



Belmont Quarry Development – Part B

Substantive Application
Appendix B.5.B – Ecological Offset Management
Plan
Winstone Aggregates

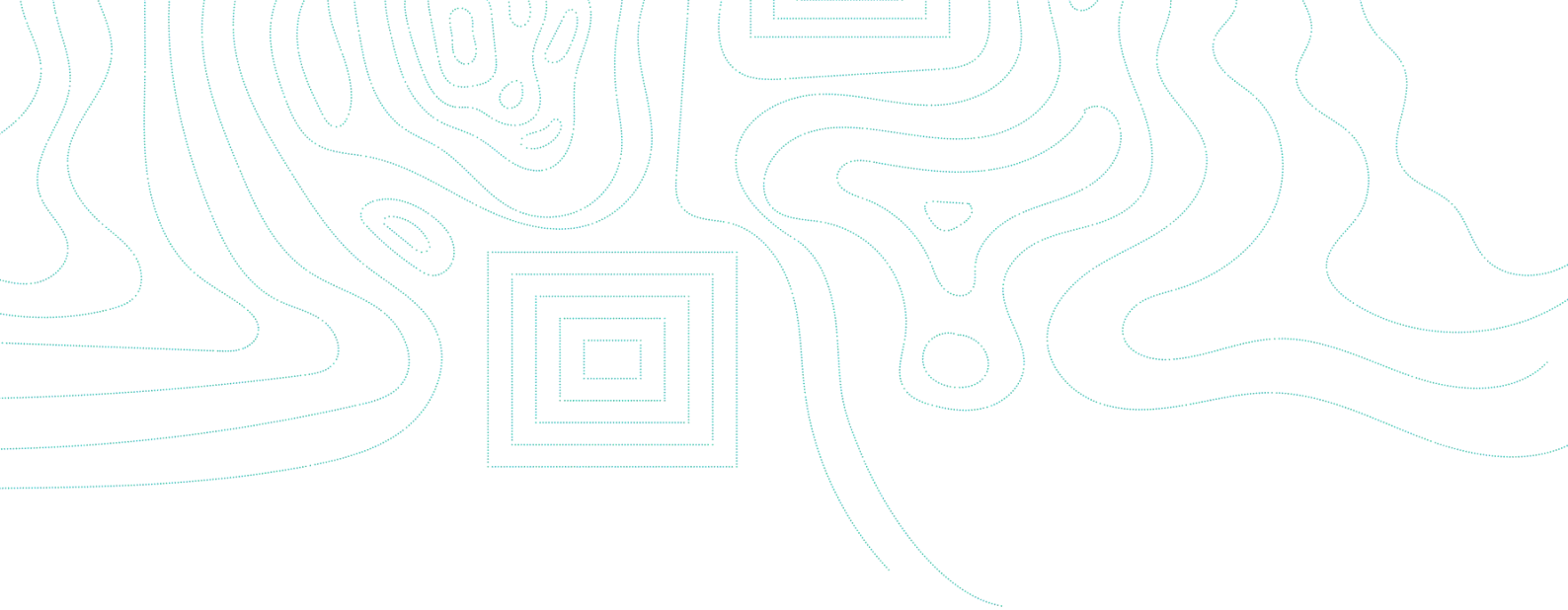
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BlueGreen



Belmont Quarry OBDA Offset Management Plan (Draft)

Prepared by Dr Vaughan Keesing
9 August 2026



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Prepared by:	Dr Vaughan Keesing BlueGreen Ecology BGE	
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1.0 Introduction

DRAFT

This Offset Management Plan (**OMP**) has been prepared to guide the implementation, management, monitoring and reporting of ecological offsets required to address residual ecological effects associated with the proposed Belmont Quarry overburden disposal area (**OBDA**).

Opportunities will be provided for ongoing engagement with Taranaki Whanui ki Te Upoko o Te Ika and Ngati Toa Rangatira regarding implementation of this Offset Management Plan. This may include opportunities for input into restoration planning, wetland and riparian restoration initiatives, species selection, monitoring outcomes and adaptive management measures. Hence this is a final draft only.

The Plan provides a framework for establishing and maintaining indigenous terrestrial, riparian and wetland habitats as a result of the residual effects identified through the ecological assessment and Biodiversity Offset Accounting Model (BOAM) analysis.

The offset requirements fall into three categories:

1. **Terrestrial vegetation and habitat** due to the lag time in the remedial revegetation of the OBDA;
2. **Wetland offset** for the loss of wetlands in the OBDA;
3. **Swamp maire (precautionary offset)** due to the experimental nature of the swamp maire remedy (direct transfer);
4. **Stream offset (precautionary offset)** to the potential failure of the remedial stream recreation.

The Plan adopts an adaptive management approach and is intended to provide clear performance expectations while allowing flexibility to respond to actual site conditions and monitoring outcomes over the life of the project.

1.1 Offsets Objectives

The objectives of this Offset Management Plan are:

- a) to result in 17 ha of the Heffernan block becoming revegetated in representative native vegetation assemblages reflecting slope, hydrology and microclimate. This must achieve:
 - (i) at least an 80% total area canopy cover; and
 - (ii) 95% of the species planted to survive.
- b) To result in 1,318 linear metres of Ca. 20m wide riparian restoration associated with Speedys Stream in the Stage 1 area of the terrestrial offset at the Heffernan Block (this may be used to offset failed OBDA stream creation, or otherwise be considered as part of the above terrestrial offset,

- c) To result in 2 new wetlands totalling 0.2ha (2,000m²) of indigenous natural inland wetland being created with at least a 15 species diversity to a self-sustaining condition.
- d) To result in 140 sapling swamp maire to be reared, planted and established (each 2m height) in the various adjacent wetland and wet gully areas local to the OBDA.
- e) Included in the 17ha offset in (a) is an offset for loss of 10.93ha of lizard habitat from the OBDA.

Offset activities are proposed to occur within the Belmont Regional Park known as the Heffernan Block (**offset Site 1**), whereas Swamp Maire plantings will occur in existing Swamp Maire habitat within the Regional Park, adjacent to the OBDA footprint (**Offset Site 2**).

1.2 Heffernan Block (Offset site 1)

The following map (Figure 1 **Error! Reference source not found.**) illustrates the length of riparian enhancement 1318 m required (blue line) to meet the aquatic offset (if the offset is required) for streams in the Heffernan Block. The green areas indicate where wetland currently exists including species such as *Juncus*, mosses, water cress, monkey musck and *Isolepis prolifera* and meet the criteria for natural inland wetland through the NRP definition. While the wetland areas fall within the wider terrestrial offset and will end up being supported by the revegetation process, the stream extends beyond this area.

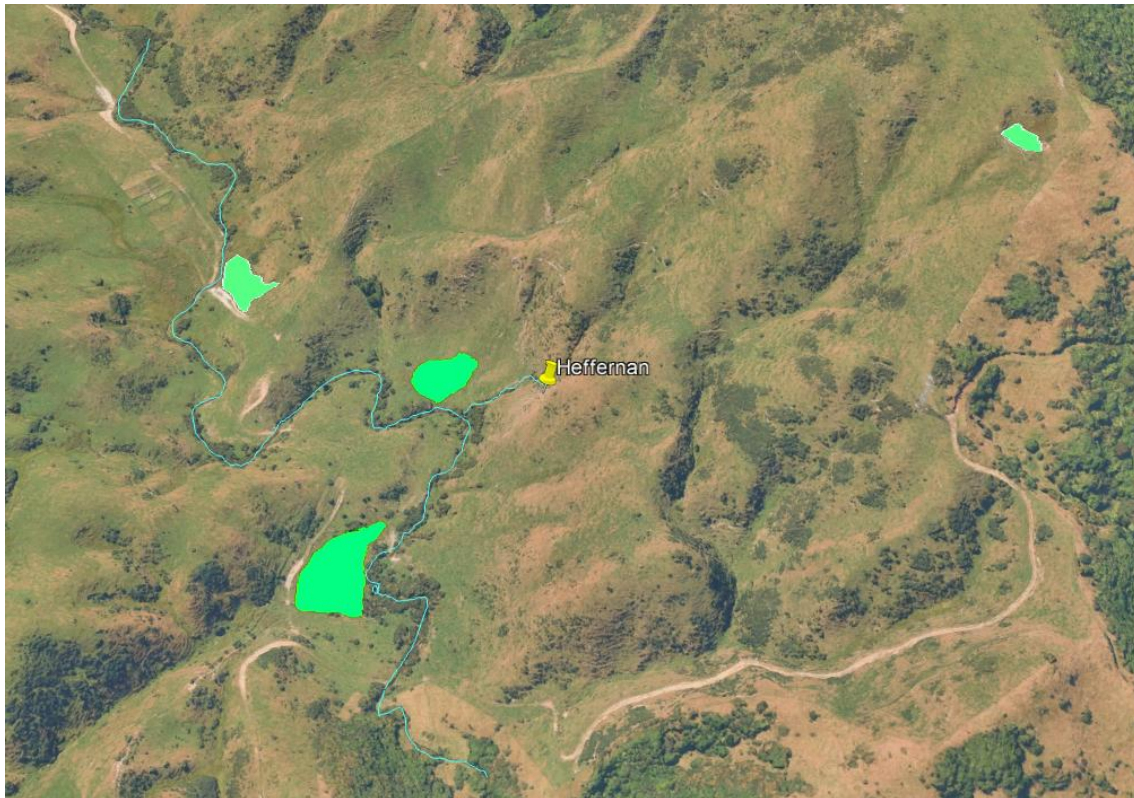


Figure 1 Location of potential stream and wetland offset areas on the Heffernan Block.

The western portion (half) of the block contains most of the current wetlands, and the eastern half has steeper gullies. The western side contains the perennial tributary of

Speedy's Stream and stream terrace. The eastern boundary is about the current power line and access track. These features are shown below in the photos taken from across the valley looking north.





River terraces and slopes to be planted.

2.0 Offset Site Description

2.1 Terrestrial vegetation and habitat

The primary offset area known as the Heffernan Block is located within the Belmont Regional Park, approximately 2 km west of the Belmont Quarry. An area of 17ha has been identified through BOAM modelling, as the size of the offset required. This will be achieved by restoring the land to indigenous forest (where none currently exists), in addition to rehabilitating the OBDA site to native forest.

After consultation with Greater Wellington Regional Council (GWRC) and its Belmont Park Ranger and Parks Restoration Team, Taranaki Whānui ki te Upoko o te Ika and Ngāti Toa Rangatira, the Heffernan Block was identified as being a suitable site (Figure 2).

This area has been identified as a suitable block because it provides a good restoration opportunity for revegetation, faunal habitat, wetland and riparian (stream) areas.

While located in the Belmont Regional Park and subject to a recreational reserve listing, this area has historically been used for grazing and therefore has the necessary legal protection.

Greater Wellington, in its role as the Statutory Manager, has identified the land as a suitable candidate for ecological restoration. GWRC has provided a written in-principal approval for its use as an offset location and has confirmed that there are no plans or funding in place for these restoration works. Therefore, the area was suitable for Winstone's to undertake the required Habitat offsets. HCC in its capacity as owner of the Heffernan Block was also consulted.

This block also has the advantages over other areas of the park near the OBDA in that it is less exposed to inclement weather, has a stream headwater (for Speedy's Stream) and wet hydrology areas. It is therefore an area that offers riparian enhancement and potential wetland creation, provides a good opportunity to meet all of the offset requirements for the Proposed OBDA Project one area (except for the swamp mire offset).

The Heffernan Block has conditions suitable for restoration works, which means that there is a greater certainty of a successful outcome than in some other places in the park.

The block is a south-west facing basin with slopes and gullies leading to a stream basin floor. The northern area is the high point and one of the higher places in the park at Ca 1000m (BRP resource statement 2007).

The dominant soils are brown earth over greywacke. Orthic Brown (BO) soils (NZ soil classification) are prominent in the majority of the site with firm brown soils in the higher altitude areas. BO soils are those enriched in kaolin-group clays with iron and aluminium oxides. This is the common soil of New Zealand and contains good soil organisms' populations, that are neither wet nor dry and therefore offer suitable growing conditions for native forest development.

Figure 2 illustrates the Heffernan Block area and Speedy's Stream headwater. It is an area of approximately 20 ha of variable morphology.

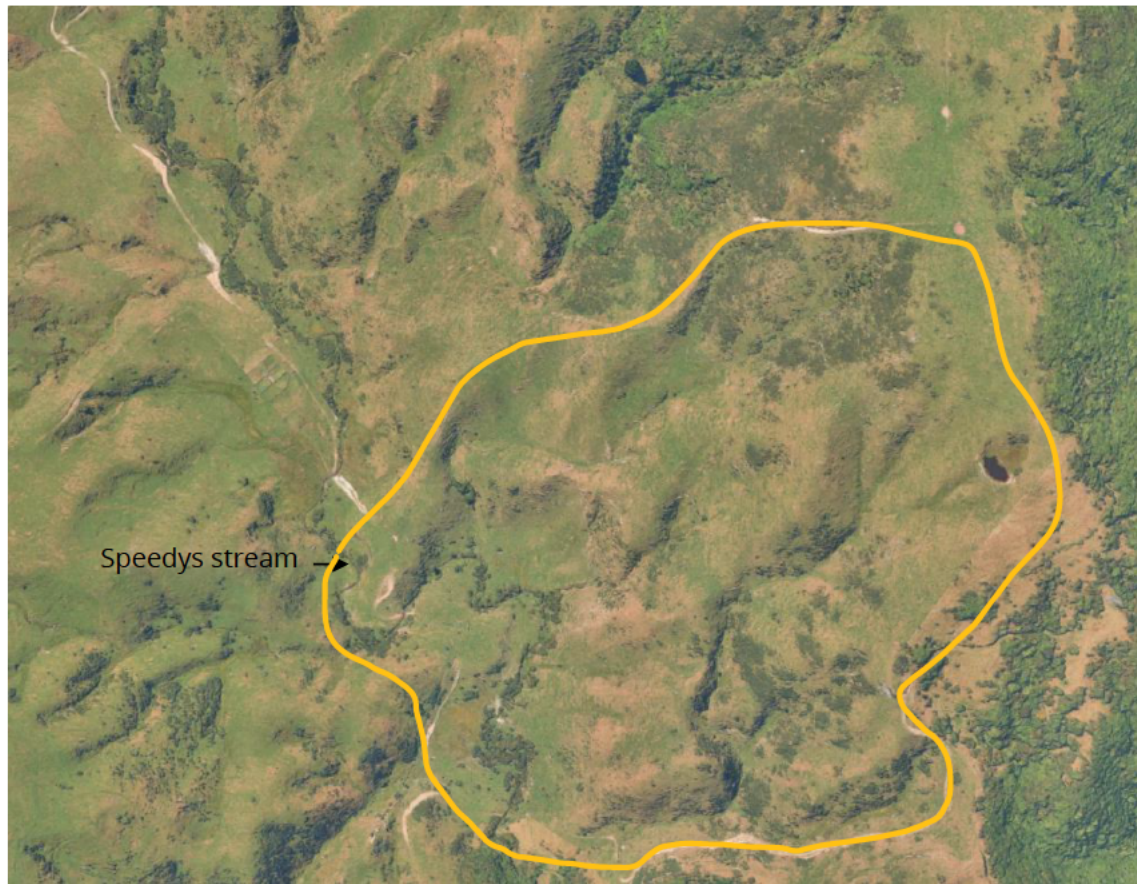


Figure 2. *The land of the offset (Google earth) roughly encapsulated in the orange line.*

The Heffernan Block offset program is proposed to take place over 30 years, to be completed in 5 stages (a stage every 5 years and until Stage 5 is becomes established at 5 years old).

The staging of the restoration programme mimics the staged clearance regime of the OBDA in that areas are cleared through the 30 years of the OBDA process, in stages. However restoration will run several years' ahead of areas of when vegetation is cleared within the OBDA. This allows sufficient time to locate, propagate and grow up each stages plant material.

Maintenance of the stages progresses from stage 1 to stage 5 (and subsequent stages) follow the same planning stages, but animal pest actions need to include the whole offset area from stage 1 so that there is limited pest challenge to any stage through the process to give the plants the best chance to become established and due to the mobility of the animal pests. Figure 3 shows by colour the stages of restoration (as well as several existing features).

The plan is to start restoration works in Stage 1 - the lower basin (where the riparian planting occurs) and move up hill in subsequent stages.

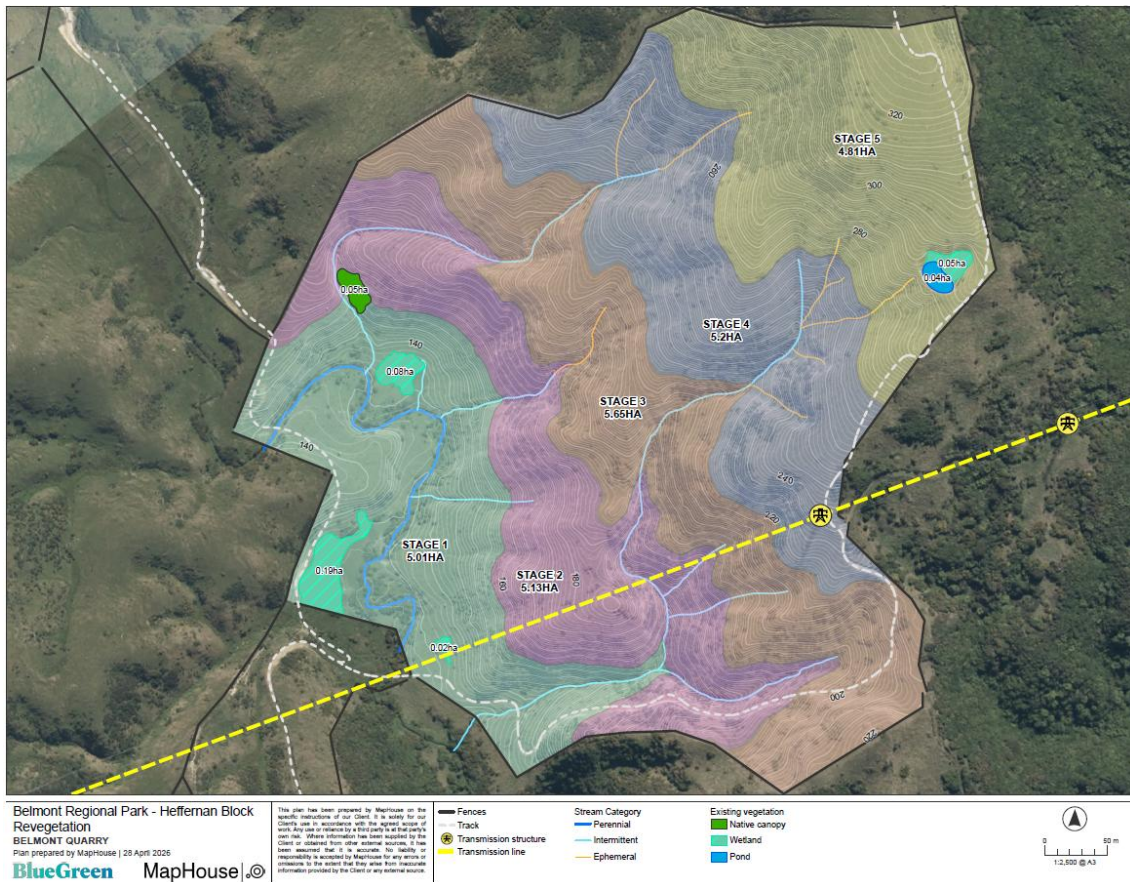


Figure 3. Offset Site 1 – Heffernan Block depicting the restoration 5 yearly staging concept plan showing areas of current and potential wetland, existing native shrub, tracks and the power lines. Not all of the proposed area is shown in this schematic.

When the offset is completed (at the end of year 30), there will be 5 stages ranging from established through to in development (i.e. from 5 to 30 years of age), corresponding to the timing of the stages, and at least half the area will be in tall native shrubland and forest.

We note that the corridor under the power lines requires sufficient clearance under any final canopy such that there is no risk of interference. Stages 4 and 5 planting may need to be arranged to reflect the gap such that only the lower canopy species are planted in that corridor. It is noted that because the lines pass over the basin, the clearance height is well beyond any species' final mature height for all but the stage 5 component. The current Transpower access appears to be also the current recreation track, and that is to remain.

Wetland creation

Two new wetlands are proposed to be created for the offset requirement. The existing wetlands do not require additional restoration and will be supplemented along the edges with forest revegetation reflecting appropriate species composition.

The proposed new wetlands are in areas with with existing suitable soils and hydrology for wetland creation but are still predominantly pasture species covered. The western opportunity (new wetland 1) is adjacent and downstream of the primary wetland and

currently has a small tributary running through the area. It is around 1400m² and requires a lowering of the current ground level by perhaps 0.5m and a small bund. The tributary and natural flow from the upper wetland will enable wetland hydrology and wetland revegetation without draining the upper wetland.



Figure 4. Two new wetland creation opportunities shown in blue and summing to over 2000m²

Over the stream just north of the main track and draining a wide hill slope, inclusive of a small basin, is an area of Ca. 0.1ha where it is proposed (in stage 1) to create new wetland 2 this will require removal of around 1m of top soil and install a lower small bund that will allow a new wetland to form replacing the current pasture grasses (eastern opportunity).

In addition to the slope drainage, a small tributary north could be realigned to add water to this system rather than directly to the Speedy's Stream as it does now. Both these areas are illustrated below.



Western wetland creation opportunity (**New wetland 1**)



Part of the riparian offset includes riparian planting of the Speedys Stream headwaters. The proposed planting will result in full riparian cover, which will either count towards the terrestrial offset or the stream offset (depending on the OBDA stream remedy outcomes).

The creation of these wetlands occurs in stage 1 as there is a practical need to access this area to create the wetlands in advance of the other planting in Stage 1 being undertaken on the site.

Success of the creation is assessed by causing appropriate wetland hydrology (i.e. sufficiently wet soils) and, as per the other stagings criteria, introduction of the listed species, 95% survival to establishment and attainment of a canopy cover of over 80% with the absence of ecological weeds.

2.2 Permits and resource consents

We understand that the terrestrial revegetation (weed and pest management) can be carried out as a permitted activity.

We note that the proposed natural inland wetland activities will need to occur in conjunction with an appropriate wetland restoration plan. The consent holder shall prepare and submit to Greater Wellington Regional Council for certification a Wetland Restoration Plan encompassing the new wetlands and any proposed restoration activities for the existing natural inland wetlands on the site (if required). The plan shall be prepared by a suitably qualified and experienced freshwater ecologist and shall include where relevant:

- Schedule 2 -Restoration plans for the natural inland wetlands of the Resource Management (National Environmental Standards for Freshwater) Regulations 2020; and

- Schedule F3a -Contents of wetland restoration management plans of the Natural Resources Plan for the Wellington Region.

Other resource consents may be needed for aspects of the wetland creation (earthworks and spoil) which have been applied for as part of this project.

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3.0 General Actions required to enable revegetation processes.

3.1 Site preparation

The current vegetative cover is predominantly exotic grass species and gorse and some minor weeds. There are also small clusters of native scrub and shrub species, none forming a cohesive canopy of area. Only problematic ecological weeds will be removed prior to planting (vines, ground mats and potential tree canopy weeds). The gorse will be allowed to persist to act as a nursery species.

The soils are likely to have likely reasonable fertility, in part due to the old farming management. However, a fertiliser tablet is recommended to be added at the base the hole dug for the planting of woody species. Mulch will also be added, each plant will receive a stake and a combe guard, in the main to assist the maintenance programme in identifying the plant for weed release, but also as added herbivore protection, wind protection and to enable monitoring of the success of the planted material. Further details are set out below.

The species selected (listed below) are species which are naturally found in this situation and ecological district. They are species that have been chosen because they are well suited to the soil and the local climate and the successional stage with the addition of the potential final canopy species in smaller abundance.

This, along with eco-sourcing of the plants, not only recreates a representative ecosystem, but increases the success of planting establishment.

3.2 Availability of Plant Material

The species to be used reflects the findings of the RECCE plots from the early and mid-seral vegetation communities in and near the OBDA. The late successional species reflect the altitude, expected wind and soil and the predicted forest cover for this area (Singers et al., 2018).

Plant propagation material will be sourced from as close to the planting site as possible and from local nurseries which are able to supply eco sourced appropriate plant material. We emphasise the requirement for the material to be eco-sourced and the material to have records that allow verifiable seed stock (i.e. collection certification and propagation documentation). This increases the ecological values of the site in keeping true to the local population genetics and increases the establishment success of the plantings, as they are more adapted to local conditions.

3.3 Timing of Planting

Planting in the location is generally successful through late summer to early winter and also early spring (to avoid frosts). We recommend between April-July and October-November in stage 1 where the soils are moist than up slope.

Where nurseries do not have sufficient eco-sourced stock required, then procurement of stock will require a lead-in time. This can be as much as 18 months to obtain seed and

propagate plants to meet required grades for planting, if required. Some eco-sourced stock may be available from specialised nurseries that already have seed or plants in stock.

3.4 Plant Condition

All plant material shall be well hardened off and acclimatised to the proposed site conditions prior to delivery to site or at site. Plants must be free from pests and diseases, materially undamaged, healthy and vigorous.

All plants shall be true to botanical name and grade as specified in the plant schedule. All plants shall be of the size stated and supplied in the container size as specified.

3.5 Pre-Planting Pruning

Immediately prior to delivery, all shrubs shall be pruned by skilled staff as necessary to conform to the best horticultural practice appropriate to the type of plant. If removal of excess top foliage is required, the excess material shall be in proportion to the overall plant growth and rootball size, with generally only half or the top third material being removed.

Pruning shall remove all damaged twigs and branches and shall compensate for any loss of roots during planting operations. Pruning shall be carried out without any bruising or tearing of the bark. Operations are to be carried out using sharp clean implements to give a clean sloping cut with one flat face. Ragged edges of bark or wood are to be trimmed with a sharp knife.

3.6 Plant Guards

All woody species shall be planted with a combi-guard cell Combi-guards allow smaller grades to be planted with a higher survival rate. Thus, allowing a dense canopy to form quickly, suppressing weed species. Establishment and survival rates are increased by using combi-guards, preventing browse from rabbits and hares, preventing spray damage, frost damage and the sleeve which the plant sits within also creates a humid environment conducive to plant growth.

3.7 Mulch

Nutrient cycles are one of the functions that needs to be returned to the land, and is predominantly driven through the decomposition of organic material at a site. Therefore, a thick layer of mulch (minimum depth of 20cm) should be placed within the planted areas (where slope allows it). Wool mats can be used instead of mulch and give protection and some nutrient but not as much as a good wood mulch. Mulch has several benefits in a planting area, firstly it provides a large amount of organic material, providing food for important soil insects and bacteria, it also covers bare soil lessening the establishment of weeds, it also holds in moisture lessening the loss of plants in a dry period, and it can utilise on site woody material saving on cost.

3.8 Drought Conditions

Should the area undergo a period of drought in the summer season following planting, it may result in death of some plant species. In order to achieve the offset those plants will need to be replaced and managed to reach the same established levels as the rest of the revegetation.

3.9 Workmanship

All materials and construction shall be to a high standard, and workmanship shall be that of appropriately qualified tradespeople performing all labours in the best trade practice.

3.10 Plant material, numbers and Setting Out

3.10.1 Plant numbers

Given that the area in total is relatively large the project will adopt a 1.5m planting spacing. This spacing is at the upper end of standard revegetation spacing but acceptable for forest community projection. Where as a 1m spacing increases the speed of canopy closure it does not produce as fast growing large plants as a 1.5m spacing (Sullivan et al., 2009). The trade off is that under the wider spacing there may be greater weed management, and it may be that canopy closure takes a year or two longer. That is less plants up front against potentially more management for longer to achieve an 80% canopy closure.

3.10.2 Site Responsive Approach

A suitably qualified and experienced ecologist should be on site during the set out of plants to ensure the location of plants within a general planted area follow the best hydrological, soil and topographical locations for species. Where appropriate, opportunities will be provided for mana whenua review of restoration planting plans, particularly in relation to species composition. The species lists and proportions given below reflect the wider site assemblage character and cover but cannot prescribe the micro-site characters which will drive the allocation of specific species to micro-sites.

This may include adjustments for localised soil or moisture conditions within a specified treatment mix. The overall objective is to plant in a manner and in places where plants will have the best chance of survival and healthy growth.

3.10.3 Planting Generally

All planting shall be performed by experienced workers in accordance with recognised good horticultural practice and under the supervision of a skilled site manager.

All plants shall be placed with the main stem vertical and at such a depth that the soil, when firmed down is at the same height as the earth marks on the stem from the soil level of the container. Loose roots shall be spread out in a natural fashion; the soil being carefully placed under and amongst them to fill all voids and firmed in.

The bottom of each hole shall be pierced to a depth of 200mm with the tines of a fork or similar implement to ensure compactions are loosened for root penetration and free drainage. The sides of the hole shall be roughened to remove any glazing of the surface.

Container grown plants shall have the container removed immediately prior to planting. Care shall be taken to ensure that the root ball is not disturbed during container removal or planting. Any major roots that become accidentally broken off or frayed shall be cleanly cut off from the plant.

3.10.4 Planting Work Completion

The work will be deemed complete when all work, materials and processes have been carried out as set out in the plans, drawings and specifications.

3.11 Plant Pest and Animal Control

3.11.1 Pest control management plan

3.11.1.1 Pest Assessment

The Installer will undertake an assessment of plant and animal pests prior to planting. This assessment shall outline the pests to be controlled and include a list of pest species (both animal and plant pests). These are to include:

- possum,
- rabbits, hare,
- wild goats and pigs (if present).

Based on this assessment the Installer will prepare a pest management program in consultation with GWRC Regional Park staff.

The area to be controlled will be the full extent of the offset planting area as shown on Figure 3 for all stages. It is noted that a consequence of the site preparation strategy is not to control annual and small stature low / non ecological concern weeds only those with real ability to prevent the establishment and persistence of the native assemblage targets.

3.11.1.2 Pest Plant Removal

Pest plant control shall be undertaken during site preparation and prior to planting, with all planting areas being cleared of pest plants prior to planting. Pest plants are defined as exotic species likely to interfere with the desired plants progression.

3.11.1.3 Disposal

Unless otherwise specified, the Installer is responsible for the disposal off site all pest plant materials and pest animals in a safe and legal manner.

3.11.1.4 Other Maintenance actions and timing

The Maintenance Plan shall be prepared by the Installer and identify maintenance operations and their timing for the three years of active maintenance. That maintenance includes:

- Weed suppression / removal

- Pest level monitoring and control actions
- Maintenance of trees, shrubs and groundcovers, including staking, trimming, fertiliser application, watering, replacement.

While aspects of this will be in the annual offset monitoring reports, monitoring is considered later in this management plan.

4.0 Terrestrial Habitat, stream and wetland offsets assemblages

We note that the Heffernan Block also offers the habitat recreation for the lizard habitat offset which arises from the unavoidable loss of 10.93ha of lizard habitat from the OBDA. The Heffernan Block includes areas of rocky out crop to be appropriately revegetated.



Northern slope with rock out crop.

The following prescribes the target make-up of the plant assemblages for the terrestrial, riparian and wetland offset areas.

Given the variation in topography, soils, hydrology and climatic conditions across the Heffernan Block, the restoration programme adopts a habitat-based planting approach. The species selected for each stage are intended to reflect the environmental conditions. This approach seeks to ensure successful establishment and survival of the plants.

The terrestrial 17 ha requirement is split between the lower (stage 1 and 2), central (stage 3 and 4) and upper third (stage 5) reflecting the change in slope, soil, wind, humidity etc a bespoke planting plan takes into account the environmental changes in the areas to be restored. .

Detailed design of riparian and wetland restoration works may be informed through engagement with mana whenua, including consideration of culturally appropriate indigenous species selection, ecological connectivity and water quality outcomes.

4.1 Species for use in stages 1 -5 - terrestrial

The following table (Table 1) shows the species and their proportional mix to be used in the Offset area and sensitivities (if any) to assist micro-siting. This proportion will then allow the

total species number required to be calculated based on the actual areas to be planted. Each stage will be approximately 4ha (based on 5 stages to make up 17ha).

Based on an area of 40,000m² at an average of 1.5 plant per meter square, 20,372 plants (more or less) will be required for stages 1-4 and for stage 5 5,000 plants). The following is for Stage 1 and 2, with Stage 1 having different end canopy species than Stage 2.

The species reflect the RECCE data from the OBDA and exchange areas and local plant lists from the NZ plant conservation website (Liverton Heights bush, etc) and in targeting the end community determined for the area. While ferns make up a noticeable component of the ground tier and middle tier and canopy in the RECCE seral communities measured, they are not commonly propagated and used in restorative plantings, and we do not suggest their use in the following but note that local spread of the common species (mamaku, gully fern, silver fern, Aspleniums) will occur. We further use sparingly those species (pate, kawakawa, hangehange) that can be a little prone to early serial exposure issues with survival.

Wetland and Riparian planting requirements are set out separately below.

Table 1. Species to be planted (1.5m spacing), proportion in the mix, resultant number required and notes for planting in stage 1 and 2.

Species	Stage	Proportion (%) in stage	Number (20372 stage) /	Notes
<i>Hedycarya arborea</i>	1&2	10	2037.2	
<i>Myrsine australis</i>	1&2	10	2037.2	
<i>Melicytus ramiflorus</i>	1&2	10	2037.2	
<i>Coprosma robusta</i>	1&2	5	1018.6	
<i>Coprosma grandifolia</i>	1&2	5	1018.6	
<i>Brachyglottis repanda</i>	1&2	5	1018.6	
<i>Coprosma crassifolia</i>	1&2	2	407.44	
<i>Pseudopanax arboreus</i>	1&2	10	2037.2	
<i>Leptospermum scoparium</i> var. <i>scoparium</i>	1	10	2037.2	
<i>Piper excelsum</i> subsp. <i>excelsum</i>	1	3	611.16	More sensitive to wind, use cover
<i>Schefflera digitata</i>	1	5	1018.6	More sensitive to wind
<i>Aristotelia serrata</i>	1	5	1018.6	More sensitive to wind and insect attack
<i>Cordyline australis</i>	1	5	1018.6	
<i>Pennantia corymbosa</i>	1	5	1018.6	
<i>Kunzea ericoides</i>	2	10	2037.2	
<i>Olearia rani</i> var. <i>colorata</i>	2	10	2037.2	
<i>Griselinia littoralis</i>	2	10	2037.2	
Canopy				
<i>Alectryon excelsus</i> subsp. <i>excelsus</i>	1&2	3	611.16	Prone to insect damage
<i>Elaeocarpus dentatus</i> var. <i>dentatus</i>	1&2	3	611.16	
<i>Dacrycarpus dacryoides</i>	1	2	407.44	Moister soils and in clusters

<i>Laurelia novae-zelandiae</i>	1	2	407.44	Wetter soils
<i>Knightia excelsa</i>	2	2	407.44	Ensure a 3m spacing between final canopy species in the mix.
<i>Beilschmiedia tawa</i>	2	3	611.16	
<i>Dacrydium cupressium</i>	2	1	203.72	
<i>Pectinopitys ferruginea</i>	2	1	203.72	
Special species				
<i>Lophomrytus bullata</i>	1&2	40		40 plants distributed between stages 1 and 2 (lower slopes)
Total number of plants for stage 1			20,372	
Total number of plants for stage 2			20,372	
Number of species	18			

Stages 3 and 4 present steeper slopes that are drier, with thinner soil, more wind exposure, colder conditions, and damp gullies.

Table 2 Species to be planted (1.5m spacing), proportion in the mix, resultant number required and notes for planting in stage 3 and 4

Species	Stage	Proportion (%)	Number (20372/ha)	Notes
<i>Hedycarya arborea</i>	3&4	5	1018.6	
<i>Myrsine australis</i>	3&4	10	2037.2	
<i>Melicytus ramiflorus</i>	3&4	10	2037.2	
<i>Coprosma robusta</i>	3&4	10	2037.2	
<i>Brachyglottis repanda</i>	3&4	5	1018.6	
<i>Pseudopanax crassifolius</i>	3&4	10	2037.2	
<i>Pseudopanax arboreus</i>	3&4	10	2037.2	
<i>Kunzea ericoides</i>	3&4	10	2037.2	
<i>Pittosporum tenuifolium</i>	3&4	5	1018.6	
<i>Olearia rani var colorata</i>	3&4	5	1018.6	
<i>Ozothamnus leptophyllus</i>	4	5	1018.6	
<i>Cordyline australis</i>	3	5	1018.6	
<i>Griselinia littoralis</i>	4	6	1222.32	
Canopy				
<i>Knightia excelsa</i>	3	3	611.16	Ensure a 3m spacing between final canopy species.
<i>Prumnopitys taxifolia</i>	3&4	2	407.44	
<i>Beilschmiedia tawa</i>	3&4	5	1018.6	
<i>Pectinopitys ferruginea</i>	3	3	611.16	
<i>Elaeocarpus dentatus var dentatus</i>	3	2	407.44	
<i>Pterophylla racemosa</i>	4	2	407.44	

Total number of plants for stage 3			20,372	
Total number of plants for stage 4			20,372	
Species richness stage 3	16			
Species richness stage 4	13			

It is noted that stages 2, 3 and 4 include wetter, more sheltered south-draining gullies in which the planted assemblage should use more of the “softer” broadleaf species and wetter adapted (FAC) later canopy species, were as in other areas there are steep faces which should better reflect the drier tolerant and harder species of the mix. A uniform grid set out approach cannot be used over each stage, but especially so for stages 3 and 4.

Stage 5 presents the highest point in the restoration block. This area is the coldest, windiest, but also has deeper soils for planting.

Table 3 Species to be planted (1.5m spacing), proportion in the mix, resultant number required and notes for planting in stage 5

Species	Proportion (%)	Number (5093/ha)	Notes
<i>Psedowintera axillaris</i>	5	254.65	
<i>Myrsine australis</i>	5	254.65	
<i>Melicytus ramiflorus</i>	5	254.65	
<i>Pseudopanax crassifolius</i>	5	254.65	
<i>Coprosma crassifolia</i>	5	254.65	
<i>Kunzea robusta</i>	20	1018.6	
<i>Olearia rani var colorata</i>	5	254.65	
<i>Olearia paniculata</i>	10	509.3	
<i>Ozothamnus leptophyllus</i>	5	254.65	
<i>Griselinia littoralis</i>	5	254.65	
<i>Coprosma rigidula</i>	5	254.65	
<i>Corokia cotoneaster</i>	5	254.65	
Canopy			
<i>Pterophylla racemosa</i>	10	509.3	
<i>Podocarpus totara</i>	5	254.65	
<i>Beilschmiedia tawa</i>	5	254.65	
Total number of plants for stage 5		5093	
Species richness	15		

4.2 Riparian to Speedys stream

This planting will occur at Stage 1. It may not be required for OBDA stream offsetting as the remedial actions restoring riparian vegetated flow paths in the OBDA may be fully successful.

It is suggested here that it is done at Stage 1 and that the successful re-establishment of the OBDA Stage 1 stream recreation (perhaps year 10) be tested to indicate if the remedy is achieved. If so the other stream remedies can be assumed to work and then the riparian

component completed at Stage 1 will factor into the terrestrial area offset and stage 5 can be reduced comensurately so as to sum in total 17ha only.

If the stream remedy in the OBDA does not succeed then Stage 5 may need to be expanded by 1.3ha on the assumption no OBDA stream recreation remedy will work opportunity exists within the Heffernan Block to do so.

At that stage the 2.6ha of riparian re-vegetation will then either count towards the stream offset (in the event that remedial actions fail) or to the total terrestrial habitat offset and Stage 5 can be altered as required.

Assuming a 10m either side requirement and 1,300m long the area of revegetation is 26000 m² (2.6ha). At a 1.5m spacing such an area will require in the order of 13,242 plants.

Species	Proportion (%)	Number (13,242)	Notes
<i>Pennantia corymbosa</i>	10	1324.2	
<i>Melicactus ramiflorus</i>	5	662.1	
<i>Pseudopanax arboreus</i>	15	1986.3	
<i>Coprosma grandifolia</i>	10	1324.2	
<i>Hoheria</i>	10	1324.2	
<i>Plagianthus regius</i>	10	1324.2	
<i>Phormium tenax</i>	5	662.1	
<i>Pseudopanax arboreus</i>	10	1324.2	
<i>Olearia rani var colorata</i>	5	662.1	
<i>Canopy</i>			
<i>Dacrycarpus dacryoides</i>	5	662.1	
<i>Laurelia novae-zelandiae</i>	5	662.1	
<i>Alectryon excelsus subsp. excelsus</i>	10	1324.2	
Total		13242	
Species richness	12		

4.3 Wetlands

The wetland offset considers existing hydrological opportunities that do not have a representative indigenous vegetation cover, but are currently in wet exotic pasture. The offset allows these areas to become representative indigenous wetland communities. There will be a need to alter the topography in the two wetland creation sites, in ways to enhance water surface presence year-round and retention.

The two wetlands total A0.2ha (2,000m²) the proposal is to create marsh with sedgeland, ferns and edge woody cover (manuka) at a 2 plant per m² which will require 9,167 plants. Some (raupo), *Isolepis habra*, one *Coprosma rubra*) will be a transfer (the C. rubra also propagated), and the manuka for use as edge planting.

Species	Proportion (%)	Number (9,167)	Notes
<i>Leptospermum scoparium</i> var. <i>scoparium</i>	10	917	
<i>Coprosma propinqua</i>	2	183	
<i>Sphaeropteris medullaris</i>	2	183	
Giant umbrella sedge	20	1833	
<i>Carex geminate</i>	20	1833	
<i>Carex secta</i>	10	917	
<i>Juncus (edgariae, pallidus)</i>	20	1833	
<i>Isolepis prolifera</i>	10	917	Probably as salvage and therefore clusters
<i>Typha orientalis</i>			To be added as transfers from salvage areas
Special species			
<i>Coprosma rubra</i>		20 plants	Will require propagation specialist and use of on site seed source
Total		9167	
Species richness		10	

4.4 (Offset location 2) - Belmont Regional Park Adjacent to the OBDA - Swamp maire

4.4.1 Transplanting

As part of the project it is proposed to transplant the swamp maire within the project footprint. Further details about translocation and associated monitoring are set out in the translocation strategy in the Landscape and Ecology Management Plan (LEMP) 9.0 and 10.

4.4.2 The backup (offset)

The primary swamp maire management is the direct transplanting of the 14 known swamp maire located within the OBDA into suitable habitat in proximity of the removal site. The methods for that are covered in the LEMP. Each stage will be subject to a detailed relocation plan to provide the best opportunity for success in relocating the existing swamp maire within the footprint.

However, as a contingency measure to support the direct transplanting programme (and in the event the translocation fails to meet the completion criteria set out in 9.5 of the LEMP),

a minimum of 140 swamp maire saplings will be propagated and established within suitable habitat in the Belmont Regional Park.

This equates to approximately ten propagated saplings for every swamp maire proposed for translocation from within the footprint. The propagation programme will commence during the initial stages of the offset implementation to ensure replacement plants are established well in advance of most swamp maire transplanting activities. Only two swamp maire are currently required to be translocated during Stage 1 of the OBDA development. The initial translocation of the swamp maire into nearby existing swamp maire habitat will provide a good indication of likely success/outcome of the relocation.

Two primary sources of plant propagation materials have been identified. The first sources of plant material are small seedlings germinated beneath the swamp maire canopy in the central western gully. These seedlings are in dense numbers beneath the existing canopy, and the majority are unlikely to reach maturity due to competition and shading. The careful extraction and propagation of these seedlings will fast track production of sizable saplings for planting.

Should insufficient numbers of naturally occurring seedlings are available to meet the propagation target of 140 seedlings, additional seedlings will need to be sourced through the collection and germination of seeds. There is sufficient information on that process and its typical outcomes (with a 90% germination rate) that this is a secure seedling attainment back up.

That extraction, and rearing (and seed propagation also) will be carried out by a suitably experienced nursery person.

Secondly cuttings are taken from the swamp maire plants in the OBDA prior to removal, again by the same expert, to be developed into new plants, the purpose of which is to secure the genetic material.

To that end we recognise the eastern wetlands and gullies to the OBDA as offering swamp maire habitat and recommend areas Figure 5.



Figure 5. Eastern wetland and gully areas suitable as swamp maire recipient edges where haul roading allows access.

The establishment of the 140 swamp maire saplings we recommend be in the areas that have already been surveyed as being swamp maire suitable.



Figure 6. Swamp maire suitable habitats into which to add sapling swamp maire.

5.0 Monitoring, Reporting and Adaptive Management

5.1 Swamp maire Monitoring

Monitoring of the health of the transplanted trees should fall to a qualified arborist who has experience in judging tree health.

The precautionary pre offset planted sapling swamp maire must be regularly monitored (bi monthly for the first year and biannual after, for weed competition issues, and plant survival and growth.

Those monitoring events must be recorded and the records made available to Councils and IWI.

Where a transplanted plant does not survive, then this is recorded and places emphasis on the planted saplings surviving to establishment. Where a planted sapling does not survive, then further saplings will be required to be grown and planted into the appropriate wetland habitat in the park, which may be different to the areas initially attempted.

5.2 Terrestrial / wetland staged revegetation monitoring and reporting

Monitoring includes regular inspection for weeds, pest damage and health and survival of each plant in each of the stages. In the first year monitoring should be monthly (and may coincide with programmed care actions) and all defects replaced and all weed and pest issues recognised and result in control actions to be undertaken.

The year's monitoring results and actions should be reported to Councils and Iwi at the end of that year. Year 2 should receive quarterly monitoring and triggered pest management actions with an annual report. Year three: binannual inspection, action triggers and reporting at the end of the year. Year 4 has an annual inspection and report including any pest action triggers. Year 5 is also an annual inspection again recording pest issues (including the success of the controls of year 4 if present) but now also the extent of canopy coverage and a plant survival percentage for the stage.

Should offset outcomes fall short of expected outcomes at year 5 in the monitoring process, then the contingency actions provided here will counterbalance those shortfalls. If survival statistics are >95% but canopy cover is not yet 80%, then no actions may be required other than to continue monitoring cover increase each year.

The key outcomes to be monitored include species/plant survival, canopy closure (measure of area cover), plant height, girth and vigour.

The table below is a summary of the monitoring process for the offsets.

Table 4 Monitoring purpose, timing actions and reporting

Stage 1	What how	Actions	Report
Determination of pests on site	Indicators - print traps, visual spotting.	Pest management actions, shooting, poisons, hand weeding	Brief note re issues and actions after completed
Determination of issues with soils or structures, access plan etc	Site inspections	Fertiliser use, physical removal, minor earthworks	Brief note re issues and actions after completed
Pest management	Determine by indicator monitoring successful control	Measure by repeat of initial detection systems to low incidence	Report annually.
Planting	Three years of establishment monitoring and management (weed and pest and plant replacement) – monitor plant survival and health	Installer processes to investigate and respond to weeds, pests, plant failures and replacements	Annual report on actions and issues
Year 4 biannual monitoring	Plant survival, growth, canopy cover (sample plots and drone total coverage).	Measure by randomised 20 x 20 vegetation plots and by drone site area measures plant survival, growth, death and canopy cover.	Report annually
Year 5	Repeat year 4	Continue until conformation of 80% canopy cover and 95% of planted material has survived.	Report end of year 5, determine if success achieved if not repeat with continued management as determined by identification of the retarding issues.
Next stage	Repeat		

Monitoring progression and revegetation success occurs regularly through the first three years post planting (as in any planting contract) to ensure establishment and survival. Then

monitoring falls to an annual process to ensure survival persists, the trend to canopy cover progresses and to ensure no retarding ecological weeds occur post site preparation.

The purpose of the monitoring at the five year mark is to track the progress of identified biodiversity attributes and provide feedback with recommendations for any additional management required to ensure the offset performs to target.

It is also to identify any requirements for contingency actions early, where any shortfalls could affect offset outcomes.

Reporting

An annual monitoring report regime can effectively demonstrate that the offset is developing as expected and is being appropriately managed and maintained and at the five year end of stage process to demonstrate if that part of the offset has reached success or requires continued management.

Thus, monitoring for the first three years is annual and involves the planter ensuring that the material remains healthy, established and is animal pest (herbivore) and weed free. Then success metrics become the monitored aspect annually (survival and development) until the end of the stage where a round up monitoring process occurs to inform survival rates per species, and as to the trends towards canopy closure and weed and pest status.

While ultimate success will be determined at 30 years, the stage targets provide an indication of expected values for attributes at each 5-yearly interval with the gradual development and maturation of the offset vegetation.

Failure to meet biodiversity attribute targets prior to 30 years may not necessarily result in failure of the offset, however monitoring outcomes that result in values that are short of the targets would inform adaptive management actions, such as additional planting, provision of fertilisers, greater pest management etc.

Reports to Council would be prepared annually outlining the planting achieved, the survival and what and where actions were undertaken to combat pests or that required substantive replanting.

An annual monitoring report and five yearly reviews shall be provided to Taranaki Whānui ki Te Upoko o Te Ika and Ngāti Toa Rangatira. Opportunity will be provided to mana whenua for feedback on monitoring outcomes and proposed adaptive management responses. At the end of each stage a comprehensive stage wide report would be and detail where improvements for the next stage may be advantageous and the trends towards success of the offset (plant survival and canopy closure).

