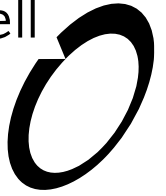


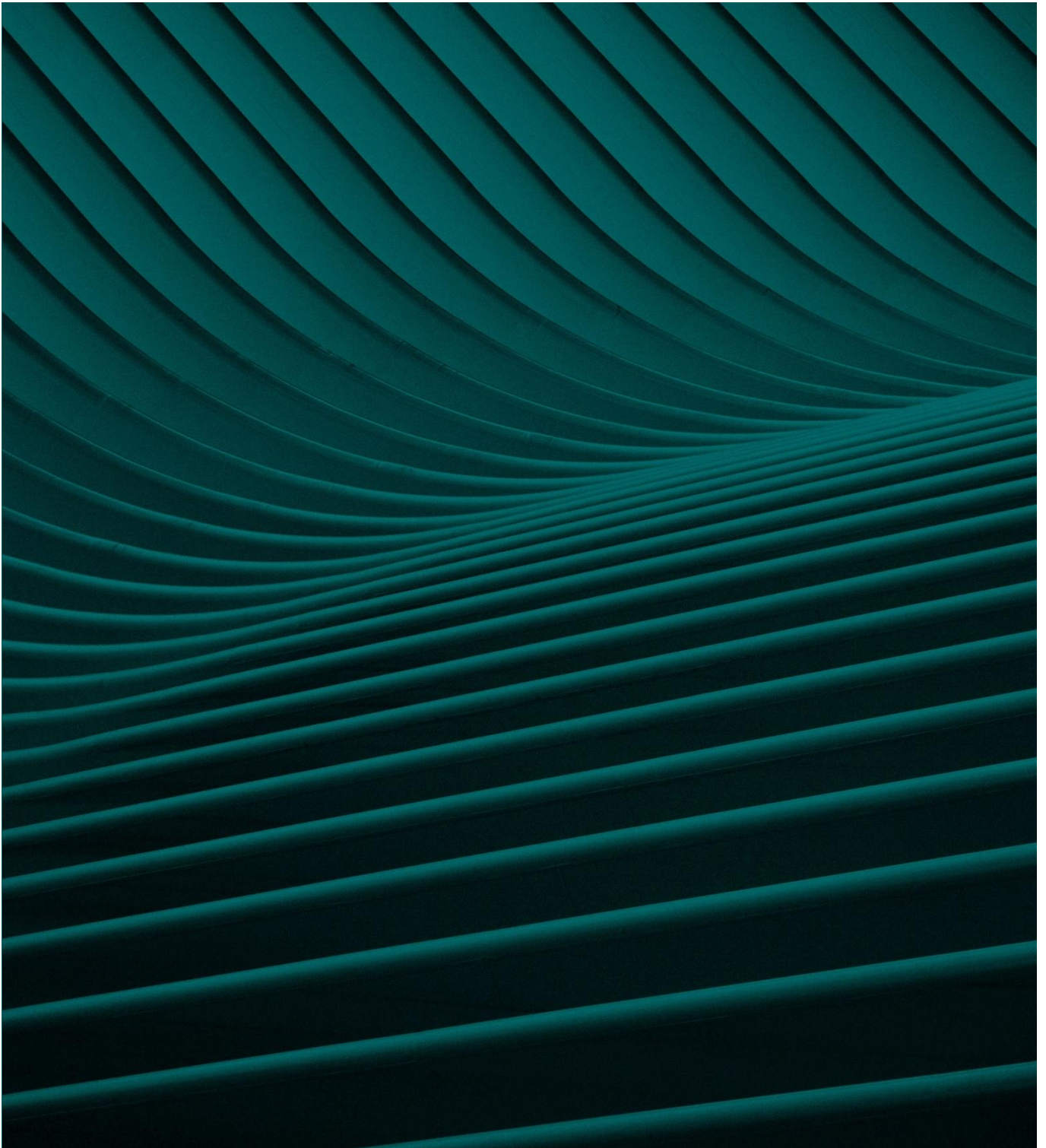
Boffa Miskell



Bendigo Ophir Gold Project

Freshwater Ecology Management and Monitoring Plan
Prepared for Matakanui Gold Limited

[23 October 2025](#) | [21 June 2026](#)





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Appendices

Appendix 1: Shepherd Creek Rehabilitation Plan (Growplan 2025)

1.0 Introduction

1.1 Background

Matakanui Gold Limited (“MGL”) is seeking approvals for the Bendigo-Ophir Gold Project (“BOGP”), a new gold mine, ancillary facilities and environmental mitigation measures on Bendigo and Ardgour Stations in the Dunstan Mountains of Central Otago. The project site is located approximately 20 km north of Cromwell.

The BOGP is located within the footprint of Minerals Exploration Permit 60311, which overlays several pastoral stations that have grazed sheep and cattle in the area for over 100 years. MEP60311 is held by MGL under the Crown Minerals Act 1991. MGL has land access agreements with Bendigo and Ardgour Stations. The BOGP is located adjacent to land administered by the Department of Conservation (“DOC”), including the Bendigo Historic Reserve, the Bendigo Conservation Area and the Ardgour Conservation Area. BOGP mineral extraction activities will not occur in these areas.

Ecological work will include rehabilitation on direct disturbed areas, ecological uplift activities and pest exclusion area(s) adjacent to the footprint on nearby areas such as Ardgour and Bendigo Stations. A full description of the various activities comprising the establishment, operation and rehabilitation within the BOGP is provided in the Assessment of Environmental Effects prepared by Mitchell Daysh Limited.

To manage effects on freshwater values the BOGP will:

- ~~divert~~ [realign](#) watercourses to divert clean water from disturbed areas.
- [monitor the ecological values above and below the treated water discharge.](#)
- ~~This~~ [Freshwater Ecology Management and Monitoring Plan \(FEMMP\) plan](#) sets out the purpose, principles, design and monitoring of the diversion channels [and monitoring of the treated water discharge.](#)

[1.2 Layout of the FEMMP](#)

~~1.2.1.3~~ [Objective](#)

The objective of the Freshwater Ecology Management and Monitoring Plan (FEMMP) is to provide details [of the:](#)

~~for the De~~ [Design and development of ecologically functional diversion channels as remedy for the loss of watercourses from the construction and operation of the BOGP.](#)

[Aquatic ecological monitoring of the treated water discharge.](#)

[Other aquatic ecological monitoring](#)

1.31.4 Purpose

This management and monitoring plan is proposed for the construction and operation of the stream diversions [and aquatic ecological monitoring](#). The purpose of the management and monitoring is to set out:

- Responsibilities and competencies.
- Protocol for effects minimisation.
- Diversion design principles.
- [Diversion design](#).
- [Protocols for aquatic ecological performance and confirmatory monitoring](#).
- [Monitoring Thresholds for actions where required](#).
- [Hierarchy of responses](#).
- Reporting.

1.41.5 Information sources

This plan draws on the existing information set out in:

- Bendigo Ophir Gold Project: Assessment of Effects on Aquatic Habitat. Report prepared by Water Ways Consulting, June 2025.
- Bendigo Ophir Gold Project: Assessment of Freshwater Ecology Effects. Report prepared by Boffa Miskell, October 2025.

2.0 Responsibilities and Competencies

2.1 Purpose

The Environment Manager holds overall accountability for implementation of and compliance with all ecology management plans (including this freshwater plan) (Figure 1). Additional roles and responsibilities are detailed where relevant in the various individual plans. The Project Ecologist has specific responsibilities for the freshwater plan as set out below

[2.2 Responsibilities](#)

[The responsibilities of the Project Ecologist are:](#)

- [Confirming and approving the FEMMP](#).
- [Briefing contractors on the purpose and content of the FEMMP](#).

- [Undertaking or contracting visual inspections and monitoring .](#)
- [FEMMP reporting.](#)

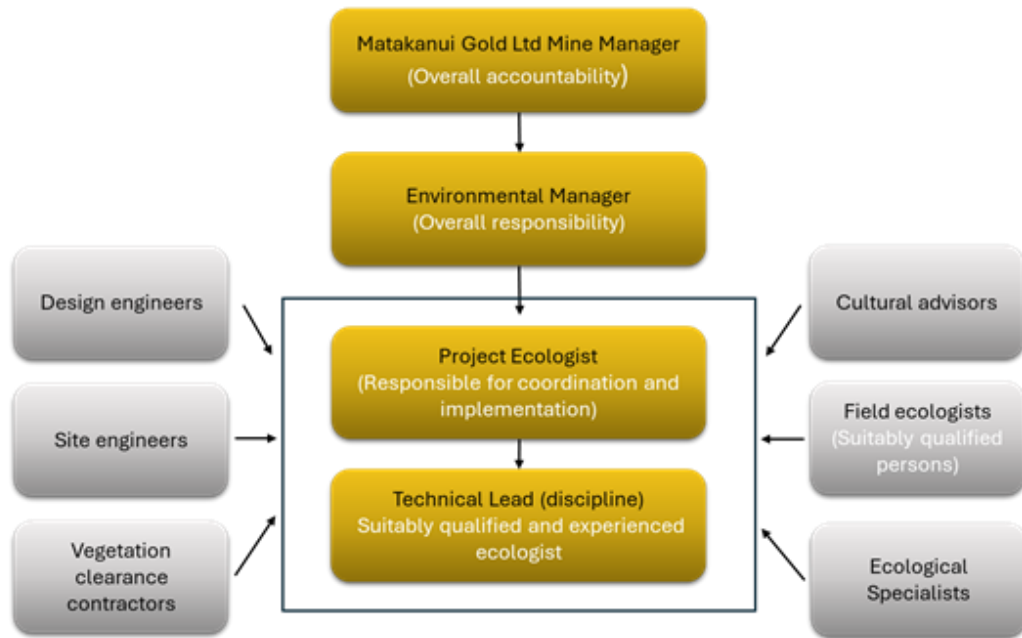


Figure 1. Overview of roles and responsibilities for the environment management at BOGP.

2.2 Responsibilities

The responsibilities of the Project Ecologist are:

- [Confirming and approving the FEMMP.](#)
- [Briefing contractors on the purpose and content of the FEMMP.](#)
- [Undertaking or contracting visual inspections and monitoring](#)
- [FEMMP reporting](#)

3.0 Existing Ecological Values

3.1 Overview

In their assessment of effects, Water Ways (2025) characterised each of the watercourses and their catchments, in particular Shepherds Creek and Rise and Shine Creek. In general, the

study found that the ecological value of the Shepherds and Rise and Shine Creeks and associated tributaries varied from moderate-to-high in the upper reaches to moderate-to-low in the lower reaches. It is not our intention to repeat the findings here, but we summarise the ecological values below.

3.2 Shepherds Creek

The presence of the Ardgour Conservation Area in the headwaters provides a clean water supply to the stream and there is a low level of nitrogen increase in the farmed perennial reach of Shepherds Creek indicating that stock impacts are more limited to physical damage than to declines in water quality.

Shepherds Creek has several tributaries that, aside from Jean Creek, can be divided into two groups: the perennial flowing spring fed streams and the ephemeral streams that have very short duration flow periods. Shepherds Creek is considered representative of a low gradient Dunstan Mountains perennial small stream. This assessment indicates that Shepherds Creek can be divided into reaches:

- The upper reaches of Shepherd Creek: moderate to high ecological value. From the Ardgour Conservation Area boundary to at least the downstream gorge section in the middle of the project area. This reach has good water quality, low to moderate habitat diversity and no introduced aquatic species.
- Downstream of the gorge section: moderate ecological value. Habitat modification increases with various impacts including water abstraction, channel modifications (e.g., the dam), crack willow, and stock impacts are evident.

Water Ways (2025) report that most of the main stem of Shepherds Creek is a gentle gradient single channel stream 0.5 - 1.0 m wide flowing along a 10 - 100 m wide valley floor.

[No fish occur at the location of and upstream of the BOGP in the upper reaches of Shepherds Creek in the vicinity of the diversions.](#)

3.3 Rise and Shine Creek

Water Ways (2025) report that the Rise and Shine Creek catchment has a range of ephemeral, intermittent and perennial streams that support a fauna of high to low ecological value:

- The stream draining Mt Moka in the upper Rise and Shine catchment is considered a high-quality habitat area, aside from the lower 200 m where historic and present modifications occur.
- Rise and Shine Creek downstream of the Mt Moka Stream confluence is a perennial stream and is considered to have low to moderate ecological value.
- Rise and Shine Creek and its tributaries upstream of the Mt Moka Stream confluence are intermittent and ephemeral water courses.

Water Ways (2025) report that none of the stream channels are large with a maximum width of 0.5 m and most less than 0.3 m wide.

None of the species occurring in the study samples are listed as threatened or of conservation interest. No fish occur at the location of and upstream of the BOGP in the upper reaches of Rise and Shine Creek.

3.4 Lindis River

The Lindis River rises in the low ranges to the north of the Lindis Pass and is bounded by the Ahuriri catchment and the Dunstan Ranges to the east and to the west by tributaries of Lake Hawea. Most of the Lindis River catchment consists of agricultural grasslands. As a result of the very dry climate in the lower catchment where much of the high-producing pasture and cropping is located there is heavy demand for water abstraction from the lower third of the Lindis River. Komanawa (2025) describe the hydrological characteristics of the downstream and surrounding catchments.

Five species of native fish and two sports fish have been recorded in the Lindis catchment. Native species recorded include¹: longfin eel (*Anguilla dieffenbachii*), koaro (*Galaxias brevipinnis*), Clutha flathead galaxias (*Galaxias* sp. D), common bully (*Gobiomorphus cotidianus*) and upland bully (*Gobiomorphus breviceps*). The introduced species present are brown trout (*Salmo trutta*) and rainbow trout (*Onchorhynchus mykiss*).

Macroinvertebrate communities at sampled sites within the Lindis River are typically dominated by mayfly and are generally indicative of very good water quality and habitat. Periodic drying of the lower reaches of the Lindis River will contribute to fluctuations in the magnitude and quality of the ecological values.

4.0—In a study of the Lindis River by Otago Regional Council (ORC 2016), macroinvertebrate communities were found to comprise a mix of tolerant and sensitive species but made up of commonly occurring species. Although likely to be variable in abundance during different seasons and in variable river conditions, representatives of key feeding types² were apparent within the macroinvertebrate community reflecting a typical, if simplistic³, natural ecosystem functionality. None of the macroinvertebrate species occurring in the study samples are listed as threatened or of conservation interest.

~~5.0~~4.0 Stream Diversions as Effects Management

The assessment of effects of the BOGP on aquatic ecological values is set out in Waterways (2025) and the aquatic effects management in Boffa Miskell (2025). The outcome of the effects

¹Otago Regional Council (2008) Management Flows for Aquatic Ecosystems in the Lindis River. Otago Regional Council, Dunedin.

² Variety of different gazing types, filter feeders and predators.

³ Simplistic = only few species and levels of feeding structure, as opposed to a more multi-level complex trophic structure at each

management is set out in Table 1. The main outcome is the development of ecologically functional diversions of the watercourses.

Boffa Miskell (2025) confirms that the functional need of the proposed BOGP activities means that the loss of watercourses is unavoidable. Although loss will be minimised as much as possible, the proposed mine activities will result in the loss of **7,139 m of permanent stream** length whilst **1,631 m of intermittent stream** length will be modified in Shepherd Creek.

Effects management provides **remedy of 9,558 m (9,558 m² of stream area) of created permanent watercourse** through rehabilitation of the proposed diversion of Shepherd Creek, including the reinstated stream across the surface of the TSF at closure. A further 1,196 m length (~957 m² of stream area) of Shepherds Creek will be enhanced to improve aquatic ecological values. This amounts to a total enhancement of **10,754 m of stream length (~10,515 m² of stream area)** of stream values.

Estimates of stream loss and modification in Rise and Shine Creek suggest that some 1,483 m length of stream (~741.5 m²) will be lost and approximately **1,600 m of stream length (800 m² of stream area) will be created** within the catchment, and the equivalent will apply for enhancement of aquatic ecological values.

Table 1: Effects management hierarchy applied to freshwater values for the BOGP.

Effects management		
	Shepherd Creek	Rise and Shine Creek
Ecological values	Moderate to high	Low to moderate
Avoid	Options to locate the project elsewhere are not available due to the location of the gold resource. Unavoidable reclamation of some 7,799 m of perennial and intermittent stream length. This equates to approximately 7,000 m ² of stream area.	Options to locate the project elsewhere are not available due to the location of the gold resource. Unavoidable reclamation of some 1,483 m of perennial stream length (741.5 m ²) and no loss of intermittent stream. Temporary diversion of some 880 m (440 m ²) of perennial Mt. Mocha stream is unavoidable. This amounts to a total of approximately 1,181 m ² of stream area.
Minimise	Diversions to capture water from ephemeral watercourses and transfer it back into the creeks.	Diversions to capture water and transfer it back into the creeks.
Remedy	Creation of some 7,643 m rehabilitated stream diversion (7,643 m ²). Diversion channel to be created in year 1 ahead or at same time as the reclamation of Shepherds Creek. Rehabilitation of 1,196 m of Shepherds Creek retained in existing bed above gorge. Reinstatement of some 1,915 m of stream on surface of TSF at mine closure.	At the completion of mining the temporary diversion of 880 m of the Mt. Mocha Creek line will be remedied and rehabilitated, and with other diversion design requirements leads to creation of some 1,599 m (800 m ²) of stream. Remediation of the connected flow between the SRX pit and SRX ELF.
Offset	Principles of offset cannot be fully satisfied due to lag time from full loss to full gain in values.	Principles of offset cannot be fully satisfied due to lag time from full loss to full gain in values.
Compensation	Additional compensation is proposed in the form of management of existing willows and transformation to native riparian vegetation over some 6,700 m of Bendigo and Clearwater Creeks (Willow concession area). Compensation completes the effects management by providing for the lag time to achieve ecological values.	

~~6.05.0~~ 6.15.0 Design of Stream Diversion

~~6.15.1~~ 6.15.1 Diversion design principles

The following high-level principles of design will be applied to the permanent and temporary diversion of the affected parts of Shepherds Creek and Rise and Shine Creek (as set out in Boffa Miskell 2025):

- As much as practicable, the diversion should be designed with an average width of no less than 0.8 m, and preferably 1 m for Shepherds Creek, and no less than 0.5 m for Rise and Shine Creek.
- As much as possible, the stream diversion channel must be a similar length and stream area than the channel to be reclaimed. This aims to ensure that there is no loss of extent and values of the watercourse.
- The channel design does not have to replicate the form of the channel to be reclaimed but would benefit from a low-flow (or baseflow) channel, a bank full channel and where available, a floodplain area.
- As much as possible, water flow should mimic the hydrology of the existing watercourse (i.e., flows intermittently or permanently same as existing channel).
- The channel should mimic, as much as practicable, the natural meanders of the stream to be reclaimed.
- Hydrologic heterogeneity and instream habitat complexity can be achieved through the creation of natural features such as runs, riffles and small and large pools.

In addition, we recommend the following:

- As far as is reasonably practicable, the habitat within the diversion is of a similar form and structure to the stream to be reclaimed (and like neighbouring tributaries). The final substrate present should mimic that naturally occurring in similar sized tributaries in the wider catchment to the extent that this is practicable.
- The stream profile should allow the planting of riparian vegetation close to and extending over and into the water surface at the margins to create ample stream edge habitat. This can be low stature planting that provides vegetation overhang over and into the watercourse and to enhance habitat for the aquatic ecosystem.
- To the extent practicable, riparian vegetation is to be planted along the length of the stream diversion. Riparian vegetation plays an important role in the ecological success of a stream diversion. Appropriate riparian species selection will enhance stream ecology through providing shade to the stream, reducing water temperature, producing habitat and providing a food source. As much as possible, riparian vegetation should extend along either side of the diversion channel.

When implemented the recommended principles and actions will provide acceptable remediation for the loss of the extent and values of Shepherds Creek and Rise and Shine Creek.

6.25.2 Diversion design guidelines

6.2.15.2.1 Overview

The design of the stream diversion must be fit for purpose and ensure that stream ecological functions are maintained or improved on. The diversion channels must provide appropriate aquatic habitat for macroinvertebrates and plants, while conveying water. The below are a guideline for the design and construction of the diversion.

6.2.25.2.2 Channel length and meander

The stream diversion channel must be the same length, or longer, than the channel to be reclaimed to ensure no loss of stream length (stream extent). The channel should mimic and improve upon, as far as practicable, the natural meanders of the stream to be reclaimed. Where possible, the addition of boulders, submerged logs, etc. will be used to aid meander development and increase flow heterogeneity.

6.2.35.2.3 Habitat diversity and channel complexity

Hydrologic heterogeneity and instream habitat complexity can be improved through the creation of natural features such as runs, riffles and small and large pools. These features can be created utilising natural substrates such as rocks, logs and large boulders. Gravels, cobbles and boulders should be used to increase stream heterogeneity and stability.

These should be consistent with the habitat present in the stream to be reclaimed and similar to neighbouring natural tributaries. The final substrate present should mimic that naturally occurring in similar sized tributaries in the wider catchment. The channel complexity and availability will 'naturalise' over time as the new diversion channel becomes established.

We recommend the inclusion of a shallow low flow channel in the initial channel design. The purpose of a low flow channel is to provide flow when climate conditions typically result in dry conditions. The low flow channel extends the period of habitat availability should dry conditions persist.

6.2.45.2.4 Stream depth, wetted width and velocity

Stream depth and wetted width affect the total area of habitat that can be utilised by aquatic biota, and the volume of water conveyed during normal flows. Stream width, depth and should mimic that of the channel to be reclaimed. With the design seeking to create a stream that meets an average depth and width, with some localised variation for the creation of large and small pools and meanders. These depths and widths shall be established at the detailed design stage.

As much as practicable, the channel design must create a low flow or baseflow channel, a bank full channel and a floodplain area. The low flow must connect to the seasonal groundwater flow to ensure water flow mimics that of the existing stream (i.e., permanently same as existing channel).

The designed channel should be an average width of no less than 0.8 m, and preferably 1 m for Shepherds Creek, and no less than 0.5 m for Rise and Shine Creek.

6.2.55.2.5 Fish Passage

Fish have not been detected as present in the Upper Shepherds Creek or the Rise and Shine Creek and there are several barriers to fish passage upstream and downstream in both Creeks. No provision for fish passage is required.

6.2.65.2.6 Riparian Vegetation

Riparian vegetation is to be planted along the length of the stream diversion. Riparian vegetation plays an important role in the ecological success of a stream diversion. Appropriate riparian species selection will enhance stream ecology through providing shade to the stream, reducing water temperature, providing habitat and a food source. Riparian vegetation should mimic the local vegetation and be appropriate for the local bioclimatic conditions.

The stream profile should allow the planting of riparian vegetation close to and extending over the water surface to create ample stream edge habitat. This will provide shading to the water surface, detritus in the form of fallen leaves and potential habitat for macroinvertebrate species.

6.2.75.2.7 Key features of the diversion rehabilitation

The key features of the diversion rehabilitation are outlined below and in Table 2:

- Drop structures and/or weirs designed to create series of stream pools and habitat diversity.
- Tree trunks embedded in the stream to provide flow complexity and habitat diversity.
- Mixed substrate diversity (occasional large boulders along with large, moderate and small sized gravels).
- Bund or swale alongside road edge to prevent road silt and materials entering the diversion channel.
- Transplant of plants from Shepherds Creek to diversion channel via holding area.
- Engineered structures may be necessary in more complex or steeper reaches.

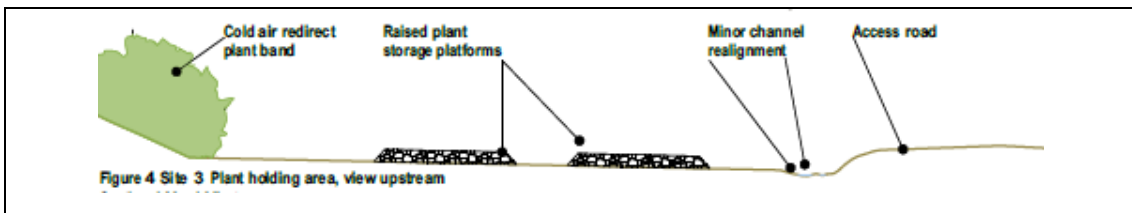
Access for maintenance and other purposes is required alongside the diversion. Example and indicative cross-sections of the proposed landscape diversion channel are shown in Figure 2 and drawn from the rehabilitation plan provided in Appendix 1.

6.35.3 Construction Principles

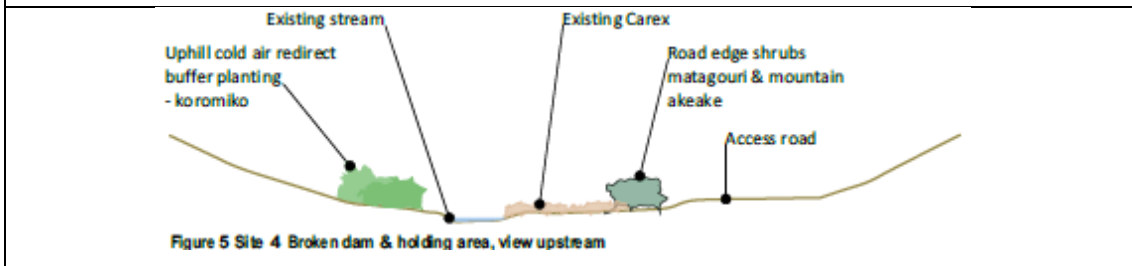
- As much as practicable, the stream diversion channel should be constructed offline and prior to any instream works within the channel to be reclaimed.
- During construction, and at completion of the diversion channel, it should be inspected by a Freshwater Ecologist to ensure ecological principals have been integrated.

Table 2: Key features of the Shepherds Creek and Rise and Shine Creek diversions and applied to Diversion principles.

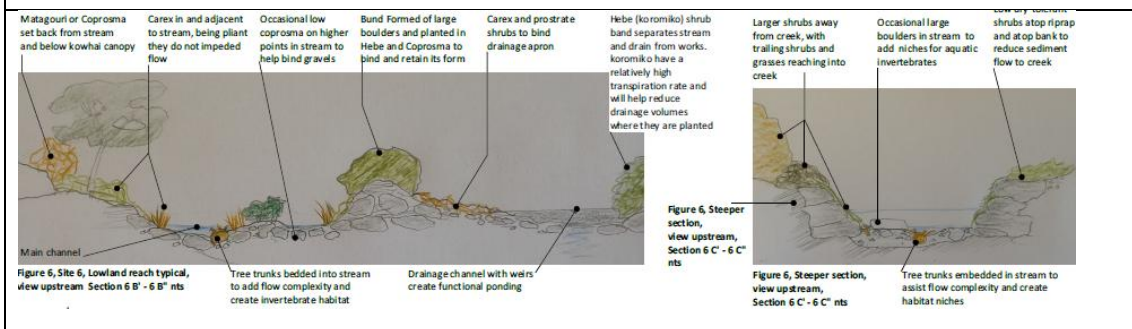
Diversion Principle	Shepherds Creek	Rise and Shine Creek
<ul style="list-style-type: none"> To the extent practicable, the diversion should be designed with an average width of no less than 0.5 m, and preferably 1 m. 	The diversion is expected to be formed with an average width of no less than 0.8 m, and preferably 1 m.	The diversion is expected to be formed with an average width of no less than 0.5 m, and preferably 1 m.
<ul style="list-style-type: none"> To the extent practicable, the steam diversion channel must be a similar length and stream area than the channel to be reclaimed. This aims to ensure that there is no loss of extent and values of the watercourse. 	The steam diversion channel length and stream area of the diversion does not meet the equivalent of loss and compensation is proposed.	The steam diversion channel length and stream area of the diversion does not meet the equivalent of loss and compensation is proposed.
<ul style="list-style-type: none"> The channel design does not have to replicate the form of the channel to be reclaimed but would benefit from a low flow (or baseflow) channel, a bank full channel and where available, a floodplain area. 	The proposed design features a low flow (or baseflow) channel, a bank full channel and where available, a floodplain area.	The proposed design features a low flow (or baseflow) channel, a bank full channel and where available, a floodplain area.
<ul style="list-style-type: none"> To the extent practicable, water flow should mimic the hydrology of the existing watercourse (i.e., flows intermittently or permanently same as existing channel). 	Hydrological conditions of the diversion channel are expected to mimic the hydrology of the existing watercourse, or features will be designed to accommodate modified hydrology.	Hydrological conditions of the diversion channel are expected to mimic the hydrology of the existing watercourse, or features will be designed to accommodate modified hydrology.
<ul style="list-style-type: none"> The channel should mimic, as much as practicable, the natural meanders of the stream to be reclaimed. 	The diversion channel will mimic natural stream character to the extent it is practicable.	The diversion channel will mimic natural stream character to the extent it is practicable.
<ul style="list-style-type: none"> Hydrologic heterogeneity and instream habitat complexity can be achieved through the creation of natural features such as runs, riffles and small and large pools. 	The diversion channel will mimic natural stream character.	The diversion channel will mimic natural stream character.



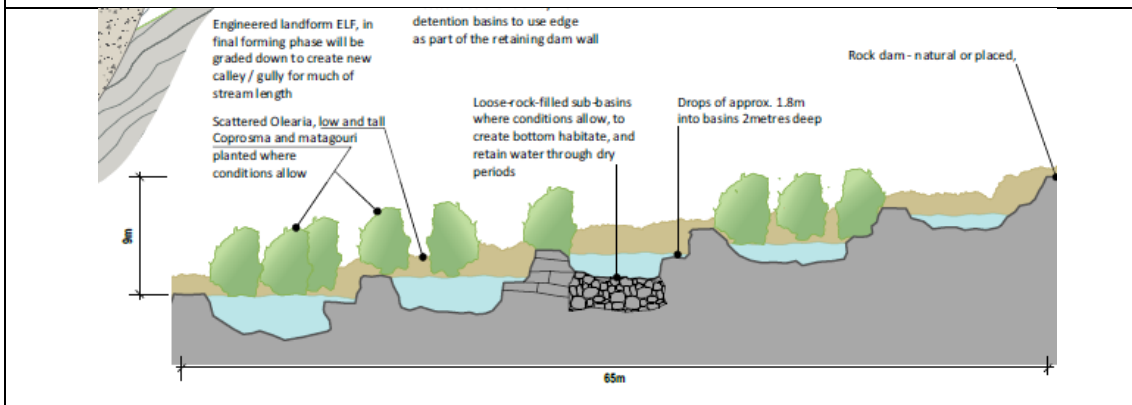
a) Plant holding area



b) Broken Dam and holding area



c) Indicative lowland and steeper sections



d) Drop series

Figure 2: Indicative cross-sections of the proposed rehabilitated Shepherds Creek diversion (from Growplan, Appendix 1).

5.4 Stream Ecological Valuation (SEV)

5.4.1 Consent condition

The resource consent requires that an SEV be carried out on the watercourses to be diverted, and for the design (on paper) of the final diversions to have a Stream Ecological Valuation (SEV) score equal to or greater than that measured in the corresponding diverted reaches prior to works commencing.

The stream ecological valuation of the existing streams and final diversion designs are to be calculated by a suitably qualified and experienced person in accordance with the methodologies set out the “Stream Ecological Valuation (SEV): A User’s Guide (Auckland Council Report No. GD2011/001). Auckland Council, Auckland, New Zealand”. For the avoidance of doubt, no further or additional SEVs need to be conducted for any other purpose in relation to this consent.

The following functions are not considered when calculating the SEV:

- Fish fauna intact.
- Invertebrate fauna intact.

Accordingly, an SEV assessments were undertaken of Shepherds and Rise and Shine Creek in April 2026 (Bioresearches 2026).

5.4.2 SEV scores

5.4.2.1 Shepherds Creek

SEV assessments were undertaken at two sites within the Shepherds Creek catchment:

- Within the central area of the of the proposed reach to be diverted. SEV score = 0.49.
- Upstream of the water take (and within the reach to be diverted). SEV score = 0.36.

Bioresearches (2026) attributed these relatively low scores to limited shading due to the pasture- dominated riparian margins and stock access, which has damaged stream banks and increased fine sediment loading, thereby reducing biogeochemical function.

A summary of the four ecological functions assessed are provided in Appendix 2. These descriptions indicate where an uplift in ecological function can be achieved.

5.4.2.2 Rise and Shine Creek

SEV assessments were undertaken at a single site within the Rise and Shine Creek:

- Immediately downstream of the proposed reach to be diverted. SEV score = 0.63.

Bioresearches (2026) attributed this relatively high score is largely attributed to the natural channel form, the presence of an indigenous, evergreen riparian zone extending more than 20 m from the stream banks, which provides consistent shading, and a predominantly hard-bottomed streambed supporting a healthy macroinvertebrate community.

[A summary of the four ecological functions assessed are provided in Appendix 2. These descriptions indicate which features where an uplift in ecological function can be achieved.](#)

7.05.5 Post-Construction Monitoring

7.15.5.1 Overview

Immediately following the livening of the diversion channel and inspection should be undertaken by a suitably qualified Freshwater Ecologist. It should ensure that the diversion channel is operating as intended. [As noted above, SEV assessment of the constructed channel is not required by the resource consent.](#)

To measure the overall success of the diversion channel ~~ongoing~~ continuing monitoring is required. The success is to be measured using habitat and macroinvertebrate community composition metrics. These are detailed below.

7.25.5.2 Monitoring parameters

The following monitoring parameters and methods will be undertaken as set out in Table 3.

Table 3. Proposed monitoring parameters and methods, BOGP.

Monitoring attribute	Method	Metrics	Protocol (where appropriate)
Habitat	Rapid Habitat Assessment (RHA)	HQS	Clapcott et al. (2020)
Settled sediment	In-stream visual estimate of % sediment cover	Fine sediment cover (%)	Sediment Assessment Method 2 (Clapcott et al. 2011)
Algal cover	Periphyton cover (%)	<ul style="list-style-type: none"> • No algae • (bare substrate) • Films • Mats, • Filaments. 	National Environmental Monitoring Standards for Periphyton (NEMS 2022a)
Macroinvertebrates	Benthic macroinvertebrates	<ul style="list-style-type: none"> • Taxa number • MCI, • EPT, • %EPT 	Quantitative hardbottom protocols. (Stark et al. 2001) National Environmental
Riparian planting	Cover% Planted success%	Cover% Planted success%	

7.35.5.3 Frequency of monitoring

Ecological Monitoring of the stream channel should be undertaken after years 1, 2 and 5 post-livening to ensure the channels are meeting ecological objectives.

7.45.5.4 Riparian Planting Monitoring

The riparian vegetation planting should be inspected at least every six months by a suitably qualified person in the year following the planting. The plants should be inspected to assess plant health. Where any plants appear to be in poor health or dying, the plants shall be removed and replanted, or care measures implemented as soon as is practicable.

Pest plants shall be assessed within the riparian planting. Where pest plants are considered to be dominating the vegetation and/or smothering desired plants then control activities shall be undertaken as soon as is practicable.

7.55.5.5 Indicative Performance Targets

The indicative targets for the performance of the diversions are set out in Table 4. These performance targets have been drawn from the existing ecological values as assessed by Waterways (2025) report, NOF from the NPS-FM and related metrics (i.e., RHA).

Table 4. Indicative ~~performance targets thresholds~~ for diversions at BOGP.

Diversion	Shepherd's Diversion	Rise and Shine Diversion(s)
Metric		
Habitat		
Habitat Quality Score band	Good	Good
Deposited fine sediments NOF Table 16	Band B	Band B
Macroinvertebrates		
Taxa number	10-13	8-10
MCI	>90	>90
EPT	5-7	3-5
MCI Band NOF Table 14	Band C	Band C

5.6 Hierarchy of response

Typically, the following steps would be applied to action a response:

1. Confirm if trigger breach is consistent (repeat monitoring and/or confirm observation).
2. Consider the nature of the change and likely cause or source.
3. Test the cause or source of the threshold breach as required and/or required.
4. Decide appropriate action if required (including no action).
5. Initiate action as required.
6. Continue monitoring as scheduled or at an appropriate revised frequency of all or specific metric.
7. Where recovery and/or return to accepted metric levels has not occurred consider whether further action is required.

7.6 Reporting

6.0 A report summarising the ecological monitoring will be prepared and submitted to Council in November in the year of sampling. Aquatic Ecological Performance Monitoring

6.1 Purpose

The purpose of the aquatic ecological monitoring is to confirm the protection afforded by the consented water quality limits of the treated water discharge, and no effects on the ecology the watercourses are occurring.

6.2 Consent condition

The consent condition requires that 'Annual summer macroinvertebrate and periphyton monitoring should be undertaken in Shepherds Creek at sites located upstream and downstream of the treated seepage water discharge point as set out in the FEMMP'.

The frequency, location and methodology of the aquatic ecology monitoring is set out in this FEMMP, along with the threshold triggers where actions are required.

6.3 Monitoring locations

The aquatic ecological performance monitoring sites for the treated seepage water discharge will be located at:

- SC01 – Shepherds Creek Monitoring Site.
- RS03 – Rise and Shine Creek Monitoring Site.

Reference monitoring sites upstream of each of the performance monitoring sites on each of Shepherds, and Rise and Shine Creeks, will be selected to be comparative to the performance monitoring site locations. As much as possible the upstream control monitoring sites should reflect similar habitat, substrate and channel characteristics as those at the performance monitoring sites.

6.4 Monitoring parameters and methods

The monitoring methods, protocols and metrics for the aquatic ecological performance monitoring are set out in Table 5.

Table 5. Proposed monitoring parameters and methods, and reporting metrics for BOGP.

<u>Monitoring attribute</u>	<u>Method</u>	<u>Metrics</u>	<u>Frequency</u>	<u>Protocol (where appropriate)</u>
<u>Habitat</u>	<u>Rapid Habitat Assessment (RHA)</u>	<ul style="list-style-type: none"> • <u>HQS</u> 	<u>Annual</u>	<u>Clapcott et al. (2020)</u>
<u>Settled sediment</u>	<u>In-stream visual estimate of % sediment cover</u>	<ul style="list-style-type: none"> • <u>Fine sediment cover (%)</u> 	<u>Monthly</u>	<u>Sediment Assessment Method 2 (Clapcott et al. 2011)</u>
<u>Periphyton cover</u>	<u>In-stream visual estimate of % periphyton cover</u>	<ul style="list-style-type: none"> • <u>No algae</u> • <u>(bare substrate)</u> • <u>Films</u> • <u>Mats,</u> • <u>Filaments.</u> 	<u>Monthly</u>	<u>National Environmental Monitoring Standards for Periphyton (NEMS 2022a)</u>
<u>Periphyton productivity</u>	<u>Periphyton</u>	<ul style="list-style-type: none"> • <u>Chlorophyll a (CHLa)</u> 	<u>Annual</u>	<u>National Environmental Monitoring Standards for Periphyton (NEMS 2022a)</u>
<u>Macroinvertebrates</u>	<u>Benthic macroinvertebrates</u>	<ul style="list-style-type: none"> • <u>Taxa number</u> • <u>MCI,</u> • <u>QMCI,</u> • <u>EPT,</u> • <u>%EPT</u> 	<u>Annual</u>	<u>Quantitative hardbottom protocols. (Stark et al. 2001)</u>

6.5 Performance monitoring thresholds

6.5.1 Overview

The performance monitoring thresholds requiring further attention and possible action are set out in Table 6.

Table 6. Aquatic ecological performance monitoring thresholds, BOGP.

<u>Parameter</u>	<u>Metric</u>	<u>Threshold</u>
<u>Periphyton</u>	<u>CHLa (mg/m²)</u>	<u>>200 mg/m² at performance monitoring site when <200 mg/m² at upstream reference site</u>
<u>Periphyton</u>	<u>Visual cover (%weighted composite periphyton cover)</u>	<u>>50% at downstream site than occurs at upstream reference site</u>
<u>Macroinvertebrates</u>	<u>QMCI and MCI scores</u>	<u>Score change of 20% or more above natural variation at downstream site than occurs at upstream reference site</u>

6.5.2 Periphyton

The consent condition requires that should periphyton biomass exceeds 200 mg chlorophyll-a per m² and/or weighted composite periphyton cover exceeds 50% at the downstream site but not at the upstream site, the applicant shall engage a suitably qualified and experienced person (SQEP) to investigate the cause of the change and implement appropriate remedial actions as appropriate.

6.5.3 Macroinvertebrates

The consent condition requires that MCI and QMCI change of greater than 20% above natural variation between the upstream and downstream sites, the applicant shall engage a suitably qualified and experienced person (SQEP) to investigate the cause of the change and implement appropriate remedial actions as appropriate.

6.6 Hierarchy of response

The typical, responsible, and most important response when a performance threshold is met or breached is to repeat the monitoring or observation to confirm that the threshold truly has been met or breached, and that it is not a feature of a single unusual or inexplicable event, sampling error, or a broader effect occurring beyond the control of the consent holder.

Typically, the following steps would be applied to action a response:

1. Confirm if trigger breach is consistent (repeat monitoring and/or confirm observation).

2. [Consider the nature of the change and likely cause or source.](#)
3. [Test the cause or source of the threshold breach as required and/or required.](#)
4. [Decide appropriate action if required \(including no action\).](#)
5. [Initiate action as required.](#)
6. [Continue monitoring as scheduled or at an appropriate revised frequency of all or specific metric.](#)
7. [Where recovery and/or return to accepted metric levels has not occurred consider whether further action is required.](#)

[7.0 Downstream Ecological Confirmatory Monitoring](#)

[7.1 Purpose](#)

[The purpose of the downstream aquatic ecological monitoring is to provide a confirmatory measure that no effects on the ecology the watercourses are occurring further in the receiving environment and provides an assessment of recovery if additional actions are required as set out in section 6 above.](#)

[No consent related compliance or performance thresholds or targets apply to these downstream locations.](#)

[7.2 Monitoring locations](#)

[The downstream confirmatory aquatic ecological monitoring sites will be located at:](#)

- [Lindis River at Ardour Road \(ORC SOE monitoring Site\).](#)
- [Bendigo Creek at BSL Gauging Site \(Bendigo Station\).](#)

[7.3 Monitoring parameters and methods](#)

[The monitoring methods, protocols and metrics for the downstream confirmatory aquatic ecological monitoring locations are set out in Table 7.](#)

[Table 7. Proposed parameters and methods, and reporting metrics for downstream confirmatory monitoring locations at BOGP. No threshold requirements apply to these sites.](#)

Monitoring attribute	Method	Metrics	Frequency	Protocol (where appropriate)
Habitat	Rapid Habitat Assessment (RHA)	• HQS	Annual	Clapcott et al. (2020)

Settled sediment	In-stream visual estimate of % sediment cover	<ul style="list-style-type: none"> • Fine sediment cover (%) 	Monthly	Sediment Assessment Method 2 (Clapcott et al.
Periphyton cover	In-stream visual estimate of % periphyton cover	<ul style="list-style-type: none"> • No algae (bare substrate) • Films • Mats • Filaments 	Monthly	National Environmental Monitoring Standards for Periphyton (NEMS 2022a)
Periphyton productivity	Periphyton	<ul style="list-style-type: none"> • Chlorophyll a (CHLa) 	Annual	National Environmental Monitoring Standards for Periphyton (NEMS 2022a)
Macroinvertebrates	Benthic macroinvertebrates	<ul style="list-style-type: none"> • Taxa number • MCI • QMCI • EPT • %EPT 	Annual	Quantitative hardbottom protocols. (Stark et al. 2001)

8.0—

8.0 Reporting

[A report summarising all of the ecological monitoring provided in the FEMMP \(diversion performance and confirmatory monitoring\) will be prepared and submitted to Council in November in the year of sampling. The report will include:](#)

- [A summary all monitoring undertaken during the previous year, including diversion, performance and confirmatory monitoring \(as set out above\).](#)
- [The results of that monitoring including tables, graphs and summary data to describe the findings.](#)
- [A summary of the diversion and performance monitoring results.](#)
- [A summary of any actions or works that have been, or are proposed to be, undertaken to improve environmental performance.](#)

9.0 References

9.0—

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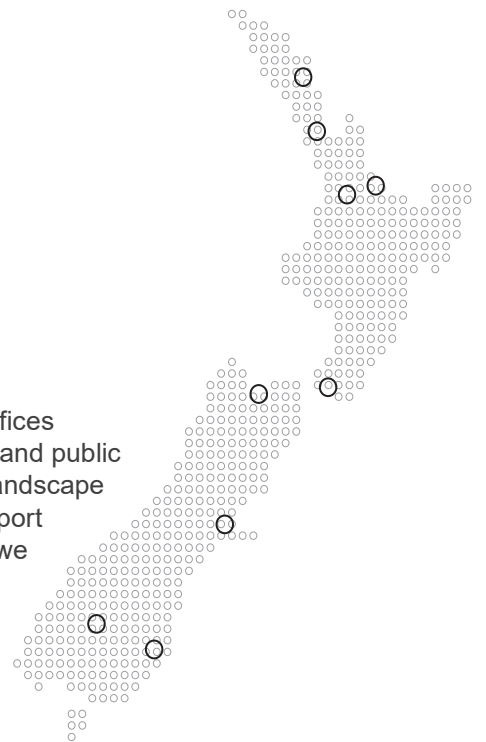
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Appendix 1: Shepherd Creek Rehabilitation Plan
(Growplan 2025)

Appendix 2:

Together. Shaping Better Places.

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