What is the purpose of this project?

This Session

What is the aim of today's session?
- To discuss the future challenges of a changing landscape and climate for this area
- To discuss possible adaptation options for the main adaptation challenges – this is a chance for you to have your input into this process.

What are our next steps?

- **Evaluation of options** - based on a range of considerations, including your input and,
  - » **Discussion with our project partners** – DOC, QLDC, and Iwi
  - » **Technical studies** to assess feasibility and costs of possible options.
- **Compilation of possible adaptation pathways** based on your feedback and preferences, input from our project partners, technical studies, and assessment against evaluation criteria
- **The next community sessions are planned for late 2021**. We will present possible pathways of adaptation options for further discussion.

What types of adaptation options are available, and how can they be assessed?

There are four types of adaptation options available

Accommodation: adjusting existing assets to anticipate hazard risk and reduce future hazard impacts.	Examples: retrofit flood-aware designs, raising floor levels, or flood warning and Civil Defence planning.
Defence: 'holding the line' using natural buffers or hard structures.	Examples: construction of floodbanks or erosion protection structures.
Retreat: Moving existing people and assets away from the hazards in a managed way over time, or as a consequence of damage after natural hazard events.	Examples: Relocation of Kelso township due to repeated flooding impacts. Also, Christchurch 'red zone' following liquefaction damages, or at Matata due to debris flow risks
Avoidance: Stop putting people and assets in harm's way	Example: using land use planning rules to prevent further growth into areas prone to natural hazard impacts.

The alternative is **the status quo – no adaptation actions**

- Continuing with the current approach of reactive small-scale actions to hazard impacts
- Not taking any proactive action to address natural hazards, and accepting that their impacts may increase in severity.

How will possible adaptation options be assessed?

A range of factors will need to be considered for all options, for example:

- Environmental impacts,
- Cultural values,
- Costs and benefits,
- Feasibility of implementation,
- Acceptability to community
- Effectiveness and lifespan

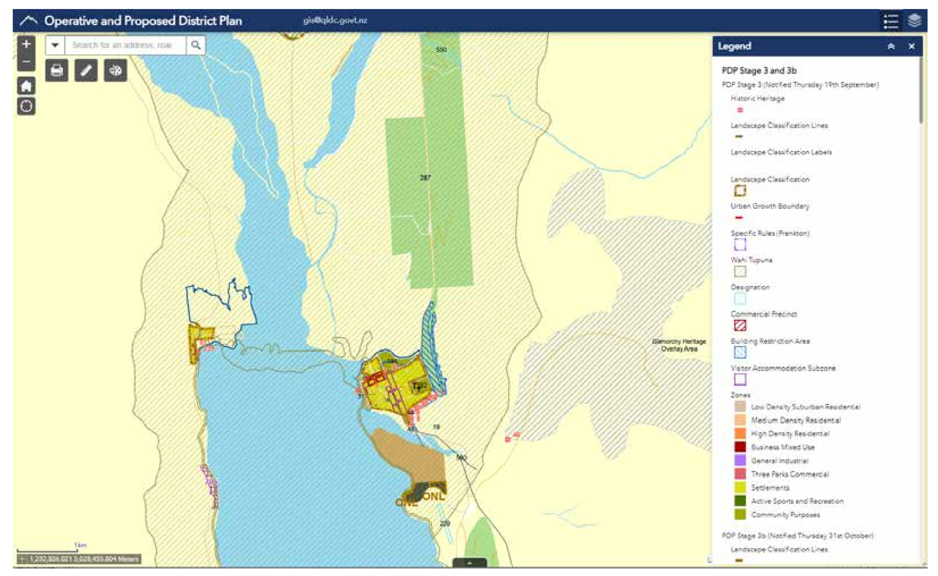
Evaluation of adaptation options will include the factors above, and also take into account:

- Community feedback from these discussions
- Input from our project partners – DOC, QLDC, and Iwi
- Technical studies to assess feasibility and costs of possible options.

Defence actions

Retreat actions

Avoidance actions



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Comments or questions, need further information?

Please feel free to contact us
Email: headofthelake@orc.govt.nz
Phone: 0800 474 082

Sign up for our monthly project update newsletter at:
https://mailchi.mp/orc/headoflakewakatipu

Read more about this project at:
www.orc.govt.nz/managing-our-environment/natural-hazards/head-of-lake-wakatipu

What is adaptation?

What are the natural hazard risks, and how are they changing?

The dynamic environment at the Head of Lake Wakatipu is regularly impacted by natural hazard events. Its landscape has a long history of large-scale environmental changes, and the processes shaping this terrain will continue.

For example:
- Migration of the braided Dart and Rees rivers across their floodplains
- Riverbed aggradation and growth of the Dart and Rees deltas

In addition, climate change is expected to bring more frequent and heavier rainfalls, increasing the flood hazard from the rivers and lake.

These changes will exacerbate many of the existing natural hazards present in this area, and the impacts of these changes on people, infrastructure, and land use in these areas are expected to get worse, particularly for low-lying lakefront areas and floodplains.

Other less frequent hazards, could also have large impacts in this area, for example:
- Earthquakes and liquefaction,
- Landslides, rockfall and Debris flows
- Tsunami triggered by a large landslide or collapse of delta sediments

Why is an adaptation strategy needed?

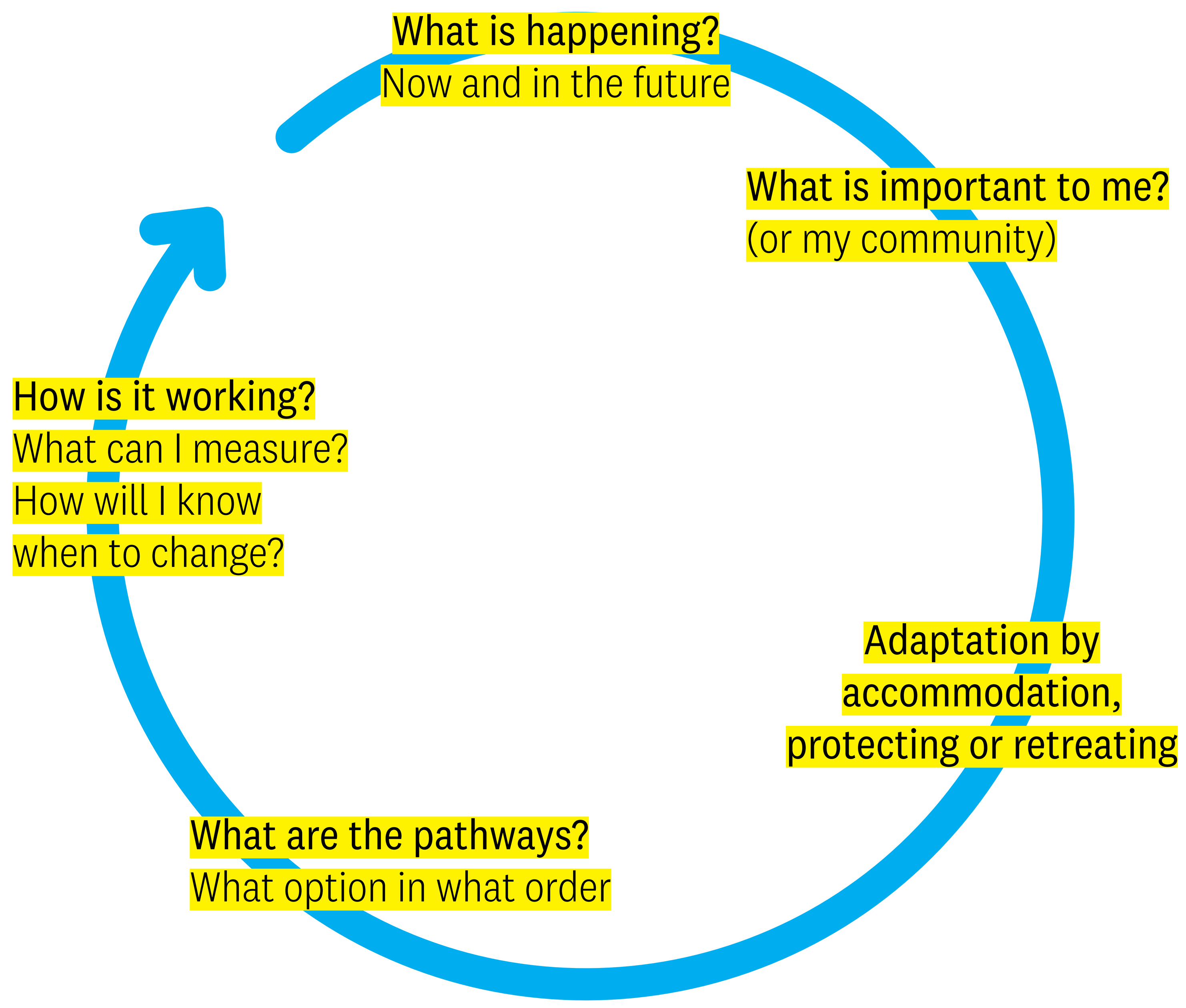
Future climate and landscape changes increase the potential natural hazard consequences.
We need to develop options to adapt to these risks, by understanding the risks and anticipated changes, and planning ahead for how to live with these hazards.

ORC has previously undertaken engineering works to address natural hazards issues such as flooding and river management. While engineering works provide temporary benefits, they do not fully deal with the problems permanently and are unlikely to be sustainable financially or environmentally in the long run.
These types of approaches may however be suitable for specific cases, for example as temporary structures with a limited lifespan.

A strategic and holistic approach is needed to address these issues in the longer term,
It is very important that this strategic approach is developed collaboratively with the local community and other project stakeholders and partners, and that their values and views are incorporated into this planning.

What we want to achieve by developing an adaptation strategy:

"To provide a framework to actively manage risks associated with natural hazards for the resilience of the area located at the Head of Lake Wakatipu, including Glenorchy and Kinloch."



What is Adaptation?

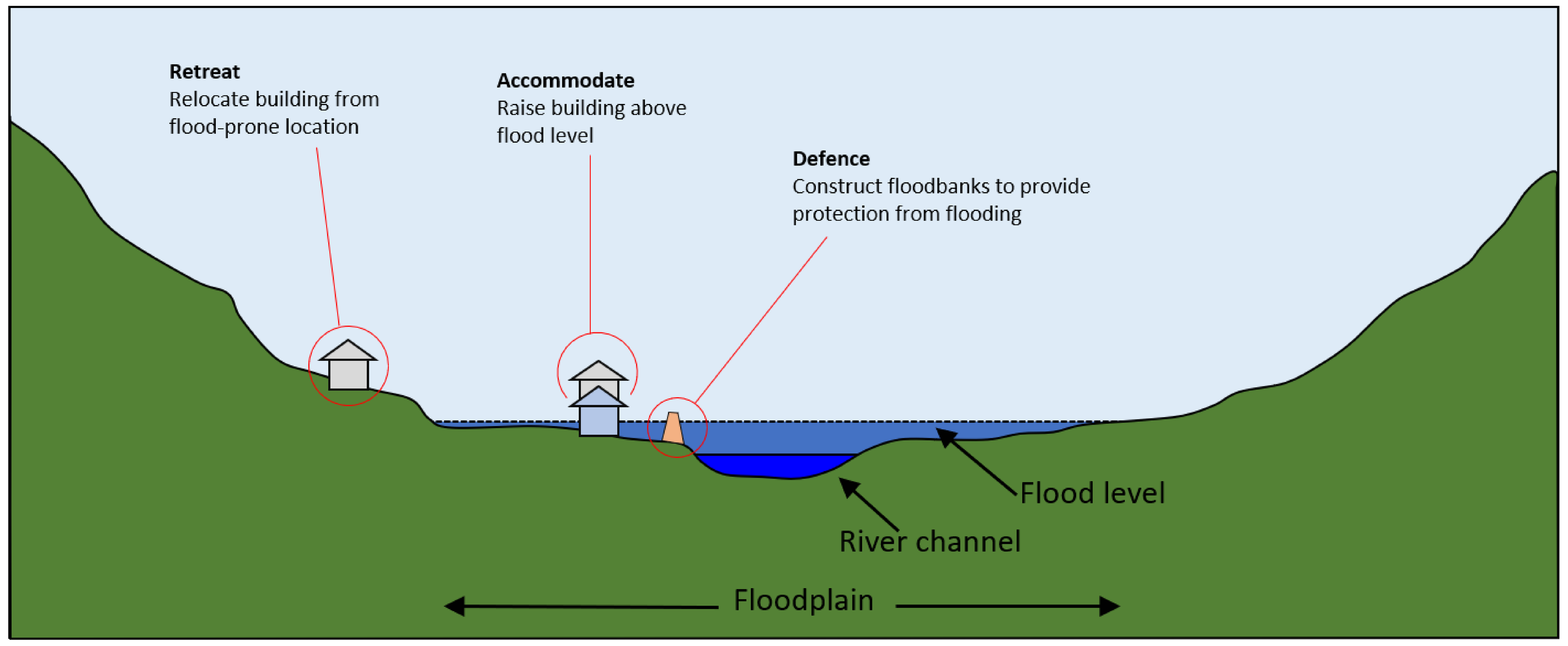
Adaptation is a response strategy to anticipate and adjust to actual and expected changes in environmental conditions

What is the 'Adaptation Pathways' approach?

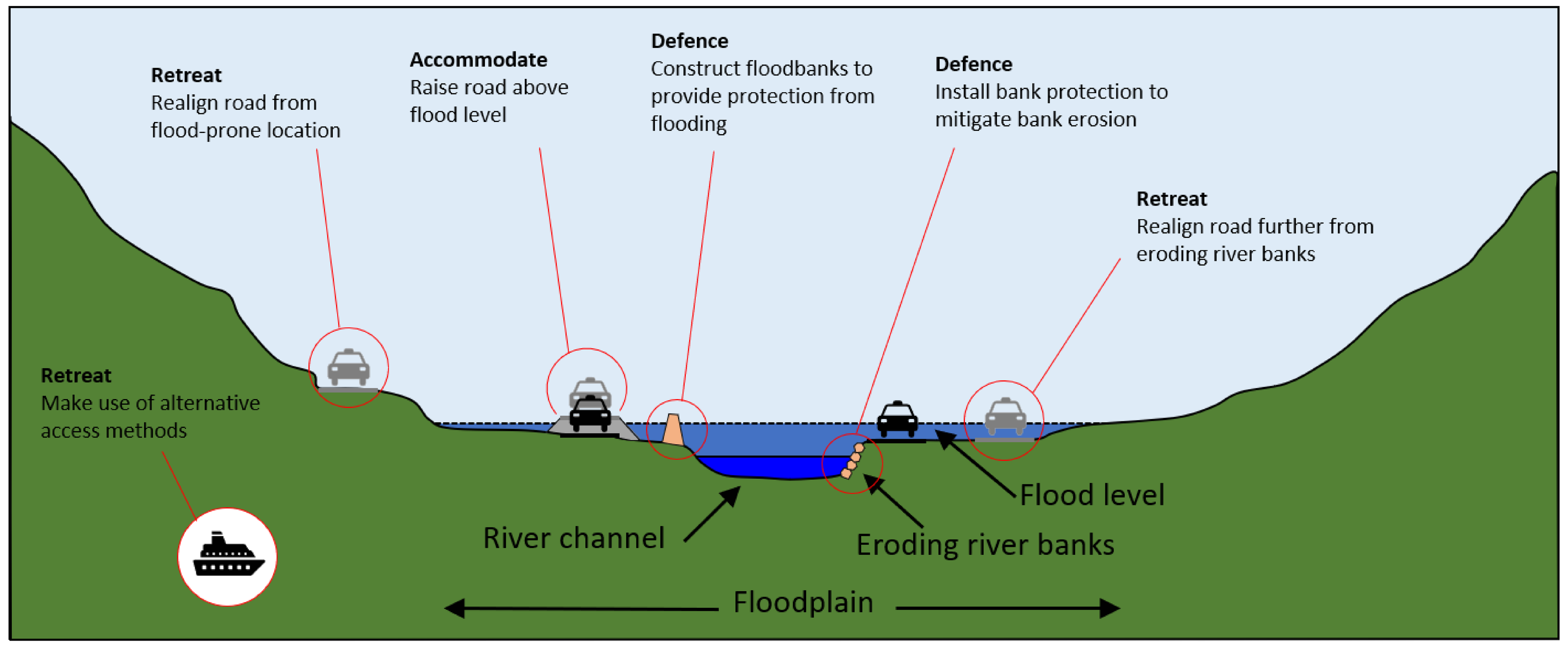
- Our approach is a method known as 'Adaptation Pathways'.
- Developed by the Ministry for the Environment as a blueprint for community-led decision making in areas affected by natural events.
- This approach has been developed specifically to help plan and adapt for situations where the future is uncertain – it allows for flexible and adaptive decision-making, and for planning under conditions of uncertainty regarding the rate, timeframes and magnitude of future changes.
- We will be collaborating with the community and our other project partners - QLDC, Kāi Tahu, and DOC – to work through this process.
- The objective is to develop an 'Adaptation Pathway' strategy for the area
- This adaptation strategy will include a mix of short, medium, and long-term adaptation options, selected from a range of option types available.
- We aim to agree on pre-defined decision points, or triggers, where the first options can be revisited, depending on how the future evolves.

Types of commonly-used adaptation options

Building located in flood-prone area



Road located on floodplain subject to flooding and erosion



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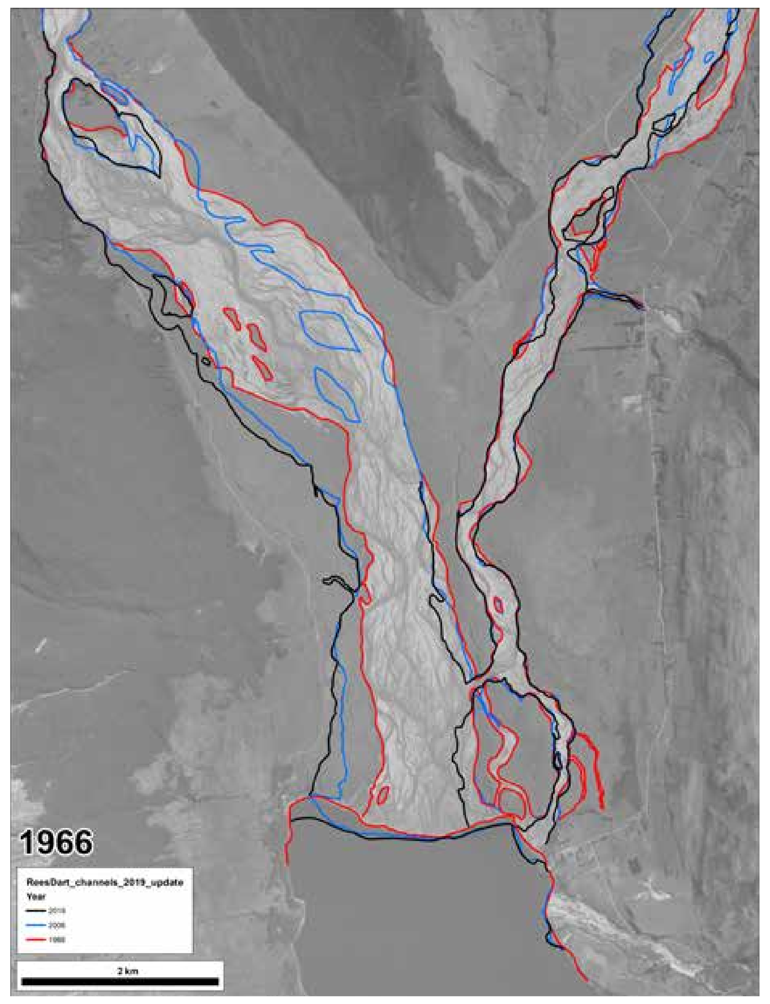
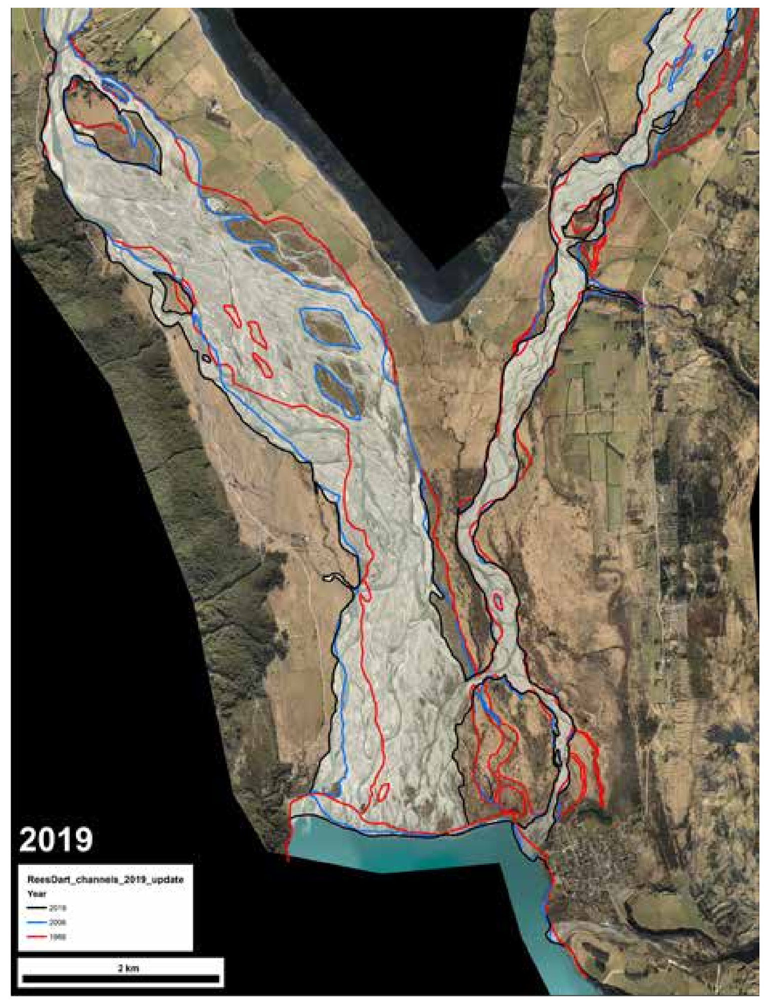
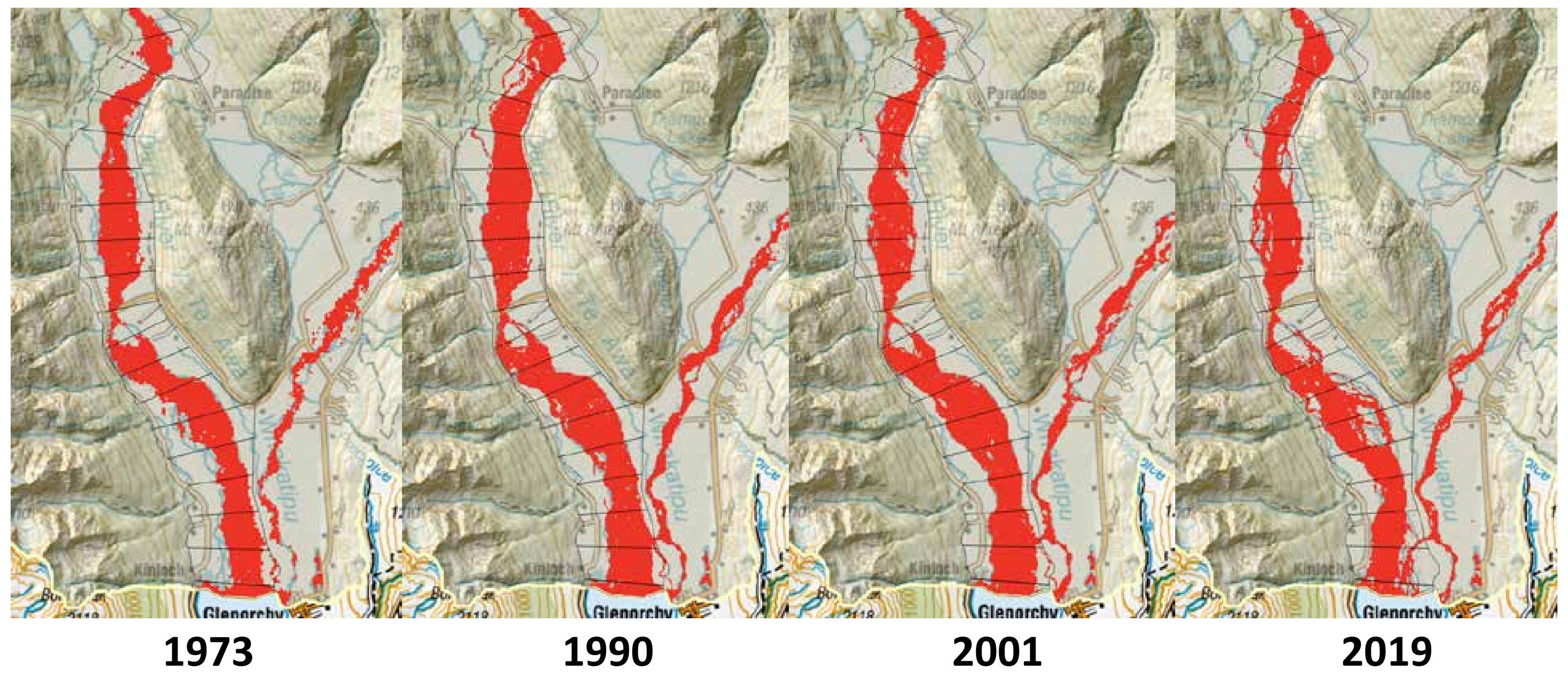
Supporting Natural Hazards Information

Dart and Rees floodplains



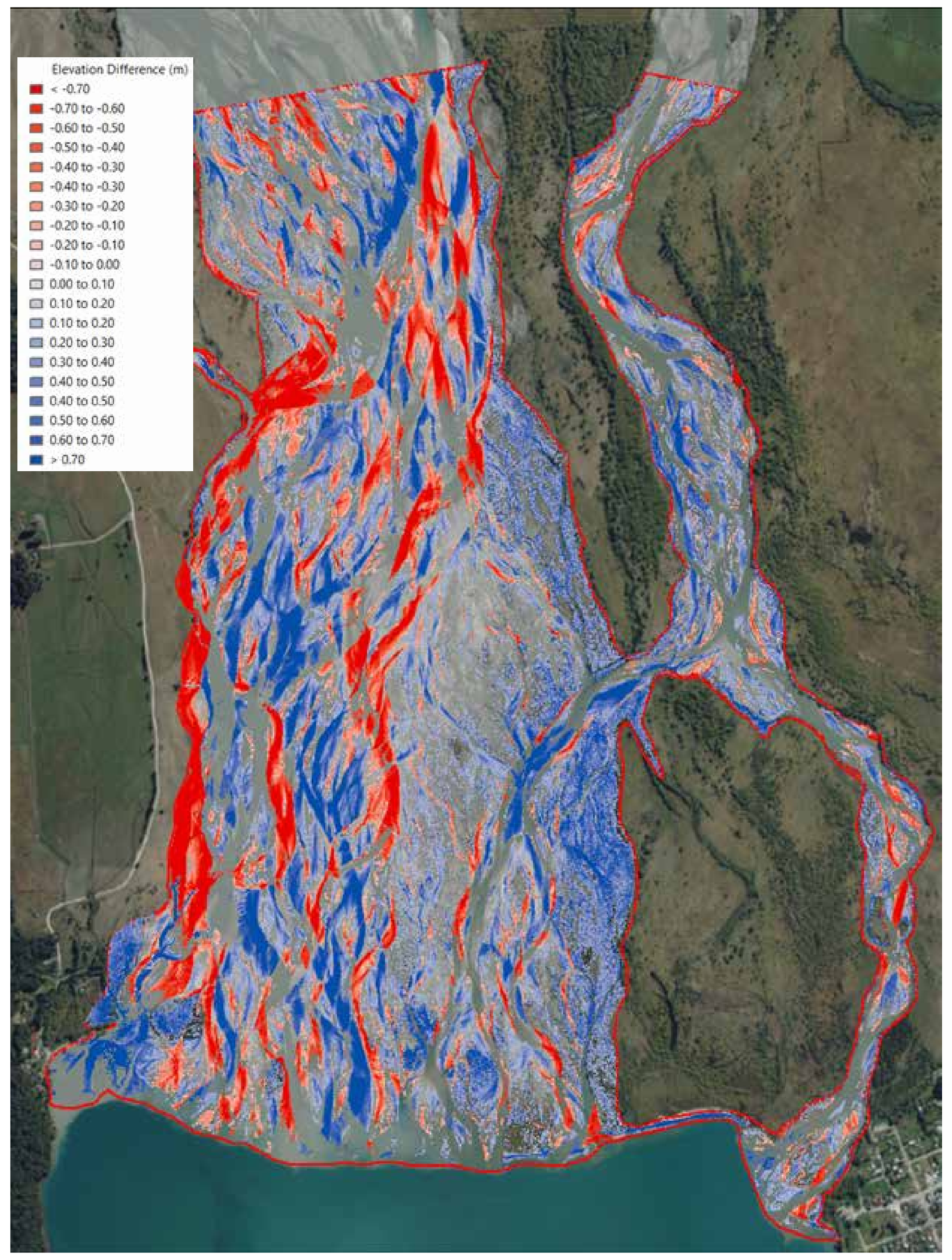


Comparison of 1960s and recent aerial photography to show changes to the Dart and Rees River floodplain and delta over about the last 50 years. Lines show positions of the 1966 (red), 2006 (blue) and 2019 (black) river banks and delta shorelines.

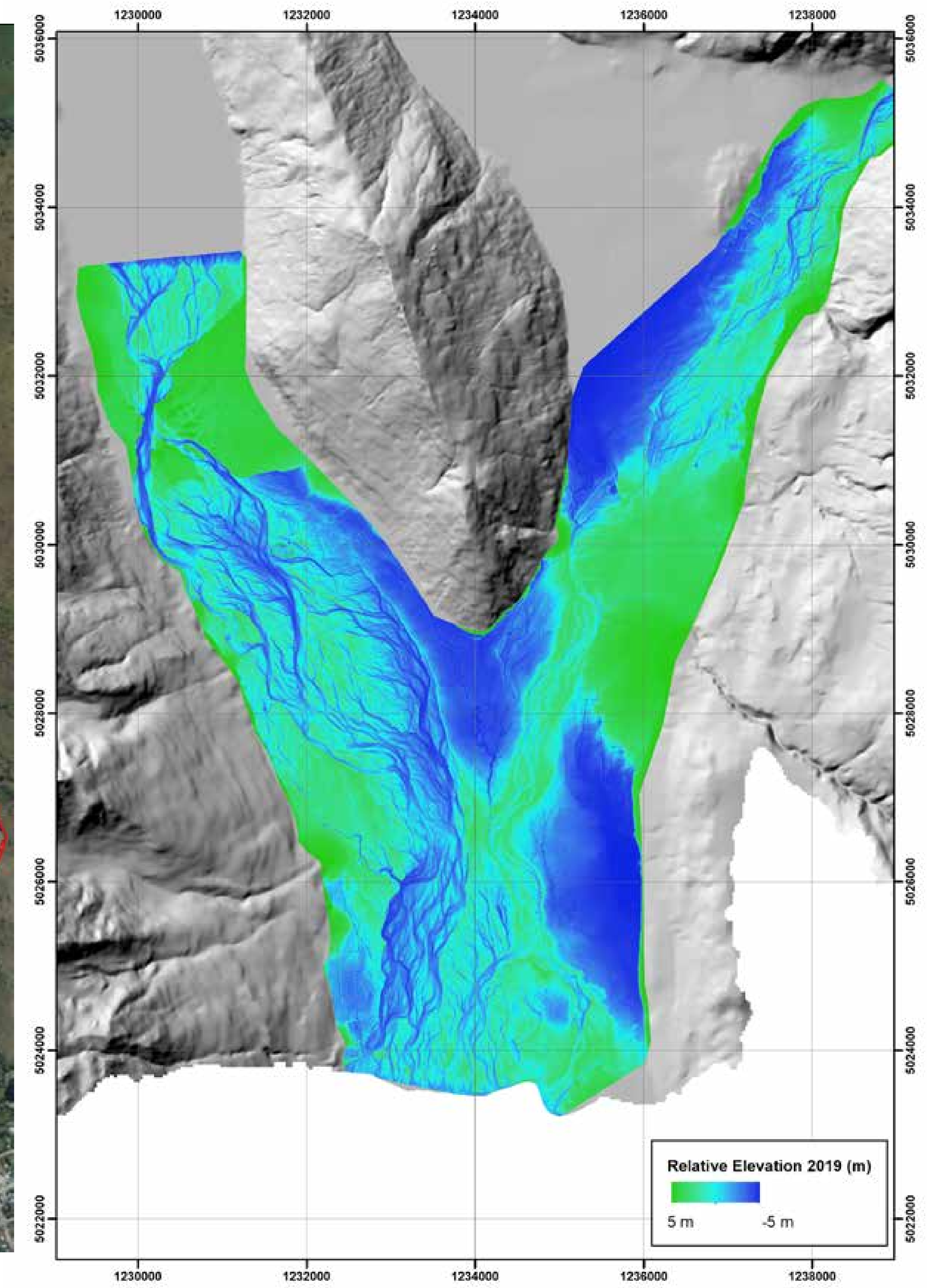


Analysis of the active river channels over about the last 50 years,

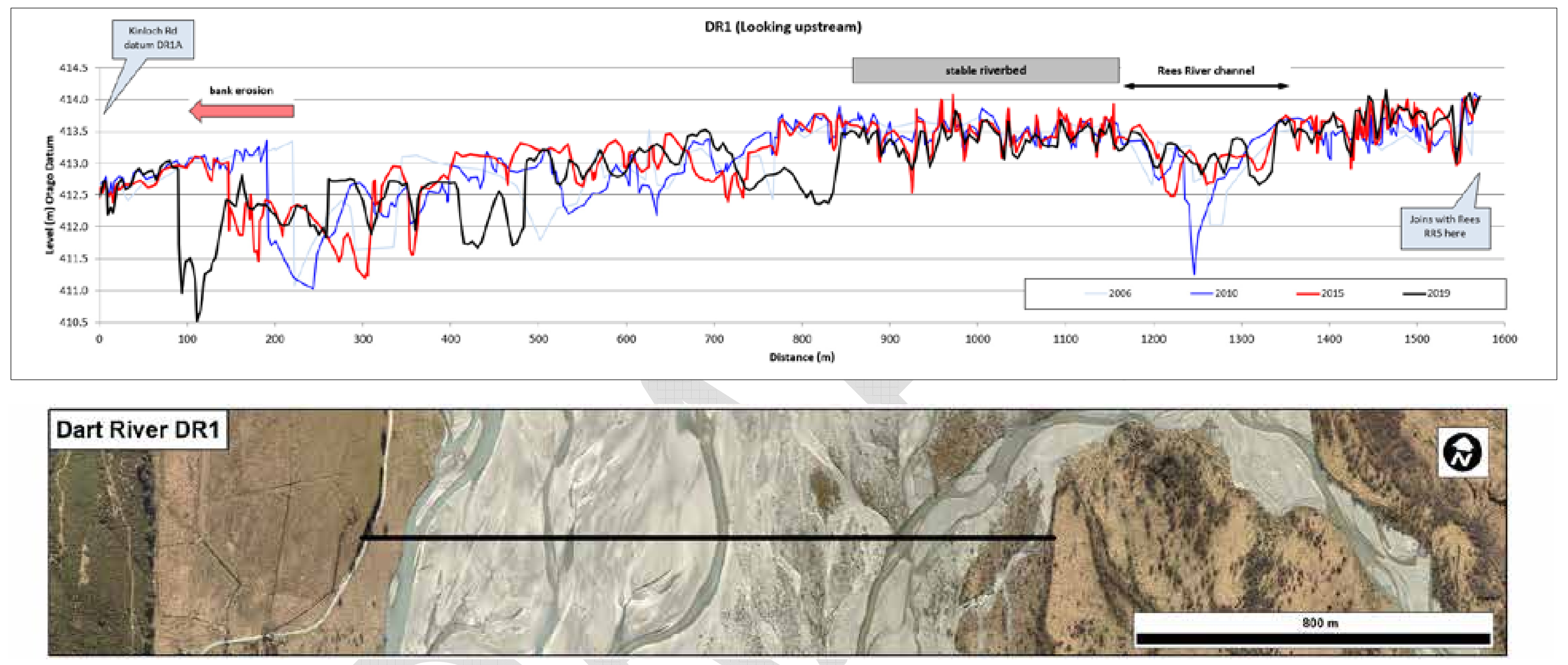
- Westwards migration of the lower section of the Dart River
- Widening of the Dart River channel width from 1970s to 1990, and narrowing from 2000s to 2019.



Analysis of differences between 2011 & 2019 LiDAR surveys for the Dart and Rees Rivers. showing widespread riverbed aggradation in the Rees River (blue), as well as erosion (red) along the western banks of the Dart.



Analysis of 2019 LiDAR survey to show floodplain elevations relative to the river level. Showing areas of the valley floor lower (blue) and higher (green) than the average river bed level.



Dart River cross section DR1, surveys from 2006-2019. Showing westwards channel migration, and also a lowering of the western river bank height.

Overview of the Dart-Rees floodplain area – viewed looking westwards towards Kinloch and Humboldt Mountains.

Examples of Dart River flooding in moderate (November 2019) and large (March 2019) flood events. [LH photo above credit to Geoffrey Thompson]

Examples of Dart floodplain erosion

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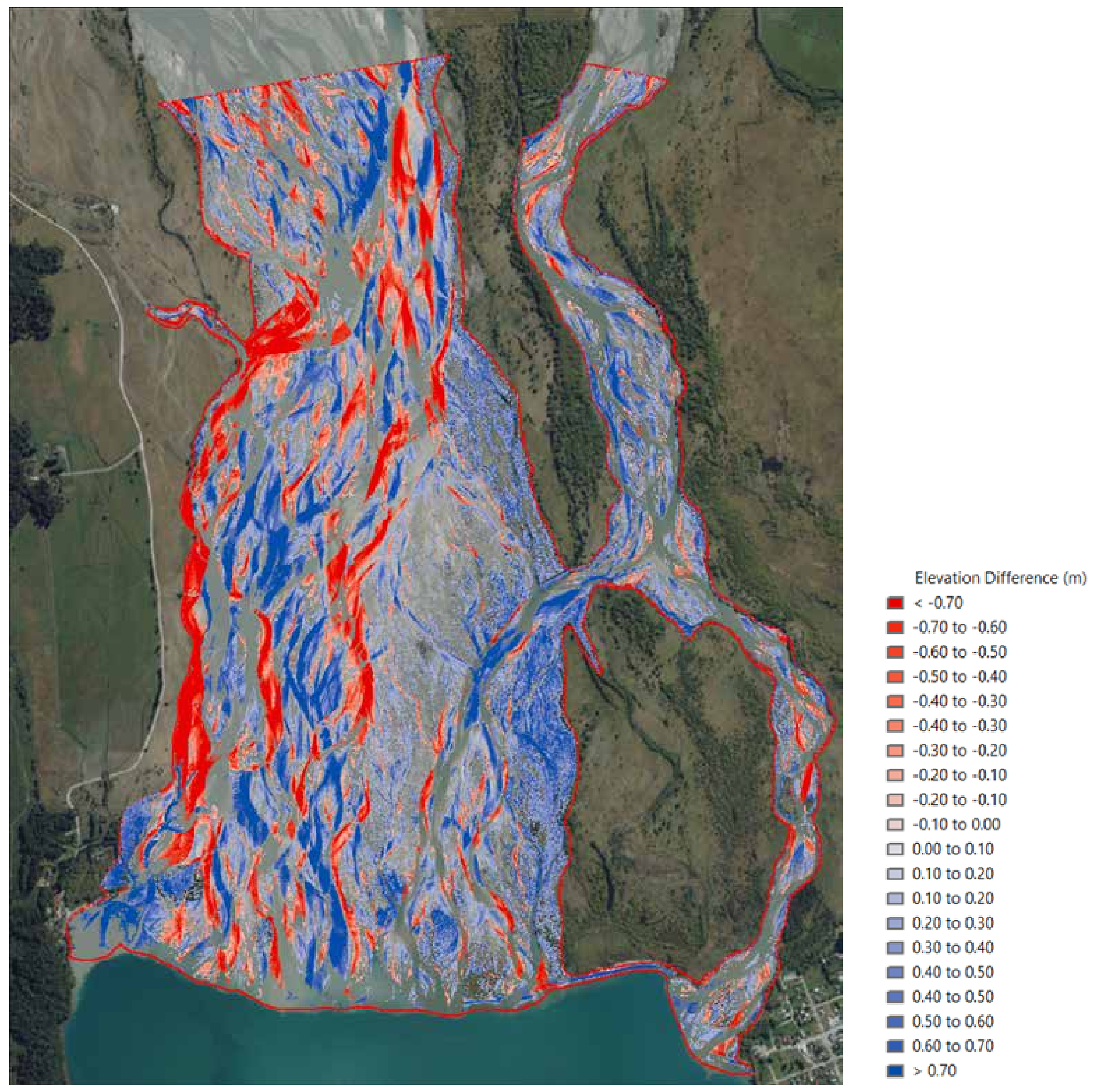
Supporting Natural Hazards Information

Rees River and Glenorchy

Historical and modelled landscape changes at the Rees Delta

Overview of the Glenorchy area, showing the township located between the Rees River and Delta to the north, and Buckler Burn to the south.



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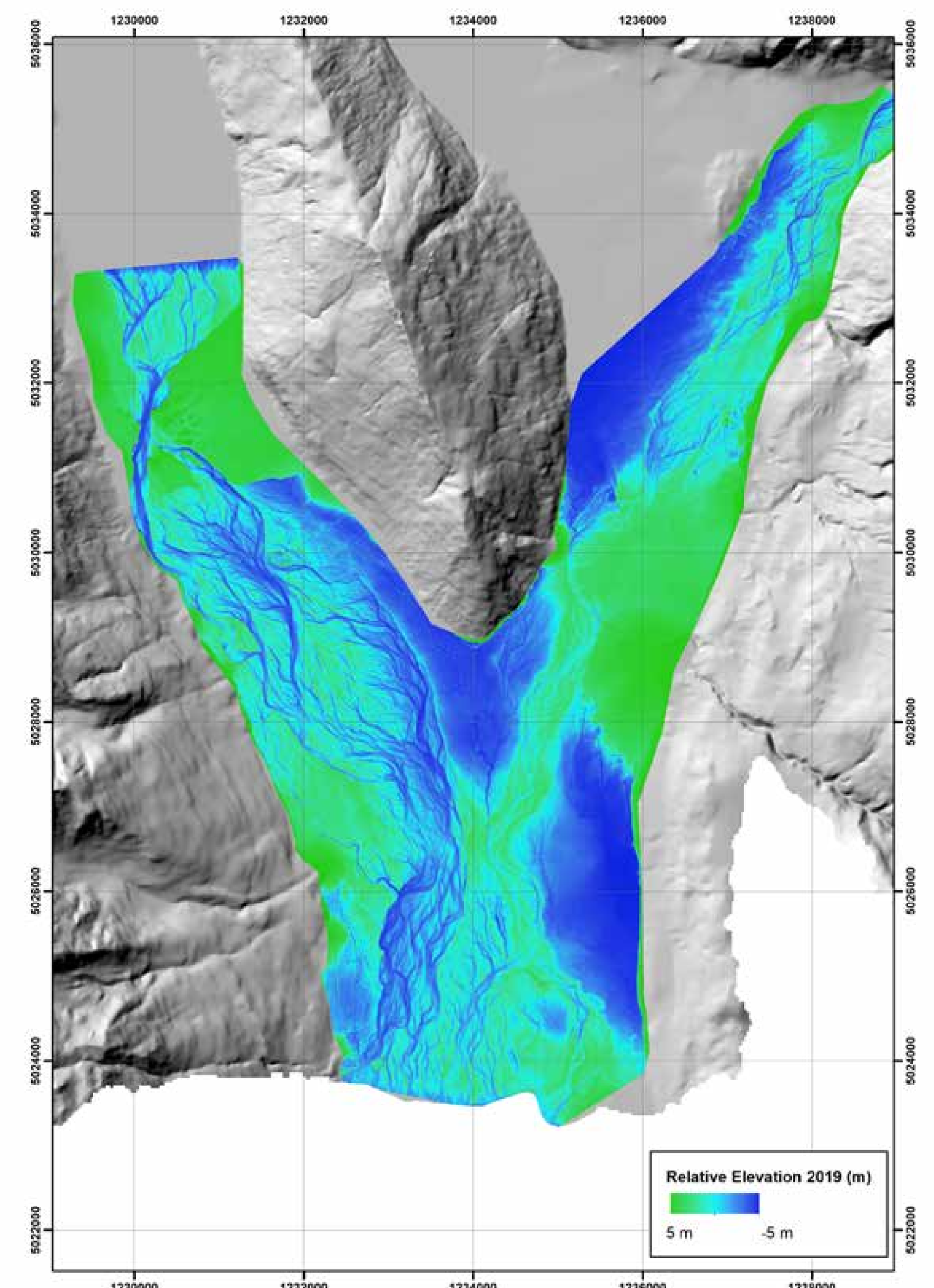
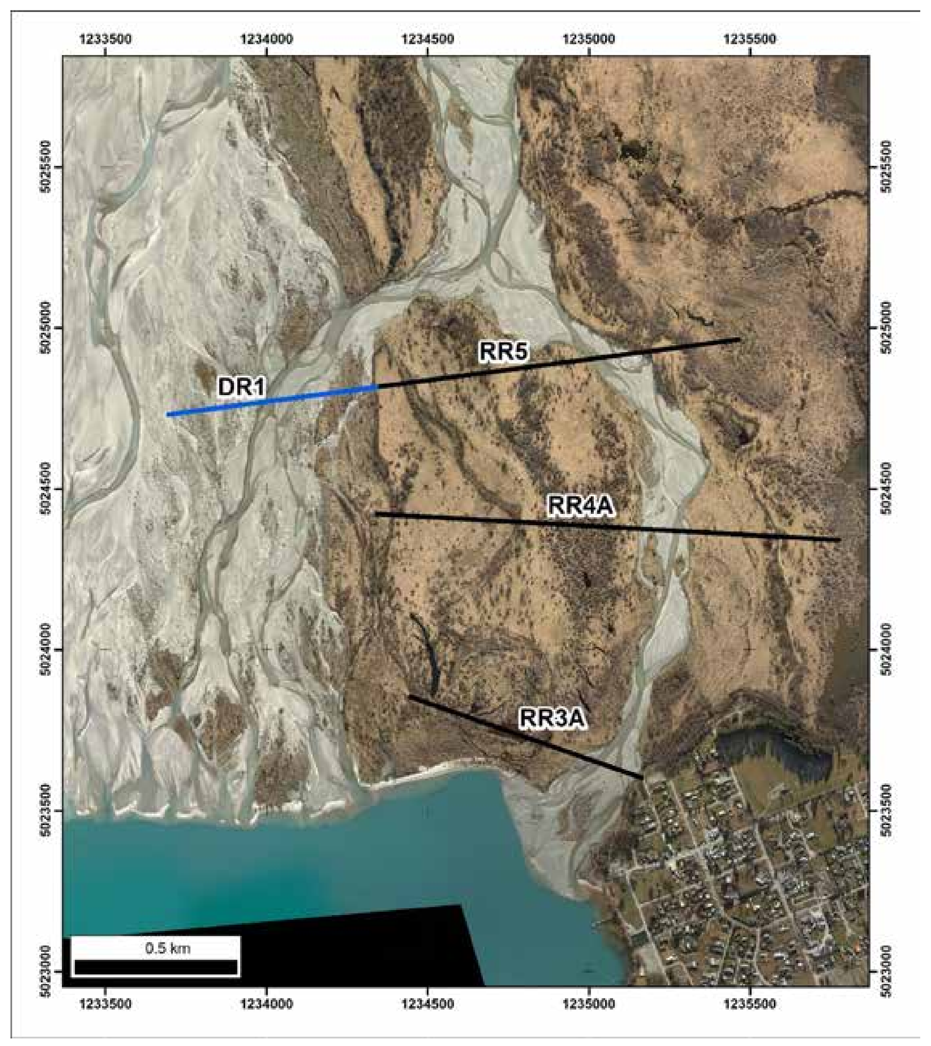


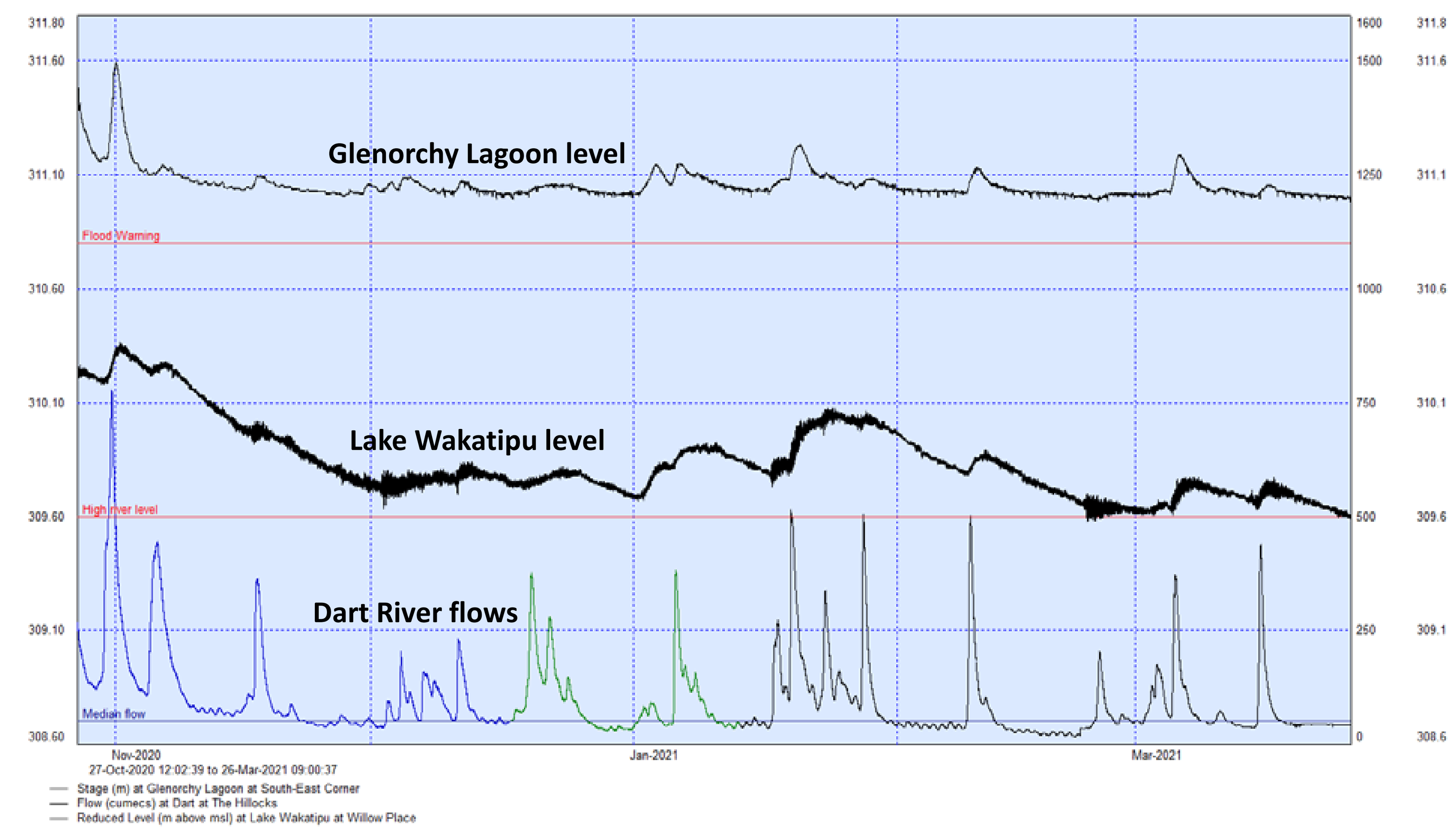
Analysis of 2019 LiDAR survey to show floodplain elevations relative to the river level. Showing areas of the valley floor lower (blue) and higher (green) than the average river bed level.

Significant flooding events in Glenorchy: December 1999 (above), and February 2020 (right) [RH photo above credit to Luke Hunter]



Lower Rees River cross section surveys, showing a gradual rise in river bed levels over about the last 10 years.

New water level monitors in place at the Glenorchy Lagoon (right), and at the Glenorchy boat ramp (left).



Comparison plot of monitoring data for the Dart-Rees area, showing relationships between river flows, lagoon levels and the lake level.

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The Head of Lake Wakatipu area – consequences of a changing future landscape and climate

Geomorphic change – rivers, floodplains and deltas

Channel migration and floodplain erosion
Erosion continues westwards on the Dart floodplain, continuing the trend observed for at least the last 50+ years.

As is expected in braided river systems, erosion and channel migration is also expected at other sections of these floodplains.

Riverbed aggradation
Ongoing sediment deposition in the Dart and Rees rivers gradually raises riverbed levels.

Based on survey data from the lower section of rivers, this rise is at least 0.1m each decade, and may be as high as 0.2-0.4 per decade.

Continued rise of the Rees channel will eventually breaks its banks to form a new channel through the wetland and lagoon.

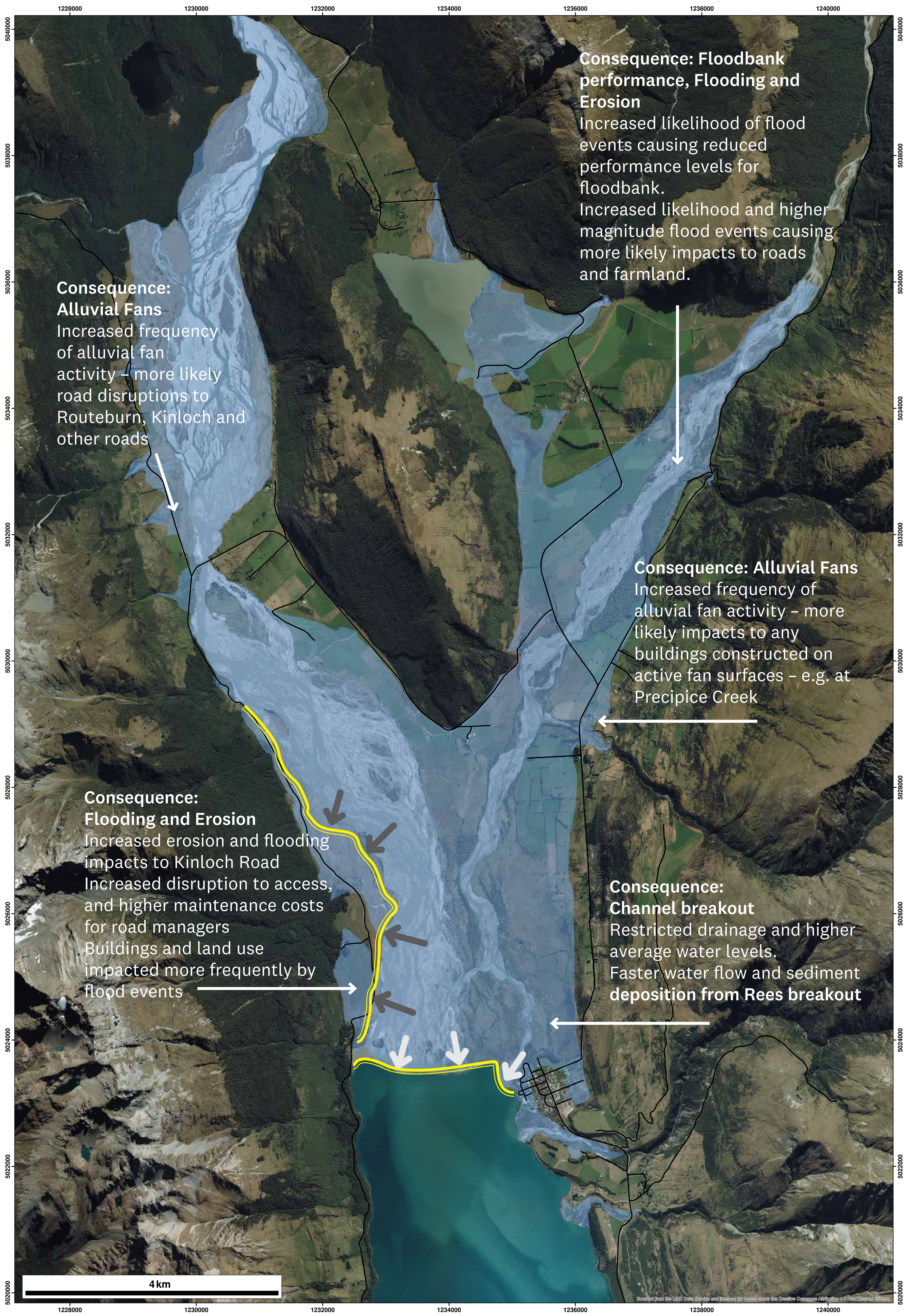
Delta growth
The delta shoreline will continue to grow into the lake at a rate of 2 or 3 metres every year.

Climate change

The climate will continue to change, with more frequent and heavier rainfalls.

This causes larger and more frequent flood events, and an increased rate of sediment transported through the river system.

Higher intensity rainfalls may also cause more likely rainfall-triggered events such as alluvial fan activity and debris flows.



Glenorchy – consequences of a changing future landscape and climate

Future Changes Anticipated

Geomorphic change – rivers, floodplains and deltas
As is expected in braided river systems, erosion and channel migration likely at other sections of these floodplains.

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Ongoing sediment deposition in the Rees riverbed gradually raises riverbed levels.

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