

APPENDIX H Fish Passage Assessment

New Zealand Transport Agency Waka Kotahi

BRYNDERWYN HILLS RECOVERY WORKS: FISH PASSAGE ASSESSMENT

13 AUGUST 2024



BRYNDERWYN HILLS RECOVERY WORKS - FISH PASSAGE

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REV	DATE	DETAILS
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EXECUTIVE SUMMARY

WSP completed a fish passage assessment of 10 structures in the beds of watercourses as part of the Brynderwyn Hills Recovery Works Project. This requires assessment under the Severe Weather Emergency Recovery (Waka Kotahi New Zealand Transport Agency) Order 2023 (WK-OIC) which includes modification to the Freshwater Fisheries Regulations 1983. There are specific conditions that emergency recovery works avoid more than minor adverse effects on: a naturally uncommon ecosystem, a At Risk or Threatened species, a taonga species, and significant adverse effects on protected wildlife.

A desktop assessment included a review of stormwater design drawings. Field assessments were undertaken from October 2023 to January 2024 and included assessment of stream classification, collection of Environmental DNA (eDNA), characteristics of instream habitat upstream and downstream of the road, and assessment of existing and/or installed stormwater structures.

Species recorded directly upstream and downstream of the road include 'Not Threatened' shortfin eel (*Anguilla australis*), freshwater crayfish (*Paranephrops planiformis*), and 'At Risk, Declining' longfin eel (*Anguilla dieffenbachii*) and Hochstetter frogs (*Leiopelma hochstetteri*). All of these species are taonga species.

The streams in the vicinity of the road are near the headwaters within naturally high gradient sites. They are challenging to provide fish passage for at the points where they intersect the road. Some of the structures, installed during emergency works, will be retrofitted with fish passage solutions to enhance the passage of indigenous fishes with good climbing ability, such as eels.

Fish habitat upstream of State Highway 1 (SH1) is limited in many streams, either due to being intermittent, having minimal flow, minimal habitat, the steep gradient of the natural stream or being lost as part of damage incurred during severe weather events.

Fish passage exemptions are proposed at Sites A, B1, F1, and G3 as the overall level of effect is considered low or very low. Fish passage is required at Sites D2, G2, H and J as there is considered a higher level of effect. Low cost retrofit options are proposed to achieve fish passage at these sites to achieve a low or very low overall level of effect.

Site I is not eligible for an exemption under the WK-OIC. This site is considered to restrict fish passage and there is risk of this structure receiving an abatement notice for non-compliance, requiring fish passage to be improved. Therefore, a low cost retrofit option has been recommended.

1 INTRODUCTION

1.1 REPORT OVERVIEW

New Zealand Transport Agency Waka Kotahi (NZTA) have engaged WSP New Zealand (WSP) to undertake a Fish Passage Assessment of all structures in the beds of watercourses as part of the Brynderwyn Hills Recovery Works Project ('Project'). A total of 10 structures are located within stream through the project area. This Report details the findings of this assessment.

1.2 PURPOSE AND SCOPE

The purpose of this Report is to inform a resource consent application and permit application under Clause 39 of the WK-OIC for the exemption or dispensation in relation to the provision of fish passage at certain structures within the project area.

The scope of this work includes:

- An introduction, project overview and WK-OIC
 - A description of sites and structures in the beds of streams
 - A high-level fish passage assessment
 - An assessment of the potential effects of restricted fish passage on freshwater fauna
-

1.3 PROJECT OVERVIEW

SH1 serves as a vital transport link, connecting Northland with Auckland and the rest of the country. This section of SH1, situated in the Waipu River catchment, through the Brynderwyn Hills (Brynderwyns) has become subject to multiple landslips following the extreme weather events that occurred in 2022 and 2023. NZTA first started undertaking emergency works at the Brynderwyns in August 2022, which were subsequently held up due to additional weather events, including Cyclone Gabrielle in February 2023.

To enable the SH1 road repair and reinstatement works, slip remediation and land stabilisation works must first be undertaken to allow safe access to the damaged road. To address these issues and ensure the continued safe and reliable operation of SH1, NZTA is now undertaking bulk earthworks to remediate slips, and repair and strengthen SH1 along the affected section. As part of this work, culverts, and associated stormwater infrastructure, conveying watercourses beneath SH1, have been repaired and replaced where necessary. These structures now require an assessment against the specific requirements of Section 39 of the WK-OIC, which is set out below in Section 1.4.

Providing and maintaining fish passage through structures in waterways is a requirement of the Freshwater Fisheries Regulations 1983 and regulated under the National Environmental Standards for Freshwater 2020 (NES-FW). However, in cases where facilitating the passage of fish is not feasible or possible, NZTA may seek fish passage authorisations (i.e., permits exempting structures from providing for the passage of fish) from the Department of Conservation (DOC), pursuant to the WK-OIC. These authorisations essentially serve as permits exempting them from the obligation to ensure fish passage as per the Freshwater Fisheries Regulations 1983 (as modified by Clause 39 of the WK-OIC).

1.4 ORDER IN COUNCIL

Part 5 of the WK-OIC sets out modifications to the Freshwater Fisheries Regulations 1983. Section 39, set out below, is the relevant section of this Part and sets out the information and assessment requirements in relation to fish passage.

39 Approval, exemption, or dispensation in relation to fish passage

(1) This clause applies if the Agency applies, under regulation 42(1) or (2), 43(2), or 44(1) of the regulations, for an approval, an exemption, or a dispensation for the purpose of carrying out recovery work.

(2) Regulations 43 and 44 of the regulations are modified as set out in this clause.

(3) Regulations 43(3), 44(2) and (3) of the regulations do not apply to the application, approval, exemption, or related recovery work.

(4) Every application for an approval, an exemption, or a dispensation must include the following information, except where the Director-General or Minister of Conservation alters these requirements to make them less onerous, on a case-by-case basis:

(a) a description of the proposed activity, including:

(i) the purpose and description of the culvert, ford, dam, or diversion structure; and

(ii) the type of approval, exemption, or dispensation for which the applicant is applying; and

(iii) a description of the place where the proposed activity will be carried out (including the legal status of that place); and

(iv) the proposed duration of the approval, exemption, or dispensation, and the reasons for the proposed duration; and

(b) an assessment of the potential effects of the proposed activity, including:

(i) known and predicted freshwater ecosystem and fishery values of the water body or wetland; and

(ii) an assessment of the effects on those values of providing or not providing fish passage, including the matters addressed in subclause (8); and

(iii) any actions that the applicant proposes to take to avoid, remedy, or mitigate any adverse effects of the proposed activity; and

(iv) for a ford or culvert, the name of the person who determined that fish passage was or will be impeded; and

(v) for a dam or diversion structure,—

(A) whether a fish facility is proposed to be included or a dispensation sought; and

(B) technical specifications for any fish facility to be provided; and

(c) details of any consultation in addition to that required by Schedule 5; and

(d) relevant information relating to the applicant, including any information relevant to the applicant's ability to carry out the proposed activity.

(5) The application must also include a report on the consultation undertaken in relation to the proposed recovery work.

(6) The report must include the following information:

(a) the names and contact details of Māori entities the Agency has engaged with:

(b) the names of entity representatives who attended meetings on the proposed recovery work and the dates of those meetings:

(c) a summary of discussions, including any concerns raised about the potential adverse effects of the proposed recovery work on taonga species known or predicted to be in the area for which the approval, exemption, or dispensation is sought:

(d) the Agency's responses to any concerns raised.

(7) A policy, management strategy, or management plan that would otherwise apply to fish passage does not apply in relation to the application, approval, exemption, dispensation, or recovery work.

(8) The Director-General may decline to grant the approval, exemption, or dispensation if the Director-General considers that—

(a) the information provided in accordance with subclauses (4) to (6) in support of the application is insufficient to enable the adverse effects of the recovery work on the ecosystems and fisheries to be adequately assessed; or

(b) the conditions set out in Schedule 5 would not be sufficient to avoid—

(i) more than minimal adverse effects on any of the following that are known or predicted to be in the water body in relation to which approval is sought:

(A) a naturally uncommon ecosystem:

(B) at-risk or threatened species (other than a species categorised as at-risk and recovering, relict, or naturally uncommon):

(C) a taonga species:

(ii) significant adverse effects on protected wildlife.

(9) The only conditions that the Director-General may impose on the approval, exemption, or dispensation are the conditions set out in Schedule 5.

(10) If, 20 working days after the date on which the application referred to in subclause (1) was received by the Department of Conservation, the Director General has not granted or declined to grant the approval, exemption, or dispensation, the Agency is deemed to have been granted the approval, exemption, or dispensation with all the conditions set out in Schedule 5.

1.5 SITE LOCATIONS

The Project location in the Brynderwyns is shown below on Figures 1-1. The affected SH1 corridor ('Corridor') is approximately 2.5 km in length, situated within indigenous forest area, classed as an Outstanding Natural Landscape by the Northland Regional Council (NRC Local Maps, 2021), with high ecological values (WSP, 2023). The Project footprint is largely within road reserve and Crown owned land; however, some areas requiring remediation work extend into private land (Table 1-1).

Watercourses at the Project site are largely high-gradient stream systems, close to their headwaters, which are too small to be captured on the River Environment Classification (REC) system (Snelder et al., 2004).

The locations of culverts in the beds of watercourses that have been assessed by this Report are identified below in Table 1-1 and shown on Figure 1-2.

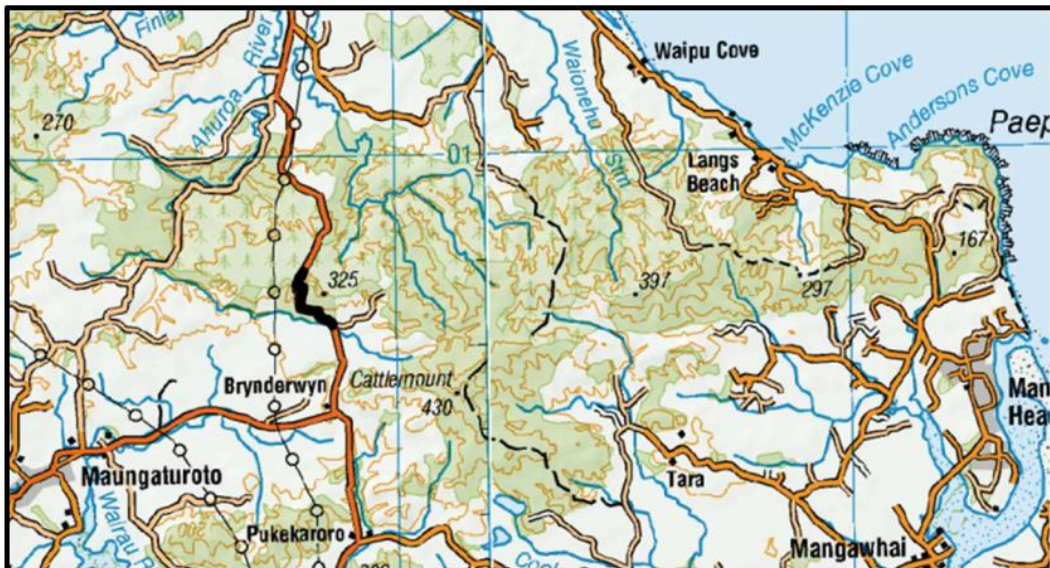


Figure 1-1: SH1 Recovery works location (black line). (Source: www.topomap.co.nz)

Table 1-1: Site locations

CULVERT IDENTIFICATION ¹	STREAM NAME	APPROXIMATE CHAINAGE	APPROXIMATE COORDINATES (NZTM)	LEGAL DESCRIPTION OF LAND	PROPERTY OWNER
1	A (Fill Site)	CH11685	1728005.28 6007334.98	Lot 1 DP 422449	Zentral Estate Limited
2	B1 (Fill Site)	CH11846	1727859.57 6007251.38	Part Allot 316A PSH OF Waipu	Zentral Estate Limited
3	B2	CH12044	1727747.31 6007134.33	Part Lot 2 DP 24461	Crown land
4	C	CH12160	1727755.67 6007066.26	Part Lot 2 DP 24461	Crown land
5	D1	CH12264	1727890.62 6007074.62	Part Lot 2 DP 24461	Crown land
6	D2	CH12365	1727953.92 6007012.51	Part Lot 2 DP 24461	Crown land
10	F1	CH12760	1727838.60 6006744.21	Part Lot 2 DP 24461	Crown land
12	F2	CH12840	1727914.29 6006664.12	Part Lot 2 DP 24461	Crown land
13	G1	CH12920	1727964.73 6006622.85	Part Lot 2 DP 24461	Crown land
14	G2	CH12980	1728021.46 6006623.45	Part Lot 2 DP 24461	Crown land
15	G3	CH13060	1728094.91 6006616.88	Part Lot 2 DP 24461	Crown land
16	G4	CH13140	1728179.64 6006564.56	Part Lot 2 DP 24461	Crown land
17	H	CH13220	1728264.44 6006579.03	Part Lot 2 DP 24461	Crown land
19	I	CH13580	1728345.66 6006352.05	Part Lot 2 DP 24461	Crown land
21	J	CH13700	1728573.66 6006278.72	Part Lot 2 DP 24461	Crown land

¹ WSP (2024). Brynderwyns Stormwater Report. A full list of culvert structures from the stormwater report including comparison between culvert names (stormwater report) and stream names (ecology fish passage report) are presented in Appendix B.

2 METHODOLOGY

2.1 FIELD ASSESSMENT

Field assessments were undertaken by Senior Freshwater Ecologist, Treffery Barnett (Bioresarches Limited) on 13 and 14 December 2023, and Senior Ecologist Mark Yungnickel (WSP) on 13 and 14 December 2023, and 9 to 11 April 2024. eDNA sampling was undertaken across the project area from October 2023 to January 2024 as part of the wider freshwater ecology assessment.

2.2 RIVER AND STREAM CLASSIFICATION

Watercourse classification assessments were undertaken using the definitions of the Proposed Regional Plan for Northland (PRPN)² and definition of a 'river' under the Resource Management Act (RMA) 1991. The definitions are used to assess whether a river or stream is permanent, intermittent, or ephemeral. Both permanently and intermittently flowing rivers or streams meets the definition of a 'river' under the RMA 1991, whereas an ephemeral stream does not and is therefore not subject to the same legislative provisions, including the requirement to provide for the passage of fish.

2.2.1.1 WATERCOURSE DEFINITIONS

RESOURCE MANAGEMENT ACT 1991

River: means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal).

2.2.1.2 PROPOSED NORTHLAND REGIONAL PLAN

PROPOSED REGIONAL PLAN FOR NORTHLAND

Ephemeral river or stream: Reaches with a natural bed level above the water table at all times, with water only flowing during and shortly after rain events, and which do not meet the definition of an intermittently flowing river.

Intermittently flowing river or stream: A river that is naturally dry at certain times of the year and has two or more of the following characteristics:

- 1) it has natural pools, and
- 2) it has a well-defined channel, such that the bed and banks can be distinguished, and
- 3) it contains surface water more than 48 hours after a rain event which results in river flow, and
- 4) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel, and

² These definitions have been used as the proposed regional plan for Northland has been updated to include all provisions arising from the resolution of appeals to the Environment Court and the plan is operative.

5) it appears as a blue line on topographical maps at 1:50,000 scale.

Permanently flowing river or stream: There is no specific definition for a permanently flowing river or stream in the PRPN. However, a coastal river, small river or large river that is not an intermittently flowing river or stream and is not an ephemeral river or stream is permanent. The definition defaults to the RMA 1991 definition

Coastal river: A river in the Coastal River water quantity management unit.

Small river: A river in the Small River water quantity management unit

Large river: A river in the Large River water quantity management unit

2.3 FISH PASSAGE ASSESSMENT

Fish passage through culverts has been assessed using eDNA sampling, results from site observations, salvage efforts and review of design drawings. Solutions for providing fish passage has considered the New Zealand Fish Passage Guidelines (Franklin et al., 2018), and Fish Passage Guidance for State Highways (NZTA, 2013) where possible. Professional judgement has also been applied.

2.4 EFFECTS ASSESSMENT

This effects assessment assesses the impact of culverts and associated infrastructure on freshwater fauna in relation to fish passage. It does not assess the overall ecological value of sites and the Project impact on those sites, which are covered by the pending Ecological Impact Assessment (EcIA).

The Environment Institute of Australia and New Zealand (EIANZ) guidelines for undertaking EcIA's (Roper-Lindsay et al., 2018) has been used for assessing the Projects impacts and effects on freshwater fauna (i.e., fish and amphibians) in relation to fish passage. The steps involve (1) determining the values of freshwater fauna (based on the species conservation status), followed by (2) predicting the magnitude of effects of culverts on that fauna in relation to fish passage (Table 2-1). Ecological values and magnitude of effects scores are then combined using a matrix approach to determine the overall level of effect, as show below in Table 2-2.

The scale of this assessment has been set at the sub catchment level (tributary of the Piroa Stream) and the baseline as the pre-existing conditions prior to the most recent extreme weather events (i.e., existing baseline)³.

Note the pending EcIA for resource consent will detail the overall ecological value and impacts for each watercourse site, which is not covered by this Report.

³ The baseline does not account for whether the structure is lawful under the Freshwater Fisheries Regulations.

Table 2-1: Criteria for describing the magnitude of effect on species.

MAGNITUDE	DESCRIPTION
Very High	Loss of a very high proportion of the known population or range of the element/feature
High	Loss of a high proportion of the known population or range of the element/feature
Moderate	Loss of a moderate proportion of the known population or range of the element/feature
Low	Having a minor effect on the known population or range of the element/feature
Negligible	Having negligible effect on the known population or range of the element/feature

Table 2-2: Criteria for describing the overall level of effects.

MAGNITUDE OF EFFECT	ECOLOGICAL VALUE				
	Very High	High	Moderate	Low	Negligible
Very High	Very High	Very High	High	Moderate	Low
High	Very High	Very High	Moderate	Low	Very Low
Moderate	High	High	Moderate	Low	Very Low
Low	Moderate	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

The effects of the project on freshwater fauna have been assessed in accordance with relevant conditions in the WK-OIC. These are summarised as:

WK-OIC relevant conditions

Emergency recovery works should avoid, as far as practicable:

- More than minimal⁴ adverse effects on following:
 - A naturally uncommon ecosystem.
 - At Risk or Threatened species (other than a species categorised as At Risk – Recovering, – Relict, or – Naturally Uncommon).
 - A taonga species.
- Significant adverse effects on protected wildlife

⁴ A 'more than minimal' effect under the RMA 1991 broadly equates to an overall level of effect that is Moderate or above under the EIANZ Guidelines.

3 FISH PASSAGE ASSESSMENTS

3.1 RIVER AND STREAM CLASSIFICATION

Table 3-1 below shows the result summary of the river and stream classification assessment. Watercourses that meet the RMA definition of a 'river' are required to provide for the passage of fish under NES-FW (for new structures installed since 2020) and the Freshwater Fisheries Regulations 1983.

All streams identified at the Project site are unnamed tributaries of the Piroa Stream, located up small, steep gullies in the Brynderwyns.

Table 3-1: River and stream classification results

CULVERT ID	STREAM NAME	CLASSIFICATION TYPE	FISH PASSAGE ASSESSMENT OF EFFECTS REQUIRED (YES/NO)
1	A (Fill Site)	Intermittent	Yes
2	B1 (Fill Site)	Permanent	Yes
3	B2	Ephemeral	No – does not meet definition of a 'river/stream'
4	C	Ephemeral	No – does not meet definition of a 'river/stream'
5	D1	Intermittent	Yes
6	D2	Permanent	Yes
10	F1	Permanent	Yes
11	F2	Ephemeral	No – does not meet definition of a 'river/stream'
13	G1	Ephemeral	No – does not meet definition of a 'river/stream'
14	G2	Permanent	Yes
15	G3	Permanent	Yes
16	G4	Ephemeral	No – does not meet definition of a 'river/stream'
17	H	Permanent	Yes
19	I	Permanent	Yes
21	J	Permanent	Yes

3.2 STRUCTURES AND THEIR EFFECTS ON FRESHWATER FAUNA

Fish passage has been assessed through culverts and associated infrastructure at sites that meet the definition of a 'river' under the RMA 1991 (as shown above on Table 3-1). The effect of restricted fish passage on freshwater fauna has also been assessed for each site.

3.2.1 OVERVIEW

The Project is situated within rugged hill country, where the Corridor has been carved into steep slopes. The upper reaches of streams running through the Corridor are characterised by their small size and high gradient. Consequently, the landscape poses obstacles to fish passage that would naturally restrict access to species with adept climbing skills only. Historical development of the road and associated stormwater infrastructure has likely further constrained the movement of fish within these streams due to the difficulty in maintaining connectivity between steep reaches that are intersected by the road. As such, some of these structures may be unlawful for not providing for the passage of fish under Section 42 of the Freshwater Fisheries Regulations 1983.

Species recorded directly upstream and downstream of the road include 'Not Threatened' shortfin eel (*Anguilla australis*), freshwater crayfish / kōura (*Paranephrops planiformis*), and 'At Risk, Declining' longfin eel (*Anguilla dieffenbachii*) and Hochstetter frogs (*Leiopelma hochstetteri*)⁵. All of these species are taonga species.

Based on the nature of these streams near the headwaters within naturally high gradient sites, it is not possible to meet the National Environmental Standards for Freshwater (NES-FW) 2020 standard regulation 70 permitted activity criteria, and minimum design standards set out in the New Zealand Fish Passage Guidelines (Franklin et al. 2018). Instead, fish passage can be achieved through the Project site by retrofitting fish passage devices to the new and upgraded culverts once installed. Using retrofit measures to achieve fish passage through the Project site is considered justified based on the following:

- The nature of the high gradient streams, which restrict use of larger sized culverts.
- The presence of only native eels.
- The downstream reaches largely only providing upstream passage for juvenile eels with good climbing abilities.
- No new culverts are being installed to convey streams.

⁵ The freshwater fisheries regulations do not require assessment of passage for native frogs. Therefore, observations of hochstetter frogs have been recorded upstream and downstream of the road for context but have been excluded from the specific values assessment for fish passage.

3.2.2 CULVERT 1 (SITE A)

DESCRIPTION

The intermittent stream was surrounded by a mix of native and exotic vegetation which was largely removed in December 2023 and completely removed in April 2024 (Plate 3-1). The site is within the headwaters of a small tributary that was found to have two branches.



Plate 3-1: (A) Fill Site A in April 2024, (B & C) Sections of stream at Fill Site A in December 2023, (D) Sections of stream at Fill Site A in October 2023.

FRESHWATER FAUNA RECORDED

Table 3-2 shows species recorded in eDNA samples taken within the stream gully system at Site A. Upstream of the road only longfin eel was present within one of the four eDNA sample. Based on limited water being present at the time of sampling, there is potential there was cross

contamination and this was a false positive. Downstream of the road longfin eel, shortfin eel, and freshwater crayfish were present within eDNA samples.

Table 3-2: Species recorded in eDNA samples at Fill Site A

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ⁶⁷⁸	SPECIES VALUE ⁹	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	D
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk – Declining	High	U* & D
<i>Leiopelma hochstetteri</i>	Hochstetter’s frog	At Risk - Declining	High	D
<i>Paranephrops planiformis</i>	Freshwater crayfish	Not Threatened	Low	D

* There is potential there was cross contamination and that this reading was a false positive.

COMPLETED WORKS

The gully above the road at Site A was cleared and filled to stabilise the bank and create a stockpile area for cut material (Figure 3-1).

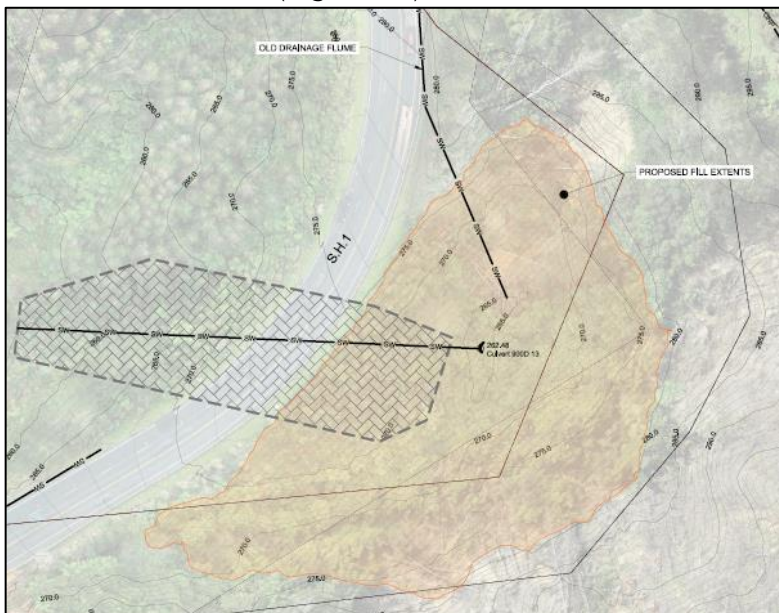


Figure 3-1: Site A fill area (red).

⁶ Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

⁷ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

⁸ Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

⁹ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

The affected area was approximately 8,700 square metres (m²) and included a total of approximately 100m of stream length. The existing headwall inlet was removed and replaced with a new manhole at the same location. The manhole lid level was increased by addition of new risers as filling progressed to match the finished ground level. The existing 900mm culvert beneath SH1 at Site A will remain (Figure 3-2). A flow path is proposed to be established to the new manhole; however, it is likely additional fill will be added to this site during potential future works.

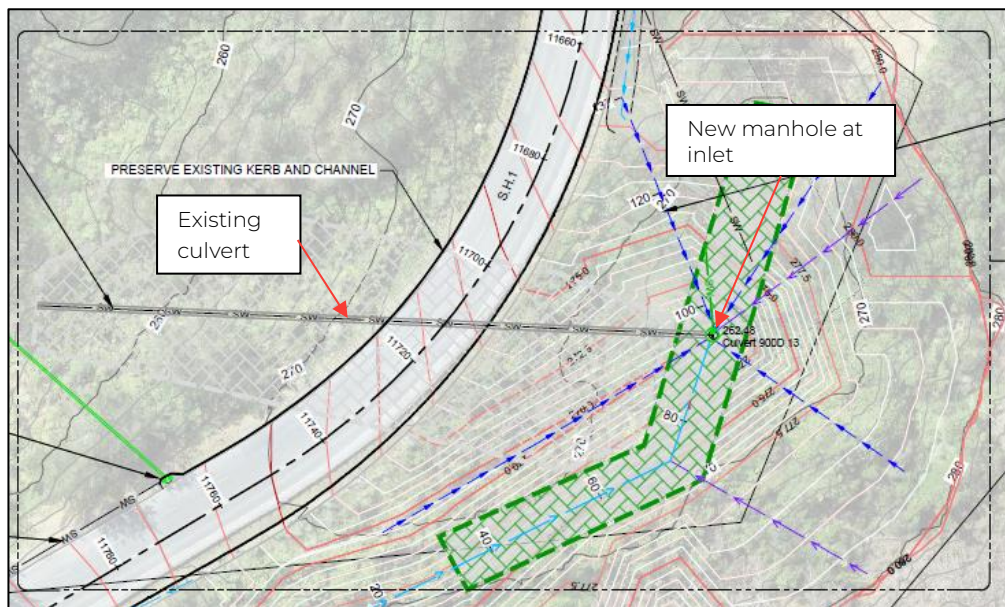


Figure 3-2: Site A existing culvert shown in grey and new manhole extension in green.

FISH PASSAGE

The existing 900 mm wide culvert, which has a steep gradient (ca. 10%), is long in length (ca. 90m) and headwall inlet have historically restricted upstream fish passage, although longfin eel have managed to access this habitat, based on eDNA results. Following completion of emergency works, freshwater habitat upstream of the road at Site A has been filled and is no longer suitable for freshwater fauna.

EFFECTS

Due to the loss of upstream habitat for freshwater fauna at Site A and total loss of access to fish, there is now no value in providing the passage for fish through the culvert beneath the road. Furthermore, the stream was intermittent, had limited upstream habitat and the quality of fish passage through the culvert and manhole remains broadly similar to existing baseline conditions. Therefore, the magnitude of effect on freshwater fauna has been assessed as being Negligible. Based on this the overall level of effect of culvert upgrades on fish passage at Site A has scored Very Low. An exemption is proposed to Site A as fish passage is not required based on the WK-OIC.

3.2.3 CULVERT 2 (SITE B1)

DESCRIPTION

Site B1 is predominantly situated in harvested pine plantation, with a small strip of natural vegetation along the road. The stream and wetland habitats had very low flow in December 2023 and have been impacted by forestry activities (Plate 3-2).



Plate 3-2: A) Stream at Site B1 (fill site) upstream of the road in December 2023, B) Stream at Site B1 downstream of the road in April 2024

FRESHWATER FAUNA RECORDED

Table 3-3 shows species recorded in eDNA samples taken within the stream gully system at Site B1. No fish and amphibians were detected during eDNA sampling upstream of the road. Longfin eel, shortfin eel and freshwater crayfish were detected during eDNA sampling located downstream of the road.

Table 3-3: Species recorded in eDNA samples at Fill Site B1

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ¹⁰¹¹ ¹²	SPECIES VALUE ¹³	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	D
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	High	D
<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk - Declining	High	D
<i>Paranephrops planiformis</i>	Freshwater crayfish	Not Threatened	Low	D

COMPLETED WORKS

To accommodate road widening the existing 32 m long 450 mm wide culvert at Site B1 has been extended by 6 m from the inlet and includes a 430 mm wide pipe and two new manholes along the extended length (Figure 3-2). The 1.5 m high manhole with scruffy dome at the new inlet is proposed to sit flush with the level of the bed of the stream, amongst rock armouring. The second manhole is 3.6 m high and located outside of the stream bed and will only convey flood flows.

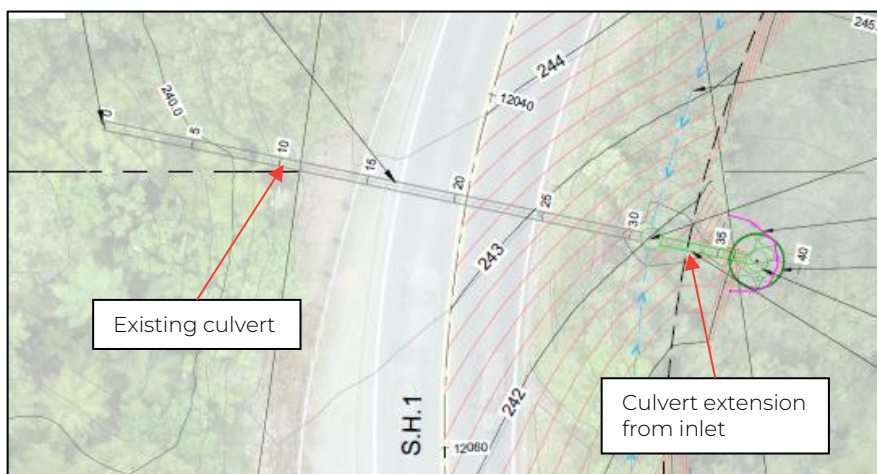


Figure 3-3: Site B2 existing culvert shown in grey and new extension and scruffy dome manhole in green.

¹⁰ Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

¹¹ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

¹² Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

¹³ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

FISH PASSAGE

The existing 450 mm culvert has likely restricted upstream fish passage historically, based on eDNA results. Fish passage is further restricted by culvert upgrade works due to extending the culverts length and installing a new manhole with a 1.5 m head drop. Fish habitat is naturally minimal upstream of the structure due to the small scale, steepness, and low flow of the stream.

EFFECTS

Based on the existing structure restricting fish passage and/or lack of suitable upstream habitat for fish, as indicated by the eDNA results, the magnitude of effect of culvert upgrades to the existing fish passage baseline has been assessed as Negligible. Therefore, the overall level of effect on fish passage scores Very Low. An exemption is proposed to Site B1 as fish passage is not required based on the WK-OIC.

3.2.4 CULVERT 5 (SITE D1)

DESCRIPTION

The intermittent stream at Site D1 is within indigenous forest. This stream was impacted by slips during severe weather and there is now only approximately 9 m of channel remaining upstream of SH1, which is conveyed through a manhole at the road (Plate 3-3). Downstream of the road there is a suspended smooth bore high density polyethelene flume pipe.

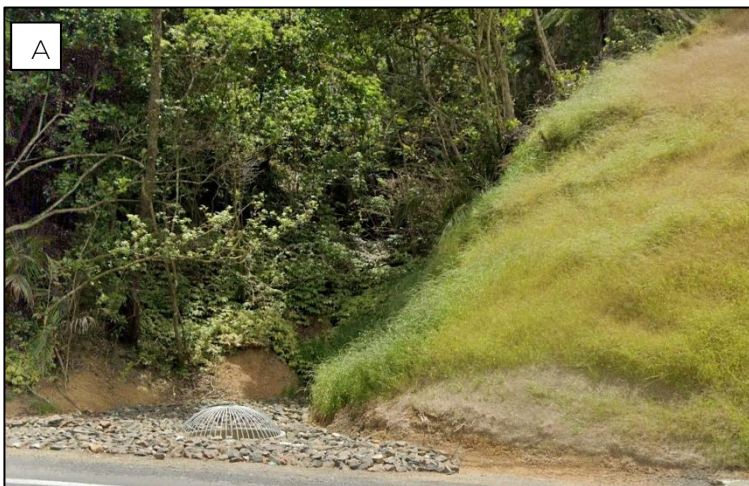


Plate 3-3: A) Stream and scruffy dome at Site D1 upstream of the road in December 2023, B) Stream upstream on the road after completed works in April 2024, C) Flume downstream of the road.

FRESHWATER FAUNA RECORDED

Table 3-4 shows species recorded in eDNA samples taken within the stream or recorded during salvage works at Site D1. Upstream of the road, no fish were observed, however, Hochstetter's frogs were recorded during salvage works. Downstream of the road shortfin eel and longfin eel were recorded in eDNA samples.

Table 3-4: Species recorded in eDNA samples or during salvage works at Site D1.

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ¹⁴¹⁵ ¹⁶	SPECIES VALUE ¹⁷	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	D
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	High	D
<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk - Declining	High	U
<i>Paranephrops planiformis</i>	Freshwater crayfish	Not Threatened	Low	D

COMPLETED WORKS

An existing 25 m long, 500 mm wide culvert beneath SH1 was extended by 7 m upstream from a manhole inlet (Figure 3-4).

The existing manhole, which has a 1 m head drop, was shifted upstream, embedded flush with the stream bed and fitted with a scruffy dome. It was also armoured with rip rap. A second, new manhole inlet was also installed to convey flood flows outside of the road widening formation.

¹⁴ Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

¹⁵ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

¹⁶ Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

¹⁷ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

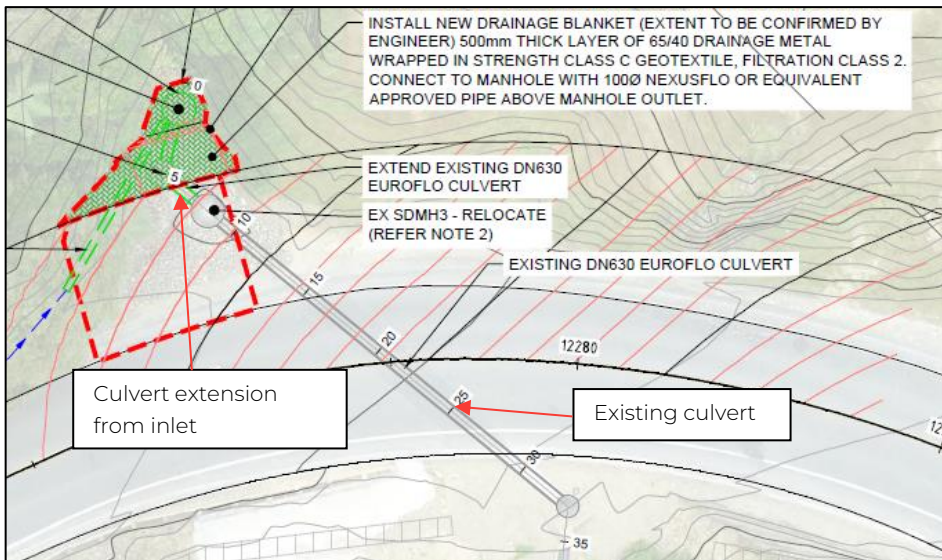


Figure 3-4: Site D1 existing culvert shown in grey and new extension, manholes and drainage blanket scruffy in green.

FISH PASSAGE

The intermittent nature of the stream has likely prevented or restricted upstream fish passage. There is also now very limited habitat available since the slip. Salvage results suggest that no fish were present upstream of the road, however, a population of Hochstetter's frog was found.

EFFECTS

Based on the existing structure restricting fish passage and little upstream habitat remaining following the slip, the magnitude of effect of culvert upgrades to the existing fish passage baseline has been assessed as Negligible. Therefore, the overall level of effect on fish passage scores Very Low. An exemption is proposed to Site D1 as fish passage is not required based on the WK-OIC.

3.2.5 CULVERT 6 (SITE D2)

DESCRIPTION

The stream at Site D2 is a steep permanent stream located within indigenous forest. The stream has high quality habitat with various pools and runs upstream of the road before in flows down a waterfall at the road edge (upstream end; Plate 3-4).



Plate 3-4: A) Stream waterfall upstream of the road at Site D2 in December 2023, B) Stream waterfall downstream of the road at Site D2 in April 2024, C) Longfin eel salvaged from upstream of SH1 waterfall in April 2024.

FRESHWATER FAUNA RECORDED

Table 3-5 shows species recorded in eDNA samples taken within the stream at Site D2 downstream of the road and recorded during site assessments and salvage work. Upstream of the road longfin eels ranging from 270 to 600 mm eel, and various freshwater crayfish were recorded during site assessments and salvage work. Downstream of the road shortfin eel, longfin eel and freshwater crayfish were recorded from eDNA samples.

Table 3-5: Species recorded in eDNA samples at Site D2 downstream and recorded during site assessment and salvage works.

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ¹⁸¹⁹ ₂₀	SPECIES VALUE ²¹	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	U* & D
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	High	U & D
<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk - Declining	High	U & D
<i>Paranephrops planiformis</i>	Freshwater crayfish	Not Threatened	Low	U & D

* no eDNA samples were taken from upstream side of the road, therefore the presence of shortfin eel cannot be ruled out and therefore are assumed present based on habitat and results from the downstream site.

COMPLETED WORKS

The existing 12 m long, 900 mm wide culvert is proposed to be extended by 5 m at its upstream length. This has historically restricted fish passage with an existing approximately 1m drop. This includes installation of a manhole and drop structure which is creating a total barrier to the upstream passage of fish without retrofits.

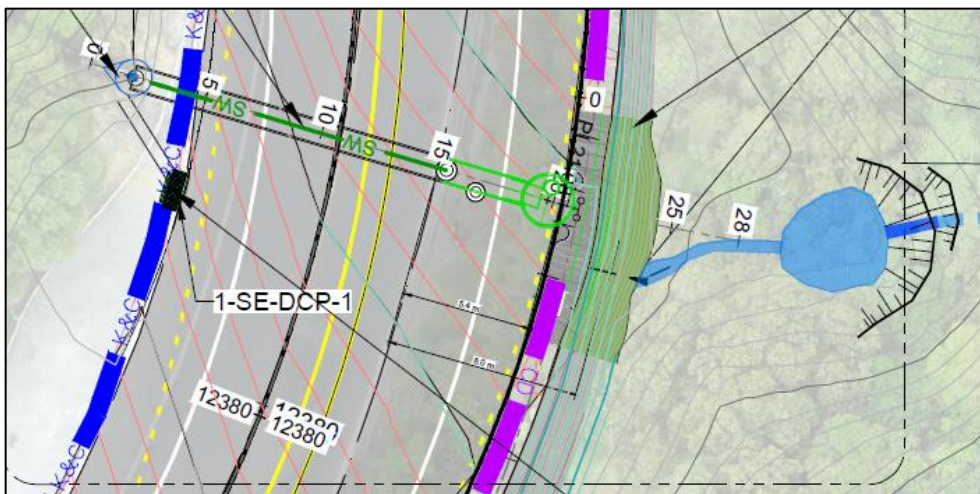


Figure 3-5: Site D2 existing culvert shown in black and new extension and manhole in green.

¹⁸ Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

¹⁹ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

²⁰ Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

²¹ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

FISH PASSAGE

The existing structure has restricted fish passage. However, longfin eel and freshwater crayfish have been confirmed upstream.

EFFECTS

The existing structure is restricting fish passage. Upstream of the road, there is high quality habitat present for aquatic fauna and longfin eel and freshwater crayfish that are confirmed present. Without retrofits there is potential to result in a total barrier for upstream fish passage to approximately 30% of the sub catchment. Therefore, the magnitude of effect from the current design has been assessed as Moderate. Therefore, the overall level of effect on fish passage scores High.

Options to retrofit this structure have been proposed to provide fish passage at this site resulting in a Negligible magnitude of effect (see Appendix A). Therefore, with retrofits the overall level of effect on fish passage scores Very Low.

3.2.6 CULVERT 10 (SITE F1)

DESCRIPTION

The stream at Site F1 is a permanent stream within indigenous forest that has minimal flow and upstream habitat for fish. Flow is conveyed across SH1 through a manhole and culvert (Plate 3-5).



Plate 3-5: A) Stream at Site F1, upstream from SH1 in December 2023, B) Stream at Site F1 after construction in April 2024.

FRESHWATER FAUNA VALUES

Table 3-6 shows species recorded in eDNA samples taken within the stream, site assessment and salvage work at Site F1. Longfin eel was recorded upstream of the road in eDNA samples, and freshwater crayfish during salvage works. No eDNA samples were taken downstream of the road but it is assumed shortfin eel, longfin eel and freshwater crayfish are present based on the habitat and results from other tributaries downstream of the road.

Table 3-6: Species recorded in eDNA samples at Site F1 and assumed to be present.

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ²²²³ ²⁴	SPECIES VALUE ²⁵	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	D*
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	High	U & D*
<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk - Declining	High	U & D*
<i>Paranephrops planiformis</i>	Freshwater crayfish	Not Threatened	Low	U & D*

* no eDNA samples were taken from downstream of the road, however, species are assumed present based on habitat and results from other downstream site tributaries.

COMPLETED WORKS

The existing 75.5 m long, 375 mm wide culvert was repaired, and a new manhole and scruffy dome was installed at the culvert's inlet. The manhole is perched above the height of the stream bed by approximately 35 cm and has a 1.7 m head drop.

²² Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

²³ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

²⁴ Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

²⁵ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

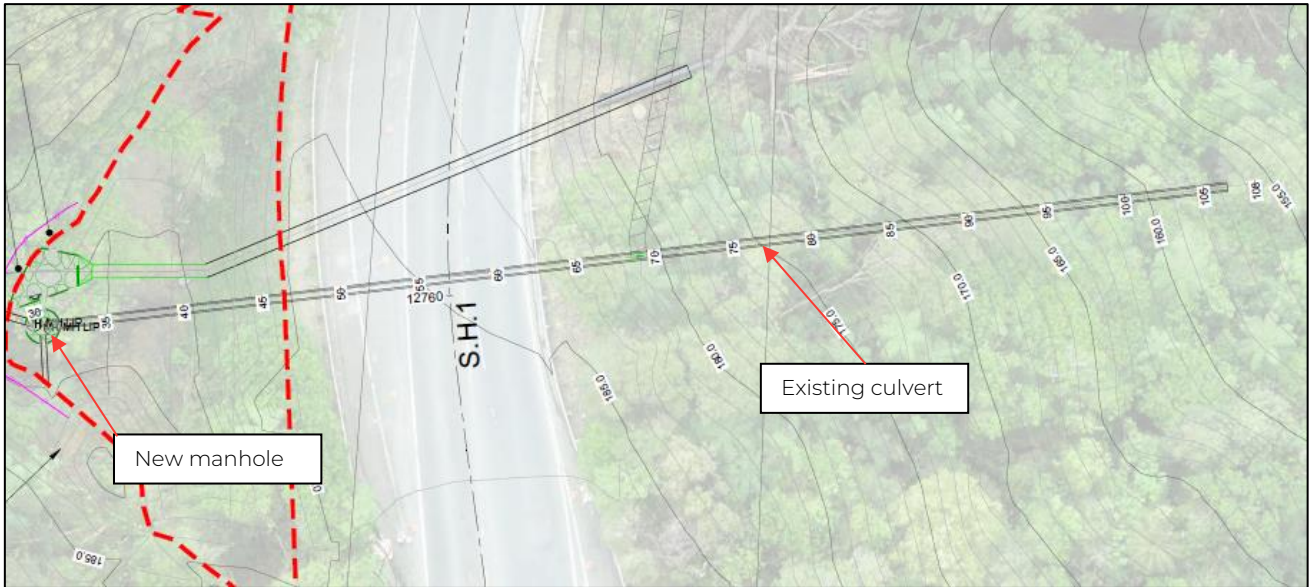


Figure 3-6: Site F1 existing culvert shown in black and new extension and manhole in green.

FISH PASSAGE

Based on CCTV, the existing culvert was found to have a buried junction manhole, which is not benched and is inaccessible (*pers comm*, Mat Chiaroni, WSP stormwater Engineer). This in addition to the minimal flow observed within the stream have likely prevented fish passage historically.

EFFECTS

Based on the existing structure restricting fish passage and little upstream habitat remaining following the slip, the magnitude of effect of culvert upgrades to the existing fish passage baseline has been assessed as Low. Therefore, the overall level of effect on fish passage scores Low. An exemption is proposed to Site F1 as fish passage is not required based on the WK-OIC.

3.2.7 CULVERT 14 (SITE G2)

DESCRIPTION

At Site G2 there is a permanent stream within native bush. Directly upstream of the road there is various fish habitat and a waterfall and pool on the edge of the road. Flow is conveyed beneath SH1 through a manhole and culvert (Plate 3-6).



Plate 3-6: A) Stream at Site G2 upstream of SH1 in December 2023, B) Stream at Site G2 during construction upstream of SH1 in April 2023, C) Outlet of culvert downstream of SH1 in April 2024

FRESHWATER FAUNA RECORDED

Table 3-7 shows species recorded in eDNA samples taken within the stream at Site G2. Upstream of the road shortfin eel, longfin eels and freshwater crayfish were recorded in an eDNA sample. No fish species were recorded during site assessment. It is assumed shortfin eel; longfin eel and freshwater crayfish are also located downstream of the road based on results from other tributaries.

Table 3-7: Species recorded in eDNA samples from Site G2.

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ²⁶ <small>2728</small>	SPECIES VALUE ²⁹	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	U & D*
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	High	U & D*
<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk - Declining	High	U & D*
<i>Paranephrops planiformis</i>	Freshwater crayfish	Not Threatened	Low	U & D*

* no eDNA samples were taken from downstream of the road, however, species are assumed present based on habitat and results from other downstream site tributaries.

COMPLETED WORKS

A new manhole with scruffy dome was installed at the inlet amongst rip rap protection in the bed of the stream (Plate 3-7). The manhole has a head drop of 1 m. Approximately 3.6 m of rip rap was installed from the inlet of the scruffy dome to the pool at the bottom of the waterfall.

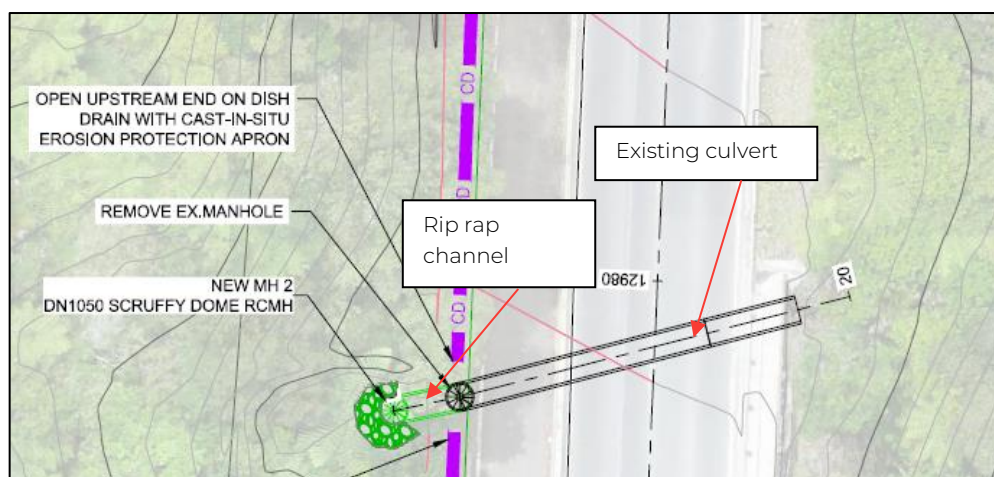


Figure 3-7: Site G2 existing culvert shown in black and rip rap channel and manhole in green.

²⁶ Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

²⁷ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

²⁸ Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

²⁹ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

FISH PASSAGE

The current culvert does restrict fish passage, including a small perch at the culvert outlet. However, longfin and shortfin eels, which have good climbing ability as juveniles, have managed to access habitat upstream of the existing culvert, as indicated by the eDNA samples.

EFFECTS

Based on the current construction design, there is no upstream passage for fish. This results in a total barrier for upstream fish passage to approximately 50% of the sub catchment. The magnitude of effect is considered Moderate. Therefore, the overall effect on fish passage is considered High.

Recommendations have been provided to retrofit the design to provide fish passage at this site (see Appendix A), and if implemented are considered to provide fish passage resulting in Negligible magnitude of effect. Therefore, with retrofits the overall level of effect on fish passage scores Very Low.

3.2.8 CULVERT 15 (SITE G3)

DESCRIPTION

At Site G3 there is a permanent stream within native bush (Plate 3-7). Flow is conveyed beneath SH1 through a manhole and culvert, then down a large flume to the gully.



Plate 3-7: A) Stream at Site G3, upstream of SH1 in December 2023, B) Manhole upstream of the road with drop into inlet, C) manhole downstream of the road with flow disappearing before it flows down the flume, D) Flume down to stream, E) Stream at Site G3 upstream of SH1 in April 2024, F) perched outlet at end of flume, G) flows going subsurface at outlet of flume.

FRESHWATER FAUNA RECORDED

Table 3-8 shows species recorded in eDNA samples taken within the stream at Site G3. Upstream of the road no fish species were recorded in an eDNA sample. Downstream of the road shortfin eel and freshwater crayfish were recorded in eDNA samples. It is not known if fish were present in the stream prior to installation of the current flume therefore it is assumed native eels may have been present for the purposes of this assessment.

Table 3-8: Species recorded in eDNA samples at Site G3.

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ^{30,31,32}	SPECIES VALUE ³³	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	D
<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk - Declining	High	U & D
<i>Paranephrops planiformis</i>	Freshwater crayfish	Not Threatened	Low	D

COMPLETED WORKS

New scruffy domes have been attached to two manholes, part of the existing culvert, which is made up of a 26 m long, 600 mm wide pipe and a 26 m long corrugated flume down a steeper grade (Figure 3-8). A concrete apron will also be constructed at the culvert's inlet.

³⁰ Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

³¹ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

³² Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

³³ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

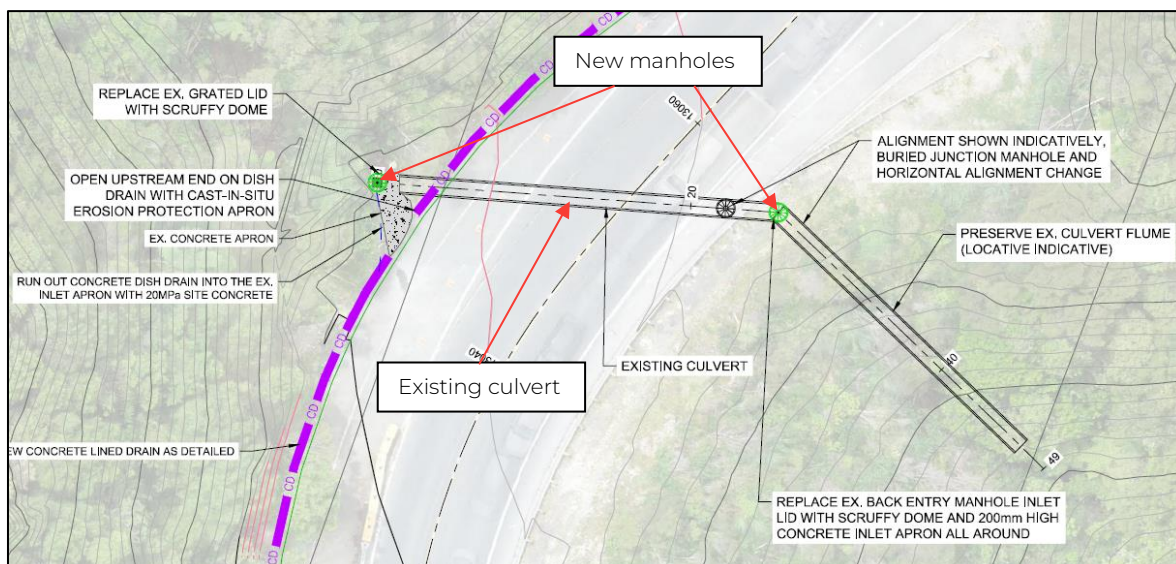


Figure 3-8: Site G3 existing culvert shown in black and manholes in green.

FISH PASSAGE

The existing culvert has likely prevented fish passage historically and no fish were recorded upstream of SH1 in the eDNA results. Issues with the existing structure, which restrict fish passage or result in a total barrier, include an existing 85cm drop from the culvert into a manhole upstream of the road. Downstream of the road, the manhole which joins the plastic pipe has flows that go subsurface. The current corrugated flume currently restricts fish passage, and the outlet is perched by 100mm. Flows were subsurface at the time of observation in April 2024 from the outlet for approximately 10m before flowing into the natural stream (Plate 3-7). The existing flume was installed prior to Cyclone Gabrielle.

EFFECTS

The existing structure and flume are preventing upstream fish passage which is resulting in a total barrier for upstream fish passage to approximately 50% of the sub catchment. However, upstream of the road there was a waterfall and little flow during site visit. There is some habitat upstream for eels particularly during winter months, although no fish had been observed based on a number of issues restricting passage with the current structure and other existing downstream artificial barriers. The existing design does not modify or make fish passage worse at this location. Therefore, the magnitude of effect has been assessed as Negligible and the overall effect on fish passage is score Very Low.

An exemption is proposed to Site G3 as fish passage not required based on the WK-OIC. Furthermore, based on issues with the current structure prior to works, there is likely a lot of effort to retrofit this site, and there is no certainty this can be achieved. The only aspect proposed to be fixed is the hole in the manhole where flows are going subsurface which will be filled with epoxy grout.

3.2.9 CULVERT 17 (SITE H)

DESCRIPTION

Permanent stream at Site H flows within native bush. Flow was previously conveyed beneath SH1 through a culvert.



Plate 3-8: A) Stream at Site H, downstream of SH1 in December 2023, B) Constructed culvert inlet upstream of SH1 in April 2024, C) Existing culvert outlet at Site H, downstream of SH1 in April 2024.

FRESHWATER FAUNA VALUES

Table 3-9 shows species recorded in eDNA samples taken within the stream at Site H. Shortfin eels and longfin eels were recorded upstream of the road in an eDNA sample. In addition, freshwater crayfish were recorded downstream of the road in eDNA samples.

Table 3-9: Species recorded in eDNA samples at Site H.

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ³⁴ <small>3536</small>	SPECIES VALUE ³⁷	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	U & D
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	High	U & D
<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk - Declining	High	U & D
<i>Paranephrops planiformis</i>	Freshwater crayfish	Not Threatened	Low	D

COMPLETED WORKS

The existing 61 m long, 600 mm wide culvert has been extended 7 m, including addition of a new manhole with scruffy dome at the junction between the existing and new pies. The new pipe is perched above the height of the old one in the manhole, by approximately 30 cm. At the inlet of the new pipe a wingwall and rock armour apron will be installed.

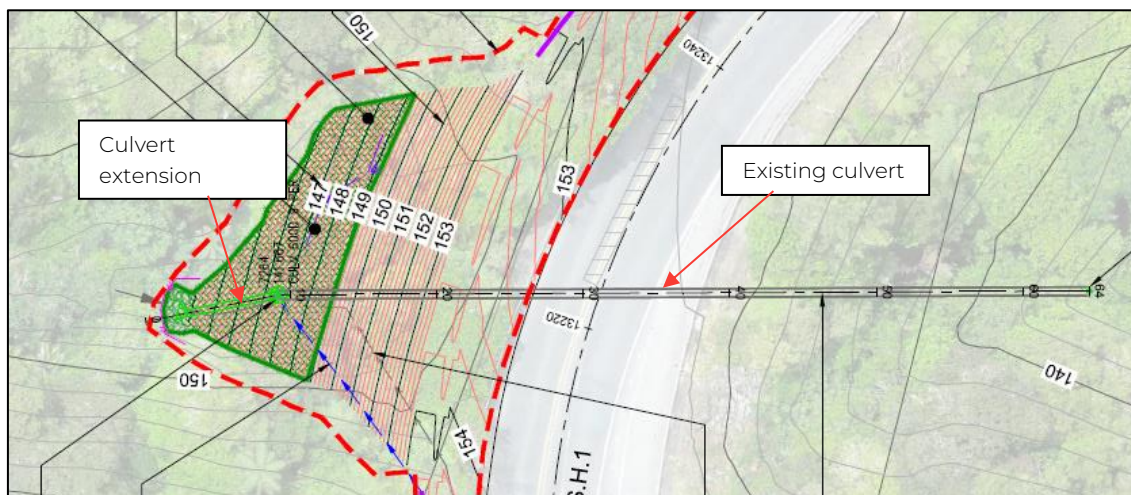


Figure 3-9: Site H existing culvert shown in black and culvert and manhole in green. New drainage blanket and fill shown in green and red, respectively.

³⁴ Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

³⁵ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

³⁶ Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

³⁷ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

FISH PASSAGE

Long and shortfin eels managed to access habitat upstream of the existing culvert, as indicated by the eDNA samples. In this case, the addition of a new manhole with new perched pipe will further restrict fish passage through this culvert. To maintain fish passage for eels, retrofit solutions will be installed through the culvert and manhole.

EFFECTS

The culvert is undersized based on the size of the stream and has now been extended. The design and implementation are resulting in a total barrier for upstream passage to approximately 60% of the sub catchment. Based on the higher flows, existing fish species present and suitable high-quality habitat upstream of SH1, the magnitude of effect has been assessed as Moderate. Therefore, the overall level of effect on fish passage scores High.

Options to retrofit this structure have been proposed to provide fish passage at this site resulting in Low magnitude of effect (see Appendix A). Therefore, with retrofits the overall level of effect on fish passage scores Low.

3.2.10 CULVERT 19 (SITE I)

DESCRIPTION

Permanent stream which flows within native bush. Relatively flat, high-quality habitat for aquatic biota is present upstream of the road.

FRESHWATER FAUNA VALUES

Table 3-10 shows species recorded in eDNA samples taken within the stream at Site H and assumed to be present. Shortfin eel and freshwater crayfish were recorded upstream of the road within eDNA samples, whilst no fish species were recorded during site assessment. It is assumed shortfin eel; longfin eel and freshwater crayfish are present downstream of the road based on results from other tributaries.



Plate 3-9: A) Stream at Site I, upstream of SH1 in December 2023, B) Culvert inlet with large debris screen.

Table 3-10: Species recorded in eDNA samples form Site I and assumed to be present.

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ³⁸ <small>3940</small>	SPECIES VALUE ⁴¹	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	U & D*
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	High	D*
<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk - Declining	High	U & D*
<i>Paranephrops planiforms</i>	Freshwater crayfish	Not Threatened	Low	U & D*

* no eDNA samples were taken from downstream of the road, however, species are assumed present based on habitat and results from other downstream site tributaries.

COMPLETED WORKS

No work is proposed at Site I, therefore fish passage remains unchanged to the existing baseline.

FISH PASSAGE

Shortfin eels have managed to access habitat upstream of the existing culvert, as indicated by the eDNA samples. Freshwater crayfish were also found to be present upstream of the culvert. However, the current culvert which has a perch at the outlet in restricting fish passage.

EFFECTS

The restrictions within the current culvert are currently restricting passage to high quality stream, which includes approximately 90% of the sub catchment. However, given there are no changes to the existing baseline the magnitude of effect from the current situation could be considered Negligible. Therefore, the overall level of effect on fish passage scores Very Low. However, given no works have taken place at this site it is not eligible for an exemption. Also, given the requirements of the freshwater fisheries regulations this site is at risk of receiving an abatement notice.

Options to retrofit this structure have been proposed to improve fish passage resulting in Positive magnitude of effect (see Appendix A). Therefore, with retrofits the overall level of effect on fish passage scores Net Gain.

³⁸ Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

³⁹ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

⁴⁰ Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

⁴¹ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

3.2.1 CULVERT 21 (SITE J)

DESCRIPTION

Permanent stream in native bush at Site J (Plate 3-10). The stream is conveyed beneath SH1 through culvert.



Plate 3-10: A/B) Stream at Site J, upstream of SH1 in December 2023, B) Outlet of culvert at Site J, downstream of SH1 in April 2024

FRESHWATER FAUNA VALUES

Table 3-11 shows species recorded in eDNA samples taken within the stream at Site J. Shortfin eel, longfin eel, and freshwater crayfish were found in eDNA samples upstream of the road, whilst no fish species were found during site assessments. It is assumed shortfin eel; longfin eels and freshwater crayfish are located downstream of the road based on results from other tributaries.

Table 3-11: Species recorded in eDNA samples at Site J.

SPECIES NAME	COMMON NAME	THREAT CLASSIFICATION ⁴² 4344	SPECIES VALUE ⁴⁵	LOCATION (UPSTREAM AND/OR DOWNSTREAM OF THE ROAD)
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	Low	U & D*
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	High	U & D*
<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk - Declining	High	U & D*
<i>Paranephrops planiformis</i>	Freshwater crayfish	Not Threatened	Low	U & D*

* no eDNA samples were taken from downstream of the road, however, species are assumed present based on habitat and results from other downstream site tributaries.

COMPLETED WORKS

The existing 21 m long, 600 mm wide culvert was extended by 9 m at stream bed level. The new inlet was proposed to be embedded into a new gravity wall, but this was not required and is a fill embankment (Figure 3-10). A new manhole was also installed at the junction between the new and old pipe. The new 25 m long 600 mm culvert is an emergency overflow is rather than to permanently convey the stream.

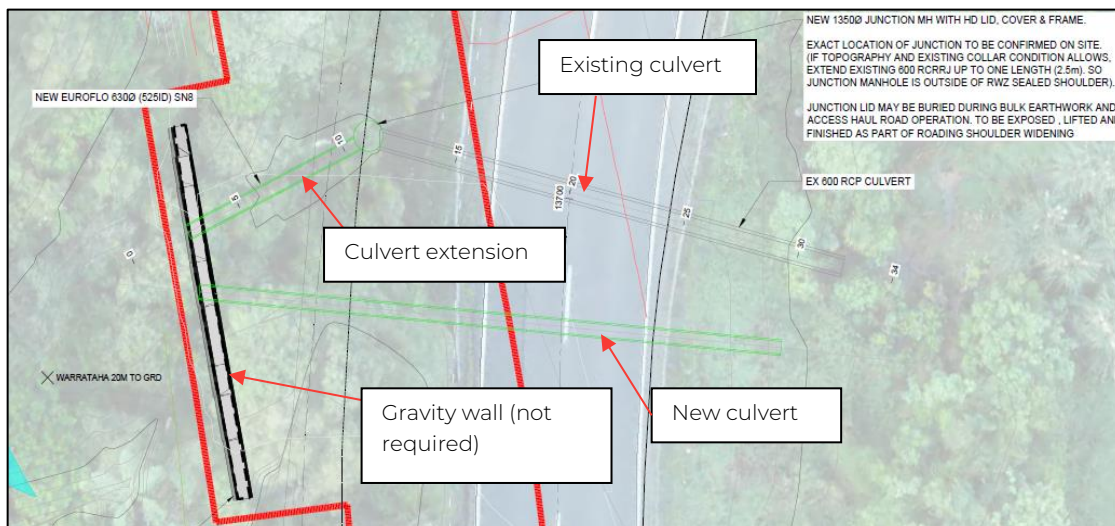


Figure 3-10: Site J existing culvert shown in grey and new culverts and manhole in green.

⁴² Conservation status of New Zealand freshwater fishes, 2017 (Dunn et al., 2018)

⁴³ Conservation status of New Zealand amphibians, 2017 (Burns et al., 2018)

⁴⁴ Conservation status of New Zealand freshwater invertebrates, 2018 (Grainger et al., 2018)

⁴⁵ EIANZ Guidelines for assigning value to species (Roper-Lindsay et al., 2018).

FISH PASSAGE

Long and shortfin eels managed to access habitat upstream of the existing culvert, as indicated by the eDNA samples. The new culvert is longer than the existing culvert but positioned at a slightly lower grade (4% slope compared to a 6% slope).

EFFECTS

The existing culvert is undersized and has been extended. There is an overhang at the outlet. Therefore, the current culvert and design restricts fish passage to high quality stream, which includes approximately 90% of the sub catchment. Therefore, the magnitude of effect from the current situation could be considered Moderate. Therefore, the overall level of effect on fish passage scores High.

Options to retrofit this structure have been proposed to provide fish passage at this site resulting in Negligible magnitude of effect (see Appendix A). Therefore, with retrofits the overall level of effect on fish passage scores Very Low.

3.3 SUMMARY OF ASSESSMENT

Table 3-12 below provides a summary of Project effects on freshwater fauna in relation to the current design of structures in waterways. The eligibility of structures to be exempt from providing for the passage of fish, based on the level of effect being not 'more than minimal' (i.e., Very Low or Low effect), is also provided.

Table 3-12: Summary of assessment based on the current design/implementation.

CULVERT ID	STREAM NAME	SPECIES VALUE	MAGNITUDE OF EFFECT ON FRESHWATER FAUNA (CURRENT DESIGN)	OVERALL LEVEL OF EFFECT (CURRENT DESIGN)	IS ELIGIBLE FOR FISH PASSAGE EXEMPTION
1	A	High	Negligible	Very Low	Yes
2	B1	Negligible	Negligible	Very Low	Yes
5	D1	High	Negligible	Very Low	Yes
6	D2	High	Moderate	High	No
10	F1	High	Low	Low	Yes
14	G2	High	Moderate	High	No
15	G3	Negligible	Negligible	Very Low	Yes
17	H	High	Moderate	High	No
19	I	High	Negligible	Very Low	No
21	J	High	Moderate	High	No

Based on the results of this assessment, instream structures at the following sites and are considered eligible to be exempt from providing for the passage of fish under the WK-OIC. These are:

- Site A
- Site B1
- Site D1
- Site F1
- Site G3

Project effects at the remaining sites (Sites D2, G2, H and J) can be minimised by retrofitting fish pass devices to structures to achieve or improve fish passage.

Site I is not impacted by the works so is not eligible for a fish passage exemption. The structure currently restricts fish passage and is at risk of getting an abatement notice. It can easily be remediated to improve fish passage. Table 3-13 below shows sites that are, and are not, eligible for fish passage exemption under the WK-OIC.

Table 3-13: Fish passage exemptions and achievability.

FISH PASSAGE EXEMPTION STATUS	CULVERT ID	STREAM NAME	FISH PASSAGE WOULD PROVIDE ECOLOGICAL BENEFIT AT SITE	LIKELIHOOD OF RETROFITS TO IMPROVE FISH PASSAGE	REASONING	FISH PASSAGE EASILY AND COST-EFFECTIVELY ACHIEVED
Eligible for fish passage exemption	1	A	No	Not Required	No upstream habitat	Not Required
	2	B1	No	Not Required	No upstream habitat	Not Required
	5	D1	No	Not Required	Little to no upstream habitat	Not Required
	10	F1	Potentially	Potentially	Some habitat upstream	No
	15	G3	Yes	Potentially	Some upstream habitat but uncertainty around success of retrofits.	No
Not eligible for fish passage exemption	6	D2	Yes	High	High quality habitat upstream	Yes
	14	G2	Yes	High	High quality habitat upstream	Yes
	17	H	Yes	High	High quality habitat upstream	Yes
	21	J	Yes	High	High quality habitat upstream	Yes
Fish passage recommended ⁴⁶	19	I	Yes	High	High quality habitat upstream	Yes

Table 3-14 below summarises Project effects following implementation of retrofit devices to structures to improve the passage of fish (based on installing retrofits to Sites shown as green in Table 3-13 above). If retrofits recommended in Appendix A are implemented the overall level of effect is considered Low, Very Low or Net Gain.

⁴⁶ The structure is not impacted by the works but is currently restricting the upstream passage of fish. Under the freshwater fisheries regulations there is risk this could receive an abatement notice to improve fish passage. Therefore, to minimise risk of an abatement notice minor low-cost retrofits are recommended.

Table 3-14 Summary of assessment based on implementation of retrofit devices.

CULVERT IDENTIFICATION	STREAM NAME	SPECIES VALUE	MAGNITUDE OF EFFECT ON FRESHWATER FAUNA (RETROFITS)	OVERALL LEVEL OF EFFECT (RETROFITS)
1	A	High	Not Required	Not Required
2	B1	Negligible	Not Required	Not Required
5	D1	High	Not Required	Not Required
6	D2	High	Low	Low
10	F1	High	Not Required	Not Required
14	G2	High	Low	Low
15	G3	Negligible	Not Required	Not Required
17	H	High	Low	Very Low
19	I	High	Positive*	Net Gain
21	J	High	Negligible	Very Low

* not required by the WK OIC but recommended to minimise risk of an abatement notice under the freshwater fisheries regulations.

4 DISCUSSION AND CONCLUSION

High level fish passage assessments have been conducted on 10 structures that convey streams beneath SH1 at the Brynderwyn Hills Recovery Works Project site. The streams are high-gradient and challenging to provide fish passage for at the points where they intersect the road. Some of the structures, installed during emergency works, may be retrofitted with fish passage solutions to enhance the passage of indigenous fishes with good climbing ability, such as eels. However, fish habitat upstream of SH1 is limited in many streams, either due to being intermittent, the steep gradient of the natural stream or being lost as part of historic weather events. Retrofit fish passage solutions have been proposed and have/will be applied where feasible to maintain or improve passage for species found to be using upstream habitats and present within downstream habitats where suitable upstream habitat is present. When assessed at the sub catchment scale, effects of the Project on freshwater fauna, in relation to fish passage, scored Very Low to Low for many sites, which broadly equates to being not 'more than minimal,' in accordance with the wording used in the WK-OIC. However, some sites scored High where there was extensive suitable upstream habitat for fish. At these sites, retrofits are proposed to bring the overall level of impact to low, very low or net gain.

5 REFERENCES

Literature and Technical Reports

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Legislation and Policy

- Freshwater Fisheries Regulations 1983
- Resource Management Act 1991
- Resource Management (National Environmental Standards for Freshwater) Regulations 2020.
- National Policy Statement for Freshwater Management 2020
- Severe Weather Emergency Recovery (Waka Kotahi New Zealand Transport Agency) Order 2023.

Websites

- Northland Regional Council (NRC). (2021): NRC Local Maps: Regional Policy Statement. Last updated September 2021.
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- NZ Topo Map <https://www.topomap.co.nz>

6 LIMITATIONS

In preparing this Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('Client Data') provided by or on behalf of the Client. Except as otherwise stated in this Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions, and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable for any incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented, or otherwise not fully disclosed to WSP.

APPENDIX A: OPTIONS FOR RETROFITS

GENERAL RECOMMENDATIONS

- The following, not covered by this Report, should be addressed by the EclA:
 - The loss/modification of stream length and habitat for aquatic biota as a result of the Project.
 - Project effects on freshwater fauna other than those related to fish passage.
- Installation of retrofit fish passage devices such as baffles and spat rope should be inspected and installed by an experienced suitably qualified fish passage specialist, such as ATS-Environmental who provides fish passage solutions. This is based on experience of best tailoring these to the specific site and ensuring it functions as intended. Some adjustments may be required onsite to make the proposed solution work.
- Regular maintenance checks of retrofit fish passage devices should be undertaken to ensure they are still in place and functioning as designed and intended over time.
- Ensure that where rip rap has been deposited on the bed of streams voids have been filled and water is flowing across the surface (i.e., not subsurface, which will restrict the passage of fish).
- Ensure that culvert (or manhole) inlets are embedded within, or flush with, the stream bed for the purposes of providing and maintaining for the passage of fish.

RETROFIT OPTIONS

Section 'Summary of Proposed Retrofits' below outlines the culverts that are considered to require fish passage where retrofits can occur. Retrofits include void filling rip rap, the use of baffles through structures, backfilling a manhole with concrete, the use of baffles and pipe in a manhole, and removing perched culverts at outlets through the use of spat rope and polyvinyl chloride (PVC) felt lining (Figure 1).

VOID FILLING RIP RAP

All rip rap used on the bed of streams including inlet and outlet structures should be appropriately void filled using mixed grade material to ensure flows do not go subsurface within streams and that fish passage is maintained throughout a range of flow conditions (i.e., not subsurface, which will restrict or remove fish passage). This should take place by washing substrate fines into voids and any rip rap areas should be monitored.

BAFFLES

Baffles placed inside culverts have been found to reduce velocity, increase depth, interrupt laminar flow, extend range of flow characteristics, retain stream bed material, and have been found to effectively facilitate the passage of a range of fish species during high and low flows (Olleyology Ltd (2019); DOC, 2024).

SPAT ROPE

Mussel spat rope are used in a large number of fish passage projects throughout in New Zealand (David & Hamer, 2012; DOC, 2024; Franklin et al. 2018)⁴⁷. There are limitations in installing spat rope throughout the length of culverts. However, this is the best solution for culverts ca. <900mm where baffles cannot be installed. For culverts ca. >900mm (of a size to allow installation of baffles) the combination of baffles and spat rope (at outlets) is considered the best solution. It is important spat rope is fastened in place. Spat rope should only be used as a retrofit and not for new or replaced structures.

FLUMES

To reduce velocities of water running through pipes in large storm events it has been confirmed that weir baffles can and have been installed into plastic flume pipes before they are installed onsite.⁴⁸ These should also be installed into current flume pipes that have been installed within the site. There is also the option to retrofit Site G3 with a combination of baffles and spat rope to facilitated fish passage.



Figure A1. Low cost retrofit fish passage solutions A) baffles, B) mussel spat rope through culverts, C) mussel spat rope lined with PVC felt at outlets, D) combination of spat rope and pipe through manhole, E) spat rope and baffles through flume pipe.

⁴⁷ David, B. O., & Hamer, M. P. (2012). Remediation of a perched stream culvert with ropes improves fish passage. Marine and Freshwater Research, 63(5), 440-449.

Franklin, P., Gee, E., Baker, C., & Bowie, S. (2018). New Zealand fish passage guidelines: for structures up to 4 metre. NIWA Client Report No. 018019HN

⁴⁸ <https://www.ats-environmental.com/solutions/culvert-baffles/>

SUMMARY OF PROPOSED RETROFIT OPTIONS AT KEY SITES

CULVERT 6 (SITE D2)

Retrofits are proposed at Site D2 to meet the requirements of the WK-OIC. Upstream of the road the pipe has been extended the manhole has been replaced (Figure A2). The scruffy dome will be backfilled with concrete from the base to the lip of culvert overhang. This should include a slight angle to the centre of the concrete ramp to concentrate flows but should be less than 15 degrees. Baffles should be installed along the backfilled concrete slope, and potentially some spat rope from the upstream pool through the culvert inlet into the manhole may be required. The newly constructed and reformed waterfall is proposed to be similar to the current situation. It may take several years to establish moss that is previously helped facilitate fish passage which will need to be monitored to ensure fish passage is successful at this site.

Downstream of the road it was not possible to fully view the downstream outlet based on health and safety constraints with the steep banks. However, there may be the opportunity to install a small piece of spat rope lined with PVC if there is a small perch at the outlet (Figure 1B). Spat rope is proposed to be installed throughout the length of the culvert.

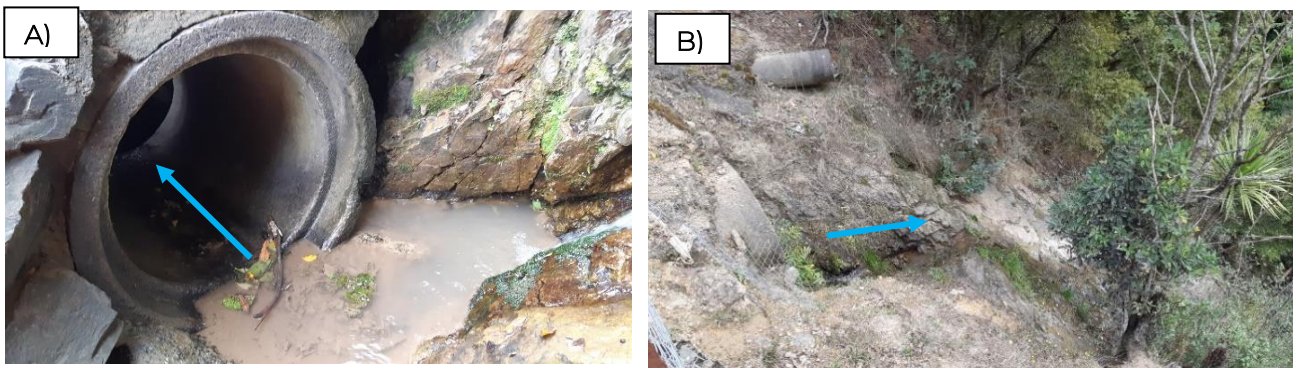


Figure A2. Site D2: A) Waterfall: current inlet to be replaced, B) outlet.

CULVERT 14 (SITE G2)

Retrofits are proposed at Site G2 to meet the requirements of the WK-OIC. Upstream of the road there was a 3.6 m of rip rap with sandbags and a temporary bypass (Figure A3). A permanent pool is proposed to be created which may need some concrete to secure it in place.

Consideration was given to installing a culvert between the pool and the scruffy dome (the pipe would have been installed part way down the scruffy dome and baffles would have been installed). However, based on cost constraints a channel was created through the rock rip rap and a notch was created into the top of the manhole. The manhole is proposed to be retrofitted with spat rope through the plastic pipe installed in a spiral to the base of the culvert (Figure A3).

Downstream of the road spat rope lined with PVC at the outlet to pool is recommended to better facilitate passage into the culvert (Figure A3). Spat rope is proposed to be installed throughout the length of the culvert.



Figure A3. Site G2 (CH12980): A) waterfall and stream upstream of the road, B/C) current installed inlet with large rip rap with subsurface flow to scruffy dome, D) current outlet showing perch.

CULVERT 17 (SITE H)

Retrofits are proposed at Site H to meet the requirements of the WK-OIC. Upstream of the road the large rip rap installed has subsurface flow at the culvert inlet. The rip rap should be void fill and baffles could be installed within the culvert extension to the manhole (Figure 4A/B/C).

The manhole inlet pipe upstream of the road is perched. Some rock has been put in place here for Hochstetter's frog, but the inlet is still perched (Figure A4). There is the option to void fill with fines but there are issues with this washing through the pipe and the small rocks damaging the structure over time. It is proposed that some of the small rocks are removed and replaced with larger rocks. Then the outlet includes a small amount of spat rope lined with PVC. Spat rope is also proposed to be installed through the length of the culvert.



Figure A4. Site H: A/B/C) culvert extension and rip rap installed at inlet, D) manhole inlet currently still perched, E) outlet downstream of road.

CULVERT 19 (SITE I)

Retrofits are proposed at Site I to minimise risk of an abatement notice. No changes are proposed to this culvert, and the culvert is not eligible for an exemption. The existing culvert provides restrictions and there is the ability to improve fish passage (Figure A5).

Baffles could be installed throughout culvert to improve fish passage. Downstream of the road the outlet has not been observed and may require some type of retrofit such as spat rope lined with PVC if the outlet is perched.

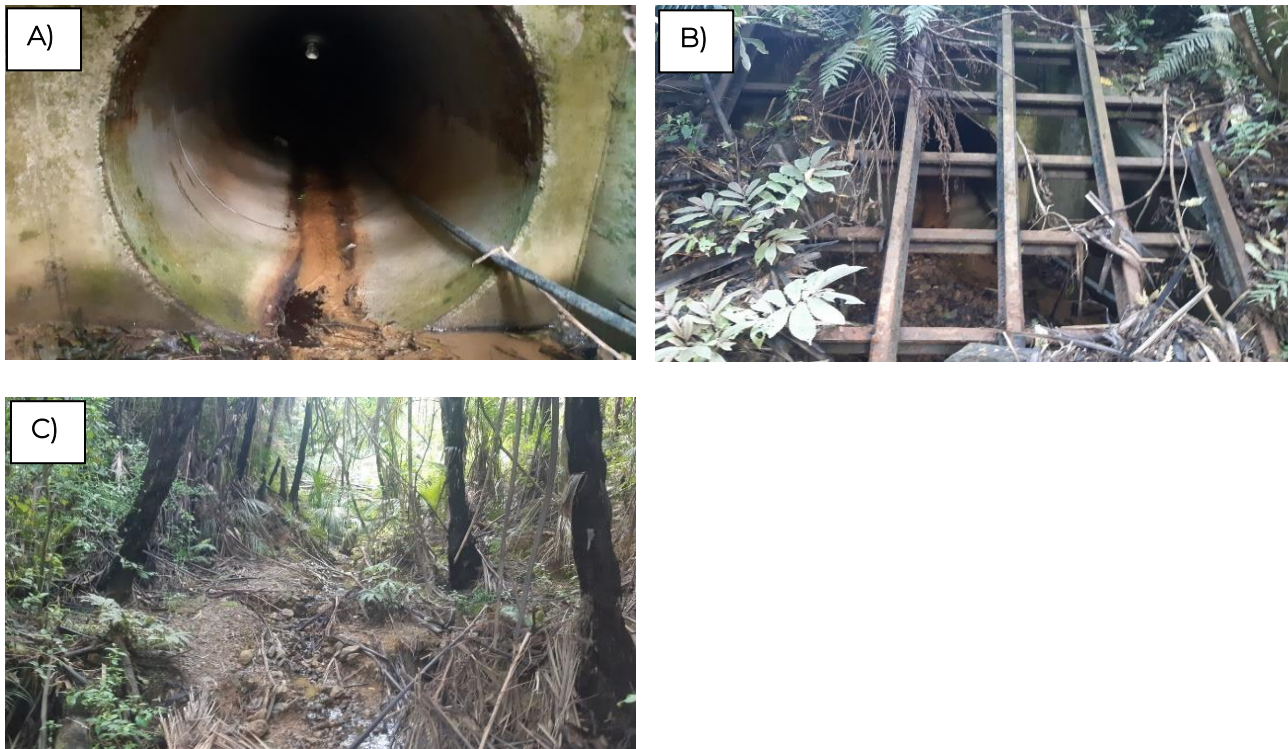


Figure A5. Site I: A/B) existing culvert inlet and grate, C) upstream stream habitat

CULVERT 21 (SITE J)

Retrofits are proposed at Site J to meet the requirements of the WK-OIC. Upstream of the road the culvert is undersized at 600mm diameter compared to the size of the stream.

Downstream of the road there is an approximately 50mm overhang at outlet (Figure A6). It is proposed that some spat rope lined with PVC is installed at the outlet. It is not possible to retrofit this culvert with baffles as it is approximately 0.6m in diameter therefore spat rope is proposed to be installed throughout the length of the culvert.



Figure A6. Site J: A/C) existing upstream stream habitat, B) newly installed emergency overflow at inlet that is offline to the main stream bed, D) perched outlet.

APPENDIX B: SITES COMPARISON TABLE

CULVERT NO.	CULVERT NAME / FLUME NAME (STORMWATER REPORT)	STREAM NAME (ECOLOGY REPORT)	LOCATION	MEETS THE RMA DEFINITION OF A 'RIVER'/'STREAM' (YES/NO)
N/A	Outfall A1	-	11620	No
N/A	Outfall A2	-	11760	No
1	Gully A	A	11685	Yes
2	Gully B	B1	11846	Yes
3	Gully B2	B2	12044	No
4	Gully C South	C	12160	No
N/A	Outfall at C south	-		No
5	Gully D North	D1	12264	Yes
6	Gully D (Waterfall)	D2	12365	Yes
7	Gully E Roadside North	-	12420	No
8	Gully E Roadside South	-	12480	No
N/A	Outfall at gully E roadside south	-	12480	No
9	Gully F North	-	12560	No
N/A	Outfall at gully F north	-	12560	No
NA	Gully F north	-	12680	N/A - Abandoned
10	Gully F Existing	F1	12760	Yes
12	Gully G North - 1	F2	12840	No
N/A	Outfall at gully G north	-	12840	No
13	Gully G North - 2	G1	12920	No
14	Gully G North - 3	G2	12980	Yes
15	Gully G North -4	G3	13060	Yes
16	Gully G South	G4	13140	No
N/A	Outfall at Gully G south	-	13140	No
17	Gully H	H	13220	Yes
N/A	Outfall at Gully H	-	13350	No
18	Gully I -RR	-	13400	No
19	Gully J North	I	13580	Yes
20	Gully J Middle		13630	No
21	Gully J South	J	13700	Yes
22	Gully J New (last)		13755	No