Hawke's Bay Regional Council

Responses to Questions from the Hawke's Bay Independent Flood Review

Point of contact:
Matt McGrath
Legal Counsel
Matt.McGrath@hbrc.govt.nz

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

Contents

10	***To what extent has the Council considered non-market mechanisms to address the locations at which gravel is extracted and the amounts to be removed at each and will non-market mechanisms be part of any future initiatives to manage excess gravel build-up in rivers across the Region?***	**20**
11	***Please provide any information that explains how the extent to which this performance standard is being achieved is determined - using the Northern Schemes Assets as an example.***	**21**
12	***Please provide details of river mouth opening practices generally across the Region, with a particular emphasis on the Esk River, Wairoa River and Te Ngarue Stream and whether any works had been undertaken on these river mouths in the days leading up to Cyclone Gabrielle.***	**22**
13	***Please provide Council's assessment of what effect more open river mouths would have had on the flooding that occurred in the lower reaches of the Wairoa and Esk Rivers and the Te Ngarue Stream during Cyclone Gabrielle?***	**24**
14	***Please advise what, if any, future initiatives the Council has planned for managing river mouth opening practices/procedures to prevent impediment to river flows.***	**25**
Structural Assets		
15	***Please explain the rationale for the Super Design Contingency Plan for the Heretaunga Plains being taken out of the improvement plan.***	**26**
16	***Please advise what plans/systems the Council had in place for events that exceeded the capacity of the Heretaunga Plains stopbank system?***	**28**
17	***Please confirm the factual situation as to the extent of flood protection provided in this area [Waiohiki].***	**29**
18	***Subject to the response to 17. above, would the flooding experienced around the Waiohiki marae have been any different if flood protection up to the 1% AEP protection referenced in the HP-AMP had been in place prior to Cyclone Gabrielle?***	**30**

19	***Subject to the response to 17. above, what plans are in place for addressing the gap in the stopbanks at Waiohiki?***	**31**
20	***Please provide Council's assessment of whether and to what extent guidebanks/access tracks contributed to the failure of stopbanks on the Ngaruroro River, including details of the condition rating from last asset inspection of the Ngaruroro River stopbanks.***	**32**
21	***Please provide Council's assessment of why the Whirinaki Drainage Scheme failed below its agreed level of service.***	**33**
22	***Please clarify how long this stopbank had been below the design standard and the reasons why reinstatement/repairs had not been completed.***	**35**
23	***If this stopbank had been up to full design standard, would this breakout have occurred and what would the effects on the main river channel have been?***	**36**
24	***Please provide the Council's response to that suggestion and if it has any plans in that regard.***	**37**
25	***Please provide details of how the Council works with bridge asset owners to manage debris build-up removal and any information available on the state of debris at the railway bridge at Awatoto prior to Cyclone Gabrielle.***	**38**
26	***Please provide performance standards from any recent bridge resource consent applications and comment on how these may change in response to Cyclone Gabrielle.***	**39**
27	***Please provide details of how the overall capital works budget for flood management assets is determined.***	**40**
28	***Please provide details of any changes to capital works budgets that have been made, or are proposed across the Region in direct response to Cyclone Gabrielle?***	**41**
29	***What additional capital budget does the Council have/intend to enable capital works to address the effects of climate change?***	**42**

Flood response		
30	***Please provide further details on the Council's flood forecasting model including specifically how antecedent conditions are incorporated into the model's inputs and outputs.***	**43**
31	***Could you please clarify how the Council utilises MetService forecasts for decision-making and the role it plays in location-specific (e.g. Esk Valley) risk-based approaches?***	**44**
32	***If the MetService forecasted rainfall had been exactly what actually occurred, to what extent would the Council's flood forecasting model results have changed?***	**47**
33	***To what extent would the Council's flood management responses have been different if the flood forecast two days prior to Cyclone Gabrielle had been more aligned with what actually occurred?***	**48**
34	***What, if any, future initiatives are planned in this regard [flood warning systems]?***	**49**
35	***Please provide details of what evacuation trigger levels were used to inform and advise Civil Defence on evacuation requirements during Cyclone Gabrielle and what planning and analysis were used as the basis for this information.***	**50**
36	***Please provide details of the current back-up systems in general for pump stations in the case of power outages and any plans the Council has to improve them.***	**53**
37	***Please provide details of funding and investment in pump stations arising as a result of climate change.***	**54**
38	***Please comment on any observations to support the theory of the formation and failure of landslide dams in upper catchment areas and the extent to which/if this may have contributed to flood waves propagating downstream.***	**55**
39	***Please comment on any observations of maximum head build up at bridges that subsequently failed and the extent to which/if this may have contributed to flood waves propagating downstream.***	**56**

40	***Please provide details of any designated breach points on the Tutaekuri River stopbank system and whether instructions were issued to activate any of them during the Cyclone Gabrielle.***	**57**
Planning Controls		
41	***As a result of Cyclone Gabrielle, what, if any, consideration has the Council given to updating the Regional Policy Statement to provide a more directive framework that would avoid or limit residential/urban development in flood prone/high hazard areas?***	**60**
42	***In relation to flood prone/high hazard areas, what involvement has Hawkes Bay Regional Council taken when the Region's District Councils have notified their respective district plans?***	**61**
43	***Citing as many examples as possible, to what extent does the Hawkes Bay Regional Council become involved in land use and subdivision consent applications involving flood prone/high hazard areas?***	**63**
44	***Does the Council have access to any technical information that compares the erodibility of steep country in the Region's upper catchments and the respective downstream flood risks associated with pastoral farming, plantation forestry, and the retention/regeneration of native vegetation?***	**64**
45	***Please explain the existing controls available to Hawkes Bay Regional Council for managing agriculture and forestry activities in the Region, particularly in head water catchments and/or upper catchments, and the approach taken when such activities are proposed at scale.***	**65**
46	***Please advise any intended changes to existing controls for managing agriculture and forestry activity in the Region, particularly in head water catchments and/or upper catchments, to address the effects of climate change.***	**66**
Mana whenua		
47	***Using representative examples, please provide details of the formal and informal relationships the Council has with mana whenua organisations, at both the governance and operational levels.***	**67**

48	***Please provide details of if/the extent to which Council engages with mana whenua when planning and implementing flood protection and flood management activities?***	**69**
49	***Where Māori land was compulsorily acquired for flood protection purposes (for example at Waiohiki) to what extent did the subsequent works adequately protect Māori land and communities during Cyclone Gabrielle?***	**69**
50	***Feedback from Māori and the community is that Māori land and less prosperous communities are disproportionately underserviced in terms of flood protection and flood management activities. The Council is invited to respond to this criticism, including addressing the question of how the quantum of Council's investment in flood management activities is linked to rating policies.***	**71**
51	***Could the Council please explain if/the extent to which its flood management activities are influenced by the presence of wāhi tapu, mahinga kai, wai Māori and whenua Māori alongside and within rivers it manages?***	**7373**

Maintenance Issues

A common theme of feedback the Panel has received from the community concerns a perceived lack of maintenance in and around rivers and the Council's drainage network across the Region.

1. ***Please comment in general terms on the levels of maintenance across the Region's rivers and drainage network and provide Council's assessment of the contribution the levels of maintenance made to the magnitude and duration of flooding during Cyclone Gabrielle.***

In terms of river maintenance, which involves activities such as edge protection (trees, rope-and-rail, groynes, etc.) stop bank integrity, etc. the state of the system was in good shape, and any minor difference in state of maintenance would have had very minor difference in the resulting damage from Cyclone Gabrielle. In general, the scale and magnitude of Cyclone Gabrielle in most locations was extremely large and widespread, which eclipsed the design standards of the scheme. HBRC conducts many inspections every year, with clear documentation and photos. Any deficiencies are followed up with and corrected within reasonable timeframes. There were no outstanding maintenance issues that were lacking just prior to Cyclone Gabrielle.

On the other hand, the drainage network only serves local surrounding land, and does not cater for river flows, in particular overflows from the rivers to the drainage network. Since very little rain fell on the drainage areas, there were no specific issues that the state of the maintenance regime would have changed to make any difference to the outcome of the deluge – they were ultimately overwhelmed by flood waters of a magnitude that they were not designed to handle. For example, some pump stations failed to operate when they were overwhelmed and submerged by flood waters from rivers overtopping and breaching stopbanks, rather than being overwhelmed by the pooling water that they were designed to handle.

2. Please provide details of how the Council's annual budget for river maintenance is determined.

Budgets for all Council activities are initially set in the Long Term Plan approved every three years. In the intervening years Annual Plans update those budgets for any changes that have occurred. This can be for a variety of factors including; current state of the rivers, outcomes of annual inspections and future work programmes, as defined by the relevant Asset Management Plan.

The annual budget for planned maintenance activities is reviewed annually and adjusted in the Work Group contract and other contracts to reflect changing needs of the schemes. There is no specific calculation or allocated percentages of total values. Rather, needs are assessed annually. Changes to maintenance budgets are reflected in the Long Term and Annual Plans.

Additionally, all HBRC budgets are increased annually based on inflation factors provided by Taituarā and BERL. Where significant changes to an activity are proposed these are consulted on with the ratepayers before being included in plans.

Capital for new and renewal activities are provided for in the Asset Management Plans (AMPs), which are then used to build the Long Term Plan. Reviews of asset conditions are undertaken annually and help inform the renewals programme.

3. Please provide details of how the Council prioritises river maintenance activities across the Region.

Maintenance activities are organised through several planned maintenance programmes, which have been in existence for a number of years. Regular asset inspections are undertaken, and defects are noted, which drive a programme of reactive work. Prioritisation of reactive work is based on several factors, with consequence of the defect being the dispositive factor, as determined by the Engineering Officer.

There is no material deficit in maintenance tasks noted within the organisation. In 2021, HBRC initiated deployment of a new enterprise asset management system (TechOne), which represents a step change in maintenance management and go live of the first components is forecast for September 2024.

HBRC uses a multi-criteria analysis method to prioritise capital upgrades. A sample is shown below at Figure 3.1.

Criteria			Project Number	1		2		3		4	
Description	Range	Weighting	Site	Taradale		Moteo		Omaranui		Haumoana	
			Chainage	17-22-L		43b-47-R		23-41-R		1-4-R	
Consequence of Failure (Overtopping)		15	River	Tutaekuri		Tutaekuri		Tutaekuri		Lower Tukituki	
Value of Buildings & Property within 100m	10 - more than $10m0 - less than $100,000	3		0	0	0	0	0	0	0	0
Value of Economic Impact	10 - High 0 - Low	2		0	0	0	0	0	0	0	0
Number of People to be evacuated	10 - more than 100 0 - less than 10	4		0	0	0	0	0	0	0	0
Time for community to largely recover	10 - more than 2 year0 - less than 1 month	3		0	0	0	0	0	0	0	0
Reputational Damage to HBRC	10 - High profile site, will receive extensive coverage and enquir	1		0	0	0	0	0	0	0	0
Impact on Insurability	10 - If investigated and found to be sub-LOS insurers would defir	1		0	0	0	0	0	0	0	0
Archeological/Cultural/Recreational dama	10 - Areas of significant value likely to sustain irreparable damag	1		0	0	0	0	0	0	0	0
Consequence of Failure (Structural Breach		45									
Value of Property Impacted	10 - more than $500m0 - less than $1,000,000	8		0	0	0	0	0	0	0	0
Value of Economic Return Impacted	10 - High0 - Low	5		0	0	0	0	0	0	0	0
Damage to Key Infrastructure	10 - Inevitable loss of roads, bridges, bulk water/wastewater0 - I	5		0	0	0	0	0	0	0	0
Lives put at risk (people in the immediate b	10 - more than 1000 - less than 1	10		0	0	0	0	0	0	0	0
Time required to recover incl psychological	10 - more than 5 years0 - less than 1 year	4		0	0	0	0	0	0	0	0

Figure 3.1 – Sample multi-criteria analysis for asset maintenance prioritisation

The method is well-documented in literature, and HBRC uses a team of in-house staff and industry experts from consulting firms to develop the analysis and assign scores to the various criteria.

4. Please advise what plans the Council has /intends in order to quantify and fund additional river maintenance arising as a result of climate change?

HBRC is undertaking a programme of full reviews of all 25 of its river management and drainage schemes. This programme was funded through the 2021 Long Term Plan and is expected to be completed by late 2027. A list indicating the status of these reviews is shown at figure 4.1 below. The criteria for these reviews consider population growth and the effects of climate change on weather patterns and sea level rise, through to 2100.

As an example, Napier/Meeanee scheme review has been completed, and an additional $50m of capital upgrades have been incorporated into the draft 2024 Long Term Plan.[1] As scheme reviews are completed, the recommendations will be incorporated into Asset Management Plans and ultimately Long Term Plans. Councillors have been advised that material increases in scheme investment will be required as this work programme is completed.

HBRC has also secured additional funding to accelerate scheme reviews – prioritising the Heretaunga Plains Flood Control, Upper Tukituki Flood Control, Awatoto/ Brookfield Drainage and Pakowhai Drainage schemes as part of the North Island Severe Weather Funding Agreement with the Crown.

Any recommendations from the HBIFR will also be used as a justification to seek additional funding for climate change adaption in our river management and drainage schemes, as appropriate.

Reviews completed	Reviews underway	Reviews to be started
• Napier/Meeanee • HPFC Brookfields/Awatoto • HPFC Pakowhai	• Heretaunga Plains Flood Control • Upper Tukituki • Opoho • Ohuia/Whakaki • Wairoa Rivers and Streams/Nuhaka • HPFC Karamu and HPFC Raupare/Twyford*	• Upper Makara • Porangahau • Esk and Whirinaki* • HPFC Haumoana and Te Awanga - Maraetotara* • HPFC Muddy Creek • Paeroa • HPFC Puninga • Te Ngarue • Kairakau • Poukawa • Kopuawhara • Central and Southern • HPFC Tutaekuri Waimate/Moteo
* Two schemes addressed together in a combined review.		

Figure 4.1 – Status of HBRC Scheme Reviews

[1] HBRC is currently drafting the 2024 Long Term Plan for consultation. It is anticipated that it will be adopted later in the year.

5. ***Please provide details of any changes to maintenance plans that have been made, or are proposed, in direct response to Cyclone-Gabrielle***

HBRC is committed to taking a deliberate, well-considered and evidence-based approach to its response to Cyclone Gabrielle. Accordingly, changes to maintenance plans for existing infrastructure as a direct result of Cyclone Gabrielle have been limited to reactive activities to remediate damage or address other effects of the event. Outside of these necessary reactive changes, our independent scheme reviews will inform any substantive changes to our maintenance plans. We also look forward to the the recommendations from the HBIFR, which will inform these changes.

In terms of the changes that have been made in this respect, there has been some short-term reduction in maintenance to eliminate duplication with activities undertaken during response and recovery work. For example, the following activities were undertaken in direct response to the event and have therefore been unnecessary to subsequently attend to in accordance with our maintenance plan:

- drain desilting,
- edge protection work where edge protection was destroyed,
- floodgate maintenance, and
- pump reconditioning.

However, river and waterway channels are being resurveyed and assessed for inclusion in the annual channel excavation programme, following the initial silt clearing response, with priority work undertaken in the Wairoa and Northern Schemes. Upgrades have also occurred at Makara dams #1 and #4 and an associated desiltation programme is also being undertaken as a response to the Cyclone Gabrielle event.

Another common theme of feedback received from the community relates to a perceived lack of gravel extraction across the large gravel bed rivers of the Region. From the Panel's evaluation of available information (HBRC 2022-23 Gravel Allocation Report) the Waipawa River stood out as having a significant volume (1,452,000 m3) of excess gravel above the design grade line.

6. ***Please comment and provide all relevant data on the extent to which this excess gravel build-up in the Waipawa River contributed to the flooding that occurred through Waipawa during Cyclone Gabrielle.***

Anecdotal observations about gravel build-up causing higher river levels are not easily substantiated, since any build-up would likely be mobilised in the extreme events. It should be noted that river models used for forecasting and to analyse levels of service are all referred to as 'fixed bed models'. During the simulation runs, there is no mechanism to alter the bed levels in the computer models, therefore the predicted levels will always have an element of variation which cannot be resolved.

To examine the difference that may occur as a result of gravel build-up (or extraction), a computer simulation was done using a variation in the bed level assuming 50,000m^3 of gravel was extracted over a length of approximately 2.5 km. Results showed a decrease in water level of approximately 180 mm at the greatest point, tapering to 0 mm difference at distances away from the bed lowered section. An approximate average of 100 mm decrease could be concluded to result from the removal of 50,000 m3 of gravel. Results could vary depending on the details of the other parameters which affect river control, being slope, meander, bed material, roughness, depth and width, as are shown the following Figure 6.1.

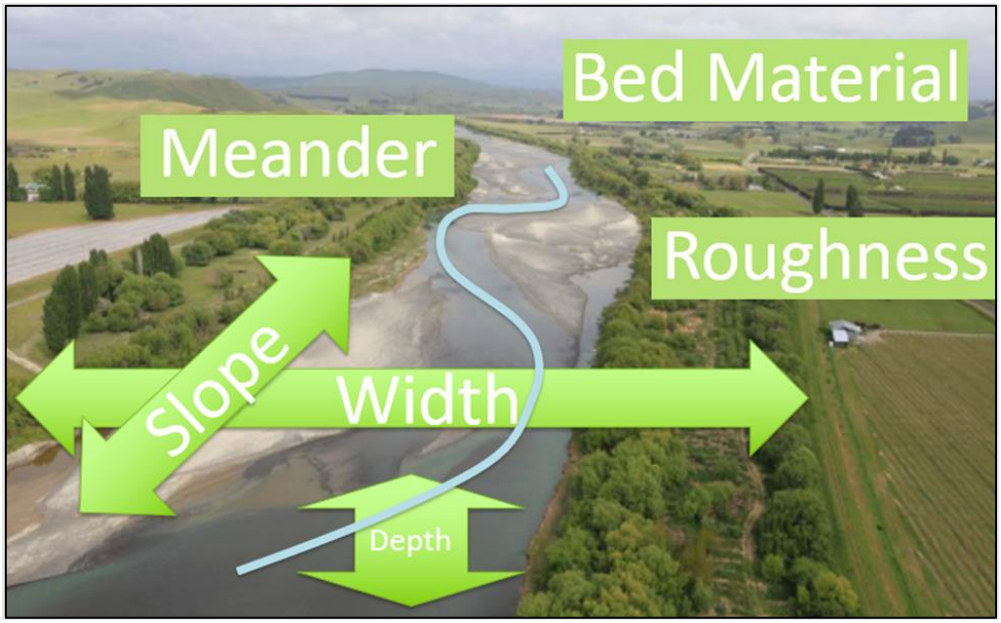

Figure 6.1 – Illustration showing the key variables affecting river control

The anecdotal observation of gravel build-up is also difficult to reconcile with a river in full flood. Consider, for example a deposit of gravel in the bed increasing the bed by 200 mm over a 40 m wide river. When the river is in flood, the top water width increases to around 300 m, so the effect of the gravel becomes less significant as the river depth increases. At lower flow conditions, a small build-up of gravel may have a large effect. However, this is not an issue since the increase in water level is still within the main channel.

HBRC monitors riverbed gravel and provide the mechanism for extraction, in areas where environmental conditions allow.

Based on our observations and analysis, the increase in gravel in the rivers was generally not in the locations where stopbank overflows or breaches occurred, such that a correlation could be drawn between increased gravel levels and the key mechanisms causing flooding (i.e. stop bank overtopping and breaching) during Cyclone Gabrielle.

HBRC staff presented to a Council gravel workshop on 7 Jun 2023 the following data on Waipawa River. Staff concluded that there was not a significant volume above grade from the section adjacent to the Waipawa township (where flooding occurred), as demonstrated in Figures 6.2 below to 6.4 below.

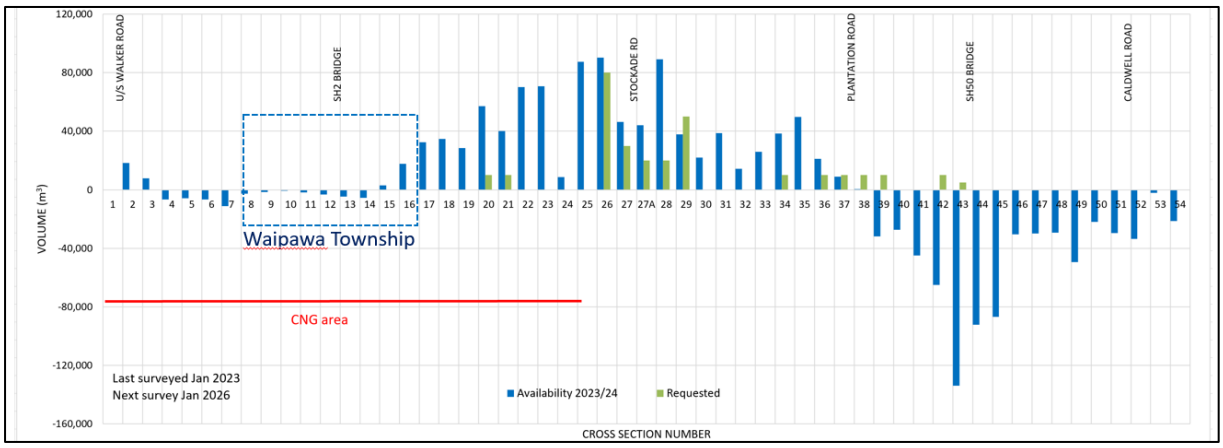

Figure 6.2 – Waipawa River Gravel Availability 2023-24

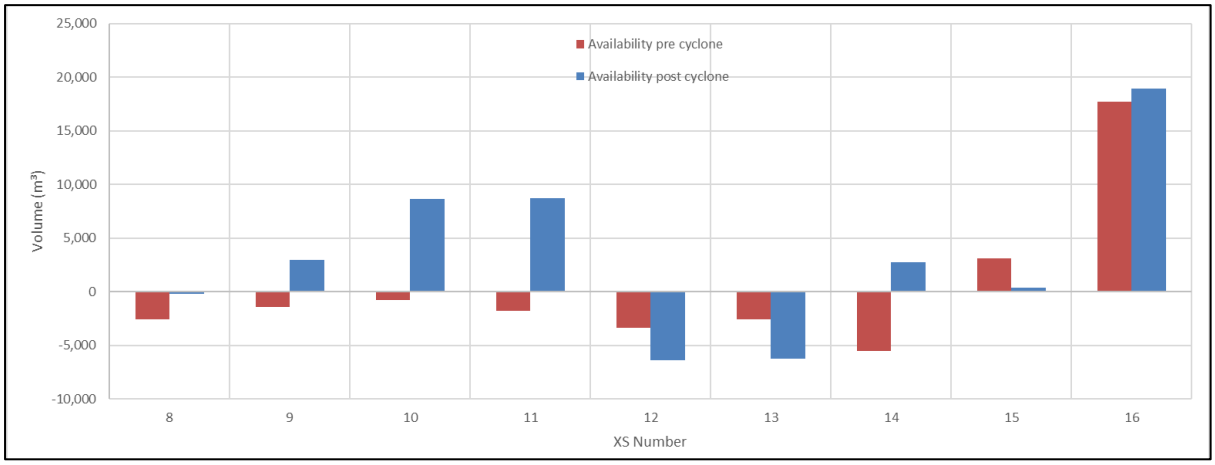

Figure 6.3 – Waipawa River gravel availability at Waipawa pre-cyclone vs post-cyclone

Note: While this graph shows the total movement in gravel (in m3) upstream and down stream of the SH2 bridge (Bench mark 12) - the total change in grade was 150mm.

It should be noted that, while in some sections gravel is above the current grade line, in other sections it is below the grade line.

It should also be noted, as was mentioned above, that any areas of gravel aggradation are many kilometres from the Waipawa township, were overtopping of stopbanks occurred. The width of Waipawa river diminishes significantly, from an average width of 160m to around 100m, just downstream of the township. This is more likely to have been a factor in containment of flood flows.

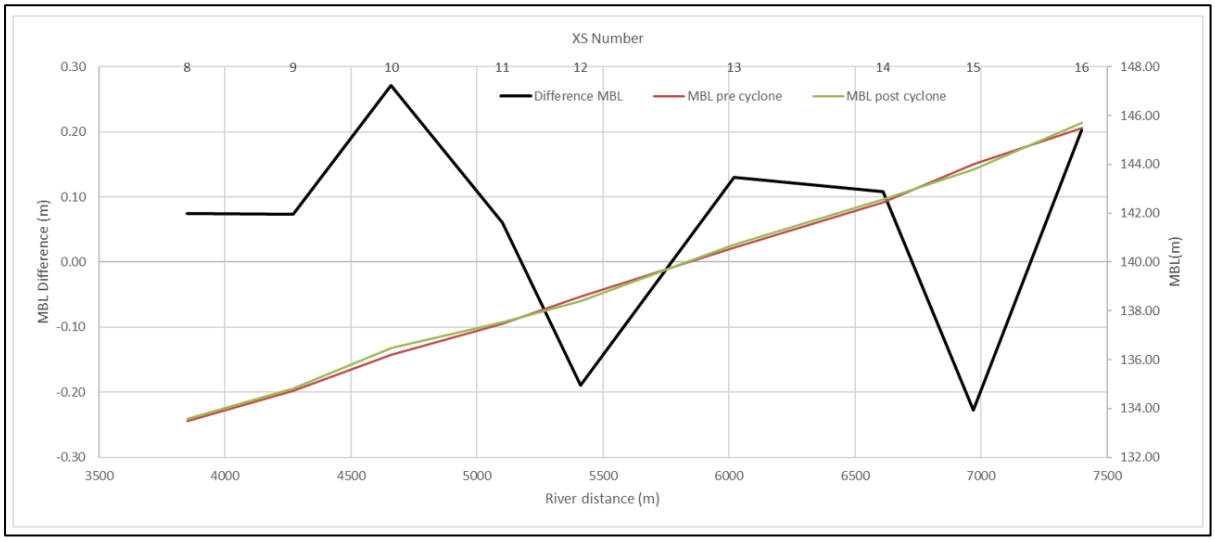

Figure 6.4 – Waipawa River - Mean Bed Level (MBL) at Waipawa; Comparison and Difference pre-cyclone vs post cyclone

Gravel extraction activities are undertaken by private contractors at no cost to the scheme. In fact, the scheme charges contractors \$0.8/m^3 to extract gravel within the Waipawa River. The general cost of gravel extraction is between \$5 - \$10/m, depending on beach size, location to hard standing, and length of extraction site.

The Upper Tukituki is dependent on private gravel extractors to extract gravel at their own cost. Given that the operating budget of the scheme is around \$700k per annum, the scheme would not be able to afford to pay extractors to extract gravel, without significant increases to the target rate.

Most of the areas of aggradation are in reaches of the rivers that are not attractive to private gravel extractors – in that the cost of extraction and cartage of gravel from these reaches isn't commercially viable.

If HBRC were to pay for the removal of the aggraded material in the Waipawa, the scheme would need to spend between \$5 - \$10m as a one-off cost and then around \$300k pa, which isn't viable for the scheme at its current revenue.

To address this issue, in 2021 HBRC developed a Crown-supported[2] programme for gravel extraction in the Upper Tukituki scheme. This involved a 64% contribution from the Crown, with a total value of \$8m over 3 years. This programme has enabled HBRC to directly contract gravel extractors and to pay them for extraction of gravel from non-commercially viable aggradation areas.

The graph at figure 6.6 below demonstrates the success of this programme through to the end of 2022. 800,000m^3 has been removed so far under this programme. By the end of 2024 we anticipate that over 1 million m^3 of gravel will have been extracted from the Waipawa and Tukituki rivers, with the majority extracted from the Waipawa.

[2] Through Infrastructure Reference Group (IRG) funding

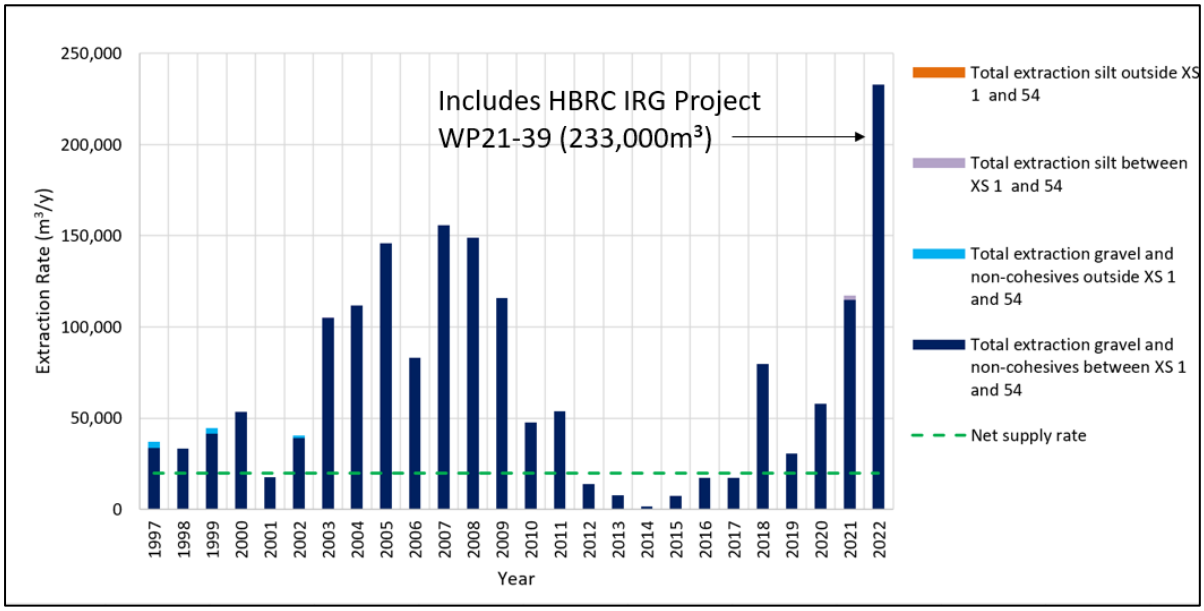

Figure 6.6 - Waipawa River Extraction History – 1997-2022

The programme was delayed for over a year due to the effects of Cyclone Gabrielle and the reprioritisation of resources. However, the programme restarted in 2024 and will continue into 2025.

7. What, if any, future initiatives are planned for managing excess gravel build-up in the Waipawa River?

As noted in the above question, HBRC has a partially Crown-funded programme for gravel removal which is targeting the removal of aggraded gravel in the Upper Tukituki scheme. This has recommenced in 2024 after delays resulting from Cyclone Gabrielle, and is due to continue into 2025.

Further, the River Managers' Special Interest Group, as part of Te Uhu Kahika, has been working with the Crown to extend the Crown-funded programmes across the sector. HBRC, in its submission, has requested a further 3 years of additional subsidised gravel extraction with the Upper Tukituki scheme.

The scheme review for the Upper Tukituki scheme, being undertaken by Tonkin + Taylor, has a provision for review of gravel management including a review of the current mean bed level. The outcome of this review may suggest a change in bed level, which may encourage further extraction.

With regard to gravel extraction within the Upper Tukituki scheme outside of the IRG programme, the extraction fee is discounted when compared to the rivers in the Heretaunga Plains.

We also note that the Controlled Area Notice (CAN) relating to Chilean needle grass that was in effect over areas of the Waipawa river, including in the vicinity of Waipawa, expired on 31 March 2024. This CAN placed conditions on the extraction of gravel, and we expect that its expiry will enable a greater level of gravel extraction from the Waipawa River for local use such as farm tracks.

8. What, if any, future initiatives are planned for managing excess gravel build-up in other rivers across the Region?

Gravel build-up requiring active management is primarily a feature of river systems with flood control schemes. This is a result of the confinement of the river channel focusing the deposit of sediment within the confines of the scheme, raising the mean bed level of the river. This effect may result in the lowering of the level of service of the scheme if the gravel level is not actively managed. Accordingly, initiatives to manage excess gravel build up are primarily focused on the controlled major rivers, namely the Tukituki, Ngaruroro and Tutaekuri rivers.

HBRC has a process for managing gravel thought our global consents for gravel extraction, which proves to be an effective approach to gravel management for the Ngaruroro and Tutaekuri Rivers. This requires regular surveying, the determination of sustainable gravel extraction volumes and the targeting of extraction of gravel from areas where gravel has aggraded.

However, for rivers in the Heretaunga Plains Flood Control Scheme, there has a been an historic process of overextraction. In many reaches, gravel levels are below the design bed level. As such, gravel extraction from these rivers is likely to decrease in coming years.

9. How does the Council respond to resource consent applications for gravel quarries outside of the active river channels and how does this affect Regional gravel supply?

Consent 'triggers' for quarrying gravel outside of riverbed (i.e. land-based quarrying) are in accordance with national regulations and/or regional rules (being discharge permits, water permits and occasional land use consent). Such quarries typically fall to territorial local authorities as the principal (land use) consent authority. HBRC may be involved in relation to impacts on groundwater, removal of vegetation (if in proximity of a waterway) and stormwater controls.

For land use consent applications that are publicly notified by territorial local authorities, HBRC has the opportunity to make submissions like any other person. Occasionally, HBRC might be considered to be an affected person in relation to a land use consent application. The TLA holds discretion as to who it considers to be an affected party for the particular circumstances of each resource consent application.

In HBRC's statutory advisory activities, HBRC often promotes/refers to HBRC Waterway Guidelines.

Land-based quarries are a way of managing gravel availability by contractors etc. HBRC doesn't get directly involved in supply and demand considerations. They have been established to ensure continuity of supply and will be used in combination with river sourced gravel to match demand.

10. ***To what extent has the Council considered non-market mechanisms to address the locations at which gravel is extracted and the amounts to be removed at each and will non-market mechanisms be part of any future initiatives to manage excess gravel build-up in rivers across the Region?***

HBRC considers that the market alone is an insufficient mechanism for managing gravel availability. Accordingly, we undertake market interventions such as the IRG-supported programme outlined in the answer to Question 6 above.

HBRC has also considered further non-market mechanisms for managing gravel at key locations. These include maintenance operations such as channel shaping, spraying and beach raking and ripping. There remains a cost to the scheme (recovered through targeted rates) in undertaking these activities.

Market-based gravel extraction, with appropriate intervention, is still considered the most cost-effective tool for gravel management. HBRC has been mindful that the traditional policy of removing gravel at no cost to the ratepayer has been of overall benefit to the ratepayer.

HBRC has also considered designing reaches to become transition zones. However, HBRC has not been confident that this will be effective. We note that this method was the primary form of gravel management in the upper reaches of the north stream of the Ashburton River and proved to be ineffective in the 2021 floods.

The following performance measure is included in the 2022-2023 Asset Management Contract:

> *B.7.3 Maintenance of Streams, Waterways and Channels*
>
> *Streams, Waterways and channels shall be maintained such that:*
>
> *e) Channel siltation does not occur to a depth of more than 150mm above the design invert or a straight line between the inverts of the nearest culverts upstream and downstream from that location. Culvert inverts are to checked against design invert levels, where these are available.*

11. ***Please provide any information that explains how the extent to which this performance standard is being achieved is determined - using the Northern Schemes Assets as an example.***

Whether this performance standard is being achieved is determined through a programme of regular inspections and surveys. Drains are re-surveyed as required and the new bed levels measured against baseline inverts.

The Northern scheme drains (Paeroa, Ohuia-Whakaki, Opoho, Kopuawhara and Northern Streams) are currently going through the process of resurveying and drain clearing. It is expected that this process will be completed by 2026.

Another common theme of feedback received from the community was that river mouths were partially blocked and consequently river flows impeded during Cyclone Gabrielle. The Panel notes that river mouth openings are not included in the scope of the Esk/Whirinaki Scheme nor the Northern Scheme that includes the Wairoa River.

12. ***Please provide details of river mouth opening practices generally across the Region, with a particular emphasis on the Esk River, Wairoa River and Te Ngarue Stream and whether any works had been undertaken on these river mouths in the days leading up to Cyclone Gabrielle.***

The Operative Regional Coastal Environment Plan applies to the opening (and closing) of a river mouth, lagoon or estuary by Councils. This is a permitted activity as per Rules 54 and 133, subject to compliance with five conditions. There is no direction in the rule on when a river mouth should be opened. This would be guided by operational considerations.

Operationally, river mouth openings are managed in accordance with the HBRC Lagoon and River Mouth Instructions 2021. We have included these instructions in the HBRC/HBIFR Share site for the Panel's consideration.

Assessment of whether an opening is required is based on operator observations of staff gauges at key locations in the relevant mouths. In some locations remote sensors (Waterwatch) are used to monitor the height of water in the mouths.

HBRC has provisioned through the draft 2024 Long Term Plan to install cameras at key locations to monitor and record the state of the river mouth.

The mouths of all key rivers and streams were assessed in the days leading up to Cyclone Gabrielle, with the Esk being assessed and photographed at around 5pm before the event. It is standard practice for operational teams to assess each key river mouth when there is a risk of flooding.

It was noted, that the Esk River was full, and the mouth was open. Blockage of the mouth likely occurred during the flood event itself with a strong easterly swell and accumulated woody debris.

It is also worth noting that during high intensity flooding events, flood conditions rapidly scour out river mouths for effective discharge. This was seen at the Wairoa River mouth and the Ngaruroro, Tutaekuri and Clive River mouths – particularly where the Tutaekuri created a new river mouth. Figures 12.1 and 12.2 below show those river mouths in the immediate aftermath of Cyclone Gabrielle.

Figure 12.1 – Wairoa River Mouth – 16 February 2023

Figure 12.3 – Tutaekuri and Ngaruroro/Clive River mouths – 16 February 2023

13. ***Please provide Council's assessment of what effect more open river mouths would have had on the flooding that occurred in the lower reaches of the Wairoa and Esk Rivers and the Te Ngarue Stream during Cyclone Gabrielle?***

River mouth inspections were undertaken in preparation for Cyclone Gabrielle. All, including Wairoa and Esk Rivers and the Te Ngarue were functioning well and the high flows over the previous months associated with Cyclone Hale and other rain events had assisted to maintain open mouths.

Operator observations demonstrated that the Esk mouth was fully open prior to the Gabrielle event. Blockages of the mouth occurred during the event itself, and given the forces involved (river flows and swell) were impossible to safely clear. Evidence from this location is that the quantity of trees and woody debris was significant (see Figure 13.1 below), which caused a massive block to the water escaping the lower reaches.

Water levels were likely increased by at least 1 m higher than what might be expected without the debris. Our engineering team have assessed that be extremely difficult to maintain an open river mouth at the Esk which would have prevented that amount of debris seen in Cyclone Gabrielle from causing a blockage.

Storm surge at least 0.6 m during the event was significant, and gravel movement which blocks the mouth is a constant issue that cannot be overcome within the budgets that would be expected for such a catchment. There is consented concrete dump site near the river mouth on private land that would likely influence or prevent a permanent wide opening to cater for the amount of debris during the event.

Figure 13.1 - Woody Debris build-up near Esk River mouth.

Evidence from the Wairoa River is that the condition of the river mouth had very little influence on the flooding in North Clyde. At the location where the overflow occurs in North Clyde, the ground elevations are approximately 10m above mean sea level. The variation in water levels at the coast range up to about 3m above mean sea level. This results in about 7m of elevation head of water at the North Clyde overflow point above the high point at the coast. This amount of elevation head is significant and will overwhelm the variation at the coast. As a corollary, blocking the mouth completely would not result in causing an overflow at North Clyde.

14. Please advise what, if any, future initiatives the Council has planned for managing river mouth opening practices/procedures to prevent impediment to river flows.

As noted in question 12 above, HBRC has provisioned budget for the addition of cameras to each of the key river mouths in the 2021 LTP over a ten-year period. Automated IOT sensors (Waterwatch) are being installed at key river mouths to monitor water levels.

A new SCADA system is currently being installed and these sensors will feed back to the Telemetry system. This will allow trending and alarming of river levels upstream of river mouths and will enable timely responses for mouth openings, where required. This is an acceleration of the planned 2021-2031 programme.

Structural Assets

Stop Banks

The following questions relate to planning for a flood event larger than the design standard of the current stopbanks.

A Super Design Contingency Plan is referred to in the Heretaunga Plains Flood Control Scheme 2021 Asset Management Plan (HP-AMP) - "Review and development of contingency plans for super-design events within the main river systems is to be undertaken as part of the super design flood review, following recommendations made in the report Super Design Flood Event (Beca 2000)" Pg 64 "Develop a Super Design Contingency Plan in accordance with the actions set out in the 2008 proposal" Pg 195. It was also noted on Pg 195 that the development of this plan was taken out of the improvement plan.

15. ***Please explain the rationale for the Super Design Contingency Plan for the Heretaunga Plains being taken out of the improvement plan.***

The recommendation to plan for super design events from the 2000 Beca report was developed into a proposed programme in 2008 (the super design flood review). That programme was included in the Asset Management Plan as part of the improvement plan in 2015. However, it was removed from the improvement plan in 2017. This did not necessarily reflect a decision by HBRC to not pursue super design contingency planning, only that it would not be pursued and funded as part of the asset management improvement plan.

We can find no record of the specific reasons for the decision to remove the programme from the improvement plan. However, there are records that show that the development of this plan would be particularly onerous, both in terms of financial cost and staff time, given the size and structure of HBRC's asset management team the time. Figure 15.1 below demonstrates that the programme was anticipated to consume the equivalent of 148 weeks of staff time. We think that it is likely that this project did not meet the threshold for funding in the LTP and consequently was removed from the AMP improvement plan, to be addressed by other means. However, we have subsequently restructured and grown the asset management team and contracted out key technical workstreams in order to achieve this required work programme. These changes commenced in 2018.

We note that the ongoing technical scheme reviews for the Heretaunga Plains and Upper Tukituki schemes will develop plans for managing super-design events, demonstrating HBRC's commitment to super design contingency planning outside of the previous super-design flood review.

Table 1 Super Design Flood Contingency Planning - Programme summary

Tasks	Staff Time (weeks)
Computer modelling and flow depth, velocity plots	82
Population and asset value maps for each scenario, risk and liability assessment	11
Identify preferred breach scenarios, re-entry points, model, and design	22
Pre-event planning options, hazard plans, designations, buildings, and land use criteria. Options for land shaping, private land controls	11
Cost / benefit assessments, activation protocol for controlled breaching. CDEM communications protocol	11
Public consultation, communications plan, flood manual updates and CD alert level	11
TOTAL	**148**

June 2008.

Figure 15.1 – Programme Summary of Super Design Flood Contingency Planning

16. Please advise what plans/systems the Council had in place for events that exceeded the capacity of the Heretaunga Plains stopbank system?

HBRC has produced flood extent maps (1999) with approximately 21 scenarios to account for events that exceed the capacity of the system. At the time of publication of that map series, Civil Defence was a more integrated part of HBRC, and the teams worked together to develop strategies associated with the exceedance scenarios. This was a period prior to widespread internet use, and approximately 100 sets of hard copy maps were produced and distributed to all agencies involved.

In more recent years, with the current Civil Defence structure centralised in the Hawkes Bay Civil Defence Emergency Management Group Office, the systems in place for dealing with such events involve HBRC working with Civil Defence agencies (local council Emergency Operations Centres (EOCs) and/or the Group Emergency Coordination Centre (GECC)) to advise on appropriate actions in accordance with those flood extent maps. As discussed in further detail below, this is broadly what occurred with respect to the overtopping of the true left stop bank of the Tutaekuri in the vicinity of Taradale on the morning of 14 February.

We also note that the scale and magnitude of Cyclone Gabrielle was such that it exceeded the capacity of the system by a significant margin. Plans for exceedance events had been discussed for many years, and responders would generally use the available resources to manage the events. It is also important to understand that an important aspect of the Heretaunga Plains Flood Control Scheme was that all areas had equal flood protection (of 1%AEP) such that no single area would be disadvantaged if a super-design event eventuated. Despite this concept, the reality is that when the capacity was exceeded by such a large margin, including above the freeboard (safety margin of stopbank height above the 1%AEP), certain areas were more vulnerable to the overflows. The concept of equal protection for all areas may be reviewed, such that a dedicated overflow or spillway area may be implemented, which may affect some areas more than others. Prior to any such action taken, public consultation will be required.

It was noted during the Panel's site visits and hui at Waiohiki marae that the Tutaekuri stopbank on the right bank upstream of Waiohiki Bridge stops at or about benchmark BM24R with no obvious high ground to the north of Victoria, Pentar or Ngati Hinewera Lanes. It appeared that this area was the source of significant flooding in this area.

17. Please confirm the factual situation as to the extent of flood protection provided in this area.

This portion of the scheme was constructed in 1989-92, and the design flood levels indicate that at all cross-section locations and all interpolated locations in this area, the 100-year flood level was below the high ground level (i.e. this location was adequately protected up to the 1%AEP event). This is shown in the following figure 17.1. The blue shaded area shows the extent of the 100-year flood level. Contours shown use NZVD16 datum.

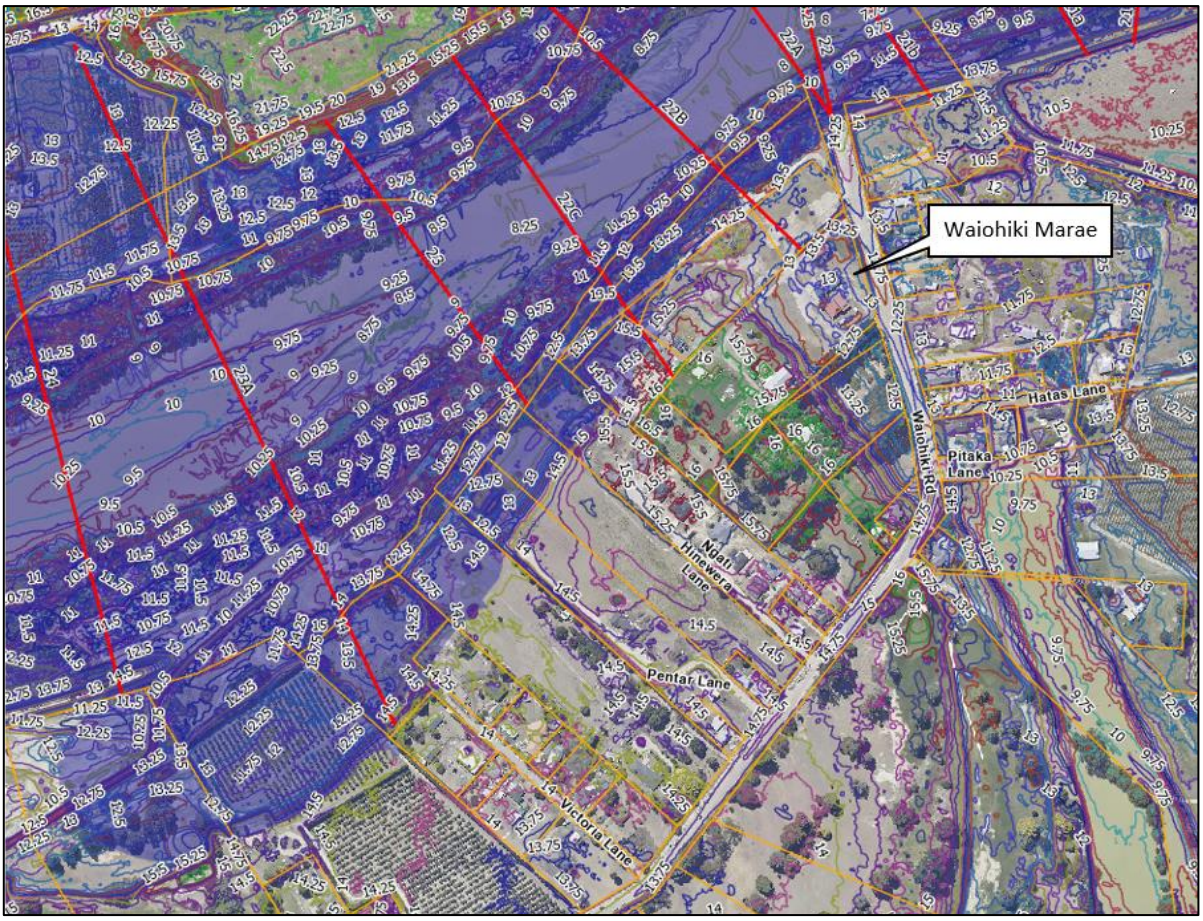

Figure 17.1 – 1:100-year flood extent in vicinity of Waiohiki

This area was subject to flooding during Cyclone Gabrielle. Two main causes for this flooding were that the flooding significantly exceeded the 1:100-year level and that debris at the Redclyffe Bridge created a damming effect, forcing water into the referenced area.

18. Subject to the response to 17. above, would the flooding experienced around the Waiohiki marae have been any different if flood protection up to the 1% AEP protection referenced in the HP-AMP had been in place prior to Cyclone Gabrielle?

As illustrated in Figure 17.1 above, this area was already protected to the 1%AEP. Based on the original analysis for the stopbank design, the referenced area was above the 1%AEP flood levels.

19. Subject to the response to 17. above, what plans are in place for addressing the gap in the stopbanks at Waiohiki?

Notwithstanding the fact that the referenced area is above the modelled 1:100-year flood levels, Cyclone Gabrielle demonstrated that this area is a relative weak point in the Heretaunga Plains Flood Control Scheme. This is due to its proximity to the bridge and because the high ground, while above the 1:100-year flood levels, appears to provide less freeboard above those levels than areas protected by stop banking. HBRC has therefore identified the need for better resilience at this location.

Accordingly, HBRC's negotiated funding agreement with the Crown for a programme of flood resilience works across the Hawke's Bay includes a co-funded sum of $10m, which is dedicated to works at Waiohiki.

Planned works at Waiohiki include a new stop bank from Redclyffe Bridge to the rear of Napier Golf Course and realignment of Upokohino Stream to accommodate the new stopbank. A schematic of the proposed works is provided at Figure 19.1 below. This project is presently in planning phase with site investigations complete and preliminary design underway. We anticipate that this project will benefit from the streamlined consenting pathway presented by the proposed Order in Council for Hawke's Bay Flood Works under the Severe Weather Emergency Recovery Legislation Act 2023.

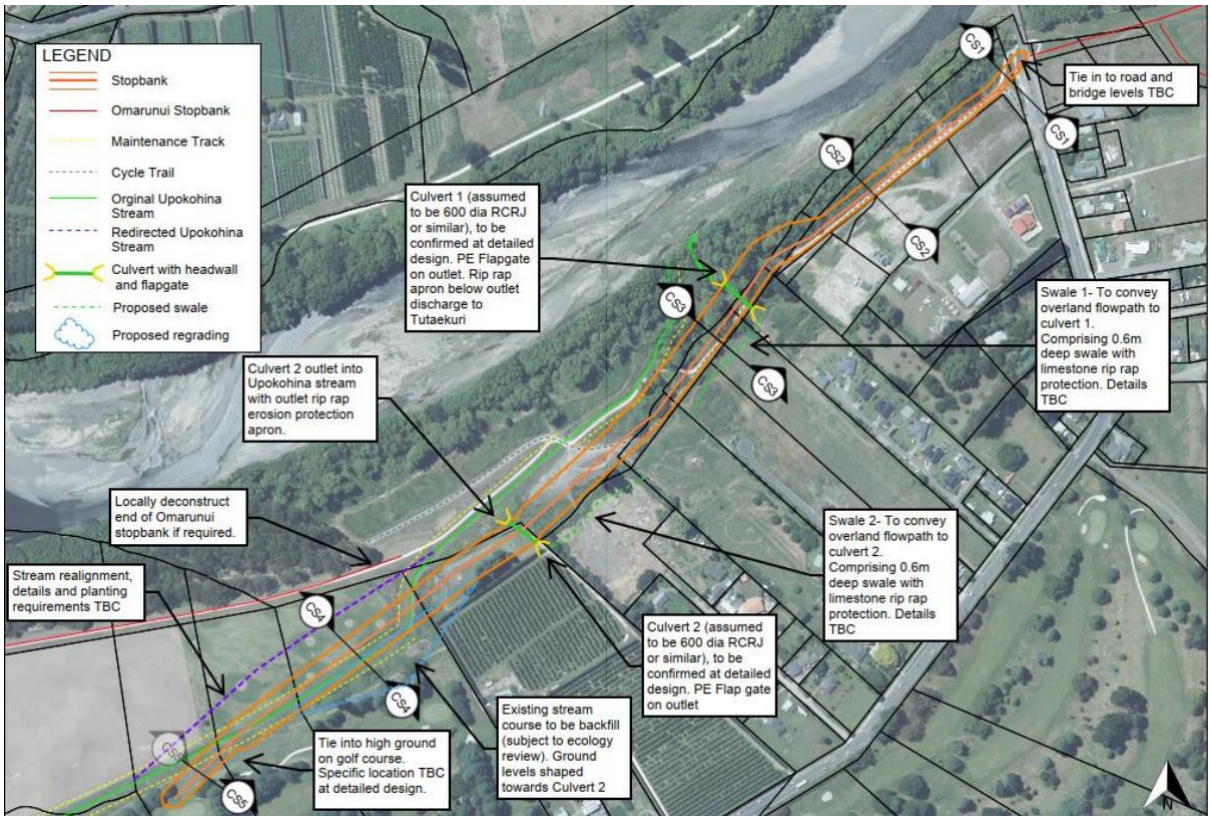

Figure 19.1 – Schematic of proposed works at Waiohiki

Another common theme of feedback from the community was that several stopbank breaches occurred on the Ngaruroro River where guide banks/access tracks were located on stopbanks.

20. ***Please provide Council's assessment of whether and to what extent guidebanks/access tracks contributed to the failure of stopbanks on the Ngaruroro River, including details of the condition rating from last asset inspection of the Ngaruroro River stopbanks.***

The fact that elements of the stopbank system such as access tracks and guidebanks result in increased water levels on the upstream side of the tracks, is known and accounted for in the design of the system. Freeboard is included to account for such variations. However, in key locations, flooding during Cyclone Gabrielle exceeded the design levels and the freeboard by a significant margin.

We note that Ian Heslop's contribution to the shared learnings report of the River Managers' Special Interest Group[3] made some observations and recommendations on this point. Recommendations for future design consideration included that access track ramps should go from downstream upwards and not the other way around, that stopbanks could be offset to allow for access ramps and that the use of deflection banks should be reviewed. These recommendations, combined with others from the HBIFR and scheme reviews will be taken into consideration in future maintenance and design work.

[3] A yet-to-be published report, made available to the HBIFR panel.

The draft information provided to date by NIWA suggests that Cyclone Gabrielle was around a 200-year flood in the Esk River. The Esk River & Whirinaki Drainage Scheme AMP states a 500+ year flood as the level of service for the Pan Pac/Contact Energy/Transpower site which was significantly flooded during the event.

21. Please provide Council's assessment of why the Whirinaki Drainage Scheme failed below its agreed level of service.

Our assessment, based on the revised NIWA data, is that the flooding at this location exceeded the level of service of this scheme

The analysis in the Esk Asset Management Plan was derived in 2013 (prior to 2018 and 2023 events) and showed the 500-year return period using a Gumbel Distribution for the Extreme Value Analysis was determined to be 1,340 m3/s. The estimated peak flow at Waipunga Bridge during Cyclone Gabrielle was 2,175m3/s. Note this value was estimated from peak levels during the event and includes silt and debris.

The current NIWA analysis presents an update using the additional data from 2013 to 2023, which include the 2018 and 2023 events, both extreme events. This new analysis updated the Extreme Value Analysis with new data to now show the 500-year event is considered to be 3970 m3/s using a Generalised Extreme Value distribution (i.e. a different distribution than that which was used in 2013 and prior).

However, we note that there is a very large margin of error on this present analysis from NIWA. We also note the significant upward curvature of NIWA's estimated flood frequency curve (as demonstrated in figure 21.1 below). We consider the present estimate in the NIWA report requires additional analysis before a direct comparison to the agreed level of service with this drainage scheme can be drawn. That work will be undertaken as part of the planned resilience works for the Whirinaki Drainage Scheme.

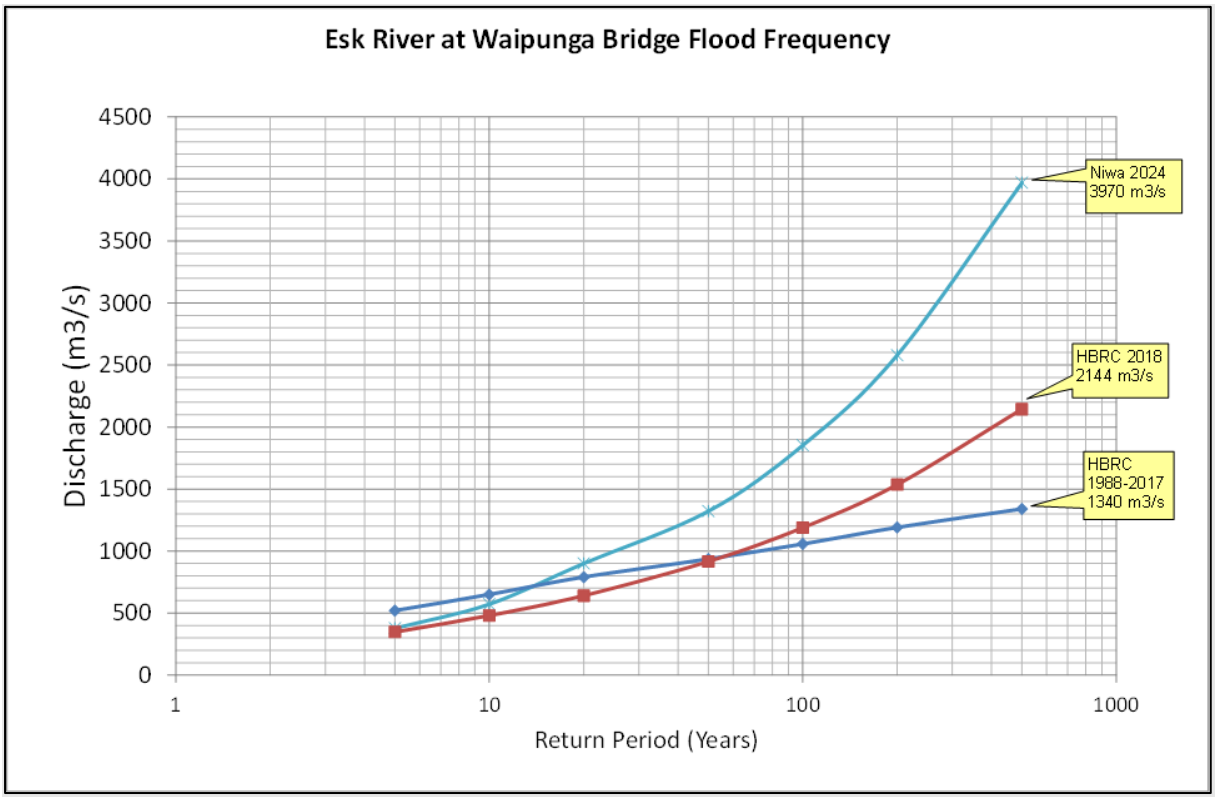

Figure 21.1 - Comparison of flood frequency curves

We also note that there was significant backwatering around the Whirinaki stopbank due to debris blockage of the Esk river at the mouth. Unlike many other stopbanks, the Whirinaki stopbank suffered very little

damage from overtopping. The primary damage to the stopbank was caused by the property owners breaching the stopbank to allow floodwaters back into the Whirinaki drain. This suggests the flow's velocities were exceptionally low and suggests the significant effect of backwatering. It is therefore impossible to draw a definitive conclusion about the return period of the flood event at this specific location as compared to the level of service of the stop bank, as many other factors were at play. A definitive conclusion in this regard would need to control for the effects of damming at the SH2 bridge and river mouth, the heavy easterly swell, significant ponding and backwatering in the lower catchment.

Civil Defence briefings reviewed by the Panel indicate that the Waipawa River stopbank at Walker Road was not at design standard prior to Cyclone Gabrielle. From information received from the community and the Panel's site visits, a significant breakout occured at this location, resulting in water flowing down the old course of the river (Papanui Stream).

22. Please clarify how long this stopbank had been below the design standard and the reasons why reinstatement/repairs had not been completed.

The inference taken from the Civil Defence briefings indicating the stopbank at Walker Road was not at design standard is not accurate. Rather, the comment was in relation to the river channel near the stopbank, not the stopbank itself. As with all rivers, the main channel migrates side to side during a flood. The occurrence of Cyclone Hale in January 2023 resulted in the main channel of the Waipawa River migrating towards the Walker Road stopbank. This was inspected by HBRC river engineers in January 2023, and it was determined that under normal conditions, the migrated river channel was not ideal. However, attempting to alter the migrated channel at the location would require considerable investment into the design and construction.

We understand the evidence collected after Cyclone Gabrielle indicates the failure of the Walker Road stopbank was likely due to seepage and erosion at the stopbank, as opposed to the migration of the river channel.

Further, analysis of the flood frequency on the Waipawa River in the NIWA report indicates the frequency of discharge in the Waipawa was in the order of greater than 1000 years, which was much greater than the design standard of 100 years (1%AEP). Based on these details, it is unlikely that any correction to the migrated river channel would have had any effect on whether the stopbank failed.

23. If this stopbank had been up to full design standard, would this breakout have occured and what would the effects on the main river channel have been?

The stopbank was up to the design standard of 100 years (1%AEP). The pre-cyclone return period of the event was calculated in the NIWA report to be approximately 1100 years. This far exceeded the capacity of the system, and we conclude that the breakout would have occurred regardless of the state of the system.

Feedback from the community suggests that it would be desirable to provide a controlled overflow (or low flow) provision into the Papanui Stream.

24. Please provide the Council's response to that suggestion and if it has any plans in that regard.

Providing a controlled overflow provision from the Tukituki system to the Papanui would require careful examination and comparison between the expected damage saved in the Lower Tukituki system versus the potential damage in the Papanui system.

This scenario is being reviewed as part of the Upper Tukituki scheme review, and a more definitive answer on the effectiveness of this approach will be addressed in the review.

Bridges

Debris loadings on bridges has been highlighted as a significant issue across the Region during Cyclone Gabrielle and appears to have contributed to stopbank breaches, particularly at Awatoto.

25. ***Please provide details of how the Council works with bridge asset owners to manage debris build-up removal and any information available on the state of debris at the railway bridge at Awatoto prior to Cyclone Gabrielle.***

Observations during the cyclone indicate large debris build-up on bridges, and failures of assets upstream of these locations. Computer modelling of the river system with and without particular bridge blockages confirmed this.

It is custom and practice within the sector for the owner of an asset in a river to be responsible for its maintenance. As such, the maintenance of bridges, including the removal of debris from bridge piers, lies with the owner – whether a private landowner, NZTA, KiwiRail or the relevant TA.

Under law, HBRC is not able to operate within 15m of a KiwiRail bridge.

There is an expectation that the asset owner will undertake sufficient inspections to ensure that their assets are operating effectively. Where significant debris have accumulated over time on a bridge pier, and the relevant asset owner has not undertaken any maintenance, HBRC will contact the owner regarding the condition of their assets.

With regards to the rail bridge at Awatoto, HBRC are not aware of there being a build-up of debris on this bridge pre-Gabrielle.

26. Please provide performance standards from any recent bridge resource consent applications and comment on how these may change in response to Cyclone Gabrielle.

The erection and placement of structures such as a bridge is a discretionary activity under Rule 69 of the Regional Resource Management Plan. The Plan provides broad discretion over the matters that can be considered and covered in conditions. We don't have any specific design performance standards in the Plan or any specific referenced best practice design documents.

Applications are required to be submitted with the associated design calculations and design plans and levels. The assessment is expected to address the effects of the proposed structure, such as on river dynamics, bed or bank scour/erosion, flooding, and passage of flood flows and debris. Recent examples of consented bridges can be provided if required. In these examples the proposed bridge levels exceeded the estimated 1 in 100 yr event flow level. These designs were reviewed as part of the consent process by HBRC engineers or consultant engineers. Other aspects of design are also considered, including the width and orientation of the proposed bridge and need for erosion and scour protection.

Consent applicants will need to have regard to changes in design flows and levels post-Cyclone Gabrielle. For example, we are currently considering an application by Hastings District Council for the replacement bridge at Puketapu. The design is currently being reviewed by HBRC engineers but is based on modelling that takes into account Cyclone Gabrielle flows and levels. The new bridge will be significantly higher than the old bridge, and higher than the reported Cyclone Gabrielle flood levels. The design also considers the need to pass debris under the bridge.

Capital works on flood management assets

27. Please provide details of how the overall capital works budget for flood management assets is determined.

The Capital delivery programme starts with the 30-year infrastructure strategy, where focus has been on meeting the needs of growth, changing land use, adapting to climate change, and anticipating any new standards or policy direction from Government.

The capital programme is built within the relevant AMPs, which reference the infrastructure strategy and look at provisioning for capital development to meet level of service requirements within the scheme.

Scheme reviews are performed at regular intervals to assess the level of service that the scheme is performing to and make recommendations for change to scheme assets to better meet the needs of the community. This flows into the AMP which further flows into the LTP.

Prior to Cyclone Gabrielle as part of the 2021-31 LTP, HBRC initiated a full review of all schemes over a 6-year period. The expectation is that this will be completed by 2027. The full list and status of these reviews is shown below at Figure 27.1 below (which is the same as Figure 4.1 above)

Renewal works for each are defined and phased by the relevant AMP and are scheduled into the relevant LTP, for delivery.

Reviews completed	Reviews underway	Reviews to be started
• Napier/Meeanee • HPFC Brookfields/Awatoto • HPFC Pakowhai	• Heretaunga Plains Flood Control • Upper Tukituki • Opoho • Ohuia/Whakaki • Wairoa Rivers and Streams/Nuhaka • HPFC Karamu and HPFC Raupare/Twyford*	• Upper Makara • Porangahau • Esk and Whirinaki* • HPFC Haumoana and Te Awanga - Maraetotara* • HPFC Muddy Creek • Paeroa • HPFC Puninga • Te Ngarue • Kairakau • Poukawa • Kopuawhara • Central and Southern • HPFC Tutaekuri Waimate/Moteo
* Two schemes addressed together in a combined review.		

Figure 4.1 – Status of HBRC Scheme Reviews

28. Please provide details of any changes to capital works budgets that have been made, or are proposed across the Region in direct response to Cyclone Gabrielle?

Capital budgets have changed significantly since Cyclone Gabrielle. The land categorisation work has required HBRC to create a capital programme to improve flood resilience in 7 new communities. Furthermore, additional capital is required in the Awatoto and Pakowhai drainage schemes to upgrade and improve the resilience of 3 pumpstations. The total budget for this work has been costed to $250m.

As noted above, scheme reviews are being undertaken on all schemes and it is highly likely that there will be recommendations for new capital investment to improve resilience and meet the changes in service performance (i.e. overdesign event management). The exact details will be seen in the recommendations from the reviews.

Provision has also been made to renew assets which fall below the post Gabrielle 1%AEP level of service criteria. The details of this renewal programme will be worked on over the coming months.

Council officers have signalled to councillors that significant increases are likely over the next 30 years to respond to Cyclone Gabrielle and Climate Change. These will be progressively included in Asset Management Plans and future Long Term Plans.

29. What additional capital budget does the Council have/intend to enable capital works to address the effects of climate change?

The effects of climate change and our response to them are being assessed through HBRC's programme of scheme reviews. The expectation is that a recommended Capital delivery plan will be produced as part of the reports which will identify works required to mitigate against the effects of climate change.

As an example, prior to Cyclone Gabrielle, HBRC commissioned the Napier/Meeanee scheme review, which reviewed how the Napier/Meeanee scheme would meet a 1%AEP level of service in 2050 and 2100, considering climate change (primarily sea level rise) and population growth. This review recommended a $50m capital investment programme over the next 10 years. This has been incorporated into the draft 24-27 Long Term Plan.

Flood Response

The performance and accuracy of the Council flood forecasting model is a key part of informing and prioritising flood response activities. Feedback received from the community indicates that the months leading up to Cyclone Gabrielle had been particularly wet (not least due to Cyclone Hale in late January 2023) and it is likely the groundwater levels and base flows in rivers were elevated above "normal" levels.

30. ***Please provide further details on the Council's flood forecasting model including specifically how antecedent conditions are incorporated into the model's inputs and outputs.***

The forecasting models incorporate antecedent conditions by using previous rainfall values continuously. The model stores a value for soil moisture in a field called the 'Lower Root Zone'. Water is added to this field from rainfall and is converted to discharge in the river as a function of the amount of water in the lower root zone. Wet antecedent conditions will result in a high value in the lower root zone variable and will result in higher runoff.

The forecasting system also has a component referred to as 'Data Assimilation', whereby the forecast river level values are updated with actual levels, such that the model predictions are improved during an event since the state of the river is known to the model (albeit with a 1 hour delay, as that is the time it takes for the data to be transferred from the sites through the telemetry system and for the models to be run). The data assimilation assists with the forecasts in the upcoming 3-8 hours, but the accuracy degrades significantly over longer times.

We note that during Cyclone Gabrielle, many critical instruments for the forecasting system were either destroyed or rendered offline due to technical outages. This had a major impact on the flood forecasting system, and use of the flood forecasting system was halted on the night of the cyclone. Manual observations were sought where possible and safe to do so.

31. Could you please clarify how the Council utilises MetService forecasts for decision-making and the role it plays in location-specific (e.g. Esk Valley) risk-based approaches?

The MetService forecasts are critical to the HBRC's flood response. HBRC receive a gridded forecast (which predicts rainfall for the coming 84 hours) for every rainfall site. This data is downloaded automatically from MetService and is available to view in the software Council uses (Hydrotel). A sample is included in the following Figure 31.1, showing rainfall at a variety of sites in Wairoa.

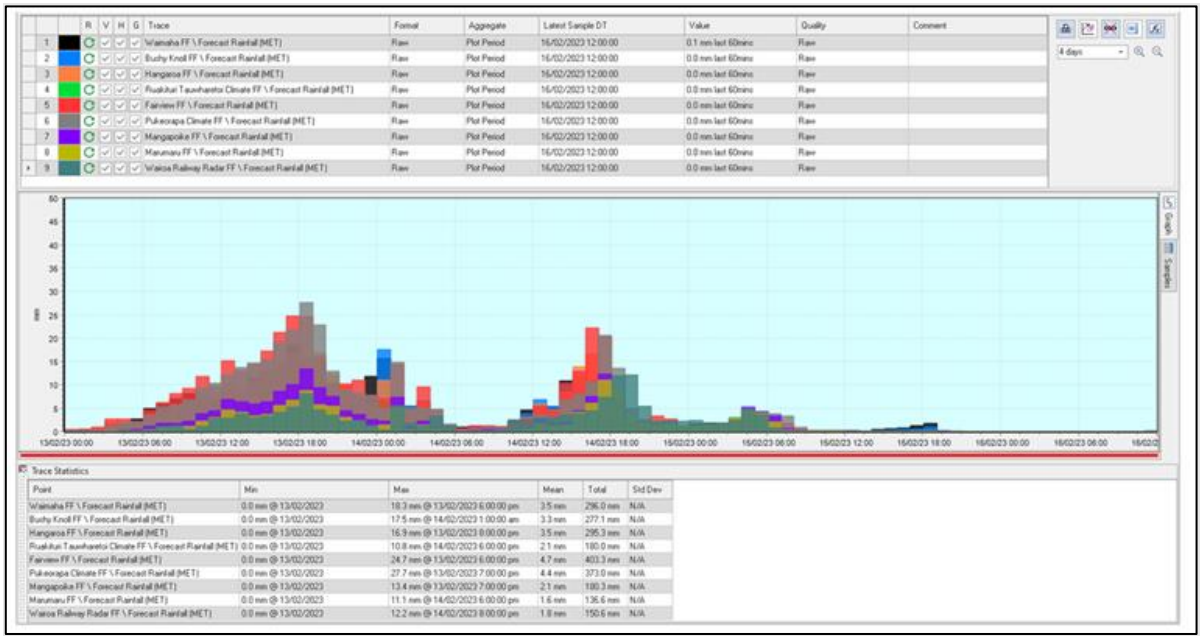

Figure 31.1 – Example Hydrotel entry showing Wairoa rainfall sites

The data from the rainfall forecast is input into the river level forecast models. At the time of Cyclone Gabrielle, HBRC was in the process of upgrading the forecasting system. Wairoa was complete in the new system, while Ngaruroro, Tutaekuri and Tukituki (Upper to Lower) were still available in the existing system. Rainfall is input to the Wairoa model automatically, while the older system required manual input of forecast rainfall.

HBRC also receives textual forecasts from MetService, an example of which is shown at Figure 31.2 below.

Area: Hawke's Bay
Valid: 21 hours from 10:00am Mon 13 Feb to 7:00am Tue 14 Feb
Forecast: Expect 250 to 350 mm of rain in the ranges and the eastern hills south of Napier, possibly up to 400 mm in the Ruahine Range, and 100 to 150 mm elsewhere. Peak intensities of 10 to 20 mm/h in general, but 25 to 40 mm/h about the ranges this evening and overnight Monday.

Figure 31.2 – Example MetService textual forecast

This forecast is examined in comparison to rainfall return periods to determine how significant the rainfall is likely to be, and how widespread the coverage area may be.

HBRC also use a subscription service called MetConnect, a service from MetService which provides a variety of additional weather-related forecasting products. One specific product is the Modelled Forecast Fields, an example of which is shown in Figure 31.3 below.

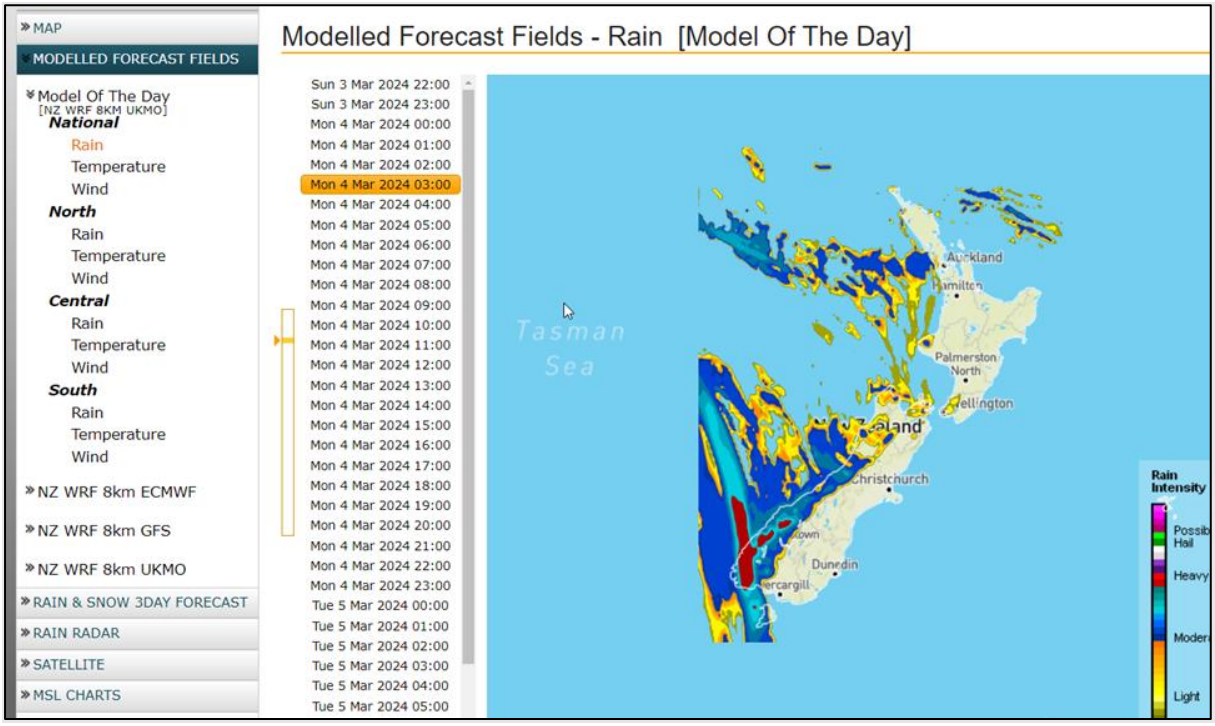

Figure 31.3 – Example of MetService Modelled Forecast Fields product

This product provides hourly forecasts from 3 different MetService products. MetService provide their advice by identifying the 'Model of the Day' which they consider to be the most accurate forecast. HBRC flood forecasters examine all three models, however, we always have in the past used the Model of the day forecasts based on MetService advice.

Regarding the Esk catchment, the forecast for the Esk appeared to be underestimated in part of the mid and lower catchment, and well estimated in the upper portion. We note there can be, and was, a difference in the textual forecast as compared to the gridded forecast. The example provided below shows the warning as issued at 3:15pm Monday February 13, indicating 250-350 mm rainfall in the hills south of Napier (Esk is north of Napier), and 100-150 mm elsewhere (which includes the Esk).

> *SEVERE WEATHER WARNING*
> *Issued by MetService at 3:15 pm Monday 13-Feb-2023 {MEDIA} Cyclone Gabrielle to bring widespread significant severe weather to northern and central parts of New Zealand*
> *==========*
> *HEAVY RAIN WARNING - RED*
> *==========*
> *Area: Hawke's Bay*
> *Valid: 21 hours from 10:00 am Monday to 7:00 am Tuesday*
> *Forecast: Expect 250 to 350 mm of rain in the ranges and the eastern hills south of Napier, possibly up to 400 mm in the Ruahine Range, and 100 to 150 mm elsewhere. Peak intensities of 10 to 20 mm/h in general, but 25 to 40 mm/h about the ranges this evening and overnight Monday.*

The gridded forecast provided for approximately 280 to 300 mm of rain in the Esk Catchment over the 21 hour period. Actual rainfall turned out to be approximately 520 mm in the Esk Catchment. HBRC flood forecasters were reacting to the larger gridded rainfall forecast amounts in the Esk (i.e., working on what was considered the worst case scenario), noting that 300 mm rainfall in 21 hours is approximately a 50-60 year event. This was considered to be a significant event, and preparation was already taking place for evacuations of the vulnerable areas. The 100-year flood hazard area map was transmitted to CDEM to show the potentially vulnerable areas,

again to account for what was considered to be a worst case scenario. The final result of over 500 mm rainfall had a return period far in excess of 100 years, and together with the silt and debris in the water far exceeded any forecast flood extents.

32. If the MetService forecasted rainfall had been exactly what actually occured, to what extent would the Council's flood forecasting model results have changed?

HBRC maintains three separate models for flood forecasting, covering:

1. The Wairoa River and its tributaries,
2. The Ngaruroro, Tutaekuri and Mangaone rivers, and
3. The Tukituki (Upper, Middle and Lower) and its tributaries in the Upper Tukituki Flood Control Scheme.

In many parts of these catchments, the MetService forecast rainfall was very close to actual rainfall and the model results were similar to observations.

However, where significantly more rain fell than forecast, if the forecast rainfall was exactly as occurred, a much different forecast model would have resulted (bearing in mind, that the models also include assumptions dealing with the amount of runoff derived from the rainfall). For example, a major portion of non-forecast rainfall occurred on the Okawa catchment, leading to the Ngaruroro River above Fernhill. Forecast river levels on the Ngaruroro would have been much higher if this rainfall was input to the model.

These river forecast models are not 2-dimensional floodplain models that show flood extents over large areas. Rather, the models are single-channel river models that predict levels in the river, assuming no breaches or overtopping. Once simulated water is in the river model, it will travel down the system and exit at the sea. This will not account for the losses that occurred due to overtopping or breaches, and thus result in higher values in the lower reaches than would have occurred.

Despite that limitation, the models are also self-correcting at the water level gauges, once the observed levels are assimilated back in the model (i.e. the forecast improves as the flow is moving down the system). It should be noted that there is still a large margin of error associated with modelling very high flows, due to the inherent non-linearity of the rainfall to runoff process. River levels forecast several days in advance which are based solely on forecast rainfall will have a large margin of error. The accuracy of the forecasts increases greatly when some rain has fallen in the upper catchments, and the actual water level measurement are combined with the forecast rain to produce forecast water levels in the lower parts of the catchments. This is valid for short time periods, in the range of around 3 to 8 hours depending on the length of the catchment and time of concentration.

We also note that if HBRC received a rainfall forecast of the exact rain that did fall, a significantly different level of escalation would have occurred in the CDEM response preparation. The return periods for some major catchments have been calculated as being between 500 to 1000 years, and this event involved almost every catchment in Hawke's Bay. If such knowledge had been available, river forecasting models would have been only a small component of the response, since the knowledge of 500-to-1000-year return periods would already indicate extreme river levels will ensue, and a much higher level of escalation would have taken place.

33. To what extent would the Council's flood management responses have been different if the flood forecast two days prior to Cyclone Gabrielle had been more aligned with what actually occured?

We have to assume, for the purposes of this counterfactual, that we did not know the actual location of overflows or breaches on rivers with flood control schemes. The seemingly random nature of stopbank breaches results in planning with trigger levels as an impossible task, as the variables that cause the breaches are not known beforehand.

If the knowledge had been available that significant high river flows were to be occurring based solely on a forecast, the flood forecasts would likely have warranted a recommendation to evacuate all areas such as Flaxmere, Clive, Twyford, Pakowhai, Taradale, Napier, Awatoto, Brookfields, Waiohiki, Puketapu, Moteo, Dartmoor, Rissington, Esk, Te Ngarue, Waipatiki, Aropaoanui, Wairoa, North Clyde, Ohuia, Nuhaka, Opoutama, Mahanga, Kaiwatau Road, Waipawa, Waipukurau, Porangahau (and likely other locations).

This would potentially have captured upwards of 100,000 people.

Actioning evacuations is the responsibility of Civil Defence Emergency Management agencies, in coordination with other agencies such as FENZ and New Zealand Police. However, the input from the HBRC Flood Forecasters would be required to identify areas that were unlikely to flood, as well as safe access and egress routes. The scale of such an undertaking would be well beyond the resources that HBRC had to be able to provide answers within a short time.

If we had advance knowledge that such an event was to occur, there would need to have been a request for significant assistance from external resources. There would be no possible way that the current resources of flood management response would be able to cope with such an event, and we think it is unlikely that additional resources would have been available within the timeframe to significantly have changed the approach to the response on this occasion, particularly noting that many other regional councils and unitary authorities were also significantly impacted by the event.

We note that evacuation plans generally follow an initial procedure of 'be prepared'. We believe HBRC was sending many signals that this event was likely to be very large. As it happened, the event was still significantly larger than we had foreseen.

Feedback from the community is critical of the Council for not having an accessible flood warning system available to the public.

34. What, if any, future initiatives are planned in this regard?

We note that the responsibility to provide, maintain, control, and operate warning systems sits with the Hawke's Bay Civil Defence Emergency Management Group in accordance with section 18(2) of the Civil Defence Emergency Management Act 2002. HBRC inputs, particularly our telemetry systems and flood forecasting products, would plainly be critical to any such system. However, it is unlikely that HBRC itself would lead any such initiatives that result in warnings of hazards being *pushed* to the public.

There is significant planning at present, including working with the National Flood Warning Steering Group, to enable common platform flood warning alert systems to be developed and installed at all participating councils. MetService has also expressed an interest in being involved in this project.

A critical component of the improved service is that it should be enabled such that resources from neighboring councils could be made available during large scale events. We note that flood forecasting is a specialist task for which councils generally struggle to recruit and maintain suitable staff. Councils generally have only a couple of people who fulfil these roles, which makes implementation and continued improvement difficult.

However, HBRC is reviewing our approach to the provision of public-facing information to ensure that it is of maximum use to the users. We note that feedback we receive from users of a public system, i.e., river levels shown on our website, are that just seeing some number on a chart does not mean much to most people. The users need a context of the severity of the forecast, and the implications to different areas. This is only achieved by careful interpretation of the river level forecasts from the specialist staff who are familiar with various ground levels in relation to river levels. However, we note that other Councils' public facing rivel level information (for example Horizons Regional Council) have a greater ability for the public to subscribe to receive alerts directly via text message or email. HBRC is looking at whether such an ability may be appropriate to roll out for Hawke's Bay.

We finally reiterate that power and equipment outages during the night of Cyclone Gabrielle did render our telemetry system ineffective, and HBRC resorted to manual observations relayed back to others to make informed decisions. This would also have affected a publicly available alerting system.

It is noted that the Council's Flood Response Manual (2015) has no information on evacuation trigger levels for any of the rivers within the Region. From reviewing the timeline and communications logs evacuation warnings appeared to be fairly ad-hoc during Cyclone Gabrielle.

35. ***Please provide details of what evacuation trigger levels were used to inform and advise Civil Defence on evacuation requirements during Cyclone Gabrielle and what planning and analysis were used as the basis for this information.***

HBRC has historically taken the approach of providing bespoke advice on flood extents and recommendations for evacuations catered for the event in question. Rather than trigger points being pre-set, the trigger for providing evacuation advice has been the expert assessment of HBRC's flood forecasters. That assessment is based on flood modelling, MetService forecasts, antecedent conditions, the observed levels of rivers, etc. An explanation of how evacuation advice was developed during Cyclone Gabrielle is provided below.

We note that this approach is consistent with that taken by most other regional councils and unitary authorities. Most approaches, as ours, appear to rely on using available data and resources at the time to make provide appropriate advice.

While they would not necessarily have made a difference to the approach taken during Cyclone Gabrielle, HBRC acknowledges that having more formalised trigger points included in our Flood Manuals would be an additional tool to assist in the tendering of timely evacuation advice to Civil Defence agencies. We will consider this improvement as part of our overall response from the recommendations of the Government Inquiry and independent review into the cyclone response and anything to this end included in the HBIFR's recommendations.

We note that there is always a need to consider the best course of action before a warning or evacuation notice is given, rather than triggers automatically prompting evacuation. Accordingly, HBRC input to Civil Defence is always in the nature of advice, and the best course of action will not necessarily be issuing an evacuation order or warning. Evacuations undertaken at the wrong time can result in people increasing their chance of harm if they move from relative safety into more dangerous situations. Our advice is for Civil Defence agencies and emergency services, who can consider the advice in context and make fully-informed decisions with regard to evacuations and warnings.

Approach during Cyclone Gabrielle

In areas where there are flood protection schemes, particularly stop banks, evacuation advice was based on any concerns about the integrity of the relevant infrastructure or in the anticipation that the level of service of the scheme would be exceeded. Notably, it was not anticipated by HBRC's flood forecasters that the level of service of the schemes would be exceeded. So, advice was informed by observed river levels and observations of the performance of the infrastructure. For example, during Cyclone Gabrielle, the advice to evacuate Taradale was given when it was observed that water was just flowing over the stopbank near EIT. That became the natural trigger point, decided upon at the time using available resources and knowledge. Forecasting of the flood extent for that scenario was produced in the 1999 Super-Design flood strategy report, which informed the advice to Civil Defence agencies.

Given that it is not possible to predict in advance where and how schemes will fail in super-design events, applying a formalised trigger point would necessarily result in evacuation advice being given before levels of service are exceeded and capture various breach scenarios. During Cyclone Gabrielle, this may have resulted in unworkable advice to evacuate swathes of the Heretaunga Plains, highlighting the need for the advice to be filtered through Civil Defence agencies before being formalised into evacuation orders and warnings.

Where no flood protection exists, such as in Esk, Rissington and Te Ngarue, evacuation recommendations are initially based on weather and HBRC flood forecasting. The most at-risk areas such as low-lying areas of Esk Valley, were identified well in advance. Advice on forecast flood extents, including the need for evacuations at places like Shaw Rd, Hukarere Girls School and the Eskdale Holiday Park, was given to Civil Defence agencies in the days leading up to the event.

This approach was constantly monitored, and updates were provided using river level warnings. Such an update occurred during Cyclone Gabrielle when it became evident that rainfall was exceeding MetService forecasts and therefore also exceeding HBRC's flood forecasts. When the Mangaone at Rissington reached the 20-year (red) level, with further rainfall expected, Civil Defence agencies were advised of the need to evacuate that area. Similarly, when the Esk River reached levels beyond forecast the advice was updated and eventually it was determined that it would be "best to consider that any house in the Esk Valley may be at risk".

For Wairoa, HBRC had previously produced a series of flood maps which provide the details relating to the water level recorder at the Railway Bridge in relation to the flood extents that may occur in North Clyde, i.e. trigger levels that would indicate the need for evacuation. Each map contains a hydrograph with a line indicating the current state of the water level at the Railway Bridge, as well as the modelled flood extents which shows the depth of flooding according to the legend. Two examples are shown at Figure 35.1 below, with the left-hand image showing no flooding occurring in North Clyde when the level at the Railway Bridge has just reached the RED warning level. The right-hand image shows flood extents associated with the level at the Railway Bridge above the RED level.

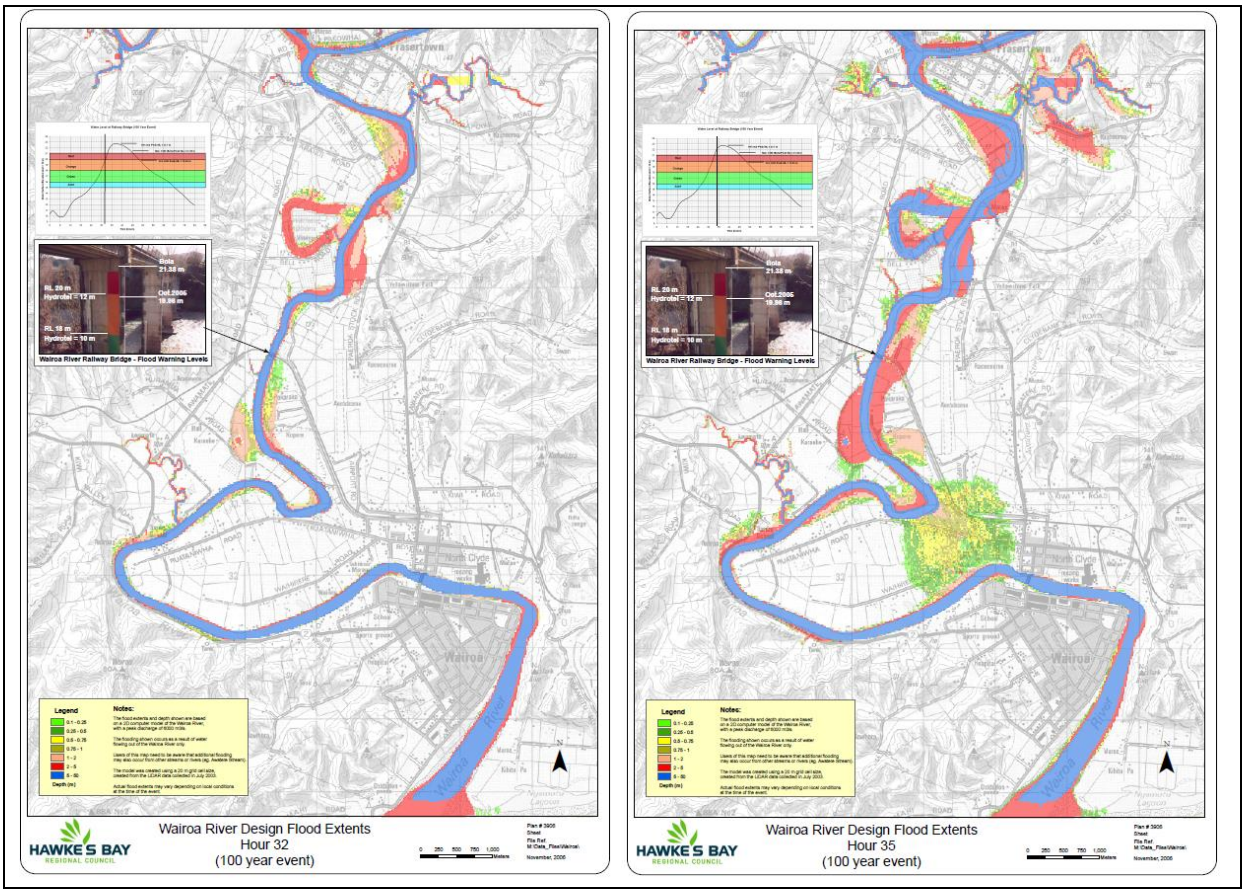

Figure 35.1 – Example Wairoa Flood Maps

Shortly after HBRC produced these maps, presentations were made to Wairoa District Council staff, Councillors, and CDEM staff. Many booklets of the maps were made and distributed to appropriate staff. The intended use involved referencing anticipated flood levels from the forecasting system and conveying that

information to appropriate staff such that, for example, the expected flooding could be stated as being similar to the map showing Hour 35. This would enable CDEM agencies or other staff to make decisions on appropriate evacuations.

We note that during Cyclone Gabrielle, three distinct issues arose which hampered the use of this system, or otherwise made the system not become as effective as it may have been. Firstly, in the eastern catchment of Wairoa, significantly more rain fell than was forecast by MetService. For example, at Fairview, the MetService forecast was for 235 mm of rain, and the measured rainfall was 449 mm. Pukeorapa was similar with a forecast of 230 mm, and observed rainfall of 381 mm. The forecast river levels using the MetService forecast rainfall resulted in lower river levels than what was observed, and the out of channel flow through North Clyde was not forecast by HBRC flood forecasters. Secondly, at a critical time, communications with Wairoa were either completely cut off or severely hampered such that no updated data was available, and no discussion could be had with on-site observations from staff in Wairoa, and therefore no updates could be readily provided to assist with updated forecasts. Thirdly, due to extremely high workload on HBRC flood forecasters staff during Gabrielle, resources were allocated to catchments such as Esk, Mangaone, Tutaekuri and Ngaruroro, where high river levels and stopbank breaches were becoming life-threatening. Since forecast rainfall was not indicating any significant flooding in Wairoa, the forecasting team anticipated that area would be unlikely to have significant immediate life-threatening issues.

A consistent theme from the community's feedback was that the performance of pump stations during Cyclone Gabrielle was clearly affected by the widespread power outage and in some cases complete innundation of the stations occurred – one example, of many, being at Haumoana.

36. Please provide details of the current back-up systems in general for pump stations in the case of power outages and any plans the Council has to improve them.

HBRC owns two mobile generators (150kva and 400kva) and has an agreement with Napier City Council with regard to provision of up to 8 mobile generators within the Napier/Meeanee scheme.

HBRC further owns 6 tractor mounted pumps of various sizes (300 – 750l/s) and 2 skid mounted 6'' diesel pumps which can be used to temporarily augment or overpump from pumpstations. HBRC's Works Group maintains the pumps and is trained and experienced in their provisioning and operation.

HBRC also has commercial relationships with a generator services company and a mobile pump supplier to provide pumps and generators, on a hire basis, rapidly in response to an event.

Finally, agreements are in place with large local farming enterprises to use tractors and pumps in rural catchments in the case of pump failure.

HBRC is reviewing its provisioning of back-up systems and is taking a holistic view, where new pumpstations (such as the 3 new pumpstations in Pakowhai and Awatoto) will be resilient to power or pump failure through redundancy and dedicated generation.

37. Please provide details of funding and investment in pump stations arising as a result of climate change.

This has been answered in question 29, particularly with regard to the Napier/Meeanee scheme and the pumpstations associated with this scheme. Further, as addressed in question 4, all schemes are undergoing a programme of scheme reviews which will assess the current level of service of the scheme, which will include consideration of funding and investment in pump stations. This will take into account population growth and the effects of climate change and will develop a series of capital programmes to allow the schemes to meet their level of service into the future.

It is expected that the pumpstations associated with these scheme reviews will feature in these capital programmes, where they will need to be upgraded to maintain a level of service with regard to climate change and population growth or change.

The three pumpstations that form part of the HBRC Flood Resilience Programme, Pakowhai, Brookfields and Mission, had already been part of a review and assessment against an enhanced level of service which takes into account the effects of climate change. The enhanced level of service will see them move from a rural drainage level of service (32mm/ha/d) to an urban stormwater level of service (2% AEP).

A number of eye-witness accounts suggested sudden "waves" of flood water occurred where levels rapidly rose and then subsided.

38. ***Please comment on any observations to support the theory of the formation and failure of landslide dams in upper catchment areas and the extent to which/if this may have contributed to flood waves propagating downstream.***

We have no specific evidence of this occurring. While it is difficult to comment with any certainty as to this occurring during Cyclone Gabrielle without commissioning specific investigation or analysis, we agree that the failure of landslide dams is a valid theory to explain this observed phenomenon.

39. Please comment on any observations of maximum head build up at bridges that subsequently failed and the extent to which/if this may have contributed to flood waves propogating downstream.

There is ample evidence showing debris build-up on bridges contributed to increased water levels on the upstream sides. As the bridges failed, the flood wave travelling downstream would then release the additional water and cause further water level increases downstream.

The panel has been told about a "spillway" on the right bank of the Tutaekuri River and that there had been some intention of mechanically breaching it during Cyclone Gabrielle.

40. Please provide details of any designated breach points on the Tutaekuri River stopbank system and whether instructions were issued to activate any of them during the Cyclone Gabrielle.

No controlled breaching of stop banks occurred during Cyclone Gabrielle.

Details of the only designated breach point in the Heretaunga Plains Flood Control Scheme are available on Pages 110 and 111 of the Heretaunga Plains Asset Management Plan, as snipped at figure 40.1 below. Figure 40.2 shows the approximate location.

The Tutaekuri River has one section of cement stabilised stopbank at Cross Section right bank 19 + 300, located in a position which is able to provide a controlled overflow to the Tutaekuri-Waimate area.

This may be activated at times when there is a risk of a breach on the left bank which may flood Taradale and Napier.

Figure 2-7: Tutaekuri Section 19+300 – cement stabilised detail

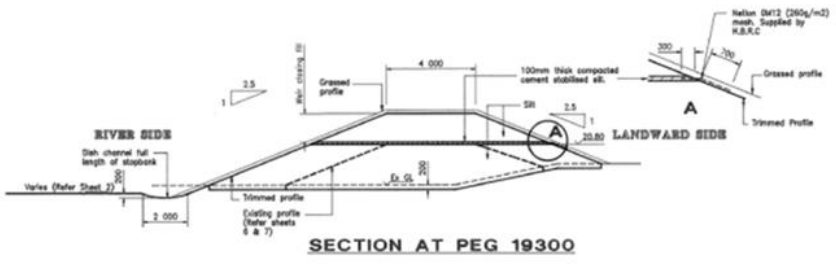

Figure 40.1 – Extract of Heretaunga Plains Asset Management Plan detailing a designated breach point

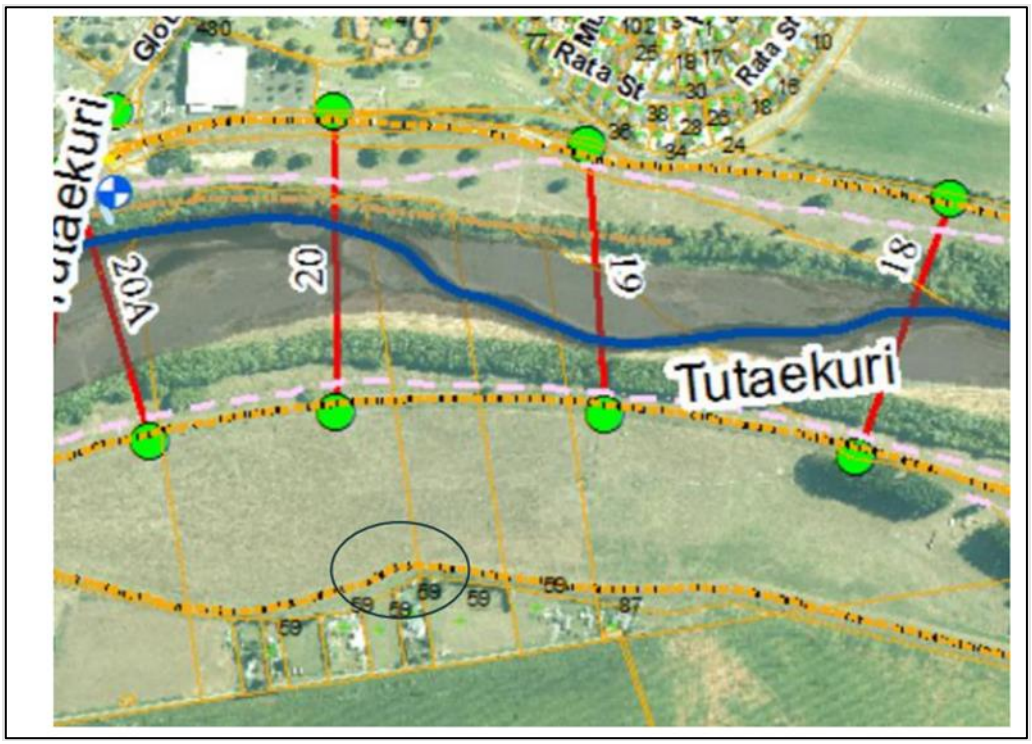

Figure 40.2 – Approximate location of the designated breach point

During Cyclone Gabrielle, when it became evident that there existed a significant threat to Taradale, an excavator was instructed to mobilise to this location, with the intention for HBRC to provide further instruction on whether to enable the controlled breach to occur. Due to accessibility constraints, the excavator and operator did not reach the site.

We note that if a breach were to have been enabled, the effect in Pakowhai would have been minimal, accounting for only a very small proportion of the flooding that actually occurred. An estimate is that the overflow rate from the controlled breach would have been in the order of 20 – 40 m3/s for a short time, causing ponding in the lowest parts of Pakowhai of about 300 mm, whereas the flooding to depths of 6 m in Pakowhai was the result of perhaps 1000-2000 m3/s of river flow from multiple uncontrolled breach locations for many hours.

Indeed, post event analysis has shown that water which escaped the right bank of the Tutaekuri at Waiohiki was actually flowing back into the river near the location of the designated breach site, as shown in the following figure 40.3.

Figure 40.3 – Photos showing water flowing back into the Tutaekuri river at the approximate location of the designated breach site

While HBRC confirms that there was an intention to move plant to the location during Cyclone Gabrielle to enable the option of a controlled breach at the designated breach site, we note that it is unlikely that a decision to undertake a controlled breach would have been actioned. This is because since the designated breach point was installed, residential development has been undertaken adjacent to the applicable section of stop bank.

The appropriateness of this option continuing to feature in the asset management plan will be reviewed by HBRC in light of the findings of this review.

Planning Controls

41. As a result of Cyclone Gabrielle, what, if any, consideration has the Council given to updating the Regional Policy Statement to provide a more directive framework that would avoid or limit residential/urban development in flood prone/high hazard areas?

Prior to Cyclone Gabrielle, HBRC had commenced a review of the Regional Policy Statement and its regional plans. Our work programme was configured to prepare a combined document branded as the "Kotahi Plan". RPS and plan preparation had commenced pre-Cyclone. However, as a result of the priority of cyclone recovery work and various other factors, HBRC is now progressing RPS preparation ahead of regional plan content. The RPS focuses on identification of key issues and options.

Modernising the RPS provisions for natural hazards was already a priority for HBRC. One option under consideration for the RPS is indeed a more directive approach for control of land use activities to avoid or mitigate significant risks of some types of hazards. No decisions on preferred options have been made yet. We would welcome the HBIFR's recommendations in this respect.

National direction in the form of Government Policy Statements or National Policy Statements (other than the New Zealand Coastal Policy Statement) are notably absent. NPSs for flood management and natural hazard decision-making have been attempted over past decade or so, but none are in effect. A 'Climate Adaptation Act' has also been hailed as delivering some assistance; but such a Bill is still yet to emerge.

The Hawke's Bay Regional Coastal Environment Plan (RCEP) already identifies coastal hazard zones (erosion and storm surge inundation) with associated Coastal Hazard Zones and land use controls. Accordingly, something similar for flooding hazards would not be entirely precedent setting.

However, the RPS is not the regulatory instrument per se. It would set an intention for the organisation to take a more directive approach. That approach would need to be given effect in regional plans and district plans. We note that Regional Plans cannot control subdivision, pursuant to sections 30-31 of RMA. Accordingly, HBRC's ability to take truly directive approach to determining where residential/urban development takes place is ultimately limited by our statutory role.

Meanwhile work continues on preparing the Napier-Hastings Future Development Strategy ('FDS') as per the National Policy Statement for Urban Development. HBRC is jointly responsible for preparing that FDS with Napier City Council and Hastings District Council. The FDS is building on earlier urban growth strategies for the Heretaunga Plains. All of these successive growth strategies have used best available information on natural hazard-related constraints to inform preferred settlement patterns for residential and urban development. Change 4 to the operative RPS was notified in December 2011 and took effect in January 2014. Notably, Change 4 inserted Chapter 3.1B into the RPS. That chapter features policies that identify locations considered suitable and unsuitable for future greenfield residential developments. Those locations arose from the 2010 Heretaunga Plains Urban Development Strategy prepared jointly by NCC, HDC and HBRC.

42. In relation to flood prone/high hazard areas, what involvement has Hawkes Bay Regional Council taken when the Region's District Councils have notified their respective district plans?

HBRC takes an active approach to our involvement in the development, notification, and amendment of district plans, by providing advice and information to the territorial authorities. This occasionally involves HBRC making submissions on proposed plans/plan changes. This 'active advocacy' is consistent with Policy 55 of the HB Regional Resource Management Plan, the relevant extracts (relating to flooding, in particular) of which are provided below at Figure 42.1.

3.12 Natural Hazards

ISSUE

3.12.1 **The susceptibility of the region to flooding, droughts, earthquakes, volcanic ash falls, and tsunami, and the potential impact of these on people's safety, property, and economic livelihood.**

OBJECTIVE

OBJ 31 The avoidance or mitigation of the adverse effects of natural hazards on people's safety, property, and economic livelihood.

Explanation and Reasons

3.12.2 Flooding and droughts are the most recurrent natural hazards in Hawke's Bay, but the region also has a history of earthquakes, volcanic ash falls and tsunami. Each of these is briefly discussed below.

Flooding

3.12.3 Within Hawke's Bay, there is widespread potential for flooding. Individual rainfall events causing flooding that can range from localised downpours affecting particular catchments, to cyclonic storms causing general flooding over large parts of the region. Considerable flood protection works have been carried out in the region, particularly on the Heretaunga and Ruataniwha Plains. These works have significantly reduced the risk from most flood events. However, very large events exceeding flood protection design standards can be devastating to normally protected areas. Indeed, measures taken to reduce the flood risk, such as river control works and post-disaster relief, can actually increase the catastrophic potential of large floods because they enable an increased occupancy and level of development within flood plains. To be truly effective flood protection works must be undertaken in conjunction with better land use planning, and adequate and timely flood forecasting.

POL 55 ROLE OF NON-REGULATORY METHODS

3.12.10 To use non-regulatory methods set out in Chapter 4, as the principal means of addressing hazard avoidance and mitigation, in particular:

(a) **Liaison with territorial authorities**[12] **-** To provide information on natural hazard risk to territorial authorities, and advocate that future development is managed in such a way that the risk of exposure to natural hazards is avoided, remedied or mitigated.

(b) **Works and services -** To provide hazard mitigation measures, in particular flood mitigation measures, where the benefits can be shown to outweigh the costs and the identified beneficiaries can meet the costs.

(c) **Natural hazard priorities -** To focus both hazard avoidance and mitigation on areas of high human population density as a first priority.

Explanation and Reasons

3.12.11 Policy 55 sets out the role of the HBRC in providing information to territorial authorities, providing works and services where these are cost-effective, and prioritising natural hazard responses as the principal means of addressing natural hazard avoidance and mitigation. This policy recognises the need for an integrated approach by territorial authorities and the HBRC to address land use planning and service provision with the view of minimising the risk and impact of natural hazards. The HBRC will provide hazard mitigation measures (e.g. stopbanks for flooding) where the benefits outweigh the costs, and the costs can be recovered from those who will benefit from the works. Furthermore, the HBRC will, as a first priority, focus hazard avoidance and mitigation on the areas of high human population density (e.g. cities and towns) as these areas are likely to experience significant effects on people's safety and economic livelihood as a result of a natural hazard event.

ANTICIPATED ENVIRONMENTAL RESULTS

Anticipated Environmental Result	Indicator	Data Source
Natural hazard mitigation measures in place to minimise the risk to human safety and the environment from natural hazards	Loss of life and property in a natural hazard event	Emergency services records

Figure 42.1 – Extracts of Regional Resource Management Plan

A notable example of such advice was that in 2013 HBRC presented a flood hazard map of the Esk Valley to HDC and NCC. The map was a worst-case scenario, showing flood extents from an event beyond the 50- or 100-year return period events. This map is shown below as Figure 42.1, and it is noted that it matches almost exactly the extents of flooding during Cyclone Gabrielle (apart from the area near Pohutukawa Drive that flooded during the event, but which we believe was exacerbated by the debris and logs which blocked the river mouth).

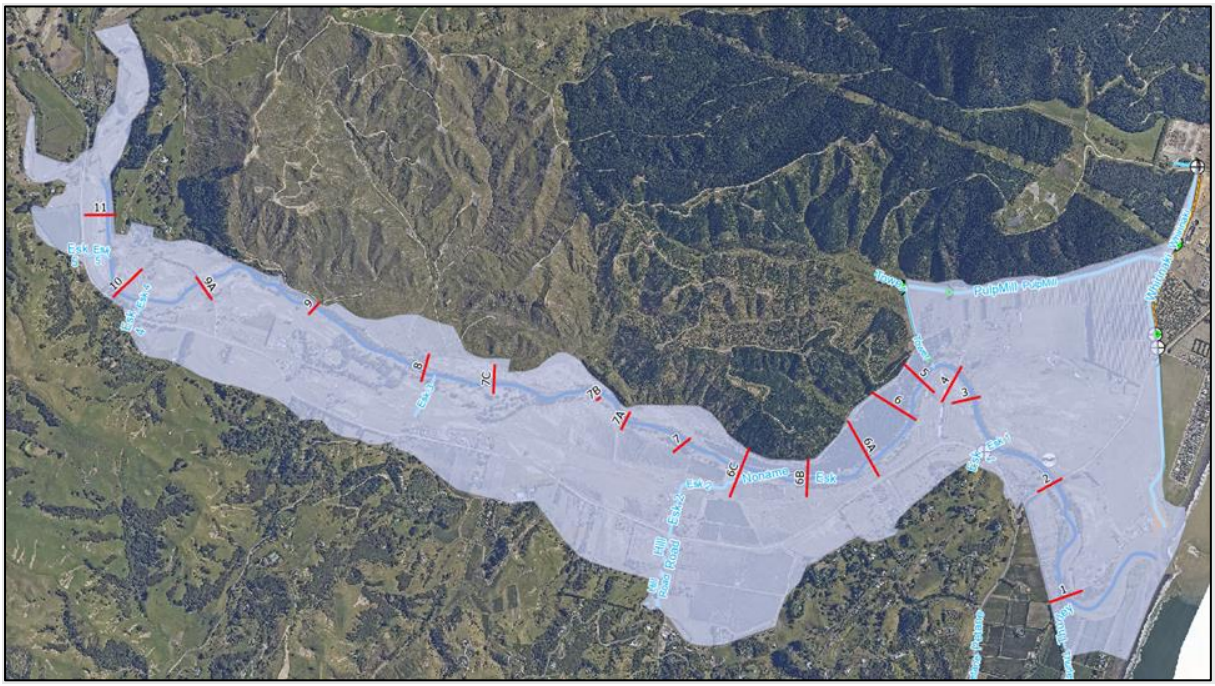

Figure 42.1 – 2013 HBRC flood hazard map for Esk Valley

The proposed hazard map was rejected from being included in the two district plans with the following reason given by one of the councils:

> *Our rules regarding land uses within the River Hazard Overlay are fairly restrictive however, and applying these rules / standards to a new wider area modelled on 'a worst case scenario' or extreme events with return periods greater than 100 years may not sit so easily with those land owners.*

HBRC also published the book of super-design flood scenarios in 1999, the results of which were also not included in any district plan.

In August 2021, HBRC submitted on the proposed Central Hawke's Bay District Plan, particularly on the [then] proposed plan's provisions for flood hazard areas and associated land use controls. HBRC appeared at the hearing. Many of HBRC's submission points relating to flood hazard areas were accommodated by the CHBDC's Hearing Panel's decisions (issued 25 May 2023).

We intend on continuing our involvement and input into the natural hazards chapter of the proposed Napier District Plan. Napier City Council intends publicly notifying a district plan Variation later in 2024 to include provisions for management of natural hazards in Napier City.

43. Citing as many examples as possible, to what extent does the Hawkes Bay Regional Council become involved in land use and subdivision consent applications involving flood prone/high hazard areas?

HBRC takes an active approach to our involvement in land use and subdivision consent applications to the extent where there is an opportunity to be involved.

We often provide information and advice to developers who ask us, prior to them formally lodging applications with the city and district councils. Once an application is made to the relevant TLA, there are very limited opportunities for HBRC's involvement, unless the TLA determines that the application is notified. Public notification of consent applications presents an opportunity for HBRC to assess the application and make a submission if deemed appropriate. We also note that approvals advanced through Māori Land Court approval pathways for subdivision appear to proceed without the opportunity for HBRC to provide advice.

We have provided advice on many subdivision consent applications in this way, including the subdivisions at Iona Triangle, Riverbend Road, Jervoistown, Flaxmere, Te Awa, Parklands, Brookvale, Arataki, Ongaonga (x 3), Mt. Herbert Road, SH2 Waipawa, Waipawa near Bush Drain, Te Awanga, School Road Clive, Pohutukawa Drive. There are likely to be many others.

A common theme with these applications is that the developers tend to just reach the minimum standard to satisfy the 50-year (for building code compliance) or 100-year (for subdivisions) return period flood control, and rarely if ever take into account design events which exceed these levels.

We provide a couple of specific examples, relevant to areas affected by flooding during Cyclone Gabrielle.

One of the more notable examples was a private plan change request in 2007/08 to rezone approximately 4ha of land at Beach Road, Tangoio from Rural to Coastal Residential. The purpose of this change was to develop approximately 30 residential lots in the subdivision. HBRC submitted on that rezoning request opposing the application and seeking that the rezoning request be declined. In relation to flooding risk issues, HBRC's submission, in part, stated:

> *"The site is located on the highly volatile Te Ngaru Stream flood plain. The Regional Council considers residential development on the floodplain to be unacceptable due to the area's history of extreme flood events and the threat of coastal inundation. In a flood event, the area will be inundated with high velocity waters capable of causing significant damage to property. There is a substantial risk to public safety and health, and any permanent structures in this environment will be at risk. In the Council's opinion, residential occupation of the floodplain is not sustainable."*

The plan change and subsequent residential development was nonetheless approved. The Beach Road development was severely impacted by flooding during Cyclone Gabrielle and has been classified as Category 3 land.

Another notable case, where the subject land was impacted by Cyclone Gabrielle flooding was a subdivision at Ohiti Road, Omahu. We understand this subdivision was advanced via a pathway through the Māori Land Court, rather than the typical pathway where the TLA is the consent authority. To the best of our knowledge, HBRC was not given any opportunity to be involved in proceedings for that subdivision proposal. That development has been classified as Category 2C land post Cyclone Gabrielle, meaning that community-level interventions need to be implemented in order for the risk to life to be mitigated. HBRC and the Crown have committed $10m for those flood protections to be developed.

The Panel has received a significant amount of feedback on how land uses in the upper reaches of the Region's rivers affect erodibility of the land and flood potential in the lower catchments - in particular, the relative contributions resulting from pastoral farming vs plantation forestry vs the retention/regeneration of native vegetation.

44. Does the Council have access to any technical information that compares the erodibility of steep country in the Region's upper catchments and the respective downstream flood risks associated with pastoral farming, plantation forestry, and the retention/regeneration of native vegetation?

HBRC has extensive technical literature, and monitoring and investigation projects that aim to inform our understanding of erosion processes, soil loss, landslide susceptibility, efficacy of mitigation techniques and effects on downstream receiving environments. These projects do not currently assess the flood risks associated with land use or erosion processes.

HBRC has current funding to investigate the feasibility of nature-based solutions for reducing flood peak flows in two catchments, which is a work programme through to June 2025.

45. Please explain the existing controls available to Hawkes Bay Regional Council for managing agriculture and forestry activities in the Region, particularly in head water catchments and/or upper catchments, and the approach taken when such activities are proposed at scale.

The 2017 National Environmental Standards for Plantation Forestry (NES-PF)[4] applied and was administered by HBRC across the region including in upper catchments. This sets conditions for afforestation and forest harvesting. On steeper slopes, resource consents are required. These are generally issued with conditions that are consistent with the Permitted Activity standards of the NES. Conditions include control of sediment, slash, protection of wetlands and indigenous vegetation. There were limited circumstances where rules in the regional or district plans could be more stringent than the NES-PF.

There are Rules in the Regional Resource Management Plan (RRMP) addressing vegetation clearance and soil disturbance. It is a Permitted Activity to clear vegetation and disturb soil (e.g. through earthworks) subject to conditions preventing transportation or deposition of disturbed matter into any water body, and site rehabilitation. Similar rules apply under the Regional Coastal Environment Plan in relation to the landward parts of the coastal environment above mean high-water springs. Rules do not address favouring one land use over another.

In May 2020, HBRC publicly notified proposed Plan Change 9 (PC9) to the RRMP. PC9 is a package of amendments relating to land and freshwater management in the Tutaekuri, Ahuriri, Ngaruroro and Karamu river catchments - the 'TANK' catchments. Decisions on PC9 submissions were issued in September 2022. Provisions in PC9 featured clearer policy direction, rules, non-regulatory methods etc to achieve freshwater limits over time. These included limits for sediment.

PC9 is currently subject to sixteen appeals filed in the Environment Court where appeal proceedings are ongoing.

Like other parts of New Zealand, the following national regulations also apply (or soon will apply) to forestry and agricultural activities in HB:

- Resource Management (National Environmental Standards for Freshwater) Regulations 2020
- Resource Management (National Environmental Standards for Commercial Forestry) Regulations 2023
- Resource Management (Stock Exclusion) Regulations 2020[5]
- Resource Management (Freshwater Farm Plans) Regulations 2023.[6]

[4] In 2023, the NES was amended and renamed to apply to "commercial forestry."
[5] In 2023, an Order in Council was passed granting an extension to some of the stock exclusion regulation requirements. The Order in Council was passed under the Severe Weather Emergency Recovery Legislation Act 2023.
[6] These Regulations are not yet in force in the Hawke's Bay region, but are likely to come into effect in 2025 (unless the Government makes further amendments to farm planning and freshwater farm plan requirements).

46. Please advise any intended changes to existing controls for managing agriculture and forestry activity in the Region, particularly in head water catchments and/or upper catchments, to address the effects of climate change.

The NES-PF has been amended to become the NES-CF since Cyclone Gabrielle. This includes more specific provisions for slash control that will be administered by the Regions. They also allow for rules in regional or district plans for afforestation to be more stringent.

These rules could be used to determine the appropriateness of, respectively, afforestation, agriculture and indigenous revegetation in certain locations. This provision was not available pre-cyclone and may now be considered by HBRC in the preparation of future regional plans.

Mana Whenua

47. Using representative examples, please provide details of the formal and informal relationships the Council has with mana whenua organisations, at both the governance and operational levels.

HBRC has a myriad of formal and informal relationships with Mana whenua organisations which support, shape and enhance our work. Such relationships pervade both the governance and operational levels of HBRC.

At the governance level, HBRC has been privileged since 2022 to be a local authority with Māori representation enabled through the provision of Māori constituencies. There are two Māori constituencies, Māui ki te Raki and Māui ki te Tonga, each with one member representing Māori who live in the northern and southern areas of Hawke's Bay. Additionally, the Chairs of both the Regional Planning Committee and Māori Committee of Council (both external appointees representing Mana Whenua organisations) sit in on meetings of Council in a non-voting capacity.

The Regional Planning Committee (RPC), a Council Committee established pursuant to the Hawke's Bay Regional Planning Committee Act 2015, is established to oversee the review and development of the Regional Policy Statement and regional plans for the Hawke's Bay region, as required under the Resource Management Act 1991 (RMA). This committee is the co-governance group for the management of natural resources in Hawke's Bay, with an equal number of Regional Councillors and Post Settlement Governance Entity (PSGE) appointees.

All RPC members have full speaking and voting rights.

This committee considers and recommends strategies, policies, rules and other methods for inclusion into the Regional Resource Management and Regional Coastal Environment Plans to Council. The committee will also make recommendations to Council to ensure the effective implementation of plans, processes, research, monitoring and enforcement to satisfy the requirements of the RMA, National Policy Statements, National Environmental Standards and relevant associated legislation.

Many of HBRC's standing committees have Mana Whenua representation. Representative examples include:

- the Māori Committee, which includes 13 representatives nominated by the Tangata Whenua, appointed at the first meeting of the Māori Committee each triennium; plus one alternate representative nominated to attend in an appointee's absence,[7] and
- the Corporate and Strategic Committee, which includes one (non-council) member of the Māori Committee, and one tāngata whenua representative from the Regional Planning Committee.

Further, many of the Joint Committees that HBRC administers (or is involved in) have appointees from Mana Whenua organisations. Again, as representative examples:

- The Clifton to Tangoio Coastal Hazards Strategy Joint Committee includes "Tangata Whenua Members" appointed by:
    - The trustees of the Maungaharuru-Tangitū Trust, on behalf of the Maungaharuru-Tangitū Hapū,
    - Mana Ahuriri Incorporated, on behalf of Mana Ahuriri Hapū, and
    - Tamatea Pokai Whenua,[8] on behalf of the hapū of Heretaunga and Tamatea.
- The Climate Action Joint Committee includes:
    - One member (and one alternate) from each Post-Settlement Governance Entity within the region, and
    - Two members (and one alternate) appointed to represent the Ngāti Kahungunu Taiwhenua and Board representatives on the HBRC Māori Committee.
- The Hawkes Bay Civil Defence Emergency Management Group Joint Committee includes advisory,

[7] Notably, the Māori Committee has been a standing committee of HBRC since the early 1990's.
[8] Formerly the Heretaunga Tamatea Settlement Trust.

non-voting[9] members representing:

- Mana Ahuriri,
- Maungaharuru-Tangitu Trust,
- Tatau Tatau o Te Wairoa, and
- Ngati Kahungunu Iwi Incorporated

At the operational level HBRC's Māori Partnerships group provides organisation-wide leadership, guidance and representation and will help staff and councillors engage more effectively with Tāngata Whenua. This includes leading HBRC's tailored engagements with Mana Whenua organisations. Some representative examples are demonstrated in Figure 47.1 below. These examples list various projects being undertaken by HBRC and the mana whenua organisations that are engaged as part of that mahi.

Kaupapa/Project	**Marae/ Hāpū/ Group**
Hawea Historical Park development	Waipatu, Ruahapea, Waiohiki, Matahiwi, Kohupatiki.
Karewarewa Paritua Restoration Karamu Catchment Review	Marae: Mangaroa, Taraia, Mihiroa, Houngarea
HBRC and external Science Monitor Agencies. Mana Taiao Hub	Tamatea Pokaiwhenua Heretaunga Taiwhenua Kahungunu Inc Tamatea Taiwhenua
Coastal Waste Management. Te Ikatiere reserve Te Angiangi Marine reserve, Rahui	Coastal Hapū Collective MACA – Rangitane, Papauma, Ngati Kere Authority, Kairākau Land Trust.
Recovery/ Land Cat 2	Nga Piringa hapu, Omahu Marae. Tihei Tamatea
Lake Poukawa Lake Runanga Between Two Rivers Stop Bank upgrade CIA work	Kahuranaki Marae Te Runanga Marae Awhina Marae
Whirinaki Resilience Project	Petane Marae Mana Ahuriri
Waiohiki Stop Banks	Ngati Paarau Trust

Figure 47.1 – Examples of HBRC activities and engaged Mana Whenua organisations

[9] Under the extant Civil Defence Emergency Management Act 2002, non-elected members cannot be full members of a Civil Defence Group. HBRC supports the change proposed in the Emergency Management Bill that will allow for Mana Whenua organisations to sit as full members of Civil Defence Groups.

48. Please provide details of if/the extent to which Council engages with mana whenua when planning and implementing flood protection and flood management activities?

HBRC's Māori Partnerships group offer guidance to the Asset Management Group regarding best practices for engaging with mana whenua concerning flood management activities. They provide advice on tikanga to ensure that meetings between HBRC representatives and mana whenua are conducted respectfully and productively. In many cases, Māori partnerships facilitate connections between asset management and mana whenua, and sometimes participate in hui to provide cultural guidance, fostering meaningful connections.

Management plans received by HBRC that have been prepared by iwi authorities and/or hapu groups are also used to inform various asset management operations, to the extent that they are relevant at place. Management plans received by HBRC are routinely made publicly available via HBRC's 'Pataka' interactive mapping portal. For example, these management plans have been used to inform preparation and review of various HBRC documents such as various recent editions of the Code of Practice for Flood Control and drainage works, river mouth opening protocols, Scheme asset management plans and HBRC's waterway design guidelines.

In close collaboration between HBRC's Asset Management Group and the Māori partnerships team, the integration of tangata whenua values into asset management practices unfolds through a structured process. Scoping and planning sessions are held with mana whenua representatives to determine the objectives of Cultural Values Assessments (CVAs) and Cultural Impact Assessments (CIAs), focusing on key assets and projects. Led by mana whenua expertise, CVAs delve into the significance of cultural values associated with specific assets, while subsequent CIAs evaluate potential impacts of proposed actions on tangata whenua values and customary practices. Findings from these assessments are integrated into HBRC's decision-making frameworks, ensuring that infrastructure projects and maintenance activities align with tangata whenua aspirations and respect their cultural heritage.

Post cyclone, HBRC has engaged Mana Ahuriri and various hapu along the Tutaekurī in order to ascertain their cultural values as they relate to the river. These assessments will give HBRC an understanding of what is of cultural importance to the mana whenua of the river. We have also contracted marae and hapu along the river to carry out Cultural Impact Assessments. These assessments will inform our stop bank designs and highlight how different designs will impact upon various cultural values.

49. ***Where Māori land was compulsorily acquired for flood protection purposes (for example at Waiohiki) to what extent did the subsequent works adequately protect Māori land and communities during Cyclone Gabrielle?***

We have no evidence to suggest that any flood protection infrastructure failed below its nameplate level of service, which for the major schemes is a 1% AEP flood level. We address the specific issues with regard to Waiohiki at questions 17-19 above. In this respect we consider that no communities within the flood schemes were inadequately protected by them as a matter of design.

If the suggestion here is that some Māori land was compulsorily acquired, but that despite the compulsory acquisition the relevant community and/or its land was not subsequently protected by the scheme, then we can confirm that we are aware of no specific instances of this occurring. Indeed, with respect to Waiohiki we reiterate that the design of the scheme saw the community there protected to the same level of service as other parts of the scheme.

50. ***Feedback from Māori and the community is that Māori land and less prosperous communities are disproportionately underserviced in terms of flood protection and flood management activities. The Council is invited to respond to this criticism, including addressing the question of how the quantum of Council's investment in flood management activities is linked to rating policies.***

Historically, river management and flood protection schemes evolved from The Soil Conservation and River Controls Act 1941. This enabled the formation of a scheme and allowed the controlling authority (most often a Catchment Board) to set a fee to pay for the scheme from those who would benefit from the scheme. This essentially set a 'user pays' process for financing of schemes. As befits the time in which they were created - schemes were often set up to protect urban environments and to increase the amount of productive land available for farming.

At the time that most schemes were created, regrettably little thought was given to the protection of isolated, predominantly Māori communities, and little thought was given to the protection of cultural values.

In 1989, local government was reformed with the Regional Councils brought into existence. Catchment Boards were disbanded and the flood control schemes were moved under the remit of the Regional Councils. The bulk of financing for flood control schemes still sat with the targeted ratepayers, who enjoyed the greatest benefits of the scheme.

Events like Cyclone Bola had dramatic effects on Hawke's Bay, and particularly on Māori communities such as Nuhaka and Wairoa. At the time, there were proposals to create flood control schemes in these areas – particularly in Wairoa. However, the cost of the scheme – from capital investment to ongoing operations - would need to be met by the community under the extant rating models. The proposal was assessed as unaffordable for the community, the proposal was not adopted and therefore no operating flood control scheme exists today.

Post Cyclone Gabrielle, there is greater recognition given to the limitation of a targeted rating approach on the ability of smaller, less prosperous local communities to enjoy the protection of a flood control scheme. As such, the Crown ensured that all capital funding for a flood control scheme in Wairoa is 100% funded by the Government.

HBRC itself have also looked at how schemes could be made more affordable for smaller, less prosperous communities and have enacted a revised Revenue and Financing Policy. This allows for a greater proportion of general rates to be used to finance scheme activities. It essentially removes the burden of targeted rates from small rivers and streams schemes, as follows:

- 30% general rate and 70% targeted rate (with 9 rating factors) based on capital value (CV) for the 4 flood protection and control schemes
- 10% general rate and 90% targeted rate (with 19 rating factors) based on CV for all drainage and pumping (except for Raupare Enhancement and Opoho schemes which are to remain based on area and fixed charge respectively).
- Rivers and stream maintenance moves to the general rate (25 rating factors).

Flood Protection	Drainage	Rivers and stream maintenance
Heretaunga Plains	Brookfields/Awatoto	Central/Southern
Maraetotara	Clive and Muddy Creek	Esk
Upper Makara	Haumoana and Te Awanga	Kairakau
Upper Tukituki	Karamū Drainage and Tributaries	Kopuawhara
	Karamū Enhancement	Pōrangahau
	Napier/Meeanee/ Puketapu	Te Ngarue
	Ohuia Whakakī	Wairoa
	Opoho	Whirinaki
	Paeroa	
	Pākōwhai	
	Poukawa	
	Puninga	
	Raupare and Twyford	
	Raupare Enhancement	
	Tūtaekurī/Waimate/Moteo	

Figure 50.1 – HBRC's Flood Protection, Drainage and River and Stream Maintenance Schemes

The new policy also increases the proportion of general rate into Flood Control and Drainage schemes, making them more affordable for those who are directly affected.

For areas like Nuhaka and Whakaki, who have previously had to pay targeted rates for drain clearance under the Wairoa and Northern Streams schemes, and for the residents of Kopuawhara, all scheme fees will now be met from the general rate.

51. Could the Council please explain if/the extent to which its flood management activities are influenced by the presence of wāhi tapu, mahinga kai, wai Māori and whenua Māori alongside and within rivers it manages?

Flood management activities are becoming far more attuned to the cultural impact of physical works carried out in the natural environment. With reference to question 47 and 48, HBRC engages and participates heavily in discussion with mana whenua in regard to undertaking new capital works and, increasingly, operational and maintenance activities.

In the case of new consents that HBRC has gained to undertake flood management activities (Westshore Tidal Gates and the Global Gravel Extraction consents), significant effect is given to ensuring that culturally significant places, spaces and features are protected. There are requirements for undertaking cultural value and cultural impact assessments and a greater requirement for partnering. An example of this working successfully in practice is the effort and investment that HBRC has committed to the Hawea Historical Park as part of the Karamu Stream enhancement works.

When undertaking new capital delivery (such as for the IRG-funded Tukituki gravel extraction programme or Flood Resilience Programme (Category 2) works), significant time is taken working with mana whenua groups to understand the cultural impacts of the proposed works and in all cases, works are modified, changed or off-set, to ensure that culturally significant items, spaces, or places are protected.

This will especially be the case in areas where flood protection activities have not been undertaken previously, such as Wairoa and Porangahau.