Kaiao Irrigation Scheme
Biodiversity Mitigation Plan

Version: 2.1
Status: DRAFT
Date: 17November 2021

PLACE GROUP

environmental planning

Nancy Willems

Status: DRAFT
Date: 17 November 2021
File reference: TLDC-21-403
Contact: nancy@placegroup.co.nz 027 294 4558

1. Introduction

The Kaiao Irrigation scheme is located at Te Kaha and intends to draw water from the Kereu River which will service horticultural operations to the east and west of the Kereu River. Supply will be pumped to properties to the east, and pumped up to a reservoir tank on a high point to the west. This will enable the pipeline to operate largely by gravity to deliver water to the western portion of the scheme.

The purpose of this report is to document a proposed plan to address ecological effects of the installation and infrastructure for Kaiao Irrigation Scheme. This includes areas of vegetation clearance at stream crossings, the location of infrastructure at the Kereu River, the construction of the reservoir access road and reservoir site, and the disposal of excess fill from the road and reservoir. The estimated area of clearance is 1 hectare in total, and approximately half of that is permanent loss at the reservoir and access road.

A mitigation plan is required to address potential and actual adverse effects from the works in relation to biodiversity values in the Section 92 further information request from Opotiki District Council (dated 4 October 2021).

Note that the biodiversity areas and vegetation are described in the Wildlands report[1] and are not repeated here.

1.1. Applying the Biodiversity Offsetting Guidelines[1]

Bay of Plenty Regional Council and Opotiki District Council have requested that mitigation be applied in line with the Biodiversity Offsetting Guidelines (Maseyk *et al*. 2018)[1], which were produced to provide guidance from policy development to implementation with regard to the management of effects on biodiversity values. The offsetting guidelines draw from the Business and Biodiversity Offsets Programme (BBOP) 2012[2], to provide guidance around identifying when, where and how biodiversity offsetting could or should be used. A key principle of the offsetting guidelines is the application of the effects management hierarchy, in sequential order, to minimise residual adverse effects:

[1] Wildland Consultants Ltd. (2021). Terrestrial vegetation assessment for the proposed Kereu River Irrigation Scheme, Te Kaha. Contract Report No. 5649b. Prepared for Te Kaha Group and Kaiaio Hapū, Te Kaha.
[2] Business and Biodiversity Offsets Programme (BBOP) 2012. Biodiversity Offsetting Standard. http://bbop.foresttrends.org/pages/guidelines.

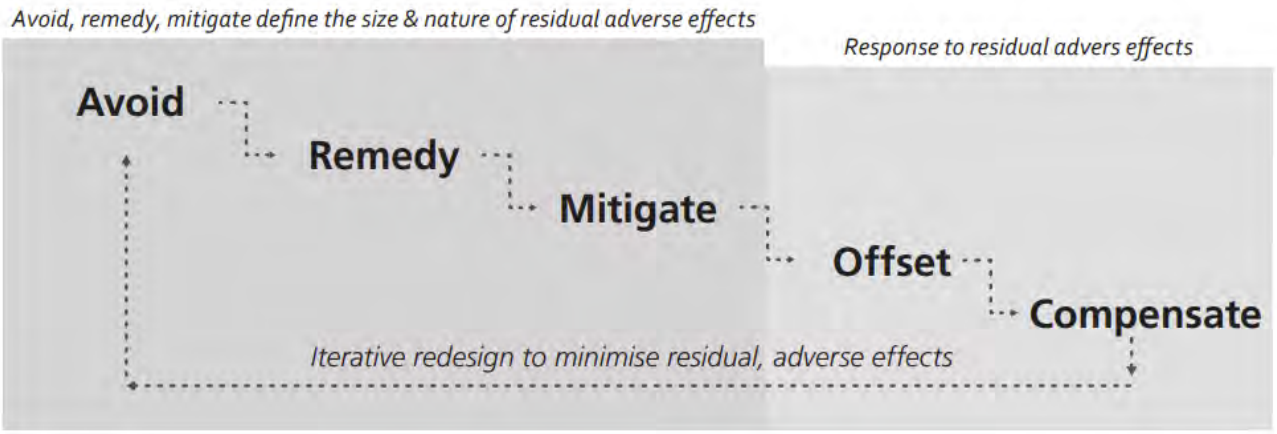

Figure 1: The effects management hierarchy. Extract from Maseyk *et al* (2018).

Offsetting specifically is not feasible in this area due to the occupation of the coastal area and lack of space to establish new areas of vegetation to offset losses from the project. An offset site that is isolated from other natural areas would also not provide for sufficient area (even at a 3:1 ratio) to manage edge effects and develop a true forest environment and habitat. Biodiversity gains would be unlikely to be lasting, the site would be isolated and would lack connectivity. The use of areas up against the existing sites are not available due to lack of landowner permissions.

This plan proposes a combination of actions following the effects management hierarchy and compensation, as per the Biodiversity Offsetting Guidelines (Maseyk *et al*. 2018)[3], to address the ecological effects of the pipeline and associated infrastructure to minimise residual adverse effects.

2. Proposed works

A full construction methodology is provided in the Construction Management Plan (CMP) and is not repeated here. The key elements of the construction and installation process in relation to biodiversity values are as follows:

- The establishment of infrastructure at the Kereu River intake site, including a wet well, a concrete pad for the cyclone separators and flow meters, and two storage tanks. A gravel area will be established to enable all weather access to the site for maintenance, and an access road to the intake will be sealed for all weather access

[3] Maseyk, F; Ussher, G; Kessels, G; Christensen, M; Brown, M. (2018). *Biodiversity Offsetting under the Resource Management Act - A guidance document*. Prepared for the Biodiversity Working Group on behalf of the BioManagers Group. https://www.lgnz.co.nz/assets/Uploads/7215efb76d/Biodiversity-offsetting-under-the-resource-management-act-full-document-....pdf

to the intake structure.

- Vegetation clearance at stream crossings where directional drilling is not able to be used and the pipe is to be installed above ground.
    - Installation above ground would include the need for concrete plinths to support the pipeline in some locations, involving the clearance and excavation of approximately a 1 m x 1 m area for each support, with supports located up to approximately 12 m apart.
    - Directional drilling would require a receiving pit which may be able to be located outside areas of vegetation, although this may not be possible at some locations.

- Installation methodology across identified wetland areas will require confirmation, however it is intended to use directional drilling or suspending the pipeline above the wetland to avoid disturbance of wetland vegetation wherever possible.

- Vegetation clearance to establish the reservoir site and reservoir access road, involving cut and fill and the need to dispose of excess spoil.

- Vegetation clearance at an identified proposed fill site to receive excess spoil, and reinstatement of indigenous vegetation.

- Gravity main pipe installation from the reservoir, which runs down a steep slope to the west. This section may be installed either by directional drilling or above ground. An above ground installation would require concrete supports, which may involve the use of a small excavator to carry supports and pipe into position. This would require some vegetation clearance for the excavator to gain access from the top and bottom of the slope. A helicopter could be used for some of the supports, however overhead power lines limit the area in which a helicopter can fly.

- There are some large mature puriri scattered throughout the alignment, with several individuals mapped by Wildlands (2021) that are close to the pipeline alignment in different locations. These are remnants of the original forest cover and will provide an important seed source for the spread of puriri into surrounding areas.

- Two additional wetland areas that are near or in the pipeline alignment were identified as possible wetlands through the consenting process and assessed during the site visits. Measures to manage effects on these sites are also included[4].

[4] A third possible wetland queried by Bay of Plenty Regional Council was confirmed as dryland forest.

3. Ecological effects

Wildland Consultants (2021)[5] describe a range of ecological effects from the pipeline installation. In response to Opotiki District Council's S92 request for further information, this has been further assessed. Ecological effects to be addressed through the mitigation plan include:

- Effects of sediment run-off from open earthworks on wetland and biodiversity areas.
- Potential colonisation of the open soil areas by pest plants like pampas, either before or in competition with the establishment of hydroseed or other cover.
- The potential spread of pest plants via machinery movements and/or proliferation of pest plants in the newly disturbed soils and more open environment.
- Temporary disturbance of birds during the construction period.
- Temporary removal of all vegetation within the fill site, estimated by Wildlands (2021) at approximately 0.4 ha.
- Edge effects on the kānuka forest upslope of the fill site while the site is bare.
- Permanent loss of areas of vegetation at the reservoir access road and reservoir site, estimated by Wildlands (2021) at approximately 0.6 ha.
- Damage to root systems of large mature puriri and kohekohe. There are no mature taraire along the alignment that are close enough to be affected.
- Potential effects on wetlands within the project area.
- Vegetation disturbance at stream crossings for pipe installation and supports where directional drilling cannot be used.

3.1 Impact assessment

Roper-Lindsay et al (2018) provide guidance for assessing ecological impacts of a proposal. This has been applied using the guidelines document, with reference to Tables 4, 5, 6, 8, 9 and 10 of that document, site assessments from Wildlands (2021), observations during the site visits and installation methodologies being considered. The impacts are discussed and summarised in Table 1. These assessments relate to the project as a whole and include consideration of temporary effects and residual adverse effects, with mitigation being applied to avoiding or managing residual adverse effects.

3.1.1 Reservoir site and reservoir access road

The permanent vegetation loss amounts to approximately 0.6 ha, which is a small proportion of a much larger site, and a wider area of continuous indigenous forest that stretches from East Cape to Whirinaki. Only part of these areas fall within the coastal bioclimatic zone, which would provide the opportunity for succession to a coastal forest type that is much reduced in extent due to human activity and its limited distribution within the coastal and lowland bioclimatic zones.

[5] Wildland Consultants Ltd. (2021). *Terrestrial vegetation assessment for the proposed Kereu River Irrigation Scheme, Te Kaha.* Contract Report No. 5649b. Prepared for Te Kaha Group and Kaiaio Hapū, Te Kaha.

Table 1: Ecological impact assessment - Site value ratings are as per the Wildlands (2021) report.

Site	***Site Value (Tables 4, 5, 6)***	***Magnitude of effect (Table 8)***	***Timescale of effect (Table 9)***	***Level of effect (Table 10)***
Reservoir site	*Moderate above the saddle and in the proposed reservoir site.*	*Moderate to low in the context of the larger site*	*Permanent*	*Moderate to Low*
Reservoir access road	*Moderate to High*	*Moderate to low in the context of the larger site*	*Permanent*	*Moderate*
Fill site	*Low (Vegetation types 11 and 12) to moderate (Vegetation type 10)*	*Moderate*	*Medium to long term*	*Low*
	High Vegetation type 9	*Moderate*	*Medium term*	*Low*
Stream crossings	*Pakaranui, Puremutahuri and Waikanae Streams,* *Low to high value vegetation types.*	*Low*	*Short to medium term*	*Low to very low*
Intake site sedgeland	*Moderate*	*Negligible*	*Short term*	*Very low*

3.1.2 Fill site

The effects of vegetation clearance are temporary, because the vegetation will be replanted. The period of time for replanted vegetation on the fill site to reach a similar stature, diversity and full structure is less likely to be achieved in 15 years, and is a long term effect under the EIANZ guideline time scale definitions, however, in the long term (15-25 years) the fill site would approximate its pre-construction condition.

Edge effects along the open edge into the higher value hillslope vegetation type 9 (Wildlands, 2021), will reduce over time as the plantings develop. In addition there will be some response of the trees and shrubs along that edge to close the openings, and the effects of the open edge will be reduced earlier in terms of the timeframe required for the remainder of the fill site to re-establish full structure and composition as per the pre-clearance state.

3.1.3 Stream crossings

The pipeline crosses these three streams and small amounts of indigenous vegetation will need to be cleared to complete the installation. Options for the installation at these sites include above ground with concrete support plinths, or directional drilling below the ground as described in the CMP.

Some understorey clearance will be needed to install the concrete supports and the pipe for above ground installation. Where directional drilling is used, a small area for the receiving pits will be needed at each end of the drilling length.

Vegetation at the stream sites ranges from high value areas of pohutukawa forest or treeland at Puremutahuri Stream through moderate and low regenerating or successional areas. There are some large individual puriri as mapped in the Wildlands report that are close to the alignment.

It is highly undesirable to damage or remove any of the pohutukawa at the Puremutahuri Stream, as these are long-lived and challenging to establish, and the works will completely avoid these.

The remaining vegetation at the stream crossings is of lesser concern as a relatively common successional type, although acknowledging that it occurs within the coastal bioclimatic zone where indigenous vegetation is much reduced with 10-20% of the original cover remaining.

Clearance will be minimal and temporary in nature, aside from the concrete support footprints, as the understorey will re-establish in the short to medium term.

3.1.4 Intake site sedgeland (delineated wetland area)

There is an area of sedgeland at the intake site that is defined as a natural inland wetland in relation to the National Environment Standard for Freshwater (NES FW). This site was assessed on the ground, and the Wetland Delineation Protocols[6] were applied. This assessment is provided as Appendix 1.

The establishment of the intake site will involve earthworks to contour and level the site. There are several structures proposed to be located here (see the CMP), including a wet well for shaft pumps, cyclone separators and flow meters, two storage tanks, and an access road to the intake itself. The remainder of the site is intended to be stabilised with aggregate to

[6] Ministry for the Environment. 2020. Wetland delineation protocols. Wellington: Ministry for the Environment.

ensure all weather access. The pipe needs to cross the identified wetland area to get up to the road before heading west, attached to the Kereu River bridge.

Earthworks to contour the site, the construction of the wet well and a concrete pad for some of the infrastructure will occur within 1-2 metres of the margin of the delineated wetland, but will remain outside the sedgeland vegetation. The installation of the fence may cause some damage due to trampling for the installation of posts into the margins. The fence will run along or close to the margin of the wetland, as its placement will need to allow for space between the structures and the fence. Works will be completed from the other side as much as possible to minimise this damage.

In order to suspend the pipe across this wetland area, concrete supports will also need to be placed close to the wetland margins to remain within the maximum 12 m span for the pipe.

Under the NES FW vegetation clearance or earthworks within or within a 10m setback from a natural wetland are non-complying activities and require resource consent from the regional council. The General Conditions of S55 apply, and the management of effects in relation to S55 are discussed in Section 4.1.

Trampling of vegetation in one or two small areas of the wetland margin are virtually nil, as the vegetation will quickly recover, and the disturbance will be kept to the minimum necessary. There will be no effect on the potential extent or future values of the wetland from these activities. The vegetation change to dryland exotic species is the natural shift from wetland to dryland, with the future potential extent limited by the ground conditions.

4. Management of effects

Potential and actual effects on terrestrial biodiversity are most obvious at the intake site at the Kereu River, the fill site, the reservoir access road and the reservoir site, and at the three stream crossings identified in the Wildlands (2021) report. Wetland areas and large puriri may also be affected.

Mitigation actions to minimise residual adverse effects are described in relation to these parts of the project, and the project area generally, and use a range of actions following the effects management hierarchy.

4.1 Kereu River intake site

The wet well, concrete pad and tanks will be installed outside the wetland vegetation, to avoid the need for any removal of wetland vegetation, although as noted above, it is not possible to keep the structures more than 10 m away and there may be a small area of

damage to wetland vegetation during the installation of the security fence. This will be kept to the minimum necessary.

The footprint is demonstrated in Figure 2[7], showing the structures and the site footprint against mapped wetland vegetation.

Figure 2: Works area footprint against wetland and non-wetland areas. Site plan provided by applicant.

A containment fence will be installed roughly at or close to the current edge of the sedgeland with little or no disturbance and does not require the removal of any vegetation. There may be some trampling in the sedgeland area in order to pour concrete around the poles, however this will be minimal and the bulk of the work will be undertaken from outside the sedgeland. Pest plant control of disturbed areas as part of the whole project area biosecurity measures will avoid the establishment of pest plants and encourage indigenous dominant sedgeland.

The pipe will be suspended over the wetland to avoid the need for trenching and removal of wetland vegetation. Careful placement will be used to position these outside the sedgeland/wetland area, however it is again not possible to stay more than 10 m away from the wetland area. In Figure 2 this section of pipe is marked in red. It is considered that

[7] The graphics portion is snipped from drawing NZ18013-PW-70 to enable it to be imposed on aerial photography.

outside of the support structure footprint, effects will be temporary in nature and located in non-wetland vegetation. The supports will avoid wetland vegetation. Monitoring and control of pest plants should allow for the current vegetation to re-establish over time, and hydroseeding could also be used to stabilise and vegetate earthworks more rapidly if considered necessary.

Earthworks to clear the site, establish the access road to the intake structure and to place the pipe supports will be undertaken outside the wetland area.

Potential effects of sediment or spoil entering the wetland will be managed by sediment controls that will prevent sediment from entering the wetland, and all clearing and spoil will be pulled away from the wetland. No sidecast will occur into the wetland area.

Open earthworks will be stabilised and covered with aggregate as part of the site construction, and any excess spoil will be removed or managed away from the wetland.

Machinery will not enter the wetland, as works can be completed entirely from outside the delineated wetland. Any refuelling and maintenance activities will be completed outside the 10 m setback from the wetland, with appropriate bunding or other controls to contain any spillage.

Machinery hygiene practices (detailed in Section 4.6.2) will reduce the risk of new pest plants arriving at the site, and follow-up inspections and weed control will reduce the establishment of pest plants at the site with a focus on preventing the establishment of new pest plants to the site.

Placement of structures and access will also avoid impacts on the pohutukawa fringing the river edge.

4.2 Fill site

The identified fill site is approximately 0.5 ha, and is covered in indigenous vegetation of moderate and low value on the actual proposed footprint, with several pest plants in the understory. Vegetation types are mapped and described in Wildlands (2021). Edge effects are noted in relation to the high value mānuka dominant areas upslope and 'behind' the fill site.

The fill site footprint is mapped as potential ecosystem type WF7-1 by Bay of Plenty Regional Council (see Figure 3- the fill site is indicated by the blue box), which is characterised by "broadleaved forest of abundant puriri" by Singers and Rogers (2014)[8]. This vegetation type

[8] Singers, NJD; Rogers, GM. (2014). A classification of New Zealand's terrestrial ecosystems. *Science for Conservation 325*. Department of Conservation, Wellington.

has been significantly reduced from its pre-human extent because of the predominance of clearance in coastal areas throughout New Zealand. Settlement and development on the East Coast is concentrated in the coastal zone so very little coastal forest remains.
At the site, there are some mixed broadleaved species under a canopy dominated by mānuka and kānuka currently, however there are no puriri or other coastal forest species like kohekohe and taraire that might be expected at later stages of succession. The site is in moderate condition with pest plants common in the understorey, including tuber ladder fern and wild ginger. This area is likely to have been cleared in the past, and retrolens historical aerial photography shows that the extent of scrub and forest in this general area is larger in 2021 than in 1966.

The current forest type is an early stage of development following earlier clearance, and has yet to reach a coastal forest in structure and composition. If left for a sufficient length of time, manuka will eventually be replaced by broadleaved species, with a mix of coastal species like puriri, kohekohe and taraire becoming more prominent. These species are important fruit bearing food sources for birds like kereru and will not establish outside the coastal bioclimatic zone. Opportunities for this forest type to re-establish following clearance are rare, and although this area is small, the removal of the vegetation will set back the succession process.

It is acknowledged that the removal of the vegetation here will prevent successional processes from attaining the mapped potential ecosystem type for at least several decades. The area mapped as WF7-1 is small and mostly covers only the fill site, as opposed to the remainder of the larger site traversed by the pipe and access road.

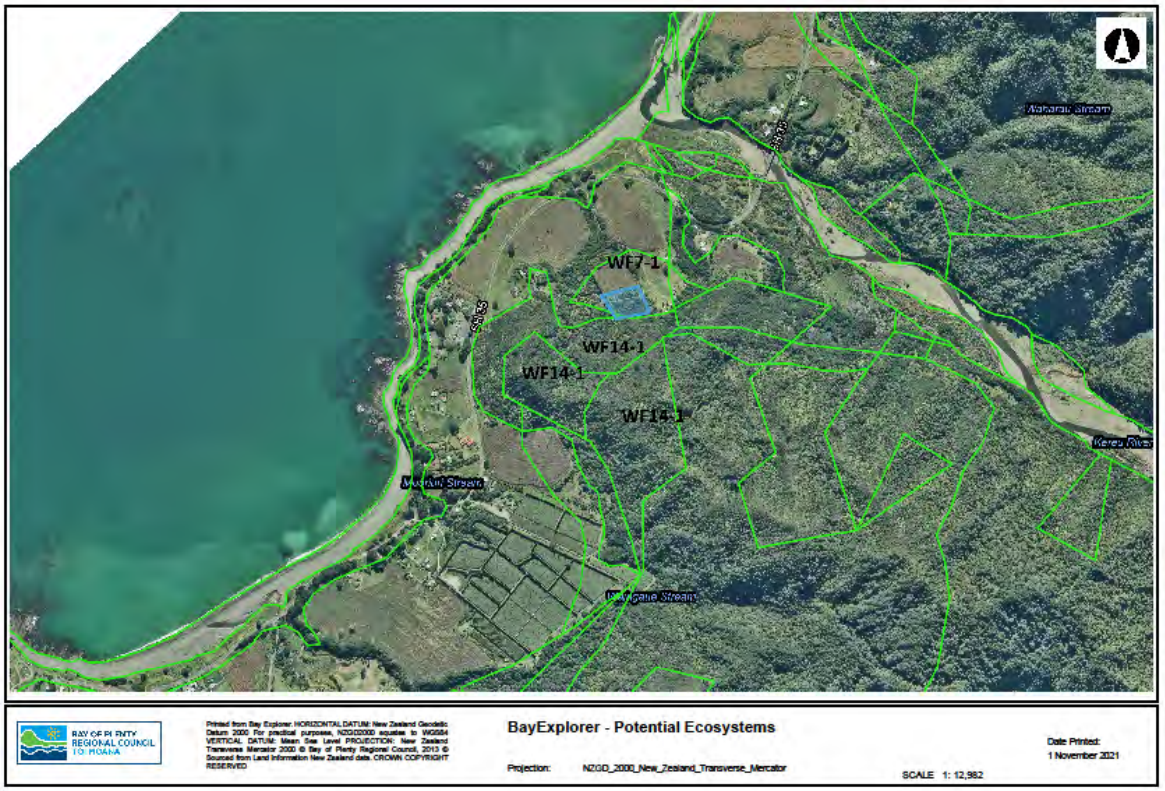

Figure 3: Potential Ecosystem types relevant to the fill site (indicated in blue), reservoir site and reservoir access road, as mapped by Bay of Plenty Regional Council.

The approximate location of the fill site on 1966 aerials appears to have vegetative cover that looks like regenerating edge habitat at that time (See Figure 4 in Section 4.3). This would be consistent with what is present at the site now.

The proposed vegetation removal will be remedied by replanting the site with an appropriate set of species, which will reinstate indigenous vegetation of similar species composition. This will help to protect the edge that will be formed by the clearance as the planting area matures so that the long term result will approximate the original condition. The full composition will take some time to develop, particularly in the understorey, however the intent is to control pest plants and prevent the re-establishment of the pest plants currently present, which include wild ginger and tuber ladder fern, which represents improvement with regard to reducing pest plants and encouraging an indigenous dominant understorey.

In this case reinstatement is considered to result in no nett loss of the area of indigenous vegetation for the fill site specifically. The ability to achieve a nett gain is not feasible, although controlling pest plants should provide some improvement in condition. The potential ecosystem type is a coastal vegetation type, and there is no ability to create additional area because the coastal areas around Te Kaha are largely occupied by settlements, horticulture, agriculture and scattered housing. Space is not available to establish a new area.

A planting plan is provided in Appendix 2 to reinstate indigenous vegetation on the site, which details species to be planted, numbers of plants required to achieve both reasonably rapid canopy closure and some early succession enrichment species to promote forest development in the early stages, plant spacings and maintenance requirements (including infill planting where required).

To avoid the proliferation of weeds at the site, all pest plants will be controlled prior to clearing the vegetation, to reduce viable propagules. All pest plants will be controlled again prior to planting and control will be applied annually until canopy closure is achieved at a minimum. This could take 3-5 years, and monitoring for weeds should continue for 5 years.

Machinery hygiene will be employed, as described in Section 5, to prevent the spread of propagules from the fill site into the wider area around the access road and reservoir site. This is particularly important for pest plants like tuber ladder fern and wild ginger.

4.3 Reservoir site and reservoir access road

The reservoir site, the access road and the gravity main installation to service the western extent of the pipeline will all involve the clearance of indigenous vegetation with some permanent losses.

The area where the reservoir access road and site are to be located are mapped as WF14-1, which is a potential ecosystem type that is less reduced from its original extent. Note that this mapping is not intended to precisely delineate individual ecosystem types with a hard boundary, and is indicative only. Singers and Rogers (2014)[5] characterise WF14-1 as kāmahi, tawa, podocarp, hard beech forest, however remnant large individuals of puriri suggest that this area may have been covered by a more coastal forest type.

Parts of the reservoir site and access road route were clear of vegetation in the 1966 aerial photography (Figure 4, sourced from Retrolens), which is reflected in the current composition, with only a one remnant mature puriri noted near the proposed access road alignment amongst the dominant manuka canopy.

Again, the ability to offset this area of vegetation is not possible because of the almost complete occupation of the coastal strip around Te Kaha.

Mitigation measures proposed to reduce effects from the construction activities are as follows:

- Sediment and erosion controls.
- Minimising the work area footprint in relation to the final road corridor and reservoir site.

- Machinery hygiene practices to avoid the spread of pest plants existing both within the immediate surrounds and between the fill site and the hillslopes.
- Hydroseeding to stabilise open earthworks soon after completing the works to prevent establishment of weeds like pampas within the site.
- Hydroseeded areas could also be covered with seeded manuka slash to promote colonisation of these areas by indigenous species. This may speed the process, however it is likely to occur without interference, provided weed control is maintained until cover is established.
- Pest plant monitoring and control will be undertaken annually to treat any pest plants found within the works footprint as per project wide biosecurity measures (see section 4.6).
- Enrichment planting of coastal forest species appropriate to the site and area (puriri, taraire, kohekohe). This could also provide some compensation for setting succession back in time at the fill site, by encouraging development of coastal forest components.

Figure 4: Retrolens aerial photography dated 2/11/1966, showing the indicative locations of the reservoir site and access road (blue). The fill site is located approximately in the area outlined in red.

As well as the mitigation actions proposed for the immediate works area and construction period, additional compensation is proposed because offset can not be provided for the permanent loss of vegetation to the access road and reservoir site.

Management actions proposed as compensation and partial offset (through improved condition) for the loss of vegetation at this site are as follows:

1. Wilding pine (*Pinus radiata*) control over the Maungaroa blocks west of the Kereu River (Figure 5).

   The area proposed for control amounts to approximately 66 ha and takes in the majority of wilding pines visible on aerial photography. It is intended to extend the area of control to mop up scattered individuals outside this defined area, however this is dependent on resource availability, and this area represents an achievable operational area.

   Methods for control are to be confirmed and could involve felling and/or drill and fill and/or basal spray.

Figure 5: Proposed wilding pine (radiata) control area

2. Enrichment planting of coastal forest species through the project area around the reservoir access road and pipeline, within the coastal bioclimatic zone (Figure 6).

   The aim of enrichment planting is to promote the establishment of saplings of coastal species under the manuka canopy, which will encourage the coastal forest characteristics to develop and provide a seed source within the site for further

recruitment. Individuals or groups of two or three individuals will be planted in scattered locations, and planted at larger planting grades, up to PB12. Recommended species for planting are puriri (50), kohekohe (50) and taraire (25).

Plants will need to be grown from locally sourced seed, starting early in the project, to enable planting at the end of 3-5 years, provided the plants are considered ready. Planting guidance is provided in Appendix 3.

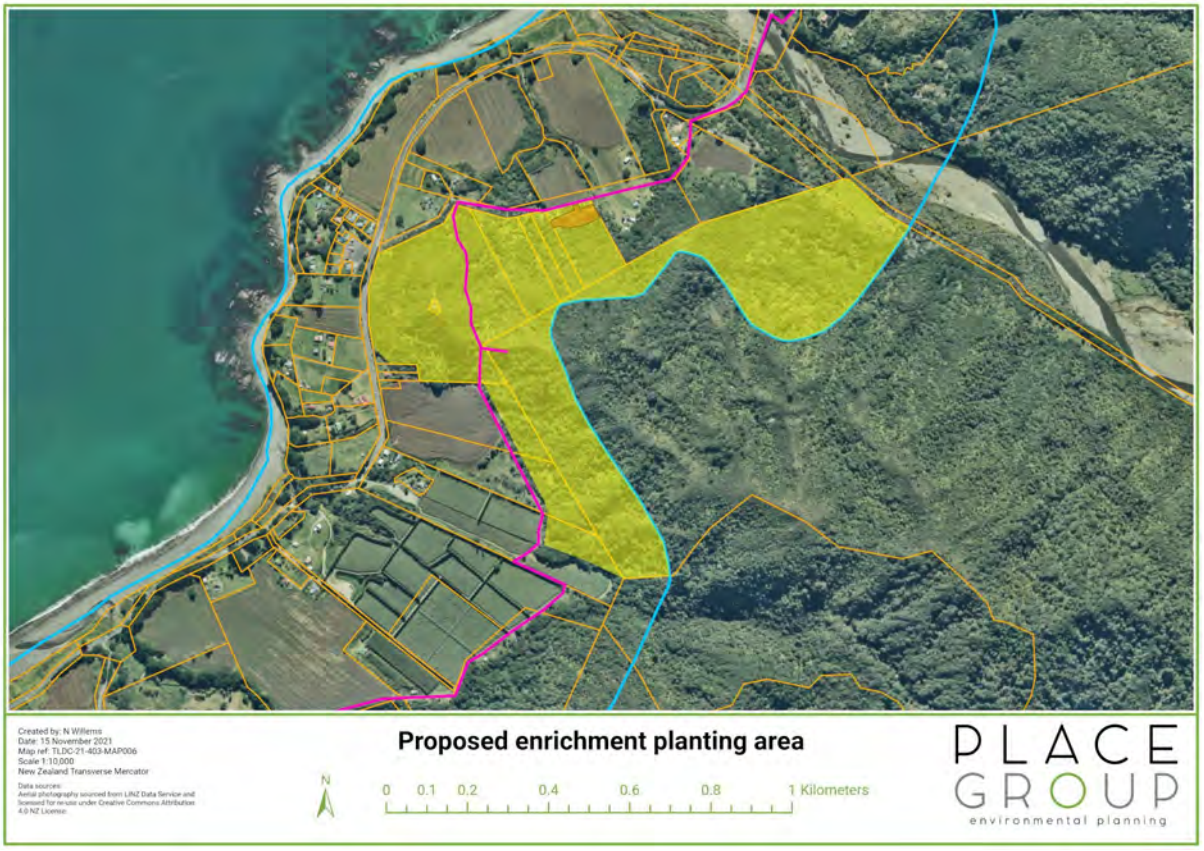

Figure 6: Proposed enrichment planting area.

4.4 Stream crossings

Large trees will be avoided and damage to root systems minimised. Vegetation clearance will be minimised and should only be required to accommodate the concrete supports (1 m x 1 m area) and possibly for the directional drilling receiving pit, although this will be located outside vegetated areas where possible. Trenching will not occur at these crossing sites within steeper banks and indigenous vegetation areas.

Vegetation will be cleared by hand. Cleared work areas will most likely be recolonised without assistance, however they will be monitored for the establishment of weeds and any weeds controlled as required.

The high value area of pohutukawa at the Puremutahuri Stream is entirely avoided as the pipe installment will follow the state highway and then turn into the existing access road, which sits below the embankment that the pohutukawa are growing on.

4.5 Wetland areas

There are two identified wetland areas[9] that require consideration in relation to the effects (See Figure 7). The impacts are not assessed in Table 1 as the project will avoid impacts on these areas, so that they remain unaffected.

Wetland A near the Pakaranui Stream is located near and below the pipeline location. An assessment against the NES FW noted obligate wetland species present, and dominant, at the site (*Isachne globosa; Bolboschoenus fluviatilis*) and no further assessment was required to conclude its status as a natural inland wetland. The pipeline will be located outside the 10m buffer required by the NES FW regulations and will avoid effects by managing sediment controls during the trenching process. Where the pipeline is above the wetland, on a track cutting, it is well outside the buffers. There is some potential for sediment to flow down into the wetland if not well managed, however sediment controls will be installed as per the Regional Council's Sediment Control Guidelines to prevent this. There is also a dense grass sward between the embankment and pipeline location and the wetland area which will also serve to capture sediment if it escapes the controls.

[9] Other potential wetland areas were also investigated and are addressed in the response to the S88 letter from BOPRC.

Figure 7: Wetland A (near Pakaranui Stream) and Wetland B (Copenhagen Loop Road).

Wetland B is located at Copenhagen Loop Road on the Te Kaha 16B1 and 12A blocks. This also meets the definition of a wetland at and below the proposed pipeline location and options for avoiding impacts on the wetland area include directional drilling or suspending the pipeline over the wetland. Investigation is needed to determine whether drilling is possible. Both suspension and directional drilling will avoid disturbance of wetland vegetation. If suspension is the better option, the pipe will be located above the wetland area on the dryland sections.

4.6 Project wide biosecurity measures

Biosecurity is becoming increasingly important to limit the spread of pest plants and animals that are not present in a region, local area or the site. The introduction of new pests to an area can create long term and costly impacts for landowners, and the effects can be irreversible. The effect of pests on biodiversity values have frequently been found to be significant, and control of new species becomes very difficult where either a pest plant or pest animal is able to establish a substantial and self-sustaining population. Prevention of spread through pathway and vector management is the most cost-effective option for pest control, and critical for the long term maintenance of indigenous biodiversity.

There are several biosecurity risks in relation to this project, including the use of machinery from outside the area and/or the region, sources of aggregate and other materials from stockpiles or yards that may include infestations of pests like exotic ants or plague skinks, and the movement of weeds throughout the work sites and project area.

Weeds of concern have been noted in the project area and the spread of those weeds is highly undesirable due to the range of impacts on biodiversity values, and on horticultural and other farming operations in the project area. While some are more light demanding and unlikely to establish under indigenous vegetation, and are therefore less of a threat to ecological values, others are shade tolerant and capable of spreading widely in the ground cover, or scrambling up vegetation into the canopy and smothering existing vegetation. Weeds are often adapted to colonising disturbed ground, and propagate through a range of means that are easily spread on machinery and machinery transport vehicles. Some species can become very costly to manage around productive land uses.

A range of weeds were noted in the project area, including pampas, gorse, blackberry, Japanese honeysuckle, tradescantia, wild ginger, selaginella, agapanthus and tuber ladder fern. Wild ginger, ragwort, blackberry and radiata pine are under the sustained control programme status under the now operative Regional Pest Management Plan 2020-2023 (BOPRC, 2020[10]). This means that moving, planting, or propagating pests in any way is not permitted and is an offence under the Biosecurity Act 1993. Landowners are required to control wilding radiata pine and ginger within 200 m of any property boundary if the adjoining landowner is also controlling these pests within 200 m of the property boundary, or if required by a written direction from an authorised person.

Species such as blackberry, gorse and pampas are unlikely to colonise and dominate existing indigenous vegetation because they are light demanding, however they will readily, and rapidly establish on disturbed ground, including road cuttings and the cut and fill areas for the reservoir. Brush wattle is also found in the project area and will rapidly colonise open disturbed areas (eg; the fill site). Once established they dominate the area and produce long lived seed, which means that control of wattles becomes a multi-decade problem for management.

Several species will reproduce from small pieces of plant (eg; crack willow, selaginella, tradescantia), and others have corms, bulbs or tubers (ginger, tuber ladder fern, montbretia) that are easily moved in mud and difficult to control once established. Ladder fern, ginger, tradescantia and selaginella are all shade tolerant species. Ginger, tradescantia and ladder fern, in particular, are capable of flourishing in the understorey of a closed canopy forest at very high densities to the exclusion of all else. Note that ginger is already scattered throughout the area being traversed by the access road and at the reservoir site.

[10] Bay of Plenty Regional Council. 2020. *Regional Pest Management Plan for the Bay of Plenty Region - Te Mahere Patu Kīrearea ā-Rohe e Marohitia Ana mō Toi Moana 2020 – 2030*. Strategic Policy Publication 2020/01 ISSN 1176-4112 (print) ISSN 1178-3907 (online). https://www.boprc.govt.nz/your-council/plans-and-policies/plans/regional-plans/regional-pest-management-plan

4.6.1 Monitoring for weed incursions

This requires an individual with at least some knowledge of plants or attention to detail to be able to identify anything that is new to the area, as a minimum. It could involve, for example, a weed control contractor, pest plant officer from a regional council, or an ecologist with sufficient knowledge, and/or training of someone within the community to take on the work.

Before and after photography can also be used to demonstrate that the site is 'clean' if practicable, for example at support plinth sites, along trenched sections, and at the fill site. For the purposes of maintaining biodiversity sites, monitoring should be completed within the biodiversity sites and include a buffer of 20 m from the edge of the site, on all sides or around the works area, including both sides of the reservoir access road.

The project area will be surveyed and weeds controlled, particularly targeting new establishment on disturbance areas before planting or hydro seeding.

After a section of work is completed, those work areas should be travelled within 2 months after work is undertaken, and repeat monitoring completed in mid-spring-early summer, and again into late summer-early autumn for the first year following completion. The goal is to identify new weeds to a site, and control weeds before the plants mature and seed. This monitoring is to be repeated for the required 5 years following the completion of works once a year during spring-late summer. If no incursions are identified after 2-3 years, then monitoring for weeds may no longer be necessary, however any sites where new incursions occur should continue to be monitored until no weeds have been found for two years minimum, depending on the species.

Possible new incursions should be photographed and/or a plant sample taken to confirm identification if there is any uncertainty; an examination of the surrounding area completed to determine the area of spread, or if the plant is already established in the immediate area; and a GPS location recorded to enable the site to be relocated for control and further monitoring.

4.6.2 Hygiene standards for machinery

A key risk for the area is the introduction of weeds new to the area or new to the site from elsewhere via the machinery being used. This can create long term and costly impacts for landowners. Some of the pest plant species found are included in the Bay of Plenty Regional Pest Management Plan (BOP RPMP), with associated restrictions, statutory obligations and the potential for penalties if they are spread.

There is a national guideline manual for machinery hygiene - "Keep it clean"[11] - available from a range of online location, which provides useful information for standards and cleaning, and a log book to document machinery cleaning. This can be downloaded or a similar log created for use.

Actions required to maintain machinery hygiene include:

- Ensuring all machinery being transported from outside the area is cleaned before it leaves the depot.
- Planning the order in which sites are worked to prevent weeds present on one section being moved to another.
- Cleaning machines after working on an infested site, before moving the machine off that site, and before the machine is used on a new site.
- All machinery should be subject to the hygiene standards, as well as vehicles that enter infested work areas.

The methodology described in the "Keep it clean" publication is intended to set a standard for reducing the spread of pest plants and pest animals, and where applied consistently will avoid the need for significant follow-up control of new infestations.

4.6.3 Aggregate, fill and other materials

Aggregate or other fill that may be used for the project is a high risk vector for the movement of pest plants and animals into the project area from outside, or from one part of the project to another. The source site should be 'clean' and clear of weeds if possible, or sprayed to remove weeds before it is used in the project site. This is most important if the aggregate is sourced from outside the East Coast area. Investigations into stockpiled material has found multiple species of plants able to germinate and is a common source of weeds in roading.

Other stockpiled materials like pipes provide a high risk concealment of pest animals like ants and plague skinks, particularly where these are stored for a period of time before transport to the project area. The source depot should be considered a biosecurity risk area and materials inspected and treated if needed, particularly where there are known populations of pests present.

It is an offence under the Biosecurity Act 1993 to move identified pest plants and animals from one area to another. The establishment of new pests to an area can have significant consequences for biodiversity and for agriculture and horticulture.

[11] https://www.bionet.nz/assets/Uploads/A16-KeepItClean-minor-revision-2020.pdf

5.0 Summary

While offsetting specifically is not possible due to the fully occupied coastal strip around Te Kaha, the mitigation plan applies the effects management hierarchy to manage residual adverse effects arising from the project.

Disturbance of wetland areas can largely be avoided by suspending or directional drilling, although a small area of vegetation may be disturbed at the intake site. Vegetation removal at the fill site can be replanted once the works are completed.

Compensation in the form of pest plant control and enrichment planting of coastal forest species is proposed. It is recognised that this does not bring the same level of certainty as a direct offset or offset ratio calculated by area. The compensation proposed is over a larger area of land, and aims to address pest plant issues and encourage coastal forest within the project area.

Reducing the spread of pest plants through good machinery hygiene practices will avoid encouraging species like pampas and ginger from colonising and dominating in the project area.

Appendix 1

Kereu River intake site - wetland assessment and delineation (NES FW)

An assessment of the identified sedgeland area (Wildlands, 2021) using the NES Freshwater/NPS Freshwater wetland delineation protocols[12] identifies this area as meeting the definition of a natural inland wetland on the basis of the dominance test. Rautahi is dominant, and covers over 50% of the area outlined.

The prevalence index calculation is less than 3.0 (Table 2), which is the threshold for defining an area as wetland. The area was distinctly wet, as well as having a strongly channelised water flow through the site.

Table 2: Prevalence index calculation - Kereu River intake location - Area 2, Figure 8.

Total% cover of		Multiply by:	
OBL	0	x 1	0
FACW	70	x 2	140
FAC	5	x 3	15
FACU	25	x 4	100
UPL	0	x 5	0
Column totals	100 (A)		255 (B)
Prevalence index = B/A		**2.55**	≤ 3.0 = wetland

Figure 8: Wetland delineation at the intake site.

[12] Ministry for the Environment. 2020. Wetland delineation protocols. Wellington: Ministry for the Environment.

Appendix 2

Planting guidelines for fill site

The following species will be established on the fill site. Plant numbers required to plant the 0.5 hectare site are provided. The bulk of the planting will be manuka as this is currently the dominant species in the area. Other species are added for enrichment and to encourage the development of the broadleaf component. This can serve to encourage frugivorous birds into the area, bringing other species with them.

Species		% of planting	No. of plants	Size
mānuka	*Leptospermum scoparium*	75	1725	PB 2 or 3
karamu	*Coprosma robusta*	10	230	PB 2 or 3
mapou	*Myrsine australis*	5	115	PB 2 or 3
porokaiwhiri	*Hedycarya arborea*	5	115	PB 2 or 3
mapou	*Myrsine australis*	5	115	PB 2 or 3
TOTAL		100	2300	

Plants must be grown from locally sourced seeds and ordered well ahead of planting. PB 2 and 3 require up to three years from seed to planting size, with larger grades requiring more time. Plants should be ordered or grown early in the project to ensure they are ready in time for planting towards the end of the project, with timings confirmed with the nursery.

Prior to planting

Because of the range of weeds at the site, pest plant control will need to be particularly thorough.

Pest plants must be sprayed out before the top-soil is removed and stockpiled. The stockpiles should be monitored and treated for any weeds that emerge.

When sub and top-soil is replaced on the fill site, it will need to be monitored and treated again for any weeds that emerge. This should be done at least once before planting. If pest plant regrowth is especially prolific, a full year of treatment should be applied, with a final control operation within 2 months prior to planting.

Planting

Plants should be planted at 1.5 m spacings. Spots can be sprayed out for each plant if there is a dense grass sward or other vegetation on the site, or the site can be blanket sprayed if weeds are particularly prevalent.

It is important that plants are not widely spaced as this makes maintenance amongst the plants fiddly and time-consuming.

Ensure that planting holes are sufficient for the planter bag soil to be level or very slightly below the ground surface.

Planting maintenance

The planting will need to be closely monitored, 2-3 times in the first year, particularly in spring, with pest plant control undertaken to prevent plants from being smothered. Care needs to be taken to avoid damage to the planting. Where plants are surrounded by dense grass or other non-weedy vegetation they need to be released by clearing a space around them. The area should not be totally cleared however, as this provides shelter to the trees.

Maintenance will need to continue at least until the trees are tall enough to sit above surrounding vegetation, preferably until the canopy is fully closed, and should include infill planting if required.

The site must be securely fenced to exclude stock and horses.

Contingency and infill planting

Infill planting is likely to be required to replace plants that do not survive. A survival rate of 80% or more can be achieved with good management. A contingency order of replacement plants should be established of 10% for the first 3 years of the planting. More or less may be required as the established plants grow and fill the spaces, however this will allow gaps to be filled before pest plants establish.

Species for infill planting can be drawn from the above table, and can also comprise largely mānuka as a pragmatic option, particularly if mānuka is mostly successful and the other species are failing.

Performance measure

The planting will be successful once there is 80% indigenous cover from the planting over the fill site area.

Appendix 3

Planting guidelines for enrichment planting

Species characteristic of coastal forest are to be planted within the bioclimatic zone within the project area around the reservoir site and access road (see Figure 6 in section 4.3).

Species		No. of plants	Size
puriri	*Vitex lucens*	50	Minimum PB12 (8 L)
kohekohe	*Dysoxylum spectabile*	50	
taraire	*Beilschmiedia tarairi*	25	
TOTAL		125	

These trees should be grown to a minimum PB12 or 8L size before planting, and could be larger if possible.

Plant in small groups of up to 3, spaced 5-10 m apart, with some as scattered individuals under the manuka canopy. Positioning in existing openings in the ground cover and understorey will avoid the need to clear spaces. They do not need to be planted in canopy gaps, although a few could be placed in canopy gaps as an experimental aspect and survival and growth monitored for future reference.

Plants should be GPS marked to enable monitoring to determine survival rates.

Performance measure
The planting success measure is 80% survival after 3 years.

If survival drops below 80% (or less than 100 individuals), more should be planted to replace those individuals to bring the number up to 100 individuals after 3 years from planting. This means that if new plants are added, they will need to survive for 3 years from their individual planting date/year, as opposed to 3 years from the initial bulk planting.

Replacement planting should continue annually for 5 years from the initial planting to maintain 100 or more individuals. The initial planting would be year 1, plus five years with the final planting in year 6.

If survival of 80% or 100 individuals is not able to be achieved in that timeframe, this should be recorded/reported and remaining individuals monitored for as long as possible. In relation to potential conditions of consent, survival of 100 individuals beyond year 6 is not considered to be necessary or reasonable as this is somewhat experimental with uncertainty as to the results and outcomes. The intent is to attempt to establish a coastal component,

however there is no recorded information in the literature to provide strong guidance or evidence of the potential for success at this site.

The enrichment planting should be viewed as an adaptive management and experimental approach, where learnings from the planting exercise are documented. This methodology could be used in the future to begin to encourage greater diversity in the coastal zone along the east coast and encourage coastal forest development to maintain this as a component of the landscape.