



Response to Minute 18 memorandum by Dr Keesing

Prepared for:	Porirua City Council	Reviewed and approved for release by:  Justyna Giejsztowt Principal Ecologist – Biodiversity and Modelling Specialist
Author:	Nyree Fea	
Report No:	7831f	
Date:	September 2026	

1.0 Introduction

An application for resource consent under the Fast-track Approvals Act 2024 (FTAA) is being sought by the Pukerua Property Group Partnership for a staged 949 lot residential subdivision at 422 State Highway 59, Pukerua Bay (FTAA-2603-1181).

On behalf of Porirua City Council, I was invited to review the ecological assessment (dated 20 November 2025, Appendix 15) and the subsequently released response to my review (dated 8 June 2026, Appendix J) by Blueprint Ecology. These documents form part of the Mt Welcome Fast Track application.

Expert conferencing between the applicant’s ecologist (Dr Vaughan Keesing), myself, Tayla Hooker of the Department of Conservation, and Dr Gary Bramely (an independent facilitator) took place on 18 August 2026 to resolve outstanding terrestrial ecology matters. A conference was then held on 3 September with members of the Environmental Protection Agency (EPA) Panel, and the interested parties listed above, to further discuss unresolved matters. This meeting resulted in requests from the Panel to Dr Keesing to provide more details on ecology (as detailed in Minute 18, Points 9-10). Specifically, Dr Keesing was instructed to provide the information below (by 11 September):

1. Describe what is proposed in greater detail [for the proposed planting and/ regeneration of slopes adjacent and above the proposed retention wetlands] and advise how it is proposed that that work would be maintained, and how its ongoing management would be conditioned.
2. Identify the areas suitable for this conversion [to terrestrial ecological offsets and/or compensation] in greater detail (including with appropriate mapping) and describe how its management would differ (including in conditions) as a result.
3. Complete a Biodiversity Accounting Offset Model (BOAM) assessment for areas of SNA27 proposed to be cleared to identify the appropriate offset.

Dr Keesing released a memorandum in response to this request on 10 September 2026. Another version of the report was released a week later (17 September 2026). I have read the most recent version of the memorandum by Dr Keesing, and my responses are provided below.

2.0 Review of Dr Keesing’s memorandum

2.1.1 Summary of memorandum

Dr Keesing provides descriptions of sites above proposed retention wetlands (A and B) that could potentially offer additional areas for terrestrial offsets, if additional areas were required.

Dr Keesing also provides results from a BOAM to guide management for the loss of indigenous vegetation cover at the site. The following metrics were considered as potential candidates as attributes in the BOAM (following expert conferencing towards the Joint Witness Statements):

1. Basal area (of the most common species)



2. Canopy cover
3. Canopy height
4. Different tiers of vegetation present
5. Species richness
6. Ground cover

2.1.2 Comment 1 (additional areas for terrestrial offsets)

Dr Keesing provides details on the location of the additional areas that could be potentially used for offsetting if required. I have attempted to superimpose this area onto Appendix 30-40 (drawing 1753-02 SK9202) in Figure 1 below.

Although no descriptions of current vegetation cover were provided, the vegetation and habitat types that currently characterise these sites appear to be grazed pasture and pine (*Pinus radiata*) shelterbelts.

In theory, these sites appear to offer suitable sites for potentially offsetting the loss of indigenous vegetation cover for construction of the subdivision. However, the polygon to the west is within an area also ear-marked as being potentially useful for additional lizard release areas, if required (Fea, 2026). To avoid double-counting of management actions, attempts should not be made to use this western area for both terrestrial vegetation offsets and lizard release areas.

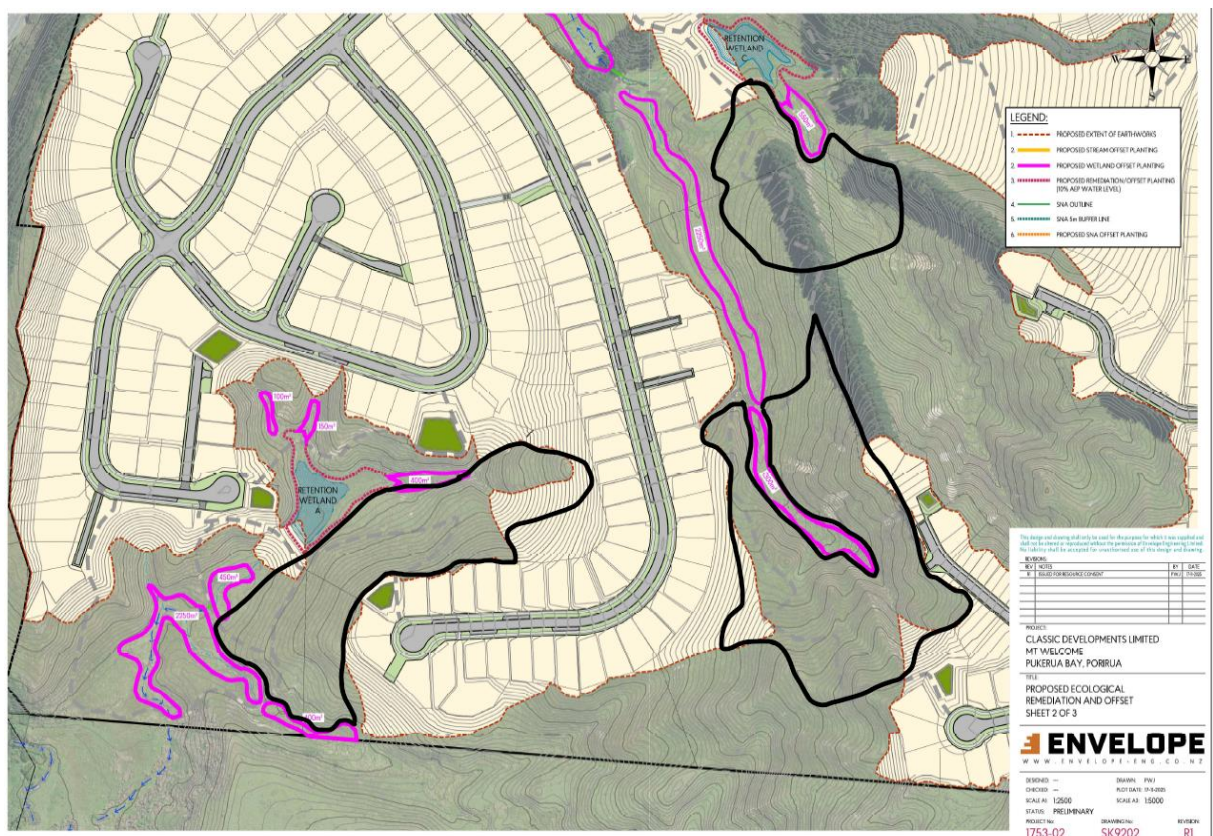


Figure 1. An estimation of additional sites for potential use as terrestrial offset areas (black polygons) as described in Dr Keesing's memorandum.

2.1.3 Comment 2 (review of the BOAM)

Dr Keesing undertook two 20 metre x 20 metre Recce plots, following standardised methods (presumably using the methods in Hurst et al. 2022). One plot was located within SNA027 (on the west side of SH59), and the other plot was located within the area described as 'Shrubland 1' (south east of SNA029 and north of the access track). Multiple plots would normally be required to estimate an



overall average for the site (i.e. at least two within SNA027 and the Shrubland 1 site), however we recognise that Dr Keesing was working under a tight deadline and can overlook the lack of plot replicates.

The following measurements were taken at these plots:

1. Basal area (m^2/ha , trees¹ only)
2. Canopy height (m, trees and saplings²)
3. Counts of trees/saplings individuals
4. Counts of seedlings
5. Counts of all species (i.e. species richness: includes trees, saplings, ferns, epiphytes etc)
6. Counts of seedling species
7. Diameters at breast height (DBH) for trees and saplings

For the plot within Shrubland 1, trees that are not locally native (i.e. outside its natural northern New Zealand range such as karaka, karo, pōhutukawa) were excluded. I consider this decision as acceptable for the model.

Finally, Dr Keesing chooses to use the following metrics in his models:

1. Canopy height (trees only for SNA vegetation, all tiers for Shrubland 1)
2. Basal area (although there are problems with tree diameter measures for the benchmark site)
3. Species richness (although it is not clear if this is for all tiers combined or trees only)
4. Counts of saplings
5. Counts of seedlings

SNA Vegetation (SNA027 and SNA029)

Dr Keesing's BOAM states the area of loss as 1400 m^2 . However, the total amount of SNA removal that is scheduled to occur is 2036 m^2 ($1,345 \text{ m}^2$ in SNA027 to the west, 691 m^2 in SNA029 to the east). I do not agree that the loss of the smaller area of SNA029 be treated separately as this habitat was similar in character to that of SNA027 (i.e. māhoe-five finger-mamaku dominant forest). *Tradescantia* (a weed) is prevalent as ground cover but there are also weeds in the ground cover tier of SNA027 (e.g. gorse, broom, *Montbretia*). Native ferns and seedlings (e.g. tawa and kohekohe) are also present in the SNA029 ground cover tier.

It is not clear (from information on page 2) which datasets from the National Vegetation Survey (NVS) database were used for the benchmark data. Mr Keesing notes that the Kāpiti Island kohekohe forest data was not appropriate as the mature forest appears to have a stunted canopy (possibly because it is an exposed site). This is a reasonable conclusion. Dr Keesing then states that other plot data was available for mature tawa-podocarp forest from three other Wellington sites (Otari-Wilton's Bush in Karori, Belmont Park, and the Akatarawa Forest), however it is not clear which sites were used for the comparative benchmark data. I am assuming that Mr Keesing selected data from the Kapiti Island site, however, Dr Keesing should clearly state which sites were used for the benchmark data. If multiple sites were used, it is also important to know how the data were aggregated. It would also be useful to see a table providing a summary of the data for the benchmark site (i.e. the number and names of the plots used, and the summary data for each attribute).

There is also a footnote on page 5 that is unclear ("other NVS plots had as a common forest tree side 12 cm "). I assume the author meant 'size' (as in, diameter) here. I believe the tree diameter of 8.3

¹ Described as a woody species over 10 cm DBH and over 3 m

² Described as any other woody species above 2 m but under the tree dimensions



centimetres for the benchmark site is not appropriate, as this small measure does not fairly represent a mature forest, although tree diameters per se were not carried forward into the BOAM, they are a function of the basal area data. Therefore, estimates of basal data need to be treated with caution as it would appear the kohekohe trees measured on Kapiti Island are not true examples of mature kohekohe forest in the Wellington Area.

The following page 6 states that a subjective measure for forest tree height was used to replace that from the NVS database. In the absence of good data this is an appropriate step and I accept an estimate of 12 metres to represent mature kohekohe tree height forest height. Dr Keesing has also applied a discount rate of 30% (i.e. 0.3) which is much higher than the standard 3% (0.03). The 3% penalty (applied per year) is currently accepted as a reasonable penalty for the time lag between loss of a biodiversity element and its eventual replacement through an offset.

Regarding the current vegetation cover of the proposed offset are(s), I believe there are existing trees and shrubs in the area that have not been accounted for, however my photos show that these are limited to infrequent ducksfoot (*Pennantia corymbosa*) and *Coprosma* sp. shrubs with some bracken and *Carex secta* cover. As this is very sparse cover, I will accept the zero estimates for current values at the offset site.

It is best practise to separate out the elements of biodiversity that are used to define the different components in separate sections of the BOAM. For example, the Biodiversity Components are not the entire broadleaf forest, they are the components that characterise that forest (e.g. plant diversity (e.g. species richness), ecological function (e.g. basal area, seedling counts etc)). It is then best to discuss the final results (the multiple 'Component Net Present Biodiversity Values (NPBVs)') in relation to the overall health of the habitat that is being lost/affected. To that end, I have undertaken my own BOAM, and I have separated out two different biodiversity attributes: diversity and function, and I have used the standard 3% discount rate.

Regarding the 'Time til Endpoint' that Dr Keesing has chosen in the offset model (≤ 10 years), this estimate is not reflective of the time it would take to replace the lost vegetation. The existing SNA vegetation is between 40-60 years old, and replacement of the character lost is likely to take at least 40 years for the different attributes to reach the stated endpoint, which is over four times the time stated in Dr Keesing's BOAM. Therefore, my BOAM uses a more realistic 'Times til endpoint' (40 years). I have also chosen a finer scale (m^2) as the unit in the model, as using the coarser scale of hectares can result in inaccuracies caused by the 'rounding up' of estimates.

The results from my own BOAM (Figure 2: Impact Model; Figure 3: Offset Model and NPBV results), using the data supplied by Dr Vaughan for the impact model, introducing more realistic estimates for the measures expected after 40 years of restoration, and accepting all other benchmark data as being appropriate, show that restoration of 7500 m^2 (0.75 ha) as an offset would likely result in a net positive outcome for indigenous forest at the Mt Welcome site.

I therefore offer a minimum replacement:loss ratio of 3.9:1 (i.e. more than the 3.6:1 ratio offered by Dr Keesing) to offset the loss of 2036 m^2 of SNA vegetation at the site. I do not agree that a lower ratio be used for the loss of the smaller area of SNA029 (691 m^2) as this habitat was similar in character to that of SNA027 (albeit with a denser understorey of *Tradescantia*). The results from my BOAM, using an offset area of 7500 m^2 , show that one attribute is negative and two attributes are very close to zero (species richness and canopy height). If considered within the uncertainty inherent in these exercises, a larger offset area would be appropriate, as a 7500 m^2 represents an offset that scrapes by. Therefore, it would be best practise to increase the offset area to 8000 m^2 to increase the likelihood of offsetting success (i.e. 3.9:1 ratio).



BIODIVERSITY TYPE

Broadleaf Forest

brown. Cells coloured light green will auto-populate.
Step 11: Repeat Steps 4–10 for as many Biodiversity Attributes as required.
Step 12: Repeat Steps 3–10 for as many Biodiversity Components as required (scrolling down the sheet).

This section captures which elements of biodiversity, and over what area, will be impacted by the proposal					This section is where the change in measure of each Biodiversity Attribute due to the proposed Impact is quantified, and Attribute Biodiversity Value calculated. Inputs are derived from direct measures, existing data or models where available, or expert estimated predictions				
Biodiversity Component	Biodiversity Attribute		Measurement Unit	Area of Impact (m2)	Benchmark	Measure <u>prior</u> to Impact	Measure <u>after</u> Impact	Biodiversity Value	
0.1	Diversity	0.1a	Species richness (all tiers)	count	2036	27	23	0	-1734.37
		0.1b							Not calculated
		0.1c							Not calculated
		0.1d							Not calculated
		0.1e							Not calculated
This section captures which elements of biodiversity, and over what area, will be impacted by the proposal					This section is where the change in measure of each Biodiversity Attribute due to the proposed Impact is quantified, and Attribute Biodiversity Value calculated. Inputs are derived from direct measures, existing data or models where available, or expert estimated predictions				
Biodiversity Component	Biodiversity Attribute		Measurement Unit	Area of Impact (m2)	Benchmark	Measure <u>prior</u> to Impact	Measure <u>after</u> Impact	Biodiversity Value	
0.2	Function	0.2a	Canopy height	Tree (m)	2036	12	6	0	-1018.00
		0.2b	Basal area	Trees only (m2/ha)	2036	34.8	14.17	0	-829.03
		0.2c	Seedling abundance	count	2036	117	101	0	-1757.57
		0.2d	Sapling abundance	count	2036	189	32	0	-344.72
		0.2e							Not calculated

Figure 2. Estimates of impact for Significant Natural Area (SNA) indigenous vegetation at the Mt Welcome site.



BIODIVERSITY TYPE

0

#N/A

DISCOUNT RATE

0.03

Step 5: Biodiversity Attributes will be auto-populated once Cell B11 is populated.

Step 6: Work through accounting model for each Biodiversity Attribute entering values into light brown cells. At column K choose method of accounting for time and follow instructions. If using a finite end point, continue on this sheet. If calculating the offset as accrued over time use the Offset Model_5 yearly worksheet.

Step 7: Repeat for additional Biodiversity Components (scrolling down the sheet)

This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model

Biodiversity Component

Biodiversity Attribute

Measurement Unit

Benchmark

These cells provide information about the proposed Offset Actions

Proposed Offset Actions

Offset area (m2)

Confidence in Offset Actions

Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L

Measure prior to Offset

Measure after Offset

Time till endpoint (years)

Biodiversity Value at Offset Site

Biodiversity Value at Impact Site

Attribute Net Present Biodiversity Value

This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each Attribute

This is the average Net Present Biodiversity Value for the Biodiversity Component

Component Net Present Biodiversity Value

54.73

0.1

Diversity

0.1a

Species richness (all tiers)

count

27

Revegetation

7500

Very confident >90%

Finite end point

Continue to Column M

0

22

40

1789.10

-1734.37

54.73

0.1b

Confident 75-90%

Choose option

Not calculated

0.1c

Low confidence >50% <75%

Choose option

Not calculated

0.1d

Low confidence >50% <75%

Choose option

Not calculated

0.1e

Low confidence >50% <75%

Choose option

Not calculated

This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model

Biodiversity Component

Biodiversity Attribute

Measurement Unit

Benchmark

These cells provide information about the proposed Offset Actions

Proposed Offset Actions

Offset area (m2)

Confidence in Offset Actions

Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L

Measure prior to Offset

Measure after Offset

Time till endpoint (years)

Biodiversity Value at Offset Site

Biodiversity Value at Impact Site

Attribute Net Present Biodiversity Value

This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each Attribute

This is the average Net Present Biodiversity Value for the Biodiversity Component

Component Net Present Biodiversity Value

343.48

0.2

Function

0.2a

Canopy height

Tree (m)

12

Revegetation

7500

Confident 75-90%

Finite end point

Continue to Column M

0

7

40

1106.48

-1018.00

88.48

0.2b

Basal area

Trees only (m2/ha)

34.8

Revegetation (trees)

7500

Confident 75-90%

Finite end point

Continue to Column M

0

20

40

1090.13

-829.03

261.10

0.2c

Seedling abundance

count

117

Revegetation

7500

Confident 75-90%

Finite end point

Continue to Column M

0

100

40

1621.21

-1757.57

-136.36

0.2d

Sapling abundance

count

189

Natural colonisation

7500

Confident 75-90%

Finite end point

Continue to Column M

0

150

40

1505.41

-344.72

1160.69

Figure 3: Estimates for the offset model for Significant Natural Area (SNA) indigenous vegetation at the Mt Welcome site.

Shrubland 1

It is excellent to see that Dr Vaughan also took the time to undertake plot measurements for Shrubland 1 and has presented the results from the BOAM for this area of indigenous vegetation. I have checked the model and have found some inconsistencies / inaccuracies. I have therefore undertaken another BOAM to model appropriate replacement:loss ratio for this area (Figures 4 and 5 below).

The results from my BOAM show that an offset of 10,000m² (1 ha) to replace the loss of indigenous shrubland would present a positive outcome for three of the five attributes. There is variation across the five attributes, however, three are sufficiently positive to outweigh the slightly negative responses of seedling abundance and canopy height, with a clear net positive outcome for all five attributes overall. I therefore agree with Dr Keesing's statement that the ratio of replacement to loss be 2:1 (i.e. restoration of 10,000 m² to replace the loss of 5000 m² of Shrubland 1). Restoration of this area over a 20 year period is likely to result in an overall net positive outcome for indigenous scrub/shrubland at the site. Again, the existing fragment is over 20 years old, therefore at least twice the time given in Dr Keesing's model will actually be needed to replace what is being lost.

BIODIVERSITY TYPE		brown. Cells coloured light green will auto-populate. Step 11: Repeat Steps 4–10 for as many Biodiversity Attributes as required. Step 12: Repeat Steps 3–10 for as many Biodiversity Components as required (scrolling down the sheet).						
Broadleaf Forest								
This section captures which elements of biodiversity, and over what area, will be impacted by the proposal					This section is where the change in measure of each Biodiversity Attribute due to the proposed Impact is quantified, and Attribute Biodiversity Value calculated. Inputs are derived from direct measures, existing data or models where available, or expert estimated predictions			
Biodiversity Component	Biodiversity Attribute	Measurement Unit	Area of Impact (m2)	Benchmark	Measure prior to Impact	Measure after Impact	Biodiversity Value	
0.1	Diversity	0.1a Species richness (all tiers)	count	5000	27	18	0	-3333.33
		0.1b						Not calculated
		0.1c						Not calculated
		0.1d						Not calculated
		0.1e						Not calculated
This section captures which elements of biodiversity, and over what area, will be impacted by the proposal					This section is where the change in measure of each Biodiversity Attribute due to the proposed Impact is quantified, and Attribute Biodiversity Value calculated. Inputs are derived from direct measures, existing data or models where available, or expert estimated predictions			
Biodiversity Component	Biodiversity Attribute	Measurement Unit	Area of Impact (m2)	Benchmark	Measure prior to Impact	Measure after Impact	Biodiversity Value	
0.2	Function	0.2a Canopy height	Tree (m)	5000	8	4.8	0	-3000.00
		0.2b Basal area	All tiers (m2/ha)	5000	34.8	6.1	0	-876.44
		0.2c Seedling abundance	count	5000	117	92	0	-3931.62
		0.2d Sapling abundance	count	5000	189	12	0	-317.46

Figure 4. Estimates of impact for Shrubland 1 at the Mt Welcome site.

BIODIVERSITY TYPE		DISCOUNT RATE		Step 5: Biodiversity Attributes will be auto-populated once Cell B11 is populated. Step 6: Work through accounting model for each Biodiversity Attribute entering values into light brown cells. At Column K choose method of accounting for time and follow instructions. If using a finite end point, continue on this sheet. If calculating the offset as accrued over time use the Offset Model_5 yearly worksheet. Step 7: Repeat for additional Biodiversity Components (scrolling down the sheet)												
0	#N/A	0.03														

This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model						These cells provide information about the proposed Offset Actions			Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L		This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each						This is the average Net Present Biodiversity Value for the Biodiversity Component
Biodiversity Component	Biodiversity Attribute	Measurement Unit	Benchmark	Proposed Offset Actions	Offset area (m2)	Confidence in Offset Actions	Measure prior to Offset	Measure after Offset			Time till endpoint (years)	Biodiversity Value at Offset Site	Biodiversity Value at Impact Site	Attribute Net Present Biodiversity	Component Net Present Biodiversity Value		
0.1	Diversity	0.1 a	Species richness (all tiers)	count	27	Revegetation	10000	Very confident >90%	Finite end point	Continue to Column M	0	20	20	3916.74	-3333.33	583.41	583.41
		0.1 b						Confident 75-90%	Choose option							Not calculated	
		0.1 c						Low confidence >50% <75%	Choose option							Not calculated	
		0.1 d						Low confidence >50% <75%	Choose option							Not calculated	
		0.1 e						Low confidence >50% <75%	Choose option							Not calculated	

This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model						These cells provide information about the proposed Offset Actions			Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L		This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each						This is the average Net Present Biodiversity Value for the Biodiversity Component
Biodiversity Component	Biodiversity Attribute	Measurement Unit	Benchmark	Proposed Offset Actions	Offset area (m2)	Confidence in Offset Actions	Measure prior to Offset	Measure after Offset			Time till endpoint (years)	Biodiversity Value at Offset Site	Biodiversity Value at Impact Site	Attribute Net Present Biodiversity	Component Net Present Biodiversity Value		
0.2	Function	0.2 a	Canopy height	Tree (m)	8	Revegetation	10000	Confident 75-90%	Finite end point	Continue to Column M	0	5	20	2854.89	-3000.00	-145.11	590.73
		0.2 b	Basal area	All tiers (m2/ha)	34.8	Revegetation (trees)	10000	Confident 75-90%	Finite end point	Continue to Column M	0	10	20	1312.59	-876.44	436.16	
		0.2 c	Seedling abundance	count	117	Revegetation	10000	Confident 75-90%	Finite end point	Continue to Column M	0	100	20	3904.12	-3931.62	-27.50	
		0.2 d	Sapling abundance	count	189	Natural colonisation	10000	Confident 75-90%	Finite end point	Continue to Column M	0	100	20	2416.84	-317.46	2099.38	

Figure 5: Estimates for the offset model for Shrubland 1 at the Mt Welcome site.

3.0 References

Hurst J., Allen R. and Fergus A. (2022). *The Recce method for describing New Zealand vegetation – field manual*. Manaaki Whenua - Landcare Research. 51pp.