



River sedimentation management

Review, Scoping and Recommendations

Report prepared for Gisborne District Council (GDC)

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1. Introduction

Gisborne District Council (GDC) is currently looking at options and implications for dredging the Waimatā River (around the bridges). GDC needs high level assessment and recommendations of what might be required to support consenting in terms of work packages, but also desktop analysis on dredging options / dredging plants.

Proposed scope:

- Review of survey and sedimentation and make recommendations about additional data requirements and frequency.
- Present high level range of options that may be used to remove or shift sediment restricting conveyance.
- Assess potential impacts, negative effects/risks of dredging that would need to be investigated and considered.
- Discuss proposed methodologies and studies required to assess impact (high level overview).
- List results and analysis that are required for consent and/or additional assessments.

Each scope item is presented in more details in Section 2 to Section 6. A summary is presented in Section 7.

1.1 Background

The Waimatā River, located in the Gisborne Region, flows primarily southward toward the city of Gisborne. There, it converges with the Taruheru River, and their combined flows continue as the Turanganui River, discharging into northern Poverty Bay adjacent to the port of Gisborne.

Elevated sediment loads discharged into Poverty Bay are influenced by, among other factors, the occurrence of high intensity rainfall events during winter months and during tropical and extra-tropical cyclones in summer and autumn months (Hessell, 1980; Foster and Carter, 1997; Beamsley, 2003).

The Waimatā drains a catchment area of 227 km² (Gisborne District Council, 2024). It is estimated to contribute around 690,000 tonnes of sediment per year to Poverty Bay (Gisborne District Council, 1994). This corresponds to an annual suspended sediment yield of 3,136 tonnes/km² for the catchment area (Beamsley, 2003).

Cyclone Gabrielle drove massive amounts of sediment and woody debris into Waimatā River. A large-scale clean-up effort had cleared over 420,000 tonnes of debris over five



months post cyclone. (Source: https://www.nzherald.co.nz/the-country/news/clearing-30km-of-woody-debris-from-gisbornes-waimata-river/YF7XTUTGMBFS7ARGPXXRJF6MBE/#google_vignette).



2. Surveys, Sedimentation Analysis, and Recommendations

This section provides a review of existing survey data and sedimentation patterns. Based on this analysis, recommendations are made regarding additional data requirements and the frequency of data collection.

2.1 Bathymetric surveys

Bathymetric surveys of the Waimatā River were undertaken in 2021 and 2023 and are presented in Figure 2-1 and in more detail in Figure 2-2. Elevation is presented relative to the reference datum NZVD2016. Shallower areas are presented as positive values (yellow/green shades), and deeper areas presented as negative values (blue shades).

The 2021 survey shows broader coverage with more sparse measurements, mainly conducted as transects. It covers Waimatā/Turanganui rivers as well as Taruheru river. The 2023 survey covers the Waimatā/Turanganui rivers, and it has higher resolution, showing a more continuous survey of the main channel.

Shallower or elevated areas (yellow/green) in the Waimatā river are more prominent in 2023, possibly due to sediment deposition or as a result of a more detailed survey capturing those areas. A more detailed temporal and spatial comparison or additional data points might be needed to understand seasonal or post-event variations and long-term patterns.

A comparison between the two surveys is shown in Figure 2-3, showing degradation (erosion, negative values in red) and aggradation (sediment deposition, positive values in blue) over time. Selected cross sections (A–H) are presented in more details in the inset maps.

Although a clear pattern of erosion and sedimentation cannot be established solely from the two surveys, some high level assessment can be made based on the observed elevation and depth changes.

Sediment deposition is noticeable in blue areas, with some transects showing the accumulation located in the main channel of the river (e.g., transects E, F and C), potentially a result of changes in sediment load after the passage of cyclone Gabrielle. Erosion is observed near the riverbanks in these transects marked by red zones. This may indicate increased flow velocities or scouring processes, potentially caused by shifts in



the location of peak flow or the redistribution of flow velocity across the channel due to the updated, shallower bathymetry.

The histogram in Figure 2-3 shows a statistical summary of elevation changes, with most changes occurring around +0.39 m. The distribution suggests that, overall, most changes are due to sedimentation processes, however, there are some significant localised areas of erosion.

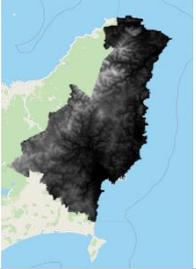
2.2 Aerial lidar and imagery data

Several high-resolution aerial lidar and aerial imagery campaigns were flown over the Waimatā River and greater Gisborne region in recent years with the data publicly available on LINZ data service (LDS). While accurate elevation measurements cannot be acquired over inundated areas from lidar, especially in the deeper tidal area of the lower Waimatā and Turanganui rivers, very shallow or dry channels and riverbanks are well-resolved in the data. Lidar surveys acquired pre- and post-cyclone Gabrielle enable maps of elevation change to be derived which give additional insight alongside the bathymetry surveys into sedimentation dynamics in the greater river environment. Imagery captured at the same time or close to when the lidar survey was conducted provide context for the elevation changes as well.

1 m Digital Surface Models (DSMs) and imagery tiles were downloaded from LDS over the area of interest from the datasets summarised in Table 2-1. A difference of DSMs (DoD) was constructed between the September 2023 and January 2019 DSMs. Elevation changes over the Waimatā River through Gisborne and further upstream from the urban centre are shown in Figure 2-4 Figure 2-7. Figure 2-8 and Figure 2-9 show maps of elevation changes for selected locations along the river alongside aerial imagery of the same locations.



Table 2-1 Elevation and imagery datasets available from LINZ Data Service in the area of interest.

Dataset Name	Data type	Coverage	Acquisition Date(s)
Gisborne Lidar 1m DSM (2023)	Elevation		11-20 September 2023
Gisborne 0.1m Rural Aerial Photos (2023-2024)	Imagery		11-20 September 2023 for Waimatā River area
Gisborne 0.2 m Cyclone Gabrielle Aerial Photos (2023)	Imagery		11-20 September 2023 for Waimatā River area
Gisborne Lidar 1 m DSM (2018-2020)	Elevation		31 December 2018, 03-06 January 2019, 30-31 January 2019 for Waimatā River area
Gisborne 0.3 m Rural Aerial Photos (2017-2019)	Imagery		2017-2019 (Exact dates unknown for Waimatā River area)

The DoD reveals changes in the Waimatā River, particularly for areas upstream of the tidal zone where the water is shallower and more of the riverbed is dry and exposed. Near the confluence with the Turanganui River, there is evidence of sediment aggradation



on the true right side of the river (Figure 2-4). Throughout the urban centre, the river has largely remained within its historical position, however tall vegetation has been destroyed in some places (Figure 2-5). In previously unvegetated areas, there has been widening of the river channel with aggradation at the water's edge as shown in Figure 2-8 (B). Figure 2-8 (C) shows aggradation on both sides of the river bend, loss of vegetation, and widening of the river around its outside corner. Further upstream outside of the urban centre, the river has widened by 5-10 m in some places with aggradation close to the water's edge (Figure 2-6 and Figure 2-7). Erosion has occurred along steep riverbanks, with material accumulated at the base of the banks (Figure 2-6).

2.3 Recommendations

High resolution surveys:

- Ensure the continuation of high resolution surveys, similar to the 2023 survey.
- Consider bathymetric lidar surveys for synoptic scale coverage of inundated areas.

Additional Data Requirements

High resolution surveys:

- Conduct more frequent surveys in areas identified as having high sedimentations/erosion (e.g., river bends and areas of rapid changes).

Sedimentation analysis:

- Additional field sampling to determine sediment grain size, mineralogy, and organic content to assess sources and transport behaviour.

Hydrodynamic data:

- Measure flow velocities and water levels to link sediment transport with hydrodynamic conditions.

Sediment transport rates:

- Deploy sediment traps, turbidity sensors, or acoustic devices to measure sediment fluxes.

Land use and catchment changes:

- Information on upstream land use (e.g. deforestation, storm events) to assess sediment supply factors.



Frequency of Data Collection:

Baseline surveys:

- Conduct yearly surveys (as a minimum).
- Conduct quarterly surveys to assess seasonal sedimentation patterns.

Event based surveys:

- Undertake surveys during/post high-flow events, such as storms or floods, when sediment transport is likely to peak.
-

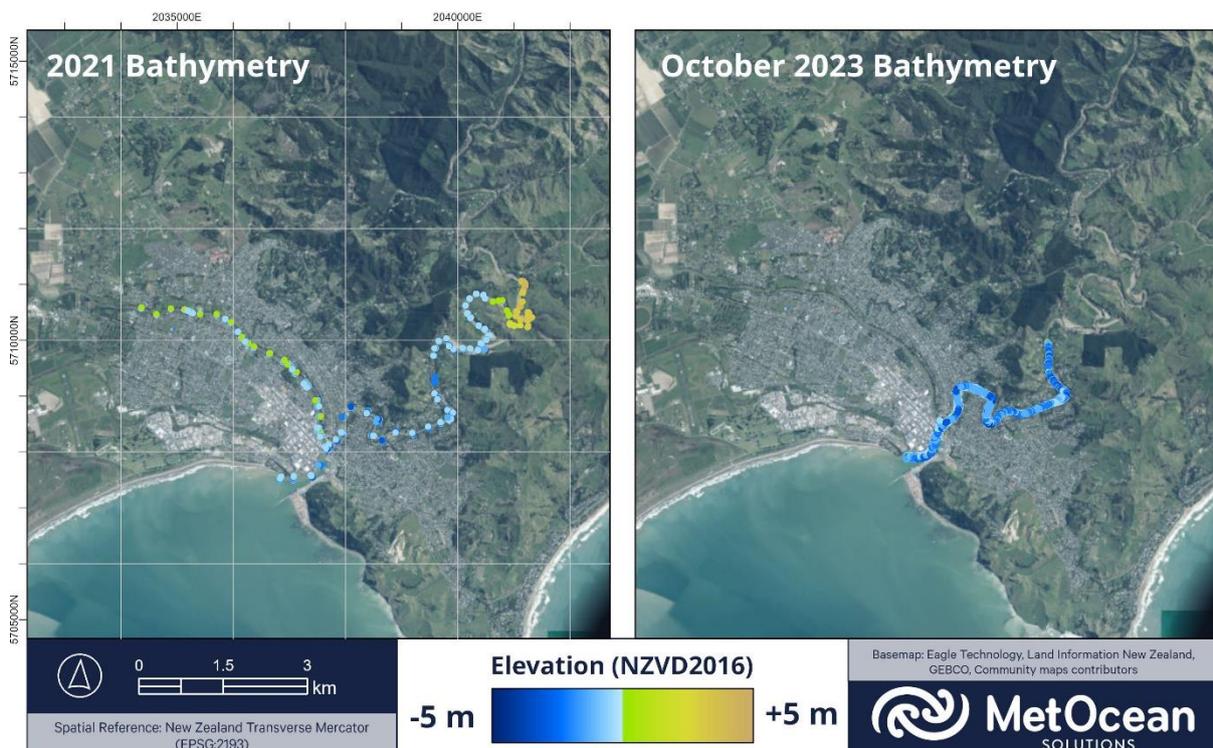


Figure 2-1 Bathymetric surveys undertaken in 2021 (left) and 2023 (right).

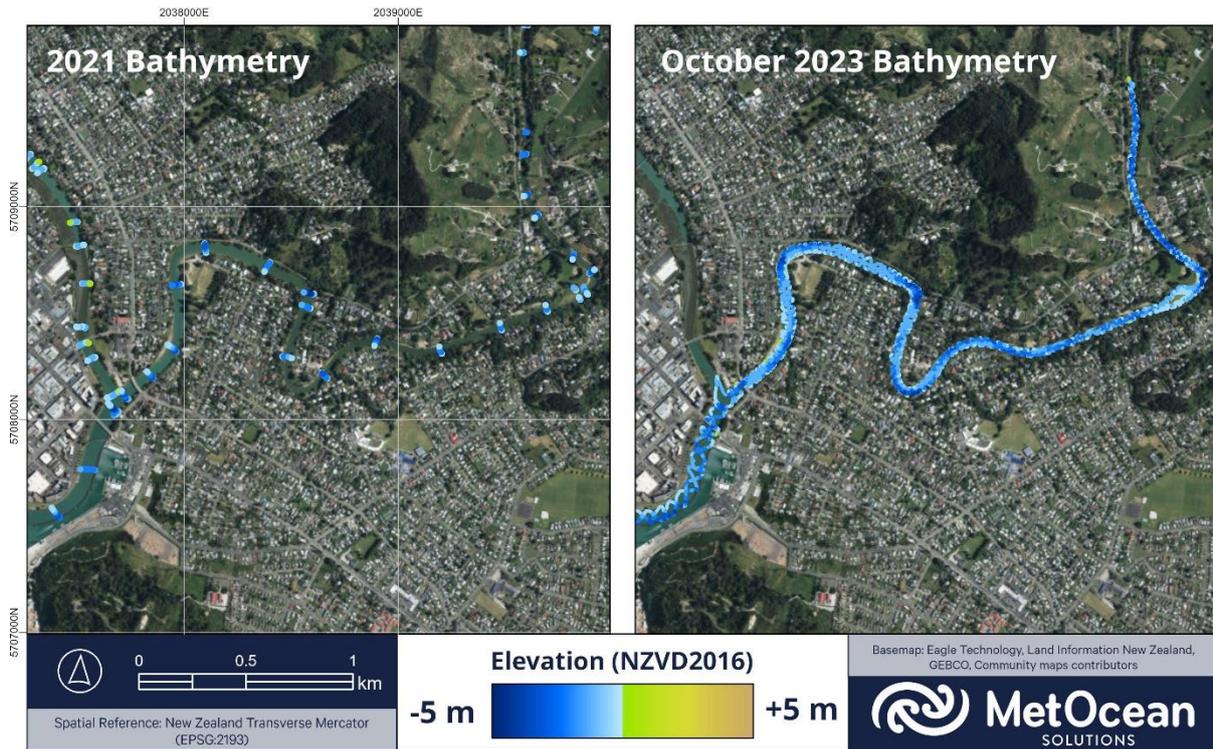


Figure 2-2 Zoomed in to show details of the bathymetric surveys undertaken in 2021 (left) and 2023 (right).

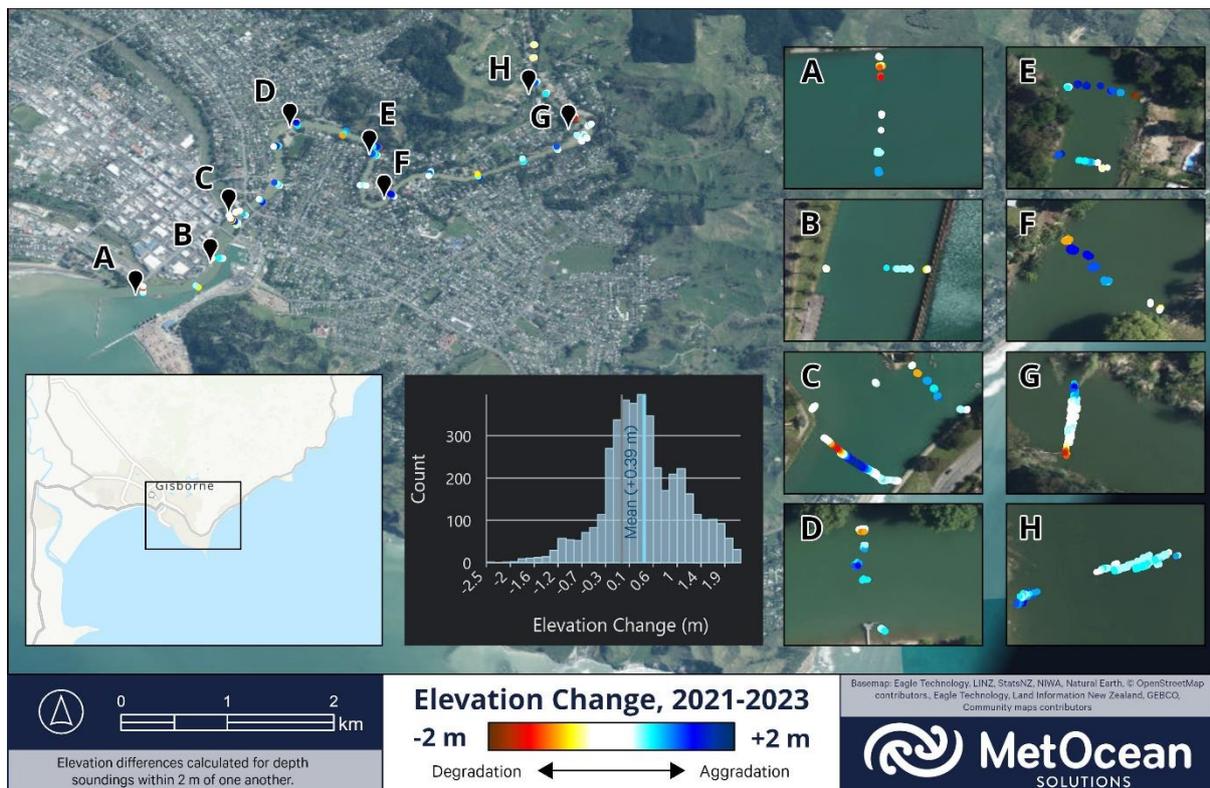


Figure 2-3 Differences between bathymetric surveys undertaken in 2021 and 2023.



Figure 2-4 Elevation changes between January 2019 and September 2023 at the confluence of the Waimatā and Turanganui rivers. Note that elevation changes over inundated areas of the main river channel are not resolved in the lidar data.

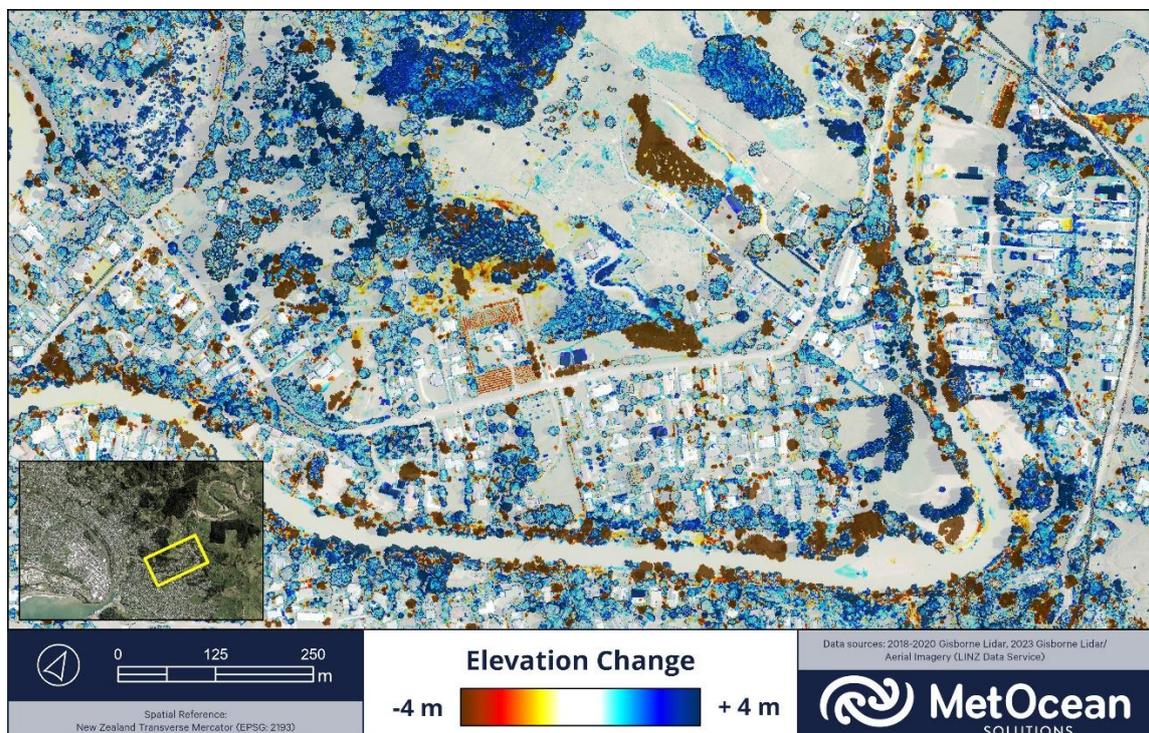


Figure 2-5 Elevation changes between January 2019 and September 2023 in the Waimatā River area near the Inner Kaiti suburb of Gisborne. Note that elevation changes over inundated areas of the main river channel are not resolved in the lidar data.

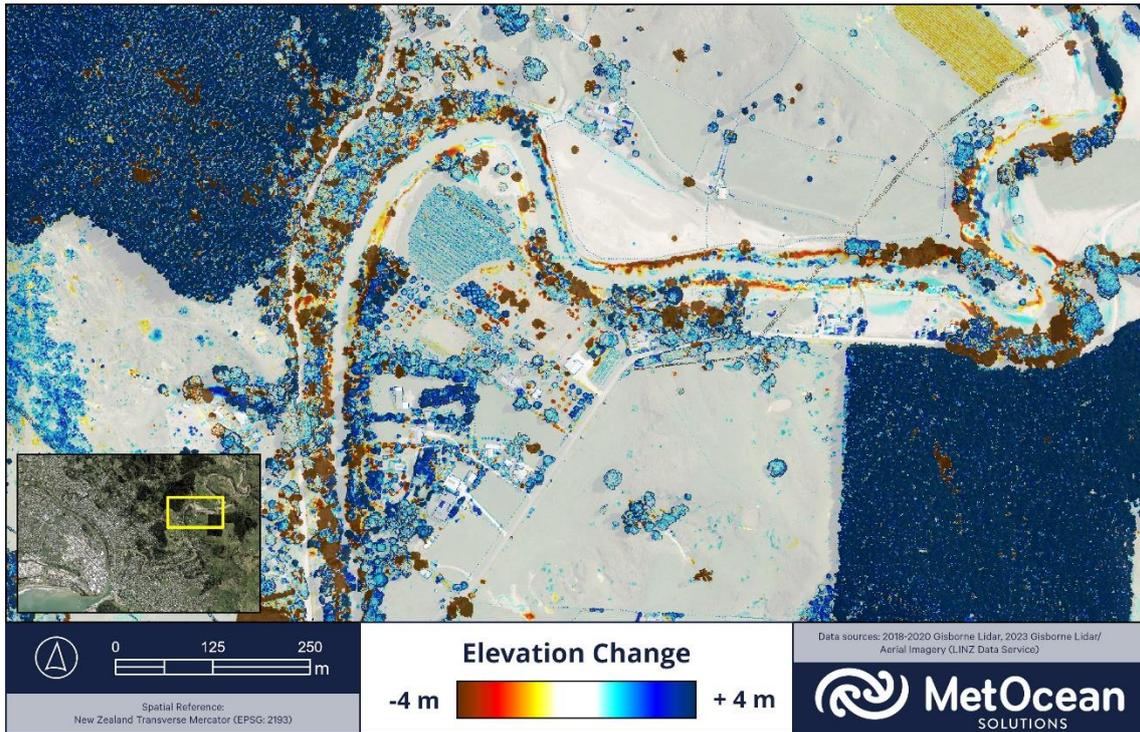


Figure 2-6 Elevation changes between January 2019 and September 2023 in the Waimatā River and surrounding areas northeast of Gisborne. Expansion of the river's margins and aggradation of sediment deposits in dry areas of the riverbed is apparent.

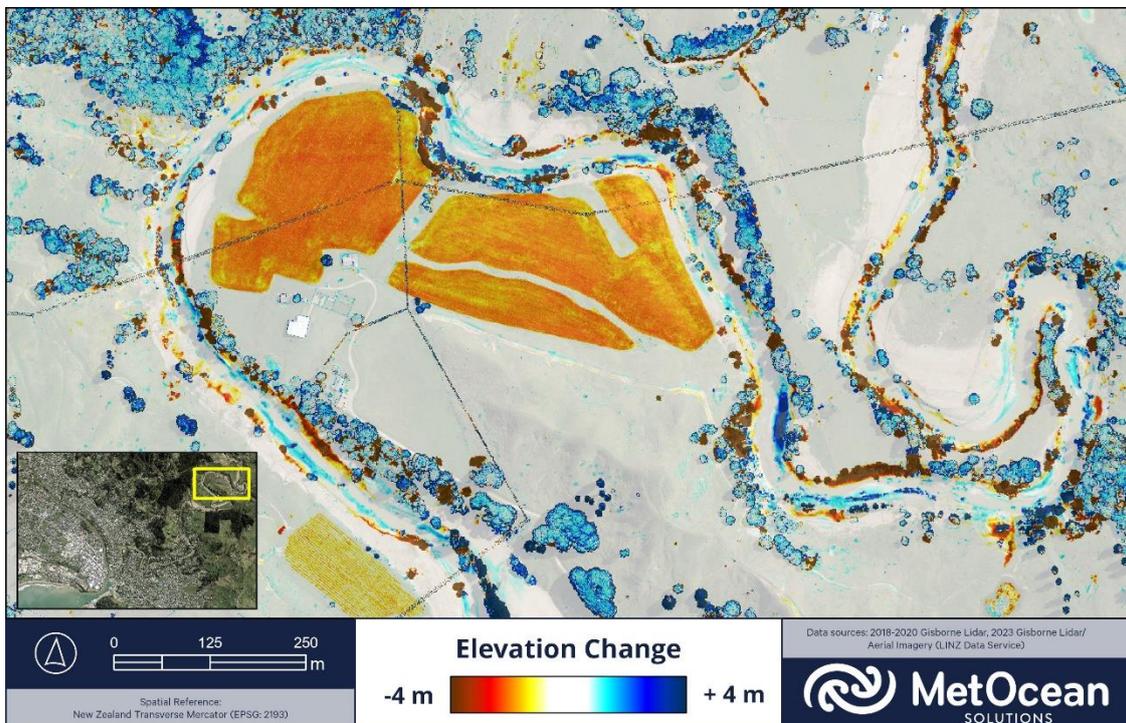


Figure 2-7 Elevation changes between January 2019 and September 2023 in the Waimatā River and surrounding areas northeast of Gisborne. Expansion of the river's margins and aggradation of sediment deposits in dry areas of the riverbed is apparent.

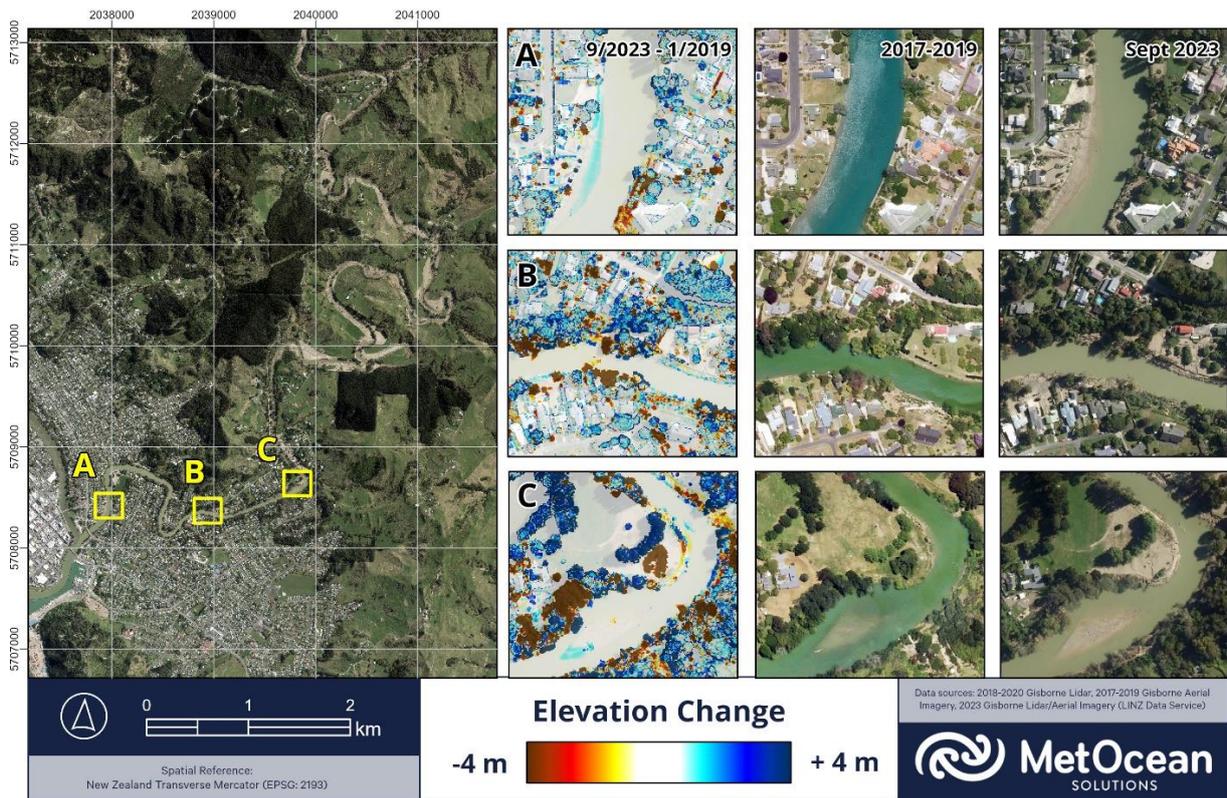


Figure 2-8 Changes in the lower Waimatā River as revealed through maps of elevation change as well as aerial imagery. (A) shows aggradation along the true right bank near the confluence with the Turanganui River. (B) shows vegetation growth and destruction along the riverbank as well as some expansion of the river margin in the unvegetated area. (C) shows aggradation on the sandbar, vegetation changes and some aggradation around the inside of the riverbend, and some expansion of the river margin around the outside of the riverbend.

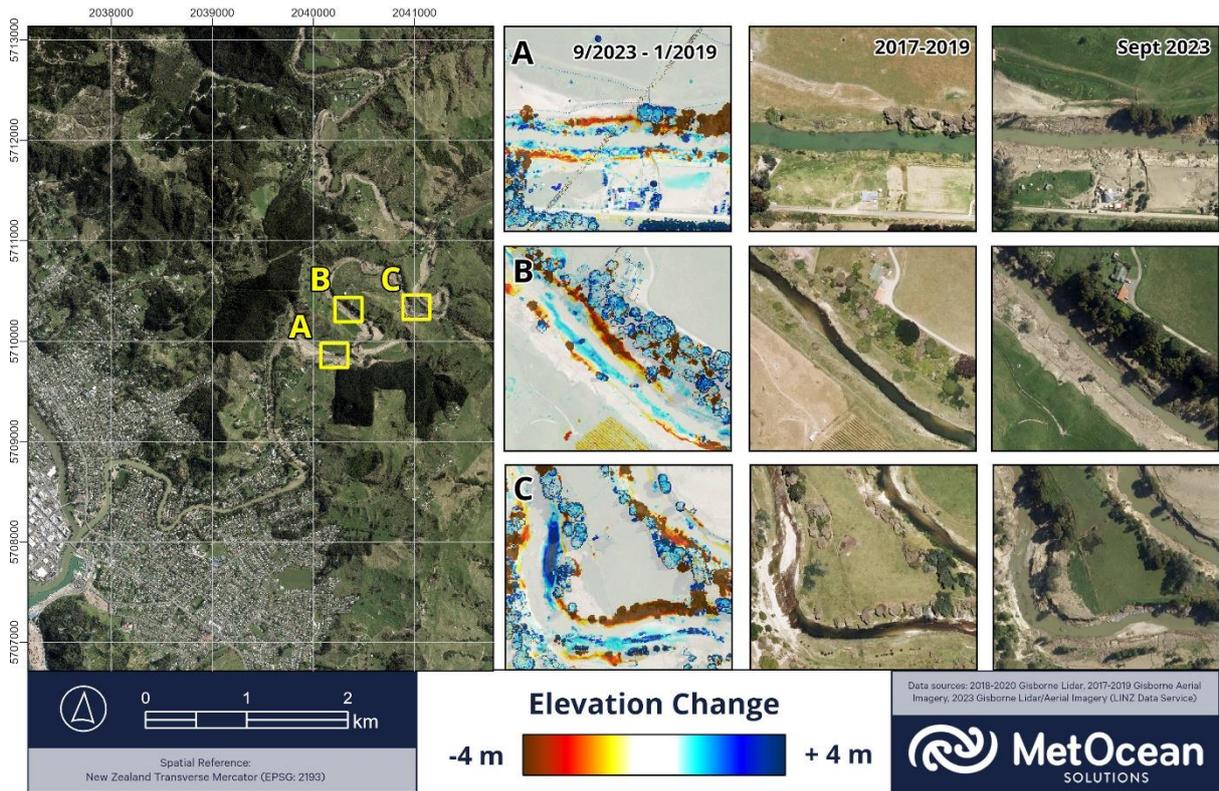


Figure 2-9 Changes in the Waimatā River upstream of the urban centre of Gisborne. (A) shows expansion of the river's margin, as well as aggradation in the dry parts of the channel. (B) shows some aggradation and erosion on either side of the river. (C) shows aggradation on inside corners and erosion on outside corners.

3. High level options for sediment shift/removal

This section presents a range of options for sediment removal, highlighting methods suitable for use in riverine environments.

When deciding the type of dredger, it is important to consider several factors:

- Location of dredging (e.g., high boat traffic area, low bridges, confined space, water depth).
- How to get dredger into place (e.g., tow or self-propelled).
- Sediment to be dredged (e.g., sand, silt).
- Sediment disposal (e.g., disposal in water or on land, use of barges or pipes, transport of dredged sediment)
- Environmental impact (e.g., dredger type to reduce impact)
- Financial aspects (e.g., costs to hire, transport of dredged sediment and disposal, transport of the dredger).

Dredging:

- Removal of sediment from the riverbed to increase conveyance using mechanical equipment (e.g. excavators, backhoe dredgers) or hydraulic systems (e.g. suction dredgers).
- Backhoe dredgers (BHD): The sediment is dredged using a bucket, placed onto a barge and then transported to a designated disposal location. Most backhoe dredgers are not self-propelled and must be towed into place (Figure 3-1).
- Cutter Suction Dredgers (CSD): are hydraulic dredging vessels, self-propelled or stationary, that uses a rotating cutter head to break and suction various types of sediments. Most CSDs can dredge in depths under 2 metres to over 35 metres (Figure 3-2 and Figure 3-3).
- Trailing suction hopper dredgers (TSHD): are self-driven dredgers, with a pipe, a hopper, and a mechanism to dump dredged material. This dredger type is comparatively larger than other options of dredgers and most used in harbours, likely not an option for the Waimatā river (Figure 3-4).
- Water injection dredgers: a strong jet of water is injected under the sediment, agitating the sediment. The sediment then mixes with the water and is taken away by the currents or tide (Figure 3-5).
- Amphibious excavator: multi-function dredger which can work on land and in water. Some options can have various capabilities in one machine including



backhoe dredging, suction dredging and pile driving. Suitable for shallow waters, lakes, rivers, canals, ponds and basins (Figure 3-6).

- Example case: Heathcote River Dredging Project (2018-2020) (Figure 3-7) – An amphibious excavator was used to dredge silt from the riverbed and load it onto trucks. Dredging during adverse weather conditions or areas of difficult access via water was undertaken using a long reach excavator on the riverbank to load silt from a barge onto trucks (Figure 3-7 and Figure 3-8).

Sediment disposal:

- Disposal on land using pipes or trucks.
- Disposal offshore, using barges (no need for barges if using TSHD). Need for resource consent in case of sourcing a new disposal area. Potentially use of Port's disposal areas.

Alternative or combined options to dredging:

- Sediment Relocation: Moving sediment from one part of the river to another within the river system to restore balance to areas suffering from erosion or sedimentation (e.g., using dredged sediment to rebuild eroded riverbanks).
- Bioengineering solutions: Using vegetation to improve riverbanks, stabilise sediment and reduce erosion (e.g., planting vegetation along banks to trap sediment and stabilise the river margin).
(some insights here: <https://www.gdc.govt.nz/environment/rivers,-water-and-wetlands/our-rivers/riverbank-management>)

Dredging rate:

Estimating dredging rates involves analysing key factors like the volume of sediment to be dredged, sediment type (sand, silt, or clay), equipment capacity, working hours, and disposal logistics. Other factors to be considered include potential delays due to adverse weather conditions or equipment downtime, affecting the timeline of the operation.

Using the dredging volume reported for the Heathcote River project as an example, approximately 70,000 tons of sediment were removed, equivalent to around 35,000 to 40,000 m³, depending on the sediment composition (e.g., sand vs. silt).

Using a backhoe with a bucket size of 0.4 m³ (Table 3-1), the average cycle time (including loading, swinging, unloading, and returning) is approximately 30 seconds. This results in 120 cycles per hour, with a dredging capacity of about 48 m³ per hour. Removing 40,000 m³ of sediment would require roughly 100,000 cycles, resulting in approximately



834 operational hours. If the dredging operation worked continuously, 24 hours a day, the total dredging project would be completed in about 35 days.

However, continuous operation is unrealistic, and this estimate excludes time for transportation of the dredger to the dredging sites and transport and disposal of the dredged sediment. For instance, filling a 100 m³ barge would take around 2 hours, and the round trip for transportation and disposal of the dredged material would add another 2 hours. This 4-hour total cycle would allow for three complete cycles in a 12-hour workday, enabling the removal of approximately 300 m³ per day. At this rate, dredging 40,000 m³ would require about 133 days of work, or approximately 4.5 months.

Again, this high-level dredging rate estimate does not account for other factors such as adverse weather conditions or other potential delays.

Table 3-1 Examples of dredger sizes and capacity.

Dredger Type	Operator	Size	Capacity
Demountable Modular Backhoe	Heron Construction Company Ltd	Length overall: 23.8 m Breadth: 8.8 m Depth: 1.8 m Max Draft: 1.5 m	Bin capacity: 100 m ³ Bucket size: 0.4 m ³
Cutter Suction	Heron Construction Company Ltd	Length overall: 18 m Breadth: 6 m Draft: 0.9 m	Suction Size: 300 mm Discharge Size: 350 mm
Cutter Suction	Heron Construction Company Ltd	Length: 23.8 m Width: 7 m Draught: 1.5 m	Suction size: 300 mm Discharge size: 350 mm
Trailing suction hopper	Westport Harbour	Length: 55 m Loaded Draft: 4.1 m	Hopper Capacity: 635 m ³
Water Injection	Van Oord	Length: 10.33 m, 17.50 m, 18.73 m Breadth: 4.08 m, 4.50 m, 1.25 m Depth: 1.50 m, 1.25 m, 1.80 m	Total power installed (kW): 89, 410, 460
Amphibious Excavator	Hitachi	Length: 8.03 m Width: 5.94 m Counterweight clearance: 1.94 m	Bucket size: 0.4-0.6 m ³
Longreach Excavator	Heron Construction Company Ltd	Width overall: 3.40 m Longreach configurations: 18 m, 20 m, 21 m	Bucket Size: 1.2 m ³ , 0.8 m ³ , 0.4 m ³





Figure 3-1 Example of a Modular Backhoe. Source: <https://www.heeronconstruction.co.nz/Equipment/Combi.html>.



Figure 3-2 Example of a Cutter Suction. Source: <https://www.heeronconstruction.co.nz/Equipment/Beaver.html>.



Figure 3-3 Example of a Cutter Suction. Source: <https://www.heeronconstruction.co.nz/Equipment/Kotuku.html>.



Figure 3-4 Example of a Trailing Suction Hopper. Source: <https://www.westportharbour.co.nz/about/dredging/#:-:text=Westport%20Harbour%20owns%20and%20operates,also%20available%20for%20outport%20dredging.>



Figure 3-5 Example of a Water Injection Dredger. Source: <https://www.vanoord.com/en/equipment/water-injection-dredger/>.



Figure 3-6 Example of an Amphibious Excavator. Source: <https://relongdredger.com/product/amphibious-multipurpose-dredger-amd450>.





Figure 3-7 Example of dredging in the Heathcote River Project. Amphibious Excavator (top) and alternative barge unloading from riverbank (bottom). <https://www.johnstoncivil.nz/projects/river-dredging/>.



Figure 3-8 Example of a Longreach Excavator. Source: <https://www.heronconstruction.co.nz/Equipment/ZX+330.html>.



4. Potential impacts, negative effects/risks of dredging

Dredging can be an effective method for managing sediment accumulation; however, it is important to assess its potential impacts and risks. Understanding these impacts is critical to mitigate potential negative effects, comply with regulatory requirements and maintain the long-term health of the ecosystem. This section describes the various factors that could result from dredging activities.

Environmental impacts:

- Removal of sediment can cause disruption of aquatic habitats and ecosystems, such as damaging spawning grounds for fish or displace benthic invertebrates.
- Increased turbidity can affect water quality and downstream ecosystems. Suspended particles can reduce light penetration, affecting aquatic plant photosynthesis and fish feeding.
- Dredging may disturb sediment containing heavy metals, pesticides, or other pollutants, leading to downstream contamination.
- Disposal of sediments can smother benthic fauna and contain pollutants.

Hydrological risks:

- Alteration of river flow dynamics can lead to unintended erosion or sedimentation downstream, potentially worsening flood risks. E.g., dredging upstream causing increased siltation in estuarine zones.

Economic and social risks:

- High operational costs of dredging and ongoing maintenance requirements (e.g., how often will it need dredging after significant flood events).
- Potential conflicts with local stakeholders or users of the river.
- Risk of riverbanks erosion and damage to nearby houses.

Cultural and legal considerations:

- Adverse effects on areas of cultural significance or native species important to local iwi.
- Compliance with environmental regulations and resource management plans, e.g. the Resource Management Act (RMA) or other local regulations.



5. Proposed methodologies and studies required to assess impact (high level overview)

This section provides a high-level overview of proposed methodologies and studies required for impact assessment. These methodologies also aim to guide data collection, analysis, and interpretation, ensuring a robust understanding of potential effects and supporting informed decisions.

Baseline Studies:

- Sediment composition and distribution analysis: sediment sampling to analyse grain size, contaminant levels, geochemical analysis, and organic matter content.
- Biodiversity and ecosystem health surveys to identify key species and habitats that could potentially be affected by dredging.
- Hydrological modelling to understand flow patterns, sediment transport, and flood risks.

Impact assessment:

- Water quality monitoring pre- (and potentially post-dredging) to measure turbidity, nutrient loads, and contaminant levels (e.g., combine efforts with water monitoring program in <https://www.gdc.govt.nz/environment/maps-and-data>).
- Ecological impact studies to assess habitat loss, species displacement, and recovery potential.
- Cultural and social impact evaluations, including consultation with local stakeholders, communities and iwi.

Mitigation planning:

- Proposing strategies to minimise effects, such as installing silt curtains to limit sediment dispersal, planning dredging activities outside sensitive breeding seasons, converting dredger to run on biofuel.

Modelling studies:

- Hydrodynamic modelling: numerical modelling of currents and tidal flows to assess flow dynamics for current scenario and for modified flows post dredging. The modelling can also be undertaken for various river discharges, including extreme events that could lead to flooding (Figure 5-1).



- Morphodynamic and sediment transport modelling: modelling of sediment transport and bathymetric changes. The model can simulate changes in depth cause by erosion or sediment accumulation due to changes in water flow and dredging operations (Figure 5-2).
- Plume modelling: modelling the dispersion of sediment potentially released during dredging and disposal of sediments. Since dredging (and disposal in water) often results in the suspension (entrainment) of sediment, it is important to consider the fate and movement of this sediment plume (Figure 5-3).
- Contaminants dispersion modelling: numerical modelling to assess the fate and dilution of contaminants released in the water during dredging and disposal operations (Figure 5-4).
- These modelling studies provide critical data that serve as input for specialists conducting downstream assessments (e.g., ecological and water quality impact assessments), helping to evaluate the potential effects on local ecosystems and water resources.

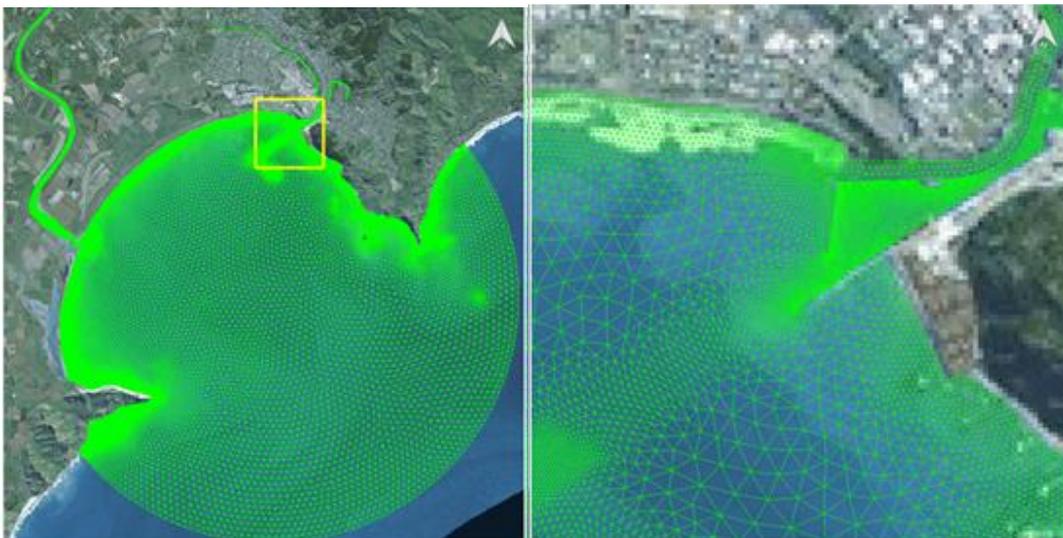


Figure 5-1 Example of numerical modelling domain showing areas with high resolution, meaning the model has capability to simulate the hydrodynamic flows in narrow waterways such as rivers.

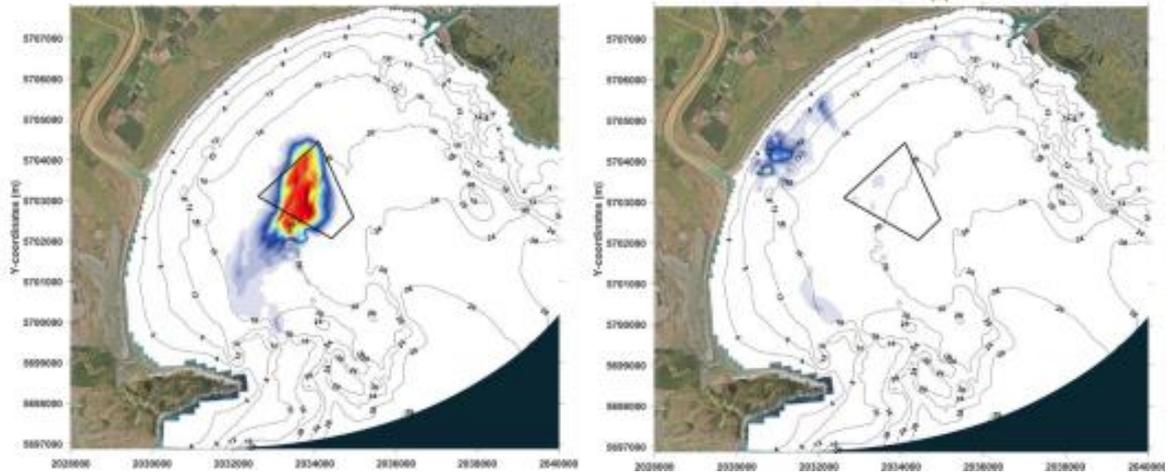


Figure 5-2 Example of morphodynamic modelling showing the erosion and transport of sediments from a disposal ground due to waves, tides and currents.



Figure 5-3 Example of dredging plume modelling showing suspended sediment plume footprint related to the method of dredging and sediment type.

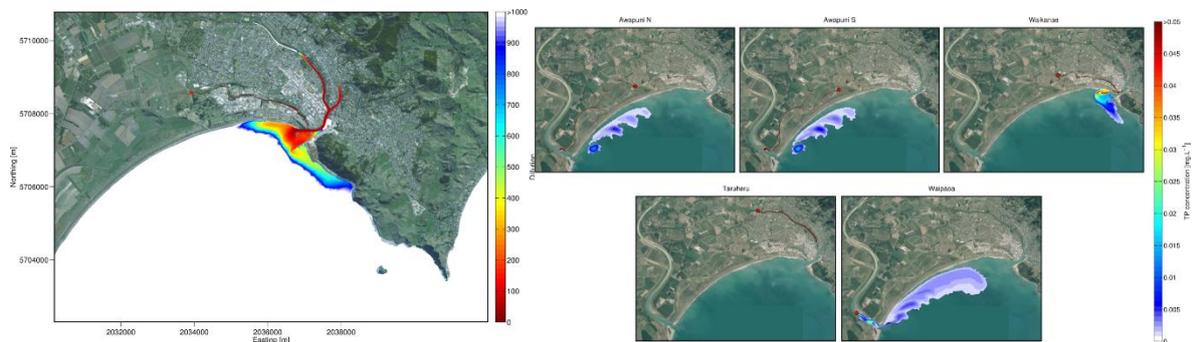


Figure 5-4 Example of modelling of discharge plume and dilution study.



6. Required results and analysis for Consent and other assessments

This section lists the surveys, studies and analysis that are commonly required to support resource consent applications to undertake dredging (and disposal) of sediments.

Hydrological data:

- Measure flow rates and conduct flood risk analysis.
- Modelling how dredging affects floodplain during high flow events.
- Modelling sediment transport pathways.
- Investigate potential for downstream effects (e.g., potential negative effects related to increased sedimentation or potential benefit of reducing infilling of the harbour channel).

Environmental reports:

- Assessing impacts on aquatic life, ecosystems, and biodiversity, including endangered or migratory species.

Water quality:

- Turbidity measurements, nutrient loading, contaminant analysis and sediment composition, demonstrating compliance with national water quality standards post-dredging.

Cultural impact assessment:

- Identification of culturally significant areas, consultation outcomes with iwi and evaluation of potential effects on cultural values and resources.

Mitigation and monitoring plans:

- Clear strategies for mitigating identified risks.
- Ensuring ongoing monitoring post-dredging (e.g., monitoring of water quality and ecological parameters).

Alternative analysis:

- Justification for dredging compared to other sediment management options (e.g., comparing dredging to bioengineering solutions) based on cost-effectiveness and environmental impact.



Stakeholder engagement reports:

- Evidence of consultation with affected parties, including local communities, iwi, and recreational users, e.g., meeting minutes and survey results.



7. Summary

Gisborne District Council (GDC) is currently looking at options and implications for dredging the Waimatā River. This document provided a high level assessment and recommendations of what might be required to support consenting and or additional analysis.

The Waimatā River in the Gisborne Region flows into Poverty Bay, contributing 690,000 tonnes of sediment annually, driven by seasonal rains and cyclones. After Cyclone Gabrielle, a major clean-up had cleared over 420,000 tonnes of debris after 5 months post cyclone. Despite cleanup efforts, excess sediment is restricting conveyance, and dredging may be considered as a potential method to address this issue.

This report provided a high-level overview of the following items:

Review of survey and sedimentation and recommendations about additional data requirements and frequency:

- Bathymetric surveys of the Waimatā River in 2021 and 2023, presented in comparative maps, provided a high-level assessment of elevation and depth changes. Recommendations included more frequent, high-resolution surveys and additional data to better identify sediment pathways.

Present high level range of options that may be used to remove or shift sediment restricting conveyance:

- This section discussed sediment removal options suitable for riverine environments and listed factors to be considered when choosing the appropriated method, such as dredging location, material type, and sediment transport and disposal logistics. Examples included equipment such as backhoe dredgers and amphibious excavators.

Assess potential effects/risks of dredging that would need to be investigated and considered.

- This section described potential impacts of dredging, highlighting the importance of understanding these factors to mitigate risks, comply with regulations, and protect ecosystem health. Key considerations included environmental, hydrological, economic, social, cultural, and legal aspects.



Discuss proposed methodologies and studies required to assess impact (high level overview).

- This section described methodologies and studies for impact assessment, providing an overview of data collection and analysis to support informed decision-making. It includes baseline studies, impact assessments, mitigation planning, and modelling studies (e.g., hydrodynamic, sediment, and plume dispersal modelling).

List results and analysis that are required for consent and/or additional assessments.

- The final section of the document lists the surveys, studies, and analyses commonly required for resource consent applications for dredging and sediment disposal, including hydrological data, environmental reports, water quality assessments, cultural impact assessments, mitigation and monitoring plans, alternative analysis, and stakeholder engagement reports.

