

Kūao Kau Uha Farm

Biodiversity Management Plan



Please note: This farm plan has had farm, family and place names anonymised by the pilot team for the purpose of the pilot, but other than that this is an example of a biodiversity management plan prepared for a working farm.

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Kūao Kau Uha Farm - Introduction

Paul and Susan Wilson own Kūao Kau Uha Farm in Northland, farming 335 ha total (320 ha effective) at. They are an intergenerational farming family with Susan's parents buying the farm in 1989 and with Paul and Susan's son keen to take over the farm one day in the future. Kūao Kau Uha Farm's focus is on prime beef finishing with 14 heads per ha, and has a fully reticulated system with some dams. Riparian fencing and planting are well underway with kilometres of riparian margins fenced and already planted out where practical. The farm is within the Whangarei District Council, Northland Regional Council, and Te Urioroi Maungāroho takiwā.



Biodiversity vision statement

“Our vision is to enjoy what we do and a big part of that is living and farming in a beautiful environment. It is important to us that we create a beautiful farm for the next generation with an abundance and variety of native fauna and flora providing benefits to the farm and the people who live and work at Kūao Kau Uha Farm. We have teamed up with the Kaipara Moana Remediation Programme, working together to restore the health and mauri of Kaipara Moana.”

Paul and Susan Wilson

Stocktake of Biodiversity assets

Indigenous Vegetation

Prior to human settlement

Before human settlement, the land that is now Kūao Kau Uha farm would have been dominated by kauri, kahikatea, rimu and tōtara emergent over a diverse canopy dominated by varying mixtures of taraire, kohekohe, and tawa. Other widespread tree species would have included hīnau, pukatea, rewarewa, and miro. Pūriri would have been locally abundant at lower elevations.

Present

Today there is 6.3 ha of established native woody vegetation across the farm. Most of the vegetation is along the riparian margins of the Wai and Awa Rivers. The riparian margins are currently dominated by tōtara and kahikatea.

Since taking over managing the farm, 0.7 ha along the northern drain was planted and has become established. In 2022, 0.5 ha of livestock-excluded land was planted with native plants. There are plans to plant out a similar size area each year for multiple years.



Tōtara



Rimu

Exotic Vegetation

Across the farm, there is 2.7 ha of exotic tree species, primarily as shelter belts. These exotics will provide some support for native species in the form of nesting sites and are likely used as corridors for native birds to get around the landscape.

Native fauna

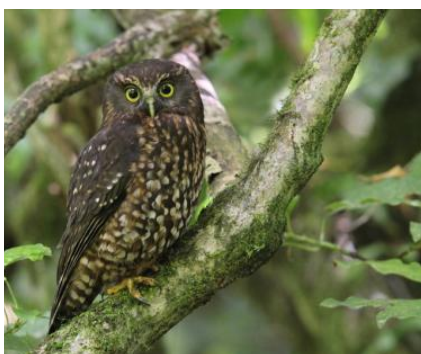
Across the farm tūī, morepork/ruru, swamp harrier/kāhu, fantail/pīwakawaka, spur-winged plover, and kingfisher/kōtare have been seen and their population is believed to be increasing. Kererū are notably absent on the farm. The paradise shelduck/pūtangitangi population is thriving on the farm. The occasional parakeet/kākāriki is seen on the farm, but it is likely a vagrant and is not an established population.

Although not seen, there is the possibility that the occasional long-tailed cuckoo/koekoeā, shining cuckoo/pīpīwharau, bellbird/korimako or silvereye/tauhou will be present. It is also possible that native bats are present in the wider landscape, moving along the rivers. However, it is very unlikely they are present on the farm due to the absence of suitable roosting trees.

In the rivers, there is a healthy and increasing population of eels/tuna. eDNA tests have shown that native bullies, kokopu, freshwater crayfish/kōura, and kākahi are present. However only the empty shells of fresh water mussel/kākahi have been seen on the riverbanks along the farm. The presence of trout and gambusia is likely harming populations of native freshwater species.



[Tūī](#)



[Morepork | Ruru](#)



[Sacred kingfisher | Kōtare](#)

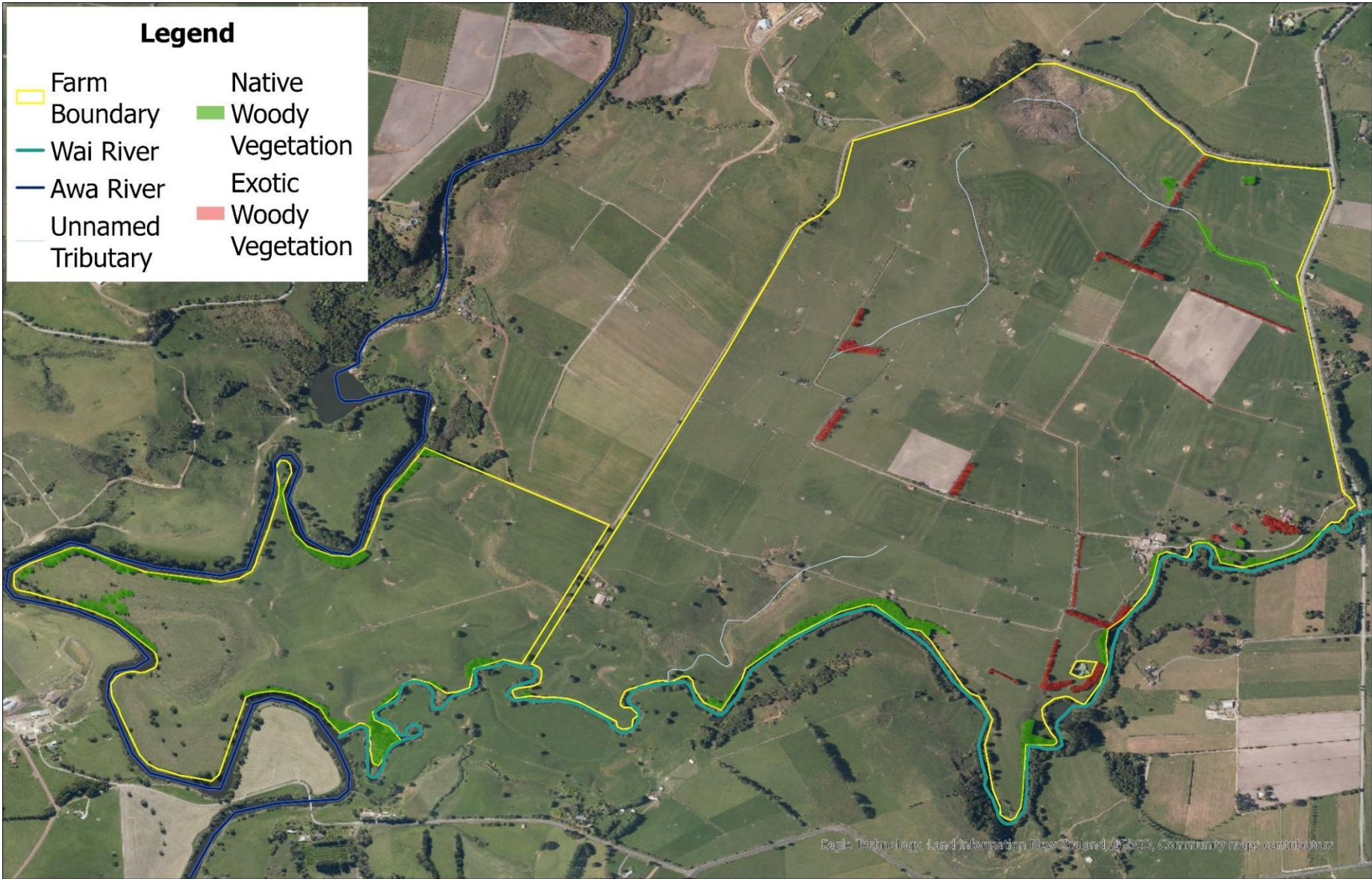
Mahinga Kai Values

Mahinga kai is about the value of natural resources – our birds, plants, fish, and other animals and resources that sustain life, including the life of people. It is a culturally important practice as it connects people with the land, allows for customary traditions to be passed down through generations, and provides a vital food source. These things are the essence of kaitiakitanga, or what many people today call guardianship. Below are just some examples of mahinga kai species that are found on Kūao Kau Uha Farm:

- Pūtakitaki | Paradise Duck
- Kōtare | Kingfisher
- Pūkeko | Swamp Hen
- Tuna | Longfin + Shortfin eel
- Kākahi | Freshwater Mussel
- Harakeke | NZ Flax
- Ti kōuka | Cabbage Tree
- Karamū | Coprosma robusta
- Pūkio | Carex secta
- Mānuka | NZ Tea Tree
- Kahikatea | White Pine

Assessment of Biodiversity Assets

Map showing identified habitat that would support indigenous aquatic and terrestrial biodiversity



Areas That Likely Support Indigenous Biodiversity

0 0.75 1.5 3 Km

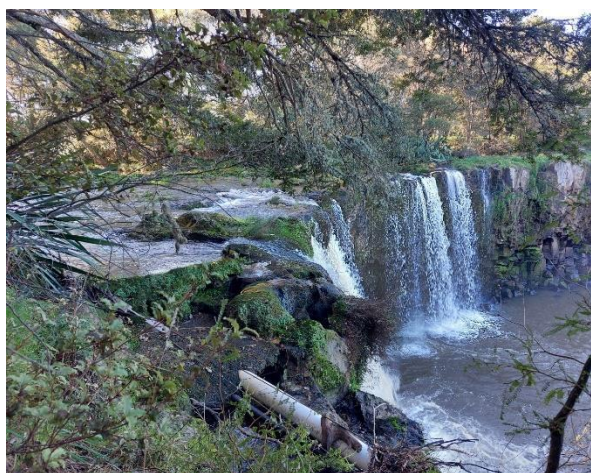
Asset 1: Two Major River Systems.

Both the Wai River and the Awa River define the southern half of the farm's boundary. The entire boundary has been fenced to exclude livestock from the rivers. The non-continuous canopy of the riparian strip is dominated by tōtara and kahikatea, with the occasional rimu. With livestock excluded, there is some regeneration of subcanopy and understory species. Due to annual flooding, there are no plans to do any enrichment planting along the margin as it is likely that these plants will be washed down the river. Therefore, this area is being left to naturally regenerate.

Along the Wai River, there is a waterfall that is of importance to the local iwi. As the waterfall is a natural barrier for eels to migrate up the river, there has been discussion with multiple partners including iwi to conduct elver transfer from the bottom of the waterfall.

The greatest risk to terrestrial biodiversity in the area is flooding, which has been mitigated as much as possible on the farm. Furthermore, on-farm operations are minimising the impact of nitrogen and sediment on the waterways, but there are still high levels of both. However, Paul and Susan are working alongside Kaipara Moana Remediation (henceforth referred to as KMR), Northland regional council, and other landowners to reduce nitrate and sediment levels. The presence of Trout and Gambusia in the Awa River is likely harming native freshwater species populations, but this is beyond the control of the farming operation.

The possum population is believed to be increasing despite periodic night shooting operations by the farmers. Their increasing population poses a significant threat to native terrestrial biodiversity and the transmission of TB. Mustelids and rodents will also be negatively impacting birdlife along the riparian margins.



Wai Waterfall: Site of importance to local iwi. With livestock excluded there is natural regeneration of the area. This site will eventually become a source of elvers that are harvested for translocation as the waterfall is a natural barrier.



Example of the annual flood of the farm by both rivers overflowing. Due to floods, there is a high risk that any enrichment planting along the riparian margin will be washed down the rivers or buried under sediment

Asset 2: KMR Planting Project.

Funding granted by KMR led to the fencing of a natural spring and its tributary from the spring head to the point it flows into the Wai River. In 2022, 0.5 ha of the northern portion was planted with a mixture of mānuka, kānuka, tī kōuka, karo, harakeke, māhoe, karamū, hebe and nīkau. There are plans to plant out a further 1.2 ha in this area across the next couple of years.

With livestock excluded, the biggest risks to the saplings will be weeds and rabbits. Currently, rabbits are controlled by shooting predictably. The annual release of weeds will need to occur for a minimum of 5 years so that the juvenile plants are not smothered.

In the future, once plants become established and there is some canopy-forming, further enrichment planting of tawa, taraire, tōtara, tītoki, pukatea, kōhūhū, pūriri, large-leaved kōwhai, miro, mataī. and porokaiwhiri will increase the biodiversity of plant species in the area. These species will also increase the amount of food available to native fauna year-round.



The first year of planting inside the fenced-off area. Early colonising species have been planted to establish the canopy.

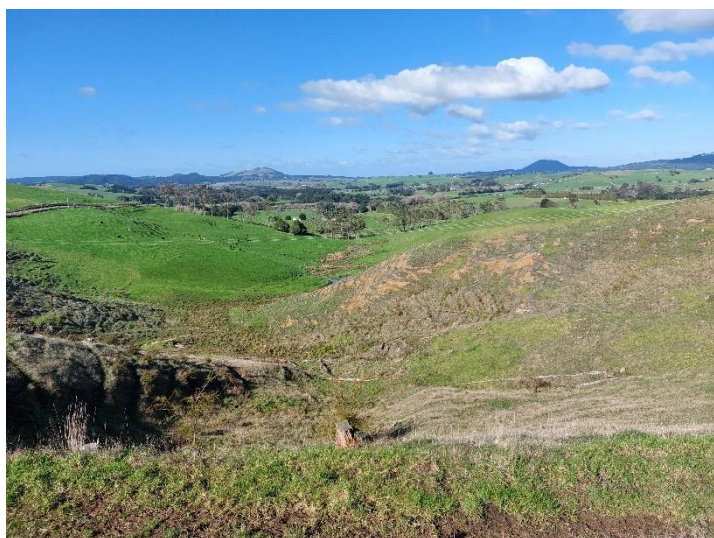
Asset 3: Paddock 27B and drain way.

On the northern end of the farm, paddock 27B used to be a pine block, but was felled and cleared years ago. After the pines were cleared it was added back into grazing rotation, but it was discovered the slopes were not suitable for cattle grazing. There is also a springhead in the middle of the paddock that flows to the Wai River. Therefore, most of this paddock will be retired from grazing and refenced to protect the springhead. Eventually, this area will be planted with native trees. As there is a powerline running above this area, shorter-growing trees and shrubs will need to be planted beneath the powerline so that they do not contact the powerlines.

Further downstream there is another spring head that flows into the same drain. This spring head has been fenced off to prevent damage caused by livestock. Surrounding this spring head there are a few pūriri, rimu, and tōtara forming the canopy. The understory was dominated by karo, red matipo and māhoe.

The northern drain that these two spring heads flow into has been fenced, which has created a 1.4 ha riparian margin. In recent years, 0.2 ha of this area has been planted with a mixture of mānuka, kānuka, tī kōuka, harakeke, māhoe, and karamū to supplement the existing 0.3 ha of tōtara, red matipo, bracken/rarauhe and wheki-ponga. There are a few pockets of environmental weeds along the drain way, but they are actively being monitored and removed as necessary.

The long-term plan will be to connect the two spring heads with a continuous canopy along the waterway. Eventually, this will create a 6.2 ha eco corridor and island for mobile animals to move throughout the landscape.



Standing at the top of Paddock 37B, looking east downstream. Topsoil is eroding and not suitable for cattle grazing. Eventually, this will be planted with 5 ha of native vegetation.



Looking north, upstream to the fenced springhead in the background. In the foreground, there is an example of one of many recent plantings to establish a continuous eco corridor.

Risks to Biodiversity

The main risks to native biodiversity identified on Kūao Kau Uha Farm are from pest animals such as:

- Pest plant: Blackberry and Pampas.
- Mammalian Herbivores: Rabbit.
- Mammalian predators: Possums, Rats, and Stoats.
- Freshwater Fish: Trout and Gambusia.
- Natural disasters: Flooding.



Possums can strip a tree of foliage within one night. They also predate on bird eggs and young chicks.



Blackberry invades natural ecosystems, smothering native vegetation. It is also a problem in pasture and plantation forests



Rabbits can cause damage by overgrazing native and sown pastures, leading to loss of plant biodiversity and reduced crop yields.

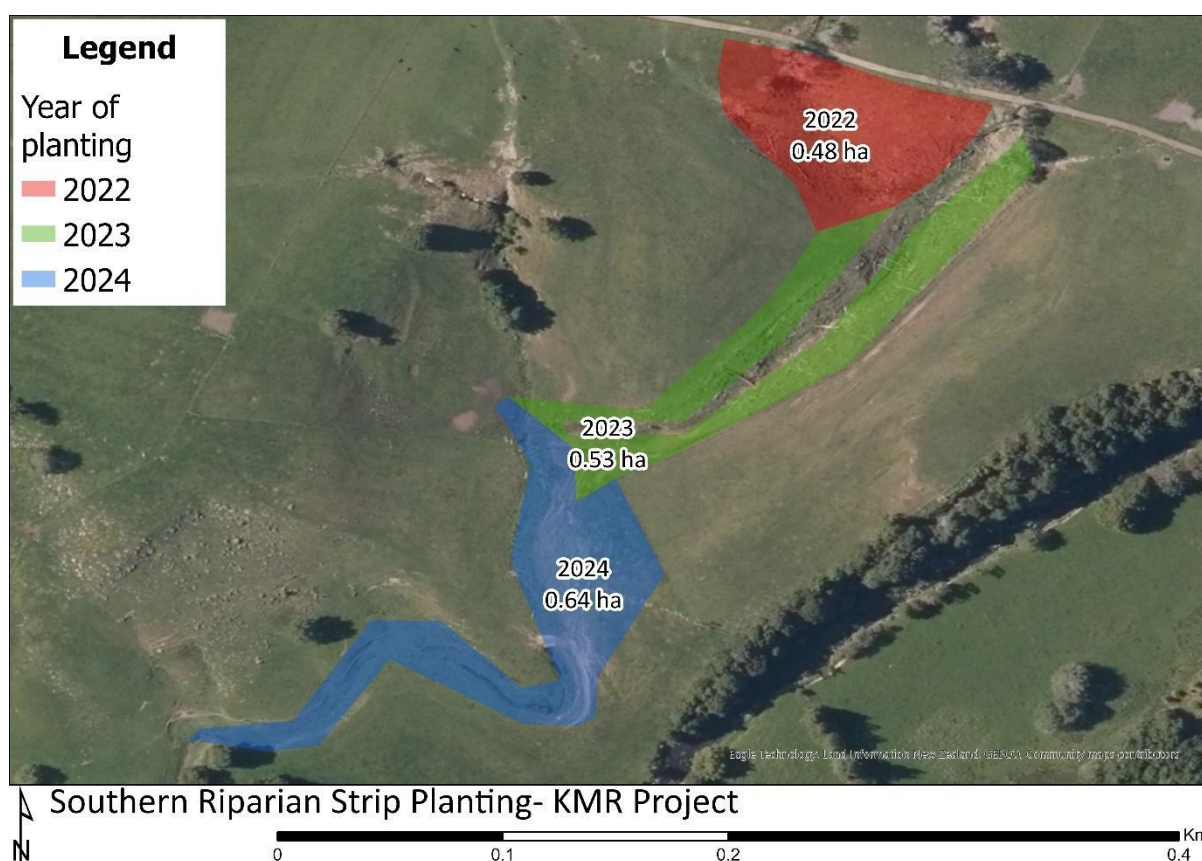


Flooding can have detrimental environmental effects on soil and bank erosion, bed erosion, siltation, or landslides.

Biodiversity Objectives and Action Plan

Goal 1: KMR Programme Planting Continuation and Maintenance.

Funding has been granted by the KMR to plant the area marked in red on the map below which was planted in July 2022. As juvenile saplings are at risk of being smothered by grass and other weeds, yearly maintenance must be carried out to release the saplings. It is recommended to plant the rest of the fenced-off area as weeds will take over with livestock excluded. To spread the costs, it is proposed that plantings of the green and blue sections occur over consecutive years until the entire area is planted. Plant species in the green and blue areas will be identical to those that were planted in the red area, a planting list is provided in appendix 2.



Benefits for Biodiversity

These areas will provide habitat and food sources for a variety of native bird and invertebrate species, as well as provide shelter for stock. These plantings will also provide connectivity between other native vegetation areas across the farm.

Effects on Farm Business

Provides ecosystem services such as pollination, and increased soil and pasture health from beneficial insects and microorganisms to the farm

Goal 2: Northern Drain Maintenance and Planting.

The southern half of the north drain has established native vegetation. The northern half of the drain was planted out in 2019 and will require ongoing weed and grass releasing for the next few years, so saplings are not smothered.

In 2022, a few pockets of pampas grass and blackberry were sprayed. Follow-up spraying will likely be required to ensure the weeds do not become established. Controlling these weeds will help the survival of the planted trees and reduce seed sources from the weed species. In areas where weeds are removed, infill planting will reduce the area that weeds can establish and will improve canopy connectivity. This planting should occur alongside goal 3.

Benefits for Biodiversity

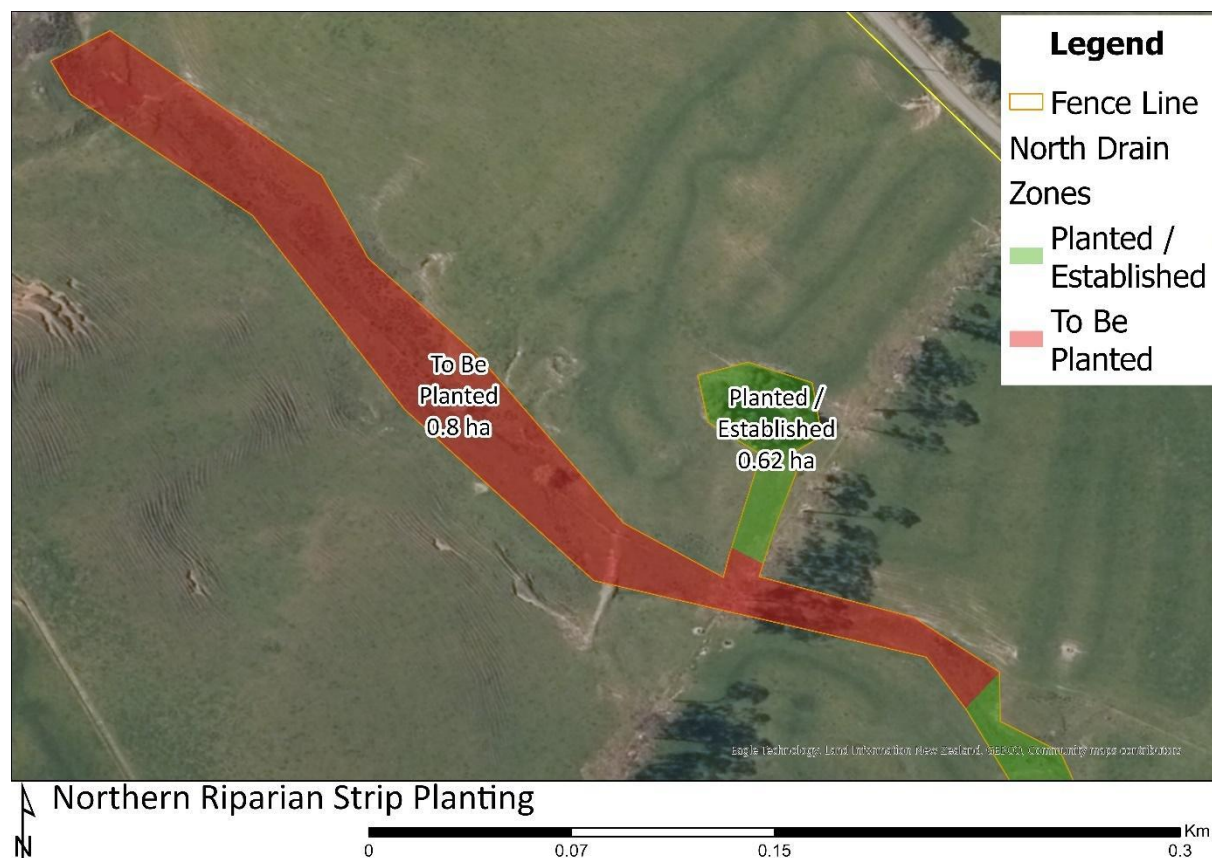
Suppressing weeds minimises the chances of native vegetation being smothered in its early stages of growth. Once native plants are established it will improve landscape connectivity by joining the planting area of goal 4 to the Wai River.

Effects on Farm Business

Weed control protects the farm's investment of time and money put into planting the riparian strip. Eventually, this area will provide ecosystem services beneficial to the farm's production.

Goal 3: Continuation of Northern Drain Planting.

Over half of the northern drain way has been planted with an assortment of native species. To improve landscape connectivity for mobile native species, it is recommended to plant out the remainder of the riparian zone of the northern drain. This will connect the area of goal 4 to the planting of the riparian strip in 2019. This should occur after goal 2 is completed as weeds will need to be removed as they will smother new saplings. Plant species will complement what is already growing in the southern half of the drain. A planting list is provided in Appendix 3.



Benefits for Biodiversity

This area will provide habitat and food sources for a variety of native bird and invertebrate species, as well as provide shelter for stock. These plantings will also provide connectivity between other native vegetation areas across the farm.

Effects on Farm Business

Native biodiversity provides ecosystem services such as pollination and increased soil and pasture health from beneficial insects and microorganisms.

Goal 4: Paddock 27B Retirement and Conversion into Native Vegetation.

To retain as much productive land as possible, it is recommended to bring the dividing fence of paddocks 27a and 27b to the east, making paddock 27a an approximate 6-ha paddock. This creates the opportunity to divide paddock 27a into four 1.5 ha paddocks, or three 2 ha paddocks to bring it in line with the farm's ideal paddock size for stock rotation. Attentively, the fence line could be kept where it currently is and a further 0.5 ha could be planted into tall-growing native vegetation.

By moving the fence line east, it will create a ~ 5 ha area to be planted into native vegetation which will create a large area of habitat for native species. As there is a power line running across the northern portion of the paddock, species with a lower maximum growth height will need to be planted underneath the power line to meet the compliance of growth limit zones.

As there is a waterway that eventually flows into the Wai River, this area could qualify for some funding through KMR. As KMR only funds plants 10m on either side of the waterway, only 0.5 ha of plants will likely be funded. Therefore, the remaining 4.5 ha will need to be funded by the farm or other grants. Due to the high costs, this area has been assigned the lowest priority to allow the business to build up the capital over multiple years in order to fund this project.

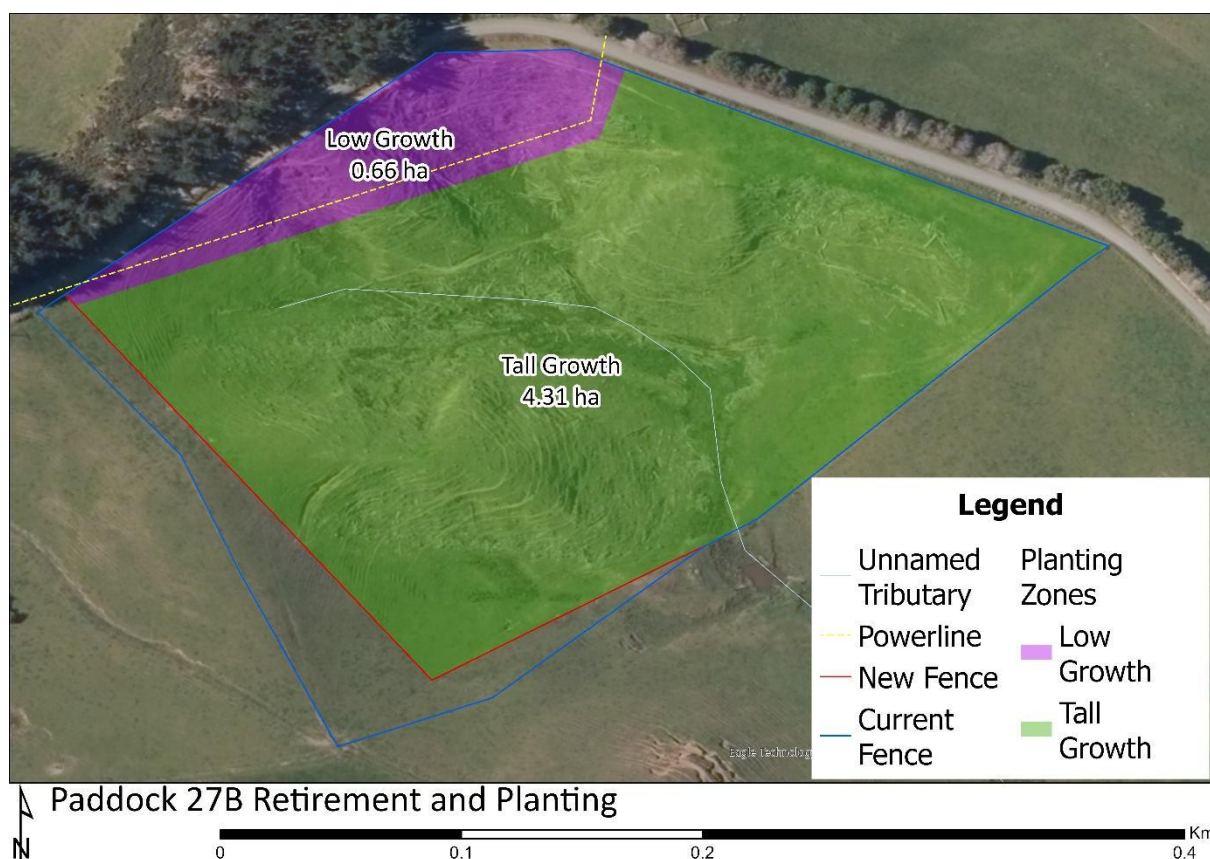
A planting list is provided for which species should be grown in each zone is given in Appendix 4. When planting flax in the low-growth zone, it is recommended to plant a single continuous row along the fence line of Stratton Road to create a sheltered edge.

Benefits for Biodiversity

Creates a large biodiversity asset for the farm. This area will create a large habitat for native fauna filled with year-round food.

Effects on Farm Business

This area will be large enough to enter the Emission Trading Scheme or be used to offset farm greenhouse gas emissions.



Goal 4: Establish Biodiversity Monitoring

This goal aims to establish a biodiversity monitoring plan for the farm. Establishing biodiversity monitoring as soon as possible will provide baseline data for the farm.

Establish automated acoustic bird monitoring:

One acoustic bird recorder should be purchased from the Cacophony Project (<https://www.2040.co.nz/collections/cacophonometer-bird-monitoring>) and installed near the KMR project planting. Installing a bird recorder now will provide baseline data and show improvement in bird abundance after biodiversity management actions are completed. The recorder will need to be checked regularly to back up data, this will need to be done every 3-12 months depending on the storage capacity option chosen. Good records of when the location changes occur must be kept, ensuring that the data is accurate.

Establish photo point monitoring:

The simplest way to monitor change in your native vegetation (as a proxy for biodiversity generally) over time is to install a photo-point monitoring network. This entails taking photos from the same location, in the same direction at the same time every year. Ideally, photo points should be of areas of land where you expect to see a change in vegetation over time. Therefore, it is recommended to install in areas where management actions such as planting, weed control and stock fencing have already been applied and where future management will be conducted.

Further detail on these methods is found in Appendix 1. Suggestions for where to set up photo points are also found in Appendix 1.

Take an environmental DNA (eDNA) water sample of the Wai River:

Water samples should be taken annually from the Wai River just before it meets the Awa River. eDNA gives a snapshot of what species are present in your waterways, both native and invasive, and is an important step in biodiversity monitoring. However, as the farm is at the bottom end of the Wai River, it is likely that not for species detected in the sample are found on the farm but could be kilometres away upstream.

The equipment is simple to use, further information and directions can be found at:

<https://www.wilderlab.co.nz/directions>.

Freshwater stream monitoring using The Stream Health Monitoring and Assessment Kit (SHMAK):

Stream health is the condition of the whole stream ecosystem, including water quality, physical features of the stream and its banks, and the plants and animals living there. It also includes aspects that affect human health, safety, and enjoyment.

SHMAK provides a way to assess whether land-use practices are affecting waters. It also allows stream health to be tracked over time, so you can recognise if stream health is getting better, worse or staying the same. It is recommended to do this assessment along the northern drain way. It will only be needed to be done once per annum.

More details can be found at

<https://niwa.co.nz/freshwater/management-tools/water-quality-tools/stream-health-monitoring-and-assessment-kit>. the local and regional councils may have a kit you can borrow.

Benefits for Biodiversity

Understanding which species are on the property and how their presence is changing because of management actions, will influence future decisions on how to manage these species to further increase biodiversity on your property.

Effects on Farm Business

Monitoring changes in biodiversity on the farm is likely to become important as local and international customers are increasingly looking to source products from farms that operate to environmentally high standards and this is likely to become important as new regulations come into effect. It is important to have a record of any biodiversity enhancement conducted on your property.

Goal 5: Review of Biodiversity Management Plan

It is important that this biodiversity plan isn't just a one-off exercise and that it is reviewed regularly and the results from monitoring are used to guide future management. While the whole biodiversity plan will have a substantial review every 5 years, annual reviews and updates to the 5-year operational plan are considered essential and should be undertaken. An annual review is also important because this plan is designed to be able to meet the needs of regulators and market auditors.

Review this biodiversity plan at the same time as setting the overall farm work programme and budget for the next year. This review will include:

- Summarising the results of monitoring information from the past year.
- Undertaking a review of biodiversity management achievements against what we have proposed and assessing why the management actions did or did not work.
- Undertake planning for both the next year and the next five-year period, which will include updating the operational plan.

Benefits to biodiversity

Having a structured approach to planning biodiversity restoration work will increase the likelihood of biodiversity management actions being undertaken.

Effects on farm business

Having records of biodiversity work undertaken and the results of monitoring may become important to comply with future regulations.

5-Year Operational Biodiversity Action Plan

This work plan outlines the tasks that will be necessary for achieving high-quality biodiversity management outcomes on Kūao Kau Uha Farm that addresses the long-term vision for the property. The plan is written as a 5-year calendar so that biodiversity management actions can be easily scheduled into the working year with a draft budget included for anticipated costs.

This calendar should be reviewed and updated annually alongside your normal farm management planning so that you have the flexibility to carry out the work when you have the capability and make changes in the face of unexpected events. Costs are written as estimates only.

| Kūao Kau Uha Farm Calendar and Costings for Biodiversity Management Actions. | | | | | | | | | | | | |
|--|-------------|--------|--------|--------|--------|------------------|---------------|-------------|-------------|------------|------------|---|
| Time of year | | | | | | | Cost per year | | | | | Notes |
| Goal 1: KMR Programme Planting Continuation and Maintenance | | | | | | | | | | | | |
| Action | Location | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | |
| Weed releasing | KMR site | Oct | Oct | Oct | Oct | Oct | \$336.00 | \$707.00 | \$1,155.00 | \$1,155.00 | \$1,155.00 | \$700/ha/pa |
| Contact nursery | Office | Feb | Feb | | | | \$0.00 | \$0.00 | | | | |
| Site prep | KRM site | | June | June | | | | \$371.00 | \$448.00 | | | \$700/ha/pa |
| Purchase plants | Nursery | | July | July | | | | \$13,250.00 | \$16,000.00 | | | \$5 per plant. 2650 plants are needed for area two, 3200 for area three |
| Planting | KMR site | | July | July | | | | \$1,325.00 | \$1,600.00 | | | Min 50 plants an hour at \$25/hr |
| | | | | | | Total each year: | \$336.00 | \$15,653.00 | \$19,203.00 | \$1,155.00 | \$1,155.00 | Total cost over 5 years: \$37,502.00 |
| Goal 2: Northern Drain Maintenance and Planting | | | | | | | | | | | | |
| Action | Location | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | |
| Weed releasing | North Drain | Oct | Oct | Oct | Oct | Oct | 434 | 434 | 434 | 434 | 434 | \$700/ha/pa |
| | | | | | | Total each year: | \$434.00 | \$434.00 | \$434.00 | \$434.00 | \$434.00 | Total cost over 5 years: \$2,170.00 |
| Goal 3: Goal 3: Continuation of Northern Drain Planting | | | | | | | | | | | | |

| Action | Location | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | |
|-----------------|-------------|--------|--------|--------|--------|--------|-------------|----------|----------|----------|---------------------------------------|-------------|
| Contact nursery | Office | Feb | | | | | \$0.00 | | | | | |
| Site prep | North Drain | June | | | | | \$560.00 | | | | \$700/ha/pa | |
| Purchase plants | Nursery | June | | | | | \$20,000.00 | | | | \$5 per plant. 4000 plants are needed | |
| Planting | North Drain | July | | | | | \$2,000.00 | | | | Min 50 plants an hour at \$25/hr | |
| Weed releasing | North Drain | Oct | | | | | | \$560.00 | \$560.00 | \$560.00 | \$560.00 | \$700/ha/pa |

| | | | | | | | | |
|------------------|-------------|----------|----------|----------|----------|----------|--------------------------|-------------|
| Total each year: | \$22,560.00 | \$560.00 | \$560.00 | \$560.00 | \$560.00 | \$560.00 | Total cost over 5 years: | \$24,800.00 |
|------------------|-------------|----------|----------|----------|----------|----------|--------------------------|-------------|

Goal 4: Paddock 27B Retirement and Conversion into Native Vegetation

| Action | Location | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | |
|-----------------|-------------|--------|--------|--------|--------|------------------|-------------|------------|------------|------------|------------|---|
| Contact nursery | Office | Feb | | | | | \$0.00 | | | | | |
| Move fence | Paddock 27b | May | | | | | \$4,650.00 | | | | | Removed 360 m of fencing. Install 310 m of fencing. Reusing materials |
| Site prep | Paddock 27b | June | | | | | \$3,479.00 | | | | | \$700/ha/pa |
| Purchase plants | Nursery | June | | | | | \$69,500.00 | | | | | \$5 per plant. 13,910 plants are needed |
| Planting | Paddock 27b | July | | | | | \$6,950.00 | | | | | Min 50 plants an hour at \$25/hr |
| Weed releasing | Paddock 27b | Oct | | | | | | \$3,479.00 | \$3,479.00 | \$3,479.00 | \$3,479.00 | \$700/ha/pa |
| | | | | | | Total each year: | \$84,579.00 | \$3,479.00 | \$3,479.00 | \$3,479.00 | \$3,479.00 | Total cost over 5 years: \$98,495.00 |

| Goal 5: Establish biodiversity monitoring | | | | | | | | | | | | | |
|--|-----------------|--------|--------|--------|--------|------------------|------------|----------|----------|----------|----------|--|------------|
| Action | Location | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | | |
| Establish automated acoustic bird monitoring | Site specific | Nov | | | | | \$818.00 | \$79.00 | \$79.00 | \$79.00 | \$79.00 | 1 bird recorder at \$479 each | |
| | | | | | | | | | | | | 1 x solar panel at \$339 ea. | |
| | | | | | | | | | | | | Cloud storage at \$79 each year. | |
| Establish photo point monitoring | Farm wide | Nov | | | | | | | | | | Suggested photo point locations provided with biodiversity management plan. Approx. 3 hours of work required to take initial photos and mark locations | |
| Repeat photo point monitoring | Farm wide | | Nov | Nov | Nov | Nov | | | | | | 2 hours of work required to take retake photos | |
| Perform SHMAK | Mangaoho Stream | Aug | Aug | Aug | Aug | Aug | \$1,250.00 | \$100.00 | \$100.00 | \$100.00 | \$100.00 | SHMAK Plus kit with clarity tube @ \$1250, ~\$100 for water testing once per year | |
| Take eDNA samples | Mangaoho Stream | Aug | Aug | Aug | Aug | Aug | \$255.00 | \$255.00 | \$255.00 | \$255.00 | \$255.00 | Comprehensive freshwater eDNA packages at \$255 ea. | |
| | | | | | | Total each year: | \$2,323.00 | \$434.00 | \$434.00 | \$434.00 | \$434.00 | Total cost over 5 years: | \$4,059.00 |
| Goal 6: Annual management plan review | | | | | | | | | | | | | |
| Action | Location | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | | |
| Undertake annual review of biodiversity management plan | Office | Nov | Nov | Nov | Nov | Nov | | | | | | Half day reading management plan, ticking off completed actions and scheduling actions for the year ahead. Do this in conjunction with farm business planning. | |
| | | | | | | Total each year: | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | Total cost over 5 years: | \$0.00 |
| Total cost of biodiversity management actions for 5 years: | | | | | | | | | | | | \$167,026.00 | |

Appendix 1 Biodiversity Monitoring

Understanding which species are on the property and how their presence is changing because of management actions will influence future decisions on how to manage these species to further increase biodiversity on your property.

Automated Acoustic Bird Monitoring

Forest bird activity can now be monitored with an automated recording device. Installing one recorder in a biodiversity area where the vegetation is likely to develop over the next 5-10 years as a result of your management work, is a good way to prove your impact on biodiversity. Areas that have been planted with native species or existing forests and wetlands that have a new pest control programme and/or have been fenced from stock are other ideal sites to monitor for increases in bird activity.

Automated bird recorders should be installed where they are easy to access but are sheltered from noise created by roads, machinery and stock as this can interfere with your monitoring results.

Recorders run all day and should be set to collect data over the whole year. recorders with solar panels are the best option. It is important to keep detailed records about where the recorders are and if recorders are rotated around the property.

If there is cell phone coverage where the recorders are located, acoustic data will be automatically uploaded to the cloud. If there is no coverage, recorders will need to be checked regularly to back up data, this will need to be done every 3-12 months, depending on the storage capacity option chosen.

To back data up you will need to copy files from the recorder's memory and upload them to a cloud service provided by 2040 Limited. Once uploaded, the data will be analysed and will be made available for you to access.

Currently, only one company in the country manufactures automated bird recorders and offers an analysis of the data. Equipment for automated acoustic bird monitoring can be bought at this link: <https://www.2040.co.nz/collections/cacophonometer-bird-monitoring>.

Photo point Monitoring

Photo points should show an area of land where you expect to see a change in vegetation over time. Any areas where you are undertaking biodiversity management work (e.g. planting, weed control, stock fencing) should have photo points installed before work commences so that you can demonstrate that you are carrying out biodiversity monitoring and prove the implementation of your plan.

This method entails taking photos from the same location, in the same direction at the same time every year. Early summer (November-December) is the best time to photograph native vegetation after the flush of growth in spring but before vegetation starts to die back in mid-summer. Installing a waratah is a good way to mark the location of where to take the photos from. Place your photo points near well-travelled tracks or roads, so they are not a chore to reach in future.

Aligning the frame of repeated photos is key. It is recommended that you take copies of the original photos out with you when taking follow-up photos to ensure that you are pointing the camera in the same direction (consider using a compass bearing) and showing the same trees year after year. Relying on your memory to aim and frame the picture correctly usually produces poor results.

Panoramas made of multiple pictures taken from the same point may be useful for photographing wide areas of vegetation. The panorama feature on your phone's camera may be effective but it can stretch or compress the scene resulting in degradation in the quality of your biodiversity monitoring data.

More information about photo point monitoring can be found here:

<https://www.nzpcn.org.nz/conservation/monitoring/photo-points/>

Freshwater monitoring:

Environmental DNA (eDNA) can be collected from streams and used to detect the presence of animals and plant species in the catchment above. This monitoring method does not provide any information on the overall health of a catchment's freshwater or terrestrial biodiversity, but it is a cheap and simple way of detecting what species are living there. Repeated sampling over several years will give you information useful for directing future biodiversity management work and may show increases or decreases in a catchment's biodiversity over the long term. This is a new technology that is rapidly improving and we hope this method of measuring biodiversity in freshwater will grow to replace comprehensive monitoring techniques over the next 5-10 years as it could save a considerable amount of time and money. eDNA monitoring works best when the stream is not running high, and the weather is stable so this job has been scheduled for summer.

The only supplier for this service can be found at: <https://www.wilderlab.co.nz/order>. You will receive a report summarising all the organisms detected in your stream water. Please see an example report here:

<https://s3.ap-southeast-2.amazonaws.com/wilderlab.openwaters/reports/df3cee2238757344.html>.


A more comprehensive freshwater assessment requires the use of a Stream Health Monitoring and Assessment Kit (SHMAK). These methods provide a much better picture of stream health but require some training and investment to be used effectively. If possible, purchase a kit within your catchment or community conservation group to share the costs. You may need someone with freshwater ecology knowledge to assist you.

SHMAK manuals and kits:

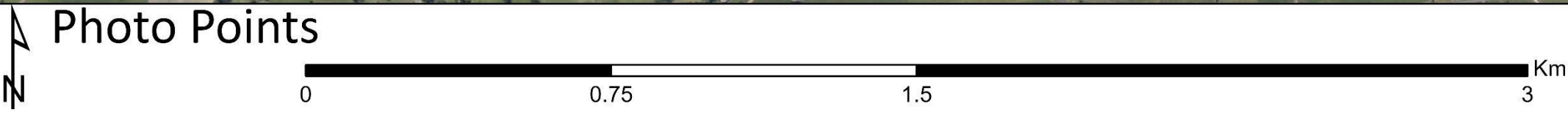
https://niwa.co.nz/sites/niwa.co.nz/files/SHMAK_orderform_Sept2021.pdf

<https://niwa.co.nz/our-science/freshwater/tools/shmak/shmak-manual>



 Biodiversity Monitoring Points

0 0.75 1.5 3 Km



Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Appendix 2: List of Plants and Birds Found at Kūao Kau Uha Farm

Plants found at Kūao Kau Uha Farm

| Common name | Māori name | Scientific name | Conservation status |
|---------------------|--------------------|---|------------------------------------|
| Bracken Fern | rarauhe | <i>Pteridium esculentum</i> | Not Threatened |
| Cabbage Tree | tī kōuka | <i>Cordyline australis</i> | Not Threatened |
| Carex secta | pūkio | <i>Carex secta</i> | Not Threatened |
| Clubmoss | | <i>Phlegmariurus varius</i> | Not Threatened |
| Common Maidenhair | | <i>Adiantum cunninghamii</i> | Not Threatened |
| Creek Fern | kiwakiwa | <i>Cranfillia fluviatilis</i> | Not Threatened |
| Forest sedge | | <i>Carex lambertiana</i> | Not Threatened |
| Glossy Karamū | karamū | <i>Coprosma robusta</i> | Not Threatened |
| Golden Tree Fern | wheki-ponga | <i>Dicksonia fibrosa</i> | Not Threatened |
| Hangehange | | <i>Geniostoma ligustrifolium</i> var. <i>ligustrifolium</i> | Not Threatened |
| Hen & Chicken Fern | pikopiko | <i>Asplenium gracillimum</i> | Not Threatened |
| Hook Sedge | kamu | <i>Carex uncinata</i> | Not Threatened |
| Hooker's Spleenwort | | <i>Asplenium hookerianum</i> var. <i>hookerianum</i> | Not Threatened |
| Kahikatea | | <i>Dacrycarpus dacrydioides</i> | Not Threatened |
| Kaikōmako | | <i>Pennantia corymbosa</i> | Not Threatened |
| Kānuka | | <i>Kunzea ericoides</i> | Threatened & Nationally Vulnerable |
| Karo | | <i>Pittosporum crassifolium</i> | Not Threatened |
| Knobby Club Rush | wiwi | <i>Ficinia nodosa</i> | Not Threatened |
| Koromiko | | <i>Veronica stricta</i> var. <i>stricta</i> | Not Threatened |
| Lance Fern | rereti | <i>Austroblechnum lanceolatum</i> | Not Threatened |
| Māhoe | | <i>Melicytus ramiflorus</i> | Not Threatened |
| Maidenhair | makaka | <i>Adiantum aethiopicum</i> | Not Threatened |
| Mānuka | | <i>Leptospermum scoparium</i> var. <i>scoparium</i> | At Risk & Declining |
| Mingimingi | | <i>Coprosma propinqua</i> var. <i>propinqua</i> | Not Threatened |
| Ntkau | | <i>Rhopalostylis sapida</i> | Not Threatened |
| Nz Flax | harakeke | <i>Phormium tenax</i> | Not Threatened |
| Nz Watercress | matangoa | <i>Rorippa divaricata</i> | Threatened & Nationally Vulnerable |
| Pepper tree | kawakawa | <i>Piper excelsum</i> subsp. <i>Excelsum</i> | Not Threatened |
| Pūriri | | <i>Vitex lucens</i> | Not Threatened |
| Red Matipo | | <i>Myrsine australis</i> | Not Threatened |
| Rimu | | <i>Dacrydium cupressinum</i> | Not Threatened |
| Sharp Spike Sedge | | <i>Eleocharis acuta</i> | Not Threatened |
| Shining Spleenwort | huruhuruwhenu a | <i>Asplenium oblongifolium</i> | Not Threatened |
| Small-leaved kōwhai | | <i>Sophora microphylla</i> | Not Threatened |
| Smith's Tree Fern | kātote | <i>Cyathea smithii</i> | Not Threatened |
| Speckled Sedge | | <i>Carex testacea</i> | Not Threatened |

| | | | |
|-------------|-------|--------------------------------------|----------------|
| Swamp Sedge | pukio | <i>Carex virgata</i> | Not Threatened |
| Tōtara | | <i>Podocarpus totara var. totara</i> | Not Threatened |

Known to be present

| Common name | Māori name | Scientific name | Conservation status |
|----------------------|--------------|-------------------------------------|---------------------|
| Morepork | ruru | <i>Ninox novaeseelandiae</i> | Not Threatened |
| New Zealand fantail | pīwakawaka | <i>Rhipidura fuliginosa</i> | Not Threatened |
| Paradise shelduck | pūtangitangi | <i>Tadorna variegata</i> | Not Threatened |
| Pūkeko | | <i>Porphyrio melanotus</i> | Not Threatened |
| Sacred kingfisher | kōtare | <i>Todiramphus sanctus</i> | Not Threatened |
| Spur-winged plover | | <i>Vanellus miles</i> | Not Threatened |
| Tūī | | <i>Prothemadera novaeseelandiae</i> | Not Threatened |
| Red-crowned parakeet | kākāriki | <i>Cyanoramphus novaezelandiae</i> | Relict |

Likely to be present

| Common name | Māori name | Scientific name | Conservation status |
|--------------------|-----------------|------------------------------|-----------------------|
| Bellbird | korimako | <i>Anthornis melanura</i> | Not Threatened |
| Long-tailed cuckoo | koekoeā | <i>Eudynamys taitensis</i> | Nationally Vulnerable |
| Shining cuckoo | pīpīwharau a | <i>Chrysococcyx lucidus</i> | Not Threatened |
| Silvereye | tauhou | <i>Zosterops lateralis</i> | Not Threatened |
| Tomtit | miromiro | <i>Petroica macrocephala</i> | Not Threatened |

Appendix 3: Plants for Goal 1: KMR Programme Planting Continuation.

| Year | KMR Project | Total area 1.17 remaining | | | |
|------------------|--|----------------------------|---|----------------------------|--|
| Year 2 (0.53 ha) | 1.5 m x 1.5 m spacing. 5000 stems/ha. | <u>Species</u> | <u>Scientific name</u> | <u>Number of seedlings</u> | <u>Specifics</u> |
| | | Mānuka | <i>Leptospermum scoparium</i> var. <i>scoparium</i> | 400 | Drought resistant. Well-drained, Moist moderate drainage. Tolerates light frost. |
| | | Kānuka | <i>Kunzea ericoides</i> | 400 | Prefers a sunny position in any well-draining soil. Tolerates partial shade, drought, wind, poor soils, and moderate frosts. |
| | | Māhoe | <i>Melicytus ramiflorus</i> | 400 | Prefers full sun and wet soils. Avoid heavy frosts when young. |
| | | Karo | <i>Pittosporum crassifolium</i> | 350 | Prefers full or partial shade with free-draining soil. It can also tolerate drought and can withstand high winds. |
| | | Karamū | <i>Coprosma robusta</i> | 350 | Full sun or partial shade. Tolerate damp soils. |
| | | Tī kōuka | <i>Cordyline australis</i> | 250 | Full sun or partial shade. Likes moist soil but can cope with considerable drought once established. |
| | | Harakeke | <i>Phormium tenax</i> | 250 | Tolerant of a wide range of conditions and is frost-hardy. |
| | | Hebe | <i>Veronica diosmifolia</i> | 150 | Sun or semi-shade, best in well-drained soil, will grow in dry sites. Hardy to cold. |
| | | Nīkau | <i>Rhopalostylis sapida</i> | 100 | Prefers deep, well-drained soils. Grows in full sun to full shade. |
| | | Total number of seedlings: | | 2,650 | |
| Year 3 (0.64 ha) | 1.5 m x 1.5 m spacing. 5000 stems/ha. | <u>Species</u> | <u>Scientific name</u> | <u>Number of seedlings</u> | <u>Specifics</u> |
| | | Mānuka | <i>Leptospermum scoparium</i> var. <i>scoparium</i> | 500 | Drought resistant. Well-drained, Moist moderate drainage. Tolerates light frost. |
| | | Kānuka | <i>Kunzea ericoides</i> | 500 | Prefers a sunny position in any well-draining soil. Tolerates partial shade, drought, wind, poor soils, and moderate frosts. |
| | | Māhoe | <i>Melicytus ramiflorus</i> | 500 | Prefers full sun and wet soils. Avoid heavy frosts when young. |
| | | Karo | <i>Pittosporum crassifolium</i> | 400 | Prefers full or partial shade with free-draining soil. It can also tolerate drought and can withstand high winds. |
| | | Karamū | <i>Coprosma robusta</i> | 400 | Full sun or partial shade. Tolerate damp soils. |
| | | Tī kōuka | <i>Cordyline australis</i> | 300 | Full sun or partial shade. Likes moist soil but can cope with considerable drought once established. |
| | | Harakeke | <i>Phormium tenax</i> | 300 | Tolerant of a wide range of conditions and is frost-hardy. |
| | | Hebe | <i>Veronica diosmifolia</i> | 200 | Sun or semi-shade, best in well-drained soil, will grow in dry sites. Hardy to cold. |
| | | Nīkau | <i>Rhopalostylis sapida</i> | 100 | Prefers deep, well-drained soils. Grows in full sun to full shade. |
| | | Total number of seedlings: | | 3,200 | |

| North Drain | | Total area 0.8 ha remaining | | |
|----------------------------|----------------|---|-----------------------------|--|
| 0.8 ha | Species | Scientific name | Number of seedlings | Specifics |
| | Mānuka | <i>Leptospermum scoparium</i> var. <i>scoparium</i> | 400 | Drought resistant. Well-drained, Moist moderate drainage. Tolerates light frost. |
| | Kānuka | <i>Kunzea ericoides</i> | 400 | Prefers a sunny position in any well-draining soil. Tolerates partial shade, drought, wind, poor soils, and moderate frosts. |
| | Māhoe | <i>Melicytus ramiflorus</i> | 400 | Prefers full sun and wet soils. Avoid heavy frosts when young. |
| | Karo | <i>Pittosporum crassifolium</i> | 350 | Prefers full or partial shade. It can also tolerate drought and can withstand high winds. |
| | Karamū | <i>Coprosma robusta</i> | 350 | Full sun or partial shade. Tolerate damp soils. |
| | Taupata | <i>Coprosma repens</i> | 350 | Prefers full sun and well-draining soil. |
| | Harakeke | <i>Phormium tenax</i> | 300 | Tolerant of a wide range of conditions and is frost-hardy. |
| | Mingimingi | <i>Coprosfrost-hardya</i> | 300 | Requires moist but free-draining soil in full sun or light shade. |
| | Hebe | <i>Veronica diosmifolia</i> | 250 | Sun or semi-shade, best in well-drained soil, will grow in dry sites. Hardy to cold. |
| 1.5 m x 1.5 m spacing. | Manatu | <i>Plagianthus regius</i> | 250 | It does well in most conditions but prefers fertile, moist but free-draining soil. |
| | Kōhūhū | <i>Pittosporum tenuifolium</i> | 250 | Grow best in fertile, moist, but well-drained soil either in full sun or in partial shade. |
| | Tī kōuka | <i>Cordyline australis</i> | 150 | Full sun or partial shade. Likes moist soil but can cope with considerable drought once established. |
| | Makomako | <i>Aristotelia serrata</i> | 150 | Prefers damp soils. Tolerant of wind. Attractive to birds and bees. |
| | 5000 stems/ha. | Whauwhaupaku | <i>Pseudopanax arboreus</i> | 100 |
| Total number of seedlings: | | | 4,000 | |

Appendix 4: Plants for Goal 4: Paddock 27B.

| Year | Paddock 27b | | Total area 4.97 | | |
|-----------------------|----------------------------|---------------------------------------|-----------------------|---|--|
| Tall Growth (4.31 ha) | Species | Scientific name | Number of seedlings | Specifics | |
| | Māhoe | Melicytus ramiflorus | 1800 | Prefers full sun and wet soils. Avoid heavy frosts when young. | |
| | Karo | Pittosporum crassifolium | 1600 | Prefers full or partial shade with free-draining soil. It can also tolerate drought and can withstand high winds. | |
| | Mānuka | Leptospermum scoparium var. scoparium | 1600 | Drought resistant. Well-drained, Moist moderate drainage. Tolerates light frost. | |
| | Kanuka | Kunzea ericoides | 1600 | Prefers a sunny position in any well-draining soil. Tolerates partial shade, drought, wind, poor soils, and moderate frosts. | |
| | Tōtara | Podocarpus totara var. totara | 1100 | Slow-growing, long lives species. Tolerant of wet and dry conditions. Stands strong to wind | |
| | Karamū | Coprosma robusta | 800 | Full sun or partial shade. Tolerate damp soils. | |
| | Kōhūhū | Pittosporum tenuifolium | 800 | It is fast-growing, very hardy, and tolerates dry, cold conditions; but is less tolerant of a wet climate. | |
| | Kahikatea | Dacrycarpus dacrydioides | 525 | Easy to establish and grow and its relatively fast growth. Grows well in poorly drained soils | |
| | Tītoki | Alectryon excelsus subsp. Excelsus | 350 | Ok with a wide range of light conditions and will thrive in either full sun or partial shade. Titoki prefers well-drained soil. | |
| | Nīkau | Rhopalostylis sapida | 200 | Prefers deep, well-drained soils. Grows in full sun to full shade. | |
| | Large-leaved kōwhai | Sophora microphylla | 200 | Can grow in wet or dry soils. Frost and wind tolerant. Prefers full sun but grows well in partial sun. | |
| | 2500 stems/ha. | Mātai | Prumnopitys taxifolia | 200 | Tolerates dry periods, partial shade, frosts, and cool climates. |
| | Total number of seedlings: | | 10,775 | | |
| Low Growth (0.66 ha) | Species | Scientific name | Number of seedlings | Specifics | |
| | Mountain flax | Phormium cookianum subsp. Hookeri | 800 | Tolerant of a wide range of conditions and is frost-hardy. Max height 1.6m | |
| | Mirror plant | Coprosma repens | 600 | Tolerate very exposed, dry conditions but not waterlogged or wet soil. Max height 0.5m | |
| | Shining karamu | Coprosma lucida | 600 | Tolerant of frost, heavy soil, and Wind. Full Sun to partial shade. Attractive to Birds and bees. Max growth height of 3 m | |

| | | | | |
|--|--------------------|---|-------|--|
| 1.45 m x 1.45 m spacing. 4750 stems/ha. | Hebe | <i>Veronica diosmifolia</i> | 350 | Sun or semi-shade, best in well-drained soil, will grow in dry sites. Hardy to cold. Max height 2.5m |
| | Horopito | <i>Pseudowintera colorata</i> | 250 | It tolerates quite dry conditions it does appreciate watering during dry spells. Grows in sun or semi-shade. Max height 3m |
| | Koromiko | <i>Veronica stricta</i> var. <i>stricta</i> | 250 | Hardy plant and does not tolerate shade. Full sun only and prefers open habitats on edge of bush Max height 2.5m |
| | Twiggy Coprosma | <i>Coprosma rhamnoides</i> | 135 | Prefers full sun. Good for exposed, dry areas. Frost tolerant. Max height 1.5m |
| | NZ Iris | <i>Libertia grandiflora</i> | 75 | Tolerant of all soil types except very wet areas and prefers full sun to partial shade. Max height 0.5m |
| | Mikoikoi / NZ Iris | <i>Libertia ixioides</i> | 75 | Tolerant of all soil types except very wet areas and prefers full sun to partial shade. Max height 0.4m |
| Total number of seedlings: | | | 3,135 | |