

EXISTING (PRE CONSTRUCTION)



POST CONSTRUCTION

Key:

Max. hazard

- H1: generally safe for people and buildings (not shown)
- H2: unsafe for small vehicles
- H3: unsafe for vehicles children and elderly
- H4: unsafe for people and vehicles
- H5: buildings vulnerable to structural damage
- H6: all buildings vulnerable to failure

Building footprints

- Building footprints

Cultural sites

- Urupa
- Marae

Railway

- Railway

Model extent

- Model extent

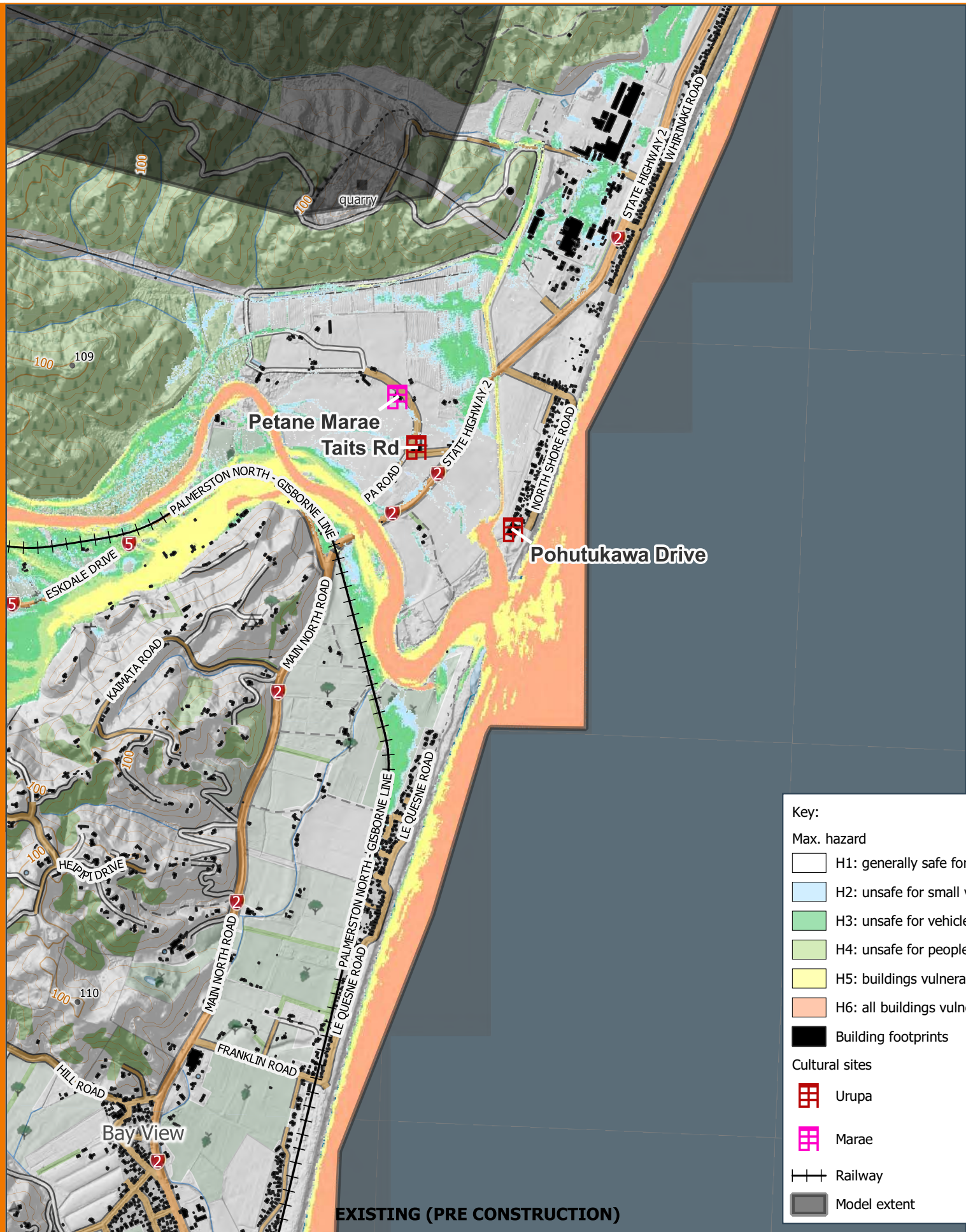
pdp Figure B1, flood hazard, existing (left) and post construction (right) Cyclone Gabrielle)

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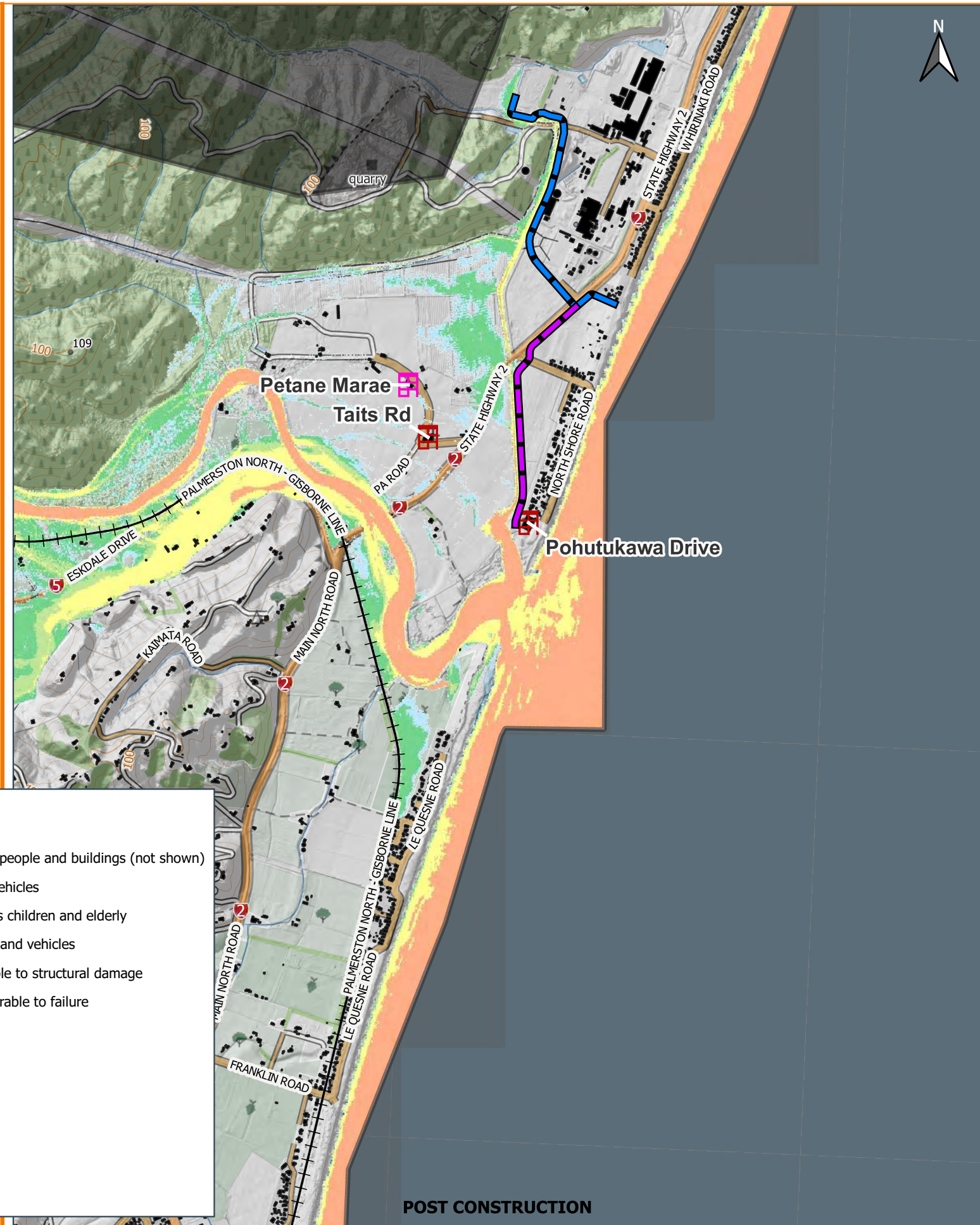
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CLIENT: HBRC



EXISTING (PRE CONSTRUCTION)



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- H6: all buildings vulnerable to failure

Building footprints

- Building footprints

Cultural sites

- UR Urupa
- MR Marae

Railway

- Railway

Model extent

- Model extent

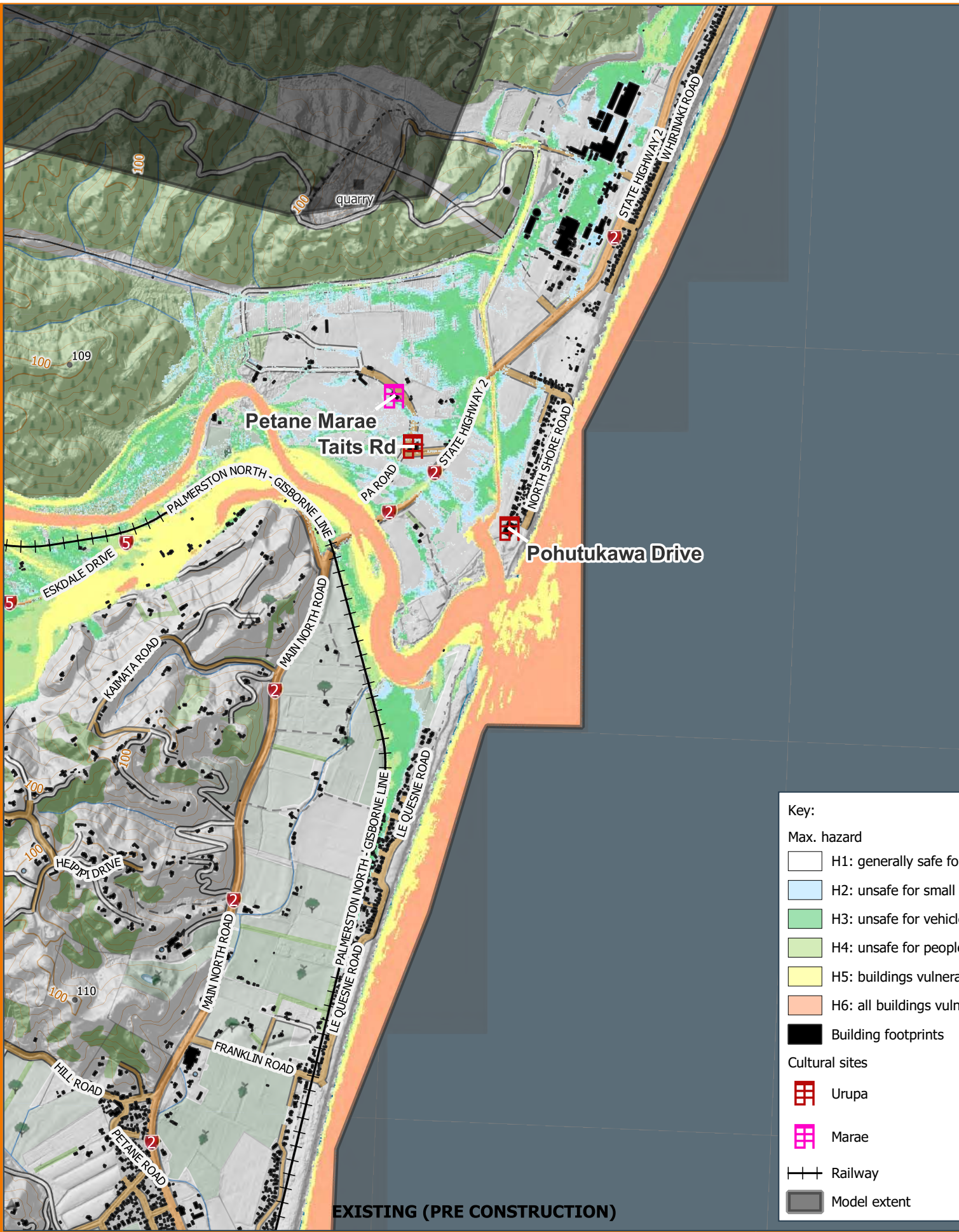
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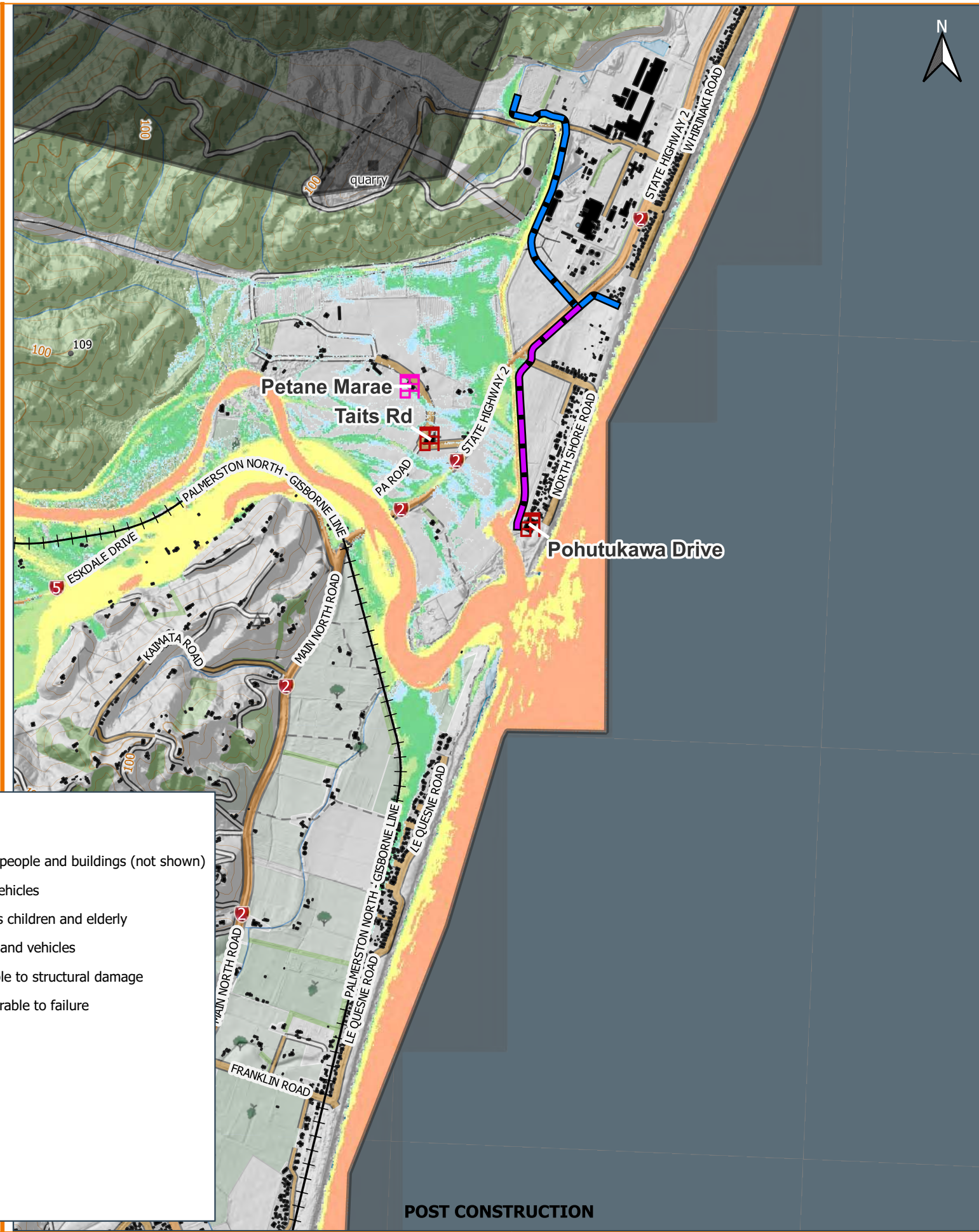
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pdp Figure B2, flood hazard, existing (left) and post construction (right) 50-year ARI, no climate change



EXISTING (PRE CONSTRUCTION)



POST CONSTRUCTION

Key:

Max. hazard

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- H2: unsafe for small vehicles
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- H6: all buildings vulnerable to failure

Building footprints

- Building footprints

Cultural sites

- UR Urupa
- MR Marae

Railway

- Railway

Model extent

- Model extent

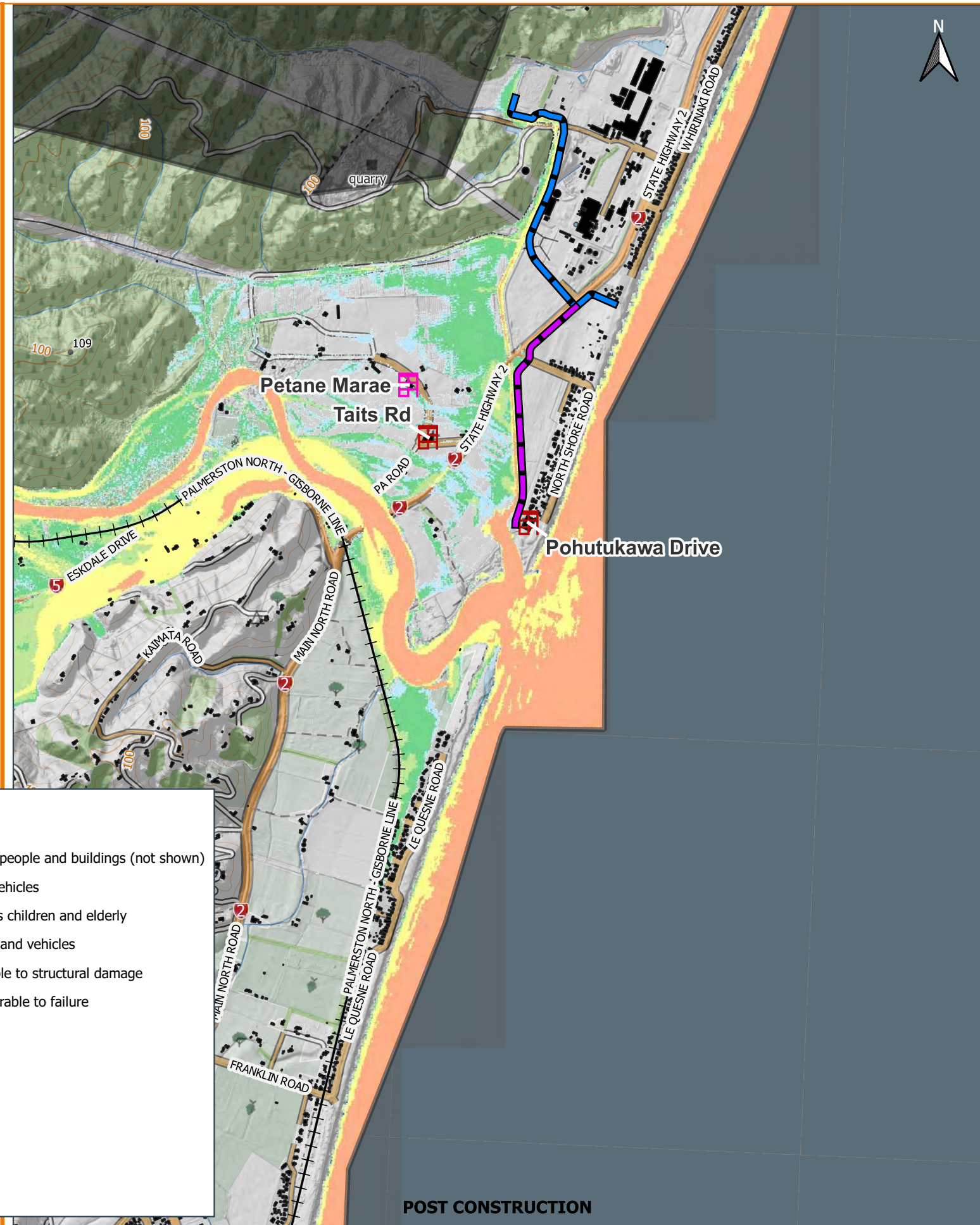
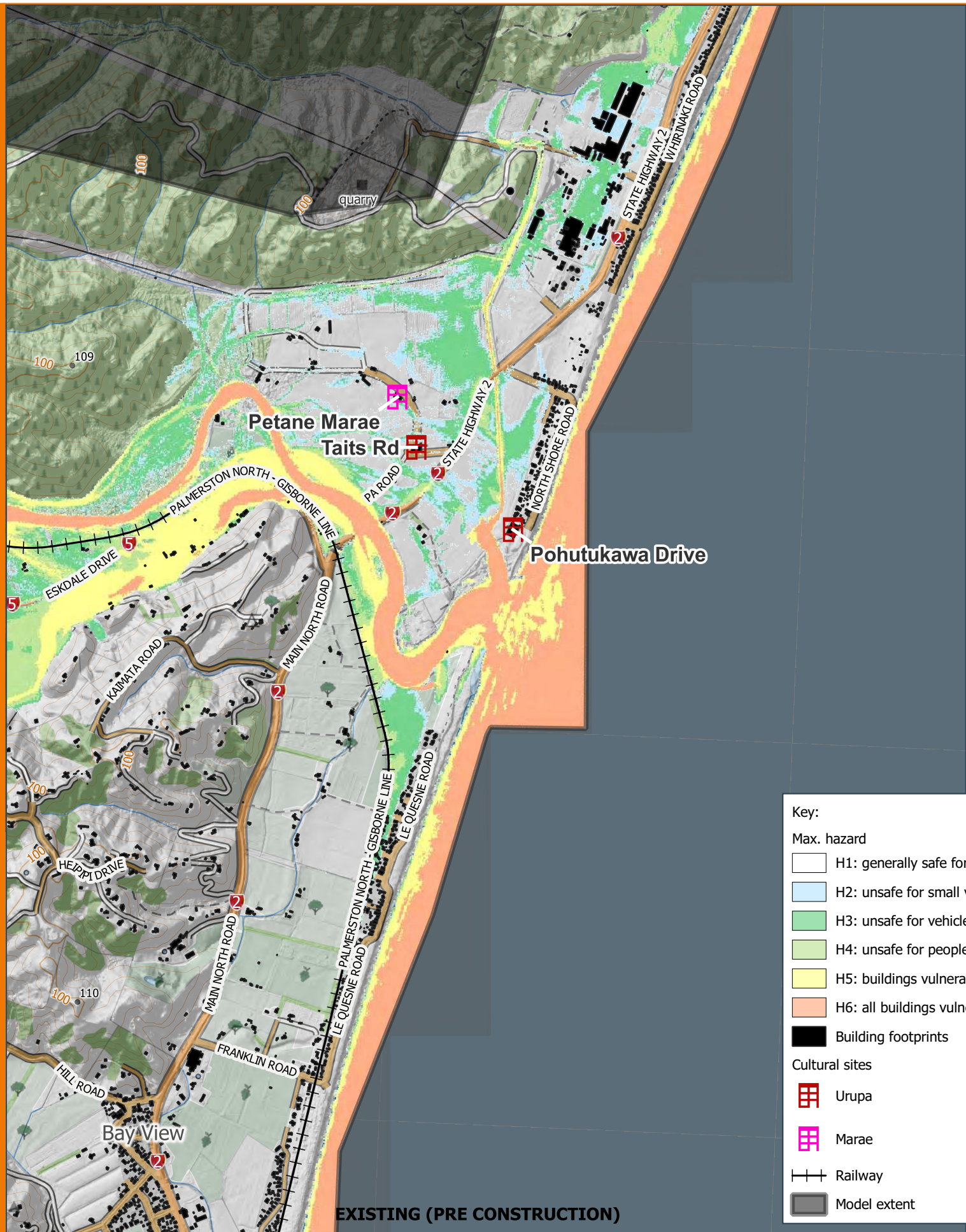
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pdp Figure B3, flood hazard, existing (left) and post construction (right) 50-year ARI, with climate change

SCALE : 1:23,000 (A3)

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Key:

Max. hazard

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- H2: unsafe for small vehicles
- H3: unsafe for vehicles children and elderly
- H4: unsafe for people and vehicles
- H5: buildings vulnerable to structural damage
- H6: all buildings vulnerable to failure

Building footprints

- Building footprints

Cultural sites

- Urupa
- Marae

Railway

- Railway

Model extent

- Model extent

EXISTING (PRE CONSTRUCTION)

POST CONSTRUCTION



Figure B4, flood hazard, existing (left) and post construction (right) 100-year ARI, no climate change

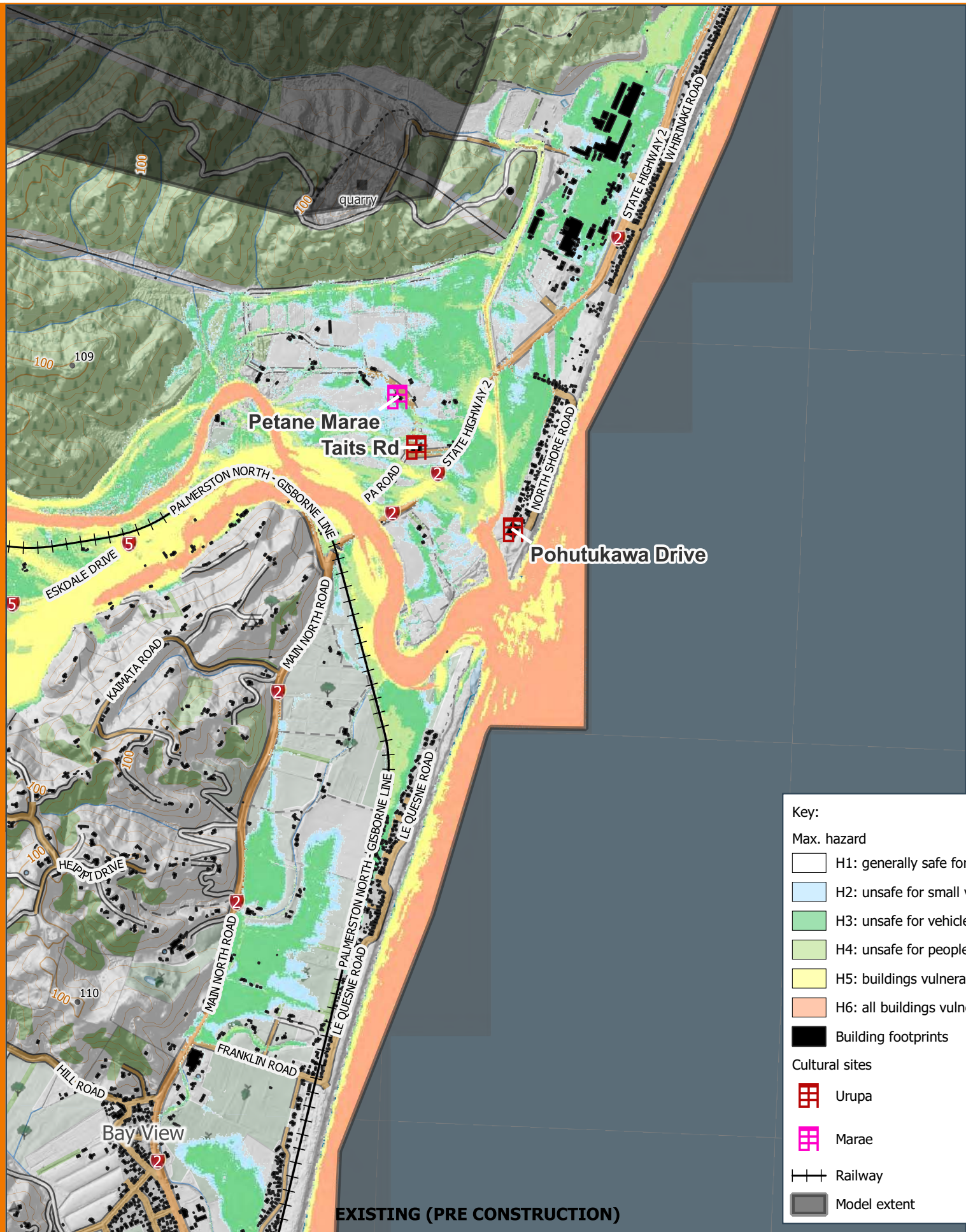
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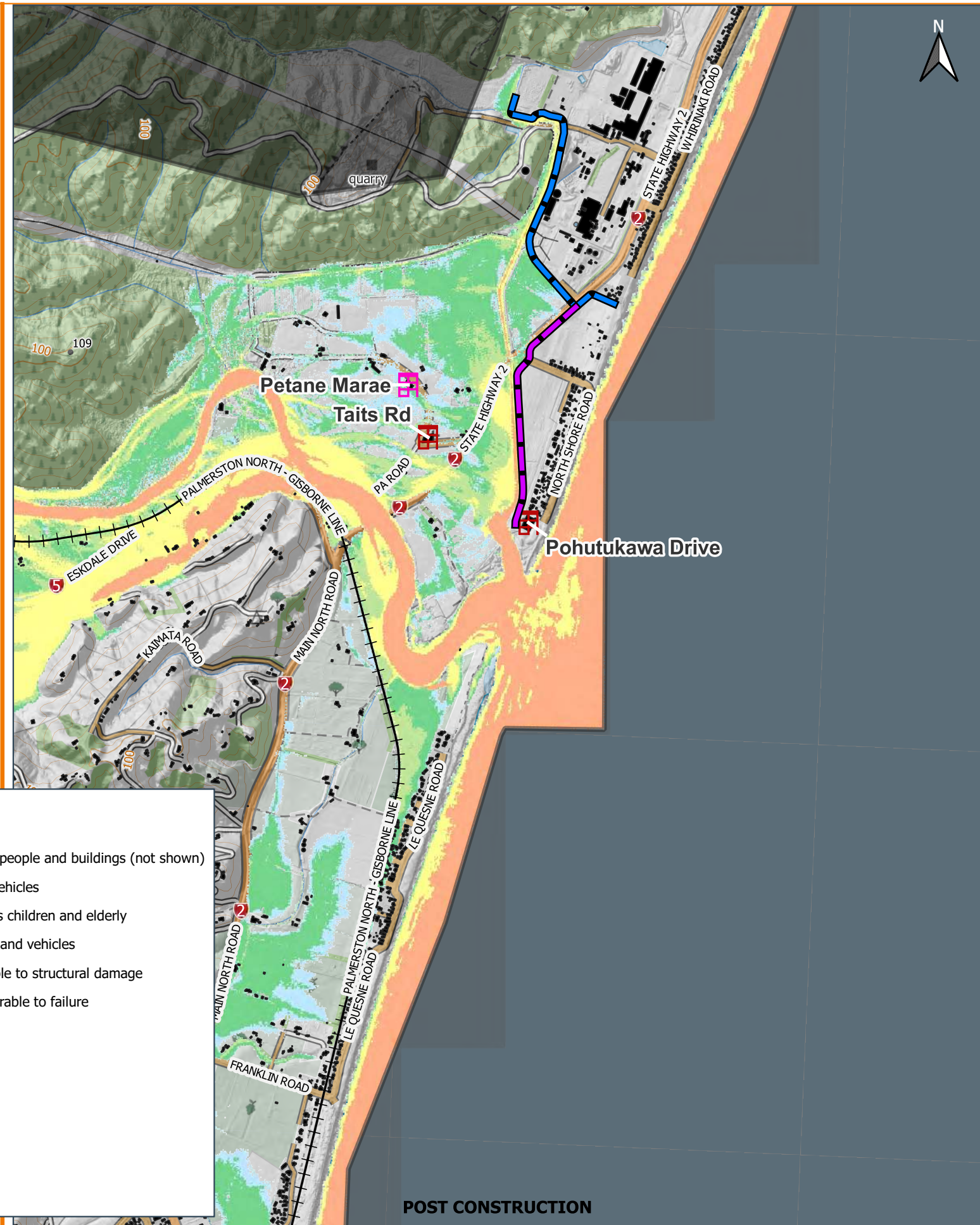
SCALE : 1:23,000 (A3)

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EXISTING (PRE CONSTRUCTION)



POST CONSTRUCTION

Key:

Max. hazard

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- H2: unsafe for small vehicles
- H3: unsafe for vehicles children and elderly
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- H5: buildings vulnerable to structural damage
- H6: all buildings vulnerable to failure

Building footprints

- Building footprints

Cultural sites

- Urupa
- Marae

Railway

- Railway

Model extent

- Model extent

NOTES:
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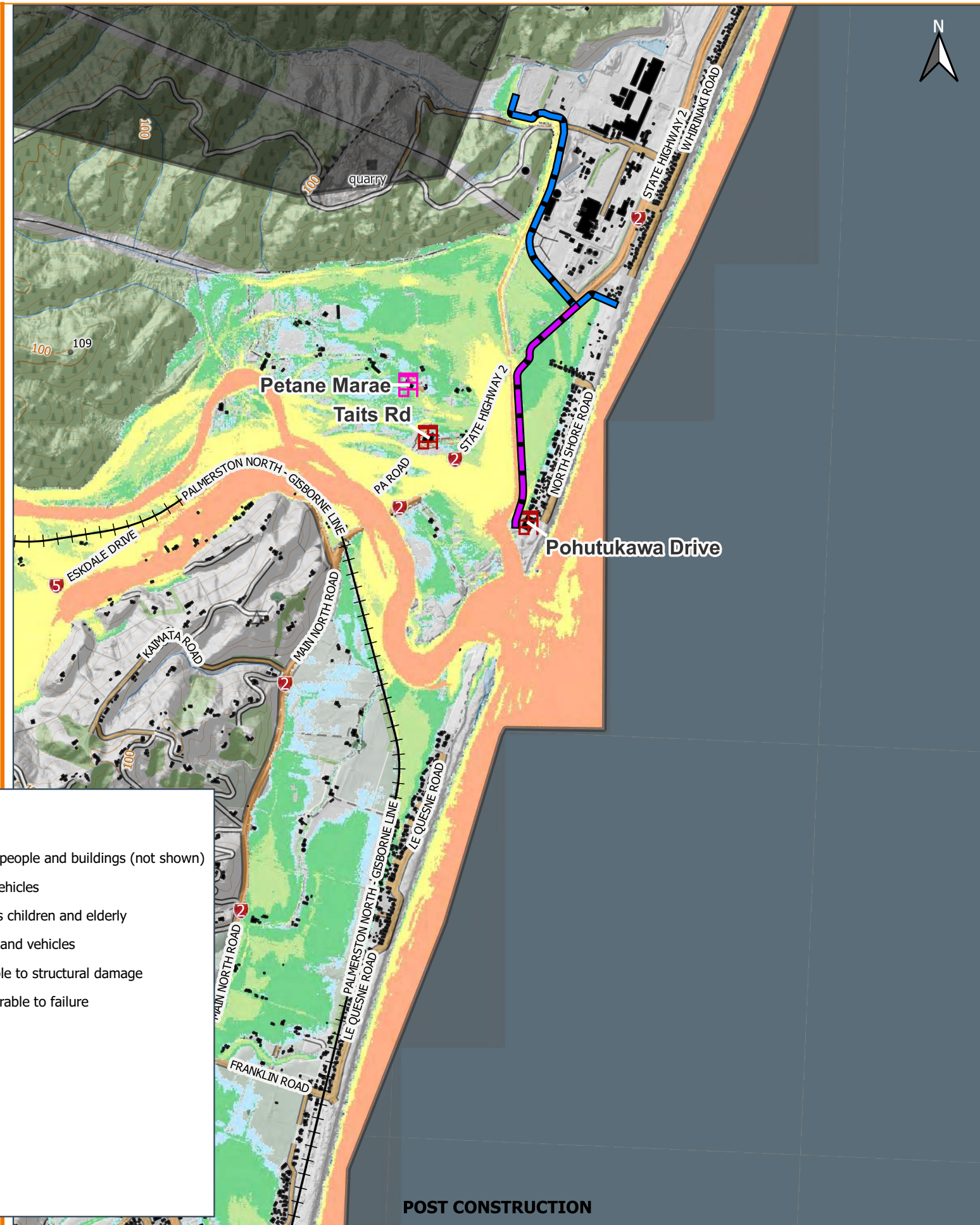
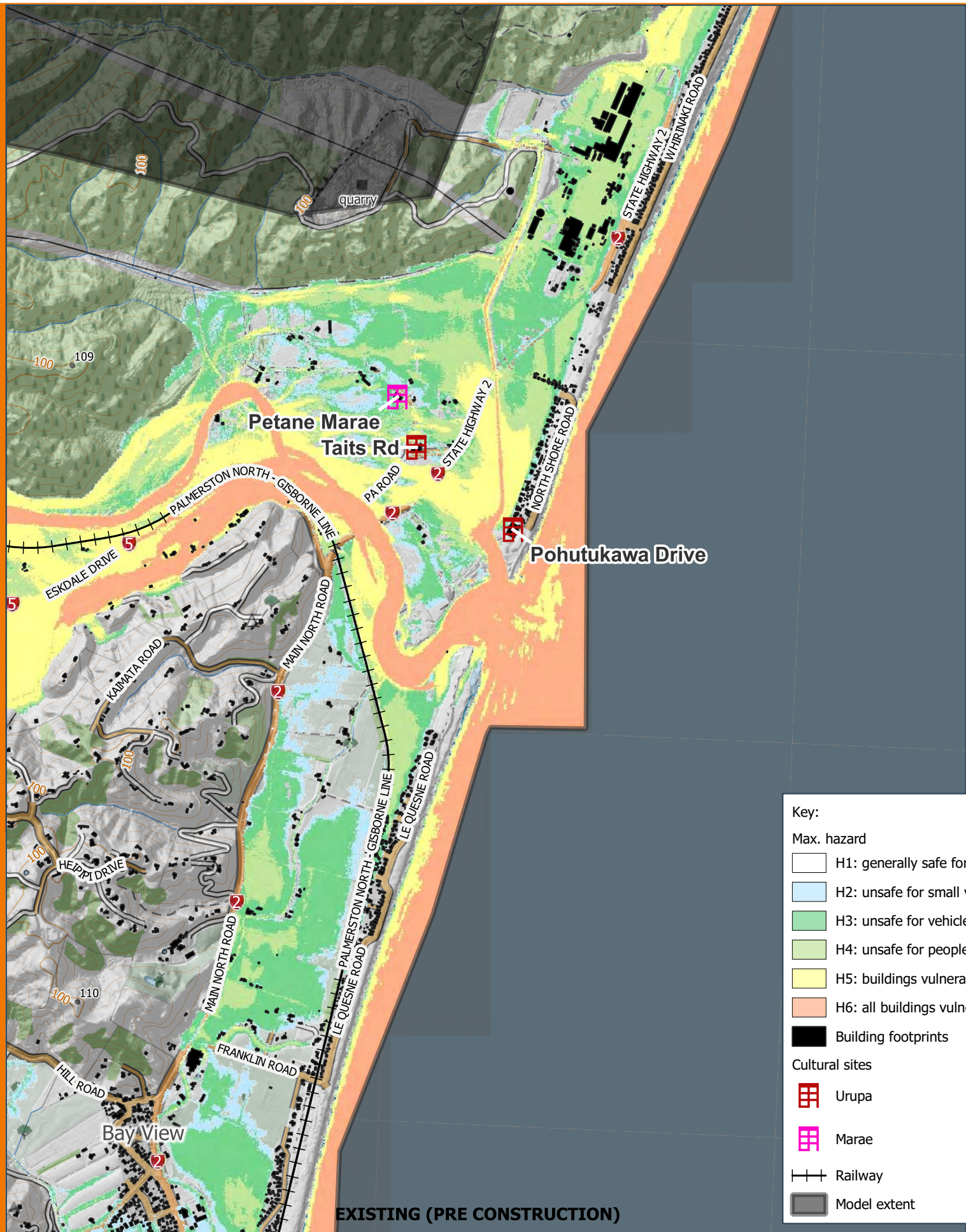
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pdp Figure B5, flood hazard, existing (left) and post construction (right) 100-year ARI, with climate change

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Key:

Max. hazard

- H1: generally safe for people and buildings (not shown)
- H2: unsafe for small vehicles
- H3: unsafe for vehicles children and elderly
- H4: unsafe for people and vehicles
- H5: buildings vulnerable to structural damage
- H6: all buildings vulnerable to failure
- Building footprints

Cultural sites

- Urupa
- Marae
- Railway
- Model extent

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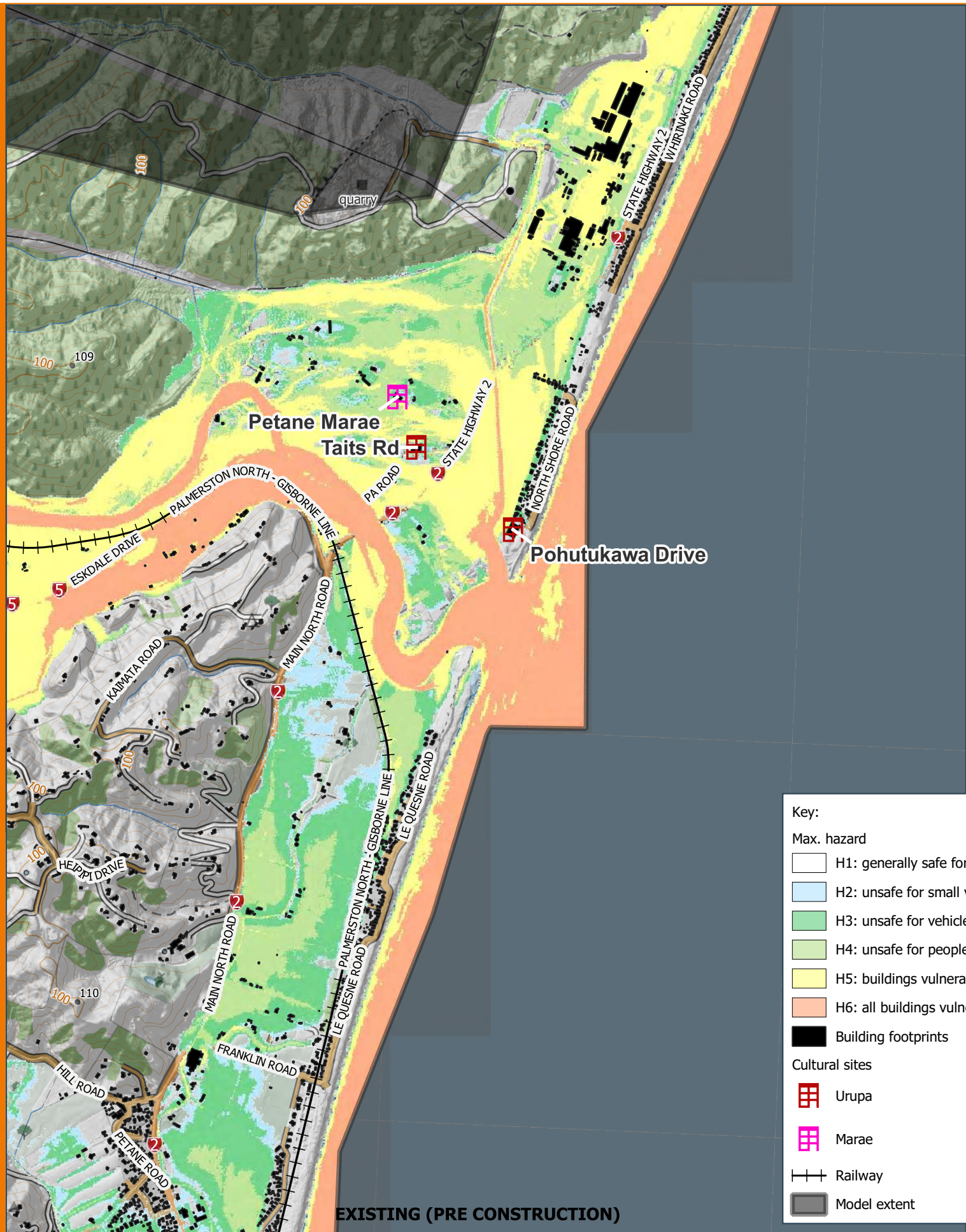
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pdp Figure B6, flood hazard, existing (left) and post construction (right) 500-year ARI, no climate change



EXISTING (PRE CONSTRUCTION)



POST CONSTRUCTION

Key:

Max. hazard

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- H2: unsafe for small vehicles
- H3: unsafe for vehicles children and elderly
- H4: unsafe for people and vehicles
- H5: buildings vulnerable to structural damage
- H6: all buildings vulnerable to failure

Building footprints

- Building footprints

Cultural sites

- Urupa
- Marae

Railway

- Railway

Model extent

- Model extent

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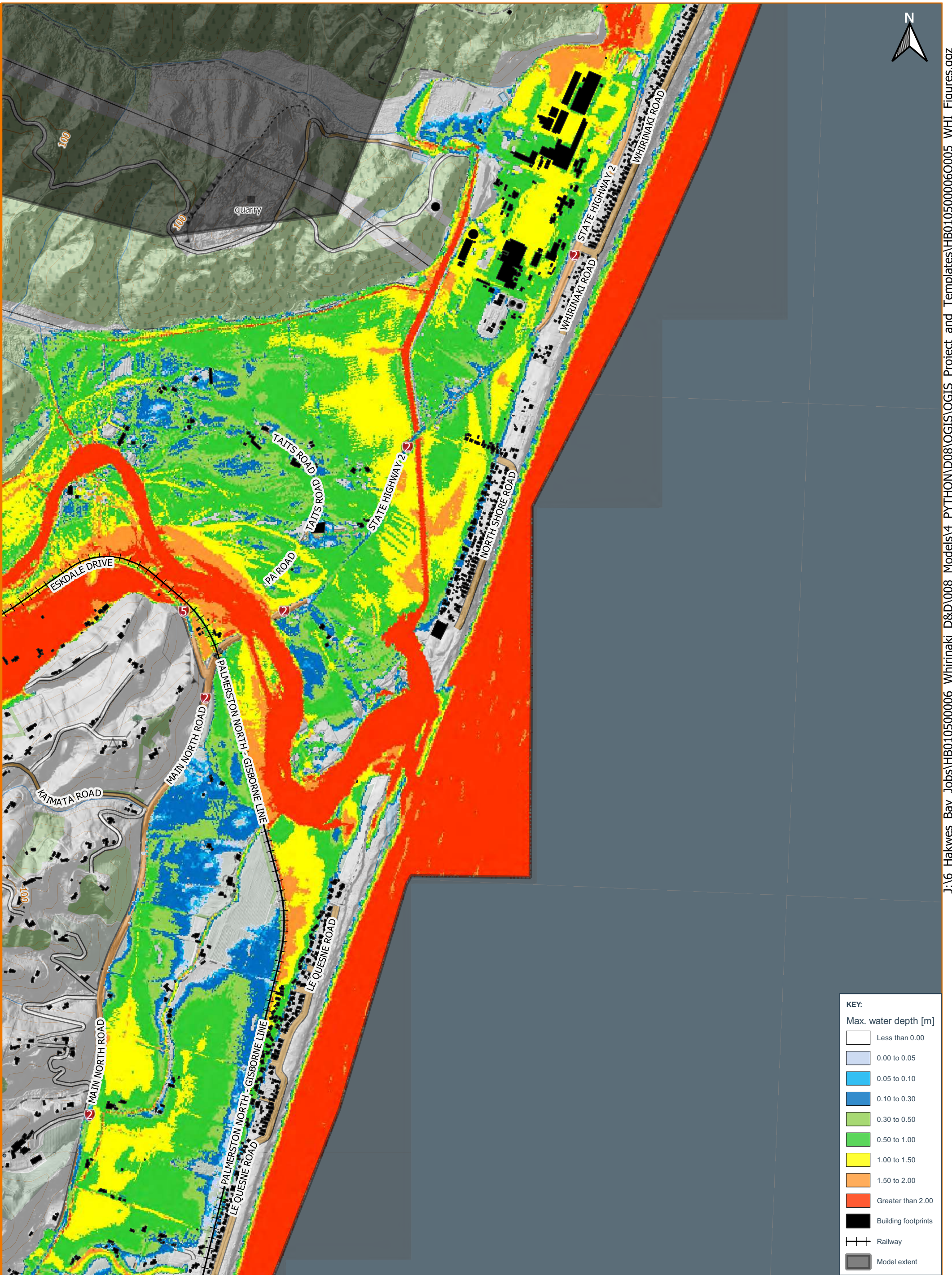
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pdp Figure B7, flood hazard, existing (left) and post construction (right) 500-year ARI, with climate change



Appendix C: Detailed Figures (Bayview and Pan Pac)

D
R
A
F
T



KEY:

Max. water depth [m]

White	Less than 0.00
Light Blue	0.00 to 0.05
Blue	0.05 to 0.10
Dark Blue	0.10 to 0.30
Light Green	0.30 to 0.50
Green	0.50 to 1.00
Yellow	1.00 to 1.50
Orange	1.50 to 2.00
Red	Greater than 2.00
Black	Building footprints
Grey with cross-ticks	Railway
Grey outline	Model extent

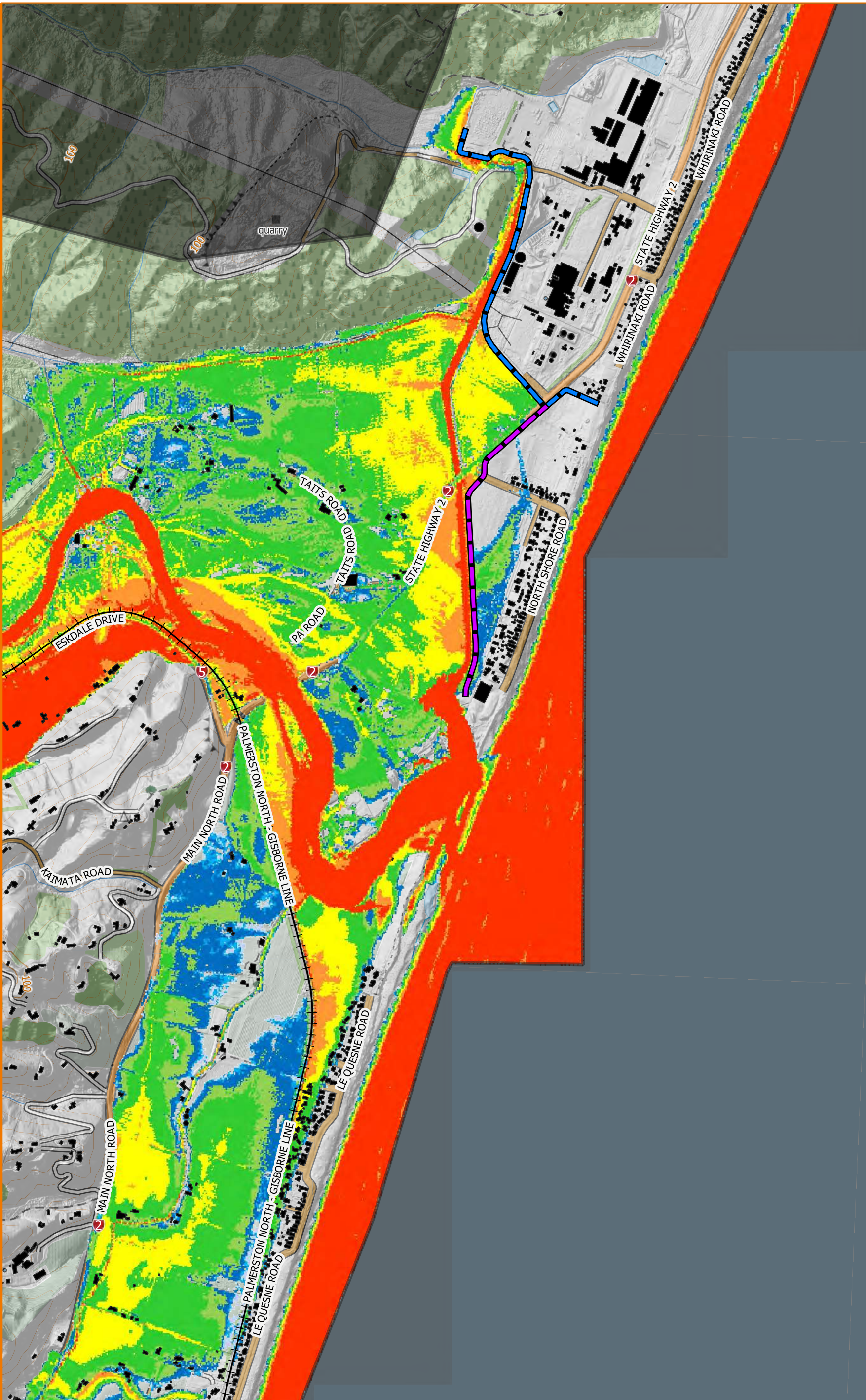
0 75 150
METRES (A3)
SCALE : 1:13,000

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DATE: 25 Jun 2025
BY: TC
CLIENT: HBRC

Figure C1, Existing flood depths, Cyclone Gabrielle. The model simulates flows exclusively from the Esk River and does not incorporate localised rainfall.



KEY:

Max. water depth [m]

- Less than 0.00
- 0.00 to 0.05
- 0.05 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- Greater than 2.00

Mixed Level of Service Stopbank

- 100 Year (Overtopped)
- 500 Year

Other Symbols:

- Building footprints
- Railway
- Model extent

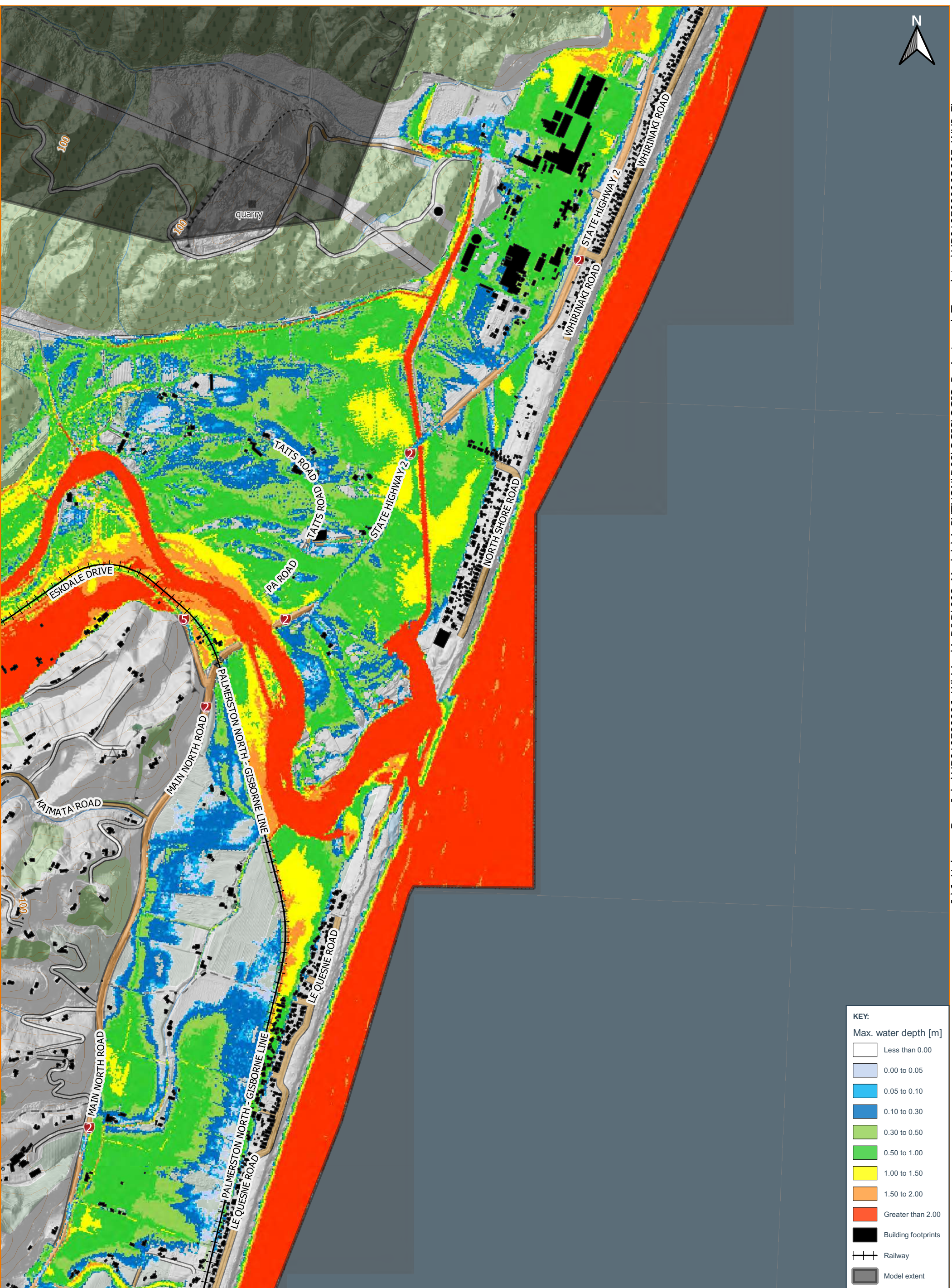
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SCALE : 1:13,000

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Figure C2, Post construction flood depths, Cyclone Gabrielle. The model simulates flows exclusively from the Esk River and does not incorporate localised rainfall.



KEY:

Max. water depth [m]

White	Less than 0.00
Light Blue	0.00 to 0.05
Blue	0.05 to 0.10
Dark Blue	0.10 to 0.30
Light Green	0.30 to 0.50
Green	0.50 to 1.00
Yellow	1.00 to 1.50
Orange	1.50 to 2.00
Red	Greater than 2.00
Black	Building footprints
Grey with cross-ticks	Railway
Grey outline	Model extent

0 75 150
METRES (A3)
SCALE : 1:13,000

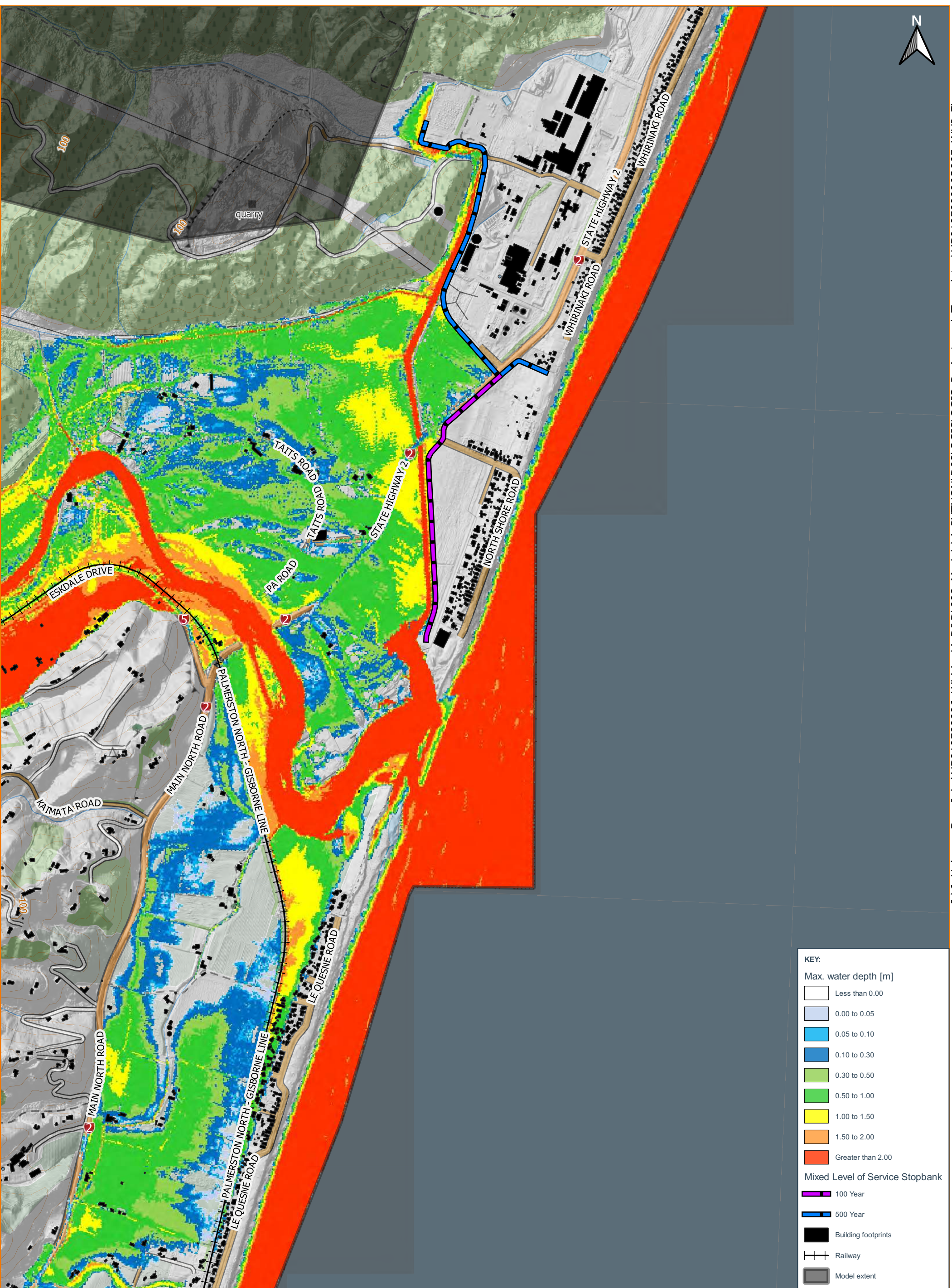
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Figure C3, Existing flood depths (100-year ARI, with climate change)



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KEY:

Max. water depth [m]

- Less than 0.00
- 0.00 to 0.05
- 0.05 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- Greater than 2.00

Mixed Level of Service Stopbank

- 100 Year
- 500 Year

Other Symbols:

- Building footprints
- Railway
- Model extent

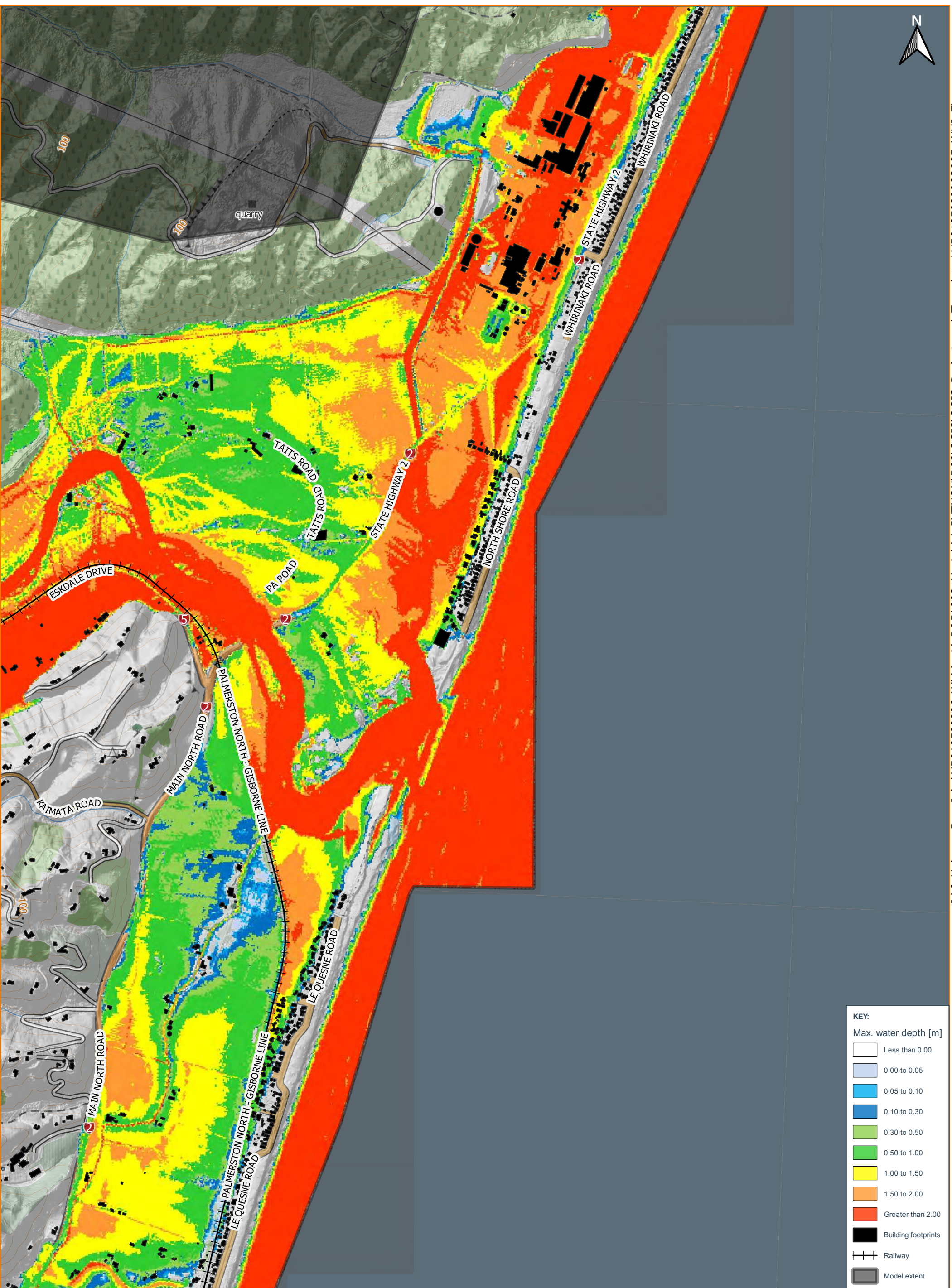
0 75 150
METRES (A3)
SCALE : 1:13,000

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Figure C4, Post construction flood depths (100-year ARI, with climate change)



KEY:

Max. water depth [m]

White	Less than 0.00
Light Blue	0.00 to 0.05
Blue	0.05 to 0.10
Dark Blue	0.10 to 0.30
Light Green	0.30 to 0.50
Green	0.50 to 1.00
Yellow	1.00 to 1.50
Orange	1.50 to 2.00
Red	Greater than 2.00
Black	Building footprints
Grey with cross-ticks	Railway
Grey outline	Model extent



0 75 150
METRES (A3)
SCALE : 1:13,000

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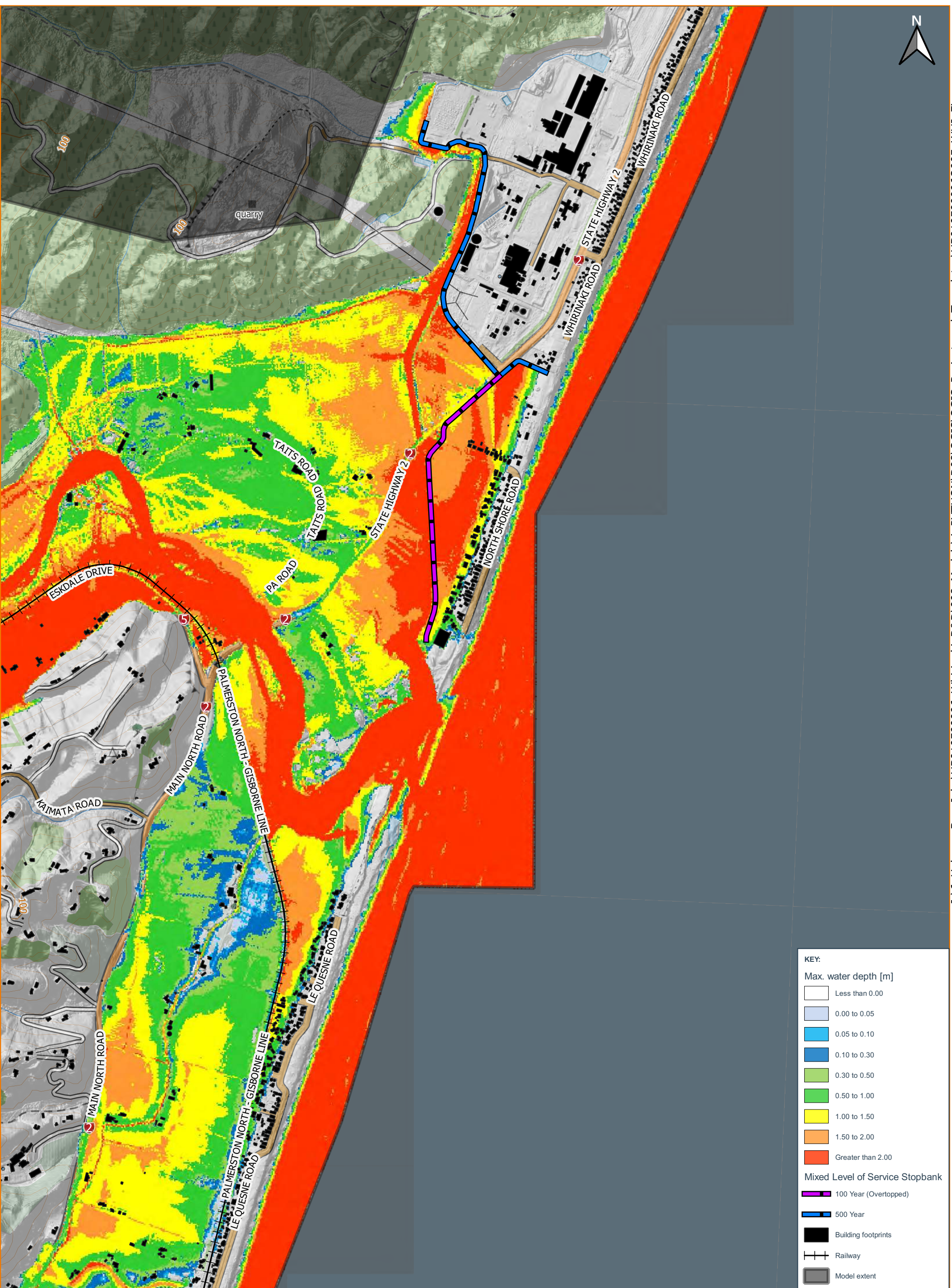
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Figure C5, Existing flood depths, (500-year ARI, with climate change)

Esk Valley Hydraulic Model: Flood effects assessment



KEY:

Max. water depth [m]

- Less than 0.00
- 0.00 to 0.05
- 0.05 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- Greater than 2.00

Mixed Level of Service Stopbank

- 100 Year (Overtopped)
- 500 Year

Other Symbols:

- Building footprints
- Railway
- Model extent

0 75 150
METRES (A3)
SCALE : 1:13,000

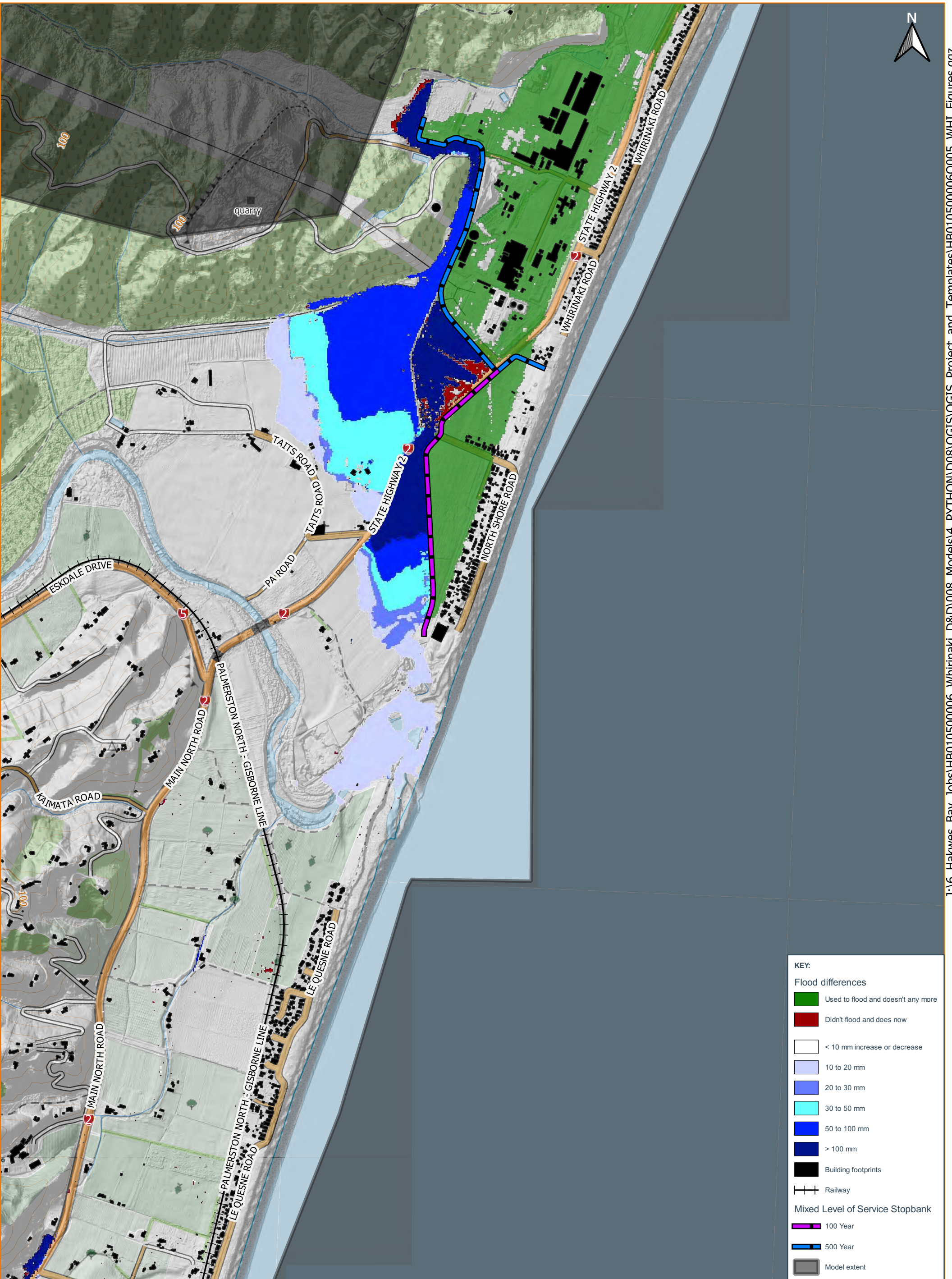
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Figure C6, Post construction flood depths, 500-year ARI, with climate change



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KEY:

Flood differences

- Used to flood and doesn't any more
- Didn't flood and does now
- < 10 mm increase or decrease
- 10 to 20 mm
- 20 to 30 mm
- 30 to 50 mm
- 50 to 100 mm
- > 100 mm
- Building footprints
- Railway

Mixed Level of Service Stopbank

- 100 Year
- 500 Year
- Model extent

0 75 150
METRES (A3)
SCALE : 1:13,000

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Figure C7, flood difference (post construction - existing) 100-year ARI, with climate change. Increases less than 10 mm are transparent



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Appendix D: Climate change memo

D
R
A
F
T



Esk River Climate Change Assessment

TO Rob Waldron FROM Tylan Collins and Ben Throssell
Hawkes Bay Regional Council DATE 25 July 2024
RE Climate Change Assessment for Esk River flows

1.0 Purpose

This letter outlines the climate change assumptions applied to design flows in the Esk River. These climate-adjusted flows were used as a boundary condition for the Esk River hydraulic model, built by Pattle Delamore Partners (PDP).

As requested by Hawke's Bay Regional Council (HBRC), we considered a Representative Concentration Pathway (RCP) 8.5 climate scenario for the year 2074. This memo details the methodology used to determine the projected increase in flow in the Esk River under this climate scenario.

2.0 Esk River climate change induced flow increase

The impact of the 2074 climate change horizon on the Esk River's flow rate was estimated using rainfall projections and hydrological model results. The hydrological model was developed by Tonkin and Taylor (T+T)¹. This model, built with HEC-HMS software, simulates the relationship between rainfall and flow for various storm durations and Annual Exceedance Probabilities (AEPs) under different climate scenarios.

2.1 Rainfall projections

The climate change increase was determined by correlating the changes in rainfall for RCP8.5 in 2074 and transforming the rainfall increase into a predicted flow rate increase for the Esk River using results from the T+T hydrological model:

- ∴ The T+T hydrological model of the Esk Catchment, reports that the time of concentration is estimated to be between four (model calibration) and six (USBR² method) hours.
- ∴ From HIRDS V4³ Table 6 (reproduced below). The percentage rainfall increase for a four-hour storm event (time of concentration) is not provided. Instead, Table 6 provides:
 - for a six-hour storm (1% AEP event), the rainfall increase is 11.5% per degree of temperature increase; and,

¹ KiwiRail: Esk hydrology – HEC-HMS model of the Esk River, Tonkin and Taylor July 2023.

² United States Bureau of Reclamation (USBR) equation 1973

³ High Intensity Rainfall System Version 4, NIWA August 2018

- for a two-hour storm (1% AEP event), the rainfall increase is 13.1% per degree of temperature increase.
- ∴ From HIRDSv4 Table 8 (see below) there will be a 1.65 degrees temperature increase for RCP 8.5 in 2074. Multiplying the temperature increase (1.65) and the rainfall increase per degree of temperature increase results in a total rainfall increase of between 19.0% (six-hours) and 21.6% (two-hours).

Table 6: Percentage change factors to project rainfall depths derived from the current climate to a future climate that is 1 degree warmer.

DURATION/ARI	2 YR	5 YR	10 YR	20 YR	30 YR	40 YR	50 YR	60 YR	80 YR	100 YR
1 HOUR	12.2	12.8	13.1	13.3	13.4	13.4	13.5	13.5	13.6	13.6
2 HOURS	11.7	12.3	12.6	12.8	12.9	12.9	13.0	13.0	13.1	13.1
6 HOURS	9.8	10.5	10.8	11.1	11.2	11.3	11.3	11.4	11.4	11.5
12 HOURS	8.5	9.2	9.5	9.7	9.8	9.9	9.9	10.0	10.0	10.1
24 HOURS	7.2	7.8	8.1	8.2	8.3	8.4	8.4	8.5	8.5	8.6
48 HOURS	6.1	6.7	7.0	7.2	7.3	7.3	7.4	7.4	7.5	7.5
72 HOURS	5.5	6.2	6.5	6.6	6.7	6.8	6.8	6.9	6.9	6.9
96 HOURS	5.1	5.7	6.0	6.2	6.3	6.3	6.4	6.4	6.4	6.5
120 HOURS	4.8	5.4	5.7	5.8	5.9	6.0	6.0	6.0	6.1	6.1

Table 6, reproduced from the HIRDS V4 documentation

Table 8: New Zealand land-average temperature increase relative to 1986—2005 for four future emissions scenarios. The three 21st century projections result from the average of six RCM model simulations (driven by different global climate models). The early 22nd century projections are based only on the subset of models that were available and so should be used with caution.

	2031—2050	2056—2075	2081—2100	2101—2120
RCP 2.6	0.59	0.67	0.59	0.59 (4 model avg)
RCP 4.5	0.74	1.05	1.21	1.44 (5 model avg)
RCP 6.0	0.68	1.16	1.63	2.31 (CESM1-CAMS only)
RCP 8.5	0.85	1.65	2.58	3.13 (3 model avg)

Table 8, reproduced from the HIRDS V4 documentation

2.2 Flow increase estimation

T+T did not model a 2-hour or 6-hour RCP8.5 2074 event which have a 19.0% and 21.6% increase in rainfall depths. In terms of percent rainfall increase, the closest event modelled by T+T was a 12HR RCP4.5 2130 rainfall event which has a 16.0% increase.

For this event, the T+T hydrological model predicts a flow increase of 19.8%. Given our percentage rainfall increase is slightly higher, between 19.0% and 21.6%, we have applied a 25% increase to the Esk River design flows to represent the RCP8.5 scenario for 2074.

3.0 Conclusion

For the design flows in the Esk River, we have applied a 25% increase to allow for climate change scenario RCP8.5 for the year 2074. To obtain this increase, we have used results from a hydrological model developed by T+T to derive a relationship between increased rainfall and flow using HIRDSv4 climate change rainfall projections.

4.0 Limitations

This memorandum has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Hawkes Bay Regional Council and others (not directly contracted by PDP for the work), including Tonkin and Taylor Ltd, National Institute of Water and Atmosphere and Land Information New Zealand. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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Prepared by



Tylan Collins

Environmental Engineer

Prepared by



Ben Throssell

Service Leader

Reviewed and Approved by



Bas Veendrick – Technical Director

Technical Director



Appendix E: Memo on the effects of the Railway on flooding

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Whirinaki Resilience Works - Rail Line Impacts

TO Harry Donnelly FROM Ben Throssell and Tylan Collins
Hawke's Bay Regional Council DATE 19/12/2024
RE Whirinaki Resilience Works - Rail Line Impacts

1.0 Introduction

Pattle Delamore Partners (PDP) has been engaged by Hawkes Bay Regional Council (HBRC) to summarise the impact that the condition of the Palmerston North to Gisborne Rail line has on the effects on flood levels and effects associated with the Whirinaki resilience works. The resilience works comprise of three main components:

- ∴ A stopbank, adjacent to Whirinaki Drain (true left) to prevent flood breakouts from the Esk River;
- ∴ Changes to the SH2 road elevation to tie in with the proposed stopbank elevation; and,
- ∴ Upgraded culvert capacity on Whirinaki Drain (SH2), from 1.8 and 2 m circular pipes, to two 3 m X 3 m box culverts.

The findings presented here are preliminary and may be revised. They are based on climate change projections using RCP8.5 for a 50-year timeframe (to 2074). Final design details for the stopbank, road, and culverts are still in progress, and the climate change assumptions used in this report may also be updated. The proposed stopbank location and layout is shown in Figure 1.

The Palmerston North to Gisborne Rail line was previously acting as an unofficial stop bank for bay view. During Cyclone Gabrielle the rail line was partially washed out and has not been re-instated. Consideration is being given to if the rail line will be re-instated and when. This memo outlines the impact that the state of the rail line has on predicted flood effects associated with the Whirinaki resilience works.

When considering the effects on flooding, it is critical to determine what constitutes the existing environment and what changes to the environment should be modelled. At the time of writing this letter, we understand that:

- ∴ KiwiRail have a designation over the rail corridor which allows them to perform repair work;
- ∴ KiwiRail have no plans to re-instate the railway. We understand that this has been confirmed to HBRC informally (verbal communication); and,
- ∴ HBRC are not currently planning to re-instate the railway as part of this package of resilience works;

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- ∴ We understand that KiwiRail have a designation which allows them to carry out repair and re-instatement works; and,
- ∴ We understand that HBRC may decide to partially re-instate the railway line although this decision has not yet been made.



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Figure 1: Proposed stop bank location and railway.

2.0 Model scenarios of railway pre and post construction

Figure 2 shows profiles of the terrain (abstracted from LIDAR) before and after Cyclone Gabrielle and the location of the profile line is shown in Figure 1. Figure 2 shows:

- ∴ There were significant washouts of the rail line from chainage zero to 100;
- ∴ The washouts are generally up to 500 mm deep indicating that the ballast, which sits on top of the foundation, was subject to wash outs rather than the foundation – although in several instances, the foundation also appears to have been washed out too; and,
- ∴ From Chainage 300 onwards, the washouts are minor and may simple be due to variations in the LIDAR capture process rather than true washouts of the rail line.

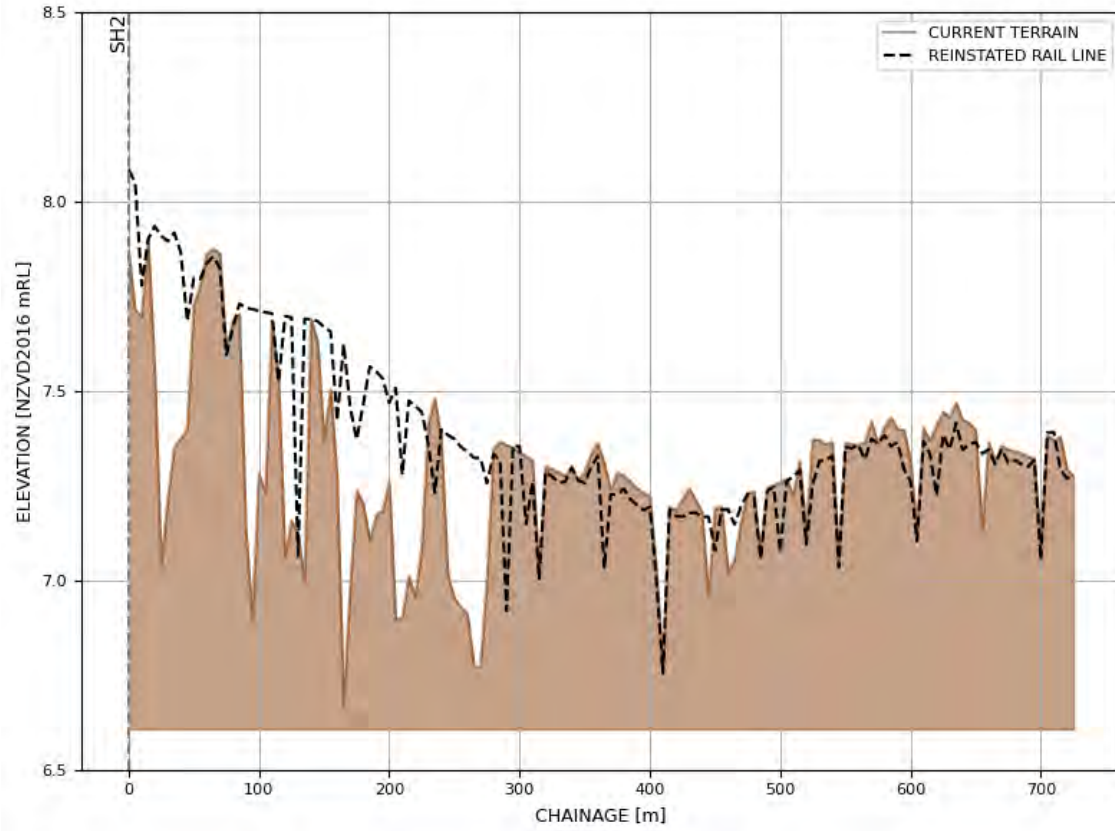


Figure 2: Terrain profiles abstracted from the 2021 (pre-Gabrielle) and 2023 (post Gabrielle) LIDAR series. Starting at SH2 (chainage zero) and ending at the open drain (chainage 723).

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Three scenarios (presented in Appendix A) were considered for the rail line:

Scenario 1: The rail line will be left as the status quo – damaged and washed out after Cyclone Gabrielle. Both pre and post development models assume the current (damaged) rail condition;

Scenario 2: The rail line will be reinstated as part of the existing environment. Under this scenario, the reinstated rail line forms part of the existing environment and therefore is also part of our baseline for model effects. Both pre and post development models will assume the reinstated (prior to Cyclone Gabrielle) rail condition; and,

Scenario 3: The rail line will be reinstated as part of the resilience works but as KiwiRail have no plans to reinstate the rail line, the existing environment is the rail line in its current (damaged) condition. Under this scenario, the pre model is the current (damaged) rail condition and the post model is the reinstated (prior to Cyclone Gabrielle) rail condition.

Four model runs were required to assess the three scenarios:

- ∴ Railway line as is:
 - no stopbank; and,
 - with stopbank and proposed works;
- ∴ Railway line reinstated:
 - no stopbank; and,
 - with stopbank and proposed works;

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3.0 Results

The attached figures show the modelled effects on flooding for the three rail line scenarios. Figures B1 to B3 (Appendix B) show the flood hazard maps comparing scenarios 1 to 3. Figures B4 and B5 show the flood differences across all three scenarios for the 100 and 500-year flood events.

Figure 3 (below) shows the flows over the railway line from the Esk River for both the 100-year and 500-year event.

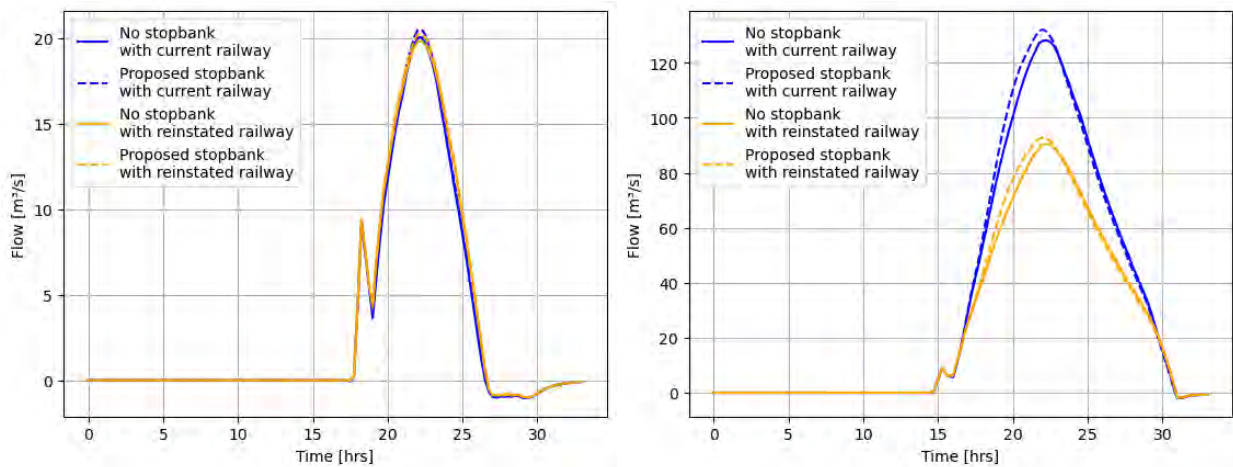


Figure 3: 100-year (left) and 500-year (right) flows over the railway line (from Esk River into Bayview). Note the y-axis scale differs between the two plots.

3.1 100-year event

The predicted effects of a 100-year flood event on the Bayview area are largely unaffected by the state of the railway. As shown in Figure 3, the flow of water over the railway remains consistent, regardless of whether the line is repaired or not. Further analysis shows that this is because the primary source of flooding in Bayview is the Esk River, which enters the area at the southern end of the railway line, near the residential zone. The damaged section of the railway, affected by Cyclone Gabrielle, is not a significant factor for flooding in the 100-year event.

The appended figure (scenarios 1 and 2), show that the impact on flooding in Bayview is minimal, regardless of the railway's condition. However, scenario 3 demonstrates that if the railway is reinstated as part of the proposed construction works, there is a varied effect on flooding. There are potential reductions in some areas, such as orchards near the railway line, but increases in other areas, such as Bayview residential. These changes are primarily attributed to the reinstatement of the railway, rather than the construction of the proposed stopbank.

If Hawke's Bay Regional Council (HBRC) decides to include railway reinstatement in their proposed construction plans, additional mitigation measures may be necessary to address potential adverse flooding effects on north Bayview for the 100-year event.

3.2 500-year event

For a 500-year flood event, the condition of the railway significantly affects the flow of water into Bayview (Figure 3). When the railway is reinstated, the flow is approximately 90 m³/s. However, if the railway is not repaired, the flow increases to around 130 m³/s.

In contrast, the proposed stopbank and associated works have a minimal impact on water flow, regardless of the assumed rail condition. For both scenarios (existing railway and reinstated railway) flows due to the construction of the stopbank, increase by around 0.5 m³/s.

Therefore, the flood levels in Bayview during a 500-year event are far more sensitive to the state of the railway (change of 40 m³/s) compared to the inclusion or exclusion of the proposed stopbank (change of 0.5 m³/s).

As shown in the appended figure (scenarios 1 and 2), the changes in flood levels due to the stopbank and associated works are comparable, regardless of whether the railway is reinstated or not. Scenario 3 shows there are significant benefits for Bayview if the railway line is reinstated.

4.0 Conclusion

PDP have completed four model runs and assessed three post construction pre construction scenarios. The purpose of the modelling was to determine the impact that the assumption of the railway line status has on flood effects.

In the 100-year and 500-year events, flood effects due to construction of the stopbank and associated works are similar regardless of whether the current (damaged) rail line or reinstated line forms the basis for the existing environment.

For effects on Bayview residents, flood levels and flows in a 500-year event are far more sensitive to the state of the railway (change of 40 m³/s) compared to the inclusion or exclusion of the proposed stopbank (change of 0.5 m³/s).

5.0 Limitations

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Prepared by

Ben Throssell

Service Leader

Tylan Collins

Water Engineer

Reviewed and approved by

Martina Groves

Group Director - Land

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PRE CONSTRUCTION



POST CONSTRUCTION

NOTES:
1. AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE [https://data.linz.govt.nz] AND LICENCED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.



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FIGURE

SCENARIO 1: RAILWAY LEFT AS IS (NO REINSTATEMENT), BUILD STOPBANK

PROJECT

ESK HYDRAULIC MODEL

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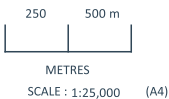


EXISTING ENVIRONMENT

NOTES:
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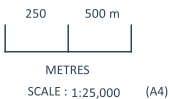
FIGURE
SCENARIO 2: RAILWAY REINSTATED TO PRE-GABRIELLE, THEN BUILD STOPBANK

PROJECT ESK HYDRAULIC MODEL

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NOTES:
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FIGURE
SCENARIO 3: RAILWAY LEFT AS IS (NO REINSTATEMENT), THEN BUILD STOPBANK AND REINSTATE RAILWAY

PROJECT ESK HYDRAULIC MODEL

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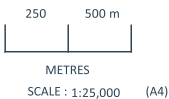


EXISTING ENVIRONMENT



POST CONSTRUCTION

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FIGURE

SCENARIO 4: RAILWAY LEFT AS IS (NO REINSTATEMENT), DON'T BUILD STOPBANK BUT REINSTATE RAILWAY

PROJECT ESK HYDRAULIC MODEL

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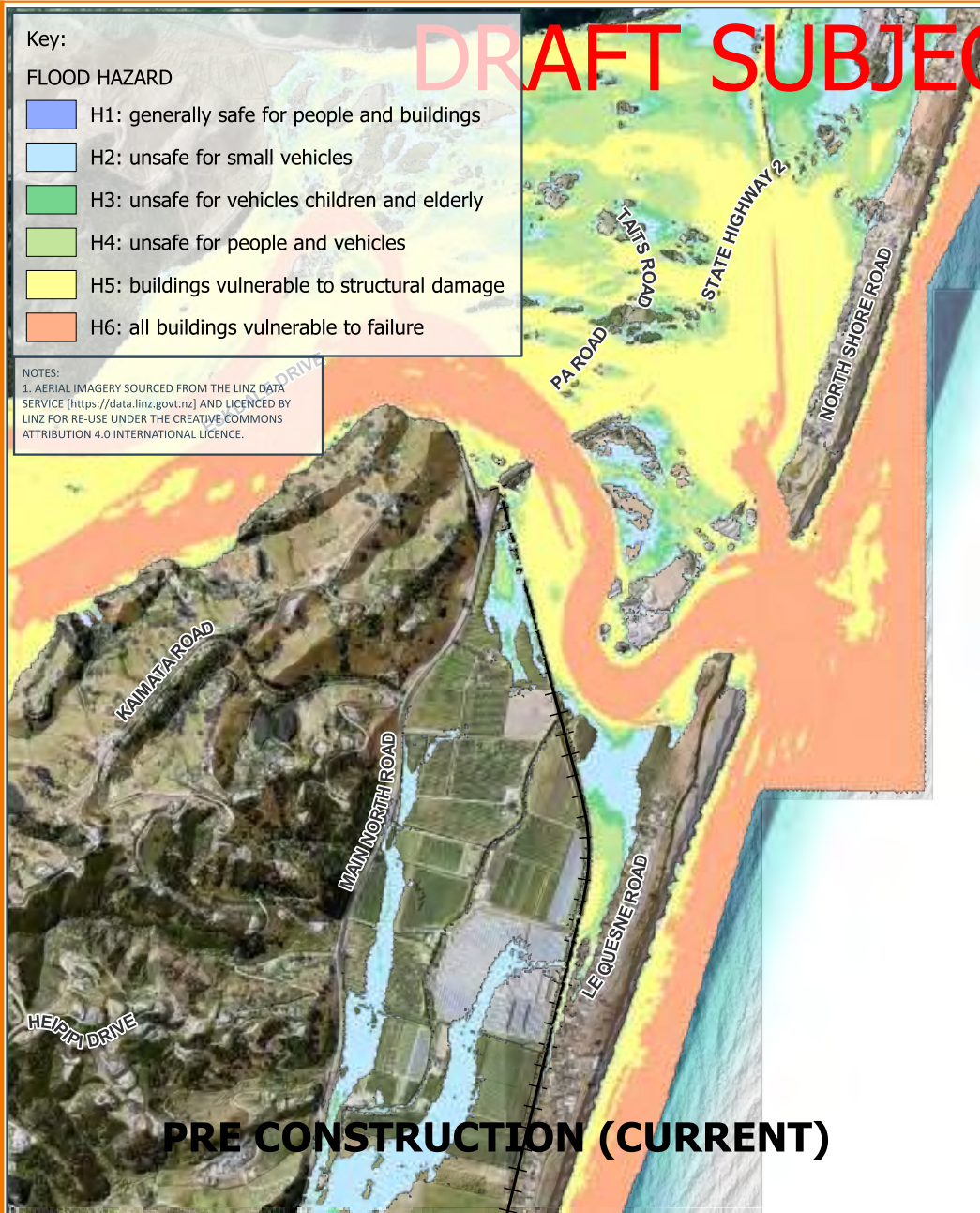
Key:

FLOOD HAZARD

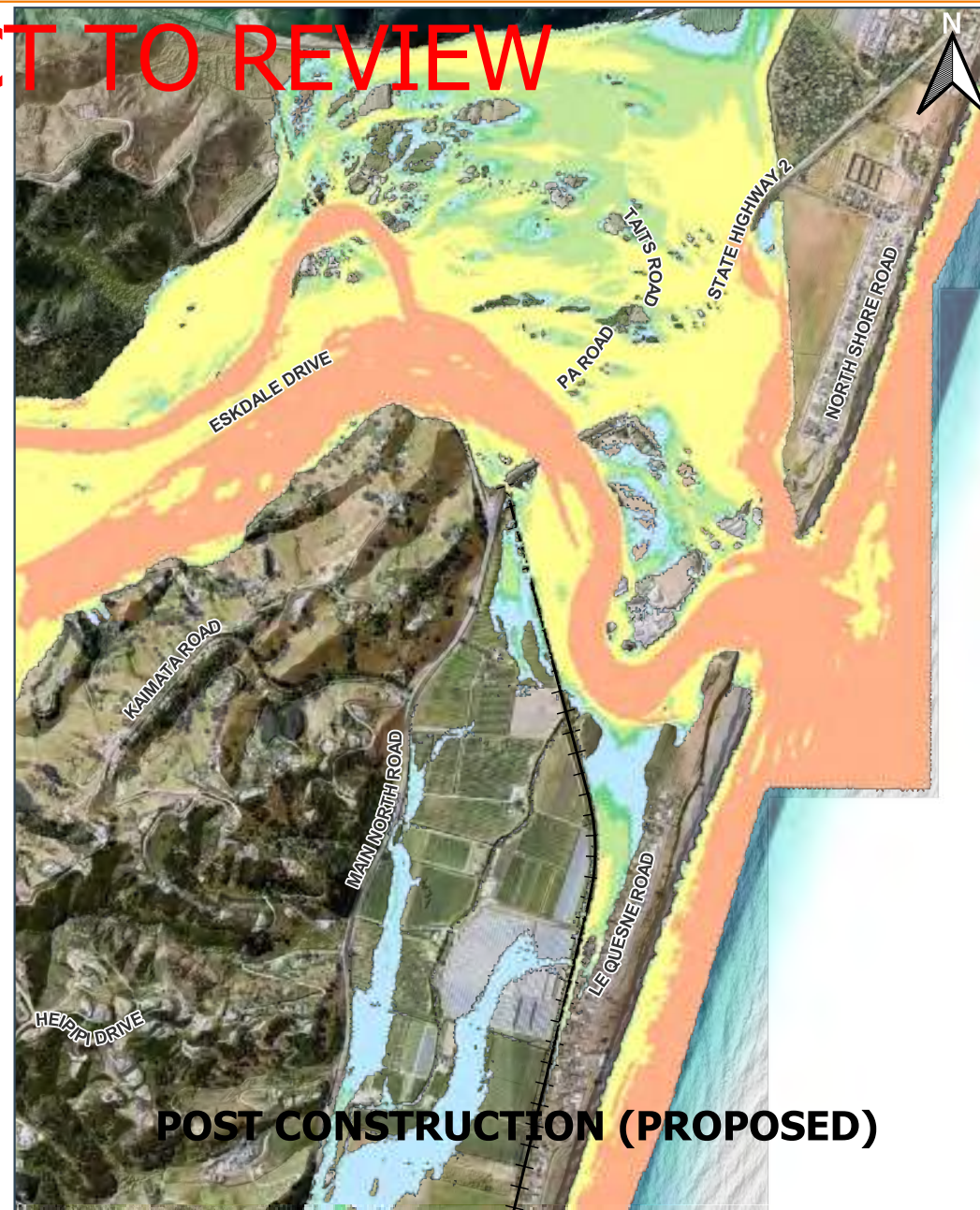
- H1: generally safe for people and buildings
- H2: unsafe for small vehicles
- H3: unsafe for vehicles children and elderly
- H4: unsafe for people and vehicles
- H5: buildings vulnerable to structural damage
- H6: all buildings vulnerable to failure

NOTES:

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PRE CONSTRUCTION (CURRENT)



POST CONSTRUCTION (PROPOSED)



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FIGURE

FIGURE B1: FLOOD HAZRD PRE (LEFT) AND POST(RIGHT) CONSTRUCTION FOR THE 500-YEAR EVENT WITH THE CURRENT RAILWAY (SCENARIO 1).

PROJECT

ESK HYDRAULIC MODEL

Key:

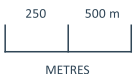
FLOOD HAZARD

- H1: generally safe for people and buildings
- H2: unsafe for small vehicles
- H3: unsafe for vehicles children and elderly
- H4: unsafe for people and vehicles
- H5: buildings vulnerable to structural damage
- H6: all buildings vulnerable to failure

NOTES:

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FIGURE

FIGURE B2: FLOOD HAZRD PRE (LEFT) AND POST(RIGHT) CONSTRUCTION FOR THE 500-YEAR EVENT. RAILWAY LINE REINSTATED AS PART OF EXISTING ENVIRONMENT (SCENARIO 2).

PROJECT ESK HYDRAULIC MODEL

Key:

FLOOD HAZARD

- H1: generally safe for people and buildings
- H2: unsafe for small vehicles
- H3: unsafe for vehicles children and elderly
- H4: unsafe for people and vehicles
- H5: buildings vulnerable to structural damage
- H6: all buildings vulnerable to failure

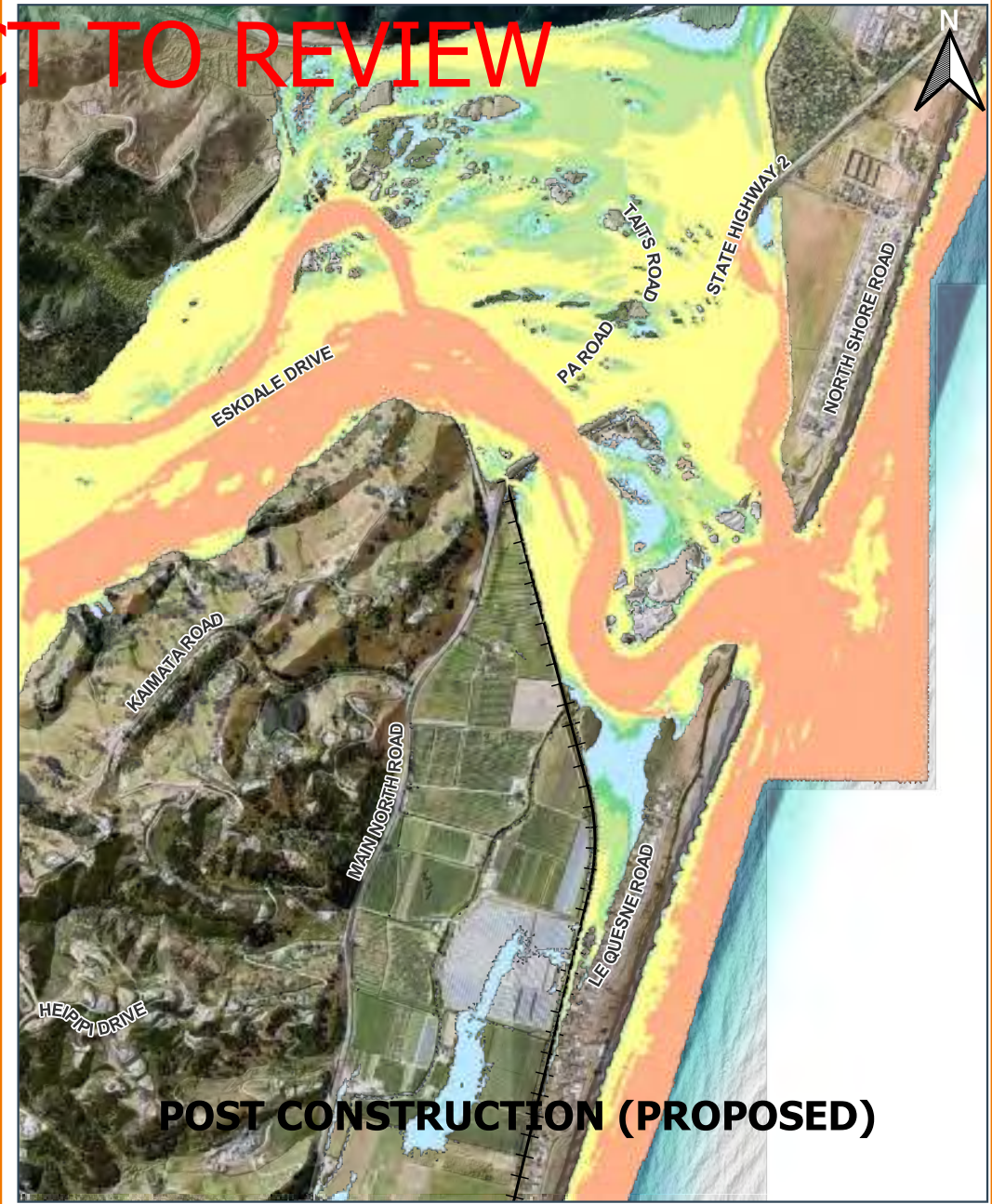
NOTES:

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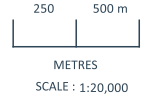
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PRE CONSTRUCTION (CURRENT)



POST CONSTRUCTION (PROPOSED)



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FIGURE B3: FLOOD HAZRD PRE (LEFT) AND POST(RIGHT) CONSTRUCTION FOR THE 500-YEAR EVENT. RAILWAY LINE REINSTATED AS PART OF THE PROPOSED WORKS (SCENARIO 3).

PROJECT ESK HYDRAULIC MODEL

DRAFT SUBJECT TO REVIEW

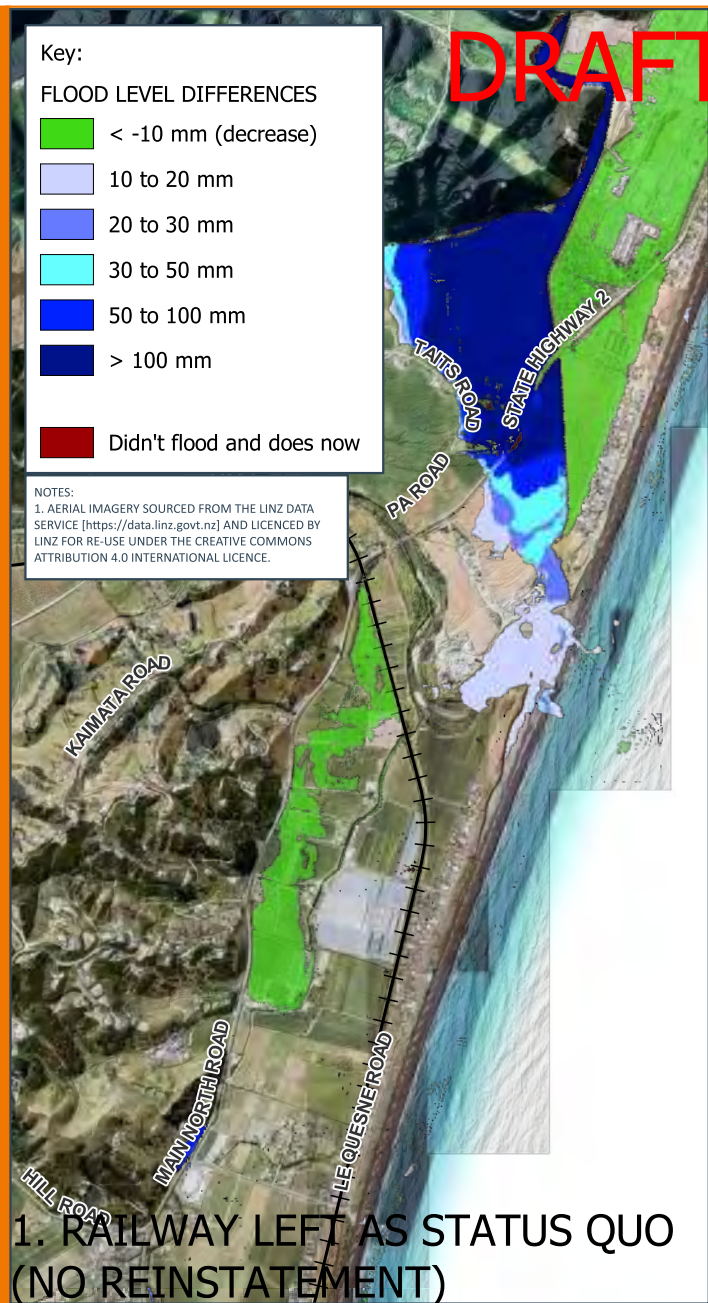
Key:

FLOOD LEVEL DIFFERENCES

- < -10 mm (decrease)
- 10 to 20 mm
- 20 to 30 mm
- 30 to 50 mm
- 50 to 100 mm
- > 100 mm

Didn't flood and does now

NOTES:
 1. AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE [https://data.linz.govt.nz] AND LICENCED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.



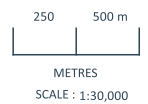
1. RAILWAY LEFT AS STATUS QUO (NO REINSTATEMENT)



2. RAILWAY REINSTATED AS PART OF THE EXISTING ENVIRONMENT



3. RAILWAY REINSTATED AS PART OF PROPOSED WORKS



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FIGURE
 FIGURE B4: MAXIMUM FLOOD DEPTH DIFFERENCE FOR A CLIMATE ADJUSTED RCP 8.5 2074 1% AEP FLOOD EVENT

PROJECT ESK HYDRAULIC MODEL

DRAFT SUBJECT TO REVIEW

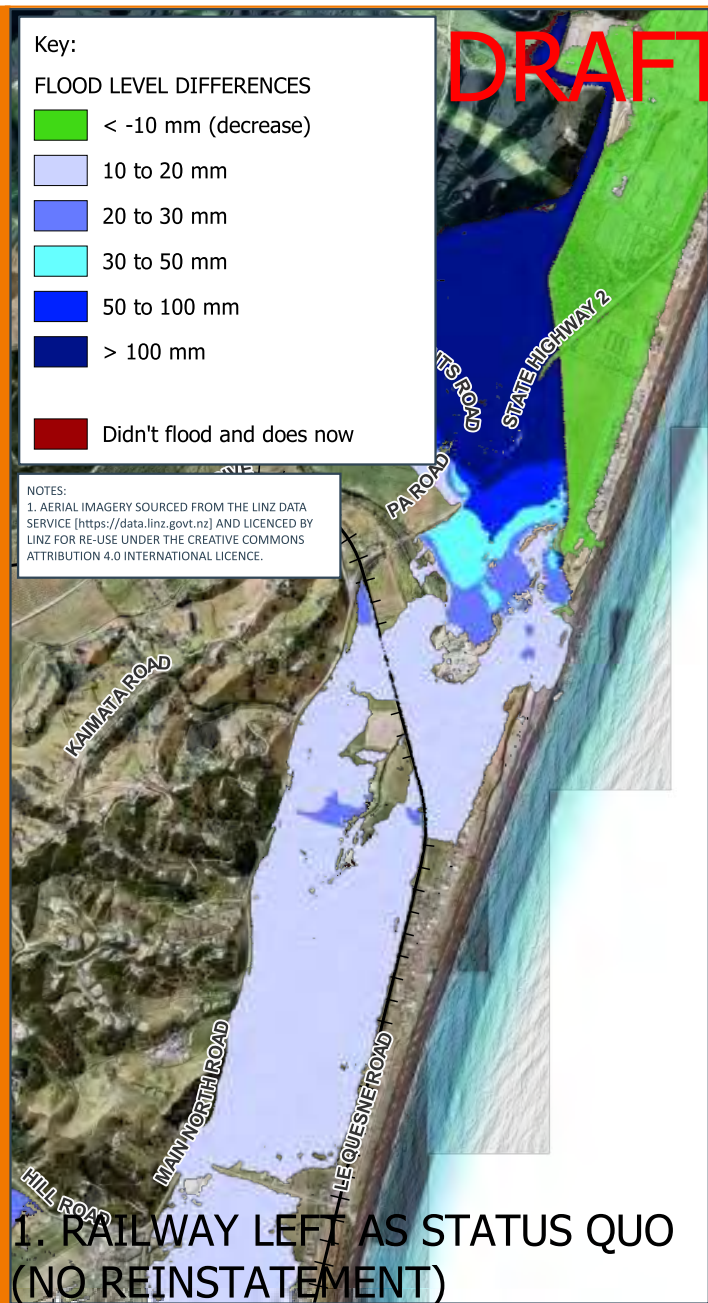
Key:

FLOOD LEVEL DIFFERENCES

- < -10 mm (decrease)
- 10 to 20 mm
- 20 to 30 mm
- 30 to 50 mm
- 50 to 100 mm
- > 100 mm
- Didn't flood and does now

NOTES:

1. AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE [https://data.linz.govt.nz] AND LICENCED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.



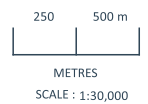
1. RAILWAY LEFT AS STATUS QUO (NO REINSTATEMENT)



2. RAILWAY REINSTATED AS PART OF THE EXISTING ENVIRONMENT



3. RAILWAY REINSTATED AS PART OF PROPOSED WORKS



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FIGURE

FIGURE B5: MAXIMUM FLOOD DEPTH DIFFERENCE FOR A CLIMATE ADJUSTED RCP 8.5 2074 0.2% AEP FLOOD EVENT

PROJECT ESK HYDRAULIC MODEL



Appendix F: Detailed consequential flooding tables

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Commercial_50YR_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		77	0	0	0	0	0	0
Old hazard category	H0	21						
	H1	28						
	H2	24						
	H3	4						
	H4	0						
	H5	0						
	H6	0						

Commercial_50YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		77	0	0	0	0	0	0
Old hazard category	H0	17						
	H1	26						
	H2	27						
	H3	7						
	H4	0						
	H5	0						
	H6	0						

Commercial_100YR_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		77	0	0	0	0	0	0
Old hazard category	H0	17						
	H1	26						
	H2	24						
	H3	10						
	H4	0						
	H5	0						
	H6	0						

Commercial_100YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		77	0	0	0	0	0	0
Old hazard category	H0	12						
	H1	10						
	H2	19						
	H3	36						
	H4	0						
	H5	0						
	H6	0						

Commercial_500YR_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		77	0	0	0	0	0	0
Old hazard category	H0	9						
	H1	1						
	H2	3						
	H3	27						
	H4	36						
	H5	1						
	H6	0						

Commercial_500YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		77	0	0	0	0	0	0
Old hazard category	H0	1						
	H1	1						
	H2	2						
	H3	9						
	H4	30						
	H5	34						
	H6	0						

Commercial_CGB_2023_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		77	0	0	0	0	0	0
Old hazard category	H0	10						
	H1	2						
	H2	3						
	H3	54						
	H4	7						
	H5	1						
	H6	0						

Open Space_50YR_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		11	1	0	0	1	0	0
Old hazard category	H0	11						
	H1		1					
	H2	0						
	H3	0						
	H4	1				1		
	H5	0						
	H6	0						

Open Space_50YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		11	1	0	0	0	1	0
Old hazard category	H0	11						
	H1		1					
	H2	0						
	H3	0						
	H4	0						
	H5	1					1	
	H6	0						

Open Space_100YR_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		11	1	0	0	0	1	0
Old hazard category	H0	11						
	H1		1					
	H2	0						
	H3	0						
	H4	0						
	H5	1					1	
	H6	0						

Open Space_100YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		11	0	1	0	0	1	0
Old hazard category	H0	11						
	H1	0						
	H2	1		1				
	H3	0						
	H4	0						
	H5	1					1	
	H6	0						

Open Space_500YR_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		2	0	2	8	0	1	0
Old hazard category	H0	2						
	H1	0						
	H2	2		2				
	H3	8			8			
	H4	0						
	H5	1					1	
	H6	0						

Open Space_500YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		2	0	0	10	0	0	1
Old hazard category	H0	2						
	H1	0						
	H2	0						
	H3	10			10			
	H4	0						
	H5	0						
	H6	1						1

Open Space_CGB_2023_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		2	1	1	8	0	1	0
Old hazard category	H0	2						
	H1		1					
	H2			1	1			
	H3				7			
	H4							
	H5						1	
	H6							

Residential_50YR_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		1330	9	10	5	0	0	0
Old hazard category	H0	1330						
	H1	10	9	1				
	H2	9		9				
	H3	5			5			
	H4	0						
	H5	0						
	H6	0						

Residential_50YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		1302	19	11	22	0	0	0
Old hazard category	H0	1293	1291	2				
	H1	25	7	17	1			
	H2	15	4		10	1		
	H3	21				21		
	H4	0						
	H5	0						
	H6	0						

Residential_100YR_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		1296	23	10	25	0	0	0
Old hazard category	H0	1286	1285	1				
	H1	28	6	22				
	H2	15	4		10	1		
	H3	25	1			24		
	H4	0						
	H5	0						
	H6	0						

Residential_100YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		1263	36	20	33	2	0	0
Old hazard category	H0	1242	1240	2				
	H1	44	9	34	1			
	H2	22	2		19	1		
	H3	44	12			32		
	H4	2					2	
	H5	0						
	H6	0						

Residential_500YR_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		1098	96	72	81	7	0	0
Old hazard category	H0	1066	1065	1				
	H1	106	15	90	1			
	H2	76	7	4	65			
	H3	91	8	1	6	76		
	H4	15	3			5	7	
	H5	0						
	H6	0						

Residential_500YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		1039	86	75	129	18	7	0
Old hazard category	H0	958	952	6				
	H1	117	33	80	4			
	H2	83	10		71	2		
	H3	160	32			127	1	
	H4	27	9				17	1
	H5	9	3					6
	H6	0						

Residential_CGB_2023_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		1142	95	67	47	3	0	0
Old hazard category	H0	1101	7					
	H1	16	86	1				
	H2	75	9	66				
	H3	63	16		47			
	H4	5		2		3		
	H5	0						
	H6	0						

Rural_50YR_NOCC

**Change in building
count in each hazard
category**

Post hazard category

H0	H1	H2	H3	H4	H5	H6
----	----	----	----	----	----	----

Totals **806** **44** **27** **44** **17** **11** **0**

Old hazard category	H0	804					
	H1		44				
	H2			27			
	H3	2			44		
	H4					17	
	H5						11
	H6						
	0						

Rural_50YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		776	35	25	60	32	21	0
Old hazard category	H0	775	774	1				
	H1	34		34				
	H2	25			25			
	H3	60				60		
	H4	34	2				32	
	H5	21						21
	H6	0						

Rural_100YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		679	60	42	89	40	38	1
Old hazard category	H0	677	4					
	H1	60	56	1				
	H2	41		41				
	H3	90	1		89			
	H4	42	2			40		
	H5	38					38	
	H6	1						1

Rural_500YR_RCP8pt5_2074

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		500	49	48	163	93	86	10
Old hazard category	H0	501	498	3				
	H1	47		46	1			
	H2	48			47	1		
	H3	165				162	3	
	H4	90					90	
	H5	88	2					86
	H6	10						

Rural_CGB_2023_NOCC

Change in building count in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		563	86	71	116	56	54	3
Old hazard category	H0	549						
	H1	5	86	1				
	H2	5		70	1			
	H3	2			115			
	H4					56		
	H5	2					54	
	H6							3

LC3_CGB_2023_NOCC

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		12840.71	36.292	74.057	73.991	221.89	86.927	
Old hazard category	H1	12826.48	12825.73	0.698	0.022	0.018	0.015	
	H2	37.621	1.305	34.05	2.022	0.242	0.002	
	H3	83.172	8.425	0.022	71.29	3.045	0.39	
	H4	79.768	4.55	1.23	0.495	70.538	2.955	
	H5	220.268	0.7	0.292	0.228	0.148	218.528	0.372
	H6	86.555						86.555

LC3_50YR_NOCC

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		13023.21	50.201	85.238	52.268	79.725	43.23	
Old hazard category	H1	13023.05	1.678			0.008		
	H2	50.166	0.16	48.518	1.428	0.045	0.015	
	H3	83.956		0.005	83.808	0.143		
	H4	52.128			0.002	52.078	0.048	
	H5	79.696				0.002	79.652	0.042
	H6	43.19					0.002	43.188

LC3_50YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category					
		H1	H2	H3	H4	H5	H6
Totals		12946.52	56.13	89.352	70.71	121.033	50.123
Old hazard category	H1	12943.24	12941.45	1.788		0.005	
	H2	59.558	2.618	54.33	2.55	0.052	0.008
	H3	90.046	2.452	0.012	86.792	0.79	
	H4	70.158			0.01	69.86	0.288
	H5	120.848				0.008	120.732
	H6	50.015					

LC3_100YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category					
		H1	H2	H3	H4	H5	H6
Totals		12880.14	44.689	87.65	74.103	180.271	67.01
Old hazard category	H1	12866.79	12865.73	1.042	0.01	0.005	
	H2	47.657	2.335	43.635	1.645	0.03	0.012
	H3	99.768	10.433	0.008	85.95	3.325	0.052
	H4	73.931	1.642	0.002	0.045	70.72	1.522
	H5	179.005	0.005	0.002	0.028	178.675	0.295
	H6	66.72				0.005	66.715

LC3_500YR_NOCC

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		12811.87	29.09	69.677	85.041	237.236	100.955	
Old hazard category	H1	12810.36	12809.8	0.54	0.01	0.005		
	H2	29.778	0.652	27.568	1.432	0.108	0.018	
	H3	69.452	0.542	0.87	64.875	3.09	0.075	
	H4	84.569	0.522	0.032	3.235	78.355	2.425	
	H5	239.028	0.352	0.08	0.125	3.488	234.708	0.275
	H6	100.685				0.005	100.68	

LC3_500YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category					
		H1	H2	H3	H4	H5	H6
Totals		12793.21	10.192	35.503	72.914	281.873	140.172
Old hazard category	H1	12792.59	12792.34	0.252	0.005	0.002	
	H2	10.478	0.062	9.73	0.61	0.068	0.008
	H3	36.604	0.23	0.012	34.312	2.05	
	H4	71.806	0.332	0.098	0.348	68.758	2.27
	H5	282.566	0.255	0.1	0.228	2.038	279.575
	H6	139.82				0.018	139.802

Res + Comm_50YR_NOCC

Change in area in each hazard category		Post hazard category					
		H1	H2	H3	H4	H5	H6
Totals		2944.403	0.815	1.792	0.748	0.973	0.02
Old hazard category	H1	2931.252	2930.978	0.26	0.002		0.012
	H2	8.843	7.93	0.545	0.315	0.045	0.008
	H3	7.213	5.478	0.01	1.47	0.255	
	H4	0.598	0.015		0.005	0.44	0.138
	H5	0.83	0.002			0.008	0.815
	H6	0.015					0.015

Res + Comm_50YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category					
		H1	H2	H3	H4	H5	H6
Totals		2942.459	1.3	2.788	0.94	1.235	0.028
Old hazard category	H1	2922.676	2922.265	0.388	0.008	0.015	
	H2	12.057	10.765	0.902	0.32	0.018	
	H3	12.266	9.365	0.01	2.448	0.005	
	H4	0.754	0.032		0.012	0.448	0.262
	H5	0.979	0.032			0.002	0.935
	H6	0.018					0.018

Res + Comm_100YR_NOCC

Change in area in each hazard category		Post hazard category					
		H1	H2	H3	H4	H5	H6
Totals		2942.312	1.281	2.905	0.953	1.272	0.028
Old hazard category	H1	2921.15	2920.732	0.398	0.008		0.012
	H2	12.868	11.572	0.868	0.355	0.048	0.025
	H3	12.933	9.938	0.015	2.53	0.445	0.005
	H4	0.787	0.032		0.012	0.458	0.285
	H5	0.995	0.038			0.002	0.945
	H6	0.018					0.018

Res + Comm_100YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		2940.738	1.565	3.688	1.157	1.564	0.038	
Old hazard category	H1	2904.697	2904.152	0.435	0.1	0.002	0.008	
	H2	11.207	9.688	1.122	0.335	0.04	0.022	
	H3	29.401	25.665	0.008	3.238	0.478	0.012	
	H4	2.227	1.135		0.015	0.635	0.442	
	H5	1.2	0.098			0.002	1.08	0.02
	H6	0.018						0.018

Res + Comm_500YR_NOCC

Change in area in each hazard category		Post hazard category					
		H1	H2	H3	H4	H5	H6
Totals		2932.933	5.474	6.37	1.811	2.047	0.115
Old hazard category	H1	2885.647	2884.84	0.492	0.272	0.028	0.015
	H2	7.967	2.728	4.725	0.448	0.038	0.028
	H3	24.732	18.475	0.255	5.39	0.54	0.072
	H4	27.982	25.855	0.002	0.26	1.2	0.665
	H5	2.365	1.035		0.005	1.265	0.06
	H6	0.057				0.002	0.055

Res + Comm_500YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		2928.207	5.285	9.752	2.512	2.727	0.265	
Old hazard category	H1	2874.236	2873.135	0.622	0.422	0.032	0.025	
	H2	7.68	2.392	4.663	0.555	0.032	0.038	
	H3	16.507	6.895		8.765	0.775	0.072	
	H4	26.306	23.87		0.01	1.648	0.778	
	H5	23.892	21.915			0.025	1.812	0.14
	H6	0.127					0.002	0.125

Res + Comm_CGB_2023_NOCC

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		2935.968	5.04	4.362	1.421	1.872	0.085	
Old hazard category	H1	2891.225	2890.482	0.503	0.198	0.022	0.02	
	H2	8.455	3.518	4.535	0.352	0.03	0.02	
	H3	36.755	32.408		3.802	0.495	0.05	
	H4	10.854	9.365	0.002	0.01	0.872	0.605	
	H5	1.419	0.195			0.002	1.172	0.05
	H6	0.04					0.005	0.035

Rur + Open_50YR_NOCC

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		6587.16	64.728	108.434	61.782	99.935	59.035	
Old hazard category	H1	6560.798	6558.985	1.805		0.008		
	H2	66.941	2.42	62.918	1.538	0.05	0.015	
	H3	132.807	25.705	0.005	106.892	0.205		
	H4	61.662	0.05		0.002	61.525	0.085	
	H5	99.891			0.002	0.002	99.825	0.062
	H6	58.975					0.002	58.973

Rur + Open_50YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		6499.054	68.387	115.953	85.503	144.535	67.642	
Old hazard category	H1	6463.485	6461.585	1.895		0.005		
	H2	74.068	4.892	66.478	2.638	0.052	0.008	
	H3	126.407	12.202	0.012	113.303	0.888	0.002	
	H4	105.292	20.375		0.012	84.555	0.35	
	H5	144.332		0.002		0.008	144.17	0.152
	H6	67.49						67.49

Rur + Open_100YR_NOCC

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		6490.596	67.57	116.64	87.51	149.814	68.945	
Old hazard category	H1	6453.85	6452.003	1.84	0.005	0.002		
	H2	73.55	5.24	65.718	2.51	0.08	0.002	
	H3	127.255	12.218	0.008	114.115	0.912	0.002	
	H4	108.113	21.135	0.002	0.01	86.508	0.458	
	H5	149.542		0.002		0.01	149.35	0.18
	H6	68.765						68.765

Rur + Open_100YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		6354.078	77.942	156.631	96.477	209.601	86.344	
Old hazard category	H1	6311.22	6305.862	3.875	1.478	0.005		
	H2	82.598	3.343	74.045	5.163	0.035	0.012	
	H3	170.69	17.13	0.015	149.945	3.548	0.052	
	H4	122.229	27.738	0.002	0.045	92.862	1.582	
	H5	208.359	0.005	0.005		0.032	207.945	0.372
	H6	85.977					0.005	85.972

Rur + Open_500YR_NOCC

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		6107.649	120.119	215.713	133.77	281.208	122.615	
Old hazard category	H1	6069.015	2.005	0.1		0.01		
	H2	122.116	0.97	117.372	3.638	0.118	0.018	
	H3	220.591	3.462	0.622	208.832	7.6	0.075	
	H4	136.862	8.622	0.035	3.015	122.54	2.65	
	H5	308.08	25.58	0.085	0.128	3.512	278.44	0.335
	H6	122.295				0.015	122.28	

Rur + Open_500YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H1	H2	H3	H4	H5	H6	
Totals		6026.749	84.982	220.057	141.492	343.748	164.048	
Old hazard category	H1	5989.698	5988.195	1.488	0.005	0.01		
	H2	86.082	0.372	83.25	2.38	0.072	0.008	
	H3	221.84	1.345	0.038	217.062	3.39	0.005	
	H4	144.02	3.925	0.098	0.372	135.94	3.685	
	H5	375.868	32.912	0.108	0.238	2.09	340.002	0.518
	H6	163.568				0.038	163.53	

Rur + Open_CGB_2023_NOCC

Change in area in each hazard category		Post hazard category					
		H1	H2	H3	H4	H5	H6
Totals		6182.08	121.247	197.567	112.915	259.306	107.96
Old hazard category	H1	6136.485	6132.035	3.58	0.832	0.02	0.018
	H2	123.19	1.66	116.105	5.158	0.262	0.005
	H3	210.185	12.435	0.035	190.832	6.485	0.398
	H4	125.573	14.708	1.235	0.51	105.98	3.14
	H5	278.205	21.242	0.292	0.235	0.168	255.74
	H6	107.437					0.005

LC3_CGB_2023_NOCC

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		12808.82	31.887	36.291	74.057	73.991	221.89	86.927
Old hazard category	H0	12796.14	0.122	0.012				
	H1	30.207	1.685	27.782	0.685	0.022	0.018	0.015
	H2	37.621	1.16	0.145	34.05	2.022	0.242	0.002
	H3	83.172	7.75	0.675	0.022	71.29	3.045	0.39
	H4	79.768	1.89	2.66	1.23	0.495	70.538	2.955
	H5	220.269	0.198	0.503	0.292	0.228	0.148	218.528
	H6	86.555						

LC3_50YR_NOCC

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		12926.6	96.61	50.201	85.238	52.268	79.725	43.23
Old hazard category	H0	12925.74	12924.6	1.14				
	H1	98.992	1.838	95.468	1.678		0.008	
	H2	50.166	0.158	0.002	48.518	1.428	0.045	0.015
	H3	83.956			0.005	83.808	0.143	
	H4	52.128				0.002	52.078	0.048
	H5	79.696					0.002	79.652
	H6	43.19						0.002

LC3_50YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		12866.56	79.966	56.13	89.352	70.71	121.033	50.123
Old hazard category	H0	12856.08	12855.74	0.338				
	H1	87.163	5.755	79.615	1.788		0.005	
	H2	59.558	2.61	0.008	54.33	2.55	0.052	0.008
	H3	90.047	2.448	0.005	0.012	86.792	0.79	
	H4	70.158				0.01	69.86	0.288
	H5	120.848					0.008	120.732
	H6	50.015						50.015

LC3_100YR_NOCC

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		12861.77	77.414	55.463	89.95	72.21	125.778	51.285
Old hazard category	H0	12850.95	12850.62	0.332				
	H1	84.078	5.318	77.065	1.693		0.002	
	H2	59.275	3.02	0.015	53.76	2.405	0.075	
	H3	91.173	2.805		0.008	87.535	0.825	
	H4	71.707	0.005	0.002	0.002	0.01	71.3	0.388
	H5	125.538					0.01	125.388
	H6	51.145						51.145

LC3_100YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		12829.24	50.902	44.69	87.65	74.103	180.271	67.01
Old hazard category	H0	12812.66	12812.55	0.1	0.005			
	H1	54.13	2.282	50.795	1.038	0.01	0.005	
	H2	47.657	2.33	0.005	43.635	1.645	0.03	0.012
	H3	99.767	10.43	0.002	0.008	85.95	3.325	0.052
	H4	73.931	1.642		0.002	0.045	70.72	1.522
	H5	179.005	0.005		0.002		0.028	178.675
	H6	66.72					0.005	66.715

LC3_500YR_NOCC

Change in area in each hazard category		Post hazard category							
		H0	H1	H2	H3	H4	H5	H6	
Totals		12792.74	19.129	29.09	69.677	85.041	237.236	100.955	
Old hazard category	H0	12791.89	12791.68	0.215					
	H1	18.463	0.388	17.52	0.54	0.01	0.005		
	H2	29.779	0.075	0.578	27.568	1.432	0.108	0.018	
	H3	69.452	0.3	0.242	0.87	64.875	3.09	0.075	
	H4	84.569	0.3	0.222	0.032	3.235	78.355	2.425	
	H5	239.028		0.352	0.08	0.125	3.488	234.708	0.275
	H6	100.685					0.005	100.68	

LC3_500YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category							
		H0	H1	H2	H3	H4	H5	H6	
Totals		12788.46	4.76	10.192	35.503	72.914	281.873	140.172	
Old hazard category	H0	12787.68	12787.58	0.095			0.002		
	H1	4.92	0.008	4.655	0.252	0.005			
	H2	10.479	0.058	0.005	9.73	0.61	0.068	0.008	
	H3	36.604	0.23		0.012	34.312	2.05		
	H4	71.807	0.328	0.005	0.098	0.348	68.758	2.27	
	H5	282.566	0.255		0.1	0.228	2.038	279.575	0.37
	H6	139.82					0.018	139.802	

Res + Comm_50YR_NOCC

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		2942.681	1.72	0.815	1.792	0.748	0.973	0.02
Old hazard category	H0	2907.432	2907.182	0.24	0.008	0.002		
	H1	23.819	22.09	1.465	0.252		0.012	
	H2	8.843	7.92	0.01	0.545	0.315	0.045	0.008
	H3	7.212	5.472	0.005	0.01	1.47	0.255	
	H4	0.598	0.015			0.005	0.44	0.138
	H5	0.83	0.002				0.008	0.815
	H6	0.015						0.015

Res + Comm_50YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		2940.613	1.845	1.299	2.787	0.94	1.235	0.028
Old hazard category	H0	2901.469	2901.082	0.38	0.002	0.005		
	H1	21.204	19.352	1.45	0.385	0.002	0.015	
	H2	12.057	10.76	0.005	0.902	0.32	0.052	0.018
	H3	12.266	9.355	0.01	0.01	2.448	0.438	0.005
	H4	0.754	0.032			0.012	0.448	0.262
	H5	0.979	0.032				0.002	0.935
	H6	0.018						0.018

Res + Comm_100YR_NOCC

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		2940.355	1.958	1.28	2.904	0.953	1.272	0.028
Old hazard category	H0	2900.73	2900.345	0.375	0.005	0.005		
	H1	20.418	18.442	1.57	0.392	0.002	0.012	
	H2	12.869	11.568	0.005	0.868	0.355	0.025	
	H3	12.933	9.93	0.008	0.015	2.53	0.005	
	H4	0.787	0.032		0.012	0.458	0.285	
	H5	0.995	0.038			0.002	0.945	0.01
	H6	0.018						0.018

Res + Comm_100YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		2937.958	2.78	1.565	3.688	1.157	1.564	0.038
Old hazard category	H0	2892.167	2891.692	0.465		0.01		
	H1	12.53	9.685	2.31	0.435	0.09	0.002	0.008
	H2	11.207	9.688		1.122	0.335	0.04	0.022
	H3	29.401	25.66	0.005	0.008	3.238	0.478	0.012
	H4	2.227	1.135			0.015	0.635	0.442
	H5	1.2	0.098				0.002	1.08
	H6	0.018						0.018

Res + Comm_500YR_NOCC

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		2925.37	7.562	5.474	6.371	1.811	2.047	0.115
Old hazard category	H0	2873.748	2872.935	0.66	0.13	0.015	0.008	
	H1	11.901	4.538	6.708	0.362	0.258	0.02	0.015
	H2	7.966	2.535	0.192	4.725	0.448	0.038	0.028
	H3	24.731	18.472	0.002	0.255	5.39	0.54	0.072
	H4	27.982	25.855		0.002	0.26	1.2	0.665
	H5	2.365	1.035				0.005	1.265
	H6	0.057					0.002	0.055

Res + Comm_500YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		2921.186	7.02	5.285	9.753	2.512	2.727	0.265
Old hazard category	H0	2862.142	0.718	0.302	0.038	0.01		
	H1	11.026	3.972	6.302	0.32	0.385	0.022	0.025
	H2	7.68	2.392		4.663	0.555	0.032	0.038
	H3	16.507	6.895			8.765	0.775	0.072
	H4	26.306	23.87			0.01	1.648	0.778
	H5	23.892	21.915				0.025	1.812
	H6	0.127						0.002

Res + Comm_CGB_2023_NOCC

Change in area in each hazard category		Post hazard category							
		H0	H1	H2	H3	H4	H5	H6	
Totals		2928.421	7.549	5.04	4.362	1.421	1.872	0.085	
Old hazard category	H0	2877.645	0.808	0.035	0.018	0.002			
	H1	12.718	5.475	6.555	0.468	0.18	0.02	0.02	
	H2	8.455	3.518		4.535	0.352	0.03	0.02	
	H3	36.755	32.34	0.068		3.802	0.495	0.05	
	H4	10.855	9.248	0.118	0.002	0.01	0.872	0.605	
	H5	1.419	0.195				0.002	1.172	0.05
	H6	0.04						0.005	0.035

Rur + Open_50YR_NOCC

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		6474.421	112.74	64.728	108.434	61.782	99.935	59.035
Old hazard category	H0	6440.538	6439.29	1.248				
	H1	120.261	6.958	111.49	1.805		0.008	
	H2	66.941	2.418	0.002	62.918	1.538	0.05	0.015
	H3	132.807	25.705		0.005	106.892	0.205	
	H4	61.662	0.05			0.002	61.525	0.085
	H5	99.891				0.002	99.825	0.062
	H6	58.975					0.002	58.973

Rur + Open_100YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category						
		H0	H1	H2	H3	H4	H5	H6
Totals		6229.276	124.802	77.941	156.631	96.477	209.601	86.344
Old hazard category	H0	6177.713	4.98	0.452	0.048			
	H1	128.027	3.38	119.79	3.422	1.43	0.005	
	H2	82.597	3.332	0.01	74.045	5.163	0.035	0.012
	H3	170.69	17.108	0.022	0.015	149.945	3.548	0.052
	H4	122.229	27.738		0.002	0.045	92.862	1.582
	H5	208.359	0.005		0.005		0.032	207.945
	H6	85.977					0.005	85.972

Rur + Open_500YR_NOCC

Change in area in each hazard category		Post hazard category							
		H0	H1	H2	H3	H4	H5	H6	
Totals		5983.752	123.901	120.119	215.713	133.77	281.208	122.615	
Old hazard category	H0	5946.933	5945.618	1.305	0.01				
	H1	124.198	0.735	121.358	1.995	0.1	0.01		
	H2	122.117	0.558	0.413	117.372	3.638	0.118	0.018	
	H3	220.592	3.215	0.248	0.622	208.832	7.6	0.075	
	H4	136.863	8.398	0.225	0.035	3.015	122.54	2.65	
	H5	308.08	25.228	0.352	0.085	0.128	3.512	278.44	0.335
	H6	122.295					0.015	122.28	

Rur + Open_500YR_RCP8pt5_2074

Change in area in each hazard category		Post hazard category							
		H0	H1	H2	H3	H4	H5	H6	
Totals		5942.233	84.519	84.982	220.057	141.492	343.748	164.048	
Old hazard category	H0	5903.815	5903.285	0.528			0.002		
	H1	85.884	0.455	83.928	1.488	0.005	0.008		
	H2	86.082	0.35	0.022	83.25	2.38	0.072	0.008	
	H3	221.841	1.318	0.028	0.038	217.062	3.39	0.005	
	H4	144.02	3.92	0.005	0.098	0.372	135.94	3.685	
	H5	375.869	32.905	0.008	0.108	0.238	2.09	340.002	0.518
	H6	163.568					0.038	163.53	

Rur + Open_CGB_2023_NOCC

Change in area in each hazard category		Post hazard category							
		H0	H1	H2	H3	H4	H5	H6	
Totals		6025.608	156.472	121.247	197.568	112.915	259.306	107.96	
Old hazard category	H0	5979.81	5977.275	2.422	0.105	0.008			
	H1	156.676	2.098	150.24	3.475	0.825	0.02	0.018	
	H2	123.19	1.51	0.15	116.105	5.158	0.262	0.005	
	H3	210.185	11.82	0.615	0.035	190.832	6.485	0.398	
	H4	125.572	12.165	2.542	1.235	0.51	105.98	3.14	
	H5	278.206	20.74	0.503	0.292	0.235	0.168	255.74	0.528
	H6	107.437						0.005	107.432