

03 February 2020

Proposed methodology for field-based fish screening trials for the MPI Fish Screening Project

1. Fish collection and maintenance – salmonid and native species

Native fish will be collected from representative sites, preferably from within the catchment where possible. Native species collected may include juvenile bullies, galaxiids and potentially shortfin eels. A Kainga EFM 300 backpack electrofishing machine will be used to momentarily stun fish so they can be captured in a push net by an assistant immediately downstream. The smallest fish captured shall be preferentially selected for use in the field trials, but a mix of fish available is likely.

The captured fish will be transported to the respective test sites or NIWA in an aerated, insulated container or trailer and trials will be undertaken after approximately 12 hours to ensure fish have recovered from electrofishing. For salmonids sourced from a hatchery (and not electro-fished) they will be acclimatised in a holding tank for approximately 12 hours on site.

In addition to the fish collection, electrofishing upstream and downstream of the intake point to determine fish communities present (using Joy et al standard methodology) will be undertaken where this is not known or alternatively pre-release trapping will be employed.

2. Field Tests

Known numbers of marked or dyed (native) or identifiable via size distribution and numbers (salmonid) test fish shall be released upstream of screens and fish will be trapped downstream in the bypass (indicating successful screening) and in the intake (not successful screening). In certain scenarios the upstream supply channel will be capable of being drained and test fish that have not encountered the screen can be recovered.

Each site has been chosen whilst taking into account the ability to physically undertake the trapping and any remediation or new installations will be designed with to ensure trapping ability also.

Velocity measurements will be taken and averaged to determine parameters at maximum intake rates, temperature will be recorded, and fish will be acclimatised to receiving water temperature prior to release to ensure any temperature shock does not affect fish behaviour. Fish will be released in staggered experimental runs (time dependant on length of diversion and bypass, and site specific inclined plane traps will be employed and checked at regular intervals for fish.

Time of capture will be recorded for fish that are collected from nets during the trials and fish length and any visible injuries will be recorded. The use of a DIDSON or alternative sonar technology will enable the monitoring of fish contact and behaviour with the screen under the waterline to the bed. Observers will take photos of the screen during the trials and these will be analysed for screen impingements and contact. Screen contact is defined as

any contact fish have made with screen that is visible, and general behaviour of fish interacting with screen – either sitting alongside the screen, traversing the screen face or actively interacting with the screen.

If possible, in addition to the downstream/upstream testing, fish will be released at the downstream end of the bypass heading upstream to simulate fish migration behaviour upstream and risk of entrainment from entering the bywash. The ability to move back downstream will be noted and an upstream escape route will be netted off. If possible, at the at the end of the trial the intake will be dewatered and electrofished, enabling estimation of the fish that have not interacted with the screen.

These trials will attempt to use the smallest native fish given some planning provisions that require higher thresholds to protect fisheries along the coast. The species tested will be determined and provided by DoC, F&G, NIWA and Environment Canterbury with a focus on native fish requirements.

3. Key parameters for assessment

In order to compare the structures' performance against criteria suggested in the Fish Screen Guidelines (Jamieson et al. (2007)), individual elements of effectiveness will be measured or assessed (where applicable) as follows.

Site location: was the intake and associated fish screen installed at, or as close as practical to, the point of water diversion from the main stem of the river?

Screen apertures: were the apertures in the screen small enough to physically prevent fish from penetrating the screen and becoming entrained (trapped) in the irrigation system? The 2007 Guidelines recommend a bar gap of 2 mm or mesh/plate aperture size of 3 mm.

Approach velocity: was the water velocity onto and through the screen (the approach velocity) low enough so that fish could escape by swimming upstream against the flow? The 2007 Guidelines recommend approach velocities of no more than 0.12 m/sec.

Sweep velocity: were fish diverted away from the screen by a flow moving across the screen and toward a diversion? The 2007 Guidelines recommend a sweep velocity greater than the approach velocity.

Bypass provision: was a bypass provided, and were fish able to locate and use it?

Bypass connectivity: was the bypass connected to the river for fish to return safely?

Operation and maintenance: was the facility constructed, operated and/or maintained in a manner that ensured its effectiveness at excluding fish 24 hours a

day?

Additional techniques to achieve the most valuable results may be employed depending on conditions at the time of trial.

Yours Sincerely

A handwritten signature in black ink that reads "BZP Pringle". The letters are cursive and somewhat stylized.

Bridget Zoe Pringle

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Reviewed and approved by:

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