



# Consequential Flood Assessment

Proposed Pōrangahau Scheme

Prepared for Hawke's Bay Regional Council  
Prepared by Beca Limited

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None

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on behalf of	Beca Limited		

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## Executive Summary

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This report assesses the consequences of developing a flood prevention scheme for Pōrangahau township in Hawkes Bay. This assessment is limited to an assessment of information contained within PDP (2025) Assessment of Effects on Flooding for Proposed Pōrangahau Stopbanks (DRAFT, 11<sup>th</sup> August).

The proposed scheme comprises a system of compacted earth stopbanks and flood walls around the township, as well as a low bund intended to reduce flow-related damage to Kaiwhitikitiki Urapā.

PDP has identified 232 buildings within and surrounding Pōrangahau township. The proposed scheme's impact on these properties is as follows, in the 1%AEP event:

- 130 properties that previously flooded would have no flooding.
- 21 properties that previously flooded are likely to have their flooding reduced.
- 81 properties that have previously flooded may be flooded to greater depth.
- 1 properties that did not previously flood may now flood.

Of the 81 properties that have previously flooded, and that are flooded to a greater depth as a result of the proposed scheme, 67 of these (Beach Road) see increases of 1.1cm or less, which is unlikely to result in an actual change to flood risk.

The remaining properties exposed to potentially negative consequences are located on Keppel Road, Pah Road and Cooks Tooth Road and here the consequence of depth increases is unclear. This would depend upon how the new water level relates to building floor levels.

For the Pah Road properties, including the marae buildings, flood depths without the scheme are 0.5-1.43m, which likely exceeds the threshold points of all buildings and therefore results in significant damage. Increases in water levels as a result of the scheme are upto 0.11m and although this would increase water depths at the buildings it is unlikely to significantly change the amount of damage caused.

Using anecdotal evidence it would appear that only one property is likely to be at risk of flooding which would occur over a threshold that did not occur without the scheme, this being, 'Opposite 58 Cooks Tooth Road', however this could not be confirmed due to lack of floor level information.

The scope of this report has been to weigh up the benefits of protecting the Category 2C land against the adverse effects on other areas. These consequences have been evaluated by considering the effects against five criteria:

- **Magnitude of Effect:** Changes in flood depths, water velocities, and flood hazard category.
- **Event Scale:** Differences in flood effects in different design/historic events.
- **Property Sensitivity:** Consider how the change in flood effects will affect properties; removing flood risk, still flood prone but increased/decreased risk, introducing flood risk.
- **Land use:** Evaluate the vulnerability/resilience of the affected land to flooding.
- **Scale of the proposal:** Considering the scale of proposed works against the accrued benefits.

Based on the flood consequences evaluation the proposed scheme passes three of the five criteria with an unclear result for the remaining criteria. This would indicate that, subject to suitable mitigations being agreed for the marae properties, and further consideration of floor-level impacts on a limited number of properties, **the consequences of the proposed stopbank are considered acceptable.**

# 1 Introduction

## 1.1 Scope

Following Cyclone Gabrielle in February 2023, Hawkes Bay Regional Council (HBRC) commenced a series of projects to mitigate future flooding in certain areas of the region. These projects include stopbanks to protect vulnerable communities. One such project is at Pōrangahau where the Pōrangahau River flows out of the hills onto an area of flat coastal land on which the settlement is located.

HBRC appointed Pattle Delamore Partners (PDP) to undertake the flood modelling and design of the stop banks. Subsequently, HBRC appointed Beca to:

- Review and provide comment on PDP (2025) Assessment of Effects on Flooding for Proposed Pōrangahau Stopbanks (DRAFT, 11<sup>th</sup> August).
- Report on the consequences of the proposed works on the local community. This includes the areas and numbers of buildings where the risk of flooding will change due to the works, with the information drawn from the PDP report.

## 1.2 Key locations

The proposed scheme is intended to protect the township of Pōrangahau. In addition to this urban core there are other key locations that are discussed below which are of relevance. Figure 1 shows these locations.



Figure 1 Key locations

## 1.3 Land categorisation

The proposed scheme supports the reclassification Category 2C properties (Figure 2) to Category 1 in Pōrangahau (<https://www.hbrc.govt.nz/hawkes-bay/projects/restoring-flood-resilience/porangahau/>).

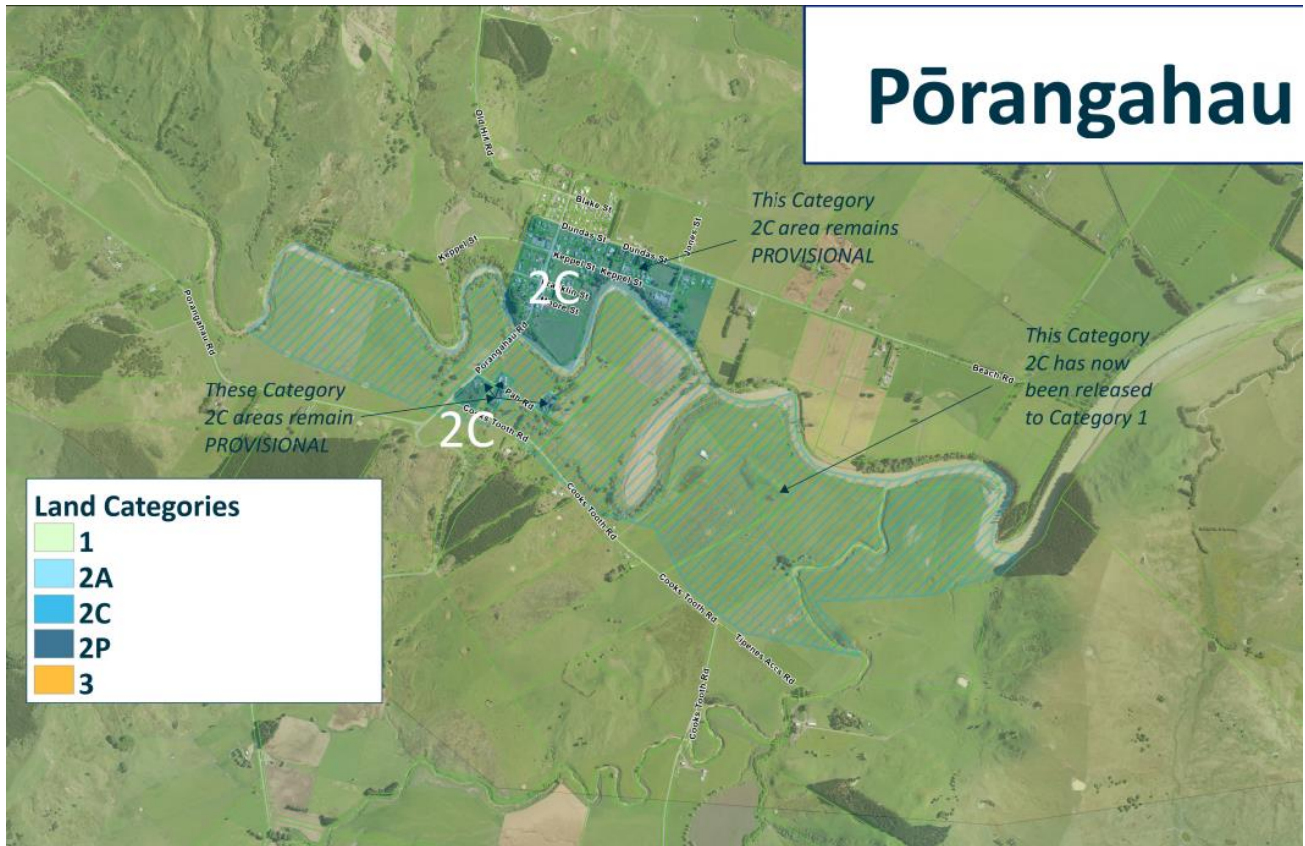


Figure 2 Land categorisation (24<sup>th</sup> October 2024) – Hastings District Council (2024)

## 1.4 Information received

HBRC provided the following documents for review:

- PDP (2025a) *Assessment of Effects on Flooding for Proposed Pōrangahau Stopbanks (DRAFT, 11<sup>th</sup> August)*
- PDP (2025b) *Pōrangahau River: Design Model Build Report (DRAFT, 8<sup>th</sup> April)*
- *Te Tore o Puanga (2025) Pōrangahau Flood Resilience Project*

## 1.5 Site visit

The author visited Pōrangahau on the 6<sup>th</sup> of June 2025 and inspected each of the areas affected by the proposed scheme. The site inspection started at the Pōrangahau/Te Paerahi Water Treatment Plant on Beach Road then returned to Pōrangahau township via Beach Road. Other locations inspected were Keppel Street, Pah Road, Pōrangahau Road and Cooks Tooth Road. Notes and photographs were taken which were used to inform the assessment below.

## 2 Proposed flood mitigation works

### 2.1 Scheme components

The components of the proposed flood mitigation works (Figure 3) are listed in *Pōrangahau River: Design Model Build Report* (PDP 2025a), and are repeated below:

- The construction of stopbanks and floodwalls along the true left bank of the Pōrangahau River to provide a continuous line of defence for the main township.
- The construction of a low-height bund to the northwest of Kaiwhitikitiki urupā, primarily designed to reduce flow velocities across this culturally sensitive site.

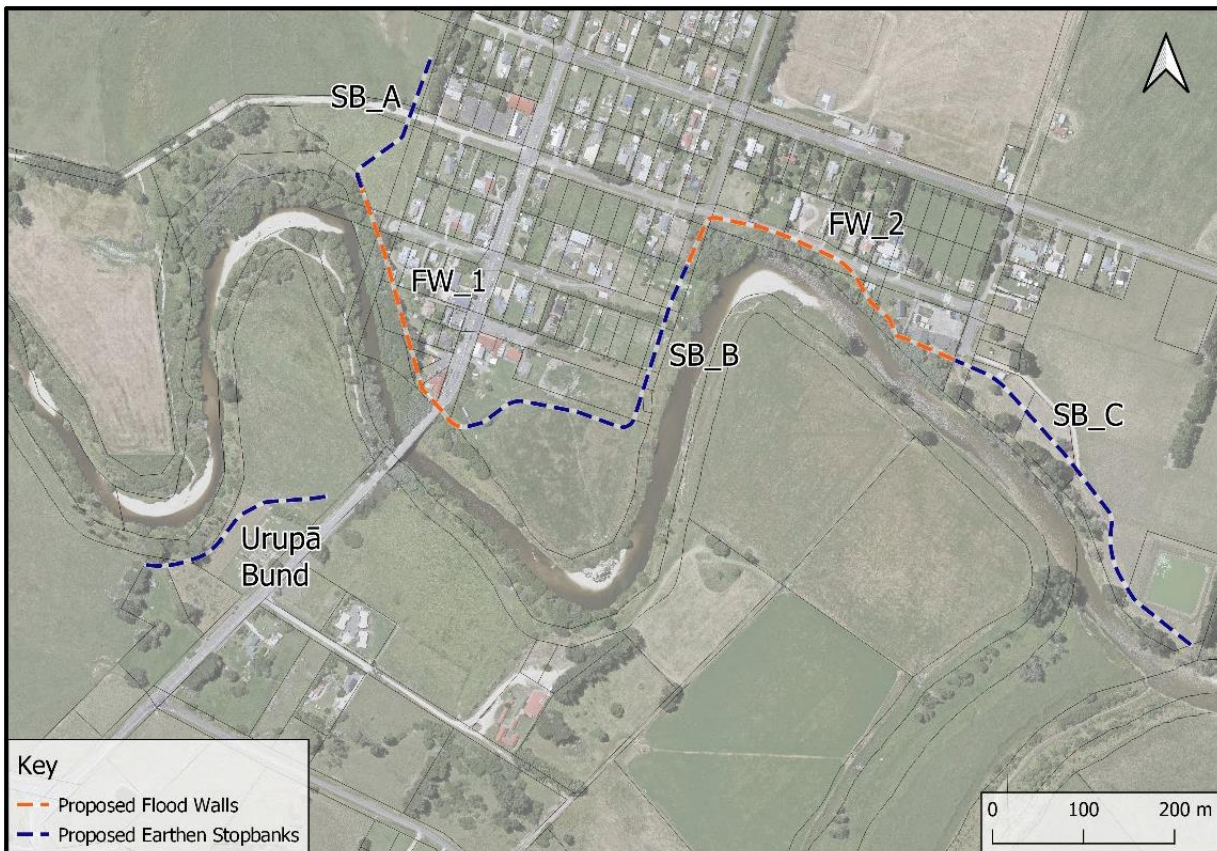


Figure 3 Proposed works, taken from *PDP (2025a)*

PDP's scheme layout is intended to mitigate flooding within the main township in the 1% AEP (Annual Exceedance Probability) event. A freeboard of at least 0.5m has been added to the peak water level in this event to set the minimum stopbank/floodwall crest level.

### 2.2 Freeboard

The main scheme floodwall/stopbank freeboard allowance of 0.5m (Table 1) is intended to cover (1) modelling uncertainties (eg hydrological and hydraulic parameter assumptions), (2) the impact on water levels from blockages occurring on the bridge piers, and (3) the influence of climate change.

Above the bridge, climate change (RCP4.5 to 2044) takes 130-170mm of the freeboard proposed. Downstream of the bridge climate change takes 70-110mm of the freeboard proposed.

Bridge blockages (at 30%) take a maximum of 160mm of the freeboard<sup>1</sup>.

Therefore, above the bridge 290-330mm of freeboard is accounted for by climate change and blockage, leaving 210-170mm of residual freeboard to cover modelling uncertainties associated with hydrologic and hydraulic parameters. Below the bridge 70-110mm of freeboard is accounted for, leaving 390-430mm of residual freeboard to cover modelling uncertainties associated with hydrologic and hydraulic parameters.

PDP have sought to validate their hydrologic and hydraulic model parameters, in the absence of calibration data. This process concluded that the model was suitably validated, once some variables had been adjusted. In general a conservative approach has been taken in setting these parameters.

Notwithstanding the validation exercise undertaken the proposed freeboard is low, particularly above the bridge. The section above the bridge is also subject to increased risk should blockages in excess of 30% occur.

Council should consider if they are willing to accept the potential risk of overtopping of the main floodwall/stopbanks which results from the freeboard selected, particularly in the section above the bridge.

The Kaiwhitikitiki urupā bund does not have a specific design level. It's intended function is to reduce flood velocities across the urupā, rather than to exclude water in a particular flow event (Table 1).

Table 1 Proposed crest levels, taken from *PDP (2025a)*

Table 1. Derived crest elevations.						
Level	SB A	FW 1	SB B	FW 2	SB C	Urupā Bund
1 % AEP Peak Flood Level (m RL)	11.11	11.07	10.03	9.45	9.02	
Nominal Crest Elevation (m RL)	11.67	11.32 – 11.67	10.00 – 10.54	9.62 – 9.97	9.45 – 9.58	11.97 <sup>[1]</sup>
Minimum Freeboard (m)	0.55	0.56	0.51	0.52	0.54	

Notes:

1. The urupā bund has been modelled without freeboard, as its primary purpose is to reduce flow velocities through the urupā, rather than reduce flood depths.

## 2.3 Climate change

An allowance has been included in the design for the effects of climate change on rainfall. This uses RCP4.5 as a pathway, with a time horizon of 2044. Should the pathway of global temperatures laid out by RCP4.5 occur then the level of service proposed for the scheme would begin to reduce beyond 2044. Assuming construction occurs in 2026/27, this means that the stated level of service would be compromised 17 years after construction.

The impact of RCP4.5 to 2044 on river flows has not been modelled explicitly, rather a 10% increase to peak flows has been used. A check of rainfall increases under this pathway shows an 8% increase in rainfall (HIRDS), which suggest the 10% increase in flow is reasonable.

<sup>1</sup> This is quoted as a maximum as results were not provided with the most recent model runs, which will likely result in a lower 'take' of freeboard for bridge blockage. Results from previous model runs (April 2025) have been used to support this statement.

## 3 Consequential flood risk

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### 3.1 Summary

PDP has identified 232 buildings within and surrounding Pōrangahau township which are within the currently flooded area. The proposed scheme's impact on these properties is as follows:

- 130 properties that previously flooded would have no flooding.
- 21 properties that previously flooded may have flooding depths reduced.
- 81 properties that previously flooded may have an increase in flood level.
- 1 property that did not previously flood may flood, and would be added to the flooded area.

Of the 81 properties that have previously flooded and that are flooded to a greater depth, 67 of these see increases of 1.1cm or less. It is not considered that this is a material increase and is well within the uncertainty of the model predictions.

In addition to these quantifiable measures of consequence the social impact of increasing flood hazard in certain areas so that other areas may be afforded a higher level of protection should not be ignored.

### 3.2 Key locations

#### 3.2.1 Pōrangahau township

The significant positive consequence of the proposed scheme is for the township. In this location all buildings are protected in the 1% AEP event, with considerable flood depths of up to 3m avoided. Flood hazard is removed for the township.

Specific locations protected include the police station, fire station, school, community hall and wastewater treatment pond. These locations are of importance during civil defence emergencies and the resilience of the community will be improved through their protection.

#### 3.2.2 Kaiwhitikitiki Urapā

The scheme will have a positive impact on the urapā during any flood event that breaks out of the river's banks, up to the 1% AEP flood event. Although the bund will not stop water entering the urapā, it will reduce the water speed and therefore reduce the likelihood of damage to land and memorials. The flood hazard classification reduces from H5 (buildings vulnerable to structural damage) to H3 (unsafe for vehicles, children and elderly).

#### 3.2.3 Lifeline routes

There are three access routes for Pōrangahau; Pōrangahau Road/Abercromby Street, Old Hill Road, and Beach Road.

The proposed scheme does not change the flood hazard on these routes and so access to the township would not be improved, but also it would not be made worse.

The scheme will reduce flooding on various streets within the township, improving much of the community's ability to move around and access services during a flood event.

### 3.2.4 Rongomaraeroa Marae

The proposed scheme does not protect the marae. Rather, it will displace flood waters that would otherwise have flowed through the township and this water will flow instead through the area around the marae, raising water levels in this location.

At the peak of the 1% AEP event water levels at the marae are estimated to increase by up to 0.11m. The speed of water flowing through the area does not appear to change.

The depth increases estimated to occur do not change the flood hazard categorisation at the marae, which remains at H2 and H3.

The resulting damage from a post-scheme 1% AEP event is unlikely to be greater than the pre-scheme damage as peak water depths in the pre-scheme scenario are already significant (0.51-0.65m) and so an increase of 0.11m would be unlikely to result in additional damage.

The depth increases in the 1% AEP event suggest that the rainfall event required to first flood the marae will be lowered by the scheme i.e. the scheme will cause the marae to flood in smaller events than those which would have caused flooding previously. This consequence has not been addressed by the proposed scheme. It is understood that separate flood mitigation options for the Marae buildings are being considered.

### 3.2.5 Kaumātua Flats and 14 Pah Road

The proposed scheme does not protect the flats, or buildings on the opposite side of Pah Road. Flood levels at these buildings will increase.

At the peak of the 1% AEP event water levels at the flats are estimated to increase by up to 0.11m. The speed of water flowing through the area does not appear to change.

The depth increases estimated to occur do not increase the flood hazard categorisation at these buildings which remains at H3 and H4 (unsafe for vehicles, children, elderly and unsafe for people and vehicles). The hazard for the eastern-most flat reduces from H4 to H3.

The resulting damage from a post-scheme 1% AEP event is unlikely to be greater than the pre-scheme damage as peak water depths in the pre-scheme scenario are already in excess of one metre (1.04-1.43m) and so an increase of 0.11m would be unlikely to result in further damage.

The depth increases in the 1% AEP event suggest that the rainfall event required to first flood the buildings will be lowered by the scheme i.e. the scheme will cause the buildings to flood in smaller events than those which would have caused flooding previously. This consequence has not been addressed by the proposed scheme.

### 3.2.6 Cooks Tooth Road buildings

Along this road there are four properties that have an increased flood depth as a result of the proposed scheme. One of these properties did not previously flood in the 1% AEP event. For these properties the maximum flood depth increase estimated is 131mm. It is not clear how this increase in water depth relates to floor levels for the buildings and so the consequence for these buildings is unclear. Using Google Street View and the water depth predicted by PDP it appears that only 'opposite 58 Cooks Tooth Road' may be at risk of flooding above the building floor, however this has not been confirmed.

### 3.2.7 109 Keppel Street buildings

There are two buildings at 109 Keppel Street, one of which has an increased flood depth as a result of the proposed scheme. For this property the maximum flood depth estimated is 137mm higher. It is not clear how this water depth relates to floor level for the building and so the consequence is unclear.

### 3.2.8 WTP

Water treatment for Pōrangahau occurs near Te Paerahi, several kilometres downstream of the township. Flood modelling results have not been provided for this location. Model results for the camp site across the road shows a 0.011m (1cm) increase in water level as a result of the scheme, which would likely be the same at the WTP. We do not consider this to be relevant and consequences are not likely.

### 3.3 Indicators

Previous PDP effects reporting has noted that “There is no formal guidance available nationally or locally which can be applied as a framework for assessing effects on flooding and flood hazard.” (pp 6&7, PDP Effect Report for Whirinaki Stopbank), and so they propose a framework of five criteria against which to evaluate the effects of proposed works. To maintain consistence across the Consequential Flood Assessments an assessment against the five criteria is provided (Table 2).

Table 2 Flood consequences evaluation

Criteria	Effect and consequences of the scheme	Evaluation
<b>Magnitude of Effect:</b> Changes to the flood depth/level and changes to the flood hazard classification.	Within the town flood hazard is removed, positively impacting a large number of properties. On the opposite side of the river (and at Keppel Road) a smaller number of properties are negatively impacted. This negative impact does not increase flood hazard classification, but depths increase.	Pass
<b>Event Scale:</b> An effect for a smaller, more frequent, event is considered worse than the same effect for a larger, less frequent event.	Only modelling for the 100-year event has been provided. It is likely that for properties on the opposite side of the river from the town (and upstream at Keppel Road) that properties will begin to be inundated in events smaller than without the proposed scheme. Although this effect is likely to be small, it has not been assessed.	Unclear
<b>Property Sensitivity:</b> Properties with existing flood vulnerabilities have a lower tolerance for additional flooding compared to those with low or no flood hazards.	Flood depths are increased at several residential properties outside the protected area. Flood hazard classification does not change at these properties and the increase in flood depth is not likely to cause floor-level flooding where it did not previously occur, except for at one property. Limited floor level data means this could not be confirmed. Increase flood depths are also predicted at the marae, and housing associated with the marae. These increases generally come on top of already significant existing flood risk, and so it is unlikely that additional damage would be caused. Flood Hazard classification at these properties does not change. Although there is an argument that such increases could be considered acceptable to individual private properties, this is less clear given the importance of the marae to the wider community. Again the lack of flood level data and an assessment of likely damage means this consequence is unclear. Also noted is the intent to develop separate plans for mitigation of flood risk at the marae. These have not been assessed. The proposal has a benefit to the urupa, which should see less damage in future floods.	Unclear
<b>Land use:</b> The land use of the affected property is also a consideration. Rural land used for grazing/cropping/horticulture is considered to have a greater tolerance to flood effects when compared to residential dwellings.	The Category 2C area protected by the proposed stopbank is primarily residential land. In contrast, most of and on the opposite side of the river is rural land used for pasture and so would be considered more tolerant to flooding. However, the rural land also includes the marae, urupa and some residential properties which are considered in the row above.	Pass
<b>Scale of the proposal:</b> While less critical than the factors above, the size of the proposal generating the effect should be considered. A significant proposal which will protect regionally significant infrastructure and 100's of residential properties, generating an effect is more acceptable than a smaller proposal (for example a stopbank protecting ten houses) generating the same effect.	The proposed stopbank will protect a large number of homes, as well as important services and infrastructure for the wider area. However, this will be at the expense of increases in flood risk in the 100-year ARI event to rural land, rural properties, and the marae.	Pass

## 4 Conclusions and recommendations

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Subject to external review of the Esk Valley Design Model, the modelling and reporting undertaken by PDP is robust. PDP have cooperated in providing information to inform this report and previous versions.

The modelling suggests the consequences of the proposed scheme are:

- **Pōrangahau Township** – Flood depths reduced for 21 properties, flooding removed for 130 properties.
- **Kaiwhitikitiki Urapā** – Flood depths and velocities reduced.
- **Lifeline routes** – Depths, velocities and hazard generally unchanged.
- **Rongomaraeroa Marae** – Flood depths increased, but hazard category is unchanged.
- **109 Keppel Road** – Flood depth increased, but hazard category is unchanged.
- **Pah Road properties** – Flood depths increased for 5 properties, but hazard category is unchanged (lowered for one property).
- **Cooks Tooth Road properties** - Flood depths increased for 3 properties, and 1 new property flooded. Hazard category unchanged.

For properties on Keppel Road, Pah Road and Cooks Tooth Road the consequence of depth increases is unclear, as this would depend upon how the new water level relates to building floor levels and threshold points. The work completed to date suggests that only one property on Cooks Tooth Road (Opposite 108) may be at risk of flood depth increases that result in flooding above building threshold which did not occur without the scheme. No building threshold data is available to confirm this.

67 Beach Road properties are estimated to have a depth increase of 1.1cm. This is not considered material, as it comes on top of already considerable flood depths and is well within modelling uncertainties.

At present the proposed scheme does not provide mitigation for these adverse effects, although we understand that separate mitigations are being discussed for the Marae buildings.

The scope of this report has been to weigh up the benefits of protecting the Category 2C land against the adverse effects on other areas. Based on the flood consequences evaluation (Table 2), the proposed scheme passes three of the five criteria with an unclear result for the remaining criteria. This would indicate that, subject to suitable mitigations being agreed for the marae properties, and further consideration of floor-level impacts on a limited number of properties, **the consequences of the proposed stopbank are considered acceptable.**

## 5 References

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We have relied upon the following references in preparing this report:

- PDP (2025a) Assessment of Effects on Flooding for Proposed Porangahau Stopbanks (September 2025).
- PDP (2025b) Pōrangahau River: Design Model Build Report (DRAFT, 8<sup>th</sup> April).
- Te Tore o Puanga (2025) Pōrangahau Flood Resilience Project.
- <https://www.hbrc.govt.nz/hawkes-bay/projects/restoring-flood-resilience/porangahau/>, accessed 4/06/2025.

