# Fish Recovery and Rescue Protocols

May 2018

River Lake Ltd

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| Prepared by: | | Keith Hamill | River Lake Ltd |
| Reviewed by: | | Josh Markham | Tonkin & Taylor Ltd |
| Approved for release: | | Duncan Kenderdine | Mt Messenger Alliance |

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# Contents

# 1 Introduction

## 1.1 Purpose and scope of work

The purpose of these Fish Recovery and Rescue Protocols (FR&RP) is to minimise the direct loss of native freshwater fish as a consequence of works in waterway.

These FR&R Protocols do not cover mitigation for loss of stream habitat, fish passage through culverts or habitat enhancement of culverts. These issues are addressed separately.

# 2 Approach to fish recovery and fish rescue

## 2.1 Fish recovery, rescue and relocation

Construction works undertaken in the bed of streams causes a level of risk to native freshwater fish of mortality or injury. The magnitude of risk is determined by the nature of the activity, the area of the stream disturbed, density of fish present in the stream, and the ability of fish to escape the disturbance. These FR&R Protocols describe practicable measures to minimise the mortality of native fish.

The general approach is:

- These FR&R Protocols describe multiple methods for fish recovery, the methods applied to any particular waterway will depend on the nature of the stream.
- The FR&R Protocols take a risk based approach to match the level of effort with the risk of native fish mortality. More intensive fish recovery measures and effort will be applied to waterways where there is expected to be more native fish present.
- The Fish Rescue Protocol will apply to all waterways containing water at the time of the work.
- Fish Relocation Protocols will be followed for handling and transferring fish to appropriate alternative sites – typically a reach of similar habitat on the same stream.

The fish recovery methods are grouped as three different protocols:

- Protocol A requires netting/trapping prior to dewatering.
- Protocol B includes fish recovery measures that can occur on the day that a stream is dewatered. Where practical, and to minimise injury to fish, preference will be given to encouraging fish to voluntary leave the stream section prior to netting and electro-fishing.
- Protocol C relates to recovery of kākahi.

Some methods of fish recovery cannot be applied to some habitats, as follows:

- Fyke nets requires sufficient water depth (about 35-40 cm) and sufficient stream width (about >55 cm) free of snags.

- Gee minnow traps require about 15 cm of water depth, though they can be dug into the sediment in shallower water (Ling et al 2013).
- Backpack electric fishing requires about 10cm of water depth, but is ineffective and unsafe in deep water (e.g. about 60cm), or where there is soft deep sediment or dense aquatic vegetation.

Allowing fish to passively vacate a stream during dewatering poses the least risk of injury to fish compared to other methods, but it's effectiveness depends on the stream morphology, vegetation density and method of dewatering. Any pools remaining after dewatering will need to be actively fished.

## 2.2 Location of culverts and stream diversion requiring Fish Recover and Fish Rescue

The Project involves extending or installing 21 culverts, and multiple stream diversions. A number of culverts will be extended to upgrade the access track up the Mangapepeke Stream valley. The locations where the particular fish recovery and rescue protocols that will be applied to each stream affected by the Project is described in Table 2.1 below.

A number of the streams affected are seasonally intermittent or ephemeral. Fish Rescue Protocols will be followed if water is present in these streams at the time of works.

## Table 2.1 – Fish recovery and rescue protocol to be applied at each stream affected by a culvert or stream diversion.

| Site | Catchment | catchment area (ha) | ID culvert / diverson | Chainage | Length of impact (m) | Project impact | Fish Recovery Protocol | Fish Rescue | Comment |
|---|---|---|---|---|---|---|---|---|---|
| Ea1 | Mangapepeke trib | 3.82 | 1 | 250 | 15 | Widen existing culvert 1 | N | Y | Ephemeral |
| Ea2 | Mangapepeke trib | 1.80 | 2 | 300 | 15 | Widen existing culvert 2 | N | Y | Ephemeral cut-off drain |
| Ea3 | Mangapepeke trib | 6.3 | 3 | 570 | 117 | Culvert 3 | Y (B) | Y | run |
| Ea3a | Mangapepeke trib | 1.2 | | 650 | 65 | Drain replaced with new swale | N | Y | Recently dug drain lacking fish cover. |
| Ea4 | Mangapepeke trib | 1.8 | 4 | 750 | 80 | Shift cut-off drain upslope. | N | Y | Shallow ephemeral drain lacking fish cover. |
| Ea5 | Mangapepeke trib | 4.2 | 5 | 870 | 45 | Culvert 5 | Y (B) | Y | intermittent |
| E2 | Mangapepeke | 306 | | | 45 | Access track crosses main stream about 3 times | Y (B,C) | Y | Meander |
| Ea6 | Mangapepeke trib | 4.4 | SD2 swale | 1050 | 70 | Stream cut-off at the top of the cut and directed to stormwater. | Y (B) | Y | Intermittent |
| Ea7 | Mangapepeke trib | 6.8 | 6 | 1300 | 100 | Culvert 6 + stream diversion. Road drainage runs to treatment pond. | Y (B) | Y | Kōura and banded kōkopu present. |
| Ea8 | Mangapepeke trib | 5.8 | 7 | 1500 | 80 | Culvert 7 + stream diversion. | Y (B) | Y | Shallow step pool lackiy (b)g ficu cover. |
| Ea9 | Mangapepeke trib | 7.9 | 8 | 1700 | 55 | Culvert 8 | Y (B) | Y | |
| Ea10a | Mangapepeke trib | 67 | 9 | 1850 | 20 | Culvert 9 for tributary | Y (A,B,C) | Y | kōkopu, giant kōkopu, |
| Ea10b | Mangapepeke | 149 | SD5 | 1850-1950 | 170 | Stream diversion | Y (A,B,C) | Y | redfin bully, inanga, |
| E3 | Mangapepeke | 133 | | 1680 | 300 | Stream diversion for wetland W2 near culvert 8. | Y (A,B,C) | Y | Main stem of stream |
| Ea11 | Mangapepeke trib | 2 | 10 | 2220 | 55 | Culvert 10. Stream to man hole, conveyed back to existing stream. | N | Y | Ephemeral, step-pool |
| Ea12 | Mangapepeke trib | 1.6 | 11 | 2300 | 55 | Culvert 11 | N | Y | Ephemeral, step-pool |
| Ea13 | Mangapepeke trib | 9.8 | 12 | 2400 | 105 | Culvert 12 | Y (B) | Y | |
| E4 | Mangapepeke | 116 | | | 50 | Inside temporary footprint | Y (A,B,C) | Y | |
| Ea14 | Mangapepeke trib | 1.7 | 13 | 2700 | 35 | Culvert 13 | N | Y | Ephemeral, step-pool |
| E5 | Mangapepeke | 64 | SD6 | 2800-2900 | 360 | Culvert + stream diversion | Y (A,B,C) | Y | |
| Ea15 | Mangapepeke trib | 5 | 14 | 2900 | 140 | Culvert 15 | Y (B) | Y | Ephemeral, step-pool |
| Ea16 | Mangapepeke trib | 36 | 15 | 2960 | 127 | Culvert 15 | Y (B) | Y | |
| Ea17 | Mangapepeke trib | 17 | SD7 | 3000-3350 | 400 | Stream diversion | Y (B) | Y | |

Table 2.1 continued

| Site | Catchment | catchment area (ha) | ID culvert / diverson | Chainage | Length of impact (m) | Project impact | Fish Recovery Protocol | Fish Rescue | Comment |
|---|---|---|---|---|---|---|---|---|---|
| Ea18 | Mimi trib | 6 | SD8 | 3650-3930 | 250 | Stream diversion | Y (B) | Y | |
| Ea19 | Mimi trib | 10 | 16 | 3800 | 40 | Culvert 16 | Y (B) | Y | |
| E6 | Mimi trib | 21 | | | 215 | Culvert 16 | Y (B) | Y | |
| Ea20 | Mimi trib | 15 | Bridge | | 0 | Bridge | N | Y | No direct impact |
| Ea21 | Mimi trib | 3 | 17 | 4440 | 33 | Culvert 17 | Y (B) | Y | Intermittent. Fish survey found only kōura. |
| Ea22 | Mimi trib | 1.5 | swale | | 50 | Grass swales to stormwater pond. | N | Y | Intermittent drain. |
| Ea23 | Mimi trib | 25 | 18/19 | 4750 | 85 | Culvert 18/19 | Y (B) | Y | |
| Ea23a | Mimi trib | 25 | | | 180 | Fill upstream of SH3 with diversion around the disposal site (C19) | Y (B) | Y | Banded kōkopu, kōura, redfin |
| Ea24 | Mimi trib | 13 | 20 | 5150 | 10 | Extend/replace existing culvert. | N | Y | Drain. Short impact length. |
| Ea29 | Mimi trib | 12 | 21 | 5650 | 10 | Replace existing culvert with Culvert 21 | N | Y | Ephemeral drainShort impact length. |
| Ea30 | Mimi trib | 2 | | | 150 | Main stream avoided. Cut-off drain replaced. | N | Y | Recently dug drain, no fish cover. |
| Ea31 | Mimi trib | 4.1 | SD | 5225-5300 | 0 | Cut-off drain shifted, main tributary avoided. | N | Y | Ephemeral drain. No direct impact |
| E TL1 | Mangapepeke trib | 1.3 | | | 5 | Access track culvert extension | N | Y | Short impact length, poor habitat |
| E TL2 | Mangapepeke trib | 1.9 | | | 5 | Access track culvert extension | N | Y | Intermittent drain, poor habitat, short impact length. |
| E TL3 | Mangapepeke trib | 2.1 | SD3 | 1050 | 75 | Fill - diversion section. | Y (B) | Y | |
| E TL4 | Mangapepeke trib | 6.6 | SD4 | 1100 | 175 | Fill - diversion section. | Y (B) | Y | |
| E TL5 | Mangapepeke trib | 32 | | | 5 | Access track. Potential restoration site | N | Y | Short impact length, degraded fish habitat in affected section |
| E TL6 | Mangapepeke trib | 3.1 | | | 5 | Access track culvert extension | N | Y | Short impact length, poor habitat, intermittent. |

Fish Recovey Protocol: Y= yes, N= only fish rescue, A= Protocol A, B = Protocol B, C = Protocol C for kākahi
Length affected includes diversions, culverts, fill and access tracks.

## 2.3 Roles and responsibilities

All fish capture and relocation work is to be undertaken by experienced ecologists who have the appropriate training, knowledge, skills, and ability to ensure safe handling of fish and the safety of staff conducting the operations. In some cases, such as for carrying out the earthwork monitoring and Fish Rescue Protocols, the ecologists can train the Environmental Team or appointed contractor's staff.

In the case of seasonally intermittent streams, the decision as to whether a stream is dry will be made by the Environmental Manager in association with an appropriately trained ecologist who is familiar with the sites. Photographs of the stream will be taken.

## 2.4 Biosecurity

When nets and traps are re-used at different sites, there is a risk of weed species being introduced to new areas. Care must be taken to clean and thoroughly dry nets between sites. De Winton et al. (2010) reviewed potential decontamination treatments for algae, plant fragments and seeds. They found seeds and plant propagules to be more difficult to

remove. They recommended increasing levels of hygiene effort for increasing levels of risk to the environment:

- Where risk is considered to be low (e.g. movement between sites on the same Project), equipment shall at a minimum be disassembled and cleaned on site, followed by visual inspection before moving.
- Where risk is considered to be moderate, equipment will be cleaned in a containment area using a water blaster, followed by visual inspection. All nets shall be thoroughly dry for at least 24 hours before transferring between catchments. Alternatively, nets shall be soaked for one hour in a 7% salt solution, repeatedly rinsed, then dried. Residual dirt on footwear and other equipment shall be scrubbed off with detergent.

## 2.5 Timing of works

The timing of work will depend on the construction schedule and weather conditions.

## 2.6 Permits

Permitting requirements for fish transfers depend on the species and location of transfer. In order to capture and relocate native species, a permit will be required from the Ministry of Primary Industries (MPI), and/or the Department of Conservation (DOC) under section 26ZM and 26ZR of the Conservation Act 1987:

A Special Permit from MPI is required to capture fish, regardless of whether they will be transferred and where they will be transferred to (Fisheries Act 1996, s97).

- A permit is required from DOC and Fish and Game in order to use an electro fishing machine.
- A permit from MPI will be required if a fish species is to be released in a different catchment or within the same catchment if there is a significant barrier in place (weir, dam or waterfall) and the species could not get there of its own accord. A permit would not be required if a species is to be released within the same catchment and the species could normally get there of its own accord.
- A permit from DOC will be required if a fish species is to be released into a site where it doesn't currently exist. Not applicable for this Project.

# 3 Fish recovery, rescue and relocation

The protocols describe multiple measures for recovering fish. Preference is given to allowing fish to voluntarily leave a section of stream as water recedes and rescuing any fish remaining in pools. This involves encouraging fish to swim out of the affected section of stream on their own accord in preference to use of electric fishing or setting nets overnight. Allowing fish to passively leave a site can be very effective in many streams and it avoids the inherent risk of fish injury/death involved with nets, traps and electric fishing methods.

Protocol A is particularly effective in large waterbodies and waterways with dense macrophyte cover. Protocol A is applied in addition to Protocol B when there is water depth

sufficient for fyke nets and a high likelihood of encountering numerous indigenous fish due to either a larger area being disturbed or the presence of moderate to high quality fish habitat.

## 3.1 Fish recovery

### 3.1.1 Staging of works

- Fish capture and relocation will be undertaken in the days prior to the stream diversion or dewatering. Fish barriers will be in place for as short a time as practical to reduce the risk of barrier failure, and usually will occur immediately before the works occur. Some in-stream works, such as sheet piling of the upstream end may be undertaken prior to fish capture.
- The managing ecologist shall work with the contractor's Environmental Manager and construction staff (as required) to plan the staging and sequence for work area isolation, fish recovery and dewatering.

### 3.1.2 Isolate the work area

- Prior to recovering fish from a section of stream the stream reach shall be appropriately isolated. This will mean isolating both ends of the channel affected by the works using block nets or other suitable means depending on site conditions.
- Fish barriers shall be installed to minimise the ability of fish to swim under, or around the net, but shall not impede water flow. The net will extend well above the water surface in case of fluctuating water levels and to prevent fish swimming over the net. They often need to be secured mid-stream as well as on the banksides.
- Block nets shall preferably be constructed from fine mesh (4 mm) material, but larger mesh (e.g. 8 mm) will be used if there is a risk of the net blocking. It is easy for fine mesh nets to block from plant debris in streams with dense macrophyte cover during high flows.
- Fish barriers shall be checked daily by a representative of the construction team who has been trained by the Project ecologist to recognise the signs of barrier failure. Any failure should be rectified immediately.

### 3.1.3 Fish Recovery Protocol A: Overnight netting prior to works

- Fyke nets and gee-minnow traps (as appropriate) will be placed at intervals along the length of the stream and left in place over night. Nets and traps will be deployed in general accordance with the New Zealand Freshwater Fish Sampling Protocols (Joy et al. 2013).
    - Gee minnow traps will be set at a density of 12 traps per 100 m and fyke nets will be set at a density of 6 per 100 m of stream if the channel is deep enough.

- Gee-minnow traps will have a minimum mesh size of 6.4 mm (1/4 inch)[1]. Gee minnow traps are not required if the fyke nets are fine-meshed (e.g. mesh size <6.4mm) and incorporate a fish exclusion barrier (see Joy et al. 2013).

- Where water is at risk of night time anoxia (e.g. in ponds with very little flow), the nets /traps will be only partially submerged, or floats will be included in some net compartments to keep sections near the water surface.
- Nets / traps shall be deployed overnight and checked the following morning and any captured fish will be relocated according the Fish Relocation Protocols.
- If native fish with a conservation status of 'Threatened' or 'At-Risk – Declining' are found in densities greater than 0.5 fish per trap/net then netting/trapping will be carried out until catch rates fall below an average of 0.5 fish per trap/net (excluding juveniles). Up to three nights of netting in total will be carried out, checking the traps for fish each morning. Further nights trapping increase the risk of net failure during rain events and blocking fish passage.
- If moderate to high destinies of indigenous fish are found (e.g. >3 per net/trap on average), then nets / traps shall be deployed for a minimum of two nights.
- If the ecologist considers the site suitable, then the second or third night of netting prior to dewatering may be replaced by overnight netting / trapping after partial dewatering has occurred following Protocol B (below). This has been found to be a very effective method for fish recovery in macrophyte dominated streams if fyke nets / traps can be placed in confined channels where the water is draining.

### 3.1.4 Fish Recovery Protocol B: Electric fishing and voluntary leaving

- Stream dewatering can commence with an ecologist present to search the stream and substrate during dewatering, capturing any fish that are present.
- The safest way to remove fish from a stream (without damage from nets or electo-fishing) is to allow them to swim downstream as water recedes. If the isolated section does not need to be pumped, then as water levels recede the downstream block net will be removed to allow fish to escape.
- If the isolated section needs water to be pumped out (e.g. in low gradient streams), the pump will be placed in a pool at the downstream end of the reach. This pool / channel may need to be created /dug out with minor earth works after the channel is isolated. Access to the pump will be blocked using nets or exclusion barriers to detain and/or trap fish. If possible, fyke nets will be set in a herring bone pattern to capture any fish swimming downstream as the water level in a stream recedes.
- As water levels recede, the original channel and pools will be searched for any remaining fish. Fish will be removed using hand held nets. In some streams (e.g. streams with dense aquatic macrophytes) a channel / pools may need to be formed to

[1] If mud fish are being targeted the mesh size of traps/nets shall be 3.2mm (1/8th inch) (Ling 2013).

assist fish movement. Any macrophytes or sediment moved to create the channel will remain in the stream during the dewatering.

- If other capture methods are likely to be ineffective and stream conditions are appropriate for safe and effective electric fishing, then the stream will be electric fished using a back pack electric fishing machine. Electric fishing will occur as a single pass and particular attention will be given to the machine settings to minimise damage to fish[2]. The suitability for electric fishing will be decided by the Project Freshwater Ecologist and will not occur if the stream is too shallow (<10cm), too deep (<60m) or if soft sediment and/or dense aquatic vegetation prevents effective recovery of fish. It may occur following partial dewatering if considered a more effective.
- Any fish caught will be captured and relocated according the Fish Relocation Protocols.
- Any pump used to dewater the stream channel must have an intake screen with a maximum mesh size of 4 mm, and intake velocities of less than 0.15 m/sec. This can be achieved using slotted pipes or nets placed around the pump area in order to isolate the pump intake. Pumps will be positioned on a scour protection pad (e.g. geotextile fabric) or attached to floats in order to minimise the level of sediment mobilised by the outflow.
- Once dewatering is complete in a section of stream, and the ecologist is satisfied that all practicable steps have been taken to capture fish, then earthworks can commence removing sediment from the channel.

### 3.1.5 Protocol C: Kākahi recovery

- In streams where kākahi may to be present, then streams will be searched for presence of kākahi.
- Searches for kākahi will be carried out by hand as they are found in varying habitats including under undercut banks and in fine sediment. Searching can also be carried out visually using a bathyscope or similar.
- Any kākahi found will be placed in a container filled with water and remain in the shade until they are relocated to another suitable section of the stream following the Fish Relocation Protocol.

## 3.2 Fish rescue during earth works

Fish Rescue Protocols will be followed to rescue any fish found in the stream or on the bankside at the time of earthworks. They are intended to apply to all streams containing water at the time of earthworks and provide an additional backstop to rescue native fish that might still remain after applying the Fish Recovery Protocols (described above). These Fish Rescue Protocols are not intended to apply to small pest fish such as Gambusia.

[2] Use of electric fishing for fish recovery requires judgement. Over use can cause fish injury and death and potentially inhibit the ability of fish to leave the site during dewatering.

Fish Rescue Protocols to be followed when sediment is being excavated from a stream:

- Examine stream and recover fish, koura observed in the stream with dip nets. Transfer to recovery bin or directly to the steam outside of the work area. Native threatened or At-Risk species will be prioritised for capture followed by non-threatened native fish and then introduced species.
- When soft sediment or aquatic vegetation is being removed, the top 0.5m of spoil from excavation of stream channels will be spread out in a thin layer for inspection. When safe to access the spoil, it will be visually checked for any fish, koura or kākahi. Where practical, this will occur near the stream but in some situations, this may have to be at the disposal site (e.g. if the spoil is very liquid and needs removal from site). In some cases, excavated material may be temporarily left to dewater within the isolated stream channel to allow examination and fish rescue.
- Fish caught from the spoil will be handled and released according to the Fish Relocation Protocols.
- Any fish, koura, or kākahi rescued will be photographed, counted and the numbers recorded.
- Earthworks monitoring and Fish Rescue Protocols will be overseen by the Project Ecologist but may be carried out by the ecologist or appropriately trained members of the Environmental Team or contractor's staff.

## 3.3 Fish Relocation

Fish Relocation Protocols cover the handling, holding and release of fish. The following procedures will be followed:

- After capture native fish shall be placed in a lidded container of appropriate volume for the number of fish and part filled with clean stream water. Fish will be held in containers for as short a time as practicable.
- If release cannot occur immediately, the fish will be stored in the shade and kept below 20°C. Fish density and behaviour shall be monitored regularly for any signs of distress (e.g. air gulping). Water shall be changed at least every two hours and battery-operated aerators used to oxygenate the water if required. Fish, kōura or kākahi will typically be relocated within an hour, and they shall not be kept in containers for more than 3 hours.
- Containers shall not be overstocked and larger eels (>500 mm) and kōura shall be kept in separate containers to other captured fish to avoid injury or predation. Eels can be temporarily (up to three hours) held in wet sacks as long as they are kept wet, cool and shaded, or in the water.
- Native fish, kōura and kākahi will be relocated to suitable habitats within the same stream system with similar flow conditions and similar or better habitat. To avoid further permitting requirements, fish must be able to move between sites on their own (i.e. sites must not be separated by any natural or man-made barriers). Fish may be relocated either upstream or downstream of the capture site.

- Upon release fish shall be distributed over a similar length of stream as they were caught, with small fish released first. Large numbers of fish shall not be released in one location to minimise the risk of short term overstocking or predation.
- Any pest fish captured will be euthanized.
- Fish shall be handled with wet hands or gloves to reduce the risk of injury to fish.

### 3.3.1 Procedures for dealing with pest fish

Any captured fish species managed as pests will be humanely euthanised. The preferred methods include adding clove oil (50 ml per 10 L water) or benzocaine (3.3% solution in ethanol, 50 ml per 10 L water) to a container holding the fish. Large pest fish may be killed by a sharp blow to the back of the head.

Pest fish include: brown bullhead catfish (*A. nebulous*), koi carp (*Cyprinus carpio*), gambusia (*Gambusia affinis*), wild goldfish (*Carassius auratus*), perch (*Perca fluviatilis*), tench (*Tinca tinca*) and rudd (*Scardinius erythrophthalmus*).

Pest fish have not been caught in streams affected by the Project.

## 3.4 Reporting

A summary of the results from fish recovery will be provided to Taranaki Regional Council annually. The summary will include the following:

- Fish capture methodologies used;
- Species, number and size categories of native aquatic life captured and relocated; and
- Known fish fatalities during capture and relocation.

# 4 References

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