FRESHWATER ECOLOGY MANAGEMENT PLAN

for the

Waitaha Hydro Scheme

Date: 22 July 2025

TABLE OF CONTENTS

Produced by: Shelley McMurtrie, Principal Scientist, EOS Ecology

Reviewed by: Alex James, Senior Freshwater Ecology Scientist, EOS Ecology

Date: July 2025

1 INTRODUCTION

This Freshwater Ecology Management Plan (**FEMP**) sets out the methods that will be used to avoid, remedy or mitigate adverse effects on freshwater ecology during the construction and operational phases of the Scheme.

Construction effects potentially include sediment mobilisation, release of concrete-wash and other contaminants, the spread of didymo, maintaining fish passage during in-channel works, habitat disturbance and/or mortality of freshwater biota at the site of in-channel works during the creation of the access roads and other infrastructure (weir and intake at Kiwi Flat, tunnel, power station and tailrace), and removal of river gravels for road construction.

The potential operational effects include prolonged periods of residual flow allowing filamentous algae growth or fine sediment to accumulate in the abstraction reach, rapid flow changes during shut downs/start ups causing fish mortality from stranding, ability for kōaro to maintain access into Kiwi Flat whilst not allowing other fish species through, and fish attraction to the tail race.

1.1 Plan purpose

This FEMP specifies the methods to avoid, remedy, minimise or mitigate potential adverse effects on freshwater ecology that may occur as a result of the Scheme.

The FEMP has been guided by recommendations within the *Assessment of Effects on Freshwater Ecology* (McMurtrie & Grima, 2025)[1].

1.2 Plan objectives

The objective of the FEMP shall be to set out the management response measures necessary to avoid, remedy, minimise or mitigate, and compensate for the actual or potential adverse effects of the Scheme on freshwater ecology. More specifically:

a) **Compliance**: to ensure compliance with all requirements of the FEMP and statutory requirements of the Fast-track Approvals including, relevant Approvals conditions, for the duration of the Approvals.

b) **Implementation of protocols for construction:** implement protocols during construction to minimise construction effects on freshwater ecology including in relation to fish passage, habitat disturbance, loss of biota, and works around key sites (i.e., the ‘Stable Trib’). Note that measures to limit spread of didymo, stormwater and tunnel discharge management, monitoring and treatment will be documented in the Construction Environmental Management Plan (CEMP) and Erosion and Sediment Control Plan (ESCP) and as such is not covered here in this FEMP.

c) **Implementation of protocols for operations:** implement protocols during operations to minimise

[1] McMurtrie, S. & Grima, C. 2025. Westpower Ltd proposed Waitaha hydro scheme Assessment of Environmental Effects: Freshwater Ecology. EOS Ecology, Christchurch.

the impact of the Scheme on freshwater ecology including in relation to the residual flow, flow changes during startup/shutdowns, long-term fish passage at the intake, fish management at the tail race, in channel maintenance, and lighting.

d) **Freshwater ecology monitoring:** implement a monitoring programme for periphyton (especially filamentous algae) growth in the abstraction reach, checking ongoing kōaro access into Kiwi Flat whilst maintaining the absence of other fish species.

e) **Records and reporting:** maintain records of monitoring date, mitigation or adaptive management measures implemented, and any freshwater-related incidents or observations and reporting on those records.

Other operational matters relating to freshwater ecology but which have been covered in other management plans and/or in the Approvals conditions include those as listed below:

f) Determining the optimal ramping rate for planned startups/shutdowns to minimise fish stranding whilst taking into account public safety and infrastructure management – this is covered in the Approvals conditions with the required monitoring and adaptive management plan to be included in the Site Operations and Management Plan (SOMP).

g) Monitoring and management of any buildup of fine deposited sediment in the abstraction reach as a result of prolonged residual flows – this is covered in the Approvals conditions with the required monitoring and management approach to be documented in the Flushing Management Plan (FlushMP).

h) Any pre-requisite requirements for desander flushing during prolonged residual flow periods in the Waitaha River as set out in the Approvals conditions.

i) Maintenance (and monitoring) of fish passage for waterway crossing structures (excluding the weir at the intake) – this is covered in the Site Operations and Management Plan (SOMP).

j) Procedures for in-channel works at the intake site – this is covered in the Site Operations and Management Plan (SOMP).

1.3 Regulatory framework

The protection of rivers and significant habitats of indigenous fauna is a matter of national importance in sections 6(a) and (c) of the Resource Management Act 1991.

Policy documents with provisions for assessing the significance of freshwater ecology values include:

- West Coast Regional Policy Statement (RPS) [Policy 7.1a; Appendix 1] (WCRC, 2020)
- Westland District Plan (WDP) [Policy 4.9D] (WDC, 2002)
- Proposed Te Tai o Poutini Plan (TTPP) [Policy EOC-P1(2)(i)] (TTPPC, 2022)
- West Coast Conservation Management Strategy 2010-2020 (CMS) [Policy 3.3.2.3(1)] (DOC, 2010)

The Waitaha River has been assessed against these policy documents with the following significance of freshwater ecology values (as assessed in McMurtrie & Grima, 2025):

- **Representativeness** – **High significance value**. The rationale for this evaluation is:
    - Waitaha River mainstem is representative of a glacial-fed or mountain-fed naturally disturbed river system typical of the West Coast Region. The mainstem and its tributaries support habitats representative of indigenous freshwater plants, fish and macroinvertebrates in the Harihari and Wilberg ecological districts.

- **Rarity/Distinctiveness** – **Medium significance value overall** / **High significance value for the 'Stable Trib'**. The rationale for this evaluation is:
    - Waitaha River mainstem and its tributaries support three fish species classified as 'At Risk – Declining': kōaro (*Galaxias brevipinnis*), longfin eel (*Anguilla dieffenbachii*), and torrentfish (*Cheimarrichthys fosteri*) (Dunn *et al.,* 2018). Furthermore, the trout-free kōaro habitat upstream of Morgan Gorge (i.e., in the Kiwi Flat area) is important to the kōaro fishery.
    - The 'Stable Trib' (located on the true-right of the Waitaha River, approximately opposite Douglas Creek) is a locally unique freshwater system in the Waitaha catchment. It is locally important because the community composition of indigenous invertebrate and bryophyte communities are distinct in the Waitaha River and Wanganui River catchments. The 'Stable Trib' also supports other threatened freshwater fish species, namely lamprey (classified as 'Threatened – Nationally Vulnerable') and giant kōkopu (classified as 'At Risk – Declining') (Dunn *et al.,* 2018).
- **Diversity and Pattern** – **High significance value**. The rationale for this evaluation is:
    - Waitaha River catchment contains a high diversity of indigenous freshwater ecosystems, high diversity of habitat types for indigenous freshwater taxa, and moderate diversity of indigenous freshwater taxa.
- **Ecological Context** – **High significance value**. The rationale for this evaluation is:
    - Waitaha River catchment provides an important ecological linkage and network. The river flows through a diversity of indigenous ecosystems and agricultural land. The mainstem and its tributaries provide important freshwater habitat (including refuges from predation, or key habitat for feeding, breeding, or resting) for indigenous freshwater taxa, seasonally and permanently.
- **Intactness** – **Very High significance value**. The rationale for this evaluation is:
    - Waitaha River catchment from Macgregor Creek/Douglas Creek upstream is unmodified by land use activity. This represents well over half the catchment, and all of it is in the upper catchment.
    - Waitaha River mainstem and its tributaries comprise a predominately intact indigenous freshwater system, and are not affected in a major degree by weed or pest species.
- **Protected Status** – **Low significance value**. The rationale for this evaluation is:
    - There are no wilderness areas, as designated under the *Conservation Act*, in the project area.
    - The closest wilderness area to the project area is Adams Wilderness Area, which is a gazetted wilderness area south of the project area (Evergreen Mapping NZ, 2024).
- **Connectivity** – **High significance value**. The rationale for this evaluation is:
    - A high proportion of the catchment is unmodified by land use activities, and these unmodified areas cover the entire upper- and mid-catchment; therefore, the Waitaha River catchment makes a major contribution to the overall value and natural functioning of these areas.
- **Threat** – **Medium significance value overall / High significance value for the 'Stable Trib'.** The rationale for this evaluation is:
    - Waterways between Macgregor Creek/Douglas Creek and the top of Morgan Gorge support four fish species classified as 'At Risk – Declining': kōaro, longfin eel, torrentfish, and giant kōkopu (*Galaxias argenteus*). Waterways within the Kiwi Flat area also support kōaro. Notwithstanding these records, all four species are also common in other West Coast

catchments. Waterways between Macgregor Creek/Douglas Creek and the top of Morgan Gorge support, within the Kiwi Flat area and upstream of Kiwi Flat support four freshwater invertebrate species classified as 'At Risk – Naturally Uncommon' (Grainger *et al.,* 2018). Such findings mean that this criterion is not sufficient to rate it as a high value for the Waitaha catchment or the area affected by the Scheme.

  - The 'Stable Trib' is considered of high significance value owing to the large numbers of ammocete lamprey, indicating this is a key spawning habitat for lamprey.

- **Migratory Species** – **Medium significance value**. The rationale for this evaluation is:
  - The 'Stable Trib' is considered a 'hotspot' for fish diversity and density within the Waitaha River catchment. It supports seven migratory fish species (kōaro, longfin eel, torrentfish, brown trout (*Salmo trutta*), redfin bully (*Gobiomorphus huttoni*), lamprey (*Geotria australis*), and giant kōkopu), has significant lamprey rearing habitat, and potentially rearing habitat for brown trout. Although the 'Stable Trib' provides significant habitat for migratory species at the local/catchment level, other catchments within the region also contain these fish species; therefore, it is of lesser significance at a regional level as these migratory species are widespread in other West Coast rivers.
  - Despite the trout-free kōaro habitat within Kiwi Flat Reach not being rare on a regional level, this habitat is considered important to the kōaro fishery.
- **Viability** – **High significance value**. The rationale for this evaluation is:
  - Kōaro, longfin eel, torrentfish, and giant kōkopu are indigenous fish species that have a national conservation status of 'At Risk – Declining', and lamprey has a conservation status of 'Threatened – Nationally Vulnerable' (Dunn *et al.,* 2018). Whilst at the national level these species have a conservation status that indicates they are at risk or threatened, the Waitaha catchment provides them with an environment that allow them to persist in that area over time.

1.4 Plan structure

This FEMP is set out as follows:

- Section 1 – Introduction (this section);
- Section 2 – Summary of the existing environment relevant to freshwater ecology;
- Section 3 – Summary of the Scheme's potential effects on freshwater ecology;
- Section 4 – Summary of the measures to manage effects on freshwater ecology;
- Section 5 – Protocols for managing construction effects on freshwater ecology;
- Section 6 – Protocols for managing operational effects on freshwater ecology
- Section 7 – Compliance monitoring and reporting
- Section 8 – Adaptive Management
- Section 9 – Review

1.5 Implementation of the FEMP

This FEMP is to be referred to and implemented during the following phases of the Scheme:

- Detailed design: Pertaining to the design of key structures (kōaro fish passage structure at the intake site, intake structure, tail race structure). These matters are covered in Section 5 (protocols for managing the effects of construction on freshwater ecology) of this FEMP.
- Construction phase: During construction all matters as described in Section 4 of this FEMP will need to be referred to and followed.
- Operational phase: For the life of the scheme there will be matters described in Section 5 to Section 8 of this FEMP that will need to be referred to and followed, and which provide relevant referral to Section 4 (construction management) where relevant.

1.6 Responsibilities and competencies

The Principal, as the Approvals Holder (Westpower Limited), will be responsible for ensuring that the site works are undertaken in accordance with this FEMP and all relevant conditions set out in the Approvals.

Delivery of, and compliance with, the FEMP will be the responsibility of the following for construction and operational phases of the Scheme:

For the Construction Phase

- The Project Engineer will, with support from the Liaison Officer, liaise with an appropriately qualified freshwater ecologist (the designated freshwater ecologist), Contractor and Site Construction Manager regarding all activities requiring in-river works, vegetation removal, earthworks or other works that may result in discharges to the Waitaha River or tributaries.

The responsibilities of the Project Engineer include but are not limited to:

- Reading and understanding the FEMP;
- Facilitating a project start-up meeting with the Project Liaison Officer, the designated freshwater ecologist, Contractor, Site Construction Manager and any relevant sub-contractors contracted by the Contractor before any Project Construction Work Components that may impact freshwater commence. The objective of this meeting will be to determine areas scheduled for construction to enable forward planning and avoid delays in the construction schedule and to confirm all relevant pre-construction requirements;
- Contacting the Liaison Officer and the designated freshwater ecologist before any works that may impact freshwater;
- Maintaining clear lines of communication with the Contractor, Liaison Officer, the designated freshwater ecologist, Site Construction Manager, other site engineer(s) and any relevant contractors regarding any changes in the works schedule; and
- Briefing new personnel about the contractor’s responsibilities under this FEMP.

The Contractor will be responsible for managing the physical vegetation removal and earthwork, blasting and in-channel activities including the activities undertaken by relevant sub-contractors employed by the Contractor.

As it relates to fish salvage activities undertaken during construction, the Project Liaison Officer or Project ecologists is/are responsible for reporting the discovery and/or salvage of ‘At Risk’ or ‘Threatened’ freshwater fish species to the Department of Conservation Local Area Manager and for maintaining a database with an incident register and file log of actions taken for each such discovery.

The designated Project ecologist for freshwater ecology will supervise the implementation of this FEMP and various phases of freshwater ecology-related work on this Project.

For the Operational Phase

- The Waitaha Hydro Site Manager who will liaise with the designated freshwater ecologist as required, including as determined by the Approvals conditions and any relevant operational management protocols or procedures set out in this FEMP.

1.7 FEMP induction

Westpower must ensure that a copy of the FEMP is always available onsite during construction of the Project.

A site induction for all employees and contractors who are likely to be involved in construction activities that may impact waterways is required to understand and comply with the specific constraints and requirements of this FEMP.

This induction will include, at a minimum:

- protocols for managing effects on freshwater ecology;
- procedures for the occurrence of didymo;
- the importance of compliance with the protocols and the reporting processes for observed breaches of required protocols; and
- contact details for the Project Engineer and designated Project Ecologist for freshwater ecology, environmental compliance staff, and emergency numbers for any identified issues observed onsite.

2 SUMMARY OF EXISTING ENVIRONMENT – FRESHWATER ECOLOGY

The freshwater ecology of the Waitaha River catchment was assessed in the *Assessment of Effects on Freshwater Ecology* (McMurturie & Grima, 2025). The following is a brief summary.

Flow regime

The Waitaha River exhibits a high natural disturbance regime with frequent large floods, high fluxes of bed-material, and transient deposition and re-working of sediment. The annual frequency of floods greater than three times the 20 cumec median flow (FRE_3) at Kiwi Flat (downstream of the Whirling Water confluence) is approximately 26; meaning that approximately 26 times a year there are flood flows that are greater than three times the median flow of 20 cumecs. This type of flood frequency is in the upper range for New Zealand rivers, and is a significant factor affecting/limiting the biological community inhabiting the Waitaha river.

Water quality

The Waitaha River catchment from Douglas Creek upstream is a naturally low nutrient system. The results of most nutrient tests from samples collected in the catchment were either below the laboratory detection limits or were at very low levels that were well below the national average for rivers across the country (based on data from the National River Water Quality Network (NRWQN)). The low-nutrient water of the Waitaha catchment is typical of other West Coast rivers where catchment modification is minimal. The low nutrient water of the Waitaha River mainstem, combined with a high flood frequency, means that the risk of excessive algal growth in the river is minimal.

Periphyton (algae) and bryophytes (mosses and liverworts)

Periphyton (algae) taxa recorded in the catchment are typical of low nutrient South Island rivers. Diatoms dominated the assemblages, underscoring the low nutrient and flood-prone nature of most of the waterways. Periphyton biomass was lower in the Waitaha River and higher in the tributaries, further reflecting the nature of the river. The Waitaha River and most tributaries supported few bryophytes (mosses and liverworts). However, the stable tributaries in the area serve as biodiversity hotspots for bryophytes, which are vital for supporting freshwater invertebrate habitats. Such stable environments are less common in the catchment, underscoring the importance of these tributaries for maintaining freshwater biodiversity within the catchment.

The introduced didymo (*Didymosphenia geminata*) is known to be present in the Waitaha River catchment, with eDNA sampling in 2024 detecting it in the mainstem and tributary waterways in the downstream of Morgan Gorge and in the Kiwi Flat area. Whilst it thrives in low-nutrient waters the glacial flour and unstable flood-prone nature of the Waitaha River mainstem will likely ensure that it is unable to reach nuisance levels in the mainstem at least.

Freshwater invertebrates

The freshwater invertebrate community of the catchment is dominated by insect groups such as mayflies, chironomid midges, caddisflies, and stoneflies. There were four taxa recorded that have a conservation status of 'At Risk – Naturally Uncommon – these were one stonefly (*Megaleptoperla grandis*), one mayfly (*Deleatidium magnum*), and two caddisflies (*Costachorema brachypterum* and *Philorheithrus latentis*). The community was comparable to those of other neutral pH, fast-flowing West Coast rivers from unmodified catchments in high rainfall areas; where water quality is high and nutrient levels and algal biomass low.

The Waitaha River and tributaries (with the exception of the stable tributaries) had low densities, low species diversity, and low species evenness, with the mayfly *Deleatidium and* orthoclad midges dominating the community of these sites. The limited invertebrate community is attributed to the naturally unstable nature of these sites, with a high disturbance regime, low nutrients and presence of glacial flour (fed from the glaciers in the upper catchment) also limiting basal food supply. In contrast the stable tributaries, particularly the stable spring-fed tributary ('Stable Trib') on the true right of the river opposite Douglas Creek supported almost three times as many invertebrate taxa as the mainstem and had a high species evenness and high numbers of EPT taxa. The 'Stable Trib' site was also the only location where waikoura/freshwater crayfish were found. The stable tributaries are considered to be biodiversity 'hotspots', and are locally important for maintaining biodiversity values and ecosystem functioning within the wider catchment.

Fish

Eight fish species have been recorded in the Waitaha catchment; these were (in order of occurrence from most recorded to least recorded) kōaro (*Galaxias brevipinnis*), longfin eel (*Anguilla dieffenbachii*), brown trout (*Salmo trutta*), torrentfish (*Cheimarrichthys fosteri*), lamprey (*Geotria australis*), redfin bully (*Gobiomorphus huttoni*), common bully (*Gobiomorphus cotidianus*) and giant kōkopu (*Galaxias argenteus*). Of these the following have a conservation status

- 'Threatened – Nationally Vulnerable': lamprey
- 'At Risk – Declining': kōaro, longfin eel, torrentfish, giant kōkopu.

Kōaro (*Galaxias brevipinnis*) was the only fish species found upstream of Morgan Gorge; meaning that Morgan Gorge represents a fish passage barrier to all species other than kōaro, which have evolved key physiological and behavioural traits that allow them to negotiate barriers impassable to

other species. However, even the distribution of kōaro diminished with distance further up the catchment, indicating the natural attrition caused by multiple natural barriers in this mountainous catchment. For kōaro, the tributaries represented a preferable habitat over the river mainstem; which reflects the unstable environment and limited food supply available in the mainstem.

Between Morgan Gorge and Douglas Creek seven fish species were recorded from the Waitaha River and in tributary waterways. These were kōaro, brown trout, torrentfish, longfin eel, lamprey, redfin bully and giant kōkopu. Only four fish species (kōaro, brown trout, torrentfish, longfin eel) were found in the Waitaha River mainstem, where their numbers were low. The low density and diversity of fish in the mainstem channel reflects the unstable environment and limited food supply available in the mainstem. Tributaries represented preferrable habitat for fish through this section, with seven species recorded (kōaro, brown trout, torrentfish, longfin eel, lamprey, redfin bully and giant kōkopu) and generally a greater diversity and density of fish compared to the river mainstem. Within the tributaries, most fish species were limited to the Douglas Creek and the 'Stable Trib' (the stable spring-fed tributary opposite Douglas Creek). Upstream of these tributaries, only kōaro and longfin eel were found in any of the surveyed tributary waterways of the Douglas Creek Reach. Many of the tributaries between Morgan Gorge and Douglas Creek are intermittent or ephemeral and so are not suitable fish habitat. Others have natural fish passage barriers (steep sections and short waterwalls/drops) near their confluence with the mainstem, that would prevent most fish from being able to access them.

The 'Stable Trib' (the spring-fed stable tributary on the true right opposite Douglas Creek) is a 'hotspot' for fish diversity and density within the Waitaha catchment. It is also a significant lamprey rearing habitat and could also represent a trout rearing habitat in this section of the catchment.

The mainstem of the Waitaha River upstream of Douglas Creek is suboptimal habitat for brown trout and of little value to the brown trout fishery. No records of Chinook salmon (*Oncorhynchus tshawytscha*) has been recorded in the Waitaha catchment.

3 SUMMARY OF THE SCHEME'S POTENTIAL EFFECTS ON FRESHWATER ECOLOGY

Potential adverse effects of the Scheme on freshwater ecology were assessed in the *Assessment of Effects on Freshwater Ecology* (McMurturie & Grima, 2025). Key potential adverse effects include:

- Construction effects relate to the creation of the access roads and other infrastructure (weir and intake at Kiwi Flat, tunnel, power station and tailrace) including:
    - sediment mobilisation, release of cementitious and other contaminants to surface water,
    - the spread of didymo,
    - impacts on fish passage during in-channel works, and
    - habitat disturbance and mortality of freshwater biota at the site of in-channel works.
- The operational effects relate to the operation of the scheme infrastructure (pertaining to flows, fish passage and lighting) and ongoing in-channel maintenance as required to maintain the Scheme infrastructure:
    - residual flow, with possible altered sediment dynamics and algae changes
    - flow changes during Scheme startup/shutdown
    - fish passage at the fish passage at road crossings and the weir at the intake site
    - fish attraction into the power station tailrace
    - in-channel maintenance works

- lighting around infrastructure

Overall, the potential effects of the construction phase are minimised to a 'less than minor' level via the planned and recommended programme to reduce effects as well as the nature of the environment (e.g., the existing unstable nature and high sediment load of the Waitaha River mainstem and of most of the tributary waterways within the construction footprint, and the intermittent/ephemeral nature of some of the tributary waterways that will be crossed by the access road)

4 PROTOCOLS FOR MANAGING THE EFFECTS OF CONSTRUCTION ON FRESHWATER ECOLOGY

1. To ensure that freshwater ecology is not adversely impacted by construction, the protocols and requirements set out in the Construction Environmental Management Plan (CEMP) and the Erosion and Sediment Control Plan (ESCP) in particular, as well as the vegetation removal protocols in the Vegetation Management Plan (VMP), are to be followed.
2. In addition, the following measures are proposed here (in summary):
    a) Maintaining kōaro fish passage at the intake weir whilst excluding other fish species
    b) Minimising habitat disturbance during instream works
    c) Minimising loss of freshwater biota during construction
    d) Minimising disruption of fish passage during instream works
    e) Designing tail race to minimise entrainment of fish
    f) Avoiding infrastructure and construction activities in proximity of the 'Stable Trib'
3. Further detail on how to achieve the above is set out below.

4.1 Maintaining kōaro fish passage at the intake weir whilst excluding other fish species

4. The detailed design of the kōaro passage structure at the intake site will be designed with input from the designated freshwater ecologist, who will be suitably qualified and experienced, so that it can be designed to allow for the upstream movement of kōaro whilst preventing the upstream movement of other fish species. The detailed design will be contingent on the specific *in situ* conditions, but will need to incorporate the following key criteria:
    a) A rough surface that has a micro texture that will facilitate the ability for kōaro to grip the surface. A rough concrete surface could work well in that regard.
    b) A ramped structure with a varied slope that provides flatter resting areas as well as steeper sections for climbing up. The location of this ramp structure may be best housed between the elbow of the weir structure and the natural rock on the true-left of the river, where the structure could be embedded to angle down/wrap around the side of the existing rock face, therefore providing flexibility in the slopes used.
    c) Larger material (i.e., rocks) embedded into the surface to provide variations in water velocity and patches of cover.
    d) A small amount of water running over the surface – the key criteria is more of a wetted surface and splash zone rather than a full flow of water; kōaro will climb up the structure not swim up it.
    e) No sharp edge or sharp angle at the top of the structure; climbing fish are not able to

negotiate such structures.

f) Located off to the true-left side of the main weir structure where it should be possible to control how much water goes over the surface.

g) The kōaro passage structure may also be used to facilitate the upstream passage of whio/blue duck chicks. Whilst it is likely that the design criteria for kōaro will also suit whio, if there becomes a conflict between the design of a kōaro upstream passage structure (whilst excluding trout) and a whio chick upstream passage structure, then the criteria for the former will take precedence.

5. The design of the kōaro passage structure will need to be approved by the designated freshwater ecologist (see paragraph 4, with input sought from the Department of Conservation (DOC).

6. Construction of the kōaro passage structure will have oversight from the designated freshwater ecologist.

7. The only fish species found upstream of Morgan Gorge are kōaro (*Galaxias brevipinnis*). As such, construction at the intake site will ensure that the current status of fish passage into Kiwi Flat is maintained, which means that ONLY kōaro fish passage will be maintained during construction. As kōaro are a climbing species this can be used to good effect in the management of the current fish passage status quo during construction of the weir.

4.2 Minimising habitat disturbance during instream works

8. Prioritise construction of the permanent crossing structure for Macgregor Creek to limit the amount of vehicle crossing via the temporary access track across the braid plain.

9. Prioritise the construction of the temporary bridge across Granite Creek to limit the amount of vehicle crossings via other means.

10. When establishing the temporary access route for machinery around the edge of Macgregor Creek, Waitaha River and Granite Creek (to construct the temporary bridge at Granite Creek), site the access route such that it is not crossing small tributaries directly, or where this is unavoidable, the crossing location at those small tributaries is suitable for culvert installation. This may require siting the access route within the wider braid plain of the Waitaha River where tributary water flows typically dissipate through the river gravels. When disestablishing the temporary access route ensure that the area around tributary inputs is returned to pre-construction conditions.

11. Minimise the instream construction area for channel crossings as much as is practicable.

12. For the tail race construction at the Power Station, construct as much of the race as possible ‘in the dry’ before breaking through to the river. Undertake fish rescue work along the river edge prior to construction to break through to the river (refer to Section 4.4).

13. Power poles are not to be located within perennial waterways or wetlands.

14. For gravel extraction from the Waitaha River, do not extract from active wetted channels, and ensure extraction does not intercept the water table, and otherwise follow the conditions provided in Rule 29 (b-j) of the West Coast Regional Land and Water Plan (RLWP).

4.3 Minimising loss of freshwater biota during construction

15. Follow the Erosion and Sediment Control Plan (ESCP) and Construction Environmental Management Plan (CEMP) in relation to any works around or near to waterways. This will include, but not be limited to the following:

a) Ensure concrete-contaminated water or waste does not enter surface waters by fully curing cement-based products before contact with water for any instream structures.

b) Ensure wash water from washing concrete tools, machinery, formwork is not able to enter waterways.

c) Maintain dry work areas when using wet cement-based products in waterways.

d) Treat water contaminated with cementitious runoff, testing and treating pH before release.

e) Refuel and store machinery/equipment/fuel/chemicals away from waterways to prevent contamination in case of spills.

f) Maintain machinery regularly to reduce breakdown risks.

g) Keep a spill kit on site to contain accidental spills and protect waterways.

16. Involve a suitably qualified and experienced freshwater ecologist during the detailed design phase of the intake to assist with matters around reducing the potential for kōaro larvae entrainment into the tunnel.

17. Undertake a fish rescue prior to the commencement of any instream works, except for the mainstem of the Waitaha River at the intake site where fish rescue work is not required (given low fish density and high health and safety risks)[2]. This would therefore relate to the construction of crossing structures for tributary waterways and when connecting the tail race to the Waitaha River. Fish rescue protocols as described in Section 4.4 will be followed.

18. All fish rescues need to be undertaken by suitably qualified and experienced freshwater ecologists from an organisation with the relevant permits to allow for the capture and release of fish. An example of the relevant permits that will be required include:

    a) An MPI Special Permit (Pursuant to Section 97(1) of the Fisheries Act 1996) for the collection of aquatic biota (including freshwater fish).

    b) A permit (Pursuant to Section 26ZM(2a) of the Conservation Act 1987) to transfer native fish and other aquatic life to appropriate water bodies in the same catchment as the capture site where these species currently exist.

    c) Approvals from West Coast Fish & Game Council (Pursuant to the Freshwater Fisheries Regulations 1983) to capture and possess sports fish for the purposes of fish surveys or fish relocations within the specific Fish & Game Region.

    d) Note that for fish rescues undertaken in DOC land (i.e. land south of Macgregor Creek), additional DOC permits will need to be obtained by the organisation undertaking the fish rescues – these DOC permits will be secured at least several months prior to commencement of the fish rescue work.

19. All fish rescues will be documented with a fish rescue memo that provides relevant information as specified in Section 4.4. The fish rescue memos will be sent to the Project Engineer, who is responsible for passing these onto Department of Conservation (as per Section 1.6) via the Project Liaison Officer.

20. Where any waterway dewatering is undertaken for instream works or other water takes relating to construction, the inlets for any dewatering pumps will be fitted with a fish screen of maximum 3 mm mesh size to prevent fish from being sucked into the dewatering pump.

[2] Fish rescues at the location of the weir for the intake site is not required due to the dangerous nature of the river at this point and the lack of fish species found in the mainstem of the river near this location.

21. Any stream diversion pumping activities during construction must be undertaken under supervision of the designated freshwater ecologist (or a freshwater ecologist appropriately qualified to undertake fish rescue as per paragraph 18.

4.4 Protocols for fish rescues relating to instream works where there is water

22. For tributary waterways, the contractor is responsible for sectioning off the channel with appropriate methods (i.e., fish screens and/or cofferdams or similar methods of sectioning of the stream channel) upstream and downstream of the planned work site. For the mainstem of the Waitaha River, in relation to the tail race construction works, sectioning off the channel will not be practicable.
23. The qualified fish rescue specialists (as per Paragraph 18 will then electrofish the works area (i.e., the section between the fish screens) to remove fish before any dewatering or in stream work commences. If the site is not suitable for electrofishing then the use of traps (i.e., Gee's minnow traps) and fyke nets is acceptable. If traps and nets are used then they need to be appropriately labelled with the Special Permit number of the organisation undertaking the fish rescue work.
24. Upon capturing, fish (as well as kakahi/freshwater mussels (*Echyridella menziesii*) and waikōura/freshwater crayfish (*Paranephrops planifrons*), if also caught) shall be placed in a lidded container of appropriate volume for the number of fish and part filled with clean stream water.
25. If release cannot occur immediately, the fish will be stored in the shade and kept below 20°C. Fish density and behaviour shall be monitored regularly for any signs of distress (e.g. air gulping).
26. Containers shall not be overstocked and larger eels (>500 mm) and waikōura, shall be kept in separate containers to other captured fish to avoid injury or predation.
27. Fish (and kakahi and waikōura if caught) will be released to a location outside of the works area and containing suitable habitat for the species caught. The release site will have suitable habitats within the same stream system with similar flow conditions and similar or better habitat and containing no barriers to fish passage that would otherwise prevent them returning to the work site on completion of works.
28. Upon release, the fish shall be distributed over a similar length of stream as they were caught, with small fish released first. Large numbers of fish shall not be released in one location to minimise the risk of short-term overstocking or predation.
29. Any pest fish captured will be humanely euthanised.
30. Fish shall be handled with wet hands or gloves to reduce the risk of injury to fish.
31. If fish anaesthetic is used to reduce stress for fish whilst handling (such as for eels) then its use will follow accepted anaesthesia use protocols and be an anaesthetic that is approved for use on food fish. Any fish that are anaesthetised will be closely watched and allowed to fully recover prior to transfer to the release site.
32. Following fish relocation, the site can be dewatered following the contractor's approved methods and site works can be undertaken. The contractor will remain vigilant for fish that may have avoided capture and relocation and have a bucket of fresh stream water and net on site to capture them if seen. Any fish captured will be released upstream of the works area.

    e) Note that fish rescues will be required each time the fish barriers are removed and re-installed, and at any point following a rain event where the barriers are overtopped.

    f) A fish rescue memo will be provided by the organisation undertaking the fish rescue work, that provides information on the location of the fish rescue, the type of instream works, area fished,

fish species (and number) caught, and location of the fish release site.

4.5 Minimising disruption of fish passage during instream works

33. As noted in Paragraph 5, construction at the intake site will ensure that the current status of fish passage into Kiwi Flat is maintained, which means that ONLY kōaro fish passage needs to be maintained during construction at this location. Given the climbing ability of kōaro and the already fast flows at the site, the planned diversion of flow during the weir construction is unlikely to materially impact on the ability of kōaro to access the Kiwi Flat area.
34. Maintaining fish passage for waterways that are defined as being intermittent or ephemeral (e.g., Macgregor Creek, Alpha Creek) is not required during the construction phase.
35. Construction works at Granite Creek will not impact on fish passage due to the construction occurring out of the wetted channel. If any works are required in the channel then it will be necessary to divert flow around the immediate work site to ensure some fish passage in maintained.
36. For sites that have perennial flow, if instream works relating to culvert (or other crossing structure) construction are to occur for a period of less than two weeks then it is suitable to temporarily disrupt fish passage if this provides for an opportunity to undertake construction works ‘in the dry’. This is because working ‘in the dry’ greatly limits the wider disruption to instream environments. The use of the term ‘in the dry’ relates to where a section of waterway is sectioned off from the rest of the waterway and the area is pumped out to create a ‘dry’ working site.

4.6 Designing tail race to minimise entrainment of fish

37. The detailed design of the Power Station tail race will be designed with input from the designated freshwater ecologist, who will be suitably qualified and experienced, so that it can be designed to discourage fish access and/or facilitate the upstream movement of fish that may be otherwise attracted to the tail race.
38. The design of the tail race will need to be approved by the designated freshwater ecologist (see paragraph 37.

4.7 Avoiding infrastructure and construction activities in proximity of the ‘Stable Trib’

39. To keep all activities away from the ‘Stable Trib’ that is located on the true-right of the river downstream of the Power Station and roughly opposite of Douglas Creek, accurately mark the ‘Stable Trib’ on all maps and map apps used for the Project.
40. Ensure that no machinery or infrastructure is brought within close proximity (i.e., no closer than 20 m but further away if practicable) of the ‘Stable Trib’.
41. Ensure that no earthworks or spoil material is stored or placed within close proximity (i.e., within 20 m) of the ‘Stable Trib’ or where any surface water runoff from such areas could reach the ‘Stable Trib’.
42. Ensure that no direct discharge of water from the Power Station Site or access road can reach the ‘Stable Trib’ via overland flow paths.

5 PROTOCOLS FOR MANAGING THE OPERATIONAL EFFECTS ON FRESHWATER ECOLOGY

43. To ensure that freshwater ecology is not adversely impacted during the operational phase, the

protocols and requirements set out in the Site Operations and Maintenance Plan (SOMP) in particular, as well as the Flushing Management Plan (FlushMP), and Approvals conditions are to be followed. Key matters pertaining to freshwater ecology in those plans are summarised in Section 1.2.

44. In addition, the following measures are proposed here (in summary):

    a) Operation of the scheme to minimise the effects of the main water diversion to the Power Station

    b) Operation of the scheme to minimise the effects of shutdowns/startups

    c) Management of the kōaro passage structure at the intake site

    d) Management of the power station tail race in relation to fish; and

    e) Instream works pertaining to maintenance and repair of instream structures.

45. Further detail on how to achieve the above is set out below.

5.1 Operation of the scheme to minimise the effect of the main water diversion to the Power Station

46. Operating the scheme to leave a residual flow of 3.5 cumecs within the Waitaha River downstream of the intake site (unless the natural Waitaha River flows are less than 3.5 cumecs, in which case all river flow will continue past the intake site).

47. The use of monitoring and an adaptive management approach for managing any buildup of filamentous algae in the abstraction reach because of any prolonged periods of continuous residual flow. This is covered in Section 6.1 (monitoring) and Section 7 (adaptive management).

48. The direction and design of the bypass valve such that it minimises bank and channel erosion, and maintains some flow in the tail race during scheme shutdowns.

5.2 Operation of the scheme to minimise the effects of shutdowns/startups

49. The use of a bypass valve that will allow a 10 cumec flow to be diverted down the Scheme tunnel during emergency and planned shutdowns and planned startups, to reduce the effects of sudden flow changes at these times. When used the bypass valve will not be shut down until the flow redirected into the channel from the Headworks has reached the tail race, at which point it is closed down over at least a 30 minute period to minimise the flow deficit.

50. The use of a ramping rate (initially set at no more than 0.5 m^3/s/min during river flows less than 40 cumecs and 1.3% of river flows greater than 40 cumecs) to reduce the effects of rapid flow changes during planned startups/shutdowns.

51. The use of an adaptive management approach for testing and modifying the ramping rate if needed, based on findings from initial testing to observe flow changes and check for fish stranding within the abstraction reach and in the braided section of the Waitaha River downstream of the tail race. Details of this monitoring will be covered in the Site Operations and Management Plan (SOMP).

5.3 Management of the kōaro passage structure at the intake site

52. As set out in section 4.1, design of the kōaro passage structure will be such to allow for the upstream movement of kōaro whilst preventing the upstream passage of other fish species.

53. The kōaro passage structure will be checked after any significant bed-moving flood event, where

the size of the event is such that the movement of large substrate into Morgan Gorge could have damaged the kōaro passage structure. If there is significant visible damage to the structure then a qualified and experienced freshwater ecologist (ideally the same designated freshwater ecologist as involved in the design) will need to confirm if the structure needs to be fixed.

54. The use of monitoring and adaptive management approach for maintaining kōaro (*Galaxias brevipinnis*) access whilst preventing access of any other fish species into Kiwi Flat. This is covered in Section 6.2 (monitoring) and Section 7 (adaptive management).

55. Any works on the kōaro passage structure to fix damage or remediate it because of findings from the monitoring and adaptive management programme will follow similar erosion and sediment control, and environmental construction management as defined in the construction ESCP and CEMP.

5.4 Management of the power station tail race in relation to fish

56. As set out in section 4.6, design of the tail race will attempt to discourage fish access and/or facilitate the upstream movement of fish that may be otherwise attracted to the tail race.

57. The tail race structure will be checked after any significant bed-moving flood event, where the size of the event is such that the movement of large substrate at the confluence of the tail race with the Waitaha River could have significantly changed the tail race outlet. If there is significant change in the conditions of the tail race and outlet, then a qualified and experienced freshwater ecologist (ideally the same person as involved in the design) will need to confirm if the structure needs to be remediated in relation to meeting the original design requirements as per paragraph 56.

58. Any maintenance works on the tail race structure will follow similar erosion and sediment control, and environmental construction management as defined in the construction ESCP and CEMP.

59. If for any reason the flow of water from the Power Station is to be turned off (including the bypass flow) meaning that the tail race will become dewatered, then the tail race will need to be fished out prior to dewatering.

60. All fishing related to the tail race will follow the criteria as specified in Paragraph 18 and 19 of Section 4.3, and all of Section 4.4.

5.5 Instream works pertaining to maintenance and repair of instream structures

61. If any instream/in-channel works are required as part of operational maintenance and repair then:

    a) Follow those matters as described in Section 4.3: Minimising loss of freshwater biota during construction.

    b) Follow those matters as described in Section 4.5: Minimising disruption of fish passage during instream works

    c) Follow those matters as described in Section 4.7: Avoiding infrastructure and construction activities in proximity of the ‘Stable Trib’

    d) Minimise the instream construction area as much as is practicable.

6 COMPLIANCE MONITORING AND REPORTING

62. Overall, the effects of the Scheme on freshwater ecology will be at most minor, providing the recommended mitigations are implemented. However, the following matters require monitoring and reporting to inform a planned adaptive management approach:

a) Build-up of filamentous algae in the abstraction reach;

b) Fish population monitoring – to monitor ongoing kōaro recruitment into Kiwi Flat and the ongoing absence of other fish species

63. Monitoring and reporting will be undertaken in accordance with this FEMP as set out below.

64. All monitoring and reporting will be undertaken by suitably experienced and qualified freshwater ecologists.

65. DOC permits may be required to undertake the field surveys located within land administered by DOC, and must be applied for and approved prior to commencement of the surveys.

6.1 Periphyton (specifically filamentous algae) monitoring within the abstraction reach

66. This section covers periphyton (specifically filamentous algae) monitoring within the abstraction reach, including information regarding triggers for monitoring, the methods to be used, and the reporting requirements. This monitoring is to be used to inform adaptive management approaches as described in Section 7.1 (Managing filamentous algae buildup).

6.1.1 Timing for monitoring

67. Monitoring of periphyton/algae (specifically filamentous algae) within the abstraction reach will otherwise be required if there is a prolonged period of residual flow in the abstraction reach.

a) The trigger for implementing periphyton monitoring will be if there is a period of four weeks where the flow has remained below 5 cumecs, and short-term (less than 24 hours) increases in flow have remained below 13 cumecs. The location for monitoring this flow is at the diversion weir flow monitoring location, as described in the Scheme's **Monitoring Plan**.

b) Monitoring will be undertaken as soon as possible after this flow trigger, and no later than two weeks after the date of the flow trigger. As such it would be worthwhile alerting those who will be undertaking the monitoring when the conditions have been met for at least three weeks, such that potential dates for monitoring can be planned and ready to implement as soon as possible if the four week trigger be met.

68. If the trigger specified in the paragraph above (paragraph 67 is not exceeded within the first 12 months following commissioning of the Scheme, then periphyton monitoring will be undertaken once within the next 12 months to ascertain general conditions of periphyton cover within the abstraction reach – unless the specified trigger is breached prior to implementing this monitoring. The specific timing for monitoring will be when flow conditions are most suitable for being able to undertake the field methodology, within the wider time constraints of the monitoring timing.

69. No other planned flow changes relating to scheme maintenance will occur between the flow trigger for periphyton monitoring occurring and the periphyton monitoring being implemented.

6.1.2 Field methodology

70. Periphyton monitoring will be undertaken at five transects within the abstraction reach, although due to practicalities and health and safety considerations this will be limited to the residual reach between the downstream end of Morgan Gorge to the tail race confluence (Figure 1).

71. The location of these five transects will be chosen during the first round of monitoring undertaken. The sites will be chosen based on having habitat conditions most suitable for periphyton growth including the presence of larger substrate upon which periphyton can attach to, and less turbulent

flow. Locations where it is possible to access the full width of the channel for sampling is preferred.

72. Repeat monitoring following implementation of any flushing flows (see Section 7.1.1) must be undertaken at the same transect locations as for the before monitoring. However, given the nature of the river morphology can change after large flood events, there is no expectation for transects to be located at the same point between monitoring trigger events.

73. Monitoring will need to be undertaken by suitably qualified and experienced personnel, including the ability to identify the periphyton types/species relating to this method.

74. Monitoring of periphyton is based on the 'Rapid Assessment Method 1' (RAM1) from Biggs & Kilry (2000)[3] with some practical alterations to the methodology to better suit the conditions in the Waitaha River. At each transect undertake the following:

    a) Estimate the width of the channel (water's edge to water's edge) and divide this into ten roughly equidistant points. If it is possible to do this via running out a tape measure across the channel then do so, but if the conditions do no allow for this then estimate the channel width via other means (i.e., use of geospatial apps such as ESRI Field Maps).

    b) At each of these points across the channel use an underwater viewer to record the % cover of filamentous algae within a defined area.

        i. Filamentous algae is defined as filamentous green/brown algae which have filaments > 3 cm long. Taxa which form such growths include: *Spirogyra, Oedogonium, Stigeoclonium, Microspora, Mougeotia, Cladophora, Rhizoclonium* and *Zygnema.*

        ii. The area within which to assess algal cover will be defined via the use of a metal (or other suitable material) quadrat. The size of the quadrat is not critical (but around 20 cm diameter (or width) is useful), provided the same size is used at all sites/transects and surveys. Thus it is important to record the quadrat size such that the same size quadrat can be used in subsequent surveys. Alternately, an underwater viewer may be used rather than a quadrat on the streambed, with the diameter of the viewer dictating the area of observation.

    c) If it is not possible to sample across the entire width of the channel due to safety considerations, then distribute the quadrats on either side of the river and set the limits of your transects out into the river based on a fixed depth or distance from shore (which will also be recorded). The results will then be expressed in terms of percentage cover of filamentous algae for the "< X m deep" section of the reach. Note that monitoring in this way will require a team on either side of the river.

    d) Take site photos at each transect, and if possible some underwater photos (if water visibility is suitable).

[3] Biggs, B.J.F. & Kilroy, C. 2000. Stream Periphyton Monitoring Manual. NIWA, Christchurch, New Zealand. 246 p.

Figure 1 Map showing the section of river within which periphyton monitoring will occur.

6.1.3 Reporting requirements

75. A summary report will be produced that includes the following:

    a) Location of the monitored transects (including GPS coordinates).

    b) Date of the field survey.

    c) Details of the field methodology (which will follow the methods as described in Section 6.1.2).

    d) Information on the flow conditions prior to and during the monitoring (this can be based on flow records from the diversion weir flow monitoring location) including the date at which the trigger for monitoring occurred.

    e) The % filamentous algae cover per sampling point across each transect, and the overall site (i.e., transect) average % filamentous algae cover.

    f) Commentary as to whether the average % filamentous algae cover exceeds the specified trigger for implementing flushing flows for any of the transects. This trigger is currently set at 20% average filamentous algae cover on a site/transect basis.

76. Westpower will be contacted immediately following completion of the survey to confirm whether or not the average % filamentous algae cover exceeded the specified trigger for implementing flushing flows for any of the transects, such that they can coordinate for the flushing flows to be implemented as soon as possible. The summary report will be provided to Westpower within five working days of the completion of the monitoring.

77. Westpower will implement flushing flows as specified in Section 7.1.1. and include this monitoring and flushing information in the Annual Report.

6.2 Kōaro and other fish monitoring

78. This section covers fish population monitoring within tributary waterways in Kiwi Flat and downstream of the Scheme, including information regarding timing for monitoring, the methods to be used, and the reporting requirements. This monitoring is to be used to inform adaptive management approaches as described in 7.2: Adaptive management of kōaro and other fish in Kiwi Flat.

6.2.1 Fish population monitoring for kōaro recruitment following a BACI design

79. This monitoring will establish whether there continues to be kōaro (*Galaxias brevipinnis*) recruitment into Kiwi Flat waterways with the Scheme (and the kōaro passage structure) in place. This will be done via fish population monitoring following a BACI (before-after-control-impact) design that will allow for wider population stochasticity (i.e., factors affecting recruitment that are not related to the Scheme) to be factored out. Kōaro are diadromous and spend part of their life cycle at sea, meaning that local population dynamics can be affected by overarching factors such as climate change, coastal flow patterns, access to the river mouth, and access through the Waitaha River to the Scheme area. Fish population monitoring via a BACI design is a recommended method for measuring the performance of fish barrier remediation efforts in the New Zealand Fish Passage Guidelines (Franklin et al., 2024[4]).

Timing for monitoring

80. As this monitoring follows a BACI (before-after-control-impact) design, there will be monitoring

[4] Franklin, P., Baker, C., Gree, Eleanor, G., Bowie, S., Melchior, M., Egan, E., Aghazadegan, L. & Vodjansky, E. 2024. New Zealand fish passage guidelines Version 2.0. National Institute of Water & Atmospheric Research (NIWA), Hamilton.

undertaken before the Scheme is operational (this will be the 'before' data), and monitoring after the Scheme is operational (this will be the 'after' data).

a) The 'before' monitoring will include at least two years worth of baseline monitoring (with a preference for three years if practicable (i.e. the construction schedule may not allow for this)) [5] , to establish a realistic picture of kōaro recruitment prior to the Scheme being operational. The before monitoring will occur prior to, or within a month of, any substantial works commencing within the Waitaha River mainstem to install the weir and kōaro passage structure at the top of Morgan Gorge.

b) The 'after' monitoring will be undertaken for five consecutive years following commissioning of the Scheme (i.e., Year 1, 2, 3, 4, 5 of the Scheme's operation), then every five years thereafter (i.e., year 10, 15, 20 and so on). The regularity of the 'after' monitoring can be reviewed as described in the adaptive management approach of Section 77.2.

81. The time of year for undertaking the electrofishing will be informed by the New Zealand Freshwater Fish Sampling Protocols (Joy *et al.,* 2013[6]) which recommends that fish surveys be undertaken from December – April (inclusive). As the monitoring is focusing on kōaro recruitment, and kōaro upstream migration of juveniles is typically during spring (September to November), then sampling between December – April would be suitable to allow for the detection of recent recruits. This is confirmed via the results of past fish surveys in the catchment which were undertaken in February and March and captured recent kōaro recruits (EOS Ecology, unpublished data). Whilst the mainstem of the Waitaha River (which typically has higher flows during spring and summer due to snow melt) is not being sampled, crossing the Waitaha River mainstem may not be possible at this time of year due to the likelihood of higher flows; as such planning for the field surveys will need to allow for helicopter access to some sites.

82. Following completion of the first round of sampling, repeat sampling rounds will be undertaken within the same the same month as (or if weather and wider conditions impact on sampling, then within one month of) the first round of sampling.

Site locations

83. As this monitoring follows a BACI (before-after-control-impact) design, there will be sites within the Kiwi Flat area (i.e., the 'impact' sites) and sites downstream of Mogan Gorge (i.e., the 'control' sites).

84. Sites will be located in tributary waterways rather than the Waitaha River mainstem, as previous surveys have confirmed that there are very few fish inhabiting the mainstem of the river (McMurtrie & Grima, 2025).

85. The number of sites surveyed will need to be sufficient to capture enough kōaro to produce length frequency histograms that can indicate whether there is recruitment occurring (i.e., more than one cohort evident in the histograms). Previous surveys by EOS Ecology indicate that kōaro densities in tributary waterways within Kiwi Flat range from 0-15 kōaro/100 m^2 and in tributary waterways within the Douglas Creek Reach (i.e., from the downstream end of Morgan Gorge to Douglas Creek) range from 0-22 kōaro/100 m^2 (EOS Ecology, unpublished data).

86. Based on fish survey data and known kōaro distribution and densities in the catchment, it is anticipated that 4-7 sites within tributaries in the Kiwi Flat area and 5-9 sites within tributaries downstream of Morgan Gorge may need to be sampled. Figure 2 and Figure 3 provide suggested

[5] To get a third year of 'before data', the sites downstream of Morgan Gorge can be surveyed after the in-channel works at Morgan Gorge commence, provided that the sites in Kiwi Flat are surveyed prior to (or within a month) of those works commencing.

[6] Joy, M., David, B. & Lake, M. 2013. New Zealand freshwater fish sampling protocols: Part 1- Wadeable rivers & streams. Palmerston North, New Zealand, Massey University. Pp. 64.

locations for sites based on past survey data. Sites have not been considered within or upstream of larger tributary waterways that are known to be intermittent/ephemeral or have water flows that are subsurface for some distance (such as Macgregor Creek and Anson Creek). However, the first round of monitoring will confirm the number and specific location of sites, based on the conditions at the time of the first survey and the ability to access sites at that time. As the intent of the survey is to sample sites with kōaro populations, if kōaro are not found at a site during the first sampling round, then they will not be sampled in subsequent years. The final site number and selection will be sufficient to allow for comparison of size distribution of kōaro and kōaro recruitment between the two survey areas (i.e., below Morgan Gorge and within Kiwi Flat) following a BACI design.

Figure 2 Potential locations to undertake electrofishing for fish population monitoring within tributary waterways in the Kiwi Flat area. Number of sites and site locations to be confirmed during the first round of sampling.

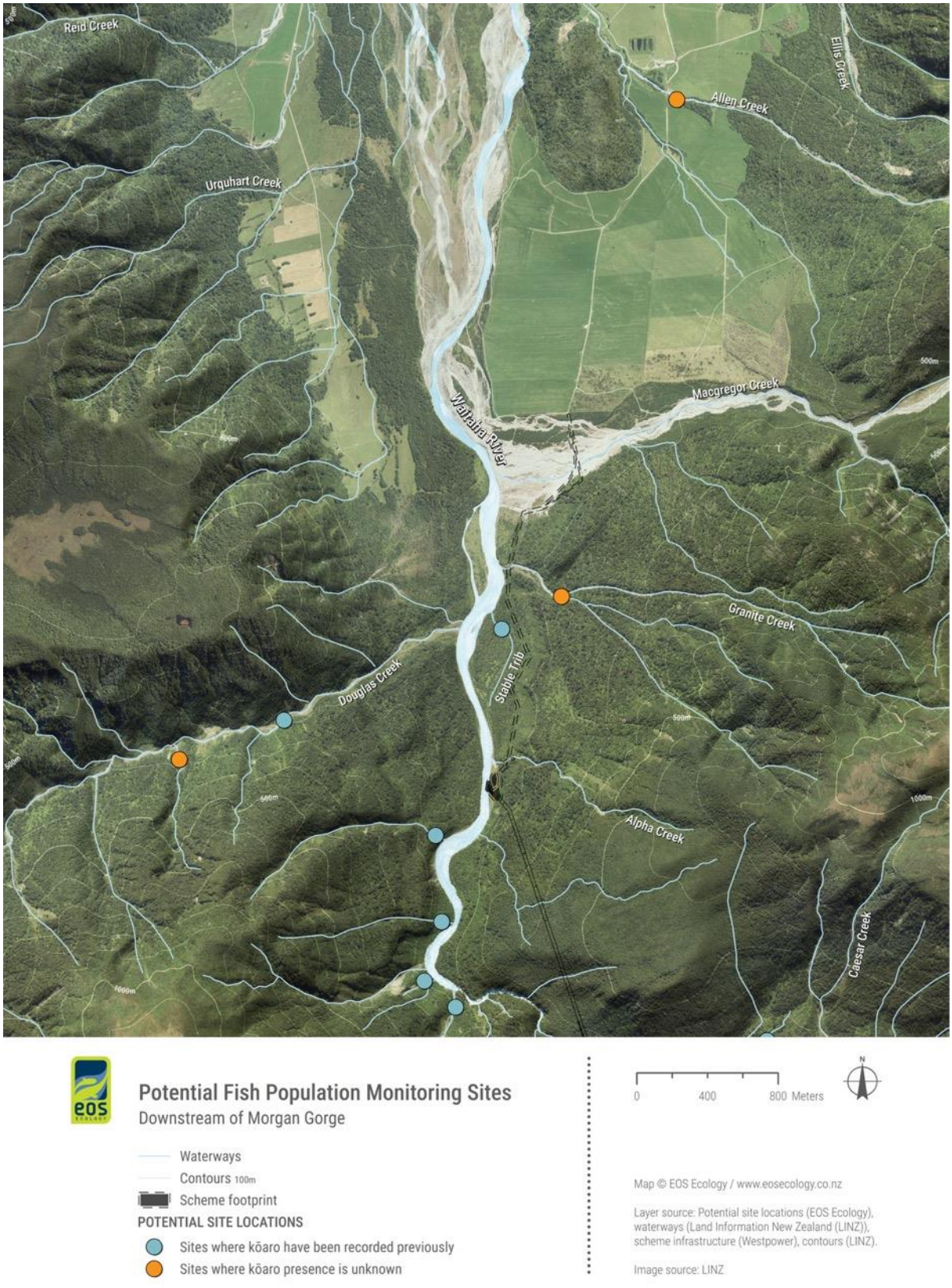

Figure 3 Potential locations to undertake electrofishing for fish population monitoring within tributary waterways downstream of Morgan Gorge. Number of sites and site locations to be confirmed during the first round of sampling.

Field methodology

88. Fish surveys will be undertaken via electrofishing. Electrofishing is defined by the New Zealand Freshwater Fish Sampling Protocols (Joy *et al*., 2013) as the most appropriate method for obtaining reliable relative abundance estimates and collecting size class data, and is classified in the New Zealand Fish Passage Guidelines (Franklin *et al.,* 2024) as an effective method for sampling for kōaro. Based on past fish survey data from within the Waitaha River catchment using a mix of electrofishing, Gee's minnow trapping and fyke netting, electrofishing was also found to be the most reliable method for capturing kōaro (EOS Ecology, unpublished data).

89. All electrofishing surveys will be undertaken by suitably qualified and experienced freshwater ecologists from an organisation with the relevant permits to allow for the capture and release of fish. The types of relevant permits are described in Section 4.3 (paragraph 18.

90. The method for electrofishing surveys is informed by the 'single pass' electrofishing survey protocols as described in the New Zealand Fish Passage Guidelines (Franklin *et al.,* 2024) for fish population monitoring. However, the methods prescribed here are based on the fish monitoring in this FEMP being focused on determining whether kōaro recruitment into Kiwi Flat is continuing following commissioning of the Scheme, rather than to quantify changes in fish numbers. In general, the electrofishing methods will be as follows:

    a) At least three personnel are used for electrofishing surveys; one to operate the machine and a dip net, one to hold the hand-held stopnet, and one with an extra dip net and assist with buckets and measuring etc.

    b) The settings for the electrofishing machine (including choice of wand size) will follow best practice and be based on site conductivity, target species, and water depth.

    c) The site can be fished either in an upstream to downstream, or downstream to upstream direction – whichever is most appropriate for the site conditions and for maintaining good water clarity for fishing.

    d) As far as practicable, fishing will move across the stream (i.e., from one bank to the other) and then step downstream (or upstream) to fish across the stream in the opposite direction, continuing on until the site has been fished. The operator of the electrofishing machine will typically be fishing from 1-2 m upstream of the hand-held net, and that is the distance that the person operating the handheld stopnet will step downstream (or upstream) for each fishing set across the channel.

    e) Fish captured will be placed in buckets for later identification and measuring, following appropriate fish husbandry measures as described below.

    f) Upon completion of the fishing all fish species caught will be identified to species level and their length measured[7] (nose to distal end of the caudal fin) in mm. Gravid individuals and other distinct conditions (such as signs of infection) will also be noted for kōaro, in particular.

    g) Fish will be returned to the survey site after measuring and recovery, following fish husbandry considerations as described below.

    h) The total shock time (elapsed time on the back of the fishing machine), the voltage used, wand size, the number of sub-reached fished (see paragraph 92, and actual start and finish time for the total reach will also be recorded.

[7] Measuring fish length for species other than kōaro is recommended but is not mandatory, given the focus on kōaro recruitment for this monitoring. However it will provide insight to the population ecology of a site and help with building up a better picture regarding heterospecific species interactions.

91. Fish husbandry considerations are as follows:

    a) Upon capturing, fish (as well as waikōura/freshwater crayfish (*Paranephrops planifrons*), if also caught) shall be placed in a bucket of appropriate volume for the number of fish and part filled with clean stream water. Fish density and behaviour shall be monitored regularly for any signs of distress (e.g. air gulping). Buckets shall not be overstocked and larger eels (>500 mm) and waikōura shall be kept in separate containers to other captured fish to avoid injury or predation.

    b) Upon release, the fish shall be distributed across the fished site, with small fish released first.

    c) Any pest fish captured will be humanely euthanised.

    d) Fish shall be handled with wet hands or gloves to reduce the risk of injury to fish.

    e) If fish anaesthetic is used to reduce stress for fish whilst handling for measuring (such as for eels) then its use will follow accepted anaesthesia use protocols and be an anaesthetic that is approved for use on food fish. Any fish that are anaesthetised will be closely watched and allowed to fully recover prior to release back to the survey site.

92. Site length:

    a) The New Zealand Fish Passage Guidelines (Franklin *et al.,* 2024) and New Zealand Freshwater Fish Sampling Protocols (Joy *et al*., 2013) recommend that the site length for electrofishing surveys be 150 m, in order to detect >90% of fish species at a site. This is considered to be impractical given the focus of the monitoring (to monitor kōaro recruitment), the environment, and the number of sites being fished during each sampling round. As such it is recommended that the site length is dictated by site conditions and the abundance of kōaro, with it anticipated that site length may be somewhere between 25-100 m.

    b) If a longer site length be used, then as per the New Zealand Fish Passage Guidelines, the site can be broken into sub-reaches (typically 15 m in length), and a portion of those sub-reaches fished. If the entire site is not fished then the number (and length) of sub-reaches fished will be recorded, with the sub-reaches fished focusing on those areas of the site that are more likely to have kōaro.

    c) As the focus of this monitoring is to establish information about kōaro recruitment, site length will ultimately be guided by the abundance of kōaro. For example, if many kōaro are being caught then it would make sense to fish a greater area to increase the number of kōaro in the dataset, as kōaro abundance at other sites may be lower.

    d) Once the first survey has been undertaken the site length will be set for the site for subsequent surveys, unless fishing effort in subsequent years needs to increase to gather sufficient information on kōaro size distribution.

93. Following completion of electrofishing, habitat measures at each site are to be taken including the following:

    a) Total site length and average width (based on at least three width measurements) to enable calculation of total survey area.

    b) Thalweg depth (taken at the same location as channel widths are measured)

    c) An estimate of substrate composition across the site (percentage composition of bedrock, boulder, large cobble, small cobble, pebbles, gravel, sand and silt).

    d) An estimate of the percentage cover of aquatic vegetation (filamentous algae, diatoms, mosses and liverworts, woody debris, coarse particulate organic matter and leaf litter).

e) An estimate of percentage fish cover provided by in-stream and riparian attributes such as substrate, macrophytes, woody debris, overhanging vegetation, undercut bank, riparian vegetation composition (percentage composition of grass, scrub, willows, native vegetation, grass or open gravel bed).

f) The proportion of habitat covered by geomorphic flow types such as pools, runs, step-pools, rapids, cascades, rock gardens, plane-bed, riffles etc.

g) Channel stability using the Pfankuch (1975) channel stability evaluation.

h) % canopy cover of the survey site.

94. The site location is to be recorded via GPS coordinates taken at the downstream end of the site, and site photos are to be taken.

Reporting requirements

95. Data analysis:

a) Electrofishing data will be presented as number of fish caught per 100 m^2, and number of kōaro caught per 100 m^2 per site, with graphs and/or tables also presenting this per survey area (Kiwi Flat and downstream of Morgan Gorge).

b) Length frequency histograms will be produced for kōaro for all combined sites within the Kiwi Flat area and for all combined sites downstream of Morgan Gorge. These will be visually assessed to identify the presence of cohorts.

c) The number and proportion of juvenile/new recruits (considered to be < 100 mm based on size distribution data collected by EOS Ecology in the Waitaha River catchment in 2008 and 2013[8]) and adult/older individuals (considered to be > 100 mm in length) kōaro found within the two survey areas (Kiwi Flat and downstream of Morgan Gorge) can be summarised. Note that the length at which it is a juvenile/new recruit vs an older individual can also be finalised following completion of the 'before' monitoring rounds.

d) The presence of kōaro juveniles/new recruits within the Kiwi Flat area would indicate that recruitment is occurring. However, additional statistical analysis of the kōaro fish data to compare the two survey areas prior to commissioning of the Scheme, and then based on the BACI approach once there is some 'after' monitoring data, is required to indicate whether there is any change occurring to kōaro recruitment into Kiwi Flat with the Scheme operational.

96. A summary report will be produced that includes the following:

e) Location of the monitored sites (via GPS coordinates).

f) Date of the field surveys.

g) Details of the field methodology (which will follow the methods as described in Section 6.2.1: Fish population monitoring for kōaro recruitment following a BACI design.

h) Information on the general flow conditions prior to and during the monitoring – this can be based on data from the Scheme's flow monitoring locations at Waitaha Gorge and Scamper Torrent.

i) A summary of the data analysis as described in paragraph 95.

j) Any other observations made during the surveys.

8 Studies have shown that kōaro size distribution can be quite variable between systems. As such it is relevant to select size cutoff points for defining 'new recruits' based on kōaro size distribution data from the catchment.

k) A conclusion regarding whether it is considered that kōaro recruitment into Kiwi Flat may be impacted by fish passage via the Scheme structure.

97. The summary report along with an excel file of the fish survey data and site photos will then be provided to Westpower within four months of completion of the fish surveys. Westpower is responsible for including this information as part of their Annual Report.

98. Fish data will also be submitted to the New Zealand Freshwater Fish Database, which is a national online database for the repository of fish survey data.

6.2.2 Monitoring for other fish species in Kiwi Flat waterways during the Scheme's operation

99. This monitoring is to confirm whether there continues to be an absence of other fish species in Kiwi Flat waterways with the Scheme (and the kōaro passage structure) in place. This is to be done via sampling waterways in the Kiwi Flat area via eDNA sampling, supplemented with the data obtained via electrofishing surveys for waterways in the Kiwi Flat area as described in Section 6.2.1.

Site locations

100. The eDNA sampling is to be undertaken at seven tributary sites and one mainstem site within the Kiwi Flat area. Site locations are provided in Figure 4, and have been informed by eDNA sampling undertaken by McMurtrie & Grima (2024[9]).

Timing for monitoring

101. Following commissioning of the Scheme, eDNA sampling will be undertaken for five consecutive years following commissioning of the Scheme (i.e., Year 1, 2, 3, 4, 5 of the Scheme's operation), then every five years thereafter (i.e., year 10, 15, 20 and so on). The regularity of the monitoring can be reviewed as described in the adaptive management approach of Section 7.2.

102. The time of year for undertaking the electrofishing will be informed by the New Zealand Freshwater Fish Sampling Protocols (Joy *et al.,* 2013[10]) which recommends that fish surveys be undertaken from December – April (inclusive). As the eDNA sampling is for detection of any fish species other than kōaro within the Kiwi Flat area, timing is not connected to any particular species migration period. Ideally, eDNA sampling within that December-April period would be undertaken at a different month to the electrofishing surveys described in Section 6.2.1, so as to increase the chance of detecting other fish across the two survey types. However, if eDNA sampling is carried out at the same time as the electrofishing surveys, eDNA sampling will occur prior to the commencement of the electrofishing surveys, to avoid any eDNA contamination from the use of fishing gear between sites.

103. Avoid collecting samples after a period of heavy rainfall, which may flush or dilute the eDNA, wash away the organisms in the stream, or stir up sediments into the water column that will quickly clog the eDNA filters.

104. Following completion of the first round of sampling, repeat sampling rounds will be undertaken within the same the same month as (or if weather and wider conditions impact on sampling, then within one month of) the first round of sampling.

---

[9] McMurtrie, S & Grima, C. 2024. Proposed Waitaha Hydro Scheme: Summary of Freshwater Biota Records from eDNA Sampling. EOS Ecology Report No. WES05-24011-01. EOS Ecology, Christchurch. 29 p.

[10] Joy, M., David, B. & Lake, M. 2013. New Zealand freshwater fish sampling protocols: Part 1- Wadeable rivers & streams. Palmerston North, New Zealand, Massey University. Pp. 64.

Figure 4 Sampling locations for eDNA sampling within the Kiwi Flat area. Proposed site locations are informed by the eDNA sampling undertaken by McMurtrie & Grima (2024).

Field methodology and laboratory testing

105. The collection of water samples for eDNA testing will follow the most recent best practice guidance (at the time of this FEMP the current best practice is provided by Melchior & Baker(2023))[11]. At the time of writing this FEMP the current best practice includes the collection of six replicate 'active' or 'syringe' samples per site. Based on past eDNA sampling by McMurtrie & Grima (2024) the water clarity is such that it will be possible to use the finer 1.2 micron filter size.

106. Samples will be taken from within the main flow of water at the site.

107. Gloves will be worn and all other sampling protocols provided with the eDNA kits should be followed. All measures will be taken to ensure that there is no contamination of the samples.

108. The amount of water filtered through the syringe will be recorded (typically this should be 1 litre of water but if there are particles in the water the amount filtered may be less as the filter becomes clogged).

109. Site coordinates and site photos will be taken at each site.

110. Samples will be stored as per the instructions provided by the testing laboratory and delivered to the testing laboratory as soon as possible after collection.

111. Laboratory testing will be undertaken by an accredited or reputable eDNA testing laboratory. At the time of writing this FEMP this service was provided by Wilderlab, with Hill Laboratories announcing provision of this service imminently.

112. Laboratory testing will be sufficient to be able to detect all fish species that may be found in New Zealand.

6.2.3 Reporting requirements

113. eDNA data supplied by the testing laboratory will be checked for the presence of fish species. If fish species are detected in a sample then the strength of the signature and the number of replicate samples that the species has been detected in will be documented to show whether the result has strong or a weak support.

114. Further interpretation of the results by an experienced freshwater ecologist knowledgeable of the Waitaha catchment and the sampling locations will be required to also ascertain if any detection of fish eDNA is likely to be a valid result or not, as eDNA sequence counts are influenced by many factors (including the proximity of organisms to the sampling point, the presence of dead or decaying organisms, environmental conditions that can accelerate or decelerate eDNA breakdown, and assay biases that might lead to preferential detection of specific groups of organisms). Further discussion can be found in Melchior & Baker (2023).

115. Results from electrofishing surveys undertaken as per Section 66.2.1 will also be used to further confirm the presence of other fish species in the Kiwi Flat area.

116. A summary report will be produced that includes the following:

l) Location of the monitored sites (via GPS coordinates).

m) Date of the field surveys.

n) Details of the eDNA field methodology (which will follow the methods as described in Section 66.2.2: Field methodology and laboratory testing).

11 Melchior, M. & Baker, C. 2023. Environmental DNA guidelines and field protocols for lotic systems. National Institute of Water & Atmospheric Research Ltd, Hamilton.

o) Information on the general flow conditions prior to and during the eDNA monitoring – this can be based on data from the Scheme's flow monitoring locations at Waitaha Gorge and Scamper Torrent.

p) A summary table showing what fish species were detected at each site based on the eDNA survey and commentary on whether the findings are considered to be valid or not (as per matters described in Paragraph 113 and 114), including further consideration of findings from the electrofishing surveys undertaken in the Kiwi Flat area as per Section 66.2.1.

117. The summary report along with the raw and cleansed data set will then be provided to Westpower within four months of receipt of the eDNA results from the testing laboratory, or completion of the electrofishing surveys as described in Section 66.2.1 (whichever comes later). Westpower is responsible for including this information as part of their Annual Report.

7 ADAPTIVE MANAGEMENT

The monitoring described in Section 6 is to be used to inform adaptive management approaches as described here.

7.1 Managing filamentous algae buildup

118. This is informed by monitoring specified in Section 76.1: *Periphyton (specifically filamentous algae) monitoring within the abstraction reach.*

7.1.1 Implementing flushing flows

119. Whilst excessive periphyton growth is not expected to be an issue due to the regularity of large bed-moving floods that will continue even with the Scheme, monitoring and the implementation of additional effects management measures where necessary would ensure any potential effects of residual flow on filamentous algae growth (and from that invertebrate communities) could be reduced from a 'minor' to 'less than minor' level.

120. If the results of any periphyton monitoring (see Section 76.1) undertaken as a result of the flow conditions trigger specified in paragraph 67 identifies that there is more than an average of 20% filamentous algae cover at any of the monitoring transects (this is based on the site/transect average), then a flushing flow will be required to help to reduce this algal cover. Studies have shown that it is the magnitude of the flow change (from the flow conditions that the periphyton have been acclimated to) that is critical to controlling periphyton growth, with a minimum change in flow of three times the preceding stable flow being needed to remove significant amounts of filamentous algal biomass (Biggs & Close, 1989[12]; Claussen & Biggs, 1997[13]). As such, this 'flushing flow' can be done by undertaking a managed shutdown of the scheme that allows for at least three times of the median flow experienced during the four week residual flow period that triggered the periphyton monitoring (i.e., paragraph 67, to pass down the abstraction reach for a minimum of 6 hours.

121. The flushing flow will be implemented as soon as possible following notification of exceedance of the monitoring trigger (paragraph 67, and no later than two weeks after this notification.

122. The ramping rate used for the flushing flow will be either

---

[12] Biggs, B. & Close, M.E. 1989. Periphyton biomass dynamics in gravel bed rivers: the relative effects of flows and nutrients. Freshwater Biology 22(2): 209-232.

[13] Clausen, B. & Biggs, B. 1997. Relationships between benthic biota and hydrological indices in New Zealand streams. Freshwater Biology 38(2): 327–342.

a) as per that specified in the Approvals conditions, or

b) any modified ramping rate as determined via the adaptive management approach for testing and modifying the ramping rate, based on findings from initial testing to observe flow changes and check for fish stranding within the abstraction reach and in the braided section of the Waitaha River downstream of the tail race. This is covered in the Site Operations and Management Plan (SOMP).

123. Following the implementation of the flushing flow the periphyton monitoring (as described in Section 66.1.2) will be undertaken again, at the same locations as per the pre-flushing monitoring. This will be done as soon as possible after the flushing flows and certainly within a week of the flushing flow.

124. If the results of this follow up monitoring identifies that more than 20% (average) cover of filamentous algae remains at any of the monitoring transects, then a repeat of the flushing flow will be required to help to reduce this algal cover. Implementation of the flushing flow will be as described in Paragraph 121 and 122, but in this instance a greater portion of flow will be passed through the residual reach for a longer period of time, with the magnitude of increase being agreed upon between the periphyton monitoring team and Westpower.

125. Following implementation of this secondary flushing flow the periphyton monitoring (as described in Section 66.1.2) will be undertaken again. This will be done as soon as possible after the flushing flows and certainly within a week of the flushing flow.

7.1.2 Adaptive management pertaining to periphyton monitoring and results from flushing flows

126. The findings from the periphyton monitoring (as per Section 66.1) and any flushing flows implemented (as per Section 77.1.1) will be used to update the following components of the periphyton monitoring and management plan:

c) The triggers for monitoring which are currently specified in Section 66.1 (paragraph 67 and which may be informed by the findings of the other periphyton monitoring undertaken as per Section 66.1 (paragraph 68.

d) The trigger for implementing a flushing flow that is currently defined in Section 77.1.1 (paragraph 120, and which can be further informed by the findings of the other periphyton monitoring if undertaken as per Section 66.1 (paragraph 68.

e) The duration of the flushing flow that is currently defined in Section 77.1.1 (paragraph 120 and Section 77.1.1 (and paragraph 124, and which can be further informed by any flushing flow that is implemented as part of this programme.

7.2 Adaptive management of kōaro and other fish in Kiwi Flat

127. This is informed by monitoring specified in Section 66.2: *Kōaro and other fish monitoring.*

7.2.1 Adaptation of methods

128. Site locations and site length, as described in Section 66.2.1 (Fish population monitoring for kōaro recruitment following a BACI design) will be confirmed upon completion of the first round of ‘before’ monitoring. Although it is acknowledged that fishing effort in subsequent years may change (i.e., increase) in order to gather sufficient information on kōaro size distribution.

129. The length at which it is considered to be a juvenile/new recruit vs an older individual can also be finalised following completion of the ‘before’ monitoring rounds.

7.2.2 Adaptive management based on fish population monitoring for kōaro recruitment

130. During the first five years of the Scheme's operation, if there are three consecutive years where report findings from Section 66.2.1 (Fish population monitoring for kōaro recruitment following a BACI design) conclude that kōaro (*Galaxias brevipinnis*) recruitment into Kiwi Flat may be impacted by fish passage via the Scheme structure, then the kōaro passage structure will be reassessed by a qualified and experienced freshwater ecologist (ideally the same person as involved in the design), with input sought from DOC, and the Scheme's engineer to confirm if there are practicable modifications that can be done to the structure to improve kōaro passage.

131. Any works on the kōaro passage structure to remediate it because of this, will follow similar erosion and sediment control, and environmental construction management as defined in the construction ESCP and CEMP.

132. Following completion of any such remediation works on the kōaro passage structure (i.e, as required for paragraph 130 and 131, the 'after' monitoring (as described in Section 66.2.1 (Fish population monitoring for kōaro recruitment following a BACI design)) four consecutive years of monitoring described in Section 6.2.1 (Fish population monitoring for kōaro recruitment following a BACI design) will be undertaken, and the adaptive management approach described in above in Paragraph 130 to 132 will be repeated.

133. Review of the monitoring regularity

a) If monitoring during the first five years of the Scheme's operation (or after remediation) concludes that kōaro recruitment into Kiwi Flat is not impacted by fish passage via the Scheme structure, then the regularity of further monitoring (currently set at every five years thereafter as described in paragraph 80 (b)) can be reviewed.

b) After four rounds of five-yearly (or otherwise modified return period) repeat monitoring, a further review of the monitoring can be undertaken, with consideration of the regularity of the monitoring or whether the monitoring stops altogether.

c) Any review of the monitoring regularity will be undertaken by the relevant freshwater ecologist, with input sought from DOC.

7.2.3 Adaptive management based on detection of other fish species (apart from kōaro) in Kiwi Flat

134. If monitoring, as described in Section 66.2.2 (Monitoring for other fish species in Kiwi Flat waterways during the Scheme's operation) detect the presence of other fish species apart from kōaro in the Kiwi Flat area via eDNA sampling that cannot be explained as an invalid result, then it will be confirmed via conventional fish surveys (such as electrofishing). If conventional fish surveys confirm the presence of other fish species apart from kōaro, then the following will be implemented:

a) Confirmation as to whether the fish species found has the potential to impact on the kōaro population at Kiwi Flat (i..e, salmonids). If not then a capture and release programme will not be needed. If so then a capture and release (downstream of Morgan Gorge) programme will be developed and implemented (with relevant transfer approvals in place) as soon as possible.

b) The kōaro passage structure will be assessed by a qualified and experienced freshwater ecologist (ideally the same person as involved in the design), with input sought from DOC, and the Scheme's engineer to confirm if there are practicable modifications that can be done to the structure to resolve the issue.

c) Any works on the kōaro passage structure to remediate it because of this should follow

relevant Approval conditions and similar erosion and sediment control, and environmental construction management as defined in the construction ESCP and CEMP.

135. Following completion of any such remediation works on the kōaro passage structure, the 'after' monitoring (as described in Section 66.2.2 Monitoring for other fish species in Kiwi Flat waterways during the Scheme's operation), four consecutive years of monitoring described in Section 6.2.2 (Monitoring for other fish species in Kiwi Flat waterways during the Scheme's operation) will be undertaken.

136. Review of the monitoring regularity

a) If monitoring during the first five years of the Scheme's operation (or after remediation) concludes that there are no other fish species present in Kiwi Flat, then the regularity of further monitoring (currently set at every five years thereafter as described in paragraph 101 can be reviewed.

b) After four rounds of five-yearly (or otherwise modified return period) repeat monitoring, a further review of the monitoring can be undertaken, with consideration of the regularity of the monitoring or whether the monitoring stops altogether.

c) Any review of the monitoring regularity will be undertaken by the relevant freshwater ecologist, with input sought from DOC.

8 REVIEW REQUIREMENTS

137. This FEMP and its implementation will be reviewed on an as needs basis during operation of the Scheme. The review will consider the following:

a) Efficacy of management practices and mitigation strategies;

b) Complaints;

c) Incident reports;

d) Changes in organisational structure;

e) Changes in novel monitoring and mitigation strategies; and

f) Changes in legislation and standards.

i. To incorporate new scientific findings, technological advancements, or changes in regulatory requirements.

ii. To update in response to any feedback from stakeholders and experts that will improve management practices.

iii. To accommodate sequencing and changes to the construction programme and design.

9 OTHER REFERENCES

DOC (Department of Conservation). 2010. West Coast Conservation Management Strategy Volume I 2010–2020. West Coast *Tai Poutini* Conservancy Management Planning Series No. 10. Department of Conservation, Hokitika, New Zealand. Available at: https://www.doc.govt.nz/documents/about-doc/role/policies-and-plans/west-coast-cms-2010/westcoast-cms-complete.pdf. Accessed: 2 July 2025.

Dunn, N.R., Allibone, R.M., Closs, G.P., Crow, S.K., David, B.O., Goodman, J.M., Grifiths, M. Jack, D.C., Ling N., Waters, J.M. & Rolfe, J.R. 2018. Conservation status of New Zealand freshwater fishes, 217. New Zealand Threat Classification Series 24. Department of Conservation, Wellington. 11 pp.

Evergreen Mapping NZ. 2024. Wilderness Areas of New Zealand. Prepared by Evergreen Mapping NZ for the Federated Mountain Clubs of New Zealand. Available at: https://www.arcgis.com/apps/View/index.html?appid=5ddf67795e9443abb933b9e751fb581b. Accessed: 2 July 2025.

Grainger, N., Harding, J., Drinan, T., Collier, K., Smith, B., Death, R., Makan, T. & Rolfe, J. 2018. Conservation Status of New Zealand Freshwater Invertebrates, 2018. Department of Conservation, Wellington, New Zealand. 25p

TTPPC (Te Tai o Poutini Plan Committee). 2022. Te Tai o Poutini Plan. A combined district plan for the West Coast. Proposed Plan. Prepared by Te Tai o Poutini Plan Committee in association with West Coast Regional Council, Greymouth, New Zealand. Available at: https://ttpp.nz/wp-content/uploads/2023/02/ProposedTTPP_2023.pdf. Accessed: 2 July 2025.

WCRC (The West Coast Regional Council). 2020. West Coast Regional Policy Statement 24 July 2020. The West Coast Regional Council, Greymouth, New Zealand. Available at: https://www.wcrc.govt.nz/repository/libraries/id:2459ikxj617q9ser65rr/hierarchy/Documents/Publications/Regional%20Plans/Regional%20Policy%20Statement/Operative%20RPS%20final%2014%20July%202020.pdf. Accessed: 2 July 2025.

WDC (Westland District Council). 2002. Westland District Council - District Plan. Operative 1 June 2002. Hokitika, New Zealand. Available at: https://www.westlanddc.govt.nz/sites/default/files/westland-district-plan-current.pdf Accessed: 2 July 2025.