

Living Shoreline Response to Building Coastal Resilience

Ralph Roob

City of Greater Geelong – Senior Environmental Engineer

University of Melbourne – National Centre for Coasts and Climate

Stephen E Swearer

Professor University of Melbourne – National Centre for Coasts and Climate

Rebecca L Morris

Research Fellow University of Melbourne – National Centre for Coasts and Climate

David M Kennedy

Associate Professor University of Melbourne – National Centre for Coasts and Climate

Teresa M Konlechner

Research Fellow University of Melbourne – National Centre for Coasts and Climate

Living Shoreline



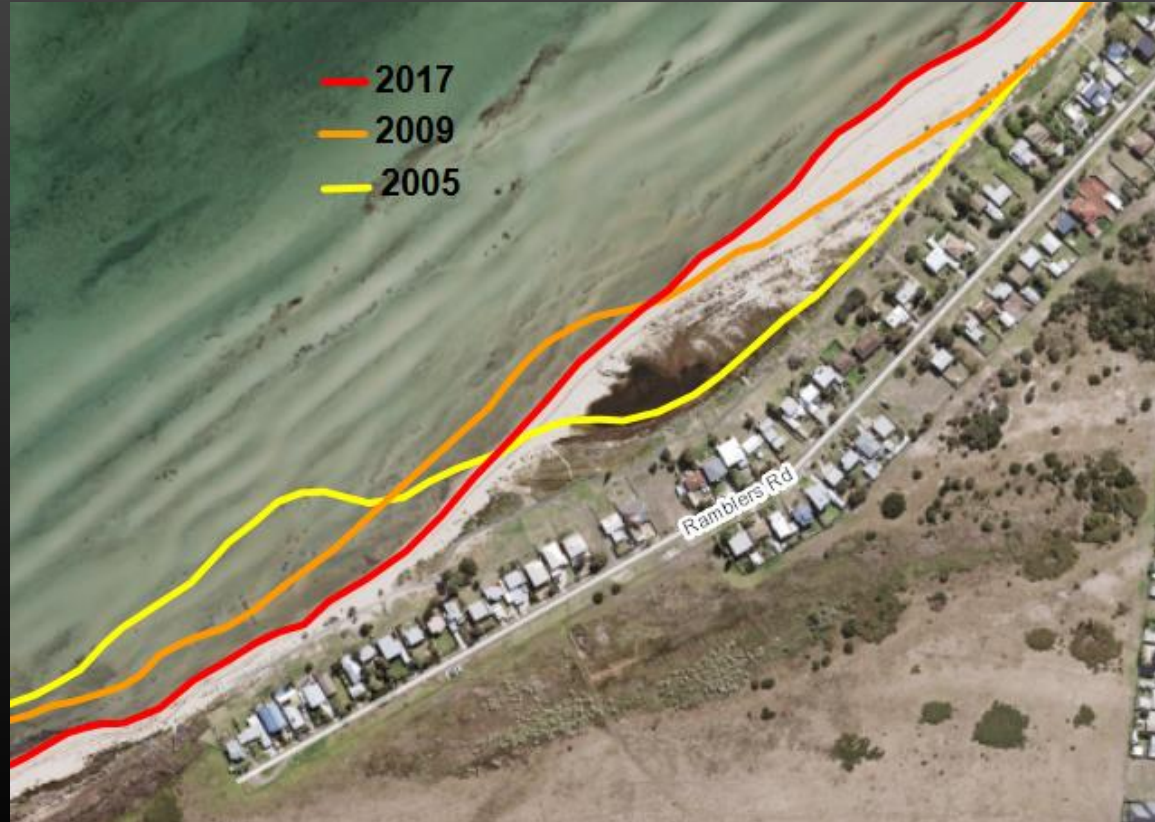
Port Phillip Bay Sea Walls



Ramblers Road Foreshore



Dynamic coastline of the Ramblers Road Foreshore



Seagrass loss



Ramblers Road 2005



Ramblers Road 2014

Winter storms and inundation



Recent works



Primary berm reinforcement



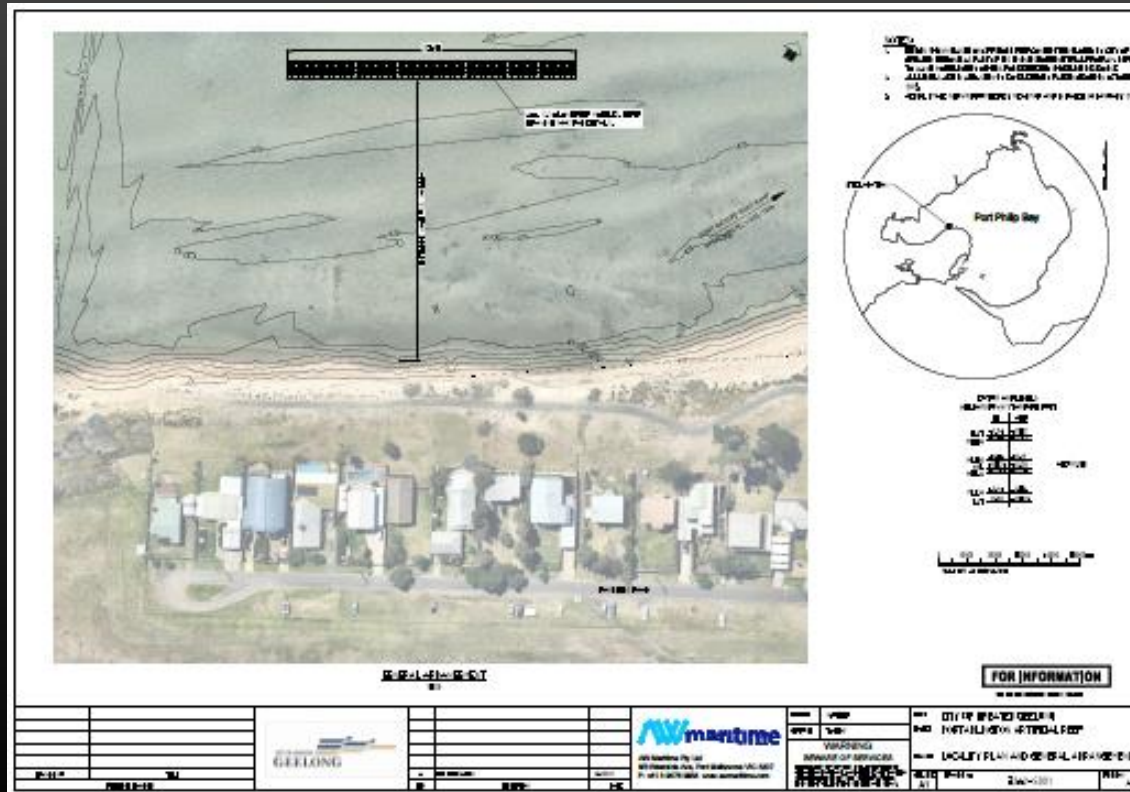
Beach renourishment and sand fencing

Foreshore works - Reshaping and vegetating low lying areas

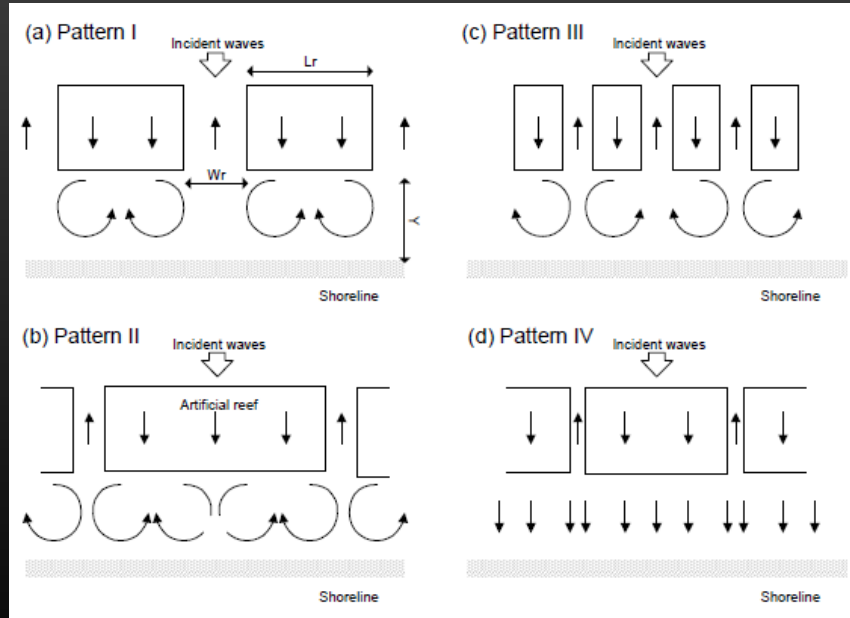


Artificial reef or breakwater

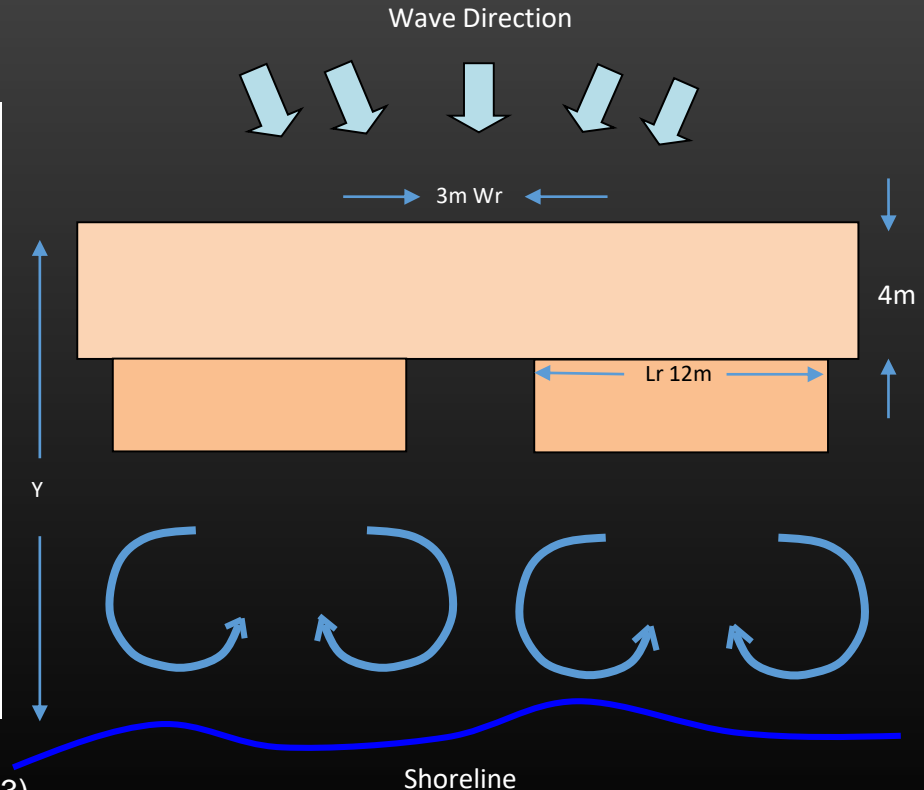
- location and orientation



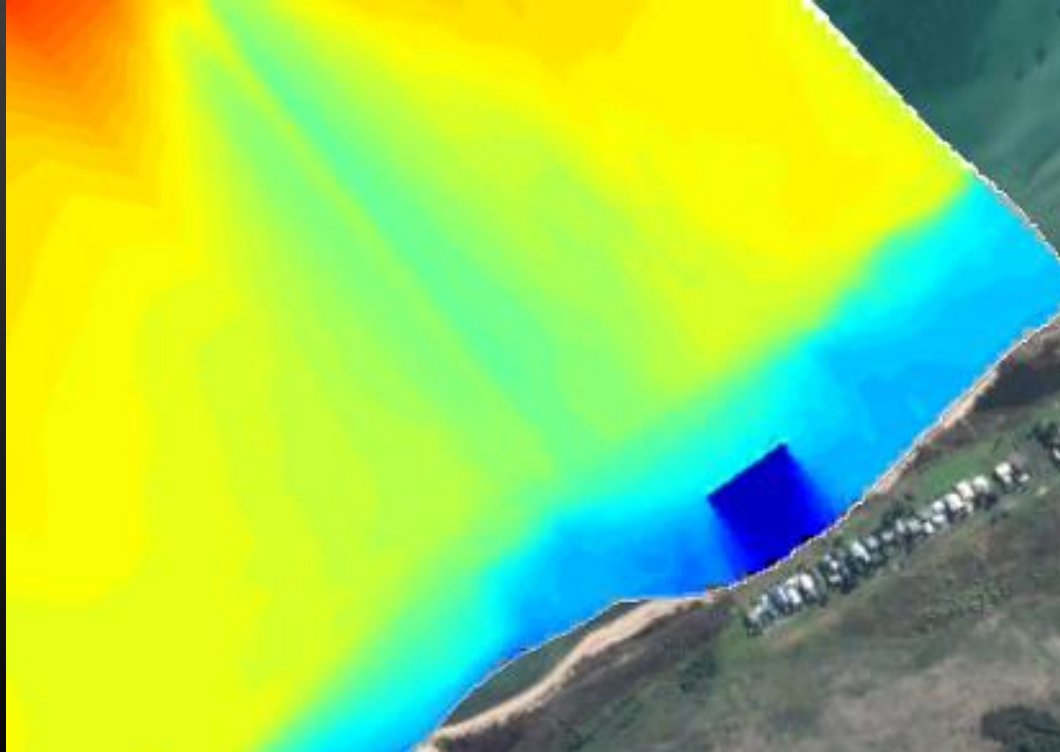
Conceptual design of an artificial reef or breakwater



The design controls sand accumulation and littoral drift
Configuration is based: $W_r > 0.25$ and $L_r < 4$ (Yoshioka et al 1993)



Modelling of offshore artificial reef or breakwater configuration



Types of artificial reefs



Reef design elements

Colonise naturally with reef communities that act to “cement” the structure

Modular structure - constructed on land, quickly installed and modified if required

Once the steel in the structure has corroded, a reef of natural appearance remains



Artificial Reef Materials

Shell recycling – bi-product from the Bass Strait scallop fishery, previously disposed of in landfill

Discarded rocks from residential development



Artificial Reef Modular Cages



Artificial Reef installation Day 1



Completed artificial reef



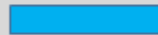
“Greening a Grey” structure - design & material use



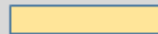
Seaward layer 2.0 x 2.0 x 0.5m steel cages with weld mesh



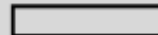
Leeward layer 1.5 x 1.5x 0.75m steel cages with weld mesh



Seeded with mussels



Rock and shell - basalt rock 200-300 dia, Bass Strait scallop shell



Rock only - basalt rock 200-300 dia

Baseline and ongoing monitoring



Biological Parameters

- Sediment grain size sampling and analysis
- Seagrass mapping / monitoring
- Reef community colonisation

Baseline and ongoing monitoring

Physical Parameters

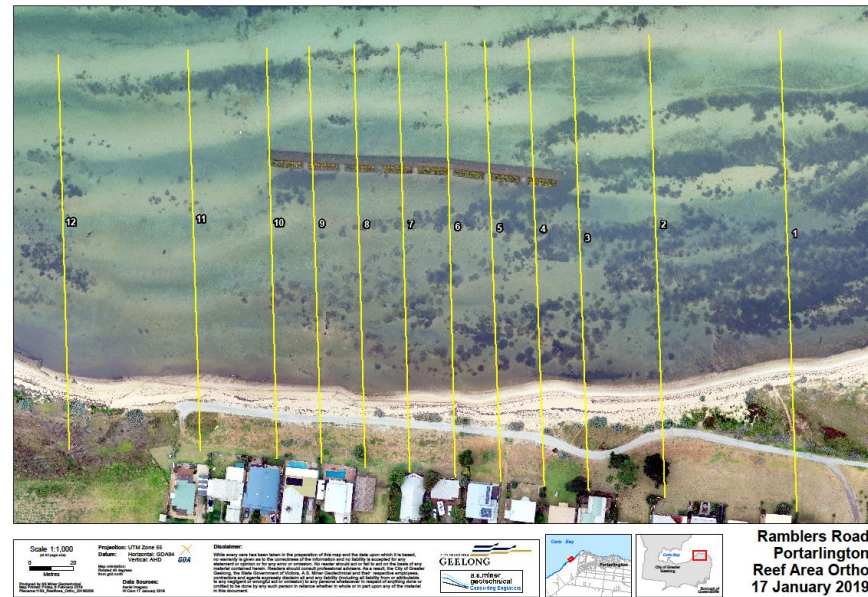
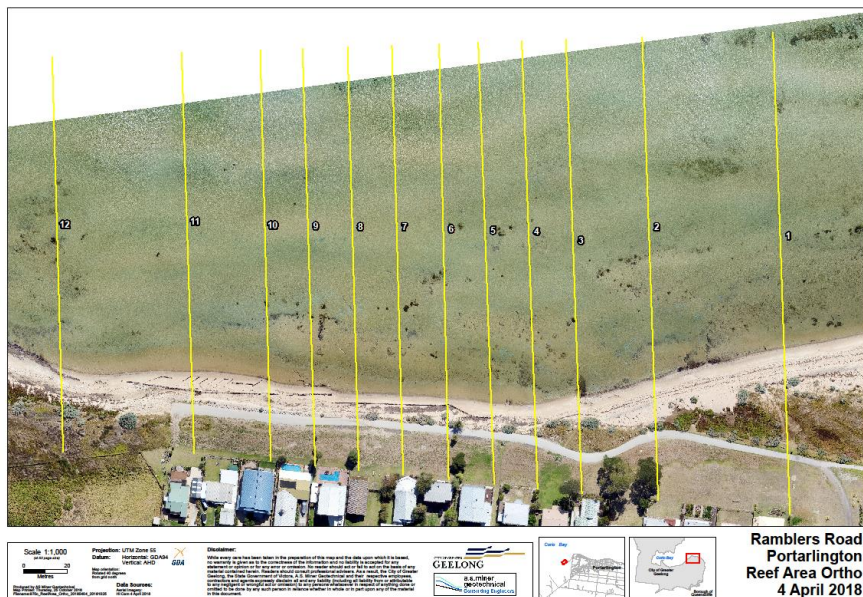
- Wave climate using pressure sensors
- Surface models using UAV (Drone) surveys
- Beach profiles and nearshore bathymetry using Total Station



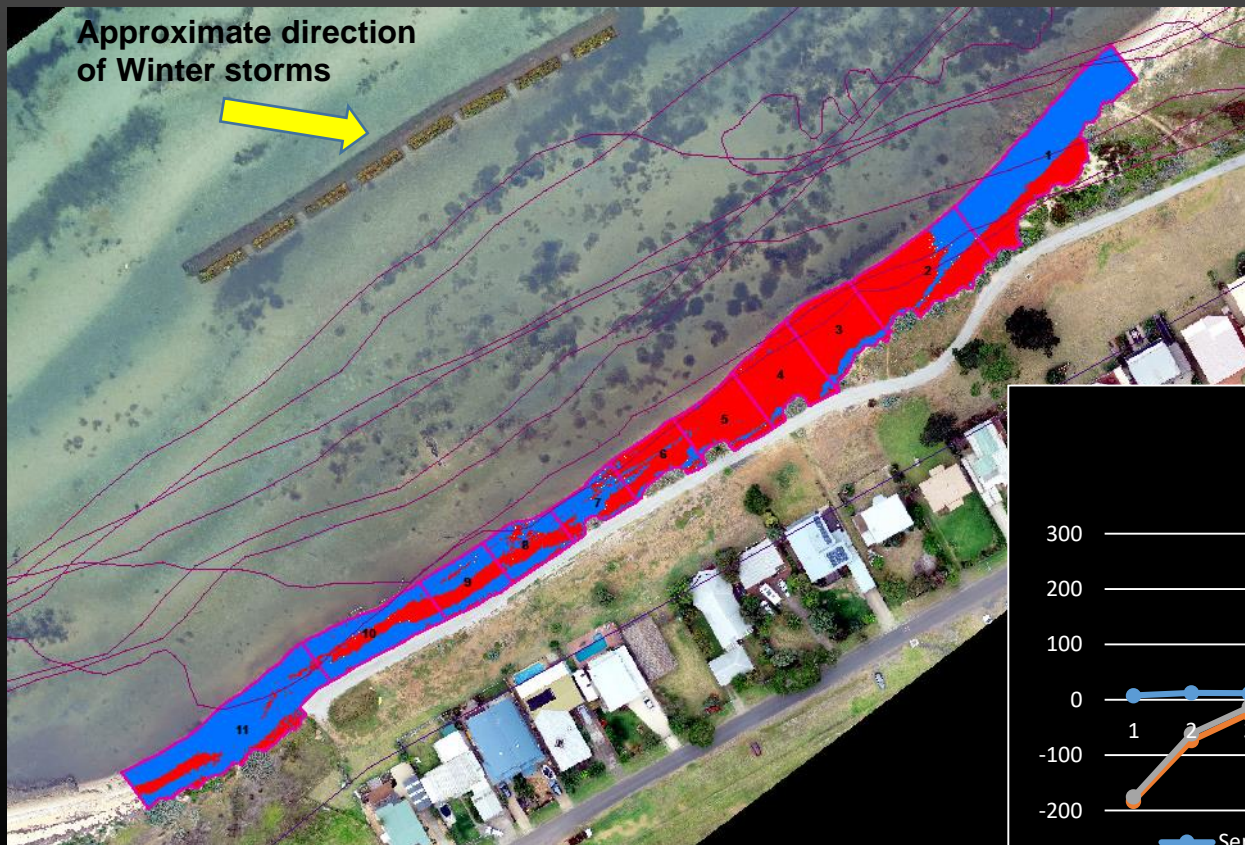
UAV (Drone) Surveys

UAV Surveys

- 3 per year
- Images are mosaicked and georeferenced
- 3D surfaces created
- Surface comparison to calculate sand volumes
- Map changes in seagrass distribution



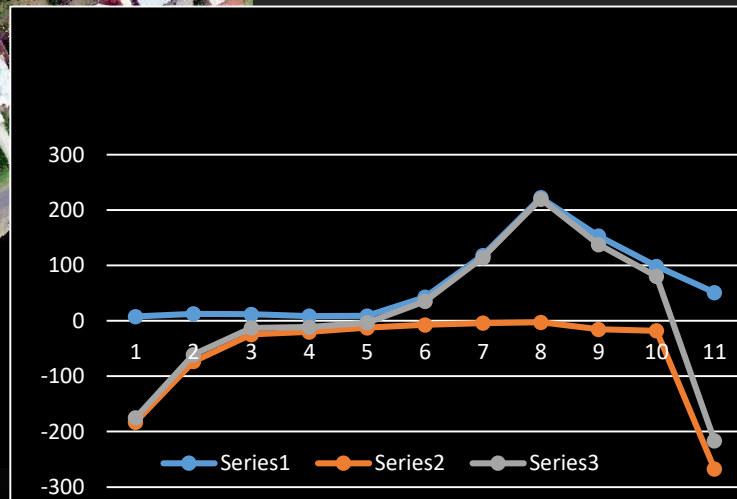
Sand volume – beach sector gain / loss



Aerial Imagery analysis

Changes in sand volume

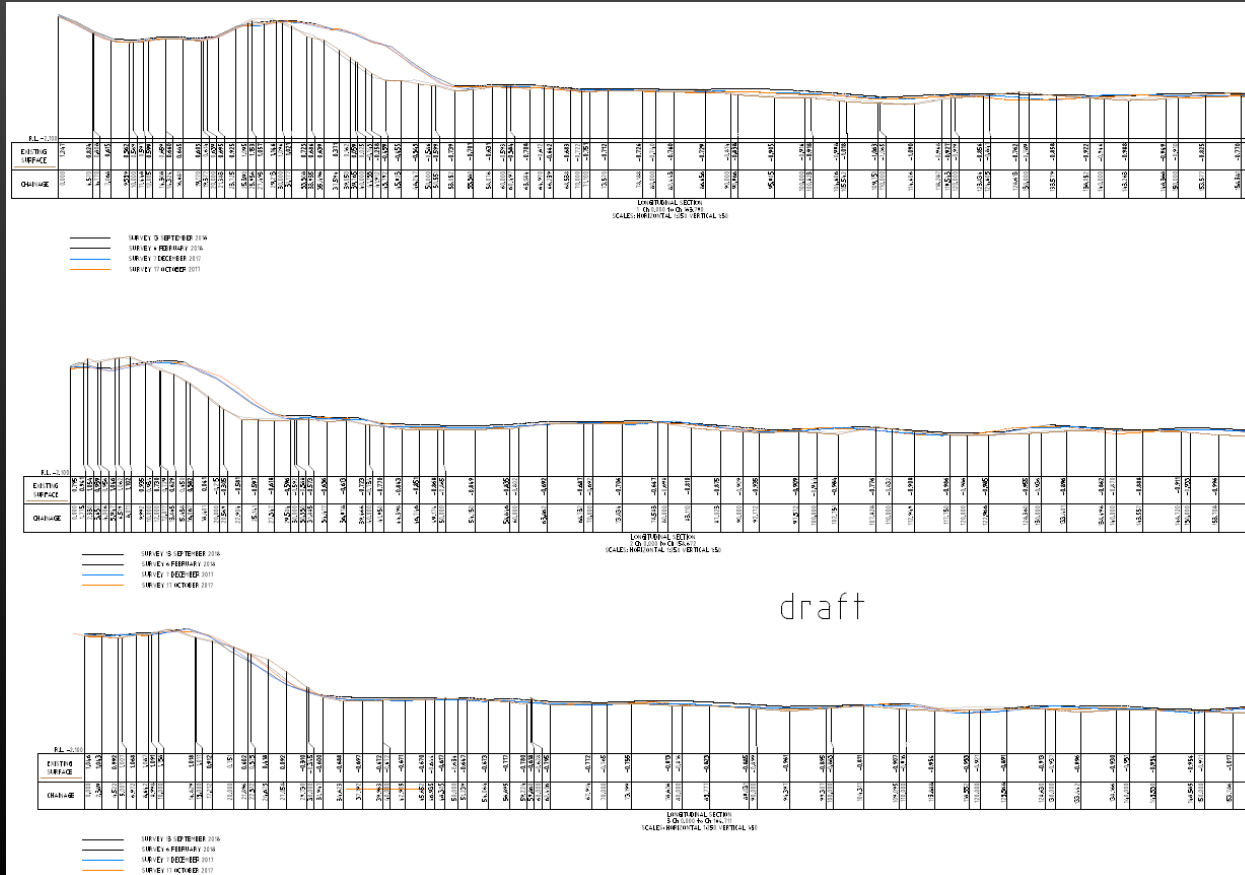
- April to August 2018
Net gain 108m³
- August 2018 to January 2019
Net gain 113m³
- Total net gain 221m³



Beach profiles and nearshore bathymetry

Surveys – total station

- 3 per year
- 12 transects average 150m offshore



Mussel seeding trial



900kg were delivered soon after harvest from nearby aquaculture site

3 techniques 0.25²m trial plots

- Loose
- On basalt tiles
- On growing ropes



2000 individuals measured to establish length frequency



Mussels fouled by algal growth during Summer



September 2018



December 2018

Natural settlement of Mussel Spat



Summary of key objectives & benefits

Understanding of the variable nature of the coastal environment

Develop a design that considers the natural environment - coastal processes

Building coastal resilience

- Shoreline defence established as part of the landscape
- Shoreline protection from wind driven waves
- Sand accretion

Realise co-benefits through enhanced ecosystem services

- Colonisation of reef marine communities
- Potential for seagrass restoration
- Trial for seeding and growing native mussels

Maintain the volume and placement of sand used to renourish beaches



Project Partners

