



Native Vegetation

This fact sheet gives an overview of the methods used to rehabilitate native ecosystems. The first step is to identify the on-site resources that can be salvaged and used for rehabilitation (Fact Sheet 5). Experience since the 1970s has highlighted the value of salvaging and reusing topsoil, and creating stable slopes with rough surfaces (by including logs, rocks, and slash). The negative impact of weed competition, highly acidic (pH<4) surfaces, and compacted growth media are also clear. West Coast miners developed ‘direct transfer’, a method where sods of intact plants and soil s are moved intact from stripped areas. This method avoids planting, and boosts ecosystem recovery and erosion control. Most areas rehabilitated to native ecosystems need initial animal and weed control to help natural succession. More detailed information on pasture rehabilitation methods is available from www.landcareresearch.co.nz (keyword: mining factsheets).

1. Identify rehabilitation resources, constraints, and sites

- Calculate approximate volumes of each resource available and the volumes needed for rehabilitation. Allow 10% wastage if stockpiling topsoil; overburden is likely to swell by 10–20%
- Identify resources that can be produced Run Of Mine
- Identify suitable receiving sites for direct transfer, transplanting, nursery planting, or hydroseeding.
- Conduct wildlife surveys and salvage required native fauna for relocation

HINT: Using ROM (Run of Mine) materials conserves stockpile volume, reduces handling costs and reduces haul distances

HINT: Place stockpiles near areas to be rehabilitated to reduce haulage distances and may remove need for truck transport

2. Stripping

- Identify, mark, and protect (if the mine plan allows), riparian zones and agreed no go (ecological protection) zones
- Survey weeds; decide on pre-stripping management (spraying, separate stripping and stockpiling or disposal)
- Identify stockpiling areas and capacity. Prepare these areas with firm bases, cut-off drains, sediment control and (at larger sites), signage or fencing to exclude vehicle traffic
- Fell/remove large trees for direct re-use, mulching, or stockpiling
- Strip vegetation and tree stumps with root plates as direct transfer
- Strip topsoil separately from subsoil if using subsoil for rehabilitation
- Strip and stockpile potential plant root zone materials separately from general backfill
- Identify and dispose of acidic rock so it won't contaminate the plant growth media or develop AMD

HINT: Maximize the salvage of plants with root plates attached as Direct Transfer- it is the most effective rehabilitation method

HINTS: Double handling is avoided by managing the mining schedule to allow direct placement of plants, wood, soil and rock from stripped areas to rehabilitated areas
Pre-order nursery-raised seedlings 1–3 years ahead

3. Stockpiling

- Separately stockpile topsoil, subsoil, slash, logs in accessible areas protected from machinery and weeds
- No surface water should enter stockpiles; divert clean water away from stockpiles to treatment ponds
- Create soil stockpiles by back-dumping, not compacting or driving over the soil
- If stockpiles will be unused for >12 months, spread mulch or sow a non-weedy cover crop

HINT: Keep track of topsoil and root zone volumes. Rehabilitation outcomes at many mines are limited by a lack of suitable soil.

HINT: Check to ensure compliance with DOC or land-owner access agreement, with WCRC requirements and relevant bond release conditions

4. Reinstate landform or create modified landform

- Place overburden to minimise the reshaping and re-handling
- Design landforms that blend into the landscape and replicate erosion-resistant slopes with small catchments
- Design streams and water detention areas; confirm flood capacity and overflows to the design event
- Reinforce water-courses with rock armouring if necessary; install culverts and crossings
- Create a safe site: defined, safe access and turnaround/parking areas if needed. Pay attention to steep drops and water/sludge hazards (sediment ponds)

HINT: Ensure treatment of streams is consistent with WCRC 2004 ‘Clean Streams’ Guide

HINT: Wetland and pond margins can be protected from wave erosion by a sheeting of gravel, boulders, logs parallel to the water's edge, and VDT of wetland species

5. Create planting media

- Spread topsoil over subsoil or other suitable plant growth overburden
- Deeper root zones (≥ 0.5 m) are needed for tall forests; thinner root zones (≤ 0.3 m) for pakihi and rushes
- Leave a surface with varied micro-topography, not a smooth surface

HINT: The surface should be rough to establish a variety of drainage, reduce erosion and create shelter spots. Scatter logs, slash and/or rocks over the surface prior to planting.

6. Re-vegetation methods

- Identify erosion-prone sites requiring additional mulches and/or logs, prioritise these areas
- Link rehabilitated native vegetation associations to adjacent similar associations where practicable
- Place individual salvaged transplants in rehabilitation areas with similar drainage and exposure
- Prioritise VDT. Pack VDT sods as close as practicable. Use topsoil or rocks to fill gaps and protect edges
- Place stumps with root plates attached in areas where extra shelter is useful
- Lay slash for erosion control and create protected sites for nursery seedlings and seed establishment
- Plant hardened-off nursery-raised plants. Plant in clumps of 3-5 plants, avoiding large areas of single species, unless this is natural. Adjust spacings according to plant growth rates and weed competition
- Place slow release fertilizers in the planting hole or in an upslope slit
- Spread branches with ripe seed of suitable colonising plants (mānuka, kānuka, flax, karamu)
- Natural revegetation without DT, planting or seeding is only an option for small, narrow sites within native forest where a stable and favourable growth medium is replaced and streams will not be affected

HINT: This is a good time to establish permanent photo-points to show rehabilitation progress

Vegetation direct transfer

Use wherever scheduling allows for:

- Pakihi wetlands
- Shrubs e.g., mānuka, *Coprosma*, *Dracophyllum*, pepper tree
- Forest saplings, e.g. beech trees, kāmahī, *Quintinia*, toatoa, rātā, and podocarps less than about 5 m, depending on quality of salvage, size of sods, how much root zone can be retrieved intact, and exposure of the rehabilitation site

Best done in autumn. Avoid summer if possible, especially for larger plants.

7. Re-introduce fauna

- Confirm the rehabilitated habitats are suitable for re-introducing fauna. Habitats will require food sources and shelter or hiding places, and may need predator control (e.g. rats, possums, stoats)
- Work alongside Department of Conservation to identify best time of year and monitoring needed

8. Initial monitoring

- Monitor after first storm and at 3-6 months
- Each rehabilitation area should be monitored every 1-3 years, depending on growth rates, risk of weed competition and erosion
- Habitat conditions may require monitoring, e.g. provision of shelter, bird food supplies, soil water for wetlands, predators

Check erosion

- Check land surface, watercourses & cut-off drains
- Identify cause of erosion, then do remedial work
- Amend rehabilitation method to reduce erosion (slope, surface roughness, timing, revegetation) unless erosion is caused by an unusual rainfall

HINT: Pay particular attention to recreating suitable places for re-establishing at risk, rare or endangered plants if present

Check weeds

- Identify weed source and why weeds are dominant
- Control weeds if necessary by selective spraying or hand weeding

Check plant survival & growth

- Identify best-performing plant species and areas
- Identify reasons for plant deaths or poor growth
- Apply adaptive management (pest control, amend root zone, fertilize)

Check fauna recovery

- Monitor populations of re-introduced or re-colonising faunal species
- Apply adaptive management to adjust rehabilitation methods for optimum habitat
- Control predators as required

HINT: Re-photograph permanent photopoints annually at the same time of the year

9. Maintenance and completion of rehabilitation and mine closure

- Maintenance manages erosion, weeds, pests and fertility to ensure native plant density, cover, and species mix (biodiversity) achieves conditions that ensure natural succession will occur
- At some sites waters that are diverted during mining need to be returned to rehabilitated catchments once the site is stable, and specific native fauna need to be reintroduced or have re-colonised
- Prematurely 'walking away and leaving it to nature' is a risky option

HINT: This is a good time to re-photograph permanent photopoints and record the best rehabilitation method for different parts of the site and different ecosystems

Closure assessment for hand-over to DOC or landowner and **Bond Release** (part/whole)

Confirm agreed outcomes with DOC/owner

West Coast Regional Council
Bond Release

This fact sheet is part of a series relating to a framework for predicting and managing the environment impacts of mining.

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