Appendix L Freshwater Ecology Assessment

Taharoa Ironsands Mine Fast-Track Consent Application

Freshwater Ecological Assessment of Effects

Taharoa Ironsands Limited

Prepared by:

SLR Consulting New Zealand

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
V1.0	22 October 2025	Keren Bennett	Hamish Dean	Keren Bennett

Basis of Report

This report has been prepared by SLR Consulting New Zealand (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Taharoa Ironsands Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report has been prepared for Taharoa Ironsands Limited in respect of its application for all approvals under the Fast-track Approvals Act 2024 for the Central and Southern Blocks of the Taharoa Ironsand Mine. The Panel appointed to consider the application for the Central and Southern Blocks Mining Project may rely on this report for the purpose of making its decision under the Fast-track Approvals Act 2024.

This report has been prepared in accordance with the Environment Court's Code of Conduct for expert witnesses, contained in the Environment Court's Practice Note 2023. The authors of this report agree to comply with the Code of Conduct, and confirm that unless otherwise stated, the issues addressed in this report are within the area of expertise of the authors. No material facts have been omitted that might alter or detract from the opinions expressed in this report.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Executive Summary

Taharoa Ironsands Limited (TIL) is seeking resource consents under the Fast-track Approvals Act 2024 to continue ironsand mining operations within the Central and Southern Blocks of the Taharoa Mine. From a freshwater ecology perspective, TIL's application involves the damming of the Wainui Stream and the take and use of water from Lake Taharoa. The Wainui Stream connects Lake Taharoa to the Tasman Sea.

This report presents an assessment of the freshwater ecological values and the potential effects of the proposed activities on the Wainui and Mitiwai Streams and associated aquatic environments.

The Wainui Stream has historically been modified by the installation of a dam and fish pass. However, for the purposes of this assessment, the existing environment against which the Project is assessed excludes TIL's current water take and discharges and excludes the dam which is assumed to have been removed.

In reality, the Stream is dammed and there is an operational fish pass that facilitates the migration of fish. The fish pass was upgraded in 2010 to improve its effectiveness for upstream fish migration. Monitoring undertaken by Tonkin & Taylor between 2010 and 2015, and more recent surveys by SLR Consulting (formerly 4Sight Consulting), confirm that the fish pass is effective in facilitating upstream passage for migratory fish. Fish QIBI scores calculated from both field sampling and eDNA data indicate "good" to "excellent" habitat quality and connectivity for fish migration.

Overall, the results of surveys undertaken demonstrate that the fish pass is effective in enabling connectivity past the dam and that this connectivity is supporting recruitment for a diverse range of native fish species within the Lake and its wider catchment. Conditions of consent requiring maintenance and monitoring are recommended to ensure that the fish pass remains functional over time.

The potential ecological effects of TIL's proposed water abstraction include changes to lake level regimes, reductions in downstream flows, and entrainment of fish at intake structures. TIL proposes to maintain residual flows through the fish pass and dam overflow weir, including by flow augmentation during low reservoir levels, to mitigate these effects.

Mining below the water table is proposed across the Central and Southern Blocks. Groundwater abstraction associated with this activity has the potential to reduce baseflows, primarily in the Mitiwai Stream, particularly during summer low flow periods. The Mitiwai Stream supports a moderate to high ecological value, with six native fish species identified, including two classified as 'At Risk – Declining' (īnanga and longfin eel). To mitigate potential stream depletion effects, TIL proposes to augment flows in the lower Mitiwai Stream using clean water from mining operations. This will ensure base flow levels and instream habitats are maintained, particularly during summer low flow periods. Water quality monitoring is recommended to ensure that augmentation appropriately maintains existing stream conditions.

Incidental stormwater discharges from the mine site are expected to be minimal and are proposed to be managed through consent conditions that prohibit discharges that would result in conspicuous contamination.

Key recommendations arising from this assessment include:

- Continued maintenance and monitoring of the fish pass to ensure ongoing functionality and effective access for migratory fish species.

- Installation of a 0.5 m deep sump/pool below the dam overflow structure (weir) to prevent injury to downstream migrating fish.
- Implementation of flow augmentation and water quality monitoring in the Mitiwai Stream during mining below the water table.
- Development of a Water Management Plan to guide monitoring and mitigation measures.

These recommendations are reflected in the proposed consent conditions submitted by TIL. Overall, the proposed mitigation measures are expected to ensure the protection of freshwater ecological values during the continued operation of the Taharoa Mine.

Intake screening is currently coarse (12 mm mesh), and while intake velocities are within acceptable limits, SLR also recommends reviewing of intake screen design to reduce entrainment risk for juvenile fish while maintaining operational efficiency.

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Acronyms and Abbreviations

eDNA	Environmental DNA
EPT	Ephemeroptera or mayflies; Plecoptera or stoneflies; Trichoptera or caddisflies
GPS	Global Positioning System
MCI	Macroinvertebrate Community Index
MCI-sb	Soft bottomed stream variant of the MCI
QIBI	Quantile Index of Biotic Integrity
SLR	SLR Consulting Limited
SQMCI	Semi-Quantitative Macroinvertebrate Community Index
SQMCI-sb	Soft bottomed stream variant of the SQMCI
T&T	Tonkin & Taylor
TIL	Taharoa Ironsands Limited
WRC	Waikato Regional Council
WRP	Waikato Regional Plan
WWLA	Williamson Water and Land Advisory

1.0 Introduction

Taharoa Ironsands Limited (TIL) operates an ironsand mine at Taharoa on the west coast of the North Island, to the south of Kawhia Harbour. TIL is seeking new resource consents to continue the existing ironsand mining operation within the Central and Southern blocks of the Mine and enable the export of titanomagnetite from the Port of Taharoa. TIL's Central and Southern Block Mining Project is included as a listed project in Schedule 2 of the Fast-track Approvals Act 2024.

This report discusses freshwater ecological values and potential and actual effects of the proposed ironsand mining operations on receiving watercourses. The report relies on desktop information, site surveys, a freshwater Ecological Impact Assessment (EcIA) completed by Tonkin & Taylor (T&T, 2020), and additional on-site surveys and assessment conducted by SLR Consulting (SLR; formerly 4Sight Consulting) prepared in relation to TIL's previous application for the same parts of the Mine, which will now be effectively replaced by its Fast-track application (4Sight, 2022; 4Sight 2023). Hydrology and groundwater modelling and associated reports (WWLA, 2025a; 2025b) and further assessments of the Mitiwai (Matauwai) Stream undertaken by SLR in 2023 to inform a culvert upgrade also inform this report (4Sight, 2023).

This report has been prepared to inform the application for all necessary resource consents sought under the Fast-track Approvals Act 2024.

1.1 The Site

The area of interest considered in this assessment is the area displayed in Figure 1 and known as the 'Central and Southern Blocks' (the Site). That is, the part of Taharoa C Block south of the Mitiwai Stream. A detailed site and project description is provided in the substantive application report, which this report is appended to.

The existing Mine is located west of the Taharoa Lakes, a chain complex of three lakes including the largest Lake Taharoa, and the smaller lakes Numiti and Rotoroa. A contributing catchment of approximately 38km^2 provides surface water inflows via a number of small streams to the Taharoa Lakes. The catchment draining to the lakes comprises a mix of land use cover, including native forest and scrub, plantation pine and exotic pasture used for stock grazing.

The Taharoa Lakes discharge via the Wainui Stream, within the Mine area, which flows out to the Tasman Sea. A dam was installed on the lower Wainui Stream in the 1970s, which raised lake levels and water levels within the Wainui Stream above the dam. The dam was installed to create an impounded reservoir to supply freshwater used to both transport and process the ironsand before shipping, and to transport the ironsand as a slurry into ships moored offshore for export. A fish pass was installed at the same time as the dam, and was subsequently upgraded, to facilitate the movement of migratory fish past the dam. As part of the application, TIL is seeking resource consents to reauthorise the damming of the Wainui Stream, along with the installation of the fish pass, to support the operation of the Mine for a further 35 years.

The Wainui Stream leaves Lake Taharoa as an open, uniform channel within surrounding wetlands, following a shallow, incised, flooded gully bed bounded by marginal raupō, to the impounded area above the dam. The short section of stream below the dam (approximately 250m in length) has a narrower channel, with scattered rocks present in addition to the sand dominated substrate. The rocks and weir added to this downstream area form part of the

Fast-track application and provide a greater diversity of instream habitats than present upstream of the dam.

Figure 1: The Mine location and extent.

1.2 Existing environment

TIL is currently authorised to maintain an existing mooring and pipeline in the coastal marine area, to dam and divert the Wainui Stream to create a water supply reservoir (the dam), to take freshwater from the dam reservoir, to discharge water, and to undertake mining operations (Existing Consents).

However, for the purposes of assessment of the proposal, the existing environment against which the Project is assessed:

- Includes the effects of past mining activities but without any ongoing mining activities occurring in the areas that are the subject of the Existing Consents.
- Considers the impact of the application on the ecological features and values that would exist immediately after the mining activities cease under the Existing Consents.
- Excludes the water take and discharges authorised by the Existing Consents but includes an environment that has acclimated to the presence of such water takes and discharges.
- Excludes the dam and related infrastructure, as it is assumed to have been removed on the date of expiry of the Existing Consents but includes a land and water form modified by the presence of the dam over the years and the removal of the dam.

Consequently, with removal of the dam the water level in the lake would have dropped (within a period of hours or days) to approximately pre-dam levels. However, the ecological features and values would not have adapted to the new water levels because the assumption is there is no gap in time between the date the decision is made (and the Existing Consents expire) and the date that the activities recommence.

Previous surveys of aquatic fauna and habitat values of the Wainui Stream and Mitiwai Stream while the Wainui Stream dam, fish pass and water-intake structures have been in operation, provide useful information to enable an assessment of effects of the proposal against the above baseline environment.

1.3 Key freshwater effects

The following proposed activities have been identified as having potential impacts on freshwater ecological values:

- Damming of the Wainui Stream, with potential effects on migratory fish passage.
- Water abstraction from the Wainui Stream including:
  - potential effects on the water regime upstream and downstream of the take, and
  - potential entrainment of fish into the water intake structures.
- Effects of mining below the water table on the stream hydrology and function of the Mitiwai Stream and Wainui Stream.
- Stormwater discharge to the Wainui Stream, with potential contamination of the receiving environment.

Each of these key factors are discussed in the sections below.

2.0 Damming of the Wainui Stream and installation of the pass and fish passage

The Wainui Stream connects Lake Taharoa to the sea. Prior to the dam installation the Wainui Stream flowed for around 2,300 m before discharging to the sea. Historic aerial imagery, taken prior to the Mine being established, indicates the presence of extensive wetland habitats at the junction of Lake Taharoa and the Wainui Stream, and the meandering stream bisecting active sand dunes. Scattered low-growing riparian vegetation was evident along the stream gully, likely able to establish in the shelter of the active surrounding dunes.

In the context of the existing environment, the Wainui Stream is considered to have been modified by the historical presence of the dam and associated infrastructure, but is now assumed to be free-flowing, with ecological features reflecting a transitional state between the dammed and pre-dam conditions.

The Wainui Stream is classified as a Significant Indigenous Fisheries and Fish Habitat class watercourse under the Waikato Regional Plan. The Wainui Stream provides an important pathway for the migration of migratory fish to and from the Tasman Sea, moving into the Taharoa Lakes and headwater tributaries that drain to the Lakes.

2.1 Previous surveys of the structures (in operation)

The dam structure creates a ponded area for the Mine's water take (Photo 1). It is located approximately 250 m upstream of the stream outlet to the Tasman Sea (Figure 2) and stream habitats upstream of the dam to Lake Taharoa comprise slow-flowing run habitat, fringed in most places by raupō. The dam itself impedes upstream fish passage for migratory freshwater fish species. To address this a fish pass was constructed to provide upstream fish passage in the 1970s. It was subsequently upgraded in early 2010 to ensure its effectiveness (Photo 2). In line with the requirements of Waikato Regional Council resource consent 100904, a monitoring programme was developed by Tonkin & Taylor (T&T, 2011a) and subsequently implemented to test the effectiveness of the upgraded pass. Intensive monitoring of the fish pass occurred during key October and January upstream migration periods for five years between 2011 and 2015 (T&T 2011b, 2012, 2013, 2014, 2015). Mine staff have also completed ongoing weekly observational surveys of fish utilising the fish pass, in accordance with the conditions of TIL's current consent.

The T&T surveys were designed to assess the success of the pass to facilitate upstream passage of native fish, focusing on five key target species: īnanga (*Galaxias maculatus*), longfin eel (*Anguilla dieffenbachii*), shortfin eel (*A. australis*), smelt (*Retropinna retropinna*) and grey mullet (*Mugil cephalus*). These target species reflect migratory species of cultural interest, and species with a range of abilities to bypass migration barriers, from īnanga (poor ability) to eels (excellent ability). While the focus was the target species, as common representatives of the wider range of fish species that could be expected from the stream, other 'non-target' species were also recorded. The fish pass was particularly designed to facilitate the passage of swimming fish such as īnanga, smelt and mullet, which can move through faster flowing areas through burst swimming between resting areas. The design was intended to also facilitate the movement of elver (juvenile eels) and eels, who would use the pass by moving upstream along the rocky substrate on the bottom of the pass (T&T 2015). Two annual survey periods were included, intended to capture peak migration periods for the key target species: October to target peak juvenile īnanga, smelt and glass eel migration; and January to target the migration of mullet and elver.

Figure 2: Site overview and fish and eDNA sampling locations.

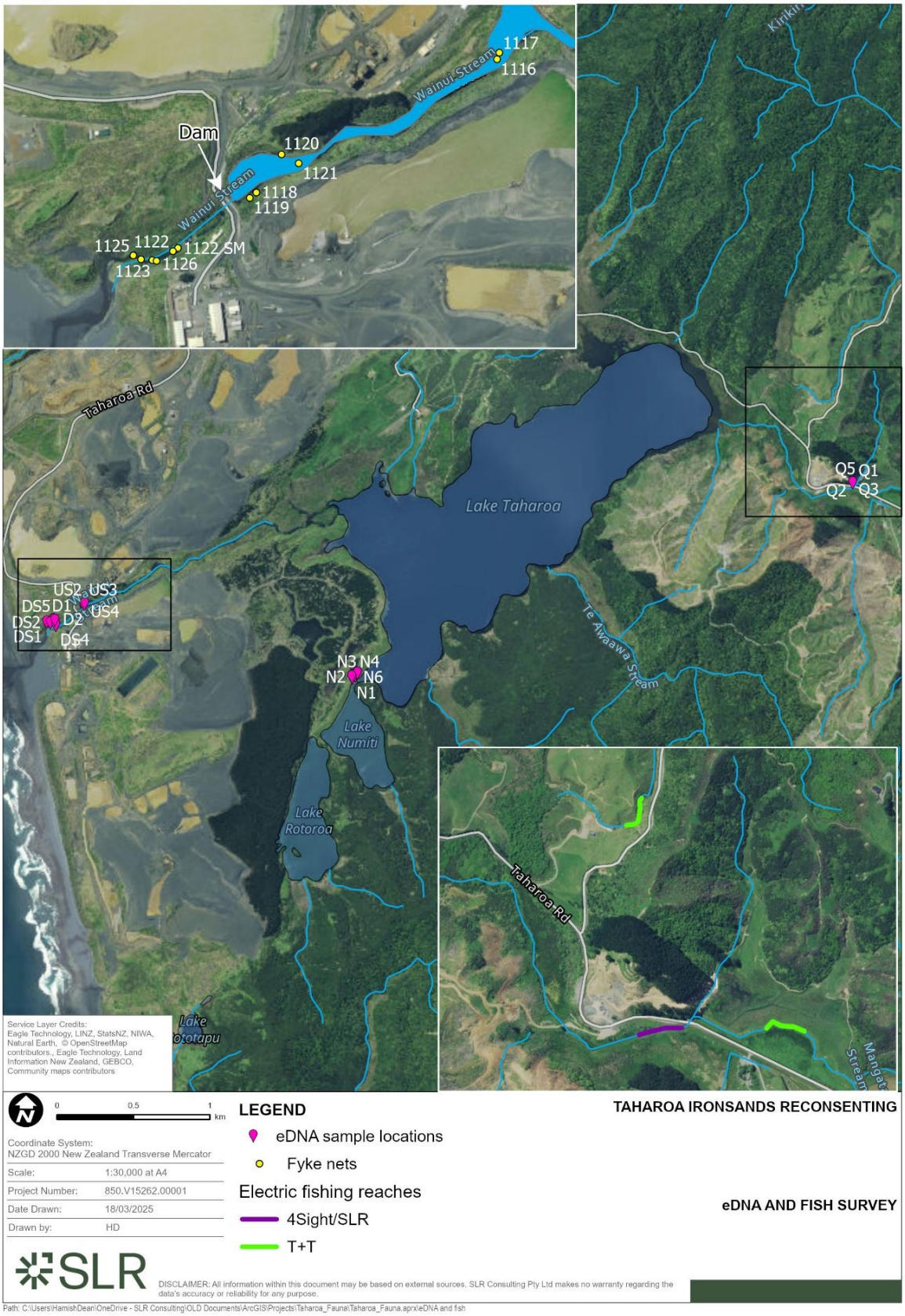


Photo 1: View of dam reservoir, looking towards the dam (January 2022).

Photo 2: Sections of the fish pass (November 2020).

Survey methods on each survey occasion included:

- Survey of the fish pass over five days for each survey period, using whitebait nets set at the base (three days) and top of the fish pass (five days). Nets were checked hourly during daytime periods. All fish captured were identified and counted before being released directly upstream of the net to continue up the pass or into the stream.
- Night-time spotlighting surveys (one night during each five-day survey period) to detect any other species present within the pass.
- Mark (dye) and release exercises using a sample of whitebait captured from the lower stream and released at the base of or mid-way up the fish pass to compare recapture rates.
- A review of results collected by mine staff over the course of the migration season from a trap deployed one day a week at the top of the fish pass.

In addition to surveys of the fish pass, wider catchment surveys were undertaken by T&T during the January survey periods. The wider catchment surveys included the deployment of fyke nets and gee-minnow traps in Lake Taharoa as well as electric fishing surveys in the Mangatangi Stream feeding to Lake Taharoa and in a tributary of the Mangatangi Stream adjacent to Whakapirau Road (Figure 2).

The key outcomes and observations from T&T's review of the five years of monitoring data from 2010 – 2015 are summarised below.

Īnanga

- Catch rates of īnanga at the top of the fish pass increased every year from when the monitoring began in 2010, following upgrades to the fish pass.
- The highest recorded catch rates of īnanga at both the top and bottom of the fish pass (average catch rates of 440 and 395 juvenile īnanga per hour respectively) were encountered in October 2014.
- Mark and release experiments showed that juvenile īnanga can move through the fish pass within 6 hours of release, although dyed individuals were also identified 24 hours after release at the top of the fish pass.
- Night-time surveys of the fish pass identified large schools of īnanga in the fish pass rest pools, suggesting that not all fish work their way upstream continuously and may take longer to move through the fish pass.
- Wider catchment surveys identified īnanga in Lake Taharoa, as well as in streams that flow into Lake Taharoa (the Mangatangi Stream and the Mangatangi Stream tributary), with the number of īnanga recorded varying between years. Variation was attributed to the large area of available habitat within the lake and the mobile nature of these fish.
- Overall, data from the monitoring of the fish pass and the wider catchment surveys indicated that the fish pass was providing passage for īnanga.

Eels / Tuna

- The average catch rate for elver using the fish pass during peak migration (October) varied over the five years of monitoring.

- Elver were regularly captured at the top of the fish pass indicating that they are able to successfully move upstream of the dam, although average catch rates indicated that they may not move continuously through the fish pass.
- Wider catchment surveys identified eels (both longfin and shortfin species) in Lake Taharoa, as well as in streams that flow into Lake Taharoa (the Mangatangi Stream and the Mangatangi Stream tributary).
- The presence of small eels in the wider catchment indicated that the fish pass was facilitating recruitment of eels to the catchment above the Wainui Stream dam.
- Overall, data from the monitoring of the fish pass and the wider catchment surveys indicated that the fish pass was providing passage for eels.

Grey mullet

- Grey mullet were the only species that were not caught using the fish pass during the T&T 2010 – 2015 intensive five-day surveys (October and January).
- However, monthly monitoring by Mine staff during the same period confirmed grey mullet using the fish pass and identified a timeframe when juvenile grey mullet appeared to move upstream (March – April).
- The T&T report referenced a study by Waikato Regional Council (WRC) (David et al., 2014) that noted a school of grey mullet in one of the lakes above the fish pass.
- T&T determined that the above observations suggested that grey mullet were able to successfully use the fish pass and the number of grey mullet found above the fish pass was expected to increase with time.

Smelt

- The average catch rate for smelt using the fish pass during migration (January) varied over the five-year monitoring period.
- Catch rates of smelt were consistently higher at the top of the fish pass compared to the bottom, indicating that smelt are capable of using the fish pass, but most likely migrate at night or do not continuously use the fish pass.
- Overall, data from the monitoring of the fish pass and the wider catchment surveys indicated that the fish pass was providing passage for smelt.

Non-target species

- A range of non-target migratory fish species were found to utilise the fish pass, including banded kōkopu (*Galaxias fasciatus*), kōaro (*G. brevipinnis*), common bully (*Gobiomorphus cotidianus*) and redfin bully (*G. huttoni*).
- All of these species (with the exception of kōaro that were recorded in low numbers) were captured at both the top and bottom of the fish pass, as well as within the wider catchment, indicating that the fish pass was successfully being used by non-target species.

At the completion of the five-year survey programme, the T&T (2015) report summarised the outcomes of the programme, stating:

"*The monitoring programme has successfully determined the numbers of different species (both target and non-target) using the fish pass, as detailed in this report and the previous*

monitoring reports (T&T 2011b, T&T, 2012, T&T, 2013 and T&T, 2014). The conclusion of these reports has been that the fish pass is effective at providing passage to both target and non-target species." [Page 18]

2.2 Additional fish surveys

Information previously collected by T&T was augmented by surveys undertaken by SLR (then 4Sight Consulting) during spring and summer of 2021/2022. Methods included environmental DNA (eDNA) sampling and instream surveys via trapping or electric fishing.

2.2.1 eDNA Sampling

Analysis of water samples for the presence of DNA has been increasingly used in recent years as a fast and cost-effective method to understand community composition in presence/absence form in freshwater, estuarine and marine aquatic environments. Aquatic organisms routinely disperse cellular material into their environment through various processes and these particles can be extracted by filtering water through a fine membrane. Nucleic acids are then extracted and purified for molecular testing, for which methods exist to target individual species (Bruno et al, 2021).

eDNA samples were collected from sites to augment and support the understanding of fish communities in the Wainui Stream and Taharoa Lake system. Samples were collected from four key localities: upstream and downstream of the dam on Wainui Stream, Mangatangi Stream near the quarry on Taharoa Road and at the outlet from Lake Numiti (Figure 2). Samples were collected between 30 November 2021 – 2 December 2021. Six replicate samples were collected from each of the four locations. In addition, drogue samplers were deployed for comparison within flowing water at two locations on the Wainui Stream, upstream and downstream of the dam. The drogue samplers were left in place to collect material continuously for at least 12 hours before being retrieved and processed.

Sampling followed the recommended methodology provided by the supplier laboratory. For each replicate, a sterile eDNA monitoring syringe kit (see https://wilderlab.co.nz) was opened and using the latex gloves included in the kit, a 60 ml syringe with pre-attached 1.2 µm cellulose acetate encapsulated syringe filter was removed and the filter unscrewed from the end and held in one hand. Facing upstream into the current to prevent any potential contamination from waders or other gear, a 50 ml sample of stream water was then sucked up from just below the surface in the middle of the stream or away from the lake edge. The filter was then re-screwed onto the syringe and the 50 ml stream water sample pushed through it. This same process of filter removal, sucking 50 ml, re-attachment, and pushing through continued until the filter was saturated with material and no more water could be pushed through. The volume filtered for each sample ranged between 350 ml and 850 ml, with an average volume of 595 ml and a median volume of 600 ml filtered.

The filter was again removed, and the syringe filled with air (50 cc) which was then forced through the filter to remove excess water. The filter was then transferred to the smaller syringe provided within the kit containing a 300 µl DNA/RNA Shield preservative. The total volume filtered, and GPS co-ordinates of the sampling location were recorded on the supplied sample kit bag.

Samples were kept at ambient temperature and couriered to the Wilderlab laboratory (Wellington) within a few days of collection for analysis.

2.2.2 Instream Fish Surveys

Fish communities in the Wainui Stream were also assessed upstream and downstream of the dam by overnight trapping. Six fine mesh fyke nets with exclusion chambers and 12 collapsible minnow traps were deployed overnight at each site. Nets were deployed on the afternoon of 25 January 2022 and retrieved the following morning. In the lower stream the six fykes were deployed through an approximately 80m reach of stream below the fish pass intake. Fyke nets were positioned, and a pair of minnow traps placed at appropriate locations within 5m upstream and downstream of each fyke net. Access to the stream above the dam was affected by water depths and dense, marginal stands of raupō. Fykes and accompanying minnow traps were deployed in pairs at three accessible locations, including near the fish pass upper intake, and the two localities on the opposite bank of the main channel. Nets were spread across an approximately 500m section of stream encompassing the reaches on either side of the dam. Deployment locations of each fyke net are illustrated in Figure 2. Fish captured were identified and lengths estimated before being released.

Electric fishing of a section of the Mangatangi (quarry) Stream was undertaken on 26 January 2022 (Figure 2). This site roughly coincides with the ‘Mangatangi Stream’ site surveyed by T&T during the 2011 – 2015 surveys. Electric fishing of an approximately 75m length of stream was completed. Fish captured were identified to species level and lengths estimated before release.

2.2.3 Results

The range of fish species recorded from the instream surveys and eDNA monitoring completed by 4Sight is outlined below in Table 1 and is consistent with those recorded during previous surveys undertaken by T&T (T&T 2011b, 2012, 2013, 2014, 2015).

The eDNA sampling identified a similar range of species with a few notable exceptions. The Australian speckled longfin eel (*Anguilla reinhardtii*) was identified from eDNA at two sites: within Wainui Stream downstream of the dam, and within the Mangatangi Stream. This species is an occasional visitor that was first recorded in New Zealand waters in the late 1950s (Chisnall, 2000). It is recorded occasionally, mostly from west coast locations between Northland and Taranaki.

Crans bully (*Gobiomorphus basalis*), a non-migratory bully species, were also recorded in eDNA samples from Wainui Stream upstream of the dam, Lake Numiti and Mangatangi Stream but were not specifically identified during the most recent surveys or during surveys undertaken by T&T. Given the large number of bullies recorded from Wainui Stream in particular, it is possible that Crans bully (which are physically similar to common bullies) were present but not identified.

Within the lower Wainui Stream, instream habitats included faster flowing riffle habitats at the base of the weirs and fish pass entry as well as shallower runs and deeper pooled areas. Raupō was present on the stream margins. Grey mullet were visibly abundant through the short reach below the fish pass weir, but were observed actively avoiding the deployed fyke nets, and were not captured in any nets. Bullies, predominantly common bully, were abundant through the lower stream. Redfin bully were recorded in small numbers from below riffle habitats. Īnanga were also abundant, and a single smelt was captured. Tuna/eels were numerous, with longfin eel dominating. Large adult longfin eel (up to approximately 1200mm in length) were recorded throughout the lower stream.

Table 1: Fish species captured during the surveys (January 2022) and eDNA sampling (November/December 2021)

Fish species		Wainui Stream Downstream of dam		Wainui Stream Upstream of dam		Mangatangi Stream		Lake Numiti outlet
Common name	Scientific name	traps	eDNA	traps	eDNA	EFM	eDNA	eDNA
Shortfin eel	*Anguilla australis*	25	yes	26	yes	12	yes	yes
Longfin eel	*Anguilla dieffenbachii*	66	yes	9	yes	8	yes	
Speckled longfin eel	*Anguilla reinhardtii*		yes				yes	
Eels	*Anguilla* sp.				yes	3		
Galaxiids	*Galaxias* sp.		yes					
Īnanga	*Galaxias maculatus*	272	yes	5	yes			
Bullies	*Gobiomorphus* sp.		yes		yes			yes
Common bully	*Gobiomorphus cotidianus*	220		665		52		yes
Redfin bully	*Gobiomorphus huttoni*	2	yes				yes	
Crans bully**	*Gobiomorphus basalis*				yes		yes	yes
Smelt	*Retropinna retropinna*	1	yes		yes	35	yes	
Grey mullet	*Mugil cephalus*	obs*	yes		yes			yes

* obs = fish were observed but were not captured in the nets

** non migratory species

Above the Wainui Stream dam, ponding and the absence of artificially added rocky substrates meant that available habitats were less variable, predominantly comprising well flowing run habitats. Shortfin eel were recorded more commonly than longfin eel through the reach surveyed. Common bully were abundant but redfin bully, which prefer well flowing streams containing hard substrates (rocks or large woody debris) were not recorded. Īnanga were present, recorded in small numbers from traps.

Electric fishing of the pebble and gravel dominated Mangatangi Stream returned the presence of smelt, common bully and shortfin and longfin eels. The eDNA survey also identified the presence of redfin bully in this stream.

The eDNA sampling at the Lake Numiti outlet identified the presence of shortfin eel, common and Crans bullies and grey mullet. A school of large mullet was observed by 4Sight (SLR) ecologists in the channel between Lake Numiti and Lake Taharoa during eDNA sampling.

Results were input to the Waikato Quantile Index of Biotic Integrity (QIBI) calculator (Joy, 2007) and a QIBI score generated based on fish species present, altitude and distance inland. The Fish QIBI scores calculated for surveyed sites were indicative of 'good' to 'excellent' habitat quality or connectivity for fish migrations at all sites, based on both eDNA and field sampling results (Table 2).

Table 2: Fish QIBI scores – comparison of field sampling and eDNA results.

Site	Sampling method	QIBI score	Rating
Wainui Stream below dam	traps	54	Excellent
	eDNA	54	Excellent
Wainui Stream above dam	traps	42	Good
	eDNA	44	Good
Mangatangi Stream	EFM	44	Good
	eDNA	54	Excellent
Lake Numiti outlet	eDNA	40	Good

2.3 Assessment of effects on fish passage

2.3.1 Fish pass effectiveness

A diverse range of native fish species have been recorded in the Taharoa Lakes with the most recent surveys identifying shortfin eel, longfin eel, common bully, smelt, īnanga and grey mullet (4Sight 2022; Bruno et al., 2014; T&T 2011b, 2012, 2013, 2014, 2015). Electric fishing and eDNA surveys have also identified the presence of shortfin eel, longfin eel, Australian speckled eel, common bully, Crans bully, redfin bully and smelt from Mangatangi Stream and a tributary upstream of Taharoa Lake (4Sight 2022; T&T 2011b, 2012, 2013, 2014, 2015).

The fish communities present above and below the dam are generally indicative of the natural range of fish that could be expected from the catchment in the absence of the dam. Based on the diverse range of fish present within the stream, the overall ecological value of the Wainui Stream is assessed as high.

Since it was installed, the dam was recognised as a key barrier to migratory fish passage within the Wainui Stream. However, the pass was upgraded in 2010 to improve functionality and design. Subsequent monitoring of the fish pass for a period of five years following its upgrade demonstrated the effectiveness of the fish pass for target species, and for a small range of other native fish species. Monitoring of the fish pass has identified upstream migration of both banded kōkopu and kōaro indicating these species are likely to be present in small headwater tributaries draining to the lakes. All the fish species recorded downstream of the dam were also recorded upstream of the dam. At the completion of the five years of monitoring, T&T concluded that "*the fish pass is effective at providing passage to both target and non-target species*" (T&T 2015). Weekly day time monitoring of the fish pass by mine staff is ongoing and continues to demonstrate fish movement through the pass.

Calculations of fish QIBI scores for the monitoring sites above the Wainui Stream dam also indicates that a diverse range of species is present within the catchment, with all sites returning scores indicating 'excellent' or 'good' connectivity for fish migration.

Overall, the results of surveys undertaken since the fish pass was upgraded and in recent years indicate that the fish pass is effective in enabling connectivity past the dam and that this connectivity is supporting recruitment for a diverse range of native fish species within the lake and its wider catchment.

This indicates that the upgraded fish pass is effective at providing passage for both target (īnanga, longfin eels, shortfin eel, smelt and juvenile grey mullet) and non-target species (including banded kōkopu).

There are no indicators that the effectiveness of the fish pass is declining. This is reinforced by the 'good' to 'excellent' QIBI scores set out above that are partly reflective of connectivity.

The upgraded fish pass forms part of the proposed activity, so the current situation is expected to continue. We recommend that maintenance and monitoring continue to ensure that the fish pass remains functional over time.

Monitoring of the target migratory native fish species (īnanga, longfin eels, shortfin eel, smelt and grey mullet), is recommended to demonstrate the ongoing effectiveness of the fish pass, as indicators of the range of species present in the catchment. This recommendation is reflected in the conditions proposed by TIL, with the fish pass monitoring plan to be updated in consultation with key stakeholders including the Department of Conservation, The Proprietors of Taharoa C Block Incorporation, Taharoa Lake Trustees, Te Runanga o Ngaati Mahuta ki te hauaauru, Te Kōraha Marae, Aaruka Marae and WRC.

The requirement for ongoing monitoring of the structural and design integrity of the fish pass is discussed below in Section 2.3.3.

2.3.2 Mullet

Mullet are a common species that are not range restricted but are a locally important species from a cultural perspective. Mullet populations in the lake became depleted following installation of the dam in the 1970s, but schools of fish have been observed following the fish pass upgrade in 2010. Nevertheless, migratory fish populations in the catchment upstream of the dam may still be recovering. Mullet have been found to be trap shy, so are likely under-represented from trapping data collected to date.

Monitoring of the fish pass since its upgrade and recent observations of schools of mullet within the lake indicate that recruitment of at least juvenile mullet into the Taharoa Lakes is occurring on an ongoing basis. However, detailed surveys of grey mullet populations within the lake have not been undertaken and habitat quality and abundance of fish communities may also be impacted by other factors within the lake's catchment, such as land use practices, that may be unrelated to the presence of the dam or the mine.

Adult grey mullet must return to the sea to breed, and monitoring data does not confirm that adult grey mullet can readily move downstream through the fish pass or back upstream after spawning. This means that further surveys are required to determine their movement and their population changes. Proposed changes to the dam overflow (discussed below in Section 2.3.4) are expected to increase safe downstream passage options for mullet.

The effectiveness of the fish pass for most migratory fish had been demonstrated in monitoring data analysed by T&T, however this had not been overtly demonstrated for adult grey mullet (T&T, 2020). As noted above mullet have been observed using the fish pass and small schools of adult mullet have been observed in the Taharoa Lakes, but to add to the understanding of mullet movements, age and population size within the Lakes, it is recommended that monitoring be undertaken as a condition of TIL's proposed resource consent. This is reflected in the fish pass conditions proposed by TIL. The monitoring programme would be developed in consultation with key stakeholders, including the Department of Conservation, The Proprietors of Taharoa C Block Incorporation, Taharoa Lake Trustees, Te Runanga o Ngaati Mahuta ki te hauaauru, Te Kōraha Marae, Aaruka Marae and WRC.

2.3.3 Fish pass maintenance and monitoring

The current design of the fish pass has been shown to facilitate upstream passage of all target native fish species. Regular maintenance and monitoring of the structure's integrity

and condition is recommended as the key means to ensure that the ongoing functioning of the fish pass is maintained. Maintenance and monitoring are proposed (as currently undertaken), focusing on clearance of excessive aquatic weed growths, debris blockages and structural integrity checks, including at the inlet and outlet of the pass.

TIL is proposing to include conditions similar to those of the previous fish pass resource consent requiring maintenance and monitoring of the condition of the fish pass and surrounding inlet and outlet. These conditions are related to operational monitoring and maintenance of the fish pass to ensure ongoing functionality and effectiveness. Provided the fish pass is well maintained (to ensure no degradation that may impact functionality) the fish pass can be expected to continue to be effective and to maintain upstream fish migration past the dam. As such the inclusion of such conditions is supported.

These conditions, combined with the recommended targeted fish monitoring programme will ensure the fish pass remains operational and any necessary modifications will be made to ensure ongoing functionality and effectiveness.

2.3.4 Downstream fish passage

Monitoring of the existing fish pass in the form of surveys have largely focused on upstream fish movements to assess performance and have not actively considered whether the pass is being utilised as a means of downstream migratory access, in particular by larger fish such as adult eels and mullet. Key migratory periods for adult eels moving downstream towards the sea occur in autumn (March/April) and typically coincide with higher flow periods associated with larger rainfall events. The key period for upstream mullet movements is understood to be during March/April so may coincide with the eels' downstream migratory period. As the adult eels are likely to be migrating during periods of elevated flow, the dam overflow weir is also likely to be operational and may attract eels away from the entrance to the fish pass.

The existing dam overflow weir drops to a concrete based structure before flows enter culverts beneath the mine access road to drain to the lower Wainui Stream channel. There is little water retained at the base of the drop structure so any migratory adult eels or mullet dropping down the overflow structure would have little to no cushioning so could be subject to physical damage.

The requirement for a pool or sump to be installed at the base of the dam weir overflow chamber is recommended. To create a sump/pool in this area would ensure that any eels, or other fish, migrating or washed downstream over the overflow weir would not be injured by falling onto the concrete base that is currently present.

The addition of a 0.5m deep sump/pool will provide two 'safe' options for downstream migration for adult eels, mullet and other native fish; the fish pass and the drop over the dam overflow weir.

3.0 Water abstraction – Wainui Stream

Water is currently abstracted from the Wainui Stream and used for various mining activities across the Site, including sand processing and for the loading of ships. TIL is proposing to continue this activity, with similar limits on the maximum rate of take, daily take volume, 28-day volume, and lake level triggers to the previous consent.

The abstraction and associated structures and activities have the potential to have the following effects on freshwater values:

- Temporary changes to the lake level regime in the Taharoa Lakes with corresponding effects on marginal lake biota and wetland values.
- Disturbance associated with periodic removal of aquatic weed from around the intake structure.
- Reductions in flows in the Wainui Stream downstream of the dam, and the requirement for residual flow maintenance.
- Entrainment and impingement of fish at the pump intake structure.

3.1 Effects on marginal lake biota and wetland values

Potential effects on marginal biota and wetland values of the Taharoa Lakes are discussed in the terrestrial[1] and fauna[2] ecology reports (SLR, 2025a; 2025b) and are not assessed here further.

3.2 Periodic removal of aquatic weed.

Periodic nuisance aquatic weed removal is proposed within the reservoir above the dam to limit weed incursions that can block the water intake structures. It is understood that the periodic weed removals will be undertaken under the permitted activity rules of the Waikato Regional Plan. The permitted activity rules require weed clearance to avoid the August to December (inclusive) fish migration period. As the work is undertaken within the permitted activity rules, the ecological effects of channel clearance are not assessed here further.

3.3 Lower Wainui Stream residual flows

Historic aerial imagery, taken prior to the Mine being established, indicated the Wainui Stream gently meandered for more than 2km through large dunes from Taharoa Lake to the sea. Scattered low-growing riparian vegetation was evident along the stream gully. Flows in the stream would have been seasonally variable, influenced by lake levels and contributing flows from the wider catchment.

With the installation of the dam on the Wainui Stream an approximately 200 – 250m section of waterway is present below the dam before discharging to the coast. Water from above the dam discharges to the lower Wainui Stream via two paths; through the fish pass and over the weir overflow structure to culverts beneath the dam. An approximately 80m section of open stream channel is present between the outflow from the dam culverts and the bottom outlet from the fish pass. Below this, flows from the two sources are combined for the remaining length of the lower Wainui Stream. TIL is proposing to maintain this layout.

As a component of the fish pass design, a low overhanging constructed weir is located at the base of this reach, beside the outlet from the fish pass, intended to prevent migratory fish moving into this section of stream and instead encouraging movement towards the adjacent entry to the fish pass (Photo 3). Based on the design, with an overhanging lip and high velocity laminar flow conditions, it is unlikely that small fish such as galaxiids and bullies can regularly bypass the low weir, however it is acknowledged eels and large mullet can bypass the weir (*pers. obs.*). This area, between the dam and the fish pass outlet, therefore provides

[1] Section 6.2.4

[2] Section 4.2.2

some habitat and refuge for those fish that may have made their way above the lower overhanging weir.

Photo 3: View of low weir near fish pass outlet, indicating a section of stream habitat below the dam during summer low flow conditions (January 2022).

Given the set heights of the overflow weir and the entry to the fish pass within the reservoir area, there is the potential for flows to the lower Wainui Stream to cease once reservoir levels fall and the inlet to the fish pass or the overflow weir sits higher than the reservoir level. The cessation of flows to the fish pass has the potential to result in stranding of fish within the pass as water depths decrease. Extended periods without dam weir overflows could similarly result in a reduction in available instream habitat in the stream immediately below the dam as water levels drop and degradation in water quality occurs, particularly an increase in water temperatures and reduction in dissolved oxygen levels, which could cause stress or deaths for aquatic biota.

Water level management currently occurs, if necessary, to ensure water flow to the lower Wainui Stream via the fish pass is continuous. There is a current requirement, outlined in the Taharoa Water Management Plan (TIL, 2019), for a pump to be in place and used to maintain a flow rate into the fish pass of between 24 – 34L/s, when the reservoir level drops below RL 9.3m. This flow augmentation was intended to reduce the risk for fish to be stranded or trapped in the fish pass when reservoir levels approach or drop below the fish pass intake level. No similar residual flow requirement was required to maintain flows over the dam weir.

Lake level monitoring between 2014 and 2020 (T&T, 2020) and analysis by Williamson Water and Land Advisory (WWLA, 2025a) determined that lake levels did not drop below RL 9.3m, with the lowest water level measured behind the dam being RL 9.45m in 2014, so flow augmentation into the fish pass has not been required to date. Similarly, flow discharge over

the dam weir has not ceased. The invert level for the v-notch (low flow) outlet in the dam weir is RL 9.36. During the lowest water level recorded behind the dam (RL 9.45m in 2014), this would have resulted in flow through the outlet weir of 10 L/s (WWLA, 2025a).

However, modelling presented in the Lake Taharoa hydrology assessment (WWLA, 2025a), indicates that under some water take scenarios, and in the absence of the water level management controls proposed by TIL, the lake levels could drop below RL 9.3m, on occasion, requiring flow augmentation. Under most conditions catchment inflows to the Lake (and subsequently the reservoir) exceed the outflows (from both evaporation and the TIL water take). As such, the potential for low reservoir levels, would be greatest in late summer, when dry weather reduces catchment inflows to the Lake. The WWLA modelling indicates that under the most likely water take scenario, the requirement for flow augmentation to the fish pass and over the weir is possible but would be unlikely to occur on a regular basis.

TIL is proposing to implement a residual flow management approach, including the requirement to augment flows into the fish pass, to retain a residual flow of at least 24L/s when the reservoir drops below RL 9.3m. This has been proposed as a condition of the fish pass consent and will ensure the potential for stranding and deaths of fish in the fish pass under low flow conditions will be avoided.

A similar condition is proposed to augment flows past the overflow weir to the 80m section below the dam, should that be necessary. Current records indicate that the dam overflow ceases at RL 9.36m. An augmentation flow at a minimum of 10 L/s is proposed to be maintained downstream of the dam weir. Provided low flow conditions are not maintained for extended periods, the addition of even a small residual flow will avoid the potential for this section of watercourse to become stagnant and help maintain dissolved oxygen levels and water temperatures. A condition has been proposed that requires monitoring of instream habitat conditions and water quality (including temperature and dissolved oxygen concentrations), should residual flow augmentation extend for more than two weeks. If monitoring identifies adverse effects occurring, additional management measures will be triggered. Such measures could include reducing take volumes or increasing residual flow volumes.

Eels and mullet (the fish most likely to be in this reach immediately below the dam) are highly mobile so the potential for stress or fish deaths if present within this reach during short periods of low flow and flow augmentation is therefore determined to be low.

3.4 Water pump intake screening

Within the reservoir, the two current water intake pumps are fitted with coarse screens, understood to be 12 mm in mesh size. There is the potential for small fish and invertebrates to be entrained or impinged on these screens.

The Wainui Stream is classified as a Significant Indigenous Fisheries and Fish Habitat class watercourse under the Waikato Regional Plan (WRP) which includes a standard requiring screen mesh size of 1.5mm for water takes at locations <100m above sea level, with a maximum intake velocity of 0.3m/s. The current screen size is not best practice for protecting small-bodied native fish and invertebrates and does not comply with this WRP standard.

Species and life stages that are likely most at risk are small galaxiids, bullies and larval fish which are likely to be highly abundant at certain times of the year. Larvae of galaxiid species that spawn in the lake tributaries or lake, such as banded kokopu, and potentially īnanga, drift downstream and out to sea and juvenile galaxiids (whitebait) and eels (elvers) entering the reservoir by migrating upstream via the fish pass could be at risk of entrainment when the pumps are on.

TIL does not propose to change the size of the screens as part of the Project. TIL has indicated that, because of aquatic weed densities accumulating in the reservoir, there are practical limitations and operational challenges that limit the feasibility of meeting the WRP standard. TIL has advised that retrofitting the intake structure to accommodate smaller mesh sizes is likely to require significant reconstruction and relocation. The assessment below therefore considers the potential adverse effects of retaining the current screens.

It is noted that the fish pass design report (T&T, 2009), prepared ahead of the fish pass upgrade in 2010, indicates that the fish pass inlet within the reservoir was positioned away from the pump inlets and dam spillway, specifically to limit the potential for fish to be swept downstream, or into the pumps, upon exiting the pass. This placement helps to mitigate the potential adverse effects on upstream migrating fish.

The screen area and pump volume[3] calculations indicate that maximum intake velocities remain less than 0.3m/s, thereby reducing the likelihood of impingement for larger fish, but the large screen mesh size would potentially allow entrainment of small-bodied native fish and invertebrates, particularly larval galaxiids, bullies, whitebait, and elvers, into the pumps. These life stages are vulnerable to entrainment due to their small size and limited swimming ability.

In summary, while intake velocities are within acceptable limits, the coarse mesh size allows small fish to potentially pass through and enter the pumps.

Potential adverse ecological effects of the large screen size include disruption of migratory cycles and reduced recruitment success for diadromous species. Although the fish pass inlet is strategically located to reduce risks to upstream migrants, the lack of fine screening remains a concern for small or larval fish moving downstream. Operational constraints are acknowledged, but it is recommended that alternative mitigation measures or retrofitting be considered to better align with ecological and regulatory expectations.

4.0 Abstraction of groundwater

TIL's application includes mining in the groundwater layer across the Site. In the northern part of the Central Block mining below the water table would commence to the south of Mitiwai Stream, moving in stages in a generally southern direction towards Wainui Stream. Similarly mining below the water table of the Southern Block, south of Wainui Stream is proposed. TIL has prepared a draft preliminary plan that illustrates the staging and methodology for mining. Essentially 'cells' within the mining block will progressively change from mining above the water table using typical earthmoving equipment to use of a dredge below the water table before being backfilled with tailings once dredging moves to the next cell. In both methods, groundwater flows need to be managed, for mining above the water table, that could include collecting runoff/perched groundwater and pumping it away from the mining area. For dredging, that could be pumping in water to maintain the required dredge pond levels, or, conversely pumping out groundwater to lower the pond level.

The activities that intercept or abstract groundwater can cause a local lowering of groundwater that may result in stream depletion effects, or changes in the hydrology of wetlands.

The potential effects of mining below the water table on the surface water features of the Mitiwai and Wainui Streams are discussed in the below sections.

[3] Approximate screen area of 27m^2 and pump volume of 1.1 m^3/s (pers. comm., J Petterson, Enviser).

4.1 Mitiwai Stream features and values

At the northern edge of the Central Block the Mitiwai Stream runs in an approximate south-westerly direction toward the coast. The stream headwaters originate in the hills to the northeast of the TIL mining site amongst mixed land use, with some tributaries lined with native bush and others surrounded by rural activities. Adjacent to the Central Block the stream is set in a deep gully with steep-sided gully banks that rise to roughly 30–40m in height.

Within the Site the lower reaches of the stream run through sand dunes that support a vegetative community of scrubby, low stature specimens dominated by exotic taxa (Photo 4). Upstream of a vehicle crossing that provides access to the Northern Block and Te Kooraha Marae, remnant plantation pine trees and wildling pines are scattered along the gully slopes and less commonly along the gully bed near the stream, undergrown with pasture grasses (Photo 5).

The lower Mitiwai Stream was surveyed in October 2023 to inform an application for a new culverted vehicle crossing approximately 200m upstream from the coast (4Sight, 2023). Instream habitat quality and riparian margins were assessed and general observations of riparian community composition, riparian shading, habitat suitability for fish, and other habitat characteristics were also noted.

Samples of benthic macroinvertebrate communities and environmental DNA (6x replicates) were also collected in the lower stream, above and below the original culvert, to identify the fish species present within the lower waterway.

Photo 4: View of older vehicle crossing on the lower Mitiwai Stream, looking towards the west (downstream).

Photo 5: Overviews of Mitiwai Stream gully.

Photo 6: View upstream to newly constructed culverted crossing on Mitiwai Stream (left), and from new crossing downstream to retained crossing (right).

The culverted crossing upgrade has since been installed, a short distance upstream of the existing crossing. Both crossings are now utilised, the new crossing for mine traffic, with the original crossing retained for vehicle access to Te Kooraha Marae (Photo 6) so both form part of the existing environment.

The information collected to inform the culvert application has been used to inform the potential effects of the groundwater extraction on the aquatic values of the Mitiwai Stream.

4.1.1 Habitat values

The lower reaches of the Mitiwai Stream run through sand dunes that support a vegetative community of scrubby, low stature specimens dominated by exotic taxa. Shading along the length of the survey reach was varied, with some areas open and unshaded, and others well-shaded due to the incised nature of the stream. A qualitative habitat assessment was undertaken following the WRC methodology for soft-bottomed streams, which guides field ecologists to score habitat criteria on a scale of 1 to 20, with scores between 1 and 5 labelled as “poor”; 6-10, “marginal”; 11-15, “suboptimal”; and 16-20 “optimal”. The assessment revealed that the lower Mitiwai Stream supports a marginal to sub-optimal habitat quality with a site score of 95 out of a total possible score of 180. The surveyed reach scored poorly for velocity/depth regimes, riparian vegetative zone width, and vegetative protection, as there is no fenced riparian buffer (Table 3).

Table 3: WRC qualitative habitat assessment results for Mitiwai Stream, 2023.

Habitat parameter	Reach score	Descriptor
Riparian vegetative zone width	1	Poor
Vegetative protection	5	Poor
Bank stability	11	Suboptimal
Channel sinuosity	8	Marginal
Channel alteration	20	Optimal
Sediment deposition	20	Optimal
Velocity/depth regimes	2	Poor
Abundance and diversity of habitat	8	Marginal
Periphyton	20	Optimal
Total score	**95**	**Marginal - Suboptimal**

4.1.2 Macroinvertebrate communities

Biotic indices were calculated to assess the ecological condition of the community (Table 4). Metrics included taxa richness, %EPT, which is the proportional abundance of three generally pollution-sensitive orders of insect recorded from each sample (Ephemeroptera or mayflies; Plecoptera or stoneflies; Trichoptera or caddisflies). In addition, the Macroinvertebrate Community Index (MCI) was calculated and, as semi-quantitative protocols were used on site, the Semi-Quantitative MCI (SQMCI). The MCI and SQMCI are based on the average pollution sensitivity scores for individual taxa recorded (Stark & Maxted, 2007). The soft-bottomed MCI variants (MCI-sb and SQMCI-sb) were calculated as sand dominated the instream substrates (Stark and Maxted, 2007). Scores of >120 and >6.0 (for MCI/MCI-sb and QMCI/QMCI-sb, respectively) are indicative of clean water or ‘excellent’ habitat quality, 100 – 120 and 5.0 – 6.0 are indicative of ‘good’ quality or mild organic pollution, 80 – 100 or 4.0 – 5.0 are indicative of ‘fair’ quality or probable moderate pollution, and scores <80 and <4.0 are indicative of ‘poor’ quality or probable severe pollution (

Table 5).

The October 2023 monitoring of macroinvertebrate communities recorded a relatively low diversity of taxa from the stream (average 12 taxa per sample; Table 4). Of those, an average of two taxa (17.7%) were from the EPT group of insects and comprised an average of 36% of the total community abundance. The MCI-sb scores (average 100.9) indicated

'good' to 'fair' habitat quality. The SQMCI-sb scores (average 5.5) were indicative of 'good' habitat quality.

The disparity between the MCI and SQMCI score reflects the difference between how the two metrics are calculated: MCI is a presence/absence measure, while SQMCI considers the relative abundance of each scoring taxon. Therefore, the lower MCI score for the lower Mitiwai Stream is reflective of few sensitive taxa (i.e., a low diversity of sensitive taxa), but the higher SQMCI score indicates that those higher-scoring individuals were numerically dominant.

The macroinvertebrate community structure of the lower Mitiwai Stream is illustrated in (Figure 3), which indicates that the community was composed largely of amphipod crustaceans and mayflies. The mayflies were all one species, the Leptophlebiid mayfly *Austroclima*, which was one of the dominant taxa. Other dominant taxa from each sample included the common amphipod *Paracalliope* (Crustacea) and the common sandfly larvae *Austrosimulium* (common in one sample).

Table 4: Macroinvertebrate community metrics for Mitiwai Stream, October 2023.

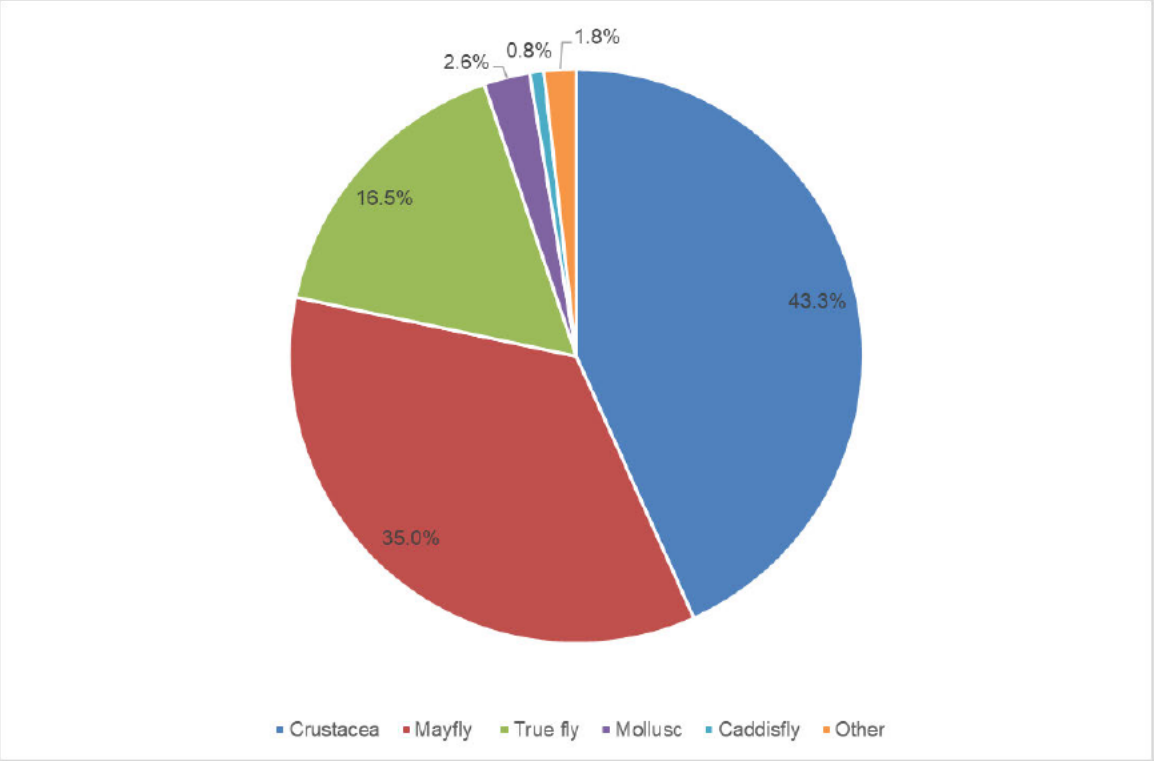
Metric	Sample 1	Sample 2	Sample 3	Sample 4	Average scores
Taxa Richness	14	9	12	14	12.3
EPT Taxa Richness*	3	1	2	3	2.3
% EPT*	37.7	28.0	35.5	42.7	36.0
% EPT Taxa*	21.4	11.1	16.7	21.4	17.7
MCI-sb	105	102	100	97	100.9
SQMCI-sb	5.6	5.6	5.2	5.6	5.5
Dominant Taxa	*Paracalliope Austroclima*	*Paracalliope Austroclima*	*Paracalliope Austrosimulium*	*Paracalliope Austroclima*	*Paracalliope Austroclima Austrosimulium*

* all EPT metrics exclude Hydroptilidae

Table 5: Values defining quality classes for MCI and SQMCI (Stark & Maxted, 2007).

Quality Class	Description	MCI / MCI-sb	QMCI / SQMCI-sb
Excellent	Clean water	> 119	> 5.99
Good	Doubtful quality or possible mild pollution	100 – 119	5.00 – 5.90
Fair	Probable moderate pollution	80 – 99	4.00 – 4.99
Poor	Probable severe pollution	< 80	< 4.00

Figure 3: Macroinvertebrate community structure in the lower Mitiwai Stream 2023



4.1.3 Fish

Fish species recorded in the lower Mitiwai Stream eDNA samples from October 2023 are presented in Table 6.

Table 6: Fish species identified in eDNA samples from the lower Mitiwai Stream, 2023.

Common name	Scientific name	Threat status
Shortfin eel	*Anguilla australis*	Not Threatened
Longfin eel	*Anguilla dieffenbachii*	At Risk – Declining
Speckled longfin eel	*Anguilla reinhardtii*	Coloniser
Banded kōkopu	*Galaxias fasciatus*	Not Threatened
Īnanga	*Galaxias maculatus*	At Risk – Declining
Redfin bully	*Gobiomorphus huttoni*	Not Threatened

Six native species were identified, including two 'At Risk – Declining' species (Dunn et al., 2018), namely the whitebait species, īnanga, and the endemic longfin eel. Additionally, banded kōkopu, redfin bully, and shortfin eel were identified. These species are native but Not Threatened. Finally, DNA of the Australian speckled longfin eel (a self-introduced coloniser from Australia) was detected. All these fish species have also been recorded from the Wainui Stream to the south.

Despite the hanging nature of the original culvert outfalls and often high velocity outflows from some or all of the culverts beneath the track (Photo 7), the range of native fish identified were recorded both upstream and downstream of the original culverts. This indicates that while the hanging culverts may provide a partial barrier to fish migrations at times, even fish

such as īnanga, with poor ability to swim past instream barriers, are not impacted under all conditions.

Results were input to the Waikato QIBI calculator (Joy, 2007) and a QIBI score generated based on fish species present, altitude and distance inland. The Fish QIBI score calculated for the lower Mitiwai Stream (58) was indicative of 'excellent' habitat quality or connectivity for fish migrations.

Photo 7: View looking upstream of original culverts, showing hanging culverts and high velocity flow (January 2022).

4.1.4 Summary

The Mitiwai Stream is a permanently flowing watercourse in its lower reaches. It supports a relatively low diversity of instream habitat and has a homogenous flow regime of fast-flowing runs interspersed with occasional deeper sections, as a result of the sand dominated substrates. A review of historical photography revealed that the morphology of the lower stream has changed over time, largely due to anthropogenic activities in the wider catchment. In the past, the lower stream resembled a broader, braided channel through mobile dunes. However, it is now narrow and incised. This is most likely a result of the dominance of dense, low-stature exotic vegetation on the stream banks and historic pine plantation forestry that helped to stabilise the mobile sand dominated substrates.

Nonetheless, the lower stream was found to support a relatively diverse community of native fish species comprising six migratory species. The diversity of fish species was also reflected in the 'excellent' fish IBI score. Two 'At Risk – Declining' native species, namely īnanga and longfin eel were recorded from the Mitiwai Stream (Dunn et al., 2018). Despite the hanging nature of the culverts beneath the original road crossing, the crossing, which

forms part of the existing environment, does not appear to be limiting migratory fish passage into the Mitiwai Stream catchment.

Conversely, the diversity of the macroinvertebrate community within the stream was found to be low, with only four taxa identified from the more sensitive insect orders, Ephemeroptera, Plecoptera, and Trichoptera ('EPT'). However, this low level of diversity may represent the natural state of the lower stream community, as the sand-dominated instream habitat of the coastal reaches of the Mitiwai Stream through the dune habitats would have naturally lacked a diverse range of substrates suitable for macroinvertebrate colonisation. Overall, the macroinvertebrate community metrics indicated 'good' to 'fair' instream habitat quality.

These lower reaches of the Mitiwai Stream represent an important connection to the upper reaches of the catchment for native migratory fish species. Several of the Mitiwai Stream tributaries in the upper catchment have a "natural state" water quality classification under the Waikato Regional Plan and flow through a canopy of native bush.

Taking into consideration the diversity of the fish and macroinvertebrate communities, instream habitat features and the role the lower waterway plays in the wider ecological context, the overall ecological value of the lower Mitiwai Stream is assessed as moderate to high.

4.2 Assessment of effects of mining below the water table

4.2.1 Mitiwai Stream

WWLA modelled groundwater conditions across the mine site, including an assessment of groundwater contributions to the stream and the potential for dewatering effects on the Mitiwai Stream associated with groundwater drawdown from proposed mining below the water table (WWLA, 2025b).

The WWLA report indicated that once mining occurs below a certain level, there is a connection with the groundwater layer and abstraction of the groundwater will likely occur as part of the mining operation. This abstraction has the potential to affect the baseflow (being that portion of the stream flow contributed by groundwater) in the lower Mitiwai Stream, because of the groundwater drawdown. Incoming surface water contributions from the upper catchment would not be depleted in the same manner, so baseflow reductions would be most notable during summer low flow periods, when incoming stream flows were reduced due to low rainfall contributions. The modelling indicated that once mining in the Central Block was complete, the stream baseflow would quickly return to near pre-mining levels and would be fully recovered within 1.5 years (WWLA, 2025b).

A reduction of flows throughout the lower reaches of the Mitiwai Stream could remove the stream's connection with the coastal area and has the potential to result in the following adverse effects on freshwater values:

- A reduction in instream habitat availability through changes in water depth and wetted stream width.
- Changes to water quality due to flow reduction, including water temperature fluctuations (increases) due to the loss of cooler groundwater inflows and associated potential reduction in dissolved oxygen levels.
- Limitations to native fish passage opportunities, during both upstream and downstream migration periods, as a result of reduced water depths or channel dewatering.

- Variation in the saltwater/freshwater transition zone and potential for saltwater intrusion upstream, potentially impacting available spawning habitats for fish such as īnanga (an 'At Risk – Declining' species).

Based on the proposed mining staging plan, dewatering effects on the Mitiwai Stream could occur over summer periods for between 4 to 5 years. As noted above, the lower Mitiwai Stream is a moderate to high value stream that, despite partial barriers to fish passage from culverted crossings, provides an important connection for migratory native fish to the upper catchment.

To mitigate the potential adverse effects of drawdown, TIL is proposing that the Mitiwai Stream is supplemented with clean water from mining operations to retain the existing flow rate at the culverted vehicle crossing, which is near the boundary of the stream with the coastal marine area. Conditions of consent have been proposed that outline the flow conditions that will trigger the need for flow augmentation to commence.

The addition of supplementary flows would address the risk to instream habitat values and fish passage by augmenting or reinstating minimum flow conditions close to natural conditions.

Baseline monitoring has been undertaken by WWLA to determine the baseline flow and the instream assessment from 2023 provided a baseline of instream habitat conditions and aquatic fauna values. Ongoing monitoring is recommended to ensure adverse effects on instream habitat quality and values and changes to water quality can be identified and minimised through management measures. As such, it is recommended that monitoring be undertaken to clearly demonstrate that the Mine water proposed to augment instream flows will not result in any notable reduction in instream water quality in the lower Mitiwai Stream, including water clarity, water temperature, dissolved oxygen, or other contaminants, and that the existing level of upstream fish passage is maintained for the duration of mining below the water table near the Mitiwai Stream.

A condition is recommended requiring monitoring of key water quality parameters within stream sections containing augmented flows. The monitoring is intended to ensure no adverse changes in water quality result from the flow augmentation. If monitoring shows a notable reduction in the characteristics above, management measures will be required to address adverse effects. This could include a review of the augmentation source water or review of augmentation flows rates. These measures will form part of a wider proposed Water Management Plan.

Overall, the reduction in baseflows and subsequent requirement for augmentation of flow conditions in the Mitiwai Stream during mining below the water table is expected to be short-term, occurring over summer seasons across a four- to five-year period. Once mining below the water table is complete and the dredge pits are refilled, natural flow conditions within the Mitiwai Stream will quickly be reinstated.

4.2.2 Wainui Stream

Mining below the water table, and the associated groundwater abstraction, near the Wainui Stream is unlikely to result in the dewatering effects anticipated for Mitiwai Stream.

If mining below the water table, and associated groundwater abstraction, were to occur in the vicinity of the Wainui Stream, the potential dewatering effects will be buffered by both:

- The presence of the Taharoa Lakes as a replenishing water source to the stream; and

- Controls that are proposed to be applied by TIL under proposed conditions of consent to maintain flows in the Wainui Stream, a minimum water level in the dam and to cease water take from Lake Taharoa below certain levels.

By way of further explanation, the potential for any stream flow reduction that may result from mining related groundwater abstraction, and any associated effects, will be avoided by the proposed requirement for there to be a minimum residual flow past the dam to the lower Wainui Stream (this flow is required to be monitored and maintained). In addition, the proposal to set minimum water levels in the dam and to cease direct water takes at low lake levels will help to ensure Wainui Stream water flows are maintained irrespective of any changes in groundwater inflows to Wainui Stream. Such measures are also likely to limit the potential for saline intrusion into the lower Wainui Stream.

5.0 Stormwater discharges

Stormwater runoff is intercepted and recycled into the mine process water system.

While this practice is proposed to continue, TIL's application includes a Discharge Permit (Discharge to Water) to authorise any incidental diffuse stormwater discharges to the Wainui Stream that may occur, for example due to adverse weather events. This will largely be from roof water and compacted surfaces around the administration building. The proposed consent conditions require that there are no discharges of oil, grease, fuel, or detergents that results in a conspicuous oil or grease film, scum, foam or a conspicuous change in colour or visual clarity after reasonable mixing. This is intended to ensure that any incidental discharge does not result in elevations of key contaminants that could adversely impact aquatic biota in Wainui Stream or within the coastal marine environment.

6.0 Summary of freshwater effects

The dam installed in the 1970s on the lower Wainui Stream created a major barrier to the upstream migration of native fish. A fish pass was installed at that time and upgraded over the years, with various degrees of success. More recently, the pass was redesigned and upgraded in 2010 with the intent of providing passage past the dam for all migratory species present in the Wainui Stream. Following upgrade of the fish pass T&T undertook five years of monitoring to assess the effectiveness of the fish pass and additional assessment of fish communities was completed in recent years. In addition, Mine staff undertake weekly observational monitoring of the fish movements in the pass.

If the consents sought are granted, the above activities will be reauthorised, and the same effects can be assumed.

Results of historical surveys have demonstrated that the fish pass will function well and will enable upstream passage for a diverse range of native fish species. Mullet, which are quite trap-shy so are not commonly recorded from trapping surveys, have historically been observed by Mine staff utilising the fish pass. In addition, schools of mullet have also been observed in the Taharoa Lakes, adding further evidence that the fish pass will be able to provide at least upstream passage for mullet.

The ongoing effectiveness of the fish pass will rely on regular maintenance and suitable flows being maintained through the pass at appropriate times. As such, maintenance and monitoring consistent with that currently undertaken is recommended, focusing on clearance of excessive aquatic weed growths, debris blockages and structural integrity checks, including at the inlet and outlet of the pass. Provided the fish pass is well maintained (to ensure no degradation that may impact functionality) the fish pass can be expected to be effective and to maintain fish migration past the dam.

In addition, targeted monitoring of fish movement is recommended to demonstrate the ongoing effectiveness of the fish pass for the key target fish species. To add to the understanding of mullet movements and age and population size within the Taharoa Lakes, it has been recommended that monitoring of mullet be undertaken as part of the wider fish pass monitoring programme. The monitoring programme should be developed in consultation with key stakeholders, including the Department of Conservation, The Proprietors of Taharoa C Block Incorporation, Taharoa Lake Trustees, Te Runanga o Ngaati Mahuta ki te hauaauru, Te Kōraha Marae, Aaruka Marae and WRC.

Flow maintenance into the fish pass is also recommended. This is only necessary when reservoir levels are reduced and fall below RL 9.3m, at which point the entrance to the fish pass could become elevated above the reservoir level, and fish within the pass could be stranded or put under stress. Modelling has indicated that flow augmentation into the pass may be required on occasion. TIL is proposing a condition of consent requiring flow augmentation to the fish pass at low reservoir levels. This will ensure flows through the fish pass and to downstream reaches will be maintained.

Seasonal variation in lake levels could result in changes to residual flows from dam overflows reaching the lower Wainui Stream below the dam. Water abstraction from the reservoir could increase the likelihood that residual flows through the fish pass and the dam weir overflow cease, potentially resulting in a reduction of available instream habitat as water levels drop, and degradation in water quality, particularly an increase in water temperatures and reduction in dissolved oxygen levels, which could cause stress or deaths for aquatic biota. As noted above, flow augmentation to the fish pass has not been triggered to date, and a diverse and abundant fish community has been recorded from the lower Wainui Stream under the current water take and management regime.

To ensure freshwater aquatic ecosystems are not placed under undue stress, particularly under summer low flow conditions when natural replenishment of the stream and lakes can be low, should the reservoir reach levels where discharges past the dam overflow weir are likely to cease, TIL is proposing to augment flows over the weir. Implementation of the augmentation flows, over the dam weir and into the fish pass, as triggered, will ensure flows are maintained through the lower Wainui Stream and the potential for adverse effects on aquatic biota are minimised.

The water intake structure is currently coarsely screened, with an approximately 12 mm mesh size. Calculations indicate that intake velocities are likely within approved guideline levels. TIL is proposing to maintain the same water intake structure as part of the application. As such there is the potential for fish, particularly small fish and larval fish, to be entrained into the intake pumps. To minimise this risk, it is recommended that TIL undertakes a review of design options, with the aim to minimise screen mesh size while maintaining operational efficiencies.

Mining below the water table is proposed across much of the Site. Activities that intercept or abstract groundwater can cause a local lowering of groundwater that may result in stream depletion effects. While the presence of the Taharoa Lakes, the proposed reservoir water management approach and residual flow requirements limits the potential for adverse effects on the Wainui Stream, there is the potential for groundwater interception to reduce base flows in the Mitiwai Stream. Modelling indicates that this would be most prevalent in the lower stream, where groundwater is a major contributor to the stream base flow. To mitigate potential adverse effects on the ecological values of the Mitiwai Stream, TIL is proposing that the Mitiwai Stream be supplemented with clean water from mining operations to retain the existing flow rate at the boundary of the stream with the coastal marine area (the lower culvert location). Water quality monitoring of the Mitiwai Stream during augmentation periods

has been recommended, to ensure potential adverse changes in water quality are identified and can be promptly addressed. Proposed monitoring will form part of a wider proposed Water Management Plan.

However, overall, the augmentation of flow conditions in the Mitiwai Stream during mining below the water table is expected to be seasonal, required during summer periods, and relatively short-term, with mining in this area expected to occur over a four- to five-year period. Once mining below the water table is complete and the dredge pits are refilled, natural flow conditions within the Mitiwai Stream will be reinstated.

7.0 Recommendations

Key recommendations that address freshwater ecological effects include:

- The ongoing maintenance and monitoring of the fish pass, to ensure the fish pass continues to provide effective access for migratory fish species.
- Ensuring that a 0.5m deep pool exists below the dam weir overflow structure, to prevent injury to any downstream migratory fish that overtop the weir on their way towards the coast.
- Maintaining residual flows to the fish pass and past the dam weir during periods of low lake levels
- Augmentation of instream flows in the lower Mitiwai Stream, to minimise the adverse effects of stream depletion resulting from groundwater abstraction during mining operations. In addition, implementation of water quality monitoring in the Mitiwai Stream, to ensure any potential adverse changes in water quality and habitat quality from dewatering and flow augmentation can be identified and promptly addressed.

These recommendations are reflected as proposed conditions of consent enclosed to TIL's application. SLR also recommends a review of intake screen options, intended to reduce the likelihood of entrainment of juvenile fish into the intake pumps, while maintaining operational efficiencies.

8.0 Closure

Please contact the author at [redacted] if you have any questions.

Sincerely,

SLR Consulting New Zealand

[redacted]

Keren Bennett
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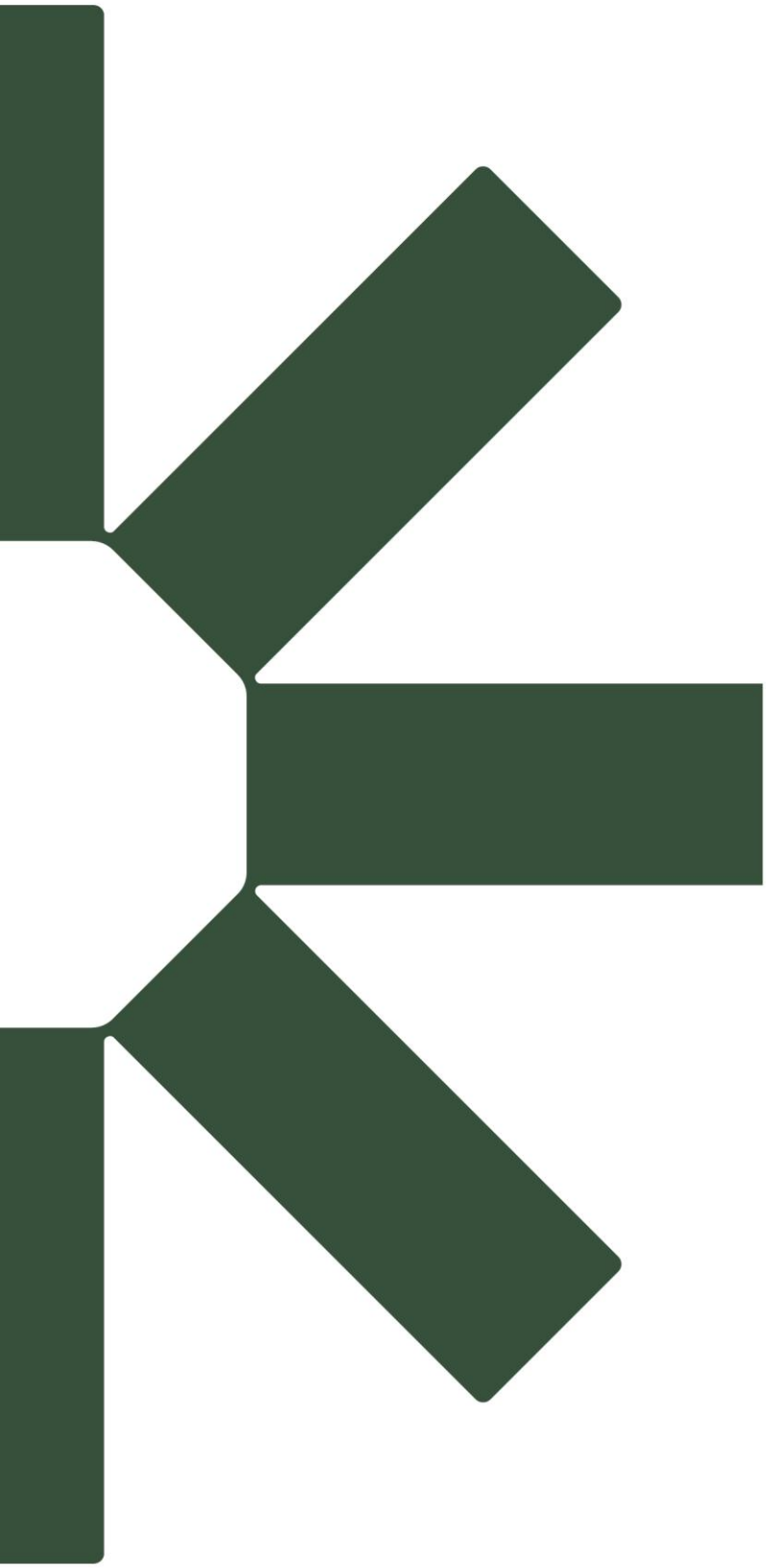

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