

Physical Modeling of Nearshore Placed Dredged Material

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Study Motivation

- The U.S. Army Corps of Engineers (USACE) continues to seek opportunities for the beneficial use of dredged material.
- Quantify benefits of nearshore dredged mound placement
- Determine movement of mound sediment
- Provide data for development of C2Shore numerical model



LARGE-SCALE SEDIMENT TRANSPORT FACILITY



- Large-scale facility with 18-m wide (cross-shore) by 30-m long (longshore) sand beach (0.15 mm median grain diameter)
- Waves produced by four synchronized wave generators oriented at a 10-degree angle to shoreline
- Wave-driven currents supplemented by an external recirculation system to simulate infinitely long beach
- Longshore sediment transport rate measured with traps installed at the down-drift boundary.

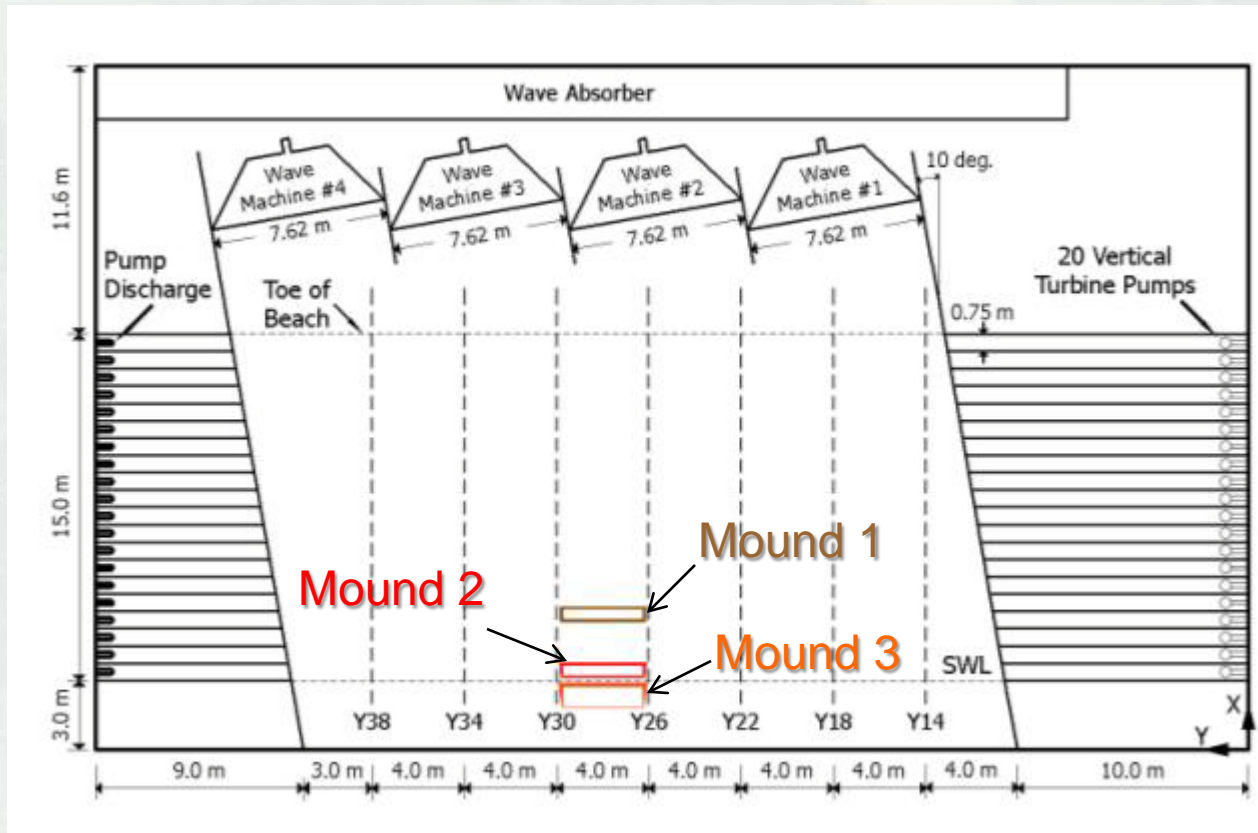


Mound Experiments

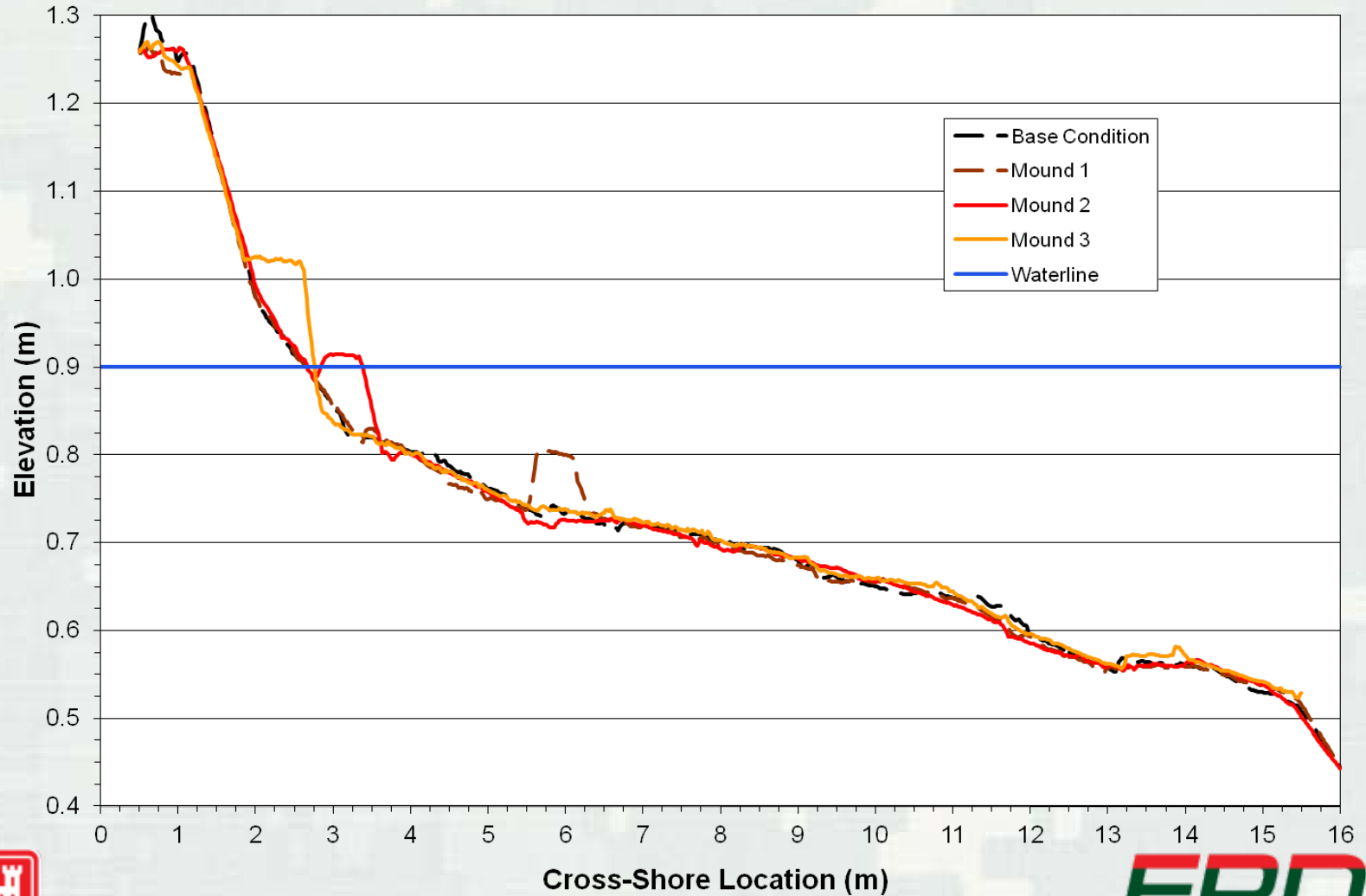
- Base case scenario was performed to measure the natural movement of sand and to help isolate the influence of each mound
- Mounds were located at approximate prototype depths of 11 (Mound 1) and 4 ft (Mound 2) relative to the still water level with a prototype height of 5 ft, and placement onshore (Mound 3) with a 10 ft prototype height.
- Each mound was dyed with a different color to increase the contrast between the placed material and the beach
- Incident wave conditions simulated at a 1:20 scale for an offshore incident wave height (H_{mo}) of 10.8 ft with a peak period of 6.7 sec and a breaking wave angle of ~6.5 degrees from shore normal.
- Each case was run for a prototype time of ~9 hours.



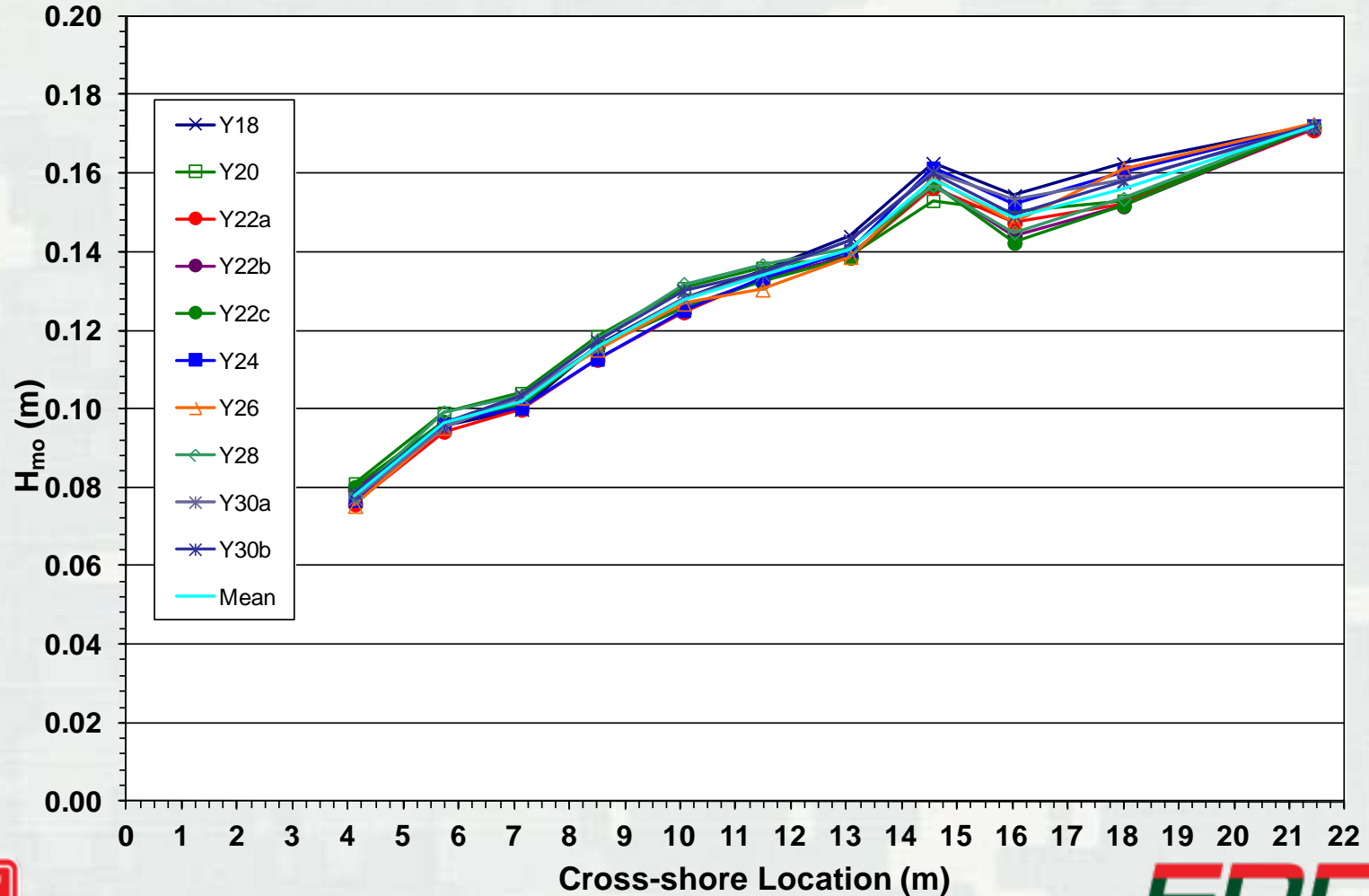
Test Cases



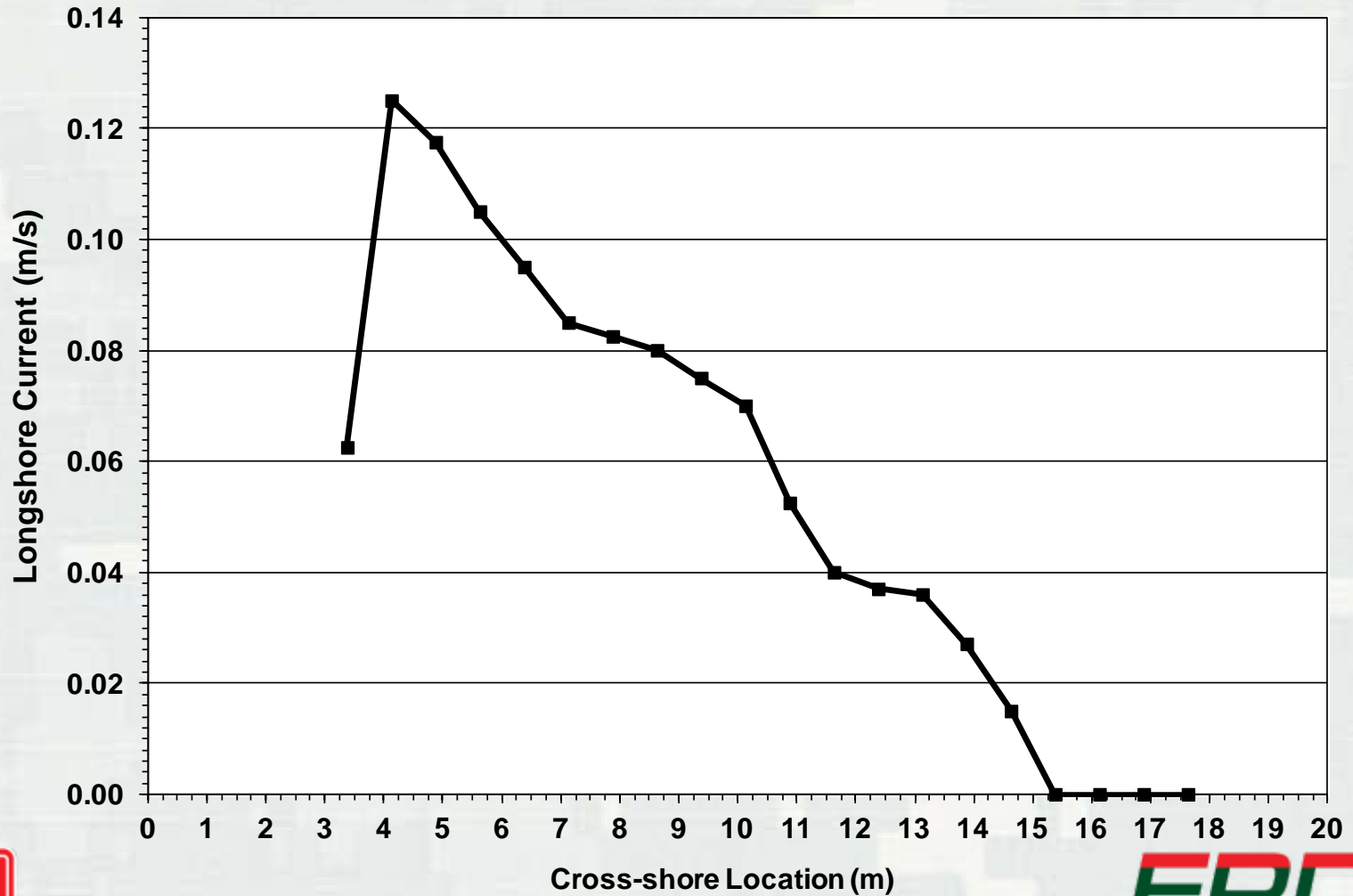
Mound Profiles



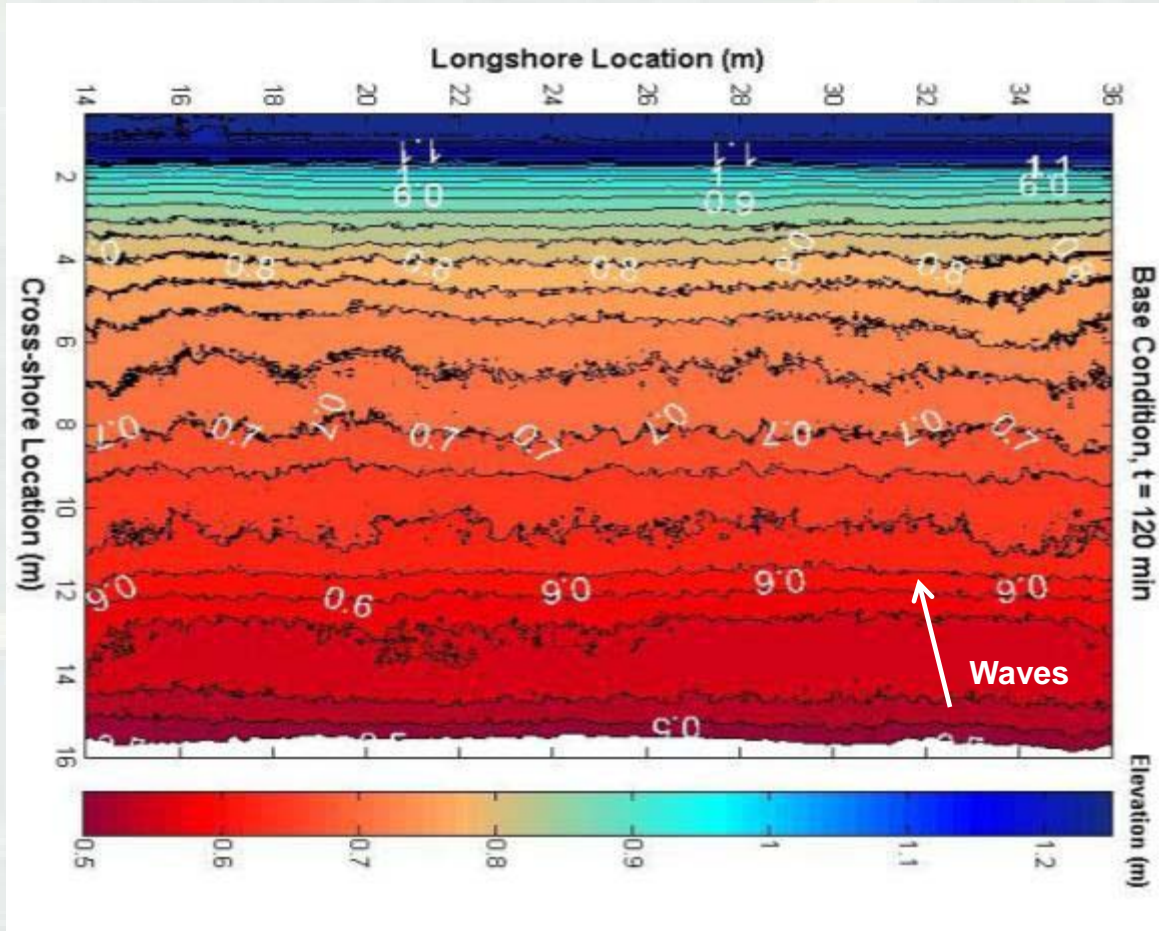
Base Condition Wave Heights



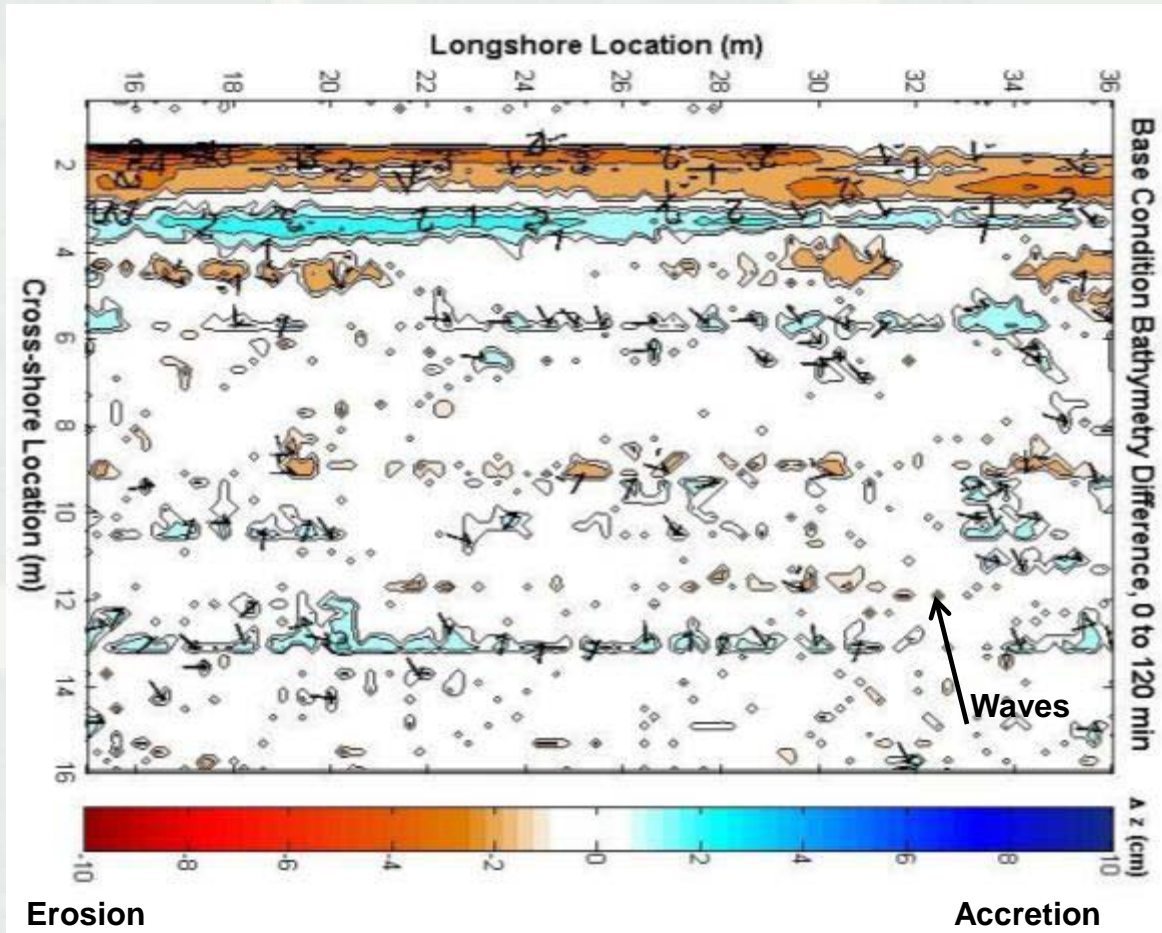
Base Condition Longshore Current



Base Condition



Bathymetry Change



Initial Mound Experiment



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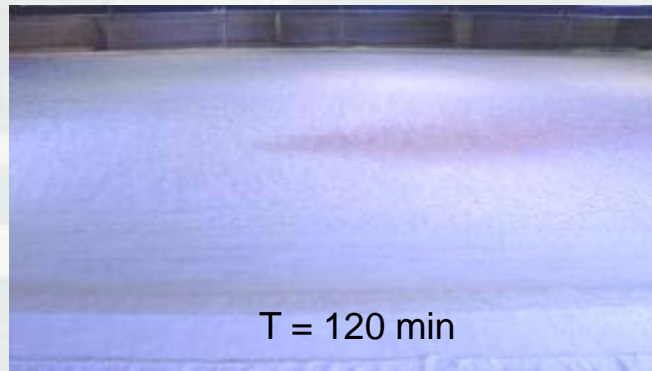
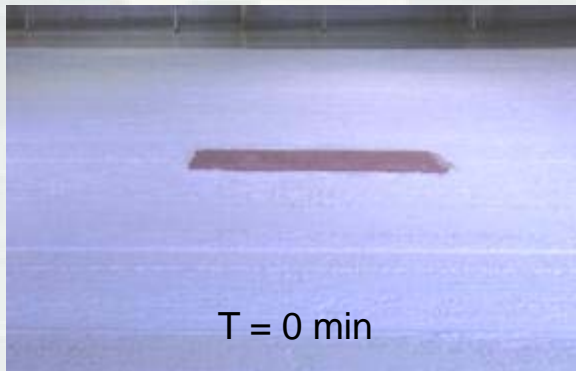
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Dyeing Sediment

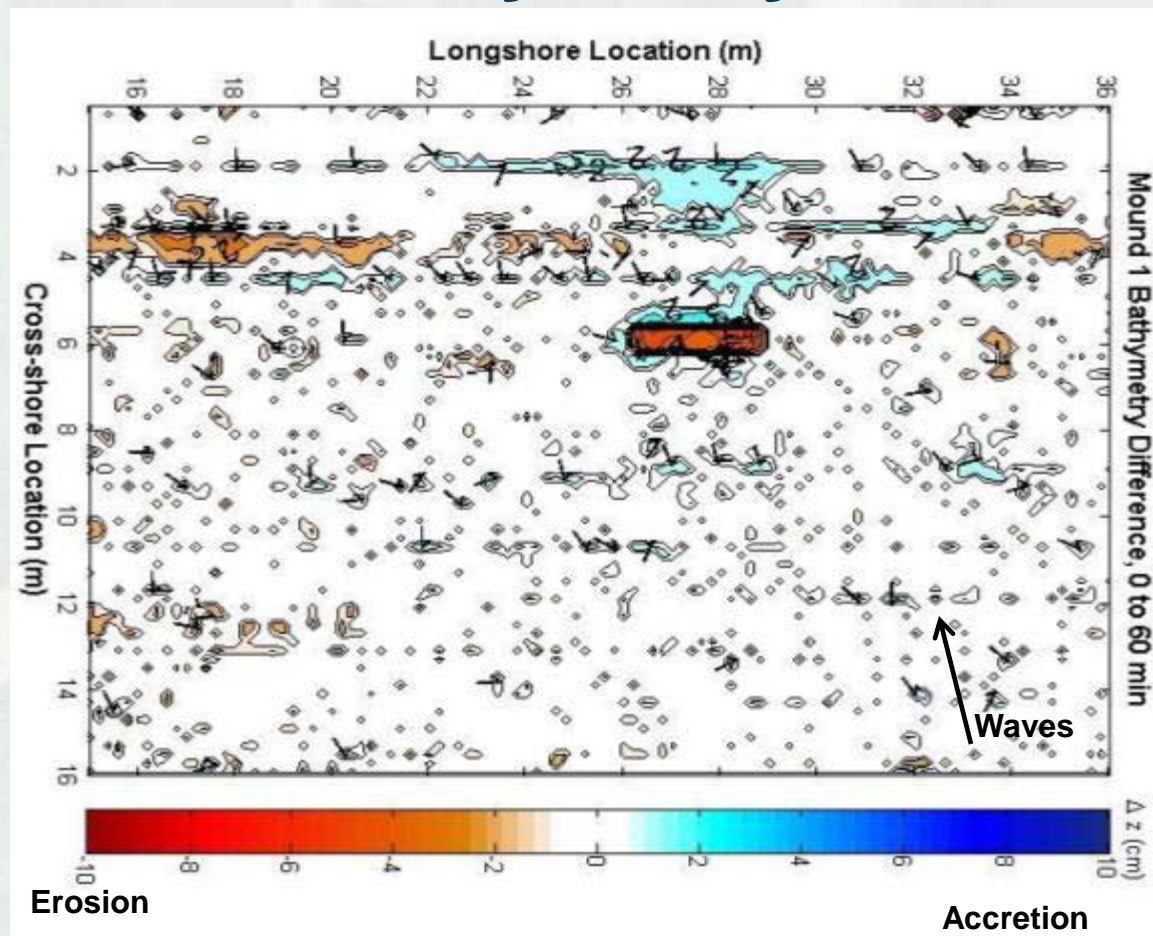
- Provided contrast to natural sand
- Dyeing Procedure:
 - Sand mixed with liquid cement color until all sand was of uniform color.
 - The sand allowed to air dry and subsequently oven-baked at 70 to 80 deg C for a minimum of 24 hours.
 - After removal from oven, the sand was suitable to be placed on the beach for testing



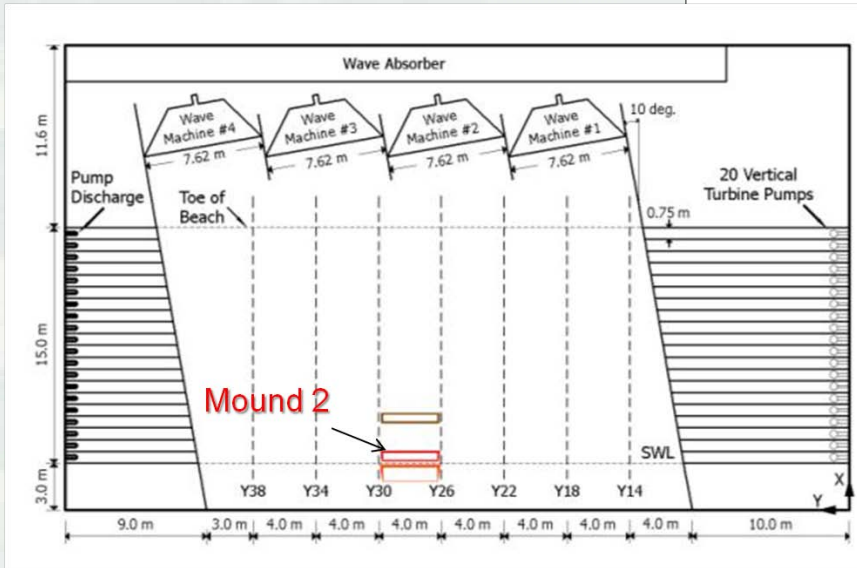
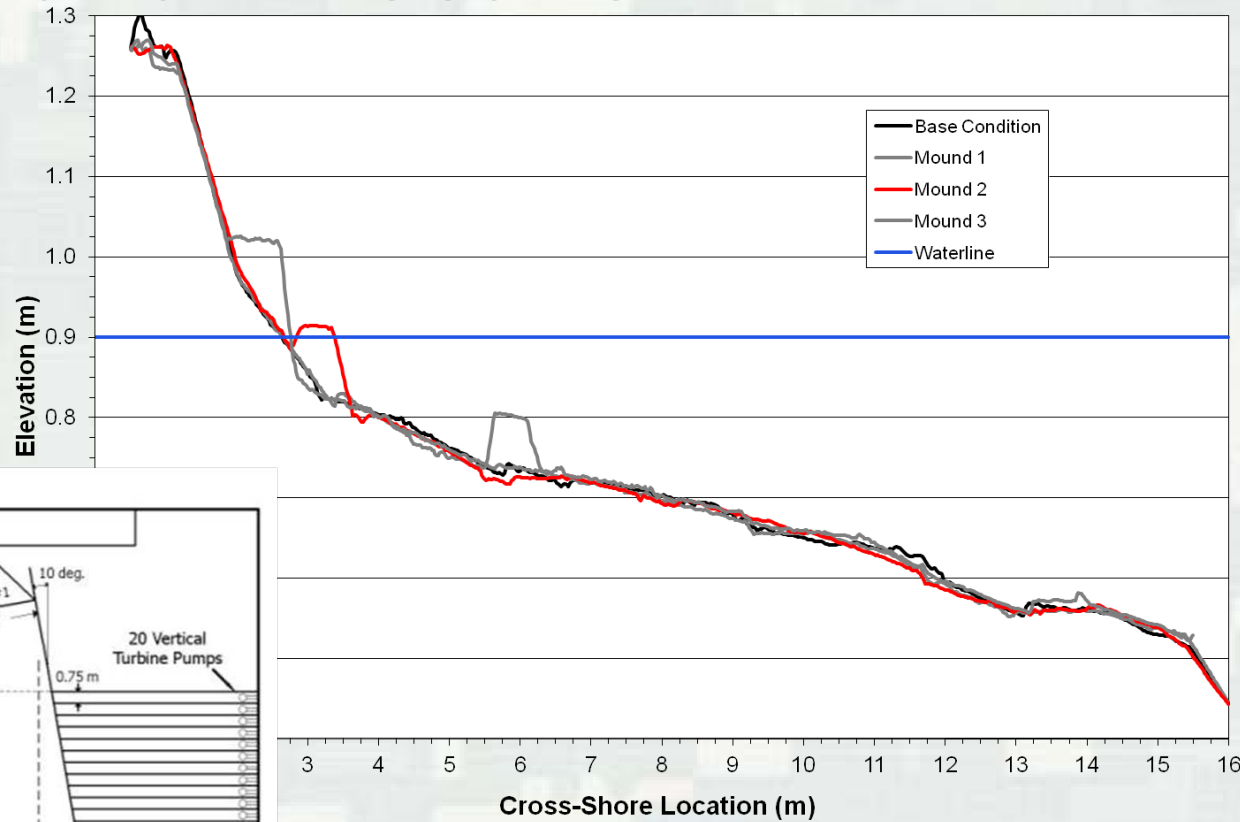
Mound 1 after 120 minutes



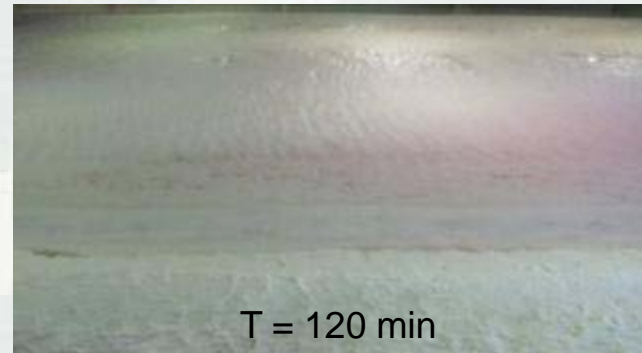
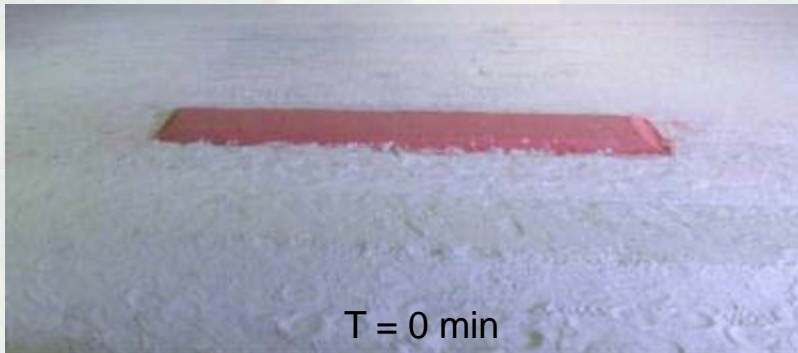
Mound 1 Bathymetry Difference



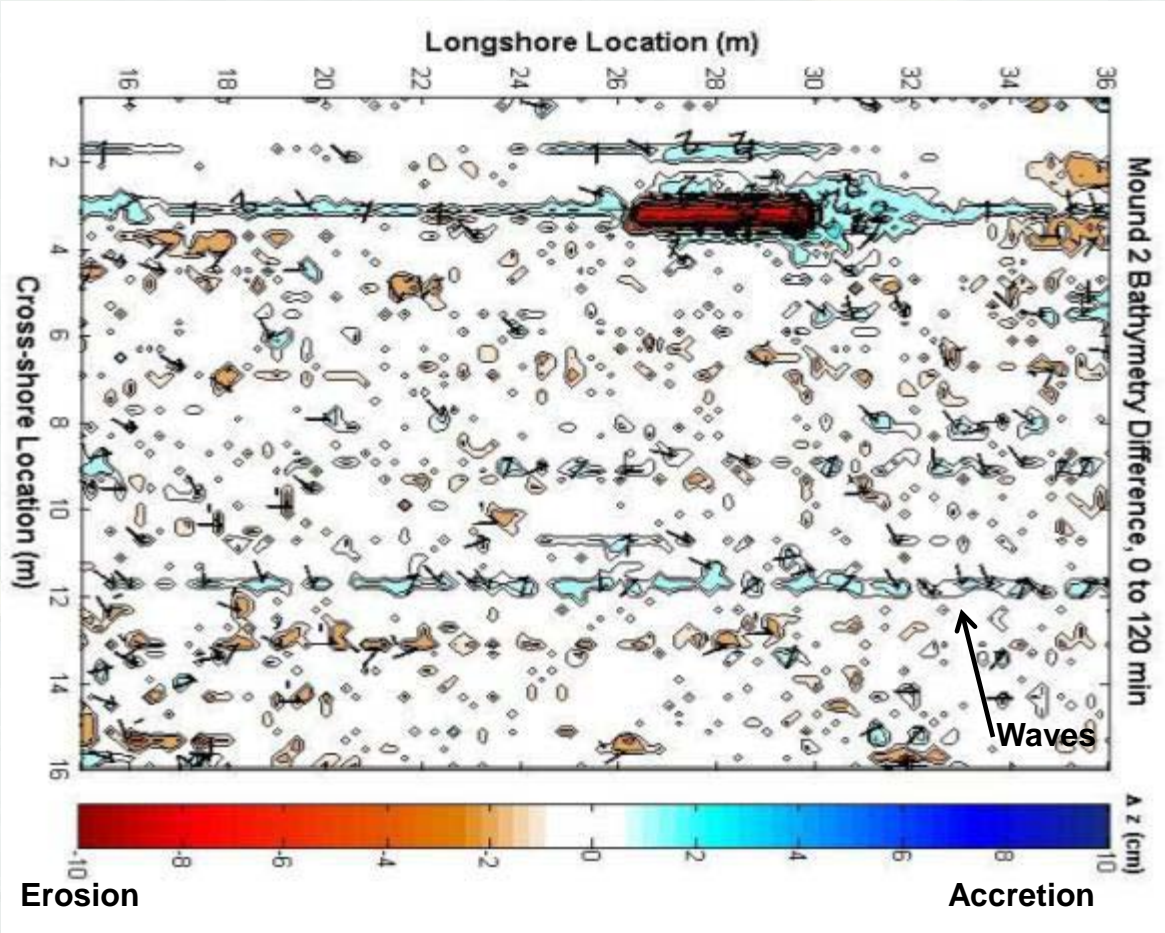
Mound 2 Location



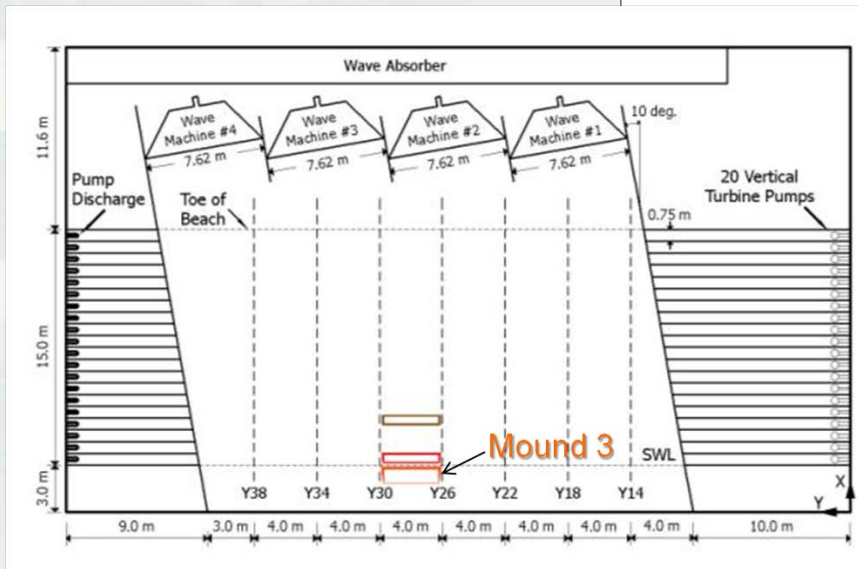
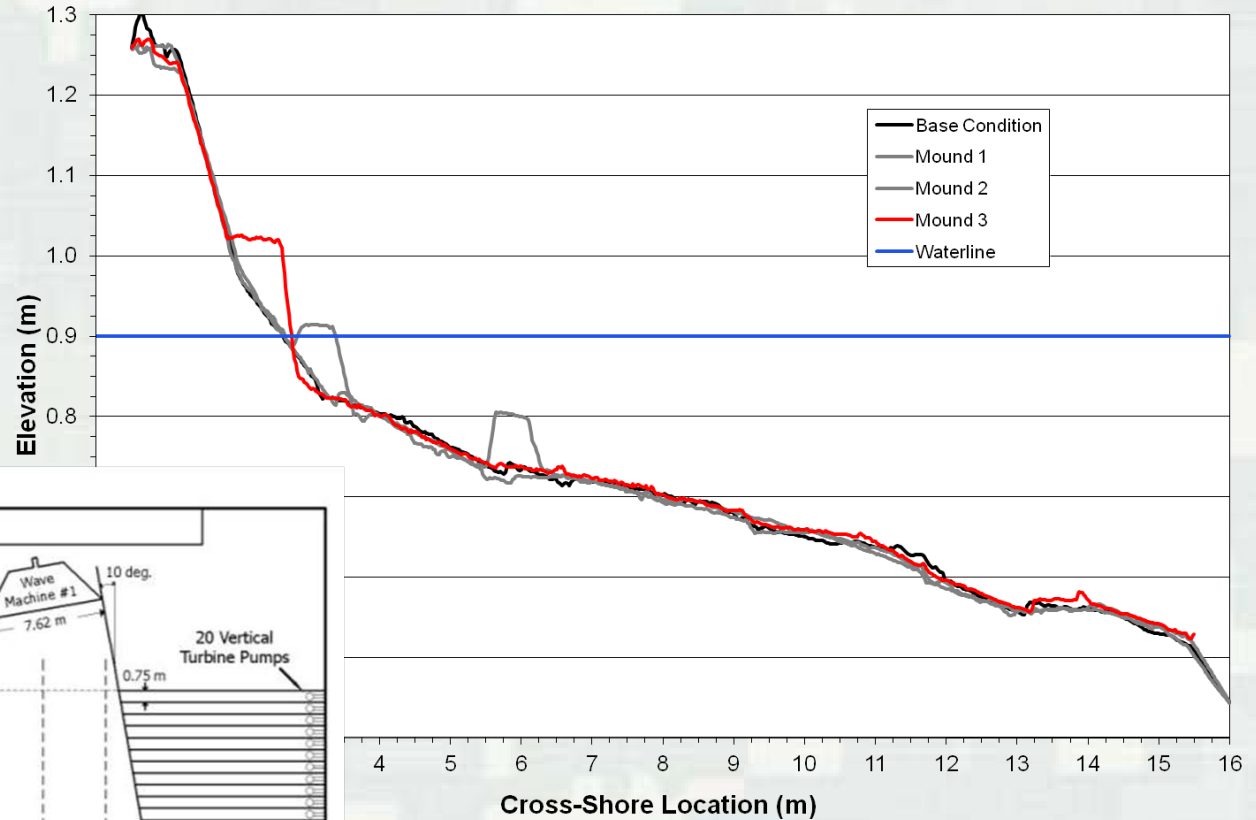
Mound 2 after 120 minutes



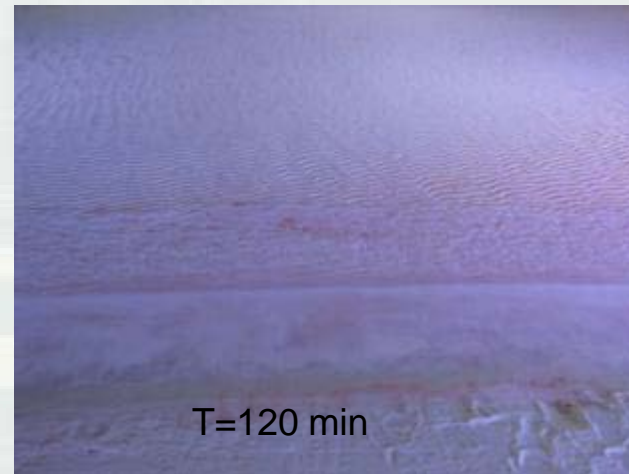
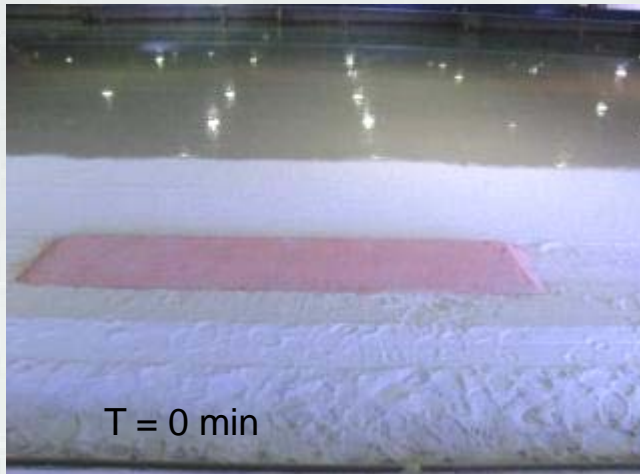
Mound 2 Bathymetry Difference



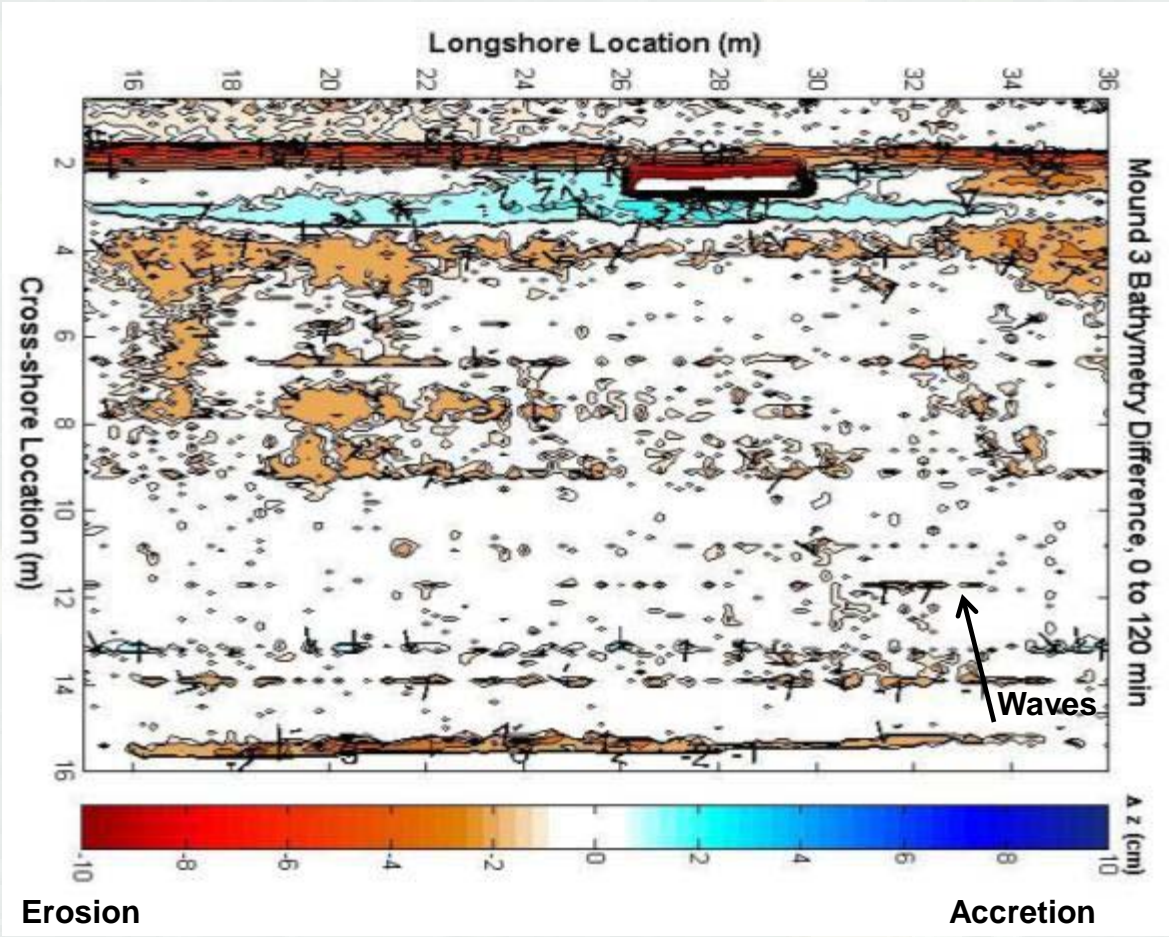
Mound 3 Location



Mound 3 after 120 minutes



Mound 3 Bathymetry Difference



Conclusions

- Sand placed in the surf zone remained in the surf zone for the given wave conditions
- Accretion often occurred onshore of the mound due to sheltering
- Mound sand transported downdrift and onshore
- Dispersion and mixing occurred quickly for each case

