Comprehensive Stormwater Network Discharge Consent Annual Report – June 2022

Prepared to meet the requirements of CRC214226

Christchurch City Council

Christchurch City Council

Internal Document Review and Approval

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Acronyms and Abbreviations

ATL ..... Attribute Target Level

CBA ..... Cost-Benefit Analysis

Council ..... Christchurch City Council

CSNDC ..... Comprehensive Stormwater Network Discharge Consent

ECan ..... Environment Canterbury Regional Council

EMP ..... Environmental Monitoring Programme

ESCP ..... Erosion Sediment Control Plan

ICCM ..... Instream Contaminant Concentration Model

IDS ..... Infrastructure Design Standards

IGSC ..... Interim Global Stormwater Consent

LWRP ..... Land and Water Regional Plan

MEDUSA ..... Modelled Estimates of Discharges for Urban Stormwater Assessments

MUSIC ..... Model for Urban Stormwater Improvement Conceptualisation

PAH ..... Polycyclic aromatic hydrocarbons

QMCI ..... Quantitative Macroinvertebrate Index

SDMP ..... Sediment Discharge Management Plan

SMP ..... Stormwater Management Plan

TPRP ..... Technical Peer Review Panel

TSS ..... Total Suspended Solids

TWWM ..... Targeted Wet Weather Monitoring

WWDG ..... Waterways Wetlands Design Guide

1. Purpose of the Annual Report

In December 2019, Environment Canterbury Regional Council (ECan), granted the Comprehensive Stormwater Network Discharge Consent (CSNDC) CRC214226, to the Christchurch City Council (Council). As per Condition 61, the Council must produce an Annual Report on 30 June each year, reporting on the previous calendar year of consent activities undertaken. The Annual Report is provided to ECan, Banks Peninsula and Christchurch West-Melton Zone Committees, Papatipu Rūnanga (via Mahaanui Kurataiao Limited), and is published on the Council's website.

This second CSNDC Annual Report primarily covers the period 1 January to 31 December 2021.

2. Summary of Developments Authorised under this Consent

The 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) applies 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 the Council to discharge stormwater under consent CRC214226 or to obtain their own resource consent from ECan.

The authorisations given by the 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 provides a list of sites that have been authorised to discharge under the CSNDC, as required by Condition 61(h).

ECan are notified of sites authorised to discharge under the consent on a monthly basis. The Council requests advice from ECan on applications for discharge approval which might hold unacceptably high risk. In accordance with Condition 2(d), those sites which ECan advice 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 ECan.

3. Changes to Regulatory Framework Affecting Stormwater Management Plans (SMPs)

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

4. Alignment with Christchurch-West Melton Sub-Regional Section of the Canterbury Land and Water Regional Plan (LWRP)

This resource consent was developed under the then operative version of the LWRP. 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 LWRP, and thus no further reporting on this matter is required.

5. Complaints or Observations regarding Spring Flow

There have been no specific complaints received by the Council 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.

6. Canterbury Regional Council – Consent Compliance Reviews

6.1. Compliance Monitoring Report December 2021

ECan undertook a compliance monitoring review of the CSNDC and sent through a report to the Council on 15 December 2021, sighting 12 non-compliances as presented below:

- Condition 4. The Stormwater Management Plans for Huritini/Halswell and Opawaho/Heathcote River Areas were submitted to ECan on the 13th of December. I have requested that the supporting documents are submitted to fully assess compliance. A summary of the engagement/consultation with the parties outlined under this condition is required to demonstrate compliance.
- Condition 8. (e) Consultation for the first two SMPs has now finished. As noted under Condition 4, please ensure that a summary of the feedback received is submitted with the supporting documents for the SMPs.
- Condition 13. This condition requires engagement with Papatipu Runanga. The annual meeting minutes have been received. Please confirm that the remainder of the engagement required by this condition has been carried out.
- Condition 15 a) A draft risk matrix has been viewed however it appears that a review of it by a member of the TPRP was not included. Please confirm whether the review of the draft risk matrix will be provided after the industry feedback has been incorporated.
- Condition 22. - Appendix A of the Annual Report, submitted in June 2021 contained a list of developments authorised under this consent over the period of 19 December 2019 to 3 June 2021. Many of the developments or redevelopments listed do not have any notes in the "device or notes" column, rather it states N/A. There is also no description as to the nature of the activity or size of the site. Therefore I cannot fully assess whether the Council is fully compliant with this condition. It is possible that a site that has "N/A" in the notes does not require mitigation for a valid reason however I cannot confirm this. In the next revision of Appendix A, to be submitted in June 2022, please ensure that additional detail is included in this table for the purposes of assessing compliance against this consent condition. No justification is provided for why some sites do not require mitigation.
- Please provide the information requested in my letter to Veronica Zefferino dated 10 December 2021 regarding Sutherlands Basins. In addition, Westmorland Rise Stage 6 does not appear have first flush treatment although it should be provided based on Schedule 6 requirements. Please detail the rationale behind this.
- Condition 25. We do not have any information regarding whether existing developments have had retrofitted water quality or quantity mitigation. Please confirm whether any retrofitting of treatment or quality mitigation has been required since the commencement date of this consent.
- Condition 26. The Lower Styx Water Level data was submitted from the 30/11/2019 through to the 9/9/2021. The weed harvesting dates were also submitted. It appears as though the dry weather base flow water level exceeded the 10.1 m trigger level set by this condition in March 2021, however the weed harvesting was not carried out within the 40 day time frame. In this instance, it was carried out on the 26th of May 2021. Please confirm whether this is the case, and please ensure that you comply with this condition in the future.
- Condition 29. I cannot confirm from Appendix One of the Annual Report whether any greenfield developments have been approved since the consent was granted, and whether these developments have installed facilities as per the requirements of this condition.

Please provide details of any greenfield developments and related facilities that have been approved since December 2019.

- Condition 35. We do not have any information regarding compliance with this condition. Please confirm whether any developments which meet this criteria have occurred since this consent commenced or have been approved.
- Condition 36. Please submit the Operations and Maintenance Manuals for all facilities which have been constructed after the commencement of this consent
- Condition 4. Submit the final report for Schedule 4 (r) once the diquat study has been completed.
- Schedule 4 (i) requires that the Council instigate, in the building consent approval and inspection process, a requirement for and process for approval and inspection of erosion and sediment control measure prior to site clearances. The Council has set out a process in the Sediment Discharge Management Plan. There appears to be a gap in this where a site has an "exemption", this has affected industrial/commercial subdivision type developments. Please provide some commentary as to how this Schedule 4 (i) is being complied with.
- Condition 41. As has been discussed with the Council, there appears to be a gap where a site has an "exemption", this has affected industrial/commercial subdivision type developments. The Council needs to look further into this. More detail is needed from the Council regarding who reviews ESCPs and checks controls for larger scale developments such as subdivisions and how the internal ESCP audit process works - also how this interacts with the Stormwater Approvals Process. Please provide a written explanation of how this process works. Please ensure compliance with this consent condition.

Most of these non-compliance matters have been addressed, which will be reported on in the next CSNDC Annual Report. For more detail on this report, see Appendix B.

7. Stormwater Management Plans

7.1. Background and Purpose

Stormwater Management Plans are required to be developed and updated for each river catchment, as per CSNDC 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 the Council for these catchments in relation to flood protection, ecology and water quality, and hydrogeology (groundwater).

7.2. Progress to-date on SMP Programme

As per Condition 5, the SMPs for the Huritīni/Halswell, and Ōpāwaho/Heathcote were completed and reviewed by the TPRP, as per Condition 14(b) and 15(b). They went out for public consultation in July and August 2021. Once submissions were considered and SMPs updated, they were sent to Council, adopted and then lodged with ECan in December 2021. ECan has provided technical feedback and Council staff are in the process of updating the SMPs for their resubmission in August 2022, for ECan signoff.

The draft Ihutai-Estuary and Coastal SMP went out for public consultation and submissions in March and April 2022. The SMP was adopted by Council on 9 June 2022 and lodged with ECan on 30 June 2022, for their review and signoff. More detail on this SMP will be provided in the 2023 CSNDC Annual Report.

7.3. Implementation Plan

The implementation plan, as per Condition 11, was lodged with ECan in 2021. An updated programme of stormwater capital works for the Council and anticipated private development, with budgets linked to the Council's Long Term Plan, for the period FY2021-30, is provided in Appendix C.

7.4. Summary of Contaminant Load Reduction Targets in SMPs

Condition 19 numerical targets require Council to specify target contaminant load reductions to be achieved by proposed facilities and devices. Numerical targets are proposed based on a contaminant load model. The Auckland Regional Council's contaminant load model was adapted to Christchurch conditions by Golder Ltd and run for the four major catchments.

Ōpāwaho/Heathcote River Catchment SMP

Table 1: Target reductions in stormwater contaminant load (tonnes/year) resulting from treatment in new facilities and anticipated changes in contaminant sources compared to the consent application base year 2018, for the Ōpāwaho/Heathcote River Catchment SMP.

Contaminant			
	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%

Huritīni/Halswell River Catchment SMP

Table 2: Target reductions in stormwater contaminant load (tonnes/year) resulting from treatment in new facilities and anticipated changes in contaminant sources compared to the consent application base year 2018, for the Huritīni/Halswell River Catchment SMP.

Contaminant			
	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%

Ihutai-Estuary Coastal SMP

Target reductions are those estimated for a proposed stormwater treatment wetland in Linwood Paddocks, adjacent to Dyers Road, treating 90% of the Bromley industrial area. The MEDUSA model jointly developed by Canterbury School of Engineering and DHI was used to estimate target reductions. This modelling was undertaken in 2021, as the Golder 2018 modelling only focused on the four main river catchments and did not provide separate results for the estuary and coastal areas. It is noted that development in this catchment has been minimal in recent years and 2021 conditions are equivalent to 2019 conditions within the limits of modelling accuracy.

Table 3: Target reductions in stormwater contaminant load (tonnes/year) into Ihutai resulting from treatment in new facilities and anticipated changes in contaminant sources compared to the base year 2021.

Contaminant	
TSS	3.4%
Total Zinc	5%
Total Copper	5.3%

The TSS reduction is smaller than metals reductions because of the large sediment contribution, attributed to hill catchments, which will be untreated.

8. Environmental Monitoring Programme (EMP)

Adherent to Condition 49, an EMP was formulated and implemented, to determine 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. Please note that the mana whenua values monitoring programme (Condition 54), will start in July 2022, so the first reporting of this will be in the 2023 Annual Report.

The latest EMP version 9, has been submitted to ECan for review and comment (Appendix D).

8.1. Soil Quality Monitoring at Infiltration Facilities

Chapter 2 of the EMP requires the sampling of soil from six different infiltration facilities, on a five-yearly basis. Monitoring was undertaken in 2010, 2015, and 2020. Sampling will be undertaken again in 2025 and findings presented in the 2026 Annual Report.

8.2. Groundwater

Annual analysis of groundwater levels and quality is required under EMP Chapter 3. Following analysis of both 2021 and historic data, the following conclusions have been made (please refer to the detailed monitoring report, attached as Appendix E for more detailed analysis):

8.2.1. Council Groundwater Level Monitoring Wells

At the end of 2021, the Council groundwater network consists of 35 permanent sites. Three of the sites, Kruses Drain (66649), Richmond Hill Waterway (66676) and Creamery Stream (67809) were decommissioned in late January as requested by the Council's Stormwater and Waterways Operations Team. The Prestons Subdivision water-level and flow site (66446) showed no discharge record for the entire period, the sensor is functioning normally however sedimentation of the sensor continues to be an issue at this site.

No significant change in water level was recorded for the 2021 calendar year.

The minimum, mean and maximum stage levels for January to December 2021 are presented in Appendix 16.5

8.2.2. Dissolved Copper, Lead, and Zinc in ECan Monitoring Wells

There was an insufficient number of monitoring events completed at each ECan monitoring well to determine any trend in heavy metal concentrations as outlined in the 2020 Annual Groundwater Report. No further trend was analysed for this calendar year in ECan monitoring wells.

8.2.3. Dissolved Copper, Lead, and Zinc in Council Water Supply Wells

There were no exceedances recorded of the attribute target level for dissolved copper in the 2021 calendar year. There were no historical exceedances reported of the attribute target level for copper. In 2020 annual report, one exceedance of the attribute target level for dissolved copper was reported in well 5, at the Lake Terrace Pump Station which extracts from aquifer 3 (Burwood gravels) – this result was incorrectly recorded due to some logistical issues and later clarified in the separate Memo (provided along with this annual report).

There were no exceedances of the dissolved zinc target level in the 2021 calendar year. In 2011, there had been three exceedances of the attribute target level for dissolved zinc in various wells and aquifers at the Brooklands (aquifer 2), Mays (aquifer 4) and Belfast Pump Stations (aquifer 1). The results appear to be a one off and none of the wells recorded above the attribute target level. Over the last few years, Council has introduced the programme of replacement of most of the shallower wells with deeper secure aquifer sources. Requirements for demonstrating that wells have a sanitary bore head mean that Stormwater should not affect the quality of the bores.

There were no exceedances of the dissolved lead target level in the 2021 calendar year. Historically there had been exceedances of the dissolved lead target level in various wells and aquifers at the Addington (2011), Main Pump (2009), Spreydon (2009), Woolston (2009), Auburn (2010), Crosbie (2011) and Parklands Pump Stations (2011). The results appear to be a one off and none of the wells recorded above the attribute target level.

No significant trend was detected for heavy metal concentrations (Zn, Cu and Pb) in Council (aquifer 1 and aquifer 2) monitoring wells. There was an insufficient number of monitoring events completed at each well to determine well specific heavy metal concentration trends.

8.2.4. *Escherichia coli* Detections in Council Water Supply Wells

There were no detection of *E. coli* equal to or above the laboratory limit of reporting (LOR) of 1 maximum probable number (MPN) per 100 ml at CCC water supply wells in 2021. In total there were, 529 samples taken from the various water supply wells in the city.

In total, 100% of *Escherichia coli* results were qualitative data expressed as being above or below 1 MPN/100ml, Mann-Kendall analysis would not be appropriate to analyse the data. The results were compared against the number of *E. coli* exceedances allowed for 95% confidence that the New Zealand drinking water MAV is not exceeded more than 5% of the time in accordance with the DWSNZ. No CCC water supply wells exceeded their respective allowable exceedances given the respective number of samples in the 2021 calendar year.

8.2.5. Statistical Analysis of *E. coli* concentration in Council Drinking Water Supply Wells

The majority of the *E. coli* data (almost 100%) was 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 well 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 wells exceeded their respective allowable exceedance in 2021.

8.2.6. Statistical Analysis of Conductivity in ECan Monitoring Wells

In 2020, Council engaged an external consultant to conduct the statistical analysis of electrical conductivity for the ECan Monitoring wells. A statistically increasing trend in electrical conductivity of groundwater at a 95 % confidence interval was determined at eight of the ECan monitoring wells, M35/1051, M35/1864, M35/2961, M35/5251, M35/6656, M35/6946, M36/1057 and M36/5893. The result for these wells does not satisfy the receiving environment objective of

no statistically significant increase in electrical conductivity. Furthermore, there was an insufficient data to determine any trends in heavy metal concentration at eight of wells monitored.

In 2021, Council performed the statistical trend analysis of electrical conductivity for Council wells mainly at aquifer 1 and aquifer 2 using the Mann-Kendall Trend Test Analysis. No significant trend was noticed at aquifer 1 (n= 83) and aquifer 2 (n= 54). A separate statistical analysis of electricity conductivity for Coastal and Estuary wells were conducted, there was an insufficient data to conduct a trend analysis separately at aquifer 1 and aquifer 2.

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

Subchapter 4.3 requires the Council 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 model updates;
- Ōpāwaho/Heathcote River Catchment model calibration and updates;
- Huritīni/Halswell River Catchment model build; and
- Matuku Takotako/Sumner model calibration and updates.

Pūharakekenui/Styx River Catchment model build has been delayed due to resourcing shortfalls at the procurement stage. This model build is expected to be delivered in late 2023. Following completion of these models, after submission of this CSNDC Annual Report, detailed reports will be provided to ECan. Currently there are no new results to present. A detailed summary, and links to the Consultant reports are contained in Table 4 below.

Table 4: 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) has been updated by GHD to ED2020, and Future Development (FD) as part of Council's LDRP97 (Multi-hazard) project. Project handover has been delayed until June 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
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) has been recalibrated (calibration 2017, completed February 2022) due to mass balance errors discovered after model build project completion. Subsequent model updates by DHI to ED2020 has been completed (April 2022). Updates to Future Development (FD) as part of Council's LDRP530 (Upper Heathcote Storage Optimisation) project have been delayed until September 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
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 is being peer reviewed (expected June 2022). ED2020 results and Future Development (FD) is currently being built by Beca. Upon completion this model will be the most advanced whole catchment model. This work has been delayed until September 2022. 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
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 ED2022 and Future Development (FD) is currently being procured. A tender is to be let in June 2022, with work expected to be complete by November 2023. 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) has been recalibrated by GHD and CCC (calibration 2013, completed in December 2021). Updates to ED2020 including Future Development (FD) is scheduled for completion in June 2022. Notable improvements to the model include: • Updated boundary conditions (Tide statistics, Rainfall statistics including Climate Change increases) • Updated physical representations of pipe and channel network, and ground surface/ 2D mesh
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: ECan	ECan build and update models for some Banks Peninsula settlements including Little River.		

8.4. Waterway and Coastal Waters Monitoring

8.4.1. Surface Water Quality

Surface water quality monitoring was carried out for the 2021 monitoring year, in accordance with Chapter 5 of the EMP. A full report is attached in Appendix F.

In summary:

- The Council monitors the water quality of representative waterbodies within Christchurch and Banks Peninsula.
- 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 sites in the Pūharakekenui-Styx River catchment were monitored by the Styx Living Laboratory Trust. Three wet weather monitoring events were also conducted in the Huritini-Halswell River catchment.
- Over 33,500 tests were conducted during 2019-2021 for the Council monthly monitoring, with 20,813 of these allowing the assessment of each waterway site against relevant guideline levels.
- The priority parameters to address include bacteria (as indicated by *Escherichia coli*), dissolved copper, phosphorus (Dissolved Reactive Phosphorus), and dissolved zinc. The coastal sites generally had issues with dissolved copper and enterococci contamination.
- Based on the WQI, the Ōtūkaikino River catchment recorded ‘very good’ water quality, the Ōtākaro-Avon River and the Pūharakekenui-Styx River recorded ‘good’ water quality, and the Ōpāwaho-Heathcote River and Huritini-Halswell River recorded ‘poor’ water quality. The Banks Peninsula waterways recorded ‘poor’ (Stream Reserve Drain) and ‘fair’ (Balguerie and Aylmers Streams) water quality.
    - The Ōtūkaikino River recorded the best water quality out of all the catchments. The best site for water quality was Ōtūkaikino at Groynes, followed by Wilsons Stream and Styx at Gardiners Road.
    - The catchment with the worst water quality was the Ōpāwaho-Heathcote River. The worst site was Curletts at Motorway, followed by Heathcote at Tunnel Rd, and Heathcote at Warren Cres.
- Water quality at the sites has mostly remained steady over time since monitoring began in the early and mid-2000s.
- Wet weather monitoring concentrations were generally similar to that recorded for the monthly monitoring; however, sediment levels were lower during monthly monitoring and nitrogen levels were higher.
- Thirty-one of the 51 sites triggered further investigations due to not meeting the ATL for TSS, copper, or zinc. These sites are prioritised to four: Curletts at Motorway and Heathcote at Ferrymead Bridge in the Ōpāwaho-Heathcote River catchment, Addington Brook in the Ōtākaro-Avon River catchment, and Nottingham at Candys Rd in the Huritini-Halswell River catchment. These are the same sites prioritised for investigation last year and therefore Condition 59 investigations are already under way.

- A number of recommendations are provided in the report. In particular:
  - Curletts Stream, Nottingham Stream, Haytons Stream, Addington Brook, and the lower Ōpāwaho-Heathcote River are prioritised for contaminant source control and treatment.
  - An investigation into increasing levels of *E. coli* in the Ōtūkaikino River is implemented.
  - Construction of the Council stormwater wetlands in Belfast (Ōtūkaikino River catchment) is prioritised.
  - 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).
  - Investigations on sources of faecal and phosphorus contamination are carried out.
  - The Action Plan for the Council Community Outcome for Healthy Water Bodies is continued to be developed.
- 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.

8.4.2. Banks Peninsula Hardness Modified Guideline Values for Metals

In accordance with Condition 52(a), hardness modified guideline values have been calculated for lead and zinc for Banks Peninsula waterways. These values were used in the surface water quality report (Appendix F), with the methodology detailed in Appendix D of this surface water quality report. Section 5 of Version 9 of the EMP has also been updated to reflect these changes in guideline values and therefore ATLs.

8.4.3. Instream Sediment Quality and Aquatic Ecology

For the 2021 monitoring year, the following instream sediment quality and aquatic ecology monitoring was carried out in accordance with Chapters 6 and 7 of the EMP:

- Five-yearly aquatic ecology (habitat, macroinvertebrates, and fish) and instream sediment monitoring in the Huritini-Halswell River (8 sites) (Appendix G);[1]
- Monthly fine sediment monitoring (17 sites) (Appendix H);[2]
- Annual aquatic ecology monitoring in Cashmere Stream (2 sites) and Wilsons Stream (2 sites) (habitat and macroinvertebrates[3]) (Appendix G).

Of note from the monitoring:

- Most of the sites have not changed in ecological condition compared to the previous years. However, riparian vegetation at Cases Drain improved from cropped grasses to native plantings and habitat reduced at Creamery Drain from bank works. This was the first year the two annual sites in Wilsons Drain have been monitored.

[1] https://ccc.govt.nz/assets/Documents/Environment/Water/Monitoring-Reports/2021-reports/2021-5-Yearly-Ecology-Monitoring.pdf
[2] Sites Ōtūkaikino River at Groynes Inlet, Kā Pūtahi Creek at Ouruhia Reserve and Styx River at Styx Mill Reserve were new sites added with the Environmental Monitoring Programme (Version 8) amendments. Monitoring was instigated at these sites in July 2021.
[3] Fish monitoring is not normally carried out at annual monitoring sites; however, fishing was conducted this year to inform a Council project in the area

- The majority of the Huritini-Halswell River sites had poor habitat quality, with substrates dominated by fine sediments. One annual Cashmere Stream site had predominantly stony substrate.
- Total macrophyte cover in the Huritini-Halswell River was high, with the sites recording lower macrophyte cover corresponding with higher amounts of shade cover from riparian vegetation. Macrophyte cover was significantly higher in 2021 than in previous years at the Halswell catchment sites, due to the impacts of recent weed clearance in previous years. Macrophyte cover at the annual monitoring sites was also high, with the exception of Balguerie Stream due to high shade cover and stony substrates.
- Bed cover with long filamentous algae was low across all sites. Low periphyton cover is typical in macrophyte-dominated spring-fed waterways, such as Huritini-Halswell River and its tributaries. Low cover with long filamentous algae (and macrophytes) in Balguerie Stream likely reflects a combination of good shading and regular flushing flows.
- Concentrations of common stormwater contaminants in sediments have remained low at most sites in the Halswell catchment. Over time, Nottingham Stream has consistently had elevated levels compared with the other four monitoring sites, reflecting the greater proportion of urban land use in the catchment. All sites complied with consent ATLs, except for zinc at Nottingham Stream.
- Invertebrate communities within the Huritini-Halswell River catchment were dominated by pollution-tolerant snails and crustaceans that are common to Christchurch urban waterways. In contrast, Balguerie Stream was dominated by pollution-sensitive mayflies, stoneflies, and caddisflies (EPT taxa[4]). The Cashmere Stream and Wilsons Stream annual sites were dominated by pollution tolerant taxa indicative of urban/rural impacted streams.
- Quantitative Macroinvertebrate Community Index (MCI) scores at all Huritini-Halswell River catchment and annual monitoring sites at Cashmere and Wilsons Streams were indicative of fair (QMCI 4 to 5) or poor (QMCI <4) habitat quality. Cashmere Stream and Balguerie Stream in Banks Peninsula were the only sites that had a QMCI score indicative of good or better quality (i.e., QMCI scores >5).
- Wai kōura (freshwater crayfish) were caught during electric fishing in 2021 in Creamery Stream and during invertebrate sampling in Cases Drain, but were not recoded at any other sites. Wai kōura were once abundant in Creamery Stream and have not been recorded there since the 2011 earthquakes. They have not been previously recorded in Cases Drain. No kākahi (freshwater mussel) were found in any of the monitored sites. Both macroinvertebrate species have a conservation status of 'At-Risk – Declining'[5].
- The range of fish species caught in the Huritini-Halswell River catchment in 2021 was similar to previous years and the catch was dominated by native species common in urban environments. The pest species, perch (*Perca fluviatilis*), was found at one site in the Huritini-Halswell River which is consistent with previous

[4] The total number of taxa within the "pollution sensitive" orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies).

[5] Grainger, N., Harding, J., Drinnan, T., Collier, K., Smith, B., Death, R., Makan, T., and Rolfe, J. (2018). Conservation status of New Zealand freshwater invertebrates, 2018. Department of Conservation New Zealand Threat Classification Series 28. Department of Conservation, Wellington, New Zealand.

monitoring. Lamprey were found in Creamery Stream and Wilsons Drain at low densities. This species has a conservation status of 'Nationally Vulnerable'[6].

- There was no obvious evidence of a decline in ecosystem health that could be directly attributed to stormwater discharges at the specific sites monitored. However, it is acknowledged that stormwater inputs will be having negative effects on waterway ecology, contributing to the degraded ecosystems observed.

8.4.4. Fine Sediment

Fine sediment cover monitoring was carried out for the 2021 monitoring year, in accordance with Chapter 7 of the EMP. A full report is attached in Appendix H.

This was the first year that monthly deposited sediment data was available to summarise for the full calendar year. There were no obvious trends in fine sediment between sites and catchments, with similar but variable results. Overall, fine sediment cover was high and exceeded consent target levels at 12 of the 17 monitoring sites. Curlett Road Stream Upstream of Ōpāwaho-Heathcote River Confluence had the highest median cover across all 17 sites and Ōtākaro-Avon River at Carlton Mill corner had the lowest median cover.

There is currently insufficient data to conduct trend analysis. Further monitoring will indicate whether there are any improving or declining trends in fine sediment cover over time.

The following recommendations were made:

- Continuation of long term monitoring to establish if sediment cover changes over time;
- Stormwater treatment in catchments that are predominantly urban that do not have stormwater treatment in place (e.g., Nottingham Stream and Riccarton Main Drain);
- Working with industry to prevent sediment runoff from individual sites from getting into the stormwater system and then into waterways;
- Implementation of CSNDC tasks to reduce sediment discharges, such as:
  - Implementing the Risk Matrix and Transition Plan for Excluded Sites (Condition 3);
  - Ensuring site-specific Erosion and Sediment Control Plans (Condition 41);
  - Instigating the Sediment Discharge Management Plan (Conditions 43-46);
  - Embedding a Building Consent approval and inspection process with respect to erosion and sediment control (Schedule 4i);
  - Implementing the sustainable behaviour change programme (Schedule 4m).
- Implementation of tasks in the Healthy Water Bodies Action plan such as:
  - Reducing sediment discharges, in conjunction with other stakeholders, such as Environment Canterbury (e.g., by instigating the CSNDC, Stormwater and Land Drainage Bylaw, Building Act, Community Waterways Partnership, and Surface Water Implementation Plan);
  - Carrying out education/behaviour change campaigns via the Community Water Partnership to reduce sediment inputs to waterways;
  - Removing excessive fine bed sediment where appropriate;

[6] Dunn, N. R., Allibone, R. M., Closs, G. P., Crow, S. K., David, B. O., Goodman, J. N., Griffiths, M., Jack, D. C., Ling, N., Waters, J. M., and Rolfe, J. R. (2017). Conservation status of New Zealand freshwater fishes, 2017. Department of Conservation New Zealand Threat Classification Series 28. Department of Conservation, Wellington, New Zealand.

- Reviewing Council maintenance practices to ensure effects on water quality are mitigated as far as possible (e.g., preventing sediment discharge due to macrophyte removal).

8.4.5. Mana Whenua Values

The ATLs in Schedules 7 and 8 for the Waterway Cultural Health Index, Marine Cultural Health Index and State of Takiwa scores, as well as the associated mana whenua values monitoring sites and methodology in Chapter 8 of the EMP, are required to be developed in accordance with Condition 54. Sites and methods for the Ōtūkaikino River catchment have been confirmed to allow monitoring to be carried out in early 2022. These will be incorporated into Chapter 8 of the EMP in the coming months. However, the ATLs, and the sites and methodology for the other catchments, still need to be confirmed. They will also be incorporated into the EMP once they are available.

The results of the Ōtūkaikino River catchment mana whenua monitoring will be presented in the 2023 CSNDC Annual Report, to align with the other catchment monitoring that will be presented (e.g., aquatic ecology).

8.4.6. 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 5.

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 several threatened and locally uncommon species were found in 2021, habitat conditions and water quality conditions remain poor.

Table 5: Summary of surface water quality, instream sediment quality, and aquatic ecology, at waterway sites where monitoring overlaps. ATL = Attribute Target Level; BOD_5 = Biochemical Oxygen Demand; DIN = Dissolved Inorganic Nitrogen; DRP = Dissolved Reactive Phosphorus; EPT = the total number of taxa within the "pollution sensitive" orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies); *E. coli* = *Escherichia coli*; QMCI = Quantitative Macroinvertebrate Index; TSS = Total Suspended Solids.

Site	Monthly surface water quality	Wet weather surface water quality	Instream sediment quality	Aquatic Ecology	Monthly fine sediment
Knights Stream US of Whincops	N/A	N/A	No guidelines exceeded	• High shade cover, no algae and low macrophyte cover. Dominated by soft sediment. • Did not meet QMCI ATL • Upland bullies, common bullies, and shortfin eels, as well as the 'At Risk - Declining' longfin eel	N/A
Knights Stream at Sabys	WQI: Fair Contaminants of concern: nitrate, DIN, *E.coli*	Exceedances in turbidity, nitrate, DIN, DRP, *E.coli*	No guidelines exceeded	• Low shade, high fine sediment cover, low macrophyte and algae cover, steep banks • Did not meet QMCI ATL • Upland bullies and the 'At Risk - Declining' longfin eel	Exceeded guideline
Cases Drain	N/A	N/A	N/A	• High fine sediment cover, high macrophyte cover, native planted riparian margin • Did not meet QMCI ATL • Upland bullies, common bullies, and shortfin eels, as well as the 'At Risk - Declining' longfin eel	N/A
Creamery Stream	N/A	N/A	No guidelines exceeded	• Low macrophyte cover, reduced riparian cover • Did not meet QMCI ATL • Upland bullies, common bullies, shortfin eels, 'At Risk – declining' inanga, wai kōura and longfin eel, and 'Threatened – Nationally Vulnerable' lamprey	N/A
Nottingham Stream	WQI: Fair Contaminants of concern: copper, zinc, DRP, *E. coli*	Exceedances in copper, zinc, TSS, turbidity, BOD_5, DRP, *E.coli*	Exceedance in zinc	• High shade, shallow, low macrophyte cover, high fine sediment • Did not meet QMCI ATL • Upland bullies and shortfin eels	Exceeded guideline

Halswell River at Wroots/Halswell Rds	WQI: Poor Contaminants of concern: copper, zinc, turbidity, nitrate, DIN, DRP, *E. coil*	N/A	No guidelines exceeded	• High macrophyte cover, low shade • Did not meet QMCI ATL • Upland bullies, common bullies, and shortfin eels, as well as the 'At Risk - Declining' longfin eel	N/A
Halswell River at Tai Tapu Rd	WQI: Poor Contaminants of concern: turbidity, nitrate, DIN, *E.coli,*	Exceedances in copper, TSS, turbidity, DO, BOD_5, nitrate, DIN, DRP, *E.coli*	N/A	• Low shade, high macrophyte cover, • Did not meet QMCI ATL • Common bullies, shortfin eels, and the 'At Risk – Declining' inanga and longfin eel	N/A
Halswell River DS of Early Valley Rd	N/A	N/A	N/A	• High sediment cover, high macrophyte cover • Did not meet QMCI ATL • Common bullies, shortfin eel and 'At Risk - Declining' longfin eel	N/A
Cashmere Stream behind 420-426 Cashmere Rd	N/A	N/A	N/A	• High fine sediment cover, high macrophyte cover • Met QMCI ATL	N/A
Cashmere Stream behind 406 Cashmere Rd	N/A	N/A	N/A	• Stony substrates, high macrophyte cover • Did not meet QMCI ATL	Exceeded guideline
Wilsons Drain at Main North Rd	WQI: Very good Contaminants of concern: DIN, *E. coli*	N/A	N/A	• Low macrophyte cover • Did not meet QMCI ATL • Common bullies, upland bullies, shortfin eel, 'At Risk - Declining' longfin eel and 'Threatened –Nationally vulnerable' lamprey	N/A
Wilsons Drain at Tyrone St	N/A	N/A	N/A	• High macrophyte cover • Did not meet QMCI ATL • Shortfin eel and 'At Risk – declining' inanga	N/A
Balguerie Stream DS	WQI: Fair Contaminants of concern: copper, zinc	N/A		• Low sediment and macrophyte cover, high shade, stony substrates • Did not meet QMCI ATL but had EPT taxa present	N/A

8.4.7. Comparison to Attribute Target Levels

Tables 6 and 7 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 2021 monitoring year[7].

In summary:

- The following ATLs in Schedule 7 were met at most sites:
  - Algae cover;
  - Copper, zinc, lead, and PAHs in instream sediment;
  - Dissolved lead and TSS in surface water.
- The following ATLs in Schedule 7 were not met at many sites:
  - QMCI;
  - Macrophyte cover;
  - Fine sediment cover;
  - Dissolved copper and zinc in surface water.
- The following ATLs in Schedule 8 were met at most sites:
  - TSS and dissolved lead in surface water.
- The following ATLs in Schedule 8 were not met at all or many sites:
  - Dissolved zinc and copper in surface water.

[7] ATLs for Mana Whenua values have not yet been confirmed so an assessment is not included here. Balguerie Stream metrics could not be assessed against ATLs for macrophyte and filamentous algae cover. This is due to monitoring of this site being carried out by Environment Canterbury, who use different methods to the CSNDC EMP.

Table 6: Assessment against Comprehensive Stormwater Network Discharge Consent Schedule 7 (Waterways) Attribute Target Levels (ATLs) for 2021 monitoring year. PAHs = Polycyclic aromatic hydrocarbons; QMCI = Quantitative Macroinvertebrate Community Index; TSS = Total Suspended Solids.

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	Huritini-Halswell River five-yearly (wadeable sites) and annual aquatic ecology monitoring: Appendix G	• Five-yearly data: not met at any of the 8 sites • Annual monitoring: not met at 4 of 5 sites (Cashmere 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	Huritini-Halswell River five-yearly (wadeable sites) and annual aquatic ecology monitoring: Appendix G Monthly sediment cover: Appendix H Monthly surface water monitoring: Appendix F	• Five-yearly fine sediment cover data: not met at any of the 8 sites • Annual monitoring fine sediment cover data: not met at any of the 5 sites • Monthly fine sediment cover: not met at 12 of the 17 sites • Monthly TSS: met at all 43 sites • Monthly TSS: statistical increase recorded at Haytons Stream, Curlett at Motorway, Halswell River at Tai Tapu Road, and Wilsons Stream
Adverse effects on aquatic biota do not occur due to copper, lead and zinc inputs in surface water	Zinc, copper and lead concentrations in surface water[8]	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 • Huritini-Halswell River catchment: 0.01743 mg/L • Pūharakekenui-Styx River catchment: 0.01172 mg/L • Ōtukaikino River catchment: 0.00912 mg/L • Stream Reserve Drain & Aylmers Stream (Banks Peninsula): ≤0.00135 mg/L	Monthly surface water monitoring: Appendix F	• Zinc: not met at 17 of 43 sites • Copper: not met at 24 of 43 sites • Lead: met at all 43 monitoring sites

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

Objective	Attribute	Attribute Target Level	Monitoring Report	Outcome
		• Balguerie Stream (Banks Peninsula): ≤0.00109 mg/L Upper limit concentration of dissolved copper: • 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 • Stream Reserve Drain & Aylmers Stream (Banks Peninsula): ≤0.00293 mg/L • Balguerie Stream (Banks Peninsula): ≤0.00254mg/L No statistically significant increase in copper, lead and zinc concentrations		• Copper: statistical increase at 1 of 43 sites (Curlett at Motorway) • Lead: no statistical increase at 43 sites • Zinc: statistical increase at 4 of 43 sites (Addington Brook, Curlett at Motorway, and Nottingham at Candys Rd)
Excessive growth of macrophytes and filamentous	Total macrophyte and filamentous	Upper limit total macrophyte cover of stream bed: • Spring-fed – plains – urban waterways: 60%	Huritini-Halswell River five-yearly (wadeable sites) and	• Five-yearly data: not met at 4 of the 8 sites

Objective	Attribute	Attribute Target Level	Monitoring Report	Outcome
algae does not occur due to nutrient inputs	algae cover (>20 mm length) cover of stream bed	• Spring-fed – plains waterways: 50% • Banks Peninsula waterways: 30% Upper limit filamentous algae cover of the stream bed: • Spring-fed – plains – urban waterways: 60% • Spring-fed – plains waterways: 50% • Banks Peninsula waterways: 20%	annual aquatic ecology monitoring: Appendix G	• Annual monitoring: not met at of 4 sites (Wilsons Stream met the ATL) • Five-yearly data: met at all of the 8 sites • Annual monitoring: not met at of the 4 sites (Wilsons Stream met ATL)
Adverse effects on aquatic biota do now occur due to zinc, copper, lead and PAHs in instream sediment	Zinc, copper, lead and PAHs concentrations in instream sediment	Upper limit concentration of total recoverable metals for all classifications: • Copper = 65 mg/kg dry weight • Lead = 50 mg/kg dry weight • Zinc = 200 mg/kg dry weight • Total PAHs = 410 mg/kg dry weight No statistically significant increase in copper, lead, zinc and Total PAHs	Huritini-Halswell River five-yearly (wadeable sites) aquatic ecology monitoring: Appendix G	• Zinc: not met at 1 of 5 sites (not met at Nottingham Stream) • Copper: met at all 5 sites • Lead: met at all 5 waterway monitoring sites • Total PAHs: met at all 5 sites • No increase in copper, lead, zinc and Total PAHs at all 5 sites

Table 7: Assessment against Comprehensive Stormwater Network Discharge Consent Schedule 8 (Coastal Waters) Attribute Target Levels (ATLs) for 2021 monitoring year. PAHs = Polycyclic aromatic hydrocarbons; TSS = Total Suspended Solids. Includes tidal waterway sites of Avon at Bridge Street, Heathcote at Ferrymead Bridge, Heathcote at Tunnel Road, and Linwood Canal, which are assessed against coastal ATL due to high salinity levels.

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: Appendix F	Met at four tidal waterway sites and insufficient data for trends analysis at remaining four coastal sites (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: Appendix F	Zinc: not met at 5 of the 8 sites Copper: not met at all 8 sites Lead: met at all 8 sites Met at four tidal waterway sites, with the exception of zinc at Heathcote at Ferrymead Bridge, and insufficient data for trends analysis at remaining four coastal sites (three years of data required)

9. Condition 59 – Responses to Monitoring

Condition 59 requires the Council to report on any results which identify that 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 Council is required to engage with ECan 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 CSNDC annual report.

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

The surface water monitoring report identified that 31 of the 51 sites monitored in 2021 did not meet the ATLs for at least one of TSS, copper, lead, or zinc, due to either not meeting the guideline value, and/or recording an increasing trend (Appendix F). The sites recommended for prioritisation were those where a guideline was not met and an increasing trend was recorded. These four sites are the same as those prioritised last year: Curletts Stream at the Motorway (due to copper and zinc), Heathcote River at the Ferrymead Bridge (due to zinc), Addington Brook (due to zinc), and Nottingham Stream at Candys Road (due to zinc). This work will be carried out in conjunction with work already being conducted under Condition 59 and the CSNDC Targeted Wet Weather Monitoring Project (Schedule 3k).

Due to effects on staff availability caused by COVID19, the Condition 59 report due with this Annual Report, which assesses the investigations triggered by the 2020 monitoring data, is not yet completed. It will be provided as soon as possible in the next couple of months.

9.2. Schedule 9 (Groundwater)

Preliminary investigations indicate that it is unlikely that the result for dissolved zinc which did not meet the attribute target level in Schedule 9 is due to stormwater discharges authorised under the CSNDC. There are several reasons for this, the primary of which is that this well (BX24/0993) draws from Aquifer 3 which is considered unlikely to be affected by surface water. However, the following reasons for this conclusion have also been considered:

- Follow-up testing of bore BX24/0993 on 05/10/2021 for dissolved copper, lead, zinc, and electrical conductivity did not produce results above the attribute target levels in Schedule 9; [9]
- Bore BX24/0993 draws water from Aquifer 3 at a depth of 119.50m; [10]
- Contamination vulnerability of Aquifer 3 is considered low due to the aquifer being flowing artesian, the presence of confining layers, and an upward artesian head;
- Secure Borehead under Criterion 2 of Drinking Water Standards for New Zealand (2005, Revised 2008);[11]
- Age-dating of water in well BX24/0993 indicates a minimum residence time of 56 years; [12]

[9] CCC Lab Report – Testing of Lake Terrace Well 5 (BX24/0993) on 05/10/2021 - TRIM 22/38075
[10] Well Head Security Investigation Programme Preliminary Site Investigation for Lake Terrace Pump Station - TRIM 20/6826
[11] Lake Terrace Bore Head Security Review - TRIM 19/563027
[12] Groundwater residence time assessment of thirteen Christchurch District Council water supply wells in the context of the Drinking Water Standards for New Zealand - TRIM 21/1224945
[5] Minimum Residence Time is the modelled age of the youngest water present in the water sampled from the well outflow.- TRIM 18/422884

- No rain prior to 48 hrs of sampling on 20th October 2020. On 4th November 2020, 0.6 mm (<1mm) rain was observed 48 hrs prior to the sampling and was considered not enough to generate runoff/ponding that can cause any stormwater issues around the well; and
- All the wells at Lake Terrace Pump station are above ground, secured, and are less likely to be affected by seepage. Furthermore, the minimum residence time for each of the well at the station was 56 years.[5]

Condition 59 requires the Council to investigate exceedances of the attribute target levels for dissolved copper, dissolved lead, dissolved zinc, and *Escherichia coli*. Following the above clarifications, the Council confirms that no further Responses to Monitoring work are required under Condition 59 – Groundwater.

10. Stormwater Quality Investigation Programme (Schedule 3)

Conditions 37- 39 require the Council to carry out a series of actions contained in Schedule 3, with the aim 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.

The following information details progress for of each of the Schedule 3 actions undertaken in 2021.

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

The feasibility study gave 3 options for developing an instream contaminant concentration model (ICCM):

- Do not continue with the development of a complex ICCM;
- Develop a simple ICCM calibrated to existing data, if required for the Schedule 3d study or other business needs;
- Investigate extending the MEDUSA pollutant load generation model to the remainder of the city.

The feasibility study has demonstrated that it is technically feasible to develop a complex deterministic ICCM, at least for copper and zinc. It estimated that the time to develop a complex ICCM for city catchments, excluding Banks Peninsula (and some minor coastal catchments), to be 24-30 months and cost $660,000-$800,000. However, there is a large uncertainty with these estimates and at least 100% contingency would be appropriate for both cost and timeline (i.e. estimated final out-turn of up to $1.6M and 5 years).

The feasibility study determined that development of a simple model is feasible and can provide guidance on how the in-stream contaminant concentrations correlate to land use and respond to stormwater quality management options. While the spatial resolution is likely to be coarser than a complex model, this can be managed by ensuring that sub-catchments used are at least as small as treatment sub-catchments and key monitoring points. Work is already underway to define smaller treatment sub-catchments throughout the city and this could form the basis of sub-catchments used in a simple model. When incorporating land use activities (especially

industrial), it can provide a holistic picture of contaminant sources. When this approach is undertaken in conjunction with a comprehensive network of surface water monitoring, especially targeted wet weather monitoring, it should provide an understanding of contaminant sources and how to deal with these, as good as a complex ICCM can.

Initial estimates of cost and timeline for simple model development are $80,000 to $120,000 and 12-18 months.

The study also indicated that extending the MEDUSA model throughout the city is technically feasible. However, it is unknown at present what the cost and timeline would be for extending the model, with both likely much higher than for the simple model, though likely at less cost and duration than for the complex ICCM.

Based on the above evaluation, the simple ICCM is indicated as providing sufficient merit to be developed in a staged manner, in alignment with Council resource and funding availability.

Neither of the options of development of the complex ICCM or the extension to the MEDUSA model would be applicable to the near-to-medium term activities which Council currently has planned or is committed to. Both options also present unacceptably high cost and uncertainty of outcome.

On this basis, the Council is approaching the market to determine the cost and timeframe for developing a simple model for copper and zinc in a staged manner. Consideration will be given to incorporating existing relevant know-how from work carried out by NIWA and the University of Canterbury work in this area, along with potential application of the MEDUSA model.

If the cost and timeframe for developing a simple model are considered reasonable, this will be developed within the normal consent implementation work programme. The Council considers this combined approach using a simple model to understand sub catchment contaminant sources and instream loads along with targeted surface water monitoring will provide an adequate picture of how to mitigate and target contaminant sources within a relatively short space of time (several months). At present, with all matters considered, this is seen to be the most effective approach providing sufficient merit. Progress on the development of an ICCM will be discussed in Schedule 3(b) of the 2023 Annual Report.

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

The Council is required to investigate a knowledge base to assist with ways to predict responses of the receiving environment to changes in network contaminant loads and resulting instream concentrations. Consideration is to be given on 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.

NIWA have been engaged to lead the investigation project. A scope for this project was confirmed in 2022, following review from ECan and the TPRP. NIWA are now working on the investigations.

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

This task is being implemented via other scheduled items such as Schedule 3(a), Schedule 3(d and e), and Schedule 3(g and h).

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

The Council has scoped a feasibility investigation into the techniques for remediating adverse effects of stormwater sediment discharges on receiving environments. This work will be carried out by NIWA. The work shall include consideration of sediment cover of the bed, and copper, lead, zinc and PAH contamination. The investigations are to commence in 2022.

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

The Council is currently undertaking a 'device effectiveness' monitoring programme. The devices chosen are:

- Floating wetlands at No. 1 Drain, upstream of Te Ōranga/Horsehoe Lake;
- Prestons Wetland/Knights Stream;
- Stormfilters at Richardson Terrace, Bells Creek.

10.5.1. Floating wetlands at No. 1 Drain

The Council has constructed a stormwater retention pond within No.1 Drain, which discharges to Horseshoe Lake. Compared to the concrete lined drain prior, the wetpond consists of naturalised channels, a floating wetland system with an orifice outlet weir and naturalised plantings. The system is located within the Christchurch Golf Club in Shirley, so may also receive localised runoff from the golf course also.

The Council is interested in understanding the wet ponds performance with respect to dissolved oxygen, temperature flux and water levels due to the shallow nature of the pond system and ecological aspirations to provide for aquatic values.

The attached memo (Appendix I), summarises the performance of the No.1 Wetpond at Christchurch Golf Club for 2021.

10.5.2. Knights Stream and Prestons Stormwater Treatment Facilities

This work was undertaken from 2018 to 2021, and provides analysis of six rainfall events for the Prestons and Knights Stream stormwater facilities to determine the treatment efficiencies of the sumps, first flush basins, and wetlands. The discharge quality from these facilities have also been compared to the appropriate receiving water quality standards.

Overall, the treatment trains at both sites are treating most of the typical stormwater contaminants at both stormwater facilities, to the extent that many of these contaminants meet the receiving water standards in their outlets prior to mixing. Brief periods of contaminant concentrations that exceed the receiving water standards during a rainfall event are to be expected as the first flush of stormwater passes through the stormwater facility, however, these periods of elevated contaminant concentrations are not expected to result in exceedances of the acute toxicity limits following mixing with the receiving waterways. The full investigative report can be found in Appendix J

10.5.3. Stormfilters at Richardson Terrace, Bells Creek

The investigation of this facility has yet to commence. The Council is still negotiating with contractors with the aim of having work start before the end of 2022.

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

Schedule 3(j) requires the Council 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 2021, there were no findings significant enough to have warranted a review of either the IDS or WWDG.

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

The Council is currently undertaking a programme of Targeted Wet Weather Monitoring (TWWM) in selected receiving environments. The first TWWM project has focused on 15 locations throughout the Haytons and Curlett Stream catchments, and upstream and downstream within the Ōpāwaho/Heathcote River. Sampling was primarily conducted using autosamplers to collect water samples throughout the duration of a storm event (time weighted composite samples), supplemented with Nalgene Stormwater Sampler bottles to collect "grab" samples during high flow events at additional sites. Sites were monitored collaboratively with ECan, University of Canterbury and NIWA each running sites, with sampling by all agencies during the same rain events to allow comparisons across the catchments. Four events were sampled between May and December 2021 at 7 to 9 sites simultaneously with technical issues or flooding preventing sampling at the remaining sites.

NIWA provided a draft report on the project findings in March 2022, which has been reviewed by Council and ECan (Michele Stevenson). The final report will be available with the 2023 CSNDC Annual Report.

11. Other Actions (Schedule 4)

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.

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

A cost-benefit analysis was 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 sites 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) were considered.

This Cost/Benefit Analysis has been submitted to ECan 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. The 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. For the meantime it means that Schedule 4(l) action, to implement findings from Schedule 4(k), will not be progressed.

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

This action requires the Council 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 the Cost-Benefit Analysis found sufficient merit in instigating a programme the Council has established a draft scope and is liaising with

University of Canterbury to conduct a literature review before finalising trial methodology. This trial will commence in the second half of 2022.

11.3. Schedule 4(d) – Alternative Stormwater Treatment Methods Cost Benefit Analysis

A cost-benefit analysis was carried-out, considering 'alternate' methods of stormwater treatment and discharge. It also considered redirection of stormwater to Managed Aquifer Recharge Discharge.

The report confirmed that current stormwater treatment device selection processes utilised by the Council provides the optimum cost to benefit outcome in most situations. As such, no change to the current planning process was recommended, with the caveat that it was acknowledged that there are many situations where this generalised analysis may not be applicable.

Areas for further development which may improve this analysis include:

- Refining contaminant load modelling to better understand the contaminant generation for different sites;
- Undertaking continuous simulation modelling (e.g. MUSIC) for a range of catchment types and sizes for each device to allow for inclusion of bypass assessment;
- Refining the contaminant removal efficiencies of each device across the particulate and dissolved fractions and for different contaminant concentrations;
- Including renewal costs;
- Further investigation of large-scale corrective maintenance costs which may fall outside of renewal costs, for example, rectifying blockages and/or cleaning sediment out of soil adsorption basins;
- Include land costs; and
- Improved understanding of lifecycle costs across all devices.

While the improvements listed above would improve the analyses, it was considered unlikely that the device selection process would change significantly. These recommendations will be incorporated in the performance evaluation of stormwater treatment methods carried out within the consent implementation work programme. The report can be found in Appendix K.

11.4. Schedule 4(e)

This action states that if the Council determines that the cost/benefit analysis under Item 4(d) shows that it is warranted, carry out trials for alternate methods of stormwater treatment and discharge. Considering the findings from Schedule 4d it is viewed that there is currently no need to proceed with Schedule 4e, unless future evidence indicates that the Council should consider undertaking trials.

11.5. 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

Similar to Schedule 3(j), Schedule 4(f) requires the Council to apply the results of trials of street-sweeping, sump-cleaning, and alternative stormwater treatment (Schedule 4c), 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, IDS, and the WWDG. This work can commence once findings are available from Schedule 3(j) and schedule 4(c).

11.6. Schedules 4(g and h) – Increasing frequency of street sweeping and sump cleaning

These actions are contingent on the findings from Schedule 4(c), which is to be completed in late 2022.

11.7. Schedule 4(i) – ESCP within Building Control and Resource Consent Processes

The Stormwater and Land Drainage Bylaw has been adopted by the Council and will be operable from July 2022. The Sediment Discharge Management Plan will be revised and resubmitted to ECan for review and certification.

11.8. Schedule 4(j) – Developing a programme for operational inspection of private stormwater treatment devices

The project scope has been peer reviewed and inspections commenced in October 2021. The first programme inspection report will be lodged with ECan in December 2022.

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

The Community Waterways Partnership was launched on 22 March 2021. Since then over 50 signatories have joined, with a good number attending workshops to progress partnership charter outcomes. The partnership is looking to develop an online hub for sharing information, resources and key messaging – hopefully to be launched late in 2022.

The Community Waterways Advisor has been working with schools on waterways that flow through or next to the schools. Some of this work has been to do with restoration projects funded by Council and supported by Council's Parks staff. Unfortunately Covid 19 restrictions have slowed down the level of activity and restricted many workshops to being held online. Hopefully 2022 will see more activity as Covid 19 restrictions are lifted.

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

The River Care Liaison Group meeting was held on the 22 July 2021 with seven representatives from five community groups. The agenda items were:

- Overview of technical and feasibility studies;
- Environmental monitoring;
- Stormwater management plan programme;
- Implementation programme.

The Industrial Liaison Group meeting was held on 16 December 2021 with six representatives from four companies. The agenda items were:

- Development of the industrial site risk matrix and next steps for Transitional Plan (Condition 3);
- New technologies or preventative measures in stormwater contaminant reduction;
- Implementation of the industrial site audit process (Condition 47);

- Compliance and monitoring results (Condition 61).

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

This action was to investigate various options for river channel weed (macrophyte) management practices, to mitigate flood risk in the Pūharakekenui/Styx River. While investigations, bar the diquat study, were completed by June 2021, unforeseen circumstances and illness meant that an interim report was submitted to ECan in July 2021.

The diquat trial was eventually conducted in March 2022, so a final report can now be expected to be submitted to ECan in late 2022.

11.12. Schedule 4(s) – Identifying best practicable management options for mitigating flooding through river weed management as reported in Schedule 4(r)

A scoping workshop has been held to initiate development of the programme, which will be finalised and proceed once the Schedule 4(r) findings have been provided and the final report submitted in 2022.

12. Other Investigations and Monitoring

12.1. Condition 32 Stormwater Infiltration Facilities Investigations

This investigation looked at a series of site-specific assessments of contamination risk and appropriate mitigation. This work was undertaken in two stages:

a) Desktop Assessments: identifying which basins were not compliant with the separation distances in Condition 32(a) and 32(b), and applying an initial risk screening based on land use.

b) Conceptual Site Model: the application of a conceptual site model to identify the scale of any risk of contamination of domestic and community supply wells within the distances in Condition 32(a) and 32(b).

The summary report of the above investigations, to satisfy Condition 32(d), was lodged with ECan in December 2021. Subsequent to lodgement, ECan and Council have had discussions regarding the report findings, which are is still to be resolved. The final report will be available with the 2023 Annual Report.

12.2. Performance of Stormwater Infiltration Basins and their impact on Groundwater Levels and Quality

The CSNDC EMP 3.2.3 and 3.3.1 requires an investigation into the performance of stormwater basins and their impact on groundwater levels and quality. This study is-being carried out over a period of 12 months, monitoring the facilities detailed in Table 8 below.

Table 8: 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 assessment are:

- Monitoring in at least one new basin, designed to characterise the change from the pre-basin to post-basin environment.
- Establishment of suitable monitoring wells at each site to provide an up-gradient – down-gradient comparison of groundwater quality, assessed against Schedule 9. 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). An existing bore (M35/11995, 37.7m deep) near Kākāpō Basin could be used for monitoring subject to talks with the bore owner.
- Bores to be fitted with transducers to provide a continuous record of groundwater levels and electrical conductivity.
- Pressure transducers 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.
- Carry out monthly water quality monitoring at these bores for *E. coli*, copper, lead, zinc, and electrical conductivity. The timing of the sampling within each month is adjusted to cover the main periods of stormwater discharge as indicated by the pressure transducer readings.

This investigation has been proceeding as planned and a final report is expected in 2022 and will be available with the 2023 Annual Report.

13. Industrial Site Audit Programme

The industrial site audit programme is 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 resolve problems at the source and thereby improve the overall stormwater quality. It is anticipated that this programme will improve waterway health and instream biota.

In 2021, 15 industrial sites were audited with at least 10 of those agreed with ECan. One site was agreed to be counted for two audits – due to size, complexity and the scale of work involved in completing a thorough audit. Therefore, 16 audit credits were obtained in 2021. Details of the audited sites can be found in Table 9.

As per condition 3(b), the Council developed a 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 final risk matrix was provided to the Industrial Liaison Group and ECan on 19 November 2021 for discussion during the Annual Industrial Liaison Group meeting on 16 December 2021.

Table 9: Industrial Site Audits Undertaken in 2021

Business Name	Site Address	Audit Date	Industry Category	Waterways Impacted
CSP Valmont Webforge	27 Washbournes Road Sockburn Christchurch 8042	9/03/2021	Primary and Fabricated Metal Product Manufacturers	Haytons Stream
Terra Cat / Hyster Ltd	16 Branston Street, Hornby, Christchurch 8042	25/03/2021	Motor Vehicle and Equipment Associated Facilities	Awatea Stream
United Steel	22 McAlpine Street, Wigram, Christchurch 8042	28/04/2021	Primary and Fabricated Metal Product Manufacturers	Curletts Stream
Waste Management	88 Francella St, Bromley, Christchurch 8062	22/06/2021	Waste Treatment, Storage, and Disposal	Charlesworth Drain
Stahlton Engineered Concrete REAUDIT	133A Waterloo Road, Hornby, Christchurch 8042	28/06/2021	Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturers	Haytons Stream
ERP Group	49 McAlpine St, Sockburn, Christchurch 8042	5/07/2021	Waste Transfer and Composting Facilities	Curletts Stream
Perry Metal Protection Ltd	5 Chinook Place, Hornby, Christchurch 8042	15/07/2021	Primary and Fabricated Metal Product Manufacturers	Halswell Junction Outfall
Garden Box Ltd	57 Lunns Rd, Middleton, Christchurch 8024	6/08/2021	Building, Construction, Landscaping, and Earthworks Related Activities	Curletts Stream
A One Auto Parts	57-61 Gasson St, Waltham, Christchurch 8023	12/08/2021	Automobile Salvage Yards	Heathcote River
Southern Pine Products	635 Halswell Junction Rd, Hornby, Christchurch 8042	28/09/2021	Wood and Metal Furniture and Fixture Manufacturers	Halswell Junction Outfall
Owens Transport REAUDIT	16-31 Baigent Way, Middleton, Christchurch 8024	12/10/2021	Motor Vehicle and Equipment Associated Facilities, Bulk Chemical Storage	Curletts Stream
Tyre Retreaders Christchurch	48 Treffers Road, Wigram, Christchurch 8042	12/10/2021	Scrap and Waste Recycling Facilities	Curletts Stream
Fulton Hogan Ltd (agreed as 2 sites)	821 Halswell Junction Rd, Hornby, Christchurch 8042	10/11/2021	Building, Construction, Landscaping, and Earthworks Related Activities	Halswell Junction Outfall
BE Auto Parts	14-16 Sonter Road, Wigram, Christchurch 8042	16/11/2021	Automobile Salvage Yards	Curletts Stream

Business Name	Site Address	Audit Date	Industry Category	Waterways Impacted
KB Contracting & Quarries Ltd	180 Maces Rd, Bromley, Christchurch 8062	25/11/2021	Building, Construction, Landscaping, and Earthworks Related Activities	Charlesworth Drain

14. Updates to CSNDC Schedule 1

The current list of sites excluded from the CSNDC (Schedule 1) can be found in Appendix L.

15. Engagement with Papatipu Rūnanga

The Council is 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; and
- Te Taumutu Rūnanga.

The Council has 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 (3 August 2021). The Mahinga Kai/Nga Wai Advisor has assisted the Council with providing cultural impact assessments for the Papatipu Rūnanga on the Ōpāwaho-Heathcote, Huritīni-Halswell, and Ihutahi-Estuary Coastal SMPs. The advisor has also provided cultural reviews of various technical/ investigation scopes and reports.

16. Appendices