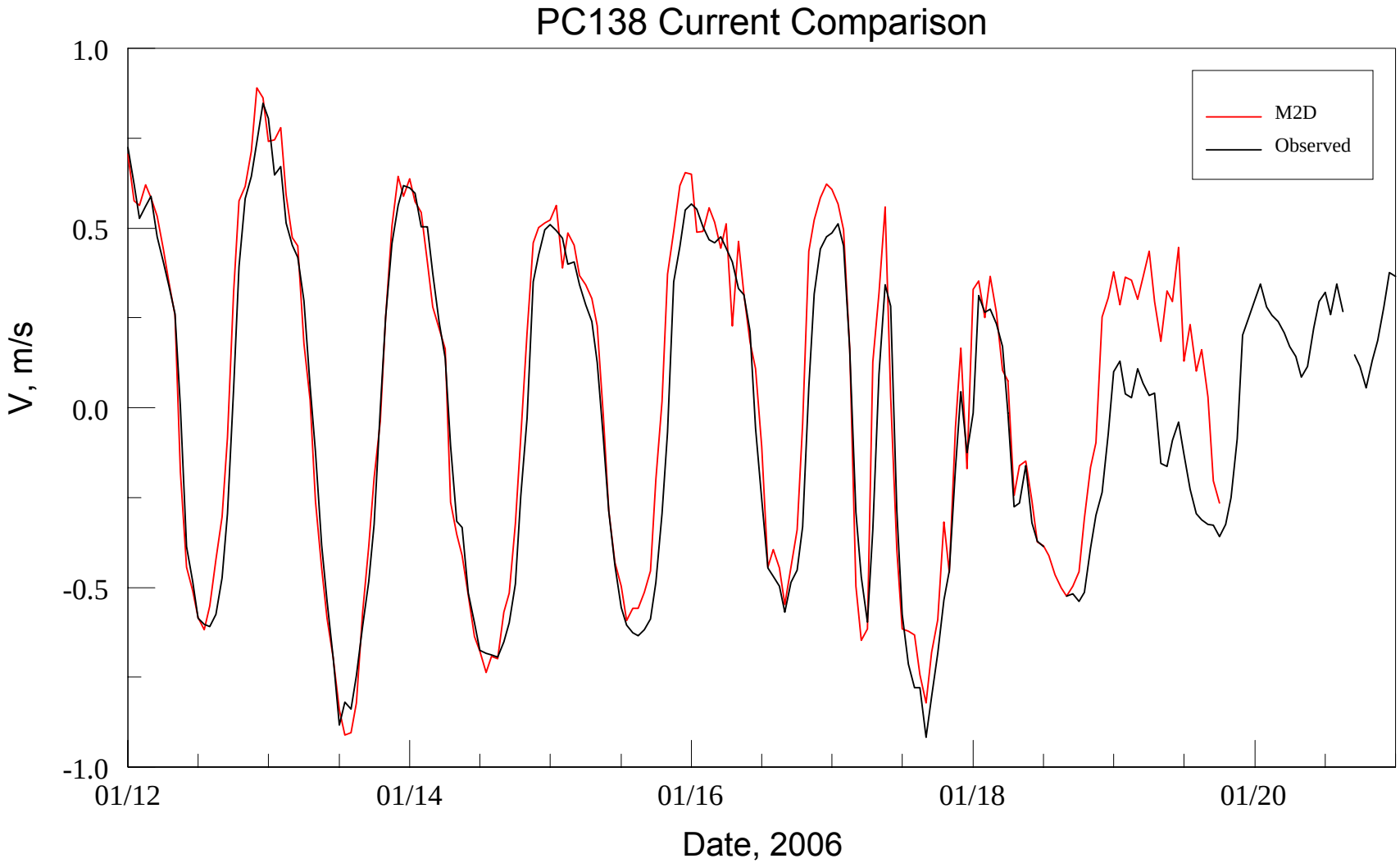
New Numerical Model of Circulation and Sand Transport by Tide, Waves, and Wind



Numerical Model, Initial Tests

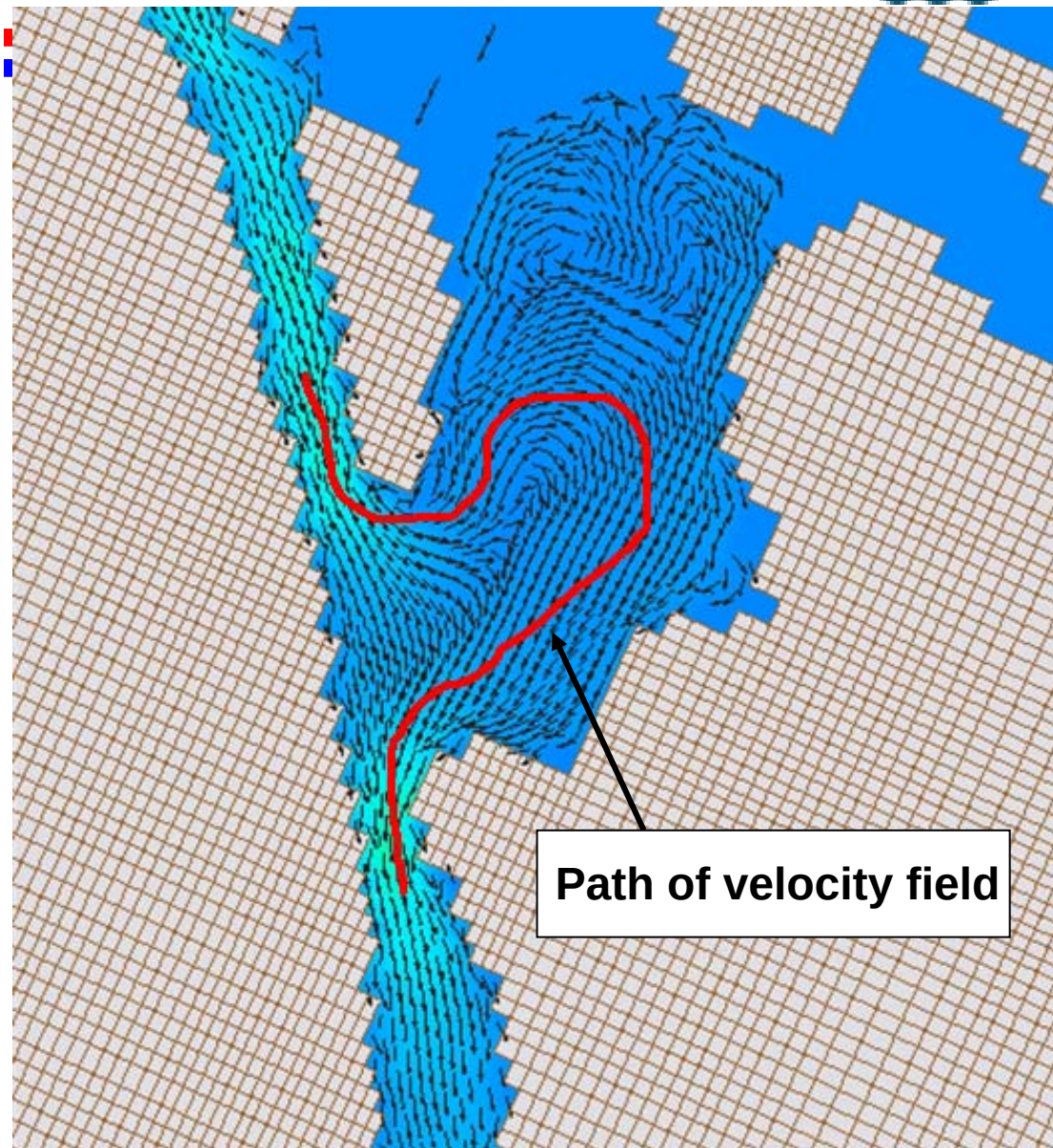


Numerical Model – Initial Tests

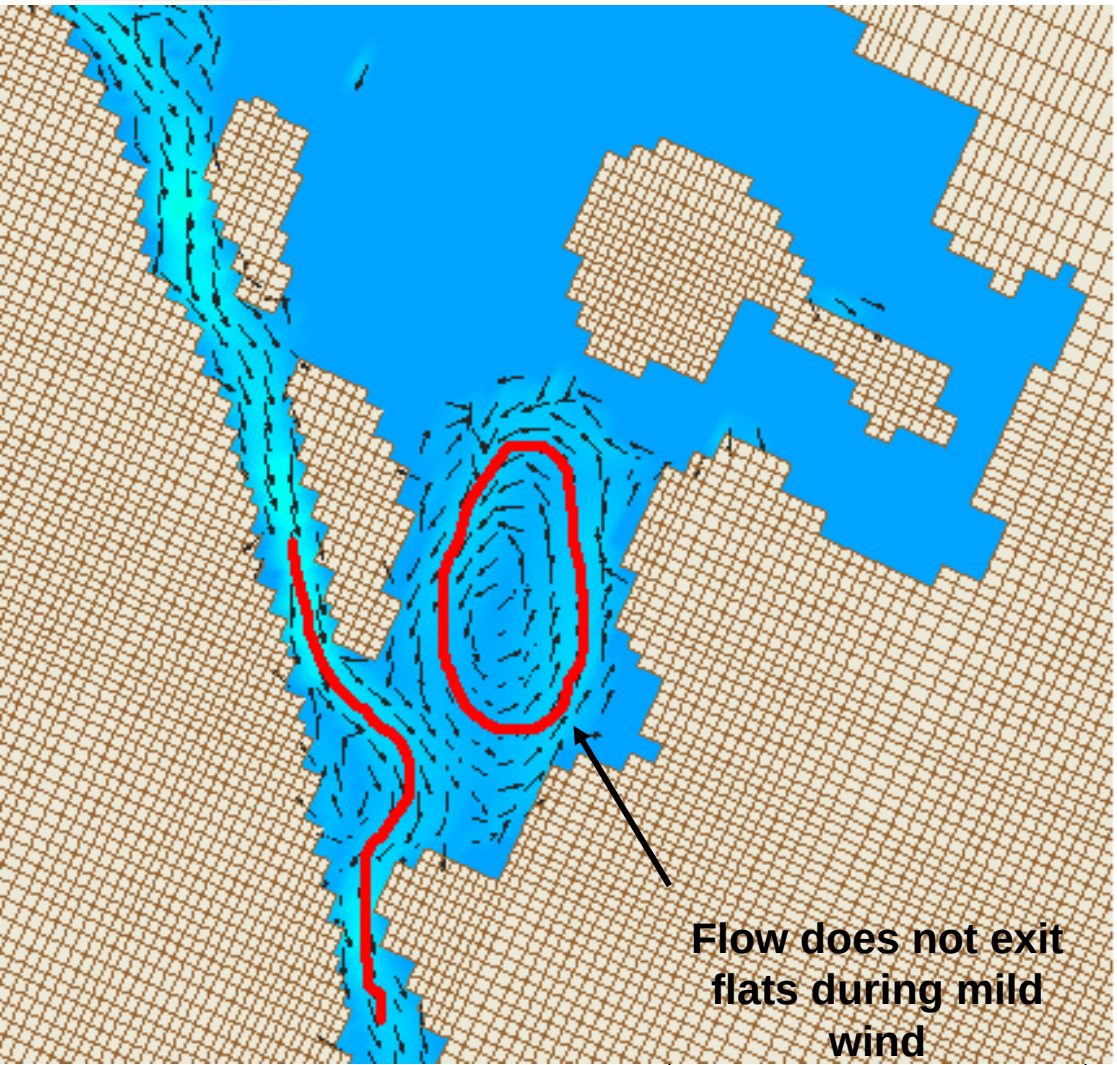


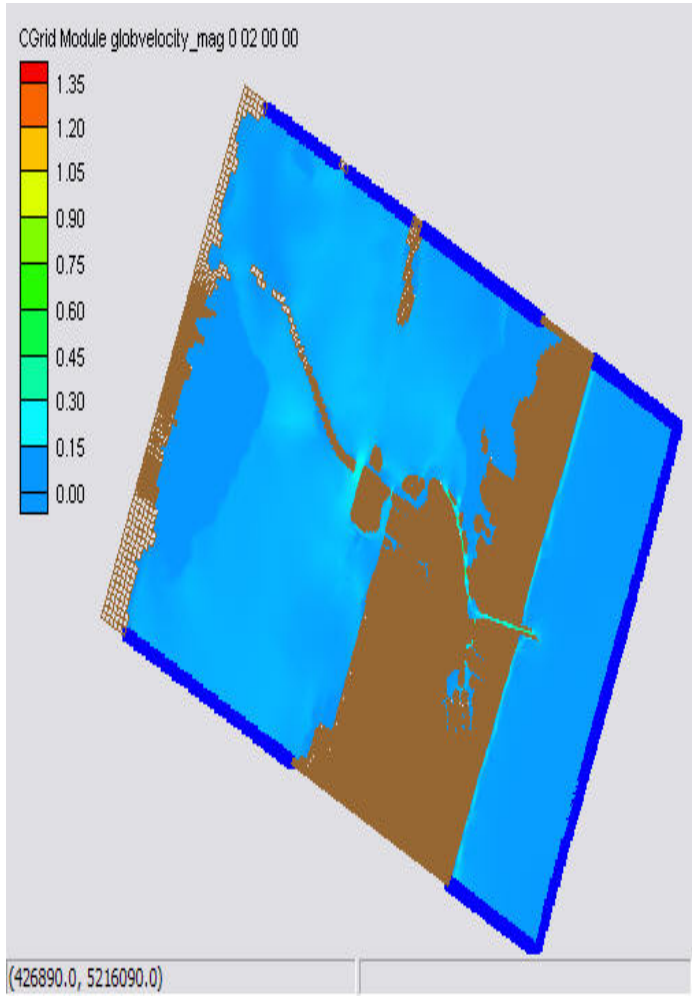
Preliminary Exploration of Circulation on Mollie Beattie Coastal Habitat Community, Mild Wind, With Channel

- Wind from north at 3 m/s
- Mild winter wind
- Flushing of flats during ebb and flood flow

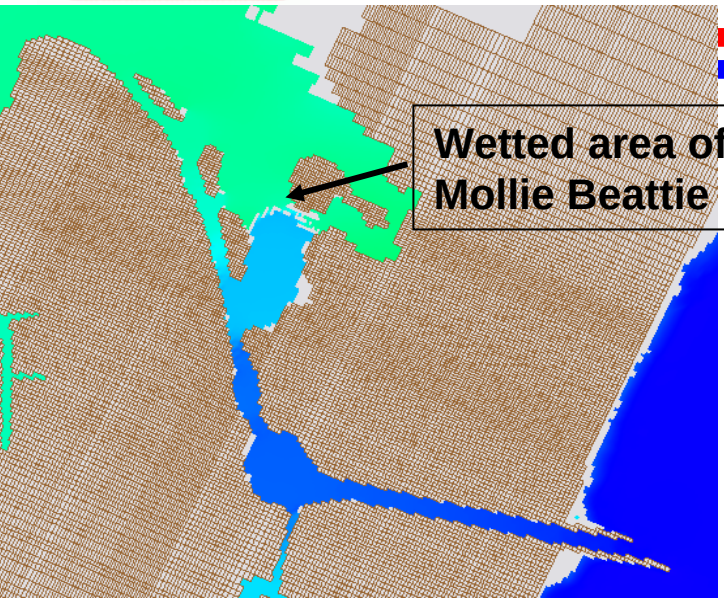


Without Packery Channel, Mild Wind

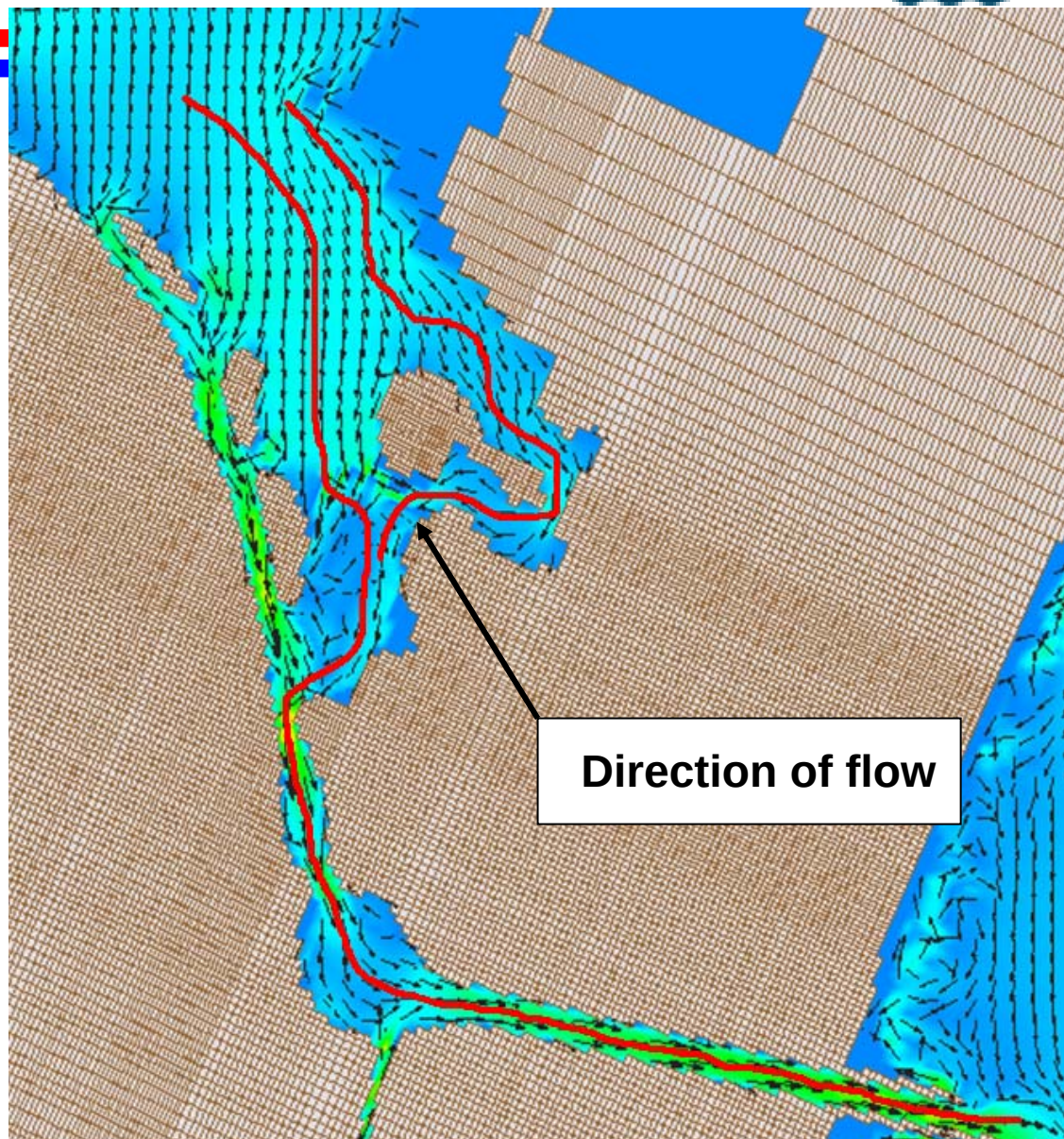




With Packery Channel, Strong Wind

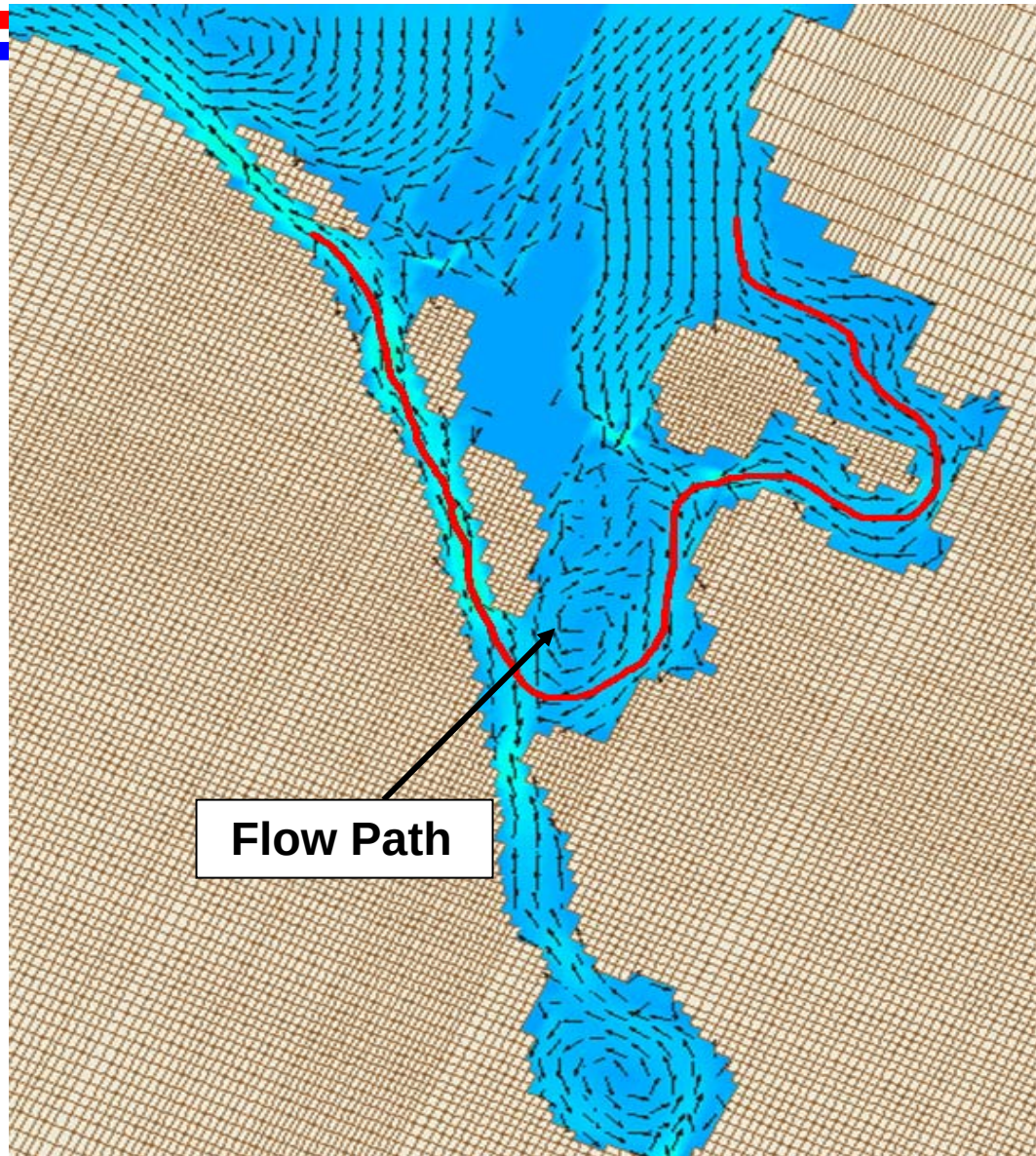


- During strong wind ~ 14 m/s blowing from north
- Winter condition during strong northeasters
- Model shows flushing of flats during ebb and flood flow



Without Packery Channel, Strong Wind

- During north wind with velocity of ~ 14 m/s
- Without inlet, flushing of flats is seen only during strong wind



Comments to City

- Continue monitoring – to allow “adaptive management”
- Expect to dredge every 1 to 2 years.
- Place dredged sand on “downdrift” beaches (might vary seasonally).
- Do not allow shoreline next to jetties to advance too much (dredge first) to avoid channel sanding in.
- Be careful to reduce sand entering channel by wind.
- Current will not be strong, promoting safer navigation.
- GIWW not expected to experience extra sand infiltration by presence of Packery Channel.