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**WHIRINAKI RESILIENCE PROJECT  
TECHNICAL FOCUS GROUP  
MEETING MINUTES - FINAL<sup>1</sup>**

**DATE** 30 June 2023  
**TIME** 1:00pm – 3:00pm  
**VENUE** Pan Pac Forest Products Ahuriri, Microsoft Teams

**IN ATTENDANCE**

Mark Smith - Resident	Geoff Huggett - Resident
Stan Evans - Resident	Daniel Gales - Resident (Esk Valley)
Jayde Demanser - Resident	Parris Greening - Mana Ahuriri (Teams)
Jacob Brownlie - Resident	Tony Clifford - Pan Pac Forest Products
Mel Swayn - Community Communications	Matthew Brady - DoC
Kyle Russell - Waka Kotahi / NZTA	Reece O'Leary - Pan Pac Forest Products
Alan Thomas - KiwiRail (Teams)	Stephen Daysh - Mitchell Daysh
Rob Nichol (Teams)	Anita Anderson - Mitchell Daysh
Tania Lund - Transpower (Teams)	Martina Groves - PDP
Graeme Hansen - HDC	Ramon Strong - PDP
Susie Young - HBRC (Teams)	Eddie Beetham - T+T (Teams)
Charlotte Drury - View Consultants (on behalf of Chris Brownlee / Hort NZ) (Teams)	Richard Reinen-Hamill - T+T (Teams)

**Apologies:**

John Clarke - Transpower	Bruce Allen - HDC
Justan Clark - Transpower	Richard Munneke - NCC
John Clark - Contact Energy	Bill Bayfield - HBRC
Daniel Headifen - KiwiRail	

**1. Introductions**

- Those present introduced themselves and provided a background as to their interest / involvement in the project. Stephen noted that there were a few new members at the meeting.

**2. Confirmation of previous meeting minutes**

- The meeting minutes from Meeting 1 of the TFG held on 26 May 2023 were confirmed as a true and correct record of the meeting.

***Moved - Matthew Brady  
Seconded - Reece O'Leary***

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<sup>1</sup> Confirmed at TFG Meeting 3, 28 July 2023

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***Carried unanimously***

- The meeting minutes will be finalised and attached to the minutes of Meeting 2 (Attachment 1).

**3. Community feedback / communications / FAQ's**

- Stephen outlined that the TFG process provided the members an opportunity for community input and transparency into the project by keeping the wider community up to date with information from this group. The project team will also provide updates to the wider community through a newsletter.
- A set of Frequently Asked Questions will be produced to provide information and responses to community questions to date.

**4. Conceptual options presentation and discussion**

- Stephen reaffirmed that the study area of the resilience project is the from the seaward extent of SH2 and introduced Ramon Strong from PDP and Eddie Beetham and Richard Reinen-Hamill from T&T as technical advisors for the project. The two presentations would introduce potential ideas and options from a river and coastal engineering and management perspective (Attachments 2 and 3).

**Presentation 1 - Ramon Strong (PDP)**

- 1931 earthquake is a significant consideration for the Esk Valley, creating uplift to the NE-SW.
- Dan asked if 1963 flood event was considered a significant flood. Ramon noted that it was not considered on par with the 1938 and 2023 flood events.
- The Esk River is a low energy system and low lying, therefore the river system doesn't have enough energy to break through the bars that are created at the mouth of the river.
- The silt deposition and scour/erosion as a result of Cyclone Gabrielle derived from LIDAR imagery showed a significant amount of erosion near the mouth to the Esk River.
- The project area is focused below SH2 and river management in this area will aim to improve resilience upstream.
- Cyclone Gabrielle was spread across all catchments and produced a flat hydrograph that was slow to build and slow to subside. This was different to the 2018 event in the Esk which was a localized weather event.
- There are some delays/ uncertainties related to the data from Cyclone Gabrielle for hydrological modelling therefore best practice traditional engineering methods will be used for this project, given the time constraints and urgency of the project.
- Mitigation options for the lower reach of the Esk River include:
  - River straightening
  - River widening
  - Additional stopbanks

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- Reducing debris and sediment loads
  - Expanding SH2 Bridge
  - More permeable river training options will be considered by the team as part of the Whirinaki Resilience Project. Multiple mitigation options will likely need to be implemented.
  - The HBRC are responsible for the decision regarding the status of the Category 2A land within the project area. The HBRC are aware of the urgency to provide residents more certainty.
  - The challenges to river management include:
    - The complex/dynamic nature of the Esk River in flood.
    - Potential adverse effects.
    - Accommodating existing transport corridors.
    - The cumulative impacts of floods and changing climates.
    - The overall cost of resilience options.
  - The project will work with the government under the Severe Weather Emergency Recovery Legislation Act 2023, and there will be a lot of effects to consider for the assessment of effects of any chosen resilience approach. An ecologist will also be added to the technical team.
  - Susie Young explained that while there will likely be government financial assistance provided for the chosen set of mitigation options, the extent of this was unknown and the remaining costs are likely to need to be funded through a targeted rate on landowners within the area - this should be front of mind when choosing a mitigation option.
  - There was discussion regarding the requirement for Whirinaki and Esk River land owners to pay the central rivers maintenance rate.
  - Reece asked whether there is any priority for government subsidy, given there is a regionally critical Transpower switch yard within the project area.
  - Susie noted that the government subsidy would be spilt amongst all of Hawke's Bay, and the type of subsidy allocation will depend on the mitigation outcome chosen - there are still a lot of uncertainties.

#### **Presentation 2 - Eddie Beetham & Richard Reinen-Hamill (T&T)**

- Eddie explained the coastal dynamics and beach processes at the mouth of the Esk River noting that the Whirinaki land is subsiding, and relative sea-level rise will be 1-1.3 m by 2100.
- The Esk River mouth is highly dynamic, with the channel position migrating over a 1km span of the beach.
- The Esk River mouth is susceptible to partial or complete closure and it was partially closed prior to Cyclone Gabrielle.
- During Cyclone Gabrielle the coastal gravel barrier and lower riverbanks were eroded.

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- The figures showed that the river mouth is 500 m to the south and that there a 20 m wide shallow berm.
  - The gravel beach is porous and will have some low flow seepage.
  - Jacob noted that community observations during the cyclone saw that the channel was blocked (not by debris), then opened and then was blocked again by debris. Stephen requested that photos or videos of any observations be sent to Anita to be complied and circulated.
  - The potential mitigation options for the river mouth and coastal area include:
    - Continuing with the existing management system (status quo).
    - Improving the channel maintenance with new maintenance triggers and actions, to be more effective.
    - Armouring of structures to limit water flow migration to north and south.
    - Building training walls or groynes on both sides to more securely maintain an open river mouth. It was noted that this would be the most costly option and would need to be a large structure due to wave climate its energy and would have significant consequences on the longshore sediment transport.
  - Geoff noted that the Tukituki River groyne has eroded away the carpark there. Richard acknowledged that if a groyne was chosen as a mitigation option there would be leeside erosion, and sediment build up on one side of the groin and erosion on the other side.
  - Mechanical opening of the channel can have health and safety implications for the excavator operator and be ineffective. Given the high energy waves and low energy river, it would be challenging to open the river channel and keep it open.
  - Jacob asked whether maintenance dredging had been considered near the river mouth. Richard responded that dredging near the wave break zone is challenging and not as effective, however it would be more effective in the spine of the bar.
  - Mark asked about a T+T report regarding erosion of the dunes in front of the properties at North Shore Road and concerns surrounding reports stating houses on North Shore Road may need to move because of erosion. Richard responded that erosion hazard assessments indicate that half a meter a year of erosion is occurring in the long term over the beach face, plus factoring in increased erosion from sea level rise and greater wave action.

## **5. Technical peer review request**

- Stephen noted that an independent technical peer reviewer is being sought to review the AEE and technical assessments. The details of this person will be provided to the TFG.
- Alan noted that KiwiRail have engaged T+T hydrologists and that they can be made available to share technical information and assumptions to avoid any duplication in work.
- Tony asked whether the northern railway would be abandoned or whether it will be considered a rebuild. Alan responded that it is considered a rebuild.



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- Kyle noted that a rebuild of the Esk Bridge is included within a Waka Kotahi business case for funding.

## **6. Next steps**

- Stephen confirmed that there will be three further TFG meetings, stating that the August meeting will run longer, and the September meeting may shift slightly.
- Mel asked whether the 2A communities will know what will happen for their communities before September, and that there needs to be urgency surrounding decision making. Stephen acknowledged that the project team understands the urgency and there are many things to consider to ensure the right decisions are made. Outcomes and concepts for this project are to be confirmed by the end of July and will assist in the decision the Council will make surrounding the outcomes for the 2A communities.
- Reece reaffirmed that the project team needs to obtain commitment from Council that the resulting option/s chosen through this process will be implemented, and Council will not deviate and do something else. Stephen planned to continue to follow up with Bill Bayfield and maintain communications with Council.

Minutes prepared by Anita Anderson

**Attachment 1: FINAL Minutes, TFG Meeting 1, 26 May 2023**

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**WHIRINAKI RESILIENCE PROJECT**  
**TECHNICAL FOCUS GROUP**  
**MEETING MINUTES - FINAL<sup>1</sup>**

**DATE** 26 May 2023  
**TIME** 3:00pm – 4:30pm  
**VENUE** Pan Pac Forest Products Ahuriri, Microsoft Teams

**IN ATTENDANCE**

Mark Smith - Resident	Geoff Huggett - Resident
Stan Evans - Resident	Parris Greening - Mana Ahuriri (Teams)
Kyle Russell - Waka Kotahi / NZTA	Daniel Headifen - KiwiRail
Matthew Brady - DoC	Reece O'Leary - Pan Pac Forest Products
Tony Clifford - Pan Pac Forest Products	Stephen Daysh - Mitchell Daysh
Tania Lund - Transpower (Teams)	Anita Anderson - Mitchell Daysh
Justan Clark - Transpower (Teams)	Martina Groves - PDP
Rob Nichol - Contact Energy (Teams)	Ramon Strong - PDP
Charlotte Drury - View Consultants (on behalf of Chris Brownlee / Hort NZ)	

**Apologies:**

Lee Grace / Liz Munroe - Maungaharuru-  
Tangitū Trust

**1. Introductions**

- Those present introduced themselves and provided a background as to their interest / involvement in the project.

**2. Project background and Technical Focus Group ('TFG') process**

- Stephen outlined the projects purpose, objectives, governance group, operational team, actions undertaken to date and the TFG process (see attached - pages 3 to 10).
- Tony explained that three industry sponsors (Pan Pac, Contact and Transpower) are funding the facilitation of the initial project to get it promptly underway, however details of the cost sharing with the companies, Councils and government are still to be worked out. The companies don't see themselves as owners of any public Council asset that may be built as a result of the project. Reece noted that this has been discussed with the Councils.
- Tony also explained that one of Pan Pac's motivations for the project related to the morale and welfare of staff both now and in any future events, and the insurability and continued operation of their site.

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<sup>1</sup> Confirmed at TFG Meeting 2, 30 June 2023

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- The team have provided budget estimates for this first stage of the project to the Hastings District and Napier City Councils for their locality plans for government funding. Reece noted that the next iteration of the plans will include costs for any works / structures that are selected as part of the project.
  - Mark asked what could be communicated to the other residents / community out of the TFG meetings. Stephen advised that the representatives at the meeting were chosen because of their connections into the community and therefore should openly share the information and discussions within their respective circles. Tony noted that it was important to let the community know that there are no firm solutions being proposed at this stage and that this process was an options review one. There will be opportunity for wider community engagement once these have been developed.

### **3. Catchment summary**

- Martina explained her previous experience with the Engineering and Asset Management teams at the HBRC. Martina's presentation (see attached - pages 12 to 20) summarises her knowledge from her experience during this time and the historical information that she has been able to obtain on the Whirinaki and lower Esk catchments. Ramon will provide the technical input into the project on behalf of PDP. Martina noted that it important that any asset that may result from this project and which the Council was to manage must be designed to their level of service and specification.
- The Whirinaki Scheme was created to protect the mill from future flooding from the Whirinaki Drain, not the Esk River. There are Council modelling reports that detail the level of service. Reece noted that the Council reports have provided some differing numbers in terms of the level of service provided by the Whirinaki drainage scheme. This will be reviewed as part of the project.
- Mark asked about the rates that landowners pay for flood protection and whether this was for the Esk / Whirinaki or the wider regional flood control schemes. It was agreed that if it wasn't specified as Esk / Whirinaki on the rates notice then it would be for the region wide flood protection.
- Martina's view was that stopbanks along the full length of the Esk River would not be feasible for a number of reasons. Reece explained that there may be a number of solutions that come out of this process for the lower Esk / Whirinaki drain which is the focus of the project – some may be quick wins / easy fixes and other longer-term options.
- Tony asked why Cyclone Bola wasn't included in the significant events in the presentation. Martina explained that Cyclone Bola didn't have as significant an effect in Hawke's Bay in comparison to Gisborne and while it was a big flood in some areas of Hawke's Bay (e.g., Twyford), there wasn't as much damage in the Esk catchment as other floods that were reviewed by PDP. Stan noted that Cyclone Bola was significant however not in comparison to Cyclone Gabrielle. Stan commented that changes to the lower Esk from an event prior to Bola in 1986 may have reduced the impact of that event (Bola) 18 months later. Daniel also noted that the railways in Hawke's Bay were not affected in Bola as much as they were by Cyclone Gabrielle. Tony proposed that it may have been the event in 1986 where the water levels at the Pan Pac water intake were higher than in Cyclone Gabrielle.

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- Tony asked if through this project are we going to review the impact of Cyclone Gabrielle. Reece noted that the Council are working with NIWA on this so there was no need to duplicate the work. Reece has asked the Council to provide the relevant records when they are available so that the team can use this data for modelling etc. NIWA presented to the Climate Action Joint Committee meeting on 22 May 2023 (link below - approx. 2 hrs 25 mins).  
<https://www.facebook.com/HBRegionalCouncil/videos/149075734727560/>
  - The impact of the river mouth during Cyclone Gabrielle and the Councils river mouth opening and maintenance process was discussed.
  - Stephen said he is meeting the HBRC interim Chief Executive, Bill Bayfield, Chris Dolley, Group Manager Asset Management and Louise McPhail, Recovery Manager on 31 May 2023 where he will discuss the HBRC's input and involvement in the project and a way to access additional information.
  - Daniel noted that there are limitations on the railway in the lower Esk and asked for any records or analysis that are available to support the views on the feasibility of stopbanks. The team explained that this is Martina's professional opinion based on her experience with the catchment. The Council did do some work in the early 1990's however the team does not have these records. Martina also noted that the Whirinaki Drainage scheme is very different from the Esk River where the stopbanks on the Whirinaki Drainage Scheme have previously been effective.
  - Kyle asked if the Council has looked at options to slow the flows / reduce the peak heights in the upper catchment to reduce the impact on the Whirinaki Area. Martina noted that there are theoretical options such as detention dams or over-flow paths that have been considered in other catchments / overseas, however there is no documented information available in relation on the Esk.

#### **4. TFG member comments**

- Kyle - aligned with Kiwi Rail, particularly in the upper catchment. Mindful that any improvements that Waka Kotahi undertake could cause issues for others. Interested to see what comes out of this project and what impact their asset management can have (e.g., additional culverts, SH5 intersection and bridge improvements).
- Geoff - having seen the impact of Cyclone Gabrielle on North Shore Road and Stans property his view was that the river mouth was blocked and that when it burst the water flow changed direction.
- Charlotte - Chris Brownlee has footage showing that the river mouth was blocked. The Brownlees have been a part of the Bay View community for a long time and want to see protection on the southern bank having lost over 2 hectares of their property in Cyclone Gabrielle. Bay View is unique horticulturally with a microclimate that provides early fruiting for a premium citrus product. Chris engaged an engineer in 2018 to draw up plans to protect the toe, wanting to discuss options with the Regional Council to actively manage the risk. He has not been successful with his engagement with the Council.
- Mark - if there is a stop bank being considered, there needs to be work on the river mouth.

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- Stan - agreed with Mark and doesn't believe that there has even been any work downstream of the state highway bridge. He has had discussions with Regional Council in regard to the lower Whirinaki drain as it was eroding over time.
  - Matthew - DoC are interested in the project in terms of any environmental values and impacts.
  - Parris - interesting hearing the feedback from the group who have similar aspirations to mana whenua in terms of the people and community and building back better. He supports the thoughts and ideas of the group and is willing to engage through the journey.
  - Justan - happy with the discussion and please to see all the background work that has been undertaken. Good to see a diverse range of stakeholders who will provide a range of opinions.
  - Rob - pleased to see that it will be an integrated community decision.
  - Daniel - may not be a simple solution that suits all. Keen to work to understand the options.
  - Ramon - reiterated that the technical comments that he and Martina had made in relation to the wider Esk Catchment are based on their experience noting that the lower catchment is different to the upper catchment and is a very complex system. He also explained that there may not ever be an accurate return period estimate for the event so there may not be absolute precision around the level of service. Tony agreed and suggested that the solution should aim for protection from a similar event to Cyclone Gabrielle.
  - Stephen thanked all for the meeting, noted that the project team want to keep the TFG fully informed throughout the process. Anita and Reece will be in touch with the TFG members to confirm meeting dates for the next meetings.

Minutes prepared by Anita Anderson

**Attachment 1: Presentation**



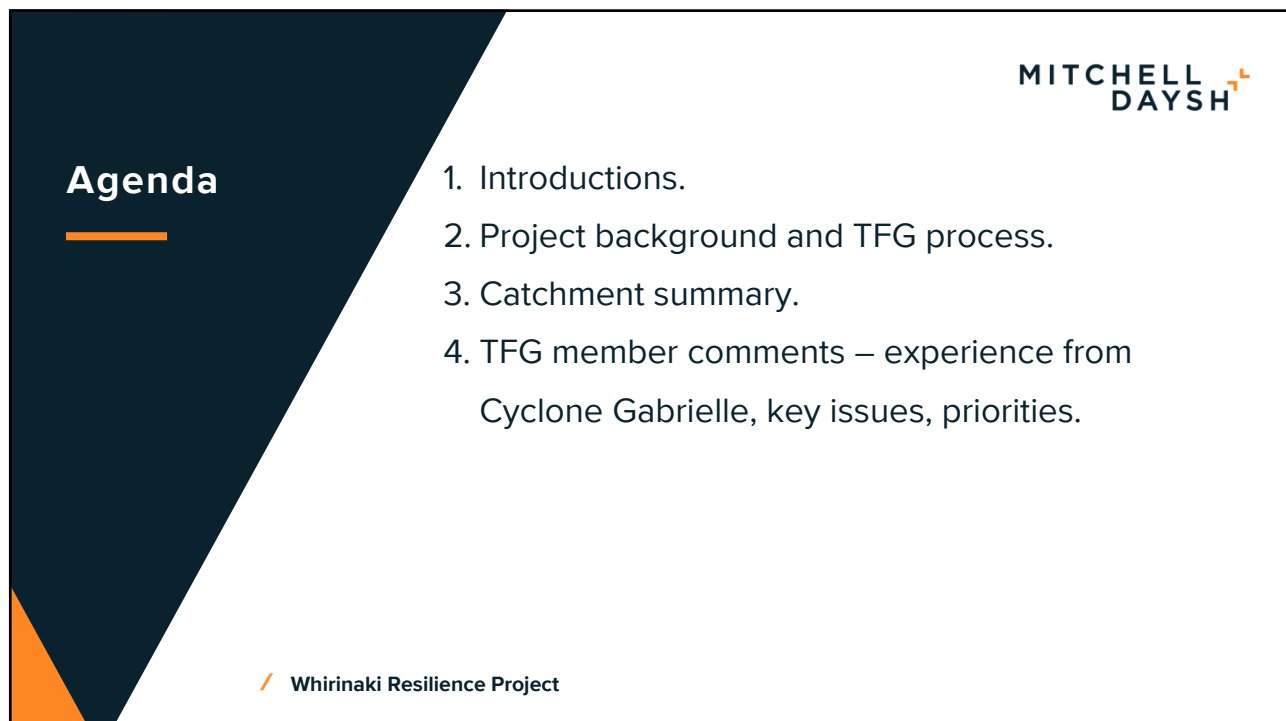
MITCHELL  
DAYSH

# Whirinaki Resilience Project

## Technical Focus Group Meeting 1

26 May 2023

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### Agenda

1. Introductions.
2. Project background and TFG process.
3. Catchment summary.
4. TFG member comments – experience from Cyclone Gabrielle, key issues, priorities.

/ Whirinaki Resilience Project

2



## Project Purpose

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*The purpose of the project is to improve resilience for the Pan Pac Forest Products Limited, Contact Energy Limited and Transpower sites and the immediate established neighbouring community and ensure personal safety, business continuity, insurability, and community morale.*

/ Whirinaki Resilience Project

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## Project Objective

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*To review and consider the event and outcome of Cyclone Gabrielle in order to rapidly assess options and decide the best overall option to provide a long-term level of protection for the Pan Pac Forest Products Limited, Contact Energy Limited and Transpower substation sites and the immediate established neighbouring community and design, consent and install the preferred solution before the end of 2023.*

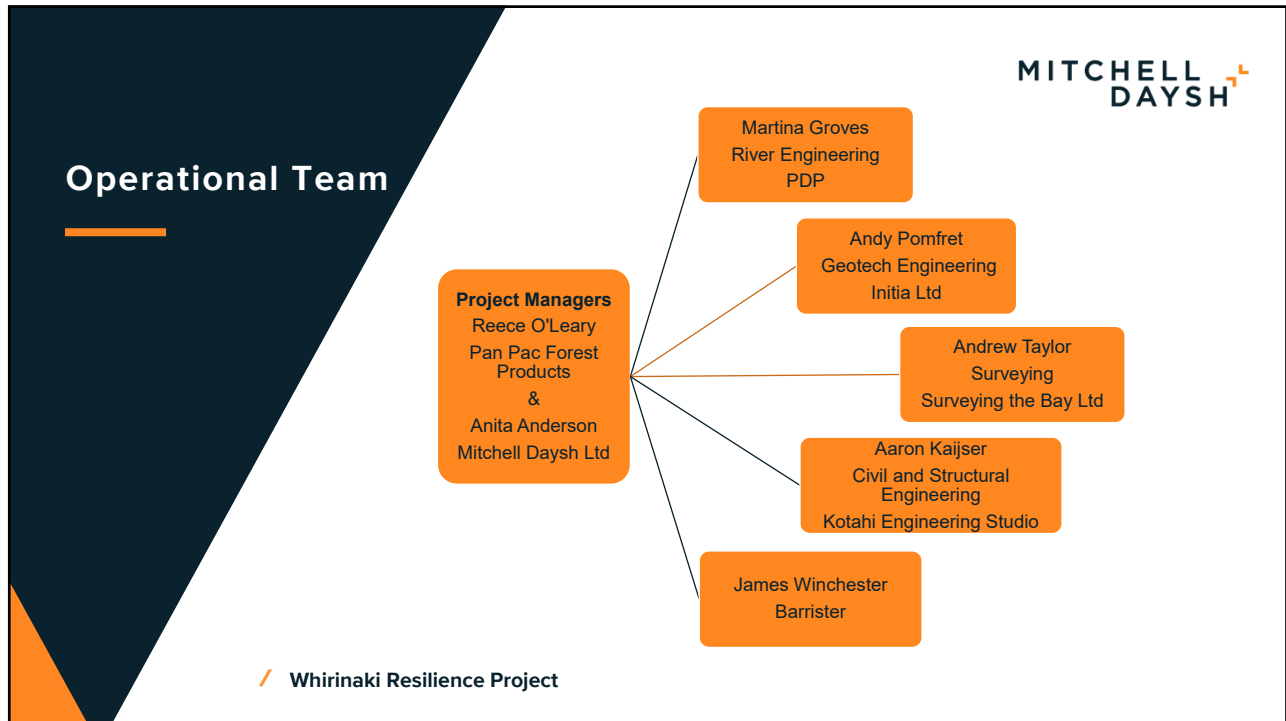
**Today's first TFG meeting is focused on listening to and understanding the community issues and aspirations.**

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## Actions underway / completed

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Action	Date
Letter to Mayors / Chairs and Chief Executives of three Councils introducing the projective initiative – support received from all three councils.	16 & 31 March 2023
Engage technical and legal team.	March 2023
Review of Severe Weather Emergency Legislation Act 2023.	April 2023
Input on project provided to HDC and NCC - included in their Locality plans.	28 April 2023
Ascertain Esk / Whirinaki River flood control design history - liaise with HBRC staff.	May 2023
Meetings with Government officials, Council representatives and the Cyclone Gabrielle Recovery Taskforce.	Ongoing
Stakeholder and community engagement.	Ongoing
Understand impacts of Cyclone Gabrielle.	Ongoing

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7

## Technical Focus Group

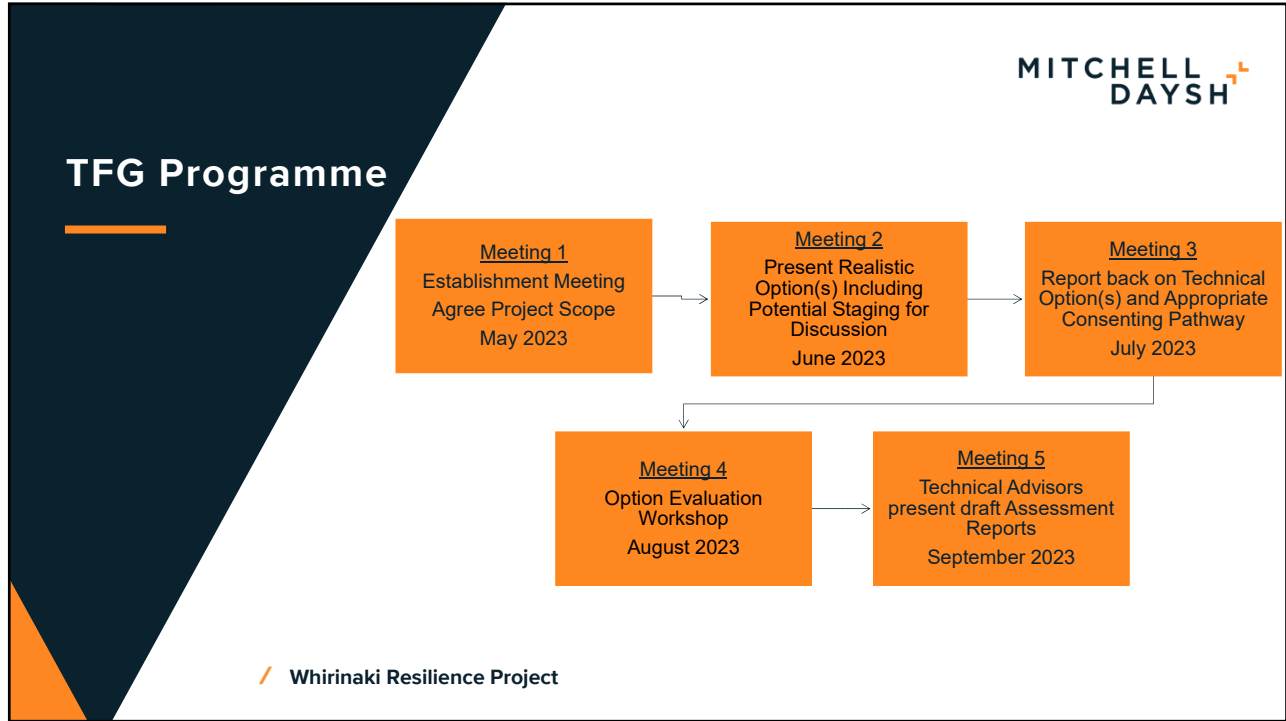
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- Made up of representatives from key stakeholder groups to engage with the Project Team during this process.
- Provide focused and coordinated advice and input as part of a two-way information sharing process

TFG Members	
<b>Councils</b>	<b>Mana Whenua</b>
<i>Engineer - Participant, Consents Planner - Observer</i>	
• Hawke's Bay Regional Council	• Mana Ahuriri - Petāne Marae
• Hastings District Council	• Maungaharuru Tangitū Trust
• Napier City Council	• Ngāti Pāhauwera
<b>Landowners</b>	<b>Other Agencies / Affected Industrial and Lifeline Businesses</b>
• Esk River Left bank Landowner - Stan	• Department of Conservation
• Bay View / Esk River Right bank Landowner - Chris Brownlie	• Waka Kotahi
• Whirinaki Resident - Geoff Huggett	• Kiwi Rail
• North Shore Road resident- Mark Smith	• Contact Energy
• Others - TBC	• Transpower
	• Pan Pac Forest Products

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8



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**Catchment summary**

*PDP Presentation*

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11

**Discussion**

Feedback from TFG members

- Experience from Cyclone Gabrielle
- Key issues
- Priorities

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Whirinaki Resilience Project

12

## TFG Meeting 1

# Whirinaki Resilience Project Esk / Whirinaki Background Information

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*Martina Groves  
Group Director- Land  
Pattle Delamore Partners Ltd  
Napier*



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1

## Past floods (only the most significant )

- 1938 - Esk Valley - Napier isolated, 54 bridges needed to be replaced.
- 1987- Napier was left underwater after heavy rain. The Esk and Mohaka rivers overflowed.
- More recent:
  - 2018: 329mm in 24hr
  - 2023: Initial modelling by NIWA suggests approx. 450mm-490mm from Cyclone Gabrielle



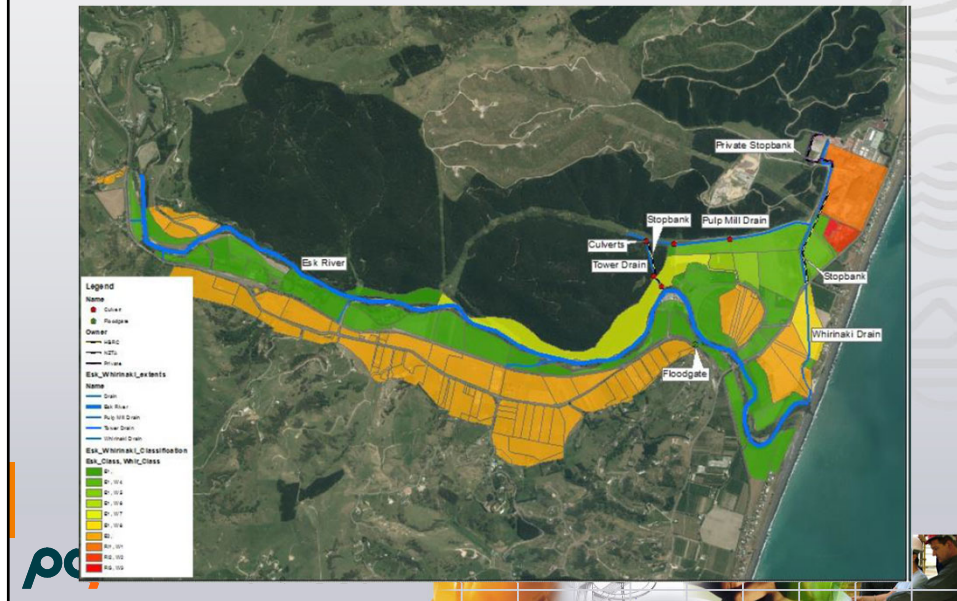
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## Esk / Whirinaki Scheme



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## The Esk / Whirinaki Scheme

- Established 1996
- Directed and operated by HBRC (AMG)
- Level of Service for Esk:
  - No flood protection structure
  - Channel conveys flood events up to an estimated two-year return period flood ( $215\text{m}^3/\text{s}$ )
- Level of Service for Whirinaki Drainage:
  - The Whirinaki Drain Stopbank is proposed to contain the 1in 100-year return period



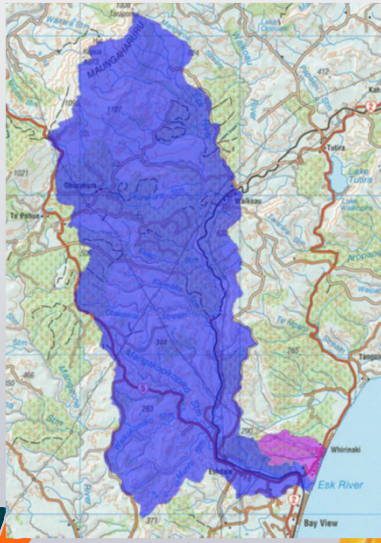
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## Esk River / catchment



- 252 km<sup>2</sup>
- Flows from Taraponui in the Maungaharuru Range and turning to east to reach Hawke Bay.
- Steep hill country to the north and west of Whirinaki as well as the narrow strip of land at the coast where Esk River and Whirinaki Drain enter the ocean

5

## Maintenance and Improvement Work - Esk Valley

- 1968 - Hawke's Bay Catchment Board undertook a small amount of riverbank protection and channel work.
- 1977 - Additional works proposed but due to a number of objections received, the proposal was rejected.
- 1986 - in depth investigation into flood protection, river channel widening, and willow clearing.



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## Whirinaki Drainage - Maintenance and Improvement Work

- 1987 - HB Catchment Board reviewed scheme and works were proposed to provide a 100-year flood protection standard.
- 1987 - Improvement work carried out by raising the Stopbank height and extension of the existing Stopbank.
- To confirm current level of service with HBRC.



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**Attachment 2: PDP Presentation**

# Whirinaki Resilience Project

UPDATE FOR TECHNICAL FOCUS GROUP MEETING 30 JUNE 2023



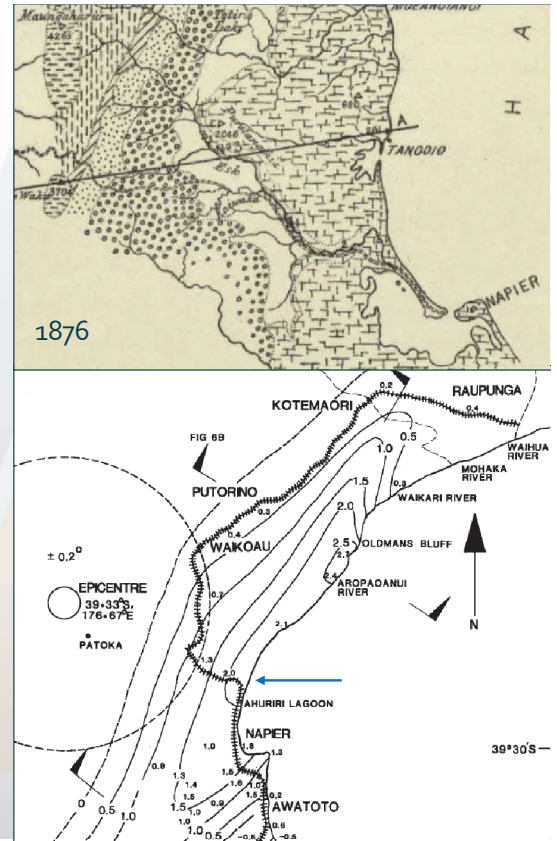
## Project Extents





# Key Geomorphological Aspects

- Changes from 1931 Earthquake
  - Formerly discharged into Inner Harbour (Ahuriri Lagoon)
  - Uplifted NE-SW trending dome
  - Coastal barrier uplift
- Changing degree of confinement
  - Lateral (and vertical) controls of bedrock in valley to open alluvial plain
- Minimal planform change (aerial sequence)
  - Channel changes have not been substantial (1943-present)
  - Even following major flood events (1938 & 2023)
  - More change in alluvial plain reach
- Long term factors
  - Vertical land movement at mouth of Esk River is -4.13 mm/yr
  - Influence of ongoing siltation (flood and average suspended sediment)
  - Minimal elevation difference between sea level and behind coastal barrier



1943

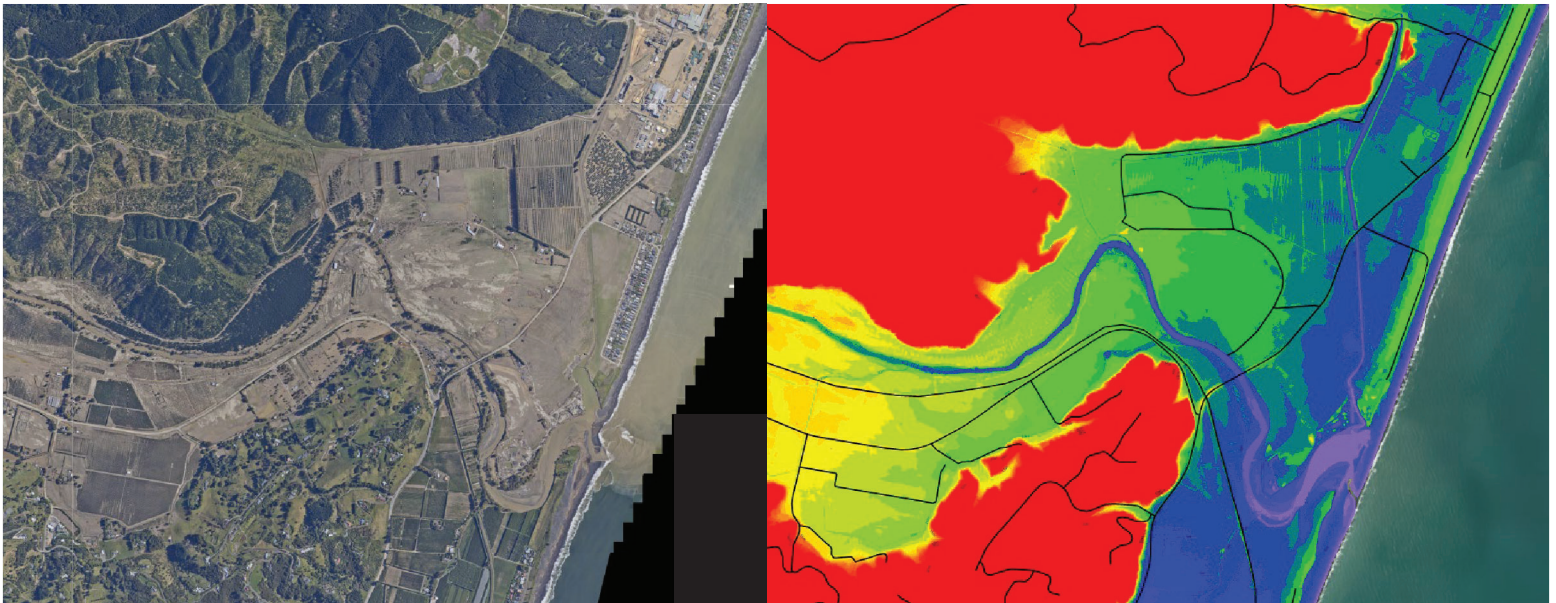
1981





2023

1943, 1981 & 2023 alignments



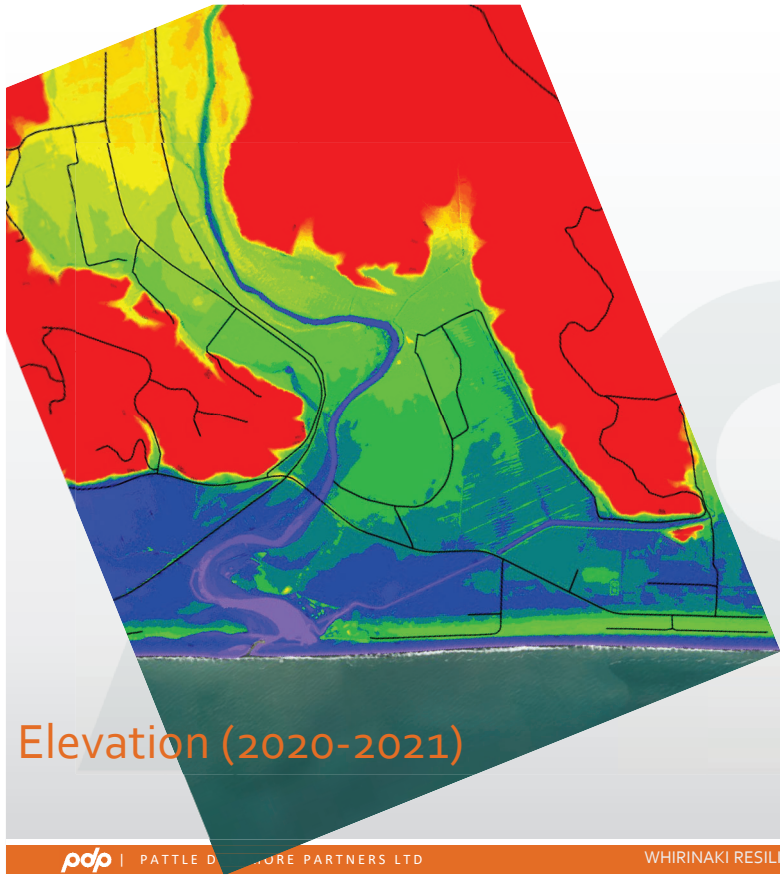
Post Gabrielle Imagery

Elevation (2020-2021)

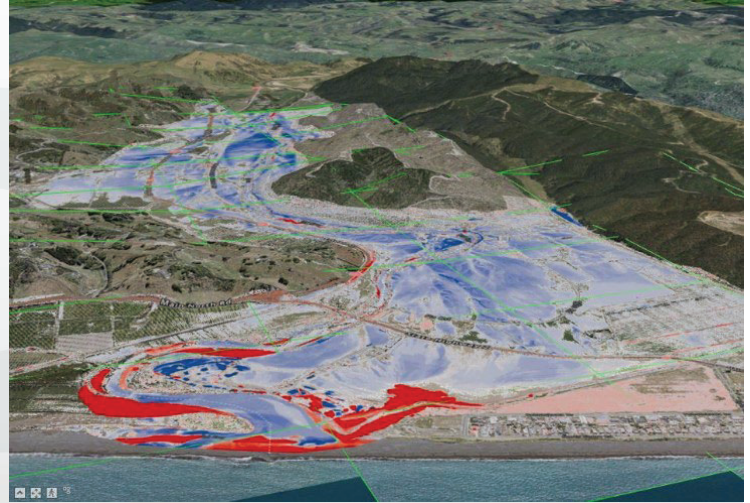
Red  $\geq 20$  m

Purple  $\leq 0$  m





## Silt Deposition



Red = reduction in ground surface (scour)

Blue = siltation

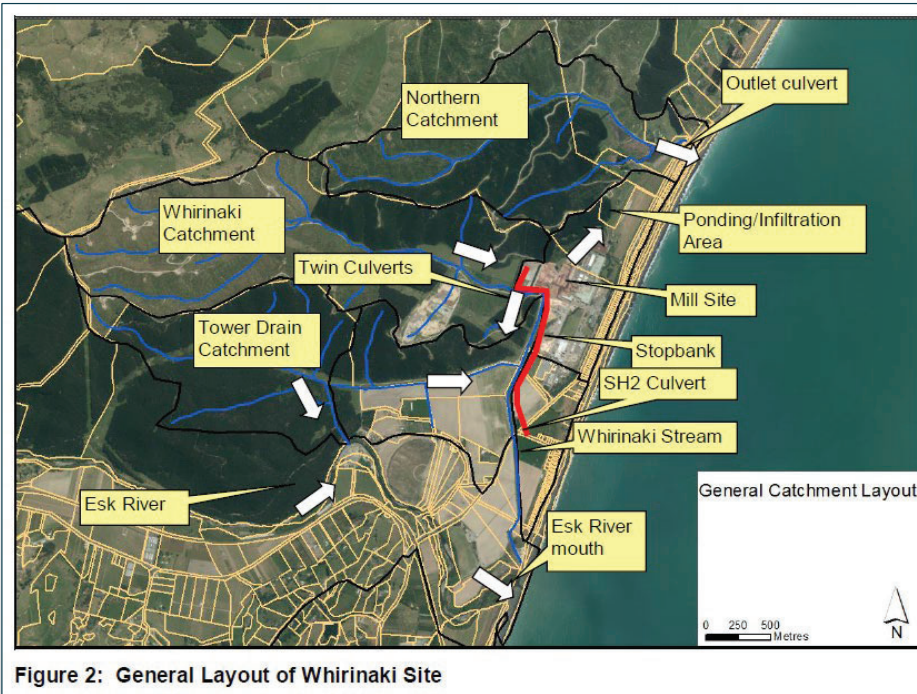
## Flood Hazard Summary

- Large catchment (250 square kilometres);
- Lower floodplain is predominantly valley floor, widening to more open plain just before the coast;
- Extreme floods (1938, 2023) characterised by significant silt and debris loads;
- Uplift resulting from the 1931 earthquake has exacerbated the flood hazard;
- Mouth prone to blockage, a combination of a dynamic coastal environment and the relatively low energy of the lower reach of the Esk River (a river not in an equilibrium state).





## Document Review – December 2013 Report



- HBRC December 2013 Report: Whirinaki Site Hydrologic and Hydrodynamic Analysis
- Documents flood risk to the Pan Pac site as it was understood at the time

## Document Review – December 2013 Report

**Table 1: Potential flooding risk factors for Whirinaki Site**

Potential Risk	Cause	Consequences	Risk
Esk River	Overflow from river	Overtopping of stopbank	Inundation of mill site
Whirinaki Catchment	Excessive rainfall	Overtopping of stopbank	Inundation of mill site
Tower Drain Catchment	Excessive rainfall	Overtopping of stopbank	Inundation of mill site
Northern Catchment	Blocked outlet to sea	Ponding area fills, lack of infiltration, causing lack of drainage from mill site	Inundation of mill site
SH2 Culvert Blocked during moderate/heavy rainfall	Debris, excessive rainfall	Overtopping of stopbank	Inundation of mill site
Twin Culverts blocked during heavy rainfall	Debris, excessive rainfall	Outflanking of stopbank	Inundation of mill site
Stopbank failure	Erosion, saturation of bank, slip failure	Direct flow into mill site	Inundation of mill site
High Seas	Severe ocean waves	Esk River mouth blocked, causing high water levels in Whirinaki Stream	Inundation of mill site

# Document Review – December 2013 Report

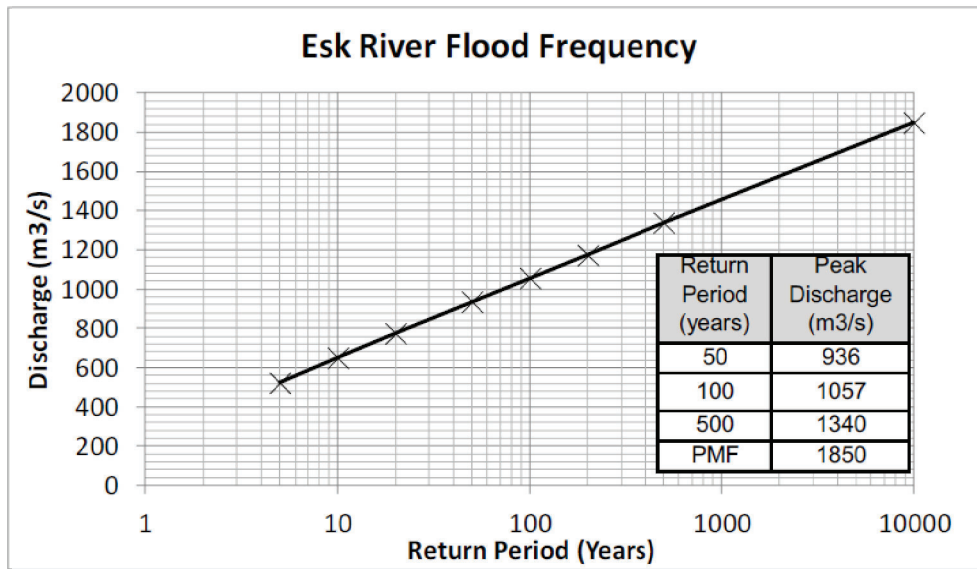


Figure 9: Esk River Flood Frequency

# Document Review – December 2013 Report

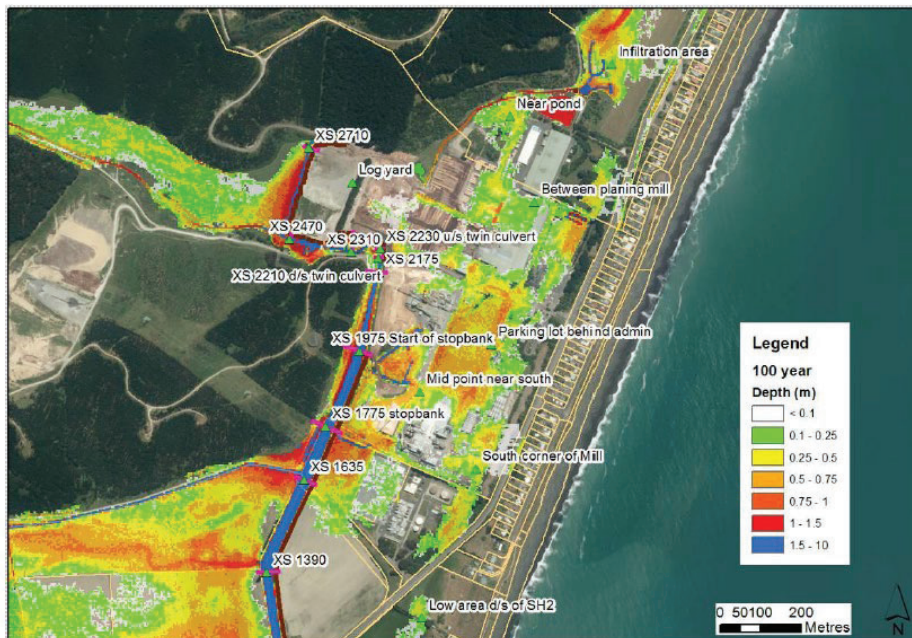
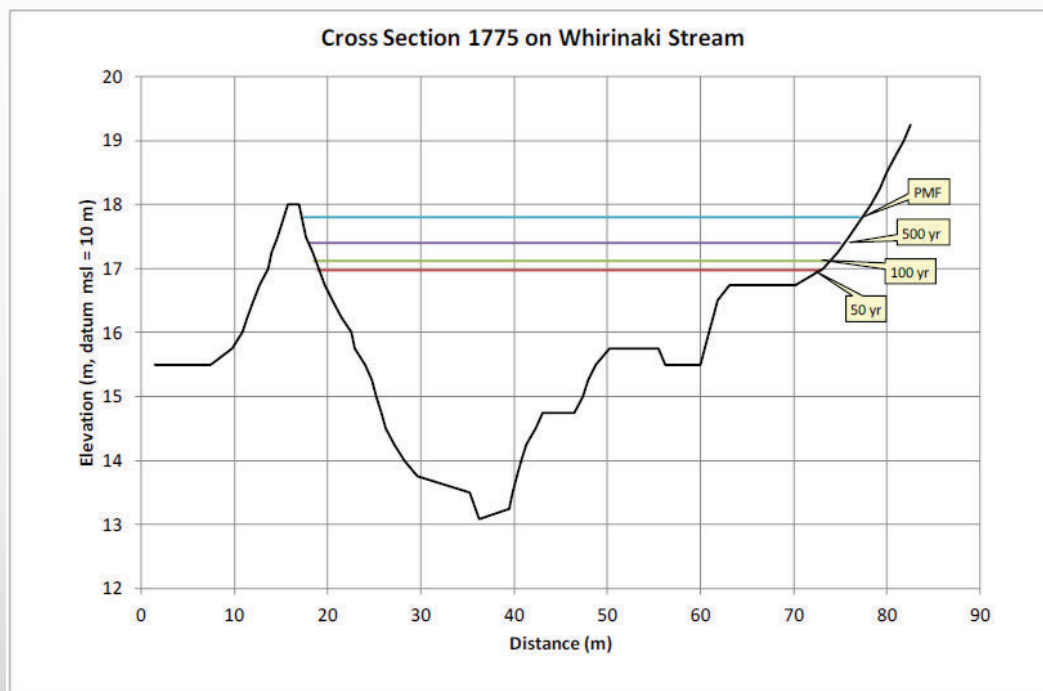


Figure 15: 2D Model result showing peak water depths for 100 year event

## Document Review – December 2013 Report



## Possible Mitigation Components

- *River straightening.* Providing the lower reach of the river with a more direct path to the sea;
- *River widening.* Increasing the conveyance capacity of the lower reach of the river;
- *Additional stopbanking.* Raising/ extending the existing stopbank and/ or new stopbanking;
- *Reducing debris and sediment loads.* Catchment wide interventions;
- *Expanded SH2 Bridge capacity.* New bridge with a greater span, higher soffit and fewer piers;
- *More permeable river training options.* Harnessing some of the catchment attributes to direct more flow toward the mouth eg lateral debris fence(s).



# Challenges

- The complex/ dynamic nature of the Esk in flood (the limitations of conventional analytical tools);
- Artificial interventions vs natural equilibrium;
- Making things better/ safer without encouraging more development;
- Potential adverse effects (particularly the potential to exacerbate flooding elsewhere);
- Accommodating existing transport corridors (road and rail);
- Drainage/ stormwater management with more extensive flood defences;
- Ground conditions particularly closer to the river mouth;
- The cumulative impacts of floods and a changing climate;
- Cost, cost and cost.



**Attachment 3: T+T Presentation**



# Whirinaki Resilience Project: Coastal Processes

Dr Eddie Beetham

Richard Reinen-Hamill

 Tonkin+Taylor



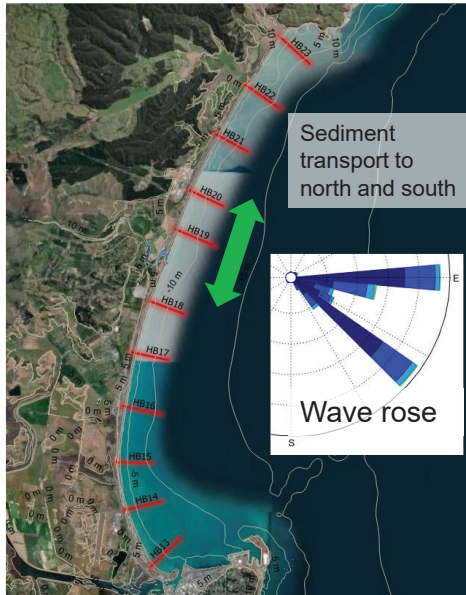
 Tonkin+Taylor

## Context

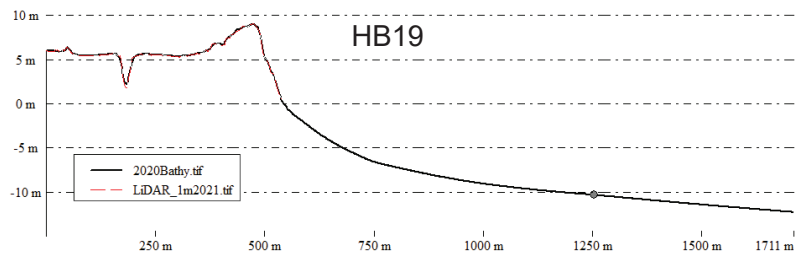
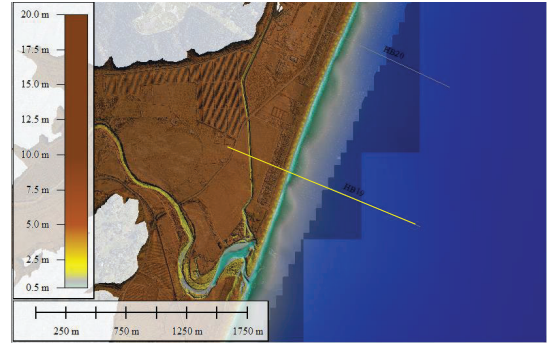
- River mouth blockage can influence upstream flooding.
- How susceptible is the river mouth to blockage?
- What options exist for 'opening' the river mouth?
- Aim is to understand coastal process dynamics at the Esk River mouth.



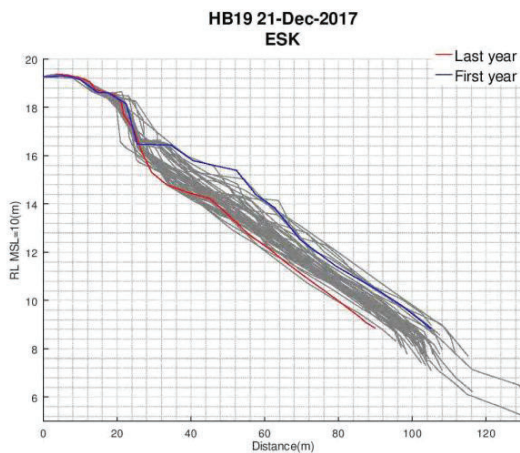
# Whirinaki coastal processes



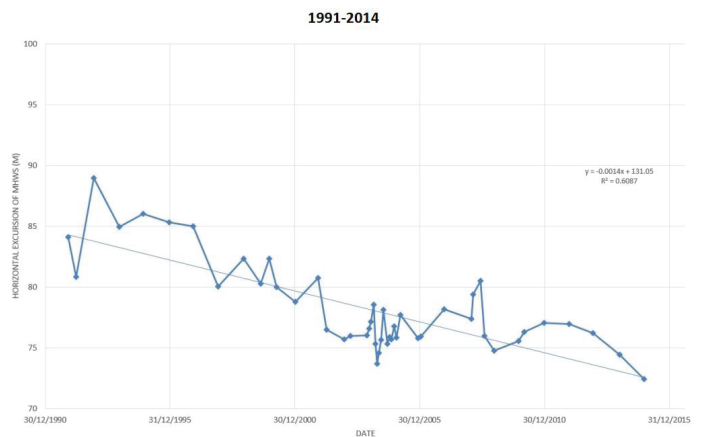
- Gravel sediment
- Mean grain size 2 – 3 mm
- Raised gravel barrier (uplifted)
- Net alongshore sediment transport to north



# Whirinaki coastal processes



From a HBRC report on coastal adaptation Beya and Asmat (2018)

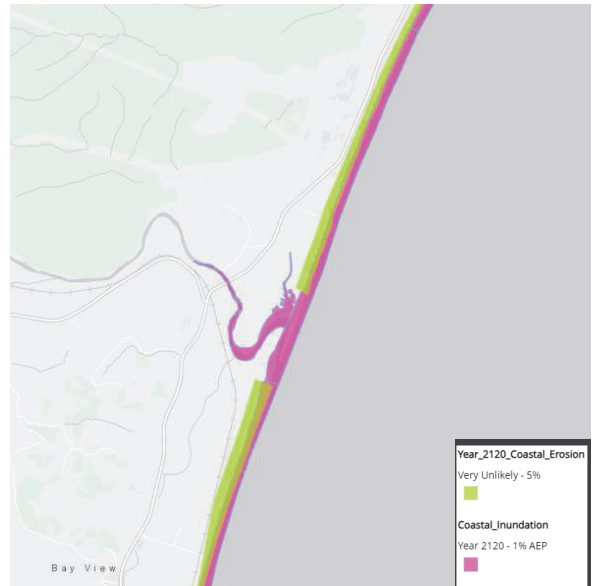


From a T+T report on coastal hazard (2015)

- Beach profile is dynamic
- Monitoring shows a trend erosion at Whirinaki

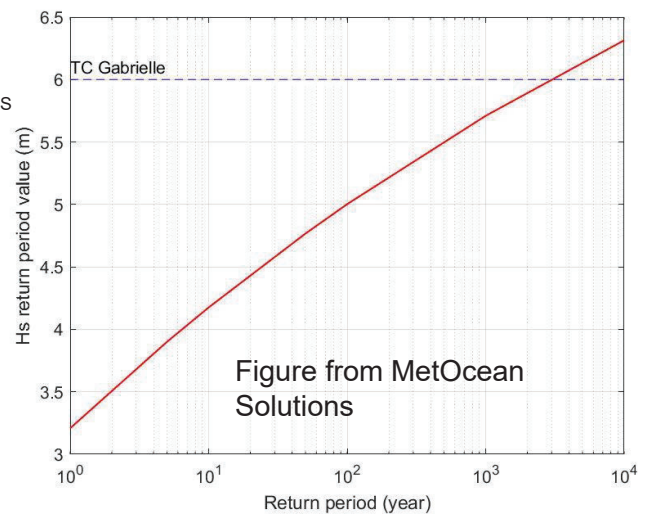
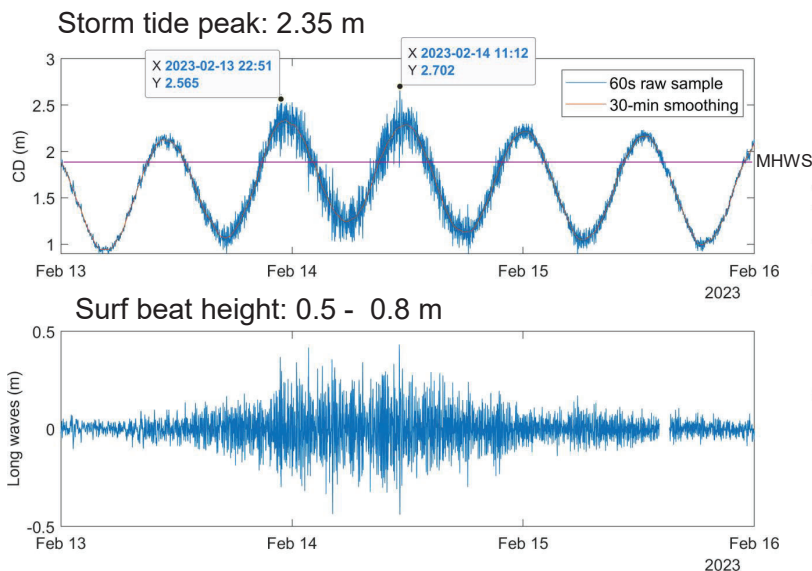
# Whirinaki Coastal Hazards

- Sea level is rising
- Land is subsiding at Whirinaki (-4.13 mm/yr based on NZ Sea Rise)
- Relative sea level rise of ~ 1 – 1.3 m by 2100
- Coastal erosion identified as a hazard for properties seaward of SH2
- Coastal inundation could influence Esk River and drainage network



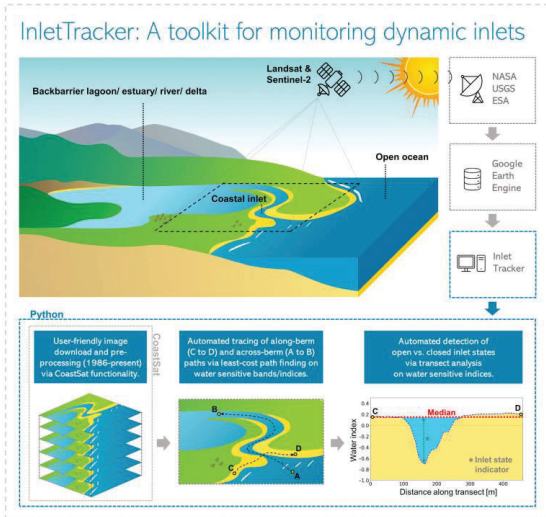
<https://gis.hbrc.govt.nz/hazards/>

# Conditions during Cyclone Gabrielle



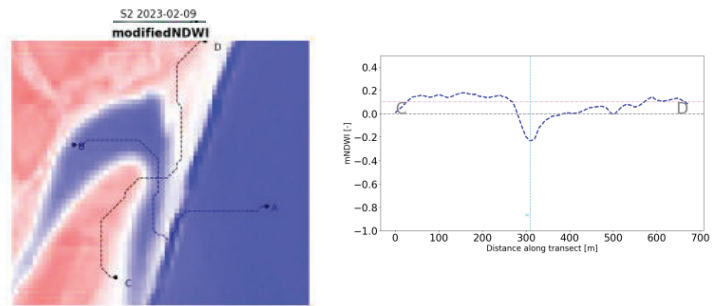


# Esk River mouth dynamics

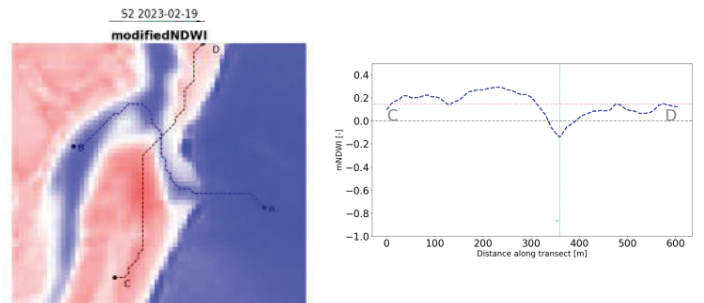


Heimhuber, V., Vos, K., Fu, W., & Glamore, W. (2021). InletTracker: An open-source Python toolkit for historic and near real-time monitoring of coastal inlets from Landsat and Sentinel-2. *Geomorphology*, 389, 107830.

5 days before TC Gabrielle

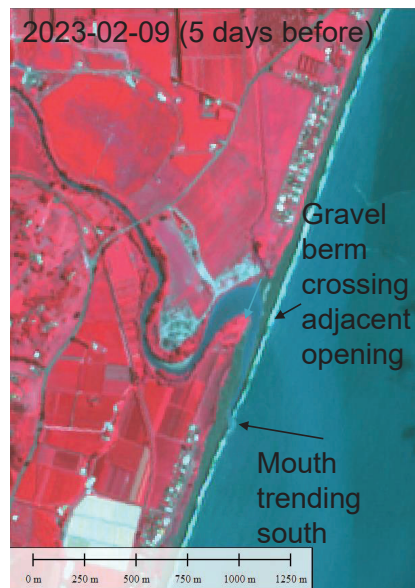


5 days after TC Gabrielle



(multi-spectral images from Sentinel 2)

# Esk River mouth dynamics: cyclone Gabrielle





# Esk River mouth dynamics

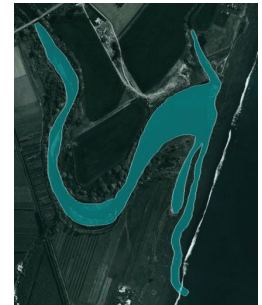
Sample of 9 inlet positions between 2003 and 2023



Open: straight (02/2010)



Open: south (08/2012)



Open: North (11/2015)



Closed (07/2021)



All images from Google Earth

## Summary

1. The Esk River mouth is dynamic with channel position migrating by 1km over the gravel beach
2. The river mouth is susceptible to partial or complete closure
3. The river mouth was partially closed (small channel to south) before Cyclone Gabrielle
4. The gravel barrier and lower banks of the river were eroded during Gabrielle.
5. Large sea conditions and the 'near-closed' gravel barrier position may have influenced river drainage to the sea

LINZ imagery 2022



LINZ imagery Feb 2023 (post Gabrielle)





# Esk River Mouth Options overview

*The following represents the preliminary coastal options for a TFG Workshop on 30 June 2023*

## 1: Status Quo

Maintain current river mouth management approaches – i.e. do nothing new.



## 2: Improved channel maintenance

Develop a new channel maintenance plan to monitor channel morphology with triggers to open manually to a design level of service.



## 3: Up-stream options

Upstream realignment and stop bank options could be designed with suitable armour near the mouth to focus river flow approaching coast. This may concentrate flow towards the channel centre and limit migration to north and south.



## 4: Training structures

Construction of training walls or groynes on both sides of the river mouth could maintain an opening. This would have significant and potentially adverse effects on coastal and ecological processes.



