City of South Padre Island Beach and Dune Assessment

Phase 1 Report: Characterize Beach and Dunes

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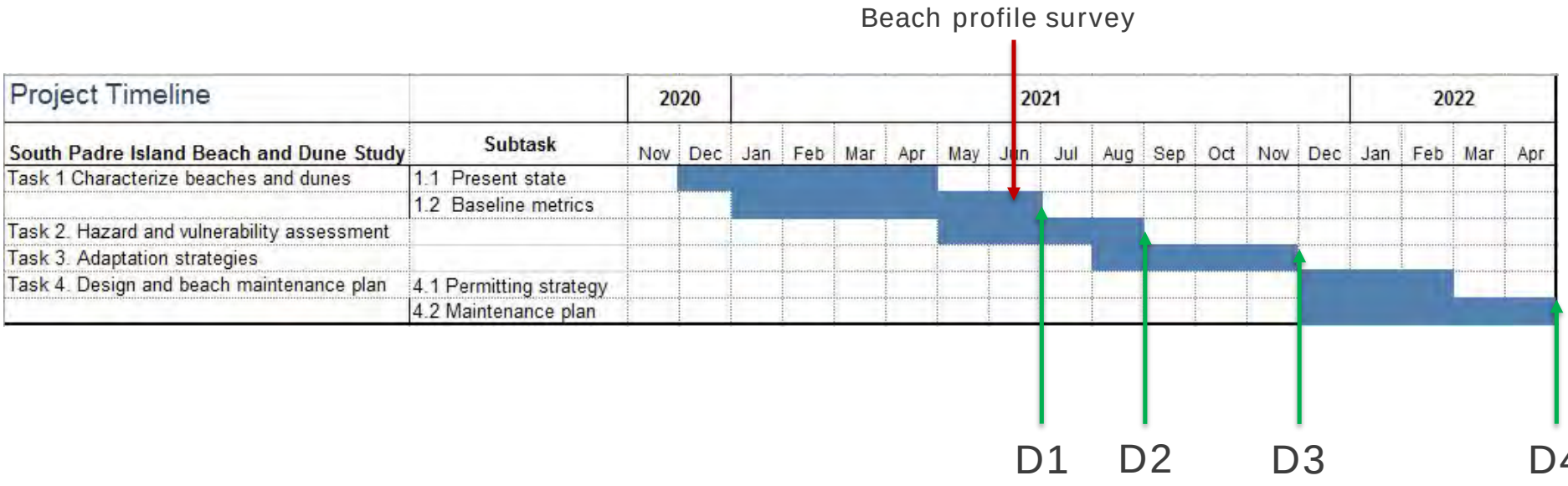
integral consulting inc.

Tasks and Deliverables (SOP)

- **Phase 1 – Characterize and evaluate state of beaches and dunes**
  - **Deliverable**: Geospatial data, Interim Report describing present coastal state with maps of present island vulnerability (in internal review)
- **Phase 2 – Hazard identification and vulnerability assessment** (May - Aug 2021)
  - **Deliverable**: Technical memorandum – vulnerability assessment results, maps of future erosion and vulnerability
- **Phase 3 – Evaluate beach and dune adaptation strategy** (Aug – Nov 2021)
  - **Deliverable**: Technical memorandum describing optimal configuration(s) and adaptation pathway(s)
- **Phase 4 – Design configurations and beach-dune maintenance plan** (Dec 2021 – April 2022)
  - **Deliverables**: Beach maintenance and management plan; Dune habitat maintenance and management plan

Timelines / Milestones

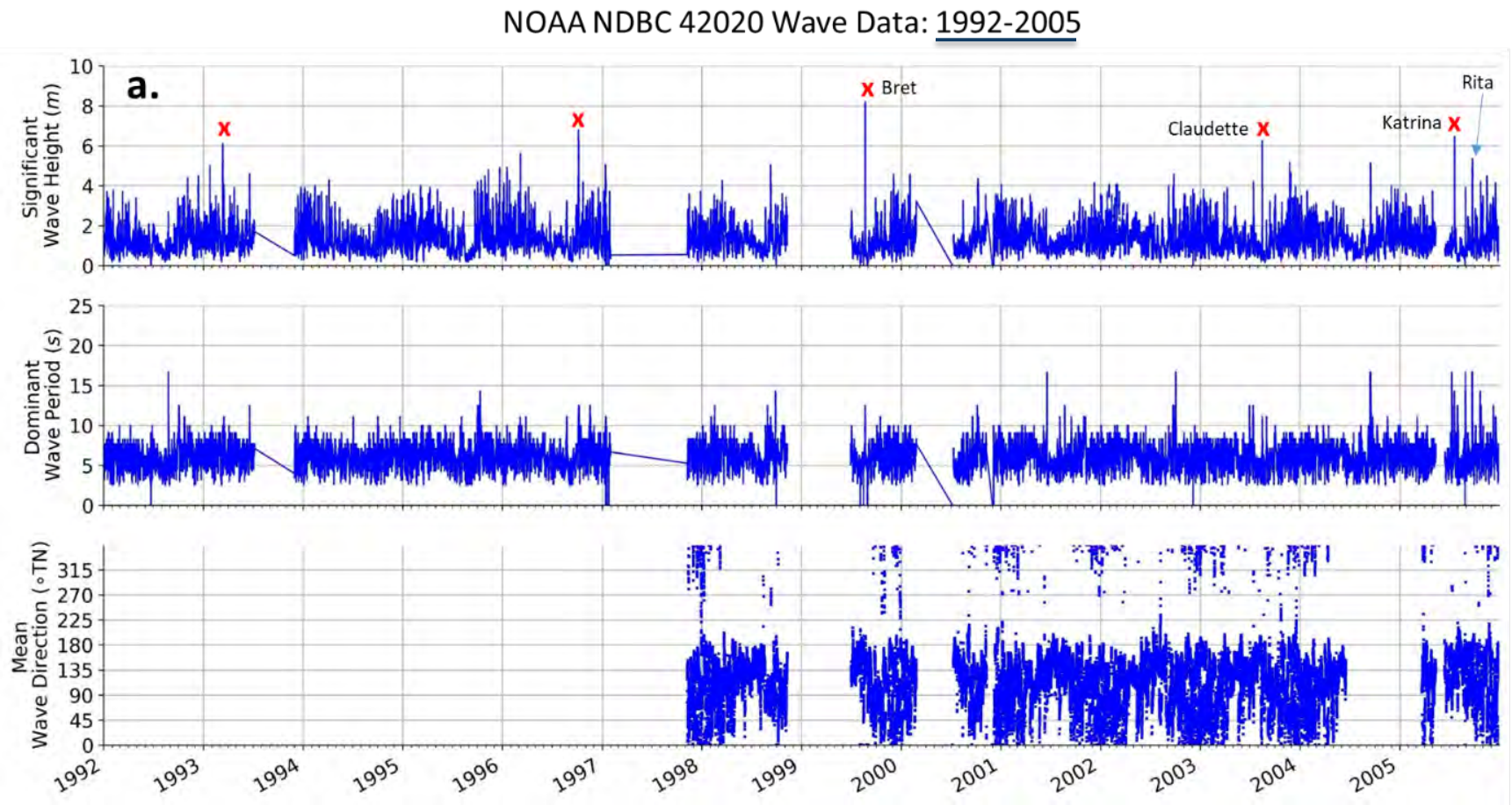


Report Outline: Phase 1 Preliminary Analyses

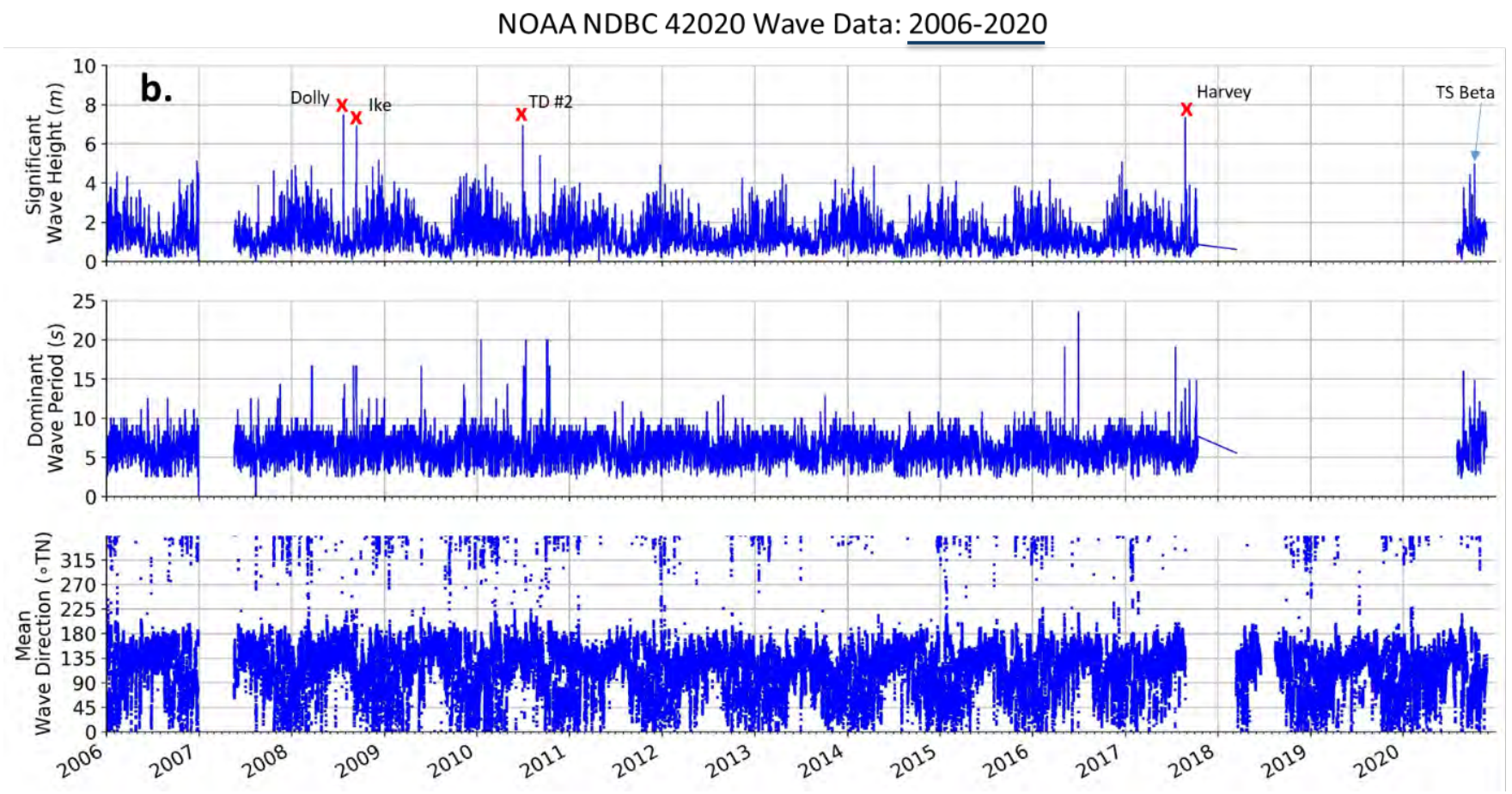
- Historic Waves and Tides
- Historical Beach and Dune Profiles
- Shoreline Change (long- and short-term)
- 3D Elevation Change (2016-2018)
- Morphology: dune toe and crest elevations, beach and dune width, profile volumes (onshore and offshore)
- Vegetation line
- Current State

Historic Waves and Tides

Historic Waves



Historic Waves

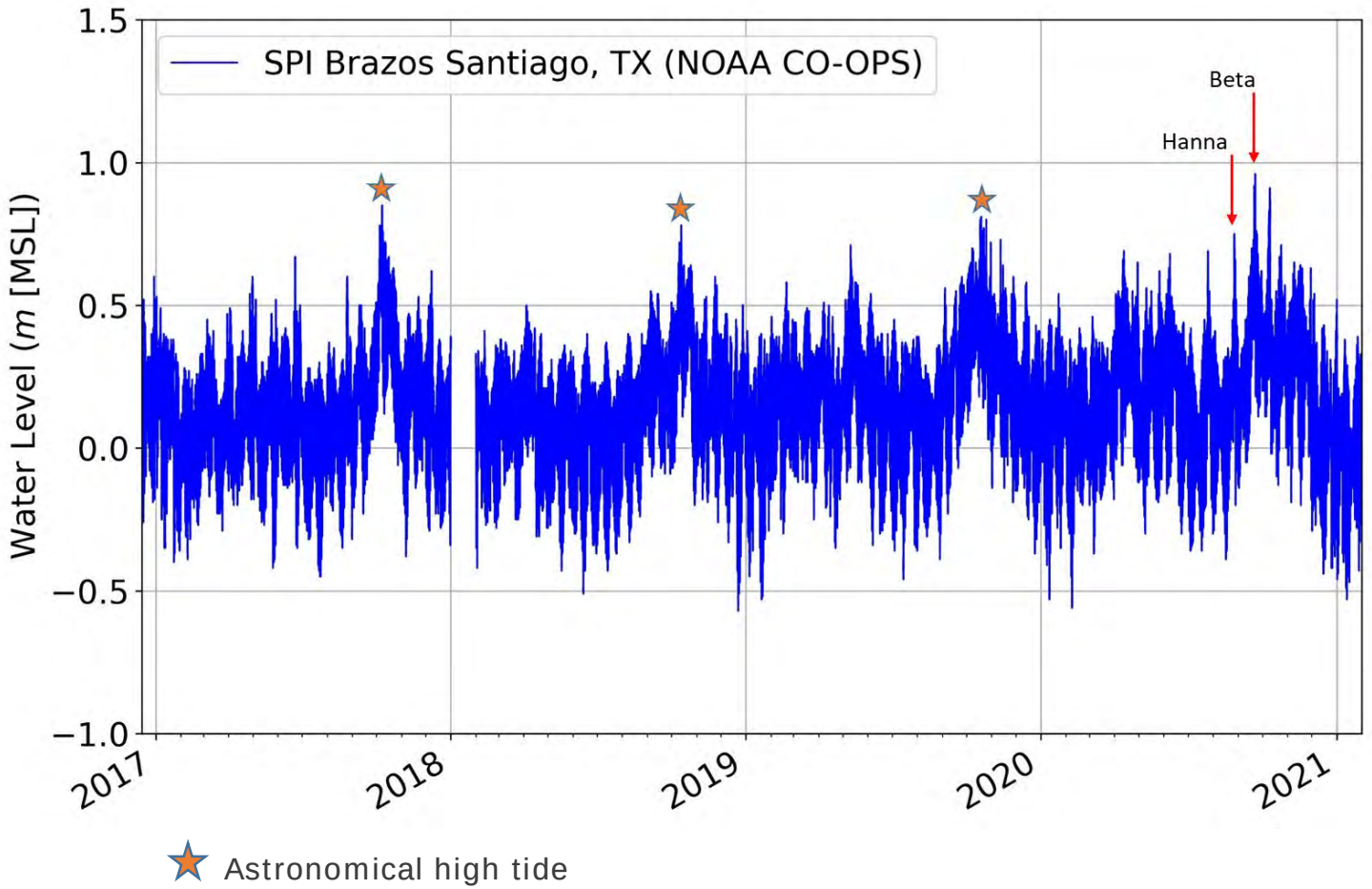


Extreme Value Analysis and Storms

Date	Name	TS	HX	Cat	Landfall	Comments
1967-09-01	Beulah		Y	3	Just N of Rio Grande	Extensive damage to SPI
1999-08-01	Bret*		Y	3	Padre Island, between Brownsville and Corpus	
2003-07-01	Claudette*		Y	1	Matagorda	
2005-08-01	Katrina*		Y	3	New Orleans	Extensive erosion to City beaches
2005-09-01	Rita*		Y	3	Louisiana	Extensive erosion to City beaches
2008-07-23	Dolly*		Y	1	City of SPI	Extensive damage to SPI
2008-09-01	Ike*		Y	4	Galveston	Moderate damage to SPI/Extensive Erosion
2010-06-30	Alex		Y	2	Soto La Marina	Heavy rain
2010-07-08	TD 2*	-	-	-	South Padre Island	
2010-09-07	Hermine*	Y			NE Mexico	3.4 ft storm surge at Port Aransas
2011-06-30	Arlene	Y			Cabo Rojo	
2015-06-01	Bill	Y			Matagorda Island	
2017-08-25	Harvey*		Y	4	Rockport	Tidal surge
2020-07-01	Hanna		Y	1	Padre Island, Kennedy County	Minor
2020-09-22	Beta*	Y			Matagorda Peninsula, TX	Damage to dunes

Return Period (yrs)	Significant Wave Height (ft)	Wind Speed (kts)
1	9.5	27.6
2	16.1	34.6
5	19.7	39.3
10	23.0	43.9
100	41.7	73.4

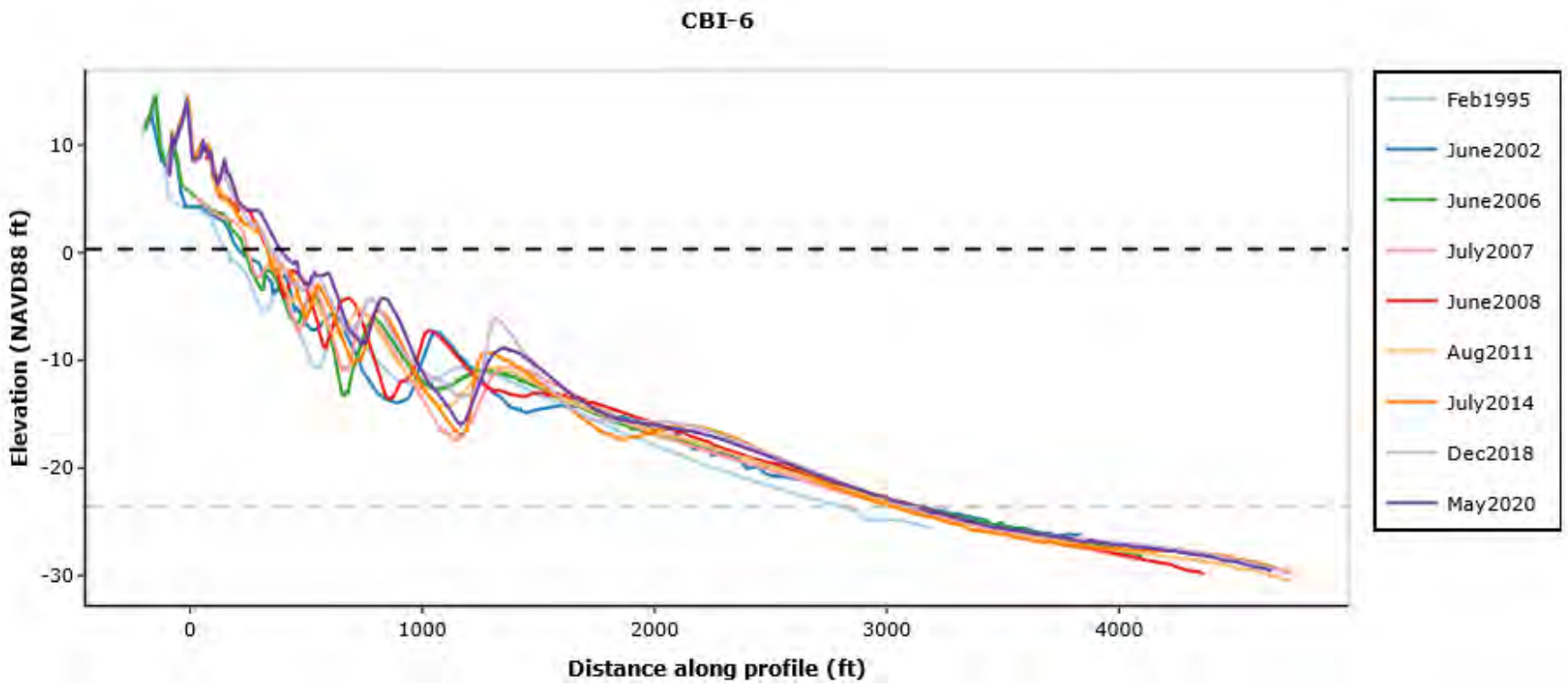
Water Levels: NOAA Tide Gage, Brazos Santiago



Beach and Dune Profiles

Survey Date	Surveyor
Feb-95	Conrad Blucher Institute
Jun-02	Texas A&M
~~Jun-05~~	~~Shiner + Texas A&M~~
Jun-06	HDR/Shiner Moseley/Frontier
Jul-07	Terrasond
Jul-08	Naismith
Aug-11	Naismith
Jul-14	Naismith
Dec-18	Naismith
May-20	Naismith

Beach and Dune Profiles



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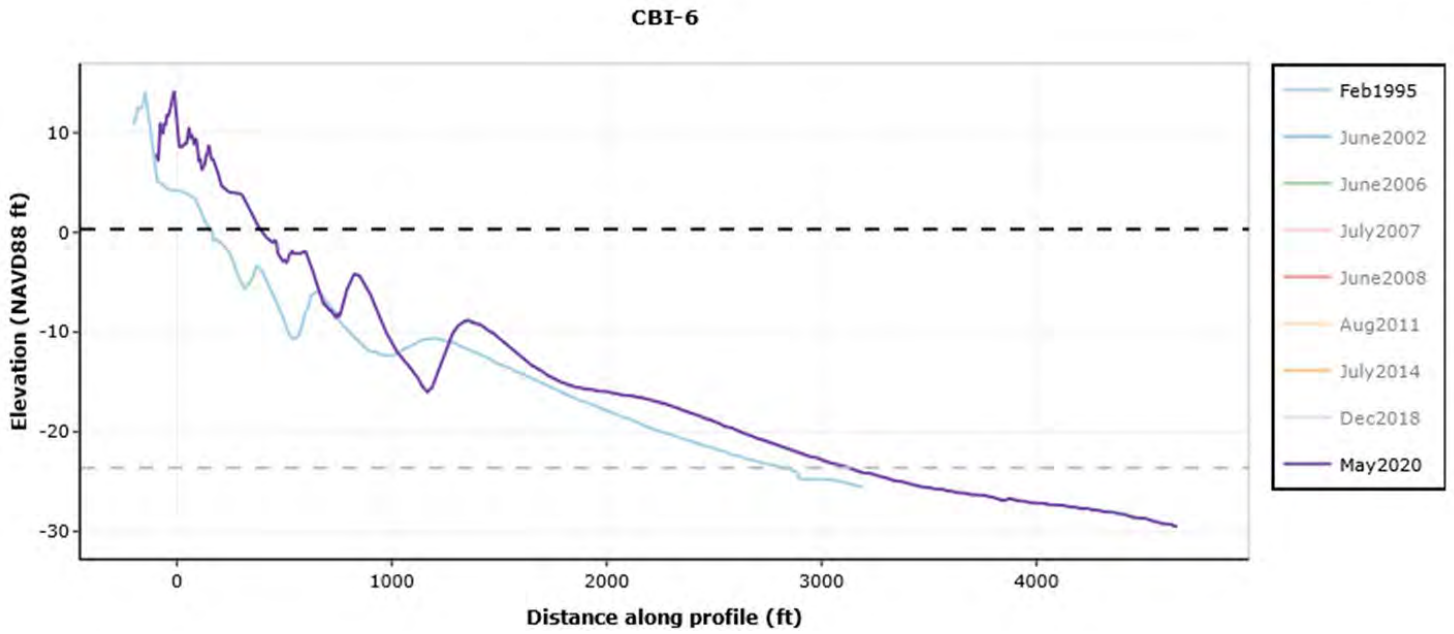
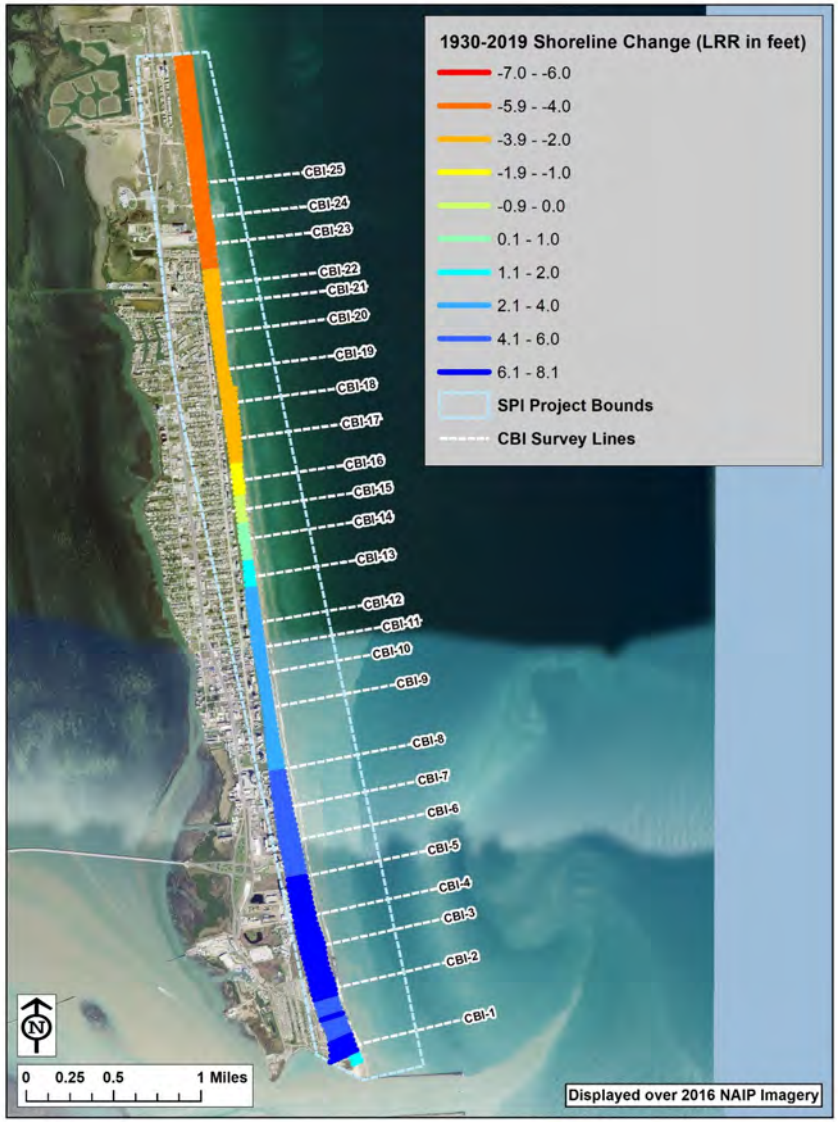
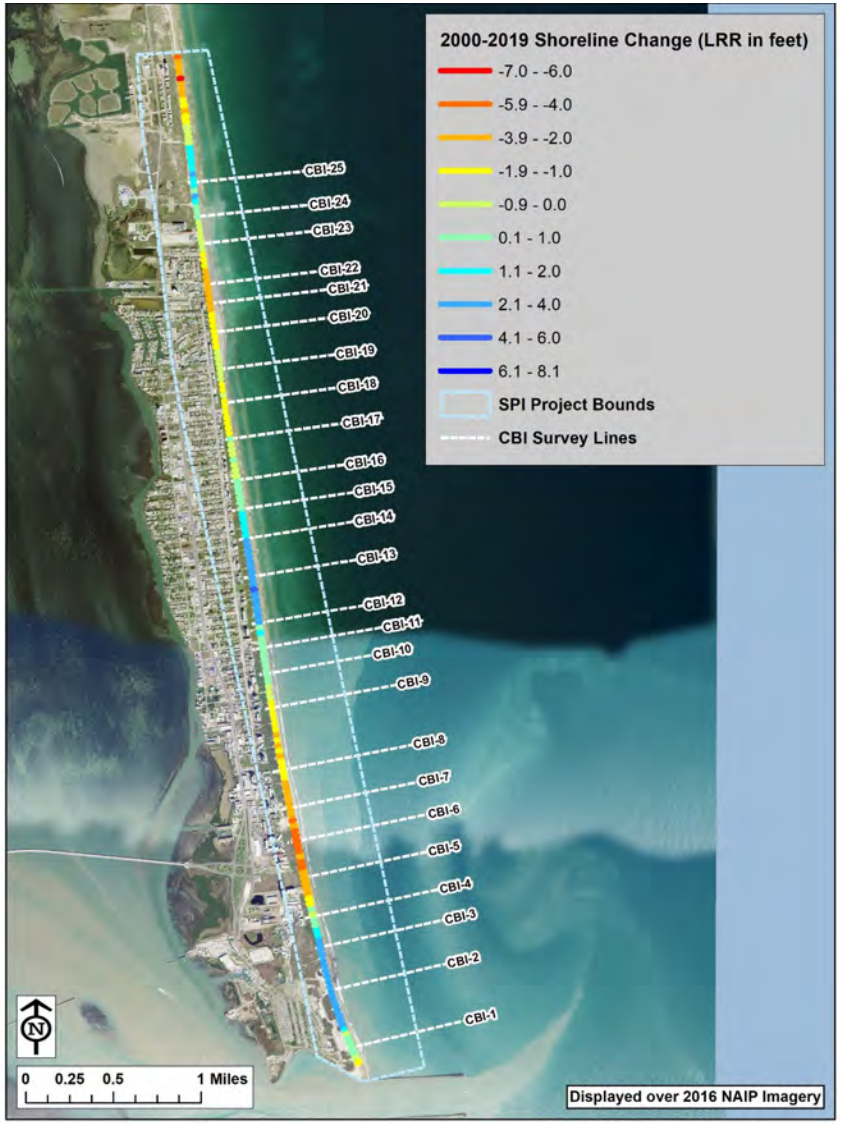
Beach and Dune Profiles

- SPI has “typical” barrier island morphology: dune field and beach with persistent offshore bar
- Most profiles have double or triple bar system
- Long-term analysis indicates the majority of the profiles have prograded, likely due to nourishment projects



Shoreline Change





3D Elevation Change (2016-2018)

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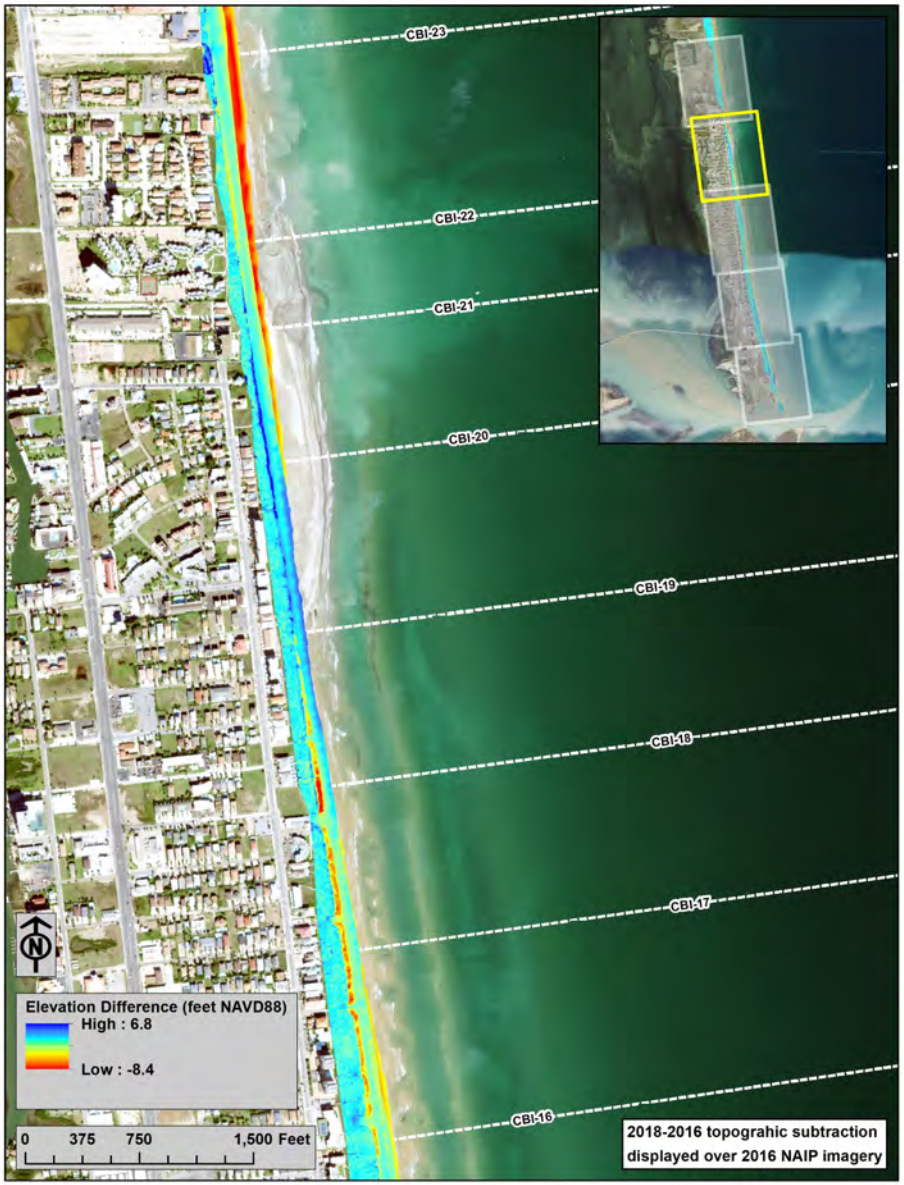

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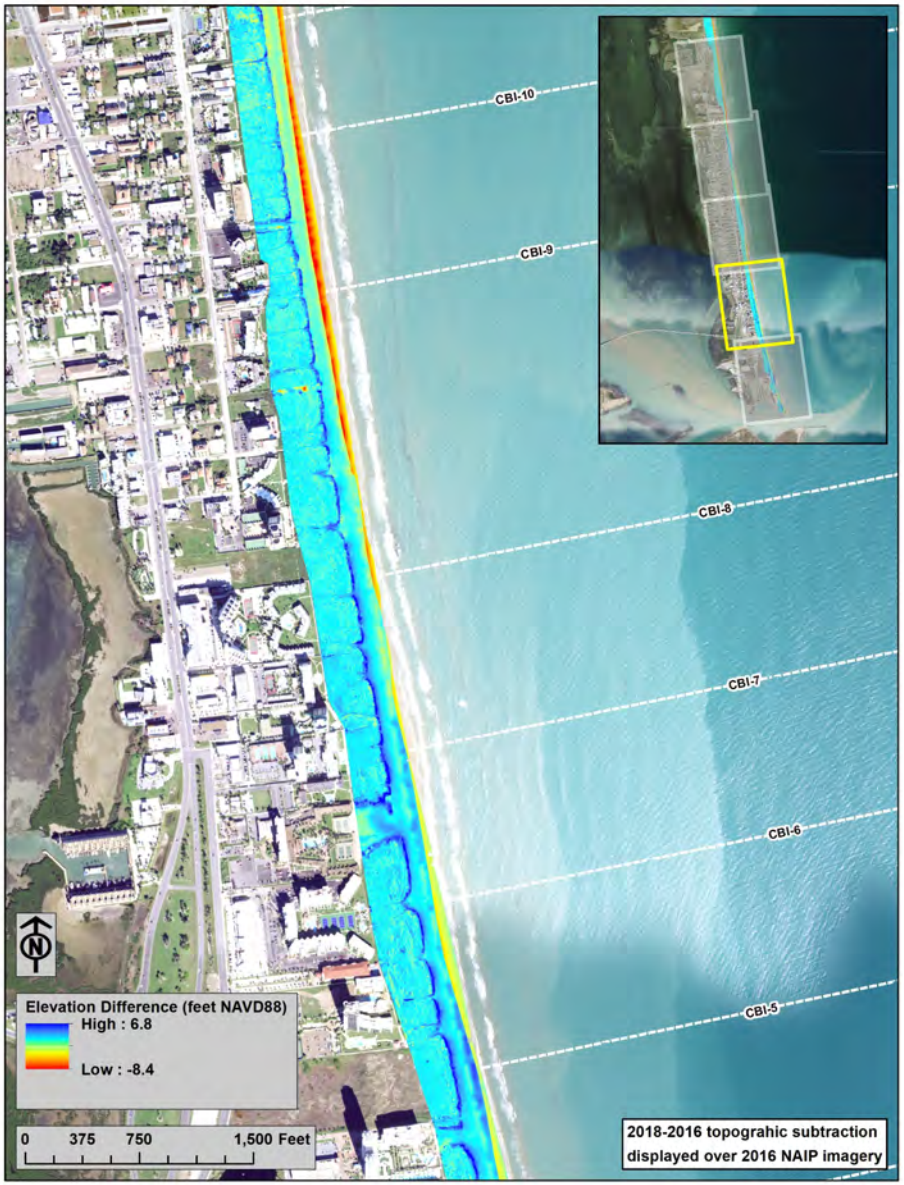

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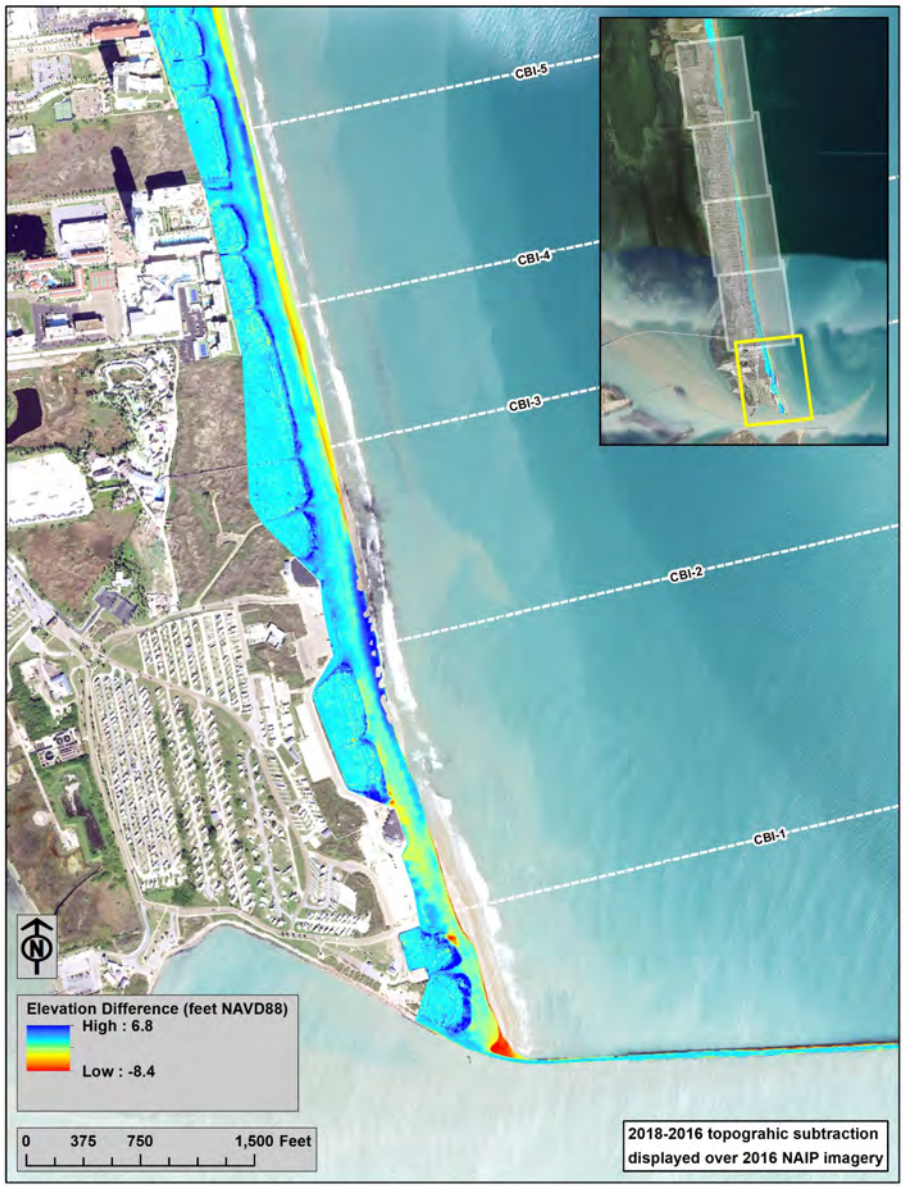
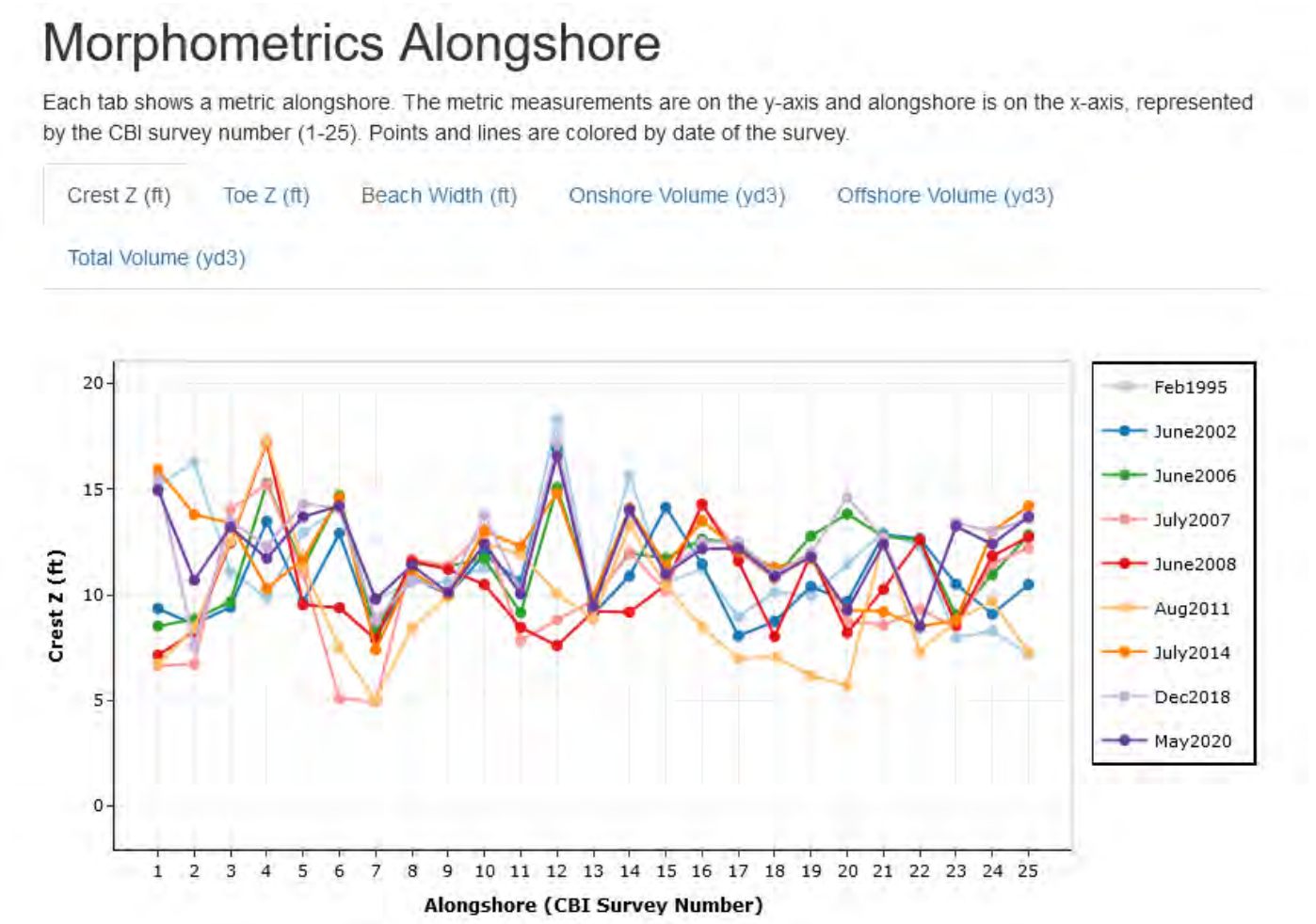


Morphometrics

- Dune crest and toe elevation, beach width, profile volume



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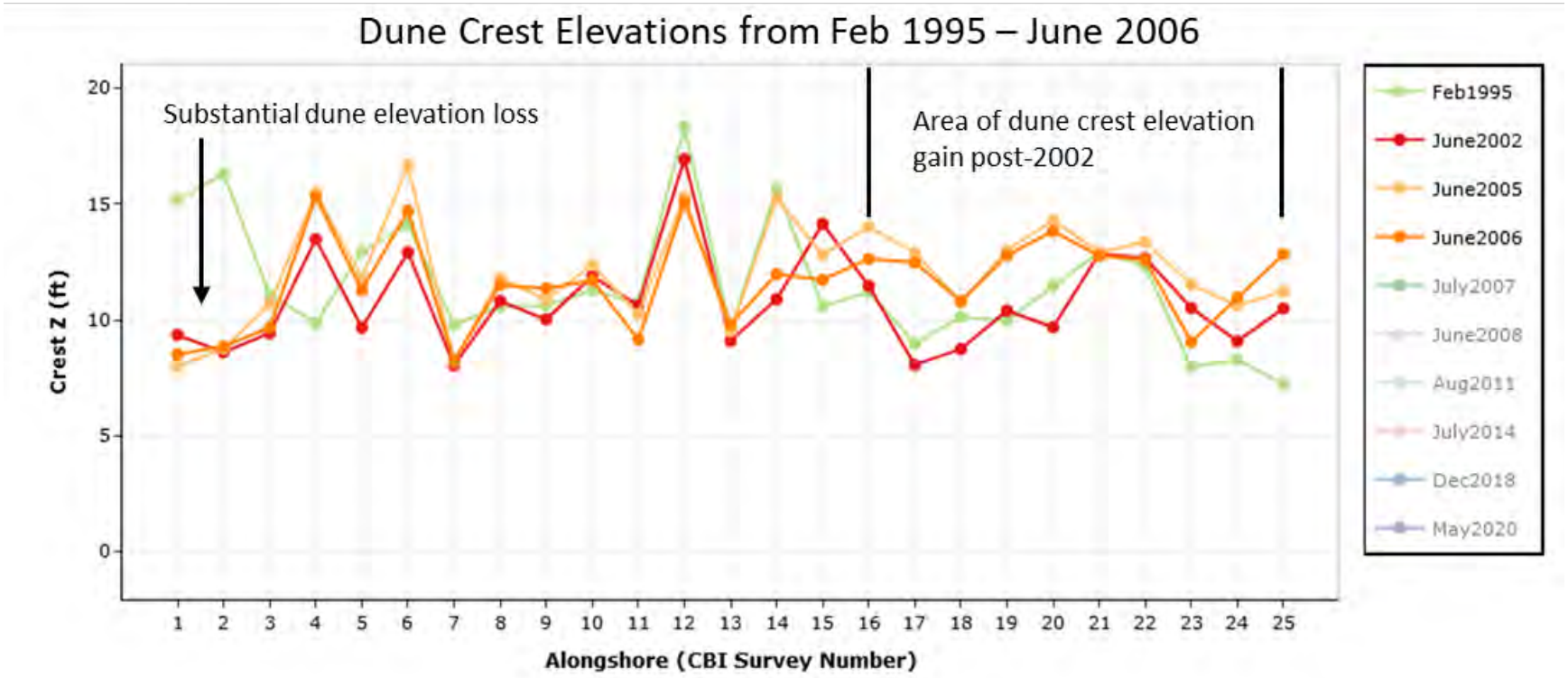
Morphometrics – Dune Crest



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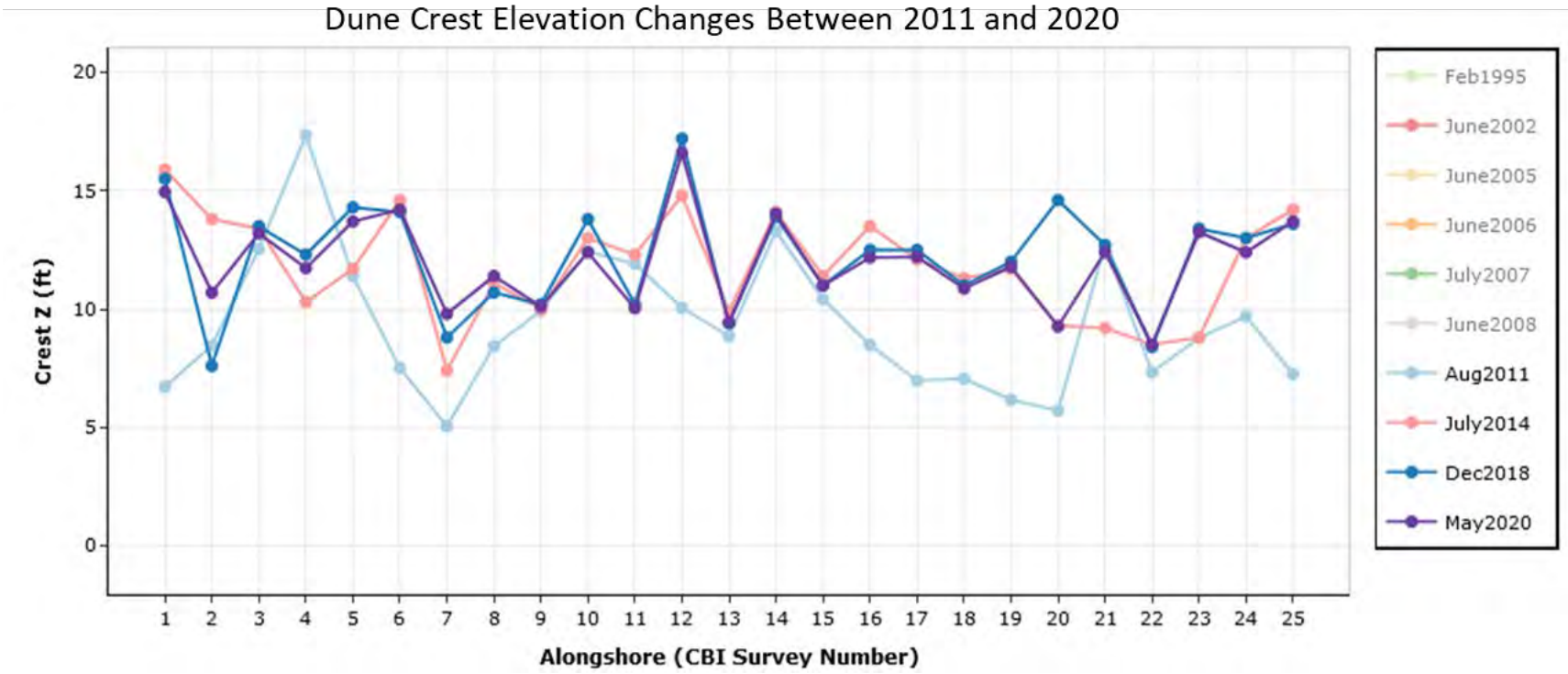

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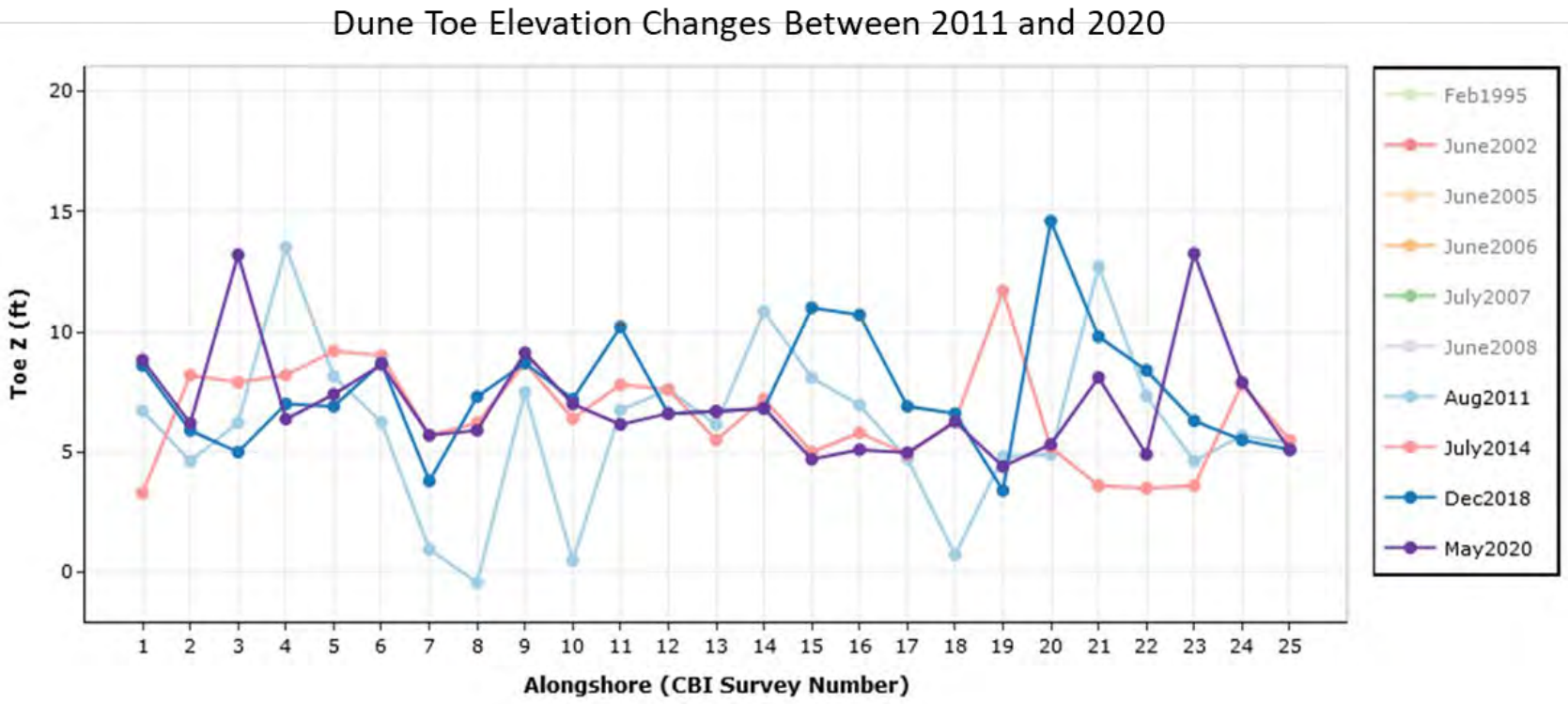
Morphometrics – Dune Toe



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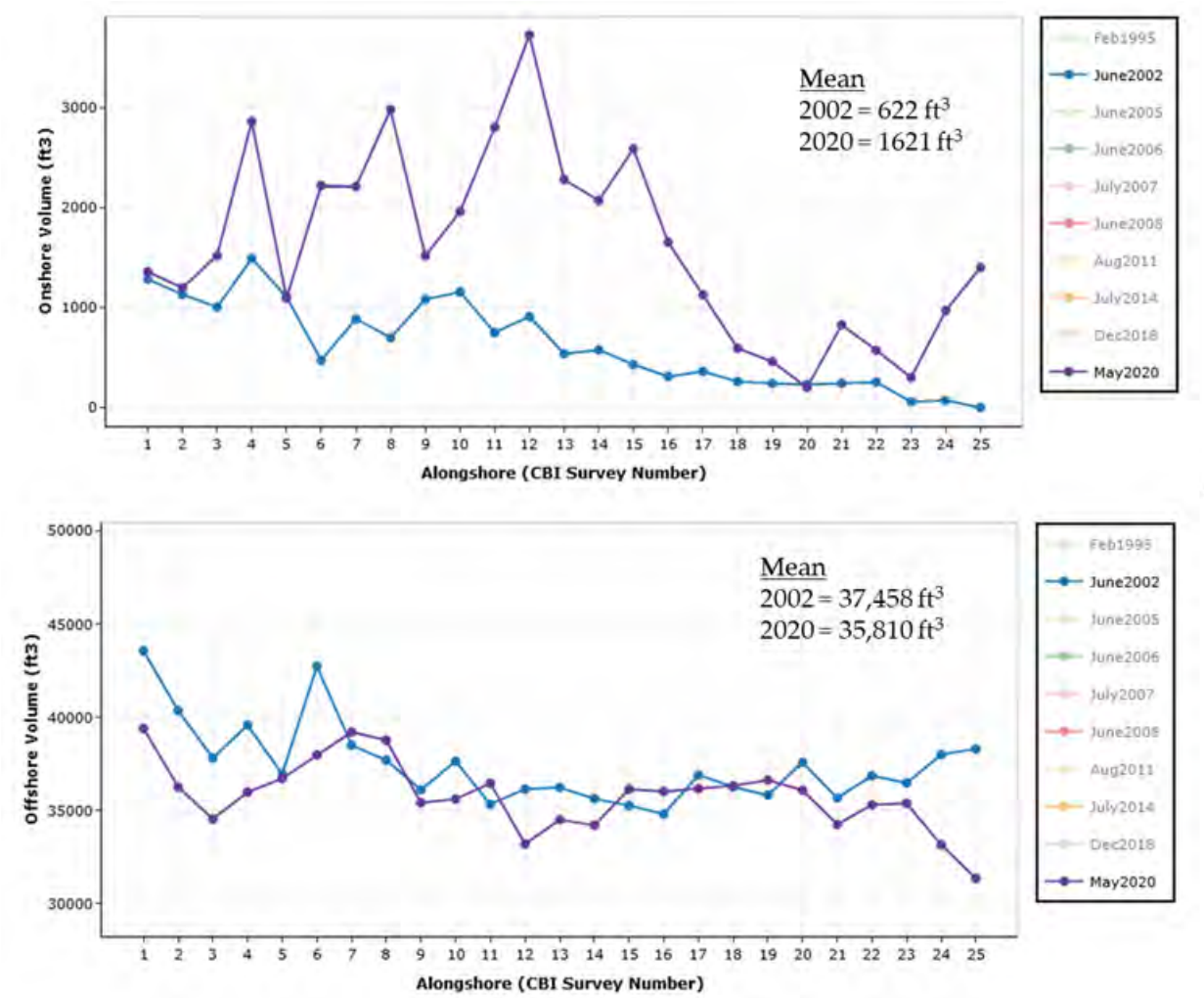
Morphometrics – Profile Volumes



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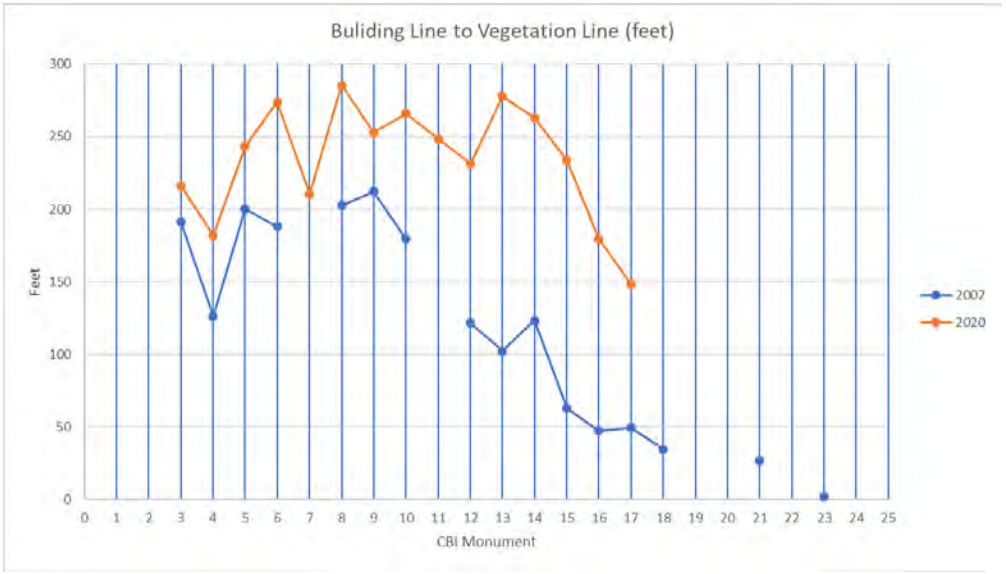
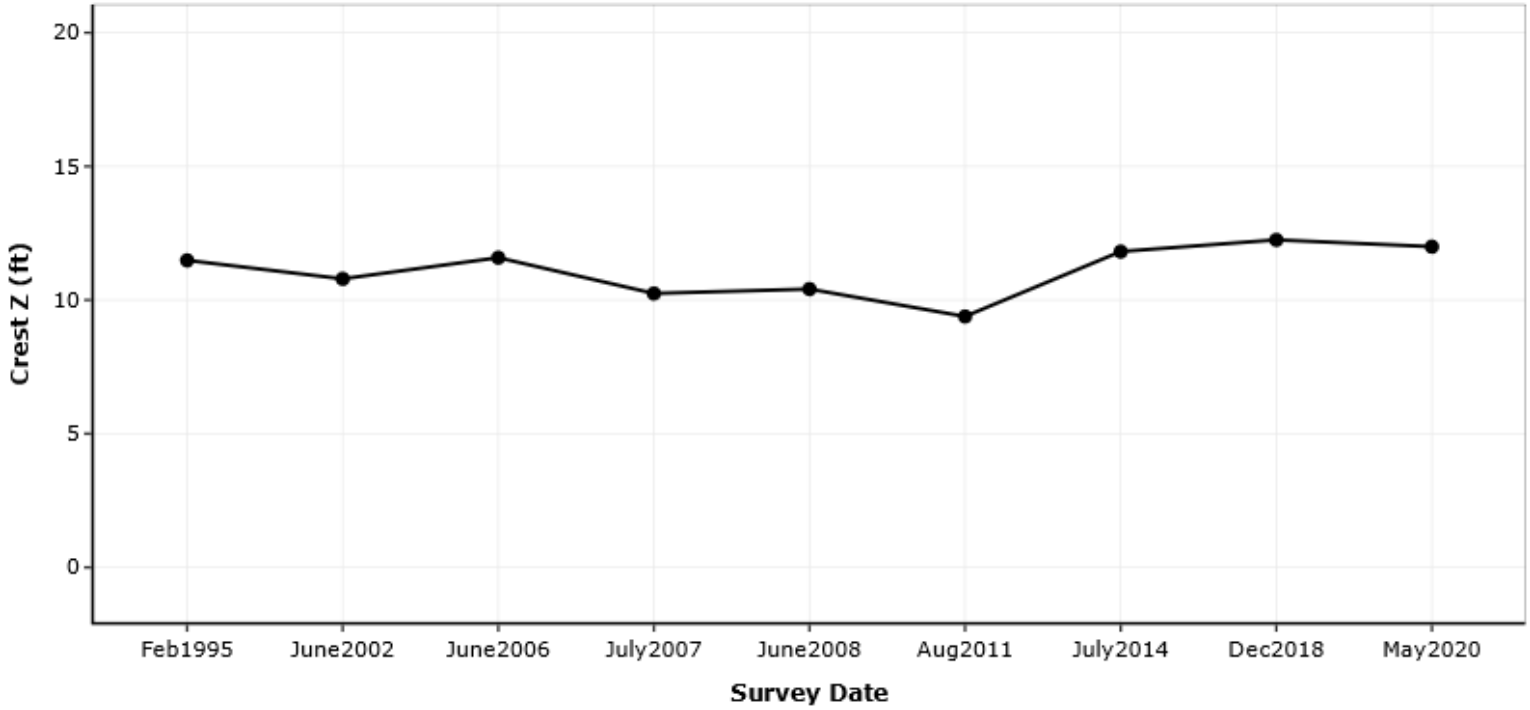
Vegetation Analysis



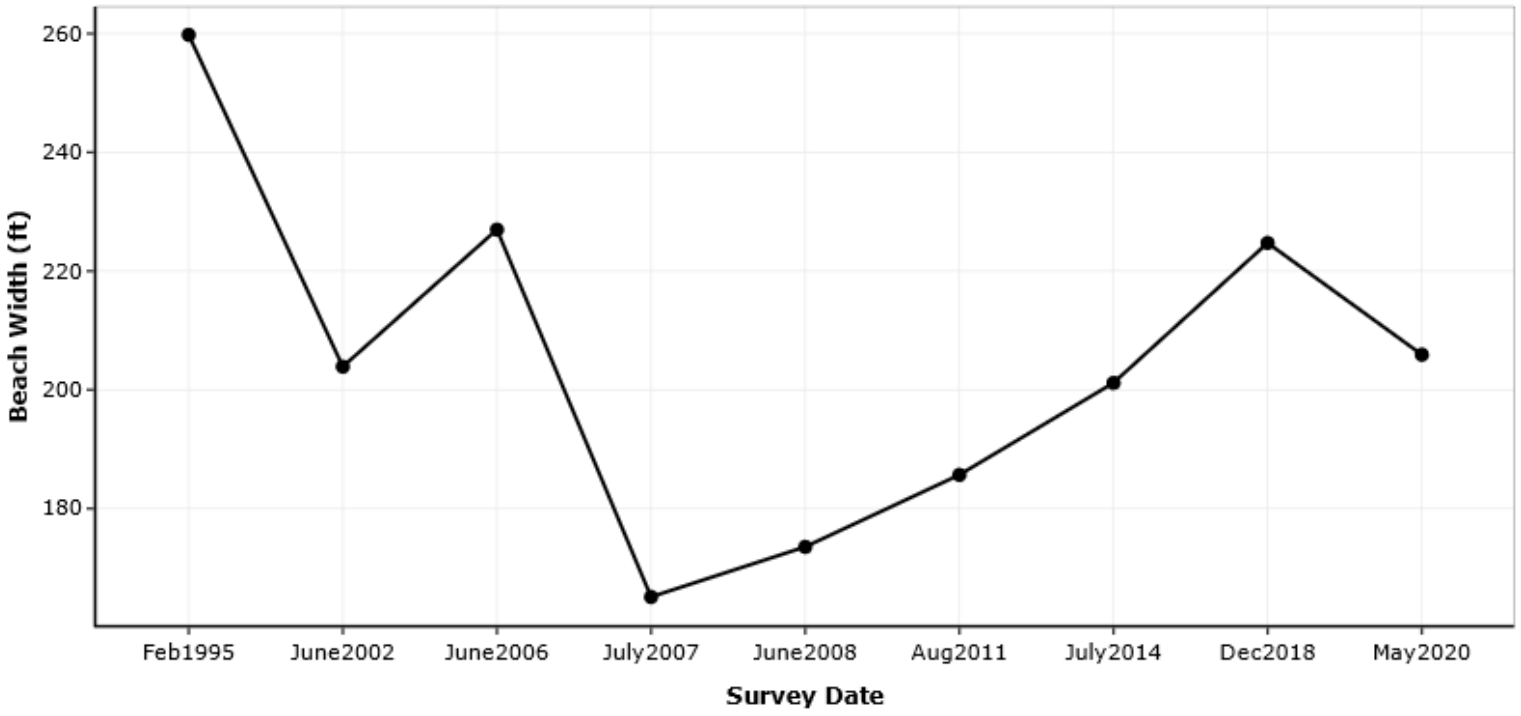
Current State

- Dune field is wide with the exception of areas where human activities have caused narrowing or loss
- Dune crest is variable alongshore; since 2011, has maintained an average of ~12 ft



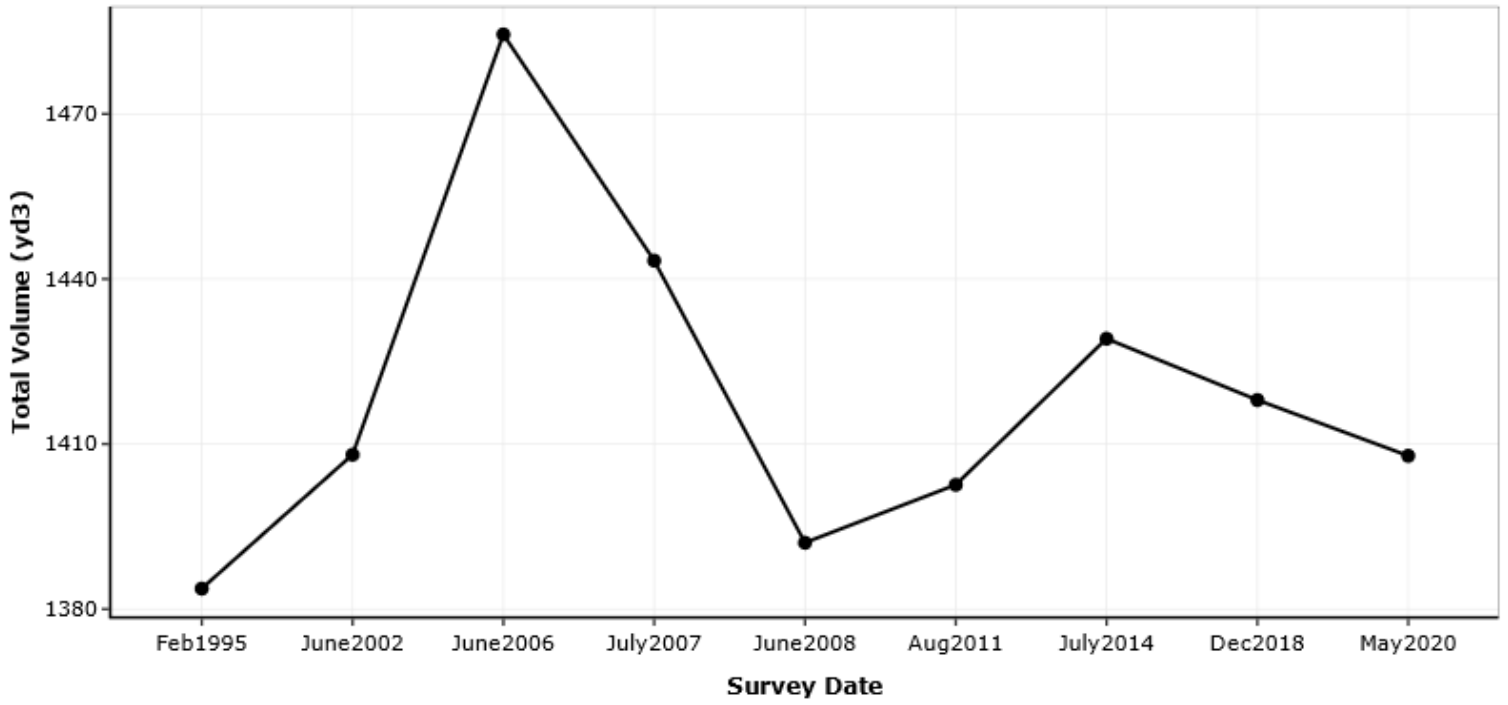
Current State

- Beach width is highly variable along coast and through time
- After a widening trend through time since 2007, slight decrease to an average of 206 feet in 2020



Current State

- Volumes are variable through time, peaking in 2006 as a result of a large offshore sand placement project in Feb 2006
- Volume decrease following 2006 likely re-adjustment of the beach-dune profile system after a series of major storms and ensuing nourishment projects



Questions?