Increasing role of Coastal Restoration

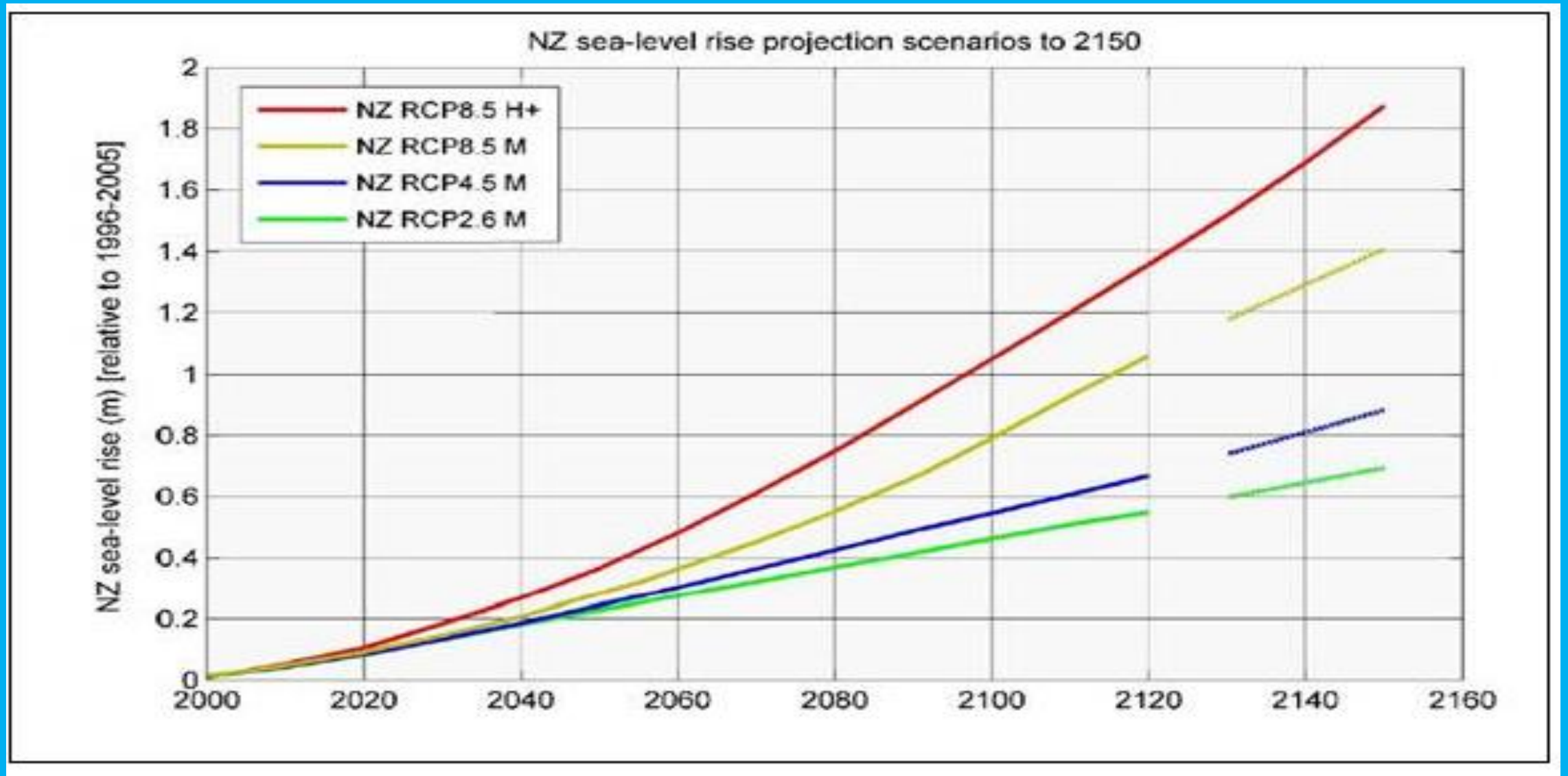
Estuary Examples

Jim Dahm
Eco Nomos Ltd

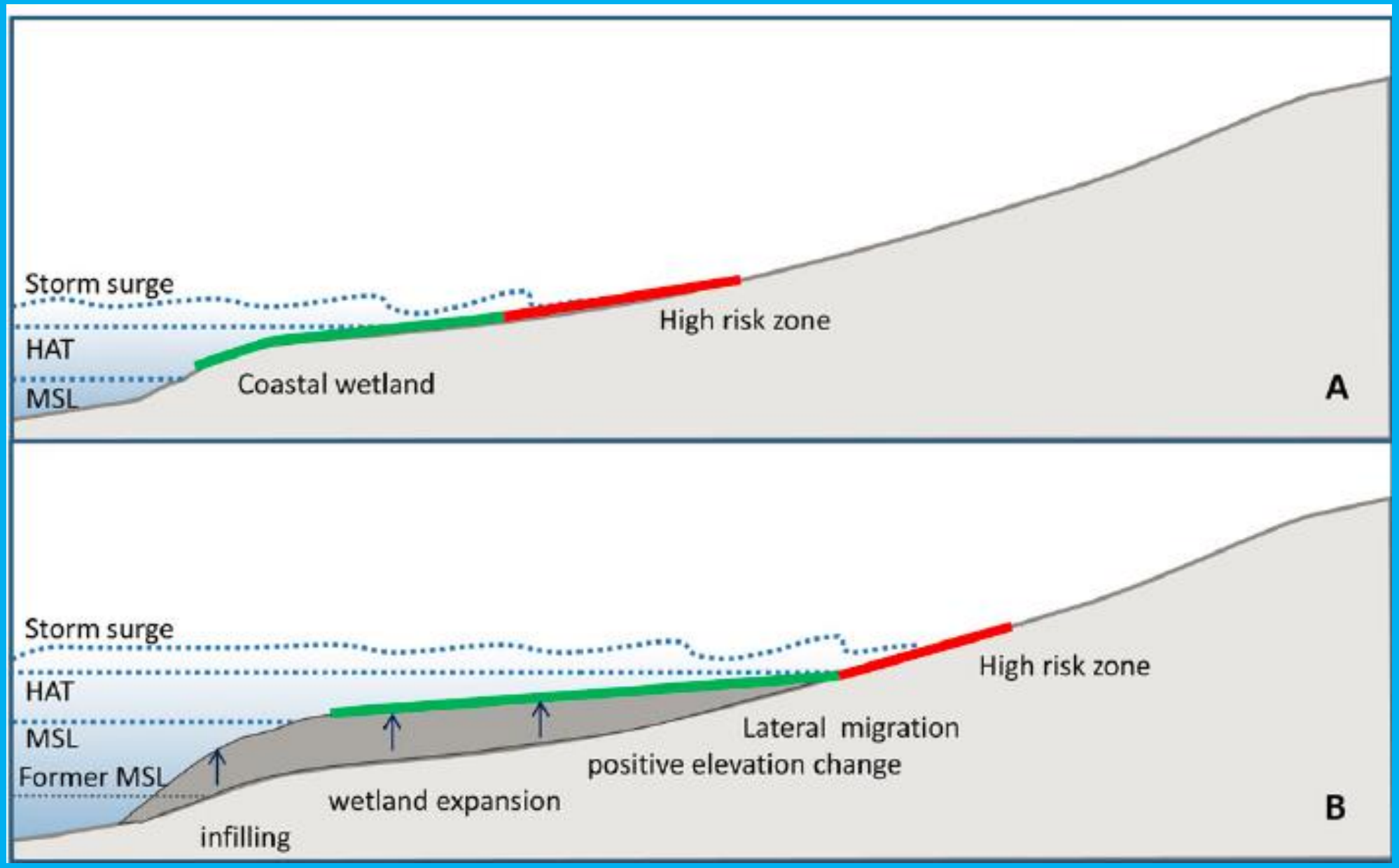
Issue

- There has been significant loss and degradation of coastal ecosystems due to human activities
- In estuarines these effects include:
  - Sedimentation issues related to catchment activities
  - Increasing levels of contaminant runoff leading to pollution and eutrophication
  - Loss of coastal margin ecosystems (e.g. saltmarsh) due to human encroachment
- As a consequence there is now a rapidly growing focus on protection, restoration and creation of functioning coastal ecosystems
- This work is still at a relatively early stage but is expanding raipidly

NZ Sea-Level Rise Projection Scenarios to 2150



Response of Coastal Wetlands to Sea Level Rise

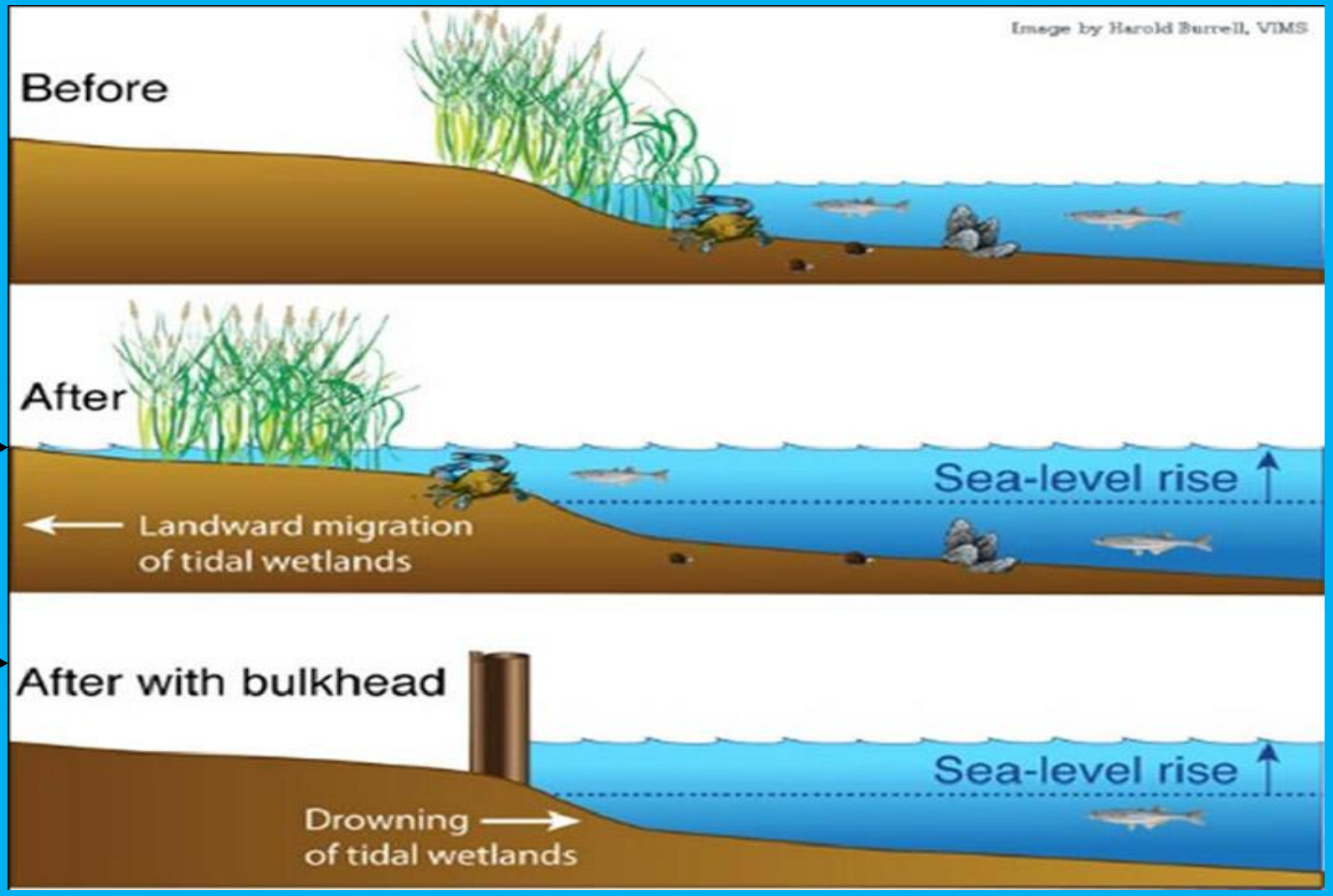


Coastal Squeeze Vs Natural Shoreline

(estuarine margin example)

Natural Shoreline

Coastal Squeeze



Restoration Example:
Whole of Estuary Focus

Kaituna River Re-diversion and Te Awa o Ngātoroirangi / Maketū Estuary Enhancement Project

Project Overview

Project goal

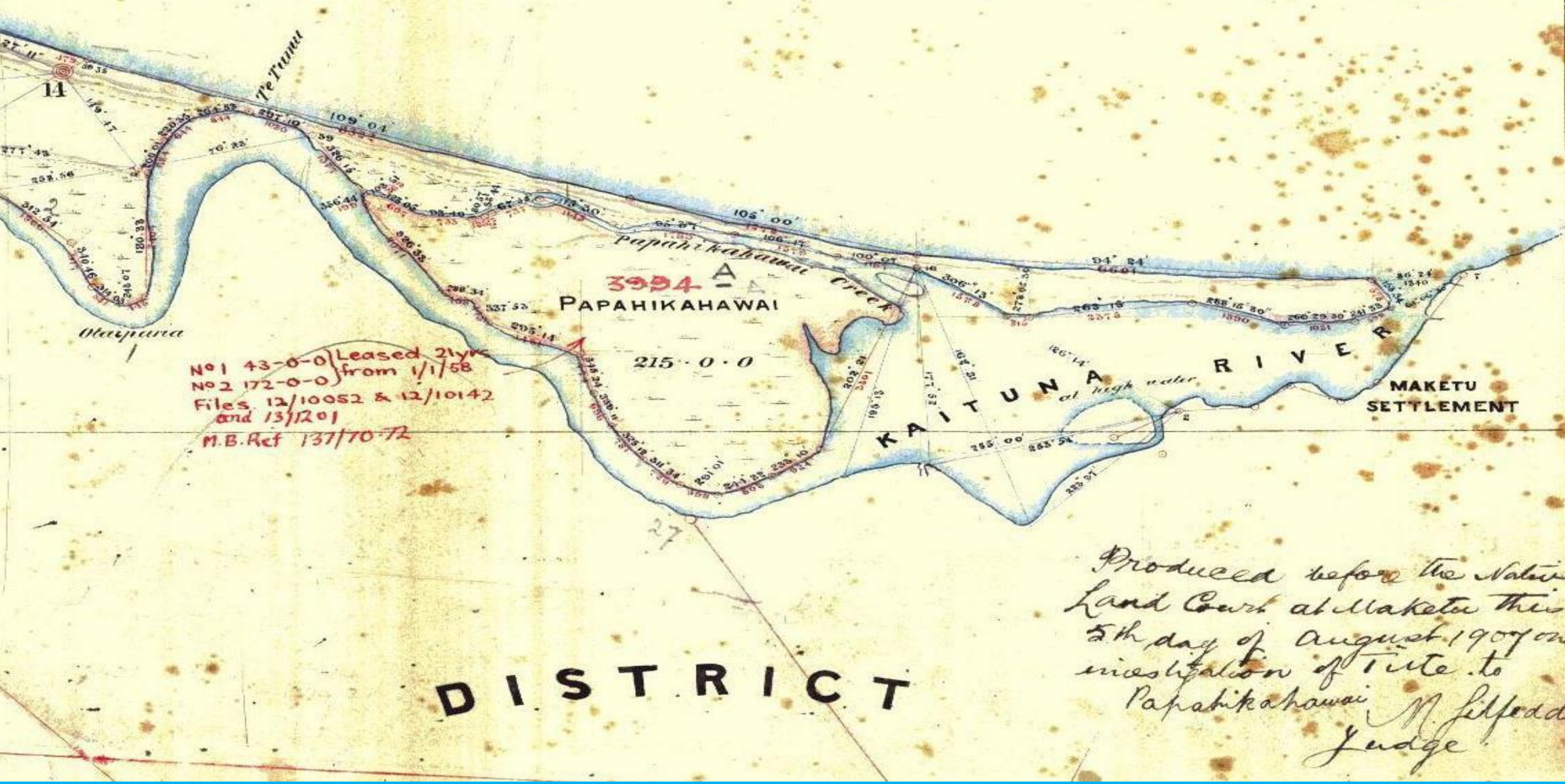
To significantly increase the volume of water (particularly fresh water) flowing from the Kaituna River into Ongatoro/Maketū Estuary by 2018 in a way that maximises the ecological and cultural benefits (particularly wetlands and kaimoana) while limiting the economic cost and adverse environmental effects to acceptable levels.

20% Kaituna flow re-diverted through estuary (currently 5%)

Creation of 22 ha (i.e. 55 acres) of wetlands

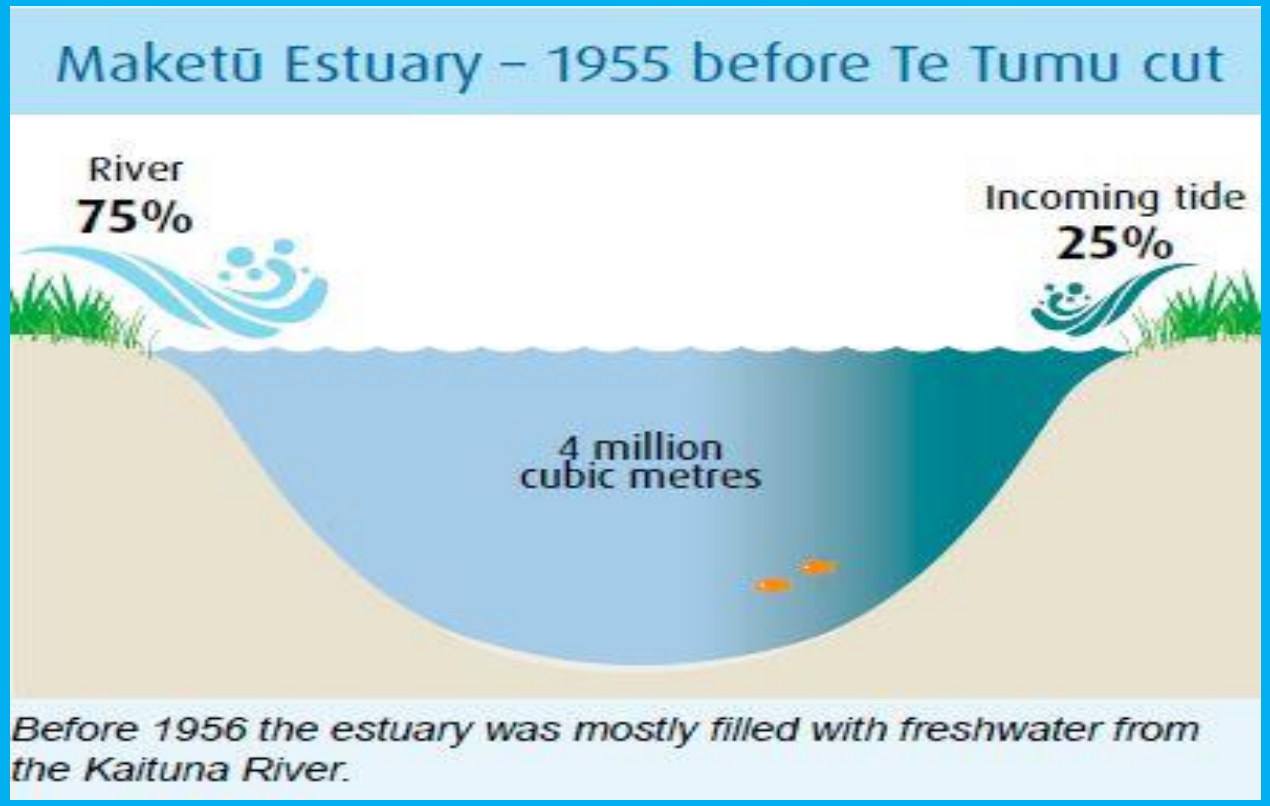
Project resources

- $6.2M over ten years 2012-22
- Skilled project team

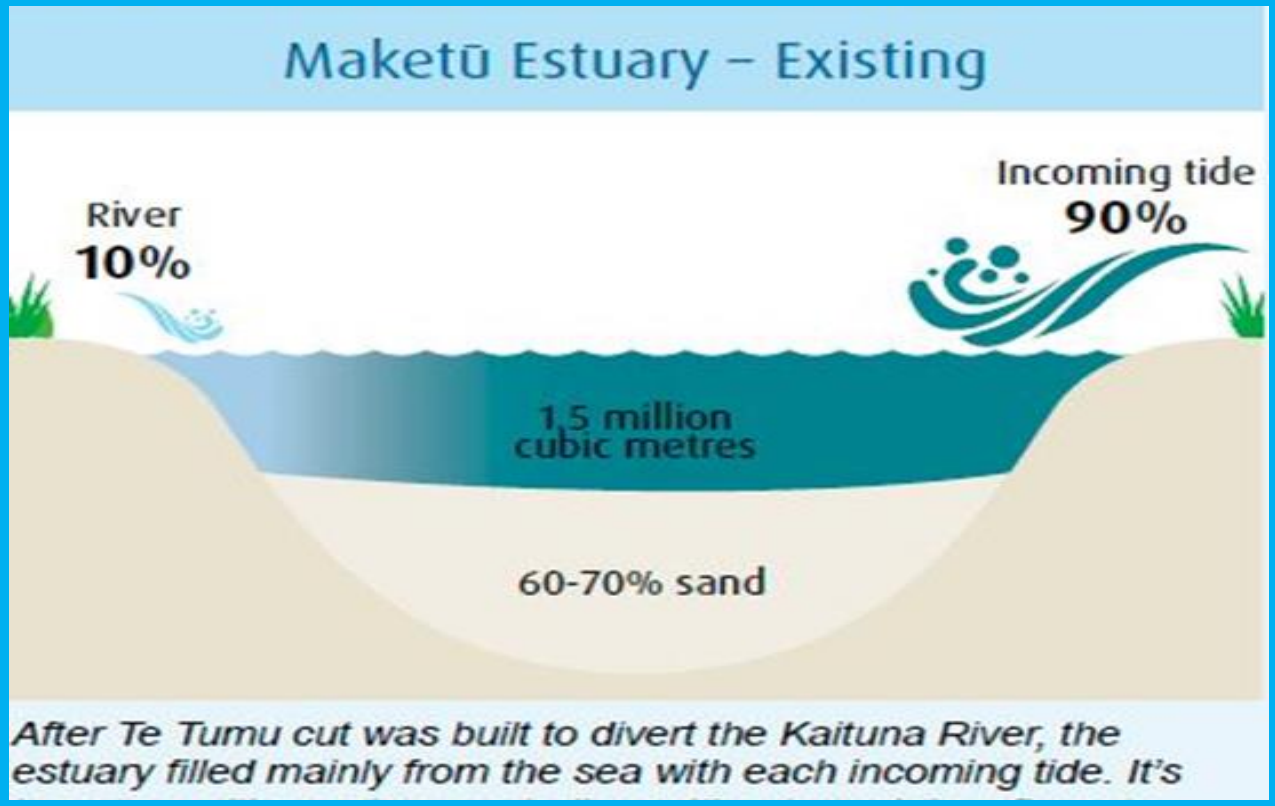

Te Tumu
Papahikahawai Creek
3994 A
PAPAHIKAHAWAI
215 · 0 · 0
Waipuna
No1 43-0-0 Leased 21yrs
No2 172-0-0 from 1/1/58
Files 12/10052 & 12/10142
and 13/1201
M.B.Ref 137/70-72
KAITUNA RIVER
at high water
MAKETU
SETTLEMENT
DISTRICT
Produced before the Native
Land Court at Maketu this
5th day of August 1907 on
investigation of Title to
Papahikahawai
Judge

Maketu Estuary – Recent View

Effects on Estuary Hydrology



Before 1956 the estuary was mostly filled with freshwater from the Kaituna River.



After Te Tumu cut was built to divert the Kaituna River, the estuary filled mainly from the sea with each incoming tide. It's

Maketu Estuary – Adverse Effects of 1956 Kaituna Diversion

- Became totally saline estuary – upper reaches used to be freshwater wetland which quickly died out
- Major expansion of flood tide delta in lower estuary reducing tidal prism and causing shoreline erosion
- Reductions in kaimoana and other life
- Significant adverse cultural effects
- Extensive loss of intertidal wetlands (particularly rushland) and sea grass beds
- Markedly reduced circulation and flushing in the upper estuary and increased nutrient loads from land leading to problematic algal growths and anoxic sediment
- Reduced the natural flushing of sand and mud

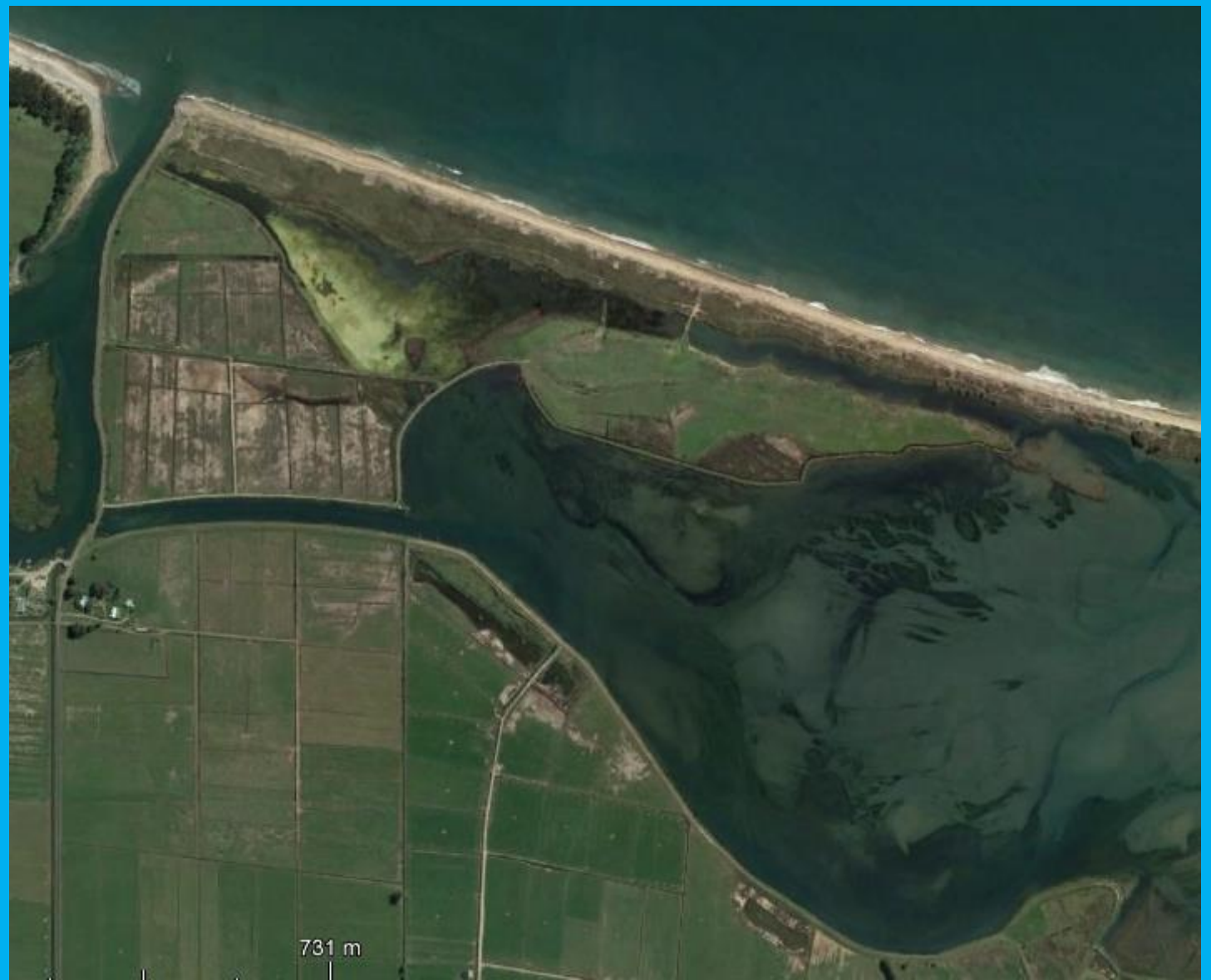
1939 (prior to diversion)

1959 (shortly after diversion)

1979 (spit breach)

Upper Estuary Wetlands (before diversion)

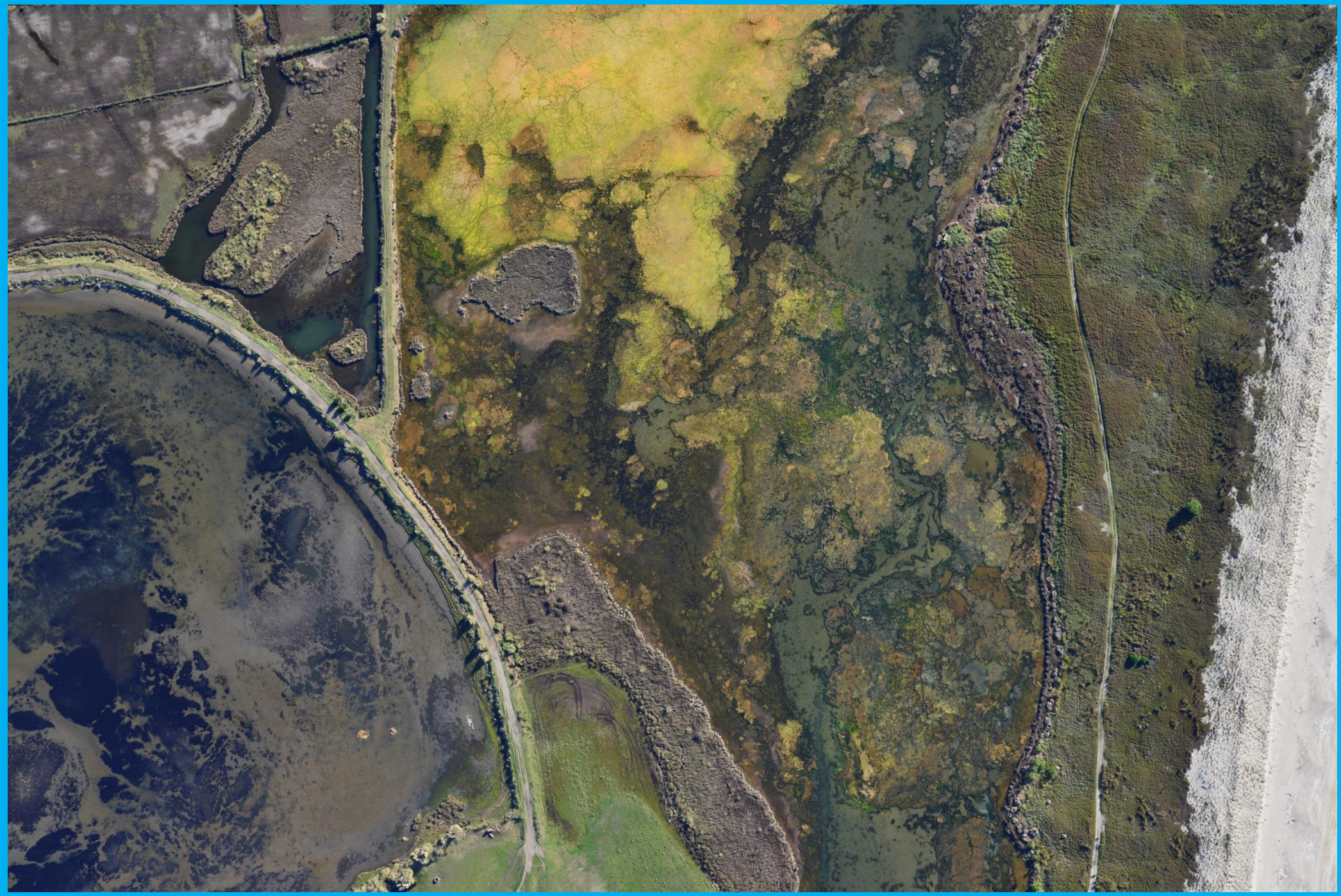
Upper Estuary Wetlands (2016 – before re-diversion)



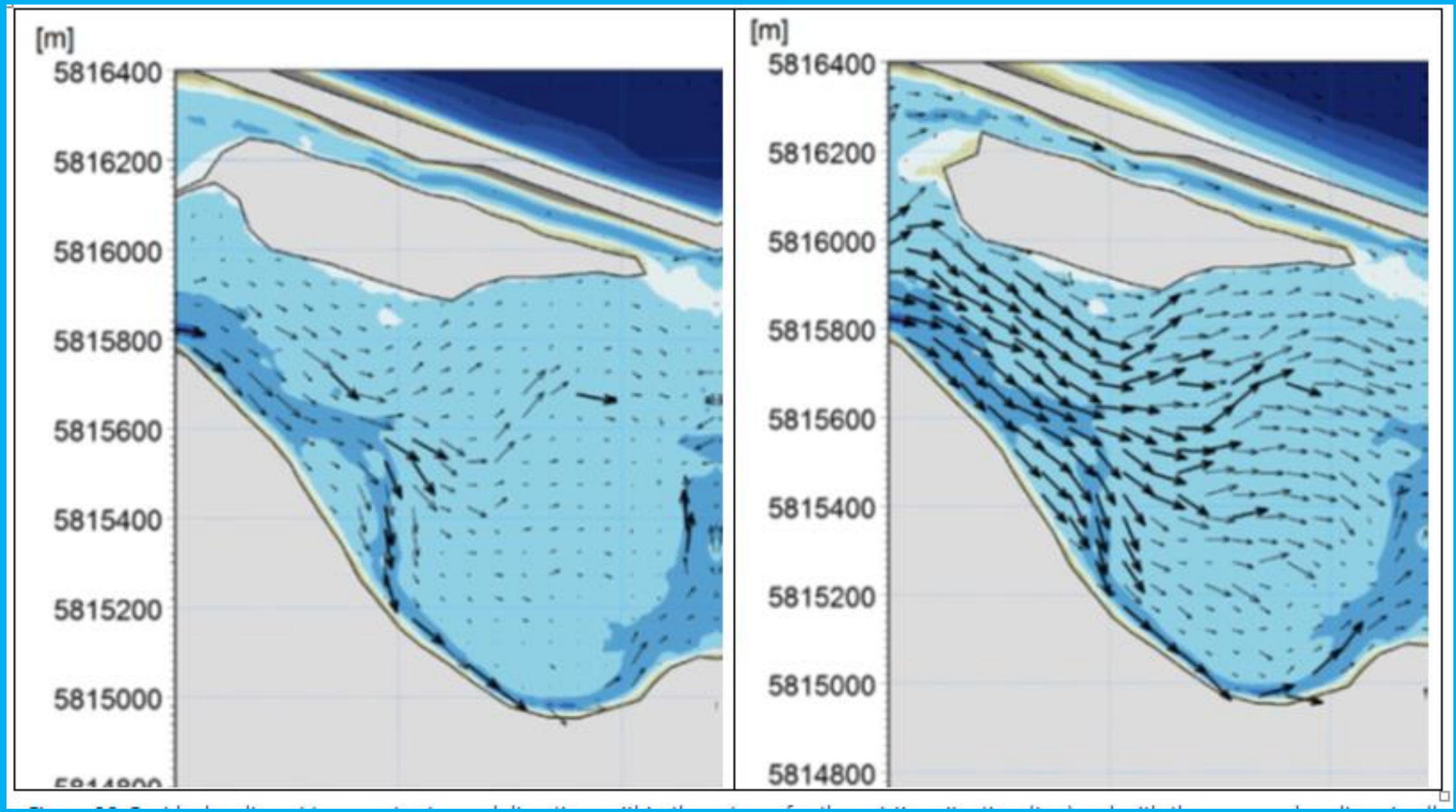
Maketu - Problematic Algal Growths

- Concentrations of nutrients such as phosphorus and nitrogen are high in the upper estuary
- Nutrients stimulate growth of algae, such as sea lettuce, Gracilaria and benthic cyanobacteria.
- Prolific algae growths in the mid and upper estuary
- Also cause large fluctuations in dissolved oxygen levels, with daily minimum dissolved oxygen levels too low to support healthy fish.

Maketu - Problematic Algal Growths




Stopbanks to be removed
Papahikahawai Island
Papahikahawai Creek
Te Tumu
Proposed wetland
Stop bank
Ford's Cut
Channel filled
Inlet structure
Ford Island
Upgraded public boat ramp + carpark
Ford Road
Kaituna River
Kaituna Road
Proposed re-diversion channel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April 2003

April 2019

April 2003

Stopbank

July 2017 – Lowering Stopbank and Removing Pampas

July 2017 Chenier Construction

January 2018

April 2019

December 2017

Chenier


Stopbanks to be removed
Papahikahawai Island
Papahikahawai Creek
Te Tumu
Proposed wetland
Stop bank
Ford's Cut
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Inlet structure
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Upgraded public boat ramp + carpark
Ford Road
Kaituna River
Kaituna Road
Proposed re-diversion channel


Te Pā Ika
shaping and planting
Flyover video

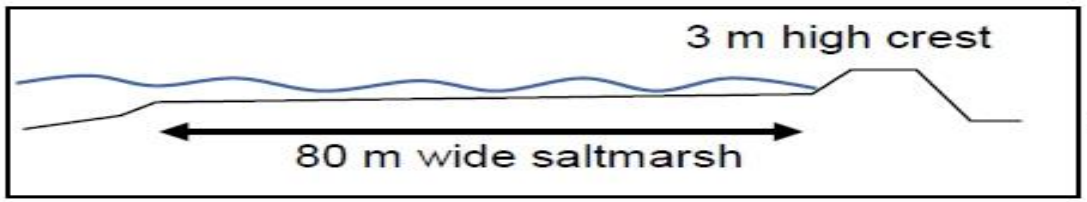
Managed Realignment

Recovery of Lost Estuarine Ecosystems:

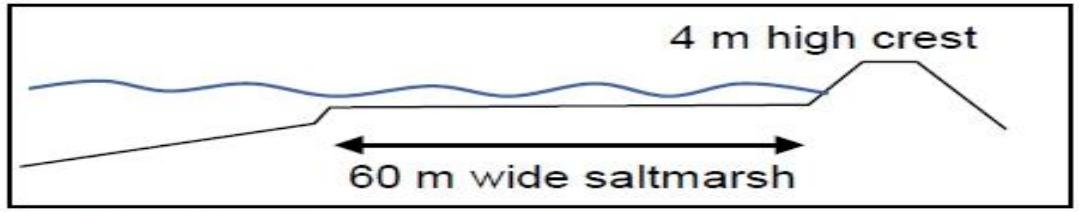
Managed Realignment UK

- Involves landward retreat of coastal defences to restore (recover) intertidal wetlands
- Enables restoration of significant areas of formerly lost intertidal wetland
- Significantly reduces the costs of coastal protection and in the UK that has been used as one of the major drivers
- Only just starting to be used (mostly UK and some isolated examples elsewhere)

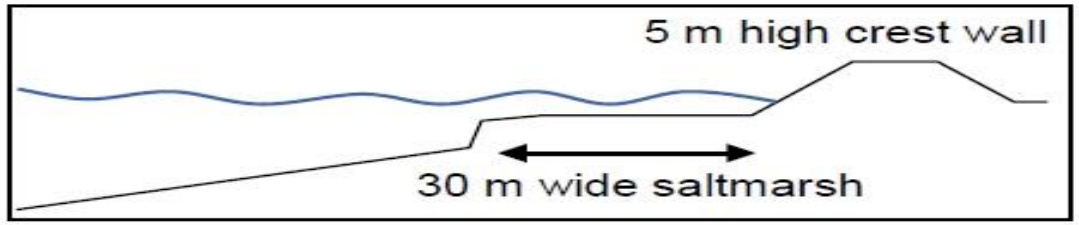
Sea Defence Costs with Differing Widths of Saltmarsh (south east UK - early 1990's)



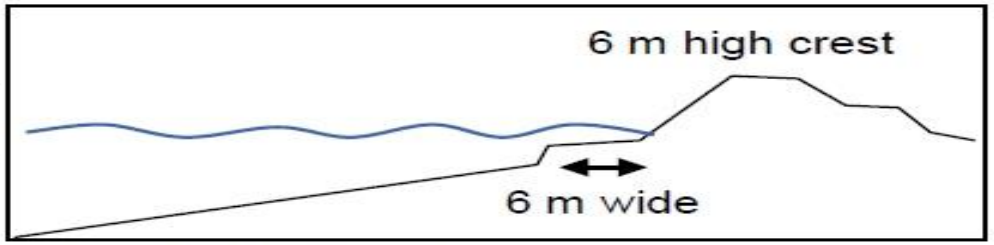
Cost £400/m of seawall



Cost £500/m of seawall



Cost £800/m of seawall

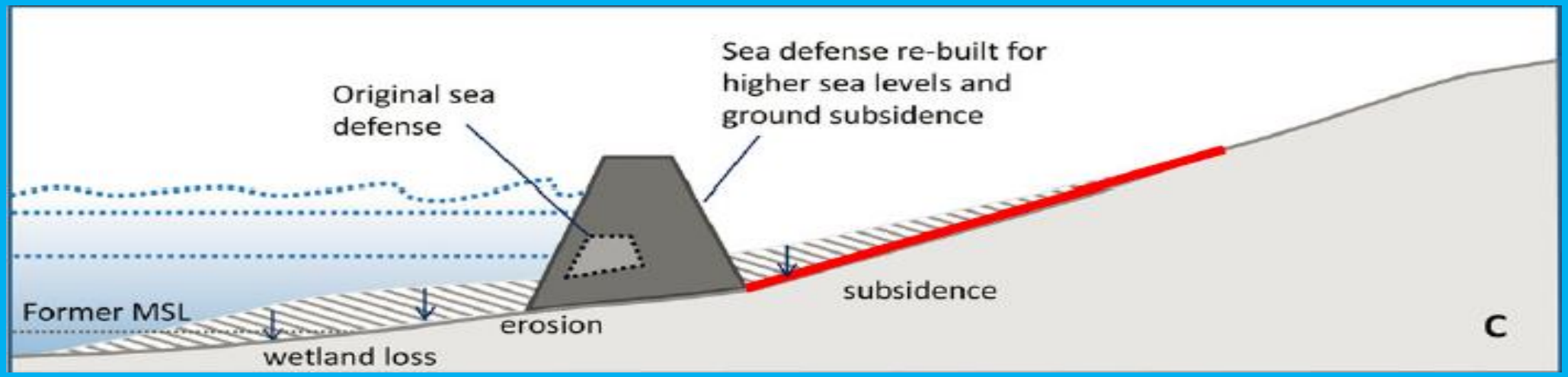


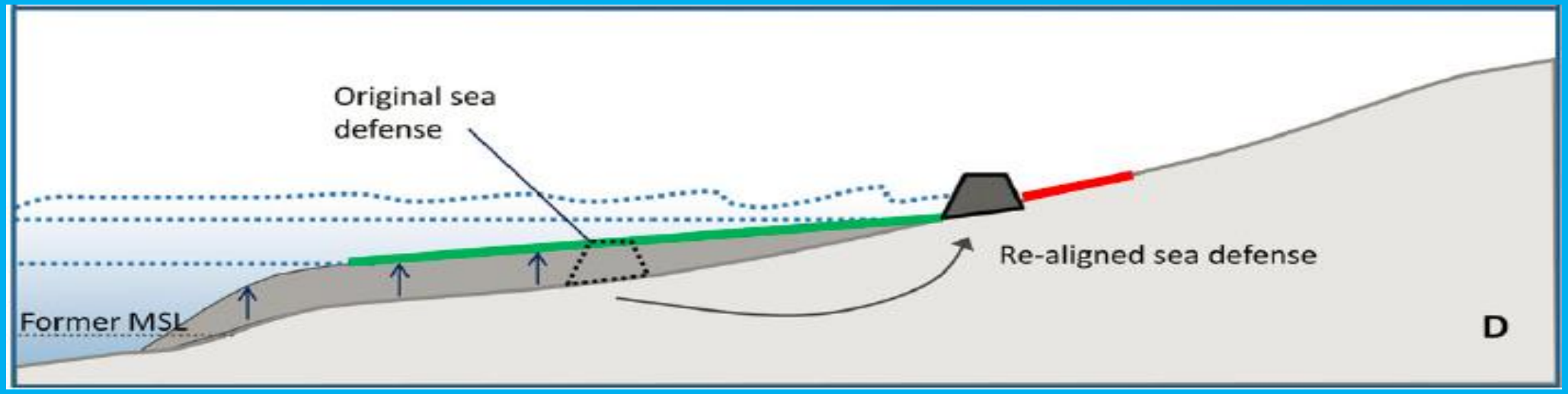
Cost £1500/m of seawall

Cost £5000/m of seawall

Indicative costs and heights of sea defences with different widths of saltmarsh fronting. Costs presented in early 1990s prices. Information drawn from south east England

Longer Term ? Managed Realignment





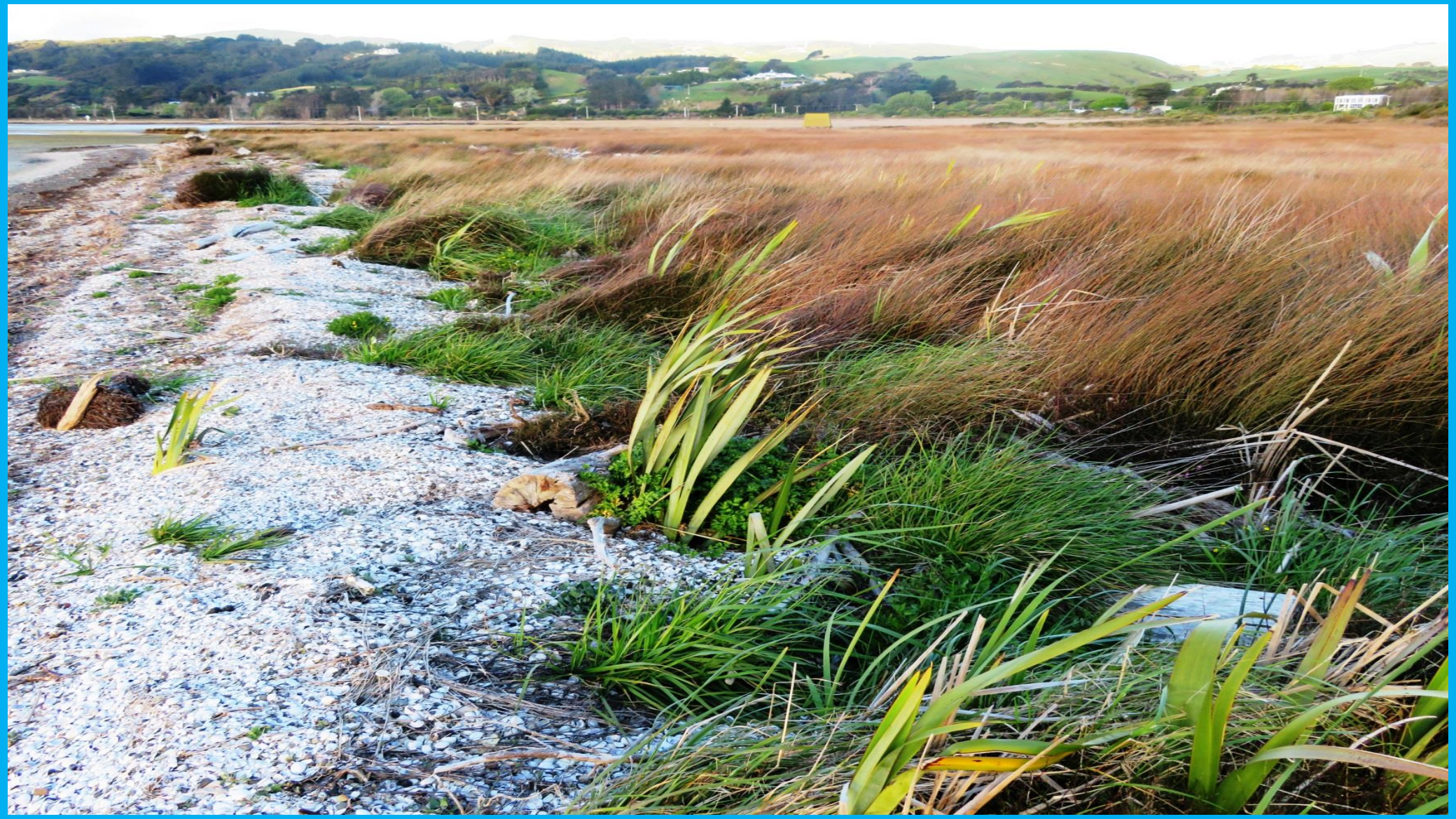
Creation & Restoration of Estuarine Ecosystems

Estuarine Beach formed by Nourishment

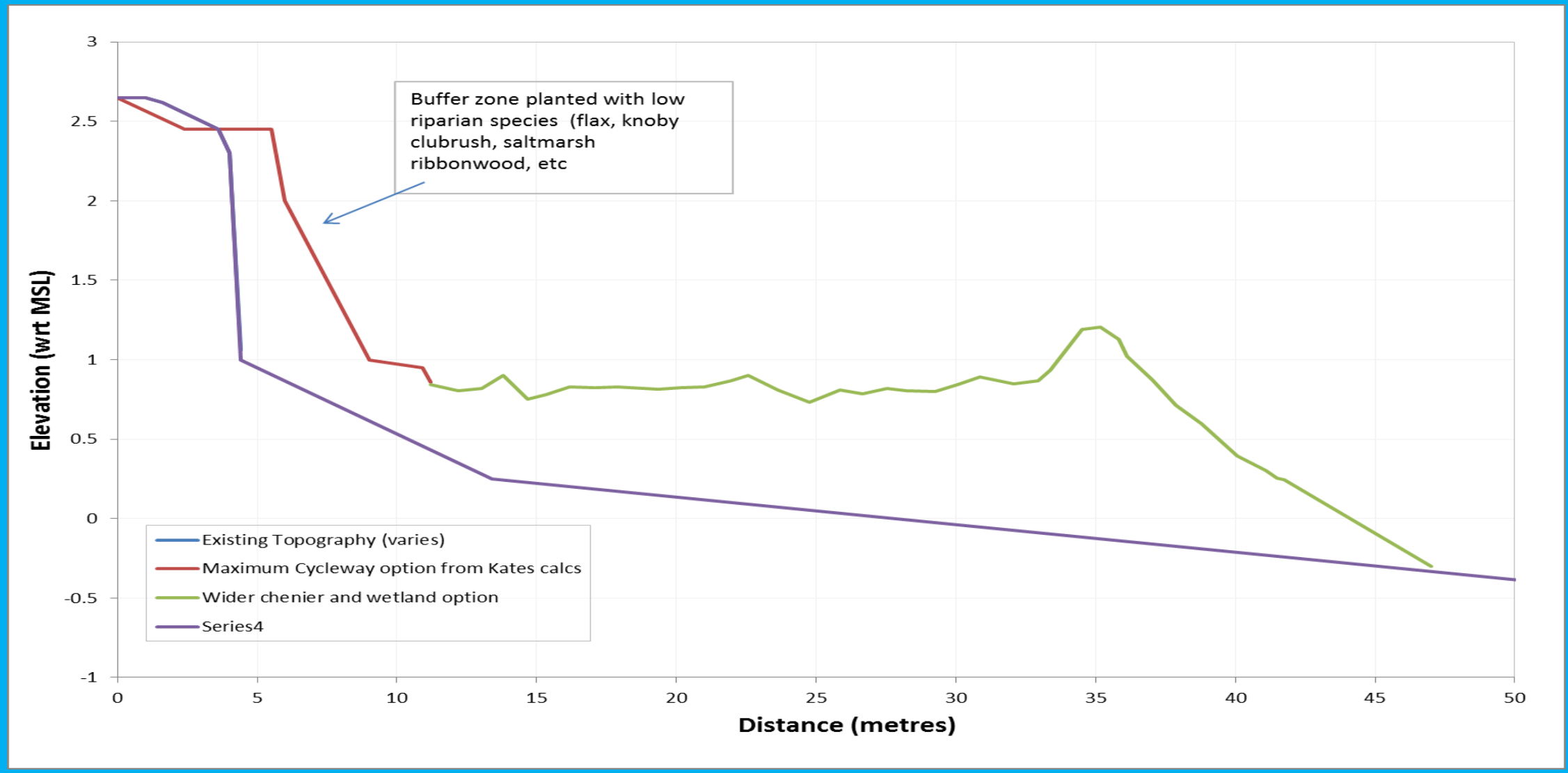
(Tairua Harbour, Coromandel)

Constructed Wetland - St Annes - Manukau Harbour

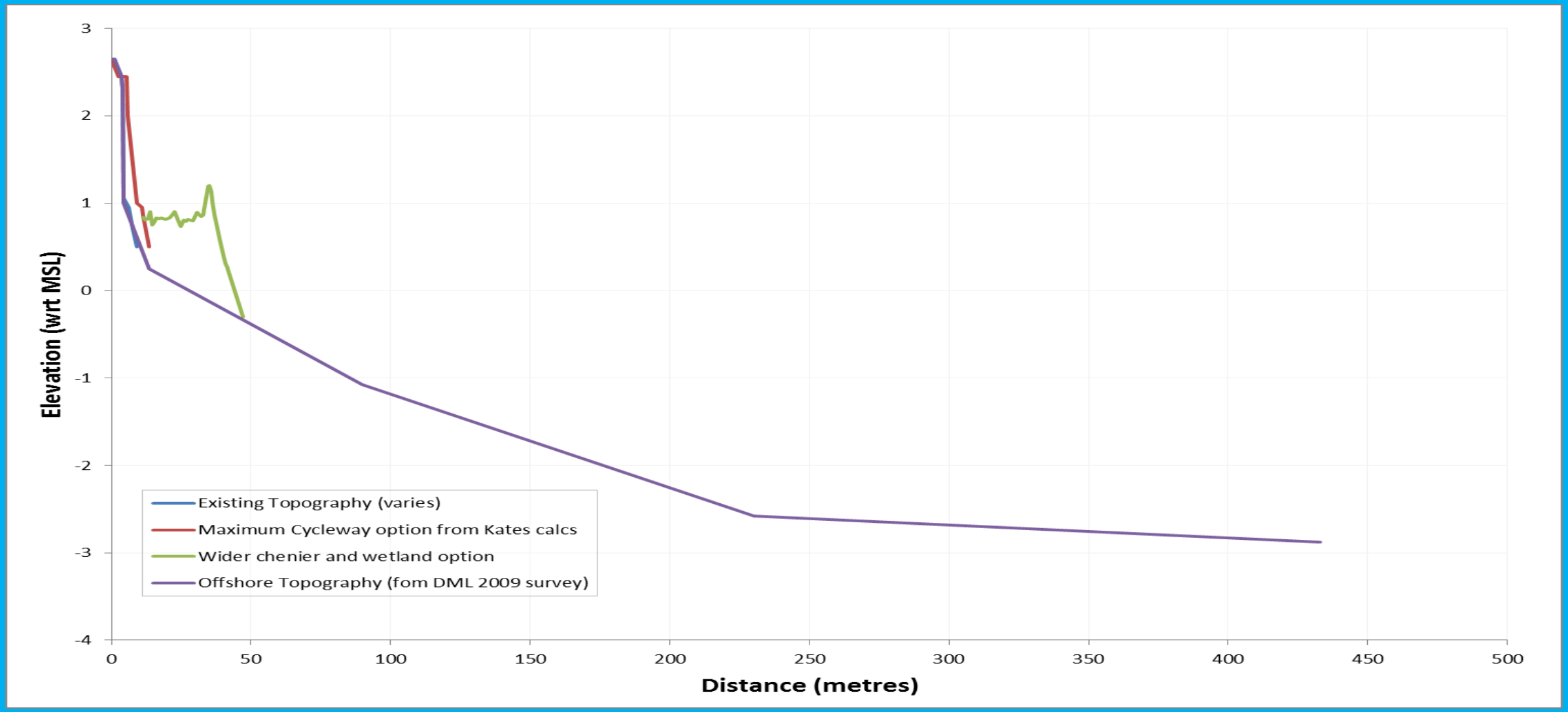
Natural Chenier and Wetland



Potential Restoration of coastal Margin Ecosystems – Porirua Harbour



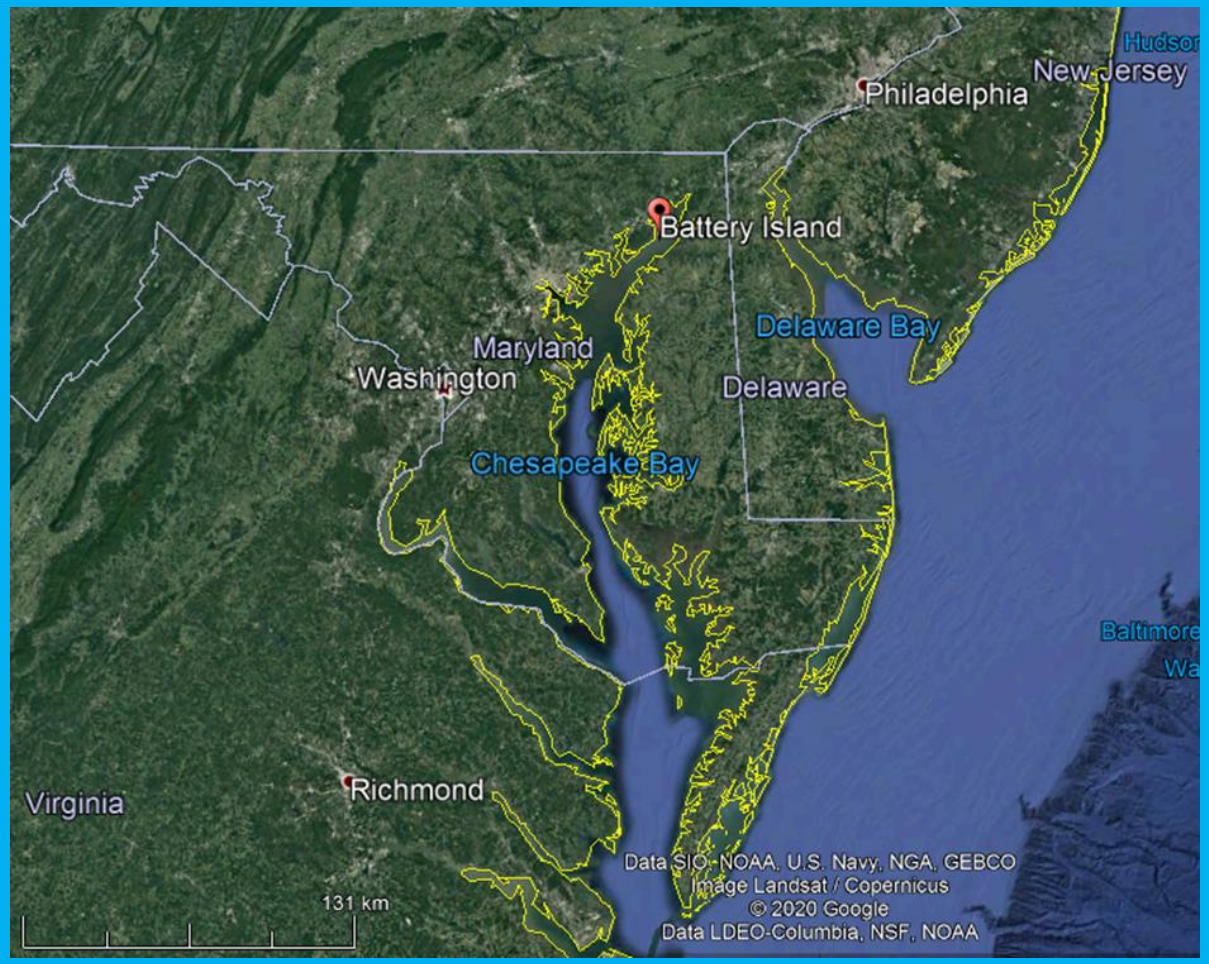
Maximum Width Wetland Option



Existing Stream Outlet

Potential option to enhance stream and stormwater outlets

Battery Island, Chesapeake Bay Eastern US

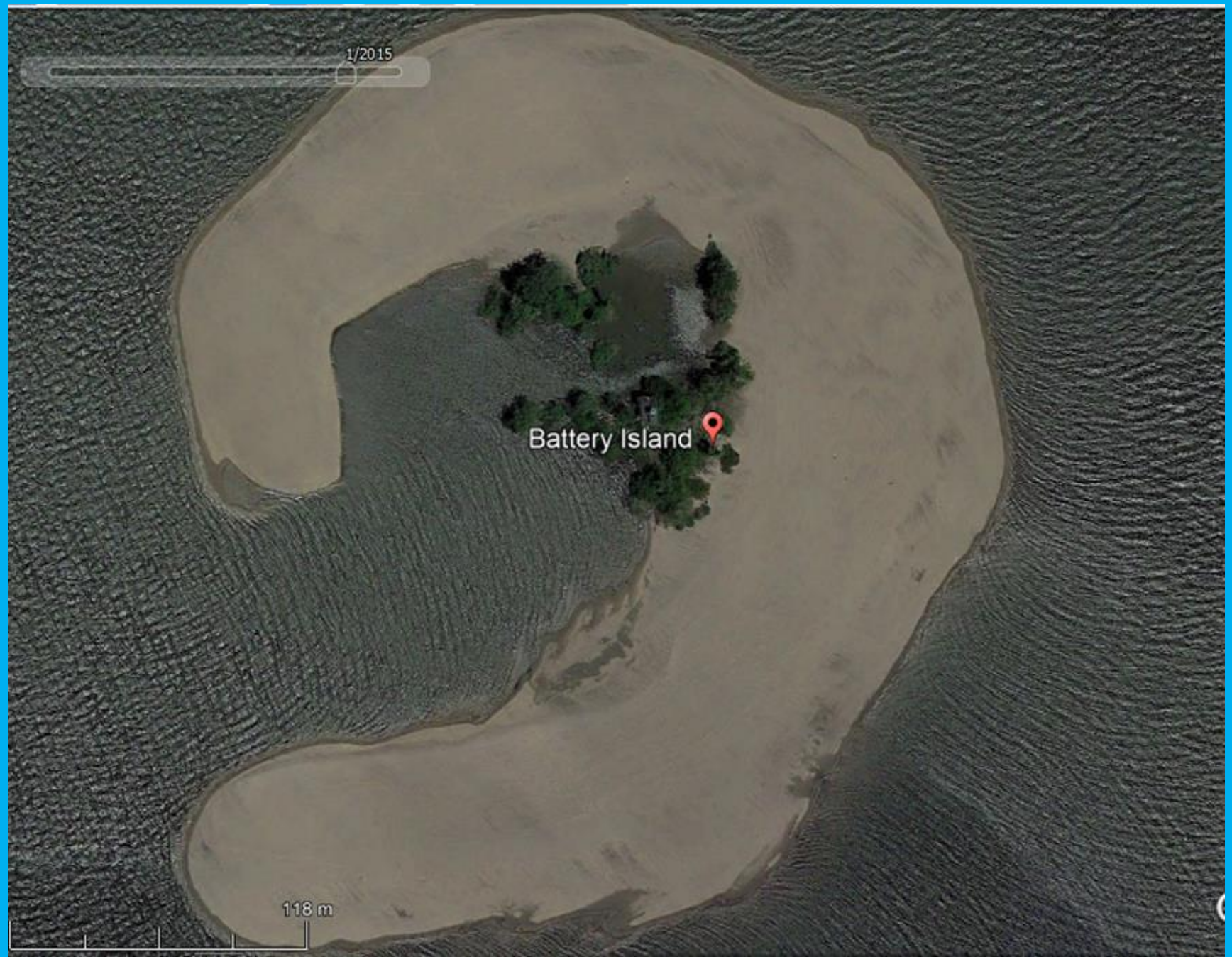


Battery Island Restoration Project, US

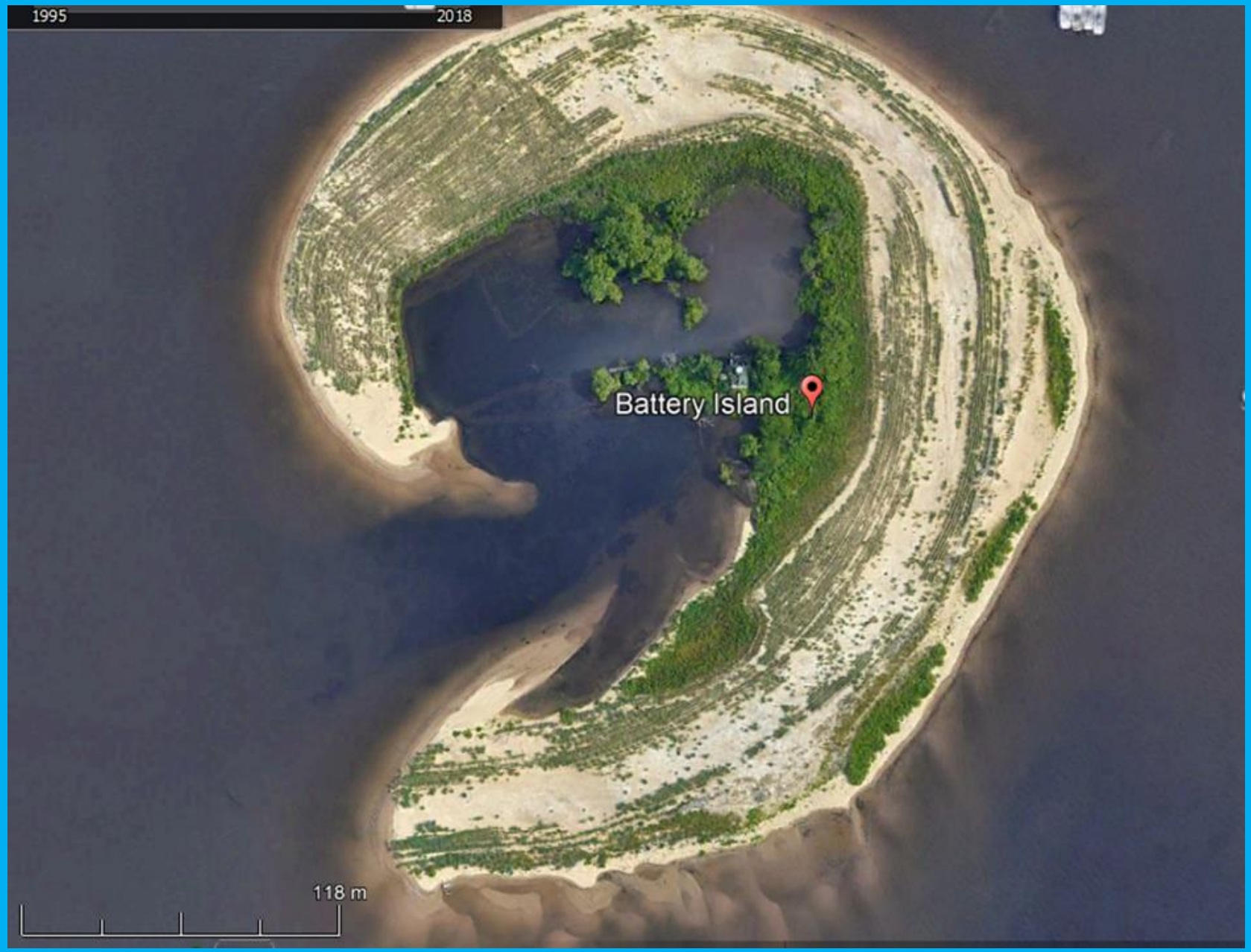
- Primary objective was to beneficially use dredged material to restore an eroded waterfowl nesting site and historic lighthouse in the Susquehanna National Wildlife Refuge, Chesapeake Bay
- Material was dredged from the Susquehanna federal channel at the mouth of the Susquehanna River
- Dredged material was placed hydraulically with a diffuser and distributed by earth moving equipment to create an unconfined horseshoe-shaped island
- This use of dredged material applying working with nature principles was cost-competitive with traditional upland confined placement alternatives.

Battery Island – Before & After

Figure 7. Battery Island before (left; 2011) and after (right; 2013) unconfined placement of dredge



After (2013)

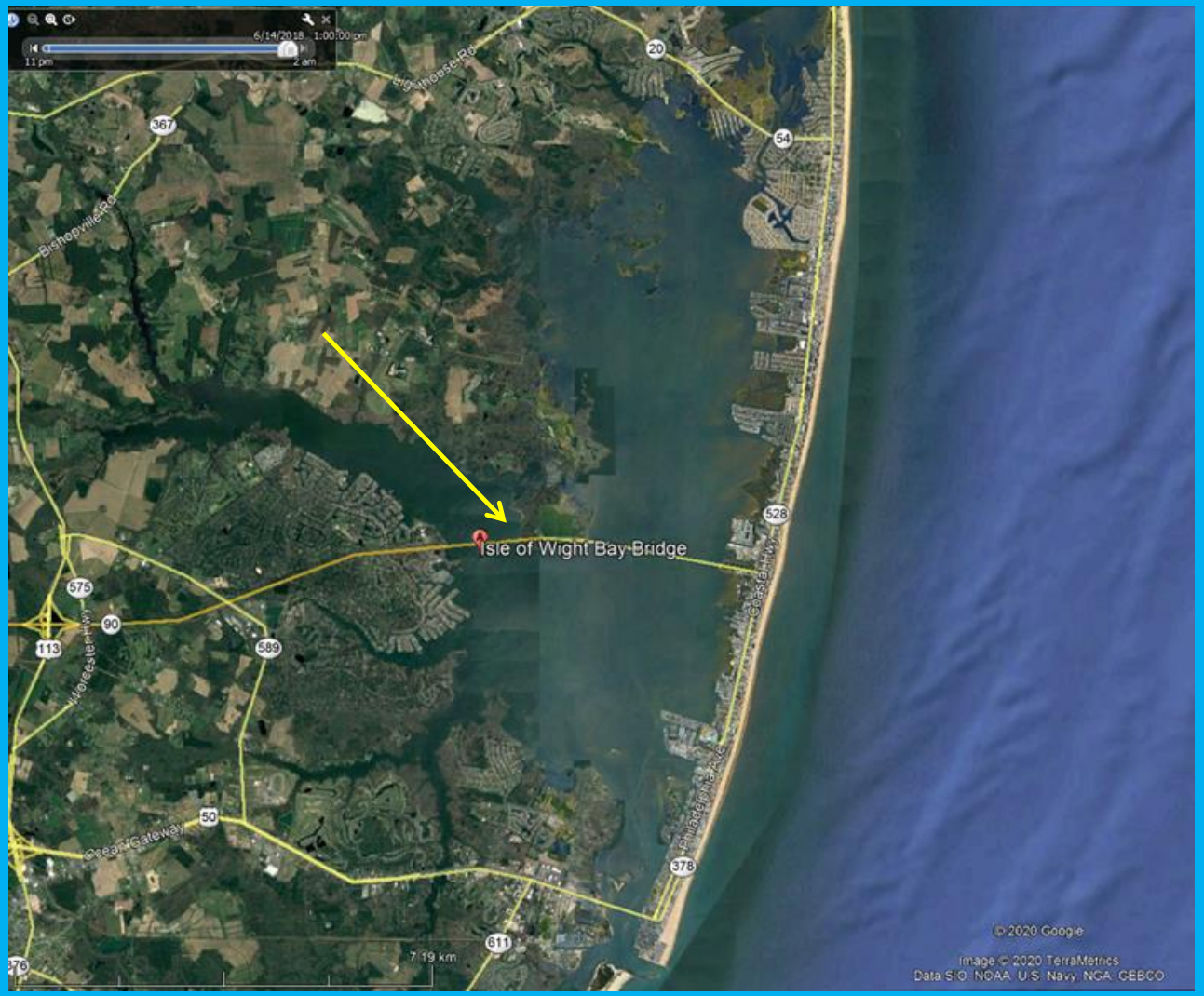


After (2017)

Elvia Island, Galveston Bay, Texas

Birds making use of the 6 acre island constructed of sediment dredged from the Houston Ship Channel

Isle of Wight



Isle of Wight Bay, MD, Eastern US

- Isle of Wight Bay Restoration Project, Worcester County, MD.
- Restoration project involved placement of dredged sediment from the Isle of Wight Federal channel to restore salt marsh habitat
- Rubble protection placed to the restored marsh
- The shoreline had eroded at this location, exposing built infrastructure through the loss of marsh habitat

Before & After

2017

Figure 2. Wading birds utilize the restored Isle of Wight salt marsh.

Summary

- Estuaries have been significantly degraded by a wide range of human activities
- While it is still very early days, there is an increasing range of restoration activities being undertaken worldwide
- These early projects indicate the considerable potential for in-harbour restoration, including:
  - Whole of estuary approaches (e.g. Maketu)
  - Recovery of lost estuary areas by managed realignment (e.g. UK)
  - Creation and restoration of harbour ecosystems
  - Beneficial use of suitable dredged sediment

Discussion