TECHNICAL COMMITTEE AGENDA

Wednesday, 12 June 2019

3PM, Council Chamber
Level 2 Philip Laing House, 144 Rattray Street, Dunedin

Membership

Cr Andrew Noone	*(Chairperson)*
Cr Ella Lawton	*(Deputy Chairperson)*
Cr Graeme Bell	
Cr Doug Brown	
Cr Michael Deaker	
Cr Carmen Hope	
Cr Trevor Kempton	
Cr Michael Laws	
Cr Sam Neill	
Cr Gretchen Robertson	
Cr Bryan Scott	
Cr Stephen Woodhead	

Disclaimer

Please note that there is an embargo on agenda items until 48 hours prior to the meeting. Reports and recommendations contained in this agenda are not to be considered as Council policy until adopted.

TABLE OF CONTENTS

1. APOLOGIES
No apologies were advised.

2. LEAVE OF ABSENCE
No leaves of absence were requested.

3. ATTENDANCE

4. CONFIRMATION OF AGENDA
Note: Any additions must be approved by resolution with an explanation as to why they cannot be delayed until a future meeting.

5. CONFLICT OF INTEREST
Members are reminded of the need to stand aside from decision-making when a conflict arises between their role as an elected representative and any private or other external interest they might have.

6. PUBLIC FORUM
No requests to address the Committee Members were received.

7. PRESENTATIONS
No Presentations are scheduled.

8. CONFIRMATION OF MINUTES

Recommendation

That the minutes of the meeting held on 1 May 2019 be received and confirmed as a true and accurate record.

Attachments

1. Minutes - Technical 20190501 **[8.1.1]**

9. ACTIONS
Status report on the resolutions of the Technical Committee

Report	Meeting Date	Resolution	Status
Lake Hayes Restoration	1/8/18	*That the consultant report by Castalia be re-framed into a more public intelligible document.*	COMPLETE
Lake Hayes Restoration	18/10/18	*Dr Palmer to follow up on receipt of the revised Castalia report*	COMPLETE
Lake Snow technical	18/10/18	*The CE engage on the with CEs at the regional CEOs*	

workshop recommendations		*meeting on 8 November 2018 on the primary objectives from the workshop.* *Invite Regional Councils and MPI to formally endorse and support the proposed research programme and to discuss funding arrangements.*	IN PROCESS

10. MATTERS FOR NOTING

10.1. General Manager Operations Report to Technical Committee

Prepared for:	Technical Committee
Report No.	EHS1856
Activity:	Flood Protection & Control Works
Author:	Jean-Luc Payan, Manager Natural Hazards Julie Everett-Hincks, Manager Science
Endorsed by:	Gavin Palmer, General Manager Operations
Date:	12 June 2019

PURPOSE

[1] To update the Council on the following matters:

- South Dunedin and Harbourside geotechnical drilling
- Dart/Rees Flood Hazard
- Flood Hazard of Manuherikia River at Ophir
- Lake Snow in Lake Dunstan
- SH85 (Brassknocker Rd) Stock Truck Effluent Disposal Facility

RECOMMENDATION

That the Council:

1) ***Receives*** *this report.*

SOUTH DUNEDIN AND HARBOURSIDE GEOTECHNICAL DRILLING

[2] As of 28 May 2019, work on the South Dunedin and Harbourside drilling project is progressing well. The project (in association with GNS Science and Oceana Gold and with support from the Dunedin City Council and the University of Otago) is drilling and installing five groundwater monitoring bores in the coastal Dunedin Central Business District area (Harbourside) and drilling two deeper holes (to bedrock) in the South Dunedin area (Figure 1).

[3] Four boreholes have been drilled to completion with a further three remaining (Figure 2). Because the drilling programme has progressed well an extra borehole has been added to the programme.

[4] This project is part of ORC's work on future climate change and natural hazards. The data collected is assisting in gaining a better understanding of the geology of the area and will also be used by ORC to study surface water, tidal and groundwater interactions. The data collected during this project will also be used for the NZ SeaRise research programme, which aims to model the effects of sea level rise on groundwater in coastal aquifers.

[5] Liaison between ORC and DCC staff on each organisation's activities to do with South Dunedin is occurring at an operational level.

[6] 

Figure 1: Drilling to bedrock at Tonga Park (NZSR01), South Dunedin 22 May 2019.

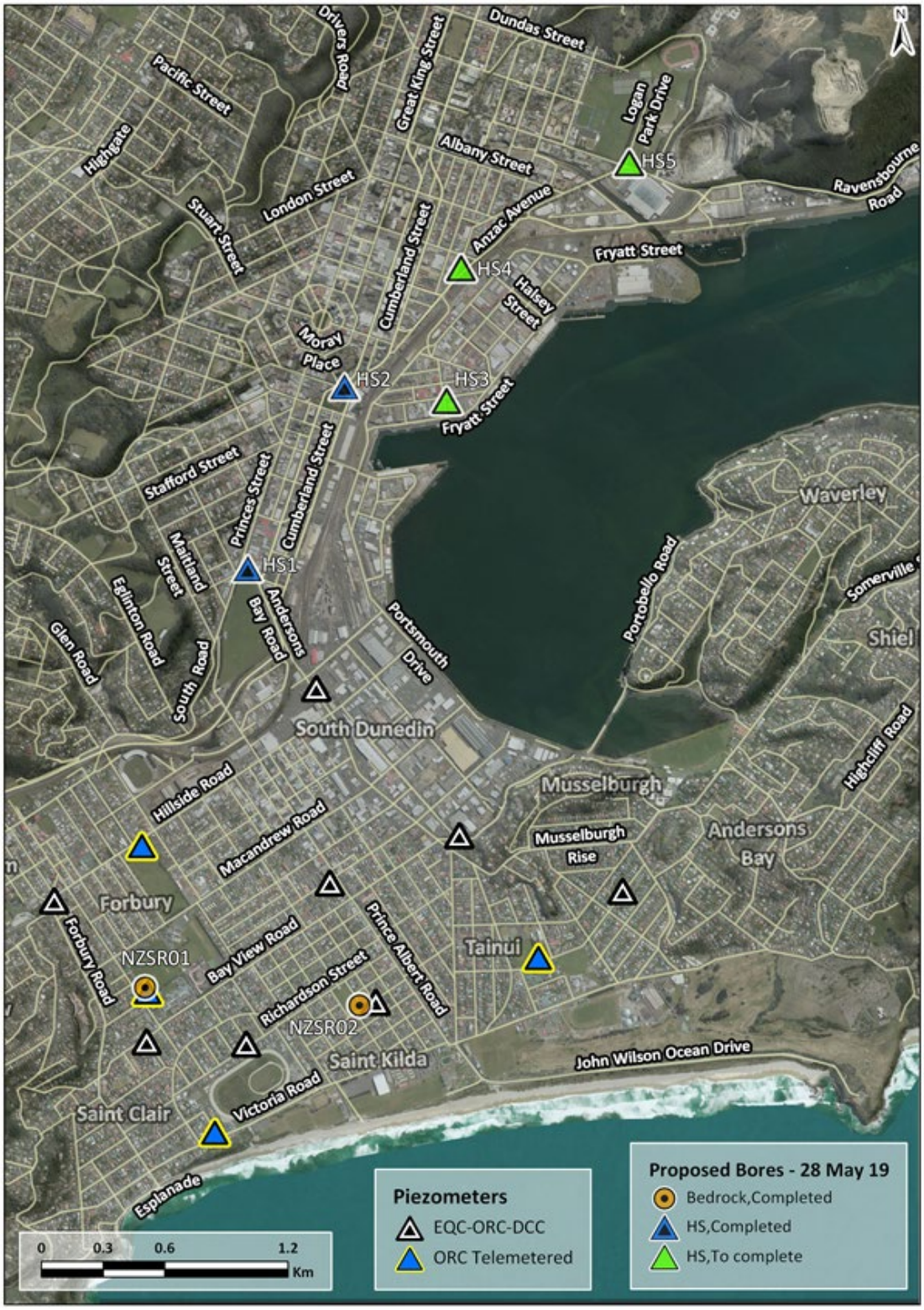

Figure 2: Existing piezometers and proposed borehole locations with progress for locations in the Dunedin central/Harbourside - South Dunedin area.

DART/REES FLOOD HAZARD

[7] Flood events in recent years have increased bank erosion taking place on the true right of the Dart River at the head of Lake Wakatipu. The river bank is of similar elevation (within 1 m typically, Figure 3) of the active Dart River bed. This makes this area prone to erosion during natural shifts of the main Dart River channel over its floodplain. Bed avulsion resulting in channel shifts is a natural process and a characteristic of braided rivers such as the Dart River.

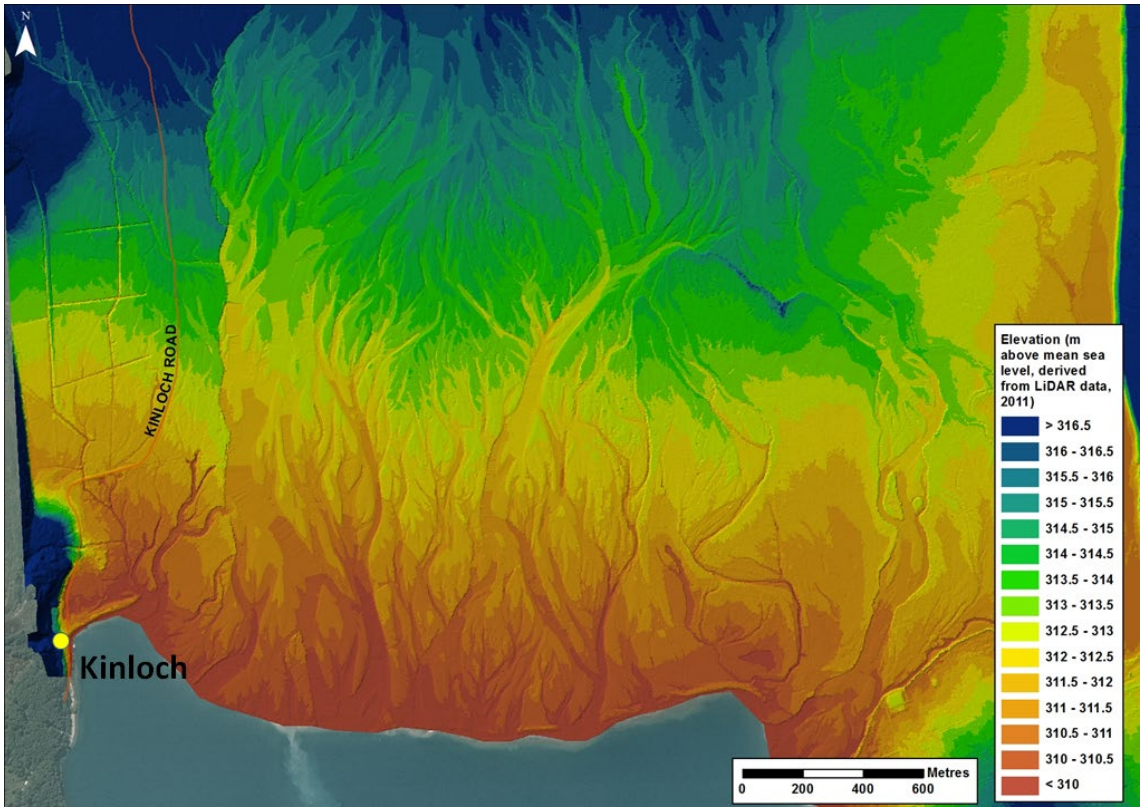

Figure 3: Topography of Dart and Rees River floodplain at the head of Lake Wakatipu derived from LiDAR data (2011)

[8] Kinloch Road, the only terrestrial access to Kinloch, has low lying sections located on the right bank in the Dart River floodplain (Figure 4). The road is affected by bank erosion and flooding and can become impassable during high river flows. This road is used by residents and to access popular tourist attractions, facilities and accommodation.

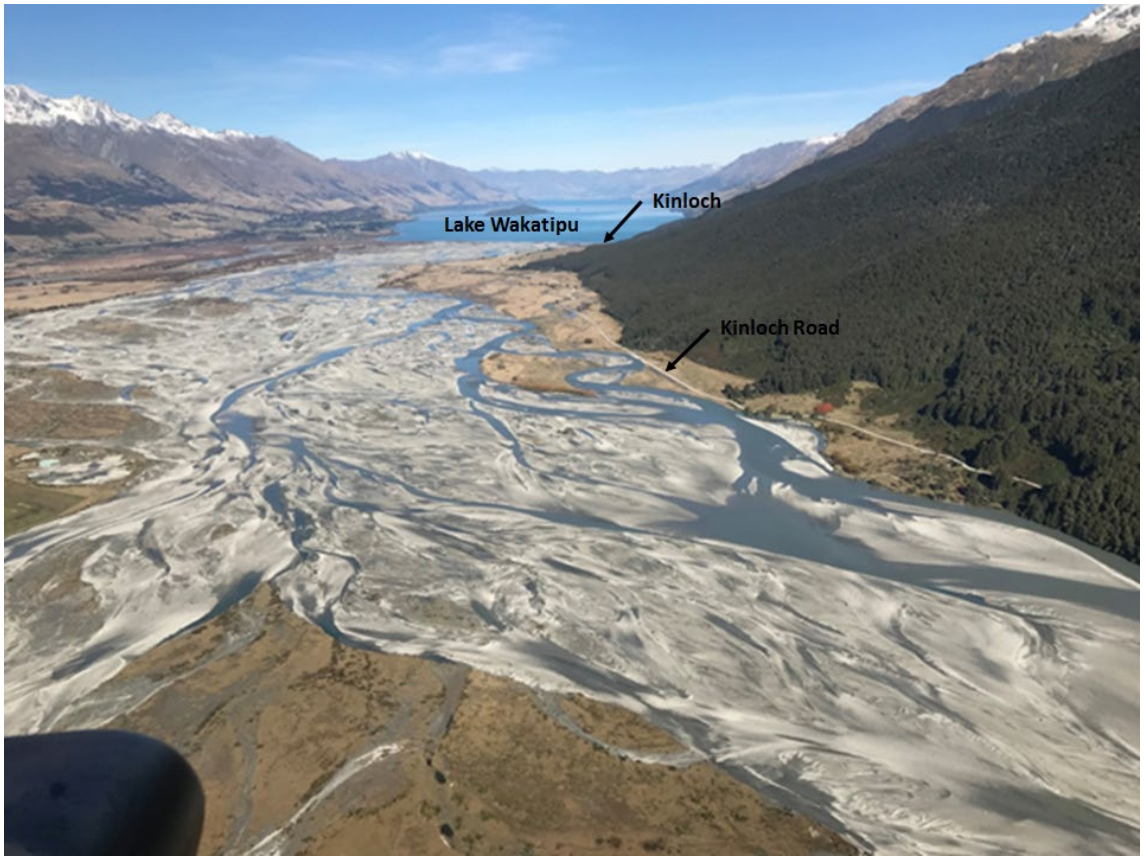

Figure 4: Dart River looking downstream towards Lake Wakatipu – Kinloch Road located on the right of the photograph (photograph taken by Geoffrey Thomson on 1 May 2019).

[9] Queenstown Lakes District Council (QLDC) maintains the road and regularly repair flood and erosion damage.

[10] In 2018, a flood channel broke through a remnant gravel bund between Kowhai and Turner Creeks and ORC agreed with residents and QLDC to reinstate this bund. The work was intended to provide limited protection to the section of Kinloch Road located downstream during small floods (Figure 5).

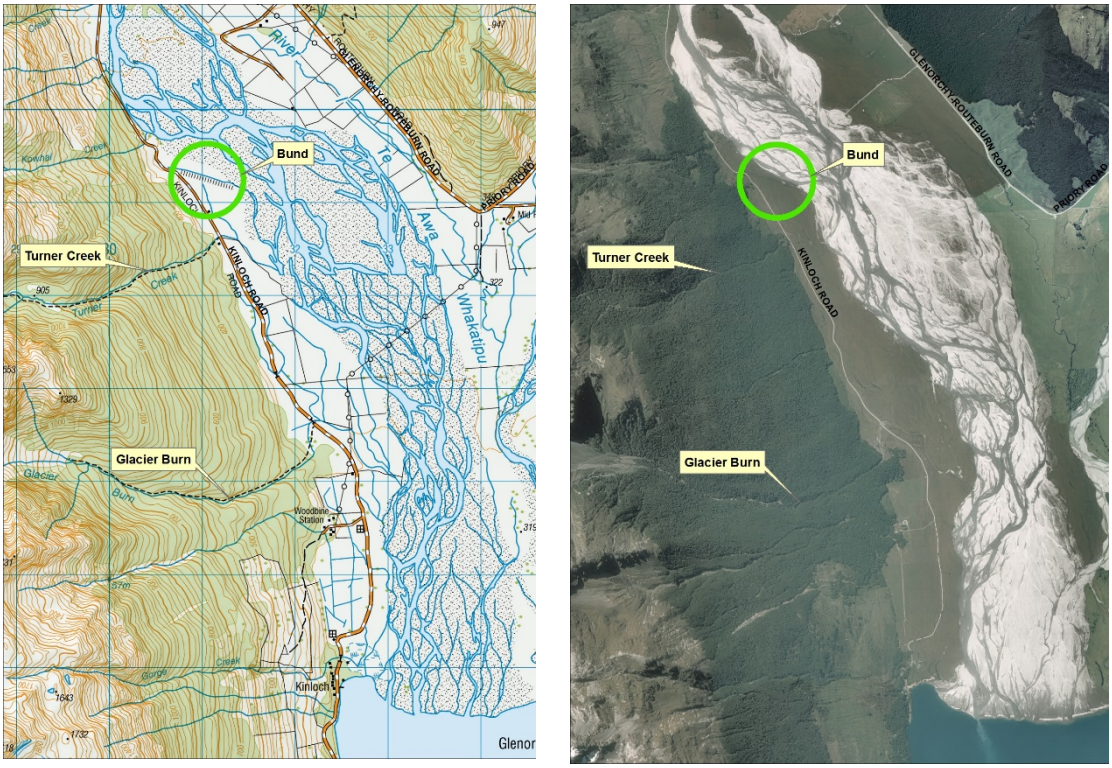

Figure 5: Bund location

[11] The bund was reinstated twice by ORC before it was entirely washed away in the record (since 1996) Dart River flows in March 2019. One active channel is now flowing in proximity to this section of road and the threshold at which Kinloch Road between Turner Creek and Glacier Burn becomes inundated has lowered (Figure 6).

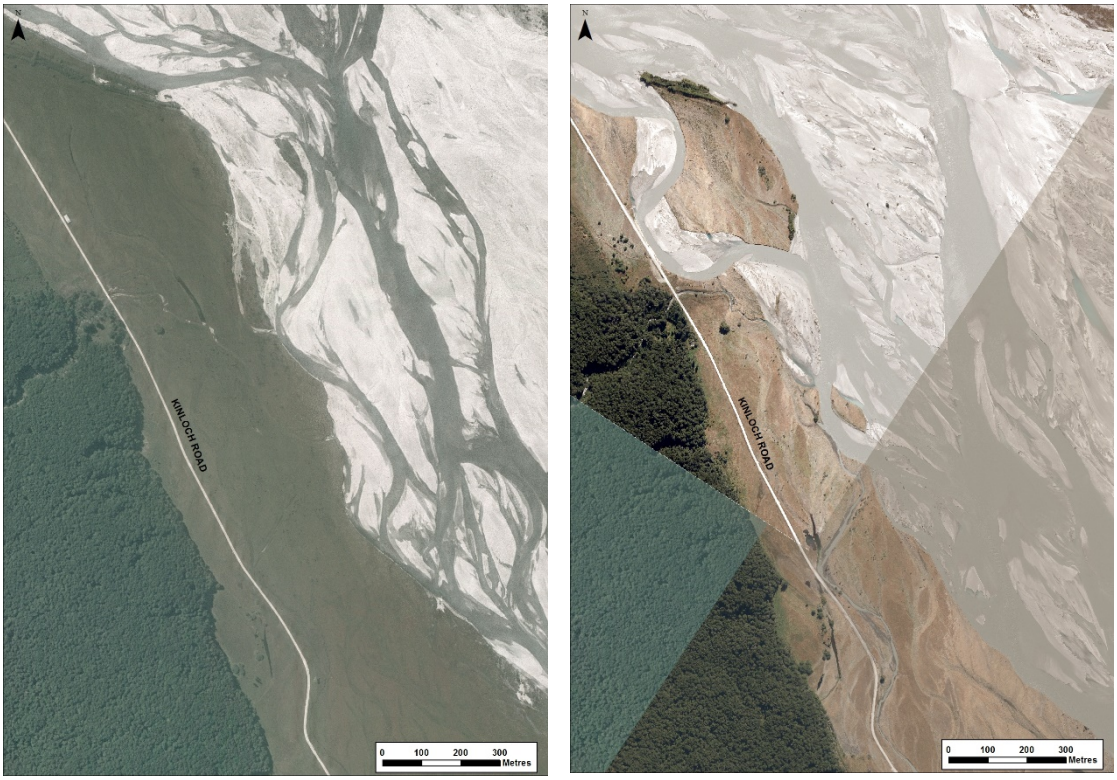

Figure 6: Top: Channel position – 2007 (left) and 2019 post March 2019 high flows (right) Bottom: Kinloch Road flooding between Turner Creek and Glacier Burn – 31 May 2019

[12] The 2018-28 Long Term Plan (LTP) provides an additional $50,000 per year over three years for urgent flood and erosion protection work to assist the protection of vulnerable sections of Kinloch Road. Between July 2018 and May 2019 ORC has spent over $35,000 (excluding staff time) on bank and flood protection work in the Dart and Rees Rivers.

[13] QLDC with assistance from ORC is currently considering short-term immediate options to improve flood and erosion protection to vulnerable sections of Kinloch Road with the intention to carry out the repair work in June 2019, pending on likely consenting requirements.

[14] The 2018-28 LTP also provides for ORC to develop, in collaboration with QLDC and affected communities and stakeholders, a long-term natural hazards adaptation strategy for the wider area located at the northern end of Lake Wakatipu (including Kinloch and Glenorchy). This recognizes that engineering works are unlikely to be sustainable financially or environmentally. Further, there are wider issues that must be considered in a strategic and holistic way including future climate change, multiple and cascading natural hazards and pressure for land use intensification. This two-year project is planned to start in the 2019/20 financial year and has an associated total budget of approximately $80,000 (excluding staff time). Initial work on the long-term natural hazards adaptation strategy has also started. Arrangements are being made to meet with QLDC staff to discuss and agree how to progress this work collaboratively.

[15] Commencing in 2007, ORC funded a PhD studentship project, in collaboration with the University of Canterbury, to study decade-to-century timescale braided, gravel-bed river delta growth dynamics (*Growth Dynamics of Braided Gravel-Bed Deltas in New Zealand*, Michelle Wild, 2013). The Rees-Dart river delta was selected as a study area and results from this project will be considered during the development of the long-term natural hazards adaptation strategy for the northern end of Lake Wakatipu.

[16] Kinloch and Glenorchy are part of the Wakatipu River Management Special Rating District (SRD). The SRD is funded from targeted rates applied to all ratable properties in the Wakatipu Basin.

[17] In the current financial year rateable properties in the Kinloch settlement pay $41.66 in total into the SRD.

FLOOD HAZARD OF MANUHERIKIA RIVER AT OPHIR

[18] In April 2019 ORC completed work to reinstate a section of the Manuherikia River left (south) riverbank and a low-level bund located approximately 1.5 km upstream of the Omakau Bridge (Figure 7). The purpose of the work is to slow the progression of bank erosion and to reduce the risk of the Manuherikia River re-occupying an old river channel on the floodplain. Reoccupation of the channel would increase the likelihood of a permanent and significant realignment of the river and the risk of parts of Ophir being flooded.

[19] Following the November 2018 high flow event in the Manuherikia River, this section was severely eroded resulting in bank damage. A low-level bund located at the same location also collapsed, resulting in significant overland flow (Figure 8). The purpose of the bund was to provide limited flood protection during small floods.

[20] Bank damage in this location occurred in the past and is the result of natural erosion processes, usually more pronounced on the outside river bends (concave side). Bank protection work in this section of the river existed prior to the November 2018 high flow event but were undermined by the high flows observed in November 2018.

[21] The purpose of the work completed in April 2019 is to protect the damaged section of left bank and to reinstate the bund to the pre-November 2018 state. A channel was also formed close on the right bank to guide the river away from the left bank during high flows (Figure 9). Willow trees will be planted at the end of winter 2019 to reinforce the stability of the left bank.

[22] These engineering works are unlikely to be successful in the longer term. Consideration will be given to incorporating a more comprehensive and strategic investigation of management options as a project in the Draft 2021-2031 Long Term Plan. Those options could include removing vegetation from the active river bed to restore channel capacity and give the river room to move.

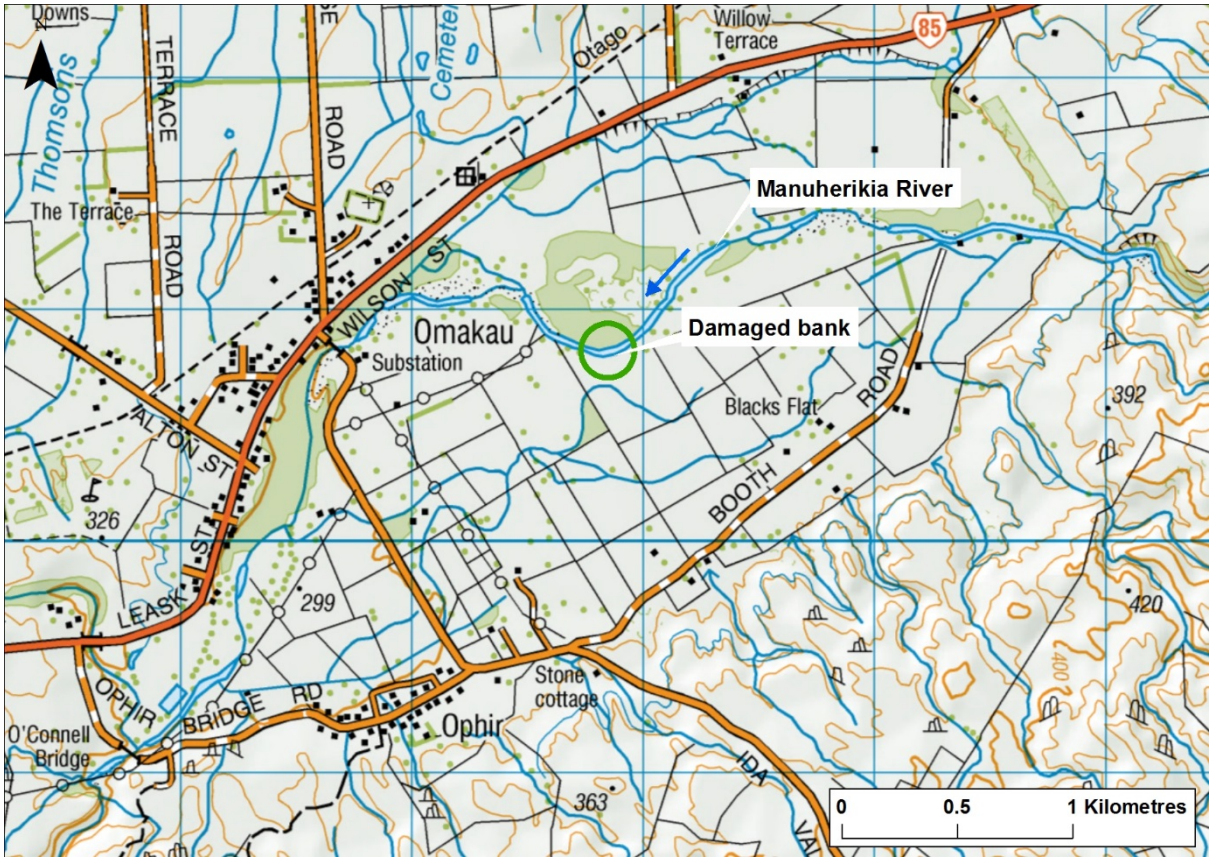

Figure 7: Location of the Manuherikia River breakout near Omakau

Figure 8: Manuherikia River – Left bank overflow – November 2018

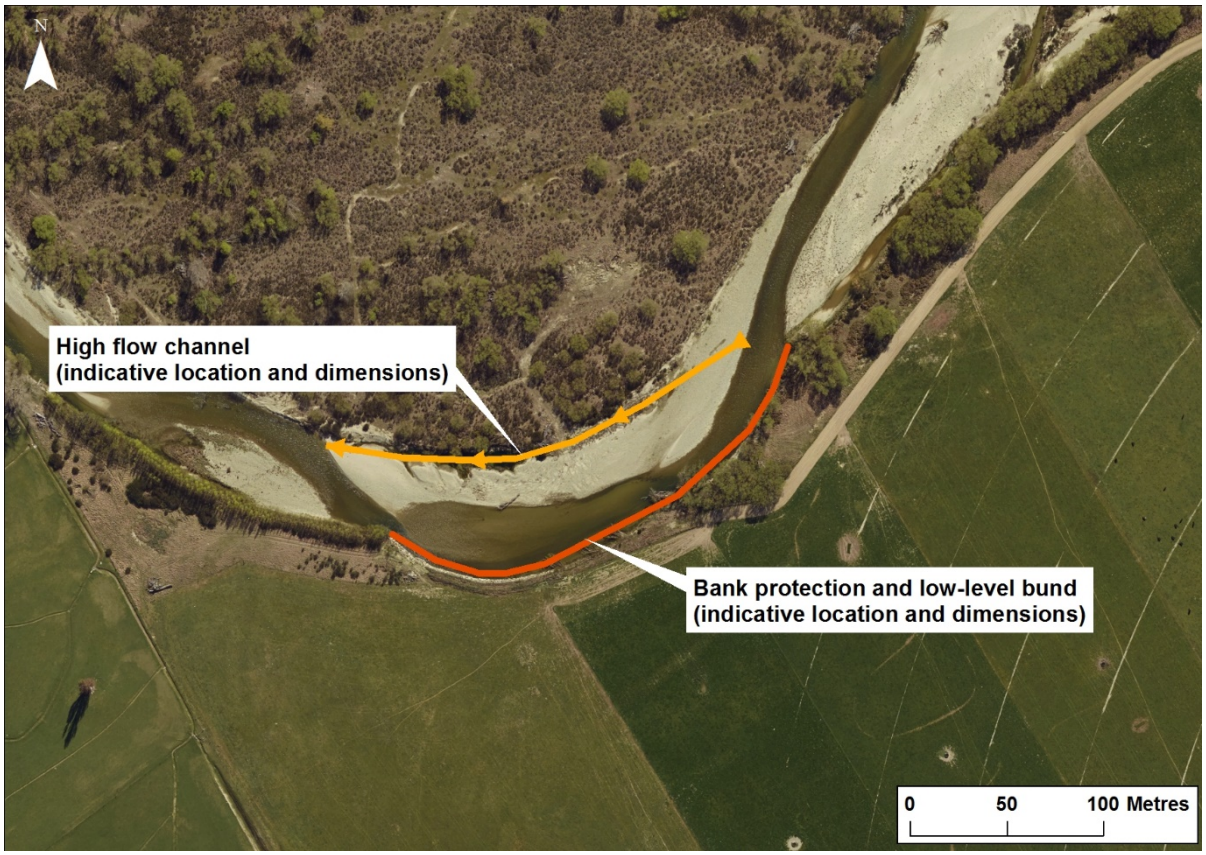

Figure 9: Indicative location and scale of the bank protection work completed in April 2019 on the Manuherikia River approximately 1.5 km upstream of the Omakau Bridge. The river flows from right to left.

LAKE SNOW IN LAKE DUNSTAN

[23] Central Otago District Council (CODC) draws water through bores on the shore of Lake Dunstan for drinking water supply. During a water treatment pilot study, *Lindavia intermedia* was found in the bore water.

[24] Lake snow has not been monitored in Lake Dunstan previously as the lake isn't part of ORC's trophic lake programme. Furthermore, Lake Snow has not been the subject of customer complaints for CODC, unlike the situation seen in Queenstown and Wanaka.

[25] On 28 May 2019 ORC in partnership with CODC carried out Lake Snow tows at three different sites (Figure 10) in Lake Dunstan to compare dry weight concentration of Lake Snow with that found in Wanaka and Wakatipu. Lake Snow was found in all three locations sampled - results of dry weight concentration are still to be reported.

[26] It is not unexpected to find *L. intermedia* in Lake Dunstan as the waterbody is downstream of lakes Wanaka, Wakatipu and Hawea, where the presence of Lake Snow has been confirmed.

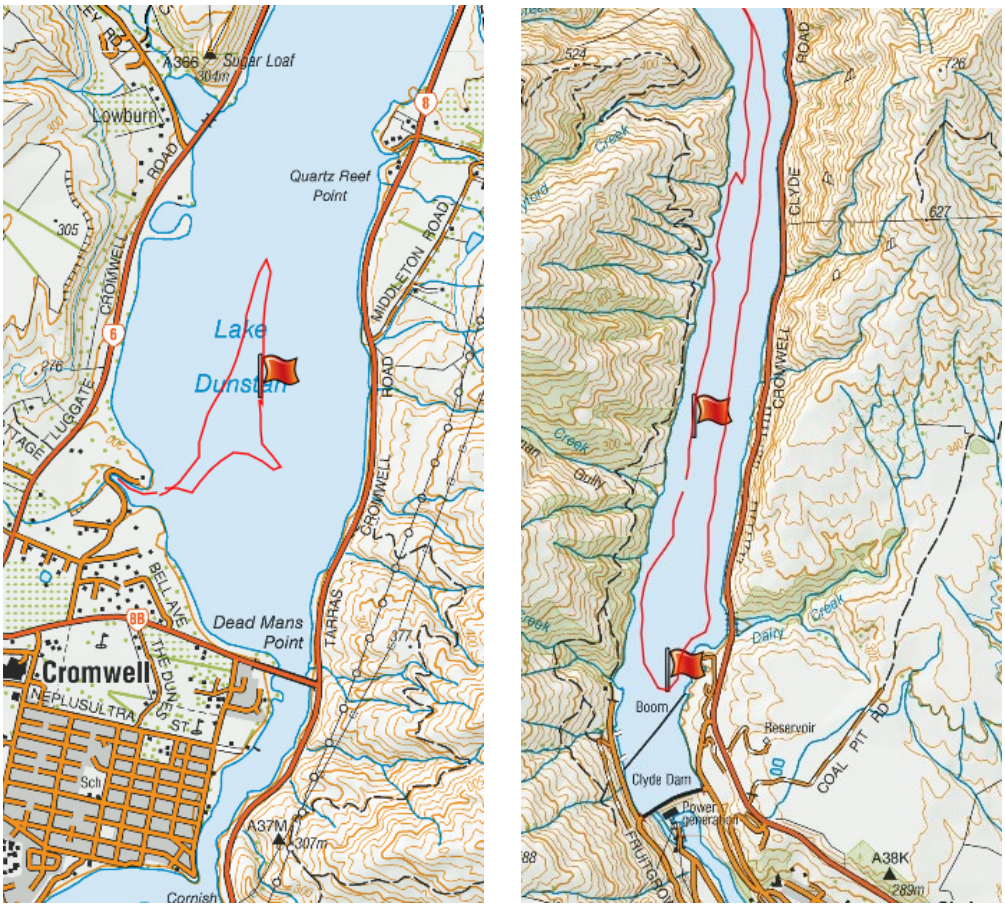

Figure 10: Sampling sites for Lake Snow tows (red flags) 28 May 2019. Left: Cromwell Yacht Club; Right: Champagne and Clyde Dam

SH85 (BRASSKNOCKER RD) STOCK TRUCK EFFLUENT DISPOSAL FACILITY

[27] The SH85 (Brassknocker Road) stock truck effluent disposal facility (STED) is in service, bringing the number of STEDs in Otago to seven in total. Effluent collected within the facility will be removed by SJ Allen (Balclutha) Ltd and disposed at the Balclutha oxidation ponds owned by Clutha District Council. The contract with SJ Allen (Balclutha) Ltd has a term expiring in March 2021. The same company disposes the effluent that is collected within the other STED located in Central Otago (Raes Junction).

[28] Figure 11 shows a stock truck discharging effluent into the SH85 (Brassknocker Road) STED on 26 May 2019. The truck had transported 42 dairy cows from Kelso (West Otago) to Lauder (Central Otago) for winter grazing. It had discharged effluent into the Raes Junction STED on the journey into Central Otago.

Figure 11: Stock truck discharging effluent into the SH85 (Brassknocker Road) STED on 26 May 2019 (photograph courtesy Bruce Robertson, Road Transport Logistics Ltd, Tapanui)

ATTACHMENTS

Nil

10.2. Glendhu Forestry

Prepared for:	Technical Committee
Report No.	PPRM1885
Activity:	Environmental: Water
Author:	Rachel Ozanne, Environmental Resource Scientist
Endorsed by:	Andrew Newman, Acting General Manager Policy, Science and Strategy
Date:	25 March 2019

EXECUTIVE SUMMARY

[1] The University of Otago were contracted to report on the Glendhu forestry water quality monitoring project (a multi-year investigation into the effects of pine harvesting operations on suspended sediment yield, and the associated impacts on water clarity, and stream sedimentation) the full report is attached as Appendix 1.

[2] The report summarises the data and outcomes of the 18-month investigation into the pine forest harvesting phase in Glendhu and supports the water plan implementation programme in relation to diffuse suspended sediment and permitted activity rules.

[3] The wider receiving environment, the Waipori River, is identified in Schedule 15 of the Regional Plan for Water and with regards to nutrient, bacteriological and turbidity contaminants, with turbidity limited to 5 NTU.

[4] For this study (2016–2018) the turbidity (80th percentile) concentration for the plantation pine catchment at Glendhu was 1.5 FNU and 2.0 NTU, indicating that the harvest phase of the pine plantation catchment is within specified limits.

[5] This result supports the pilot study (Bright, 2015[1]) which examined the preliminary effects of forest clearance in the Glendhu catchments and concluded that little to no effect of forest clearance was likely (at 40% catchment clearance).

RECOMMENDATION

That the Council:

1) ***Receives*** *this report.*

2) ***Notes*** *the report.*

BACKGROUND

[6] The Glendhu paired catchments, were developed in the late 1970s in collaboration with the NZ Forestry Service to establish the effects of converting indigenous tussock grasslands to plantation pine forestry in Otago. Two catchments were set aside, one retained in indigenous tall snow tussock (*Chionochloa rigida*), and a second planted in

[1] Bright CE, 2015. Effect of forest clearance on water quantity and water quality in Otago: a paired catchment study. Unpublished Honours Dissertation, University of Otago. 135 p.

pine forestry (*Pinus radiata*) in 1982. Figure 1 shows the location of the Glendhu catchments. The tussock catchment (GH1) covers 2.16km^2 and the pine plantation catchment (GH2) covers 3.10km^2

Figure 1. Location of the Glendhu study. The 'control' Tussock catchment and the 'treatment' forest catchment are shown on the aerial photograph.

[7] Otago Regional Council used the paired catchments to monitor sediment discharge during plantation clearance to assess whether permitted activity rules (Regional Plan: Water) relating to diffuse suspended sediment were met.

METHODS

[8] Large v-notch weirs are located at the bottom of the tussock and pine catchments (Figures 1 and 2) where water level is continuously measured. A relationship between water level and discharge was used to provide an accurate estimate of flow[1].

[9] Otago Regional Council installed and maintained turbidimeters (turbidity measured at 15-minute intervals) at each weir to estimate suspended sediment concentration and when combined with flow, suspended sediment yield.

[10] Automatic water samplers were installed upstream of the concrete weirs and attached to a water level trigger to collect water samples during high flow events. Five events were sampled between July 2016 and January 2017. Samples were taken at 30-minute intervals on the ascending limb of a hydrograph.

[11] The automatic samples were supplemented by discrete grab samples (collected by the Otago Regional Council field team, and the University of Otago at one-two month intervals) both data sets were used to develop a turbidity and suspended sediment relationship.

[1] Manaaki Whenua Landcare Research (on behalf of Rayonier) support the project by maintaining the flow monitoring sites and providing ORC with a continuous record of flow for both study catchments.

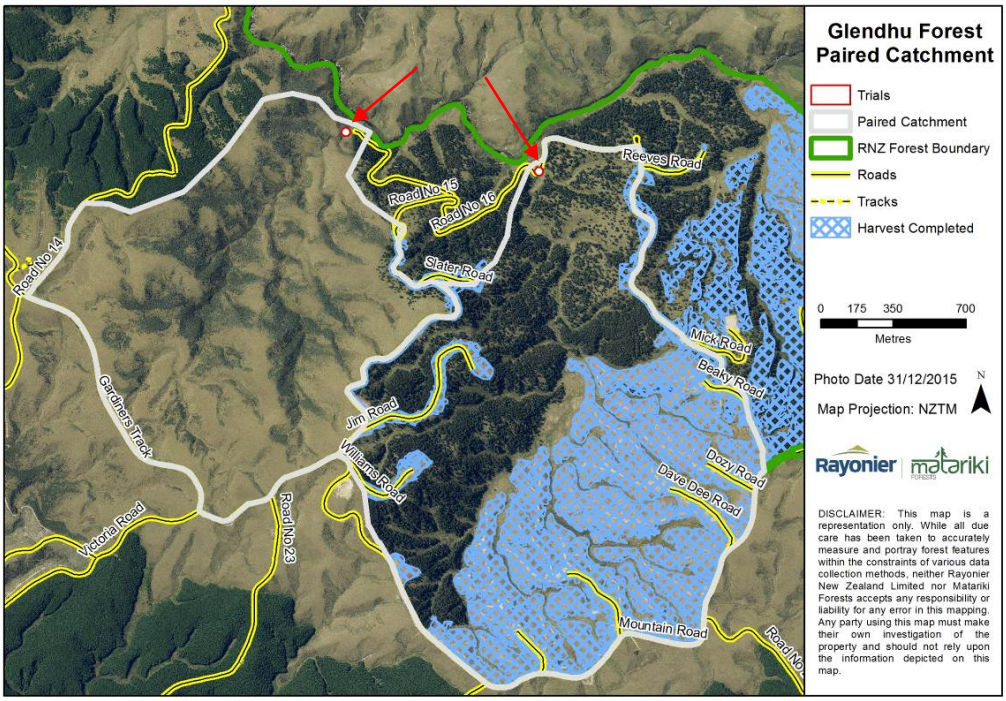

Figure 2. Aerial map (dated December 2015) showing harvesting progress on the forested catchment (right). Remaining pine was harvested by August 2018. The 'control' tussock catchment is on the left. The location of v-notch weirs indicated by the red arrows.

RESULTS AND DISCUSSION

[12] The median turbidity (July 16 to December 17) was 0.5 FNU in the tussock catchment, and 1.3 in the pine plantation catchment indicating a general trend of higher turbidity in the pine plantation catchment. The differences were greatest during high flow events, with the maximum recorded turbidity in the tussock catchment of 69 FNU compared to 453 FNU in the pine plantation catchment.

[13] There was a very strong linear relationship between field-measured turbidity and concurrent measurements of suspended sediment concentration in both catchments (R^2=0.92 tussock, R^2=0.75 pine) which enabled a conversion of in-situ turbidity to a continuous record of suspended sediment

[14] Visual clarity was determined by concurrent measurement of turbidity (in NTU) and visual clarity (in m) and plotted to determine a decay curve using regression. There was a greater decline in visual clarity observed in the pine plantation forest compared to tussock, likely attributable to greater amounts of soil particulates being disturbed in the pine catchment.

[15] Suspended sediment yield shows a different response between the two land uses, for the tussock catchment (550 days) the suspended sediment yield was 16.4 t, equivalent to 26.9 tonnes per hectare. For the pine plantation catchment (547 days) the suspended sediment yield was 80.5 t, equivalent to 132.9 tonnes per hectare.

[16] There was a very strong linear relationship between field-measured turbidity and concurrent measurements of suspended sediment concentration in both the tussock

catchment and the pine plantation catchment. However, the pine plantation catchment has increased turbidity, higher suspended sediment, and reduced water clarity as a result of forest clearance.

[17] A pilot study examining the preliminary effects of forest clearance in the Glendhu catchments during 2015 concluded that little to no effect of forest clearance was likely (at 40% catchment clearance) due to extensive riparian buffer networks, forest clearance techniques, keeping roads and landings to the periphery of the catchment, and carrying harvesting out in a staggered way over a longer period of time, which reduced the effects of landscape disturbance, and any further clearance related impacts would be best mitigated by these practices in place (Bright, 2015).

[18] Schedule 15 of the Regional Plan for Water has a turbidity limit of 5 NTU (based on a five year 80th percentile when flows are at or below median flow). For the plantation pine catchment at Glendhu (for the period 2016–2018) the turbidity 80th percentile was 2.0 NTU, indicating that turbidity during the harvest phase of the pine plantation catchment did not exceed RPW limits.

POLICY CONSIDERATIONS

[19] Schedule 15 of the Regional Plan for Water has a turbidity limit of 5 NTU (based on a five year 80th percentile when flows are at or below median flow). For the plantation pine catchment at Glendhu (for the period 2016–2018) the turbidity 80th percentile was 2.0 NTU, indicating that turbidity during the harvest phase[1] of the pine plantation catchment did not exceed RPW limits.

[20] The report suggests that forest clearance in Glendhu has, and will likely continue to have, a small but measurable effect on the discharge of sediment. However, in this instance the combination of a stable schist lithology, rolling hillslope and low risk of land erosion suggest that forestry clearance is unlikely to have lasting effects on the local and downstream receiving environments.

[21] The Glendhu forestry operation is undertaken by Matariki Rayonier Forests who operate under best practice management, which is likely to reduce the discharge of contaminants at higher flows. Other forestry operations, under different operators or under less stable lithology may see a higher contaminant load when harvesting which could adversely affect the aquatic habitat downstream.

ATTACHMENTS

1. Glendhu Forestry Water Quality Monitoring Summary Report Nov 2018 **[10.2.1]**

[1] Harvesting completed in August 2018

10.3. Catchment Monitoring Programmes 2017-18

Prepared for:	Technical Committee
Report No.	PPRM1884
Activity:	Environmental: Water
Author:	Rachel Ozanne, Environmental Resource Scientist Melanie Heather, Environmental Officer
Endorsed by:	Andrew Newman, Acting General Manager Policy, Science and Strategy
Date:	7 June 2019

PURPOSE

[1] This report is intended to provide an overview of water quality monitoring by catchment groups (in five irrigated catchments) between July 2017 and April 2019.

EXECUTIVE SUMMARY

[2] Plan Change 6A (PC6A) of the Regional Plan Water (RPW) was made operative on 1 May 2014. Under PC6A the Otago Regional Council (ORC) set rural water quality limits and targets for achieving good water quality (Schedule 15) and permitted activity discharge thresholds (Schedule 16) for contaminants discharged from rural land to water.

[3] The 2017-2019 annual plans included a rural water quality implementation target focusing on water quality in five irrigated catchments.

- Upper Taieri (upstream of Waipiata)
- Bannock Burn/Shepherds Creek
- Thomsons Creek (Manuherikia)
- Waiareka (Kakanui)
- Awamoko

[4] The 'Good Water in Otago' project commenced in 2017/18. The overall objective of the monitoring programme was to provide a more detailed study of water quality in a catchment when compared to a single point sample defined by ORC's State of the Environment (SOE) network.

[5] The intent of the programme was to get landholders to understand how land use activity impacts water quality, with a view that they could review (or change) land use activities in order to meet RPW Schedule 15 (S15) limits and targets. The programme was also intended to encourage land users to form catchment groups, devise their own sampling programmes and undertake their own sampling.

[6] Key to the success of the programme was ORC's leadership and regular communication in the first year of the programme. The right person on the ground during this period is critical in building relationships and trust with the community, this is the most important learning for future work of this nature.

[7] Positive and encouraging behaviour change during the programme was evident. The most obvious being communities taking responsibility for water quality in their catchment and linking water quality results with farm management practices.

[8] An improvement to the programme would be to monitor freshwater ecosystem condition alongside water quality. This would provide the opportunity for even greater community engagement. Tools to undertake this monitoring are readily available, i.e. NIWA's macroinvertebrate SHMAK kit or the Irish Small Streams Risk Score (SSRS) rapid macroinvertebrate assessment.

RECOMMENDATION

That the Council:

1) ***Receives*** *this report.*

2) ***Notes*** *the progress with the Catchment Monitoring Programme.*

BACKGROUND

ORC led monitoring programme 2017-2018

[9] During the 2017/2018, water quality in the Upper Taieri, Bannock Burn/Shepherds Creek, Awamoko and Thomsons Creek catchments were monitored by ORC and results reported back to community leaders.

[10] In the Upper Taieri, the Maniototo Irrigation Company (MIC) had already begun a community led water quality monitoring programme. This programme was transferred to ORC to lead, manage and expand.

[11] In the Waiareka (Kakanui catchment) ORC ran a joint programme with the North Otago Sustainable Land Management Group (NOSLaM). The North Otago Irrigation Company (NOIC) were already working closely with NOSLaM and had set up a sampling programme in the catchment, ORC expanded this programme.

[12] The catchment programmes were originally planned to run for one year with fortnightly water quality sampling.

[13] During the first year of the monitoring programme, ORC was approached by one landholder in the Upper Taieri requesting additional sampling on the Sow Burn. This landholder offered to take the samples in conjunction with the ORC programme. This trial proved successful and paved the way for full community sampling in the second year of the programme.

Community led programme

[14] As a result of the Sow Burn experience, ORC, through community meetings, gauged interest in catchment groups taking ownership of water quality sampling. Funding continued into 2018/19 to allow the community led sampling programme to be implemented in all catchments other than Waiareka Creek and Awamoko. In the Waiareka Creek and Awamoko these catchments the ORC/NOIC monitoring programme continued with NOSLaM oversight.

[15] The idea of the community led programme was for landholders to take ownership of problems and to coordinate their own testing as a group. The programme was designed to be flexible in terms of sites sampled and parameters monitored.

[16] To ensure robustness of results, all community samplers were trained (in the field) by ORC. They were supplied with a document detailing: monitoring site names; locations (grid references and photographs); S15 and Schedule 16 (S16) limits; laboratory expectations; tips for taking samples, and courier drop off details and cut off times (see example in Appendix 2).

[17] Catchment communities set up sampling programmes in various formats which ranged from a landholder sampling in the immediate vicinity of their land (Totara/Linn Burn and Riverslea) to a nominated person sampling throughout a catchment (Gimmer Burn, Ewe Burn and Bannock Burn/Shepherds Creek) or nominated person sampling more than one catchment (Pig Burn/Eden Creek and Sow Burn/Shepherds Creek).

[18] In Thomsons Creek, the community set up their own monitoring programme, and requested ORC also continue monitoring to provide community support.

[19] The joint water quality monitoring programme continued in the Waiareka and Awamoko and ORC set up a new catchment monitoring programme in the Kye Burn.

Site Selection

[20] The monitoring sites were selected in consultation with the community (Table 1 and Appendix A). The second year of sampling allowed communities the flexibility to modify and enhance ORC's original monitoring programme; to allow sites to be retired or added, depending on the nature of the results returned and the condition of the water bodies sampled. It allowed hot spots to be targeted (a focus was the water quality of water races supplying irrigation water to properties, along with races that diverted water back in to rivers).

Table 1: Monitoring Programme sites 2017/18 & 2018/19

Catchment	SOE	Active*	Retired	Not sampled**	Total sites
Upper Taieri	5	43	12	4	64
Bannock Burn/Shepherds Creek	1	31	4	0	36
Thomsons Creek	1	22	5	0	28
Kye Burn	1	16	0	0	17
Waiareka	1	13	0	0	14
Awamoko	1	2	1	0	4
TOTAL					163

**A mix of ORC & community sites **Not sampled as no water or stagnant through the year but initially identified as an area of interest ^Catchment added in year two.*

[21] Sites were tested for S15 parameters (nitrate-nitrite nitrogen, dissolved reactive phosphorus, ammoniacal N, *E. coli* and turbidity). All the catchments monitored were in

the RPW Schedule 15 receiving water group 2 and results were compared against the limits and targets in Table 2 below[1].

Table 2. Receiving Water Group 2 numerical limits for achieving good water quality.

NNN	DRP	Ammoniacal N	*E. coli*	Turbidity
0.075 mg/L	0.01 mg/L	0.1 mg/L	260 cfu/100mL	5 NTU

[22] Where drains or direct runoff from land were tested as part of the programme (i.e. irrigation run-off), the results were compared against the limits and targets specified in S16 (discharge threshold area 2) in Table 3 below.

Table 3. Discharge Threshold Area 2, permitted activity discharge thresholds

NNN	DRP	Ammoniacal N	*E. coli*
1.0 mg/L	0.035 mg/L	0.2 mg/L	550 cfu/100mL

[23] ORC recommended landholders only sample *E. coli* to allow a short turn-around time at the laboratory, which in turn meant landholders could remember land use practice at the time of sampling and investigate any results returned with high *E. coli* concentrations. ORC also facilitated faecal source tracking to clarify the source of elevated *E. coli* at sites in Shepherds Creek (Bannock Burn) and Thomsons Creek. The primary objective was to see if wildfowl, septic tanks or farm animals were responsible for elevated *E. coli* concentrations.

[24] Community led discussion resulted in a continuous turbidity meter being installed in Eden Creek (Upper Taieri) in November 2018. The site is telemetered, and the data is available on the ORC website, allowing the community to link elevated turbidity with rainfall and/or irrigation practice (elevated turbidity will generally mean elevated E. coli/nutrients). This is particularly important in the Upper Taieri, where an ORC contact recreation site (Taieri at Waipiata) is located downstream of the irrigated landscape.

[1]https://www.orc.govt.nz/media/5795/regional-plan_-water-for-otago-updated-to-1-july-2018-schedules.pdf

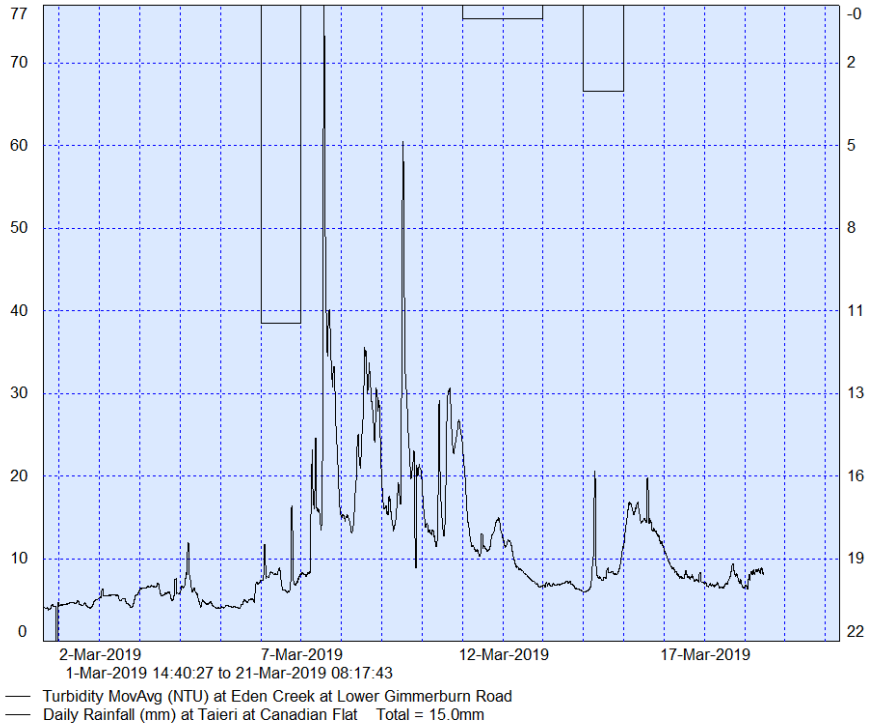

Figure 3 Continuous turbidity, Eden Creek and daily rainfall (Canadian Flat)

Community Engagement

[25] Water testing results were reported back to the communities to enable them to make informed decisions on whether changes to land use practices were required. To do this effectively each catchment group had a nominated representative to liaise with ORC. The representative assisted ORC with putting context around results (i.e. irrigation rosters, localised rainfall, etc.).

[26] Table 4 lists the number of community catchment meetings staff have held (or attended) over the last two years. The meetings have included education of the objectives of the monitoring programme, an analysis of results to date, an overview of the S15 and S16 targets and limits and planning to enable the community to lead sampling during the second year. Meetings in the Waiareka and Awamoko catchments have been facilitated by the NOSLaM. This group is farmer-led and provides practical resources and support to farmers.

Table 4. Community Meetings & Training Sessions 2017-2019

Catchment	Community meetings	Training / one on one sessions
Upper Taieri	3	8
Bannock Burn/Shepherds Creek	1	3
Thomsons Creek	2	1
Kye Burn	1	1
Waiareka/Awamoko	21	0
Total	**28**	**12**

[27] There has been positive media coverage. For example, the Otago Daily Times (ODT) reporting on the Thomson Creek monitoring programme on 12 November 2017[1].

ORC environmental officer Melanie Heather (left), ORC environmental resource scientist Rachel Ozanne, Limmerick Downs station owner Hamish Stratford (second from right) and Matakanui Station owner Andrew Paterson attended the meeting on water quality last week. PHOTO: REBECCA NADGE

Figure 2 ODT Article Photograph

DISCUSSION

[28] The first year of ORC led monitoring was a success building trust and community interest in the programme. Catchment leaders distributed water quality results to interested parties in the catchments. To enable better engagement, ORC stepped back from sampling and facilitated landholders to take ownership of the monitoring programme. The community sampling programmes were flexible (sites and analytes) and the community became more familiar with the S15 and S16 targets and limits, as well as identifying and addressing problem areas in their catchments.

[29] The catchments monitored were irrigated, and the community became increasingly aware of how irrigation can affect water quality (particularly in the Eden Creek and Wedder Burn/Gimmer Burn catchments). This resulted in ORC installing an in-situ continuous turbidimeter to assist the community to differentiate between elevated turbidity relating to rainfall, and elevated turbidity relating to irrigation.

[30] It was also noted that water quality in races was degraded at the beginning of the season, when it is likely that water flushing the irrigation races (after a winter of animals accessing the dry races) caused a significant deterioration in water quality.

[31] To improve the programme for the 2019/21 years, the selection of catchments requires early finalisation to enable meetings to be held in the catchments prior to the start of sampling. At the initial meeting, timelines should be made clear to ensure that the community knows the cut-off date for ORC involvement in any catchment programme and the expectation of community led monitoring in the second year.

[32] 'Show the science, show the problem' is an effective way of communicating water quality problems and there are other tools to use to engage the community as well as water quality monitoring. These could include using the NIWA macroinvertebrate SHMAK kit or

[1] https://www.odt.co.nz/regions/central-otago/joint-efforts-water-quality

the Irish Small Streams Risk Score (SSRS) rapid macroinvertebrate assessment. In addition, ORC's rural liaison specialists could facilitate community river assessments and stream walks to heighten community engagement.

[33] It has proven valuable to the community to have the continuous turbidity meter in Eden Creek. An expansion of continuous monitoring at key locations (turbidity/dissolved oxygen/temperature) will increase community understanding of water quality.

[34] During the first year, when ORC sampled water quality at specified sites, the results were made available on-line for the five catchments (Figure 3). The system was not able to incorporate community results (frequent change of sites, change of parameters) and these results have not been put on line. On line reporting would have been a better way of communicating monitoring programme results to stakeholders and the community involved, rather than laboratory PDF files.

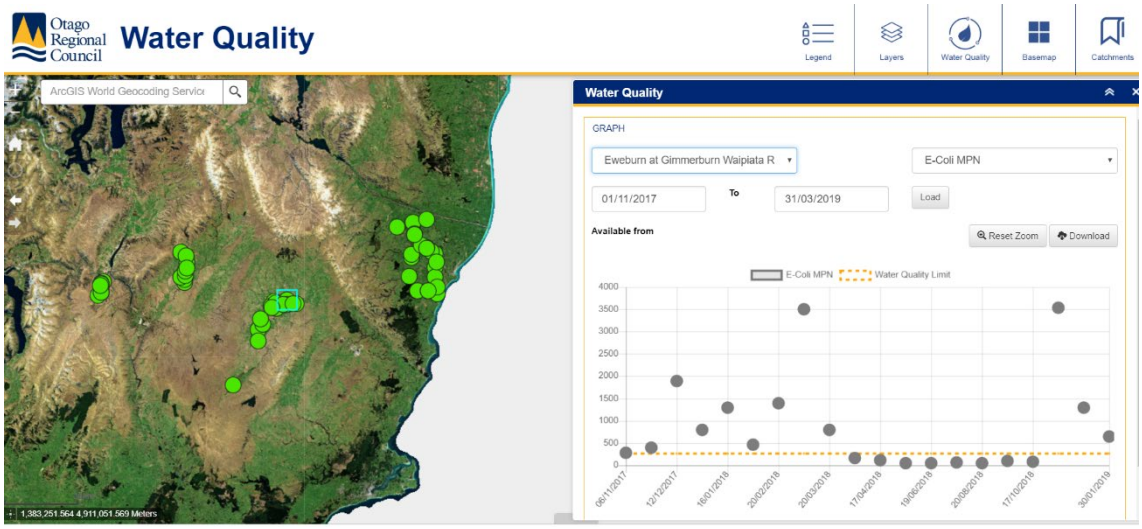

Figure 3 ORC community water quality website

[35] The catchment programme has been successful in setting up eight community led sampling programmes, six of these in the Upper Taieri, one in Thomsons Creek and one in the Bannock Burn/Shepherds Creek catchment. ORC has also supported NOSLaM in the Waiareka and Awamoko catchments. Three 'pods' (catchment groups) have been formed in this area (Awamoko, Waiareka and Friston Stream) regularly meeting to discuss water quality issues and methods to improve it. One initiative, stemming from high dissolved reactive phosphorus concentrations found in the Waiareka catchment, has been for NOSLaM to engage the University of Otago to investigate the source of high phosphorus.

[36] ORC should be proud of the engagement this project has fostered and commend those communities that have taken part and thus taken ownership of water quality in their catchment.

CONSIDERATIONS

Policy Considerations

[37] The Good Water in Otago project will focus on five new catchments in July 2019. It is proposed to focus on the Upper Clutha lakes catchments covering Wanaka, Hawea and

Wakatipu. This programme will focus on supporting established catchment groups (Upper Clutha Lakes Trust, Wanaka Water Project etc) with focused water quality monitoring as well as providing water quality information for both the Urban Water Quality strategy and the hydrodynamic model for Lake Wanaka.

Financial Considerations

[38] The budget for the monitoring programmes is in the Science Management Group. As at 20 March 2019, the Science Management Group YTD budget was 28% underspent.

ATTACHMENTS

Nil

11. NOTICES OF MOTION

No Notices of Motion were submitted.

12. CLOSURE