



Sea Level Rise & Extreme Sea Level Exposure

31 October 2023

Summary Presentation Project Update

SOUTHLAND
DISTRICT COUNCIL



Modelled Township locations



Current LiDAR - (Light Detection and Ranging) Area



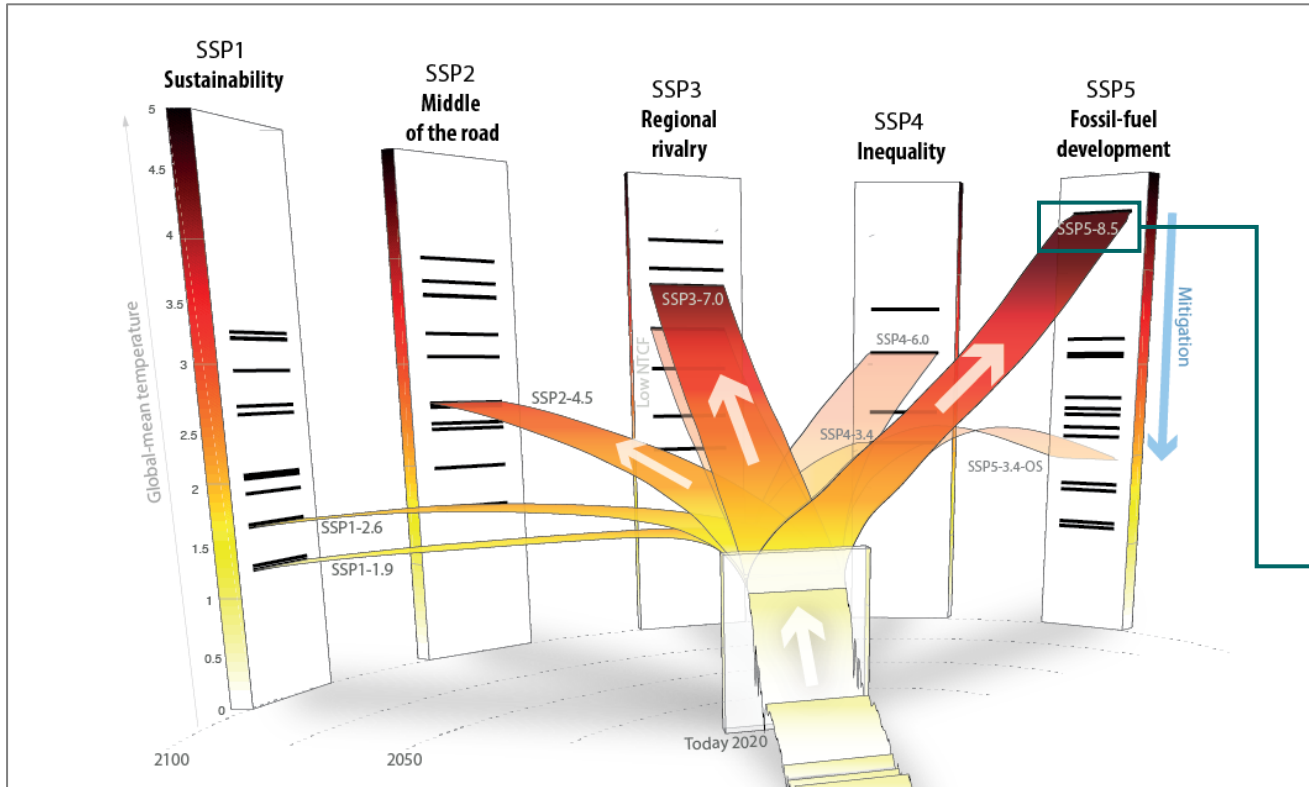
Caveat Statement

The area of Climate Change induced Sea Level Rise is a dynamic and changing area of science.

The work presented has been prepared by Great South (Southland Regional Development Agency) for the Southland District Council, with all reasonable skill and diligence based on the Ministry for the Environment's 'Interim Guidance'. It is expected that the guidance from the Ministry for Environment will be updated as climate science knowledge is further refined, and an agreed rate of Climate Change is confirmed. Accordingly, the modelling shown may change as updated climate science information becomes available. Users of this information are cautioned not to use the contents of this presentation for critical decision making, until the final Report has been completed and users are advised to seek independent qualified advice before making decisions.

Methodology

The SSP change scenarios describe the **possible greenhouse gas emissions from different climate policies.**



The labels enumerate five scenarios, which are defined by the socio-economic challenges for mitigation and adaptation.



The Ministry for Environment's 'interim guidance' (MfE, 2022), requires the modelling of:

SSP5-8.5 climate change scenario - Worst-case scenario.

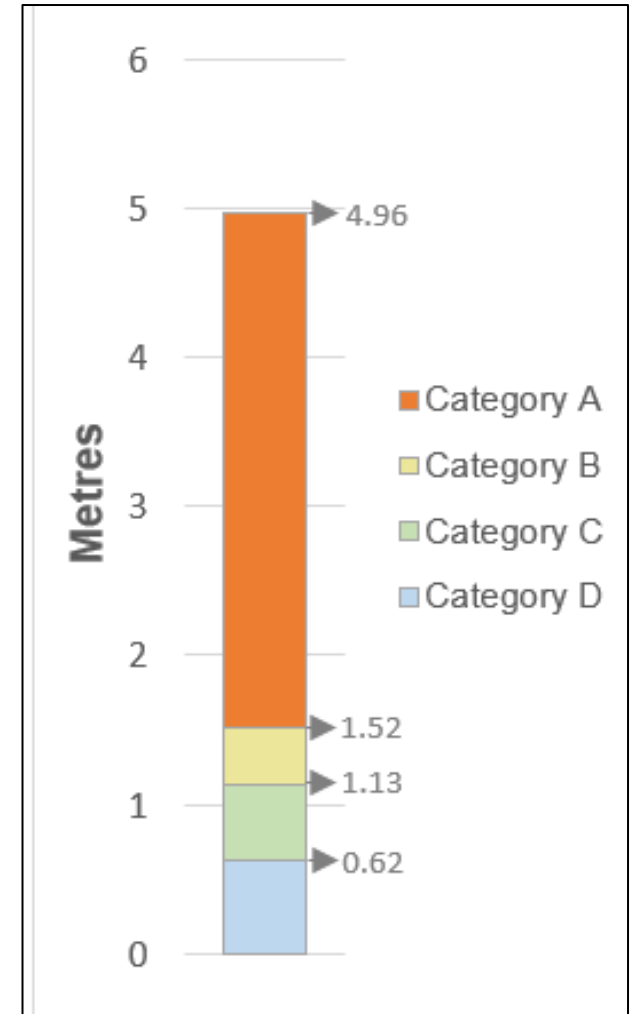
It considers the correlation between the Shared Socioeconomic Pathways SSP5 (fossil-fuelled development) and the Representative Concentration Pathway RCP 8.5. This is a **world with very high emissions with an expected increase in the global temperature of >4°C by 2100.**

Methodology - Categories

| Correlation to the MfE interim guidance | Projected year | SSP-RCP scenario* |
|---|----------------|---------------------------------|
| Category A | 2300 | SSP5-8.5 M (Low confidence) |
| Category B (High scenario) | 2130 | SSP5-8.5 H+ (Medium confidence) |
| Category C (Medium scenario) | 2130 | SSP5-8.5 M (Medium confidence) |
| Category D | 2090 | SSP5-8.5 M (Medium confidence) |

The longer the modelling period the greater the uncertainty

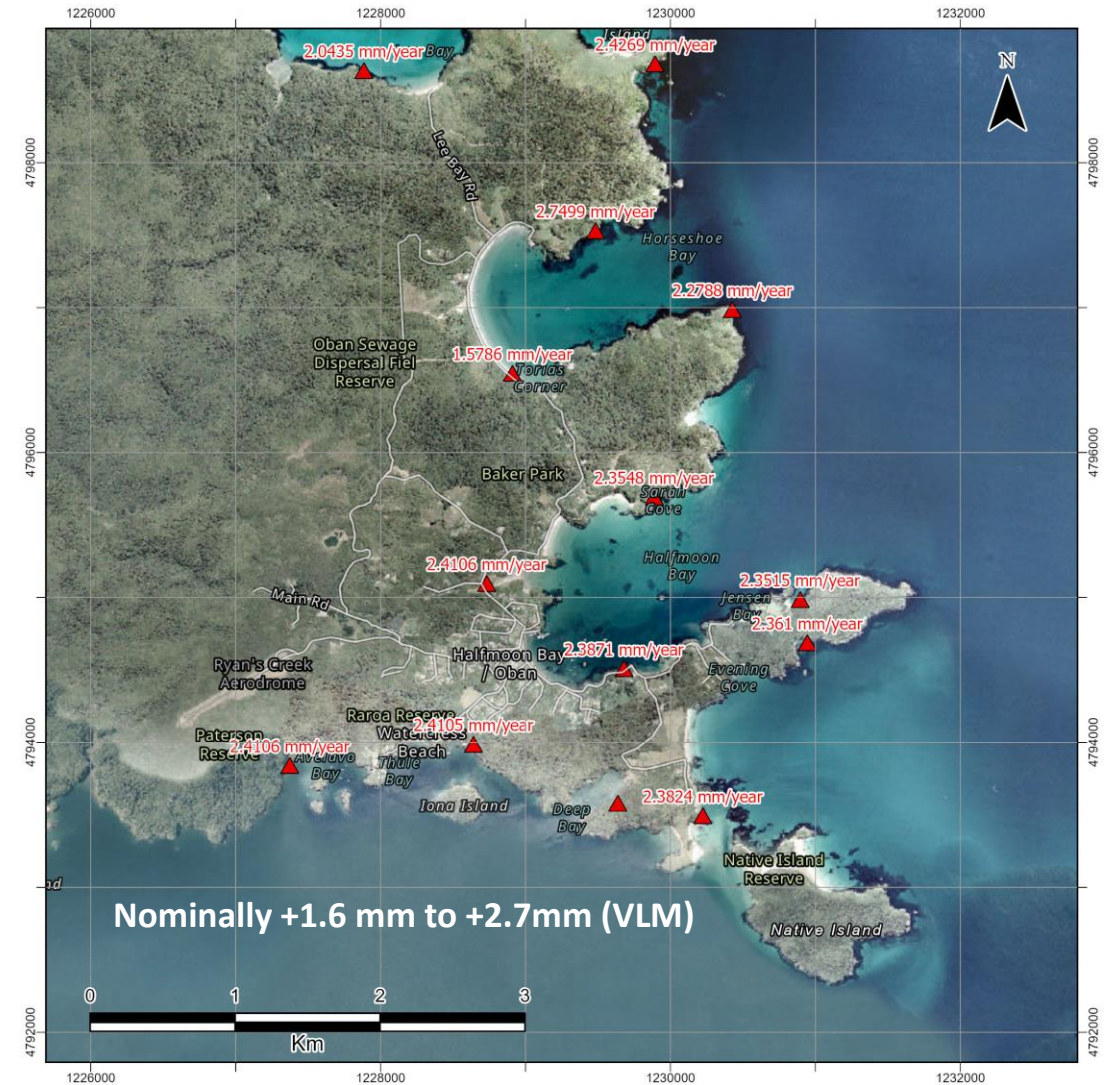
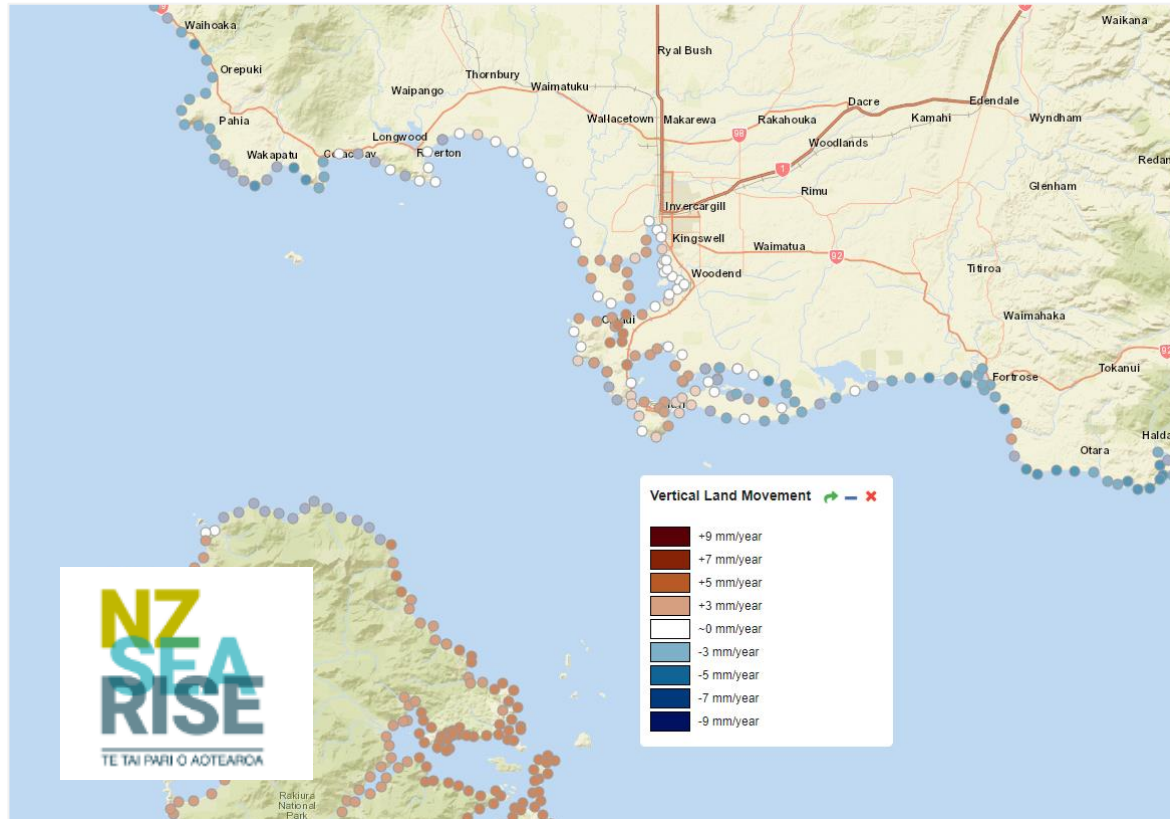
Interim guidance on the use of new sea-level rise projections (MfE, 2022)



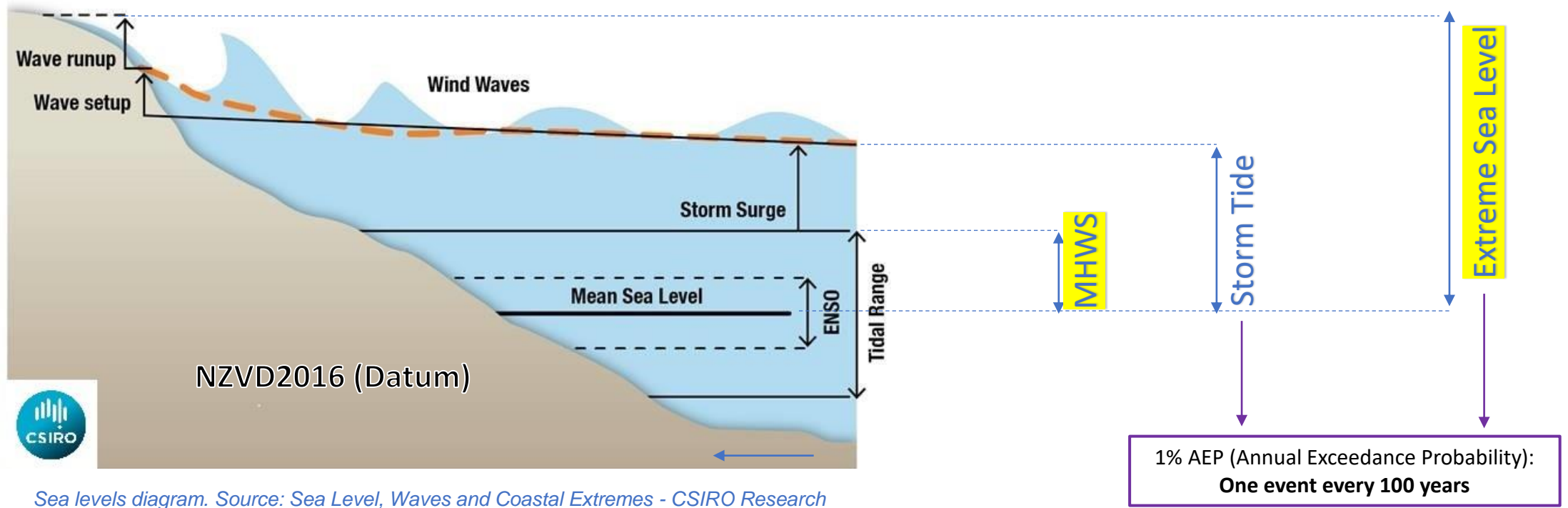
Sea level rise base values and its corresponding elevation (m) for each case scenario excluding the effects of storm waves

Methodology Includes – Vertical Land Movement

Vertical land movements (VLM) were included in determining the relative sea level rise

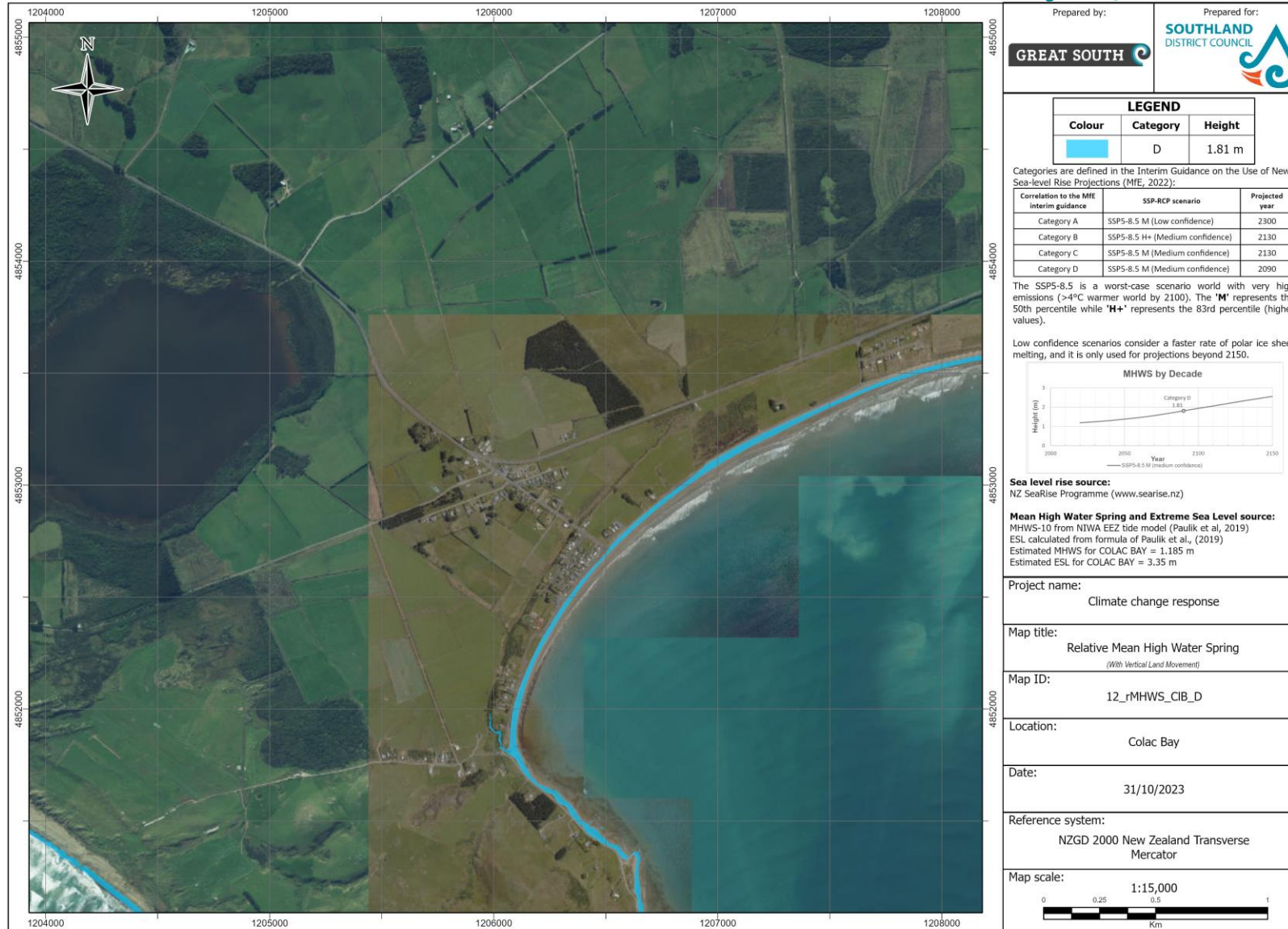


Modelled elevations

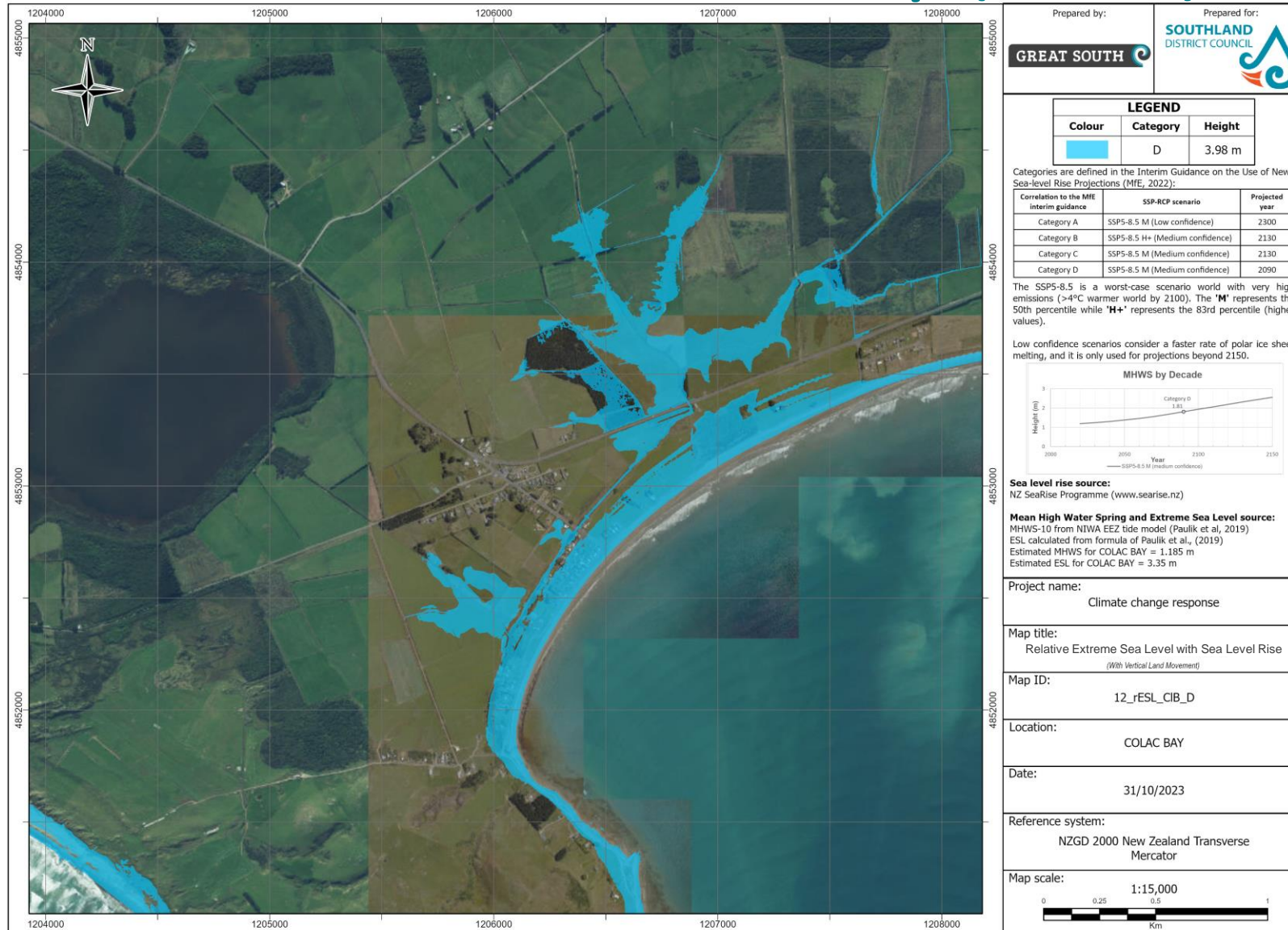


This presentation shows the modelling for 2090 because the probability of uncertainty is less, & the two maps shown for all locations 'bookend' the expected low-level impacts - Mean High-Water Spring (MHWS) & Extreme Sea Level (ESL) impacts, for each of the 6 Coastal Towns. All maps shown have been modelled from recently released LiDAR.

MHWS Inc. Sea Level Rise – Colac Bay (2090)



ESL Inc. Sea Level Rise – Colac Bay (2090)



Prepared by: **GREAT SOUTH**

Prepared for: **SOUTHLAND DISTRICT COUNCIL**

| LEGEND | | |
|--------|----------|--------|
| Colour | Category | Height |
| | D | 3.98 m |

Categories are defined in the Interim Guidance on the Use of New Sea-level Rise Projections (MfE, 2022):

| Correlation to the MfE interim guidance | SSP-RCP scenario | Projected year |
|---|---------------------------------|----------------|
| Category A | SSP5-8.5 M (Low confidence) | 2300 |
| Category B | SSP5-8.5 H+ (Medium confidence) | 2130 |
| Category C | SSP5-8.5 M (Medium confidence) | 2130 |
| Category D | SSP5-8.5 M (Medium confidence) | 2090 |

The SSP5-8.5 is a worst-case scenario world with very high emissions (>4°C warmer world by 2100). The 'M' represents the 50th percentile while 'H+' represents the 83rd percentile (higher values).

Low confidence scenarios consider a faster rate of polar ice sheet melting, and it is only used for projections beyond 2150.

Sea level rise source:
NZ SeaRise Programme (www.searise.nz)

Mean High Water Spring and Extreme Sea Level source:
MHWS-10 from NIWA EEZ tide model (Paulik et al, 2019)
ESL calculated from formula of Paulik et al., (2019)
Estimated MHWS for COLAC BAY = 1.185 m
Estimated ESL for COLAC BAY = 3.35 m

Project name:
Climate change response

Map title:
Relative Extreme Sea Level with Sea Level Rise
(With Vertical Land Movement)

Map ID:
12_rESL_CIB_D

Location:
COLAC BAY

Date:
31/10/2023

Reference system:
NZGD 2000 New Zealand Transverse Mercator

Map scale:
1:15,000

MHWS Inc. Sea Level Rise – Riverton (2090)



Prepared by: **GREAT SOUTH**

Prepared for: **SOUTHLAND DISTRICT COUNCIL**

| LEGEND | | |
|--------|----------|--------|
| Colour | Category | Height |
| | D | 1.81 m |

Categories are defined in the Interim Guidance on the Use of New Sea-level Rise Projections (MfE, 2022):

| Correlation to the MfE interim guidance | SSP-RCP scenario | Projected year |
|---|---------------------------------|----------------|
| Category A | SSP5-8.5 M (Low confidence) | 2300 |
| Category B | SSP5-8.5 H+ (Medium confidence) | 2130 |
| Category C | SSP5-8.5 M (Medium confidence) | 2130 |
| Category D | SSP5-8.5 M (Medium confidence) | 2090 |

The SSP5-8.5 is a worst-case scenario world with very high emissions (>4°C warmer world by 2100). The 'M' represents the 50th percentile while 'H+' represents the 83rd percentile (higher values).

Low confidence scenarios consider a faster rate of polar ice sheet melting, and it is only used for projections beyond 2150.

Sea level rise source:
NZ SeaRise Programme (www.searise.nz)

Mean High Water Spring and Extreme Sea Level source:
MHWS-10 from NIWA EEZ tide model (Paulik et al, 2019)
ESL calculated from formula of Paulik et al., (2019)
Estimated MHWS for RIVERTON = 1.194 m
Estimated ESL for RIVERTON = 3.37 m

Project name:
Climate change response

Map title:
Relative Mean High Water Spring
(With Vertical Land Movement)

Map ID:
08_MHWS_RV_D

Location:
RIVERTON

Date:
31/10/2023

Reference system:
NZGD 2000 New Zealand Transverse Mercator

Map scale:
1:18,000

ESL Inc. Sea Level Rise – Riverton (2090)



Prepared by: **GREAT SOUTH**

Prepared for: **SOUTHLAND DISTRICT COUNCIL**

| LEGEND | | |
|--------|----------|--------|
| Colour | Category | Height |
| | D | 3.99 m |

Categories are defined in the Interim Guidance on the Use of New Sea-level Rise Projections (MfE, 2022):

| Correlation to the MfE interim guidance | SSP-RCP scenario | Projected year |
|---|---------------------------------|----------------|
| Category A | SSP5-8.5 M (Low confidence) | 2300 |
| Category B | SSP5-8.5 H+ (Medium confidence) | 2130 |
| Category C | SSP5-8.5 M (Medium confidence) | 2130 |
| Category D | SSP5-8.5 M (Medium confidence) | 2090 |

The SSP5-8.5 is a worst-case scenario world with very high emissions (>4°C warmer world by 2100). The 'M' represents the 50th percentile while 'H+' represents the 83rd percentile (higher values).

Low confidence scenarios consider a faster rate of polar ice sheet melting, and it is only used for projections beyond 2150.

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NZ SeaRise Programme (www.searise.nz)

Mean High Water Spring and Extreme Sea Level source:
MHWs-10 from NIWA EEZ tide model (Paulik et al, 2019)
ESL calculated from formula of Paulik et al., (2019)
Estimated MHWs for RIVERTON = 1.194 m
Estimated ESL for RIVERTON = 3.37 m

Project name:
Climate change response

Map title:
Relative Extreme Sea Level with Sea Level Rise
(With Vertical Land Movement)

Map ID:
08_rESL_RV_D

Location:
RIVERTON

Date:
31/10/2023

Reference system:
NZGD 2000 New Zealand Transverse Mercator


Map scale:
1:18,000

MHWS Inc. Sea Level Rise – Fortrose (2090)



Prepared by: **GREAT SOUTH**

Prepared for: **SOUTHLAND DISTRICT COUNCIL**

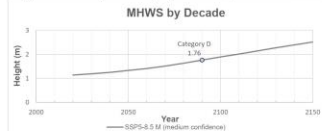
| LEGEND | | |
|---|----------|--------|
| Colour | Category | Height |
|  | D | 1.76 m |

Categories are defined in the Interim Guidance on the Use of New Sea-level Rise Projections (MfE, 2022):

| Correlation to the MfE interim guidance | SSP-RCP scenario | Projected year |
|---|---------------------------------|----------------|
| Category A | SSP5-8.5 M (Low confidence) | 2300 |
| Category B | SSP5-8.5 H+ (Medium confidence) | 2130 |
| Category C | SSP5-8.5 M (Medium confidence) | 2130 |
| Category D | SSP5-8.5 M (Medium confidence) | 2090 |

The SSP5-8.5 is a worst-case scenario world with very high emissions (>4°C warmer world by 2100). The 'M' represents the 50th percentile while 'H+' represents the 83rd percentile (higher values).

Low confidence scenarios consider a faster rate of polar ice sheet melting, and it is only used for projections beyond 2150.



Sea level rise source:
NZ SeaRise Programme (www.searise.nz)

Mean High Water Spring and Extreme Sea Level source:
MHWS-10 from NIWA EEZ tide model (Paulik et al, 2019)
ESL calculated from formula of Paulik et al., (2019)
Estimated MHWS for FORTROSE = 1.136 m
Estimated ESL for FORTROSE = 3.29 m

Project name:
Climate change response

Map title:
Relative Mean High Water Spring
(With Vertical Land Movement)

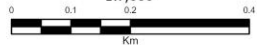
Map ID:
16_rMHWS_FT_D

Location:
FORTROSE

Date:
31/10/2023

Reference system:
NZGD 2000 New Zealand Transverse Mercator

Map scale:
1:7,000



ESL Inc. Sea Level Rise – Fortrose (2090)



Prepared by: **GREAT SOUTH**

Prepared for: **SOUTHLAND DISTRICT COUNCIL**

| LEGEND | | |
|--------|----------|--------|
| Colour | Category | Height |
| | D | 2.91 m |

Categories are defined in the Interim Guidance on the Use of New Sea-level Rise Projections (MfE, 2022):

| Correlation to the MfE interim guidance | SSP-RCP scenario | Projected year |
|---|---------------------------------|----------------|
| Category A | SSP5-8.5 M (Low confidence) | 2300 |
| Category B | SSP5-8.5 H+ (Medium confidence) | 2130 |
| Category C | SSP5-8.5 M (Medium confidence) | 2130 |
| Category D | SSP5-8.5 M (Medium confidence) | 2090 |

The SSP5-8.5 is a worst-case scenario world with very high emissions (>4°C warmer world by 2100). The 'M' represents the 50th percentile while 'H+' represents the 83rd percentile (higher values).

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NZ SeaRise Programme (www.searise.nz)

Mean High Water Spring and Extreme Sea Level source:
MHWS-10 from NIWA EEZ tide model (Paulik et al, 2019)
ESL calculated from formula of Paulik et al., (2019)
Estimated MHWS for FORTROSE = 1.136 m
Estimated ESL for FORTROSE = 3.29 m

Project name: Climate change response

Map title: Relative Extreme Sea Level with Sea Level Rise
(With Vertical Land Movement)

Map ID: 16_rESL_FT_D

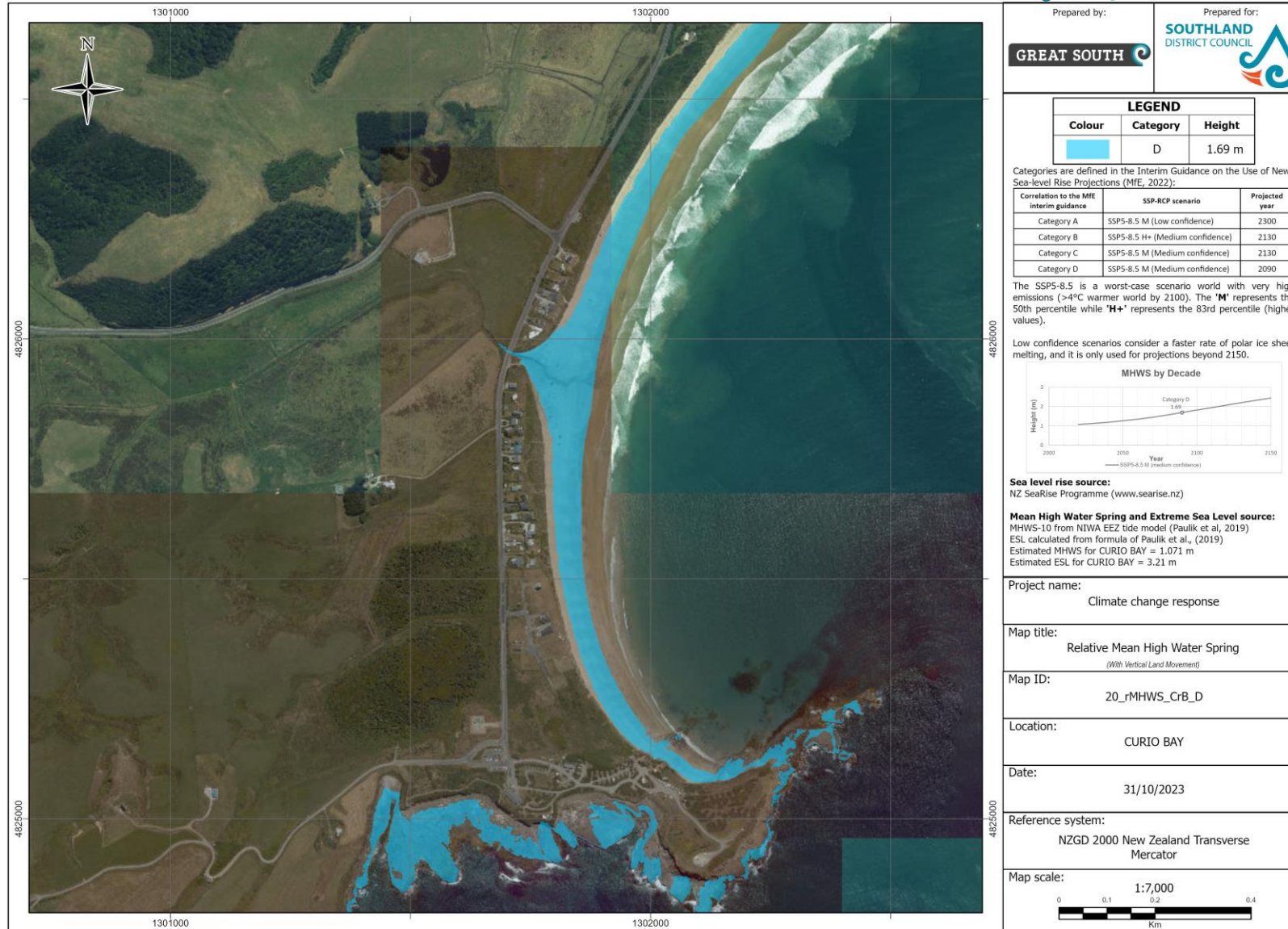
Location: FORTROSE

Date: 31/10/2023

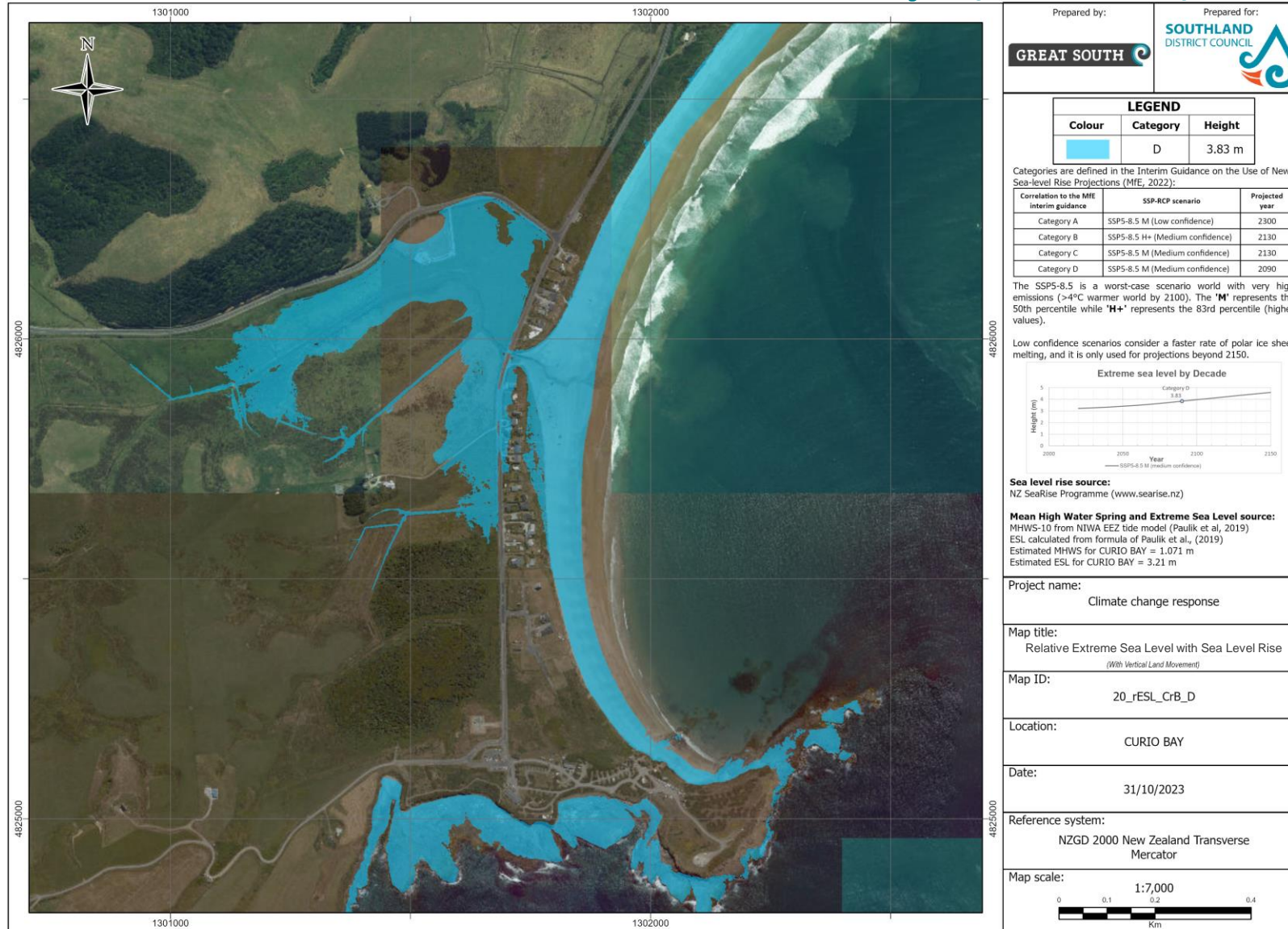
Reference system: NZGD 2000 New Zealand Transverse Mercator

Map scale: 1:7,000

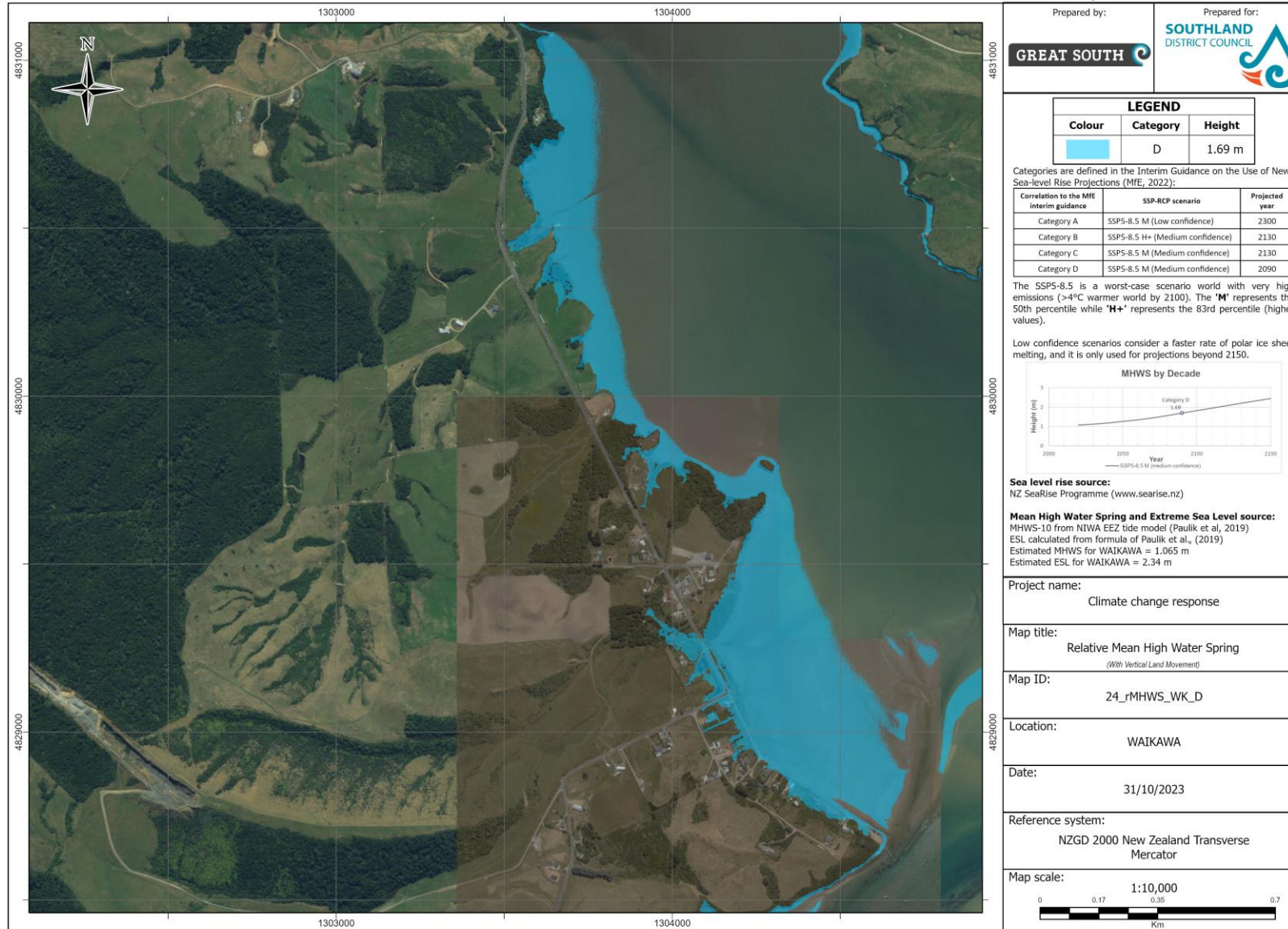
MHWS Inc. Sea Level Rise – Curio Bay (2090)




ESL Inc. Sea Level Rise – Curio Bay (2090)




MHWS Inc. Sea Level Rise – Waikawa (2090)



Prepared by:



Prepared for:



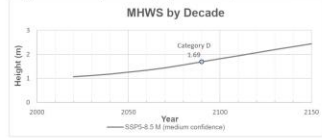
| LEGEND | | |
|--------|----------|--------|
| Colour | Category | Height |
| | D | 1.69 m |

Categories are defined in the Interim Guidance on the Use of New Sea-level Rise Projections (MfE, 2022):

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|---|---------------------------------|----------------|
| Category A | SSP5-8.5 M (Low confidence) | 2300 |
| Category B | SSP5-8.5 H+ (Medium confidence) | 2130 |
| Category C | SSP5-8.5 M (Medium confidence) | 2130 |
| Category D | SSP5-8.5 M (Medium confidence) | 2090 |

The SSP5-8.5 is a worst-case scenario world with very high emissions (>4°C warmer world by 2100). The 'M' represents the 50th percentile while 'H+' represents the 83rd percentile (higher values).

Low confidence scenarios consider a faster rate of polar ice sheet melting, and it is only used for projections beyond 2150.



Sea level rise source:
NZ SeaRise Programme (www.searise.nz)

Mean High Water Spring and Extreme Sea Level source:
MHWS-10 from NIWA EEZ tide model (Paulik et al, 2019)
ESL calculated from formula of Paulik et al., (2019)
Estimated MHWS for WAIKAWA = 1.065 m
Estimated ESL for WAIKAWA = 2.34 m

Project name:
Climate change response

Map title:
Relative Mean High Water Spring
(With Vertical Land Movement)

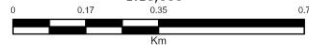
Map ID:
24_rMHWS_WK_D

Location:
WAIKAWA

Date:
31/10/2023

Reference system:
NZGD 2000 New Zealand Transverse Mercator

Map scale:
1:10,000



ESL Inc. Sea Level Rise – Waikawa (2090)



Prepared by: **GREAT SOUTH**

Prepared for: **SOUTHLAND DISTRICT COUNCIL**

| LEGEND | | |
|--------|----------|--------|
| Colour | Category | Height |
| | D | 2.46 m |

Categories are defined in the Interim Guidance on the Use of New Sea-level Rise Projections (MfE, 2022):

| Correlation to the MfE interim guidance | SSP-RCP scenario | Projected year |
|---|---------------------------------|----------------|
| Category A | SSP5-8.5 M (Low confidence) | 2300 |
| Category B | SSP5-8.5 H+ (Medium confidence) | 2130 |
| Category C | SSP5-8.5 M (Medium confidence) | 2130 |
| Category D | SSP5-8.5 M (Medium confidence) | 2090 |

The SSP5-8.5 is a worst-case scenario world with very high emissions (>4°C warmer world by 2100). The 'M' represents the 50th percentile while 'H+' represents the 83rd percentile (higher values).

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Sea level rise source:
NZ SeaRise Programme (www.searise.nz)

Mean High Water Spring and Extreme Sea Level source:
MHWS-10 from NIWA EEZ tide model (Paulik et al, 2019)
ESL calculated from formula of Paulik et al., (2019)
Estimated MHWS for WAIKAWA = 1.065 m
Estimated ESL for WAIKAWA = 2.34 m

Project name:
Climate change response

Map title:
Relative Extreme Sea Level with Sea Level Rise
(With Vertical Land Movement)

Map ID:
24_rESL_WK_D

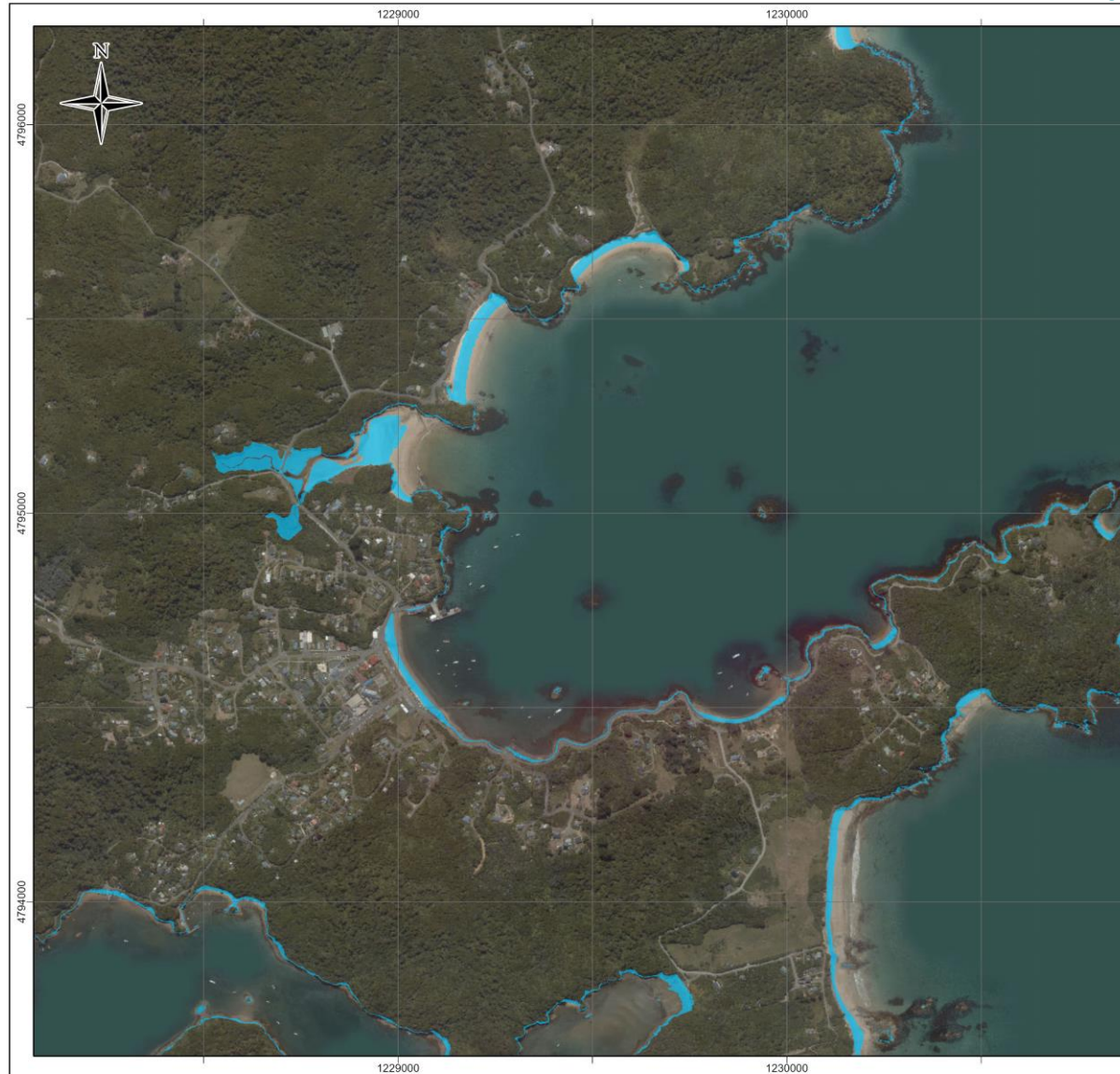
Location:
WAIKAWA

Date:
15/06/2023

Reference system:
NZGD 2000 New Zealand Transverse Mercator

Map scale:
1:10,000

MHWS Inc. Sea Level Rise – Oban (2090)



Prepared by: **GREAT SOUTH**

Prepared for: **SOUTHLAND DISTRICT COUNCIL**

| LEGEND | | |
|--------|----------|--------|
| Colour | Category | Height |
| | D | 1.71 m |

Categories are defined in the Interim Guidance on the Use of New Sea-level Rise Projections (MfE, 2022):

| Correlation to the MfE interim guidance | SSP-RCP scenario | Projected year |
|---|---------------------------------|----------------|
| Category A | SSP5-8.5 M (Low confidence) | 2300 |
| Category B | SSP5-8.5 H+ (Medium confidence) | 2130 |
| Category C | SSP5-8.5 M (Medium confidence) | 2130 |
| Category D | SSP5-8.5 M (Medium confidence) | 2090 |

The SSP5-8.5 is a worst-case scenario world with very high emissions (>4°C warmer world by 2100). The 'M' represents the 50th percentile while 'H+' represents the 83rd percentile (higher values).

Low confidence scenarios consider a faster rate of polar ice sheet melting, and it is only used for projections beyond 2150.

MHWS by Decade

Sea level rise source:
NZ SeaRise Programme (www.searise.nz)

Mean High Water Spring and Extreme Sea Level source:
MHWS-10 from NIWA EEZ tide model (Paulik et al., 2019)
ESL calculated from formula of Paulik et al., (2019)
Estimated MHWS for OBAN = 1.085 m
Estimated ESL for OBAN = 3.23 m

Project name: Climate change response

Map title: Relative Mean High Water Spring
(With Vertical Land Movement)

Map ID: 04_MHWS_OB_D

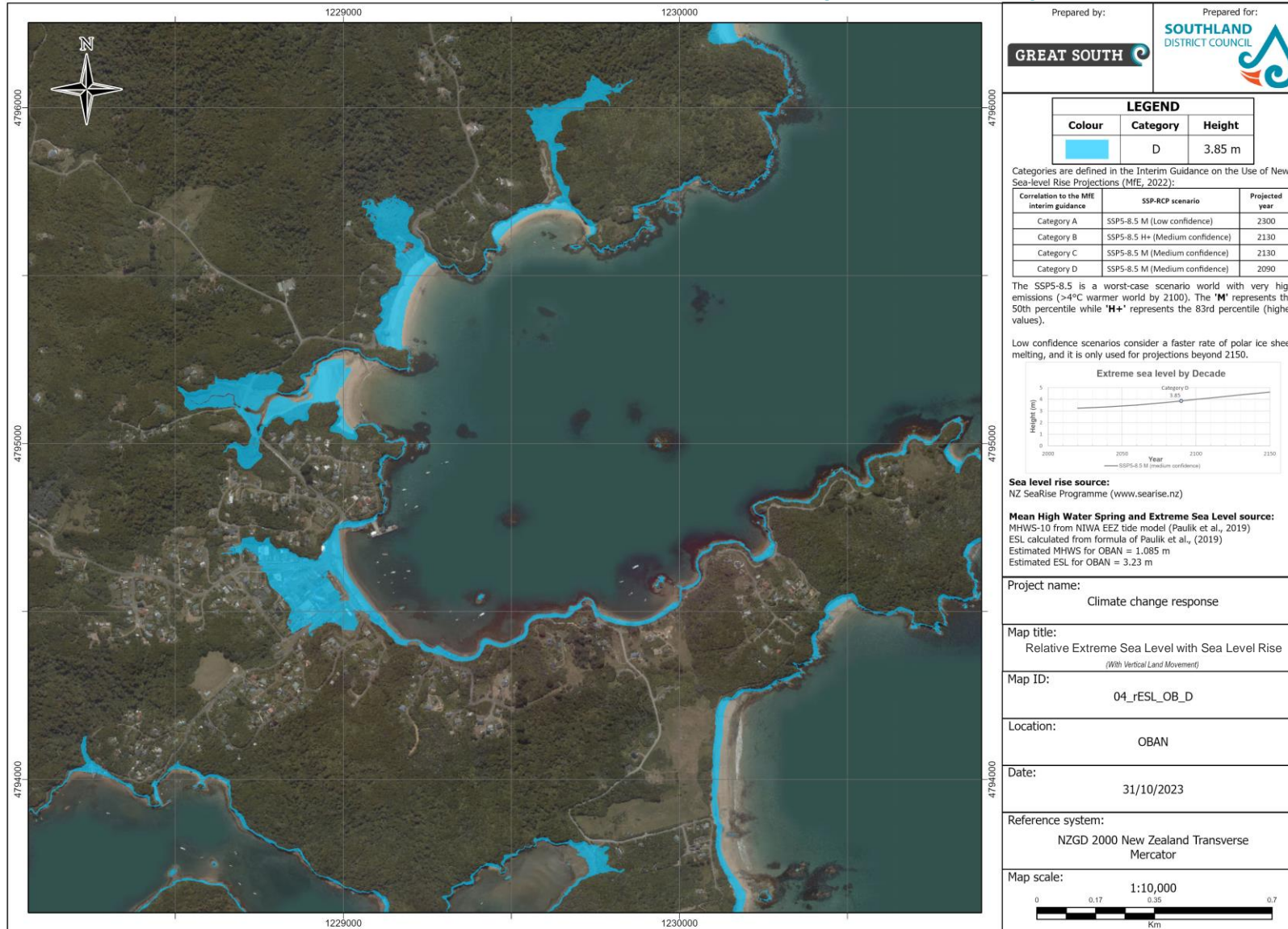
Location: OBAN

Date: 31/10/2023

Reference system: NZGD 2000 New Zealand Transverse Mercator

Map scale: 1:10,000

ESL Inc. Sea Level Rise – Oban (2090)



Prepared by: **GREAT SOUTH**

Prepared for: **SOUTHLAND DISTRICT COUNCIL**

| LEGEND | | |
|--------|----------|--------|
| Colour | Category | Height |
| | D | 3.85 m |

Categories are defined in the Interim Guidance on the Use of New Sea-level Rise Projections (MfE, 2022):

| Correlation to the MfE interim guidance | SSP-RCP scenario | Projected year |
|---|---------------------------------|----------------|
| Category A | SSP5-8.5 M (Low confidence) | 2300 |
| Category B | SSP5-8.5 H+ (Medium confidence) | 2130 |
| Category C | SSP5-8.5 M (Medium confidence) | 2130 |
| Category D | SSP5-8.5 M (Medium confidence) | 2090 |

The SSP5-8.5 is a worst-case scenario world with very high emissions (>4°C warmer world by 2100). The 'M' represents the 50th percentile while 'H+' represents the 83rd percentile (higher values).

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Extreme sea level by Decade

Sea level rise source:
NZ SeaRise Programme (www.searise.nz)

Mean High Water Spring and Extreme Sea Level source:
MHWS-10 from NIWA EEZ tide model (Paulik et al., 2019)
ESL calculated from formula of Paulik et al., (2019)
Estimated MHWS for OBAN = 1.085 m
Estimated ESL for OBAN = 3.23 m

Project name: Climate change response

Map title: Relative Extreme Sea Level with Sea Level Rise
(With Vertical Land Movement)

Map ID: 04_rESL_OB_D

Location: OBAN

Date: 31/10/2023

Reference system: NZGD 2000 New Zealand Transverse Mercator

Map scale: 1:10,000

Next Steps

- LiDAR based modelling will be completed for all Sea Level Rise Scenarios.
- These modelled scenarios will be integrated into the Southland Coast and Rakiura Stewart Island, Sea Level Rise & Extreme Sea Level Exposure Spatial Modelling.
- Full Independent Expert Peer Review Completed
- The target date for the completion of this work is 17th November 2023.
- Following the release of the remaining Southland LiDAR survey data the complete South Coast area will then be modelled and the report updated.

Southland Coast and Rakiura Stewart Island, Sea
Level Rise & Extreme Sea Level Exposure
Summary Presentation Project Update

Questions?



Thank you!

