The Great Ocean Erosion

A Speculation into the Great Ocean Road of 2100

Daniel Ichallalene

RMIT

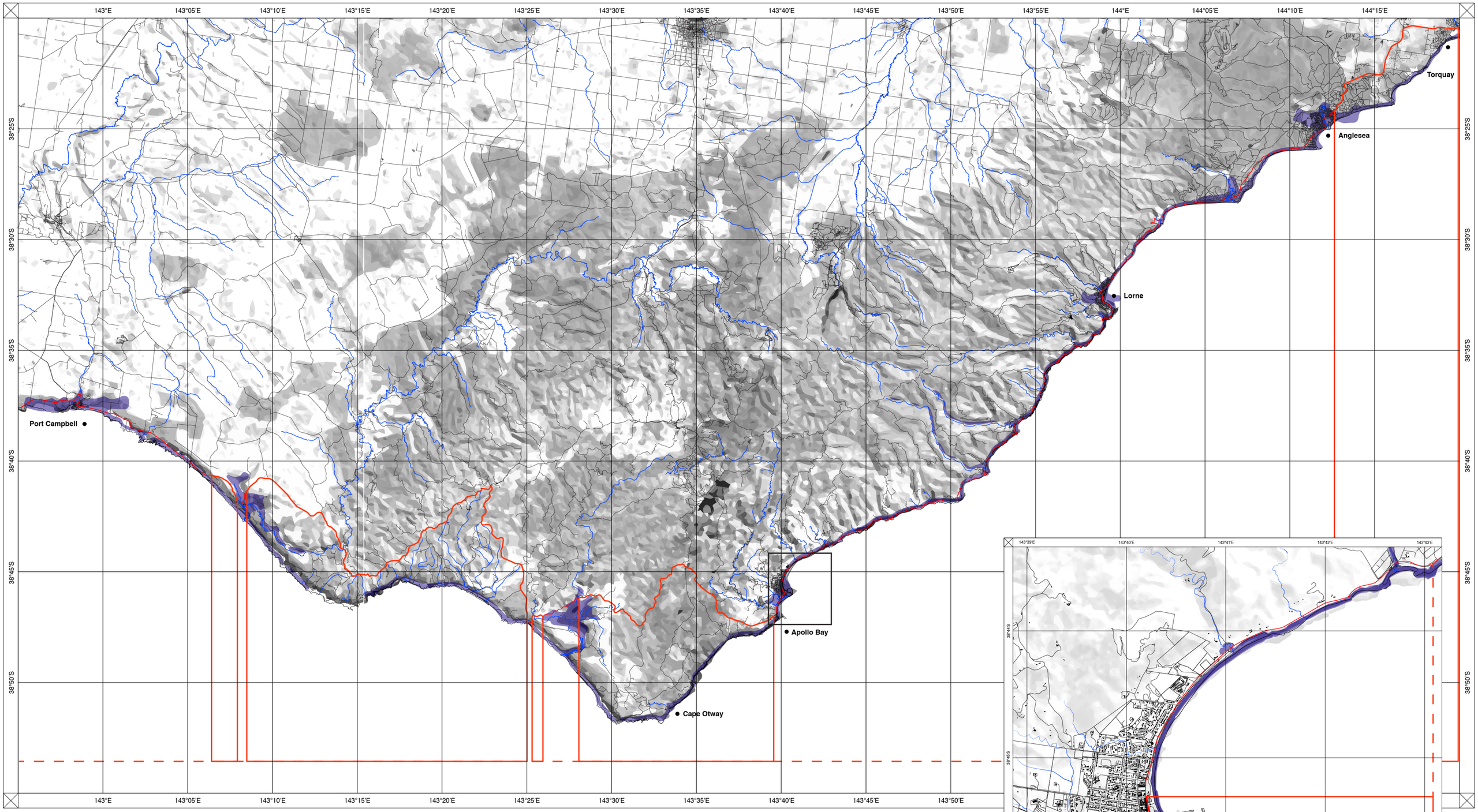
Design for Sustainable System Innovation. 2021

MDIT

The Great Ocean Erosion

A Speculation into the Great Ocean Road of 2100

If the Great Ocean Road is to retain its historical and economic significance in the post anthropogenic context of the 22nd century, It will be required to reconcile its existing paradigms of coastal living and environmental commerce, with the imminent destabilising forces of climate change.



SEA LEVEL RISE PROJECTIONS

2070 - 2100 **1 : 175 000**

GREAT OCEAN ROAD, APOLLO BAY,
VICTORIA, AUSTRALIA
[144.3520, 142.9307]
[- 38.9060, - 38.3010]

LEGEND

- CONTOURS AT X METERS
- ROADS/ HIGHWAYS
- LANDUSE BOUNDARIES
- WATERWAYS
- GREAT OCEAN ROAD
- POTENTIAL REQUIRED DIVERSIONS
- RESIDENCES/ STRUCTURES
- 2070 PROJECTED SEA LEVEL [+ 0.47 M]
- 2100 PROJECTED SEA LEVEL [+ 0.82 M]

NDVI

0.0 0.2 0.4 0.6 0.8 1.0

NDWI

<0.0 0.2 0.4 >0.5

REFERENCES

- DEWLP. 2021 - (SLR47CM_2070)
- DEWLP. 2021 - (SLR82CM_2100)
- DEA. 2021 - (NDVI)
- DEA. 2021 - (HIGH TIDES NDWI)
- OSM. 2021

DISCRIPTION

In line with current state government projections, an estimated sea level rise of 83 cm's by 2100 will result in the definitive inundation of various extents of the Great Ocean Road, by sole virtue of topography. What this data does not account for however, is the degree to which said inundation will be exacerbated by the runaway coastal erosion prevalent within the region. Subsequently, the objective of this mapping is to demonstrate conservatively, what portions of the Great Ocean Road will be viable to retain, and what extents will require diversion or extreme reinforcement measures.

Coastal Erosion Systems Research

Fig.1 - Morphodynamic Negative Feedback Loop
Fig.2 - Seawall Erosion Positive Feedback Loop
Fig.3 - Beach Nourishment Positive Feedback Loop
Fig.4 - Coastal Erosion Causal Loops

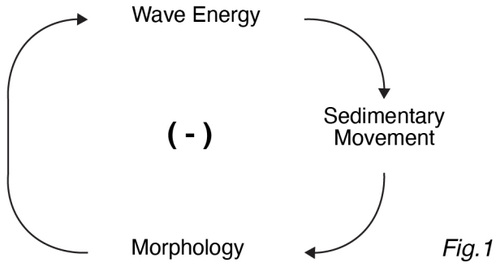


Fig.1

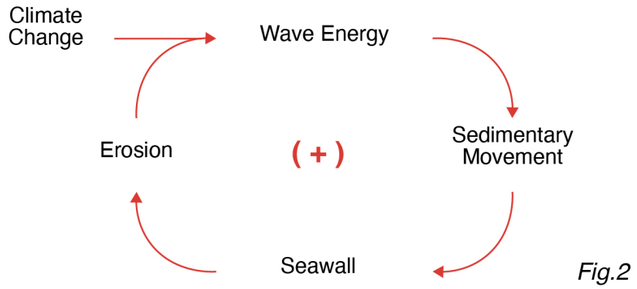


Fig.2

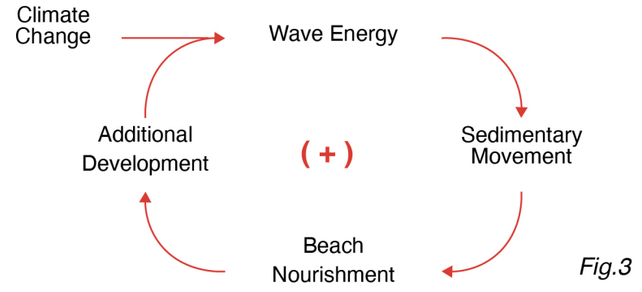
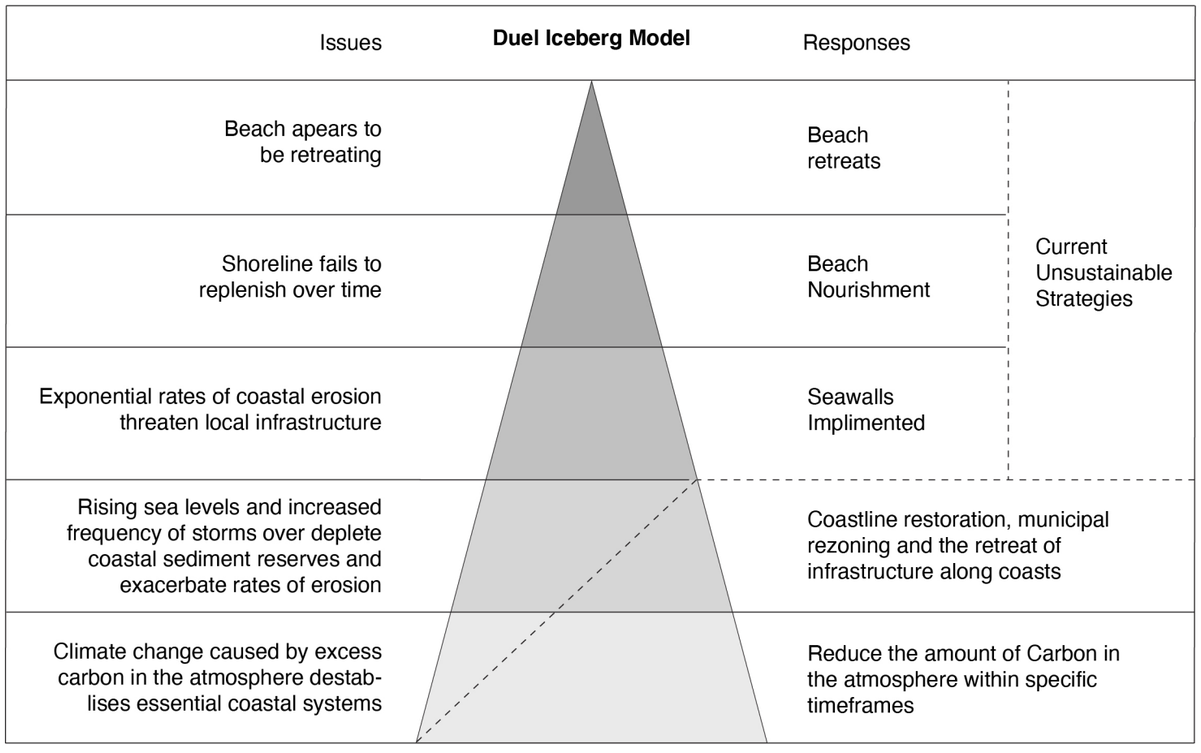


Fig.3



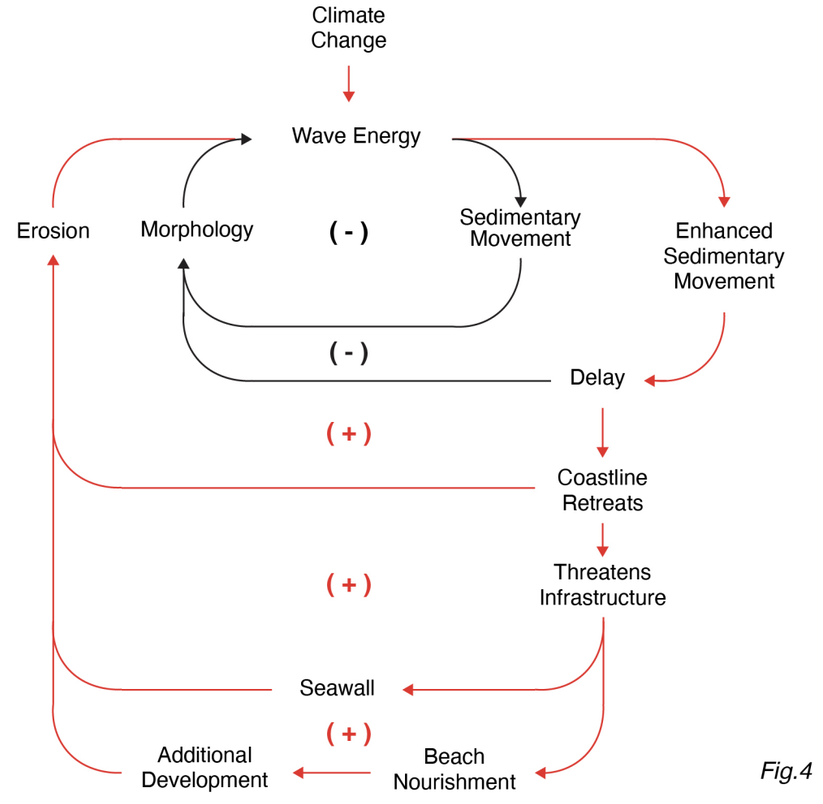
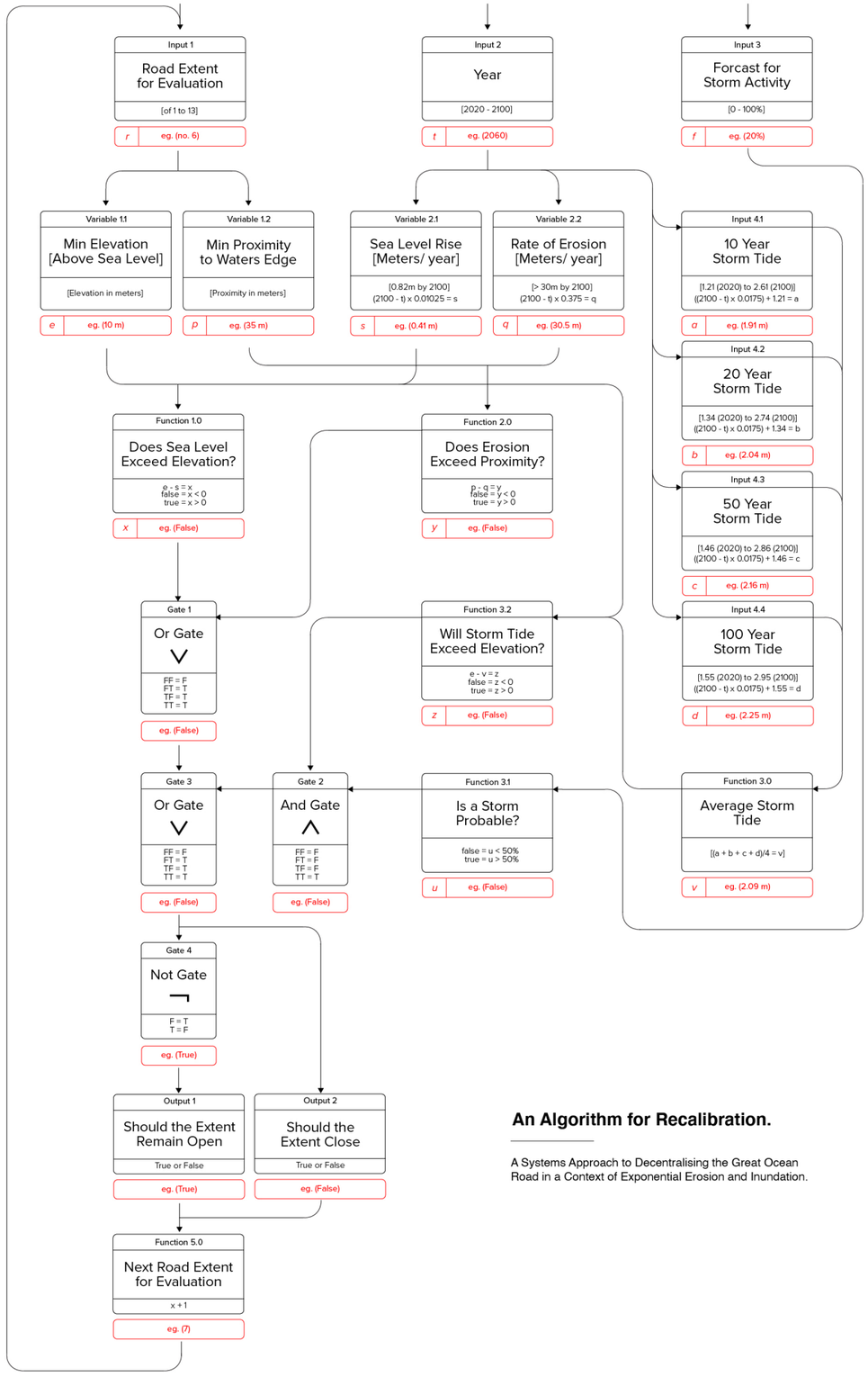


Fig.4



An Algorithm for Recalibration.

A Systems Approach to Decentralising the Great Ocean Road in a Context of Exponential Erosion and Inundation.

Projection 001 - 2060

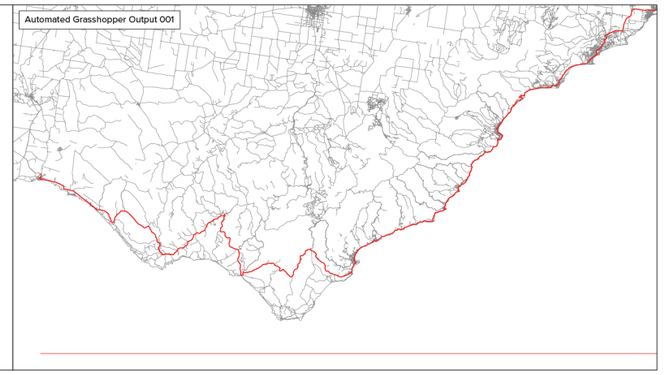
Input 2
Year: 2060

Input 3
Storm Forcast: <50%

Variable 2.1
Sea Level Rise: 0.41m

Function 3.0
Storm Tide Avg: 2.01m

Output 1/2
Extents Diverted: 0/13



Projection 002 - 2060 [Storm]

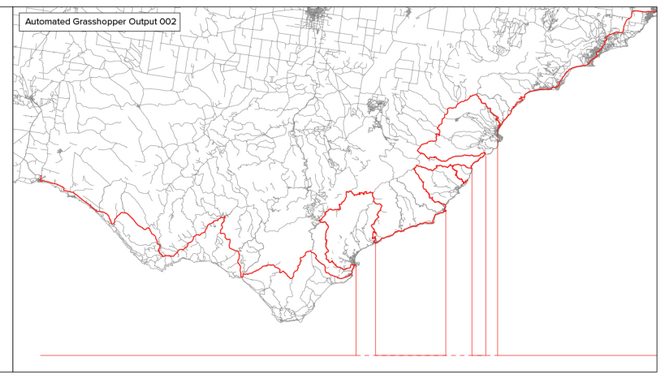
Input 2
Year: 2060

Input 3
Storm Forcast: >50%

Variable 2.1
Sea Level Rise: 0.41m

Function 3.0
Storm Tide Avg: 2.01m

Output 1/2
Extents Diverted: 4/13



Projection 003 - 2100

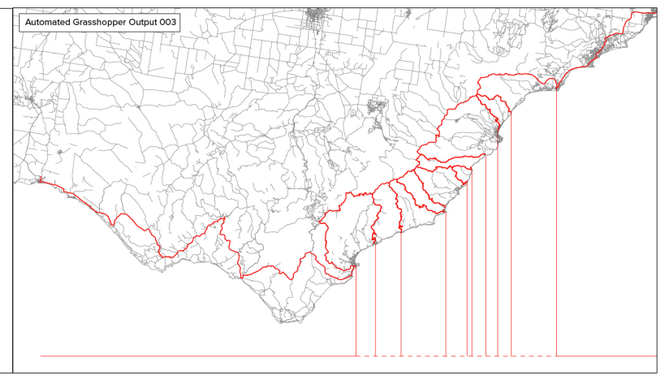
Input 2
Year: 2100

Input 3
Storm Forcast: <50%

Variable 2.1
Sea Level Rise: 0.82m

Function 3.0
Storm Tide Avg: 2.79m

Output 1/2
Extents Diverted: 10/13



Projection 004 - 2100 [Storm]

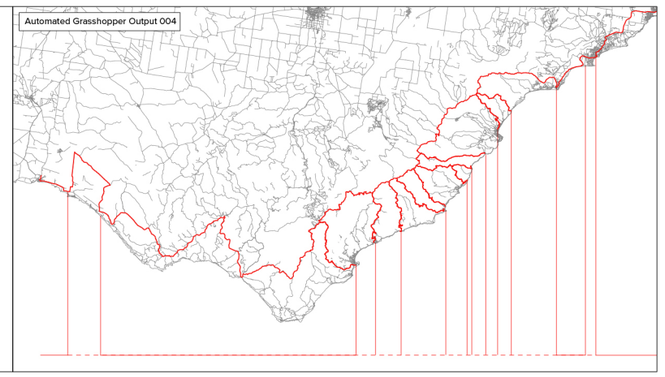
Input 2
Year: 2100

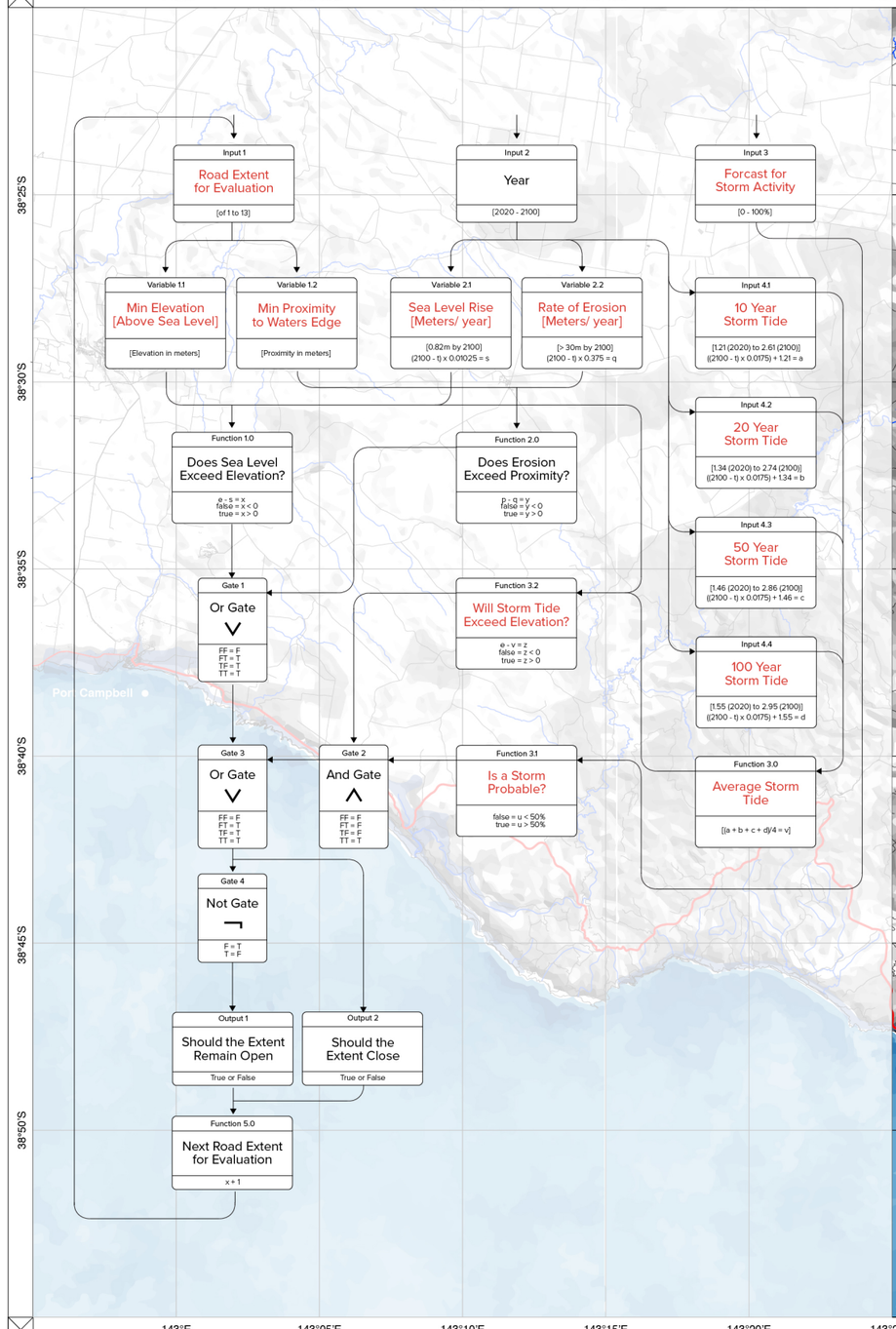
Input 3
Storm Forcast: >50%

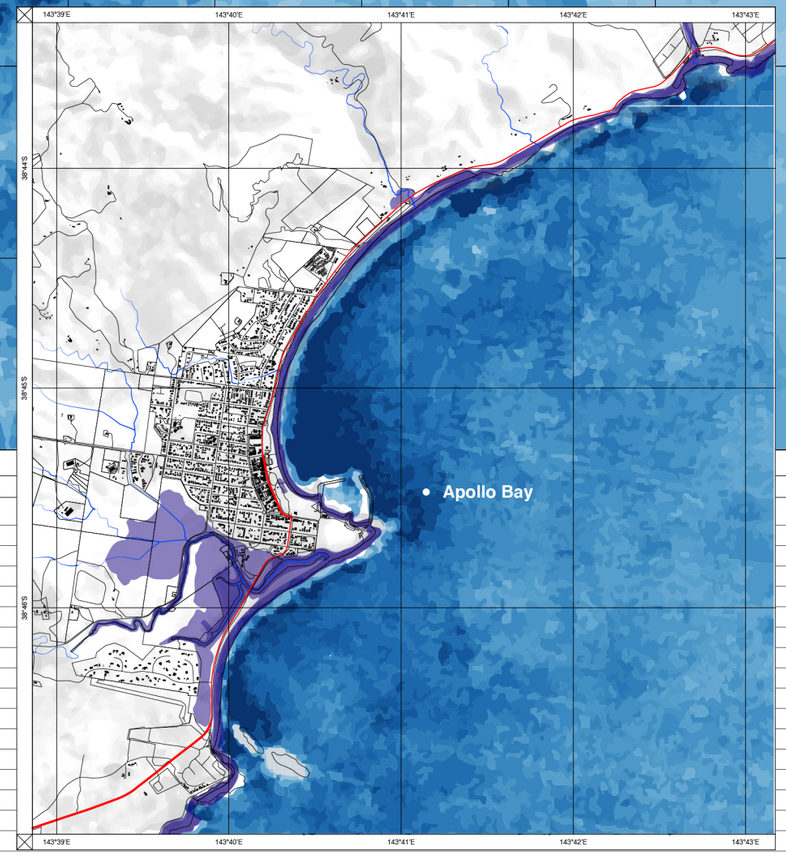
Variable 2.1
Sea Level Rise: 0.82m

Function 3.0
Storm Tide Avg: 2.79m

Output 1/2
Extents Diverted: 12/13







HIGH TIDE NORMALIZED DIFFERENCE WATER INDEX

2021 **1 : 175 000**

GREAT OCEAN ROAD, APOLLO BAY,
VICTORIA, AUSTRALIA
[144.3520, 142.9307]
[- 38.9060, - 38.3010]

LEGEND

- CONTOURS AT X METERS
- ROADS/ HIGHWAYS
- LANDUSE BOUNDARIES
- WATERWAYS
- GREAT OCEAN ROAD
- POTENTIAL REQUIRED DIVERSIONS
- RESIDENCES/ STRUCTURES
- 2070 PROJECTED SEA LEVEL [+ 0.47 M]
- 2100 PROJECTED SEA LEVEL [+ 0.82 M]

NDVI

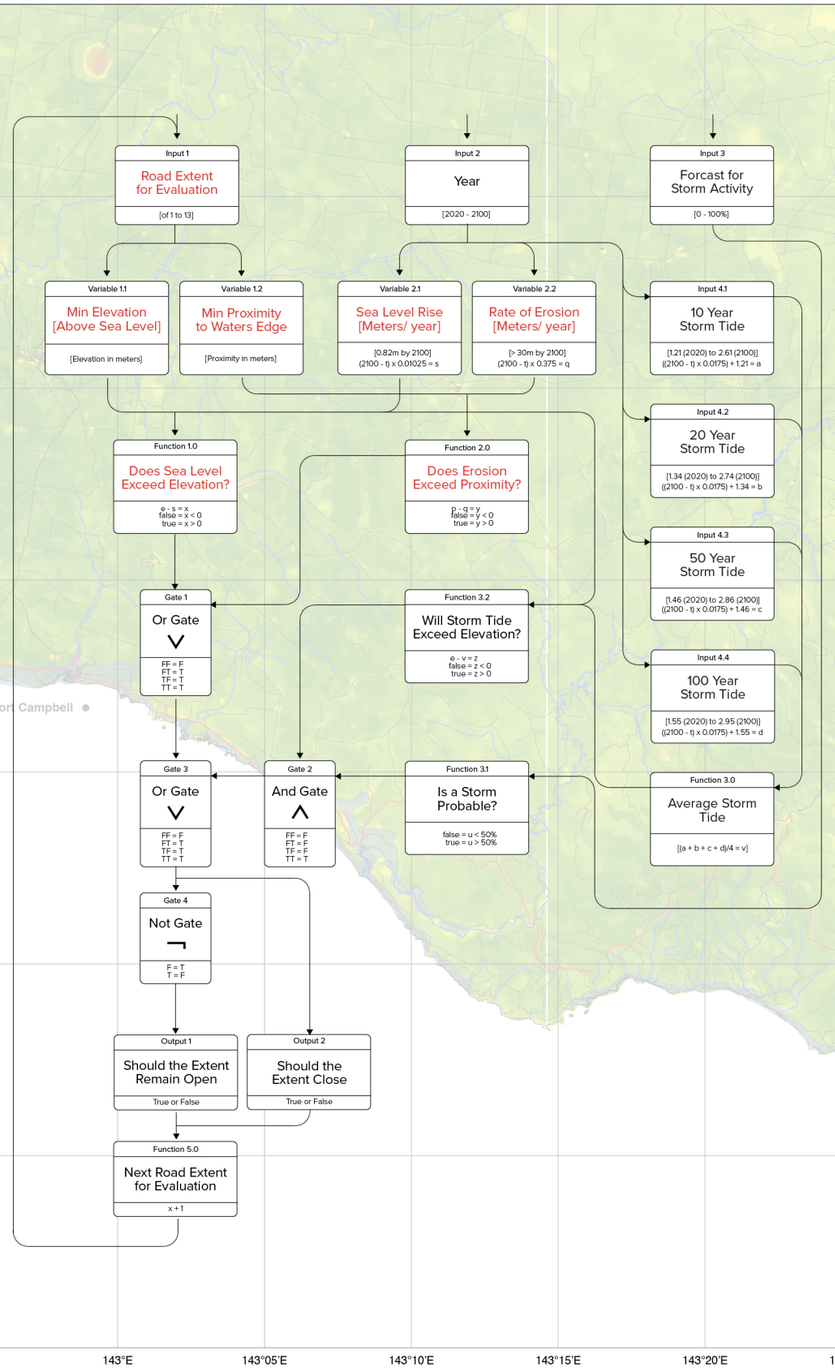
0.0 0.2 0.4 0.6 0.8 1.0

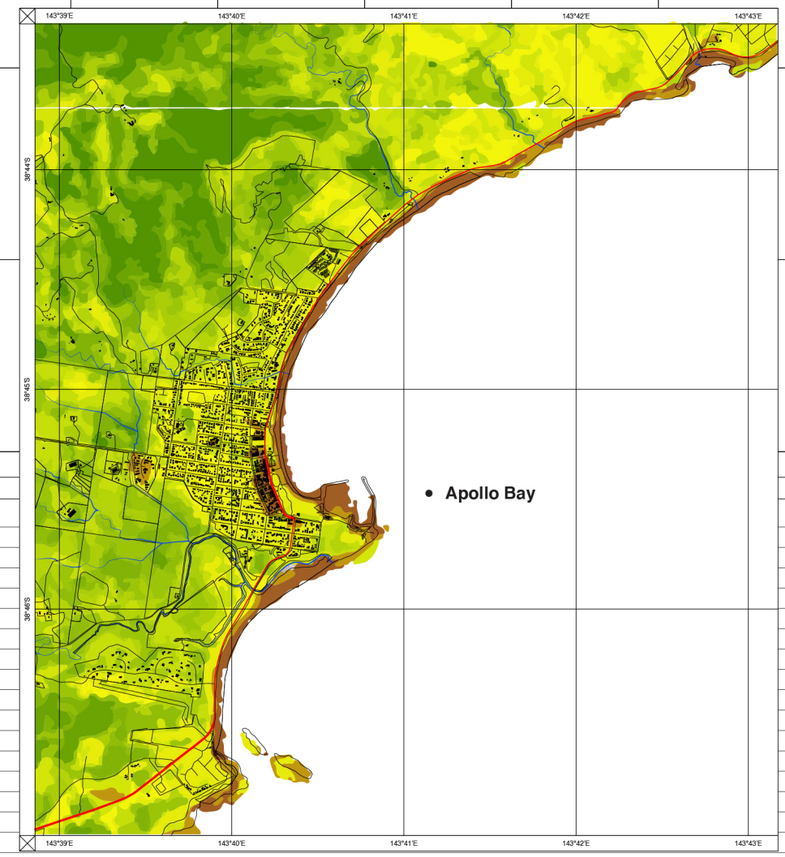
NDWI

<0.0 0.2 0.4 >0.5

REFERENCES

DEWLP. 2021 - (SLR47CM_2070)
DEWLP. 2021 - (SLR82CM_2100)
DEA. 2021 - (NDVI)
DEA. 2021 - (HIGH TIDES NDWI)
OSM. 2021





NORMALIZED DIFFERENCE VEGETATION INDEX [NDVI]

2021 **1 : 175 000**

GREAT OCEAN ROAD, APOLLO BAY,
VICTORIA, AUSTRALIA
[144.3520, 142.9307]
[- 38.9060, - 38.3010]

LEGEND

- CONTOURS AT X METERS
- ROADS/ HIGHWAYS
- LANDUSE BOUNDARIES
- WATERWAYS
- GREAT OCEAN ROAD
- POTENTIAL REQUIRED DIVERSIONS
- RESIDENCES/ STRUCTURES
- 2070 PROJECTED SEA LEVEL [+ 0.47 M]
- 2100 PROJECTED SEA LEVEL [+ 0.82 M]

NDVI

0.0 0.2 0.4 0.6 0.8 1.0

NDWI

<0.0 0.2 0.4 >0.5

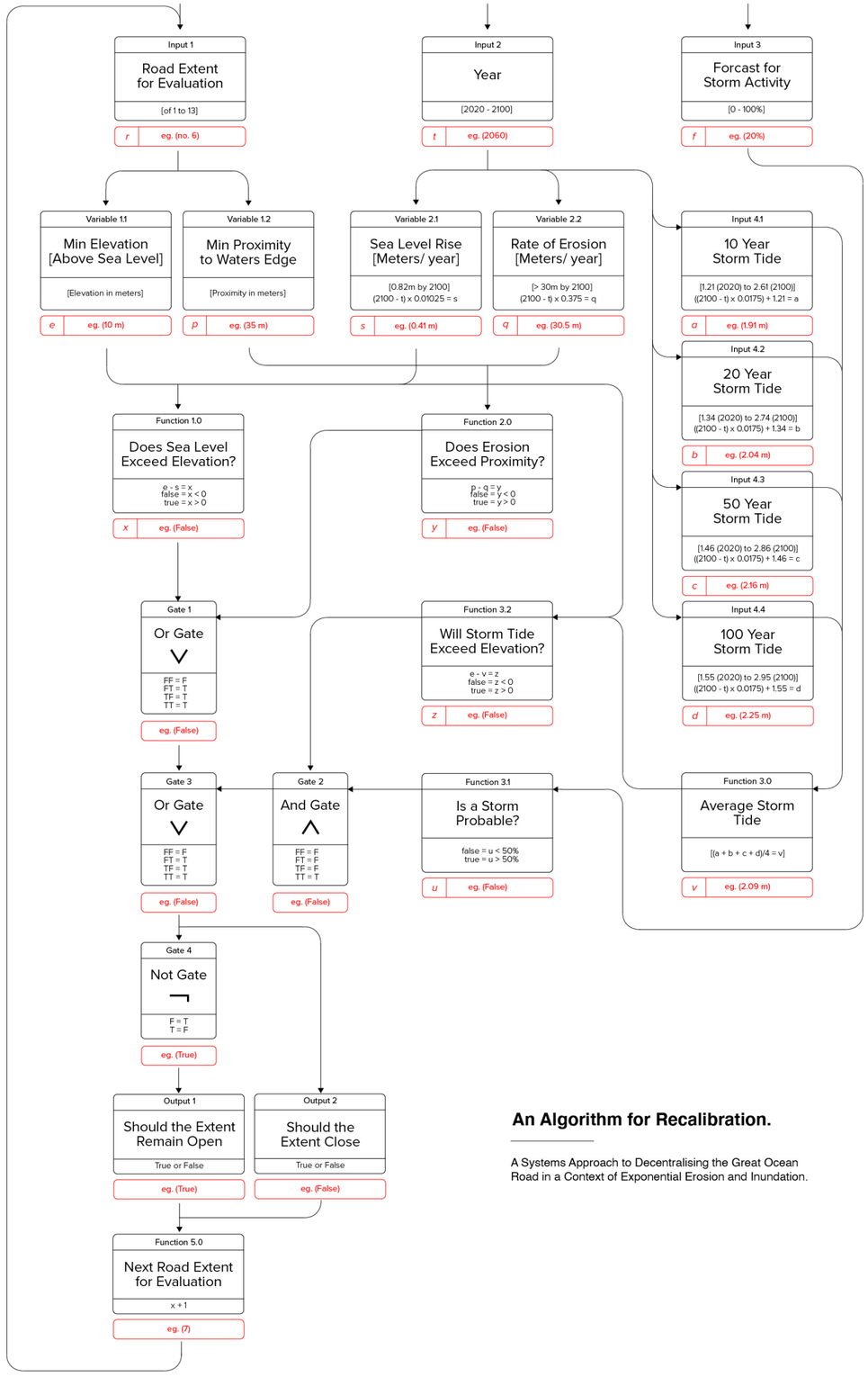
REFERENCES

DEWLP. 2021 - (SLR47CM_2070)
DEWLP. 2021 - (SLR82CM_2100)
DEA. 2021 - (NDVI)
DEA. 2021 - (HIGH TIDES NDWI)
OSM. 2021

DISCRIPTION

NDVI data functions to indicate the presence of live green vegetation through a spectrum of light and correlating values. It can infer to a degree of limited accuracy, both the existence and relative health of vegetated land.

The objective of this mapping is to demonstrate the extent of vegetative buffer present along the Great Ocean Road coastline, with the underlying rationale, that a severe lack of vegetation may exacerbate the effects of runaway coastal erosion occurrent within the region. Furthermore, this map may also indicate extents of the coastline primed for coastal restoration practices, as a means of mitigating said erosion.



An Algorithm for Recalibration.

A Systems Approach to Decentralising the Great Ocean Road in a Context of Exponential Erosion and Inundation.

Projection 001 - 2060

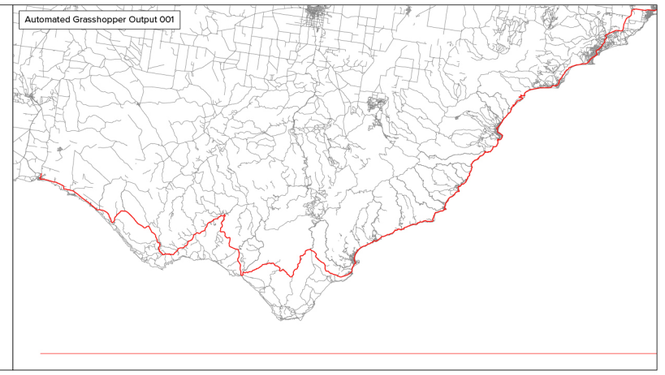
Input 2
Year: 2060

Input 3
Storm Forcast: <50%

Variable 2.1
Sea Level Rise: 0.41m

Function 3.0
Storm Tide Avg: 2.01m

Output 1/2
Extents Diverted: 0/13



Projection 002 - 2060 [Storm]

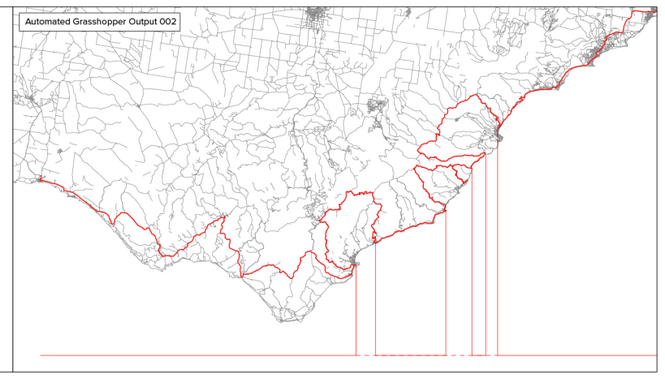
Input 2
Year: 2060

Input 3
Storm Forcast: >50%

Variable 2.1
Sea Level Rise: 0.41m

Function 3.0
Storm Tide Avg: 2.01m

Output 1/2
Extents Diverted: 4/13



Projection 003 - 2100

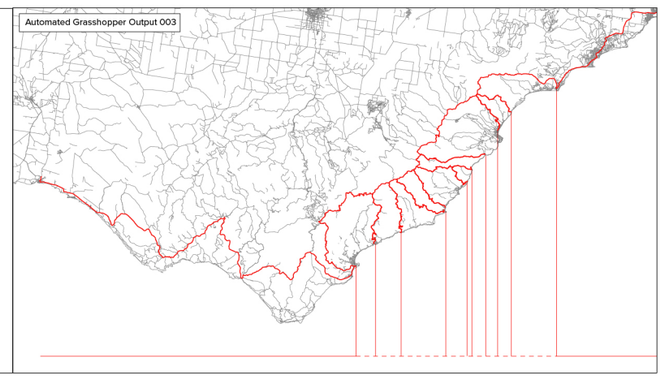
Input 2
Year: 2100

Input 3
Storm Forcast: <50%

Variable 2.1
Sea Level Rise: 0.82m

Function 3.0
Storm Tide Avg: 2.79m

Output 1/2
Extents Diverted: 10/13



Projection 004 - 2100 [Storm]

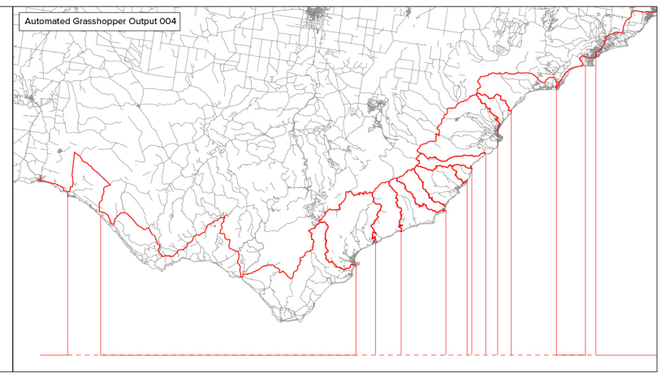
Input 2
Year: 2100

Input 3
Storm Forcast: >50%

Variable 2.1
Sea Level Rise: 0.82m

Function 3.0
Storm Tide Avg: 2.79m

Output 1/2
Extents Diverted: 12/13



The Great Ocean Erosion

A Speculation into the Great Ocean Road of 2100

DELWP, 2021. SLR82CM_2100 - Projected 82cm sea level rise by 2100. [image] Available at: <https://nationalmap.gov.au/#share=s-xn5Kk0LnN1jHOP-pVdfauXkl3NIo>

Digital Earth Australia OGC Web Services, 2021. High Tide and Low Tide Composites 2.0.0 - NDWI. [image] Available at: <http://High Tide and Low Tide Composites 2.0.0>

Digital Earth Australia OGC Web Services, 2021. High Tide and Low Tide Composites 2.0.0 - NDVI. [image] Available at: <http://High Tide and Low Tide Composites 2.0.0>

Kauffman, D., 1980. The Future Systems Series. 2nd ed. Minnesota: Future Systems Inc., pp.1-48.

Kennedy, D. McInnes, K. Ierodiaconou, D.. (2019). Understanding coastal erosion on beaches: A guide for managers, policy makers and citizen scientists. Available: https://www.eaaflyway.net/understanding-coastal-erosion-on-beaches-a-guide-for-managers-policymakers-and-citizens-scientists/.

Kim, D., n.d. Introduction to Systems Thinking. Pegasus Communications, Inc, pp.1-20.

Meadows, D., 1999. Leverage Points: Places to Intervene in a System. The Sustainability Institute,, pp.1-21.

McInnes, K., Macadam, I. and O'Grady, J., 2009. The Effect of Climate Change on Extreme Sea Levels along Victoria's Coast. Melbourne, Victoria: CSIRO Marine and Atmospheric Research.

Payo, A. Hall, J. Dickson, M. Walkden, M.. (2014). Feedback structure of cliff and shore platform morphodynamics. Journal of Coastal Conservation. 19 (6), 1-13.

Spatial Vision. (2019). coastal climate change impact assessment. Available: https://spatialvision.com.au/news-coastal-climate-change-impact-assessment/.

U.S. Climate Resilience Toolkit. (2019). Coastal Erosion. Available: https://toolkit.climate.gov/topics/coastal-flood-risk/coastal-erosion.

Waters, C. (2018). The problem with beach nourishment. Available: https://www.vox.com/2018/12/10/18125945/beach-erosion-nourishment-coastal-engineering-rebuilding-beaches