Native freshwater fish habitat restoration

CASE STUDY 7

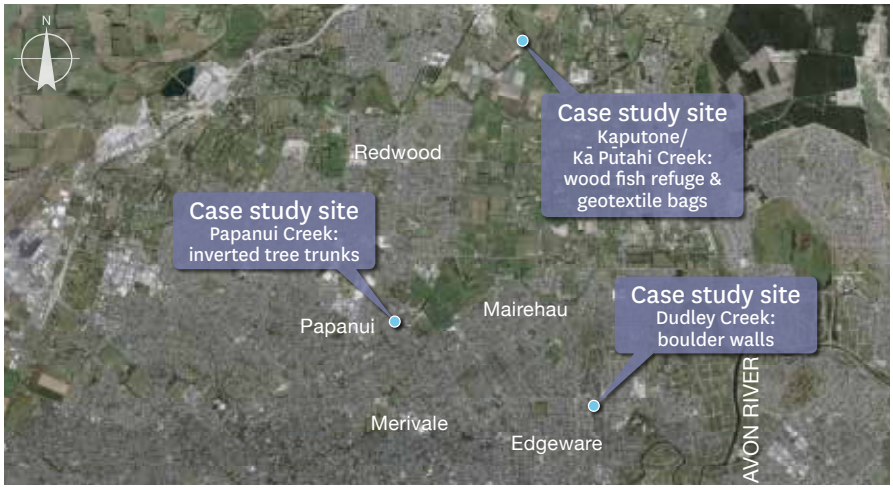
Bank naturalisation to enhance instream habitats

in Christchurch City waterways

Christchurch City Council is involved with stream restoration projects throughout the city. The council has incorporated ecological aspects into waterway design (including naturalised banks, boulders and wood to enhance instream habitat) for at least the last 20 years.

Location:

Works have been undertaken at a number of Christchurch City waterway sites.




Example of earthquake damage to Christchurch waterways

photo © CCC

Objectives:

Christchurch City Council carries out restoration to uphold its six-values approach to waterways (ecology, landscape, recreation, heritage, culture and drainage). In recent years, restoration has also occurred for earthquake recovery. This case study presents several restoration techniques commonly used by the council. In each example, the objective has been to enhance fish habitat, ecological function and water quality, while maintaining the flood carrying capacity of the waterway.

Application

instream cover

bank/riparian

This case study is part of a series providing information about techniques used to restore native freshwater fish habitat in New Zealand rivers and streams.

Some techniques are still in their trial phase, and not all techniques have been confirmed effective. Resource consent or other permissions may be required to undertake works. We recommend you seek advice before applying any of these techniques onsite.

Department of Conservation
Te Papa Atawhai

Restoration project team:

Christchurch City Council

Restoration method:

Examples of design drawings are shown for:

1. placement of boulders (Figure 1)
2. use of a geotextile bag wall for steeper banks (Figure 2)
3. overhanging wood 'fish refuges' (Figure 3)
4. inverted tree trunks (Figure 4).

These drawings should not be used as standard specifications for other projects, as they were prepared for specific projects. However, they are provided to show how fish-enhancement design features can be incorporated into engineering drawings.

In all of the examples shown, resource consent was required from the regional council for undertaking works in the bed of a river. The resource consents include conditions to avoid adverse environmental effects during construction (e.g., preparation of a sediment and erosion control plan, maintaining fish passage, and limiting the amount of time machinery is in the water).

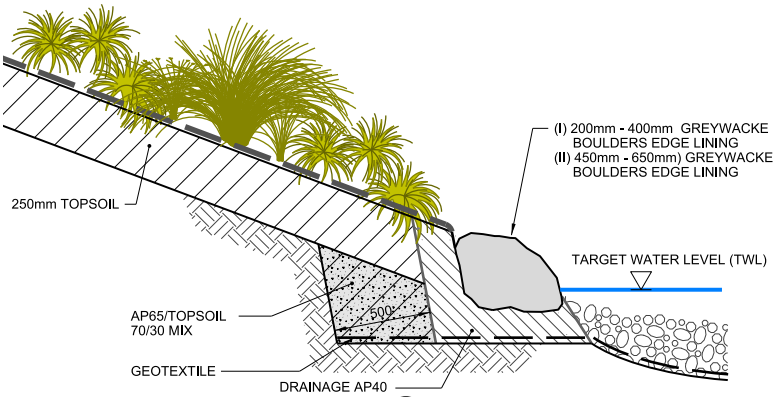


FIGURE 1: Example of a design for a boulder wall.

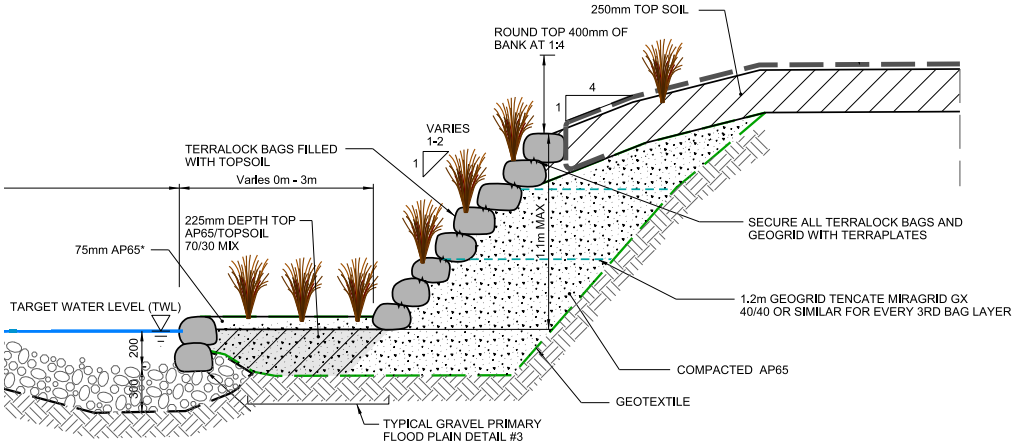


FIGURE 2: Example of the use of a geotextile bag wall for steep banks.

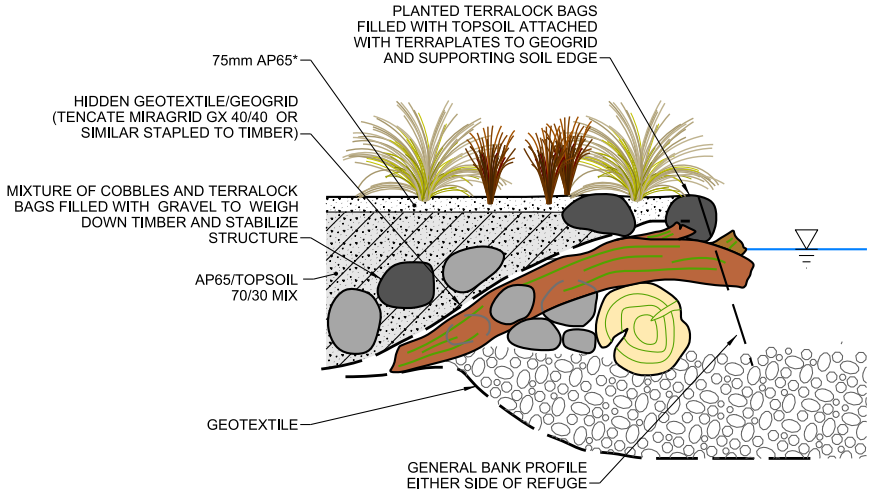


FIGURE 3: Design details for a wood overhang 'fish refuge'. Coir logs, rather than soil filled bags, on the top edge of the bank have been found to be more stable and effective.

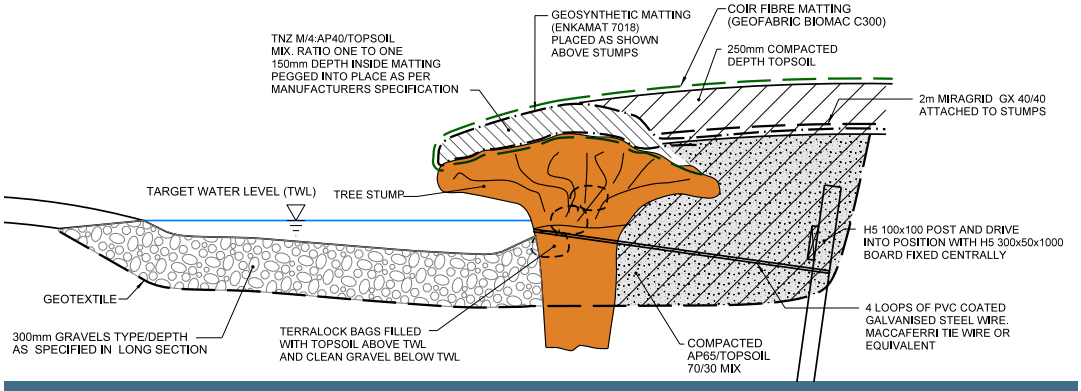


FIGURE 4: Design details for an inverted tree trunk in a river bank. Driving stumps with a longer (c. 3 m), sharpened trunk into the bank at an angle is being considered as an alternative to reduce cost.

Outcomes:

Anecdotal observations indicate that fish do use boulders and wood for cover in restored stream sections. However, there has been minimal monitoring to test the effectiveness of fish habitat enhancements in New Zealand rivers. Several regional councils and local authorities (including Christchurch City Council) have recently started monitoring programmes, and that monitoring data will become available over the next few years.

Boulders placed along river banks provide a diversity of crevices for invertebrates and small fish to hide amongst. Adding alcoves along the bank provides some hydraulic variation and may provide a refuge during higher flows, although care should be taken to avoid creating a backwater that quickly fills with sediment and becomes less usable by fish (Figure 5). Tree trunks provide cover for a range of fish species and sizes (Figure 6).

For steeper banks, purpose-made woven geotextile bags filled with a gravel and soil mix are often used to provide a softer, more natural-looking alternative to concrete or gabion baskets. They can also be planted with native grasses, which provide fish cover and help stabilise the banks. Native grasses established more quickly on geotextile bags that were hydro-seeded than bags with seed sown within them, along a new alignment of Kaputone/Kā Pūtahi Creek, north of Christchurch (Figure 7).

FIGURE 5: Boulders placed along the water edge to provide fish habitat in a Christchurch urban river. In both photographs, an alcove has been created to enhance habitat, but sediment has accumulated in the alcove on the right, due to a backwatering effect.

FIGURE 6: A wood fish refuge incorporated into the bank of Kaputone/Kā Pūtahi Creek to provide fish cover.

FIGURE 7: Steep banks stabilised with geotextile bags along a new alignment of Kaputone/Kā Pūtahi Creek. Bags in the left image have grass seed sown within the bags, whereas bags on the right were hydro-seeded, resulting in a faster strike rate. The same mix of native grass seeds were used.

OTHER LEARNINGS:

- Ecologists need to work closely with landscape architects, engineers, and contractors to ensure that their expectations are made clear. It is better to have an indicative plan showing the location of the added natural habitat features than rely on loose wording in a schedule. While it is desirable to have an ecologist on site guiding the contractor during construction, time and resources do not always allow this, in which case having explicit plans becomes essential.
- Any structures in the bed or banks of a river need to be appropriately engineered in place, to avoid bank failure or the structure becoming dislodged. For example, in the Kaputone/Kā Pūtahi Creek realignment, boulders were bedded in one third of their height and timber was buried two-thirds in locations where they were placed below the 50-year flood level. In addition, any tree stumps or logs need to be anchored back into the stream bank, if there is any risk they could be washed away (see example in Figure 3). When placing inverted tree stumps into stream banks, hardwood tree species should be used in preference to softwood, as they take longer to decay. Finding suitable hardwood stumps for the project can take time (you will not find them at the local hardware store), so start making enquiries early.
- Channel size and shape should be carefully considered in restoration design to ensure that there is sufficient flow and depth of water around the features to provide habitat for fish. For example, in Christchurch's slow-flowing lowland waterways, CCC have found that narrow and/or v-shaped channels are best for ensuring water depths are sufficient, as wide channels often create areas too shallow for fish to live in.
- Fish friendly features should be placed as unevenly spaced clusters, ideally every 5–10 m.
- The type and source of materials used should be carefully considered. For example, there are a variety of geotextile bags available on the market. Some have a life of approximately 20 years, while others may last upwards of 100 years. While planting and protection from UV light can reduce degradation time, the effects of plastic breakdown and cost versus durability need to be taken into account. Other materials may similarly have potential ecological effects, such as potential for leaching of zinc from galvanised gabion baskets or preservatives from treated timber, alkaline run-off from freshly set concrete, or mineral inputs from boulders imported from outside the area.
- For highly modified streams and drains with degraded aquatic habitat, the addition of naturalised banks, boulders and wood clearly enhance fish habitat. However, whether these added habitat features actually increase native fish diversity and abundance remains to be seen, due to a lack of monitoring data. Incorporating fish monitoring into the restoration budget will help evaluate the success of the project and will complement data being collected by councils around the country.

FURTHER INFORMATION:

Contact Belinda Margetts at Christchurch City Council.

www.ccc.govt.nz/environment/water/water-policy-and-strategy/waterways-wetlands-and-drainage-guide

www.ccc.govt.nz/assets/Documents/Environment/Water/waterways-guide/9.-Restoring-Waterway-Form.pdf

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