

Annual report & monitoring results 2022 - 2023

Kaituna River Re-Diversion and Te Awa o Ngatoroirangi/
Maketu Estuary Enhancement Project

DRAFT



Image copyright Andy Belcher and Bay of Plenty Regional Council

Braden Rowson, Courtney Bell, Pim de Monchy for Bay of Plenty Regional Council
Date: 28 August 2023

Contents

1	Introduction	4
1.1	Reporting to date	4
1.2	Condition 29.1 – Reporting	4
1.3	Condition 29.3 – Recommended changes to monitoring	6
2	Collaboration Plan and Mauri Monitoring Plan (Condition 8)	8
2.1	Condition 8A – Tangata Whenua Collaboration Plan	8
2.1.1	Monitoring results	8
2.2	Condition 8B - Mauri Monitoring Plan	12
2.2.1	Monitoring results	12
3	Wetland Restoration Plan (Condition 27)	13
3.1	Condition 27	13
3.1.1	Monitoring results	14
4	Water Levels and Flows (Condition 30)	14
4.1	Condition 30.1 & 30.3	14
4.1.1	Monitoring results	14
5	Erosion and Bed Levels (Condition 31)	16
5.1	Condition 31.1 & 31.2 – Papahikahawai Island & Maketu Spit	16
5.1.1	Monitoring results	17
5.2	Condition 31.4 – Maketu Township and Beach Road	22
5.2.1	Monitoring results	22
6	Summary of monitoring results (Conditions 32 - 35)	26
7	Water Quality and Shellfish (Condition 32)	27
7.1	Condition 32	27
7.1.1	Monitoring results – Condition 32.4 water quality monitoring	28
7.1.2	Monitoring results – Condition 32.5 – 32.7 shellfish bacteria monitoring	37

7.1.3	Monitoring results – Condition 32.8 pipi survey	39
7.1.4	Monitoring results – Condition 32.9 mid-estuary shellfish monitoring	43
8	Ecology algal mapping (Condition 33)	47
8.1	Condition 33.1 – 33.3	47
8.1.1	Monitoring results	47
9	Ecology flora (Condition 34)	48
9.1	Condition 34.1 – 34.6 – Terrestrial and Wetland Vegetation	48
9.1.1	Monitoring results	48
10	Sediment and Algae (Condition 35)	54
10.1	Condition 35.1 – 35.3	54
10.1.1	Monitoring results	54
11	Community Relationships (Condition 36)	57
11.1	Condition 36.1 – 36.7	57
11.1.1	Monitoring results	57
12	On-going Maintenance (Condition 20)	58
12.1	Condition 20.4 – Mooring basin survey	58
12.1.1	Monitoring results	58
13	Operations and Maintenance Manual (Condition 26)	59
13.1	Condition 26.10 – 26.12	59
13.1.1	Monitoring results	59
14	Other observations, information, and relevant reports	59
14.1	Inspection reports & Condition assessments	59
15	Appendices	60
	Appendix 1: Consent Conditions requiring monitoring	60
	Appendix 2: Written approval to remove requirements of Condition 23.2 - 23.4	72

1 Introduction

1.1 Reporting to date

This document is the fourth annual monitoring report as required by Condition 29.1 of Consent 67958 and corresponds with the year ending 31 May 2023 for the Kaituna River Re-diversion and Te Awa o Ngatoroirangi / Maketu Estuary Enhancement project.

The **first** annual report was submitted in 2017 and covered the early works for the project. This involved:

- Construction of Papahikahawai Bridge
- Re-contouring of Papahikahawai southern shoreline and re-planting with native plants
- Removal of two causeways blocking Papahikahawai Creek

The early works triggered a number of the Conditions where monitoring and / or reporting was required. No further physical works were undertaken up until the 31st May 2018. However, cross section monitoring continued.

The **second** annual report was submitted in 2021 and covered the main construction phase, which commenced on 12 June 2018. Results from 2018 did not show any significant changes from the 'before works' baseline.

Further monitoring was undertaken in 2019 in accordance with Conditions 31.1 to 31.4. Cross section surveys were carried out and a baseline established in April 2019 to meet the prior to Stage 1 commissioning requirement.

Stage 1 commissioning commenced on 12th February 2020 (opening and operation of nine gates) which resulted in increased flows from the Kaituna River into the Maketu estuary. This triggered a number of new Conditions requiring monitoring prior to and from Stage 1. Full commissioning occurred on 12th February 2021.

The **third** annual report includes both data from ongoing ecological monitoring as well as additional monitoring required to meet various consent Conditions.

This (**fourth**) annual report is essentially an update of the previous report including both data from ongoing ecological monitoring as well as additional monitoring required to meet various consent conditions.

1.2 Condition 29.1 – Reporting

Table 1 summarises the monitoring undertaken as per the consent Conditions for this period and is structured to align largely with Condition 29 (a) – (g). While Table 2 summarises other noteworthy data and/or observations made during this period, but not required by consent Conditions. [Appendix 1](#) contains a full table of Conditions.

The [final section](#) of this report details changes to the consent Condition reporting requirements as agreed to with the relevant consenting authority.

Table 1 – Summary of monitoring results as guided by Condition 29 (a) – (g)

Monitoring parameter	Consent Condition monitoring requirement
Monitoring results from the Mauri Monitoring Plan	Condition 8A
Wetland Restoration Plan	Condition 27
Water Levels and Flows (including model validation)	Condition 30
Erosion and Bed Levels	Condition 31.1, 31.2, 31.3, 31.4, 31.5
Summary of ecological monitoring	Summary of results for Conditions 32, 33, 34, 35
Water Quality and Shellfish	Condition 32.4, 32.5, 32.6, 32.7, 32.8, 32.9
Ecology (Fauna)	Condition 33.1, 33.2, 33.3
Ecology (Flora)	Condition 34.1, 34.2, 34.3, 34.4, 34.5, 34.6
Sediment & Algae	Condition 35.1, 35.2, 35.3
Community Relationships	Condition 36.1, 36.2, 36.3, 36.4, 36.5, 36.6, 36.7, 36.8, 36.9
On-going Maintenance (Mooring Basin Survey)	Condition 20.4
Operations and Maintenance Manual	Condition 26
Five Yearly Annual Report Peer Review	Condition 29A.1, 29A.2, 29A.3, 29A.4 29A.5, 29A.6

Table 2 – Other observations, information or reports commissioned in relation to the effects of the project

Report
New northern stopbank settling survey results – Stratum
“Recreation patterns around Maketu Estuary and Kaituna river following redirection of the Kaituna River”
Final Archaeological Report Kaituna River Re-Diversion HNZPT Authority Number 2018-3 31 June 2022
Regular inspections and Condition assessments – IceGeo

1.3 Condition 29.3 – Recommended changes to monitoring

In accordance with Condition 29.2, the monitoring parameters, site locations and frequency of sampling outlined in the Environmental Monitoring Programme and any other alterations may be reviewed as part of each monitoring report.

A review of the monitoring parameters, site locations and frequency of sampling was undertaken in 2020 and the following changes were implemented in 2021:

Condition	Proposed change	Reasons for change
34.1 Transects 10 and 11	The Condition requires one transect be north-south and the other east-west. The recommendation is for both to run north-south	The transects were relocated to better reflect the Wetland Restoration Plan and planting

As a result of work undertaken for the second annual report the following changes were recommended and adopted:

Condition	Proposed change	Reasons for change
34.1 Transects 10 and 11	Add additional plots – Te Pa Ika: lots should be established in the shrub planting zone (mostly at the western and northern ends), the planted estuarine margin, and the unplanted mudflats Reduce frequency of bare plots to 5-yearly	Many of the plots on Te Paika and some on Ford Island are 100% mud or dirt. Although some of these may never naturally regenerate in marsh species it is still worth keeping the plots in there, but it is considered appropriate to add additional plots in areas that have been planted and to reduce the frequency of measurement of the bare plots to 5-yearly.
34.1 Transect 11	Remove requirement to monitor plots 1 and 2 of Transect 11.	Two of the plots at Te Paika no longer exist as the widened diversion channel encroached on this area.

As a result of work undertaken for this annual report the following changes are recommended and proposed to be adopted:

Condition	Proposed change	Reasons for change
23	Remove Condition 23.2 – 23.4	Based on water level analysis completed by RiverSpace, Fish & Game and DoC have provided written approval to remove the requirement for an additional culvert to be installed at the Kaituna Wildlife Management Reserve. Refer also to Appendix 3.

2 Collaboration Plan and Mauri Monitoring Plan (Condition 8)

2.1 Condition 8A – Tangata Whenua Collaboration Plan

8A.1 *The objective of the Plan is to provide, to the extent reasonable and practicable, for the active involvement of Tangata Whenua, including each group individually, at all stages of the Project and its implementation.*

8A.2 *The purpose of the Plan is to identify the process and extent of involvement by Tangata Whenua in:*
(i) Developing the detail of the restoration activities for the Project;
(ii) The delivery of the restoration activities; and
(iii) Monitoring the effectiveness of the restoration activities.

8A.3 *As a minimum the Plan shall detail:*

- (a) How and when Tangata Whenua will be involved with planning and implementation of:*
 - (i) wetland restoration;*
 - (ii) monitoring in the estuary and the river; and*
 - (iii) any other matter identified through the development of the Plan;*
- (b) removed by Environment Court*
- (c) Opportunities for providing improved tuna and inanga fish passage and habitat;*
- (d) How local cultural knowledge may be incorporated in monitoring of the effects of the Project*
- (e) Mechanisms for enabling local employment and providing education opportunities for Tangata Whenua, including making material and knowledge available for educational use;*
- (f) removed by Environment Court*
- (g) A process for Tangata Whenua to have input into and provide feedback on the annual report prepared under Condition 29 prior to its lodgement with the Regional Council.*

8A.4 *The Tangata Whenua Collaboration Plan may consist of several sub-plans developed with the different Tangata Whenua groups, to recognise the unique and diverse interests and values of different Tangata Whenua groups, and to take into account the recommendations of the Cultural Impact Assessments prepared by the different groups.*

8A.5 *In the event that the Consent Holder and Tangata Whenua are unable to agree on the contents of the Plan, or in relation to a sub-plan the contents of that sub-plan:*

- (a) The Consent Holder, following consultation with Tangata Whenua and the Regional Council, shall engage a suitably qualified independent cultural expert to consider the draft contents of the Plan and the views of the parties and make a recommendation on the appropriate contents of the Plan or subplan, having had regard to the objectives, purpose, and minimum requirements of the Plan and whether the contents are reasonable and proportionate in the context of the proposal*
 - (b) When submitting the Plan to the Regional Council for certification, the Consent Holder shall identify any recommendations provided in accordance with Condition 8A.5(a) that have not been adopted and give the reasons for not adopting those recommendations*
 - (c) The independent expert may consult directly with Tangata Whenua as necessary in order to fulfil his or her functions under these Conditions prior to making a recommendation*
- 8A.6 *The Tangata Whenua Collaboration Plan, including any of its sub-plans, may be amended from time to time by the Consent Holder with the agreement of Tangata Whenua. Where a proposed amendment to the Plan or sub-plan does not affect all Tangata Whenua, the agreement is only required with the group(s) affected. A copy of the amended plan shall be provided to the Regional Council.*

2.1.1 Monitoring results

Tangata Whenua Collaboration Plans have been prepared by and previously submitted to the consenting authority.

In accordance with Condition 8, the following opportunities have been identified and actioned since 2017:

Opportunity	Action taken	Outcome
Mural for control building (2019)	<p>Te Toko Whitu (Tangata whenua working group) developed a brief for an artist to design a mural for 2 walls of the control building. Applications were received and a sub-group appointed the artist.</p> <p>The draft concept was provided for comment at a hui, following which minor changes were made.</p>	Completed mural that tells a story about the values of the area
Involvement with monitoring (2017-ongoing)	Assistance with sampling work required as part of consent Conditions	<p>Ahi kā employed to assist with shellfish sampling</p> <p>Maketu locals paid to undertake regular spit cross section profile monitoring</p> <p>Rewi Corbett supporting monitoring undertaken by Stephen Park, BOPRC</p>
Education and research projects (2020)	<p>Waikato University, School of Science – various research underway looking at estuary flushing and mixing</p> <p>Te Waata ran a three day Wānanga for school students on Papahikahawai to instruct them in various cultural matters in May 2020</p>	Various monitoring projects by university students and staff
Mauri monitoring (2019 – ongoing)	Baseline work undertaken in 2019 and reported in 2020	Agreed at July 2021 hui that further mauri monitoring work should be undertaken now and a scope of works is being developed
Other	<p>Support for Te Maru o Kaituna River Authority - Action Planning and Implementation (2020)</p> <p>Waka Ama – relocation and advocacy (2020)</p>	<p>Inclusion of projects in the Kaituna Action Plan, eg. Project 6: A work programme will be developed with tangata whenua, environmental care groups and the Maketu community to identify and prioritise restoration tasks. This may include continued wetland and/or estuarine margin planting as well as saltmarsh and seagrass restoration</p> <p>Return of club including a new launching area</p>
Social Impact Assessment (2020-2021)	Toi Ohomai, in conjunction with Te Arawa students	Social impact assessment undertaken post diversion that is compared to pre diversion

Nana (sea grass) monitoring	Working with Ngāti Pikiao and Ngāti Whakaue to ensure regular monitoring of sea grass and consider management actions over and above long-term improvement in ecological conditions	Regular inspections, photos and condition scoring anticipated – visual monitoring actually carried out
-----------------------------	---	--

An opportunity for feedback on the draft annual monitoring report is provided around July each year.

On **21 July 2020** the results of the annual monitoring were presented at a tangata whenua hui in Maketu. Key feedback on the monitoring results included:

1. Maketu locals have informally commented on the positive changes they have seen to the estuary and this is reflected in the results that have been presented
2. If requirements can be met, there was support to move from 9 to 12 culverts being open earlier.

The presentation used at the hui was used by Te Rūnanga o Ngāti Whakaue ki Maketū at their own runanga meeting to update members.

On **28 July 2021** the results for 2020/21 annual monitoring report along with the preliminary archaeological report and mauri baseline monitoring were presented at a tangata whenua hui in Maketū. Key feedback on the work included:

1. Maketu locals continue to informally comment on the positive changes they have seen to the estuary
2. Observations have been made by Maketu locals that the channel is wider but appears shallower, the sand is getting softer, pipis have increased in size, water goes further up the estuary and there is an obvious increase in number of birds
3. that further mauri monitoring work should be undertaken now, and a scope of works is being developed.

On **29 July 2022** the results for 2021/22 annual monitoring (Stephen Park, 4Sight Consulting) along with the final archaeological report (Cameron McCaffrey) and recreational use report (Toi Ohomai) were presented at a tangata whenua hui in Maketū. Key feedback on the work included:

1. Why are the pipi no longer white? Many have a green or black tinge. Also an observation that tuangi (cockles) also used to be larger & have a good colour. Question from Matt and Clester Eru, and suggestion that this be referred to Chris Battershill and Kura Paul-Burke at Waikato University in the first instance, and potentially assist iwi in seeking funding for some research.

Note, since the hui a meeting with Kura, Chris, Stephen and Pim was held, and Chris suggested that a summer student project could look at the chemical composition of the shellfish of different colours along with microbiology and perhaps some blind taste testing. Are there any students from Maketū or with Te Arawa connections who might be interested in doing this study? Regional Council is happy to contribute to it. This question to be raised and discussed again at the hui on 1 September 2023.

2. Could we aim for a shellfish recovery action plan similar to Ohiwa? Pim explained yes, although there is cross-over with Maketū Taiapure Committee and MPI's

jurisdiction, so would need some careful thought. This question will also be posed to Kura in the first instance given her experience in this area.

Feedback to be discussed at the hui on 1 September.

3. What should happen to the obsidian flakes and hangi stones unearthed during archaeological investigations? This matter was to be referred to the Maketū koeke group by Raewyn Bennett and others for guidance. Outcome to be communicated to all iwi and Cam McCaffrey at Archaeology BOP.

To be discussed at the hui on 1 September.

4. There appears to be sand building up at the Maketū boat ramp. Pim referred to the survey cross sections which appeared to show that while some change had occurred, overall there had not been a worsening (ie it was pretty marginal before the project was implemented and is still pretty marginal now except at higher tides). However, we will refer the cross sections to our Harbour Master Jon Jon Peters and surveyor Graeme O'Rourke for their opinion on the matter.

Since July 2022 there appears to have been erosion of some of the sand which was a concern a year ago, so this may no longer be an issue.

5. Could we investigate whether excavating and removing anoxic mud and weed from the estuary at the mouth of the Waitepuia Stream, or adding clean sand over the top of the existing substrate in certain areas, would have a beneficial effect? We will refer this suggestion to Stephen Park, Kura Paul-Burke and Chris Battershill and see what the response is.

Here is an email exchange between Raewyn Bennett (Ngāti Pikiao, Maketū ahi kaa) and Pim de Monchy:

RB: With reference to wanting to empower our Maketu ahi kaa as the Ongatoro knowledge holders, I recommend that in the first instance in regard to potential excavation of the anoxic area at WaiTePuia, that Rewi Boy Corbett be first contact for an informed opinion. He knows the estuary and then maybe the ecologist – forgotten his name – who contributed evidence to the diversion hearing. I would value their opinion and Boy with his machinery knowledge may have further costing knowledge. I know that when he was monitoring he noted a number of anoxic areas in the estuary.

PdM: I met with Chris Battershill, Kura Paul-Burke and Stephen Park earlier this week to discuss this, and they raised concerns about doing this prior to reducing contaminant inflows from both the Maketū Rd Pump Station and the Waitepuia Stream's gravity outlet. In their view it could be investigated but it's more important to get the paru out of the discharges. That said, I'm keen to get this idea thoroughly tested so I've copied in Keith Hamill (the ecologist you refer to) for his view, and would be happy to link him with Rewi and others to talk about it some more.

2.2 Condition 8B - Mauri Monitoring Plan

8B.1 Prior to Stage 1 commissioning the Consent Holder, in collaboration with Tangata Whenua shall prepare and submit to the Regional Council a Mauri Monitoring Plan. The objective of the Plan is to identify whether a decline in mauri is occurring over time as a result of the Project.

8B.2 The purpose of the Plan is to identify the process and methods for monitoring the impact of the Project on mauri over time.

8B.3 As a minimum the Plan shall include:

- (a) The methodology to be used to monitor the effects of the Project on mauri;
- (b) The indicators of mauri potentially adversely affected by the Project, the baseline Condition of those indicators, and thresholds that will be used to identify whether mauri is declining over time as a result of the Project;
- (c) The frequency of monitoring to be undertaken, including any possible changes in frequency over time; and
- (e) A process for reporting of results and sharing of information between the Consent Holder and Tangata Whenua, including meeting to discuss preparation of the Annual Plan required under Condition 29.1 prior to it being submitted to the Regional Council.

8B.4 The Plan may consist of several sub-plans developed with the different Tangata Whenua groups, to recognise the unique and diverse interests and values of different Tangata Whenua groups, and to take into account the recommendations of the Cultural Impact Assessments prepared by the different groups.

8B.5 In the event that the Consent Holder and Tangata Whenua are unable to agree on the contents of the Plan, or in relation to a sub-plan the contents of that sub-plan.

- (a) The Consent Holder, following consultation with Tangata Whenua and the Regional Council, shall engage a suitably qualified independent cultural expert to consider the draft contents of the Plan and the views of the parties and make a recommendation of the appropriate contents of the Plan or subplan having had regard to the objectives, purpose, and minimum requirements of the Plan and whether the contents are reasonable and proportionate in the context of the proposal.
- (b) When submitting the Plan to the Regional Council for certification, the Consent Holder shall identify any recommendations provided in accordance with Condition 8B.5(a) that have not been adopted and give the reasons for not adopting those recommendations.
- (c) The independent expert may consult directly with Tangata Whenua as necessary in order to fulfil his or her functions under these Conditions prior to making a recommendation.

The Mauri Monitoring Plan, including any of its sub-plans, may be amended from time to time by the Consent Holder with the agreement of Tangata Whenua. Where a proposed amendment to the Plan or sub-plan does not affect all Tangata Whenua, the agreement is only required with the group(s) affected. A copy of the amended plan shall be provided to the Regional Council.

8B.7 Notwithstanding this Condition or any other Condition, Tangata Whenua may at any time make recommendations directly to the Consent Holder or to the Regional Council on measures to be undertaken to address or mitigate cultural impacts arising due to the operation of the Project.

2.2.1 Monitoring results

In 2019 the consent holder engaged Te Atarangi Sayers and Paora Howe to develop a mauri monitoring baseline assessment and report. The report focuses on the development and outcomes of the Mauri Monitoring Model (developed by Dr Kepa Morgan) as it applies to the lower Kaituna River area and Te Awa o Ngātoroirangi/ Maketū Estuary project (the Project).

Mauri monitoring was raised during the **29 July 2022** presentation to tangata whenua hui. There was no clear feedback as to how or who or when the monitoring report will be repeated.

The consent holder will continue to discuss the potential for this work to be repeated with tangata whenua.

Additional feedback from this meeting included the ongoing desire expressed for the opportunity to work with Stephen Park and other Council staff in relation to estuary restoration work, with the long term mission that Maketū people become the scientists.

Staff should look to include a review of the Mauri Monitoring Plan sometime during 2023/2024, as recommended by the Independent Peer Review in 2022. However, such a venture would need to be supported by Tangata Whenua before commencing.

3 Wetland Restoration Plan (Condition 27)

3.1 Condition 27

27.1 Prior to the commencement of planting, a Wetland Restoration Plan shall be prepared and submitted to the Regional Council for certification at least two months prior to the first planting season. Regional Council's certification shall be limited to that the Wetland Plan:

- (a) Complies with Conditions 27.2 and 27.4 of this resource consent;*
- (b) Adopts the best practicable option(s); and*
- (c) Contains provisions that are enforceable.*

27.2 The Wetland Restoration Plan shall be verified by appropriately experienced and qualified practitioner(s), confirming that the Wetland Restoration Plan:

- (a) Meets the Wetland Restoration Plan objective(s); and*
- (b) Complies with the resource consent Conditions.*

27.3 The objective of the Wetland Restoration Plan is to establish as much wetland as practicable with an aim of 19 hectares or more where physical and environmental Conditions allow a sustainable cover of indigenous plants to be established that is representative in terms of species composition of wetland habitat found historically in the area, taking into consideration the substantial and irreversible human-induced changes that have occurred to the landscape surrounding the Ongatoro/Maketu Estuary.

27.4 The Wetland Restoration Plan shall provide details of how the above objective is to be achieved, including:

- (a) A map showing the locations of the proposed work;*
- (b) Identification of the key personnel or organisations that will oversee the work;*
- (c) The timescale of activities;*
- (d) Initial monitoring of site growing Conditions (especially soil salinity, soil saturation, tidal induced sediment erosion and deposition) after re-diversion and details of the process to be followed in the event die off is observed in accordance with Condition 34.5;*
- (e) Creation of a planting zone plan based on site growing Conditions and species tolerances;*
- (f) A programme for trial planting of plant species especially in areas where growing Conditions are likely to be challenging (for example, areas exposed to open tidal water and those with higher salinity);*
- (g) Details of mass planting once species can be matched to site Conditions with high confidence of success;*
- (h) Restoration planting plan produced that details the planting zones, species mixes, plant grades, site preparation and post-planting maintenance requirements;*
- (i) Identification of opportunities for Tangata Whenua and the community to be involved in planning and implementation of wetland restoration planting;*
- (j) Monitoring plan to objectively measure plant and species performance;*
- (k) Weed and pest control for each area; and*

27.5 The Consent Holder shall undertake all wetland works and weed and pest control in accordance with the Wetland Restoration Plan.

27.6 Subject to compliance with Condition 27.7 of this resource consent, the Wetland Restoration Plan may be amended at any time.

27.7 A copy of the amended Plan shall be provided to the Regional Council for their certification accompanied by verification from appropriately experienced and qualified practitioner(s) that the amended Wetland Restoration Plan meets the Conditions of this resource consent (including the objective under Condition 27.3). Regional Council's certification shall be limited to that the amended Wetland Restoration Plan:

- (a) Complies with Conditions 27.2 and 27.4 of this resource consent;
- (b) Adopts the best practicable option(s); and
- (c) Contains provisions that are enforceable.

3.1.1 Monitoring results

The Wetland Restoration Plan was prepared in accordance with the requirements of Condition 27 and submitted to the consenting authority in 2019. The Plan has guided the successful establishment of the Te Pā Ika saltmarsh.

The monitoring requirements detailed within the Wetland Restoration Plan are largely duplicated within the [Ecology \(flora\) monitoring section](#) required by Condition 34. Refer to the Te Pā Ika sub-section for discussion on the vegetation transect monitoring results.

4 Water Levels and Flows (Condition 30)

4.1 Condition 30.1 & 30.3

30.1 No less than 10 working days prior to the Stage 1 commissioning of the diversion control structure, the Consent Holder shall commence permanent water level monitoring at the following sites:

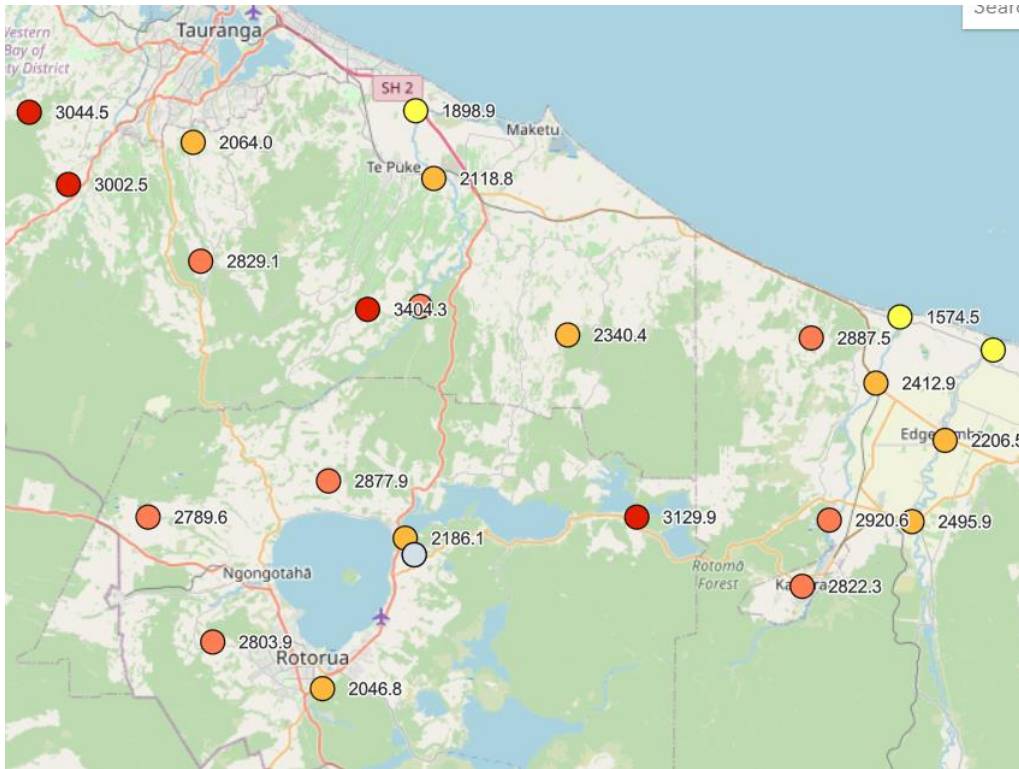
- (a) Kaituna River at Te Matai (map reference U14: 064 734) including flow rate;
- (b) Kaituna River in the vicinity of the Ford Road pump station (map reference 1,900,715 E, 5,815,802N NZTM);
- (c) Ongatoro/Maketu Estuary at Maketu township;
- (d) Fords Cut downstream of the diversion control structure. The monitoring device shall be suitable to be used for making operational decisions about the volume of water to be released into Ford's Cut; and
- (e) Sea level data obtained from the NIWA gauge at Tauranga (Moturiki) or alternative sea level gauge suitable for the purpose.

30.3 Data from the sites specified in Condition 30.1 of this resource consent shall be used to manage the flow regime through the diversion control structure in accordance with the OMM for the Project.

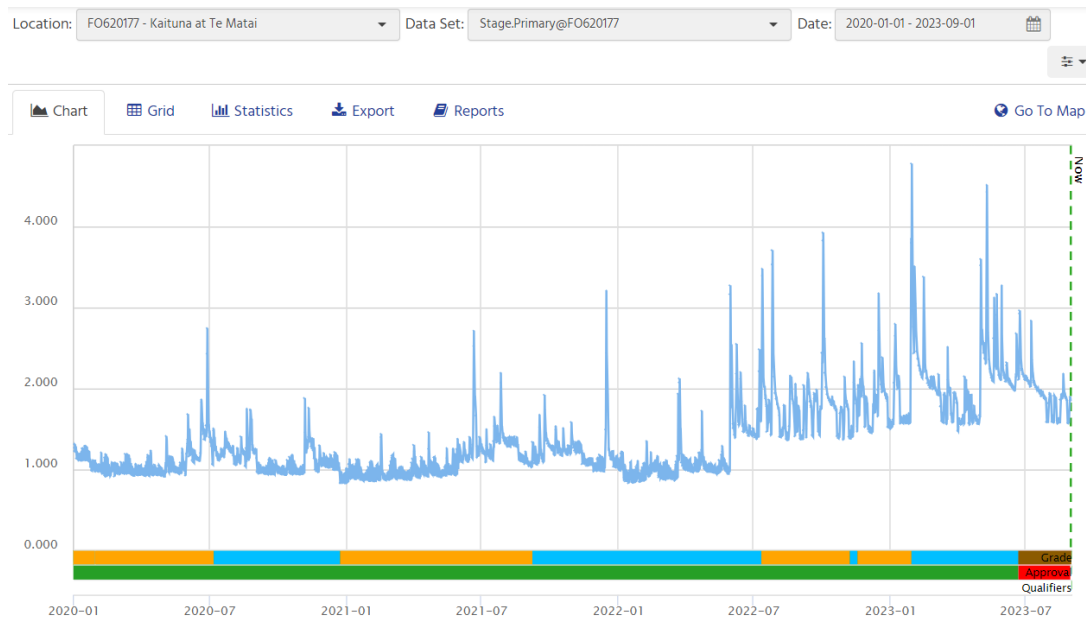
4.1.1 Monitoring results

The sites listed in (a) to (b) have been in use since the gates were first commissioned. The Operations and Maintenance Manual sets out the day-to-day automatic operation of the gates (i.e. based on water levels and tides) and the process to be followed in the event of a flood. In addition to their automated opening and closing on the rise and fall of each tide, the gates can now be operated remotely by the Consent Holder using Ricardo software. The gates and surrounding assets can also be viewed in real-time via a remotely-controlled camera with zoom, pan and audio functionality. Some of the noteworthy highlights include:

- Total rainfall in 2022 (from 30 May onwards) and in 2023 (to date) has been extremely high in the Kaituna catchment, setting a new annual maximum at many gauge sites (see image below for 2022 annual rainfall totals). The higher total rainfall has included several large and moderate sized flood events including the Auckland Anniversary and Cyclone Gabrielle events.



- Water level data collected at Te Matai is the longest running record on the Kaituna River. This shows that from 30 May 2022 when the heavy rain events began the river has been at least 0.5m higher than the long-run average, and included a much higher frequency of flood events with raised water levels. See image below for details.



- During flood events on the Kaituna River, the Regional Council evaluated whether or not the 'gate closure matrix' required temporary closure of some or all gates in order to reduce flood depth or duration at Maketū, but none of the events during the 2022/23 period triggered such a requirement. It should be noted that most of the flood risk at Maketū comes from high ocean water levels, rather than from the Kaituna River levels. However, in some circumstances, the river can contribute up to an extra 30cm to water levels, hence the use of the 'gate closure matrix.' Ten of the 12 gates were temporarily closed for several tidal cycles during the flood event at the end of May 2022, partially in response to requests from users of Te Tumu Cut who were growing concerned about the potential impact of an extended dry period on navigability.

Publicly available information on water levels in the lower Kaituna River and Maketū Estuary can be found on the Regional Council's [Environmental Data Portal](#).

5 Erosion and Bed Levels (Condition 31)

5.1 Condition 31.1 & 31.2 – Papahikahawai Island & Maketu Spit

31.1 *Prior to the commencement of works authorised under this resource consent, the Consent Holder shall undertake transect monitoring in the vicinity of Papahikahawai Island to monitor for any erosion as a result of the re-diversion, as follows:*

- An initial survey of the full width of the bunds, extending 20 metres landward of the sand bund; and thereafter*
- Permanently marked transects be located at four sites to the west and south of the island with each transect extending from the seaward face or toe of the existing sand bund to at least 50 metres offshore to pick up changes in near shore depths over time.*
- The transects shall be undertaken using Real Time Kinematic Global Positioning System.*
- Transects shall be measured as follows:*
 - Annually from the commencement of construction until Stage 1 commissioning of the diversion control structure; and then*
 - Twice a year for three years following Commissioning and thereafter the frequency shall be assessed as part of the reporting requirements of Condition 29.3.*

The requirement to establish and start monitoring was triggered by the early works ("prior to the commencement of works..."). The 2021 monitoring is the fifth year of annual transect monitoring at Papahikahawai Island.

31.2 *The Consent Holder shall survey:*

- The two transects (Maketu Spit 1 & 2) shown in the BOPRC Plan Number RC67958/12, with each survey of the transects to extend from at least mid-tide on the ocean side to at least low tide on the harbour side; and*
- The seaward toe of the dune or eroding bank over the "Dune Toe Monitoring Area" shown in BOPRC Plan Number RC67958/12.*

31.3 *The first survey under Condition 31.2 of this resource consent shall be undertaken at least one month prior to stage 1 commissioning and thereafter annually for a period of five years. After five years of annual surveys the frequency of the survey shall be assessed as part of the reporting requirements of Condition 29.3. The purpose of this survey is to monitor for any aggradation or erosion as a result of the re-diversion.*

Surveys of ground and bed levels at along transects at Papahikahawai Island, Maketū Spit, Maketū Township, and in the lower Kaituna River have been regularly monitored and the results are presented below. Many of these transects pre-date the Kaituna Re-diversion project, but some were installed and added as a result of the consent conditions.

5.1.1 Monitoring results

Papahikahawai island

The location of the Papahikahawai transects are shown in *Figure 1* along with the transect profiles in *Figure 3* and *Figure 4*. The 2022/3 monitoring results at Papahikahawai have been compared with previous survey results. Regional Council's survey and catchments teams have reviewed these together and concluded that they show stability over time with no concerning trends.



Figure 1 Papahikahawai Island survey locations

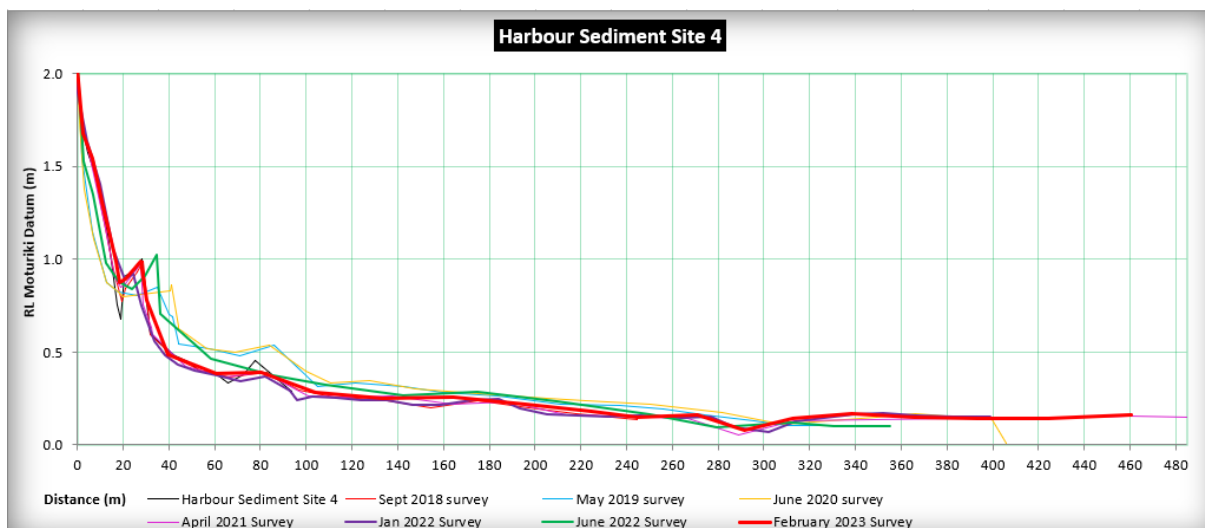


Figure 2 (cont. over page) Papahikahawai Island cross section monitoring results Sept 2016 – June 2022

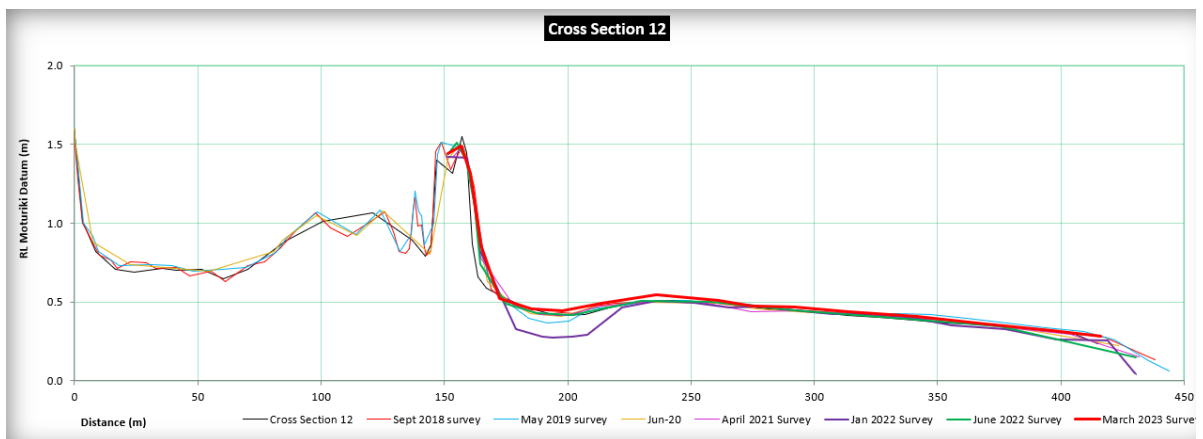
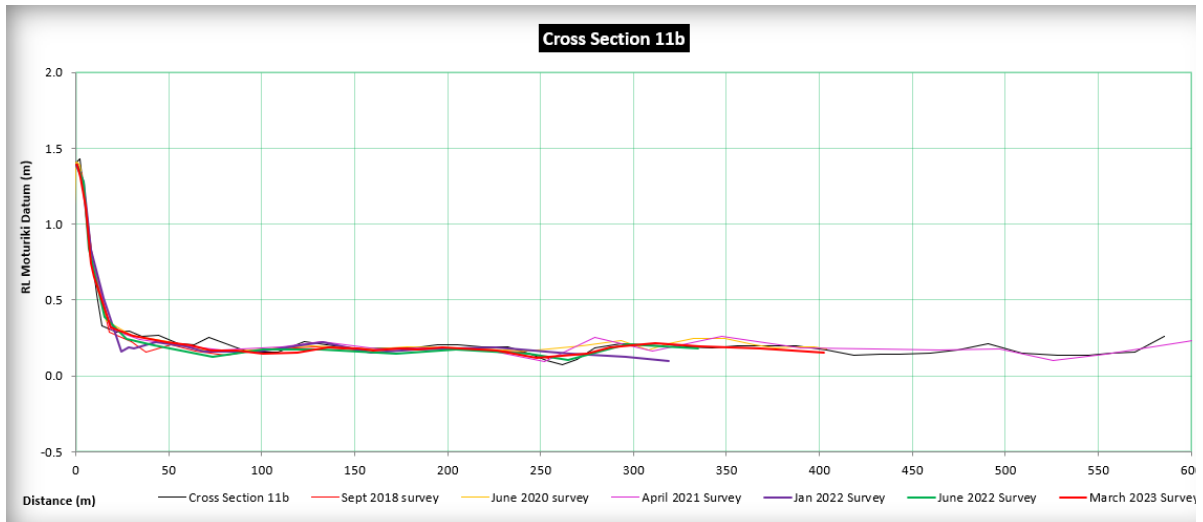
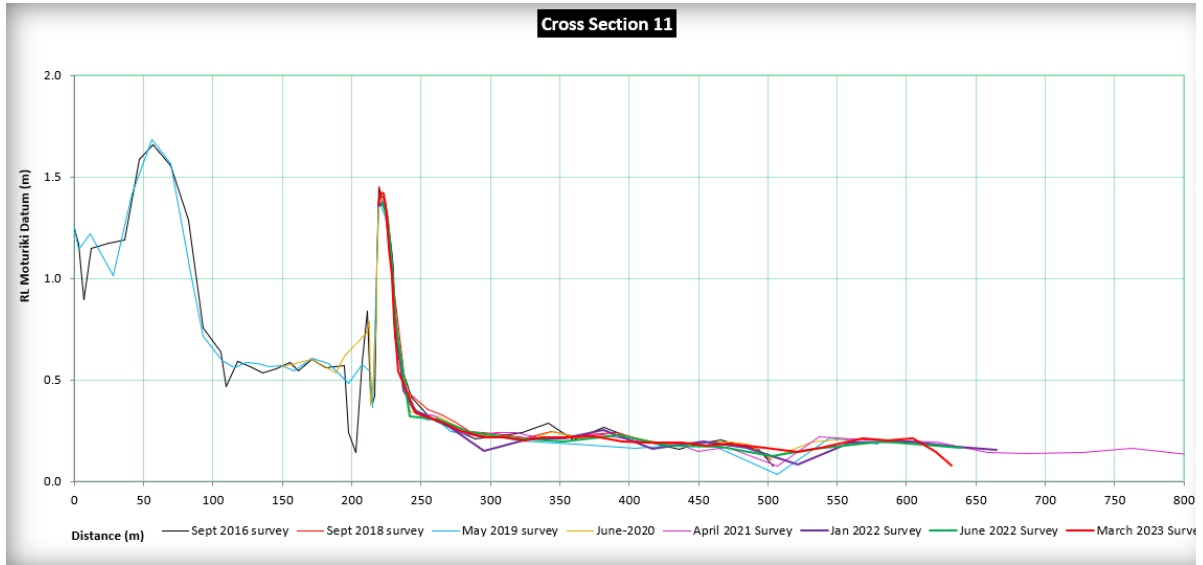


Figure 3 (cont. from prev.) Papahikahawai Island cross section monitoring results Sept 2016 – June 2022

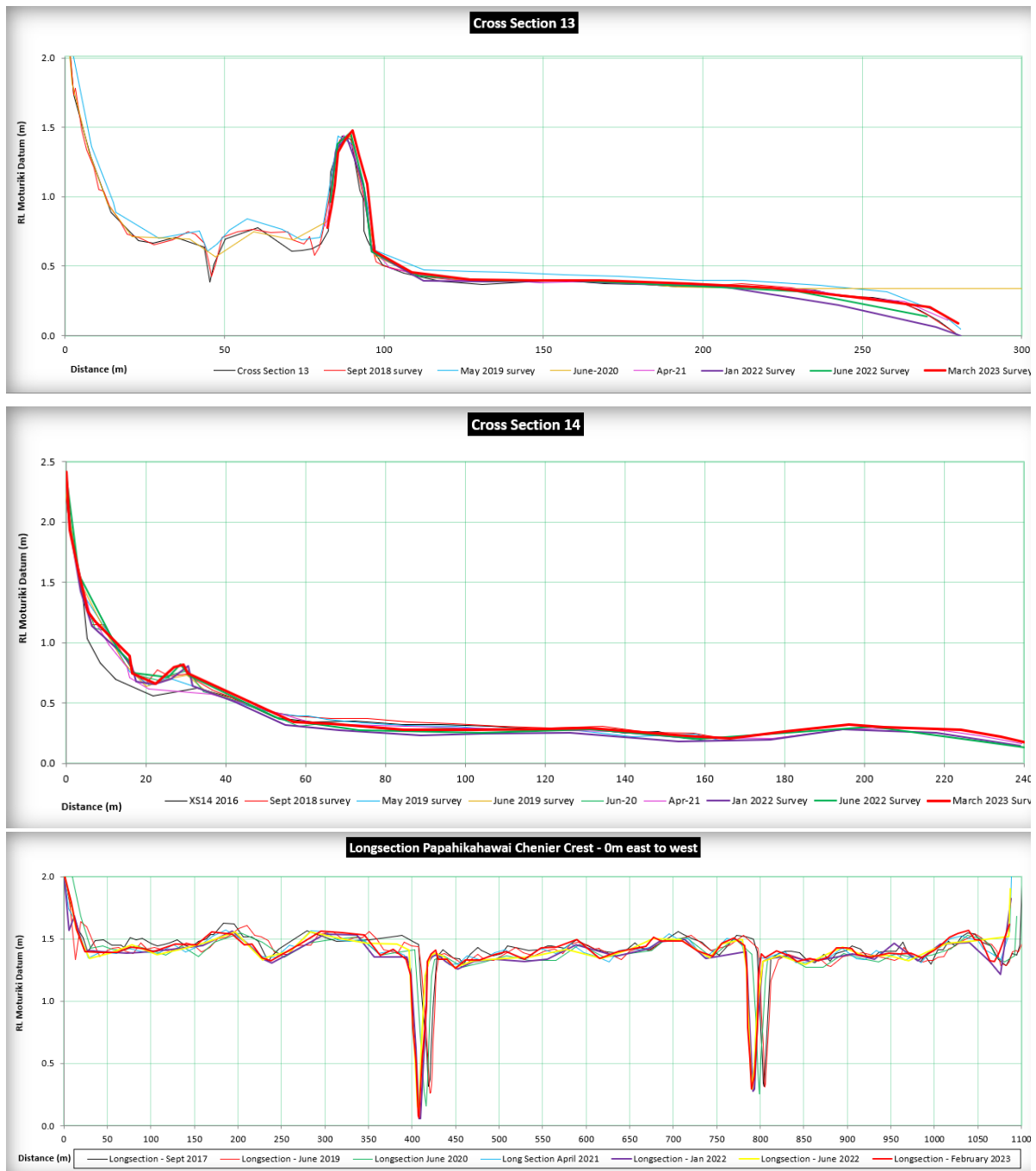


Figure 4 - Papahikahawai Island long section monitoring results September 2016 – June 2022

The 2016 profiles at Papahikahawai established a 'before works' baseline to monitor against.

There was noticeable accretion at the 5-30 m section of profile XS14 from 2016 to 2018 with it now being more stable. It should be noted that this accretion will provide a more favourable elevation for the long-term establishment of saltmarsh vegetation which once dominated much of this part of the estuary. At site 4 there was initially erosion in the upper section of the profile and considerable aggradation at the 30-100 m section however, the 2022 & 2023 surveys indicate this section may be subject to periodic fluctuation and is currently similar to 2016 for the first 95 m.

A long section was taken at Papahikahawai Chenier Crest from east to west in June 2019, June 2020, April 2021, Jan 2022, June 2022 and February 2023. From 25-600 m there has been variable minor erosion and aggradation.

Overall, the cross and long sections from Papahikahawai appear very stable, indicating that the chenier and associated works are not eroding.

Maketū Spit

The location of the Maketu Spit transects are shown in *Figure 5* and the transect profiles are shown in *Figure 6*. The February 2023 Maketu spit profiles have been compared against annual monitoring results since 2015. The overall width of the spit has not changed much over the term of the monitoring. While the estuary side continues to erode (and probably will do for some years), it has been balanced by build-up on the foredune on the ocean side. The estuary side continues to slowly erode (with the exception of cross section 9 which shows a relatively dramatic profile change post cyclone-Gabrielle) and there has also been some deepening directly offshore, likely reflecting the increased outflows.

Cross sections 7, 8 and 9 show the deepening channel slowly encroaching on estuarine side of the spit over time at the high tide line (by about 3m for XS 7 and 5m for XS 8 and 9). The previous report observed that the ocean side foredune has increased by about 1m depth but has eroded by about 0.2 - 0.5m in the tidal zone on XS 7 and 8, with little change on XS 9. This rate of change seems to be consistent for this 22/23 report.

Longer term, it is expected as the flood tide delta gradually erodes, it will reduce erosional pressure on the spit shoreline, but there remains some risk of a spit breach in the short term. That risk may be offset somewhat by the recent climate switch from La Nina to El Nino conditions, which will likely lead to fewer northerly quarter storms and heavy rain events, and potentially more westerly quarter winds and drier conditions.



Figure 5 - Maketu long section monitoring results. Yellow line is Dec 2016 survey, white line April 2019, red line June 2020, pink line March 2021, green line December 2021 and black line February 2023

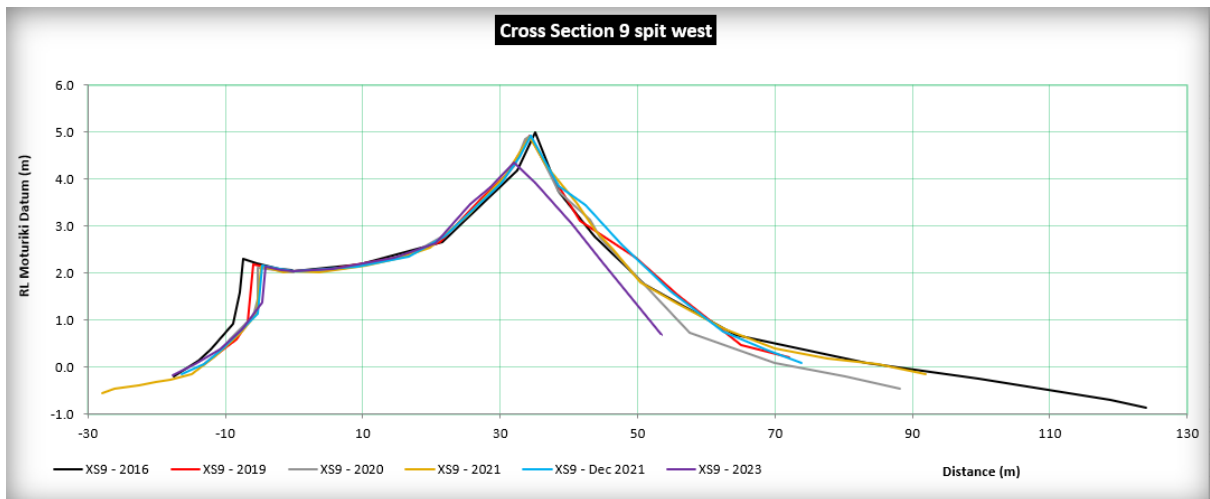
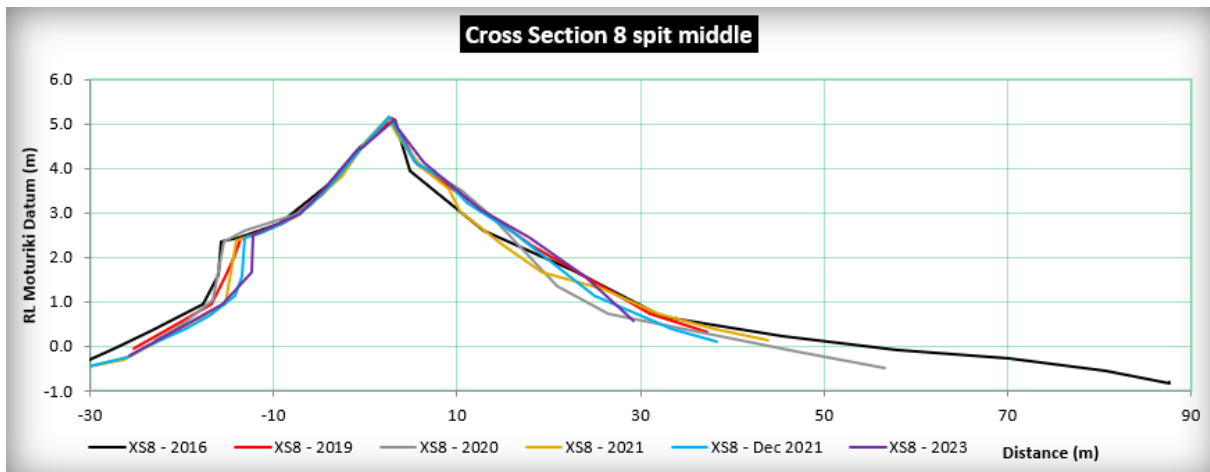
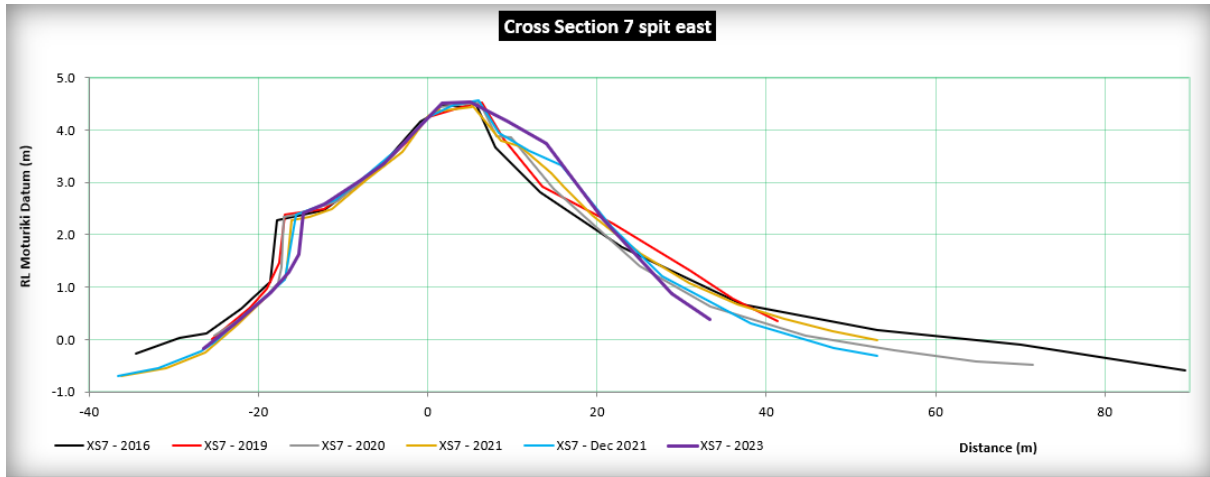


Figure 6 - Maketu Spit cross section monitoring results September 2016 – December 2021 survey

5.2 Condition 31.4 – Maketu Township and Beach Road

31.4 The Consent Holder shall undertake surveys at Maketu Township and Beach Road to monitor for any erosion or aggradation as a result of the diversion as follows:

- (a) A shoreline survey using Real Time Kinematic Global Positioning System in the area shown on BOPRC Plan Number RC67958/12 along the dune toe or seaward edge of the vegetation;
- (b) A minimum of six cross sections in total with two along Beach Road and four distributed around Maketu township from Park Road foreshore to the marae. Each cross section shall extend to no less than 50 metres offshore;
- (c) Bed and channel depths within the boat ramp access channel from Maketu Boat Ramp to 100 metres seaward; and
- (d) The survey and transects shall be measured at least one month prior to Stage 1 commissioning and thereafter annually for five years. After five years of annual surveys the frequency of the survey shall be assessed as part of the reporting requirements of Condition 29.3.

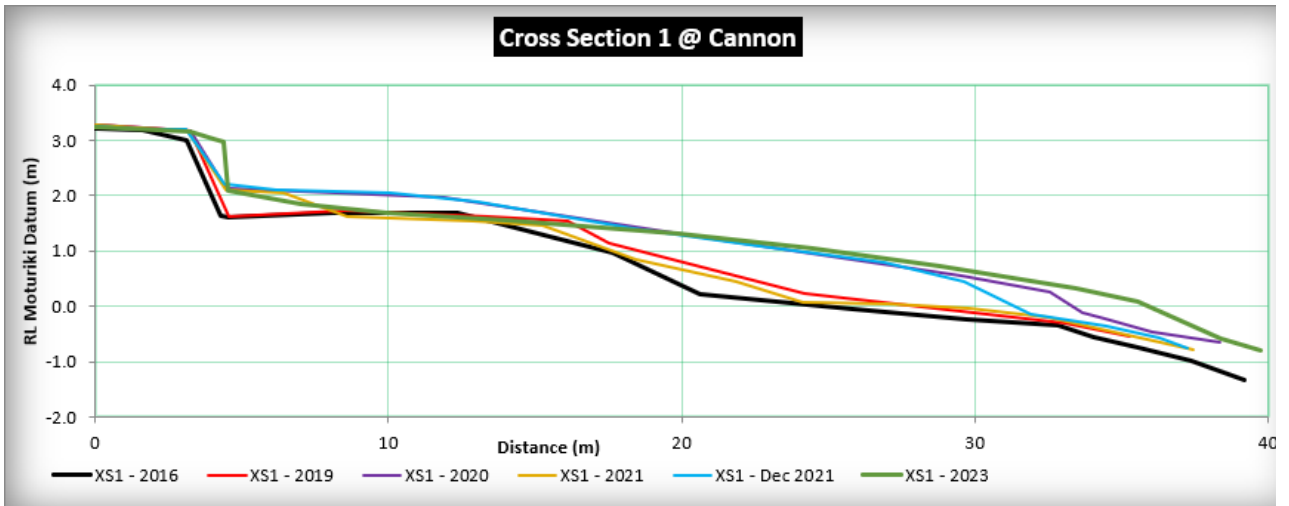
Cross section surveys were carried out in April 2019 to meet the prior to Stage 1 commissioning requirement (ie. establish a baseline). The 2020 monitoring was the first year of annual monitoring post Stage 1 commissioning and the 2021 monitoring the first since Commissioning (February 2021).

5.2.1 Monitoring results

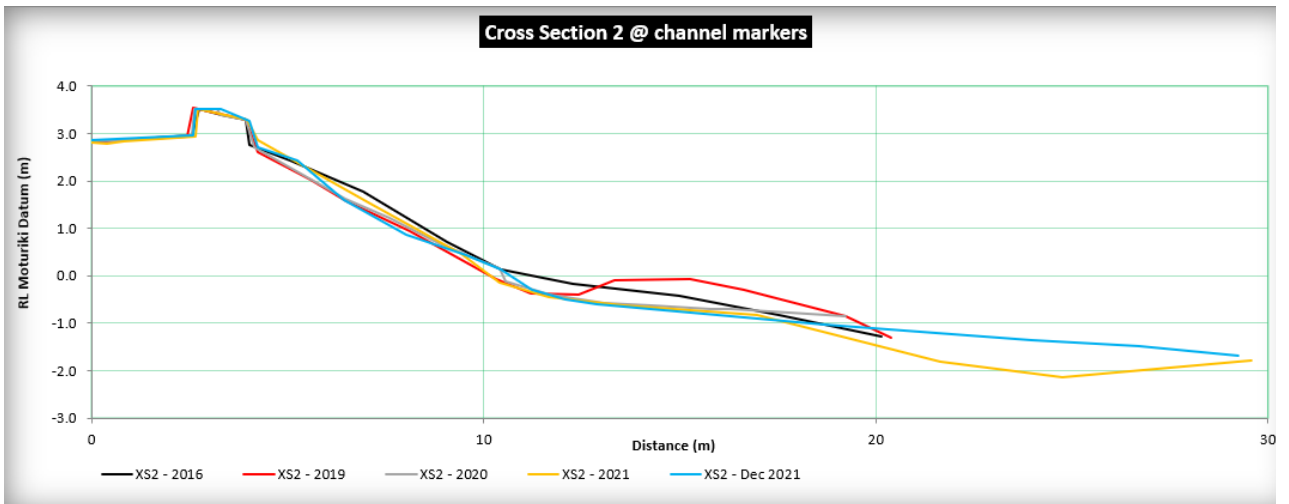
The locations of the Maketū township transects are shown in *Figure 7* along with the transect profiles in *Figure 8*. The 2023 monitoring results have been compared with previous survey results.



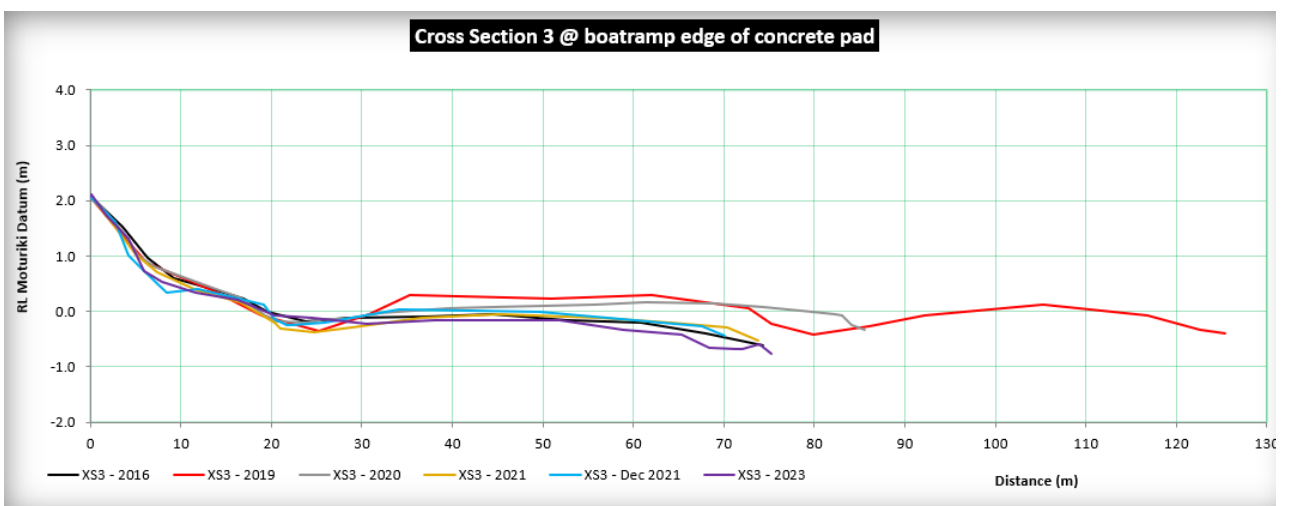
Figure 7 - Survey Locations at Beach Road and Maketu township, including Maketu boat ramp, the Spit monitoring locations and the Dune Toe



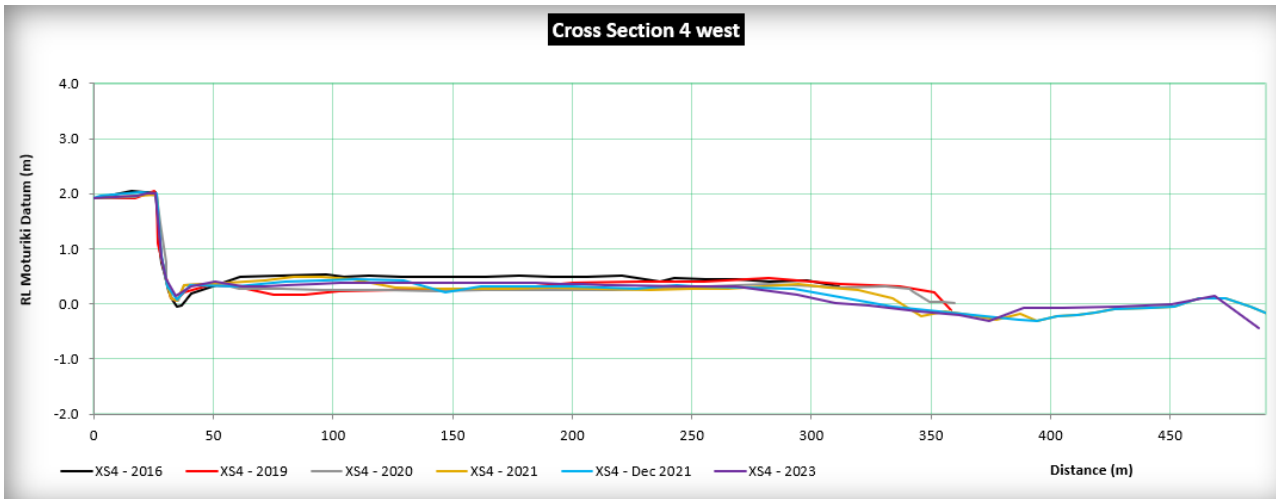
- Cross section 1 near the surf club shows that following Cyclone Gabrielle any previous accretion observed between 5m and 15m has been lost back to levels observed in 2016 but from 20-40m additional accretion has been observed.



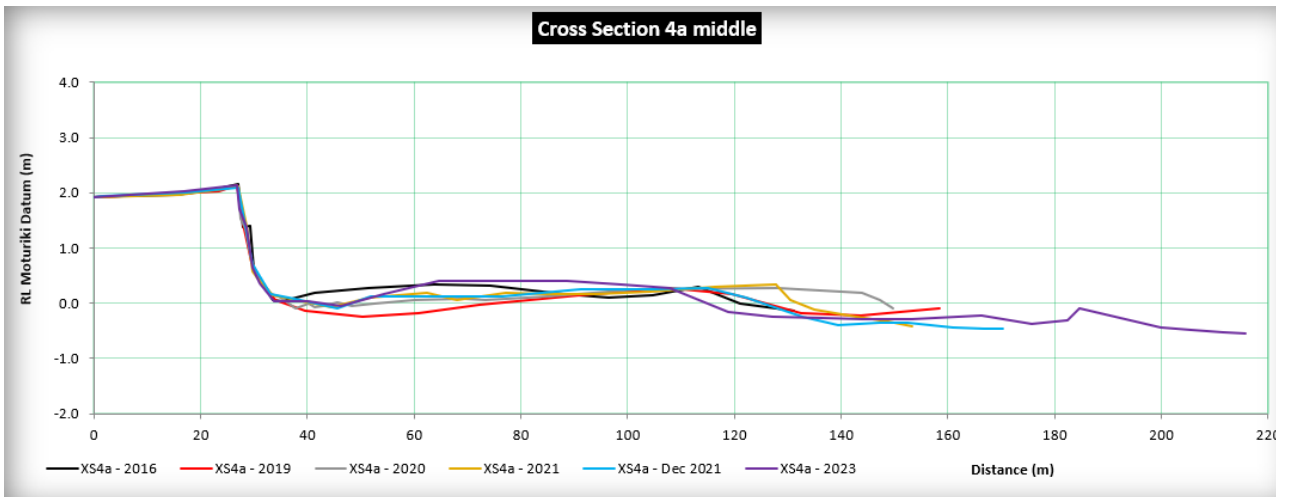
- Cross section 2 near the channel markers shows no discernible trend.



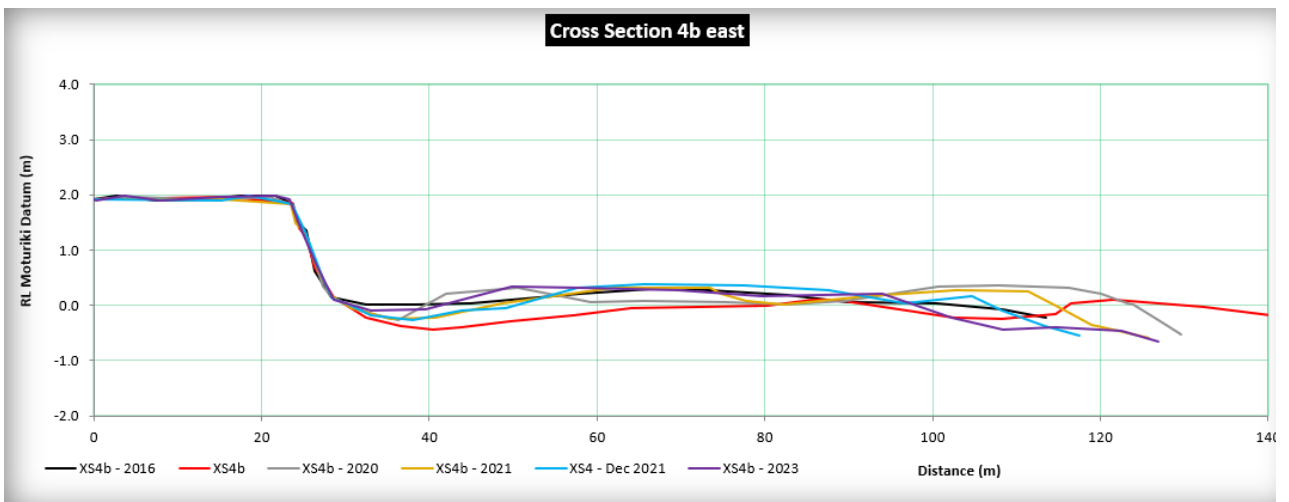
- Cross section 3 at the Maketū boat ramp shows that accretion of 0.3m sand occurred between 2016 and 2019, but disappeared again between 2020 and 2021. This has further eroded by ~200 – 400mm to February 2023.



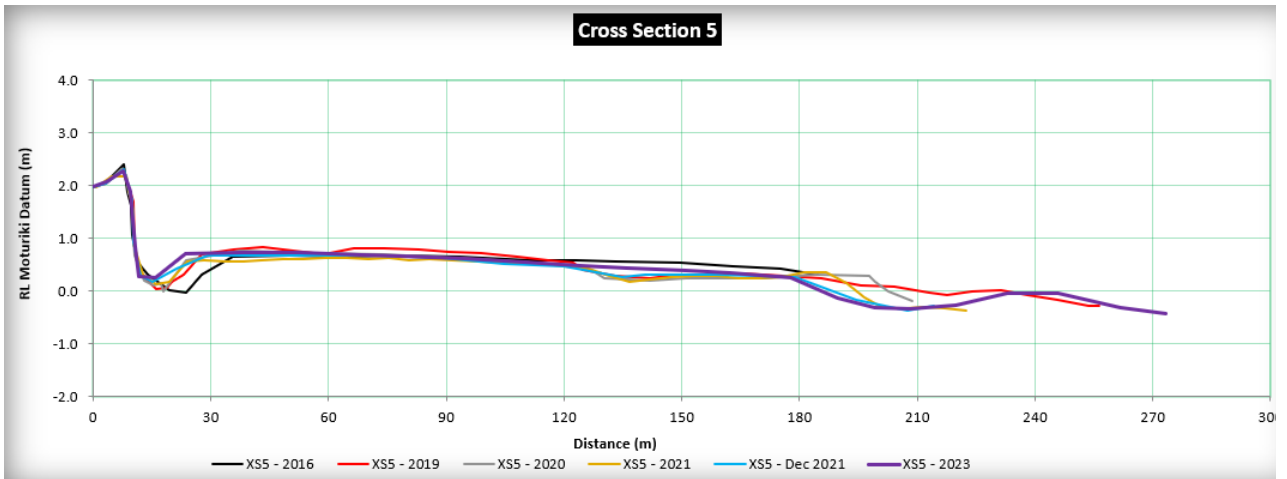
- Cross section 4 heading NW from Beach Rd Reserve shows that up to 0.5m of sand has eroded from 130m to the end of the transect at 500m, which is a desirable effect (countering the infilling of the flood tide delta since 1956). There has been no appreciable change from 2021 – 2023.



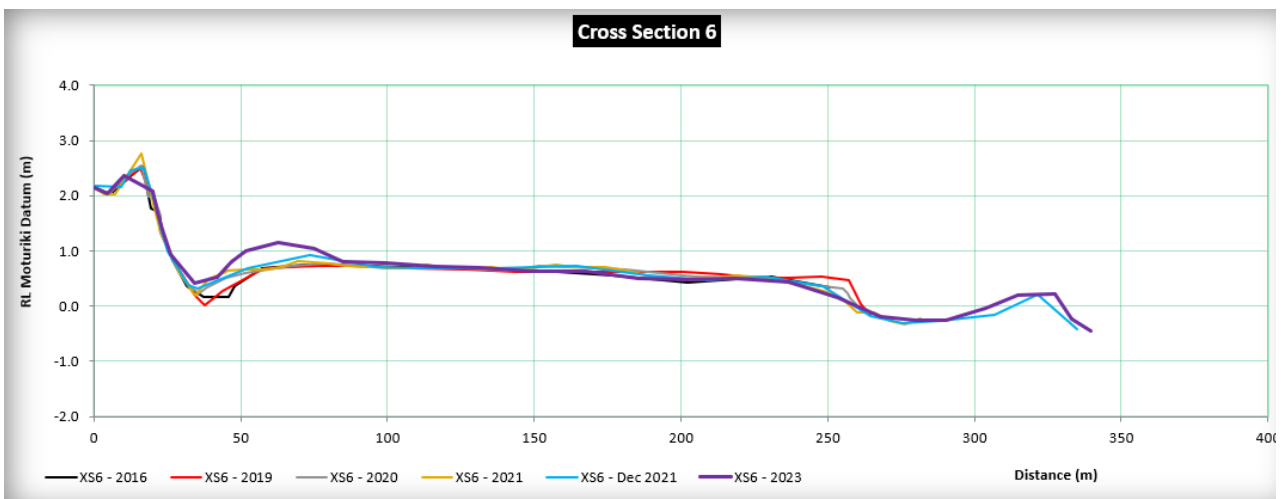
- Cross section 4a shows little change except that there is some evidence of sand erosion at the northern end of the transect, consistent with transect 4.



- Cross section 4b heading NNE from Beach Rd Reserve shows accretion of 0.5m from the rocks out to 90m, and then erosion and widening of the channel beyond that distance. Post Gabrielle has an additional 0.5m was eroded between 100m and 115m.



- Cross section 5 shows erosion of 0.3 – 0.5m beyond 120m distance. No appreciable change to February 2023.



- Transect 6 has shown no significant trend up till this report (partly because the 2016 transect was only surveyed for 250m), although the channel may have widened towards the marae by some 20m since 2019. Post Gabrielle has seen the accretion of 0.5m between 45m – 75m at the start of the flats close to the marae, a relatively sheltered portion of the transect.

Figure 8 - Maketu cross section monitoring results. September 2016 – December 2021

The 2019 profiles along Beach Road, the Maketu township and the Maketu Boat Ramp established a ‘before works’ baseline to monitor against in future surveys. The profiles at the spit monitoring locations were consistent between years but had some minor erosion on the ocean side at all three transects, with some build up on the estuary side.

Overall, the cross sections are relatively stable. The most change has occurred at the distal ends of XS 1-6, possibly suggesting some erosion of sand from the flood tide delta between the marae and the diving board close to the channel. The most drastic changes in the most recent round of monitoring appear to be the result of localised erosion or accretion at very specific locations, the result of Cyclone Gabrielle. Note the comments in the ecology monitoring (sediment plates in the mid/upper estuary) are showing about 50-100mm mud erosion and may support the XC 14 results.

6 Summary of monitoring results (Conditions 32 - 35)

Compliance monitoring of ecological conditions required for Consent 67958 have all been undertaken with the exception of the broad scale macroalgae mapping for which there has been a delay in the delivery of the finished product.

As reported last year for the water quality monitoring in Maketū Estuary, a number of the sampling occasions were impacted by prior heavy rain which has rarely occurred in the past and over this last summer it has been substantially wetter, which will influence results as heavy rain tends to increase sediment, phosphorus and bacteria levels.

Overall, there is little apparent change in nutrient concentrations in the top of the estuary at the Fords Cut site at any tidal level. At this site, the water present is largely that which has come through the diversion structure from the river, so this has not really changed from the situation prior to the increased flows. Further down the estuary at Site 5, it appears that nitrate levels may be slightly higher at high tide. This is what would be expected, as the salinity results also show that the site is now more highly influenced by the increased river diversion. Several years of drier conditions will be needed to reliably determine the degree of change that has taken place, due to the recent weather. Further down the estuary at Site 9 there also appears to be an increase in nitrate levels, especially at low tide, which is when this site would be most influenced by any increase in river flows. However, increased nitrate levels were occurring back to 2017 suggesting other possible causes for the results, other than just the increased river flow.

For the bacterial results it is also difficult to determine the influence of increased flows or recent weather. As with the nutrient concentrations, there appears to be little change at the Fords Cut site in the upper estuary with the most apparent changes occurring in the mid to lower estuary, particularly at Site 9 at low tide. Some of the slightly higher results seen for the Boat ramp site near the entrance at high tide and mid tide, indicate that there were higher bacteria numbers present in the open coastal waters, possibly as a result of the weather conditions.

Results for the bacterial numbers in shellfish are higher on average for the period since river flows have increased, particularly for the pipi results. However, comparison to the 2018 results (prior to increased river flows) the numbers are not a lot different. Taking into account the effect of rain events and wetter weather, results are generally in line with modelling, but need a longer period of monitoring to more accurately define the consistent level of change that appears to have occurred.

Surveys of the pipi bed in the lower estuary has shown that densities are very similar to those seen in 2018 prior to any increase in the river flows. The data also shows that spatially there is a high degree of change occurring over time at a finer scale which is quite normal for these dynamic environments. One of the more distinct changes that has been noted is that there were lower numbers of recruiting pipi in 2018 compared to the later surveys. And since densities are similar overall, there are respectively slightly lower densities of the larger size classes (>40 mm) sought for food, which had been noted by local shellfish gatherers.

Results for monitoring of shellfish (tuangi & hanikura) around the estuary are very similar to previous years with the main changes being the sustained improvement of shellfish densities in Papahikahawai Creek and sites where the macroalgal cover has gone. In other upper estuary areas, shellfish densities are naturally very low and don't appear to have shown much change with the lower salinity brought about from the increased river flows.

The data sets (BOPRC files) for the environmental monitoring and compliance data for those conditions covered by this memo, contain additional data summaries and graphs to those included in this memo. Those data sets can be found in the BOPRC Objective filing system with reference ID numbers; Ecological data – A2614995, water quality data – A355443, sedimentation rates – A2513353.

Overall monitoring results show changes in line with expected ecological benefits from the restoration of estuarine areas and increased river flow back into the estuary. Parts of the upper estuary have shown significant ecological improvements in terms of biodiversity and productivity which contributes significantly to the overall ecological health and integrity of the estuary. Water quality data also shows results consistent with predicted changes which may in the case of bacterial numbers, result in slightly higher numbers. No changes point to any unexpected adverse effects occurring as a result of the increased river flow and hence for ecological and water quality changes there are no concerns for maintaining the consented full river flow of 600,000 m³ per tidal cycle. Many of the potential ecological benefits of higher river flows into the estuary such as saltmarsh health, sediment and net nutrient transports out of the estuary will occur more gradually over time.

7 Water Quality and Shellfish (Condition 32)

The following is extracted from a memo prepared by Stephen Park, Senior Environmental Scientist, Bay of Plenty Regional Council dated June 2022 (Objective ID – A4126087).

7.1 Condition 32

The relevant ecological and water quality monitoring required by consent Conditions that take effect post “Commissioning” (600,000 m³ per tidal cycle) that are covered by this memo are as follows.

32.4 From Stage 1 commissioning, the Consent Holder shall undertake water quality monitoring three times every year during the periods December to March (inclusive) at high tide and low tide. Samples shall be collected from Ford’s Cut, the mid estuary and at Maketu boat ramp, and analysed for: (a) Total nitrogen; (b) Nitrate-nitrite nitrogen; (c) Total ammoniacal nitrogen; (d) Total Phosphorus; (e) Dissolved Reactive Phosphorus; (f) Salinity; (g) Faecal coliform bacteria; and (h) Enterococci bacteria.

32.5 From Stage 1 commissioning, the Consent Holder shall undertake shellfish flesh and water quality sampling at low tide on three occasions every year for each of the periods December to March (inclusive) and June to August (inclusive).

32.6 The samples required by Condition 32.5 shall be collected at three sites in the lower to mid Ongatoro/Maketū Estuary and contain a minimum of five shellfish and associated water quality samples taken from the same site, comprising a minimum of: (a) Two pipi; and (b) Two cockle samples.

32.7 The shellfish and water quality samples required by Conditions 32.5 and 32.6 shall be tested for Faecal Coliform and Enterococci bacteria concentrations.

32.8 Annually, from Stage 1 commissioning for a period of five years, the Consent Holder shall undertake a pipi survey in the lower estuary for the period December to March (inclusive) comprising a minimum of eight replicate cores along a transect parallel to the channel. All shellfish in the cores shall be identified and counted in 5.0-millimetre size classes.

32.9 Annually, from Stage 1 commissioning for a period of five years, the Consent Holder shall sample shellfish at three sites in the mid estuary during the period December to March (inclusive) comprising eight replicate sediment cores randomly collected over a 10-metre radius of the site location. All shellfish in the cores shall be identified and counted in 5.0-millimetre size classes.

Note Conditions 32.1, 32.2 and 32.3 which relate to monitoring of water quality using data loggers are not required to be undertaken at this point in time and hence not covered. These Conditions will be required again at five years from Commissioning and reported again in 2026.

The compliance monitoring requirements being reported are those which take effect following “Stage 1 Commissioning” (which occurred on 12th February 2020) and full “Commissioning” of flows with all 12 gates operating which occurred on 12th February 2021. Modelling predicted this would increase the volume of Kaituna River flow re-diverted back into the estuary to be around 600,000 m³ per tidal cycle under average tide and average river flow Conditions. Confirmation of these expected flows has been made by assessment of gauging measurements that have been made (Putt 2021).

The relevant key restoration projects within Maketū Estuary which have taken place include.

- removal of the causeway on the northern side of Papahikahawai Island to open Papahikahawai Creek back up to the estuary on 6th June 2017.
- removal of the reclamation bund around the southern margin of Papahikahawai Island to open this area back up to the estuary and restore it as intertidal wetland in July 2017.
- removal of the causeway linking the former Brain farmland (now Te Pā Ika wetland) to Papahikahawai Island in September 2018 and the removal of the reclamation bunds around the southern half of farmland in October 2018 and the northern half in June 2019.

These three projects have returned a total of around 45 ha back to the intertidal zone of Maketū Estuary (Papahikahawai Creek – 15.5 ha, Papahikahawai Island - 7 ha and Te Pā Ika - 22.5 ha). In terms of total estuary area, this represents a significant increase of around 19% on the previous extent of 230 ha. To assist in tracking changes associated with these restoration projects and changes in river flows, a number of monitoring projects in addition to the compliance monitoring requirements have been put in place (Park 2017). Previous environmental changes following the restoration projects and initial Stage 1 and full Commissioning of river flows have been reported in 2020 (Park 2020) and 2021 (Park 2021).

7.1.1 **Monitoring results – Condition 32.4 water quality monitoring**

This Condition requires that from “Stage 1” commissioning, water quality monitoring will be undertaken at three sites in Maketū Estuary during the period of December to March with sampling undertaken on three occasions at the time of low and high tides. Nutrients, bacteria and salinity are to be measured. The three water quality sites to be monitored are shown in *Figure 9* below, labelled “1”, “5” and “BR”.



Figure 9 - Water quality and shellfish compliance monitoring sites for Consent 67958 in Maketū Estuary

Water quality monitoring for condition 32.4 was undertaken on the 30th of November 2022, 16th January 2023 and 13th February 2023 at low, mid-flood and high tide. In addition, sampling also took place at site 9 shown in Figure 9.

Nutrients

With the increased river flows there is potential for changes in bioavailable nutrients throughout the estuary. Levels of dissolved reactive phosphorous (DRP), ammonium nitrogen (NH₄-N) and oxidised nitrogen (mainly nitrate) for the monitoring sites are shown in Figures 7 (high tide), 8 (mid tide) and 9 (low tide) below. Results show that nutrient levels have not changed at Fords Cut while Site 5 in the mid estuary may show an increase in nitrogen levels related to the higher river flows since February 2020. However, the results may be influenced by prior heavy rain for the 8th of February 2022 sample and the wetter weather pattern over the 2023 summer. Site 9 may also be showing a potential increase in nitrogen levels, however, being close to the entrance, it is more influenced by coastal water than the river diversion at high tide.

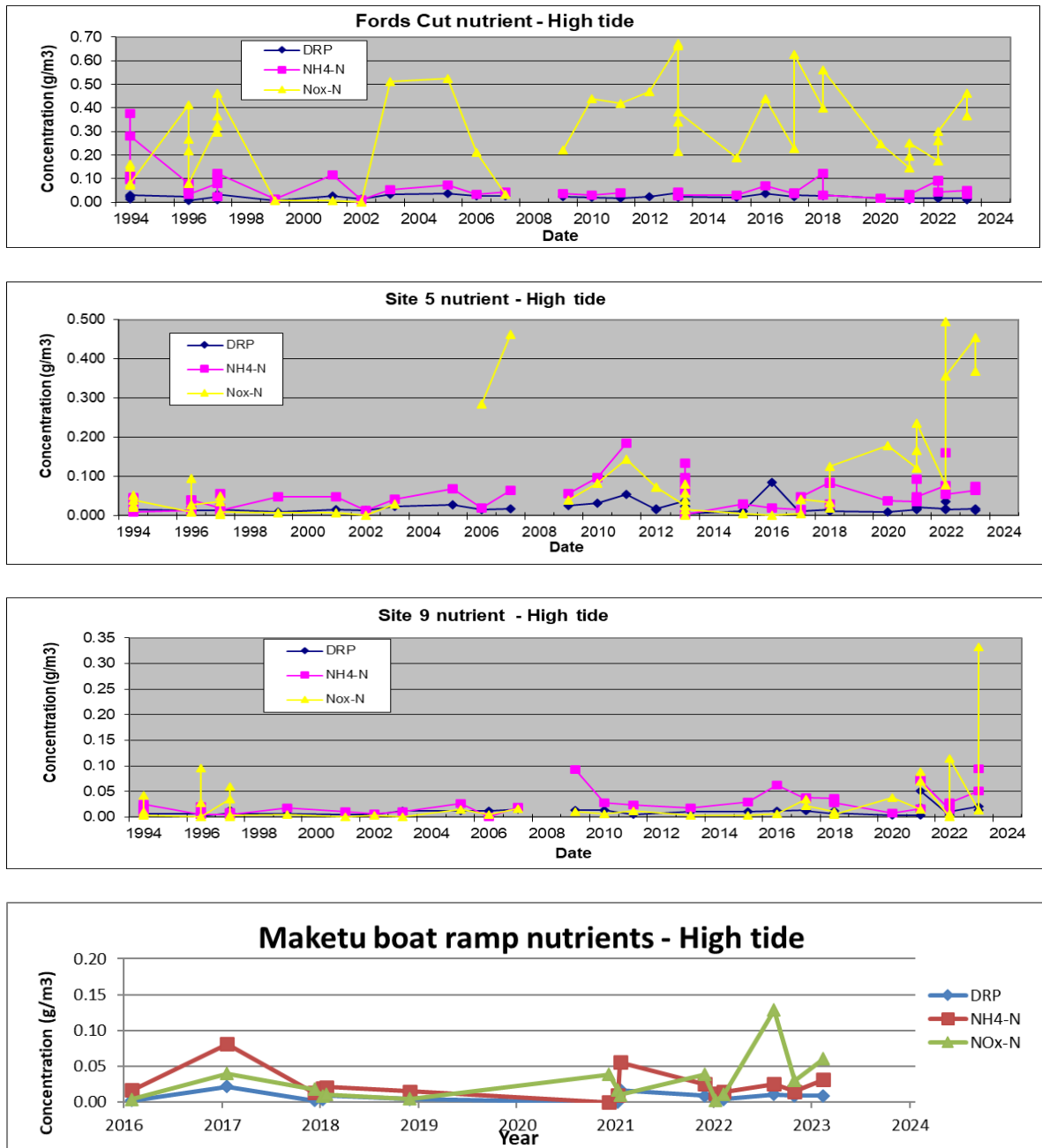


Figure 10 - Nutrient levels (DRP, Nox-N, NH₄-N) recorded at high tide for the Fords Cut, Site 5, Site 9 and Boat ramp in Maketū Estuary.

Nutrient levels at mid-flood tide for the monitoring sites are shown in Figure 10 below. As with the high tide results, there is no clear change in nutrient levels at Fords Cut at mid-flood tide with the increased river flow. Site 5 shows a potential increase in nitrate levels since the increase in river flow, however as discussed above for the high tide results, the influence of wet weather may be a factor and the levels are not that different from those recorded over the 2006 to 2009 period. The same applies to the results for Site 9 which shows potential increases for all nutrients, although at this site levels are above those recorded previously. The boat ramp site shows no apparent change in nutrient levels following the increase in river flow, but this site will have little if any river influence at mid-flood tide.

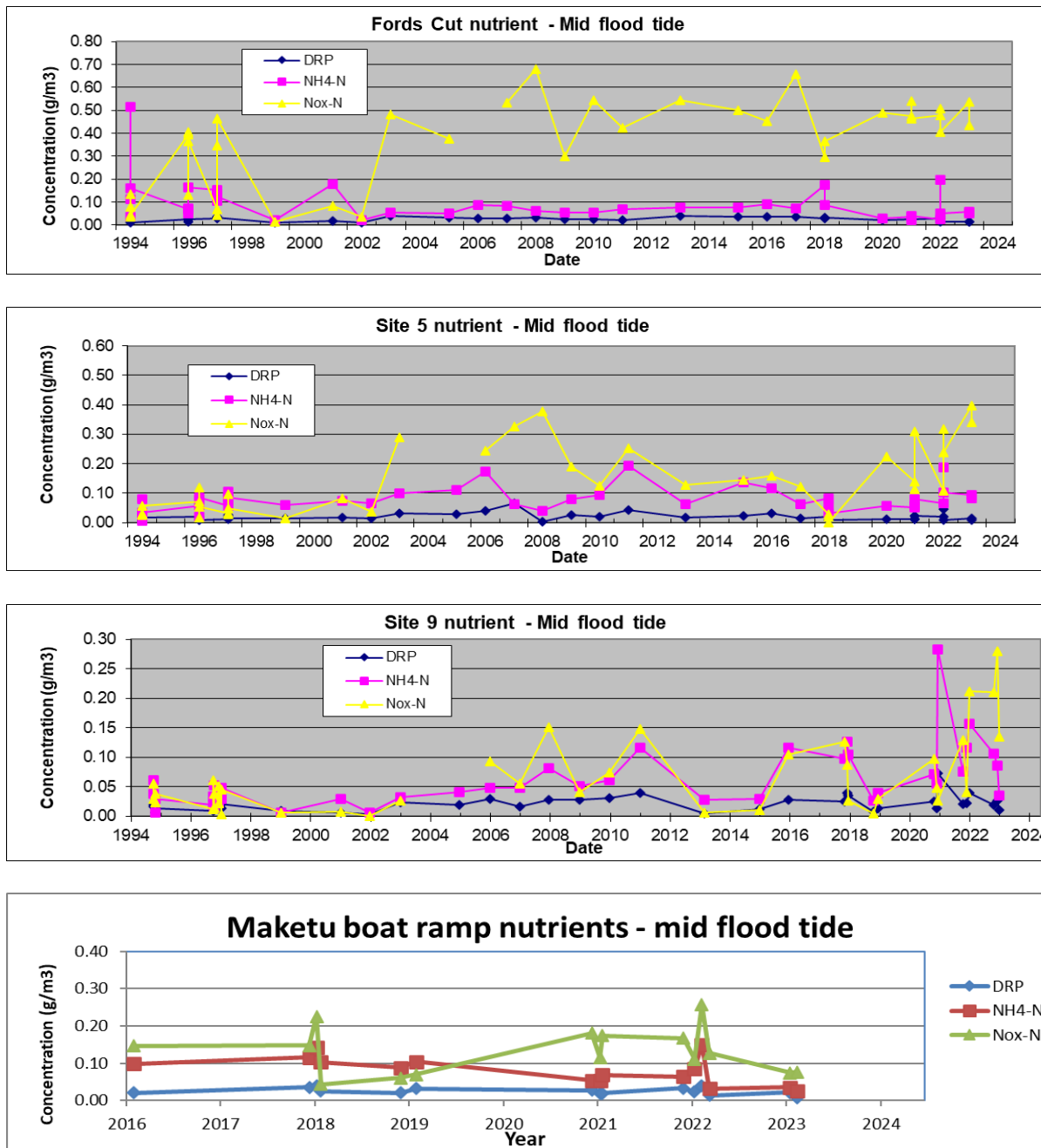


Figure 11 - Nutrient levels (DRP, Nox-N, NH4-N) recorded at mid-flood tide for the Fords Cut, Site 5, Site 9 and Boat ramp in Maketū Estuary

Nutrient levels at low tide for the monitoring sites are shown in Figure 11 below. As with the high and mid-flood tide results, there is no change in nutrient levels at Fords Cut at low tide with the increased river flow. Site 5 also shows little apparent change in nutrient levels since the increase in river flow, although the 2023 nitrate levels are some of the highest recorded. The wet weather over this period may be influencing results. Site 9 shows increases in nitrogen levels since 2016, but there is little difference in the levels pre and post the increase in river flow, especially taking the influence of wetter weather into account. Results for nutrient levels at the boat ramp for low tide remain at similar levels to those recorded prior to the increase in river flow.

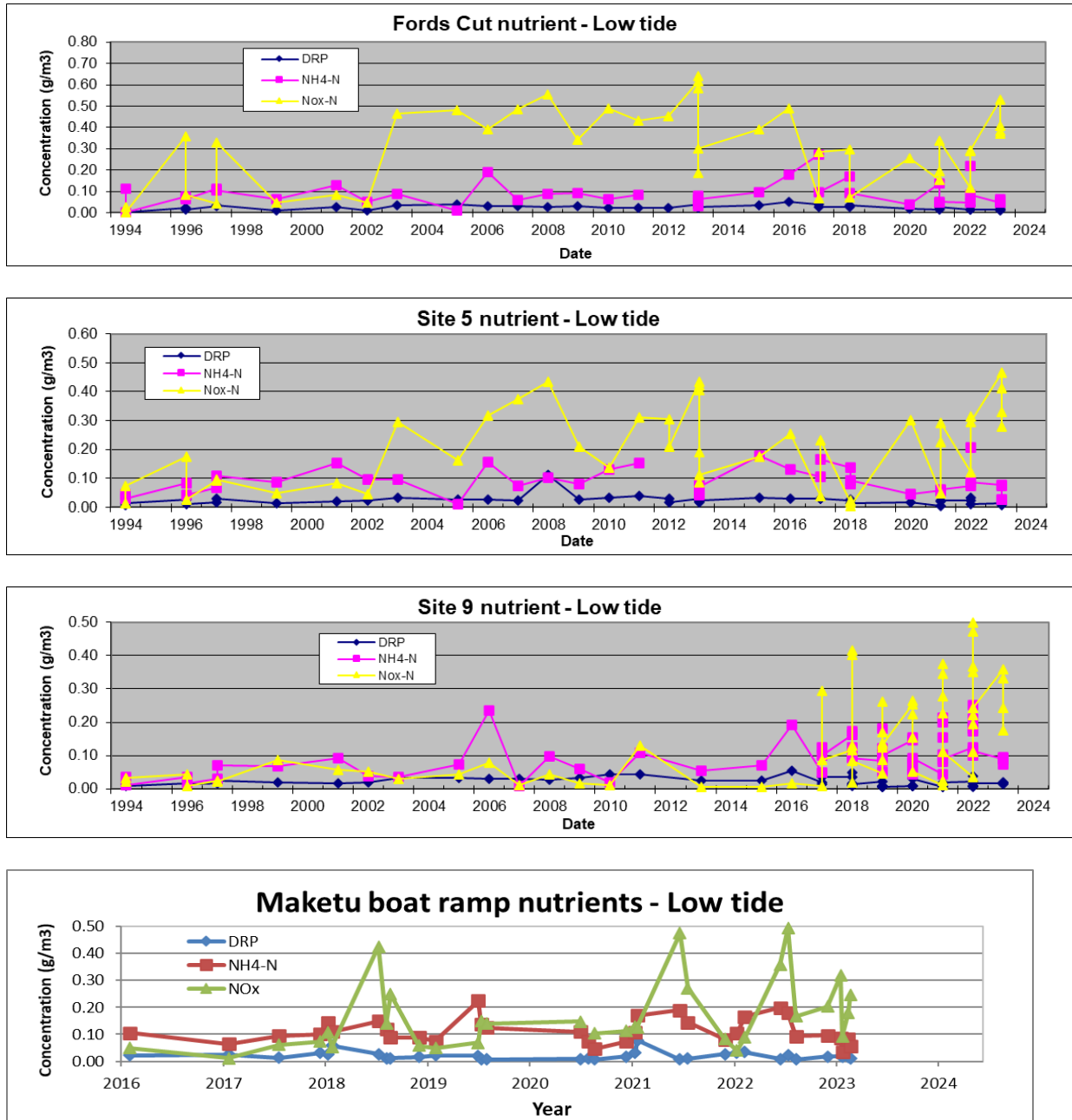


Figure 11, Nutrient levels (DRP, Nox-N, NH4-N) recorded at low tide for the Fords Cut, Site 5, Site 9 and Boat ramp in Maketū Estuary.

Overall, there is a trend of increasing nutrient levels in the mid regions of the estuary, but the rain affected sampling in 2021/22 and wetter weather over the 2022/23 summer will have an influence on the results. In addition, some of the nitrogen increases seen such as those at Site 9 occur from around 2017 onwards and show no further increases after the February 2020 increase in river flow. Fords Cut at the upper end of the estuary and the boat ramp sites show very little change over the period before and after increased river flow. Further sampling which includes drier weather patterns is still needed to show just how much nutrient levels have changed. The increased river flows will increase the average nutrient levels slightly across the mid areas of the estuary as shown by the modelling (DHI 2014).

Bacteria

Bacterial results from water quality monitoring for the sites in the estuary are shown in Figures 10 (high tide), 11 (mid-flood tide) and 12 (low tide) below. As with the nutrient results, rain affected sampling in 2022 and the wetter weather over the 2022/23 summer has likely increased the bacterial numbers making it unclear whether there have been increases due to the increased river flows since February 2020. The Fords Cut site at the top of the estuary shows little change for the mid tide results but does show higher faecal coliform numbers for both the high tide and low tide samples in 2023.

At Site 5 in the mid estuary there is little if any change for the high tide results. At mid tide the faecal coliform numbers are slightly higher in 2023 and there is a similar result for the low tide samples, but these are still within the range of results from before the increase in river flow. Site 9 closer to the entrance also shows mixed results in that faecal coliform numbers appear slightly higher in 2023 for the high and low tide samples but show no change at mid-flood tide level.

The boat ramp site at the entrance will most likely show any influence from increased river flows at low tide with the high tide samples being more reflective of the nearshore open coastal waters. However, as seen in Figures 12 – 14, results for faecal coliform numbers in particular are higher in 2023 for the high and mid-flood samples, while the low tide results show no change from levels seen prior to the increased river flows from February 2020.

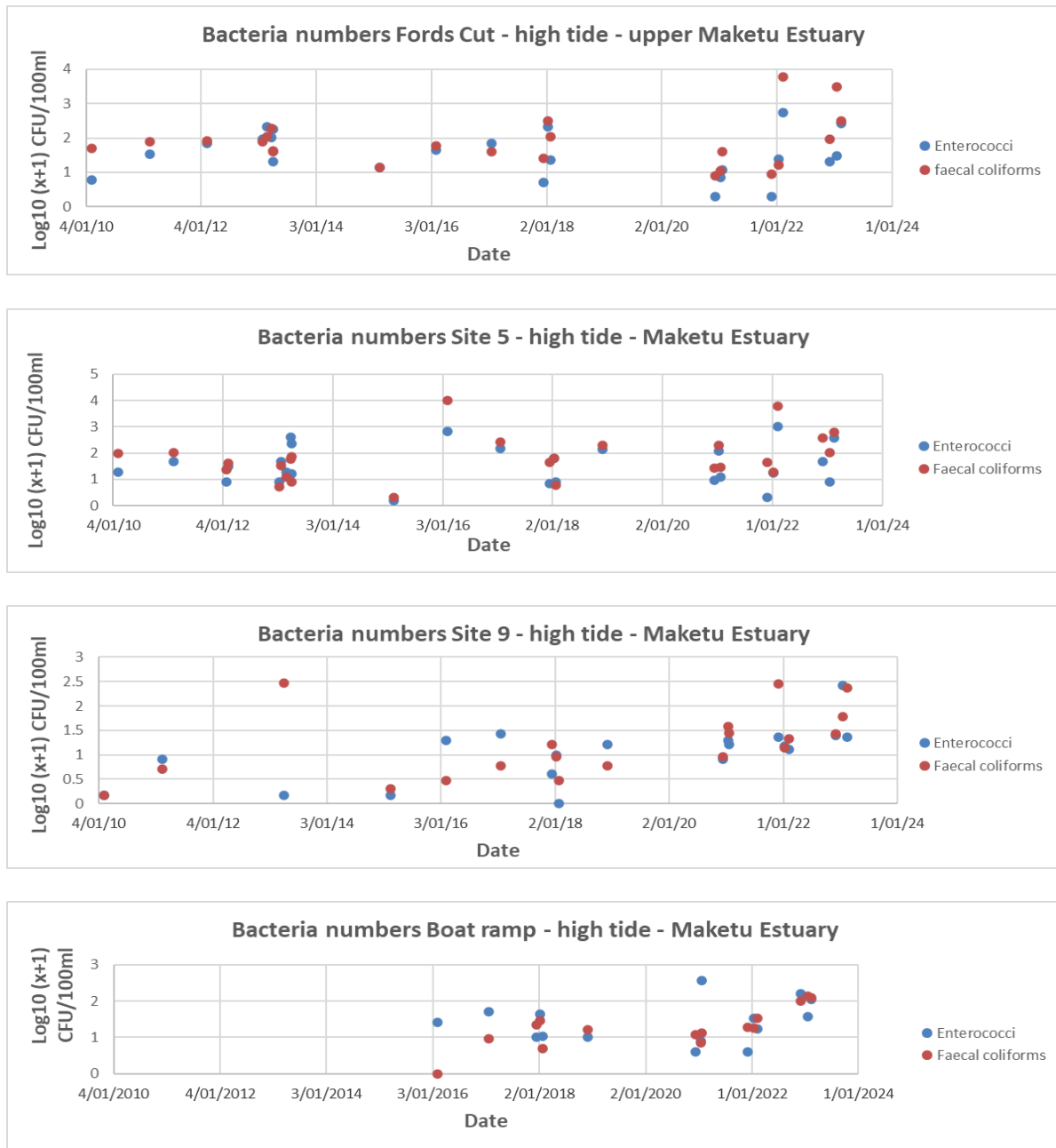


Figure 12, Faecal coliform and Enterococci bacterial numbers in water at high tide for the Fords Cut, Site 5, Site 9 and Boat ramp in Maketu Estuary.

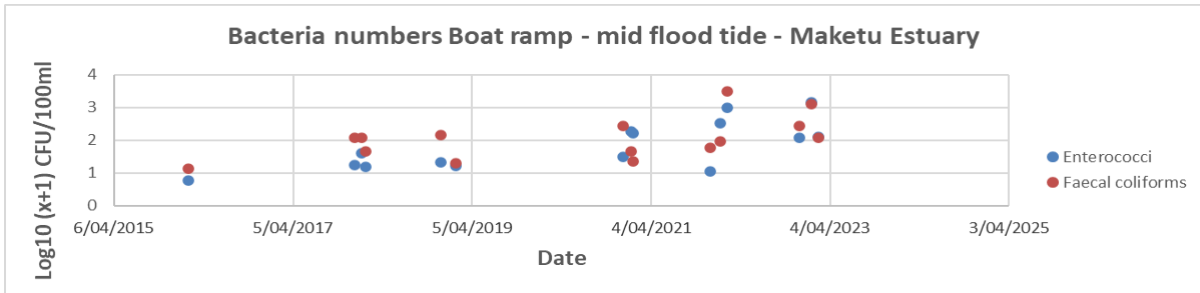
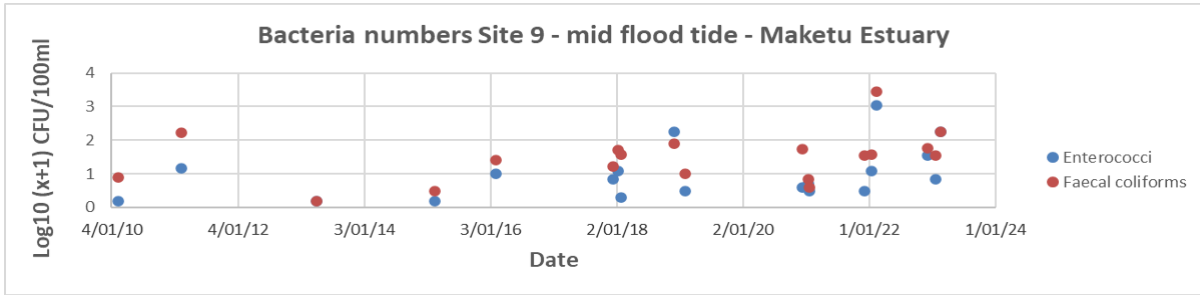
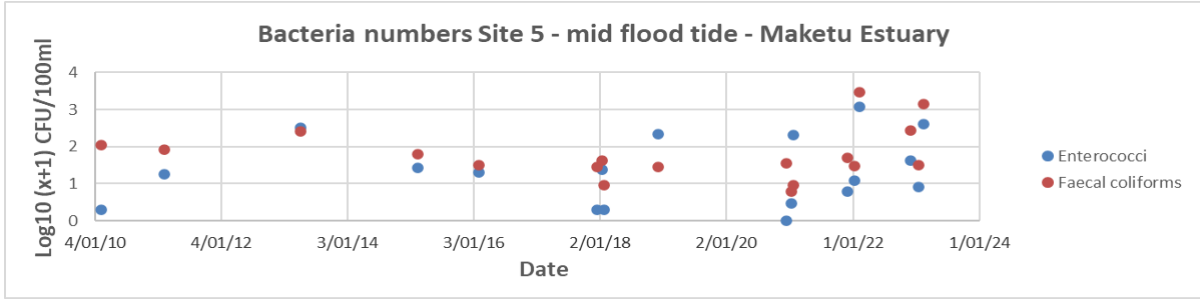
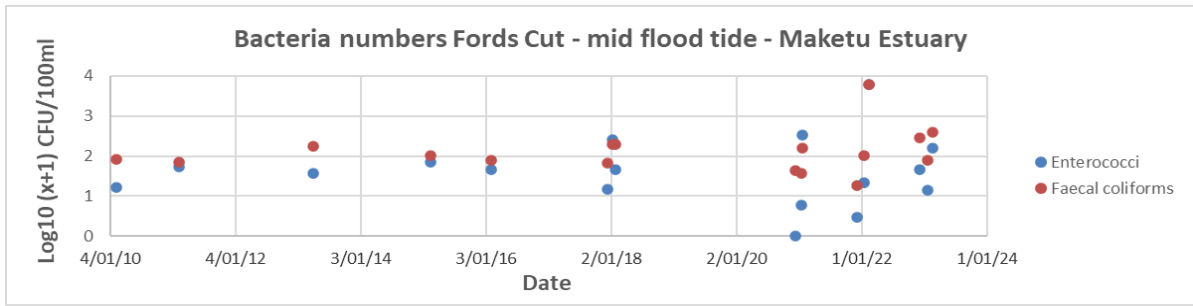


Figure 13, Faecal coliform and Enterococci bacterial numbers in water at mid-flood tide for the Fords Cut, Site 5, Site 9 and Boat ramp in Maketū Estuary.

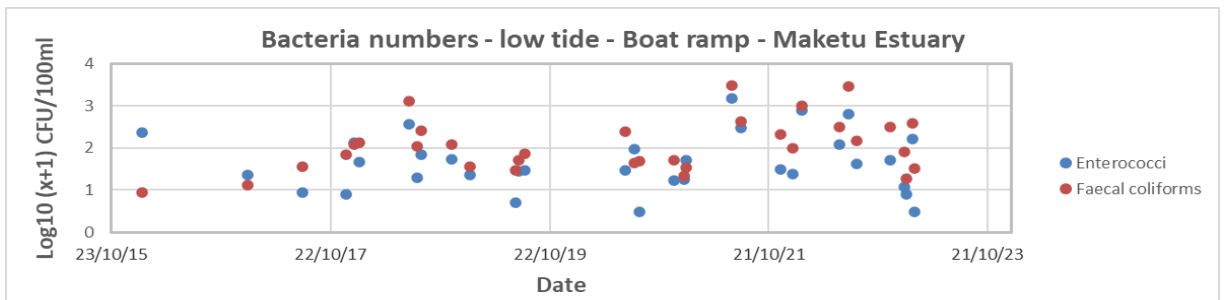
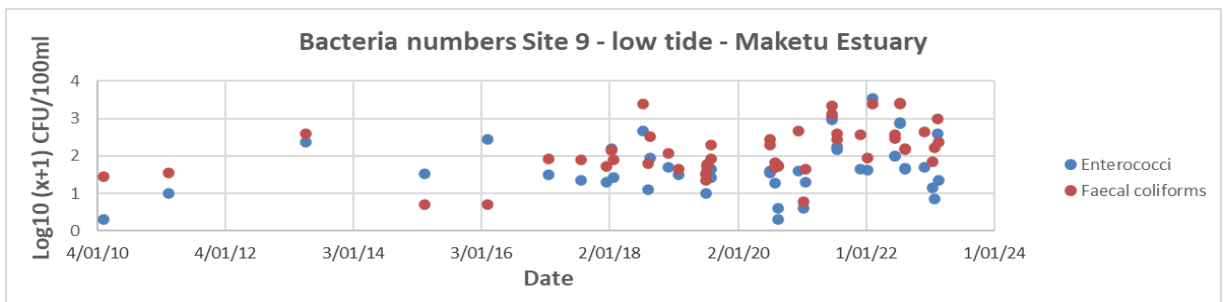
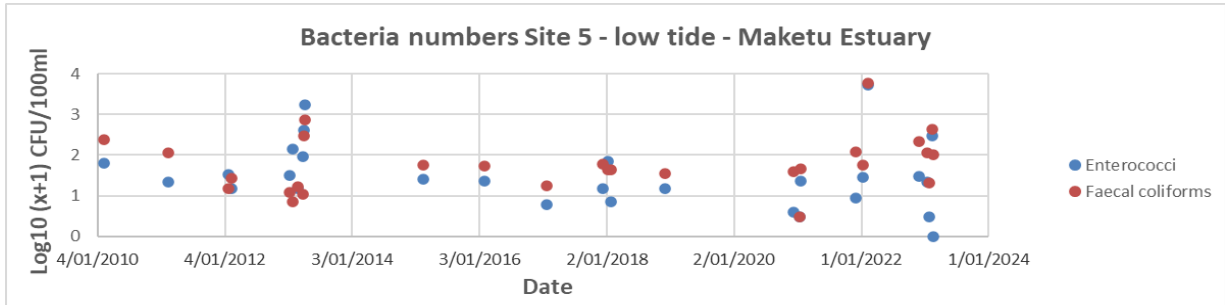
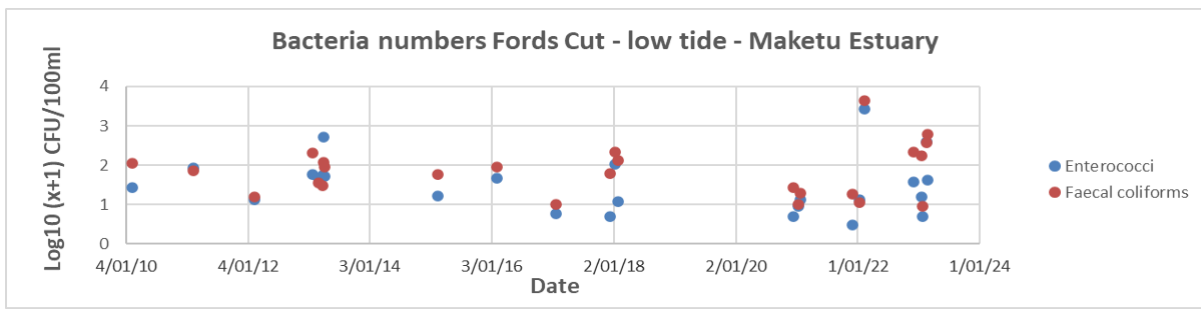


Figure 14, Faecal coliform and Enterococci bacterial numbers in water at low tide for the Fords Cut, Site 5, Site 9 and Boat ramp in Maketū Estuary.

Modelling (DHI 2014) showed that in the lower estuary the guideline for swimming (Enterococci counts – <280/100ml) would change from exceeding that value for 2% of the time to 3.3% and for shellfish gathering waters (median faecal coliform counts < 14/100ml) would change from exceeding the value 32% of the time to 44%. On the graphs above (fig. 12-13) a value of 14 on the log scale is 1.17 and 280 is 2.45. Current results appear as though results are worse than these predictions. However, with only two sets of summer results since the commencement of full diversion flow, which have been either rain affected or reflecting wet weather patterns, it is still too early to assess whether these predictions are correct. For Site 9 and the boat ramp locations near the estuary entrance, the increases seen at mid-flood and high tides are not likely the result of increased river flow, but due to other environmental factors.

7.1.2 Monitoring results – Condition 32.5 – 32.7 shellfish bacteria monitoring

These conditions all relate water quality and shellfish monitoring from Stage 1 commissioning at low tide on three occasions every year for each of the periods December to March (inclusive) and June to August (inclusive). Sampling is to be undertaken at three sites in the lower estuary and include a minimum of two pipi and two tuangi samples. Winter sampling was conducted on 14th June 13th July and 10th August 2022. Sampling is scheduled to occur on both the spring low tides and on dates when the laboratory can handle the processing and testing of these samples, which means there are few suitable days and limited capacity to change dates. All winter sampling days experienced prior rain which was heavy on two of the occasions. Summer sampling was conducted on 30th November 2021, 23rd January and 20th February 2022.

The shellfish and water quality samples from the three sampling sites are to be tested for faecal coliform and enterococci bacteria. For shellfish testing, laboratory accredited methods have changed (after the 2021 winter sampling) for bacterial analysis of shellfish flesh and enterococci and faecal coliform methods are no longer valid. Fortunately, testing for *E. coli* bacteria in Maketū Estuary shellfish has also been undertaken since 1992 which correlates strongly with the other two indicators (*E. coli*/faecal coliform $r^2 = 0.77$ for pipi sampling). Pipi and tuangi were also sampled on a number of occasions in winter prior to the compliance requirement in order to build up a comparative baseline from which any changes associated with the increased river flows might be discerned.

Results for tuangi are shown below in Figure 15 for winter sampling and Figure 16 for summer. The average winter results are all slightly higher following the increased river flows, although the 2022 winter sample results are similar to those of 2018. There is a similar result for summer with results tending to be higher after the increased river flows and the 2023 sample results lower than those for 2011. As with the results for the bacterial numbers in the overlying water, results have likely been influenced by rain events and a very wet 2022/23 summer.

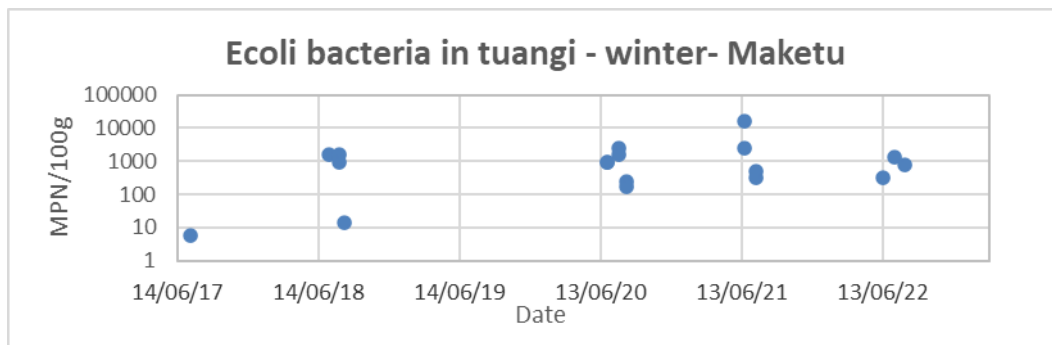


Figure 15, *E. coli* bacteria numbers in tuangi from lower Maketū Estuary over winter. River flows have been 150,000 m³ per tidal cycle up to 12 February 2020, then 400,000 m³ for the next year and then 600,000.

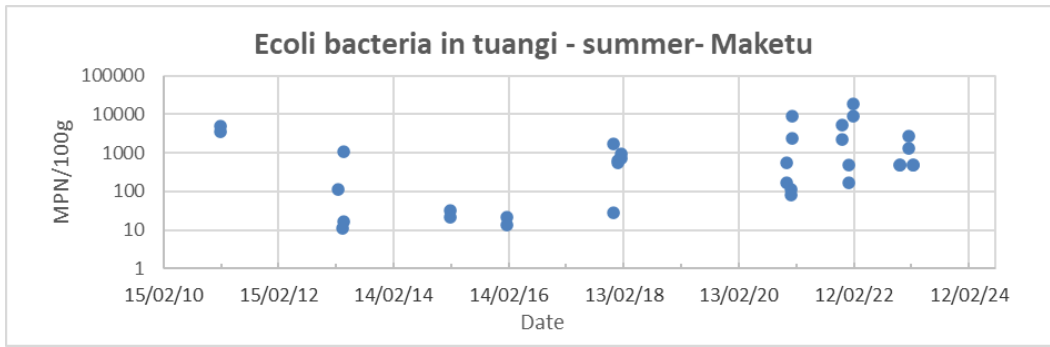


Figure 16, E. coli bacteria numbers in tuangi from lower Maketū Estuary over summer. River flows have been 150,000 m3 per tidal cycle up to 12 February 2020, then 400,000 m3 for the next year and then 600,000.

Results for E. coli bacteria numbers in pipi are shown in Figure 17 below for winter and Figure 18 for summer. Results for the winter and summer sampling show that E. coli numbers have been higher on average following the increase in river flow. As with the tuangi results, the summer 2023 pipi samples have lower E. coli numbers than those recorded in 2011. And the issue of rain affected sampling and a much wetter summer 2022/23 coinciding with the increased river flows, means that further sampling results under drier conditions will be needed to determine the change in bacteria numbers that has occurred.

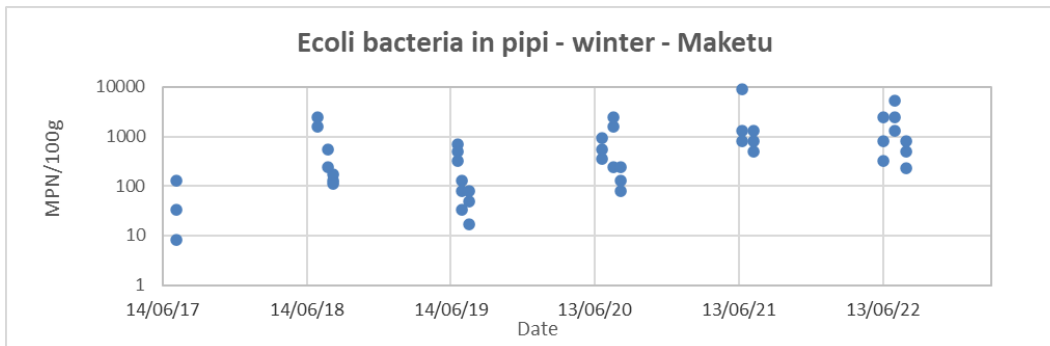


Figure 17, E. coli bacteria numbers in pipi from lower Maketū Estuary over winter. River flows have been 150,000 m3 per tidal cycle up to 12 February 2020, then 400,000 m3 for the next year and then 600,000.

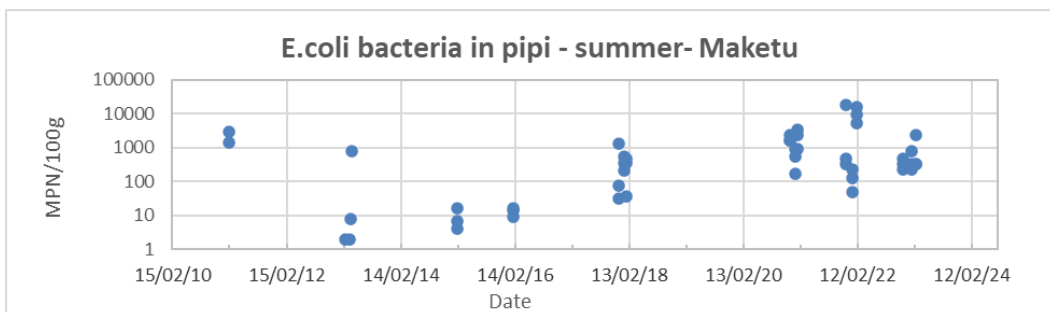


Figure 18, E. coli bacteria numbers in pipi from lower Maketū Estuary over summer. River flows have been 150,000 m3 per tidal cycle up to 12 February 2020, then 400,000 m3 for the next year and then 600,000.

7.1.3 Monitoring results – Condition 32.8 pipi survey

Condition 32.8 requires an annual pipi survey for the lower estuary within the period December to March for the first five years following Stage 1 commissioning. The survey requires a minimum of eight replicate cores along a transect parallel to the channel with all shellfish in the cores identified and counted in 5.0-millimetre size classes. More extensive (both spatially and with sample replication) surveys have been undertaken including one in February 2018 to establish a baseline. Compliance surveys have been undertaken in February 2021, 2022, and 2023. In 2018 four transects were measured in the lower estuary in the area of the main pipi bed. Each transect extended for 50m from the channel edge with 10 replicate core samples taken at 10m intervals. Every second transect along the channel had pipi size measured for every second point along that transect. The 2021 survey covered the same transects but extended further across the channel in places and further up the estuary. In 2023 transects 1, 2, 3, 5 and 6 were re-surveyed, providing data for good comparison with the 2018 and 2021 surveys.

The location of all 12 transects are shown in Figure 19 below. The aerial photography base for the figure is 2020 and the channel morphology is constantly changing over time which also shifts the habitat that pipi prefer to live in. Restoration of the tidal flows into the Te Pā Ika & Papahikahawai Creek areas from June 2017 to June 2019 meant the main channel had to accommodate the extra tidal volume which resulted in scouring and widening. In 2022 little channel edge erosion was observed, indicating that it may now be close to accommodating these flow changes in a balanced state. The increased river diversion volumes (February 2020 & 2021) do not change the amount of water flowing out the entrance but does reduce the amount of inflowing seawater coming in the entrance. Hence by the time “Full Commissioning” occurred in the February 2021, it was noted that the channel had already substantially widened and scoured. Increased river flow will have effects in terms of the estuary entrance morphology (such as the loss of the flood tide delta) and lower salinity in the main channel at low tide.



Figure 19, Location of transects in lower Maketū Estuary along which pipi have been surveyed for density and size. In February 2023 transects 1, 2, 3, 5 & 6 were surveyed.

Results for the pipi survey in 2023 are shown in Figure 20 for the densities recorded along each transect and in Figure 21 the size frequency data for each transect is provided.

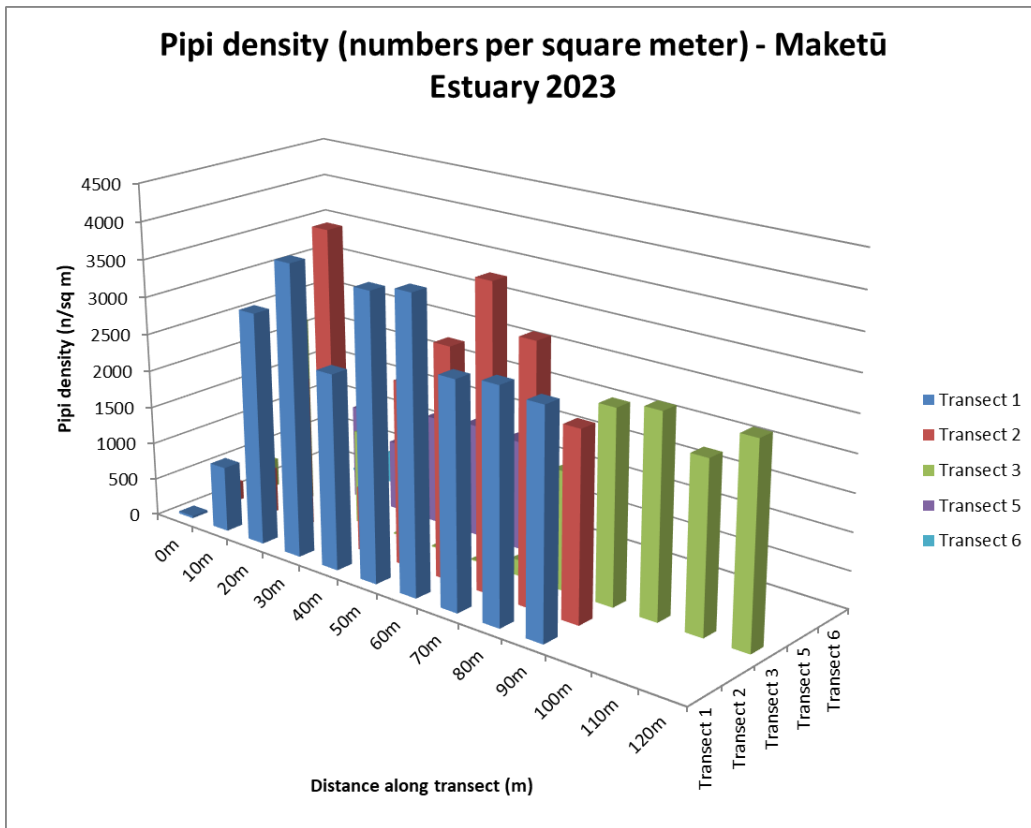


Figure 20, Pipi density (numbers per square meter) along transects in Maketū Estuary in February 2023.

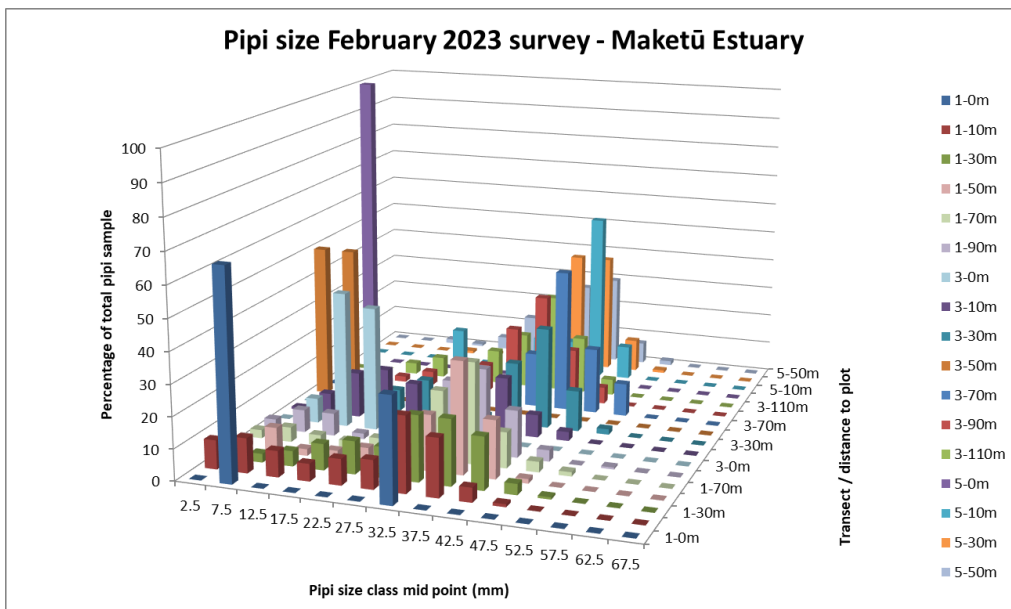


Figure 21, Pipi size (5mm classes) measured along transects in Maketū Estuary in February 2023.

A comparison of the pipi density (mean of 10 replicates) along Transects 1 to 3 from 2018 to 2023 (Figures 22 to 24) is shown below. Along Transect 1 it can be seen that pipi density varies between years and is highest overall on the southern side of the main channel in 2022/23. At Transect 2 the densities once again show moderate variability with 2018 and 2021 having higher density around 40 – 50 m from the channel edge. Transect 3 also shows a high degree of spatial variability in densities of pipi from year to year. In 2023 there were higher densities near the channel edge with pipi being largely absent from 40 – 70 m out compared to 2018 and 2021. When the spatial variation is taken into account, densities are overall similar between 2018 and 2023.

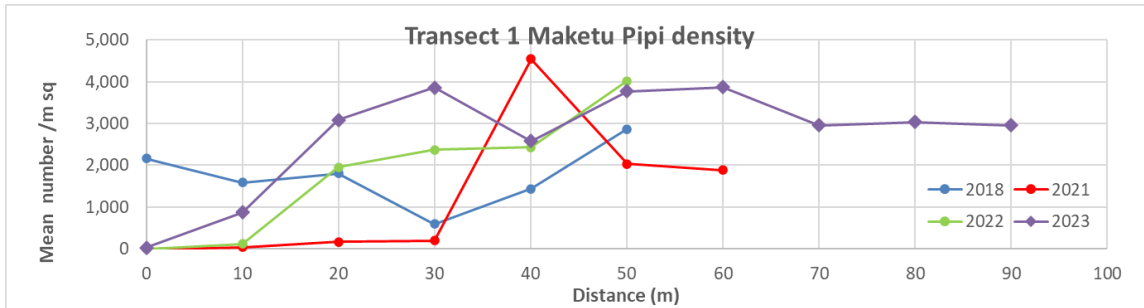


Figure 22, Pipi density (mean/m², n=10) measured along Transect 1 in Maketū Estuary in February 2018, 2021, 2022 & 2023.

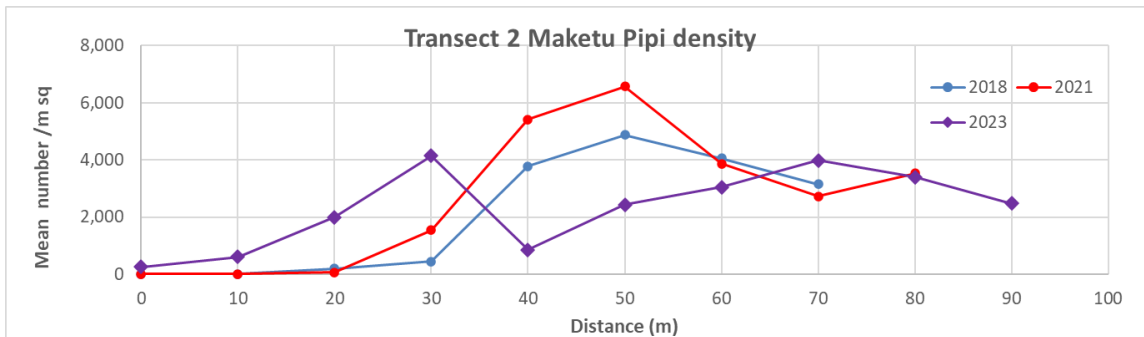


Figure 23, Pipi density (mean/m², n=10) measured along Transect 2 in Maketū Estuary in February 2018, 2021 & 2023.

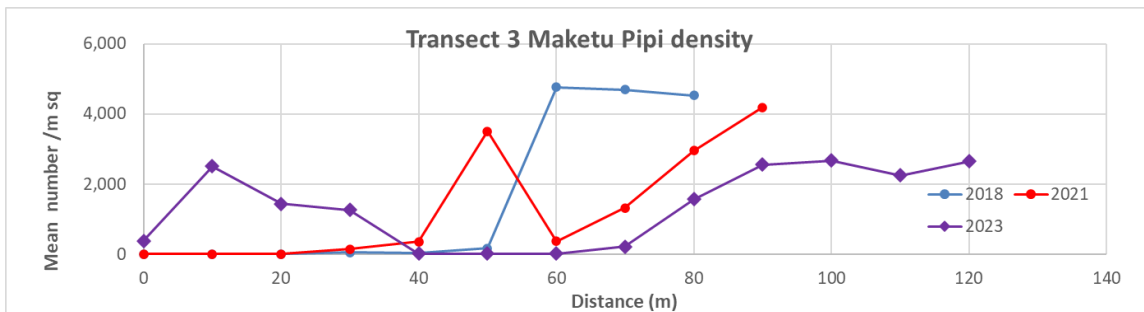


Figure 24, Pipi density (mean/m², n=10) measured along Transect 3 in Maketū Estuary in February 2018, 2021 & 2023.

Although pipi densities are similar overall between years, one distinct difference is that in 2018 there were very few pipi below 10 mm length. Some recruitment of pipis (<10 mm) was recoded at Transect 1 in 2021 and 2022, then in 2023 they made up to 8% of the total numbers at locations where good numbers of larger pipi occur. Given that densities overall are similar between years, the densities of the larger size classes of pipi (>40 mm) which are more commonly sought for kai gathering, have been compared between years in Figures 25 and 26 below. Along Transect 1 the differences are not large, but further out in the channel there were higher densities of larger pipi present in 2018 and 2021. On Transect 3 at 50 m from the channel edge there are also higher densities of the larger pipi in 2018 and 2021 compared to 2023. Average size of larger pipi can also be influenced by kai gathering which complicates interpretation of any environmental influences.

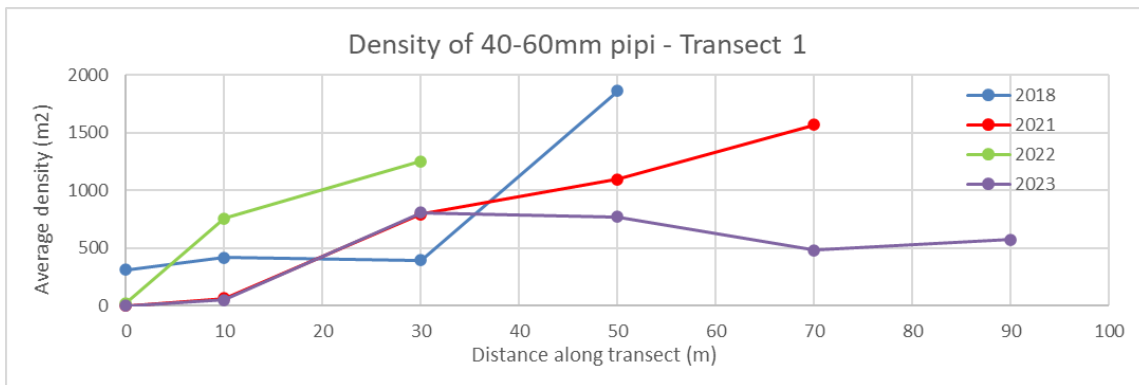


Figure 25, Density of large pipi (>40 mm) along Transect 1 measured in Maketū Estuary in February 2018, 2021, 2022 & 2023.

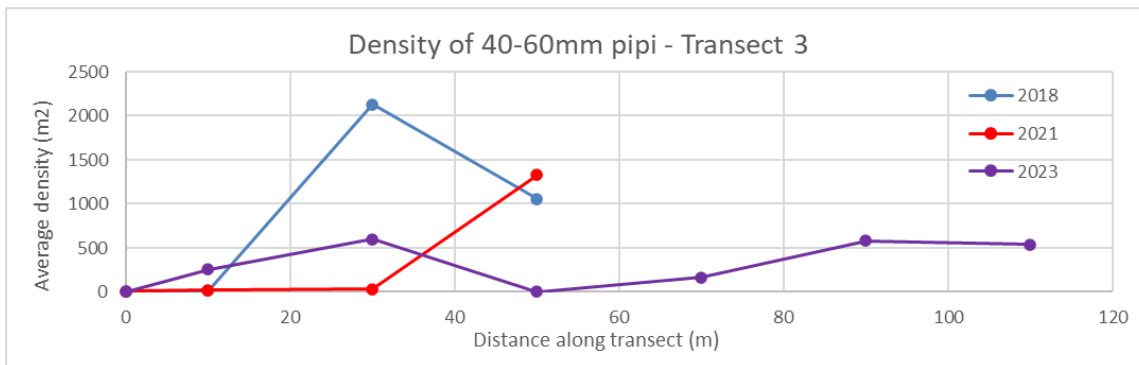


Figure 26, Density of large pipi (>40 mm) along Transect 3 measured in Maketū Estuary in February 2018, 2021 & 2023.

7.1.4 Monitoring results – Condition 32.9 mid-estuary shellfish monitoring

Condition 32.9 requires annual monitoring of shellfish (size & density) from Stage 1 commissioning for a period of five years, at three sites in the mid estuary during December to March with eight replicate samples at each site. As shown in Figure 27 below there are 7 sites in the mid estuary for which shellfish have been monitored with data available for most prior to the Stage 1 commissioning.



Figure 27, location of monitoring sites in Maketū Estuary where shellfish density and size have been monitored.

Some of the shellfish density results for the sites in the mid estuary area are shown in Figure 28 below which shows five mid estuary sites. As shown, there is no significant reduction in shellfish densities recorded since the increase in river flow commenced except for a very minor dip in tuangi numbers at site P5. At P5 over the same period, hanikura numbers have increased and this species is slightly more sensitive to salinity which suggests that observed changes are natural variability in the tuangi numbers.

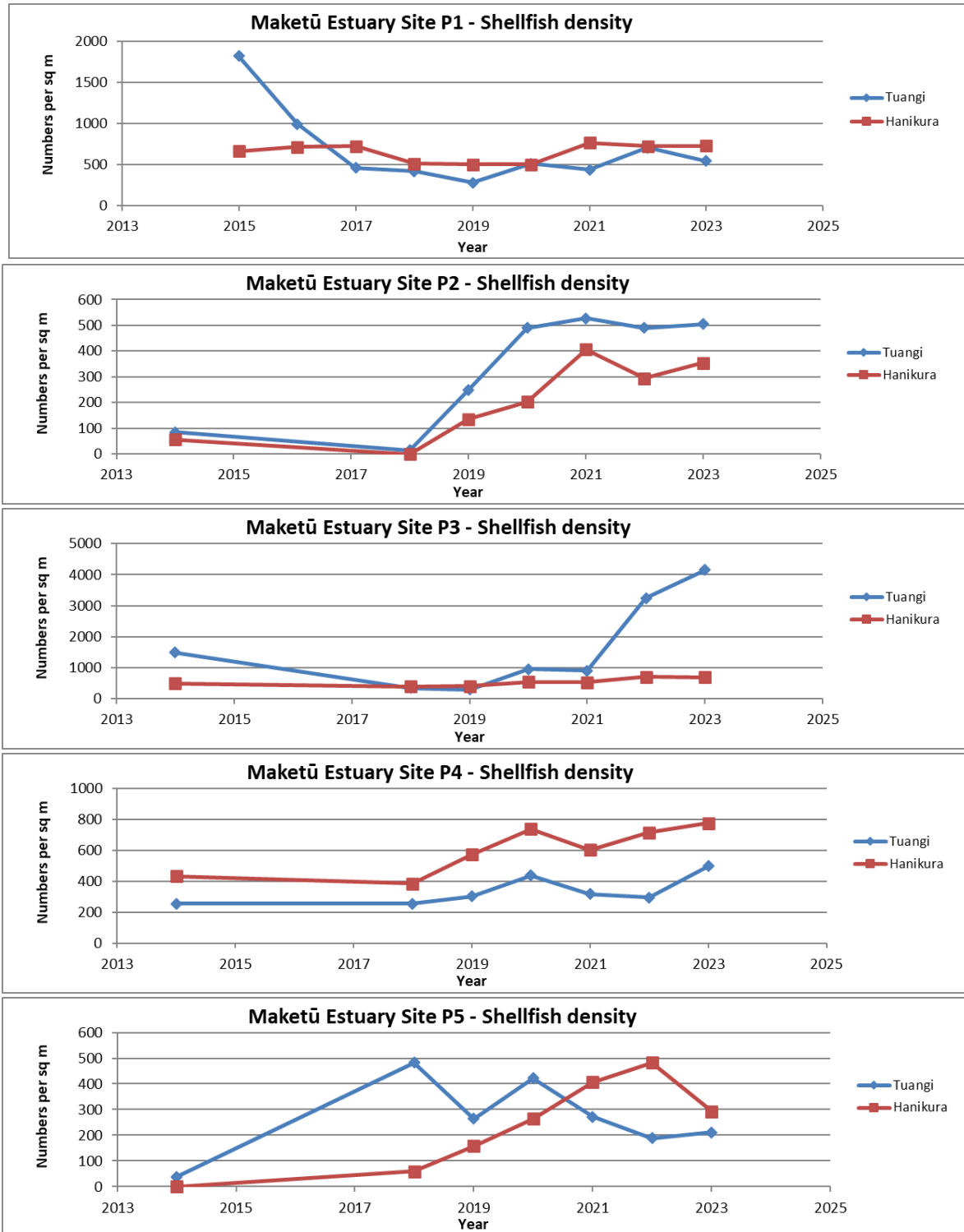


Figure 28, Shellfish density at monitoring sites P1 – P5 in mid Maketū Estuary from 2014 to 2023 summers (summers shown according to year in which they end, ie. 2020/21 = 21).

The marked changes in shellfish density shown at sites P2 and P5 are related to the loss of macroalgae cover at these locations.

The two sites in Papahikahawai Creek that had previously shown increases in shellfish numbers in response to the removal of the causeways and restoration of tidal flows have generally maintained that increase. The densities of tuangi (cockles) and hanikura (wedge shells) are shown in graphs below (Figure 29). Although tuangi numbers are still higher than prior to the restoration works, there has been a reduction in density recorded at both sites.

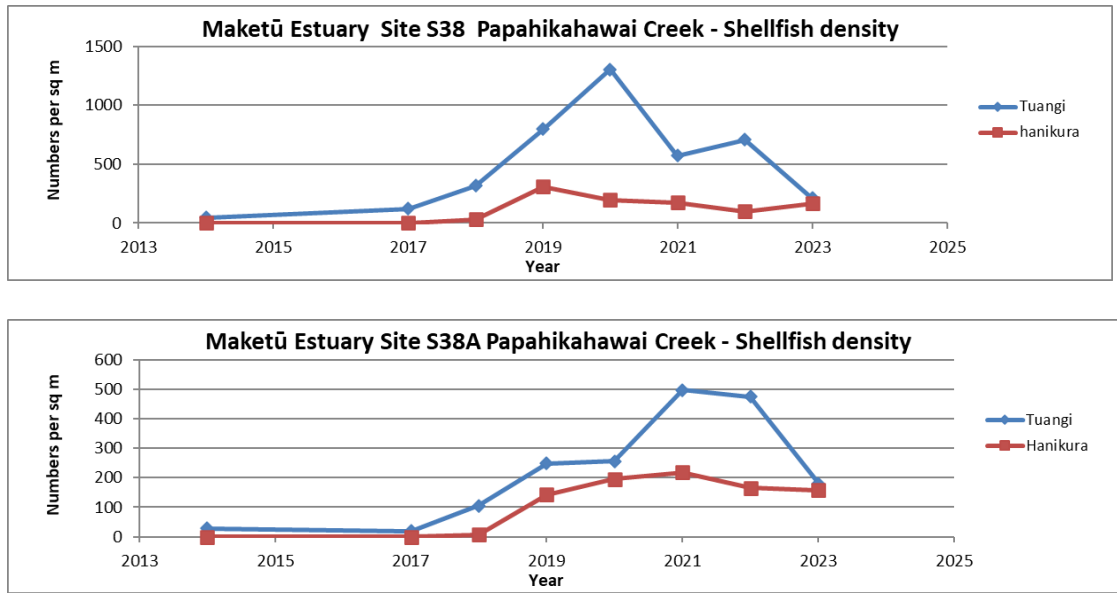


Figure 29, Shellfish density at monitoring sites 38 and 38a in Paphakahawai Creek, Maketū Estuary from 2014 to 2023 summers (summers shown according to year in which they end, ie. 2020/21 = 21).

As examples of trends in shellfish size, graphs of tuangi density and size from areas of the mid and upper estuary area nearest the influence of the increased river flow are shown in Figure 28 below. Tuangi numbers are very low at the upper estuary sites as habitat is marginal due to a range of factors such as tidal height, salinity and sediment characteristics. Site S35c recorded no shellfish in 2022 which appears to simply be by chance as the densities are very low and tuangi were found in 2023. Site P7 which should have a very similar range of salinity to S35c, showed no change in 2022 but dipped slightly in 2023, probably also due to chance as the densities are very low. Overall, there are still some tuangi present at these sites, indicating that the salinity and other changes have not had a large effect in this location of the estuary.

At sites P5 and P6 further down in the mid-estuary area, results (Figure 30) show no change in the mean and maximum size of the Tuangi, but there has been a slight decrease in density since 2020 possibly as result of increase in river flow and lower salinity at these sites. The changes in density are not large and it could also just be natural variation or by chance. Results from future years will help confirm whether this trend is real, and salinity alone could be the key factor, but other subtle changes in habitat quality may account for the change.

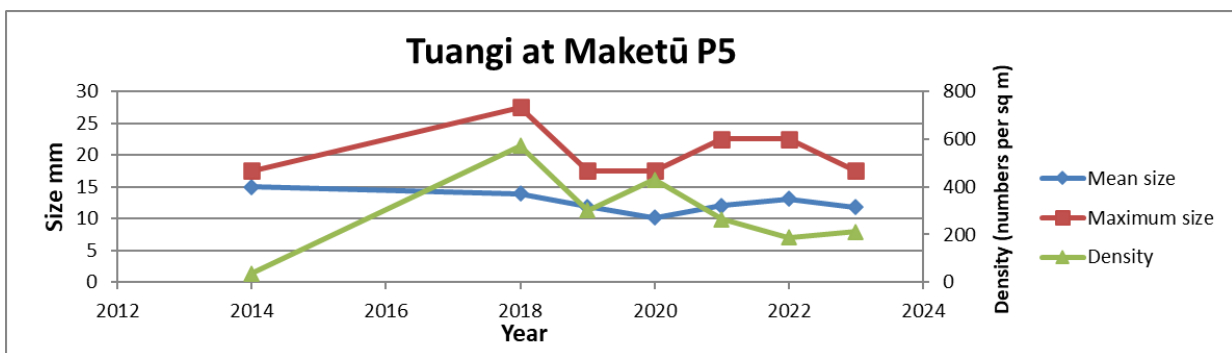
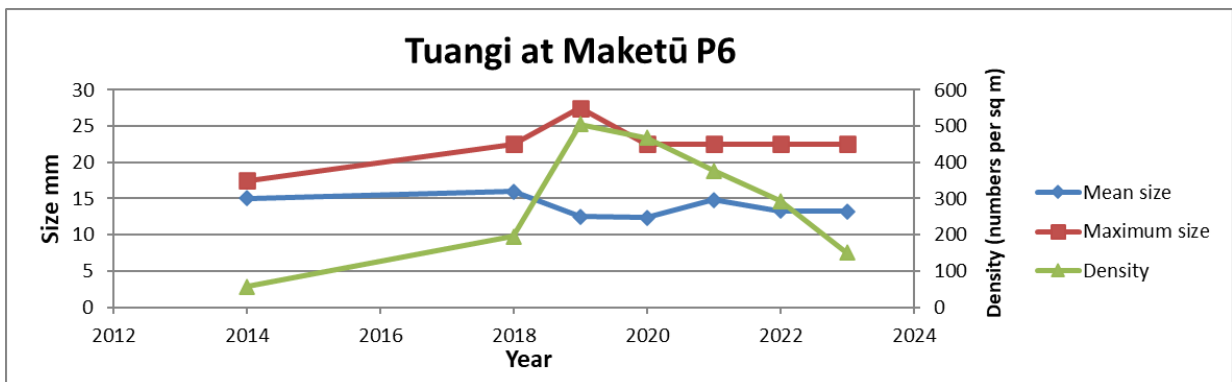
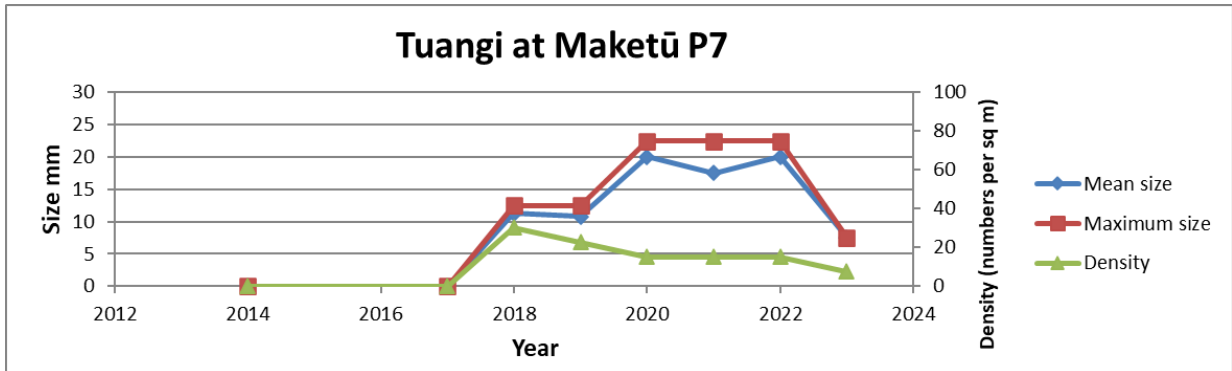
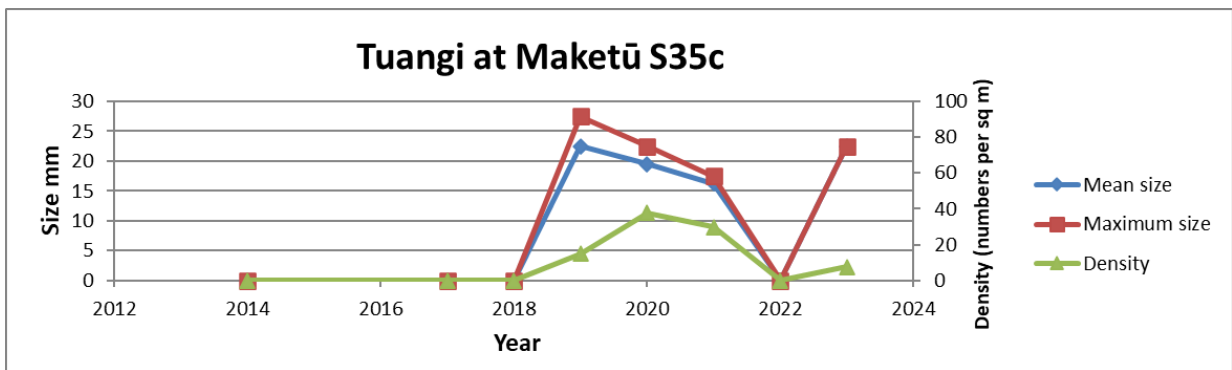


Figure 30, Tuangi size and density at monitoring sites in the upper estuary (35c & P7) and mid estuary (P6 & P5), Maketū Estuary from 2014 to 2022 summers (summers shown according to year in which they end, ie. 2020/21 = 21).

8 Ecology algal mapping (Condition 33)

8.1 Condition 33.1 – 33.3

33.1 The Consent Holder shall undertake broad scale mapping of algae distribution and species in the estuary annually from Stage 1 commissioning for a period of five years. Reporting shall generally be in the form of Figure 2.1, page 6 of Hamill (2014) “Kaituna River Re-diversion Project: Ongatoro/Maketū Estuary Condition and potential ecological effects” of the application material.

33.2 The Consent Holder shall undertake a survey of benthic macrofauna at the eight sites identified on BOPRC Plan Number RC67958/12 and one site Papahikahawai Island lagoon and one at the end of Papahikahawai Creek as follows: (a) Infauna shall be sampled using eight replicate sediment cores randomly collected within a 10 metre radius of the site location and the macrofauna identified; (b) Epifauna shall be surveyed using eight randomly placed 0.25 m² quadrats and: (c) The survey will be undertaken once within two years of Commissioning and then again at five years from commissioning.

33.3 At the location of each macrofauna replicate required by Condition 33.2 measurements shall also be taken of the following variables using methods consistent with those used for Condition 35.3: (a) Algae cover and type: (b) Percent cover of mud/silt: (c) Depth of mud/silt: and (d) Anoxic depth (that is depth of RPD (redox potential discontinuity)).

8.1.1 Monitoring results

Condition 33.1 requires annual broad scale mapping of the algae distribution and species in the estuary from Stage 1 commissioning for a period of five years. In a previous compliance report it was pointed out that the aerial photography flown for 2021 was unsuitable for mapping and that no results were available for that year. However, suitable photography was later acquired, and mapping has been done for 2021 and 2022. The macroalgae has been mapped in 2018, 2019 and 2020, so there is a good baseline of data leading up to the increase in river flow against which to compare future years. The total extent of macroalgal cover monitored in previous years up to 2022 is shown in Figure below. To date there is little overall difference in macroalgal cover over the whole estuary, but there have been beds of *Gracilaria spp.* establishing in the upper estuary in the newly formed restored areas. This is not surprising given the high levels of nutrients that had accumulated in sediments in that area. Again, delays in the availability of photography means this work will be reported next year.

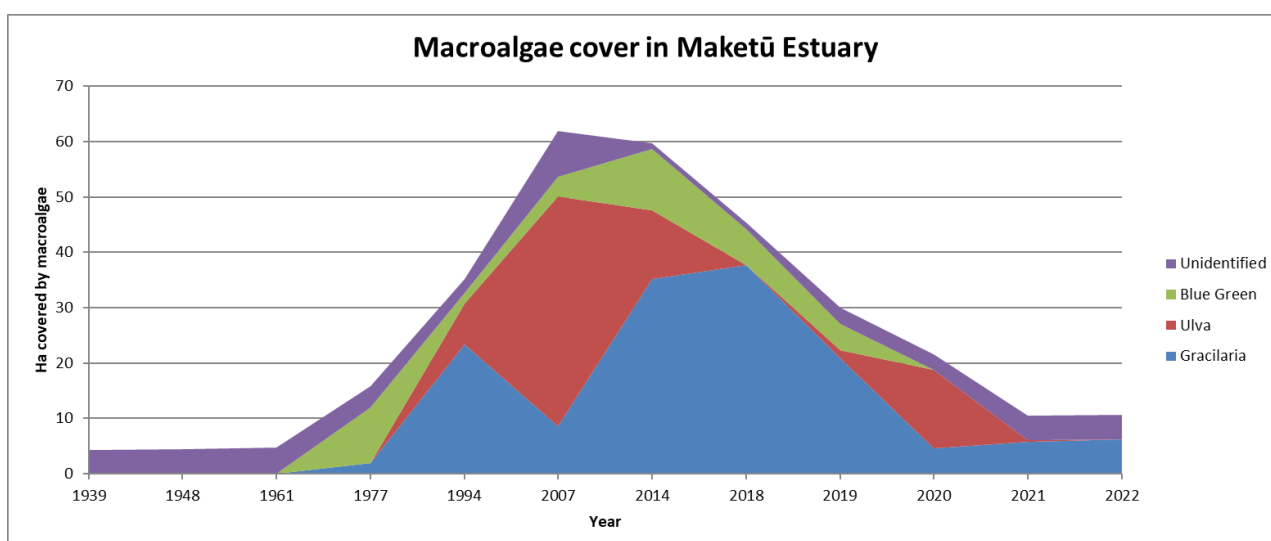


Figure 31 - Macroalgal cover (Ha) measured in Maketū Estuary from 1939 to 2020 with the proportions of the main species shown

9 Ecology flora (Condition 34)

9.1 Condition 34.1 – 34.6 – Terrestrial and Wetland Vegetation

34.1 The Consent Holder shall undertake vegetation transect monitoring to determine the effects of the re-diversion on terrestrial and wetland vegetation as follows:

	Location	Frequency
Transects 1-8	As shown on BOPRC Plan Number RC67958/12 with Transect 7 being extended to the waters edge of the new re-diversion channel	no later than 6 months after full commissioning and thereafter annually for 5 years
Transect 9	1 new transect to be established on land in the general location shown in BOPRC Plan Number RC67958/12	No less than 1 month prior to Stage 1 commissioning and then no later than 6 months after full commissioning and thereafter annually for 5 years
Transect 10 and 11	1 north-south and 1 east-west transect to be established on the land north of Fords Cut using paired plot methodology	No less than 1 month prior to Stage 1 commissioning and then within 6 months of each planting stage and then annually for 5 years

34.2 Transects should be measured using the methodology from section 3.1.5.1, on pages 18 to 20, of MacGibbon (2014) 'Kaituna River Re-diversion Project: Ongatoro/Maketu Estuary Enhancement Project – Terrestrial, Avian and Wetland Ecology' provided as part of the application material in the locations shown on BOPRC Plan Number RC67958/12.

34.3 In the event that access to Transects 6 and 8 cannot be gained from the landowner, there is no requirement to monitor. The Consent Holder shall notify the Regional Council in writing within 10 working days of access being denied identifying the attempts made to gain access.

34.4 The salt marsh remnants and the small *Sacocornia* patch in Papahikahawai Creek shall be monitored using photopoint monitoring. Surveys shall be carried out annually from Stage 1 commissioning for a period of five years.

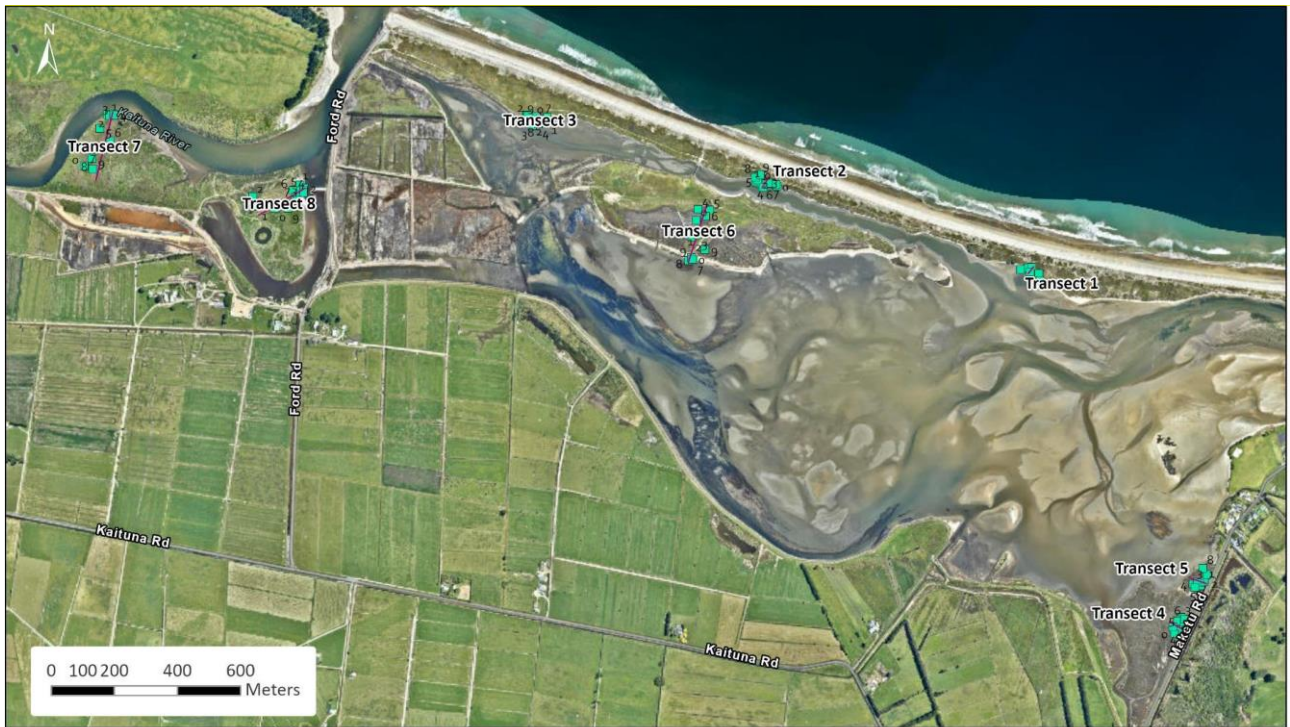
34.5 The vegetation composition and spatial extent along the true left bank of the re-diversion channel shall be surveyed prior to river re-diversion and monitored 6 monthly for a period of two years following Commissioning. In the event that any die back is observed, the dead plants shall be replaced with alternative salt tolerant plants as soon as practicable.

34.6 Any observed die back and subsequent replacement planting shall be reported on under sub-clause 29.1(vi) of this resource consent.

9.1.1 Monitoring results

Terrestrial and wetland vegetation assessments are required to be monitored to understand the effects of the re-diversion. The transects monitored are:

- **Transects 1-8**
- **Transect 9: Ford Island**



- Legend
- Quadrats
 - Transects

Client: Bay of Plenty Regional Council
 Project: Kaituna Rediversion Vegetation Monitoring
 Map Description: Transect and quadrat locations
 Date: 29/05/2022
 Version: 1.0
 Author: HD
 Approved: PW

4SIGHT
 CONSULTING

Copyright:
 This map and the copyright of this map remains the property of
 4Sight Consulting. The contents of this map may not be
 reproduced either in whole or in part by any means without
 the prior consent of 4Sight Consulting.



Figure 12 - Locations of quadrats (left) and transect lines 1-8 (above) and 9 (right image)

- **Transect 10 and 11: Te Pa Ika wetland**

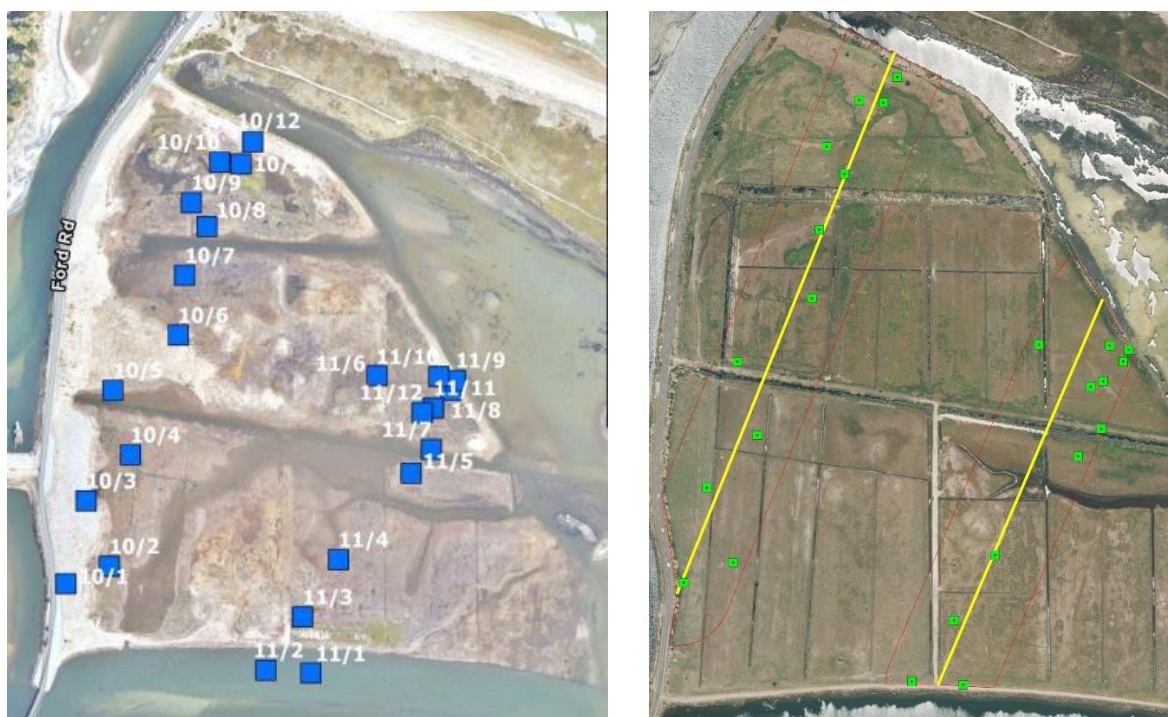


Figure 33 - Locations of quadrats (left) and transect lines at Te Paika Wetland: transect 10 (left) transect 11 (right)

Three transects were required to be established prior to commissioning (transect 9-11). Wildlands (2018)¹ established new transects and quadrats (transect 10 and 11) on the land north of Fords Cut to provide baseline data to compare ongoing changes in vegetation cover across all vegetation sites. The first vegetation assessment for these transects was carried out on 8th and 11th June 2018 (Wildlands, 2018). Transect 9 was not established until June 2020² - this is later than was required by the Conditions but was considered to still provide a suitable baseline. Transects 9-11 were remeasured in 2021.

A summary of the most relevant transect monitoring is below and a full copy of the report is in [Appendix 2](#).

Note that none of the transects were re-measured in the 2022/23 year. A reduction in the monitoring frequency was requested in the 2021/22 Annual Report.

The results presented below are a repeat of the 2021/22 report included here so that readers have an insight into the findings from the last available monitoring.

¹ Wildlands (2018) Te Paika Wetland Monitoring: Establishment, June 2018. Prepared for Bay of Plenty Regional Council August 2018. Contract Report No. 4695

² Wildlands (2020) Vegetation Monitoring at Ford Island, Lower Kaituna River, Maketu: June 2020. Prepared for Bay of Plenty Regional Council July 2020. Contract Report No. 4695b

The following is a summary of the results of Transects 1-8 re-measuring:

MacGibbon (2014) predicted that the major saltmarsh remnant in the southern part of the estuary near the Waitepuia Stream outlet (Transects 4 & 5, and part of Zone 1) would be unlikely to be impacted by the re-diversion, and that the smaller saltmarsh remnants in the Papahikahawai Creek and lagoon may change in species composition away from searush dominance but were unlikely to decrease in extent. The freshwater wetland vegetation around Ford Island and further upstream in the 'Titchmarsh Wetland' was predicted to experience changes in salinity that may impact vegetation composition over time. No major change or short-term loss of vegetation was predicted, but Condition 34.5 in the consent was put in place to monitor for any adverse effects and provide provision to rectify them.

The estuary has undergone some significant biophysical changes since 2014. First, the Papahikahawai lagoon area had tidal flows restored to it by the removal of causeways and the construction of the bridge. This area was previously almost impounded and was fed only by a 600 mm culvert from Papahikawai Creek. This change affected the vegetation around the margins of the lagoon (including Transect 3), as well as along Paphikahawai Creek (Transect 2). Second, the Stage 1 commissioning in February 2020 introduced around 400,000m³ of freshwater from the Kaituna River, up from about 150,000m³ previously. This, and the subsequent Stage 2 commissioning in February 2021 (an additional 200,000m³ of water per tidal cycle) resulted in decreased salinity in parts of the estuary as well as reductions in fine sediment and algal cover.

Although the first measurement of this vegetation data was conducted in 2014, the effects it was designed to measure didn't occur for several years after that and there has been relatively little time since the full re-diversion of water was completed. Vegetation change in response to an environmental change can be relatively rapid when it results in vegetation death, but recovery of vegetation and establishment of a new equilibrium can take a long time.

Maketu Road saltmarsh

The original ecological impact assessment (MacGibbon 2014) predicted very little change to the saltmarsh remnant adjacent to Maketu Road where the Waitepuia Stream enters the estuary. The data corroborate this prediction. There was virtually no change in species composition or abundance in either Transect 4 or 5 and the overall vegetation cover remained stable. The drop in Simpson's Diversity Index for Transect 4 is due to an increase in searush cover (to over 85%) and a reduction in oioi cover, as well as the loss of one species (mangrove) out of the transect. The measure of biological diversity takes the evenness of the community into account which is why when searush became much more dominant than the other species in the transect the diversity index dropped considerably. It is likely that having to re-establish plots contributed to this change because the exact same areas of vegetation may not have been re-measured.

Titchmarsh Wetland

The Titchmarsh wetland (later renamed Otaiparea wetland) to the west of Ford Island has experienced major changes in vegetation composition and structure. This area was covered by Transect 7. It is thought that historically low river levels have combined with the effects of the re-diversion of 20% of the Kaituna River to produce higher salinity levels in the lower river than were expected (P. de Monchy pers. comm). The vegetation in this area, and across the river in the Ford wetlands, has suffered substantial die-off. The results of this dieback are a reduction in overall vegetation cover, species richness, and diversity. Even species that usually have some salt tolerance such as *Machaerina articulata* and *Bolboschoenus fluviatilis* have suffered whereas

saltmarsh specialist species such as oioi and the invasive saltwater paspalum have survived and may be spreading. It is likely that some of the salt tolerant species that suffered dieback did so because of a reasonably rapid increase in salinity after the diversion gates were opened, but some of these species may re-establish over time. It was noted that the river appeared to have eroded the bank in this area and the northernmost plots were devoid of vegetation whereas they had between 42% and 94% cover in 2014.

Papahikahawai Lagoon

In 2014 the Papahikahawai Lagoon area had saltmarsh vegetation down to the mean tide level (Park 2020) but when the tidal flows were restored there was some dieback, probably due to increased fluctuations in water level and altered salinity. The overall vegetation cover in Transect 3 reduced considerably, especially in the Zone 2 and 3 plots where searush and *Shoenoplectus pungens* each showed large reductions. The aerial photos from 2014 and 2021 show the extent of the vegetation change.

One species change of note is the increase in relative abundance of saltwater paspalum. The overall abundance has increased by just over 2% across all zones but it has become one of the most abundant species in Zone 2. With the overall reduction in vegetation cover, it seems likely that this invasive species will take advantage of the available space and continue to spread.

There have been some substantial changes in the vegetation around the margins of the estuary, however, many of these were anticipated. Adverse effects on the saltmarsh vegetation in Papahikahawai lagoon were expected, and it is likely that those areas will continue to recover in the coming years. The exception is the loss of wetland vegetation in the Otaiparea wetland which, at that scale, was unexpected. This issue has already been identified and planning is underway to restore salt-tolerant vegetation to that area, and control the saltwater paspalum that is invading.

Ford Island

In summary:

- Species richness increased on Transect 9 between 2020 and 2021 from 15 to 22 species and native species also increased marginally.
- Overall, the composition of the plant community sampled on Transect 9 did not substantially change over time.
- Only small changes in vegetation were observed on Ford Island. This is expected given that only one year has passed since the plots were established and that the management has been confined to exotic vegetation control.

The decrease in overall cover is likely to be the result of vegetation dieback, which was evident during the remeasurement of the plots. This may be because of herbicide use or the particularly dry conditions experienced over the past year. The increase in species richness and diversity is likely to be, at least in part, because of the natural establishment of exotic rushes and grasses (e.g. *Juncus effusus* var. *effusus*) in plots 4 – 8, which were relatively devoid of living vegetation in 2020. The soil in plots 5 – 8 is very compacted and it was difficult to hammer the wooden stakes into the ground. This will undoubtedly be impacting the re-establishment of vegetation of any kind. Although limited conclusions can be derived from just one year of data, the existing vegetation community is unlikely to transition to an indigenous dominated one without further active restoration.

Te Pa Ika

In summary:

- Species richness decreased in Transect 10 but there was a substantial increase in indigenous species in that transect. The number of species recorded on Transect 11 decreased dramatically between 2018 and 2021.
- Transect 10 changed substantially between 2018 and 2021. The 2018 community is that of a salt-adapted sea meadow or modified pasture with exotic grasses. In 2021, the community represents planted revegetation species and overall, a much lower canopy cover.
- Transect 11 changed significantly from a sea meadow with sea rush to only having two species at very low abundance.

The results show the early-stage outcomes from the wetland recreation and restoration project. Although there is limited vegetation present, it is anticipated that saltmarsh and sea meadow vegetation will naturally regenerate. Ten plots on Te Pā Ika that were previously vegetated, mostly with exotic species, were completely devoid of vegetation in 2021 but this is to be expected given that the restoration process started with recontouring and is only in the early stages. The expectation is that many of these bare plots will gradually develop vegetative cover although some will not because of the depth of water and wave energy.

While the overall cover of indigenous and exotic species on Te Pā Ika decreased considerably, the proportion of indigenous vegetation increased on Transect 10. This is likely the result of the revegetation plantings on the site, which were identified on the southern and northern ends of the transect, unlike Transect 11 on which only plot 3 was planted.

The substantial changes as a result of earthworks and vegetation clearance on Te Pā Ika are reflected to a lesser extent in species richness, which suggests, at least for the western side of the site (Transect 10), that although the vegetation cover decreased dramatically, plantings and natural re-colonisation have returned some of the richness and increased the diversity. In the eastern half of Te Pā Ika, where there has been less planting and saline water has limited natural regeneration, cover, species richness, and diversity have decreased significantly.

The ordination plot and the similar diversity indices for both transects show that the composition and structure of the vegetation across the site in 2018 was reasonably uniform, but the spread on the ordination plot and divergence in diversity indices indicate a more heterogeneous vegetation composition and structure in 2021 which was evident from site observations. Although some of these early indications for the eastern end of Te Pā Ika could be interpreted that saltmarsh is not establishing, it is too early to draw any conclusions and subsequent monitoring will continue to track progress. The ordination used here utilises existing vegetation groupings (transects) but for future measurements of these plots, and for the original eight transects around the estuary margin, it would be useful to stratify the plots by community type or potential community type based on physical attributes like water depth or elevation. On Te Pā Ika, because of the extensive re-contouring that has happened, this would involve establishing more plots so that there is a relatively even distribution of sampling points in at least two habitat zones.

10 Sediment and Algae (Condition 35)

10.1 Condition 35.1 – 35.3

35.1 The Consent Holder shall undertake a survey of sediment and algae in the estuary as follows: (a) Along a minimum of three transects in the upper estuary; (b) Along a minimum of three transects in the mid-estuary, (including one at the downstream end of Papahikahawai Creek); and (c) Along a minimum of one transect in the lower estuary.

35.2 The sediment survey shall be undertaken: (a) Once prior to the Stage 1 commissioning of the diversion control structure; (b) Once within one year of the Stage 1 commissioning of the diversion control structure; (c) Once within two years of the Commissioning of the diversion control structure; and (d) Once within five years of the Commissioning of the diversion control structure.

35.3 Variables assessed during the sediment survey shall include: (a) Algae cover and type; (b) Percent cover of mud/silt; (c) Depth of mud/silt; and (d) Anoxic depth (that is, depth of RPD (redox potential discontinuity)).

10.1.1 Monitoring results

Conditions 35.1-3 requires periodic monitoring of macroalgae and sediment along 3 transects in the upper estuary, 3 in the mid estuary (1 in Papahikahawai Creek entrance) and 1 in the lower estuary. The location of the algal transects is shown in Figure 34 below.



Figure 34 - Location of the algal transects in Maketū Estuary monitored for macroalgae cover and sediment characteristics

Following the Kaituna Re-diversion works, the total organic carbon both decreased, which indicates an improvement in ecological condition associated with the increased flushing. See Figure 35. Total nitrogen (TN) in sediment also decreased, while total phosphorus (TP) remained stable.

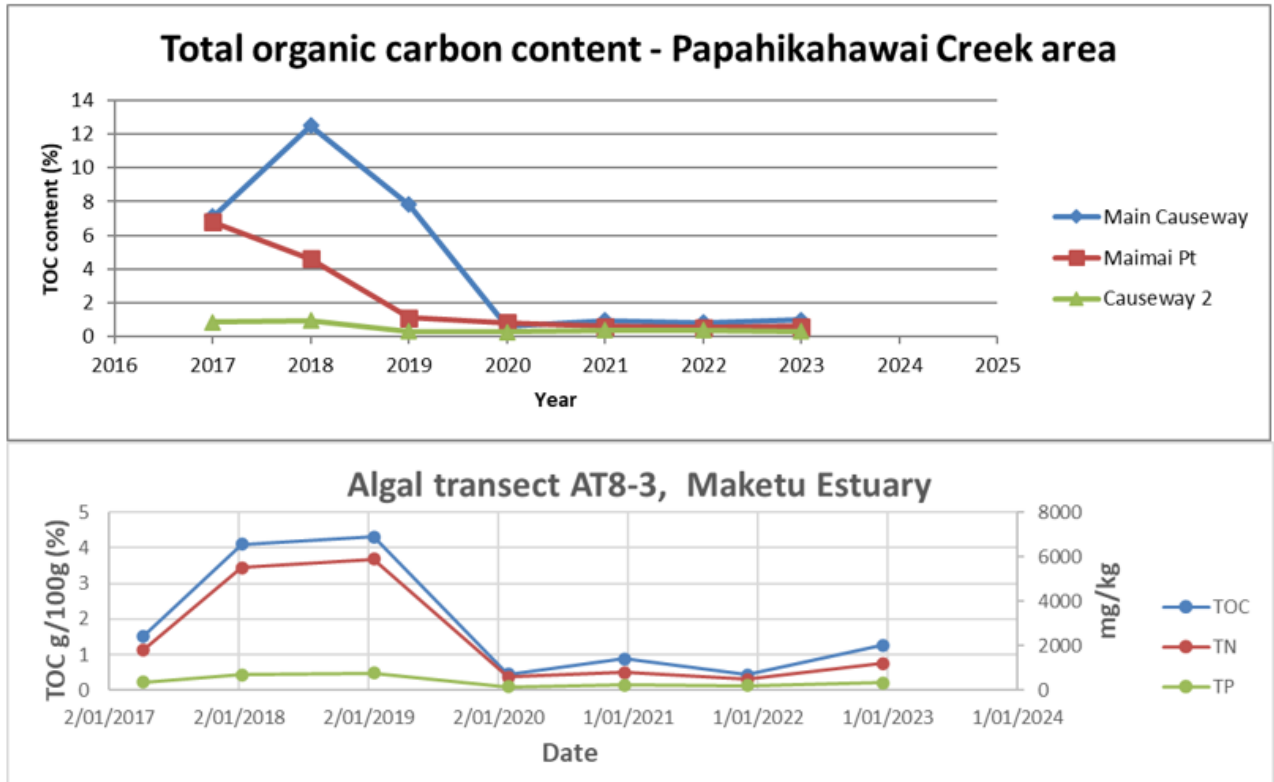
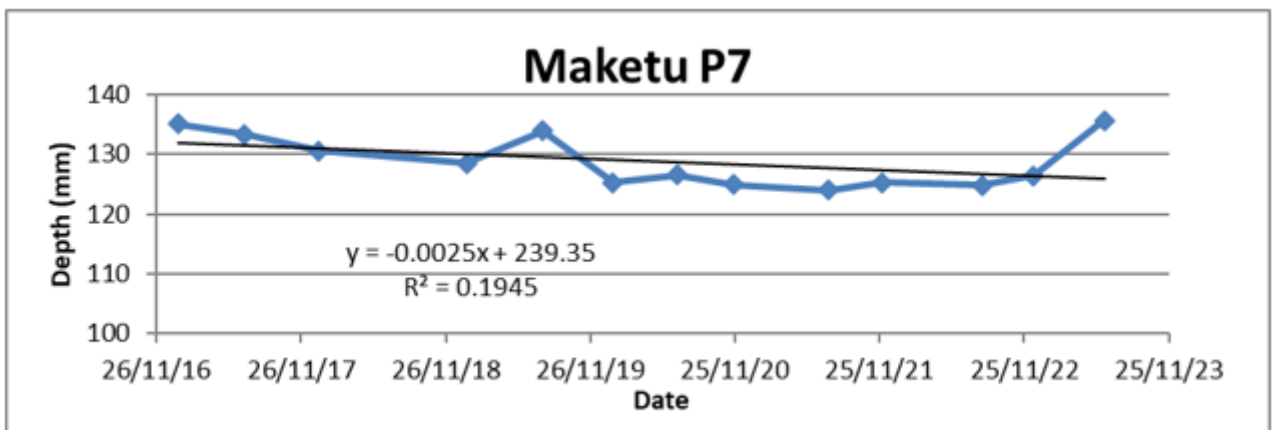


Figure 35 – Total organic carbon at Papahikahawai Creek in three locations (top), and TOC, TN and TP on algal transect AT8-3, Maketū Estuary (bottom) from 2017 to the present.

From commissioning until the middle of 2022, sediment was slowly eroding from the plates installed in the upper estuary. However, due to the high frequency of sediment-laden floodwaters since 30 May 2022, there has been a reversal of this trend. Figure 36 presents a sample of the data collected. Staff are investigating whether there might be ecological benefits in partially or fully closing the gates during some flood events, or parts of flood events, to reduce sediment in-flows, but this will need to be ‘traded off’ against the loss of flushing benefit associated with those flows.



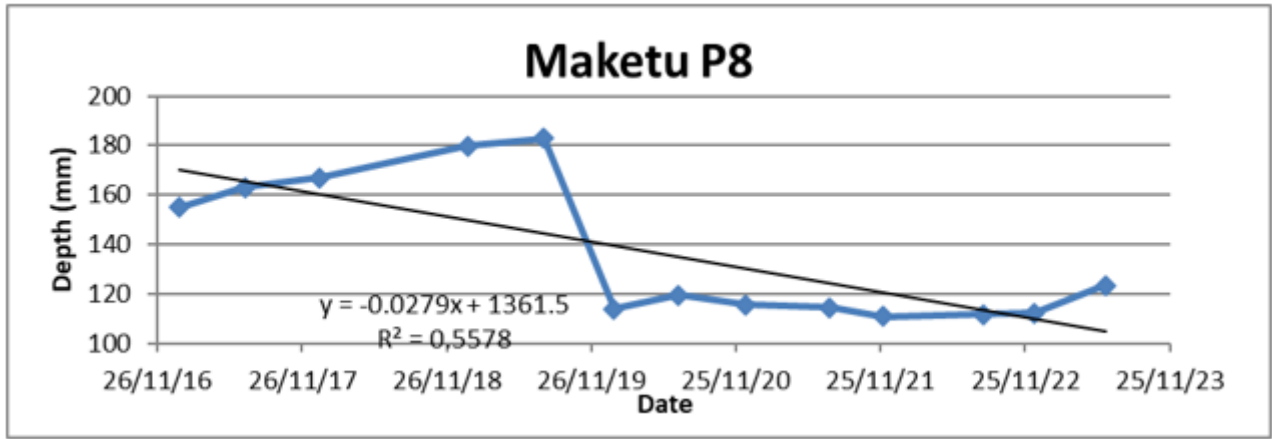


Figure 36 – Depth of sediment measured at plates installed in the upper Maketū Estuary.

Monitoring of total macroalgal cover was reported in section 8. Figure 37 provides an illustration of how the macroalgal extent has reduced over time through increased flushing in the upper and mid-estuary.

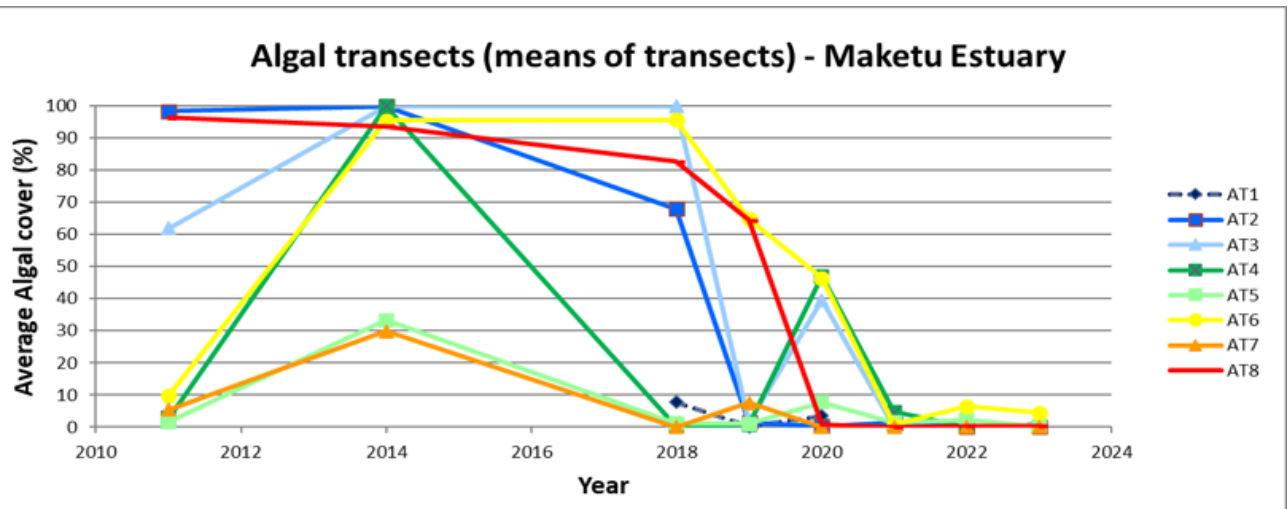


Figure 37 – Algal cover on eight transects in the mid and upper parts of Maketū Estuary.

11 Community Relationships (Condition 36)

11.1 Condition 36.1 – 36.7

36.5 As a minimum, the Community Relationship Plan shall:

- (a) Identify the frequency of communication, taking into account different phases of the Project (such as the works phase, wetland works, and monitoring and reporting phases); and
- (b) As a minimum, make provision for Public Information Sessions as follows:
 - (i) Once every three months during the construction phase;
 - (ii) Once per year for the first five years following Stage 1 commissioning of the diversion control structure; and then
 - (iii) Once every two years for the duration of the consent.
- (c) Identify an agreed method(s) for providing information, such as a website or other form of communication;
- (d) Identify the nature of information to be made available, including progress updates on the project, monitoring results, summaries of reports and complaints received with respect to the Project;
- (e) Identifying the procedures for providing feedback to the Consent Holder on the implementation of the project.

36.6 The Consent Holder shall directly invite, in writing, those parties prescribed in Condition 36.2 to the ongoing Public Information Sessions required by Condition 36.5 of this resource consent.

36.7 The Consent Holder shall keep minutes of the Public Information Sessions required by Condition 36.5 of this resource consent. The minutes shall record:

- (a) The names of those who attended the meeting;
- (b) Main topics of discussion; and
- (c) Any agreed outcomes.

The Consent Holder shall forward a copy of these minutes to the Regional Council within 20 working days of the meeting being held.

36.8 The Consent Holder shall resource and implement the Community Relationship Plan to the satisfaction of the Regional Council.

36.9 The Community Relationship Plan may be amended at any time. A copy of the amended plan shall be provided to the Regional Council.

11.1.1 Monitoring results

The annual Public Information Session required by consent Condition 36.5 (ii) shall be held on 1 September 2023. Meetings with Coastguard and Waterhouse were held on Friday 29 July 2022 and Tuesday 23 August, respectively. Minutes were recorded and circulated to attendees with a copy of the presentation.

In addition, staff from the Coastal Catchments team have engaged with members of the Maketū Community on a number of occasions on issues relating to estuarine, coastal or wetland enhancement, but not directly related to the Kaituna Re-diversion.

12 On-going Maintenance (Condition 20)

12.1 Condition 20.4 – Mooring basin survey

20.4 *In the event the mooring facilities are provided under Condition 17.2, the Consent Holder shall:*

(a) ensure the water depth at Mean Spring Low Tide of the mooring basin and the Kaituna River between the basin in the area identified on BOPRC Plan Number RC67958/12 is maintained at no less than 1 metre.

(b) assess the water depth at the request of the Maketu Coastguard or R.D. & S.F. Waterhouse Partnership through the Bay of Plenty Regional Harbour Master. If the water depth at Mean Spring Low Tide is less than 1 metre as a result of sediment deposition, then the Consent Holder shall remove the deposited sediment from the shallow areas to provide for that depth.

(c) In the event that the log deflector is not installed, the Consent Holder is not required to maintain the area identified as red hash on BOPRC Plan Number RC67958/12.

12.1.1 **Monitoring results**

Previous bathymetric surveying has illustrated compliance with condition 20.4. This, combined with conversations with users of the basin indicate that sediment has built up from the edge of Ford Island towards Ford Rd, but the channel alongside Ford Rd remains safely navigable.

13 Operations and Maintenance Manual (Condition 26)

13.1 Condition 26.10 – 26.12

26.10 *During river flood events that coincide with high sea levels, the diversion control structure shall be operated in a manner that does not increase the existing flood levels in Maketu Township above those that existed prior to the Project.*

26.11 *The Consent Holder shall meet with the Utilities Manager of Western Bay of Plenty District Council at least once per year to review the operation of the OMM in relation to flood management within Maketu Township.*

26.12 *The Consent Holder shall keep minutes of the meeting required by Condition 26.11 of this resource consent. The minutes shall record:*

- (a) The names of those who attended the meeting;*
- (b) Main topics of discussion; and*
- (c) Any agreed outcomes.*

The Consent Holder shall forward a copy of these minutes to the Regional Council within 20 working days of the meeting being held.

13.1.1 Monitoring results

The Operations and Maintenance Manual contains the key information needed to operate and maintain the Project and to ensure requirements of the resource consents are met.

Regular inspections have been undertaken by Chartered Geotech engineer Marianne O'Halloran. These regular inspections have identified mainly small areas of required maintenance to rock rip rap and the like though several larger potential issues have been identified.

Ongoing erosion/scour of the northern bank of the new diversion channel. The northern bank was shaped and intentionally left unlined at the request of tangata whenua to explore options for soft engineering, planting and the like. Unfortunately this has not proven successful most likely due to the nature of the soil being unsuitable for good plant establishment, and the swash from vessels combined with daily wetting and drying on the tidal cycles. The result is gradual scour that if is left, will cut through entirely allowing saline water during high-tide to short-cut the longer channel and flow into the Kaituna Estuary thereby negating the ecological benefits of the project to the Estuary. Consultation has been undertaken, support given by iwi/hapū and rock lining of 300m of the north bank of the new diversion channel is programmed to be undertaken this summer. Regulatory Compliance have approved the works as being within the scope of the original consents.

Inspection also discovered rapid corrosion of the sheet piling around the control gates. Further investigation found the rate of erosion was greater than the overall design tolerance for the current period. Advice has been sought from Beca who have provided further detail around the design sacrificial rates and minimum wall thickness. The outcome is that the rate of corrosion is typically higher to begin with once the surface is less exposed to the elements. A biennial survey of corrosion rate has been incorporated into the maintenance manual and a 10 yr maintenance to be scheduled.

14 Other observations, information, and relevant reports

14.1 Inspection reports & Condition assessments

Site inspections have continued to be undertaken every 1-3 months. Inspection reports include observation notes for the new channel, control gates and building, boat ramp, salinity block, Te Pā Ika saltmarsh, Ford's cut, Ford Road and Papahikahawai Island. The inspections reports identify any maintenance work required and priorities.

Appendix 1: Consent Conditions requiring monitoring

Parameter	Consent Condition monitoring requirement
Wetland Restoration Plan	<p>27.1 <i>Prior to the commencement of planting, a Wetland Restoration Plan shall be prepared and submitted to the Regional Council for certification at least two months prior to the first planting season. Regional Council's certification shall be limited to that the Wetland Plan:</i></p> <p>(a) <i>Complies with Conditions 27.2 and 27.4 of this resource consent;</i></p> <p>(b) <i>Adopts the best practicable option(s); and</i></p> <p>(c) <i>Contains provisions that are enforceable.</i></p> <p>27.2 <i>The Wetland Restoration Plan shall be verified by appropriately experienced and qualified practitioner(s), confirming that the Wetland Restoration Plan:</i></p> <p>(a) <i>Meets the Wetland Restoration Plan objective(s); and</i></p> <p>(b) <i>Complies with the resource consent Conditions.</i></p> <p>27.3 <i>The objective of the Wetland Restoration Plan is to establish as much wetland as practicable with an aim of 19 hectares or more where physical and environmental Conditions allow a sustainable cover of indigenous plants to be established that is representative in terms of species composition of wetland habitat found historically in the area, taking into consideration the substantial and irreversible humaninduced changes that have occurred to the landscape surrounding the Ongatoro/Maketu Estuary.</i></p> <p>27.4 <i>The Wetland Restoration Plan shall provide details of how the above objective is to be achieved, including:</i></p> <p>(a) <i>A map showing the locations of the proposed work;</i></p> <p>(b) <i>Identification of the key personnel or organisations that will oversee the work;</i></p> <p>(c) <i>The timescale of activities;</i></p> <p>(d) <i>Initial monitoring of site growing Conditions (especially soil salinity, soil saturation, tidal induced sediment erosion and deposition) after re-diversion and details of the process to be followed in the event die off is observed in accordance with Condition 34.5;</i></p> <p>(e) <i>Creation of a planting zone plan based on site growing Conditions and species tolerances;</i></p> <p>(f) <i>A programme for trial planting of plant species especially in areas where growing Conditions are likely to be challenging (for example, areas exposed to open tidal water and those with higher salinity);</i></p> <p>(g) <i>Details of mass planting once species can be matched to site Conditions with high confidence of success;</i></p>

	<p>(h) Restoration planting plan produced that details the planting zones, species mixes, plant grades, site preparation and post-planting maintenance requirements;</p> <p>(i) Identification of opportunities for Tangata Whenua and the community to be involved in planning and implementation of wetland restoration planting;</p> <p>(j) Monitoring plan to objectively measure plant and species performance;</p> <p>(k) Weed and pest control for each area; and</p> <p>27.5 The Consent Holder shall undertake all wetland works and weed and pest control in accordance with the Wetland Restoration Plan.</p> <p>27.6 Subject to compliance with Condition 27.7 of this resource consent, the Wetland Restoration Plan may be amended at any time.</p> <p>27.7 A copy of the amended Plan shall be provided to the Regional Council for their certification accompanied by verification from appropriately experienced and qualified practitioner(s) that the amended Wetland Restoration Plan meets the Conditions of this resource consent (including the objective under Condition 27.3). Regional Council's certification shall be limited to that the amended Wetland Restoration Plan:</p> <p>(a) Complies with Conditions 27.2 and 27.4 of this resource consent;</p> <p>(b) Adopts the best practicable option(s); and</p> <p>(c) Contains provisions that are enforceable.</p>
Water levels and flows	<p>30.1 No less than 10 working days prior to the Stage 1 commissioning of the diversion control structure, the Consent Holder shall commence permanent water level monitoring at the following sites:</p> <p>(f) Kaituna River at Te Matai (map reference U14: 064 734) including flow rate;</p> <p>(g) Kaituna River in the vicinity of the Ford Road pump station (map reference 1,900,715 E, 5,815,802N NZTM);</p> <p>(h) Ongatoro/Maketu Estuary at Maketu township;</p> <p>(i) Fords Cut downstream of the diversion control structure. The monitoring device shall be suitable to be used for making operational decisions about the volume of water to be released into Ford's Cut; and</p> <p>(j) Sea level data obtained from the NIWA gauge at Tauranga (Moturiki) or alternative sea level gauge suitable for the purpose.</p> <p>30.3 Data from the sites specified in Condition 30.1 of this resource consent shall be used to manage the flow regime through the diversion control structure in accordance with the OMM for the Project.</p> <p>30.4 The Consent Holder shall validate the DHI model findings for tidal inflow and outflow volumes in the lower Kaituna River.</p> <p>(a) Within 3 months of this consent being exercised, the Consent Holder shall commission a study by a suitably qualified independent person(s), with the aim of testing the validity of the DHI model findings for tidal inflow and outflow volumes in the lower Kaituna River.</p> <p>(b) The inflow and outflow shall be measured over a tidal cycle in the reach of river shown in BOPRC Plan Number RC67958/12. Four measurements shall be undertaken - two before construction work commences but within 5 years of Stage 1 commissioning (Pre-Project) and two within 12 months after the Commissioning of the diversion control structure (Post-Project).</p>

	<p>(c) The Pre-Project measurements will be taken when the river is at a "low flow" and there is no significant wave climate. For this Condition "low flow" is deemed to be 29 cumecs or less as measured at the Te Matai gauging station on the Kaituna River. "No significant wave climate" is deemed to be a mean wave height of less than 0.5m as measured at the Bay of Plenty Regional Council wave buoy 13 km off Pukehina Beach. In the event that the Conditions above do not eventuate, the measurements may be taken when the river is at or near its minimum annual flow.</p> <p>(d) The Post-Project measurements shall be made when the river flow is at the same flow as the Pre-Project flow (+/-2 cumecs) and during the same tidal range (+/-5cm) with wave and bar Conditions as similar as reasonably practical.</p> <p>(e) The study shall calculate the ebb tide (Le. outflow) volume and the flood tide (Le. inflow) volume for the four measurements.</p> <p>(f) The tidal volumes shall be used to validate the DHI model findings. This will be done by comparing the two measured Post-Project ebb tide volumes with the two measured Pre-Project ebb tide volumes (with any adjustments for minor differences in river lows or tidal range) to check the percentage differences relative to those predicted by the modelling.</p> <p>(g) If any of the two post-Project measured ebb tide volumes are found to be less than any of the two Pre-Project ebb tide volumes by 20% or more, mitigation measures shall be undertaken to ensure the actual flows are within 20% for "low flow" river Conditions.</p>
Erosion and Bed Levels	<p>Condition 31.1: Prior to the commencement of works authorised under this resource consent, the Consent Holder shall undertake transect monitoring in the vicinity of Papahikahawai Island to monitor for any erosion as a result of the re-diversion, as follows:</p> <p>(a) An initial survey of the full width of the bunds, extending 20 metres landward of the sand bund; and thereafter</p> <p>(b) Permanently marked transects be located at four sites to the west and south of the island with each transect extending from the seaward face or toe of the existing sand bund to at least 50 metres offshore to pick up changes in near shore depths over time.</p> <p>(c) The transects shall be undertaken using Real Time Kinematic Global Positioning System.</p> <p>(d) Transects shall be measured as follows:</p> <p>(i) Annually from the commencement of construction until Stage 1 commissioning of the diversion control structure; and then</p> <p>(ii) Twice a year for three years following Commissioning and thereafter</p> <p>31.2 The Consent Holder shall survey:</p> <p>(a) The two transects (Maketu Spit 1 & 2) shown in BOPRC Plan Number RC67958/12, with each survey of the transects to extend from at least midtide on the ocean side to at least low tide on the harbour side; and</p> <p>(b) The seaward toe of the dune or eroding bank over the "Dune Toe Monitoring Area" shown in BOPRC Plan Number RC67958/12.</p> <p>31.3 The first survey under Condition 31 .2 of this resource consent shall be undertaken at least one month prior to Stage 1 commissioning and thereafter annually for a period of five years. After five years of annual surveys the frequency of the survey shall be assessed as part of the reporting requirements of Condition 29.3. The purpose of the survey is to monitor for any aggradation or erosion as a result of the re-diversion</p>

31.4 The Consent Holder shall undertake surveys at Maketu Township and Beach Road to monitor for any erosion or aggradation as a result of the diversion as follows:

- (a) A shoreline survey using Real Time Kinematic Global Positioning System in the area shown on BOPRC Plan Number RC67958/12 along the dune toe or seaward edge of the vegetation;
- (b) A minimum of six cross sections in total with two along Beach Road and four distributed around Maketu township from Park Road foreshore extending to no less than 75 metres past the immediate Whakauae marae foreshore. Each section shall extend to no less than 50 metres offshore;
- (c) Bed and channel depths within the boat ramp access channel from Maketu Boat Ramp to 100 metres seaward; and
- (d) The survey and transects shall be measured at least one month prior to Stage 1 commissioning and thereafter annually for five years. After five years of annual surveys the frequency of the survey shall be assessed as part of the reporting requirements of Condition 29.3.

31.5 (a) The Consent Holder shall undertake a Real Time Kinematic Global Positioning System survey along both banks of the Lower Kaituna River and Ford Island as shown on BOPRC Plan Number RC67958/12 every five years from Commissioning.

- (b) The Consent Holder shall annually obtain the survey data from the Bay of Plenty Regional Council cross sections FEM 1-12 and 14-15 and XS KN2- 4. The data shall be obtained for the purpose of establishing the rate of erosion. Where monitoring sites cease to operate, the Consent Holder shall establish a new site(s) to ensure compliance with the cross section requirements of this resource consent.
- (c) The information collected under 31.5(a) and (b) shall be analysed every 5 years. In the event that the analysis shows a material increase in erosion has occurred, the Consent Holder shall engage a suitably qualified independent expert to assess whether the erosion is attributable to the Project. "Attributable to the Project" means any erosion that is materially greater than the rate and / or magnitude that is occurring naturally or as a result of river works undertaken prior to the exercise of this consent.
- (d) The Consent Holder must submit the report prepared by the expert under 31.5(c) to the Regional Council for review. A copy of the report shall also be provided to the Te Tumu Landowners Group. Should the Regional Council find the conclusions reached in this report unsatisfactory, the Consent Holder shall undertake further reporting as directed.
- (e) In the event that the final report concludes that erosion is attributable to the Project, the Consent Holder shall, within 12 months, apply to vary these Conditions, under section 127 of the RMA, in order to provide appropriate mitigation and / or appropriate compensation.

<p>Water Quality and Shellfish</p>	<p>32.4: <i>From Stage 1 commissioning, the Consent Holder shall undertake water quality monitoring three times every year during the periods December to March (inclusive) at high tide and low tide. Samples shall be collected from Ford’s Cut, the mid estuary and at Maketu boat ramp, and analysed for: (a) Total nitrogen; (b) Nitrate-nitrite nitrogen; (c) Total ammoniacal nitrogen; (d) Total Phosphorus; (e) Dissolved Reactive Phosphorus; (f) Salinity; (g) Faecal coliform bacteria; and (h) Enterococci bacteria.</i></p> <p><u>Note Conditions 32.1, 32.2 and 32.3 which relate to monitoring of water quality using data loggers are not required to be undertaken at this point in time and hence not covered. These Conditions will be required again at five years from Commissioning and reported again in 2026.</u></p> <p>32.5: <i>From Stage 1 commissioning, the Consent Holder shall undertake shellfish flesh and water quality sampling at low tide on three occasions every year for each of the periods December to March (inclusive) and June to August (inclusive).</i></p> <p>32.6: <i>The samples required by Condition 32.5 shall be collected at three sites in the lower to mid Ongatoro/Maketū Estuary and contain a minimum of five shellfish and associated water quality samples taken from the same site, comprising a minimum of: (a) Two pipi; and (b) Two cockle samples</i></p> <p>32.7: <i>The shellfish and water quality samples required by Conditions 32.5 and 32.6 shall be tested for Faecal Coliform and Enterococci bacteria concentrations.</i></p> <p>32.8: <i>Annually, from Stage 1 commissioning for a period of five years, the Consent Holder shall undertake a pipi survey in the lower estuary for the period December to March (inclusive) comprising a minimum of eight replicate cores along a transect parallel to the channel. All shellfish in the cores shall be identified and counted in 5.0-millimetre size classes</i></p> <p>32.9: <i>Annually, from Stage 1 commissioning for a period of five years, the Consent Holder shall sample shellfish at three sites in the mid estuary during the period December to March (inclusive) comprising eight replicate sediment cores randomly collected over a 10-metre radius of the site location. All shellfish in the cores shall be identified and counted in 5.0-millimetre size classes.</i></p>
<p>Ecology (Fauna)</p>	<p>33.1: <i>The Consent Holder shall undertake broad scale mapping of algae distribution and species in the estuary annually from Stage 1 commissioning for a period of five years. Reporting shall generally be in the form of Figure 2.1, page 6 of Hamill (2014) “Kaituna River Re-diversion Project: Ongatoro/Maketū Estuary Condition and potential ecological effects” of the application material.</i></p> <p>33.2: <i>The Consent Holder shall undertake a survey of benthic macrofauna at the eight sites identified on BOPRC Plan Number RC67958/12 and one site Papahikahawai Island lagoon and one at the end of Papahikahawai Creek as follows: (a) Infauna shall be sampled using eight replicate sediment cores randomly collected within a 10 metre radius of the site location and the macrofauna identified; (b) Epifauna shall be surveyed using eight randomly placed 0.25 m2 quadrats and: (c) The survey will be undertaken once within two years of Commissioning and then again at five years from commissioning.</i></p> <p>33.3: <i>At the location of each macrofauna replicate required by Condition 33.2 measurements shall also be taken of the following variables using methods consistent with those used for Condition 35.3: (a) Algae cover and type: (b) Percent cover of mud/silt: (c) Depth of mud/silt: and (d) Anoxic depth (that is depth of RPD (redox potential discontinuity)).</i></p>

<p>Sediment & Algae</p>	<p>35.1: <i>The Consent Holder shall undertake a survey of sediment and algae in the estuary as follows: (a) Along a minimum of three transects in the upper estuary; (b) Along a minimum of three transects in the mid-estuary, (including one at the downstream end of Papahikahawai Creek); and (c) Along a minimum of one transect in the lower estuary.</i></p> <p>35.2: <i>The sediment survey shall be undertaken: (a) Once prior to the Stage 1 commissioning of the diversion control structure; (b) Once within one year of the Stage 1 commissioning of the diversion control structure; (c) Once within two years of the Commissioning of the diversion control structure; and (d) Once within five years of the Commissioning of the diversion control structure.</i></p> <p>35.3: <i>Variables assessed during the sediment survey shall include: (a) Algae cover and type; (b) Percent cover of mud/silt; (c) Depth of mud/silt; and (d) Anoxic depth (that is, depth of RPD (redox potential discontinuity)).</i></p>
<p>Ecology (Flora)</p>	<p>34.1 <i>The Consent Holder shall undertake vegetation transect monitoring to determine the effects of the re-diversion on terrestrial and wetland vegetation as follows:</i></p> <p>34.2 <i>Transects should be measured using the methodology from section 3.1.5.1, on pages 18 to 20, of MacGibbon (2014) 'Kaituna River Re-diversion Project: Ongatoro/Maketu Estuary Enhancement Project – Terrestrial, Avian and Wetland Ecology' provided as part of the application material in the locations shown on BOPRC Plan Number RC67958/12.</i></p> <p>34.3 <i>In the event that access to Transects 6 and 8 cannot be gained from the landowner, there is no requirement to monitor. The Consent Holder shall notify the Regional Council in writing within 10 working days of access being denied identifying the attempts made to gain access.</i></p> <p>34.4 <i>The salt marsh remnants and the small Sacocornia patch in Papahikahawai Creek shall be monitored using photopoint monitoring. Surveys shall be carried out annually from Stage 1 commissioning for a period of five years.</i></p> <p>34.5 <i>The vegetation composition and spatial extent along the true left bank of the re-diversion channel shall be surveyed prior to river re-diversion and monitored 6 monthly for a period of two years following Commissioning. In the event that any die back is observed, the dead plants shall be replaced with alternative salt tolerant plants as soon as practicable.</i></p> <p>34.6 <i>Any observed die back and subsequent replacement planting shall be reported on under sub-clause 29.1(vi) of this resource consent.</i></p>
<p>Community Relationships</p>	<p>36.1 <i>No less than 20 working days prior to works commencing, the Consent Holder shall facilitate and resource a public information session for the purposes of discussing the scheduling and staging for works and expectations regarding communication between the Consent Holder and the community.</i></p> <p>36.2 <i>In addition to the community in general, the Consent Holder shall, as a minimum, directly invite the following parties to the public information session required by Condition 36.1 of this resource consent:</i></p> <p><i>(a) Department of Conservation;</i> <i>(b) Fish & Game;</i> <i>(c) Tangata Whenua;</i> <i>(d) The Manager of the Kaituna Catchment Control Scheme;</i> <i>(e) Coastguard Maketu;</i></p>

- (f) *Maketu Ongatoro Wetland Society Incorporated;*
- (g) *Maketu Community Board;*
- (h) *Te Maru o Kaituna;*
- (i) *R.D. & S.F. Waterhouse Partnership;*
- (j) *Te Tumu Landowners Group;*
- (k) *Vernon Wills;*
- (l) *Maketu Taiapure Committee of Management;*
- (m) *Maketu Project Team;*
- (n) *Chairman of the Papahikahawai Trust; and*
- (o) *Western Bay of Plenty District Council.*

36.3 Following the public information session required by Condition 36.1 but prior to the commencement of the works authorised by this resource consent, the Consent Holder shall prepare and submit to the Regional Council and the District Council a Community Relationship Plan.

36.4 The objective of the Plan is to enable Tangata Whenua, the general public and stakeholders to be kept informed of the works and initiatives being undertaken and to facilitate the free flow of information between the Consent Holder and these parties. Report Date: 18 August 2017 Report ID: BRCCONRP042 Page: 33 of 85

36.5 As a minimum, the Community Relationship Plan shall:

- (a) *Identify the frequency of communication, taking into account different phases of the Project (such as the works phase, wetland works, and monitoring and reporting phases); and*
- (b) *As a minimum, make provision for Public Information Sessions as follows:*
 - (i) *Once every three months during the construction phase;*
 - (ii) *Once per year for the first five years following Stage 1 commissioning of the diversion control structure; and then*
 - (iii) *Once every two years for the duration of the consent.*
- (c) *Identify an agreed method(s) for providing information, such as a website or other form of communication;*
- (d) *Identify the nature of information to be made available, including progress updates on the project, monitoring results, summaries of reports and complaints received with respect to the Project;*
- (e) *Identifying the procedures for providing feedback to the Consent Holder on the implementation of the project.*

36.6 The Consent Holder shall directly invite, in writing, those parties prescribed in Condition 36.2 to the ongoing Public Information Sessions required by Condition 36.5 of this resource consent.

36.7 The Consent Holder shall keep minutes of the Public Information Sessions required by Condition 36.5 of this resource consent. The minutes shall record:

- (a) *The names of those who attended the meeting;*
- (b) *Main topics of discussion; and*
- (c) *Any agreed outcomes.*

The Consent Holder shall forward a copy of these minutes to the Regional Council within 20 working days of the meeting being held.

	<p>36.8 <i>The Consent Holder shall resource and implement the Community Relationship Plan to the satisfaction of the Regional Council.</i></p> <p>36.9 <i>The Community Relationship Plan may be amended at any time. A copy of the amended plan shall be provided to the Regional Council.</i></p>
<p>Tangata whenua collaboration plan</p>	<p>8A.1 <i>Prior to Stage 1 commissioning, the Consent Holder, in collaboration with Tangata Whenua, shall prepare and submit to the Regional Council and District Council for certification a Tangata Whenua Collaboration Plan. The objective of the Plan is to provide, to the extent reasonable and practicable, for the active involvement of Tangata Whenua, including each group individually, at all stages of the Project and its implementation.</i></p> <p>8A.2 <i>The purpose of the Plan is to identify the process and extent of involvement by Tangata Whenua in:</i></p> <ul style="list-style-type: none"> <i>(i) Developing the detail of the restoration activities for the Project;</i> <i>(ii) The delivery of the restoration activities; and</i> <i>(iii) Monitoring the effectiveness of the restoration activities.</i> <p>8A.3 <i>As a minimum the Plan shall detail:</i></p> <ul style="list-style-type: none"> <i>(a) How and when Tangata Whenua will be involved with planning and implementation of:</i> <ul style="list-style-type: none"> <i>(i) wetland restoration;</i> <i>(ii) monitoring in the estuary and the river; and</i> <i>(iii) any other matter identified through the development of the Plan;</i> <i>(b) removed by Environment Court</i> <i>(c) Opportunities for providing improved tuna and inanga fish passage and habitat;</i> <i>(d) How local cultural knowledge may be incorporated in monitoring of the effects of the Project</i> <i>(e) Mechanisms for enabling local employment and providing education opportunities for Tangata Whenua, including making material and knowledge available for educational use;</i> <i>(f) removed by Environment Court</i> <i>(g) A process for Tangata Whenua to have input into and provide feedback on the annual report prepared under Condition 29 prior to its lodgement with the Regional Council.</i> <p>8A.4 <i>The Tangata Whenua Collaboration Plan may consist of several sub-plans developed with the different Tangata Whenua groups, to recognise the unique and diverse interests and values of different Tangata Whenua groups, and to take into account the recommendations of the Cultural Impact Assessments prepared by the different groups.</i></p> <p>8A.5 <i>In the event that the Consent Holder and Tangata Whenua are unable to agree on the contents of the Plan, or in relation to a sub-plan the contents of that sub-plan</i></p> <ul style="list-style-type: none"> <i>(a) The Consent Holder, following consultation with Tangata Whenua and the Regional Council, shall engage a suitably qualified independent cultural expert to consider the draft contents of the Plan and the views of the parties and make a recommendation on the appropriate contents of the Plan or subplan, having had regard to the objectives, purpose, and minimum requirements of the Plan and whether the contents are reasonable and proportionate in the context of the proposal</i> <i>(b) When submitting the Plan to the Regional Council for certification, the Consent Holder shall identify any recommendations provided in accordance with Condition 8A.5(a) that have not been adopted and give the reasons for not adopting those recommendations</i> <i>(c) The independent expert may consult directly with Tangata Whenua as necessary in order to fulfil his or her functions under these Conditions prior to making a recommendation</i> <p>8A.6 <i>The Tangata Whenua Collaboration Plan, including any of its</i></p>

sub-plans, may be amended from time to time by the Consent Holder with the agreement of Tangata Whenua. Where a proposed amendment to the Plan or sub-plan does not affect all Tangata Whenua, the agreement is only required with the group(s) affected. A copy of the amended plan shall be provided to the Regional Council.

Mauri Monitoring Plan

8B.1 Prior to Stage 1 commissioning the Consent Holder, in collaboration with Tangata Whenua shall prepare and submit to the Regional Council a Mauri Monitoring Plan. The objective of the Plan is to identify whether a decline in mauri is occurring over time as a result of the Project.

8B.2 The purpose of the Plan is to identify the process and methods for monitoring the impact of the Project on mauri over time.

8B.3 As a minimum the Plan shall include:

- (a) The methodology to be used to monitor the effects of the Project on mauri;
- (b) The indicators of mauri potentially adversely affected by the Project, the baseline Condition of those indicators, and thresholds that will be used to identify whether mauri is declining over time as a result of the Project;
- (c) The frequency of monitoring to be undertaken, including any possible changes in frequency over time; and
- (e) A process for reporting of results and sharing of information between the Consent Holder and Tangata Whenua, including meeting to discuss preparation of the Annual Plan required under Condition 29.1 prior to it being submitted to the Regional Council.

8B.4 The Plan may consist of several sub-plans developed with the different Tangata Whenua groups, to recognise the unique and diverse interests and values of different Tangata Whenua groups, and to take into account the recommendations of the Cultural Impact Assessments prepared by the different groups.

8B.5 In the event that the Consent Holder and Tangata Whenua are unable to agree on the contents of the Plan, or in relation to a sub-plan the contents of that sub-plan.

(a) The Consent Holder, following consultation with Tangata Whenua and the Regional Council, shall engage a suitably qualified independent cultural expert to consider the draft contents of the Plan and the views of the parties and make a recommendation of the appropriate contents of the Plan or subplan having had regard to the objectives, purpose, and minimum requirements of the Plan and whether the contents are reasonable and proportionate in the context of the proposal.

(b) When submitting the Plan to the Regional Council for certification, the Consent Holder shall identify any recommendations provided in accordance with Condition 8B.5(a) that have not been adopted and give the reasons for not adopting those recommendations.

(c) The independent expert may consult directly with Tangata Whenua as necessary in order to fulfil his or her functions under these Conditions prior to making a recommendation.

The Mauri Monitoring Plan, including any of its sub-plans, may be amended from time to time by the Consent Holder with the agreement of Tangata Whenua. Where a proposed amendment to the Plan or sub-plan does not affect all Tangata Whenua, the agreement is only required with the group(s) affected. A copy of the amended plan shall be provided to the Regional Council.

8B.7 Notwithstanding this Condition or any other Condition, Tangata Whenua may at any time make recommendations directly to the Consent Holder or to the

	<p><i>Regional Council on measures to be undertaken to address or mitigate cultural impacts arising due to the operation of the Project.</i></p>
<p><i>On-going Maintenance (Mooring Basin Survey)</i></p>	<p><i>In the event the mooring facilities are provided under Condition 17.2, the Consent Holder shall:</i></p> <p><i>(a) ensure the water depth at Mean Spring Low Tide of the mooring basin and the Kaituna River between the basin in the area identified on BOPRC Plan Number RC67958/12 is maintained at no less than 1 metre.</i></p> <p><i>(b) assess the water depth at the request of the Maketu Coastguard or R.D. & S.F. Waterhouse Partnership through the Bay of Plenty Regional Harbour Master. If the water depth at Mean Spring Low Tide is less than 1 metre as a result of sediment deposition, then the Consent Holder shall remove the deposited sediment from the shallow areas to provide for that depth.</i></p> <p><i>(c) In the event that the log deflector is not installed, the Consent Holder is not required to maintain the area identified as red hash on BOPRC Plan Number RC67958/12.</i></p>
<p><i>Lower Kaituna Wildlife Management Reserve</i></p>	<p><i>23.1 The operation of the diversion control structure shall not reduce the water inflows into the Lower Kaituna Wildlife Management Reserve as a result of lower water levels in the Kaituna River at the intake culverts.</i></p> <p><i>23.2 The Consent Holder shall prepare an Investigation Plan to determine the relationship between water levels in the Kaituna River, the water level in the wetland, and the flows into the wetland. The purpose of the Investigation Plan is to determine the requirements for the additional culvert required under Condition 23.3 below. The Investigation Plan shall specify:</i></p> <ul style="list-style-type: none"> <i>(a) exact monitoring locations,</i> <i>(b) parameters to be monitored,</i> <i>(c) frequency and duration of monitoring,</i> <i>(d) the instrument type and its sophistication and power needs,</i> <i>(e) the data retrieval method and the labour resources required, and</i> <i>(f) any other requirements.</i> <p><i>The Investigation Plan shall be prepared in conjunction with the Department of Conservation, Fish and Game and Bay of Plenty Regional Council Natural Hazards Group, and shall be informed by at least 12 months of data collection prior to the design of the additional culvert.</i></p> <p><i>23.3 In consultation with the Department of Conservation and Fish and Game, the Consent Holder shall submit a final plan for the additional culvert to the Lower Kaituna Wildlife Management Reserve for the certification of the Regional Council. This plan and certification shall include:</i></p> <ul style="list-style-type: none"> <i>(a) The final location of the culvert, which is to be somewhere between Intakes 1 and 2 as shown on the 'Location Plan' provided with the Applicant's S92 Request on the 1st of September 2014 by way of a letter prepared by Opus entitled 'Resource Consent Application 67958 - Kaituna River Re-Diversion and Ongatoro/Maketu Estuary Enhancement- Response to Further Information Request';</i> <i>(b) The diameter of the culvert, which is to be no less than 0.9 metres;</i> <i>(c) The provision of measures to allow fish passage;</i> <i>(d) Erosion and scour protection at the inlet and outflow points;</i> <i>(e) Maximum earthworks volume of no greater than 5,000 cubic metres;</i> <i>(f) Confirmation from an appropriately qualified and experienced practitioner(s) that the culvert and associated structures have been designed to an engineering standard that is suitable for their intended purposes and functions; and</i>

	<p>(g) A Monitoring Plan to demonstrate the additional culvert is providing the mitigation flow it is designed to provide. The Monitoring Plan shall identify the:</p> <ul style="list-style-type: none"> i) exact monitoring locations ii) parameters to be monitored iii) frequency and duration of monitoring iv) the instrument type and its sophistication and power needs v) the data retrieval method and the labour resources required, and vi) any other requirements. <p>The Monitoring Plan shall be prepared in conjunction with the Department of Conservation and Fish and Game. As a minimum, one monitoring site shall be within the Kaituna River and one within the Lower Kaituna Wildlife Management Reserve.</p> <p>23.4 The Consent Holder shall install the additional culvert to the Lower Kaituna Wildlife Management Reserve prior to commencing Stage 1 commissioning.</p>
Operations and Maintenance Manual	26.1 – 26.12
Five Yearly Annual Report Peer Review	<p>29A.1 The Consent Holder shall appoint an independent peer review panel following consultation with the Regional Council and Tangata Whenua.</p> <p>29A.2 The peer review panel must comprise three independent experts each suitably qualified and experienced in at least one of ecological, cultural or hydrological, engineering or coastal matters of relevance to the Project, except that there must at all times be an expert in cultural matters.</p> <p>29A.3 The Consent Holder must submit the annual report as well as all preceding annual reports submitted in accordance with Condition 29 to the independent peer review panel for review.</p> <ul style="list-style-type: none"> (a) On the 1st August of the year following Stage 1 commissioning; and (b) Once every five years thereafter for the duration of the consent. <p>29A.4 The role of the peer review panel is to provide for an integrated and independent review of the technical and cultural aspects of the annual reports and make recommendations to the Consent Holder on measures to address any identified adverse effects attributable to the Project.</p> <p>29A.5 The peer review panel must provide a draft written report to the Consent Holder within 2 months of receiving the annual reports under Condition 29A.3, including any recommendations as it considers appropriate. The final written report must be submitted to the Consent Holder, the Regional Council and Tangata Whenua within 3 months of receiving the annual reports under Condition 29A.3.</p> <p>29A.6 The peer review panel may consult directly with the Consent Holder and Tangata Whenua if necessary in order to fulfil its role under Condition 29A.4.</p> <p>29A.5 The peer review panel may make recommendations to the Consent Authority that a review of Conditions be undertaken for the purpose of avoiding, remedying or mitigating adverse effects attributable to the Project.</p>
Water Levels and Flows (Model Validation)	<p>30.4 The Consent Holder shall validate the DHI model findings for tidal inflow and outflow volumes in the lower Kaituna River.</p> <p>(a) Within 3 months of this consent being exercised, the Consent Holder shall commission a study by a suitably qualified independent person(s), with the aim of</p>

testing the validity of the DHI model findings for tidal inflow and outflow volumes in the lower Kaituna River.

(b) The inflow and outflow shall be measured over a tidal cycle in the reach of river shown in BOPRC Plan Number RC67958/12. Four measurements shall be undertaken - two before construction work commences but within 5 years of Stage 1 commissioning (Pre-Project) and two within 12 months after the Commissioning of the diversion control structure (Post-Project).

(c) The Pre-Project measurements will be taken when the river is at a "low flow" and there is no significant wave climate. For this Condition "low flow" is deemed to be 29 cumecs or less as measured at the Te Matai gauging station on the Kaituna River. "No significant wave climate" is deemed to be a mean wave height of less than 0.5m as measured at the Bay of Plenty Regional Council wave buoy 13 km off Pukehina Beach. In the event that the Conditions above do not eventuate, the measurements may be taken when the river is at or near its minimum annual flow.

(d) The Post-Project measurements shall be made when the river flow is at the same flow as the Pre- Project flow (+/-2 cumecs) and during the same tidal range (+/-5cm) with wave and bar Conditions as similar as reasonably practical.

(e) The study shall calculate the ebb tide (Le. outflow) volume and the flood tide (Le. inflow) volume for the four measurements.

(f) The tidal volumes shall be used to validate the DHI model findings. This will be done by comparing the two measured Post-Project ebb tide volumes with the two measured Pre-Project ebb tide volumes (with any adjustments for minor differences in river flows or tidal range) to check the percentage differences relative to those predicted by the modelling.

(g) If any of the two Post-Project measured ebb tide volumes are found to be less than any of the two Pre-Project ebb tide volumes by 20% or more, mitigation measures shall be undertaken to ensure the actual flows are within 20% for "low flow" river Conditions.

Appendix 2: Written approval to remove requirements of Condition 23.2 - 23.4



File: 2.01.06

10 July 2023

The Manager
Resource Consents
Bay of Plenty Regional Council
P O Box 364
WHAKATANE 3158

To whom it may concern,

Variation of Resource Consent 67958

Fish & Game have been provided information (BOPRC letter 10 July 2023 by Pim de Monchy) pertaining investigations, monitoring and analysis of the relationship between water levels of the Kaituna River since the commissioning of the river re-diversion project and the water inflows required to sustain the Lower Kaituna Wildlife Management Reserve wetland.

This monitoring was to quantify the effects of the diversion on water supply to the wetland, and should it be adverse, a condition within resource consent no. 67958 (23.2) requiring an additional water supply culvert be installed to continue supply of adequate water to sustain the integrity of the wetland's flora and fauna.

The Land Management division of the Bay of Plenty Regional Council have undertaken sufficient monitoring to provide adequate analysis, installed new light weight floodgates enabling better water inflows and undertaken annual aquatic vegetation removal within key internal water reticulation channels within the Lower Kaituna wetland, to mitigate any potential negative effects from pre diversion modelling indicating diminished water inflows into the wetland.

The Land Management division (and Rivers and Drainage division) of the Bay of Plenty Regional Council have additionally entered into an agreement with Fish & Game and the Department of Conservation undertaking regular wetland maintenance to ensure continuance of the adequate water supply into the Lower Kaituna wetland.

Fish & Game are satisfied that acceptable investigations / monitoring has occurred and that mitigation works are providing sufficient water inflows to sustain the integrity of the Lower Kaituna wetland. Consequently, we believe that the requirement of an additional water supply culvert into the wetland from the Kaituna River (as per condition 23.2) is no longer required. Fish & Game approve, as an affected party, a variation to resource consent no. 67958 to reflect this condition removal.

Yours Faithfully

John Meikle
Fish & Game Officer

A handwritten signature in blue ink, appearing to read 'John Meikle', is written over a blue circular stamp.

Statutory managers of freshwater sports fish, game birds and their habitats

Eastern Region

1130 Paradise Valley Rd, Ngongotaha, Private Bag 3010, Rotorua 3046, New Zealand, Telephone (07) 357 5501 Facsimile (07) 357 5503
Email eastern@fishandgame.org.nz www.fishandgame.org.nz



13 July 2023

Bay of Plenty Regional Council
PO Box 364
Whakatāne
Email: Courtney.Bell@boprc.govt.nz

Tena koe Courtney

Variation to Resource Consent 67958

Following final commissioning of the Kaituna River Re-Diversion Project February 2021, this letter provides you with an update on the current position of The Department of Conservation with regards to the water levels in the Lower Kaituna Wildlife Management Reserve (Reserve) and the requirements of Condition 23 of Resource Consent 67958 for the Kaituna River Re-Diversion Project not to reduce water inflow into the Reserve.

Sufficient monitoring of water levels conducted by the Bay of Plenty Regional Council, combined with works carried out to increase efficiencies of the existing inlets and reticulation channels has shown that the relationship between water levels in the Kaituna river, since the commissioning of the re-diversion project, has not had a negative impact on water inflow required to sustain the Lower Kaituna Wildlife Management Reserve wetland.

Based on this information, together with continued monitoring and maintenance to ensure water levels are sustainable for the wetland ecosystem health, The Department of Conservation supports the removal of condition 23.4, the requirement for an additional culvert from Resource Consent 67958.

Naku noa, na

Raponi Te Rangikātukua Wilson
Pou Matarautaki | Operations Manager
Tauranga District | Eastern North Island Region
Phone: 027 254 4043 | rawilson@doc.govt.nz

Tauranga District Office
253 Chadwick Road
Greerton West
Tauranga, 3112
www.doc.govt.nz