Annual Report – June 2021

Prepared to meet the Requirements of CRC214226

Christchurch City Council

Christchurch City Council

Internal Document Review and Approval

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Executive Summary

In December 2019, Christchurch City Council was granted a resource consent from Canterbury Regional Council, that being CRC214226, otherwise known as the Comprehensive Stormwater Network Discharge Consent (CSNDC). Under the conditions of this consent, Christchurch City Council must produce an Annual Report on 30 June each year, reporting on the previous calendar year. However, in the interests of transparency, further progress made on the implementation of the consent and monitoring data gathered to-date has been provided. The matters to be included in this report, where appropriate, can be found in Condition 61 of the CSNDC. Some detailed monitoring reports, specifically for Aquatic Ecology and Instream Sediment Quality are not currently available due to sampling and analysis protocols, and these will be provided as soon as they become available.

This is the first official annual report for the CSNDC and covers the period 1 January to 31 December 2020, with the addition of further information available for the period 1 January to 30 June 2021. The structure of this report is as follows:

1. **Introduction**
   Regulatory matters such as developments authorised under the CSNDC and updates to schedule 1.
2. **Stormwater Management Plans (SMPs)**
   Matters relating directly to Stormwater Management Plans.
3. **Environmental Monitoring Programme**
   Data and reports from 2020 calendar year with the addition of data available to-date for 2021.
4. **Stormwater Quality Investigation Programme (Schedule 3)**
   Progress made to-date on the design and implementation of tasks required by Condition 39 and Schedule 3.
5. **Other Actions Required by the Consent Holder (Schedule 4)**
   Progress made to-date on various other actions, including source control investigations, monitoring, and community engagement, required by Condition 40 and Schedule 4.
6. **Industrial and Monitoring**
   Information on Industrial Site Audits for the 2020 calendar year, including proposed investigations to satisfy Condition 32.
7. **Engagement with Papatipu Rūnanga**
8. **Responses to Monitoring - Surface Water and Groundwater (Condition 59)**
   To-date, for the period 1 January to 31 December 2020, there are 41 breaches of the Attribute Target Levels for Schedules 7-9. Of these, 32 were exceedances of Schedules 7 and 8 (Waterways and Coastal Waters), and 9 were exceedances of Schedule 9 (Groundwater). Of the 32 exceedances of Schedules 7 and 8, a selection of 4 sites have been put forward to be prioritised for investigation as per Condition 59.

Glossary

Acronyms and Abbreviations

CBA ..... Cost-Benefit Analysis

CSNDC ..... Comprehensive Stormwater Network Discharge Consent

IGSC ..... Interim Global Stormwater Consent

SMP ..... Stormwater Management Plan

TPRP ..... Technical Peer Review Panel

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1. Introduction

1.1. Background of the CSNDC

Prior to the granting of the CSNDC consent, Christchurch City Council held four primary resource consents for stormwater discharges. CRC090292, also known as the Interim Global Stormwater Consent (IGSC), authorised all existing stormwater discharges within Christchurch, excluding Banks Peninsula, except those authorised by the catchment specific consents. The IGSC was a short term consent that was intended to allow Christchurch City Council to develop SMPs for the catchments within the Christchurch area. As SMPs were developed and resource consents granted by Canterbury Regional Council, the SMP areas were authorised by their own consents. The first of these was known as the South West Consent CRC120223. The second was known as the Styx Consent CRC131249. Once all SMP areas possessed individual consents, the IGSC would no longer be required. The final of the four consents was an older consent authorising discharge to land, CRC000315. Subsequent to the Styx Consent being granted, a change in philosophy was agreed between Christchurch City Council and Canterbury Regional Council and resulted in Christchurch City Council seeking the now-granted CSNDC, one consent for all catchments.

1.2. Purpose of the Annual Report

Council is required by Condition 61 of the CSNDC to provide an annual report to Canterbury Regional Council, Banks Peninsula and Christchurch West-Melton Zone Committees, and Papatipu Rūnanga (via Mahaanui Kurataiao Limited) by 30 June each year. The report must cover the previous calendar year and be made available on the Christchurch City Council website. Given that CRC214226 was issued on 20 December 2019 the wording of condition 61 suggests the first report is required by 30 June 2021.

In the interests of transparency, an interim annual report was provided to Canterbury Regional Council 30 June 2020. Similarly, in the interests of transparency, this annual report provides additional information and reporting from 2021.

1.3. Summary of Developments Authorised under this Consent

Christchurch City Council has authorised stormwater discharges under consent CRC214226, since 20 December 2019, when the consent order was issued. This occurs when an applicant (e.g. developer or customer building a new residential dwelling) apply for a resource consent, building consent, or subdivision consent; and is required to ensure that the discharge of stormwater from the building or site is legally authorised. An applicant may then choose to request authorisation from Christchurch City Council to discharge stormwater under consent CRC214226, or to obtain their own resource consent from Canterbury Regional Council.

The authorisations given by Christchurch City Council to applicants have been for sites including subdivisions, redevelopment of commercial and industrial sites, residential housing units, schools, and individual house lots. Appendix A is a list of sites that have been authorised to discharge under the CSNDC, as required by Condition 61(h).

Canterbury Regional Council are notified of sites authorised to discharge under the consent on a monthly basis. Christchurch City Council request advice from Canterbury Regional Council on applications for discharge approval which might hold unacceptably high risk. In accordance with Condition 2(d), those sites which Canterbury Regional Council advise should be considered to hold unacceptably high risk, are not provided with stormwater approval by Council. Rather their discharge is managed via resource consent with Canterbury Regional Council.

1.4. Updates to Schedule 1

The current list of exclusions is provided with this Annual Report as Appendix B.

1.5. Changes to Regulatory Framework Affecting SMPs

There have been no changes to regulatory frameworks which would warrant changes to SMPs.

1.6. Alignment with Christchurch-West Melton Sub-Regional Section of LWRP

This resource consent was developed under the then operative version of the Canterbury Land and Water Regional Plan. While this plan will in future be reviewed with regard to Central Government's National Policy Statement for Freshwater Management 2020, this review has not yet addressed the Christchurch-West Melton sub-regional section of the Land and Water Regional Plan, and thus no further reporting on this matter is required.

1.7. Complaints or Observations regarding Spring Flow

There have been no specific complaints received by the Consent Holder regarding spring flow and/or quality. However, it is common to receive complaints regarding low waterway flow in the Waimairi and Wai-iti Streams, mainly during summer months when groundwater level is expected to be lower.

2. Stormwater Management Plans (SMPs)

2.1. Background and Purpose of SMPs

Stormwater Management Plans are required to be developed and updated for each river catchment, as per conditions 4 and 5. Condition 6 and Schedule 2 provide the purpose and requirements of SMPs. These SMPs provide commentary on the future approach of Christchurch City Council for these catchments in relation to flood protection, ecology and water quality, and hydrogeology (groundwater).

2.2. Progress to-date on SMP Development

As per Condition 5, the SMPs for the Huritīni/Halswell and Ōpāwaho/Heathcote catchments have been developed. These SMPs have also been reviewed by the Stormwater TPRP, as per Condition 14(b) and 15(b). As per the recently accepted consent variation application these SMPs have now been put out for public consultation and are awaiting approval from Council. It is expected that these SMPs will be submitted to Canterbury Regional Council for certification by 20 December 2021.

The next SMP to be developed is that of Te Ihutai/Estuary and Coastal region. As per the newly varied Condition 5, the deadline for submission of this SMP is 20 June 2022. Technical investigations are being planned and undertaken to fulfil this requirement. This area is of particular significance to Papatipu Rūnanga, due to mahinga kai values and the confluence of both the Ōpāwaho/Heathcote and Ōtākaro/Avon Rivers, which are each culturally significant rivers in their own right.

2.3. Implementation Plan

An Implementation Plan has been developed in consultation with Papatipu Rūnanga and the Department of Conservation, as per Condition 11. The purpose of this Implementation Plan is to give effect to certified SMPs and to include the matters set out in Condition 12. These matters are as follows:

a) A list and map of proposed stormwater mitigation methods and devices

b) A programme of stormwater works for Christchurch City Council and anticipated private development

c) A plan for regulatory, investigative, educational, and preventative activities or programmes relating to stormwater discharges, including activities undertaken under Condition 29 and 40 and Schedules 3 and 4

d) Details of budgets for capital works or resourcing that is linked to the Christchurch City Council Long Term Plan.

This Implementation Plan has been submitted in draft form to Canterbury Regional Council and provides a summary of budgets linked to the Christchurch City Council Long Term Plan for stormwater capital works, and anticipated private development. Proportions of the total budget have been broken down to SMP/Catchment areas. A map of proposed stormwater treatment facilities to be constructed by Christchurch City Council, and a Gantt chart for the tasks in Schedule 3 and 4, required under Conditions 39 and 40 have also been provided. The Implementation Plan is awaiting feedback from Papatipu Rūnanga. It is intended that a finalised version of this Implementation Plan shall be submitted to Canterbury Regional Council following this feedback and formal adoption of the Long term Plan.

2.4. Summary of Contaminant Load Reduction Targets in SMPs

Table 2-1: Target reductions in stormwater contaminant load resulting from treatment in new facilities and anticipated changes in contaminant sources for the Ōpāwaho/Heathcote River Catchment SMP.

Contaminant	Target reductions in stormwater contaminant load (tonnes/year) resulting from construction of new stormwater mitigation facilities compared to the consent application base year 2018		
	5 years from 2018 (year 2023)	10 years from 2018 (year 2028)	25 years from 2018 (year 2043)
TSS	17.9%	18.5%	19.1%
Total Zinc	10.6%	12.7%	23.8%
Total Copper	17.8%	17.9%	18.5%

Table 2-2: Target reductions in stormwater contaminant load resulting from treatment in new facilities and anticipated changes in contaminant sources for the Huritīni/Halswell River Catchment SMP.

Contaminant	Target reductions in stormwater contaminant load (tonnes/year) resulting from construction of new stormwater mitigation facilities compared to the consent application base year 2018		
	5 years from 2018 (year 2023)	10 years from 2018 (year 2028)	25 years from 2018 (year 2043)
TSS	12.6%	14.4%	13.8%
Total Zinc	9.7%	13.7%	34.4%
Total Copper	11.1%	15.5%	35.6%

3. Environmental Monitoring Programme

Adherent to Condition 49, an Environmental Monitoring Programme was formulated and implemented, with the purpose of determining whether Receiving Environment Objectives and Attribute Target Levels were being met. The monitoring carried out under this programme includes monitoring of soil quality at infiltration facilities; groundwater; surface water levels and flows, sea level, and rainfall levels; surface water quality; instream sediment quality; aquatic ecology; and mana whenua values. At the time of this report, the section of this programme which monitors mana whenua values is yet to incorporate the further input from Papatipu Rūnanga (required by Condition 54) which will occur within 30 months of the commencement of the resource consent and be detailed in the annual report for the following year, 2023.

A revised and amended version 8 of this Environmental Monitoring Programme is attached to this report as Appendix C for review and comment by Canterbury Regional Council.

3.1. Soil Quality Monitoring at Infiltration Facilities

Chapter 2 of the CSNDC Environmental Monitoring Programme requires the sampling of soil from six different infiltration facilities, on a five-yearly basis. These sites are identified in Table 2 of the CSNDC Environmental Monitoring Programme. Monitoring was undertaken in 2010, 2015, and 2020.

Sampling in 2010 and 2015 was reported under the IGSC (CRC090292). The Monitoring Plan under this IGSC and the Environmental Monitoring Programme under the CSNDC (CRC190445/CRC214226) vary, such that 2010 and 2015 sampling required analysis of Total Petroleum Hydrocarbons (TPH), while the 2020 sampling required Polycyclic Aromatic Hydrocarbon (PAH) analysis. Future sampling will occur in 2025, and at this stage is intended to report on those parameters specified under the CSNDC Environmental Monitoring Programme operative at that time.

As per 2.4 of the Environmental Monitoring Programme, a set of trigger values has been developed for these infiltration facilities, based on the list of guidelines provided in this chapter and the function of each facility [Appendix F]. No exceedances of these trigger values have been found for the available sampling results from 2010, 2015, and 2020.

At Denton Park, Beckenham Library, Tumara Park, and Richmond Housing Complex, there are 3 sets of data available for copper, lead, and zinc. At the Grove Road site, there is only one set of data available, that being 2020, due to the facility only having been constructed in 2015. At the Hornby Industrial Park Infiltration Facility, there is data available for 2010 and 2015. However, this facility was not sampled in 2020 due to works occurring on-site. Therefore, at this time, trends can only be approximated for copper, lead, and zinc at Denton Park, Beckenham Library, Tumara Park, and the Richmond Housing Complex.

An increasing trend in zinc was found at Beckenham Library, Tumara Park, and the Richmond Housing Complex, with the strongest of these being at the latter. Denton Park presented a decreasing trend.

An increasing trend in lead was found at Beckenham Library and the Richmond Housing Complex, while a decreasing trend was found at Denton Park and Tumara Park.

An increasing trend in copper was found at Tumara Park and the Richmond Housing Complex, while copper at Beckenham Library slightly decreased and remained relatively stable at Denton Park.

3.2. Groundwater

Annual analysis of groundwater levels and quality is required under Chapter 3 of the CSNDC EMP. Following analysis of both 2020 and historic data, the following conclusions have been made.

Please refer to the detailed monitoring report, attached as Appendix D for more detailed analysis.

3.2.1. CCC Groundwater Level Monitoring Wells

Groundwater Level in Christchurch City Council monitoring wells has remained relatively consistent with historical patterns, being higher in winter and lower in summer. Well 3247004 on Inwoods Road did appear to have a change in level around 1996, where groundwater appeared to increase by ~5m. This increase was measured in April-May, when levels would not be expected to be at their highest, and levels have remained relatively consistent following this increase. Groundwater levels appear to have become less pronounced in wells 3255013 and 325016 on Halswell Road and Milns/Sparks Road. Groundwater levels at well 3256018 appears to have dropped in 2011 and remained relatively consistent since then. Groundwater level appears to have also dropped in well 3256034 in 2011, but has returned to levels typically seen pre-earthquake (pre-2011) since 2017.

3.2.2. Dissolved Copper, Lead, and Zinc in Environment Canterbury Monitoring Wells

There were no exceedances of the attribute target levels for dissolved copper, lead, and zinc in Canterbury Regional Council groundwater monitoring wells' data. Two trend graphs were produced for wells BX24/0347 and M35/5119 where copper and zinc concentrations remained relatively steady, with a minor increase in well BX24/0347. No trend was produced for zinc due to insufficient data. M35/5119 showed an increase in all three metals in October 2015, but has remained steady since.

3.2.3. Dissolved Copper, Lead, and Zinc in CCC Water Supply Wells

One exceedance of the attribute target level for dissolved copper was found in Well 5 at Lake Terrace Pump Station on 20 October 2020, which extracts from Aquifer 3. All other results for dissolved copper in wells abstracting from Aquifer 3 were below the attribute target level. Weather Underground records [1] indicated that there was no precipitation recorded at the Christchurch International Airport (ICHRIS149) during the 24 hours preceding this exceedance. This suggests that minimal stormwater would have been present and was therefore unlikely to have caused the exceedance. This exceedance in dissolved copper did not exceed the Drinking Water Standards for New Zealand (2005) aesthetic standards, or 50% of the maximum acceptable value.

No exceedances of the attribute target level for dissolved lead were found in 2020. However, there have been some historical exceedances in wells at the Addington, Main Pumps, Spreydon, Woolston, Auburn, Crosbie, and Parklands pump stations. These historical exceedances were recorded at various times in April 2009, May 2010, and August 2011. Based on available weather data at these times[2], it is likely that stormwater would have been present, but it is unlikely that the network would have

[1] https://www.wunderground.com/history/weekly/nz/christchurch/NZCH/date/2020-10-20 accessed 6 April 2021.

[2] https://www.timeanddate.com/weather/new-zealand/christchurch/historic?month=8&year=2011 accessed 6 April 2021.

been under pressure and it cannot be confidently said that stormwater would have caused these historical exceedances.

No exceedances of the attribute target levels for dissolved zinc were recorded during 2020. However, there have been 3 historical exceedances for this attribute target level in various wells, drawing from various aquifers at the Brooklands, Mays, and Belfast pumping stations. These events appear to have been isolated, with no consistent exceedances. These historical exceedances occurred in August and March 2011. According to available data[3], some drizzle and rain was recorded in the 48 hours prior to the events in March, and no rain was recorded at the Christchurch International Airport in the 48 hours prior to the event in August. It is unlikely that the stormwater network would have been under pressure at these times.

3.2.4. *E. coli* Detections in CCC Water Supply Wells

There were 6 detections of *E.coli* equal to or above the laboratory limit of reporting (LOR) of 1 maximum probable number (MPN) per 100mL in 2020. Five of these were at Denton Pump Station and one was at the Sockburn Pump Station. However, all of these events were recorded as having been due to the onsite suction tank, as opposed to the wells serving those pump stations.

3.2.5. Statistical Analysis of *E. coli* concentration in CCC Drinking Water Supply Wells

Due to the nature of the majority of the data (99.88%) being qualitative, in that they reported as being either above or below the limit of detection (LOD), it was not possible to carry out Mann-Kendall analysis. The majority of results were below the LOD, and so adopting the LOD as the actual result would indicate no statistically significant increase in *E. coli* concentrations at drinking water supply wells. Nonetheless, when the number of results at each pump station was used to calculate the number of *E. coli* exceedances allowed for a 95% confidence interval that the New Zealand Drinking Water MAV was not exceeded more than 5% of the time, no pump stations exceeded their respective allowable exceedance.

3.2.6. Statistical Analysis of Conductivity in Environment Canterbury Monitoring Wells

Mann-Kendall analysis of electrical conductivity at Canterbury Regional Council monitoring wells showed an increasing trend at 8 wells: M35/1051, M35/1864, M35/2961, M35/5251, M35/6656, M35/6946, M36/1057, and M36/5893. A decreasing trend was found at 3 wells: M36/1159, M36/1160, and BX24/0347. When compared against metal analysis at these same wells, there was an insufficient number of results to determine any trends. It is recommended that more regular and frequent trace element analysis is carried out at these wells, and those others where there was an insufficient number of results available to determine a statistically significant trend in electrical conductivity.

[3] https://www.timeanddate.com/weather/new-zealand/christchurch/historic?month=8&year=2011 accessed 6 April 2021.

3.3. Surface Water Levels and Flows, Sea-Level, and Rainfall Depth

Subchapter 4.3 of the CSNDC Environmental Monitoring Programme requires the Consent Holder to report on the following with regard to stormwater quantity models on a 5-yearly basis, starting in 2021:

- Any significant changes made to the input parameters of the models
- Any significant changes to development patterns (greenfield or brownfield)
- Any significant updates to model hydraulics (bridges, culverts, etc.)
- Any significant calibration or validation exercises undertaken
- A discussion of progress toward meeting the flood mitigation targets set in Schedule 10 of the consent
- Any other relevant discussion involving changes to models or analysis of modelling results.

The following water quantity modelling projects are currently underway:

- Ōtākaro/Avon River Catchment Citywide model updates
- Ōpāwaho/Heathcote River Catchment Citywide model calibration and updates
- Huritīni/Halswell River Catchment Citywide model build
- Matuku Takotako/Sumner Citywide model calibration and updates.

Additionally, Pūharakekenui/Styx River Catchment Citywide model build is in the initial tender stages and a calibrated model is expected to be delivered in late 2022. Following completion of these models, after submission of this CSNDC Annual Report, detailed reports shall be provided to Canterbury Regional Council. Currently there are no new results to present. A detailed summary, and links to the Consultant reports are contained in Table 3-2 below.

Table 3-1: Current Baseline of Water Quantity Models by Catchment

Catchment/SMP Area	Model(s) Available	Status/Current Work Plan	Available Runs	Future Updated Programme
Ōtākaro/ Avon	Avon Citywide model ED2014 (GHD, 2018)	The Avon Citywide model calibrated to ED2014 is the most advanced whole catchment model. This DHI MIKE Flood model is described in the model status report (TRIM 20/1427462, December 2018). Section 9.2 "Recommendations for Model Improvement" detail issues that may be improved upon as part of a future model improvement programme, or capital works project.	ARI: 10/ 50/ 200 year Durations: 0.5/ 1/ 2/ 3/ 6/ 9/ 12/ 18/ 24/ 36/ 18T/ 24T/ 36T (Located in Model Warehouse)	Avon Citywide model ED2014 (GHD, 2018) is currently being updated by GHD to ED2020, and MPD as part of Council's LDRP97 (Multi-hazard) project, expected February 2022. Notable improvements to the model include: • Updated boundary conditions (Tide statistics, Rainfall statistics including Climate Change increases) • Updated physical representations of basins, pipe and channel network, pump stations, and ground surface/ 2D mesh

Catchment/SMP Area	Model(s) Available	Status/Current Work Plan	Available Runs	Future Updated Programme
Ōpāwaho/ Heathcote	Heathcote Citywide model ED2014 (Aecom, 2019); Heathcote M7 (1D) model (updated by DHI, 2019)	The Heathcote Citywide model calibrated to ED2014 is the most advanced whole catchment model. This DHI MIKE Flood model is described in the model status report (TRIM 19/1263033, October 2019). Section 10.1 "Identified Issues of Low Importance and Future Improvements" detail issues that may be improved upon as part of a future model improvement programme, or capital works project.	ARI: 10/ 50/ 200 year Durations: 0.5/ 1/ 2/ 3/ 6/ 9/ 12/ 18/ 24/ 30/ 36/ 18T/ 24T/ 30T/ 36T (Located in Model Warehouse)	Heathcote Citywide model ED2014 (Aecom, 2019) is currently being recalibrated (2017) due to mass balance errors discovered after model build project completion. This work is scheduled for completion in August 2021. Subsequent model updates by DHI to ED2020, and MPD as part of Council's LDRP530 (Upper Heathcote Storage Optimisation) project, expected April 2022. Notable improvements to the model include: • Updated boundary conditions (Tide statistics, Rainfall statistics including Climate Change increases) • Updated physical representations of basins, pipe and channel network, pump stations, and ground surface/ 2D mesh
Huritīni/ Halswell	Halswell River Hydraulic Model ED2011 (DHI, 2015)	The Halswell River Hydraulic Model has been adapted by CCC from ECan (ECan, 2013), verified to 1975 and 1977 flood events. Updated by DHI in 2015 the model is representative of approximately ED2011. This DHI MIKE Flood model is described in the model status report (TRIM 15/376874, March 2015). Section 9 "Recommendations for future work" detail issues that may be improved upon as part of a future model improvement programme, or capital works project.	ARI: 10/ 50/ 200 year Durations: 6 (Located \\ccity.biz\fileserver\Model-SurfaceWater\001_Models\05_HalswellCatchment\5a_Halswell\Draft-citywide-Halswell\Halswell_MPD_results)	A new Halswell Citywide model built in DHI MIKE Flood, calibrated to ED2014, and built to represent ED2020 and MPD is currently being built by Beca. Upon completion this model will be the most advanced whole catchment model. This work is scheduled for completion in November 2021. Notable improvements to the model include: • Updated boundary conditions (Rainfall statistics including Climate Change increases) • Updated physical representations of basins, pipe and channel network, and ground surface/ 2D mesh

Catchment/SMP Area	Model(s) Available	Status/Current Work Plan	Available Runs	Future Updated Programme
Pūharakekenui /Styx	Styx river catchment model ED2011/ ED2014 (GHD, 2012/ 2017)	The Styx river catchment model originally built in 2010, was recalibrated and fully updated in 2012, and updated to the "Citywide" specification in the 1D domain in 2017. This DHI MIKE Flood model is the most advanced whole catchment model, and is described in the following model status reports (listed in reverse chronological order): • TRIM 18/909126 (1D update, 2017); • TRIM 17/1183411 (2D not updated); • TRIM 12/256842 (full model update, 2012). TRIM 18/909126 generally states the 2D MIKE Flood model component remains to be completed as part of a future model improvement programme, or capital works project.	ARI: 5/ 10/ 50/ 200 Durations: 9/ 18/ 48 (Located in Model Warehouse)	A new Styx Citywide model built in DHI MIKE Flood, calibrated to ED2017, and built to represent ED2020 and MPD is currently being procured. A tender is to be let in June 2021, with work expected to be complete by November 2022. Upon completion this model will be the most advanced whole catchment model. Notable improvements to the model include: • Updated boundary conditions (Tide statistics, Rainfall statistics including Climate Change increases) • Updated physical representations of basins, pipe and channel network, and ground surface/ 2D mesh

Catchment/SMP Area	Model(s) Available	Status/Current Work Plan	Available Runs	Future Updated Programme
Matuku Takotako/ Sumner	Sumner Citywide model ED2014 (GHD, 2018)	The Sumner Citywide model calibrated to ED2014 is the most advanced whole catchment model. This DHI MIKE Flood model is described in the model status report (TRIM 18/634374, December 2017). Section 6.0 "Recommended Model Refinement" detail issues that may be improved upon as part of a future model improvement programme, or capital works project.	ARI: 10/ 50/ 200 year Durations: 0.5/ 1/ 2/ 3/ 6/ 9/ 12/ 18/ 12T/ 18T (Located in Model Warehouse)	Sumner Citywide model ED2014 (GHD, 2018) is currently being recalibrated by GHD, and updated to ED2020. This work is scheduled for completion in August 2021. Funding for a future project to update the model to MPD has not yet been identified, however this may be accommodated within subsequent phases of Council's LDRP97 (Multi-hazard) project.
Banks Peninsula	Grehan Stream ED2014 (GHD, 2015)	The Grehan Stream model is a single catchment model validated to ED2014. This DHI MIKE 11 model is described in the final report (TRIM 15/791494, June 2015).	ARI: 50 year Duration: 1 (Located \\ccity.biz\fileserver\Model-SurfaceWater\001_Models\06_Other\6d_Grehan_Stream)	Grehan Stream was a one-off model to inform SW flood mitigation capital works projects. There is not an ongoing programme of model updates for this model.
Banks Peninsula	Other: Environment Canterbury	Environment Canterbury build and update models for some Banks Peninsula settlements including Little River.		

3.4. Waterway and Coastal Waters Monitoring

3.4.1. Surface Water Quality

Surface water quality monitoring was carried out for the 2020 monitoring year, in accordance with Section 5 of the CSNDC Environmental Monitoring Programme. A full report is attached as Appendix E.

In summary:

- The Christchurch City Council monitors the water quality of representative waterbodies within Christchurch and Banks Peninsula, as part of the Comprehensive Stormwater Network Discharge Consent (CSNDC; CRC214226).
- Monthly water samples were collected from 51 sites in Banks Peninsula (Stream Reserve Drain, Balguerie Stream, and Aylmers Stream), Ōtākaro-Avon River, Ōpāwaho-Heathcote River, Huritini-Halswell River, Pūharakekenui-Styx River, Ōtūkaikino River, Linwood Canal, and coastal water (Ihutai – Avon-Heathcote Estuary, Lyttelton Port, Cass Bay, and Akaroa Harbour) catchments. Eleven of these sites were introduced in 2020; in particular, the Banks Peninsula and coastal sites. Eleven sites in the Pūharakekenui-Styx River catchment were monitored by the Styx Living Laboratory Trust. Two wet weather monitoring events were also monitored in the Ōpāwaho-Heathcote River catchment.
- Over 32,000 tests were conducted and there were several parameters at concentrations unlikely to cause adverse effects. However, 17% of samples (3,490 of 21,182 samples) did not meet the guideline.
- The priority parameters to address include phosphorus (Dissolved Reactive Phosphorus), nitrogen (Dissolved Inorganic Nitrogen), sediment (turbidity), bacteria (as indicated by *E. coli*), dissolved copper, and dissolved zinc. The coastal sites generally only had issues with copper contamination.
- Based on the Water Quality Index, the Ōtūkaikino and Pūharakekenui-Styx River catchments generally had 'good' water quality; however, all other catchments generally had 'fair' or 'poor' water quality. The Ōtūkaikino River recorded the best overall water quality out of all the catchments. The best site was Ōtūkaikino River at Groynes, followed jointly by Smacks Creek at Gardiners Road, Waimairi Stream, Avon River at Carlton Mill and Wilsons Stream, and then Styx River at Gardiners Road. The catchment recording the worst water quality was the Huritini-Halswell River, followed by Ōpāwaho-Heathcote River. The worst sites were Curlett Stream at Motorway, then Nottingham Stream at Candys Road, Haytons Stream, and Addington Brook.
- Water quality at the sites has mostly remained steady over time.
- Wet weather monitoring concentrations were generally similar to that recorded for the monthly monitoring; however, there were some notable exceptions to this for most parameters.
- Thirty-two of the 51 sites triggered further investigations under the CSNDC, due to not meeting the Attribute Target Levels for Total Suspended Solids, copper, lead, and zinc. These sites are prioritised to four: Curlett Stream at Motorway and Heathcote River at Ferrymead Bridge (Ōpāwaho-Heathcote River catchment), Addington Brook (Ōtākaro-Avon River catchment), and Nottingham Stream at Candys Rd (Huritini-Halswell River catchment).
- A number of recommendations are provided in the report:
    - Curlett Stream, Nottingham Stream, and Addington Brook are prioritised for contaminant source control and stormwater treatment.

- Erosion and sediment control measures continue to be implemented as a priority, and further investigations in particular are carried out to determine how to mitigate discharges of loess sediment into the Ōpāwaho-Heathcote River (principally Cashmere Stream).
- A whole-of-community approach to addressing stormwater contaminants is cemented through the Community Waterway Partnership.
- CCC and Environment Canterbury continue to work together with the community, landowners and industry to improve catchment management practices.
- Investigations are carried out to identify how best to reduce faecal contamination within the waterways, particularly from waterfowl.
- An Action Plan for the CCC Community Outcome for Healthy Water Bodies is developed that considers what we want to achieve for our waterways and what is required to achieve this.

- If the report recommendations are implemented (at a bare minimum), surface water quality improvements are anticipated. However, changes may only occur over long time scales, due to the size of the issues and the lag time in observing reductions in contaminants within the environment.

3.4.2. Instream Sediment Quality and Aquatic Ecology

For the 2020 monitoring year, the following instream sediment quality and aquatic ecology monitoring was carried out in accordance with Sections 6 and 7 of the CSNDC Environmental Monitoring Programme:

- Five-yearly aquatic ecology and instream sediment monitoring in the Ōpāwaho-Heathcote River (14 sites), Linwood Canal (1 site), and Banks Peninsula (3 sites)[4]
- Monthly fine sediment monitoring (15 sites) (since June 2020 only)[5]
- Annual aquatic ecology monitoring in the Pūharakekenui-Styx River at Styx Mill (1 site), Cashmere Stream (2 sites), and Balguerie Stream (1 site)[6].

Of note from the monitoring:

- The monitoring indicated that most of the sites have not changed in ecological condition compared to previous years. This was the first year the five-yearly Banks Peninsula sites have been monitored, meaning no long term trends could be been measured.
- The majority of the Ōpāwaho-Heathcote River sites had substrates dominated by fine sediments. The other sites had predominantly stony bed sediments overlain with fine sediment, with the exception of the Banks Peninsula sites, which were dominated by hard substrates, such as cobbles and boulders.

[4] https://ccc.govt.nz/assets/Documents/Environment/Water/Monitoring-Reports/2020-reports/2020-Heathcote-River-Five-Year_atic-Ecology-Monitoring-Report.pdf

[5] Seventeen sites were required to be monitored; however, access was not possible at one of the sites due to the sediment being too deep (Kaputone Creek at Belfast Road), and monitoring was not instigated at the other site due to awaiting subdivision development (Ōtūkaikino River & Creek). The amendments to the current Environmental Monitoring Programme (Version 8) address these issues.

[6] https://ccc.govt.nz/assets/Documents/Environment/Water/Monitoring-Reports/2020-reports/2020-Annual-Aquatic-Ecology-Report.pdf

- Total macrophyte cover in the Ōpāwaho-Heathcote River was dominated by submerged macrophyte taxa, with the invasive macrophyte *Potamogeton crispus* (curly-leaf pondweed) often dominating. Macrophytes were not present at the Banks Peninsula sites.
- Bed cover with long filamentous algae was low across all sites. Low periphyton cover is typical in macrophyte-dominated springfed waterways, such as Linwood Canal, and the Heathcote River and its tributaries. Low cover with long filamentous algae (and macrophytes) in the Banks Peninsula streams likely reflects a combination of good shading and regular flushing flows.
- Metal concentrations within instream sediment were lowest at the three Banks Peninsula sites and the two Cashmere Stream sites, and highest at Curletts Road Stream immediately downstream of the Southern Motorway.
- Invertebrate community composition in 2020 was similar to previous years in the Ōpāwaho-Heathcote River and Linwood Canal catchments, being dominated by pollution-tolerant snails and crustaceans that are common in Christchurch urban waterways. At the Banks Peninsula five-yearly sites, the macroinvertebrate communities had pollution-sensitive mayflies and stoneflies, as well as the locally endemic net-wing midge *Neocurupira chiltoni*. These sites also had the highest diversity of EPT taxa, indicating better water and habitat quality.
- The invertebrate community composition for the annual sites was similar to previous years at the Styx River and Balguerie Stream sites. Both sites had a moderate number of pollution sensitive taxa. The Cashmere Stream annual sites were dominated by pollution tolerant taxa indicative of urban/rural impacted streams.
- QMCI scores at all sites were indicative of fair (QMCI 4 to 5) or poor (QMCI <4) habitat quality. Balguerie Stream in Banks Peninsula was the only site that had a QMCI score indicative of good or better quality (i.e., QMCI scores >5).
- Kākahi (freshwater mussels) were discovered in the Ōpāwaho-Heathcote River and a recent survey of kākahi in Cashmere Stream suggests this waterway has a stable population and reasonable recruitment.
- The range of fish species caught in the Ōpāwaho-Heathcote River and Linwood Canal catchments in 2020 was also similar to previous years and the catch was dominated by native species.
- Monitoring data from 2015 and 2020 indicate that bluegill bully populations have recovered in the Ōpāwaho-Heathcote River following a decline in numbers after the Canterbury earthquakes of 2010 and 2011.
- The fish fauna present in the three Banks Peninsula waterways was typical for small streams on Bank Peninsula, but these species are distinct from most streams in Christchurch city. Several species not found in the city's urban waterways were captured, such as kōaro (*Galaxias brevipinnis*) and banded kokopu (*Galaxias fasciatus*).
- There was no evidence of a decline in ecosystem health that could be attributed to stormwater discharges.

3.4.3. Mana Whenua Values

Mahaanui Kurataiao Ltd. have appointed a 'Mahinga Kai / Nga Wai' advisor, who will assist the Consent Holder in further developing the mana whenua values monitoring in Chapter 8 of the CSNDC Environmental Monitoring Programme. This is in-line with Condition 54, which requires the Consent Holder to work in collaboration with Papatipu Rūnanga to develop the Attribute Target Levels in Schedules 7 and 8 for the Waterway Cultural Health Index, Marine Cultural Health Index, and State of the Takiwā scores; as well as the associated mana whenua values monitoring sites and methodology in the EMP. These changes, once developed, shall be incorporated into the Environmental Monitoring Programme via an amendment, in accordance with Condition 50. Under the recently accepted Consent Variation Application, the new deadline for this task will be 20th June 2022.

3.4.4. Holistic Assessment

A summary of surface water quality, instream sediment, and aquatic ecology (including monthly fine sediment) monitoring at sites where monitoring overlaps, is provided in Table 3-2.

There is some variation in monitoring aspects at the sites. For example, poor water quality did not always reflect poor instream sediment quality. Equally, better habitat quality (such as larger substrate and riparian shading) did not necessarily result in better ecological condition (e.g., QMCI).

Although the Banks Peninsula waterways recorded much better ecological values than the City waterways, they are still showing evidence of stormwater inputs in surface water and instream sediments.

Table 3-2 Summary of surface water quality, instream sediment quality, and aquatic ecology, at waterway sites where monitoring overlaps. WQI = Water Quality Index; QMCI = Quantitative Macroinvertebrate Community Index; N/A = Not Applicable.
(Continued over Page)

Site	Monthly surface water quality	Wet weather surface water quality	Instream sediment quality	Aquatic ecology	Monthly fine sediment
Heathcote River at Warren Crescent	WQI: Fair Contaminants of concern: dissolved oxygen, nitrate, *E. coli*	Exceedances in dissolved oxygen, nitrate, dissolved inorganic nitrogen, dissolved reactive phosphorus	Exceedances in lead and zinc	• Extensive native riparian zone, with high shade and high sediment cover • Did not meet QMCI target • Fish: low diversity, with common bullies, and longfin ('At Risk - Declining') and shortfin eels	Did not meet target 100% cover
Haytons Stream at Retention Basin	WQI: Fair Contaminants of concern: zinc, turbidity, dissolved reactive phosphorus	No guidelines exceeded	Large exceedance in zinc	N/A	N/A
Heathcote River at Canterbury Park/Showgrounds	N/A	N/A	Exceedance in zinc	• Hard, stony substrates with high fine sediment cover • Did not meet QMCI target • Fish: low diversity, with common bullies, upland bullies, and shortfin eels	N/A
Curlett Road Stream at Southern Motorway	WQI: Very poor Contaminants of concern: copper, zinc, turbidity, dissolved oxygen, dissolved reactive phosphorus, *E. coli*	Exceedances in dissolved copper, dissolved zinc, total suspended solids, dissolved reactive phosphorus, *E. coli*	Exceedances in lead, copper, and zinc	N/A	N/A

Site	Monthly surface water quality	Wet weather surface water quality	Instream sediment quality	Aquatic ecology	Monthly fine sediment
Curlett Road Stream Upstream of Heathcote River Confluence	WQI: Poor Contaminants of concern: copper, zinc, turbidity, dissolved oxygen, nitrate, dissolved reactive phosphorus, *E. coli*	Exceedances in dissolved copper, dissolved oxygen, dissolved reactive phosphorus	Exceedances in lead, copper, and especially zinc	N/A	Did not meet target 100% cover
Heathcote River Downstream of Spreydon Domain	N/A	N/A	Exceedances in copper, lead and zinc, particularly high zinc concentration	• Stony bottom with high fine sediment cover • Did not meet QMCI target • Fish: low diversity, with common bullies, upland bullies, and longfin ('At Risk - Declining') and shortfin eels	N/A
Heathcote River at Rose Street	WQI: Fair Contaminants of concern: copper, zinc, nitrate, dissolved inorganic nitrogen, dissolved reactive phosphorus, *E. coli*	Exceedances in total suspended solids, turbidity, nitrate, dissolved inorganic nitrogen	Exceedances in copper, lead, and especially zinc	• Stony substrate with high fine sediment cover • Met QMCI target • One of only two Heathcote sites that has EPT taxa present • Fish: diverse population, including three 'At Risk - Declining' species (giant bully, inanga and longfin eel), as well as bullies and shortfin eels	Met target
Cashmere Stream at Sutherlands Road	WQI: Good Contaminants of concern: dissolved oxygen, nitrate, dissolved inorganic nitrogen	Exceedances in dissolved zinc, nitrate, dissolved inorganic nitrogen	No exceedances	• Low shade levels and high macrophyte cover • Did not meet QMCI target • Fish: low diversity, with only upland bully and shortfin eels	N/A

Site	Monthly surface water quality	Wet weather surface water quality	Instream sediment quality	Aquatic ecology	Monthly fine sediment
Cashmere Stream at Worsleys Road	WQI: Poor Contaminants of concern: copper, zinc, turbidity, dissolved oxygen, nitrate, dissolved inorganic nitrogen, *E. coli*	Exceedances in dissolved zinc, BOD_5, nitrate, dissolved inorganic nitrogen	No exceedances	• N/A	N/A
Heathcote River downstream of Barrington Street	N/A	N/A	Exceedances in lead and zinc	• High macrophyte cover • Met QMCI target • Fish: upland bullies, common bullies, and shortfin eels, as well as the 'At Risk - Declining' longfin eel • 'At Risk - Declining' wai kōura	N/A
Heathcote River at Ferniehurst Street	WQI: Fair Contaminants of concern: copper, zinc, turbidity, dissolved inorganic nitrogen, dissolved reactive phosphorus, *E. coli*	Exceedances in dissolved zinc, dissolved inorganic nitrogen		• 60-100% cover recorded during monitoring	N/A
Heathcote River Downstream of Colombo Street	N/A	N/A	Exceedance in zinc	• High macrophyte cover • Met QMCI target • One of only two Heathcote sites with EPT taxa present • Fish: common bully, upland bully, longfin eel ('At Risk - Declining'), and shortfin eel; high number of bluegill bullies found in constructed riffle areas	N/A

Site	Monthly surface water quality	Wet weather surface water quality	Instream sediment quality	Aquatic ecology	Monthly fine sediment
Heathcote River Downstream of Tennyson Street	N/A	N/A	Exceedance in zinc	• High fine sediment cover • Met QMCI target • Fish: common species, such as common bullies, upland bullies, and shortfin eels, as well as 'At Risk - Declining' giant bullies and longfin eels	N/A
Heathcote River at Tunnel Road	WQI: N/A Contaminants of concern: copper, zinc, turbidity, dissolved reactive phosphorus, *E. coli*	N/A	Exceedance in Polyromantic Hydrocarbons	• Non-wadeable site • Did not meet QMCI target • Fish: common freshwater species, as well as estuarine fish flounder, mullet and triple fin	N/A
Heathcote River at Catherine Street	WQI: Fair Contaminants of concern: turbidity, dissolved reactive phosphorus, *E. coli*	Exceedances in dissolved copper, dissolved zinc, dissolved reactive phosphorus	Exceedances in zinc and lead	• Non-wadeable site • Did not meet QMCI • Fish: 'At Risk - Declining' giant bully, inanga, and longfin	N/A
Steamwharf Stream upstream of Dyers Road	WQI: Good Contaminants of concern: dissolved reactive phosphorus, *E. coli*	N/A	N/A	• High fine sediment cover • Did not meet QMCI • Fish: 'At Risk - Declining' inanga and longfin eel, as well as common bully	N/A
Stream Reserve Drain	WQI: Poor Contaminants of concern: copper, zinc, dissolved oxygen, dissolved inorganic nitrogen, dissolved reactive phosphorus, *E.coli*	N/A	No exceedances	• High shade, hard substrates with fine sediment cover • No macrophytes present • Did not meet QMCI, but had high EPT taxa richness • Fish: shortfin eel, and regionally uncommon banded kokopu, as well as being the only site with 'At Risk - Declining' kōaro	N/A

4. Stormwater Quality Investigation Programme (Schedule 3)

Conditions 37- 39 of the CSNDC require that the Consent Holder carry out a series of actions contained in Schedule 3: Stormwater Quality Investigation Programme. The main aim of this programme of work is to improve the management of stormwater quality and assess and reduce stormwater effects on the receiving environment. Furthermore, Condition 38 provides the following list with regards to the purpose of this programme:

- Monitor the performance of selected stormwater treatment facilities and devices
- Assess the potential for the application of new technologies and management strategies
- Investigate using various models and techniques of water quality improvement strategies and options.

Below, a summary is provided on the progress of each of these tasks, broken down by those actions completed, underway, and yet to begin. It is important to note that this reports on progress made both in 2020, and to-date, where sufficient information is available.

4.1. Actions Underway

4.1.1. Schedule 3(a) – Feasibility Study for Development of an Instream Contaminant Concentration Model (ICCM)

A study carried out for Christchurch City Council, investigating the feasibility of developing an Instream Contaminant Concentration Model (ICCM) has concluded that developing such a model is possible. Christchurch City Council is currently considering the benefits of undertaking this work further. While a draft report has been submitted to Canterbury Regional Council a final report is to be submitted by 31 July 2021.

4.1.2. Schedule 3(d) – Feasibility Study of Receiving Environment Response Research Programme

Christchurch City Council is currently scoping a feasibility study, which will seek to establish the existing knowledge base and investigate the feasibility of robustly predicting the responses of the receiving environment to changes in network contaminant loads and resulting in-stream concentrations. Consideration shall be given to how and when the receiving environment might respond to changes in contaminant concentrations, how much work would be involved to predict results, what sort of models are possible, how monitoring to obtain real world results would be carried out, how long it would take the biological community to respond, and any gaps in knowledge.

4.1.3. Schedule 3(f) – Alternative Modelling Impact Investigation

Schedule 3(f) requires the Consent Holder to investigate the impacts of applying alternative modelling tools (including 'deterministic' models) to characterise the relationship between contaminant loads, concentrations and the receiving environment, and the processes which influence that relationship. This task is an ongoing task with no specified completion date, and is being implemented via other scheduled items such as Schedule 3(a), Schedule 3(d and e), and Schedule 3(g and h).

4.1.4. Schedule 3(g) – Feasibility Study of Instream Remediation Programme

Christchurch City Council is currently scoping a feasibility investigation into the techniques for remediating adverse effects of stormwater sediment discharges on receiving environments. This shall include consideration of sediment cover of the bed, and copper, lead, zinc and PAH contamination.

4.1.5. Schedule 3(i) – Device Effectiveness Monitoring and Modelling

Christchurch City Council is currently undertaking a 'device effectiveness' monitoring programme. The devices chosen are: floating wetlands at No. 1 Drain (Christchurch Golf Club, upstream of Te Ōranga/Horsehoe Lake), Stormfilters at Richardson Terrace (Bells Creek, upstream of the Ōpāwaho/Heathcote River), Prestons Wetland/Knights Stream, and Wigram Basin. The purpose of this programme is to monitor the actual TSS, zinc, and copper reduction performance of selected stormwater treatment facilities in order to improve certainty of performance values associated with TSS, zinc, and copper in contaminant load modelling.

Currently, there are no findings to report from the floating wetland at No.1 Drain and the Stormfilters at Richardson Terrace. However, there are some findings from the Knights Stream and Prestons Stormwater Treatment Facilities.

Knights Stream and Prestons Stormwater Treatment Facilities

To-date two rainfall events have been sampled, the second of which was a notably longer event which produced higher rainfall levels at both sites. During both events, higher intensity was recorded at Knights Stream, demonstrating the variability in rainfall distribution across Christchurch City.

The Knights Stream facility appeared to be performing well, with a significant reduction observed for the majority of pollutants. The second round of sampling at the Prestons facility has enabled the performance of this facility to be assessed in response to a higher rainfall event. A change in sampling location at the Prestons facility has meant that the results for this facility are less comparable between the two events.

4.1.6. Schedule 3(j) – Implementation of Device Effectiveness Monitoring and Modelling

Schedule 3(j) requires the Consent Holder to apply monitoring outputs from Schedule 3(i), along with other stormwater modelling and monitoring data being gathered, to inform the planning and design of stormwater systems and facilities, including in the development of Implementation Plans, and reviews of SMPs, Infrastructure Design Standards (IDS) and the Waterways Wetlands and Design Guide (WWDG). This task has no start or end dates assigned to it and has been considered an ongoing objective of implementation of findings. For the calendar year 2020, there were no findings significant enough to have warranted a review of either the IDS or WWDG.

4.1.7. Schedule 3(k) – Targeted Wet Weather Monitoring Programme

Christchurch City Council is currently undertaking a programme of targeted wet weather monitoring in selected receiving environments. The locations chosen for this monitoring are Hayton Stream, Curletts Stream and Wetland, and No.1 Drain; the latter being located within Christchurch Golf Course, upstream of Te Ōranga (Horseshoe Lake). This programme will utilise auto-sampling methods to improve knowledge of the state of the receiving environment, contaminant inputs and treatment efficiency, and to inform future mitigation options under SMPs. These auto-samplers have been installed, and an event of sufficient magnitude to trigger sampling occurred during May 2021, and the results gathered from this event are currently being processed.

5. Other Actions

Schedule 4 provides a list of actions to be carried out, both to ensure the implementation of the conditions of the resource consent, and further improvement of water quality/quantity monitoring and improvement. Timeframes for these actions are provided in these same schedule, and those completed and ongoing are summarised below. Similar to above, reporting includes progress made both in 2020 and to-date in 2021.

5.1. Actions Completed

5.1.1. Schedule 4(a) – Submission to Central Government

Adherent to Condition 40 and Schedule 4(a), a joint letter signed by the Christchurch City Council Mayor and the Canterbury Regional Council Chair was sent in December 2020 to central government, seeking national measures and industry standards to reduce the discharge of contaminants including zinc and copper from metal roofs, car tyres and brake linings.

5.1.2. Schedule 4(b) – Street-Sweeping and Sump-Cleaning (CBA)

Adherent to Condition 40 and Schedule 4(b), a cost-benefit analysis was carried-out, considering options for carrying out a targeted trial for contaminant reduction from an increased level of selective street-sweeping and sump-cleaning. This analysis has been submitted to Canterbury Regional Council, and no revision has been requested.

The main conclusions of this CBA were that "street sweeping may capture on-street sediment at significantly less cost than a rain garden, depending on the volume collected. Zinc may be captured at a comparable cost to capture by rain garden, although this result seems counter-intuitive given the low percentage capture of zinc by a sweeper."

Three recommendations have been put forward from this CBA:

1. Obtain better information about the amount of detritus per kilometre of side channel and its composition. Trials should prioritise Collector and Arterial roads.
2. If possible, correlate sediment volumes obtained by street sweeping with the sediment load arriving at a StormFilter™ and rain garden.
3. Evaluate "improved" street sweeping equipment (e.g. a superior vacuum machine), if such a machine can be obtained, to for its ability to uplift zinc and copper from road surfaces.

5.1.3. Schedule 4(i) – ESCP within BC and RC Processes

A Sediment Discharge Management Plan has been developed, as per Schedule 4(i). This plan establishes best practicable options for the management of stormwater discharges, to avoid the adverse effects of sediment discharge to waterways and the Christchurch City Council reticulated stormwater network.

Canterbury Regional Council have expressed the view that they find the current draft of this plan to be 'compliant'. However, feedback is being sort from Papatipu Rūnanga and there are still some specific issues regarding the detail of erosion and sediment control plans and enforcement which are being discussed. These issues are also related to the new Stormwater Bylaw which is also still being finalised, and thus for consistency, until these issues can be finalised, the plan will remain a draft. This task has no completion date requirement.

5.1.4. Schedule 4(k) – Source Control (CBA)

A cost-benefit analysis has been carried out to assess options to further improve source control, considering allocation of staff/resources to undertake industrial site audits, expected contamination risk and possible risk reduction of industrial sits and other source control measures in Schedule 4 as required by Condition 40. More specifically, with regard to the latter the cost-benefit analysis of increased street-sweeping and sump-cleaning (Schedule 4b) and the cost-benefit analysis of alternative stormwater treatment and discharge methods (Schedule 4d) have been considered.

This Cost/Benefit Analysis has been submitted to Canterbury Regional Council and concluded that mitigation must be a multi-faceted approach due to the many contaminants that impact stormwater and by the various pathways that those contaminants enter our waterways. Based on the current analysis, there appears to be a reasonable balance of source controls applied for the available funding. Christchurch City Council may review these results annually to determine if trends change over time and whether allocation of resources needs to be redistributed in the future.

5.1.5. Schedule 4(m) – Community Water Engagement Programme

A Community Waterways Partnership Charter has been developed and this partnership was launched on 22 March 2021. At this launch, along with many different community rivercare groups and others, the Christchurch City Council, Canterbury Regional Council, and the Department of Conservation signed the official Community Waterways Partnership. A summary of the charter is provided below.

"[…] a shared statement of intent among community groups, researchers, businesses, and local regional, and central government. We are seeking to work in partnership under a Charter to achieve outcomes that cannot be attained independently. We will do this by sharing expertise, networks, and resources, to promote and achieve solutions needed to improve the ecological health, indigenous biodiversity, and amenity values of our urban waterways. We uphold Te Mana o Te Wai to actively protect and enhance the mauri of Christchurch urban waterways.

This Charter is a statement of intent to work in partnership. It imposes no binding authority, decision or obligation on partners. Each signatory partner remains autonomous, and none is bound by the Charter in undertaking its everyday activities. The partnership is not a new formal structure or organisation."

5.2. Actions Underway

5.2.1. Schedule 4(c) – Trials of Increased Street Sweeping and Sump Cleaning

Schedule 4(c) requires the Consent Holder to carry out targeted trials for increased targeted/selective street-sweeping and sump-cleaning, should the Cost-Benefit Analysis in Schedule 4(b) provide sufficient merit. Given that indeed the Cost-Benefit Analysis found sufficient merit in instigating a programme of targeted trials for increased street-sweeping and sump-cleaning, particularly in capturing on-street sediment at a higher efficiency than a rain garden, a programme of targeted trials is currently being scoped and developed in collaboration between the Consent Holder and NIWA.

5.2.2. Schedule 4(d) – Alternate Stormwater Treatment Methods (CBA)

Adherent to Condition 40 and Schedule 4(d), a cost-benefit analysis was carried-out, considering 'alternate' methods of stormwater treatment and discharge. This analysis included consideration of redirection of stormwater to Managed Aquifer Recharge Discharge. This cost-benefit analysis has been submitted to Canterbury Regional Council in draft form and will be finalised by 31 July 2021.

5.2.3. Schedule 4(f) - Application of Trial Results for Street-Sweeping, Sump-Cleaning, and Alternative Stormwater Treatment Methods to Planning/Design of Facilities, SMPs, IDS, and WWDG

Similarly to Schedule 3(j), Schedule 4(f) requires the Consent Holder to apply the results of trials of street-sweeping, sump-cleaning, and alternative stormwater treatment (Schedule 4c and e), along with results from other stormwater modelling and monitoring data being gathered, to the planning and design of stormwater systems and facilities, including in the development and review of SMPs, Infrastructure Design Standards (IDS), and the Waterways Wetlands and Design Guide (WWDG).

5.2.4. Schedule 4(l) – Implementation of Source Control

Schedule 4(l) requires that the Consent Holder apply through agreement between the Consent Holder and Canterbury Regional Council, the results of the Cost-Benefit Analysis under Schedule 4(k) to prioritise source-control measures in SMPs and the Implementation Plan and to determine the number of audits conducted under Condition 47(b). This task has no specified completion date and is an 'ongoing task'.

5.2.5. Schedule 4(n, o, p, and q) – River Care Liaison Groups and Industrial Liaisons Group

Adherent to Condition 40, Schedule 4(n), a River Care Liaison Group was established. An introductory meeting was held on 19th November 2020. The second of these meetings will occur 22 July 2021. Adherent to Condition 40, Schedule 4(p), an Industrial Liaison Group was established. An introductory meeting was held on 17 December 2020.

5.2.6. Schedule 4(r) – Pūharakekenui/Styx River Weed Management

Schedule 4(r) requires the consent holder to undertake investigations of the various options for river channel weed (macrophyte) management practices to mitigate flood risk in the Pūharakekenui/Styx River. All stages of these investigations, required for compliance with the consent have been completed. However, a further study of diquat trials will not be undertaken until the latter part of 2021 due to seasonal requirements.

Due to unforeseen circumstances and illness, the interim report, addressing all matters other than the diquat study, has not yet been submitted to Canterbury Regional Council. It is intended that a finalised interim report shall be submitted by 31 July 2021.

6. Industrial and Other Monitoring

6.1. Industrial Site Audit Programme

The industrial site audit programme is intended to identify sites undertaking industrial activities that pose an unacceptable risk to the quality of stormwater discharge. The programme assists site owners and/or operators to identify on-site risks, infrastructure, and site management practices that could impact the quality of stormwater being discharged from their sites. The purpose of the programme is to improve stormwater discharges from individual sites by resolving problems at the source, and thereby improving the overall stormwater quality. It is anticipated that this will reduce the impact on waterway health and instream biota and help to improve our waterways.

In 2020, 15 industrial sites were audited with at least 10 of those agreed with Canterbury Regional Council to be potentially high risk. One site was also agreed to count for two audits due its size and complexity and the scale of work involved in completing a thorough audit. Therefore, 16 audit credits were obtained in 2020. Details of the audited sites can be found in Table 6-1.

As per condition 3(b)(i), Christchurch City Council have developed a draft risk matrix to identify and rate the risk associated with each of the stormwater discharges where information has been provided under Condition 3(a). This risk matrix has been reviewed by the Technical Peer Review Panel and updated accordingly. This draft copy of the risk matrix has been provided to the Industrial Liaison Group, established under Schedule 4(p-q) with an invitation to provide comment within 2 months, as per Condition 3(b)(ii).

Table 6-1 – Industrial Site Audits undertaken in 2020

Status	Business Name	Site Address	Audit Date	Industry Category	Waterways Impacted
Completed	Alron Car Valet	31 Raycroft Street, Waltham, Christchurch 8023	17/02/2020	Motor Vehicle and Equipment Associated Activities	Jacksons Creek
Reviewed	Garden Makers	2 Parkhouse Road, Sockburn, Christchurch 8042	25/02/2020	Building Construction, Landscaping, and Earthworks Related Activities	Paparua Stream
Approval to Discharge Withdrawn	Firth Industries REAUDIT	149 Waterloo Road, Hornby, Christchurch 8042 30 Carman Road, Hornby, Christchurch 8042	20/06/2020	Glass, Clay, Cement, Concrete, and Gypsum Product Manufactures	Haytons Stream
Reviewed	Christchurch Ready Mix Concrete Ltd.	126 Branston Street, Hornby, Christchurch 8042 124 Branston Street, Hornby, Christchurch 8042 116 Branston Street, Hornby, Christchurch 8042 PO Box 329, Kaiapoi 7644	22/06/2020	Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturers	Halswell Junction Outfall
Reviewed	Ewing Engineering Contractors	210 Cumnor Terrace, Woolston, Christchurch 8023 208 Cumnor Terrace, Woolston, Christchurch 8023 PO Box 787, Christchurch	06/07/2020	Primary and Fabricated Metal Product Manufacturers	Heathcote River
Reviewed	Mainmark Ground Engineering	108 Bamford Street, Woolston, Christchurch 8023 108A Bamford Street, Woolston, Christchurch 8023	06/07/2020	Building, Construction, Landscaping, Earthworks, Related Activities	Heathcote River

Status	Business Name	Site Address	Audit Date	Industry Category	Waterways Impacted
Reviewed	Bristol Metals	345 Wilsons Road, Waltham, Christchurch 8023 PO Box 10107, Phillipstown, Christchurch 8145	06/08/2020	Scrap and Waste Recycling Activities	Heathcote River
Reviewed	Bits for Honda	55 Buchanans Road, Hornby, Christchurch 8042	20/08/2020	Automobile Salvage Yards	Paparua Stream
Reviewed	Go Bus Transport Ltd.	26 Birmingham Drive, Middleton, Christchurch 8024 PO Box 9149, Middleton, Christchurch	20/08/2020	Motor Vehicle and Equipment Associated Facilities	Curletts Stream
Reviewed	Oderings Nurseries	92 Stourbridge Street, Spreydon, Christchurch 8024	10/09/2020	Building, Construction, Landscaping, and Earthworks Related Activities	Barrington Park Drain
Completed (x2)	G L Bowron and Co. Ltd.	11 and 33 Jubilee Street, Woolston, Christchurch 8023	16/09/2020	Leather Tanning and Finishing Facilities	Heathcote River
Reviewed	Southern X Press Ltd.	38 Wickham Street, Bromley, Christchurch 8062 PO Box 16 929, Hornby 8441	08/10/2020	Scrap and Waste Recycling Facilities	Charlesworth Drain
Reviewed	Stark Bros Limited	12 Marina Access PO Box 144, Lyttelton 8841	03/11/2020	Boat Yards, Water Transportation Facilities, and Port-Related Activities	Lyttelton Harbour
Reviewed	Hyundai Halbro Forklifts Ltd.	167 Waterloo Road, Hornby, Christchurch	10/11/2020	Motor Vehicle and Equipment Associated Facilities	Haytons Stream
Completed	Minimix Concrete Ltd.	45/47 Washbornes Road, Wigram, Christchurch 8042	08/12/2020	Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturers	Haytons Stream

6.2. Other Monitoring

6.2.1. Infiltration Basin Groundwater Investigations

Condition 32(d) requires the Consent Holder to carry out a site-specific assessment of contamination risk from stormwater infiltration facilities on domestic and community water drinking water wells. This assessment is based on the requirement of Condition 32 for all stormwater infiltration facilities constructed after the commencement of the resource consent to maintain specified separation distances from domestic and community drinking water supply wells. This also relates to subchapters 3.2.3 and 3.3.1 of the CSNDC Environmental Monitoring Programme. Furthermore, it is noted that the facilities being monitored under Stage 2 and 3 shall also inform the monitoring being undertaken on 'device effectiveness' under Schedule 3(i).

Stage 1: Undertake a desktop assessment to identify all stormwater infiltration facilities which do not meet the separation distances defined in Condition 32(b).

Stage 2: Undertake a site-specific assessment of the contamination risk and appropriate mitigation for all the basins identified in Stage 1.

Stage 3: Assessment of Infiltration Basin Efficiency.

Stage 1: Desktop Assessment of Separation Distances

Stage 1 is nearing completion, with the desktop assessment having been carried out, however some manual auditing of records, to ensure only infiltration basins, as opposed to first-flush or other similar types of basins are considered.

Stage 2: Site-specific Assessment of Contamination Risk and Appropriate Mitigation

Stage 2 of this assessment is to be carried out over a period of 12 months and shall monitor the facilities shown below in [Table 6-2]. This study shall include the following:

- The installation of at least two or three groundwater level monitoring wells at each site
- 12 months' monitoring of groundwater levels
- 12 months' monitoring of groundwater quality, assessed against Schedule 9
- Monitoring in at least one new basin, designed to characterise the change from the pre-basin to post-basin environment.

Table 6-2 – Infiltration Basin Monitoring

Basin	Awatea Basin	Kākāpō Basin (Riccarton Racecourse)	Outlook Place Industrial Park
Area of Infiltration Basins (ha)	Six Infiltration basins ranging in size from 0.21/1.53ha	Two basins at approximately 0.05 and 0.08ha	Two basins at approximately 0.022 and 0.057ha
Estimated Depth to Average Groundwater (m bgl)	7m	9m	3m
Suitable for Spring-fed Stream monitoring	Yes, Heathcote River headwaters 350m from closest infiltration basin	No nearby spring-fed streams	No, Styx River tributary headwaters 600m from closest infiltration basin, which is too far away to observe effects specifically related to this basin
Existing Monitoring Bores	Three new monitoring bores will need to be constructed	Two new monitoring bores will need to be constructed to monitor the water table. Existing bore M35/11995 can also be used for monitoring purposes	Two new monitoring bores will need to be constructed to monitor the water table
Suitable for Pre-Basin monitoring	No, basin has been operating for many years	Yes, basin has yet to be completed	No, basin has been operating for several years

The key tasks of this Stage 2 site-specific assessment are:

- Establishment of suitable monitoring wells at each site to provide an up-gradient – down-gradient comparison of groundwater quality. This will involve drilling new monitoring bores that are screened across the water table at Awatea Basin (3 new bores), Kākāpō Basin (2 new bores), and Outlook Place Basin (2 new bores). A deeper existing bore (M35/11995, 37.7m deep) is present near Kākāpō Basin which can also be used for monitoring provided that liaison occurs with the bore owner.

- It is proposed that these bores would be fitted with transducers to provide a continuous record of groundwater levels and electrical conductivity.
- Pressure transducers will also be fitted within each basin to record when they fill with stormwater to indicate when the discharges occur and to provide a correlation with the groundwater level monitoring record.
- It is proposed to carry out monthly water quality monitoring at these bores for the parameters listed in the CSNDC Environmental Monitoring Programme (*E. coli*, copper, lead, zinc, and electrical conductivity). The timing of the sampling within each month will be adjusted to cover the main periods of stormwater discharge as indicated by the pressure transducer readings.

Stage 3: Assessment of Infiltration Basin Treatment Efficiency

Furthermore, it is proposed to extend the methodology under Stage 2 to monitor the actual TSS, zinc, and copper reduction performance of infiltration facilities which discharge directly to ground, as is the case for those selected for Stage 2 of the study. It is generally assumed that treatment via discharge to ground is 100% effective when the effects are measured on surface water. It is proposed to make a qualitative assessment, using the data collected under Stage 2, on whether this assumption is correct and to make recommendations on methods to verify this if it is uncertain.

In addition, bypass or overflow events may occur. The study shall review the overflow events compared to rainfall for the basins in Stage 2 to determine the annual average volume treated. This may involve:

- Monitoring of levels in the basin to identify whether any bypasses occur
- Definition of the basin hydraulics to identify volume that bypasses the basin
- Use rainfall data to determine approximate inflow volume
- If there are any bypasses, transform this into a general relationship using historic and/or future rainfall, e.g. 90% of annual volume is treated.

7. Engagement with Papatipu Rūnanga

Christchurch City Council are committed to working in partnership and collaboration with Papatipu Rūnanga of the Christchurch District. More specifically, these Rūnanga, in no particular order, include:

- Te Ngāi Tūāhuriri Rūnanga
- Te Hapū o Ngāti Wheke (Rāpaki)
- Te Rūnanga o Koukourārata
- Wairewa Rūnanga
- Ōnuku Rūnanga
- Te Taumutu Rūnanga

Adherent to Condition 13, Christchurch City Council have engaged with Papatipu Rūnanga in the development of SMPs and the respective implementation plan, through providing quarterly reports to and by holding annual meetings with Mahaanui Kurataiao Ltd. to discuss stormwater works, the most recent of these meetings was held 24 November 2020. A new 'Mahinga Kai/Nga Wai Advisor' has been appointed by Mahaanui Kurataiao Ltd. and Papatipu Rūnanga, who shall assist Christchurch City Council with cultural reviews under the CSNDC.

8. Condition 59 – Responses to Monitoring

Condition 59 requires the Consent Holder to report on any results which identify that the TSS, copper, lead, and zinc Attribute Target Levels in surface water, as set out in Schedules 7 and 8, and *Escherichia coli*, copper, lead, and zinc in groundwater, as set out in Schedule 9, are not being met.

Where these levels are exceeded, the Consent Holder is required to engage with Canterbury Regional Council and conduct investigations into these exceedances during the year following monitoring. The results of these investigations are to be reported in the following year's annual report.

8.1. Schedules 7 (Waterways) and 8 (Coastal Waters)

Table 8-1 and Table 8-2 provide a collation of whether all of the Receiving Environment Objectives and Attribute Target Levels for Waterways (Schedule 7) and Coastal Areas (Schedule 8), respectively, have been met for the 2020 monitoring year. This information is taken from the waterway and coastal waters monitoring as per Section 1.

In summary:

- The following ATLs in Schedule 7 were met at most sites:
  - Algae and macrophyte cover
  - Copper, lead, and Polyaromatic Hydrocarbons (PAHs) in instream sediment
  - Dissolved lead in surface water
  - Total Suspended Solids in surface water.
- The following ATLs in Schedule 7 were not met at many sites:
  - QMCI
  - Fine sediment cover
  - Zinc in instream sediment
  - Dissolved copper and zinc in surface water.
- The following ATLs in Schedule 8 were met at most sites:
  - Dissolved zinc and lead in surface water
  - The following ATLs in Schedule 8 were not met at all sites:
  - Dissolved copper in surface water.

As detailed previously, responses to monitoring under Condition 59 is only triggered if the TSS, copper, lead, and zinc Attribute Target Levels in surface water are not met. This occurred at 32 of the 51 surface water quality monitoring sites (refer to the full report in Appendix E). Four sites are recommended in the surface water quality report for detailed further investigation:

- Curletts Stream at Motorway (Ōpāwaho/Heathcote Catchment)
- Ōpāwaho/Heathcote at Ferrymead Bridge (Ōpāwaho/Heathcote Catchment)
- Addington Brook (Ōtākaro/Avon Catchment)
- Nottingham Stream at Candys Road (Huritīni/Halswell Catchment).

Table 8-1 – Assessment against Schedule 7 (Waterways)

TBC-A = To be confirmed once a full year of monitoring allows hardness modified values to be calculated in accordance with Condition 52
TBC-B = To be confirmed following engagement with Papatipu Rūnanga, through an update to the EMP, in accordance with Condition 54

Objective	Attribute	Attribute Target Level	Monitoring Report	Outcome
Adverse effects on ecological values do not occur due to stormwater inputs	QMCI	Lower limit QMCI scores: • Spring-fed – plains – urban waterways: 3.5 • Spring-fed – plains waterways: 5 • Banks Peninsula waterways: 5	Five-yearly (wadeable sites) and annual aquatic ecology monitoring: Instream Consulting Limited (2020), and Tonkin & Taylor (2020)	• Five-yearly data: not met at 6 of the 12 sites in the Ōpāwaho-Heathcote River and Linwood Canal, and not met all three sites in Banks Peninsula • Annual monitoring: not met at 3 of 4 sites (Balguerie Stream met the ATL)
Adverse effects on water clarity and aquatic biota do not occur due to sediment inputs	Fine sediment (<2 mm diameter) percent cover of stream bed TSS concentrations in surface water	Upper limit fine sediment percent cover of stream bed: • Spring-fed – plains – urban waterways: 30% • Spring-fed – plains waterways: 20% • Banks Peninsula waterways: 20% Upper limit concentration of TSS in surface water: 25 mg/L No statistically significant increase in TSS concentrations	Five-yearly (wadeable sites) and annual aquatic ecology monitoring: Instream Consulting Limited (2020), and Tonkin & Taylor (2020) Monthly sediment cover: Instream Consulting Limited (*in press*) Monthly surface water monitoring: Margetts & Marshall (2021)	• Five-yearly data: not met at 8 of the 12 sites in Ōpāwaho-Heathcote River and Linwood Canal, and not met at all three sites in Banks Peninsula • Annual monitoring data: not met at 3 of 4 sites (Balguerie Stream met the ATL)Monthly fine sediment: not met at 10 of the 15 sites • Monthly TSS: guideline met at all 43 sites. Statistically significant increase recorded at three of 43 sites (Curlett at Motorway, Wilsons Stream, and Halswell at Tai Tapu Road)
Adverse effects on aquatic biota do not occur	Zinc, copper and lead concentrations	Upper limit concentration of dissolved zinc: • Ōtākaro-Avon River catchment: 0.02951 mg/L • Ōpāwaho-Heathcote River catchment: 0.0396 mg/L • Cashmere Stream: 0.00634 mg/L	Monthly surface water monitoring: Margetts & Marshall (2021)	• Zinc: guideline not met at 15 of 47 waterway sites • Copper: guideline not met at 23 of 47 waterway sites

Objective	Attribute	Attribute Target Level	Monitoring Report	Outcome
due to copper, lead and zinc inputs in surface water	in surface water[7]	• Huritini-Halswell River catchment: 0.01743 mg/L • Pūharakekenui-Styx River catchment: 0.01172 mg/L • Ōtukaikino River catchment: 0.00912 mg/L • Linwood Canal: 0.12691 mg/L • Banks Peninsula catchments: TBC-A Upper limit concentration of dissolved copper: • Linwood Canal, Ōtākaro-Avon and Ōpāwaho-Heathcote River catchments: 0.0018 mg/L • Huritini-Halswell, Pūharakekenui-Styx and Ōtūkaikino River catchments: 0.0014 mg/L • Cashmere Stream and Banks Peninsula waterways: 0.001 mg/L Upper limit concentration of dissolved lead: • Ōtākaro-Avon River catchment: 0.01539 mg/L • Ōpāwaho-Heathcote River catchment: 0.02388 mg/L • Cashmere Stream: 0.00427 mg/L • Huritini-Halswell River catchment: 0.01089 mg/L • Pūharakekenui-Styx River catchment: 0.00601 mg/L • Ōtūkaikino River catchment: 0.00414 mg/L • Linwood Canal: 0.1361 mg/L • Banks Peninsula catchments: TBC-A No statistically significant increase in copper, lead and zinc concentrations		• Lead: guideline met at all 47 waterway monitoring sites

[7] These guidelines have been updated with more recent values, as per the Environmental Monitoring Programme

Table 8-2 – Assessment against Schedule 8 (Coastal Waters)

TBC-B = To be confirmed following engagement with Papatipu Rūnanga, through an update to the EMP, in accordance with Condition 54

Objective	Attribute	Attribute Target Level	Monitoring Report	Outcome
Adverse effects on water clarity and aquatic biota do not occur due to sediment inputs	TSS concentrations in surface water	No statistically significant increase in TSS concentrations	Monthly surface water monitoring: Margetts & Marshall (2021)	Insufficient data for trends analysis (three years of data required)
Adverse effects on aquatic biota do not occur due to copper, lead and zinc inputs in surface water	Copper, lead and zinc concentrations in surface water	Maximum dissolved metal concentrations for all classes (with the exception of the Operational Area of the Port of Lyttelton): • Copper: 0.0013 mg/L • Lead: 0.0044 mg/L • Zinc: 0.015 mg/L No statistically significant increase in copper, lead and zinc concentrations.	Monthly surface water monitoring: Margetts & Marshall (2021)	Zinc: guideline not met at one of the three sites (Ihutai – Avon-Heathcote Estuary) Copper: guideline not met at all three sites Lead: guideline met at all three sites Insufficient data for trends analysis (three years of data required)
Adverse effects on Mana Whenua values do not occur due to stormwater inputs	Marine Cultural Health Index and State of Takiwā scores	Minimum averaged Marine Cultural Heath Index and State of Takiwā scores for all classes: TBC-B	N/A – monitoring not yet instigated	N/A - monitoring not yet instigated

8.2. Schedule 9 (Groundwater)

Nine exceedances of Schedule 9 Attribute Target Levels for Groundwater have been identified in the analysis undertaken in 2021.

8.2.1. Copper, Lead, and Zinc in CCC Water Supply Wells and ECan Monitoring Wells

There was 1 exceedance of the Attribute Target Level for dissolved copper in Christchurch City Council Drinking Water Supply Wells in 2020. This exceedance occurred in Well 5 at the Lake Terrace Pumping Station which exceeded the Attribute Target Level, but not Drinking Water Standards for New Zealand (DWSNZ) (2005) aesthetic standards or 50% of the maximum acceptable value (MAV).

There were no exceedances of the Attribute Target Level for dissolved zinc or dissolved lead in 2020 in Christchurch City Council Drinking Water Supply Wells.

There were no exceedances of the attribute target levels for copper, lead, and zinc found in ECan monitoring wells for Christchurch, for the year 2020.

8.2.2. Electrical Conductivity in Environment Canterbruy Monitoring Wells

Where sufficient data was available, there were 8 exceedances of the Attribute Target Level for electrical conductivity. These occurred at wells M35/1051, M35/1864, M35/2961, M35/5251, M35/6656, M35/6946, M36/1057, and M36/5893.

8.2.3. *E. coli* at CCC Drinking Water Supply Wells

If adopting the Limit of Detection (LOD) as the actual result, it could be said that there was no statistically significant increase in the concentration of *E. coli* at drinking water supply wells.

Table 8-3 Assessment against Attribute Target Levels for Groundwater (Schedule 9)

Objective	Attribute	Attribute Target Level	Outcome
Protect Drinking Water Quality	Copper, lead, zinc, and *Escherichia coli* concentrations in drinking water	Concentrations do not exceed: • Dissolved Copper: 0.5mg/L • Dissolved Lead: 0.0025 mg/L • Dissolved Zinc: 0.375mg/L	1 exceedance for dissolved copper in 2020, at Well 5 of the Lake Terrace Pump Station, which exceeded the Attribute Target Level, but not the Drinking Water Standards for New Zealand (2005) aesthetic standards or 50% of the Maximum Acceptable Value (MAV). No exceedances for dissolved lead in 2020. No exceedances for dissolved zinc in 2020.
		No statistically significant increase in the concentration of *Escherichia coli* at drinking water supply wells	No statistically significant trend in *Escherichia coli* detected
Avoid widespread adverse effects on shallow groundwater quality	Electrical conductivity in groundwater	No statistically significant increase in electrical conductivity	8 exceedances for electrical conductivity in 2020 at the following wells: • M35/1051 • M35/1864 • M35/2961 • M35/5251 • M35/6656 • M35/6946 • M36/1057 • M36/5893

9. Appendices

9.1. Appendix A: Developments Authorised Under CRC190445/CRC214226

9.2. Appendix B: Updated Schedule 1

9.3. Appendix C: Environmental Monitoring Programme (Version 8)

9.4. Appendix: D Annual Groundwater Analysis – Detailed Report

9.5. Appendix E: Annual Surface Water Quality Monitoring Report

9.6. Appendix F: Soil Quality Monitoring Trigger Values