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Southern Link Inland Port Freshwater Ecological Impact Assessment

Southern Link Inland Port

March 2026



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**Southern Link Inland Port
Freshwater Ecological Impact Assessment**

Document Status

Version	Purpose of Document	Prepared By	Reviewer	Review Date
0.1	Draft for internal review	M. Hamer	B. Miller	25/11/2025
1.0	Draft for client review	M. Hamer	B. Miller	28/11/2025
1.1	Updated draft for client review	B. Miller		05/02/2025
1.2	Final draft for review	B. Miller		12/02/2026
2.0	FINAL	B. Miller & M. Hamer		11/03/2026



EXECUTIVE SUMMARY

Southern Link Property Ltd proposes to develop and operate the Southern Link Inland Port (SLIP) at 270–292 Dukes Road North, Taieri, under the Fast-track Approvals Act 2024. The approximately 40 ha site will be developed as an inland port, bulk storage, and logistics hub, with large warehouses and sealed yard areas that will generate a high proportion of impervious surface runoff. Stormwater from the developed site will be directed to a treatment and attenuation system, including catchpits, GPTs/UPTs, vegetated conveyance, and a large attenuation pond, prior to discharge to Silver Stream. Earthworks will be undertaken in staged development and will include erosion and sediment controls and associated construction management measures. This report provides a freshwater ecological impact assessment (FEcIA) of the sites' stormwater run-off to Silver Stream.

Silver Stream is a gravel-bed waterway of recognised regional value, with documented natural and human-use values in the Otago Regional Plan framework and ecological connectivity to upstream and downstream habitats. Baseline freshwater ecological values were characterised using desktop review (LAWA, NZFFDB, Wilderlab eDNA, and recent survey data). Additionally, a field survey was completed on 9 September 2025, which included instream habitat assessments, water quality sampling, and macroinvertebrate sampling upstream and downstream of the proposed site.

The stream reach near the site was found to have generally good local water quality at the time of sampling (high clarity, low faecal contamination, and most parameters within guideline ranges), with nitrogen identified as the main ongoing water quality pressure in the wider catchment. Habitat quality was moderate, with introduced riparian vegetation, sand-influenced substrates, and limited structural complexity, although the upstream site had slightly better substrate stability and habitat condition than the downstream site.

Macroinvertebrate communities at the site were similar upstream and downstream and were above the NPS-FM (2025) national bottom line, showing mild to moderate impairment. This contrasts with poorer long-term macroinvertebrate condition recorded further downstream at the Otago Regional Council monitored Taieri Depot site, where monitoring indicates nutrient enrichment and ecological integrity loss. Fish assessments identified an



ecologically important assemblage in the local reach, including confirmed or likely presence of brown trout, lamprey, longfin eel, redfin bully, and additional downstream species, with potentially 12 species present or nearby overall. Threatened and At-Risk species values are a key feature of Silver Stream, including lamprey, longfin eel, īnanga, and potentially giant kōkopu and Taieri flathead galaxias (the latter treated cautiously due to eDNA interpretation limits and habitat suitability). The reach was assessed via the EIANZ framework methods (Roper-Lindsay, *et al.*, 2018) as having overall high ecological value, driven primarily by rarity/distinctiveness associated with fish threat values. The overall rating was also supported by moderate representativeness, diversity/pattern, and ecological context scores.

The impact assessment also followed the EIANZ framework and identified the potential for adverse effects to be produced via two drivers.

For earthworks, unmanaged sediment mobilisation is identified as the key risk, with potential to reduce water clarity, increase deposition, infill gravels, and affect fish spawning and egg survival in habitat that may support sportfish, At Risk or Threatened species. On that basis, the unmitigated effect is assessed as moderate magnitude resulting in a high level of effect.

For the operational stormwater discharge, the primary concern is altered water quality and hydrology, including nutrient and contaminant inputs, sediment effects, and thermal/oxygen stress, particularly given the high-value fish assemblage in Silver Stream. The proposed design includes treatment and attenuation measures (catchpits, GPTs/UPTs, attenuation pond, swale conveyance, and erosion protection), which are expected to reduce these risks. The effect is assessed as low magnitude given the proposed treatment systems, corresponding to a low level of effect depending on final discharge quality and flow behaviour. Monitoring is recommended to ensure treatment systems are effective.

In order to mitigate the above potential effects, a number of management and baseline /validation monitoring is recommended. These are outlined below.

Site Development Earthworks:



1. Earthworks should be undertaken primarily during stable weather conditions and sediment attenuation pond maintenance should occur in line with Auckland Council (2016) guidelines.
2. A site investigation prior to site development earthworks should be undertaken to confirm or eliminate the presence of contaminated soils and ensure these are not disturbed and remain out of the stormwater system and stream.
3. Undertake planting of the swale between the attenuation pond outlet and Silver Stream adjacent to rock lined sections wherever possible with dense native plantings above the winter base flow level to reduce sediment erosion reaching Silver Stream bed.
4. If in-water works are required to connect the stormwater outflow and associated swale to Silver Stream these works should avoid fish spawning times of 1 May to 31 November, if possible. If this is not possible, pre-inwater works, fish salvage should be undertaken following the National Work in Water Guidelines (MfE, 2021) and additional river bank and trout redd surveys for fish eggs should be undertaken by a suitably qualified ecologist.
 - a. If any trout redds are found, they are to be avoided and if any riverbank eggs on are located the instream works should be delayed until after the next flood event.

Recommended monitoring:

5. Aquatic habitat and macroinvertebrate surveys at the upstream and downstream survey sites within this report should be replicated annually in Spring during Stage 1 of the project to verify earthworks are being effectively managed and Silver Stream ecology is remaining stable. If deposited sediment is observed at the downstream site during the annual survey, a minimum of two samples should be taken and tested for heavy metals, polycyclic aromatic hydrocarbons (PAH) and a nutrient suite.
 - a. An annual report should be provided to ORC within 3 months of fieldwork, assessing results next to appropriate guidelines, baseline (from this report), and upstream (reference site) results.

Stormwater Discharge to Silver Stream:

1. Plant any open stormwater swales on site with native shrubs or Carex to support lower water temperatures on-site.
2. Stormwater treatment is recommended to include GPTs or UPTs at the pond outlets.



3. Best practice site management (cleaning regime, chemicals indoors, vehicles maintained, spill prevention, regular GPT/UPT maintenance etc).

Recommended stormwater monitoring to ensure treatment systems (catchpits, GPT/UPT's and attenuation pond) are effective includes:

4. A Stormwater Monitoring Plan (SMP) is to be developed and include the below monitoring aspects and actions to be undertaken if high results are recorded.
5. Water quality monitoring within Silver Stream should be taken pre-discharge (at upstream and downstream sites) over 4 sampling events (ideally covering differing weather characteristics), covering the same parameters as Table 3 and including dissolved oxygen. This sampling will establish the baseline data set.
6. First flush water quality monitoring (Table 3 parameters) of the discharge and at the upstream and downstream Silver Stream sites should occur quarterly during Stage 1 and Stage 2, until the attenuation pond has been fully completed. This monitoring should also be completed (at any time) within 1 week following a large storm event (flow increase $>1 \text{ m}^3/\text{s}$) that has resulted in any overland flow from the washpad/truckwash area.
 - a. An annual report should be prepared for ORC assessing water quality parameters next to appropriate guidelines, the baseline samples and upstream (reference site) samples.
 - b. An additional report will be prepared for ORC providing the results of the survey following any washpad/truckwash overland flow events within 2 months of sampling.
7. Continuous upstream (above Outlet 2) and downstream (below Outlet 1) water temperature should occur in Silver Stream for the first two summers (1 Dec to 31 March) post stormwater attenuation pond establishment.
 - a. Water temperature downstream of discharge should not increase by 3°C or more from the upstream site sample or above 25°C .

Based on the above management actions and monitoring surveys being implemented, e3s considers the impact of the site development and associated discharge of stormwater to the freshwater ecology of Silver Stream to be low, or less than minor.



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1 Introduction

1.1 Overview

Southern Link Property Ltd is seeking approvals under the Fast-track Approvals Act 2024 to develop and operate an inland port (the Southern Link Inland Port (SLIP) Project or Project) on an approximately 40 hectare (ha) site on the outskirts of Mosgiel (area outlined in yellow in Figure 1) located at 270 – 292 Dukes Road North, Taieri (site). The site is intended to be used as an inland port/ bulk storage and logistics hub to stage shipping, rail and truck transport consignments. The site is proposed to house large warehouses and sealed yard space with a high proportion of impervious areas.

Once fully established the impervious area of the site will have stormwater directed to a large stormwater attenuation pond prior to release to the nearby Silver Stream (Figure 1). During site establishment, earthworks will be undertaken to prepare the site for the various construction activities required and appropriate measures will be implemented to mitigate the risk of erosion and sediment loss from the site. These ancillary activities are included in this report and are discussed further in the following sub-sections.

This report provides a freshwater ecological impact assessment (FEClA) to characterise the existing ecological values of Silver Stream and assess the potential and actual effects of the Project on the freshwater ecology of the receiving environment, primarily Silver Stream. The findings of the FEClA are set out in this report.



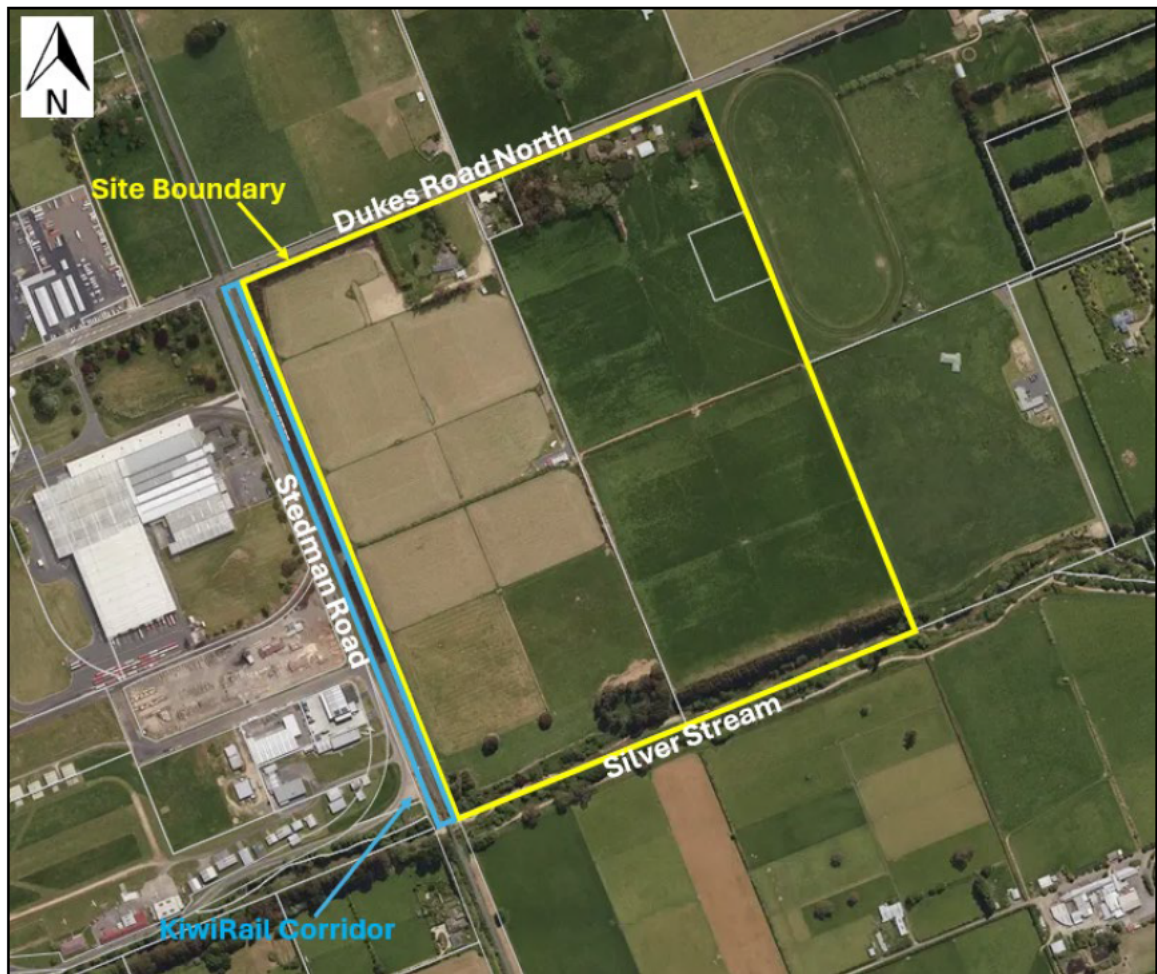


Figure 1: Project area overview.

1.2 Ecological Report Structure

The FEcIA is structured as follows:

- Section 2: Description of the proposed activity and environmental context.
- Section 3: Methodology employed during the ecological assessment.
- Section 4: Results and description of ecological values
- Section 5: Ecological impact assessment.
- Section 6: Conclusions and recommendations.

1.3 Limitations

e3s performed the requested services in a manner consistent with the normal level of care and expertise exercised by members of the environmental science profession. No warranties, express or implied, are made. The confidence in the



findings is limited by the Scope of Work, and limited data due to the singular site visit at one time of year. A full range of biota that are present at this site may not have been seen or recorded; however, desktop research was utilised to aid the assessment.

The results of this assessment are based upon site inspections conducted by e3s personnel, and information provided in scientific literature. All conclusions and recommendations regarding the properties are the professional opinions of e3s personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, e3s assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside e3s, or developments resulting from situations outside the scope of this project.

1.4 Code of Conduct

The authors of this report are Bryony Miller and Mark Hamer. Bryony Miller is the Technical Director of Marine and Freshwater Ecology at e3Scientific and is a professional ecologist with over 15 years' experience. She regularly completes freshwater and marine ecological impact assessments on behalf of regional and district councils, private companies, national governmental organisations, not-for-profit and research groups. She has been an expert witness at Environment Court and hearings and has been involved in mediation and expert caucusing. She currently is a member of the NZ Freshwater Science Society, NZ Marine Science Society, NZ Science Diving Committee and is an executive committee board member of the NZ Coastal Society.

Mark Hamer is a professional freshwater ecologist with over 17 years' experience working in the freshwater ecology and monitoring industry. Freshwater biomonitoring proficiency and experience includes wetland delineation, water and sediment quality assessments, eDNA, river periphyton, aquatic plant identification, riparian habitat assessment, macroinvertebrate collection and analysis. Freshwater fish monitoring using electric fishing, netting or spotlighting methods along with associated fish handling, analysis and fish passage assessments. At e3scientific for the past 3 years Mark's focus has been on ecological value assessments and reviewing and producing ecological impact assessments in the consenting process. He has been an expert witness at consent



hearings and is a current member of the New Zealand Freshwater Sciences Society.

We confirm that we both have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2023. This report has been prepared in compliance with that Code, as if it was expert evidence presented in proceedings before the Environment Court. Unless we state otherwise, this report is within our area of expertise, and we have not omitted to consider material facts known to either of us that might alter or detract from the opinions expressed in this report.



2 Description of the Activity and Existing Environment

2.1 Description of Activity

The Southern Link Inland Port (SLIP) is a joint venture between Port Otago and Dynes Transport. With a lack of space at Port Chalmers and the Dunedin central business district, the applicant considers that the Mosgiel location is a suitable option for bulk storage and use as a logistics hub as a staging site for shipping, rail and truck transport. The site covers approximately 40 ha and is proposed to house large warehouses and sealed yard space (Figure 2).

Construction of the Inland Port is anticipated to be undertaken in three stages however the timing of the delivery of each stage, and discrete works within each stage, may change in response to demand for logistics capacity at the Inland Port. Each stage of works will involve site clearance, earthworks, construction of buildings, hardstanding and access, installation of infrastructure, landscaping and works and management activities necessary to manage environmental effects during construction including erosion and sediment controls and construction management activities:

- Stage 1 is estimated to be completed 1 to 3 years following approval of the Project and will include clearance of the southern area of the site and construction of the 'Stage 1' container storage concrete pad, rail siding, container service area, warehouses, internal roading, parking and loading, road widening and construction of the new intersection on Dukes Road North, stormwater attenuation pond, Silver Stream stormwater outlets, servicing infrastructure, flood management measures, landscaping, acoustic barriers and eastern bund, and lighting. During this stage, half the pond will be constructed as an attenuation pond, and the other half will be constructed as a sediment and erosion control pond.
- Stage 2 is estimated to be completed 3 to 5 years following approval of the Project and will include clearance of the northern area of the site and construction of the 'Stage 2' container storage concrete pad, warehouses, ancillary offices, internal roading, parking and loading, emergency egress onto Dukes Road North, expansion of the



stormwater attenuation pond, landscaping, extension of the servicing infrastructure and lighting. During Stage 2, the erosion and sediment control pond section is demolished and converted into a large stormwater attenuation, i.e. a singular attenuation pond is left.

- Stage 3 is estimated to be completed 5 to 10 years following approval of the Project and will include clearance of the eastern area of the site, including the eastern acoustic bund, and construction of the 'Stage 3' warehouses, internal roading, parking and loading, landscaping, extension of the servicing infrastructure and lighting

Most relevant to this report, the stormwater attenuation pond will discharge to the western swale which will then discharge via an outlet into Silver Stream. The attenuation pond will have no direct discharge to Silver Stream. With no or light rainfall events the stormwater attenuation pond will be a dry grassy area with no standing water and no discharge will occur. During regular rainfall events the attenuation pond is expected to hold various low levels of water which will be discharged over a 12-24 hour time period, at which time it will return to a grassed area. In flood events, the pond will be designed to overtop to the western swale. Water from the washpad/truckwash area is to be directed to trade waste; however, in large storm events above the 1 in 10 year rainfall, the container washbay wastewater system will discharge overland and will follow the flow path to the attenuation pond. This could add additional contaminants to the attenuation pond; however, Stantec (2026) consider this risk to be low due to a significant first flush of contaminants into the wastewater system occurring prior to any overland overflow.

The Stormwater Assessment prepared by Stantec (2026) estimate the critical storm for climate adjusted rainfall is 4 hours. Based on this, the discharge from Outlet 1 and Outlet 2 is estimated to be approximately 2.262 m³/s for a 1 in 10 year rainfall event, which is less than the maximum allowable peak discharge of approximately 2.48 m³/s. For the four-hour design storm, the pond would hold approximately 24,930 m³ (capacity of 25,000 m³) of stormwater with a maximum depth of approximately 3.06 m. Stormwater treatment is discussed further in Section 2.1.1.

A preliminary site investigation was undertaken in August 2025 and suggests three Hazardous Activities and Industries List (HAIL) areas are present at the western and central areas of the property relating to historical sheep dip, vehicle workshop



and army barracks (e3Scientific, 2025). There is also a railway line which runs immediately adjacent to the western boundary that is likely to be a HAIL site. All four locations will be considered in the proposed stormwater monitoring (e.g. metals, petroleum hydrocarbons) as discussed further in the Stormwater Assessment prepared by Stantec (2026).

Throughout the development of the site the area of exposed earth will be limited by undertaking the earthworks in phases. Otago Regional Council (ORC) provides erosion and sediment control guidance for smaller residential projects but recommends following the Auckland GD05 Guidelines (Auckland Council, 2016) as *"it is the most comprehensive erosion and sediment control guide in NZ with a long history (TP90 predates GD05) and 'reputation' including recognised experts that developed the guide"* (ORC, 2023). It is therefore proposed to follow the Auckland Council Erosion and Sediment Control Guidelines (GD05) (Auckland Council, 2016). This requires a maximum catchment for stormwater attenuation ponds of 5 ha of open ground works, and depths of those ponds of 2 m (Auckland Council, 2016). The Stage 1 sediment and erosion control pond will be constructed in alignment with the GD05 guidelines.



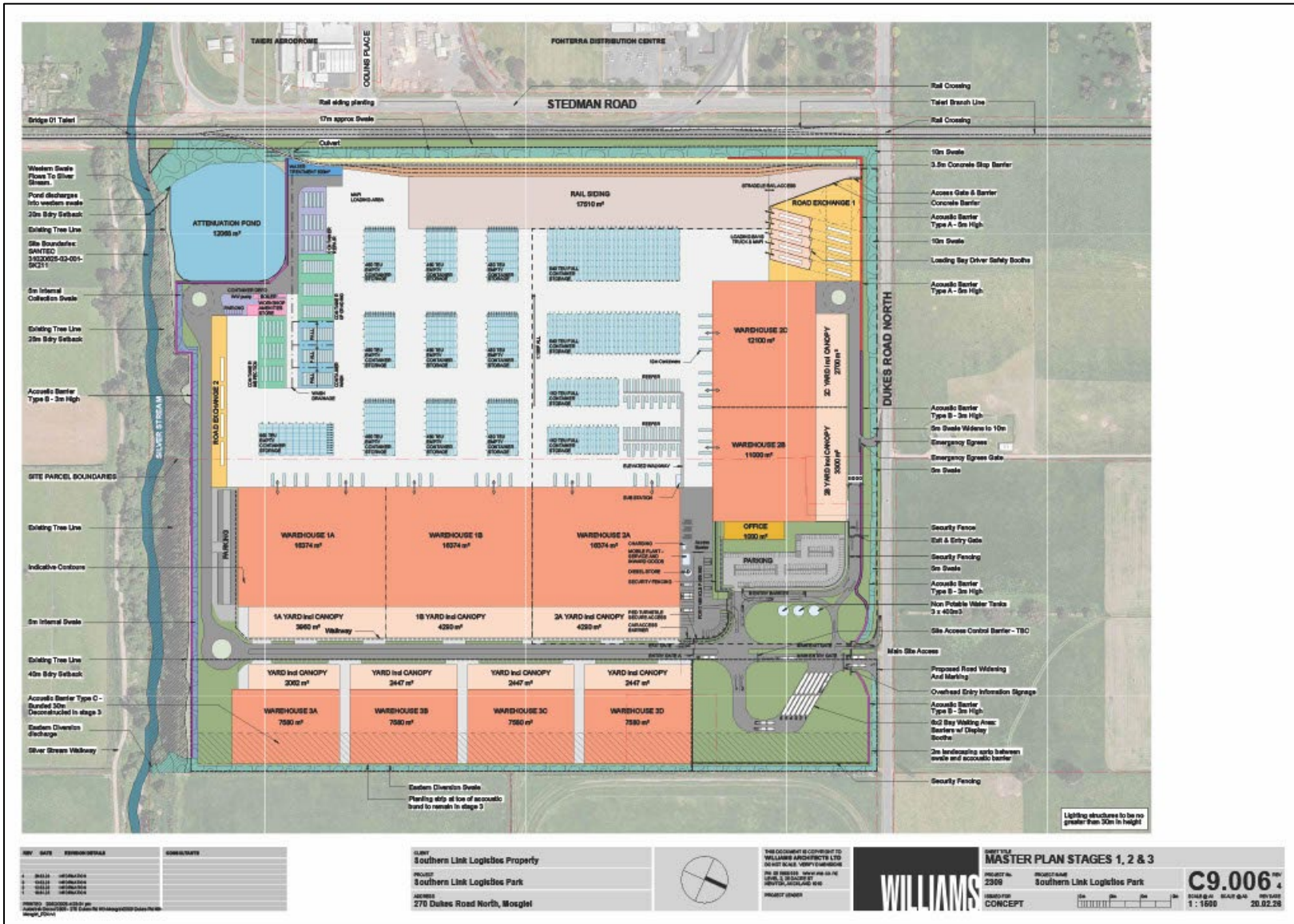


Figure 2: Southern Link Inland Port Masterplan Design (Source: Williams Architects Ltd, 2026).



2.1.1 Stormwater Treatment

Stantec (2026) have prepared a stormwater management strategy for the proposed SLIP which they have divided into two key components: internal and external stormwater systems. The external stormwater analysis considers the broader upstream catchment area and evaluates methods for diverting 'clean' stormwater around the development to the extent practicable. The internal stormwater assessment focuses on the conveyance of stormwater within the site and identifies the treatment and attenuation measures necessary to control discharge flows appropriately. The internal stormwater assessment is described and reviewed further within this FEClA to assess the potential for impacts on the freshwater ecological values within the receiving Silver Stream. Stormwater will only discharge to Silver Stream following rainfall events.

The proposed stormwater treatment aims to capture coarse grits, solid debris, and natural leaf litter in roadside catchpits across the internal road network for all catchments as the initial treatment system (Stantec, 2026). Gross pollutant traps (GPTs) or universal pollutant traps (UPTs) are also proposed to be installed at each outlet to capture floating plastics, hydrocarbons, and suspended sediments with sizes down to approximately 100-150 microns. These traps are typically proprietary manhole units installed below the road corridor surface, equipped with short bypass pipelines running parallel to the main primary system pipelines. This configuration enables water quality runoff, up to 10 mm/hr of rainfall, to be directed through the GPT or UPT, while higher flow volumes during larger storms will bypass the traps via the primary pipeline. The site discharges to an attenuation pond, allowing flows to traverse the basin footprint and receive supplementary "polishing" treatment. This process includes sedimentation, limited soil infiltration and soakage to ground, and slow overland flow through the vegetated base of the basin, facilitating biofiltration and vegetative uptake of contaminants (Stantec, 2026) (Figure 3).

This stormwater attenuation pond has design dimensions of approximately 110 m x 109 m x 5 m deep (~25,000 m³), when fully completed in Stage 2, to ensure suitable stormwater treatment is attained and peak stormwater discharge flows are attenuated. Outside of stormwater events it is envisaged that the attenuation pond will primarily be dry. During stormwater events, the large pond will slowly release stormwater in the south-western corner of the site to an existing swale (Outlet 1) and then on to the Silver Stream, approximately 20 m downstream. The attenuation pond outfall to the swale will be rock lined to minimise the risk of scour



and erosion. The Outlet 2 external stormwater conveyance swale will also have erosion and scour protection via rock lining near its' confluence with Silver Stream (Figure 3).

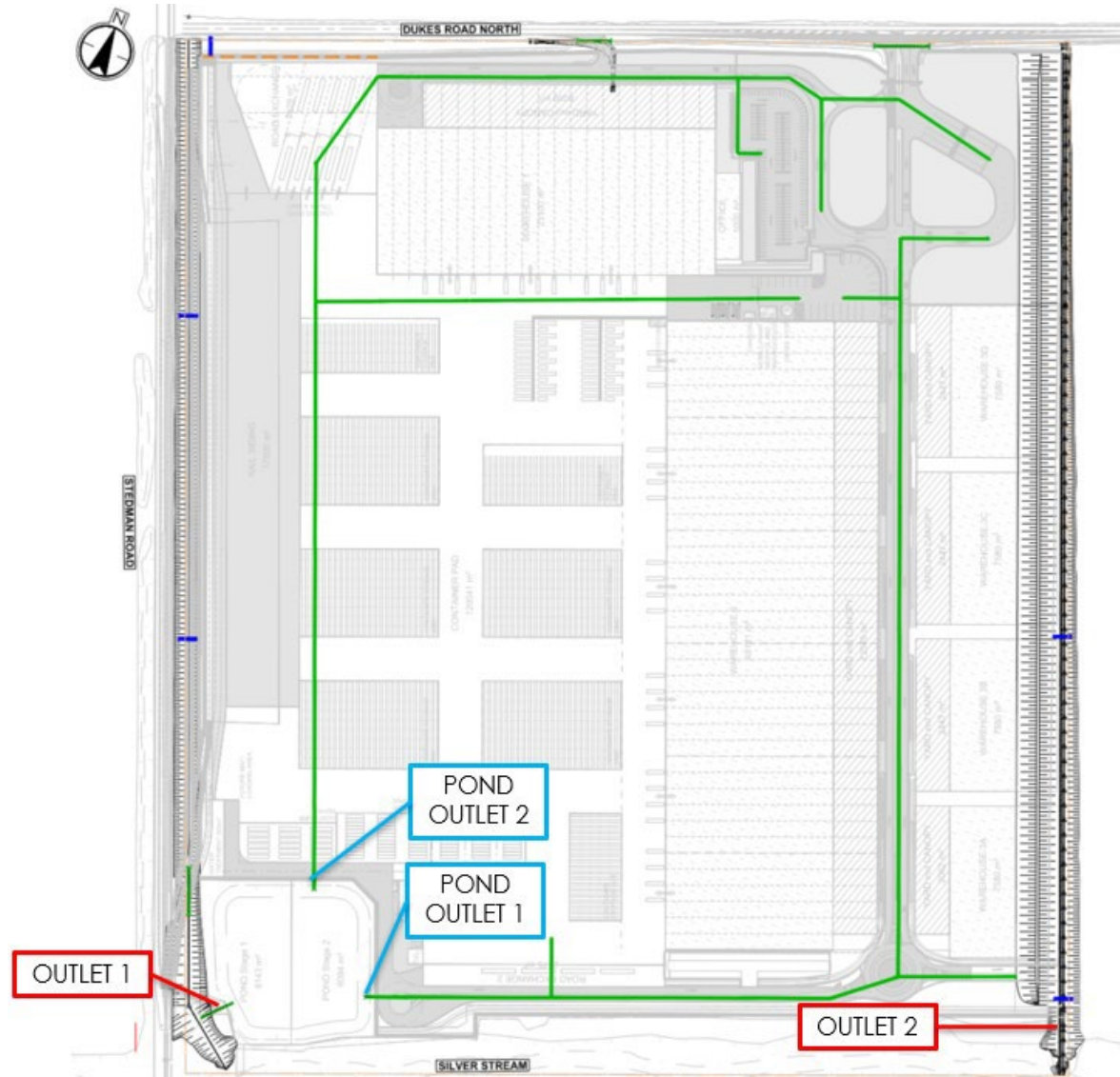


Figure 3: Stormwater treatment and discharge plan (Stantec, 2026). GPT/UPT proposed at Pond Outlet 1 and 2. Outlet 2 conveys 'external' stormwater only.

2.1.2 Stormwater Monitoring

Baseline and stormwater quality monitoring of Silver Stream is required to support understanding of the effectiveness of the proposed stormwater treatment measures. All results should be assessed alongside ORC and / or the Australian & New Zealand Guidelines for Fresh & Marine Water quality (ANZG, 2018) guideline levels for water quality. This monitoring will help ensure stormwater treatment is



being effective and highlight any areas which may require further treatment. Proposed stormwater monitoring is discussed further in Section 5.2.

2.2 Environmental Context

2.2.1 Summary of Local Waterway

The site is located on the Taieri Plains, on the outskirts of the Mosgiel township. The site is surrounded primarily by grazed pasture with scattered houses and commercial/industrial activity on the southwest boundary. The southeast boundary runs alongside Silver Stream. The soils consist of alluvial and loess soils found in coastal Otago lowlands occurring on flat, poorly drained sites on flood plains. The altitude of the site varies between approximately 28 and 33 m above mean sea level (a.m.s.l.). The alluvial filled basin that forms the Taieri Plains has a flat topography across which the Taieri River meanders. The Taieri River has two major tributaries, Silver Stream and Waipori River that also flow through the Taieri Plains (ORC, 2013).

The Silver Stream has its headwaters in the native forest covered Silver Peaks located approximately 5.5 km to the Northeast of the site. ORC has a flow recorder located 2.5 km downstream of the site on Silver Stream which shows a median flow of 0.221 m³/s (221 L/s), a typical high flow of 1.3 m³/s and a flood spillway that operates at 150 m³/s (ORC, 2025). The NIWA River Maps suggest a median flow of 0.35 m³/s, a mean flow of 0.71 m³/s, a mean annual low flow of 0.1 m³/s, usually in February, a 1 in 5 yr low flow of 0.055 m³/s, with a flood frequency (>1.05 m³/s) of 12 times per annum (NIWA, 2025). In simple terms the typical flow of the Silver Stream at this location is very low at 221 L/s. However, approximately 12 times per year there will be a flood event that is three times the base flow. Based on the ORC long-term monitoring a high flow event is considered to occur at 1.3 m³/s. There are very occasionally very large floods of over 100 m³/s that threaten the town of Mosgiel (Payan & Shretha, 2019). The site has been assessed as not having any natural inland wetlands present (e3Scientific, 2026).

Silver Stream is specifically identified in the Otago Regional Plan: Water for Otago (ORC, 2016) as having specific natural and human use values that must be maintained (or enhanced, where degraded). These values are described in the substantive application prepared by Mitchell Daysh Limited.



Schedule 1A of the Otago Regional Water Plan outlines the natural values present within the Silver Stream as a gravel bed waterway, weedfree, having eel and trout in the mid-reaches with significant trout spawning and juvenile habitat present. Riparian vegetation significant to aquatic habitats in the upper catchment with an associated rare invertebrates and rare fish upstream. Noting the ORC plan was originally published in 2004 and weeds assessment is based on the 2009 Pest Management Strategy, it is likely weeds are present now.



3 Methodology

The freshwater ecological values assessment is based on a desktop study, and a site visit completed on 9 September 2025.

3.1 Desktop Research

The desktop study included a review of existing ecological and water quality information to determine habitats and species likely present on the site.

The desktop assessment included:

- A review of the Land and Water Aotearoa (LAWA) website to access water quality and macroinvertebrate records;
- A review of the New Zealand Freshwater Fish Database (NZFFDB) and Wilderlab eDNA database for historic fish records; and
- Determination of the threat status of the species records by using the New Zealand Fish Threat Classifications as outlined in (Dunn, *et al.*, 2025).

3.2 Site Visit

On 9 September 2025 e3s senior ecologist, Mark Hamer visited 270 - 292 Dukes Road North (Figure 3) to survey the freshwater ecological values of the site. The site survey involved a visual assessment of habitat, algae and substrate at the site. Instream water and macroinvertebrate samples were also collected to characterise the baseline water chemistry and ecological health. Representative photographs of the surveyed sections of stream were taken and are provided within this report (refer to section 4.2).





Figure 4: Locations of Silver Stream sampling sites, Mosgiel.

3.3 Water Quality

The properties of the water at the upstream and downstream sampling sites shown in Figure 3 were assessed by collecting water samples in accordance with best practice to gain representative samples. The sampling methods included:

- Field personnel wore clean nitrile gloves;
- All samples were labelled in a clear and durable manner to permit clear identification of all samples in the laboratory;
- Samples were collected from mid river in mid depth; and
- All samples were immediately placed in a chilled polystyrene bin and were couriered to Eurofins for faecal bacteria analysis and Analytica Laboratories for chemical analysis within 24 hours.

Analytica Laboratories is accredited by the International Accreditation New Zealand (IANZ) for the analysis of all parameters in conduct internal QA / QC in accordance with IANZ requirements.



3.4 Habitat

Bed substrate was assessed following the SAM1 method of Clapcott, *et al.*, (2011) by visually assessing the bed substrate size class proportions (cobble 64-256 mm, gravel 2-64 mm, sand 0.06-2 mm, silt <0.06 mm) across the entire reach of each of the two sampling sites located upstream and downstream of the proposed stormwater outlet (Figure 3).

The overall habitat quality was assessed by utilising a Rapid Habitat Assessment form (RHA) in accordance with Clapcott (2015). This includes an assessment of the quality of macroinvertebrate and fish habitat along with an assessment of sedimentation and riparian conditions.

No aquatic plants were observed at either of the two Silver Stream sites. The algal cover present were assessed by visually estimating the proportion of streambed covered by different algal growth forms in accordance with Biggs & Killroy (2000) to provide an algal cover percentage for the site.

3.5 Aquatic Fauna Surveys

3.5.1 Macroinvertebrate Sampling

Upstream and immediately downstream of the proposed stormwater outlet three Surber samples were gathered by disturbing riffle riverbed within the 0.1 m² Surber area (Figure 3). The Surber sampler had a 500 micron mesh net and the three samples were labelled and then preserved in ethanol following Stark *et al.*, (2001) methods. The samples were then transported to the e3s laboratory for identification, enumeration and metric calculation.

3.5.2 Macroinvertebrate metrics

Freshwater ecological health metrics are assessed by sampling stream macroinvertebrates. This report provides the Macroinvertebrate Community Index (MCI), Quantitative Macroinvertebrate Community Index (QMCI) and Macroinvertebrate Average Score Per Metric (ASPM), taxa richness and EPT richness which measures the percentage of macroinvertebrates present that are sensitive to water pollution for the Taieri Depot Site which is located approximately 3.8 km downstream of the site. The macroinvertebrate metrics were calculated following the methods outlined in Stark & Maxted, (2007) for the MCI and QMCI,



while the ASPM was normalised using the method outlined in the National Policy Statement for Freshwater Management 2020, Amended 2025 (NPS-FM). The macroinvertebrate results from the field survey were then compared against the NPS-FM attribute bands (Ministry for the Environment, 2025) which are based on the MCI and QMCI bands of Stark & Maxted, (2007) and ASPM method (Collier, 2008; Clapcott, et al., 2017) (Table 1). Additionally, the Shannon-Weiner Diversity Index and Shannon Evenness Index are used to help explain community diversity.

Table 1: Macroinvertebrate Metric Attribute Bands (Source NPS-FM 2020).

MCI and QMCI band and description	MCI	QMCI	ASPM Band description	ASPM
A - Macroinvertebrate community, indicative of pristine conditions with almost no organic pollution or nutrient enrichment.	>130	≥ 6.5	A - Macroinvertebrate communities have high ecological integrity, similar to that expected in reference conditions.	≥ 0.6
B - Macroinvertebrate community indicative of mild organic pollution or nutrient enrichment. Largely composed of taxa sensitive to organic pollution/nutrient enrichment.	≥ 110 and <130	≥ 5.5 and < 6.5	B - Macroinvertebrate communities have mild to moderate loss of ecological integrity.	< 0.6 and ≥ 0.4
C - Macroinvertebrate community indicative of moderate organic pollution or nutrient enrichment. There is a mix of taxa sensitive and insensitive to organic pollution/nutrient enrichment.	≥ 90 and < 110	≥ 4.5 and < 5.5	C - Macroinvertebrate communities have moderate to severe loss of ecological integrity.	< 0.4 and ≥ 0.3
D - Macroinvertebrate community indicative of severe organic pollution or nutrient enrichment. Communities are largely composed of taxa insensitive to inorganic pollution/nutrient enrichment.	< 90	< 4.5	D - Macroinvertebrate communities have severe loss of ecological integrity.	< 0.3

3.5.3 Fish Survey

The Silver Stream has numerous recent fish records in the New Zealand Freshwater Fish Database and eDNA database (Wilderlab) and recent e3s surveys (see Figure 3) adjacent to or near the study site. These records were utilised.



An assessment of fish community diversity is included by reviewing fish species richness against the tables outlined in Richardson & Jowett (1996). Fish species richness is assigned a value of low, average or high value based on the number of fish species present and the altitude above sea level of the site.

The threat status of the fish present was determined by reviewing the conservation status of New Zealand fishes (Dunn, *et al.*, 2025).



4 Results and Ecological Values

4.1 Surface Water Quality Results

4.1.1 Water Quality Desktop Review

There are two long-term water quality monitoring sites on the Silver Stream maintained by the ORC. The first is the Silver Stream at Taieri Depot which is approximately 3.8 km downstream of the site, the second is the Silver Stream at 3 Mile Hill Rd approximately 3.2 km upstream (see Figure 4). The results based on the desktop review of the LAWA website for the two locations show that the water quality at 3 Mile Hill Rd upstream of the site was very good. The water clarity at Taieri Depot downstream of the site is also in the highest attribute band (Band A) but had higher nutrient concentrations and faecal bacteria levels (Table 2). Total nitrogen exceeded the ORC Schedule 15 receiving water limits for the Taieri River currently at both monitoring sites and dissolved organic nitrogen also exceeded at the Taieri Depot site downstream. Overall, the waterway generally has clear water with low faecal and phosphorus levels but elevated nitrogen levels.

Table 2: Silver Stream Long-term Water Quality Results against NPSFM (2025) standards (Source: LAWA). Bold indicates exceedance of guideline.

Parameter (5-Year median)	Silver Stream Taieri Depot	Silver Stream 3 Mile Hill Road	Guideline Values
Visual Clarity (m)	4.17	5.31	1.34 ¹
Total Oxidised Nitrogen (mg/L)	0.3	0.0042	n/a
Total Nitrogen (mg/L)	0.46	0.1	0.1 ²
Total Ammoniacal-N (mg/L)	0.005	0.005	0.24 ¹
Nitrate-N (mg/L)	0.3	0.004	2.4 ¹
Dissolved Inorganic Nitrogen (mg/L)	0.3	0.01	0.075 ²
Dissolved Reactive Phosphorus (mg/L)	0.0027	0.0014	0.018 ¹
Total Phosphorus (mg/L)	0.007	0.004	n/a
Escherichia coli # (n/100mL)	84	44	130 ¹

¹ NPSFM Sediment Class 1 based on REC CD/L/HS.

² ORC (2016) Schedule 15 receiving water limits and targets for Receiving Water Group 2 – Taieri

4.1.2 Site Sampling Results

Table 3 sets out the results of laboratory analysis on water quality samples collected during the ecological survey. Parameters measured included total recoverable metals, soluble ions, nutrients and faecal bacteria. This suite of tests



is typical for stormwater monitoring as it covers the range of predominant contaminants that relate to vehicle tyres and brakes, roofs and guttering, concrete and asphalt along with typical HAIL site contaminants and general earthworks associated sediment risks. The results show that the upstream and downstream sample sites have highly comparable water quality characteristics. This is unsurprising as there is only 800 m between the two sample sites and no obvious tributaries or discharges to the stream within this reach. Most of the results show the water quality parameters are below or within the guideline ranges provided in Table 3, except for nitrate and conductivity. The analytical results provide a useful baseline understanding of the water quality immediately upstream and downstream of the proposed stormwater discharge. These one-off samples suggest only nitrogen concentration is currently a water quality parameter of concern for this section of the Silver Stream with exceedances of the ORC nitrogen guidelines noted. Overall, the water quality at this location is good with good water clarity and low faecal bacteria contamination. It is likely that nitrogen is the nutrient contaminant from the Silver Stream with the greatest potential to impact the wider Taieri River catchment downstream, although the total nitrogen levels at the Taieri River at Allanton Bridge downstream are much higher than the values collected at the sites in this study. It should be noted the conductivity guideline value outlined below is based on an 80th percentile of monitored river sites rather than being a threshold at which ecological values are impaired.

Table 3: Results of water quality sampling. Bold if above relevant guideline levels.

Parameter	Silver Stream Downstream	Silver Stream Upstream	Guideline Values
pH	7.5	7.59	6.5 – 8.5 ¹
Water Clarity (m)	4.75	4.45	1.34 NPSFM ²
Turbidity (NTU)	1.59	2.37	1 - 20 ¹
Conductivity (µS/cm)	188	189	116 ¹
Total Suspended Solids (mg/L)	< 3	< 3	Increase of 5 mg/l from background levels ³
Alkalinity (g/m ³ as CaCO ₃)	58	56	500 ¹
Chloride (mg/L)	17.8	17.9	120 ³
Sulphate (mg/L)	9.01	9.08	400 ¹
Total Recoverable Arsenic (mg/L)	<0.0005	<0.0005	0.005 ³
Total Recoverable Cadmium (mg/L)	<0.00002	<0.00002	0.00009 ³
Total Recoverable Chromium (mg/L)	0.0002	0.0003	0.001 ³
Total Recoverable Copper (mg/L)	0.0003	0.0003	0.0012 ⁴



Parameter	Silver Stream Downstream	Silver Stream Upstream	Guideline Values
Total Recoverable Lead (mg/L)	<0.00005	<0.00005	0.001³
Total Recoverable Nickel (mg/L)	0.0006	0.0007	0.025³
Total Recoverable Zinc (mg/L)	<0.003	<0.003	0.003⁷
Total Recoverable Mercury (mg/L)	<0.0001	<0.0001	0.09⁵
Soluble Sodium (mg/L)	11.2	11.3	300¹
Soluble Potassium (mg/L)	1.31	1.28	n/a
Soluble Magnesium (mg/L)	5.34	5.41	n/a
Soluble Calcium (mg/L)	14.7	14.6	n/a
Soluble Zinc (mg/L)	<0.001	<0.001	n/a
Soluble Iron (mg/L)	0.058	0.057	0.3³
Soluble Manganese (mg/L)	0.0071	0.0078	1.2⁵
Total Oxidised Nitrogen (mg/L)	0.114	0.113	n/a
Total Kjeldahl Nitrogen (mg/L)	<0.1	<0.1	n/a
Total Nitrogen (mg/L)	0.1	0.1	0.1⁴
Total Ammoniacal-N (mg/L)	<0.005	<0.005	0.1⁴
Nitrite-N (mg/L)	<0.001	<0.001	0.075⁶
Nitrate-N (mg/L)	0.114	0.113	0.075⁶
Dissolved Inorganic Nitrogen (mg/L)	0.114	0.113	0.075^{6a*}
Dissolved Reactive Phosphorus (mg/L)	<0.002	<0.002	0.005⁶
Total Coliforms (MPN/100mL)	219	325	n/a
<i>Escherichia coli</i> (MPN/100mL)	64	65	130 NPS-FM²

¹ ANZG (2018).

² NPS-FM (2025)

³ Long-term water quality guidelines for the protection of aquatic life Invalid source specified..

⁴ Based on 95% species protection (Gadd & Hickey, 2016a).

⁵ Trigger values for high value freshwater systems 99% species protection (ANZECC, 2000).

⁶ ORC (2016) Schedule 15 receiving water limits and targets a) for Receiving Water Group 2 – Taieri

* Guideline value is for Nitrate-Nitrite-N

⁷ Based on 95% species protection (Gadd & Hickey, 2016b).

n/a = not applicable (no guideline values).

4.2 Habitat

The Silver Stream was flowing at a normal spring low flow at the time of the field visit on 9 September 2025. Between the downstream and upstream sample sites, the riparian vegetation consisted primarily of introduced trees such as willows and alder. These deciduous trees did not provide significant shade to the streambed at this time of year. Sections of the stream adjacent to the site had railway iron rammed into the banks in an apparent effort to aid with bank erosion control. Further details of this are provided in the Geotechnical Desktop Study and



Appraisal prepared by Stantec and provided as part of the SLIP substantive application.

Bed substrate was generally a consistent loose assortment with a high proportion of sand present (Table 4; Figure 5 & 6). The overall stream habitat at the upstream and downstream sample sites were similar although the cobble riffle sampled at the upstream sample site showed greater substrate stability compared to the rest of the stream. The upstream sample site also had a slightly higher RHA score with 68.5 compared to 62.5 (Table 4). A small amount of light brown mat algae was present on some stable cobbles at the downstream sample site, but the majority of gravels were free of algae. The upstream sample site had less brown mat present, but more thin algae present particularly in shallow slow flowing areas (Figure 5 & 6).

Table 4: Habitat Assessment Results.

Parameter	Silver Stream Downstream	Silver Stream Upstream
Channel Width (m)	11.1	10.6
Wetted Width (m)	6.6	6.1
Maximum Depth (m)	0.55	0.55
Canopy cover	Open	Open
Fencing	Complete	Complete
Dominant riparian vegetation	Exotic trees	Retired vegetation
Algae cover	Mat algae on cobbles only	Thin algal film on gravels
Rapid Habitat Assessment (RHA) (n/100)	62.5	68.5
Substrate compaction	Mostly loose	Moderately packed
Substrate Composition		
Cobble %	5	40
Gravel %	80	20
Sand %	15	40
Silt %	0	0





Figure 5: Silver Stream downstream site (left) and example of periphyton on cobbles only.



Figure 6: Silver Stream upstream site with stable riffle (left) and substrate (right).

4.3 Macroinvertebrates

4.3.1 Long-term Macroinvertebrate Trends

The Silver Stream at the Taieri Depot long-term macroinvertebrate community monitoring site (downstream of the Southern Link Inland Port site) indicates that the stream is in a poor state, below the National bottom line of freshwater quality (Table 5). The macroinvertebrate community is indicative of severe organic pollution or nutrient enrichment. The communities are largely composed of taxa insensitive to inorganic pollution or nutrient enrichment and the communities have suffered a severe loss of ecological integrity (Ministry for the Environment, 2025). Overall, the monitoring shows a general decline in macroinvertebrate metrics since 2019 (Figure 7).



Table 5: Silver Stream long-term macroinvertebrate results (Source: LAWA 2025).

Parameter (5-Year median)	Silver Stream Taieri Depot	Guideline Values
Macroinvertebrate Community Index (MCI)	88	90 NPSFM
Quantitative Macroinvertebrate Community Index (QMCI)	2.6	4.5 NPSFM
Average Score Per Metric (ASPM)	0.24	0.3 NPSFM
Taxa Richness *	21	N/A
% EPT Richness*	30	N/A

* Based on 15-year median

Bold if below National Bottom Line.

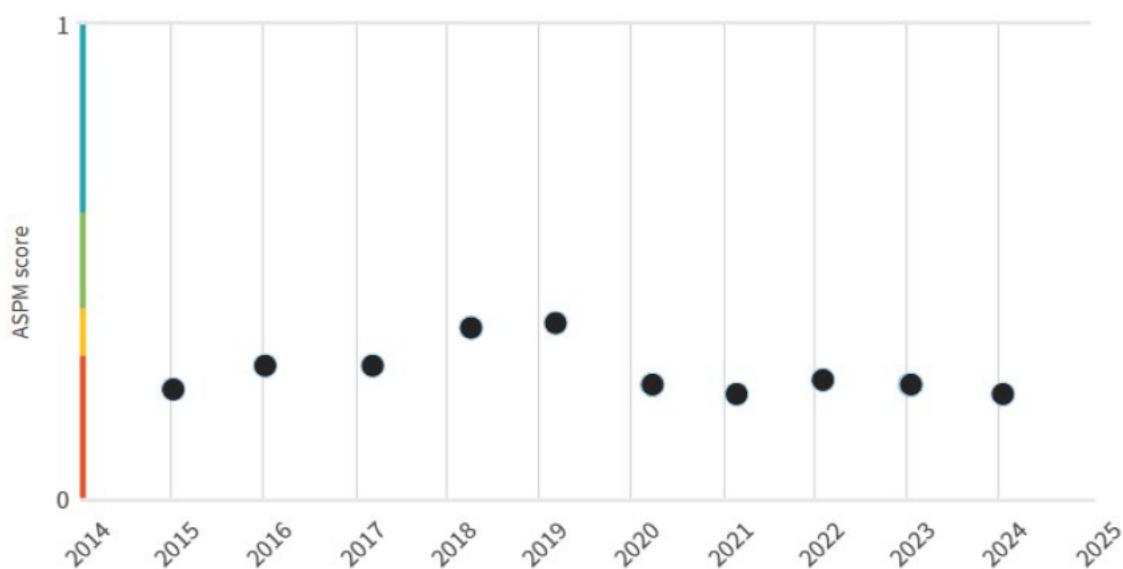


Figure 7: Macroinvertebrate Community Health measured by Average Score Per Metric (ASPM) 2015-2024 at Silver Stream Taieri Depot site (Source: LAWA).

4.3.2 Macroinvertebrate Sampling Results

Results from the macroinvertebrate samples collected as part of this survey are provided in Table 6. The MCI, QMCI and ASPM results show the upstream and downstream sample sites have very similar macroinvertebrate communities. Both communities are indicative of mild organic pollution largely composed of taxa sensitive to pollution and a moderate loss of ecological integrity. All metrics were above the National bottom line (NPS-FM, 2025). The Shannon Diversity Index found the sites both have moderately low diversity with 10-12 species present and abundance dominated by a few taxa (Table 6; Appendix A). The moderate



Shannon Evenness at both sites (0.47 and 0.54) was largely driven by dominance of *Deleatidium* mayflies (Table 6; Appendix A).

Table 6: Macroinvertebrate sampling results.

	Silver Stream Downstream	Silver Stream Upstream
Abundance	241	275
Taxa Richness	10	12
MCI	94	105
EPT% Abundance	71	74
EPT% Taxa Richness	40	53
EPT Richness	4	6
QMCI	6.2	6.6
Shannon Diversity Index	1.1	1.3
Evenness	0.47	0.54
ASPM	0.44	0.49
QMCI Attribute Band	B	A
MCI Attribute Band	C	C
ASPM Attribute Band	B	B

Recent surveys have sampled macroinvertebrates immediately adjacent to the proposed site at Stedman Rd and downstream at the ORC sampling site - Taieri Depot Site (Gordon Rd) in May 2024 (e3scientific, 2024). These results also show that the macroinvertebrate community upstream at Stedman Road is indicative of healthier stream communities than downstream at the Taieri Depot (Table 7).

The higher ecological health indicated by macroinvertebrates in this survey when compared to the ORC data and previous survey data is likely to be due to the time of year and the upstream location of the samples. ORC monitoring occurs in the summer months when algal growth and water temperatures are at their maximum. Higher summer temperatures without nutrient limitation enables for faster algal growth rates and greater algal biomass accrual. This in turn leads to a change in macroinvertebrate community structure with a change to dominance by tolerant taxa that prefer feeding on fast growing filamentous algae such as snails. This is likely to be exacerbated by the unshaded, channelised reach at the Taieri Depot and nearby stormwater inputs.

Table 7: Macroinvertebrate results from 2024 survey (e3scientific, 2024).

	Taieri Depot Site		Stedman Road Site	
	Scores	Attribute Band	Scores	Attribute Band
MCI	74	D	109	C
QMCI	3.1	D	5.1	C
ASPM	0.15	D	0.38	C



4.4 Fish

Historic fish survey (1981-2021) and eDNA (2023-2024) data was used to describe the likely fish community present and to contribute to the assessment of ecological values present within the Silver Stream in the reach adjacent to the proposed site and the proposed stormwater outfall.

Brown trout, lamprey, longfin eel and redfin bully were confirmed as present at Stedman Road (see Figure 4) in the vicinity of the proposed stormwater discharge to Silver Stream (Table 8). With an additional 8 species present in the New Zealand Freshwater Fish Database (NZFFDB) and/or the Wilderlab eDNA database 2.5 km downstream at the Taieri Depot Site (Table 8).

Based on previous eDNA data from Silver Stream, there is evidence of Threatened - Nationally Vulnerable lamprey within this stream at this location (Stedman Rd), along with the At Risk – Declining longfin eel. While the Threatened - Nationally Vulnerable īnanga are known from the Taieri Depot Site 2.4 km downstream. There are also weak detections of eDNA of At Risk – Declining Taieri flathead galaxias at Steadman Road and upstream at Flagstaff Creek. A population of Eldons galaxias is known from Whare Stream in the headwaters of the Silver Stream. There may be an error in the genetics database used for these species and the weak detection of Taieri flathead galaxias may in fact relate to stray Eldons galaxias genetic material. Although when queried Wilderlab stated the "genetic material is too different for crossover" and "I don't think the detection should be discounted" (S. Wilkinson *pers. comm.* 10/3/2026). This location is not considered typical Taieri flathead galaxias or Eldons galaxias habitat and the eDNA presence may be due to individuals being washed downstream from upstream populations, in any case this detection should be treated with caution. A weak detection has also been noted for giant kōkopu 2.5 km downstream and therefore may be present at times. Adult lamprey nest under boulders and juveniles (Amocoetes) occupy fine sediment deposits, neither habitat types are prevalent near the proposed stormwater outlet location but are present further upstream and downstream. The eDNA assessment approach can detect genetic material sourced from upstream and carried down current in the water flow, therefore the Taieri flathead/Eldons galaxias results may reflect their presence from an unknown distance upstream (Melchior & Baker, 2023). In addition, fish predated upstream and excreted near this location could also be identified within the eDNA samples.



Therefore, the presence of the Taieri flathead/Eldons galaxias should be considered with caution as the eDNA detections do not overlap with confirmed fish records (NZFFDB records known only from much further (10.5 km) upstream), unlike the other fish species assessed as present. Notwithstanding this point, the eDNA records indicate Taieri flathead/Eldons galaxias may be present nearby, at least on occasion.

In summary, brown trout, longfin eel, lamprey and redfin bully have been confirmed as present adjacent to the site, at least periodically (Table 8). With a further 8 species likely to be transient at times to reach adult or spawning habitat. While Silver Stream habitat downstream of Mosgiel is heavily developed and straightened with significant flood defences in place, the reach adjacent to the proposed development has slightly more room to meander and higher tree lined banks that provide greater shading and leave litter input at times also. The stream section adjacent to the proposed site is considered to have average fish diversity, utilising the method of Richardson & Jowett (1996).

Table 8: 2024 survey fish records (e3scientific, 2024), NZFFDB records and Wilderlab eDNA database records within Silver Stream.

Name	Taieri Depot	Stedman Rd	Threat status*
Brown trout	√ ^{1, 2, 3}	√ ¹	Introduced & naturalised
Longfin eel	√ ^{1, 2, 3}	√ ¹	At risk - Declining
Shortfin eel	√ ³		Not Threatened
Lamprey	√ ^{2, 3}	√ ¹	Nationally Vulnerable
Taieri flathead galaxias/Eldons??	√ ^{1, 3}		At risk - Declining
Redfin bully	√ ^{1, 3}	√ ¹	At risk – Naturally Uncommon
Common bully	√ ^{2, 3}		Not Threatened
Īnanga	√ ^{2, 3}		Nationally Vulnerable
Common smelt	√ ²		At Risk Declining
Banded kōkopu	√ ³		At risk – Naturally Uncommon
Giant kōkopu	√ ³		At risk - Declining
Perch	√ ³		Introduced & naturalised

* From Dunn, *et al.*, (2025)

¹ e3scientific (2024)

² NZFFDB

³ Wilderlab eDNA



4.4.1 Fish Spawning and Migration

Fish spawning timings for the Silver Stream is outlined in Table 9. Of the 12 fish species potentially present only two of the At Risk - Declining, Threatened or sportsfish are considered to potentially spawn near the site, namely giant kōkopu, and brown trout. Longfin and shortfin eel spawn at sea and īnanga spawn downstream in tidally influenced sections of Taieri River and were therefore excluded from consideration for this reason.

Spawning behaviour for fish species identified within Silver Stream are summarised as follows:

- Catadromous eels spawn only once at the end of their lives, and this breeding occurs in the ocean rather than in freshwater. Mature adult longfin and shortfin eels typically undertake downstream migrations during high-flow events in autumn (March–May) (Smith, 2014), while glass eels and elvers arrive upstream from the coast between December and March (Smith, 2014).
- Giant kokopu are known to spawn in bankside vegetation during winter flood events (Franklin, *et al.*, 2015). As floodwaters rise giant kokopu females find a suitable location generally 0.6 m above base flow with low bank slope (< 10°), approximately 1 m from and vegetation comprising of lower stems and root mats of yorkshire fog (*Holcus lanatus*) and wandering jew (*Tradescantia fluminensis*) (Franklin, *et al.*, 2015).
- Lamprey are known to spawn under large boulders in headwater streams in spring (Baker, *et al.*, 2016). They nest as a male/female pair for up to a year and guard the eggs once spawning is completed until the eggs hatch approximately 6 weeks later.
- Brown trout spawn in sediment free gravels in riffle/run habitat often at the tail end of a pool. Females dig a redd, a depression with their tails to lay their eggs in clean loose gravels with plenty of oxygenation.
- Taieri flathead galaxias/ Eldons galaxias spawn in adult habitat amongst the stream bed, clean rock substrates are important and low levels of suspended sediment are required to prevent smothering of the eggs (MPI, 2017). However, as previously stated based on the eDNA results, the presence of this species is likely to be further upstream and not adjacent to the site. Therefore this species is not considered further in this assessment.



Boulders are not present on the true right of the Silver Stream where any inwater works for the stormwater outlet is most likely occur. If works were required in winter a search of the stream bank for giant kokopu eggs could occur by suitably qualified ecologist and if no eggs are found the works could continue. Likewise an instream search for trout redds in the area could be undertaken prior to instream works occurring.

Upstream migration timings for the fish present range from May to November (inclusive) with the exception being eels which will migrate upstream December to March but are not considered sensitive to turbid water or high water sediment loadings in their migration phase (Smith, 2014).

Table 9: Spawning timings for high value fish likely to spawn nearby.

SPAWNING	D	J	F	M	A	M	J	J	A	S	O	N
Brown Trout						X	X	X	X			
Lamprey											X	
Giant kokopu							X	X	X			

^ spawning timing from Baker, *et al.*, (2016); MPI, (2017).

4.5 Ecological Values Assessment

The Environment Institute of Australia and New Zealand (EIANZ) Guidelines set out evaluation criteria that can be used to determine the ecological values of a species or habitat. The assigned ecological value is then used along with the magnitude of the proposal to determine the ecological impact. The following sections use the EIANZ Guidelines to characterise the ecological value of the aquatic habitats and faunal species that may utilise the area.

Under the EIANZ guidelines (Roper-Lindsay, *et al.*, 2018) ecological value is assigned based on the following assessment matters:

- Representativeness
- Rarity and Distinctiveness
- Diversity and Pattern
- Ecological Context

Representativeness

The representativeness value for the freshwater environment includes the extent to which the site is typical of the natural characteristics, catchment size, stream



order, and standing water characteristics. Therefore, it is considered appropriate that sites classified as such are recognised under the Representative criteria.

Rarity / Distinctiveness

The New Zealand Threat Classification System (NZTCS) is used to assess the threat status of fish (Dunn, et al., 2025), freshwater macroinvertebrates (Grainger, et al., 2018) and terrestrial and aquatic plants (de Lange et al., 2018). This FEClA has utilised these NZTCS reports to inform an assessment of rarity.

Diversity and Pattern

The desktop research undertaken within this report includes an assessment of macroinvertebrate metrics and fish likely to live within or migrate through the reach and relies on the NZFFDB and MPI Fish Spawning Indicator and diversity metrics to provide the basis for an assessment of diversity at the site.

Ecological Context

Ecological context describes an ecosystem's role in ecosystem function. Examples may include:

- freshwater and terrestrial habitat providing an important food source for fish and/or birds.
- freshwater and terrestrial habitat playing an important part in the lifecycle of a species e.g. breeding or spawning locations for bird or fish species.

For the purpose of this assessment habitats that support Threatened and At - Risk species, are biologically diverse, provide an important food source or play a critical role in the lifecycle for a species that are considered to have a high ecological value.

4.4.2 Ecological Values Summary

Table 10 provides a summary of the ecological values of Silver Stream based on the above outlined criteria.



Table 10: Ecological Values Summary of Silver Stream adjacent to the Project site.

Matter	Criteria	Value
Representativeness	Silver Stream is a 4th order waterway that consists of a catchment of approximately 98 km ² upstream from the Taieri confluence. The waterway is channelised and excluded from the wider floodplain by stopbanks below Mosgiel and an incised channel upstream. The characteristics of the water are cool, clear, well oxygenated with lots of light available for algal growth. With generally low nitrogen levels but high faecal (<i>E. coli</i>) contamination at times. This section of the Silver Stream is moderately representative of Otago waterways.	Moderate
Rarity/ distinctiveness	Two Threatened species, two 'At-Risk Declining' fish species and an introduced sportfish are identified as present. The distinct ecological features include the presence of lamprey, longfin eel, īnanga and giant kōkopu in the stream.	High
Diversity and pattern	Silver Stream was found to have average fish species richness. Macroinvertebrate samples consisted of an average diversity of pollution tolerant taxa. Stream health based on the macroinvertebrate community present is considered to range from indicative of pristine conditions to a community indicative of a mix of pollution tolerant and sensitive taxa with a mild loss of ecological integrity. The instream habitat is limited with a high proportion of sand, loose gravels and cobbles present.	Moderate
Ecological context	Silver Stream is a flood prone waterway with very limited instream and riparian habitat. The headwater catchment contributes high water flows to the Silver Stream mainstem at this location at times and there are signs of flood protection works across the reach. The waterway does have good connectivity to the sea and enables diadromous fish passage to the site and upstream to more suitable adult habitat (for longfin eel, giant kokopu and lamprey). The shaded reach adjacent to the proposed stormwater outfall has higher ecological values than downstream in the channelised open sections and maintains a population of brown trout, lamprey and īnanga with giant kōkopu and longfin eel migrating through the reach to upstream habitat.	Moderate

Combining these four matters using the method outlined in Table 6 of the EIANZ Guidelines (Roper-Lindsay, *et al.*, 2018) the overall ecological value of Silver Stream in the reach adjacent or near to the site is considered "**High**".



5 Ecological Impact Assessment

5.1 Ecological Impact Assessment Methodology

The following ecological impact assessment (FEcIA) follows the EIANZ Ecological Impact Assessment Guidelines for New Zealand. The guidelines are based on the assessment of the ecological values present within the proposed stormwater outfall receiving waters (see Section 4) and the magnitude of the effect within the zone of influence and the wider context of individual species populations and extent of Silver Stream habitat.

The FEcIA guidelines provide a series of tables that assist with the assignment of value to the ecological features that will be disturbed and the magnitude of the activity. These tables are provided as Table 11 and 12 and referred to in the discussion below. A summary of the ecological effects and the measures employed to avoid and mitigate the ecological effects of the proposed works are presented in Table 13.

5.1.1 Assigning Magnitude of Effect

The EIANZ guidelines provide criteria for assigning the extent of the effects on the ecological values within the area that may be disturbed by the activity. This assessment adopts the criteria for describing magnitude of effect and is provided in Table 11 below.

Table 11: Criteria for describing magnitude of effect (Roper-Lindsay, et al., 2018).

Magnitude	Description
Very High	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature



Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR having negligible effect on the known population or range of the element/feature

5.1.2 Assigning Level of Effect

The level of ecological effect is based on combining the ecological value of an environment that may be impacted by the proposed activities and the magnitude of the effect.

Table 12 is adapted from the EIANZ guidelines to provide a level of effect matrix. For the purpose of this assessment, where the level of effect is moderate or above, a management response is required to ensure potential environmental effects are managed appropriately. An effect level of Low or Very Low indicate the effect is ecologically less than minor.

Table 12: Criteria for describing level of effect (Roper-Lindsay, et al., 2018).

		Ecological Value			
		Very High	High	Moderate	Low
Magnitude	Very High	Very High	Very High	High	Moderate
	High	Very High	Very High	Moderate	Low
	Moderate	High	High	Moderate	Low
	Low	Moderate	Low	Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low
	Positive	Net Gain	Net Gain	Net Gain	Net Gain

5.1.3 Residual Impact

The residual impact is the final impact level assigned to the proposed activity and potential effects once proposed mitigation/remediation options have been applied and is outlined in Table 13.



5.2 Aquatic Ecology Effects

The potential effects of the discharge of stormwater from the site to Silver Stream without treatment or management could include nutrient, contaminant and sediment inputs, water temperature changes and flow regime change (increased flashiness from the increased impervious surface).

Petroleum hydrocarbons are a potential stormwater contaminant that is toxic to aquatic life by effecting aquatic organism oxygen uptake. Heavy metals from truck brakes, tyres, roof materials and HAIL sites are toxic to aquatic life and can be bound to deposited sediments. Sediment from open ground during works can smother streambed habitat if it makes its way to waterways. Organic material (entrained leaves) can contribute nutrients and contribute to diurnal oxygen depletion through microbial breakdown. Inputs of warm stormwater can alter instream temperatures under certain conditions.

However, these potential effects are very unlikely to occur as it is proposed that the SLIP will include a large stormwater attenuation pond. Prior to water entering the pond the stormwater system is designed to include catchpits, gross pollutant traps (GPT) or universal pollutant traps (UPT) to treat the internal stormwater. The catchpits and GPT/UPT treatment systems directly reduce petroleum hydrocarbons and heavy metal concentrations within stormwater and the sediment which these contaminants readily bind to, from the stormwater discharge (see example in Appendix B). The attenuation pond is also designed to be large and has short residence times for smaller rainfall events (Stantec NZ, 2026). The pond outfall will direct the discharge to a swale prior to entering the Silver Stream. The swale will be shaded and protected with erosion protection and flow deflectors to minimise the risk of scour and erosion.

5.2.1 Site Development Earthworks

Earthworks are proposed to be managed in alignment with the comprehensive Auckland GD05 Guidelines (Auckland Council, 2016) (see section 2.1) which reduces the likelihood of issues such as reduced water clarity, and sediment deposition infilling interstitial spaces between stones and impacting fish spawning and egg rearing success. Fine sands are already present in the adjacent section of the Silver Stream which is apparent in the moderate to low MCI scores; however, this location may provide spawning habitat for sportfish and At Risk fish.



All 3 stages of the project include earthworks and alongside the above mentioned best practice erosion and sediment controls, a sediment retention and stormwater attenuation pond in the southwest corner of the development will be established and all rainfall surface run-off will be directed. The attenuation pond outlet will then be directed to a swale before entering Silver Stream. This is proposed to include design features to minimise scour and erosion potential, so as not to contribute sediment to the stream. Outlet 2 discharges only external stormwater which will not be affected by earthworks within the site. Areas within the site may contain contaminated sediment (see e3Scientific, 2025), and these areas will require specific management to ensure sediment does not reach the stream. There may also be the potential for minor inwater works to be carried out to allow for the establishment of the stormwater discharge to Silver Stream. Inwater works will not occupy the entire stream width, therefore no effects on fish migration are anticipated.

The underlying character and attributes of Silver Stream could result in a minor shift from baseline, equating to a Moderate magnitude of effect from these activities. This alongside the High ecological value of the Silver Stream (based on Section 4.5) results in a **High overall level of effect**, without mitigation (Table 13).

In order to reduce the potential for effects to a low level, the following management actions are recommended:

1. Earthworks should be undertaken primarily during stable weather conditions and sediment attenuation pond maintenance should occur in line with Auckland Council (2016) guidelines.
2. A site investigation prior to site development earthworks should be undertaken to confirm or eliminate the presence of contaminated soils and ensure these are not disturbed and remain out of the stormwater system and stream.
3. Undertake planting of the swale between the attenuation pond outlet and Silver Stream adjacent to rock lined sections wherever possible with native plantings above the winter base flow level to reduce sediment erosion reaching Silver Stream bed.
4. If in-water works are required to connect the stormwater outflow and associated swale to Silver Stream these works should avoid fish spawning times of 1 May to 31 November, if possible. If this is not possible, pre-inwater works, fish salvage should be undertaken following the National Work in Water Guidelines (MfE, 2021) and additional river bank and trout redd surveys for fish eggs should be undertaken by a suitably qualified ecologist.



- a. If any trout redds are found, they are to be avoided and if any riverbank eggs on are located the instream works should be delayed until after the next flood event.

Recommended monitoring measures are as follows:

5. Aquatic habitat and macroinvertebrate surveys at the upstream and downstream survey sites within this report should be replicated annually in Spring during Stage 1 of the project to verify earthworks are being effectively managed and Silver Stream ecology is remaining stable. If deposited sediment is observed at the downstream site during the annual survey, a minimum of two samples should be taken and tested for heavy metals, polycyclic aromatic hydrocarbons (PAH) and a nutrient suite.
 - a. An annual report should be provided to ORC within 3 months of fieldwork, assessing results next to appropriate guidelines, baseline (from this report), and upstream (reference site) results.

These additional measures will ensure **a low level** of residual effect from site earthworks adjacent to Silver Stream.

5.2.2 Stormwater Discharge to Silver Stream

Stormwater within the site (internal) is proposed to be treated via catchpits, GPT/UPT and an attenuation pond before being discharged to Silver Stream. These treatments reduce the likelihood of nutrient and contaminant inputs that can result in habitat alteration by promoting algal growth or direct toxicity effects on aquatic life. Reductions in water clarity, increased water temperatures, reduced oxygen levels and increased stress in the instream community present via habitat alteration can also arise if appropriate stormwater treatment does not occur.

As above, the development proposes to actively intercept, manage and treat stormwater prior to discharging to Silver Stream and all water from the washpad/truckwash area is planned to be directed to trade waste. For smaller rainfall events the attenuation pond is large and has short residence times, with 12 hours or less of discharge to remove stormwater from the pond. The proposed large stormwater attenuation pond will delay stormwater flow peaks and catchpits, GPT or UPT's will actively reduce sediment, and contaminant loads from the internal stormwater (see Appendix B) enabling suitable treatment, particularly of first flushes (Stantec, 2026). Silver Stream water temperatures have been



assessed against a number of water temperature scenarios, and it is predicted that the attenuation pond will enable effective water passage to minimise water temperatures at all but the most unlikely extreme scenarios during summer low flow, where rainfall and stormwater events are least likely (Appendix C). Conversely, during large storm events (1 in 10 yr return) some overland flow may occur, and stormwater will be directed to the attenuation pond. Stantec (2026) consider the risk of contamination to the pond and stream via this pathway to be low due to stormwater system channelling the majority of first flush contaminants to treatment systems prior to overtopping occurring. Discharges to Silver Stream will be intermittent and only associated with rainfall events.

It is anticipated that the stormwater discharge from the site (Outlet 1 and 2ⁱ) could represent a minor shift away from the existing baseline conditions and attributes within Silver Stream. This will depend on the composition of the stormwater following treatment and the overall flow regime and the 'first flush' of the stormwater flow will likely have the highest risk of the discharge to convey contaminants. However, the proposed treatment systems should enable potential contaminants to be largely removed prior to discharge. Based on this, the underlying character and attributes of Silver Stream could range from slightly altered to similar to pre-development levels at this site, equating to a Low magnitude of effect. Alongside the high ecological value of Silver Stream, the **overall level of effect is considered Low.**

However, a precautionary approach is advocated, and monitoring of the Silver Stream is recommended alongside ensuring effective management actions to reduce the potential for adverse effects on Silver Stream. Recommended management actions include:

8. Plant any open stormwater swales on site with native shrubs or Carex to support lower water temperatures on-site.
9. Stormwater treatment is recommended to include GPTs or UPTs at the pond outlets.
10. Best practice site management to be undertaken (cleaning regime, chemicals indoors, vehicles maintained, spill prevention, regular GPT/UPT maintenance, etc).

ⁱ Outlet 2 only conveys 'external' stormwater. Outlet 1 conveys 'internal' and 'external' stormwater.
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Document ID: 25055_1



Recommended stormwater monitoring to ensure treatment systems (catchpits, GPT/UPT's and attenuation pond) are effective includes:

11. A Stormwater Monitoring Plan (SMP) is to be developed and include the below monitoring aspects and actions to be undertaken if high results are recorded.
12. Water quality monitoring within Silver Stream should be taken pre-discharge (at upstream and downstream sites) over 4 sampling events (ideally covering differing weather characteristics), covering the same parameters as Table 3, and with the inclusion of dissolved oxygen. This sampling will establish the baseline data set.
13. First flush water quality monitoring (Table 3 parameters) of the discharge and at the upstream and downstream Silver Stream sites should occur quarterly during Stage 1 and Stage 2, until the attenuation pond has been fully completed. This monitoring should also be completed (at any time) within 1 week following a large storm event (flow increase $>1 \text{ m}^3/\text{s}$) that has resulted in any overland flow from the washpad/truckwash area.
 - c. An annual report should be prepared for ORC assessing water quality parameters next to appropriate guidelines, the baseline samples and upstream (reference site) samples.
 - d. An additional report will be prepared for ORC providing the results of the survey following any washpad/truckwash overland flow events within 2 months of sampling.
14. Continuous upstream (above Outlet 2) and downstream (below Outlet 1) water temperature monitoring should occur in Silver Stream for the first two summers (1 Dec to 31 March) post stormwater attenuation pond establishment.
 - a. Water temperature downstream of discharge should not increase by 3°C or more from the upstream site sample or above 25°C .

Based on the proposed management actions and stormwater monitoring the residual level of effect is expected to reduce to **Low effect**.

5.3 Summary

The freshwater ecological values of the Silver Stream have been assessed as "High" largely due to the presence of two threatened and one At Risk fish species and a regionally significant sportfish.



Table 13 provides a summary of the potential effects and recommended management actions and improvements to mitigate the potential impact of the site earthworks and subsequent stormwater discharge on the Silver Stream habitat. Following these management actions and monitoring programmes and based on the current understanding of the site design and development, the impact from the proposed activities is considered **Low**, or **less than minor**.



Table 13: Ecological Impact Assessment Summary for proposed Inland Port Development.

Activity and Rationale		Ecological Value	Magnitude of Effect	Level of Effect	Recommended Impact Management Avoid/Mitigate/Remediate stormwater effects	Residual Impact
Earthworks and Stormwater Discharge	<p><u>Site Development Earthworks</u> Sediment associated with site development earthworks, site use and the stormwater outlet connection to Silver Stream could enter the stream and smother bed substrate if not managed correctly. Fine sands already present in this section of Silver Stream which has moderate to low MCI scores. This location may provide spawning habitat for At Risk fish and juvenile rearing habitat for Threatened fish. During construction erosion and sediment control best practice will be followed. A stormwater attenuation pond is proposed in Stage 1. Stormwater outfall designed to minimise the risk of scour and erosion to swale before reaching Silver Stream.</p>	High	Moderate	High	<ul style="list-style-type: none"> Earthworks should be undertaken primarily during stable weather conditions and sediment attenuation pond maintenance should occur in line with Auckland Council (2016) guidelines. Undertake a site investigation prior to site development earthworks to confirm or eliminate the presence of contaminated soils. Undertake planting of the swale between the pond outlet and Silver Stream adjacent to rock lined sections wherever possible with dense native plantings above the winter base flow level to reduce sediment erosion reaching Silver Stream bed. Complete an annual aquatic habitat and macroinvertebrate survey at the upstream and downstream sites (from this survey) in September during Stage 1. If sediment is observed at the downstream site this should be sampled for heavy metals, PAH's and nutrients. An annual report of the results to be provided to ORC. Works to connect the stormwater outflow to Silver Stream are to avoid fish spawning times (1 May to 31 November), wherever possible. If not possible, fish salvage and spawning survey pre-inwater works are required. 	Low
	<p><u>Stormwater Discharge to Silver Stream</u> Contaminants and nutrients associated with the industrial site to be treated with GPT/UPT, catchpits and attenuation pond prior to discharge to the Silver Stream. High ecological value lamprey, giant kokopu, inanga, and brown trout are known to be periodically present in the waterway. Stormwater discharge to be intermittent and only associated with rainfall events. It is predicted that the attenuation pond will enable effective water passage to minimise water temperature changes.</p>	High	Low	Low	<ul style="list-style-type: none"> Plant any open stormwater swales on site with native shrubs or Carex to support lower water temperatures on-site. Stormwater treatment is recommended to include GPTs or UPTs at the pond outlets. Best practice site management to be undertaken (cleaning regime, chemicals indoors, vehicles maintained, spill prevention, regular GPT/UPT maintenance etc). A Stormwater Monitoring Plan (SMP) is to be developed and include the below monitoring aspects and actions to be undertaken if high results are recorded. Baseline water quality monitoring within Silver Stream should be taken pre-discharge (at upstream and downstream sites) over 4 sampling events, covering the same parameters as Table 3. 	Negligible



Activity and Rationale	Ecological Value	Magnitude of Effect	Level of Effect	Recommended Impact Management Avoid/Mitigate/Remediate stormwater effects	Residual Impact
				<ul style="list-style-type: none"> • First flush water quality monitoring (Table 3 parameters) of the discharge and at the upstream and downstream Silver Stream sites should occur quarterly during Stage 1 and Stage 2, until the attenuation pond has been fully completed. This monitoring should also be completed (at any time) within 1 week following a large storm event that has resulted in any overland flow from the washpad/truckwash area. An annual report of results to be provided to ORC and an additional report will be provided following any washpad/truckwash overland flow events within 2 months of sampling. • Continuous upstream and downstream water temperature monitoring to occur over summer for the first two summers post stormwater attenuation pond establishment to ensure water temperature is not increased by 3°C or above 25°C. • 	



6 Conclusions and Recommendations

Southern Link Property Ltd is applying to develop an approximately 40 ha property as an inland port/ storage and logistics hub at Mosgiel, Otago. High ecological values have been identified at the adjacent Silver Stream due to the presence of Threatened and At Risk fish species. The site development and associated stormwater inputs to the Silver Stream is proposed to be managed in alignment with the comprehensive Auckland GD05 Guidelines (Auckland Council, 2016) and stormwater treatment systems such as catchpits, GPT/UPT's and a stormwater attenuation pond which reduces the likelihood of adverse effects on the high value fish community present. Alongside these management actions, further recommendations and monitoring surveys are required to reduce the potential effects on the freshwater ecological values present to low or very low and ensure stormwater treatment systems are working effectively. These actions are summarised below.

Site Development Earthworks:

6. Earthworks should be undertaken primarily during stable weather conditions and sediment attenuation pond maintenance should occur in line with Auckland Council (2016) guidelines.
7. A site investigation prior to site development earthworks should be undertaken to confirm or eliminate the presence of contaminated soils and ensure these are not disturbed and remain out of the stormwater system and stream.
8. Undertake planting of the swale between the attenuation pond outlet and Silver Stream adjacent to rock lined sections wherever possible with dense native plantings above the winter base flow level to reduce sediment erosion reaching Silver Stream bed.
9. If in-water works are required to connect the stormwater outflow and associated swale to Silver Stream these works should avoid fish spawning times of 1 May to 31 November, if possible. If this is not possible, pre-inwater works, fish salvage should be undertaken following the National Work in Water Guidelines (MfE, 2021) and additional river bank and trout redd surveys for fish eggs should be undertaken by a suitably qualified ecologist.
 - a. If any trout redds are found, they are to be avoided and if any riverbank eggs on are located the instream works should be delayed until after the next flood event.



Recommended monitoring:

10. Aquatic habitat and macroinvertebrate surveys at the upstream and downstream survey sites within this report should be replicated annually in Spring during Stage 1 of the project to verify earthworks are being effectively managed and Silver Stream ecology is remaining stable. If deposited sediment is observed at the downstream site during the annual survey, a minimum of two samples should be taken and tested for heavy metals, polycyclic aromatic hydrocarbons (PAH) and a nutrient suite.
- a. An annual report should be provided to ORC within 3 months of fieldwork, assessing results next to appropriate guidelines, baseline (from this report), and upstream (reference site) results.

Stormwater Discharge to Silver Stream:

15. Plant any open stormwater swales on site with native shrubs or Carex to support lower water temperatures on-site.
16. Stormwater treatment is recommended to include GPTs or UPTs at the pond outlets.
17. Best practice site management (cleaning regime, chemicals indoors, vehicles maintained, spill prevention, regular GPT/UPT maintenance etc).

Recommended stormwater monitoring to ensure treatment systems (catchpits, GPT/UPT's and attenuation pond) are effective includes:

18. A Stormwater Monitoring Plan (SMP) is to be developed and include the below monitoring aspects and actions to be undertaken if high results are recorded.
19. Water quality monitoring within Silver Stream should be taken pre-discharge (at upstream and downstream sites) over 4 sampling events (ideally covering differing weather characteristics), covering the same parameters as Table 3 and including dissolved oxygen. This sampling will establish the baseline data set.
20. First flush water quality monitoring (Table 3 parameters) of the discharge and at the upstream and downstream Silver Stream sites should occur quarterly during Stage 1 and Stage 2, until the attenuation pond has been fully completed. This monitoring should also be completed (at any time) within 1 week following a large storm event (flow increase $>1 \text{ m}^3/\text{s}$) that has resulted in any overland flow from the washpad/truckwash area.



- e. An annual report should be prepared for ORC assessing water quality parameters next to appropriate guidelines, the baseline samples and upstream (reference site) samples.
 - f. An additional report will be prepared for ORC providing the results of the survey following any washpad/truckwash overland flow events within 2 months of sampling.
21. Continuous upstream (above Outlet 2) and downstream (below Outlet 1) water temperature should occur in Silver Stream for the first two summers (1 Dec to 31 March) post stormwater attenuation pond establishment.
- b. Water temperature downstream of discharge should not increase by 3°C or more from the upstream site sample or above 25°C.

Based on the above management actions and monitoring surveys being implemented, e3s considers the impact of the site development and associated discharge of stormwater to the freshwater ecology of Silver Stream to be low, or less than minor.



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Appendices

Appendix A: Full Macroinvertebrate Results Table

Name	MCI_HB	Silver Stream D/S 1	Silver Stream D/S 2	Silver Stream D/S 3	Silver Stream D/S Average	Silver Stream U/S 1	Silver Stream U/S 2	Silver Stream U/S 3	Silver Stream U/S Average
Deleatidium	8	245	125	104		90	281	112	
Hydrobiosis	5	6	17	11		6		2	
Austrosimulium	3	3	7	15		13		18	
Pycnocentroides	5	2						1	
Oligochaeta	1	2	30	2			3	7	
Elmidae	6	1							
Mischoderus	4		2						
Aphrophila	5		10	2		2		3	
Psilochorema	8		1				1		
Archichauliodes	7		1	3		3		5	
Pycnocentria	7		2			3	4		
Orthoclaadiinae	2		67	41		38	19	60	
Maoridamesa	3		8	8		17		6	
Tiphobiosis	6		2						
Chironomus	1		2						
Tanypodinae	5		1						
Diplectrona	9			2		31	11	66	
Aoteapsyche	4					2	1	9	
Acroperla	5					2			

Name	MCI_HB	Silver Stream D/S 1	Silver Stream D/S 2	Silver Stream D/S 3	Silver Stream D/S Average	Silver Stream U/S 1	Silver Stream U/S 2	Silver Stream U/S 3	Silver Stream U/S Average
Paracalliope	5					4			
Lobodiamesa	5						1		
Zelandoperla	10							1	
Costachorema	7							1	
Ostracoda	3							1	
Ephydridae	4							1	
Abundance		259	275	188	241	211	321	293	275
Taxa_Richness		6	14	9	10	12	8	15	12
MCI_Taxa_Richness		6	14	9	10	12	8	15	12
MCI_HB		93	93	96	94	105	110	101	105
EPT%_Abundance		97.68	53.45	62.23	71.12	63.51	92.83	65.53	73.96
EPT%_Taxa_Richness		50	35.71	33.33	39.68	50	62.5	46.67	53.06
EPT_Richness		3	5	3	3.67	6	5	7	6.00
QMCI_HB		7.79	5.09	5.79	6.22	6.09	7.58	6.19	6.62
Shannon_Diversity_Index		0.29	1.64	1.37	1.10	1.76	0.55	1.72	1.34
Evenness		0.16	0.62	0.62	0.47	0.71	0.27	0.64	0.54
ASPM_HB		0.52	0.39	0.4	0.44	0.46	0.55	0.47	0.49
QMCI Attribute Band		A	C	B	B	B	A	B	A
MCI Attribute Band		C	C	C	C	C	B	C	C
ASPM Attribute Band		B	C	B	B	B	B	B	B

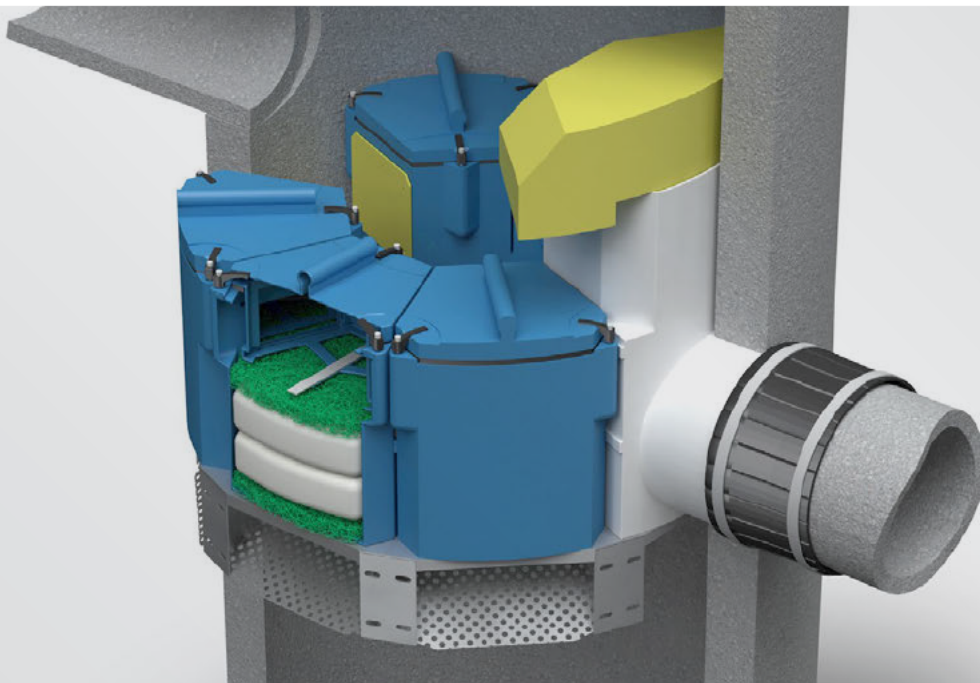
Appendix B: Up Flo Filter Specifications.

The Up-Flo[®] Filter

(Stormwater Treatment)

Technical Guide SW 11

This technical guide is designed for Land Developers, Civil Engineering Consultants, Councils and Installers to assist in the understanding of the Up-Flo[®] stormwater filter. This includes key design attributes, indicative sizing, hydraulic requirements, and FAO's



02.25 | STORMWATER | SW11 UP-FLO FILTER

Applications

Small commercial carparks
Large industrial hardstand areas
Residential sub-divisions
Municipal roadways
Retrofit into existing urban catchments
Upstream of wetland or river discharge

Product Attributes

Designed to remove 90% TSS with a mean particle size of 20 microns
Small footprint to maximise land use
Simple and cost-effective maintenance
In-line or off-line configurations
Internally bypasses storms

Approvals/Standards

Auckland Council Approval for Private & Public sites (PDEP)
Christchurch City Council Approved Private & Public treatment device
New Jersey Department of Environmental Protection, NJCAT Program
ARC TP10 approval for removal of greater than 75 percent TSS

We are the supply partner of choice for New Zealand's stormwater management and treatment solutions.

HYNDS
STORMWATER

The Up-Flo® Filter is a stormwater remedial device that incorporates gravitational separation and absorption of fine sediment, nutrients, heavy metals, oils & organics. It offers pre-screening and upward flow path filtration of polluted stormwater to achieve treatment train capabilities in a standalone small footprint device. Each Up-Flo® device consists of a highly configurable array of modules that are supplied as a complete system generally encased in a concrete manhole.

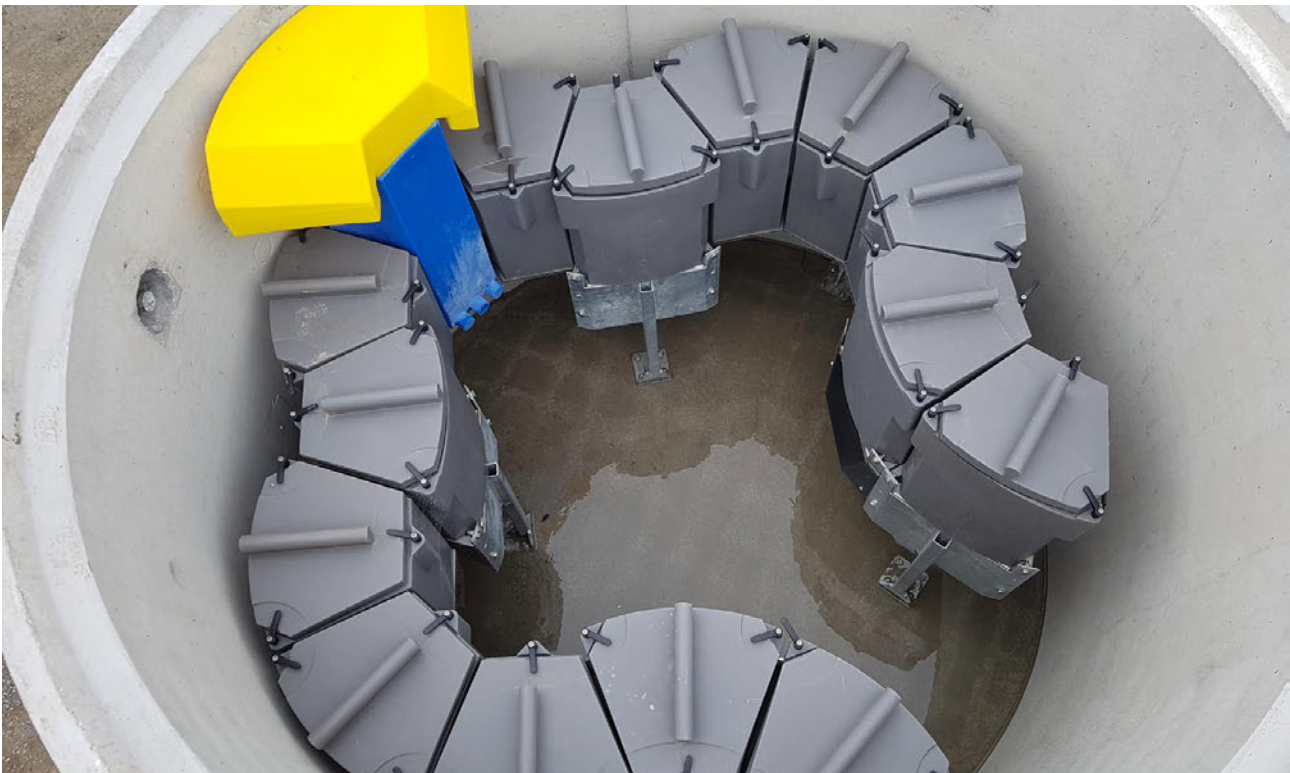


FIG. 1 14 module Up-Flo inside 2.3m dia manhole delivered to site and ready to operate. No assembly required.

Up-Flo Filter Components

- The Up-Flo® Filter has no moving parts and requires no external power.
- The internal components consist of the following:
 - Angled stainless steel screens
 - Filter modules
 - Bypass Siphon with a floatables baffle
 - Outlet module with a drain down port
- The filter module houses the media pack which consists of two filter media bags and two layers of flow distributing media comprising:
 - Carbon (granular activated) for filtration
 - Peat (organic, loose, not palletised) for absorption)
 - Zeolite (aluminosilicate mineral) for dissolved metals & some Nutrients

Design and Sizing

The Up-Flo® Filter is sized for either a specified catchment area, or a design flow rate to meet a water quality flow (WQF). Each individual filter module has a WQF of up to 1.58 L/s to meet the manufacturer's performance and design requirements (ref: NJCAT, US 2015).

Multiple versions of the Up-Flo Filter can be supplied depending on the available driving head and outlet Depth to Invert (DTI). Please email our nationwide Hynds stormwater Engineering team at hsupport@hynds.co.nz and they will complete this task for you.

Due to the reduced head of the shallow outlet design (and subsequently lower flow rate); more filter modules are required to treat the equivalent area. The following tables are for indicative use only to represent approximate catchment areas that can be treated based on number of Up-Flo modules.

TABLE 1 Auckland Council PDEP Approved Standard Design
1-6 modules (drawing T7511) 7-10 modules (drawing T7495)

Hynds Sales Code	Manhole dia (m)	Outlet DTI (m)	Total Headloss (mm)	Max WQF (L/s)	Max carpark area based on 10mm/hr rainfall intensity (m ²)
UP-FLO.1CKIT	Ø1.2	1.44	792	1.58	599
UP-FLO.2CKIT	Ø1.2	1.44	792	3.16	1197
UP-FLO.3CKIT	Ø1.2	1.44	792	4.74	1796
UP-FLO.4CKIT	Ø1.2	1.44	792	6.32	2395
UP-FLO.5CKIT	Ø1.2	1.44	792	7.9	2994
UP-FLO.6CKIT	Ø1.2	1.44	792	9.48	3592
UP-FLO.7CKIT	Ø1.8	1.59	842	11.06	4191
UP-FLO.8CKIT	Ø1.8	1.59	842	12.64	4790
UP-FLO.9CKIT	Ø2.0	1.59	842	14.22	5389
UP-FLO.10CKIT	Ø2.0	1.59	842	15.8	5987

TABLE 2 Christchurch City Council Approved Standard Design
1-6 modules (drawing T8605) 7-10 modules (drawing E1001)

Hynds Sales Code	Manhole dia (m)	Outlet DTI (m)	Total Headloss (mm)	Max WQF (L/s)	Max carpark area based on 5mm/hr rainfall intensity (m ²)
UP-FLO.1KIT	Ø1.2	1.296	750	1.58	1197
UP-FLO.2KIT	Ø1.2	1.296	750	3.16	2395
UP-FLO.3KIT	Ø1.2	1.296	750	4.74	3592
UP-FLO.4KIT	Ø1.2	1.296	750	6.32	4790
UP-FLO.5KIT	Ø1.2	1.296	750	7.9	5987
UP-FLO.6KIT	Ø1.2	1.296	750	9.48	7185
UP-FLO.7KIT	Ø1.8	1.59	750	11.06	8382
UP-FLO.8KIT	Ø1.8	1.59	750	12.64	9580
UP-FLO.9KIT	Ø1.8	1.59	750	14.22	10777
UP-FLO.10KIT	Ø1.8	1.59	750	15.8	11975

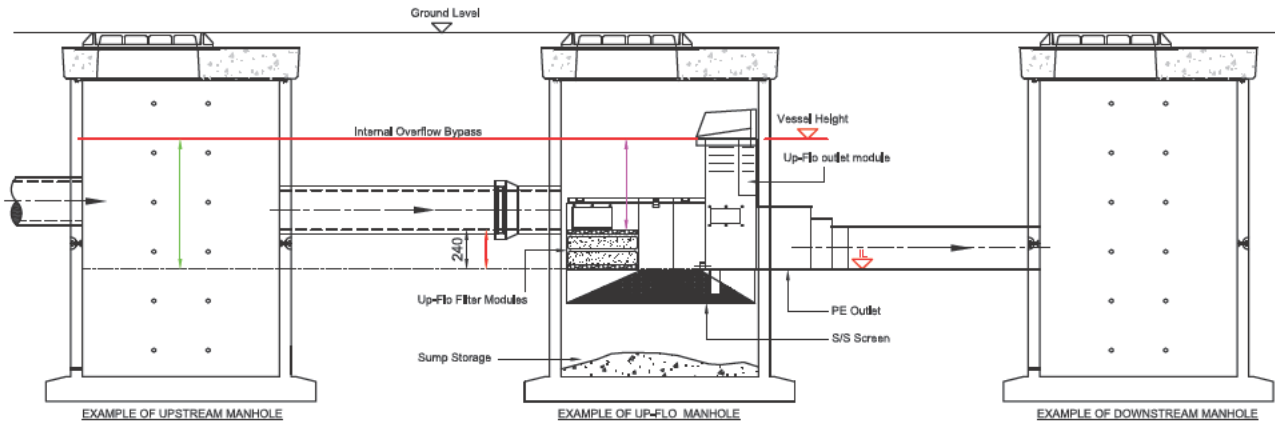
TABLE 3 Low Driving Head Shallow Outlet Design South Island (Drawing E1122) North Island (T8669)

Hynds Sales Code	Manhole dia (m)	Outlet DTI (m)	Total Headloss (mm)	Max WQF (L/s)	Max carpark area based on 10mm/hr rainfall intensity (m ²)	Max carpark area based on 5mm/hr rainfall intensity (m ²)
UP-FLO.1SKIT	Ø1.2	1.0	590	0.90	341	681
UP-FLO.2SKIT	Ø1.2	1.0	590	1.80	681	1363
UP-FLO.3SKIT	Ø1.2	1.0	590	2.90	1098	2195
UP-FLO.4SKIT	Ø1.2	1.0	590	3.80	1438	2876
UP-FLO.5SKIT	Ø1.2	1.0	590	4.70	1779	3558
UP-FLO.6SKIT	Ø1.2	1.0	590	5.80	2195	4390

NOTES:

- Rainfall intensities of 5mm/hr and 10mm/hr as provided by Auckland, Wellington and Christchurch City Councils
- Carpark area based only on runoff coefficient value (c value) of asphalt = 0.95
- Calculations above based on accepted rational method equation as an indication of stormwater runoff
- These carpark areas are indicative only, Hynds is not liable for any sizing without supplying a formal Hynds calc sheet
- To size Up-Flo's for areas outside of Auckland and Christchurch please email hsupport@hynds.co.nz
- Larger Up-Flo standard designs for 10 modules + are available upon request
- North Island Up-Flo's supplied in Pinnacle Cast Manholes ex Pokeno
- South Island Up-Flo's supplied in Hyspec Spun Manholes ex Hornby

Example of typical Up-Flo Filter Long Section Whilst Operating



↑ **'TOTAL HEAD LOSS'** at design flow rate. This is the distance between UP-FLO Outlet IL and Internal Bypass height. This should be factored into design when considering upstream surcharge.

↓ **'PHYSICAL DROP' or ELEVATION HEAD** This is the recommended difference between Inlet & Outlet Inverts = minimum 240mm, however not always required for retro fit projects

↑ **'MINIMUM DRIVING HEAD'** required to activate CPZ Media, this is the height above the conveyance slot linking modules. Total depth of media bags is 284mm.
 Standard 1 to 6 Module = 506mm @ 1.58 Ltrs / sec
 Shallow 1 to 6 Module = 306mm @ 1.10 Ltrs / sec
 Standard 7 to 10 Module = 556mm @ 1.58 Ltrs / sec

Hydraulic Parameters

- Total head loss = upstream surcharge height above outlet invert during max WQF
- Internal bypass height = Total head loss
- Multiple inlet pipes = Yes
- Maximum online bypass flow rate = 115.0L/s*
- Recommended 'hydraulic drop' between inlet and outlet = 240mm**

*Shallow outlet maximum online bypass flow rate = 45 L/s

**Please contact Hynds stormwater Engineering team to discuss alternative arrangements as this is not always required.

Engineered for Performance

- Longer filter runs
- Higher flow capacities
- Resistant to clogging
- 'Self-cleans' during drain-down period
- Media is not submerged between events
- Media does not re-release captured materials

Maintenance & Safety-led Design

- The ONLY filter with lightweight media bags for easy removal and maintenance
- The Up-Flo takes less time to replace the media when compared with floor mounted cartridge filters
- Removal of filter bags does not require any lifting apparatus
- Refer to quick reference maintenance guide

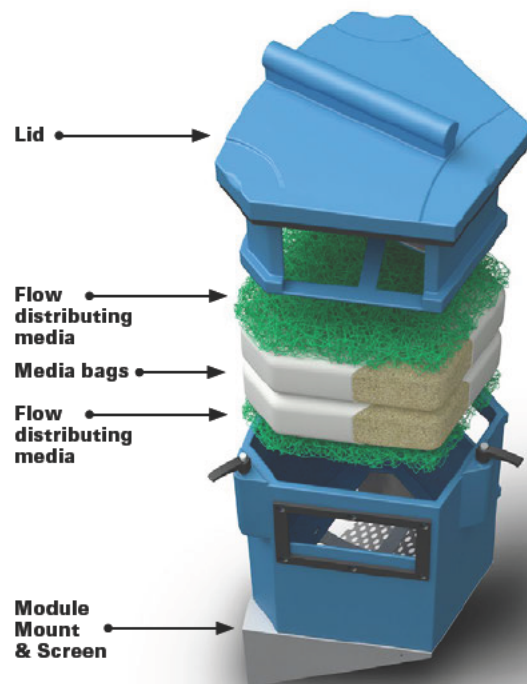


FIG. 2 Up-Flo® Filter Media Filter Module

How it Works

The Up-Flo® Filter comprises a three stage treatment train designed to achieve a high level of stormwater treatment. Coarse sediments are removed through settling. Gross pollutants are captured through screening, and fine particles are trapped through filtration. The function of the Up-Flo® Filter through each stage of a typical storm event is explained below.

■ Treatment

During a rain event, stormwater runoff enters the chamber via an inlet pipe or overhead grate. Gross pollutants and sediment settle out in the sump. As water fills the chamber, flow is directed upwards through the angled screen into the filter module. Flow is evenly distributed across the media for maximum contact and treatment. Treated flow exits the filter module via a conveyance channel to a common outlet module.

■ Siphonic Bypass

Flows in excess of the designed filtration capacity are discharged directly to the outlet using a siphonic bypass. The siphonic bypass also acts as a baffle, which prevents the escape of oils, grease, and buoyant pollutants. The shallow outlet design has a simple weir bypass, this also has a baffle to retain pollutants but at a reduced flow rate.

■ Drain-down

In traditional stormwater filters, the treatment media is often continuously submerged in water which may cause the media conditions to change resulting in anaerobic bacterial growth, degradation of the filter media, and the release of harmful leachates. The Up-Flo® Filter has a patented drain-down system to ensure the filter media is not submerged between storm events. As a storm subsides, filtered water drains out of the chamber through the drain-down port at the base of the outlet module. The reverse gravity flow backwashes filter media, ensuring continued high flow rate and removal efficiencies over the duty life of the filter module (between maintenance cycles).

Indicative Pollutant Removal Guide

The graph on the right indicates removal ranges based on [Hydro International Up-Flo® Filter with CPZ™ Media Verification Statement](#).

Verification is based on existing performance test data from two different locations with different rainfall characteristics, catchment areas and pollutant loadings. Supporting data were obtained from three independent performance monitoring studies.

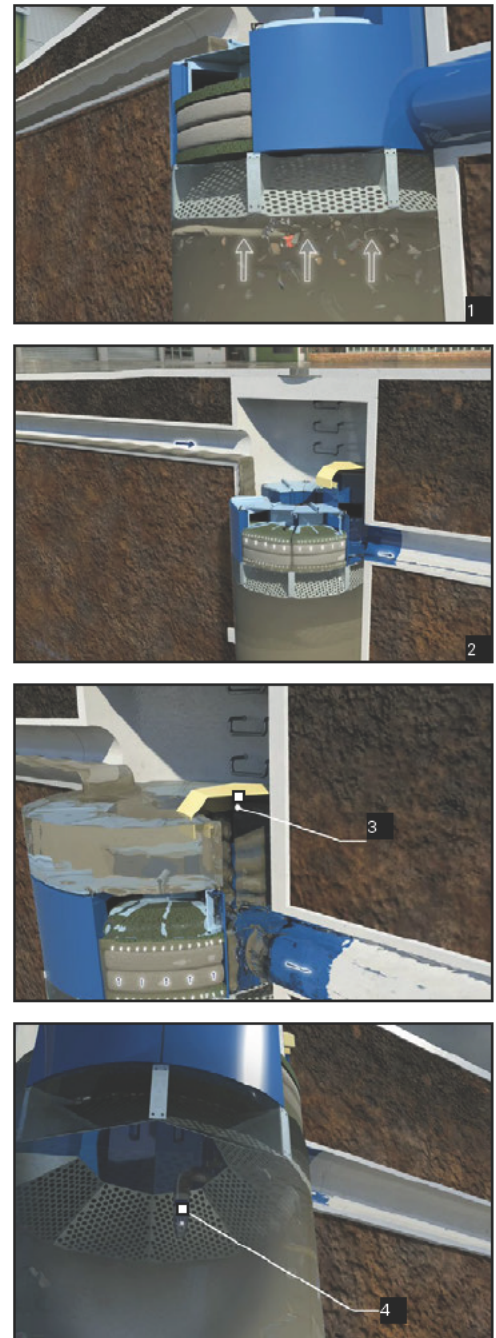


FIG. 3 Key functional stages of an Up-Flo® Filter in operation

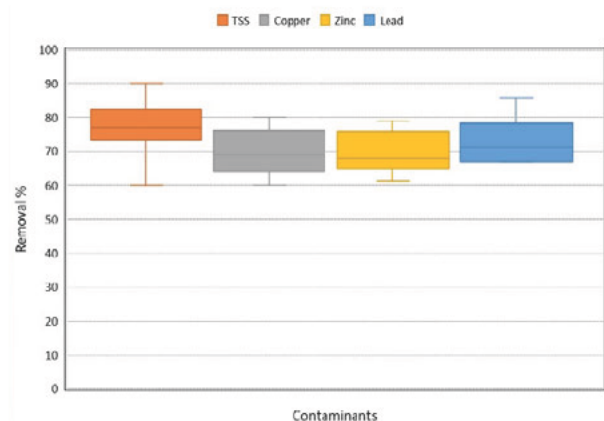


FIG. 4 Box and whisker graph depicting pollutant removal efficiency of the Up-Flo® Filter

Lifting and Handling

All Up-Flo® Filters incorporate Swiftlift lifting anchors for safe lifting and must be used with the correct lifting clutch. Hynds Pipe Systems has designed and manufactured the Up-Flo® Filter with a minimum dynamic factor of 1.2. This dynamic factor requires that all the following conditions are observed when lifting, moving or placing the units:

1. Lifting with mobile plant (*such as an excavator or similar*) where equipment is specifically exempt from the requirements of the PECPR Regulations 1999, subject to the conditions outlined in the New Zealand Gazette, No. 104, September 2015 and
2. Lifting, travelling and placing over rough or uneven ground where anchor failure is not anticipated to cause harm or injury, by adopting procedures such as:
 - a. Transporting the element as close as practical to ground level (300mm recommended)
 - b. Establishing and maintaining exclusion zones
 - c. Transporting only precast concrete elements that are unlikely to topple if they were to hit the ground
 - d. Inspecting lifting anchors both after transportation and before final lifting into place

3. Hynds uses both Reids and Ancon lifting anchors which are both designed to (*Haeussler*) specifications and as such are compatible with Reid, Deha or Ancon anchors, clutches, and recess formers of the same load range.

Refer to “Safe work with precast concrete - Handling, transportation and erection of precast concrete elements” published by Worksafe New Zealand (October 2018)

Shock loads resulting from travelling with suspended Up-Flo® over rough terrain and uneven ground may exceed design, dynamic and safety factors of the lifting systems. It is essential that care is taken during lifting and transporting as additional stresses could result in anchor failure.



FIG. 5 18 module Up-Flo inside a 3.0m dia manhole treating a 6,500m² carpark at Featherston Railway station. Credit SDCL for image.

Frequently Asked Questions

How will the Up-Flo manhole arrive to site?

The Up-Flo manhole should be treated like any other manhole. Manhole installation depth is governed by outlet DTI. The Up-Flo will arrive ready to operate with the filter bags pre-installed. The concrete lid and cast iron cover will be placed on the truck separately.

If excessive fine sediment/clay is present in runoff during construction, or if the site is expected to be unsealed for a prolonged period of time; it is advised to avoid filtering through the Up-Flo. Alternatively, the CPZ filter bags can easily be removed from the modules by the Installer and kept clean and secure until the surface is sealed.

How is the outlet connection achieved?

The Up-Flo's has a stepped PE outlet with three possible diameters (267mm, 318mm and 389mm). It is designed to be cut back to the closest pipe diameter. Recommended connection options include [Flexseal Shear Band Pipe Couplers \(Hynds Technical Guide D10.4\)](#) for concrete & PE pipes, and/or level invert reducers for PVC pipes. Please discuss with your closest Hynds branch.

Can the Up-Flo accept multiple inlet pipes?

Yes, please follow [CPAA guidelines](#) in relation to manhole spacing requirements of inlet pipe penetrations. For Up-Flo's with 2-6 modules and multiple inlets it is recommended to ensure pipes enter above the grey filter modules (435mm above outlet IL) to prevent obstruction to flow path. Alternatively, ensure the Up-Flo is manufactured with modules positioned accordingly to suit pipe orientations during order process by Contractor.

What is the total head loss of the Up-Flo?

Depends on the number of filter modules. The total head loss is the height from the outlet invert to the underside of the bypass baffle, please refer to relevant drawing.

Does the inlet have to be 240mm higher than the outlet?

No, it is not compulsory. The inlet pipe can match the same invert with the outlet pipe if available head allows. The preference is for the inlet pipe to be installed above 240mm to reduce the volume of stormwater untreated during the drain down process after the rain event.

Does the Up-Flo filter need to be commissioned?

No. Because the CPZ filter bags, mataala screens and drain down valve is pre-installed there is no need for commissioning by any agent. The Up-Flo filter is designed to treat hardstand runoff only, post construction phase. If the Up-Flo is subject to prolonged construction phase sediment runoff (fine clays etc) filter performance is likely to be compromised. It is the Installers responsibility to ensure this does not happen, not Hynds.

How often do the filter bags need to be replaced?

The acceptable industry standard is every 12-18 months with a 3-6 monthly visual inspection. For heavily trafficked commercial & industrial sites 6 monthly filter bag replacement should be considered as best practice.

What is the maximum online flow rate?

The yellow internal bypass hood is designed to convey up to 115.0L/s. For any storm flows approaching this figure it is recommended the Up-Flo is positioned offline with an upstream weir diversion.

Branches Nationwide *Support Office & Technical Services* 0800 93 7473

Disclaimer: While every effort has been made to ensure that the information in this document is correct and accurate, users of Hynds product or information within this document must make their own assessment of suitability for their particular application. Product dimensions are nominal only, and should be verified if critical to a particular installation. No warranty is either expressed, implied, or statutory made by Hynds unless expressly stated in any sale and purchase agreement entered into between Hynds and the user.

**Appendix C: Modelled water temperature and dissolved oxygen scenarios
(Source: G Ryder 2026 and Stantec 2026b).**

Temperature

Key Assumptions:

- Assume upstream temperature is a very conservative (low) 12°C, regardless of river flow and time of year (see graph of Silverstream continuous temperature monitoring at Gordon Road from ORC data).
- Silverstream flows upstream of discharge range between 160 m³/sec and 0.2 m³/sec (200 L/sec).
- Stormwater discharge rates range between 1.85 m³/sec and 0.25 m³/sec (250 L/sec).
- Stormwater discharge temperature ranges between 35 and 20 °C, regardless of climate conditions (and river flow).
- Assume full mixing of the discharge with river water.

= Downstream temperature is 3°C than upstream river temperature or greater than 19°C.

WATER TEMPERATURE

Silverstream Flow Rate (m ³ /s) ¹	Silverstream Upstream	Stormwater Flow Rate (m ³ /s) ²	Stormwater Temperature (°C) ³	Silverstream Downstream Temperature After Mixing (°C)
160	12	1.85	35	12.3
100	12	1.85	35	12.4
50	12	1.85	35	12.8
10	12	1.85	35	15.6
5	12	1.85	35	18.2
1	12	1.85	35	26.9
0.2	12	1.85	35	32.8
160	12	1.5	35	12.2
100	12	1.5	35	12.3
50	12	1.5	35	12.7
10	12	1.5	35	15.0
5	12	1.5	35	17.3
1	12	1.5	35	25.8
0.2	12	1.5	35	32.3
160	12	1	25	12.1
100	12	1	25	12.1
50	12	1	25	12.3
10	12	1	25	13.2
5	12	1	25	14.2
1	12	1	25	18.5
0.2	12	1	25	22.8
160	12	0.5	25	12.0
100	12	0.5	25	12.1
50	12	0.5	25	12.1
10	12	0.5	25	12.6
5	12	0.5	25	13.2
1	12	0.5	25	16.3
0.2	12	0.5	25	21.3
160	12	0.5	20	12.0
100	12	0.5	20	12.0
50	12	0.5	20	12.1
10	12	0.5	20	12.4
5	12	0.5	20	12.7
1	12	0.5	20	14.7
0.2	12	0.5	20	17.7
160	12	0.25	25	12.0
100	12	0.25	25	12.0
50	12	0.25	25	12.1
10	12	0.25	25	12.3
5	12	0.25	25	12.6
1	12	0.25	25	14.8
0.2	12	0.25	25	19.2

The table shows that only under unlikely combinations of low stream flow and relatively high stormwater flows, would downstream temperatures increase by more than 3°C relative to an upstream river temperature of 12°C. This is also conservative in that native fish are generally capable of tolerating short-term temperatures of 25°C or so.]

Dissolved oxygen

Key Assumptions:

- Assume upstream dissolved oxygen is a healthy 10 mg/L, regardless of river flow, and water temperature (i.e., climatic conditions).
- Silverstream flows upstream of discharge range between 160 m³/sec and 0.2 m³/sec (200 L/sec).
- Stormwater discharge rates range between 1.85 m³/sec and 0.25 m³/sec (250 L/sec).
- Stormwater DO discharge concentrations range between 0 and 5 mg/L, regardless climate conditions.
- Assume full mixing of the discharge with river water.

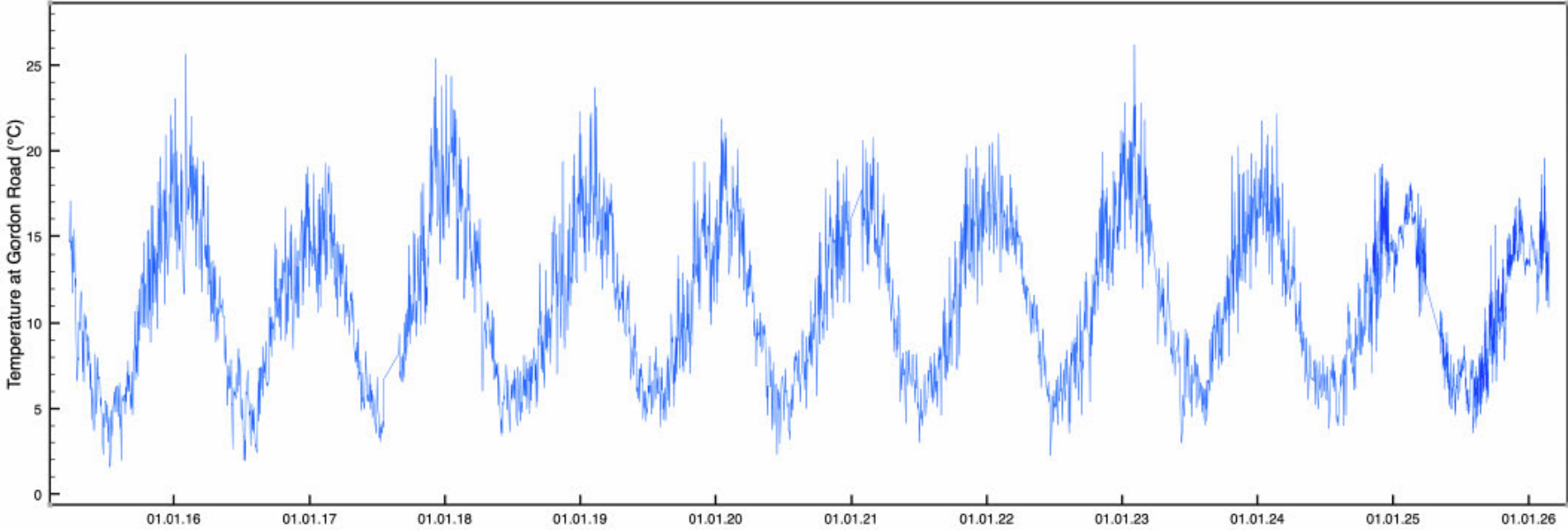
 = Downstream DO is less than the NPS-FM Class A 1-day minimum attribute state concentration of 7.5 mg/L

DISSOLVED OXYGEN

Silverstream Flow Rate (m ³ /s) ¹	Silverstream Upstream DO (mg/L) ¹	Stormwater Flow Rate (m ³ /s)	Stormwater DO (mg/L) ²	Silverstream Downstream DO After Mixing (mg/L)
160	10.0	1.85	0.0	9.9
100	10.0	1.85	0.0	9.8
50	10.0	1.85	0.0	9.6
10	10.0	1.85	0.0	8.4
5	10.0	1.85	0.0	7.3
1	10.0	1.85	0.0	3.5
0.2	10.0	1.85	0.0	1.0
160	10.0	1.5	0.0	9.9
100	10.0	1.5	0.0	9.9
50	10.0	1.5	0.0	9.7
10	10.0	1.5	0.0	8.7
5	10.0	1.5	0.0	7.7
1	10.0	1.5	0.0	4.0
0.2	10.0	1.5	0.0	1.2
160	10.0	1	0.0	9.9
100	10.0	1	0.0	9.9
50	10.0	1	0.0	9.8
10	10.0	1	0.0	9.1
5	10.0	1	0.0	8.3
1	10.0	1	0.0	5.0
0.2	10.0	1	0.0	1.7
160	10.0	0.5	0.0	10.0
100	10.0	0.5	0.0	10.0
50	10.0	0.5	0.0	9.9
10	10.0	0.5	0.0	9.5
5	10.0	0.5	0.0	9.1
1	10.0	0.5	0.0	6.7
0.2	10.0	0.5	0.0	2.9
160	10.0	0.25	0.0	10.0
100	10.0	0.25	0.0	10.0
50	10.0	0.25	0.0	10.0
10	10.0	0.25	0.0	9.8
5	10.0	0.25	0.0	9.5
1	10.0	0.25	0.0	8.0
0.2	10.0	0.25	0.0	4.4

Silverstream Flow Rate (m ³ /s) ¹	Silverstream Upstream DO (mg/L) ¹	Stormwater Flow Rate (m ³ /s)	Stormwater DO (mg/L) ²	Silverstream Downstream DO After Mixing (mg/L)
160	10.0	1.85	5.0	9.9
100	10.0	1.85	5.0	9.9
50	10.0	1.85	5.0	9.8
10	10.0	1.85	5.0	9.2
5	10.0	1.85	5.0	8.6
1	10.0	1.85	5.0	6.8
0.2	10.0	1.85	5.0	5.5
160	10.0	1.5	5.0	10.0
100	10.0	1.5	5.0	9.9
50	10.0	1.5	5.0	9.9
10	10.0	1.5	5.0	9.3
5	10.0	1.5	5.0	8.8
1	10.0	1.5	5.0	7.0
0.2	10.0	1.5	5.0	5.6
160	10.0	1	5.0	10.0
100	10.0	1	5.0	10.0
50	10.0	1	5.0	9.9
10	10.0	1	5.0	9.5
5	10.0	1	5.0	9.2
1	10.0	1	5.0	7.5
0.2	10.0	1	5.0	5.8
160	10.0	0.5	5.0	10.0
100	10.0	0.5	5.0	10.0
50	10.0	0.5	5.0	10.0
10	10.0	0.5	5.0	9.8
5	10.0	0.5	5.0	9.5
1	10.0	0.5	5.0	8.3
0.2	10.0	0.5	5.0	6.4
160	10.0	0.25	5.0	10.0
100	10.0	0.25	5.0	10.0
50	10.0	0.25	5.0	10.0
10	10.0	0.25	5.0	9.9
5	10.0	0.25	5.0	9.8
1	10.0	0.25	5.0	9.0
0.2	10.0	0.25	5.0	7.2

I have used the Class A 1-day minimum dissolved oxygen attribute state (Table 7, Appendix 2A) in the NPS-FM as a very conservative trigger for a change in downstream DO (i.e., the DO drops below 7.5 mg/L). The table shows that, again, only in unlikely combinations of low stream flow and relatively high stormwater flows, would downstream dissolved oxygen concentrations go below the Class a 1-day minimum concentration of 7.5 mg/L relative to an upstream river DO concentration of 10 mg/L. The left-hand part of the table is very conservative in that it assumes the stormwater discharge has no oxygen in it.



WATER TEMPERATURE - SUMMER SCENARIOS

Silverstream Flow Rate (m ³ /s) ¹	Silverstream Upstream Temperature (°C) ²	Stormwater Flow Rate (m ³ /s) ³	Stormwater Temperature (°C) ⁴	Silverstream Downstream Temperature After Mixing (°C)
160	15	1.85	25	15.1
100	15	1.85	25	15.2
<i>50</i>	<i>15</i>	<i>1.85</i>	<i>25</i>	<i>15.4</i>
50	15	1.5	25	15.3
<i>10</i>	<i>15</i>	<i>1.5</i>	<i>25</i>	<i>16.3</i>
10	15	1	25	15.9
<i>5</i>	<i>15</i>	<i>1</i>	<i>25</i>	<i>16.7</i>
5	15	0.5	25	15.9
<i>1</i>	<i>15</i>	<i>0.5</i>	<i>25</i>	<i>18.3</i>

WATER TEMPERATURE - WINTER SCENARIOS

Silverstream Flow Rate (m ³ /s) ¹	Silverstream Upstream Temperature (°C) ²	Stormwater Flow Rate (m ³ /s) ³	Stormwater Temperature (°C) ⁴	Silverstream Downstream Temperature After Mixing (°C)
160	8	1.85	15	8.1
100	8	1.85	15	8.1
<i>50</i>	<i>8</i>	<i>1.85</i>	<i>15</i>	<i>8.2</i>
50	8	1.5	15	8.2
<i>10</i>	<i>8</i>	<i>1.5</i>	<i>15</i>	<i>8.9</i>
10	8	1	15	8.6
<i>5</i>	<i>8</i>	<i>1</i>	<i>15</i>	<i>9.2</i>
5	8	0.5	15	8.6
<i>1</i>	<i>8</i>	<i>0.5</i>	<i>15</i>	<i>10.3</i>

Cell colour is shaded yellow if downstream temperature is greater than 3°C than the upstream river temperature or greater than 19°C.

Rows with figures in **bold** represent 'most likely estimate' combinations of stream flow and pond outlet flow. Rows with figures in *italics* represent 'possible but rare' combinations of stream flow and pond outlet flow.

DISSOLVED OXYGEN - SCENARIO 1: STORMWATER DISCHARGE HAS 0 mg/L DO

Silverstream Flow Rate (m ³ /s)	Silverstream Upstream DO (mg/L)	Stormwater Flow Rate (m ³ /s)	Stormwater DO (mg/L)	Silverstream Downstream DO After Mixing (mg/L)
160	10.0	1.85	0.0	9.9
100	10.0	1.85	0.0	9.8
<i>50</i>	<i>10.0</i>	<i>1.85</i>	<i>0.0</i>	<i>9.6</i>
50	10.0	1.5	0.0	9.7
<i>10</i>	<i>10.0</i>	<i>1.5</i>	<i>0.0</i>	<i>8.7</i>
10	10.0	1	0.0	9.1
<i>5</i>	<i>10.0</i>	<i>1</i>	<i>0.0</i>	<i>8.3</i>
5	10.0	0.5	0.0	9.1
<i>1</i>	<i>10.0</i>	<i>0.5</i>	<i>0.0</i>	6.7

DISSOLVED OXYGEN - SCENARIO 2: STORMWATER DISCHARGE HAS 5 mg/L DO

Silverstream Flow Rate (m ³ /s)	Silverstream Upstream DO (mg/L)	Stormwater Flow Rate (m ³ /s)	Stormwater DO (mg/L)	Silverstream Downstream DO After Mixing (mg/L)
160	10.0	1.85	5.0	9.9
100	10.0	1.85	5.0	9.9
<i>50</i>	<i>10.0</i>	<i>1.85</i>	<i>5.0</i>	<i>9.8</i>
50	10.0	1.5	5.0	9.9
<i>10</i>	<i>10.0</i>	<i>1.5</i>	<i>5.0</i>	<i>9.3</i>
10	10.0	1	5.0	9.5
<i>5</i>	<i>10.0</i>	<i>1</i>	<i>5.0</i>	<i>9.2</i>
5	10.0	0.5	5.0	9.5
<i>1</i>	<i>10.0</i>	<i>0.5</i>	<i>5.0</i>	<i>8.3</i>

Cell colour is shaded yellow if Downstream DO is less than the NPS-FM Class A 1-day minimum attribute state concentration of 7.5 mg/L.

Rows with figures in **bold** represent 'most likely estimate' combinations of stream flow and pond outlet flow.
 Rows with figures in *italics* represent 'possible but rare' combinations of stream flow and pond outlet flow.

Bryony Miller

Technical Director – Marine and Freshwater Ecology

e3Scientific

Lorn Street, Invercargill

e. [REDACTED]

m. [REDACTED]

w. e3Scientific.co.nz

Current Position

Technical Director – Marine and Freshwater Ecology, e3Scientific (2021 -)

Formal Qualifications

BAppSci (Environmental Science), Auckland University of Technology, NZ 2008 (Hons).

Diploma in Marine Science, Bay of Plenty Polytechnic, 2006.

PADI SCUBA DiveMaster 2005. COC Scientific Diver 2020.

Technical Capabilities

Marine and freshwater impact assessments, monitoring design and implementation for subtidal and freshwater projects, subtidal SCUBA monitoring, intertidal monitoring, infaunal/epibiota benthic assessments, infauna identification, water and sediment quality assessments, seabird assessments, fisheries management, shellfish fisheries stock assessments and species threshold limits, aquaculture habitat assessment, aquaculture husbandry, marine biosecurity monitoring and plans, coral reef health assessments, marine mammal acoustic monitoring, hearing, mediation and environment court experience.

Career Summary

Bryony started with e3Scientific in 2016, following previous positions including, Scientific Diver for the Department of Conservation; independent Environmental Consultant and expert witness at Environment Court for Southern Clams Ltd, Dunedin NZ; Fisheries Analyst for Fisheries NZ (MPI); Marine Educator and Aquarist for the NZ Marine Studies Centre, Otago University; data analyst at GNS and Antarctica NZ; and Marine Biologist for Fantasea Ltd, Airlie Beach, Australia. At e3Scientific Bryony has been involved in several marine and freshwater resource consent applications for the public and private sectors, including capital dredging, aquaculture, marinas, wharves, berth basins, breakwaters, water takes and other inwater works. Bryony is regularly engaged by Regional Councils as a technical reviewer of freshwater and marine resource consent applications and has represented council, applicants and submitters at hearings, mediation, expert caucusing, and environment court. Bryony also provides technical expertise on behalf of Fisheries NZ on a regular basis as a reviewer of the Shellfish Working Group and has led marine projects working under Regional or District legislation, EEZ legislation and the Antarctica Act 1994 (NZ Ministry of Foreign Affairs and Trade).

Affiliations

- NZ Coastal Society Executive Committee Member.
- NZ Science Divers Committee Member.
- Member of NZ Freshwater and Marine Science Societies

Key Projects

- Silver Stream Flood Conveyance Freshwater Ecological Impact Assessment. Otago Regional Council and Beca.
- Kia Whakaū Capital Dredging, South Port NZ Ltd, Bluff, NZ
- Transmission Gully Marine Ecology Expertise, NZTA, Wellington, NZ
- Wastewater Discharge Ecological Assessment. Queenstown Lakes District Council.
- Scott Base Water Intake Ecological Assessment, Antarctica NZ
- Freshwater and marine ecology support for territorial and regional authorities.

MARK HAMER

Senior Freshwater Ecologist
e3Scientific Ltd
Maple Place, Morrinsville



Current Position

Senior Freshwater Ecologist, e3Scientific Ltd (Jan 2023 - present)

Formal Qualifications

BSc (Ecology), Massey University, 2003.
MSc (Ecology) Massey University, 2005.

Technical Capabilities

All aspects of freshwater biomonitoring, including wetland delineation, water and sediment quality assessments, eDNA, river periphyton, aquatic plant identification, riparian habitat assessment, macroinvertebrate collection and analysis. Freshwater fish monitoring using electric fishing, netting or spotlighting methods along with associated fish handling, analysis and fish passage assessments. Lake water quality, phytoplankton, zooplankton, macroinvertebrate, fish and trophic status data collection and assessments. Functional indicator assessments such as dissolved oxygen, metabolism and microbial breakdown rates. Ability to develop novel monitoring methodologies to solve specific problems. Assess freshwater values and produce ecological impact assessments. Provide ecologically sound information in relation to urban streams and the variables that can impact ecological health.

Software Capabilities

ArcGIS, QGIS, Microsoft Office, Adobe, TimeTrends.

Career Summary

Mark is a professional freshwater ecologist with over 17 years' experience working in the freshwater ecology and monitoring industry. While at e3scientific Mark's focus has been on ecological value assessments and reviewing and producing ecological impact assessments in the consenting process. Prior to commencing work with e3Scientific in January 2023, Mark was employed by the Waikato Regional Council as a Team Leader – Water Quality, Coasts and Ecology. There he undertook region wide freshwater ecosystem assessments and established the wetland monitoring team to map and delineate wetlands for the Waikato Region.

Key Projects

- Project Management and development of wetland mapping for the Waikato region.
- Ecological assessments and establishment of nature-like constructed wetlands in Southland.
- Ecological Impact assessments for various clients.
- Wetland delineation following the NZ Wetland delineation protocols (plant, hydrology and soils assessment approach).
- Helped develop the first region wide probabilistic ecological monitoring design network in New Zealand.
- Producing Freshwater State of the Environment reports for multiple regional councils.