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2018 Salish Sea Ecosystem Conference
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Apr 5th, 10:15 AM - 10:30 AM

Assessing the influence of wave-induced bed shear stresses on tidal marsh colonization potential

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Assessing the Influence of Wave-Induced Bed Shear Stresses on Tidal Marsh Colonization Potential

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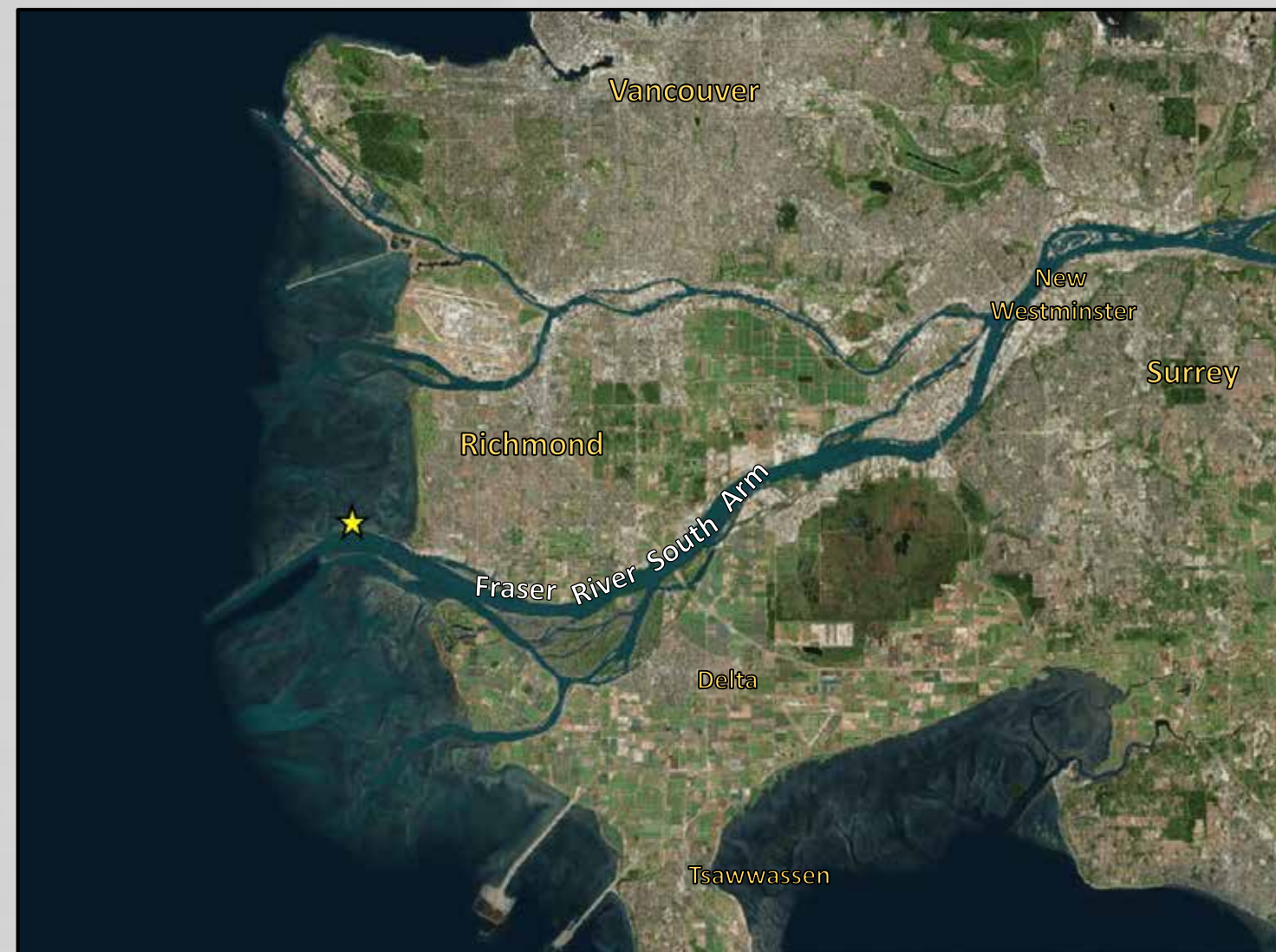


moffatt & nichol

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South Arm Jetty Tidal Marsh Project

Vancouver Fraser Port Authority



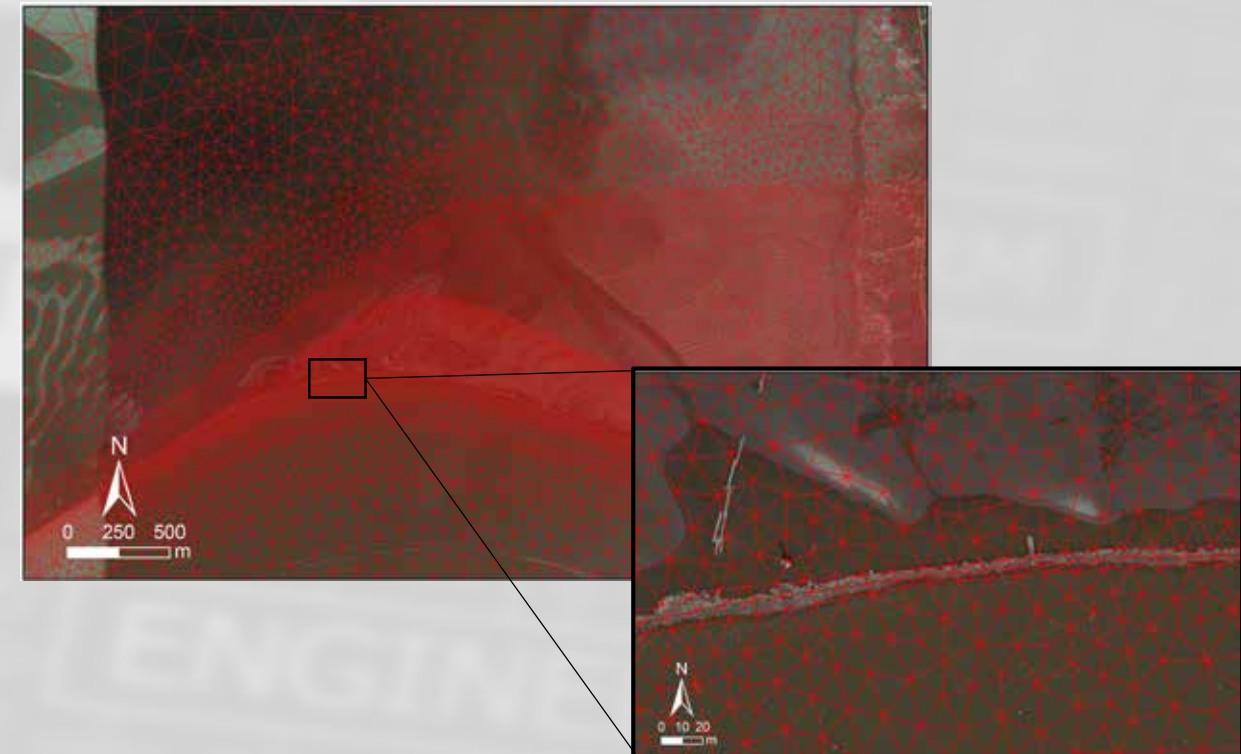
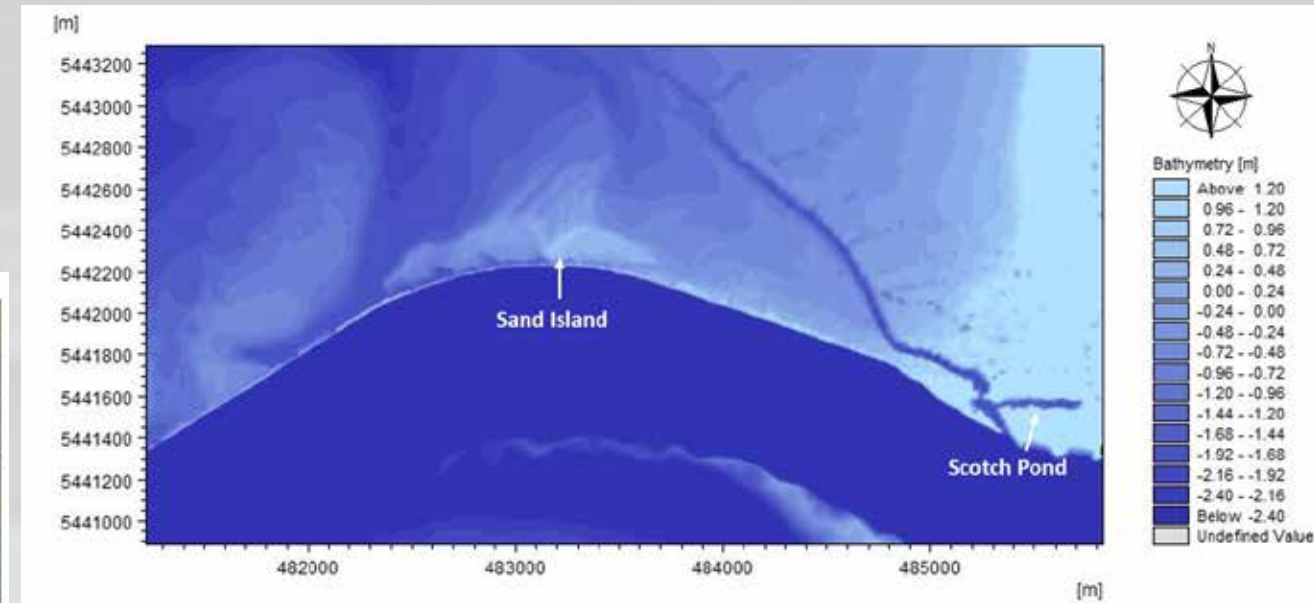
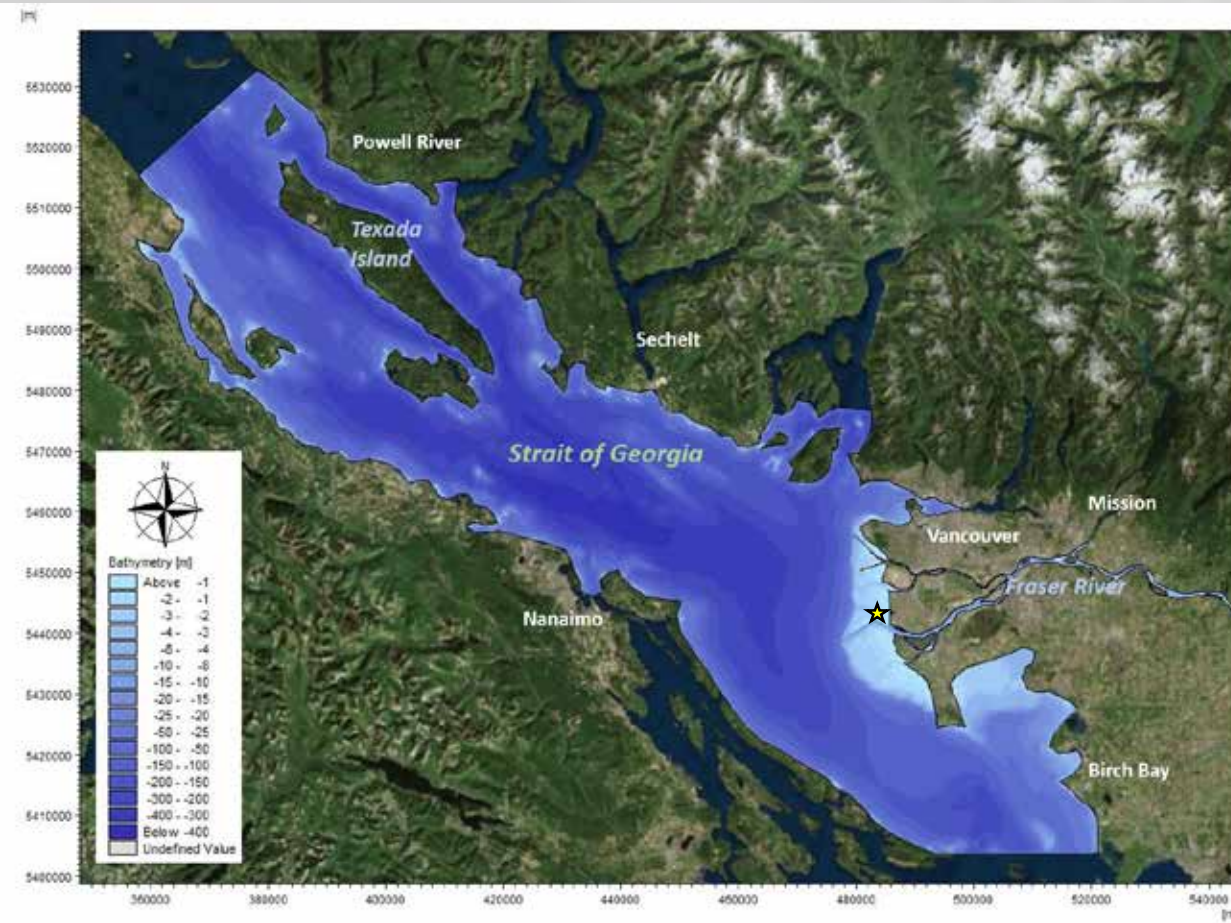
Design of proposed marsh dictated by:

- Salinity
- Elevation
- Wave energy exposure



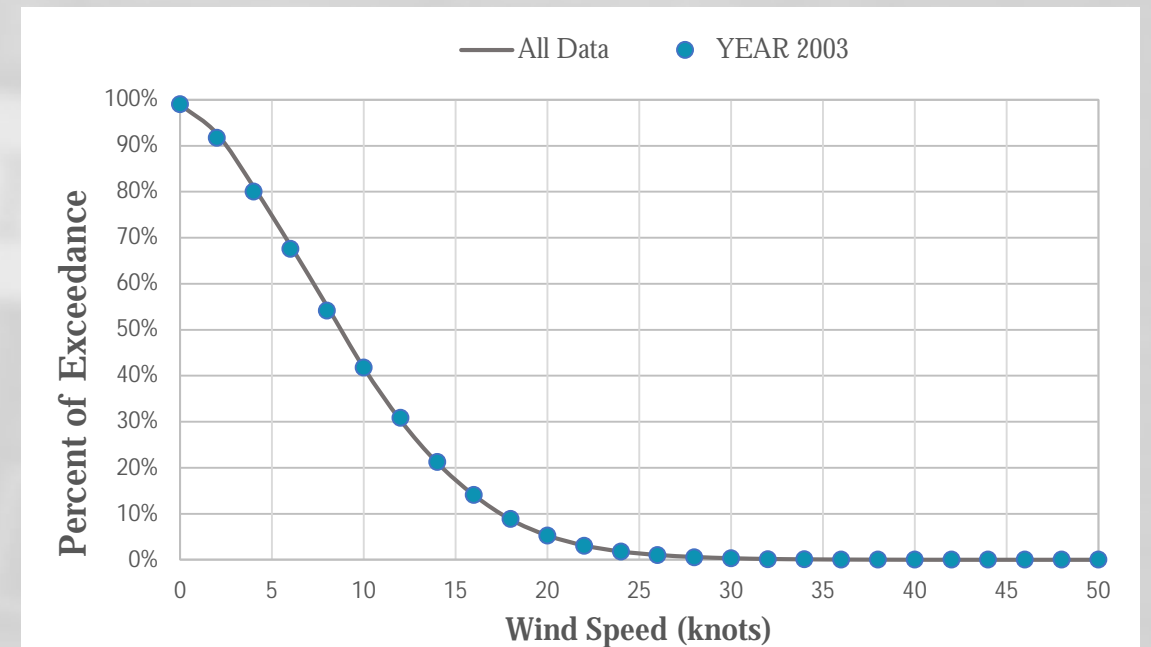
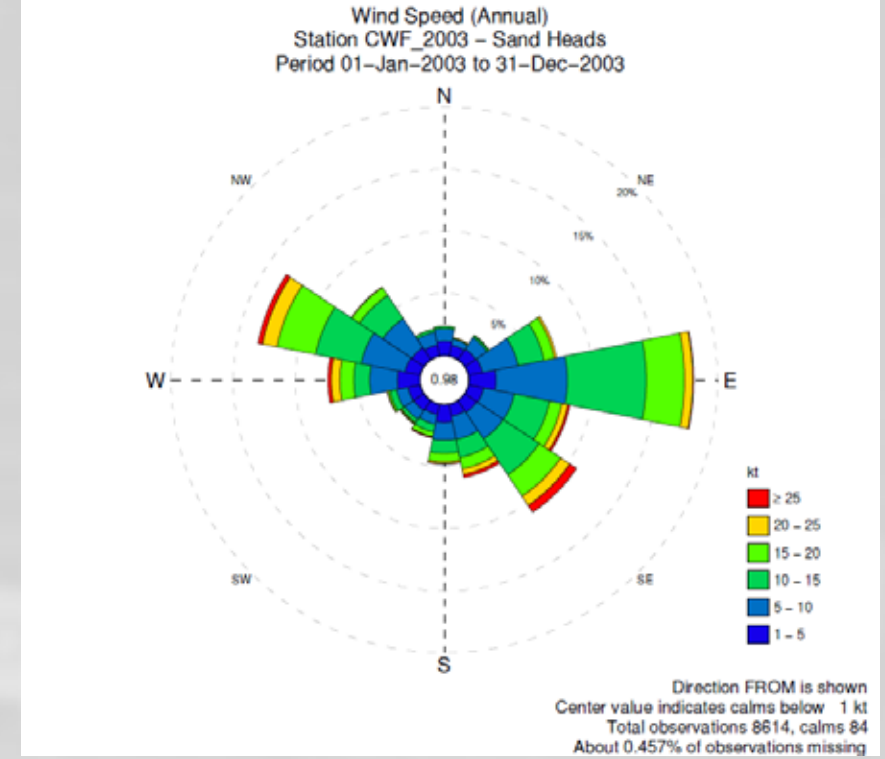
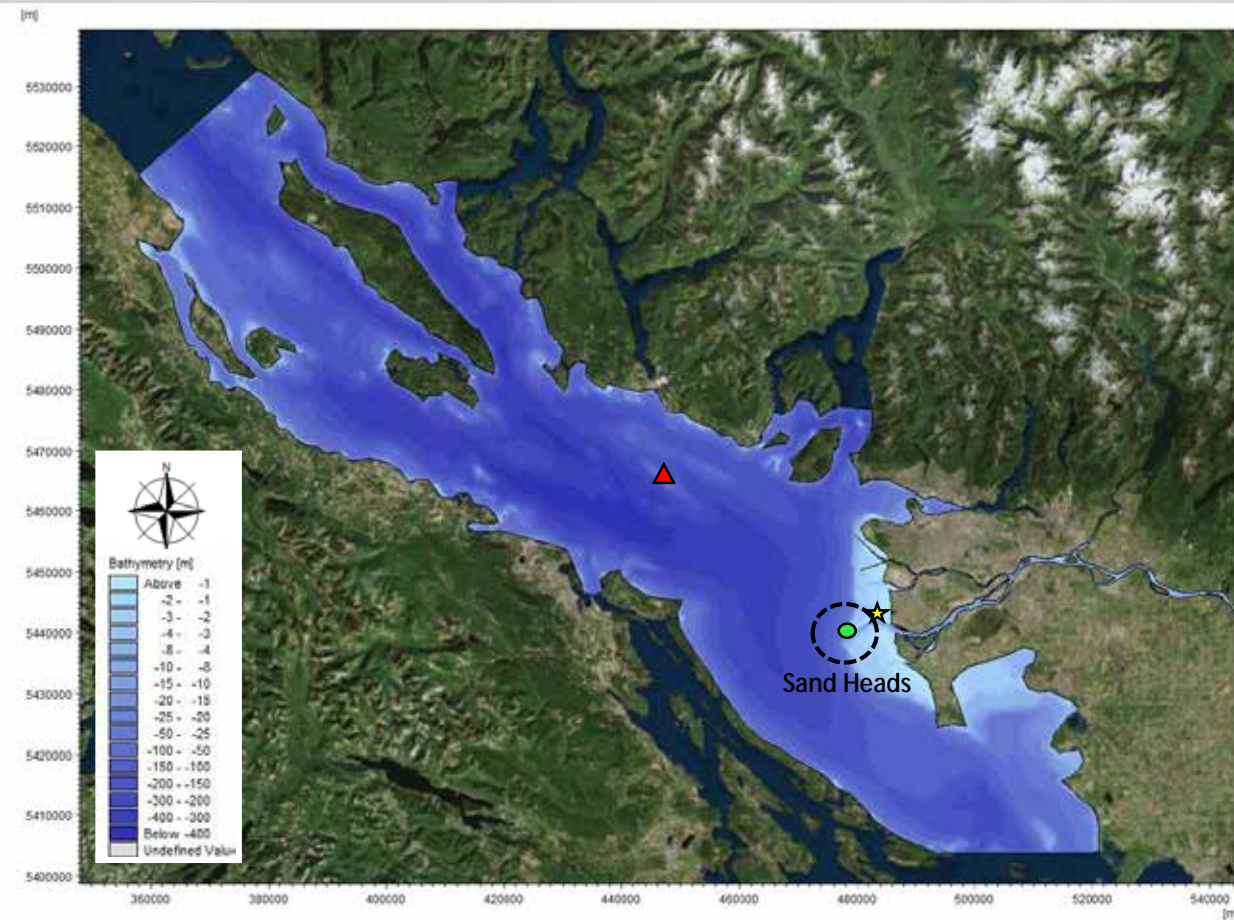
Spectral Wave Model Development

Modelling Domain



Spectral Wave Model Analysis

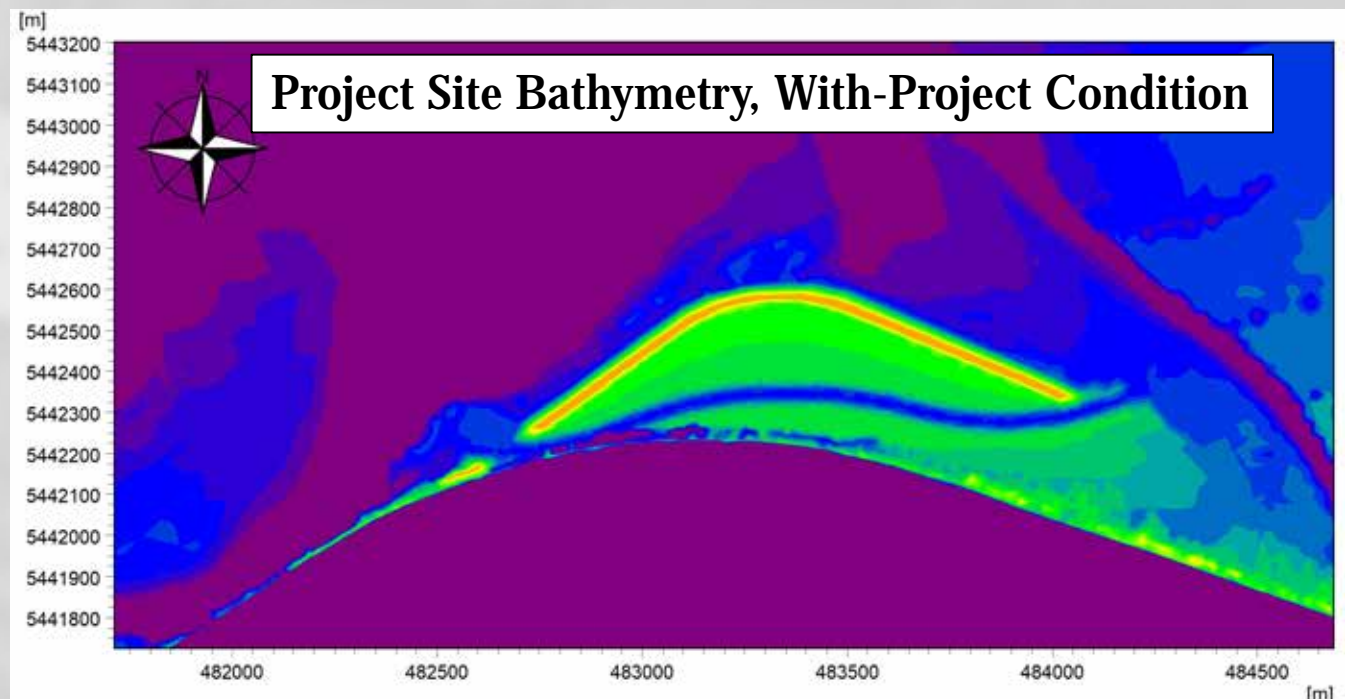
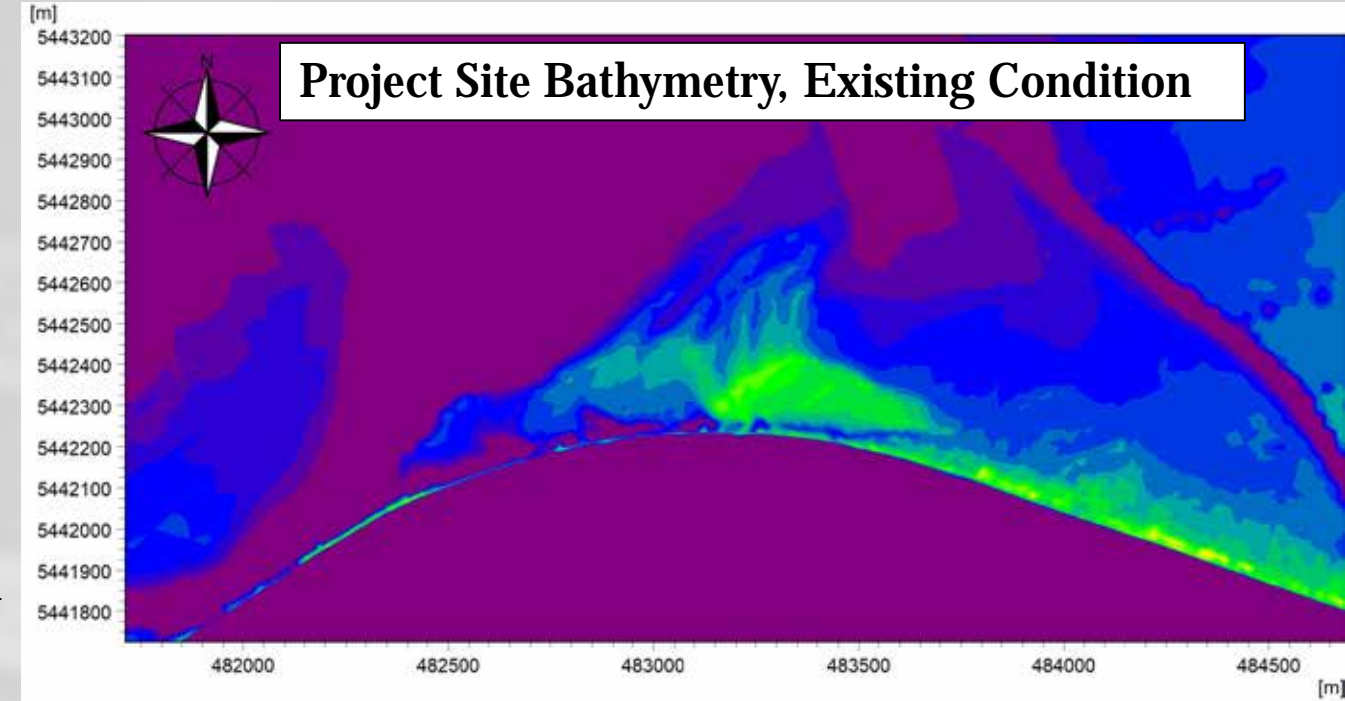
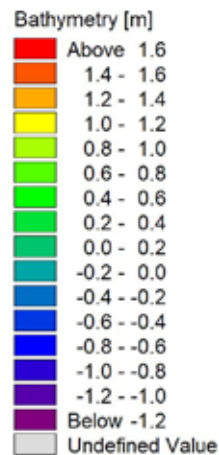
Analysis setup



Spectral Wave Model Analysis

Analysis Setup

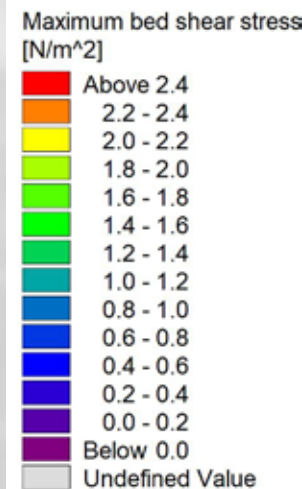
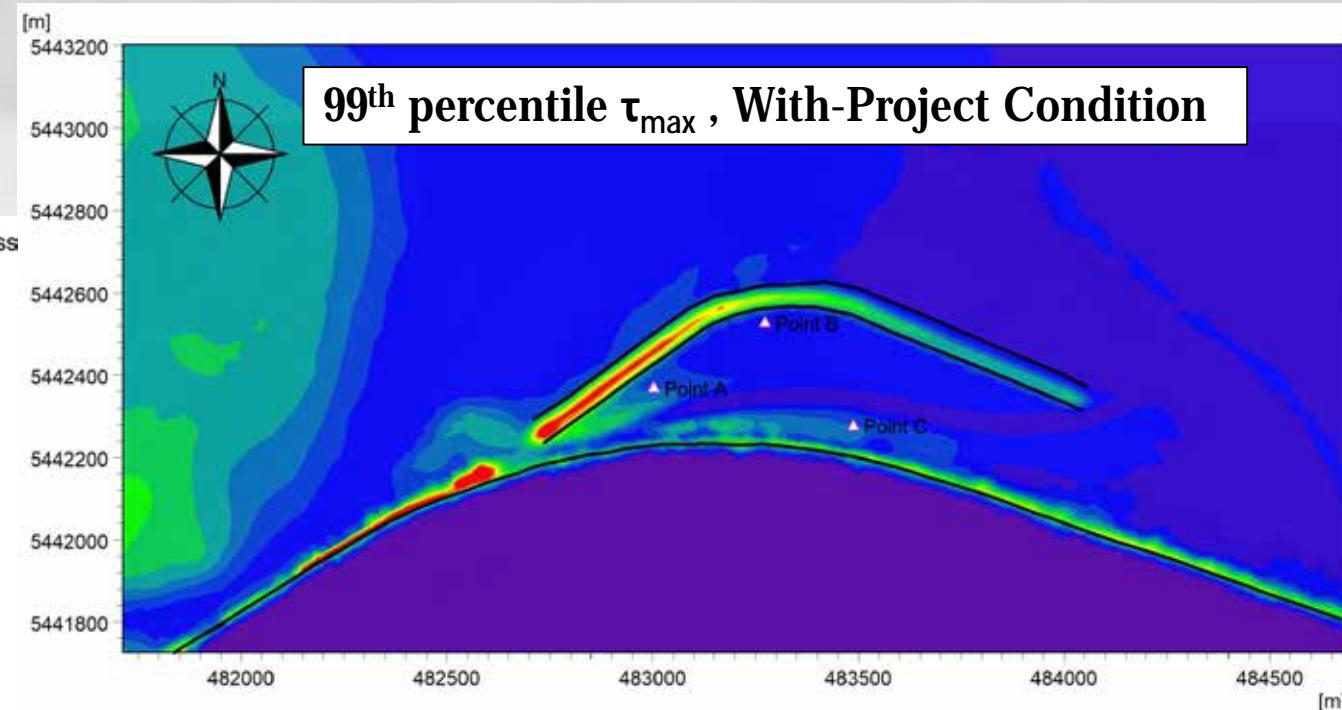
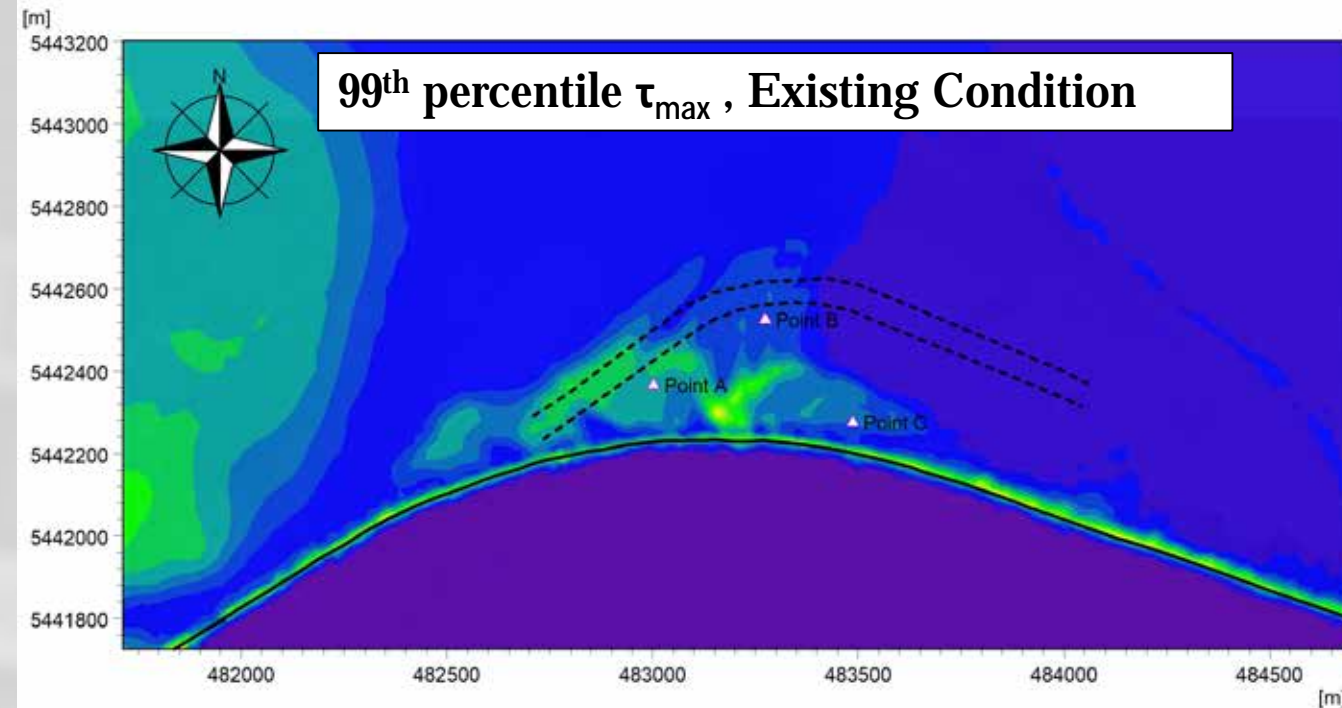
- Spectral wave simulations for entire year 2003.
- Time varying water levels (tides) to account for depth-induced wave transformation and breaking.
- Simulations of existing and with-project condition cases
- With-Project condition:
 - à 1,500m long Cobble Berm.
 - Crest El. +1.4m (GD)
 - à Adjustment of grades



Analysis Results

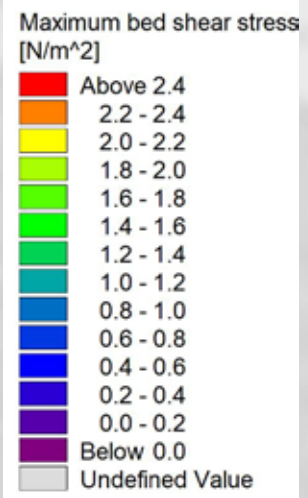
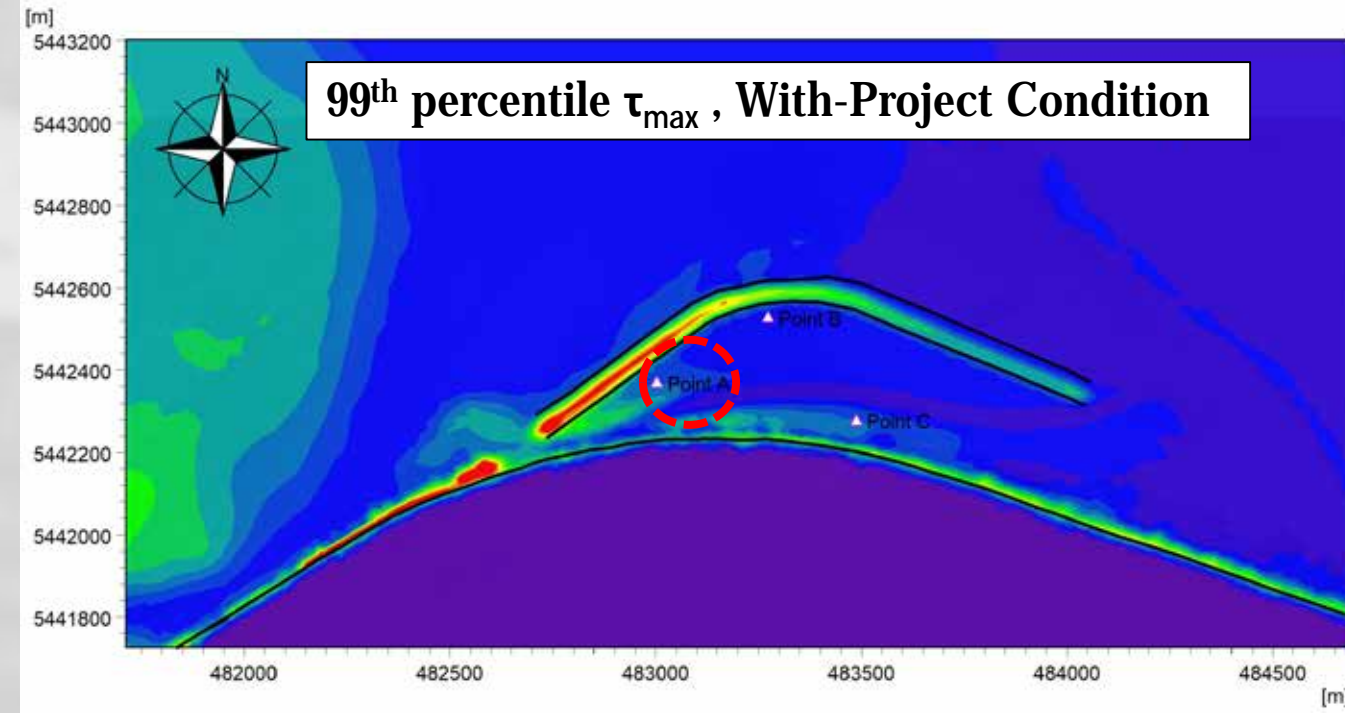
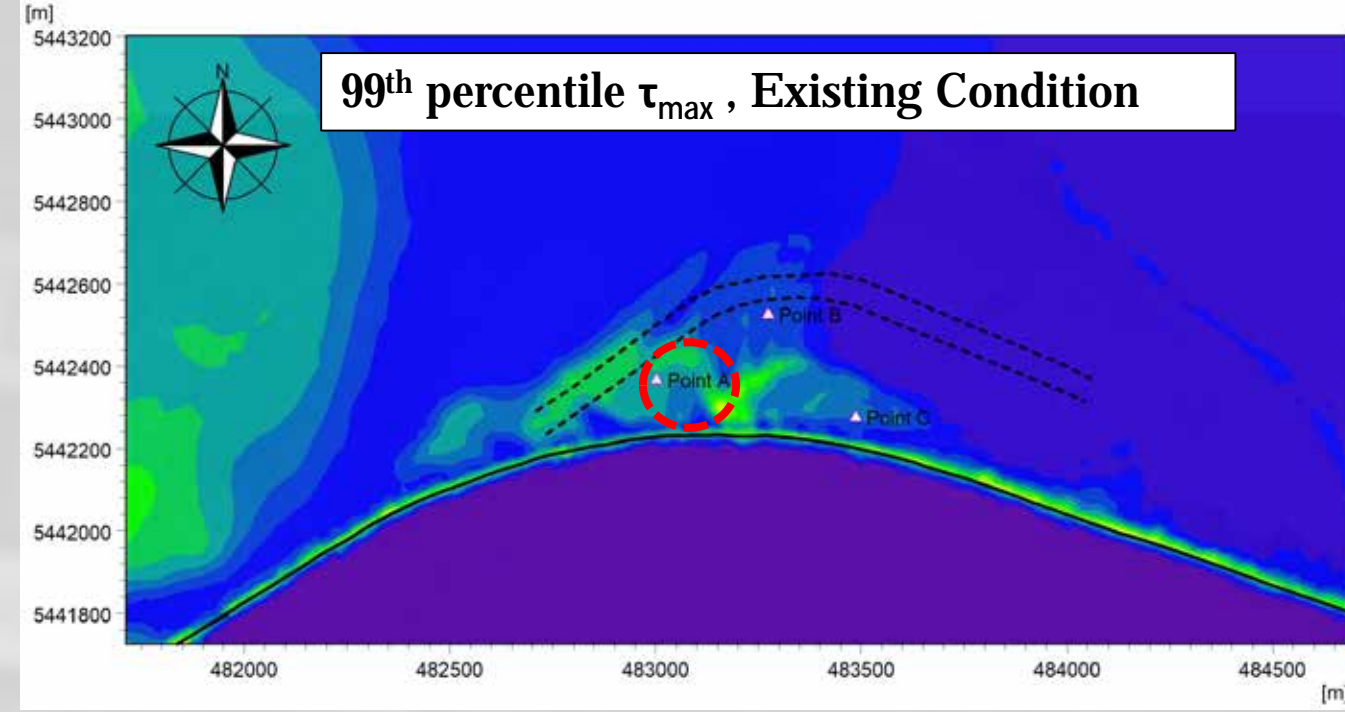
Wave Induced Bed Shear Stress, τ_{\max}

- τ_{\max} dependent on wave height and wave period and wave orbital velocity near the bed.
- Target shear-stress for existing substrate and fill material: 1 N/m^2
- 99th percentile τ_{\max} value exceeded ~ 4 days per year
- Overall decrease of $\sim 15\%$ under project conditions



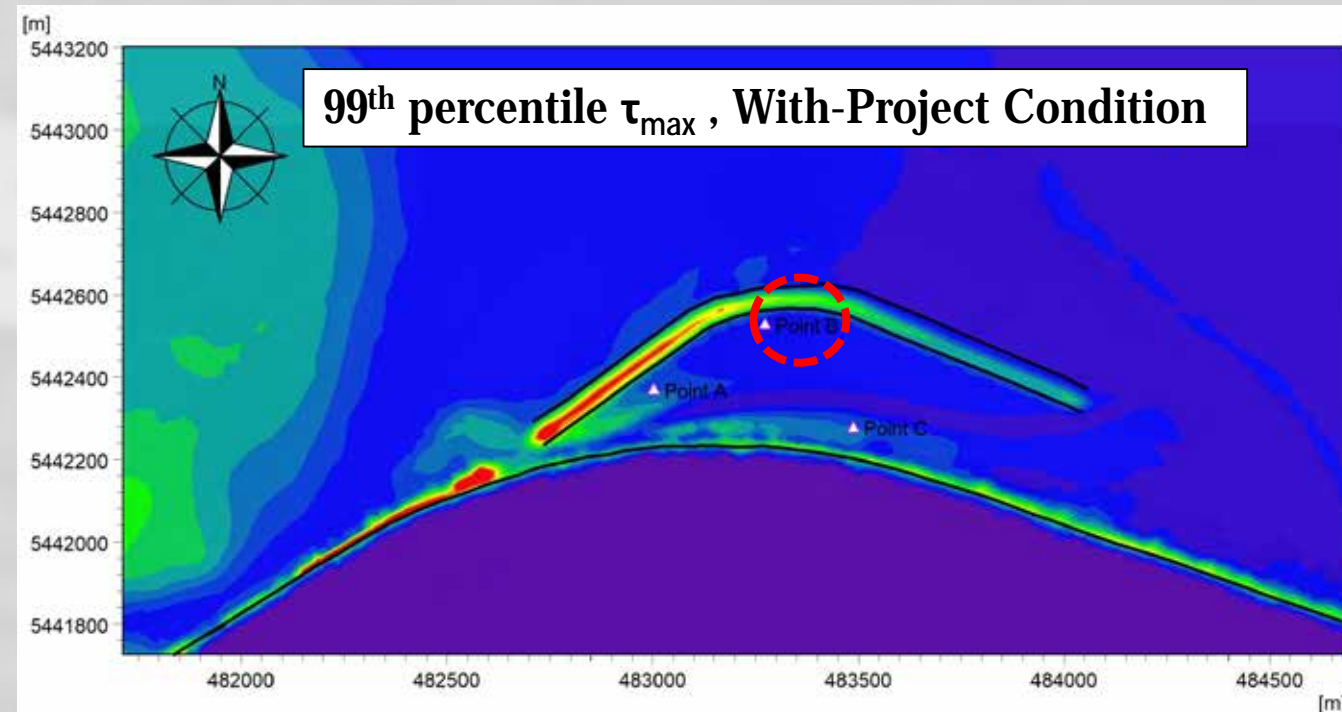
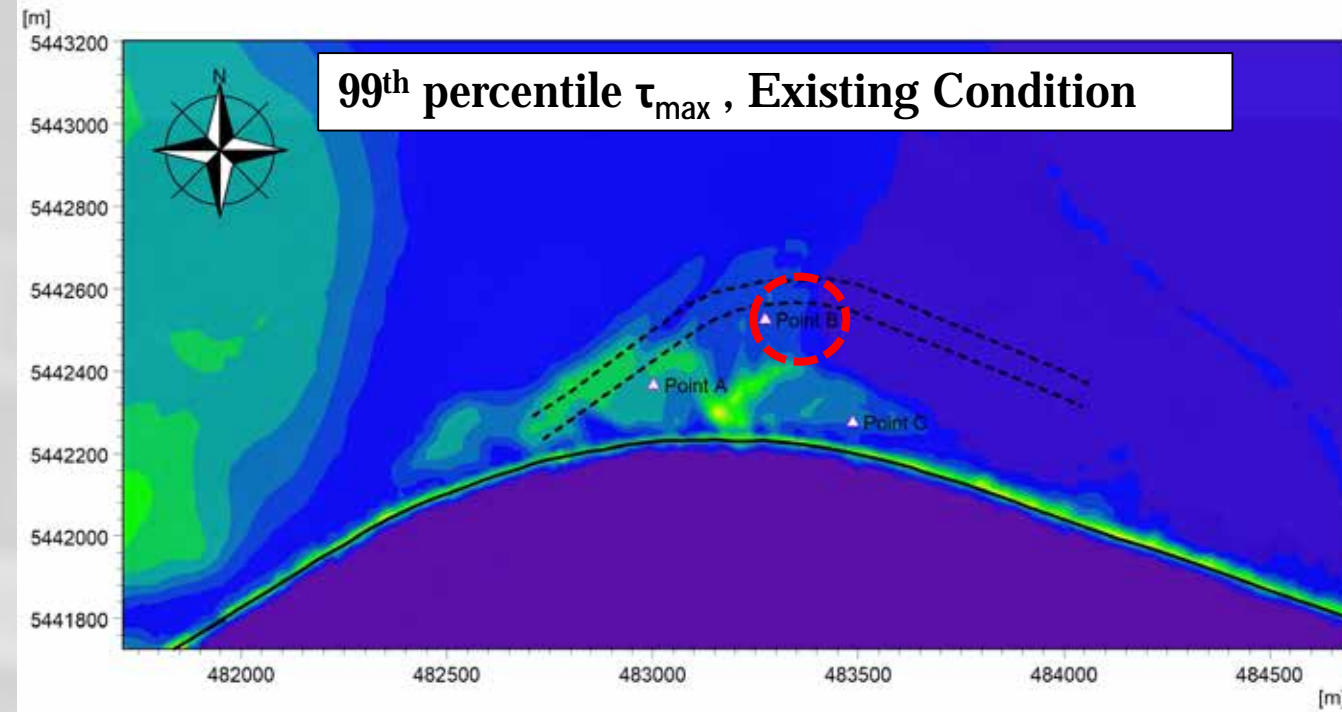
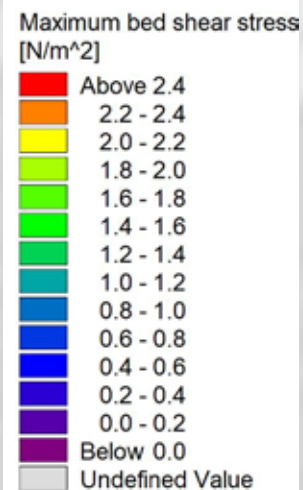
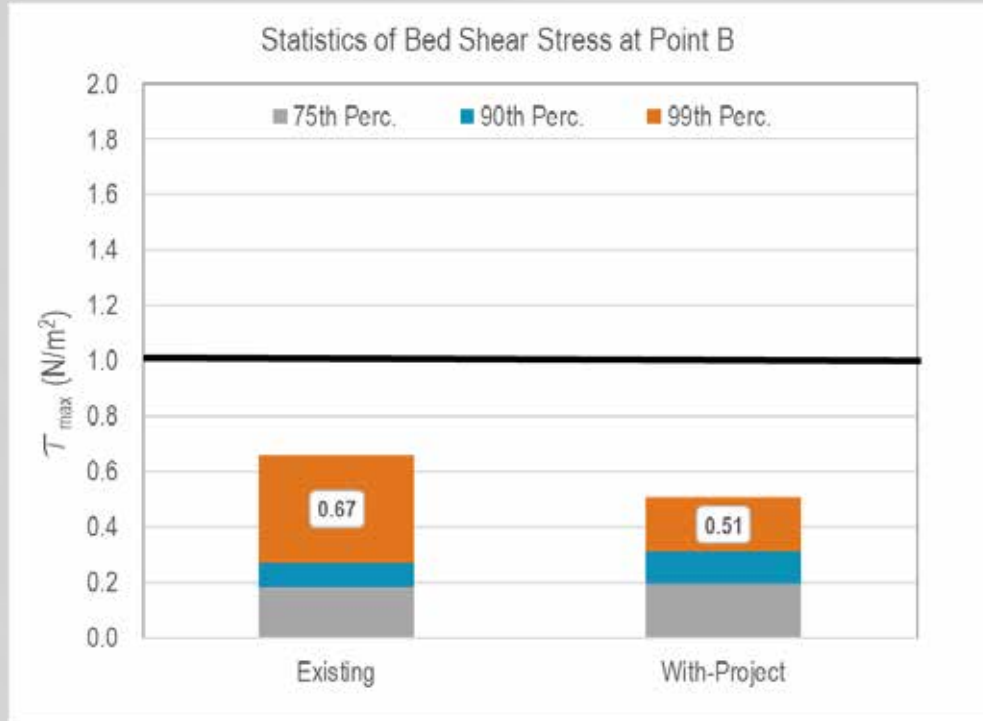
Analysis Results

Wave Induced Bed Shear Stresses



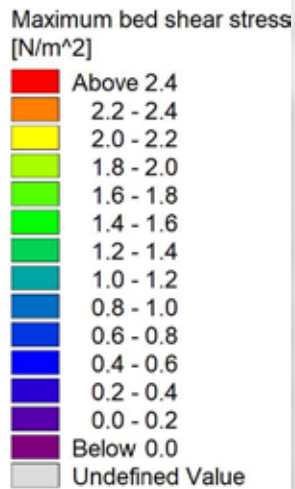
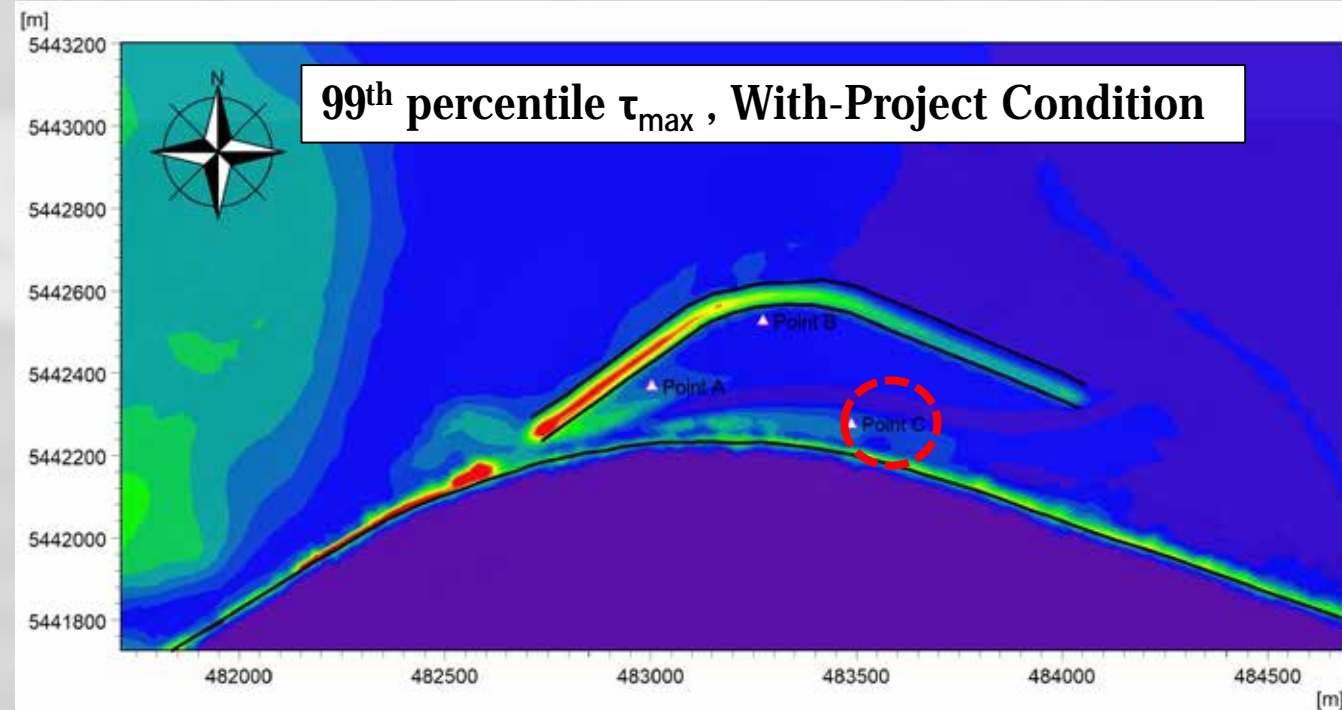
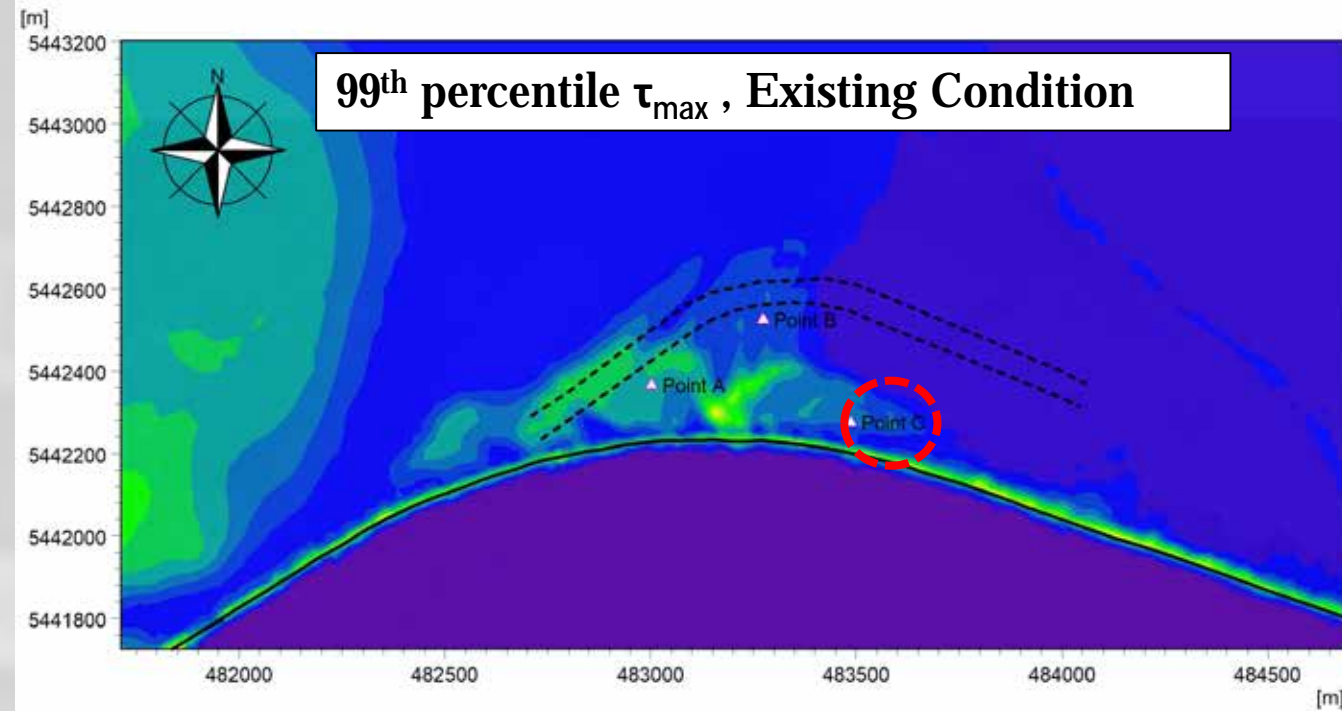
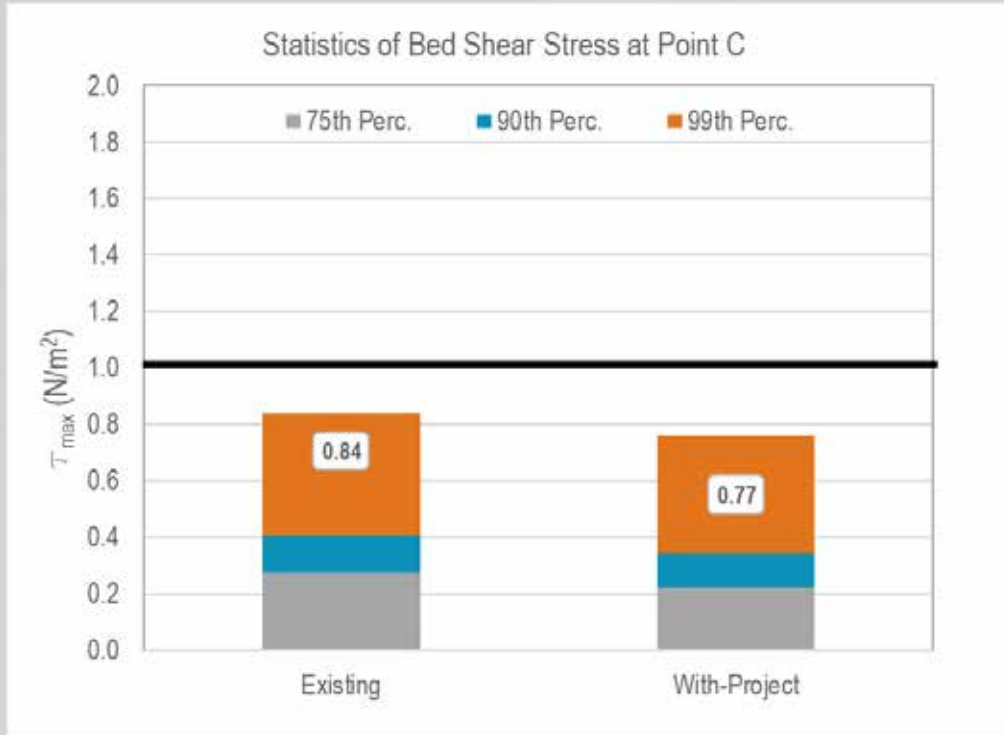
Analysis Results

Wave Induced Bed Shear Stresses



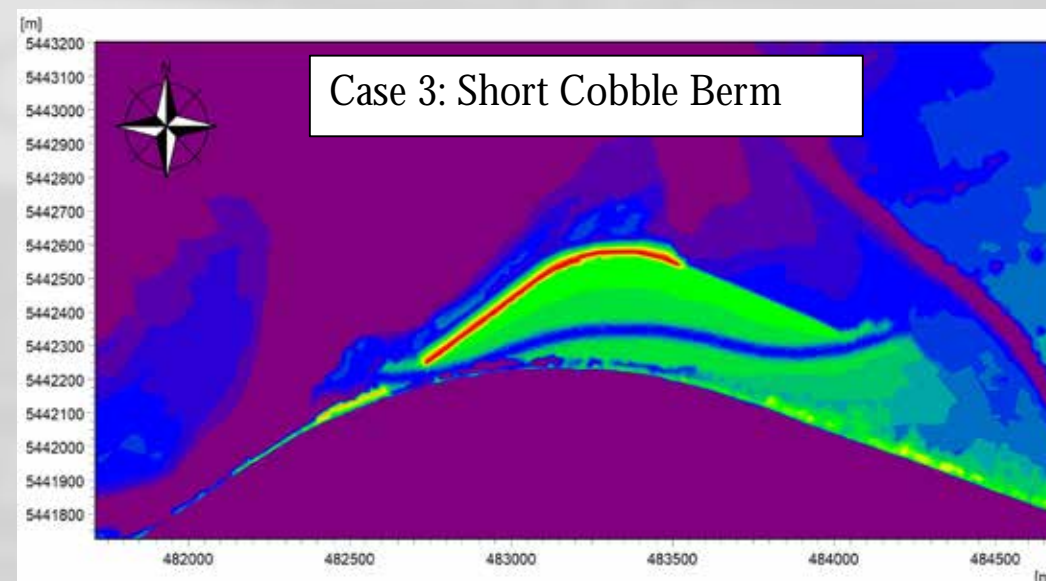
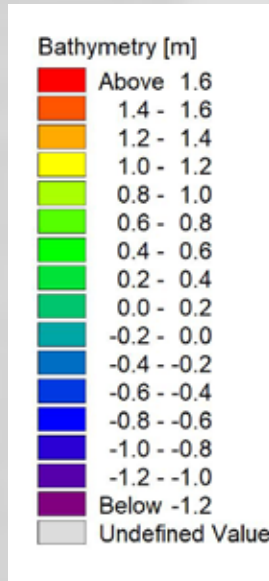
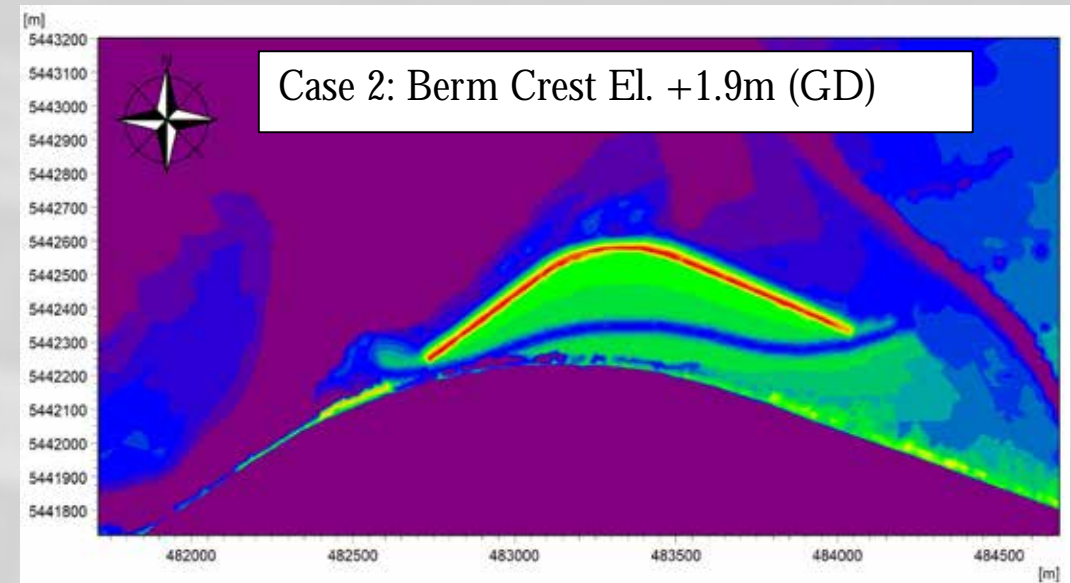
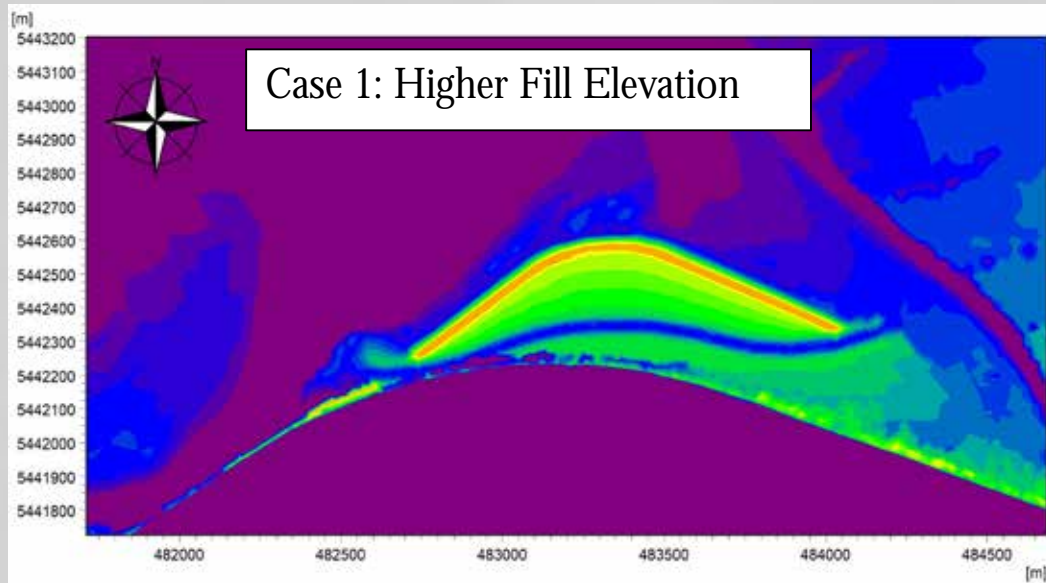
Analysis Results

Wave Induced Bed Shear Stresses



Analysis Results

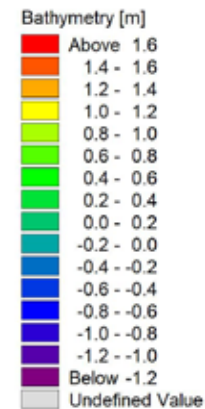
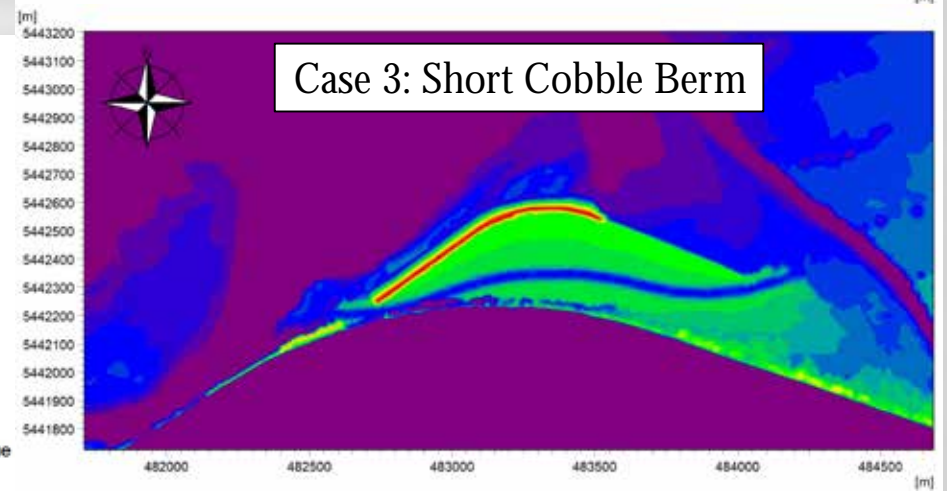
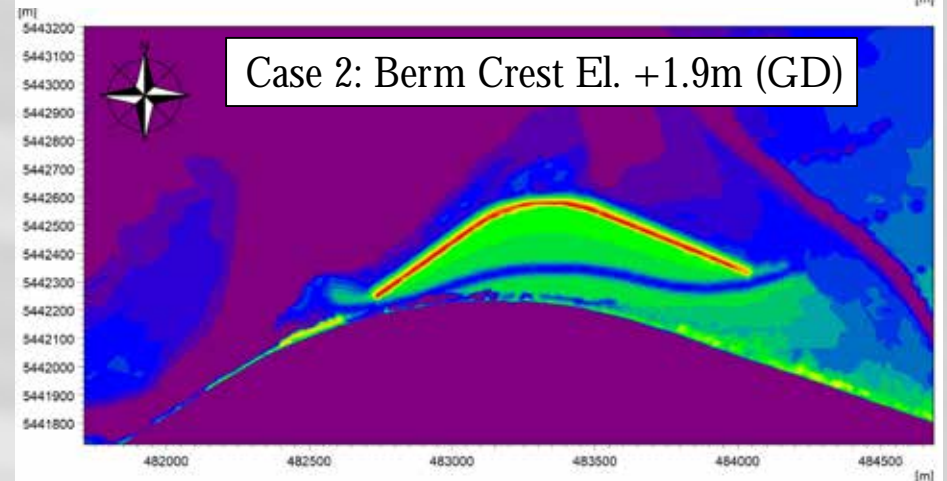
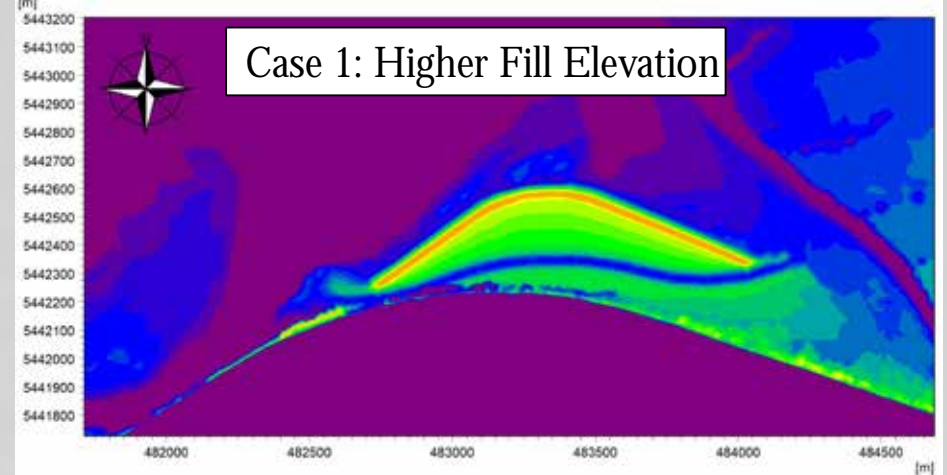
Sensitivity to Project Modifications



Analysis Results

Sensitivity to Project Modifications

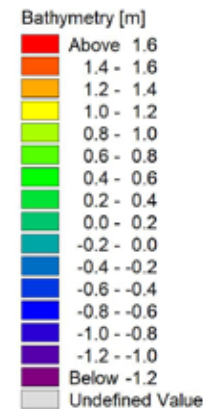
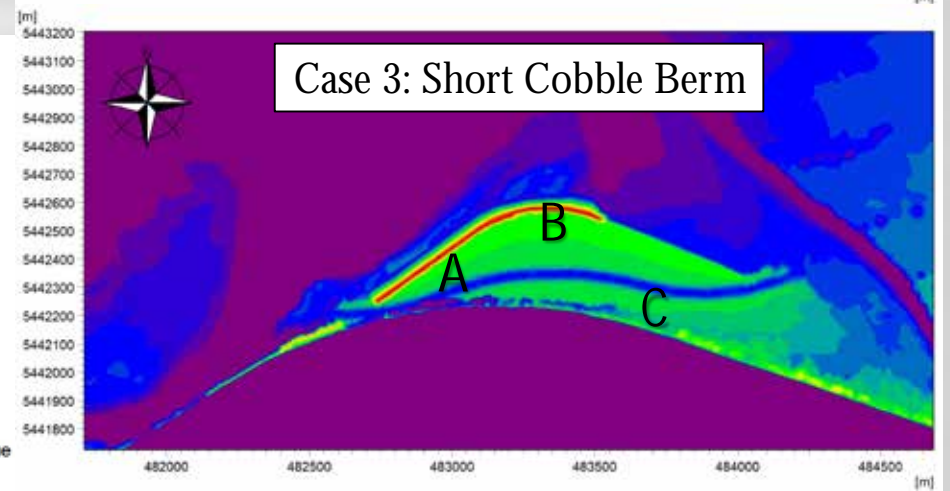
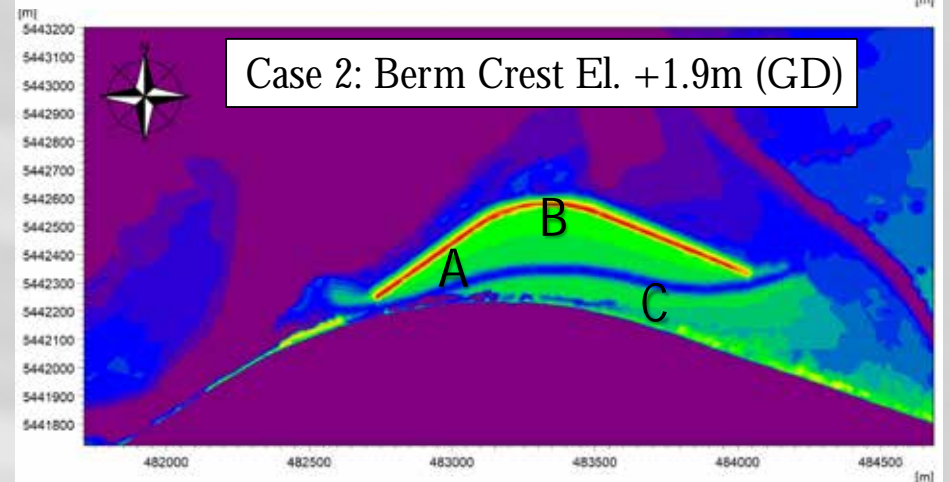
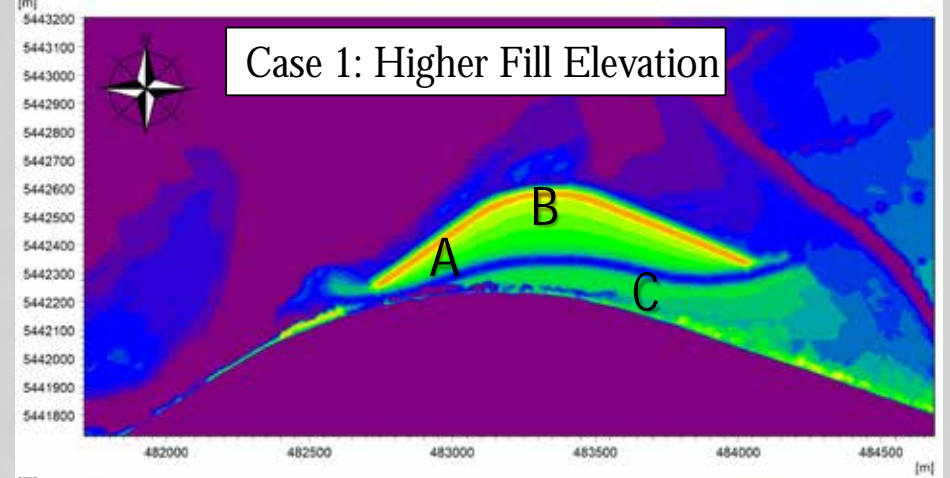
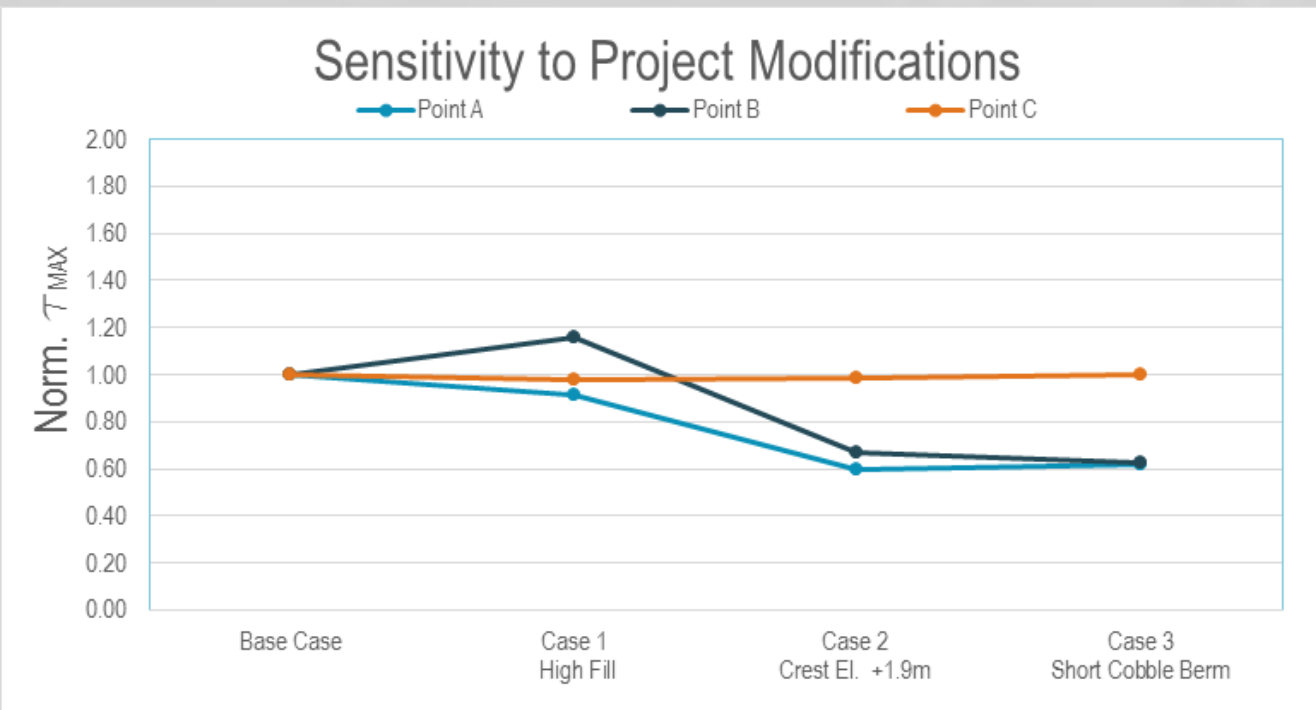
$$\text{Norm. } \tau_{max} = \frac{\tau_{max}^{Case}}{\tau_{max}^{base}}$$



Analysis Results

Sensitivity to Project Modifications

$$Norm. \tau_{max} = \frac{\tau_{max}^{Case}}{\tau_{max}^{base}}$$



Conclusions

- For a typical year: $\tau_{\max} < 1 \text{ N/m}^2$ approximately 99% of the time.
- Higher shear stress sensitivity to elevation of cobble berm crest: Recommended to keep construction elevations for a prolonged time.
- Presence of cobble berm promotes favorable conditions for the initial growth and development of proposed marsh.



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