

Wairoa

CYCLONE GABRIELLE REVIEW

Andrew Newman

Strome
Advisory

KEY TERMS

- ARI – Annual Recurrence Interval - Average time in years between floods of this size hence the expression 1 in 100 floods
- CUMECS – Cubic meters per second flowing past a given point
- WOODY DEBRIS – Mix of part trees, whole trees, slash, fence posts, etc.
- SLASH – Sawn material post-harvest, typically left on forest site
- FIELD CAPACITY – A measure of soil moisture whereby soils have no retention capacity left
- LIDAR – Light Detection and Ranging – a very high accuracy method of measuring topography – now down to centimetres

STRUCTURE

- Section 1 - Independant Review Purpose
- Section 2 - Review Method
- Section 3 - Wairoa Catchment Description
- Section 4 - History of Flooding within the Wairoa Catchment
- Section 5 - Underlying Issues which may influence flood flows pre/post Cyclone Gabrielle
- Section 6 - Flooding of North Clyde
- Section 7 - What are the lessons from Cyclone Gabrielle and other events

Independant Review Purpose

SECTION 1

SECTION 1

Independent Review Purpose

To ensure there is a robust 'on the ground assessment' of the local factors involved in driving and/ or contributing to ex-Cyclone Gabrielle (Gabrielle) flooding of, in particular, the North Clyde area of Wairoa.

Taking into account Gabrielle and other events ensure that the local voice and expertise are heard and utilised in consideration of flood management practices for the Wairoa Catchment going forward.

SECTION 1

Independent Review Purpose

The scope of work for this independent review includes the following;

1. Significance of the ex Cyclone Gabriel Flood event in comparison with the ex Cyclone Bola Event (Bola) and other relevant floods - 1948
2. Comment briefly on flood mitigation measures adopted post-Bola.
3. Confirm Hawke's Bay Regional Council's findings as per Dr. Nic Peet's memo of 4th September: 'WAIROA RAINFALL AND RIVER FLOWS IN CYCLONE GABRIELLE'.
4. Obtain and review rainfall and river flow data for subsequent significant rainfall events
5. Consider additional factors that may have contributed to the flooding of Wairoa during Cyclone Gabrielle including:
 - Impacts of woody debris including its origin and extent
 - Validation of Genesis Energy hydrology data from the Waikaremoana Hydroelectric Scheme
6. Comment briefly on the relevance of the findings for future interventions

SECTION 1

Inclusions and Exclusions

- The Wairoa Catchment in its entire extent both across the Wairoa and Gisborne Districts is in scope.
- Floods beyond Gabrielle within the Wairoa Catchment are in scope.
- Flooding issues/infrastructure damage/landscape damage including in forests and farms outside of the Wairoa Catchment but inside of the Wairoa District and or adjacent to the District are out of the frame of reference with the exception of – enabling contextual and comparative commentary in relation to the Wairoa Catchment itself.
- Civil defense actions and initiatives are not part of this review.
- Solutions to the issues arising from this review are in the frame of reference - to a limited degree.
- It is not the remit of this work to comment on the flood mitigation solutions being developed through the Tripartite process involving HBRC/WDC/Tatau Tatau o Te Wairoa.
- However, where it is evident that issues and, or practices have emerged as a consequence of Gabrielle, and other like events, and where positive actions may benefit - brief comments will be made.

LIMITATIONS

- The review has relied on evidence in the landscape 1 year after the primary event, similarly people's recollections 1 year after the event.
- The bulk of the technical data has been sourced from HBRC, the Forest Industry and the Independent Audit of the Waikaremoana Hydroelectric scheme, leading up to and through Gabrielle.
- Most of the data is considered to be of good quality by the review team.
- Exceptions to this will be identified in specifically

Strome
Advisory

Review Method

SECTION 2

- This review has involved – forming a team with sufficient expertise to cover the issues
- Catchment and key site visits
- Obtaining local and expert comment on issues
- Reviewing technical data
- A peer review – undertaken by Graeme Hansen

SECTION 2

Review Method - Team

An expert team with both relevant technical knowledge of issues and drivers associated with large scale flooding events and a sound knowledge of the Wairoa Catchment has undertaken this review.

Andrew Newman

Review Lead – Strome Advisory

Background in land management, forestry science management, water resources, infrastructure and agribusiness ex-CEO of HBRC 2007 –13, 2016 - 17.

Mike Adye

Civil Engineer

Ex-Group Manager, Asset Management, Hawkes Bay Regional Council 1993-17.

Peter Manson

Land Management - AgFirst

Ex-Land Management, HBRC in Wairoa 1985 – 22.

Brett Gilmore

Brett Gilmore Consulting

35 Years in the Forest Industry incl. 10 years with PanPac Forest Products in Hawkes Bay 2007-2017. Forester of the Year, NZ Institute of Forestry 2012.

Strome
Advisory

SECTION 2

Local People and Site Visits

Meetings with Key People

Met with 27 people within the Wairoa District and beyond covering Gabrielle and where relevant other flood event issues for Wairoa – a full list can be provided

Catchment and Key Site Visits

This included 5 trips around the catchment including critical sub-catchments/the Wairoa Bar and to key infrastructure sites.

A trip by helicopter was undertaken from the Waikare Catchment on the District Boundary across the key plantation forestry sites within the Wairoa Catchment and Wairoa District.

SECTION 2

Review of Key Documents

13 Documents have been reviewed by Andrew Newman and Brett Gilmore.

A full list of these documents can be found at the end of the presentation.

Wairoa Catchment Described

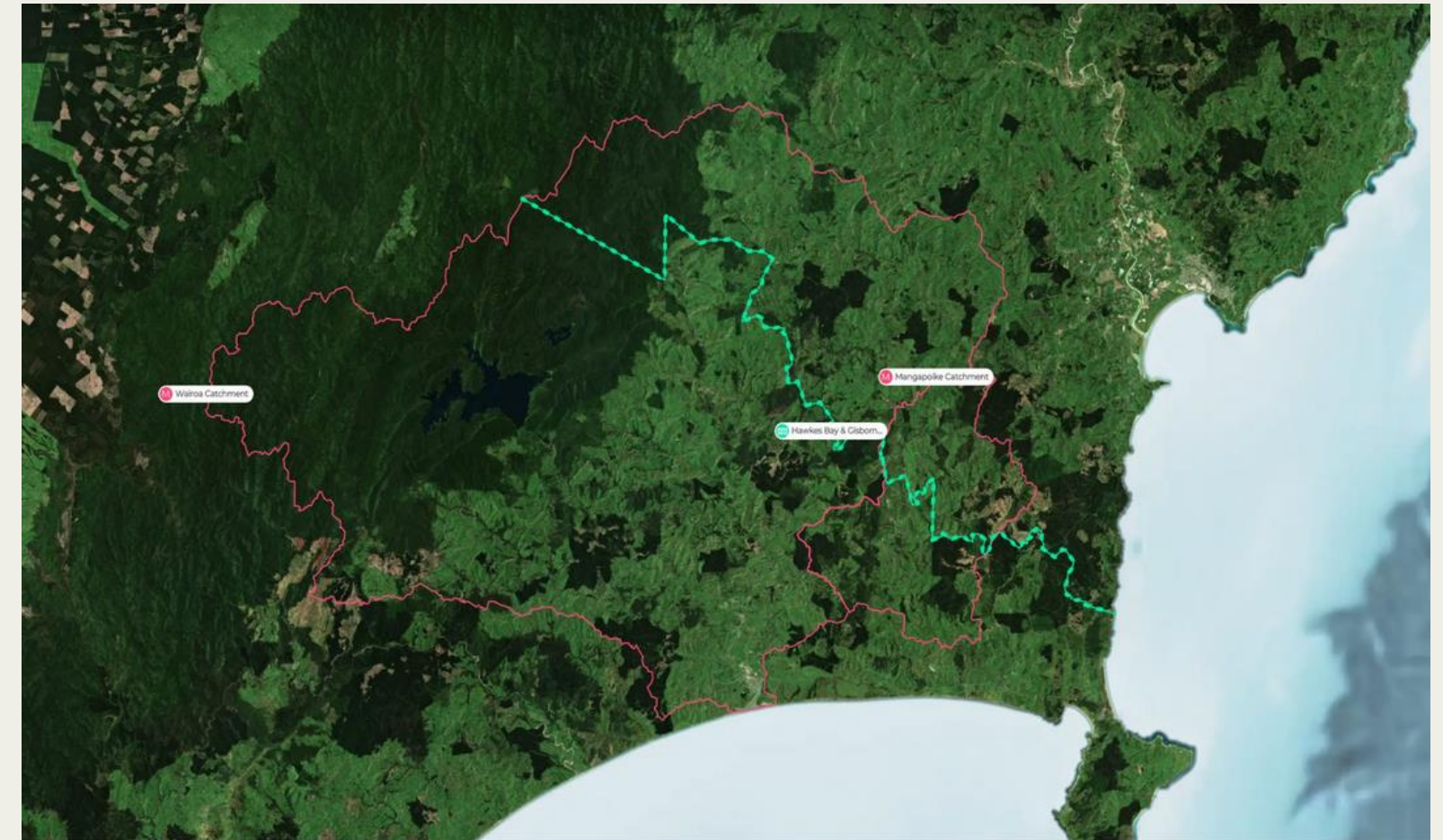
SECTION 3

Strome
Advisory

SECTION 3

Wairoa Catchment Described

- Overview / Key Insights
- Catchment is approx. 360,000 ha.
- Shaped like a half circle with all short run rivers converging into the mainstem.
- Rivers have a steep short run onto a flood plain then a very gradual fall to sea level – the river mouth is often closed by a bar
- Altitude ranges from 1,300 m above sea level (ASL) to sea level
- The geology is mainly siltstone/sandstone and is highly erodible
- Approx 40% of the catchment is indigenous forest, 45% exotic grassland, 12/13% exotic forest, balance - other



INSIGHT

Key issues that contribute to the Catchment's vulnerability to floods and their consequences include:

- its shape,
- river gradients,
- the geology,
- soil moisture retention capacity or lack there of,
- the convergence of all tributaries into a single stem,
- the incidence of a bar at the river mouth.

Floods & Flood Mitigation

SECTION 4

SECTION 4

Floods & Flood Mitigation

Event Date	Weather Event Type	Pre-Conditions (antecedent)	Scale in Flow	Key Sub Catchment Contribution	Woody Debris / Silt	Consequences
May 1948	Depression	Wet Year Preceding	8,200 cumecs +/- 35% Estimated flows- Actual potentially less!	Considered a 1 in 15 year rainfall event but a 1 in 100 year flood event	Reports of significant woody debris Significant deposits of silt in township	Flooding of North Clyde and Marine Parade/Awamate
March 1988	Ex-Tropical Cyclone Bola	Dry / Normal Year Preceding	5,000 cumecs +/- 34% Estimated flows – Actual potentially less	Rainfall extensive across catchment over 3-4 day period Considered a 1 in 30 year event	Reports of significant woody debris	Destruction of Wairoa Bridge Some flooding in Marine Parade
February 2023	Ex-Tropical Cyclone Gabrielle	Abnormally Wet Year Preceding	6,200 cumecs – preliminary noting measure peak flows – Marumaru of 4,100 cumecs Waiau Ardkeen 1656 cumecs Flows measured	Hangaroa/Wairoa/Mangapoike dominant Significant rainfall in Mangapoike in particular	Significant woody debris – evident Significant deposits of silt in North Clyde and on some farms/race course adjacent to township	Flooding of North Clyde Wairoa Campground Farms – south side of river – op Frasertown Awamate Bridge damage Highway damage & isolation

Strome
Advisory

SECTION 4

Floods & Flood Mitigation

Flood risk mitigation in Wairoa in the absence of hard infrastructure has focused on 3 main issues

- Progressive development and upgrading of the flood warning system – post-Bola, and analysis of the 1948 flood – weather stations, flow gauges, flood monitoring & modeling and an early warning system
- Manual opening of the Wairoa bar.
- Removal of poplars and willows from small streams

In summary, the flood data has improved significantly over successive events and especially post-Bola – however, the early warning system broke down on the back of communications systems at the critical time through Gabrielle.

Issues with the bar and its risk are addressed further, later on.

Underlying Issues Exacerbating or Affecting Flood Flows

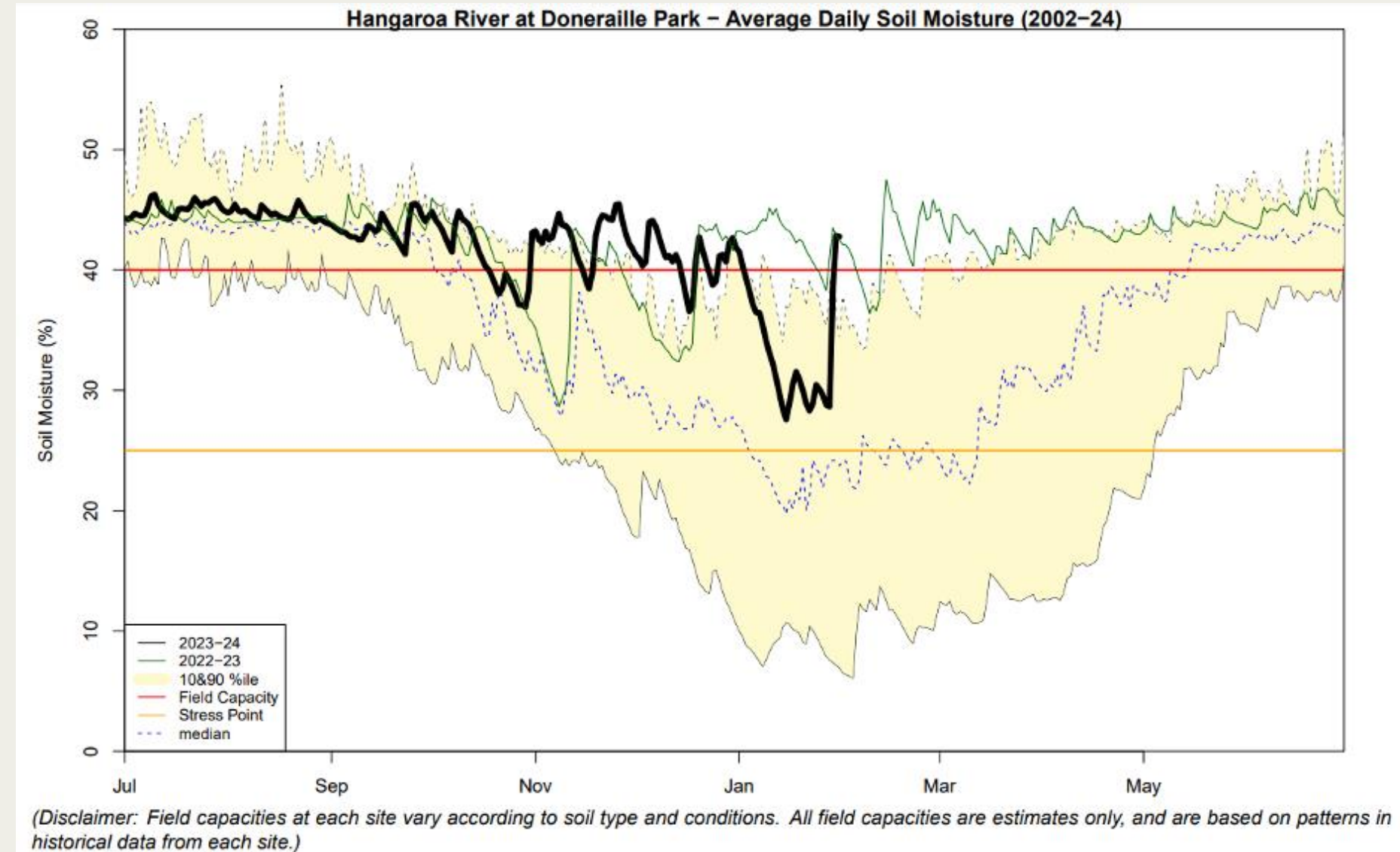
SECTION 5

SECTION 5

Underlying Issues Exacerbating or Affecting Flood Flows

Issue 1: Antecedent Climatic Conditions

- Soil Moisture ‘field capacity’ was at excess levels preceding Gabrielle.
- In the Wairoa Catchment, this greatly exacerbates flood risk and flow levels.
- Similar pre-conditions existed for the 1948 flood, but not for Bola.



INSIGHT

- In La Nina type years, flood risk levels will dramatically increase for the Wairoa Catchment. General flood risk awareness has probably been more focused on
 - the possibility of ex sub-tropical cyclones arriving, and
 - Whether or not the bar is open or closed

Versus

- awareness of soil moisture conditions ahead of storm events should be a critical indicator of the need for flood preparedness.

SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 2: Incidence of woody debris / forestry slash entering waterways and either diverting flows, damaging infrastructure and reducing amenity values.

Woody debris damage and or issues within the Wairoa Catchment

- Woody debris affecting bridges including bridge destruction has been an issue across many major flood events – 1938, 48, Bola, 2022, Gabrielle.
- The composition likely changed from native, poplar, and willow **to** poplar/willow, pine, and native.

Figure 2 - Woody Debris approaching Wairoa Bridge likely 1948 storm



SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 2: Incidence of woody debris / forestry slash entering waterways and either diverting flows, damaging infrastructure and reducing amenity values.



Figure 3 – wood debris on Wairoa Bar post Gabrielle – source Interpine woody debris survey for HBFG

Sources and Composition

Hawkes Bay Forestry Group (HBFG) woody debris survey at the Wairoa mouth suggests by volume – 36% poplar willow, 29% pine (2% slash
29% native, balance other

SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 2: Incidence of woody debris / forestry slash entering waterways and either diverting flows, damaging infrastructure and reducing amenity values.



Figure 4 Mixed Woody Debris on Riverina Bridge, Marumaru during Gabrielle – approx. 7 am February 14 2023



Figure 5 – woody debris behind Kotare Bridge – mainly pine but not physically surveyed

Strome
Advisory

SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 2: Incidence of woody debris / forestry slash entering waterways and either diverting flows, damaging infrastructure and reducing amenity values.



Figure 6 & 7 below illustrate both the incidence of the poplars on the Waikaretaheke and Waiau confluence.



Figures 8 & 9 Wairoa post Gabrielle indicating significant bank scouring.

SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 2: Incidence of woody debris / forestry slash entering waterways and either diverting flows, damaging infrastructure and reducing amenity values.

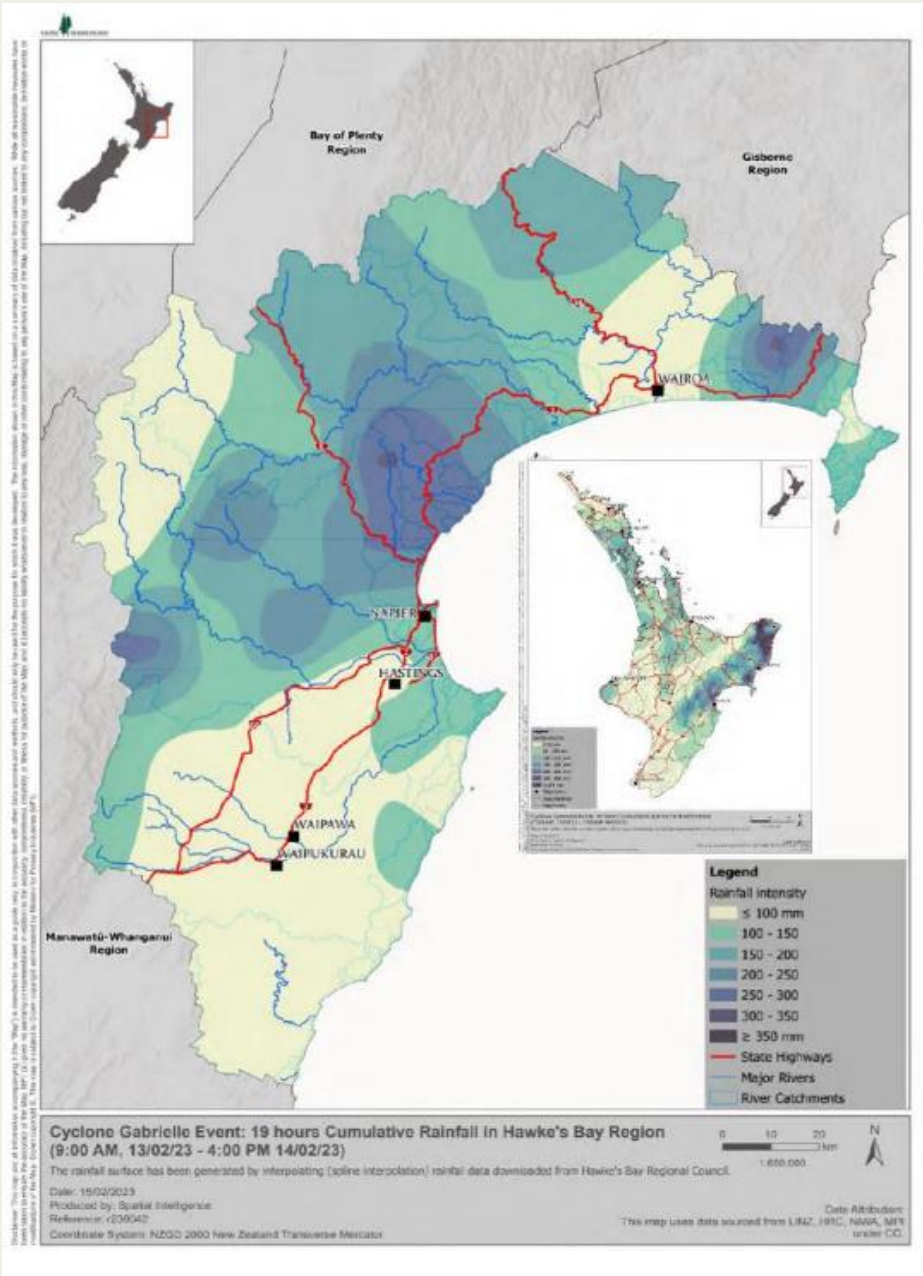


Figures 10, 11, 12 - poplar flood debris just upstream of the rail bridge and in the Waikaretaheke, and woody debris adjacent to the Wairoa tributary

SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 2: Incidence of woody debris / forestry slash entering waterways and either diverting flows, damaging infrastructure and reducing amenity values.



Figures 13 – Rainfall intensity chart Gabrielle (source Interpine Woody Debris report)

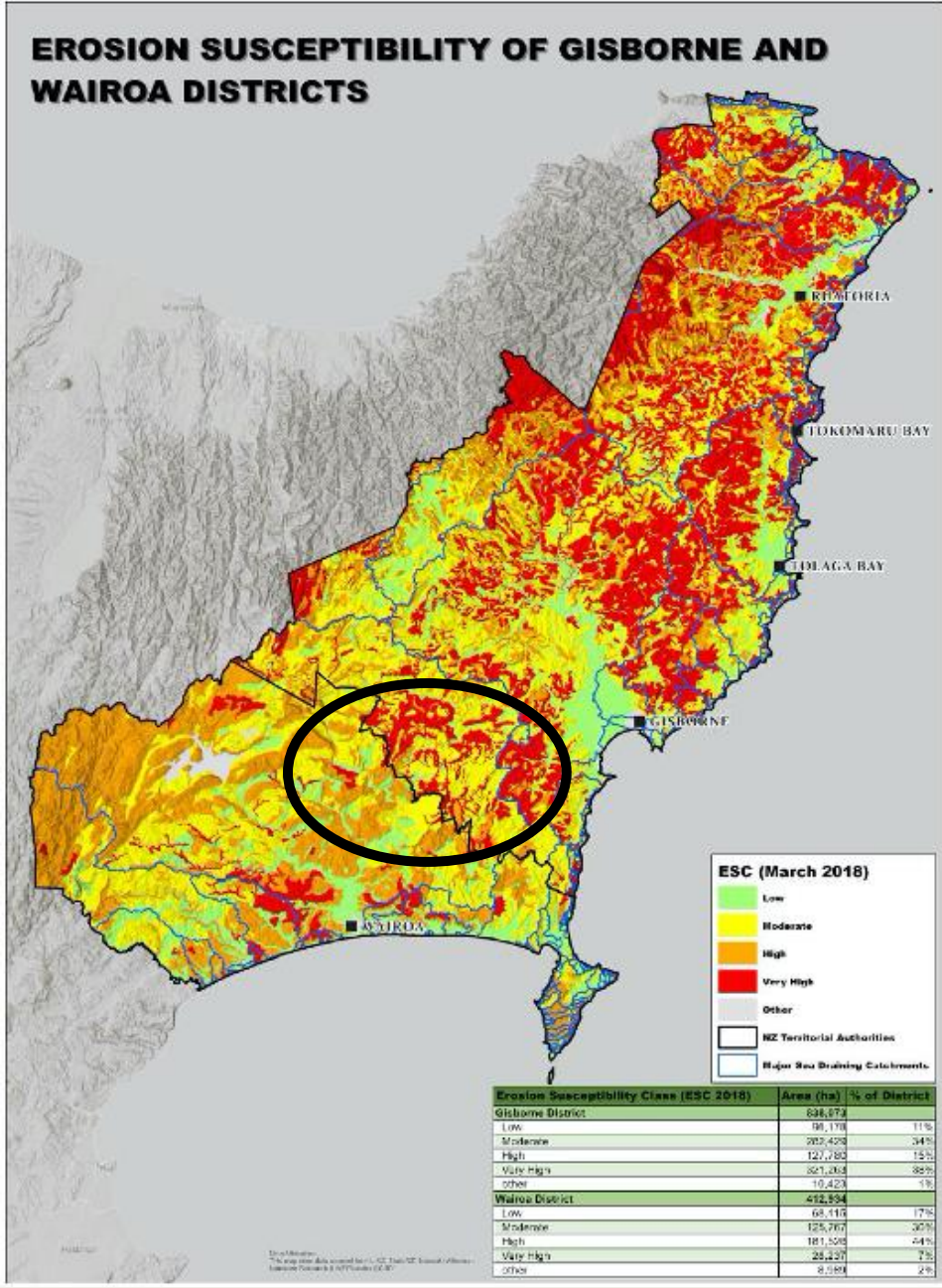


Figure 14 – Erosion risk map – source Ministerial Inquiry into Land uses in Tairāwhiti and Waioa

Strome Advisory

SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 2: Incidence of woody debris / forestry slash entering waterways and either diverting flows, damaging infrastructure and reducing amenity values.



Figure 15 'mid slope failure' Waikare Forest



Figure 17 - Windthrow in Forest in the Ruakituri area



Figure 16 Google Earth image of storm damaged forest & farmland between Mangapoike Tiniroto roads



Figure 18 intact forest/farmland near Frasertown

INSIGHTS - SUMMARY

- Poplars are a significant component of the woody debris and likely the highest risk due to size - They have likely originated from the Wairoa/Hangaroa due to bank scouring.
- Pine debris is significant behind the Kotare Bridge and has probably originated in the upper Mangapoike catchment due to extremely intense rainfall – the volume present has driven bridge abutment scouring
- The northern edge of the Wairoa Catchment contains most of the Catchment's very highly erodible land.
- Other plantation forests in the Wairoa catchment are largely intact apart from ex-Tropical Cyclone Hale induced windthrow.

INSIGHTS - SUMMARY

- Poplar debris risk has likely reduced post-Gabrielle on the Hangaroa/Wairoa due to scouring. On the Waiau, the risk remains.
- At rainfall intensities of 500 ml + as experienced on the northern edge of Wairoa Catchment – pine plantations on very highly erodible land will suffer significant failure
- This risk will be an issue for any type of forest cover but radiata's limited useful life should be a key consideration when establishing very highly erodable sites.
- Bridge infrastructure has held up remarkably well given the extent of the debris (except Ruakituri Bridge)
- **Flow diversion is dealt with further on.**

SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 3: Silt

- Silt levels in the riverbed - Local comments or questions relate to the riverbed level – is it too high which exacerbates flooding and or could it be dredged to reduce risk?
- Silt levels in the bed are governed by sea levels and tides for approx. 20 kilometers up-stream of the mouth. Typically - the the bed level is in equilibrium or close to it with the tidal levels
- Dredging to reduce bed levels is likely to be ineffective as the bed will rapidly re-set..

Silt deposition in North Clyde – and its origin

- The origin of silt deposition in North Clyde will predominantly be a combination of bank scoured silt – Wairoa/Hangaroa and of slope failure on pastoral and forest country in Hangaroa/Mangapoike

SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 4: Condition of the Wairoa Bar and Flood Risk due to blockages

- The Wairoa Bar closure is arguably the town's most frequently occurring flood risk issue
- During Gabrielle, the bar was reported to open – immediately in front of the mainstem which, whilst unusual – means the bar was not an issue during Gabrielle
- It has however been an issue on either side of Gabrielle. Most recently bar closure resulted in flooding of the Limery a recently established business relatively close to the river mouth.
- Historically the bar has been manually opened ahead of forecast flood events – approx. 20 times in the last 30 years.
- This system, in the absence of infrastructure, has worked whilst local oversight, experience, and institutional memory have been present i.e., there have been no significant floods into the residential areas of Wairoa.

INSIGHT

- Whilst there may be a view that a major scale event such as Gabrielle will blow an exit through the bar in the absence of an optimal channel – precaution would suggest you'd not plan on it.
- In the absence of an infrastructure solution for the bar – recent history suggests there's a solution – i.e., the use of expert local based staff and contractors with sufficient delegation to make timely decisions on mouth opening. This approach requires institutional continuity of approach.

SECTION 5

Underlying Issues Exacerbating Catchment Flows

Issue 5 - Genesis Hydroelectric Power Scheme/ Lake Waikaremoana Lake level and flood flow management and its contribution or otherwise to flood flows in North Clyde

- Local concerns are that flood flow releases from the hydro scheme through Gabrielle was a causal factor of North Clyde Flooding
- The owner Genesis, had an independent hydrological audit undertaken post Gabrielle which confirms the scale of the flows released – approx 40 cumecs
- This less than 1% of the mainstem flows as published by NIWA (February 2024) during Gabrielle.

INSIGHT

The question given this evidence, why does the conjecture about the scheme's contribution to damaging flood flows persist?

Local attitudes towards the scheme and perceptions as to its contribution to major issues such as North Clyde Flooding may be mixed with issues such as;

- localised flooding immediately downstream of the scheme during Gabrielle, and
- very high lake levels experienced pre-Gabrielle resulting in flooding of facilities and compromising recreational use of the lake.

Flood Flows & North Clyde

SECTION 6

Strome
Advisory

SECTION 6

Flood Flows & North Clyde

Why did North Clyde flood?



Figure 19 -Possibly 1948 Wharf Shed



Figure 20 North Clyde morning of 14 February 2023

SECTION 6

Flood Flows & North Clyde

Issue 1: Scale

A NIWA review of Cyclone Gabrielle - NIWA's 'Extreme value analysis of the flood flows that occurred during Gabrielle noted the flowing values for KEY Wairoa tributaries:

NIWA table of Flows and estimated annual recurrent interval

Tributary	Flow estimate cumecs	Pre- Gabrielle ARI	Post- Gabrielle ARI	Flow record
Wairoa Marumaru	4,100*	250	120	1980-2023
Hangaroa Doneraille Park	2070	420	220	1974-2023
Ruakituri at Tauwhretoi	998	50	40	2013-2023
Waiau at Ardkeen	1656	50	40	1988-2023

* Adjusted no. – HBRC original estimate 4,900 cumecs

HBRC in correspondence has noted that the current estimate ARI/AEP or 1 in 100 year, event is 6,700 cumecs for current versus the 6,200 cumecs estimate for Gabrielle

Note: Versus other events – 1948, Bola - the intensity of measurement is much greater and should reflect greater certainty

INSIGHT

- Gabrielle flood flows may be similar in scale to the 1948 flood as the preceding conditions and flooding of North Clyde was similar.
- HBRC flood modelling in 2006 enhanced by Lidar – previously unavailable suggested a 1 in 100 year event would flood North Clyde.
- With climate change amplifying the intensity of flood events North Clyde flood risk is likely increasing.

SECTION 6

Flood Flows & North Clyde

Issue 2: Flood Flow Diversion at the Rail Bridge

- As noted in section 5.2 significant woody debris banked up against the rail bridge.
- Local recollections note that there was a backflow on the upstream side of the bridge with the water level (anecdotally) approximately 1-1.5 m lower on the downstream side at or near peak flow - approx. 8 -11 am.

The question that arises is – was this blockage of a sufficient scale to divert the flow out of the main stem to the extent it caused flooding in North Clyde that would have not otherwise occurred?

Effect of the Rail Bridge Debris Dam

- The Rail Bridge effect at most was likely to have been a slowing of flow velocity into North Clyde and some back flow, potentially raising water levels in adjacent farmland just upstream.
- More accurate than this is the response provided by the Flood Flow Modelling engineer of HBRC.

SECTION 6

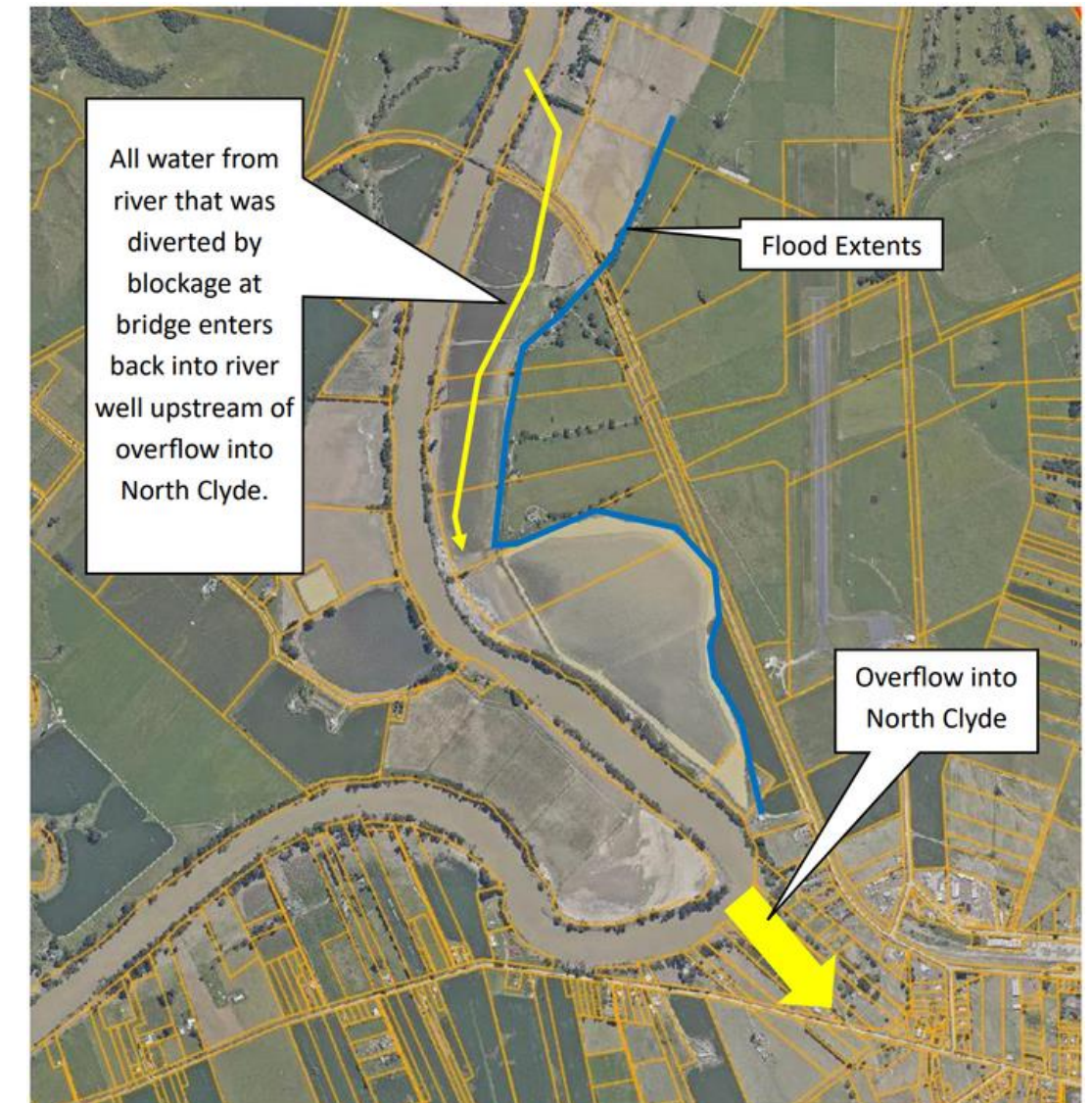
Flood Flows & North Clyde

Andrew Newman Question:

Neighbours adjacent to the Wairoa Railbridge report a significant woody debris build-up on against, on and adjacent to the bridge (ie embankment). Further commentary suggests a flow differential of (anecdotally) 1-2 metres in elevation between the upside and downside of the bridge at or near the peak flow. As per the Wairoa CommunityStakeholder group process assessing flow mitigation options - I understand an allowance equating to 10 percent of the total flow is modelled as backflow – affecting farm properties upstream with 90% of the flow continuing down the mainstem and through the showgrounds – North Clyde area. This leads to 2 questions: - 1. without the bridge would the flows have remained within the mainstem? Or would have North Clyde have flooded regardless ?– lidar levels and flow records will/have verified this presumably. 2. Pretty speculative I appreciate but is there any view as to the impact of the rail bridge blockage on flow velocity?

Craig Goodier Response:

As demonstrated below {to the right} in figure 6, the effect of blockage at the railway bridge would only have an effect of reducing the overflow into North Clyde. Imagine if the rail bridge could block a huge portion of flow and maintain the water in the channel (i.e., no out of channel flow). This would result in water arriving at the overflow into North Clyde at a slower rate and would result in lesser flooding. As a corollary, if there was no blockage at the rail bridge, the water would arrive at the North Clyde overflow earlier, and with a higher discharge, causing worse flooding.



Strome
Advisory

SECTION 6

Flood Flows & North Clyde

Issue 3: Warning or lack thereof

A number of factors are at play in this issue as follows;

- The intensity of rainfall from Gabrielle especially in the Mangapoike Catchment over a short duration (possibly 25% of the peak flood flow recorded at Maramaru may have originated out of this catchment).
- The short steep catchments from which the flood flows emerged.
- The absence of intense rainfall within and adjacent to the Wairoa Flood Plain where most people were affected.
- Critically the failure of flood warning communications systems at approximately 1 am on February 14.
- Arguably a lack of community awareness of risk - community memory of flood risk being more commonly associated with Bola, not the 1948 floods.

SECTION 6

Flood Flows & North Clyde



3D HANGAROA SUB-CATCHMENT MAP

POWERED BY  myenviro

Strome
Advisory

SECTION 6

Flood Flows & North Clyde



3D MANGAPOIKE SUB-CATCHMENT MAP

POWERED BY  myenviro

Strome
Advisory

SECTION 6

Flood Flows & North Clyde

Issue 4: Surprise as to the areas flooded

- Surprise has also been expressed by some that the North Clyde flooding was unexpected, and why was the flooding from the Gabrielle event substantially different from that experienced during Bola.
- One feature of Gabrielle was that the Wairoa Campground on the upstream of the main town bridge started flooding at 3am and people self evacuated between then and 6 am - significantly earlier than North Clyde.
- Flooding of North Clyde occurred in 1948 – 75 plus years prior to Gabrielle. Some residents still remember that event, but they are very few in number.
- In regards to localised flooding – an example being the Wairoa Campground, the HBRC flood model does identify this area as being at risk.
- Of note is that the modelling suggested a 1 in 20-year event could create localised flooding and this may explain the earlier arrival of flood water in this location than was the case for North Clyde.

INSIGHTS

- Gabrielle was a very large and extreme event especially across the Northern Catchments Hangaroa/Mangapoike/Wairoa mainstem.
- Substantial differences between Bola and Gabrielle included:
 - Scale, soil moisture conditions preceding Gabrielle, short sharp intensity of rainfall Gabrielle – versus dry year preceding Bola, duration of the rainfall – 3-4 days.
- The most recent flow statistics for Gabrielle a substantial improvement in those obtained for Bola (more sites)
- Whilst the rail bridge woody debris dam did likely reduce flow velocity through the mainstem, North Clyde, it is highly unlikely to have been a causal factor in diverting flows into North Clyde.
- An implicit if not explicit contract between HBRC and the Wairoa Community in the absence of ‘hard infrastructure’ for flood protection was to provide early warning of a flood event to local civil defence.
- Where there is very high soil moisture levels and a high risk of sub-tropical storm events there’s a need for a heightened community awareness of flood risk.
- North Clyde area of Wairoa is exposed to flooding from events that are less than 1 in 100 probability. With climate change this risk will increase.

Lessons from Gabrielle

SECTION 7

Strome
Advisory

SECTION 7

Lessons from Gabrielle

Issue	Risk	Response	Accountability
Catchment soil moisture saturation ahead of storm events	Significantly heightens flood risk of North Clyde and surrounds	Should be a key factor in Civil Defence planning – if not already so.	Civil Defence HBRC data
Woody debris	Is a risk to infrastructure primarily	River bank tree management – extension of HBRC rivers schemes – needs analysis on what if anything can be done re poplars – Southern catchment focus predominantly Plantation forestry – prime risk is - planting and harvesting on extreme erodible areas – mainly northern Wairoa Catchment Poor harvest slash management practice risk – likely worse on small block, one off, operations Some commentary on returning extreme risk areas to native – but establishment complexity and time will be major factors – let alone cost	HBRC rivers schemes Forestry Co.s and regulators
Silt Loads	Silt deposition in urban and high value primary production areas	Manage the Northern rivers to maintain their current state See comments above vis Southern rivers	HBRC
Wairoa Bar	Frequently occurring risk Wairoa Township and surrounds	In the absence of a viable infrastructure solution – revert to locally based oversight and management of manual bar openings	HBRC (WDC)
Waikaremoana Hydroelectric Scheme	Flooding risk around the lake, and immediately downstream	Proactive Genesis Community comms ahead of issues	Genesis (WDC)

**Strome
Advisory**

SECTION 7

Lessons from Gabrielle

Issue	Risk	Response	Accountability
There no 'silver bullet' for North Clyde	Increasing frequency under Climate Change	Community response via WSP project Retreat – not an option (tangata whenua) – so in addition to flood channels, embankments – house lifting? i.e., adopt more than one solution	HBRC/WDC/Iwi/home owners/ Businesses
Flood flow modelling & statistics	Risk of community scepticism over flood risk statistics and modelling – which are fundamental to flood infrastructure design	The flood modelling and flow statics need to be clearly communicated to a wide audience by the key HBRC staff qualified to do so – as part of the overall engineering response	HBRC
Flood warning - comms	Lack of warning – lives placed at risk	Ensuring robust communication systems and more than one method?	Civil Defence/Lifelines agencies
Influence of the rail bridge	Flow velocity	May be best to leave rail bridge as is but reduce woody debris risk – especially poplars	HBRC Kiwi Rail

Strome
Advisory

Other Information

OTHER INFORMATION



Strome
Advisory

OTHER INFORMATION

People Met

Person	Role	Issue or Area
Wiki Hauraki	Chairman Takitimu Marae	North Clyde flooding
Lace Blake	Whaakirangi Marae	Frasertown
Leona Kararuia	Tapokorau	
Brian Wilcox	Huramua Marae	
Dave Martin	Farmer	Frasertown
Dave Hayward & Kate Standing	Farmers	Paeroa
Fenton Wilson	Farmer/QRS Director	Frasertown
Andrew & Tracy Powdrell	Farmers	Awamate
Michael & Roz Thomas	Farmers	Adjacent to rail bridge
Jeremy Harker	QRS	Woody debris & bar
Alan Cooper		Wairoa Bar
Melissa Kaimoana	Councillor	Wairoa District
Benita Cairns	Councillor	Wairoa District

Person	Role	Input or Area
Hamish Pryde	Pryde Contracting	Wairoa Bar
Blake Charteris	Charteris Helicopters	Overview of Gabrielle Flooding Wairoa Catchment
Rick Clarke	Farmer	Near Rail Bridge
Gareth Grey	Genesis	Waikaremoana Hydroelectric scheme
Richard Grimmett	WDC	Woody debris
Michael Hardie	WDC	District Infrastructure
James Powrie	CEO Hawkes Bay Forestry Group	Plantation Forestry
Damon Wise	PanPac	Plantation Forestry
Steve Bell	Forest Managers NZ	Plantation Forestry
Matt Doyle	Forest Managers NZ	Plantation Forestry
Graham Douglas via Jamae Powrie	Juken Nissho	Plantation Forestry

Strome
Advisory

OTHER INFORMATION

Review of Key Documents

- Letter from Craig Little, Mayor of Wairoa to Hinewai Ormsby, Chairman Hawkes Bay Regional Council, 16 March 2023
- Letters dated 9 & 23 June 2023 from Hinewai Ormsby, Chairman, Hawkes Bay Regional Council to Craig Little, Mayor Wairoa District
- Memo 4 September from Kathleen Kozyniak (Acting Manager Science) to Nic Peet, CEO Hawkes Bay Regional Council – covering ‘Wairoa Rainfall and River Flows in Cyclone Gabrielle.
- Hawkes Bay Regional Council response to request for information from the Government Inquiry into the North Island Severe Weather Events – submitted 19 October 2023
- Cyclone Gabrielle – Woody Debris Species Composition Assessment, Ecological Solutions, March 31 2023 – prepared for Hawkes Bay Regional Council
- Cyclone Gabrielle – Post Event Woody Debris Assessment- Hawkes Bay, prepared for the Hawkes Bay Forestry Group, 24 April, 2023, Interpine Innovation
- Wairoa Floodplain Management – progress report to July 1994, Hawkes Bay Regional Council
- Flood Mitigation – Wairoa Urban Area, Hawkes Bay Regional Council, March 1997
- Wairoa Flood Protection, Hawkes Bay Regional Council, February 1999
- Wairoa Flood Protection, Hawkes Bay Regional Council, January, 2000
- Waikaremoana Power Scheme, Hydrological Audit, prepared for Genesis Energy Ltd by SLR Consulting NZ Ltd, 28 August, 2023
- Various Written correspondence between Andrew Newman and HBRC vis – the Flood Scale, Rail Bridge Diversion, Forestry Compliance & Use of the Wairoa Flood Reserve
- NIWA ‘Extreme Value Analysis of ex Tropical Cyclone Gabrielle Flood Flows in the Hawkes Bay Region – letter to HBRC 23 February, 2023.