IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project
BY	**NEW ZEALAND TRANSPORT AGENCY** Requiring Authority

STATEMENT OF EVIDENCE OF DR ADAM FORBES (TERRESTRIAL ECOLOGY) ON BEHALF OF THE NEW ZEALAND TRANSPORT AGENCY

8 March 2019

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INTRODUCTION

1. My full name is **Dr Adam Forbes**.

2. I am the founder and Principal Ecologist of Forbes Ecology.

3. I prepared Technical Assessment #6: Terrestrial Ecology ("**Technical Assessment 6**"), which is in Volume 3 of the Assessment of Environmental Effects ("**AEE**") which accompanied the Notices of Requirement ("**NoRs**") lodged in respect of Te Ahu a Turanga; Manawatū Tararua Highway Project ("**the Project**"). I also prepared the Terrestrial Vegetation and Habitats Assessment, which is Appendix 6.1 to Technical Assessment 6. I scoped, oversaw and reviewed aspects of the Terrestrial Fauna Assessment, which was prepared by Mr Andrew Blayney and Ms Karin Sievwright, and is Appendix 6.2 to Technical Assessment 6.

4. My qualifications and experience are set out in Paragraph 4 of Technical Assessment 6.

5. Technical Assessment 6 sets out the work I carried out in preparing that Assessment (and the Terrestrial and Vegetation Habitats Assessment). Since finalising Technical Assessment 6, and in preparing my evidence, I have:

   (a) Assisted the DOC ecology experts' site visit to the proposed designation area on 23 November 2018.

   (b) Undertaken further field work (1 and 2 December 2018) to address points made by DOC, in particular regarding delineation and inclusion of exotic-dominated seepage wetlands, the floristic composition and extent of the divaricating shrubland ecosystem type, and the distribution of ramarama within the designation area.

   (c) Met with DOC on 6 December 2018 at its Hamilton office and again on 15 February 2019 to discuss points raised in DOC's submission.

   (d) Met with Forest and Bird to discuss points raised in its submission on 14 February 2019.

   (e) Met with QEII National Trust to discuss points raised in their submission on 14 February 2019.

   (f) Attended and presented at the stakeholder mitigation workshop in Palmerston North on 15 February 2019. This workshop had a diverse range of attendees with the purpose being to reiterate the proposed package of positive effects, and to provide an opportunity for attendees

to suggest ideas for inclusion in the Project's ecological positive effect package.

(g) Engaged in expert conferencing with Dr Martin (representing DOC) on 22 February 2019.

Code of Conduct

6. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. My evidence has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this evidence is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

7. The assumptions and exclusions applied in my assessment are set out at Paragraph 7 of Technical Assessment 6.

Purpose and scope of evidence

8. Technical Assessment 6 provides an overview of the assessments carried out of the Project's effects on terrestrial ecology, and assesses the Project's actual and potential effects on terrestrial ecology, and recommends measures to manage those effects.

9. My evidence does not repeat in detail the technical matters set out in that assessment. Rather, in this evidence I:

(a) present the key findings of Technical Assessment 6, updated to take into account information received more recently, in an executive summary;

(b) comment on submissions received in respect of the NoRs;

(c) respond to questions received from the Hearing Panel on 27 February 2019; and

(d) comment on the Council section 42A materials.

EXECUTIVE SUMMARY

10. The New Zealand Transport Agency ("**Transport Agency**") is seeking to designate land for the purposes of an alternative State Highway route across the Ruahine Range.

11. Of the proposed designation area, 42.9 ha (c. 11%) comprises terrestrial vegetation and habitats which are classified (based on composition,

structure, and condition) into the following twelve distinct ecosystem types and areas, ranging in ecological value from Very High to Low. Eight ecosystem types were assessed as significant, by reference to Horizons' One Plan Policy 13-5. Revised maps of these ecosystem types are included as Appendix A to this brief of evidence.

Ecosystem type	Area (ha)	Value level	RMA s6(c)
Old-Growth (OG) Forests (Alluvial)^	4.25	Very High	Yes
OG Forests (Hill Country)	1.78	Very High	Yes
Secondary Broadleaved Forests with OG Signatures	3.07	High	Yes
OG Treelands	0.41	High	Yes
Advanced Secondary Broadleaved Forests	2.93	High	No
Secondary Broadleaved Forests and Scrublands	16.58	Moderate	No
Kānuka Forests	4.54	Moderate	Yes
Raupō Dominated Seepage Wetlands (High Value)	0.56	High	Yes
Indigenous-Dominated Seepage Wetlands (Mod. Value)	1.12	Moderate	Yes
Exotic Dominated Seepage Wetlands (Low Value)	2.74	Low	Yes
Mānuka, Kānuka Shrublands	4.55	Low	No
Divaricating Shrublands	0.33	High	No

^This area calculation includes 0.05 ha of Very High value Threatened-Nationally Critical swamp maire forest. Areas are slope corrected using the Project LiDAR dataset.

10. The proposed designation area contains potential populations of non-threatened and At-Risk lizard species, terrestrial invertebrate values ranging from Negligible to High, and Threatened and At-Risk bird species using shingle riverbed, wetland, forest and grassland habitats. **Andrew Blayney** explains in his evidence that monitoring to date has not detected long-tailed bats, however further monitoring is scheduled for the autumn of 2019 to determine the status of any bat populations.

11. Key actual or potential adverse effects of the Project include:

    (a) For terrestrial vegetation and habitats:

        (i) clearance or modification of indigenous vegetation and habitats;

        (ii) habitat fragmentation and isolation; and

(iii) edge effects on retained vegetation and habitats;

(b) For terrestrial fauna:

(i) injury or mortality during vegetation clearance and earthworks;

(ii) disturbance during critical nesting periods (birds);

(iii) permanent loss of habitats; and

(iv) modification of habitats in the form of:

(1) increased fragmentation and isolation due to reduced habitat connectivity;

(2) creation of edge effects and consequential effects to composition, structure and food sources in retained habitats; and

(3) invasions and corresponding impacts of non-native plant and animal species.[1]

12. A stepped approach is proposed for vegetation clearance. The proposed approach allows flexibility within the designation area for works to proceed without being constrained by lower value ecosystems that can be replaced in relatively short timeframes through replacement planting; and to manage effects to higher value ecosystem types through avoidance and minimisation of effects, as defined by specific effects envelopes.

13. Effects envelopes were developed to limit levels of effect on High and Very High value features to levels acceptable on ecological grounds, given appropriate mitigation and offsetting measures. Effects envelopes represent maximum allowable limits on species and ecosystems of very high conservation concern (i.e., swamp maire, old-growth forests, high value seepage wetlands) and limit the magnitude of effect in specific locations (not designation wide) for other ecosystem types. Measures are proposed to address adverse effects associated with increased fragmentation/isolation and edge effects.

[1] Another potential effect of the Project relates to sedimentation, arising from construction of the Manawatū River crossing, of foraging areas along the riverbed, which in turn could impact dotterel foraging. This potential effect will be considered in the context of the regional resource consents required for the Project, in light of the precise bridge configuration and construction methodology proposed.

14. Adverse effects on fauna from vegetation and habitat loss are directly addressed through the avoidance, replacement planting and offset measures discussed above and summarised in revised Table 6.A.1 attached as Appendix B to this brief of evidence. Disturbance of fauna (particularly lizards and birds), including during critical bird breeding seasons, will be addressed through provisions detailed in the Ecological Management Plan regarding effects management (e.g., preconstruction surveys and salvage) and scheduling of works outside of critical periods or, if not possible, through preconstruction surveys and constraints on works during specific time periods of high sensitivity.

15. Regarding terrestrial fauna, following full implementation of mitigation and offset measures, the level of adverse effect would be Very Low-Low, with net benefits to terrestrial fauna likely to be realised over time.

16. In broader terms, too, the proposed mitigation and offset package is likely to address adverse effects and offset residual adverse effects to a biodiversity net-gain position. A condition has been proposed to ensure that outcome. Put another way, on the basis of the offset package proposed, in my view the Project will have net benefits in respect of terrestrial ecology values.

Updates to Table 6.A.1

17. As noted above, Table 6.A.1 has been updated and is attached as Appendix B to this evidence. There are three types of updates that have been made to that table (and are clearly marked in the Appendix B version):

    (a) the addition of exotic-dominated wetlands as an ecosystem type and the separation of mānuka/kānuka shrubland from divaricating shrubland (formerly one combined shrubland type).

    (b) changes to potentially affected areas for each relevant ecosystem type. In particular, we have also refined the calculations of affected ecosystem types that benefit from protection through effects envelopes so as to represent (subtract) the area protected in the tally of affected area. This resulted in a reduction in the overall affected area and resulting replacement planting total.

    (c) updates to the proposed Environmental Compensation Ratios ("**ECRs**") for each ecosystem type. These are explained as part of my response to the DOC submission.

18. The changes have altered the required replacement planting for some of the relevant ecosystem types. Overall, these changes result in a slightly lower total area of replacement planting being required.

RESPONSE TO QUESTIONS OF THE HEARING PANEL

19. I respond below to questions from the Hearing Panel that relate to my evidence.

Where in the construction process outlined would mitigation and offset planting occur and how would this reflect the different establishment times for different ecological habitats?

20. All ecological replacement planting would be completed within 3 planting seasons following completion of construction. Seed collection is underway, and at restoration sites where replacement planting is not dependent on the completion of physical works, planting could commence as soon as practically possible with a priority on replacement of old-growth forest and mature forest compositions and wetland restoration.

In relation to the sub-options A-F for the western end of the NOR considered in the DBC, are any of these routes preferential compared to the proposed in terms of terrestrial ecological effects?

21. In terms of terrestrial ecology risks, all sub-options had similar implications for the Western QEII forests. As sub-options B, C, D, and E traversed to the west or north-west and did not cross the ecological area located north of the Manawatū River crossing, these sub-options all presented one level less terrestrial ecology risk compared to the proposed alignment (which was represented then by sub-option A (and F)).

To what extent, if any, would planting in areas 2, 3, 4 and 5 in Figure 6.A.9 have an adverse effect on the operation of the Meridian wind turbines?

22. I understand that Meridian has adopted a position that ecological replacement plantings should not occur within the land titles containing their wind farm. My expertise is in ecology rather than wind engineering, so it is difficult for me to answer this question. However, I can make the following observations regarding the local topography and the relative positions of the areas and the Meridian turbines.

23. Potential planting areas 2 and 5 are located >300 m (horizontally) from the nearest Meridian wind turbines. The westernmost extent of area 3 is within 300 m of the two closest turbines located within the proposed designation area which are at the top of a very steep hill. I do not understand what the specific problem is with replacement planting in this westernmost part of area 3. I have provided a photograph below (Figure A) to illustrate how replacement planting on the face east of the Western QEII would be orientated relative to the closest turbines (the photograph is taken near the turbine base). I have similar reservations about the limitations imposed that would exclude the remainder of area 3. If planting forest species near turbines is an issue from a wind flow/turbulence perspective, then I could most understand this issue relating to area 4 which is an area of less vertical relief and contains 5-6 existing turbines.

24. I am of the view that exclusion of replacement planting in the Meridian area would be an important opportunity missed in terms of positive ecological effects associated with expansion of the Western QEII to the east, the Manawatū Gorge Scenic Reserve to the north, and the riparian margins and stream headwaters where they occur along the top of the range within and adjacent to the proposed designation area.

Figure A: I took the above photograph on 11/7/2018 standing near the south-western most turbine of the Meridian wind farm, viewing down the face

toward the point where the Western QEII meets the north-western corner of the DOC Manawatu Gorge Scenic Reserve. The pasture shown in the foreground is part of Figure 6.A.9 area 3. Note that the land drops approximately 100 vertical metres from the turbine base to the distant vegetation edge and it is difficult for me – a non-wind expert – to understand how the turbines could be materially affected by replacement plantings in this area. This concerns me because not planting this area is a missed opportunity in terms of terrestrial ecology positive effects.

Can you please update us regarding the other potential sites on privately owned hill country?

25. Given the apparent limitations of replacement planting near the Meridian wind farm, I have looked at additional options for restoration treatments. This work is represented in **Appendix C** of my evidence. Further wetland restoration site options (raised by a stakeholder) are presented in **Appendix D**. I defer to **Lonnie Dalzell** of the Transport Agency on matters relating to landowner negotiations and land procurement for the Project, including for restoration activities.

Are your conclusions/recommendations set out in paragraphs 56, 66 and 70 addressed in the NOR conditions offered by NZTA?

26. Paragraph 56 relates to ensuring an appropriate level of adverse effect to ecosystems located at the CH4000-4400 Northern Bridge Landing. I have recommended an annotation be added to the table in Condition 5 e) to indicate the level of effect to the old-growth alluvial forest and raupo-dominated seepage wetland be less than Very High adverse, as per my assessment.

27. Paragraph 66 concludes with reference to recommendations made to bridge and use retaining walls at the crossing of the stream tributary at CH5800 to minimise forest and stream impacts and paragraph 70 contains my recommendation for use of retaining walls at waterway crossings between CH6400-8600. These recommendations are not directly reflected in the draft conditions (particularly not those that relate to stream works which would be covered by the regional consenting process), instead reliance is on the Cultural and Environmental Design Framework ("**CEDF**") design principles in Section 3.2 of the CEDF.

In your view, is it appropriate to require the alignment of the viaduct to be along the centreline of the NOR in order to reduce to an absolute minimum potential effects on the stand of swamp maire?

28. My concern with fixing the centreline is that I cannot be certain (given the current level of design) that would result in the best outcome for the swamp maire or for the other sensitive ecological ecosystems located north of the Manawatū River crossing. I think it best the detailed design is given flexibility within the effects envelopes to allow for innovative solutions that minimise adverse ecological effects.

How is it proposed to provide mitigation planting as identified on areas outside of the NOR?

29. I have identified and recommended suitable areas for ecological restoration to address the Project's adverse ecological effects (related to the NoRs). I defer to the Transport Agency for matters relating to the procurement of land areas for the Project, both within and outside of the designation; this is addressed in **Mr Dalzell's** evidence.

COMMENTS ON SUBMISSIONS

Horizons Regional Council

30. I note at Paragraph 9 of the Horizons Regional Council ("**HRC**") submission, and in particular:

    (a) the acknowledgement of the comprehensive nature of the terrestrial ecology assessment; and

    (b) the signal that HRC / the HRC Ecologist Advisor will be further involved once the detailed design is available and finer-scale effects assessments for both terrestrial and freshwater assessments are possible.

Manawatū Gorge Governance Group

31. The Manawatū Gorge Governance Group supports the road being constructed with a net positive gain for the ecology and native biodiversity of the area. The Group believes that Te Āpiti / Manawatū Gorge should be an area were offset compensation is targeted and requests that consultation with the Manawatū Gorge Governance Group be a condition of consent. I am supportive of these points made by the Manawatū Gorge Governance Group.

Forest and Bird

32. I met with Forest and Bird on 14 February 2019 to discuss their submission and Forest and Bird attended the 15h February 2019 mitigation workshop.

Detection of fauna species

33. At Paragraph 12 of their submission, Forest and Bird raise concern that the presence of some species may not have been detected to their full extent across the designation area, in particular bats, herpetofauna, and freshwater macroinvertebrates.

34. **Mr Blayney's** statement of evidence covers the most recent bioacoustics surveys and also the approach to determining lizard values and the corresponding effects management.

35. In respect of freshwater macroinvertebrates, this and other freshwater matters (noting paragraphs 23 – 28 of Forest and Bird's submission deals with effects on freshwater values) will be dealt with during the regional consenting process.

Quantifiable data on effects

36. At Paragraph 14, Forest and Bird raise a concern over what they say is a relative lack of quantifiable information regarding the Project's effects on flora and fauna values. At Paragraph 15 they state this creates an issue for how requirements for avoidance, remediation, mitigation and offsetting can be calculated and met.

37. Forest and Bird do not state what data they consider to be missing, or how the data that has been relied upon can be considered insufficient. I am of the opinion that the Project's effects management regime is well informed and structured, and appropriately conservative, through a combination of:

    (a) survey data; and

    (b) conservative assumptions where data deficiencies remain (e.g., assuming presence of all species in the absence of lizard detection).

38. Technical Assessment 6 has been informed by technical reports prepared by a large number of professional ecologists and adhering to best practice assessment techniques.

39. Quantitative sampling techniques (point-centred quarter[2] and Recce[3]) were applied to determine the forest tree stem density, basal area, and tree dominance of affected old-growth forests (see the Terrestrial Vegetation and Habitats Assessment, Appendices B and C). This quantitative data on relative forest tree species dominance provided the necessary evidence base to match the old-growth forest compositions to the One Plan Schedule F Table F.1 list of Threatened or At Risk forest types.

40. Monocultural kānuka forests and seepage wetlands are the other Schedule F Table F.1 ecosystem types that occur within the designation area. Neither of these ecosystems require quantitative sampling of composition or structure to confirm their One Plan Schedule F status, as these attributes are inherently obvious.

41. Other ecosystem types, such as secondary broadleaved forests, comprise a group of common species typical of the successional stage. Quantitative sampling to determine the relative dominance of species would add nothing to the assessment of value or recommended effects management.

42. The slope-corrected area of all ecosystem types has been quantified, and this quantitative data has been invaluable for the prescription of effects envelopes in those ecosystem types of elevated conservation concern.

43. In respect of fauna:

    (a) quantitative bird counts were undertaken; and

    (b) counts of both long-tailed bats (through repeated bioacoustics surveys) and lizards were attempted at length.

44. All surveys were conducted in a robust manner. Where, following survey, data deficiencies remain (e.g., absence of lizard records), a conservative approach to effects management has been taken, as described in Technical Assessment 6.

45. On this basis, I believe the ecological values assessments and effects management approaches are based on sound and adequate data.

[2] Mueller-Dombois, D., & Ellenberg, H. (2002). Aims and Methods of Vegetation Ecology. New Jersey: The Blackburn Press.
[3] Hurst, J. M., & Allen, R. B. (2007). *The Recce method for describing New Zealand vegetation – Field protocols.* Lincoln: Landcare Research. Retrieved from https://nvs.landcareresearch.co.nz/Content/Recce_FieldProtocols.pdf

46. The necessary content of specific management plans are presented in draft conditions and these will be developed as required by conditions.

Data and the measures required to address ecological effects

47. At Paragraphs 14–16 of their submission, Forest and Bird raise concern that the offset proposal is insufficient given a lack of robust data to inform its calculation. At Paragraphs 16 and 17, Forest and Bird state they feel the offset package may be more reflective of environmental compensation in many respects and that robust calculations of remediation, mitigation, offsetting and compensation are critical to a project such as this in order to ensure a net gain for conservation.

48. However, at Paragraph 22 of their submission, Forest and Bird state that to sufficiently compensate for the adverse effects, pest control should be implemented across the entirety of the neighbouring Manawatu Gorge Scenic Reserve to a 5% Residual Tracking Count, and also alongside the new State highway and in any replacement planting areas. I presume the assessment in Paragraph 22 of Forest and Bird's submission is based on the data contained in Technical Assessment 6 and its appendices.

49. There is an inherent contradiction here: Forest and Bird first state there is insufficient date to provide for a calculation of what measures are required to address adverse effects. However, they then go on to set out what sufficient compensation should entail, without having the evidence base that earlier in their submission they state is critical to have to ensure a net gain. It would appear from Paragraph 22 that Forest and Bird would be happy with an offset package that addressed pest control to the level and over the areas they specify, and that their earlier-stated concerns over data adequacy would not prevent this being an acceptable offset package.

50. Nevertheless, below I:

    (a) respond in detail to the concerns raised by Forest and Bird over the adequacy of data and the approach to determining the net-gain biodiversity offset package; and

    (b) clarify which effects are to be addressed through mitigation, and which are to be offset through the proposed delivery of other positive effects.

51. In response to Forest and Bird, I have further quantified the proposed avoidance, remedy/mitigation and other positive effects. One Plan Policy 13-4(b) provides:

    (a) consent for resource use activities in vegetation or habitats assessed to be significant under Policy 13-5 criteria should not be granted unless:

        (i) more than minor effects on the Policy 13-5 attributes of a habitat are avoided; or

        (ii) where avoidance cannot be reasonably achieved, the effects are remedied or mitigated at the point where the adverse effect occurs;

    (b) where following avoidance, remediation or mitigation measures residual adverse effects remain, these residual effects are to be offset so as to result in a net indigenous biological diversity gain.

52. There are eight ecosystem types occurring within the proposed designation area that are significant under Policy 13-5 (and are thereafter relevant to Policy 13-4(b)).

53. Through use of stringent effects envelopes, effects levels to ecosystems of high-very high conservation concern have been limited to achieve acceptable levels of adverse effects. In quantitative terms, 76% of the raupo-dominated seepage wetland, 97% of the old-growth alluvial forest and 56% of the old-growth hill country forest occurring within the designation area have been avoided through the proposed effects envelopes. These are three of the eight significant ecosystem types in terms of Policy 13-5.

54. The effects envelopes have been critical in allowing for ecologically acceptable development within the proposed designation area and I am comfortable with the effort undertaken and measures that have been proposed for the NoR phase of the Project.

55. For the remaining five significant ecosystem types[4], 65% of kānuka forest would be protected by an effects envelope. Effects management focuses on avoidance or minimisation of effects during detailed design, through management plan provisions to prevent unnecessary clearance of these

[4] Secondary Broadleaved Forests with OG Signatures, OG Treelands, Kānuka Forests, Indigenous-Dominated Seepage Wetlands (Mod. value), and exotic-dominated seepage wetlands (Low value).

ecosystem types, and through like-for-like replacement plantings at the rates prescribed in my recommended ECRs.

56. Aside from the high/very high conservation concern old-growth forest and seepage wetland ecosystems, all 'more than minor' adverse effects would be addressed through the proposed avoidance, remediation, mitigation and replacement planting measures. Other positive effects measures are therefore not required for these remaining ecosystem types.

Positive effects to address residual more than minor adverse effects

57. Residual more than minor adverse effects would occur from the potential impacts of up to 1.15 ha of old-growth forests and the 1.25 ha of affected indigenous seepage wetlands. This is due to the inability of replacement planting alone to adequately address the biodiversity lost from impacts to the vulnerable and irreplaceable old-growth forest and seepage wetland ecosystems. This means that a package of positive effects is required to make up for these residual more than minor impacts and to achieve a net indigenous biological diversity gain.

58. Effects management for the old-growth forests and seepage wetlands is based on a very proactive approach to biodiversity management by relying heavily on avoidance, which is consistent with avoidance being the first step in the mitigation hierarchy and having the greatest certainty of any effects management strategy.

59. It is important to understand that as a result of extensive avoidance of ecosystems that would require offsetting, the affected area of ecosystems requiring a package of positive effects is small (i.e., 2.4 ha required by One Plan criteria; 5.14 ha identified in total[5]) relative to both the project scale (375.7 ha designation area; 42.9 ha of existing indigenous ecosystem types) and the scale of the affected ecosystem types requiring replacement planting (26.87 ha).

60. Central to Forest and Bird's concern over the acceptability of the method used to derive the positive effects package, Policy 13-4(d)(ii) of the One Plan states an offset must reasonably demonstrate that a net indigenous biological diversity gain has been achieved using a methodology that is appropriate and commensurate to the scale and intensity of the residual adverse effect. I do

[5] The difference in area between 2.4 ha and 5.14 ha relates to exotic-dominated seepage wetlands that strictly speaking are not captured by One Plan resource consent criteria but as they meet the RMA definition of wetland have been included in the effects assessment and package of postitive effects.

not believe that the biological complexity of old-growth forests in particular can be adequately captured in a spreadsheet exercise, and I note that computations using a formal offset calculator must rely on expert judgement to populate many aspects of the model (such as defining choice of measures and metrics and setting a currency).

61. The revised New Zealand Impact Assessment Guidelines[6] states there is no universally agreed accounting and exchange system for New Zealand's terrestrial and wetland ecosystems. It suggests that in order to meet the Ecological Equivalence offsetting principle, that biodiversity at both the impact and offset site should be described and measured to quantify losses and gains. I have to a degree achieved this through my ecosystem type descriptions and quantification of effects and through my description and quantification of the recommended package of positive effects.

62. Rather, in this case, it is my opinion that the residual biodiversity effects resulting from impacts to 1.15 ha of old-growth forest (limited to moderate magnitude of effect for alluvial forest) and 1.25 ha of indigenous seepage wetlands can be appropriately addressed through a package of positive effects compiled and recommended on the basis of a professional opinion. For replacement plantings that would occur in pasture, I have described and quantified both the impact and restoration components of the offset package and it is my opinion that, for this relatively small scale transaction, I have demonstrated adequate Ecological Equivalency. As discussed in the response to DOC, the transaction for wetlands is more complicated as the ECR magnitude is dependent on the level of additionality available at the restoration site – so for this reason I have recommended the wetland ECR be confirmed at the time restoration sites are confirmed.

Herding of dotterels

63. Finally, regarding Paragraph 33 and the proposed herding of dotterels, Condition 16 c) iii. has been amended to clarify that nesting dotterels would be protected with an exclusion area and would only be relocated (by herding) if not actively nesting, and this would be done under the supervision of a suitability qualified person.

[6] EIANZ [Environment Institute of Australia and New Zealand] (2018). *EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems* [2nd Edition]. Retrieved from https://www.eianz.org/document/item/4447

Department of Conservation

64. Ecology review comments were received in a technical report[7] from the Ecological Consultant Dr Tim Martin, of Wildland Consultants, for DOC. Similar points were made in the DOC 13 December 2018 submission[8].

65. Following receipt of DOC's comments, I have consulted with DOC, with input as required from **Mr Blayney**, on their ecology-related submission points. My main response to DOCs submission points, provided on 1 February 2019, was appended to the Pre-hearing Meetings report submitted by the Transport Agency on 1 March 2019 (as Attachment D).

66. I participated in expert conferencing on a number of matters with Dr Martin on 22 February 2019. Dr Martin and I produced a joint statement, which was provided as Attachment C to the Pre-hearing Meetings Report filed on behalf of the Transport Agency on 1 March 2019. I refer to the statement as appropriate below.

67. The process of engaging with DOC, and in particular the Dr Martin's technical report and my responses, has (to my knowledge) resolved a number of DOC's submission points.

68. In summary, submission points raised by DOC which to my knowledge (to be confirmed by DOC) have been resolved include the following:

    (a) Submission point 5 a) – it was clarified that the ecosystem type mapping related to the entire designation area, and was updated to include areas assumed to be avoided. It was also clarified that One Plan Schedule F had not been used as a filter to identify the only vegetation and habitats requiring assessment.

    (b) Submission point 5 b) – further descriptions of the composition and structure (with representative photographs) of ecosystem types was provided to DOC on 21 February and a further expanded version was sent to DOC on 3 March 2019. To my knowledge this information satisfied DOC's request for further detailed data regarding vegetation.

[7] Wildland Consultants (2018). High-Level Guidance on Ecological Aspects of the Application to Bypass the Manawatu Gorge at SH3, Between Palmerston North and Woodville. Contract Report No. 4860a dated November 2018. Auckland: Wildland Consultants.

[8] Department of Conservation's (DOC) submission on publicly notified notices of requirement for a designation for a new State highway corridor to replace the indefinitely closed State Highway 3 route through the Manawatu Gorge. Dated 13 December 2018.

(c) Submission point 5 c), i), and j) – it was clarified that terrestrial habitats affected by proposed spoil sites were included in the scope of the effects assessment, and that effects to freshwater ecosystems would be addressed separately through the regional consenting process.

(d) Submission point 5 d) – at DOC's request, the loss of wetlands with exotic-dominated vegetation classes were delineated and included in the effects management regime.

(e) Submission point 5 e) and f) – at DOC's request, the terrestrial invertebrate values of young successional vegetation and the lizard and terrestrial invertebrate values of the 0.33 ha divaricating shrublands were reviewed by **Mr Blayney** (who addresses these points in his evidence).

(f) Submission point 5 g) (indigenous fauna of exotic vegetation) – was addressed by **Mr Blayney** (who addresses these points in his evidence).

(g) Submission point 5 h) – a review was undertaken for any differences in ecosystem type mapping between expert reports with points of clarification being provided.

69. The DOC submission sought revision of the package of positive effects in the following areas (at point 7 of the DOC submission):

(a) *Inclusion of wetlands that have exotic-dominated vegetation compositions* – although I note the One Plan Schedule F does not recognise exotic-dominated wetland ecosystems, these ecosystems do meet the RMA wetland definition, and given the scarcity of wetland ecosystems regionally and nationally I have included exotic-dominated wetlands as an ecosystem type and propose an ECR for management of effects to these wetlands. I have identified and mapped a number of exotic wetlands and recommend a condition requiring a full survey for exotic wetland to be conducted as part of the Outline Plan stage. This is due to the limited time I have had to respond to this request and that field visits are necessary for the identification and validation of this ecosystem type.

(b) *Inclusion of all indigenous wetlands* – it was clarified that all indigenous wetlands had been included in the NoR ecosystem type maps. Stock had been retired from one indigenous wetland at CH10550 and the

expanded indigenous vegetation wetland area was reflected in the updated ecosystem type layer.

(c) *Schedule F as a filter* – it was clarified that Schedule F had not been used as a filter to determine which ecosystem types required assessment. No changes were required in this regard.

(d) *Indigenous vegetation within spoil sites* – it was clarified that indigenous vegetation within spoil sites was included in the assessment except for where indigenous vegetation was proposed to be avoided. The draft conditions (as put forward by **Ainsley McLeod**) have subsequently been updated to specify that there will be no physical works (other than restoration planting) within the "Ramarama Protection Area", which is an area that includes valuable indigenous vegetation (including ramarama) adjacent to the western boundary of the Western QEII site at CH5700.[9] A diagram (Figure B) showing the boundary of the Ramarama Protection Area (in red) relative to the proposed designation boundary (in purple) is provided below.

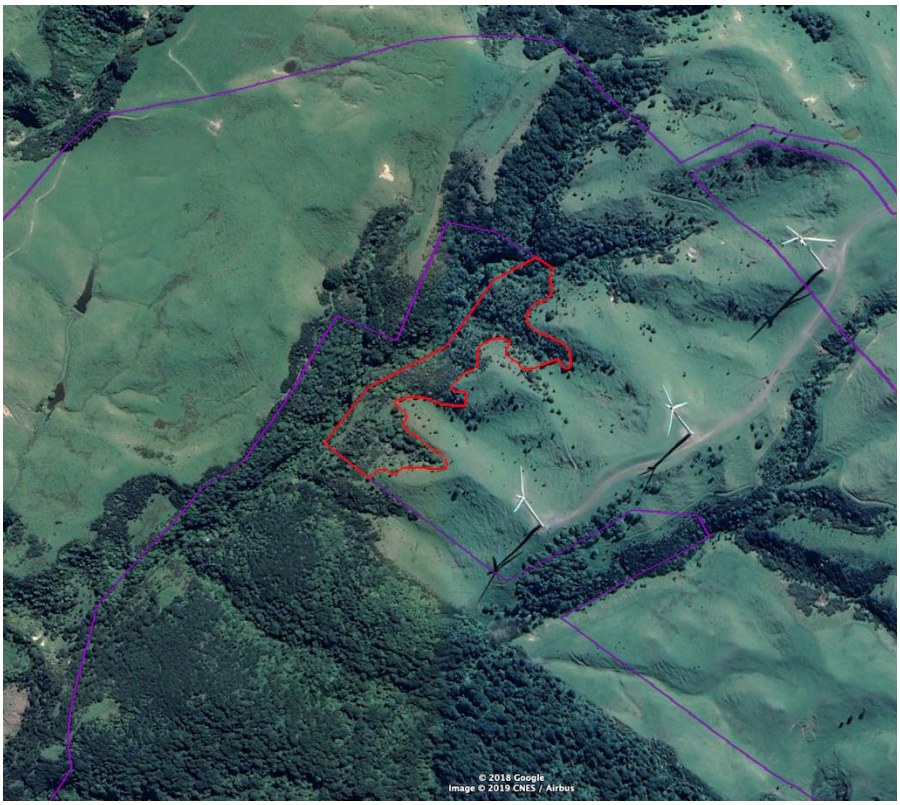


Figure B: Proposed Ramarama Protection Area

(e) *Proposed enhancement works need to address all areas of ecological value that are to be lost, use offset ratios that recognise time lags and*

[9] Refer to draft condition 2(b) and 5(e)(ii).

the value of what is to be replaced, and provide certainty of both implementation and long-term maintenance – further work was undertaken to ensure all ecosystem types requiring assessment and effects management were included in the proposal. As already noted, this resulted in the inclusion of exotic-dominated wetlands as an ecosystem type. Consideration was given to DOC's suggested changes to the proposed ECRs, as discussed below.

Proposed ECRs that are not subject to DOC Comments

70. DOC have queried[10] five of the twelve proposed ECRs. DOC have not queried the following ECRs and I therefore take it that the following proposed ECRs are not in contention by DOC:

    (a) Old-Growth Forests (Alluvial); ECR 12:1;

    (b) Old-Growth Forests (Hill-Country); ECR 10:1;

    (c) Secondary Broadleaved Forests with Old-Growth Signatures; ECR 5:1;

    (d) Old-Growth Treelands; ECR 5:1;

    (e) Kānuka Forests; ECR 5:1;

    (f) Secondary Broadleaved Forests and Scrublands; ECR 3:1; and

    (g) Divaricating Shrublands; ECR 3:1.

Addressing DOC's Comments on proposed ECRs

71. I address DOC's comments on each of the remaining ecosystem type ECRs below. The ECRs (as set out in Technical Assessment 6) that I understand DOC to be concerned about are:

    (h) mānuka, kānuka shrubland; ECR 1:1;

    (i) advanced secondary broadleaved forest; ECR 4:1;

    (j) exotic-dominated wetlands; ECR 1:1;

    (k) degraded indigenous-dominated wetlands; ECR 2:1; and

    (l) relatively-intact indigenous dominated wetlands; ECR 4:1.

[10] Stated in the Wildland Consultants November 2018 High-level Initial Guidance Report and in statements recorded by Dr Martin during expert conferencing on 22nd Feburary 2019.

72. Dr Martin's concern over the proposed **mānuka, kānuka shrubland** ECR of 1:1 is on the basis there is no multiplier to address the time lag required for the planted composition to replace the affected structure. In response, I note that much of the mānuka/kānuka shrublands occur at a lower and more variable stem density then would occur in replacement plantings, meaning there is an intrinsic multiplier where the replacement planting results in a higher-density stand structure compared to the affected vegetation. In addition, I note the proposed ECR 1:1 for replacement of mānuka/kānuka shrubland in pasture is consistent with the ECR 1:1 for shrubland in pasture established through the Transmission Gully Board of Inquiry process.

73. However, in an effort to address Dr Martin's comment regarding a need to better reflect time lag in the mānuka/kānuka ECR, while taking the above factors into account, I have recommended a revised mānuka/kānuka ECR of 1.5:1. This represents a 1:1 habitat replacement ratio with a 1.5 time-lag multiplier applied. By way of analogy, the 1.5 time-lag multiplier is employed as a matter of routine within the Stream Ecological Valuation[11] ("**SEV**") environmental compensation calculation.

74. The multiplier magnitude reflects that riparian forest growth and associated ecological gains (e.g., canopy closure and microclimate benefits) take 10-years or more from the time of planting nursery-raised seedlings. The timeframes underpinning the multiplier are conservative for the mānuka/kānuka shrubland ecosystem type. That is because SEV relates primarily to riparian forest restoration timeframes[12], which would be similar or slower (depending on the species and position) than the likely growth rates of planted and maintained nursery-raised seedlings of mānuka/kānuka.

75. Regarding the **advanced secondary broadleaved forest** ECR of 4:1, Dr Martin comments that the ECR should be increased to 5:1 due to the high historic forest loss in the Project area, and so that it is equivalent to that proposed for kānuka forest ECR 5:1. I confirm that the extent of forest loss is already an intrinsic consideration in all of the recommended forest ecosystem ECRs, as this factor forms part of what I considered when assigning ecological value to ecosystem types.

[11] See http://knowledgeauckland.org.nz/assets/publications/GD2011-001-Stream-ecological-valuation-SEV-users-guide-reprint-Nov-2015.pdf
[12] See page 52 of http://knowledgeauckland.org.nz/assets/publications/GD2011-001-Stream-ecological-valuation-SEV-users-guide-reprint-Nov-2015.pdf

76. What sets kānuka forest apart from the advanced secondary broadleaved composition is that kānuka is:

(a) a regionally Threatened ecosystem type (i.e., it is listed in Schedule F of the One Plan); and

(b) is a forest almost entirely comprising a canopy species of Threatened - Nationally Vulnerable[13] status.

77. While the advanced secondary broadleaved forest does not hold these attributes, the broadleaved composition is of an advancing maturity and does occur within a Chronically Threatened Land Environment,[14] and is legally protected.

78. This said, and in an effort to address Dr Martin's comment, I have recommended a revised ECR of 5:1 for advanced secondary broadleaved forest. As a total of only 0.98 ha of the advanced secondary broadleaved forest composition could be cleared (due to the protection afforded by the effects envelope at CH5700), this has only a minor consequence for the replacement planting quantum.

79. I note that the revisions to the mānuka, kānuka and advanced secondary broadleaved forest ECR described above mean that no forest or shrubland ECRs are left in contention from DOC's submission or their subsequent comments.

80. Regarding the three relevant categories of **exotic wetlands / seepage wetlands**, time lag for replacement of the lost exotic composition is not a relevant consideration, as a like exotic vegetation class is likely to be already present at the time the restoration site is secured and protected. This means that the floristic value of affected exotic seepage wetlands would be surpassed at the time indigenous wetland species were planted, with biodiversity gains accruing from that point on.

81. However, as seepage wetlands are irreplaceable and serve roles in addition to the provision of habitat (e.g., hydrological buffering), there is no option for effects management but to trade reduced wetland extent for improved condition of existing wetlands. For affected exotic-dominated wetlands,

[13] See https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs22entire.pdf
[14] See https://www.landcareresearch.co.nz/__data/assets/pdf_file/0012/106131/Threatened_Environment_Classification_2012.pdf

restoring an equivalent area of exotic wetland with indigenous wetland flora provides an overall gain in wetland condition.

82. Logically, to accommodate the overall loss of wetland extent, an additional area of restoration would be required. This additional margin to reflect net loss in wetland area relates to all wetland types that are unable to be recreated. I have considered this aspect further and have recommended the following revisions to wetland ECRs:

    (a) Exotic-dominated wetlands = ECR 1.5:1 (revised from 1:1).

    (b) Degraded indigenous-dominated wetlands (e.g., CH10200) = ECR 3:1 (revised from 2:1).

83. No change is proposed for the relatively-intact indigenous-dominated wetland ECR (e.g., CH4100) = ECR 4:1.

84. These wetland ECRs would be confirmed once the restoration site(s) is confirmed (see discussion below).

85. The full updated set of ECRs are shown in Appendix B, which is an updated version of Table 6.A.1, setting out mitigation and positive effects quantities. These updated ECRs have been accepted by the Transport Agency and are reflected in draft conditions as put forward by **Ainsley McLeod**.

Terminology Used to Describe Positive Ecological Effects – Environmental Compensation Versus Biodiversity Offsetting

86. DOC's Submission point 8 requested differentiation of matters to be addressed through compensation from those to be addressed through biodiversity offsets. This point was traversed in expert conferencing with Dr Martin[15], and I recap on the main conclusions here.

87. In my experience the use of terminology regarding mitigation versus compensation versus offsetting has evolved over recent years. I am aware of numerous projects where ecological replacement planting beyond the point of impact has been regarded as a form of ecological mitigation.

88. With respect to positive ecological effects, the most recent New Zealand guidance[16] suggests that mitigation activities are those that address effects at the point of impact. Aspects of the proposed positive effects that aim to

[15] See the Joint Statement of Dr Forbes and Dr Martin (Ecology Experts) 22 February 2019.
[16] See Section 7 of https://www.eianz.org/document/item/4447

mitigate adverse effects at the point of impact include planting of severed forest edges to limit microclimate edge effects within retained forest remnants.

89. Where it is not possible to address adverse effects at the point of impact, a package of positive effects is recommended comprising legally-protected like-for-like replacement plantings, plus retirement, protection and gap planting of degraded ecosystems and ongoing animal pest control to densities where the forest ecosystems can thrive.

90. Analysis of this package of positive effects against offset principles (Maseyk et al., 2018)[17] shows that the proposed package meets most principles. As restoration sites are currently unconfirmed, it is difficult to confirm the precise level of gain that restoration activities would yield. This is less of an issue for forests and shrublands were I have assumed the replacement planting would be in exotic pasture (i.e., retired farmland). Where pasture is planted with native shrub and forest species, there is a considerable margin of additionality available. Less clear is the existing value of the required wetland restoration sites and while I have recommended ECRs to address these effects, the ECR for wetlands should be confirmed once the restoration site is secured.

91. A second matter to consider with regard to the proposed package of positive effects in the context of offsetting principles is that it is developed based on my assessment of the types, areas and condition of affected ecosystem types, and uses my opinion to balance the loss with gain. This balancing is in part calculated using ecosystem specific ECRs which guide habitat replacement at rates that reflects the affected values and time required to replace affected ecosystems. In addition, other positive effects that are of direct relevance (i.e., in-kind) to the restoration of the affected ecosystems (retirement of existing ecosystems and pest control) are proposed to provide an additional margin of biodiversity gain, which is particularly important in the context of One Plan Policy 13-4.

92. While intensive efforts have gone into avoiding or otherwise minimising the level of effect to ecosystems of high conservation concern, not all of these adverse effects can be avoided (e.g., old-growth forests), and for these specific ecosystems, a net loss biodiversity outcome could conceivably

[17] See Table 1 of http://www.lgnz.co.nz/assets/Uploads/7215efb76d/Biodiversity-offsetting-under-the-resource-management-act-full-document-....pdf

occur. This is because old-growth forests hold levels of biological and functional complexity that are impossible to replicate using the available restoration treatments. This is why it is important that the replacement plantings and other relevant biodiversity effects are implemented to ensure an overall biological diversity net-gain position is achieved.

93. I note that the most recent offsetting guidance (Maseyk et al., 2018)[18] states that demonstrating ecological equivalence requires quantitative analysis of biodiversity losses and gains within an objective and repeatable framework, and unless this is achieved, not all offsetting principles can be met and thus the package cannot qualify as a biodiversity offset. As an experienced Forest Ecologist it is clear to me that complex ecosystems cannot be sufficiently described in quantitative terms using available methods or models. I am concerned that best-practice guidance directs to this practice with such confidence that it is held as the only way to credibility balance biological loss with gain.

94. What I have proposed in revised Table 6.A.1 represents what I consider to be a package of positive effects that is ecologically appropriate and adequate to address the adverse effects to ecosystems and the species supported.

95. The package performs well against biodiversity offsetting principles, although not all principles are strictly met. As the proposed gains are greater than the losses, the treatments proposed are not out-of-kind, and the areas and types of biodiversity have been balanced using Table 6.A.1, I consider the positive effect package to be conservative. In my opinion the package is one from which an overall gain in biodiversity can be expected.

Queen Elizabeth the Second National Trust

96. The submission of the QEII Trust opposes the inclusion of land subject to QEII Trust covenants within the designation corridor.

97. There are two sites subject to QEII Trust covenants within the designation corridor, referred to as the Western (CH5600-5800) and Eastern (CH6100-6400) QEII sites. Both sites have been the subject of extensive investigations into avoidance or minimisation of adverse ecological effects. These investigations were necessary not only because of the legally-protected status of the QEII sites but also due to the ecological significance

[18] See page 22 http://www.lgnz.co.nz/assets/Uploads/7215efb76d/Biodiversity-offsetting-under-the-resource-management-act-full-document-....pdf

and value of many of the ecosystems contained within the covenants. As described in Paragraphs 61-66 of Technical Assessment 6, for the Western QEII site, the objective of investigations was to reduce adverse effects on Very High value old-growth forest and High value advanced regenerating forest plus also High value tributaries.

98. However, for the reasons outlined in Paragraph 66 of Technical Assessment 6 and in the evidence of **Andrew Whaley**, it became clear that no alternative alignment within the designation corridor could avoid or significantly minimise adverse effects on the Western QEII site. At this point I recommended (and the Project team accepted) that an effects envelope be imposed on the Very High and High value ecosystems of the Western QEII covenant. I recommended to the Project team that adverse effects must be minimised through the detailed design of the road in this location (e.g., through use of bridging and retaining walls to minimise the disturbance footprint). I have also proposed a package of positive ecological effects to address the residual adverse effects to the hill-country old-growth forest that is anticipated by the effects envelope.

99. In a similar vein, and as described in Paragraphs 68-69 of the Terrestrial Vegetation and Habitats Assessment, the Project team undertook investigations into three alignments within the designation corridor to explore options for the avoidance or minimisation of effects on the Eastern QEII site. However, due largely to the low elevation of the design relative to the terrain at the Eastern QEII site, there was insufficient height to bridge the covenanted area. Thus I recommended that adverse effects to the affected ecosystems contained within the covenanted area be minimised through the effects envelope recommended in Section 5.3.3 of the Vegetation and Habitats Assessment. I have prescribed mitigation to address the adverse effects to the affected ecosystem types occurring within the Eastern QEII covenant.

100. The presence and values of QEII covenanted areas were a consideration during the process of considering alternative designation corridors for the Project. During that process, (described generally in the evidence of **Scott Wickman**), I recommended the avoidance of four other QEII covenants located on Bolton's land adjacent to CH7700-8300. All four of these covenants are located outside of the proposed designation area and therefore direct effects to these areas have been completely avoided.

Andrew Blayney discusses indirect effects to these areas in his statement of evidence.

101. I have described in my response to James Lambie (the Terrestrial Ecology Section 42A Report author) the context within which the Western QEII was assessed in terms of risk and constraint during the Detailed Business Case ("**DBC**") phase.

Manawatū River Source to Sea

102. Manawatū River Source to Sea ("**Source to Sea**") is generally supportive of the Project, but does make general comments about potential ecological effects.

103. Source to Sea comments that the Project would "*compromise a wetland area with swamp maire as well as a QEII site*". Source to Sea is correct that a 0.56 ha raupo-dominated seepage featuring a stand of swamp maire near its southern extent is within the proposed designation area (at CH4000–4200). As noted above, there are two QEII covenanted areas within the designation corridor, which will inevitably be crossed around CH5500-5800 and also at CH6100-6400.

104. Given the ecological values and levels of conservation concern contained within the seepage wetland and QEII sites, these features have been the subject of intense efforts to avoid or otherwise minimise effects. Avoidance and minimisation has principally been via the effects envelopes that I propose in the Terrestrial Vegetation and Habitats Assessment. In particular, effects envelopes have limited the extent and magnitude of disturbance within the raupo seepage (no more than 0.13 ha of Moderate magnitude/High level of effect is allowed), and the application stipulates that all swamp maire trees must be retained with effects of any canopy pruning (if required) to result in Low or Negligible magnitude of effect/Moderate or Low level of effect.

105. Effects on the alluvial old-growth forest and kānuka forest around CH4000–4300 are also minimised through effects envelope parameters that are specified in the Terrestrial Vegetation and Habitats Assessment. Swamp maire has been specified to the seed collectors, meaning that ecosourced seedlings will be incorporated into the proposed replacement planting areas. In a similar vein, the clearance extent of indigenous terrestrial ecosystem types within the two QEII sites is strictly limited through specific effects

envelopes, as detailed in the Terrestrial Vegetation and Habitats Assessment.

106. Regarding Source to Sea's comment about the inclusion of ecosourcing in the positive effects package, I can confirm that all replacement plantings will be ecosourced (seed collection has already commenced from the designation area) and that the replacement planting areas will be configured to enhance the ecological functionality at the landscape scale.

Rachel Keedwell

107. Rachel Keedwell notes the adverse effects to old-growth forest, swamp maire and the raupo seepage wetland, and goes on to state concern that replacement planting is proposed to offset the loss of mature trees and forest types, in that it would take decades to offset the effects and at the very least extensive predator control should be listed as mitigation to ensure there is no net loss in biodiversity.

108. In reply, I note that the extent and magnitude of effects to old-growth forest, the raupo seepage, and swamp maire has been the subject of much detailed work, and effects management has been structured using effects envelopes to limit effects to features of High and Very High value/conservation concern.

109. The irreplaceability of old-growth forests and the raupo seepage wetland has been discussed in detail the Terrestrial Vegetation and Habitats Assessment and forms part of the rationale for the package of positive effects that I have recommended, above and beyond replacement planting, to ensure a net gain in biological diversity can be attained. Specifically, in addition to replacement planting I have recommended the retirement and protection of approximately 32 ha of old-growth forest (which is currently grazed and includes existing swamp maire remnants) and pest control over the entire replacement planting and retirement area. As such, I consider the existing package of positive effects adequately addresses the limited impacts to old-growth forest, raupo-dominated seepage wetland, and swamp maire.

Brent Barrett

110. Brent Barrett states that the unavoidable impacts on biodiversity resulting from the Project should be offset by making the Manawatū Gorge a predator free zone to allow the reintroduction of rare native birds and other animals. The submission states that a simple acre for acre approach is not supported as it fails to recognise the value of existing, mature and original biodiversity.

111. I note the replacement planting proposed applies a range of ECRs, by which replacement planting area can be calculated based on the extent of affected habitat. As per Table 6.A.1 in the Terrestrial Vegetation and Habitats Assessment, for all but the most simple ecosystem type (mānuka/kānuka regeneration in exotic pasture) replacement planting would be provided at up to five times greater extent than is affected. It is therefore inaccurate to refer to the replacement planting as 'acre for acre'.

112. Further, where irreplaceable ecosystems such as old-growth forest or seepage wetlands are affected, other positive effects are recommended in addition to replacement planting – such as retirement and protection of existing currently-grazed old-growth forest and extensive ongoing pest control. It is the combination of habitat replacement through planting and other positive effects that would be relied upon to achieve a net gain in biological diversity.

113. While I am open to the incorporation of pest control within the Manawatū Gorge Scenic Reserve as part of the existing proposed package of measures to address ecological effects, it is important that lost habitats are replaced (net gain in the area of like ecosystem types) as a part of the offset package, and this is provided for in the recommended ECRs.

Submissions on the AgResearch Ballantrae Research Station

114. **Andrew Whaley** comments in his evidence on the suggestion made by Cory Matthew regarding potential routes sketched to the south of Ballantrae.

115. I have looked at the ecological attributes that might be affected by options through this area. The interaction of the design with the gully systems is of concern in ecological terms due to impacts to secondary/advanced secondary broadleaved forest (and associated fauna) and from a regional consenting point of view additional impacts to a significant number of waterways. I would advise against the alternative options as sketched on ecological grounds.

COMMENTS ON COUNCIL SECTION 42A REPORTS

Terrestrial Ecology (James Lambie)

116. To help progress matters, I respond to several points raised by **James Lambie** and I group my responses by topic with reference to specific paragraphs of **Mr Lambie's** report.

Western QEII – efforts to avoid or minimise adverse effects to the ecosystems of this site

117. I respond as follows to comments made in paragraph 121:

    (a) querying why the current option was not judged as fatally flawed; and

    (b) suggesting that the QEII covenant status should have indicated the presence of significant ecological assets within the proposed NOR corridor.

118. There are several aspects of the DBC process which are important to understand in terms of how the Western QEII was evaluated through that process.

119. Firstly, the DBC process is not a fulsome assessment of effects process (of the kind that would be expected when applying for RMA authorisations), and does not include estimates of mitigation/offset requirements. A fulsome assessment of effects requires the values of ecological features to be confirmed. This would require detailed assessment of the ecological values of all options considered through the DBC process (18 corridor options at the long list stage).

120. That would be unrealistic as it would mean repeating the level of ecological assessment that we have undertaken for the NoR on each unique option. As the details of ecological values were unconfirmed, this also meant that an assessment of conservation concern/offsetability was not possible – as this would have required detailed data regarding species and ecosystem attributes. Paragraph 120 speculates that some regard is likely to have been had in my methodology to EIANZ (2018). However, the basic structure of the EIANZ (2018) impact assessment approach requires (1) the ecological value and (2) magnitude of effect to be known – and this level of information was not available during the DBC.

121. Instead of assessing ecological effects, the focus of the DBC process was on evaluating ecological risk and levels of constraint. I would add that over the last decade I have participated in multiple Multi-Criteria Analysis ("**MCA**") options assessments for large infrastructure projects. The approach amongst experts has generally been focussed on an assessment of risk/constraint to inform the MCA process, followed by a detailed assessment of effects on the preferred option.

122. While it is tempting now with the plentiful effects assessment data available (for the few sites concerned) to criticise the conclusion of the DBC process, it should be remembered that the DBC, out of necessity, comprises a higher level of assessment which is informed by the best information that is readily available through existing sources and targeted site visits. Each of the four shortlisted options presented substantial ecological constraints, so again, while it is perhaps natural now to focus on several high value sites, the DBC required consideration of a much wider collection of high risk/high constraint sites (spread over many hundreds of hectares across the Tararua and Ruahine Ranges).

123. All QEII sites within the study area were identified during the DBC phase (the national dataset was used) and each was recognised as presenting a high level of risk/constraint. The majority of QEII sites were avoided by the Project corridor on this basis.

124. Whether a QEII site presented a fatal flaw was dependent on the ecological features contained within the site boundaries (the detail of which is normally unconfirmed until an effects assessment is undertaken), how a design can be developed to avoid or minimise interactions, and whether the level of risk constituted something that could be professionally supported. It was not possible to draw firm conclusions over the levels of effect, the level of conservation concern, or the likely effects management measures.

125. In the case of the Western QEII, it appeared there would be options for avoidance/minimising effects through design (e.g., bridging and alignment), and based on the process and information available there were no grounds to suggest the option was fatally flawed due to the covenant's presence. I would add that 'fatally flawing' an option is a serious matter for the MCA/DBC process and the decision requires a clear rationale.

126. As described elsewhere in my evidence, during the NoR development there have been extensive efforts undertaken to minimise adverse effects to the ecosystems of the Western QEII. I have recommended the effects envelope to limit adverse effects, and have identified that the detailed design process must take steps to minimise the level of effect on the ecosystems of the area. Unfortunately, the level of effect remains at Very High. I have reported this and have developed a package of positive effects that overall and in combination addresses impacts, particularly to the high conservation concern ecosystems.

Availability of restoration sites and stakeholder consultation

127. I have identified a number of areas that in ecological terms would be suitable for restoration activities to address the Project's adverse effects. This is not to say there are not other candidate restoration sites available. For instance, during the 15 February 2019 mitigation workshop (described below) a participant identified a large collective area of candidate alluvial and wetland restoration sites in the Ferry Reserve and on alluvial surfaces east of the Manawatū Gorge (Appendix D). Regarding landowner negotiations and procurement of restoration sites, I defer to **Lonnie Dalzell** to describe the process and intentions of the Transport Agency.

128. By way of update, stakeholder consultation regarding the package of positive effects is ongoing and has most recently included an ecological mitigation workshop (15 February 2019) held in Palmerston North where a number of stakeholders attended and discussed options for the package of ecological positive effects.

129. Suggestions from participants included the need for positive effects to be additional and clearly linked to Project effects. Also raised was a desire to integrate positive effects with the draft Manawatū Gorge master plan and Iwi management plans. One participant raised additional options for wetland mitigation planting which for the record I have included as **Appendix D** to my evidence.

130. During the workshop it was stated that possum numbers across the wider Te Apiti landscape were already <5% residual trap catch ("**RTC**"; a matter we have since confirmed with Horizons Biosecurity staff). In contrast, information subsequently supplied by DOC[19] suggests that (as of June 2018) possum (18% RTC) and rat levels (93% tracking rate) are elevated in the forest of the northern Manawatū Gorge Scenic Reserve. In this case the addition of mustelid control leading to a focus on rats and mustelids would be a clear additional positive effect if it was technically feasible.

131. As another (related) example of stakeholder participation, **Andrew Blayney** and I have in conjunction with **Siobhan Lynch-Karaitiana** and **Paul Horton** (of Rangitāne) recently explored the concept of a pest control buffer (a "ring of steel" controlling rats and mustelids) around the northern forest of the Manawatu Gorge Scenic Reserve. This could provide a positive effect in that

[19] Possum and rat control in Te Apiti – Manawatu Gorge. Battle of our Birds (August 2018). Department of Conservation.

the forest of the northern Manawatū Gorge Scenic Reserve would be more defendable against pest encroachments from the surrounding landscape. As described by **Andrew Blayney** this could mean mustelid control becomes an option for the forests of the northern Manawatū Gorge Scenic Reserve.

Suggested condition changes

132. I would support updating the condition relating to providing for 'equivalence of type' for planting, as suggested by Mr Lambie at paragraph 152 of his report.

133. In my view the matters addressed at paragraphs 227, 228 and 230 (offset planting plan) and 235 (stakeholder involvement in offset development) are appropriately addressed in draft Condition 17 (the requirement for an Ecological Management Plan).

134. Regarding paragraph 231, the avifauna condition has been amended to clarify the protection of breeding birds, as outlined in the evidence of **Andrew Blayney**.

135. I defer to **Andrew Blayney** to comment on other matters raised relating to fauna.

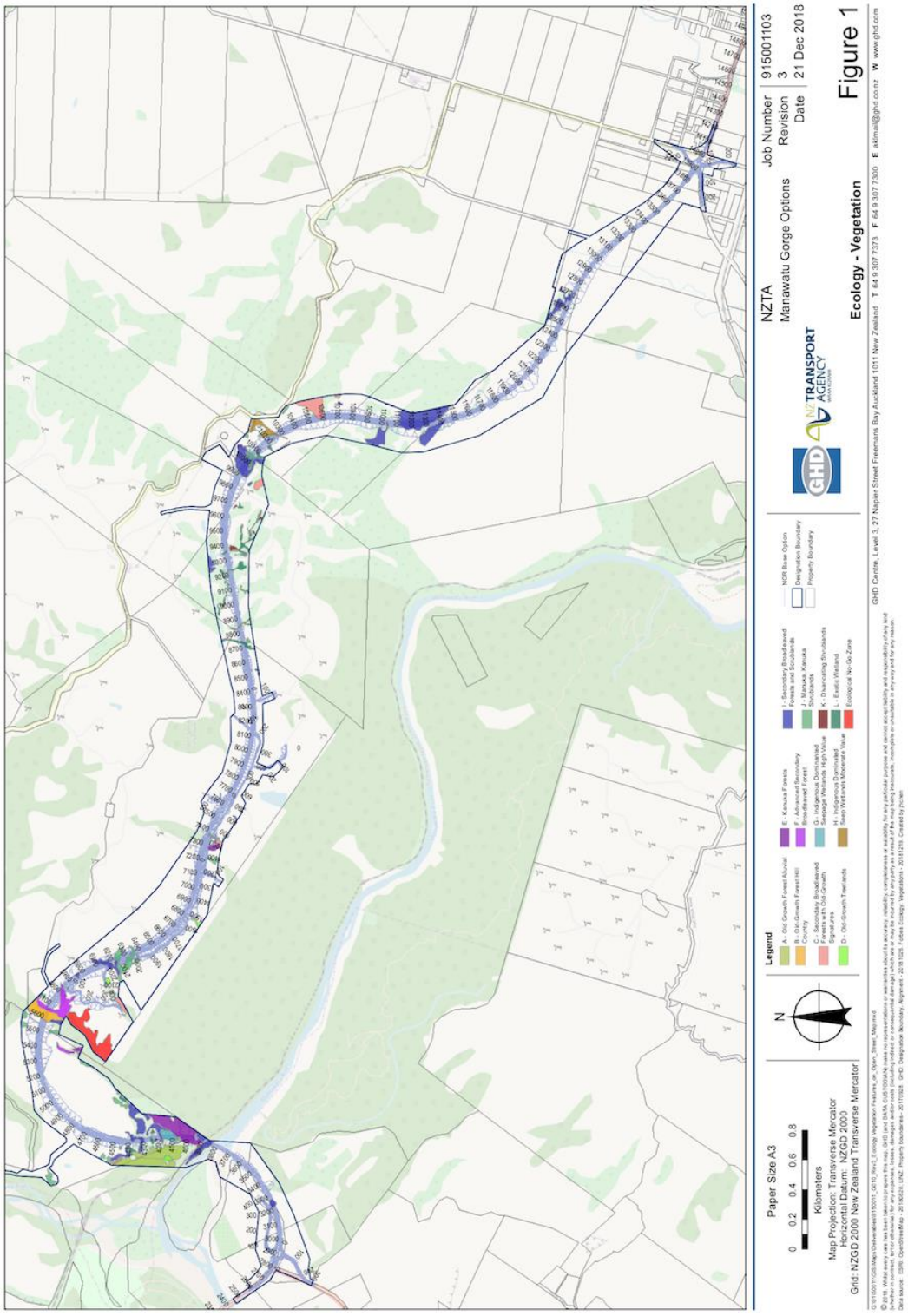
Construction and earthworks (Gregor Mclean)

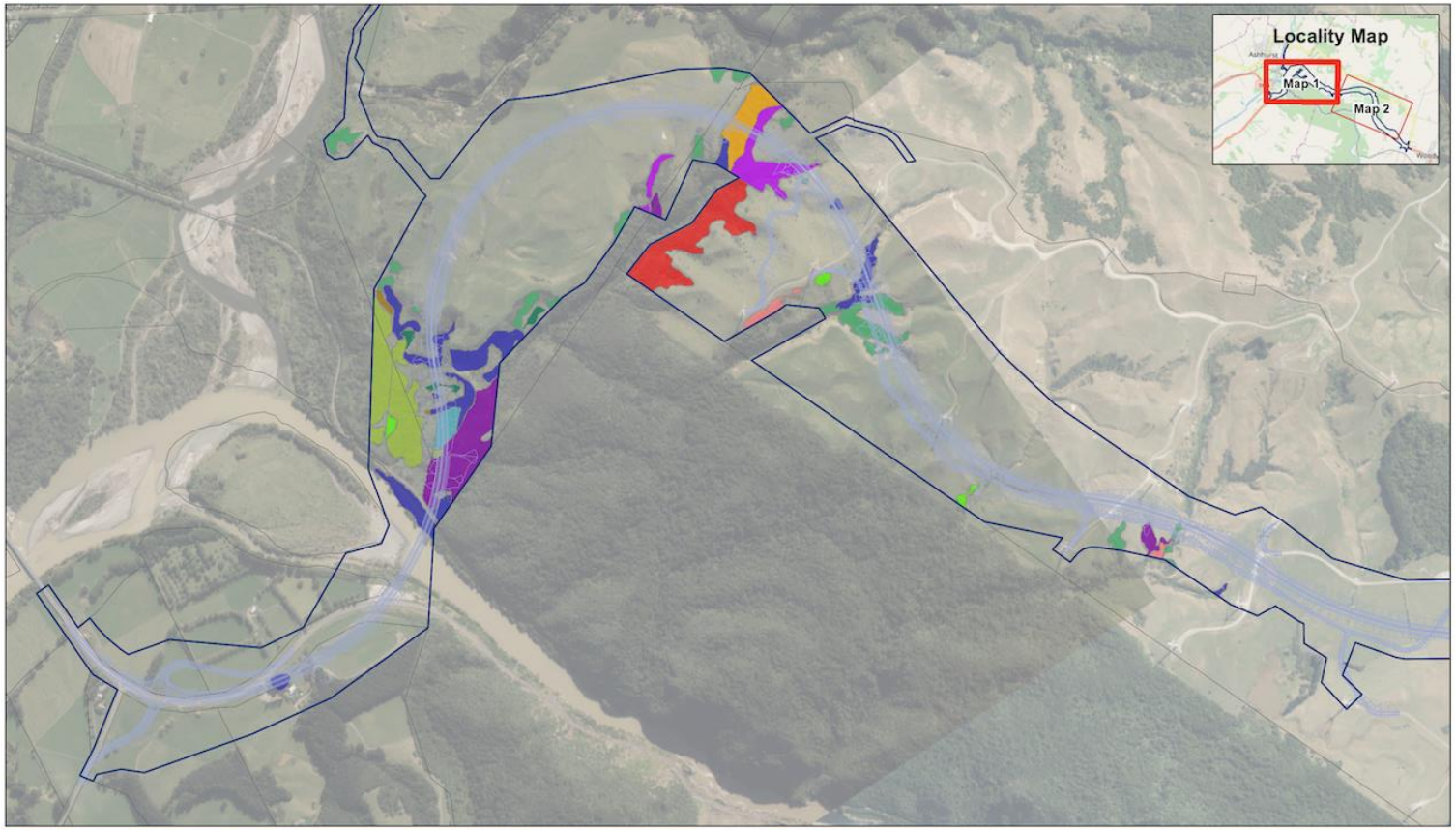
136. Regarding queries as to whether the Project's terrestrial ecology effects envelopes have made sufficient provision for engineering activities, such as the construction-related stormwater treatment (e.g., paragraph 40), I can confirm the effects envelope parameters were developed in careful consultation with the design, structures, access and construction disciplines of the NoR team and **Andrew Whaley** addresses this aspect further in his evidence.

Dr Adam Forbes

8 March 2019

APPENDIX A – REVISED ECOSYSTEM TYPE MAPS





Paper Size A0

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

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Legend

A - Old Growth Forest Alluvial
B - Old Growth Forest Hill Country
C - Secondary Broadleaved Forests with Old-Growth Signatures
D - Old-Growth Treelands
E - Kanuka Forests
F - Advanced Secondary Broadleaved Forest
G - Indigenous Dominanted Seepage Wetlands High Value
H - Indigenous Dominated Seep Wetlands Moderate Value
I - Secondary Broadleaved Forests and Scrublands
J - Manuka, Kanuka Shrublands
K - Divaricating Shrublands
L - Exotic Wetland
Ecological No-Go Zone
NOR Base Option
Property Boundary
Designation Boundary

NZTA
Manawatu Gorge Options

Job Number 915001103
Revision 3
Date 21 Dec 2018

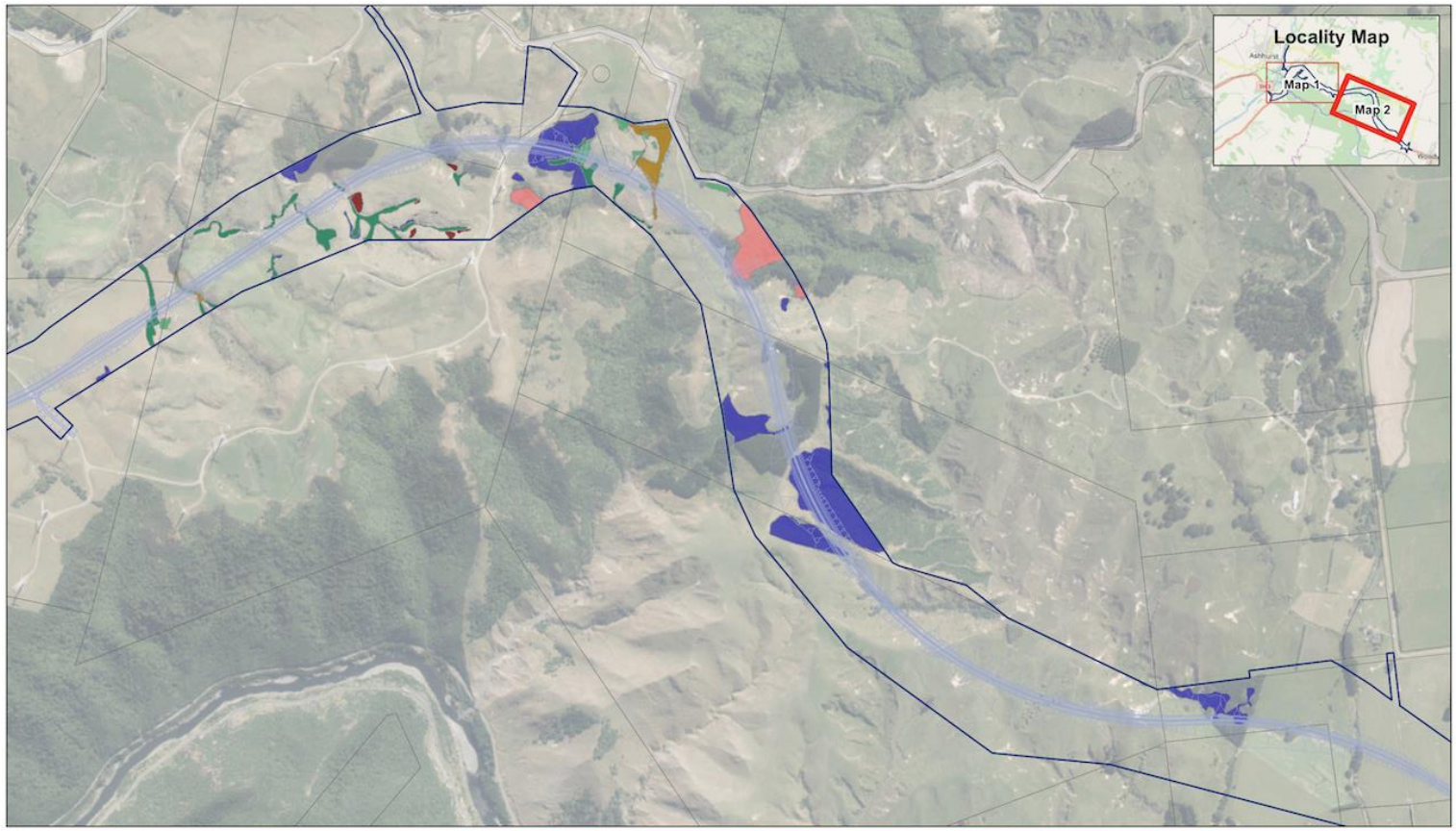
Indigenous Ecosystem Types
Map 1 of 2

Figure 1

G:\91\50011\GIS\Maps\Deliverables\9150011_G011_Rev3_Indigenous Ecosystem Types.mxd

Data source: ESRI: OpenStreetMap - 20180828; LINZ: Property boundaries - 20170928. GHD: Designation Boundary - 20181026. Forbes Ecology: Vegetations - 20181025. Created by:jhchen

GHD Centre, Level 3, 27 Napier Street Freemans Bay Auckland 1011 New Zealand T 64 9 307 7373 F 64 9 307 7300 E aklmail@ghd.co.nz W www.ghd.com



Paper Size A0

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

Legend

A - Old Growth Forest Alluvial
B - Old-Growth Forest Hill Country
C - Secondary Broadleaved Forests with Old-Growth Signatures
D - Old-Growth Treelands
E - Kanuka Forests
F - Advanced Secondary Broadleaved Forest
G - Indigenous Dominanted Seepage Wetlands High Value
H - Indigenous Dominated Seep Wetlands Moderate Value
I - Secondary Broadleaved Forests and Scrublands
J - Manuka, Kanuka Shrublands
K - Divaricating Shrublands
L - Exotic Wetland
Ecological No-Go Zone
NOR Base Option
Property Boundary
Designation Boundary

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WAKA KOTAHI

NZTA
Manawatu Gorge Options

Job Number 915001103
Revision 3
Date 21 Dec 2018

Indigenous Ecosystem Types
Map 2 of 2

Figure 1

G:\915001\GIS\Maps\Deliverables\915001_G011_Rev3_Indigenous Ecosystem Types.mxd

Data source: ESRI: OpenStreetMap - 20180828; LINZ: Property boundaries - 20170928. GHD: Designation Boundary - 20181026. Forbes Ecology: Vegetations - 20181025. Created by:jhchen

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APPENDIX B – REVISED TABLE 6.A.1 POSITIVE EFFECTS PACKAGE PARAMETERS

Revised Table 6.A.1. Positive effects quantities.

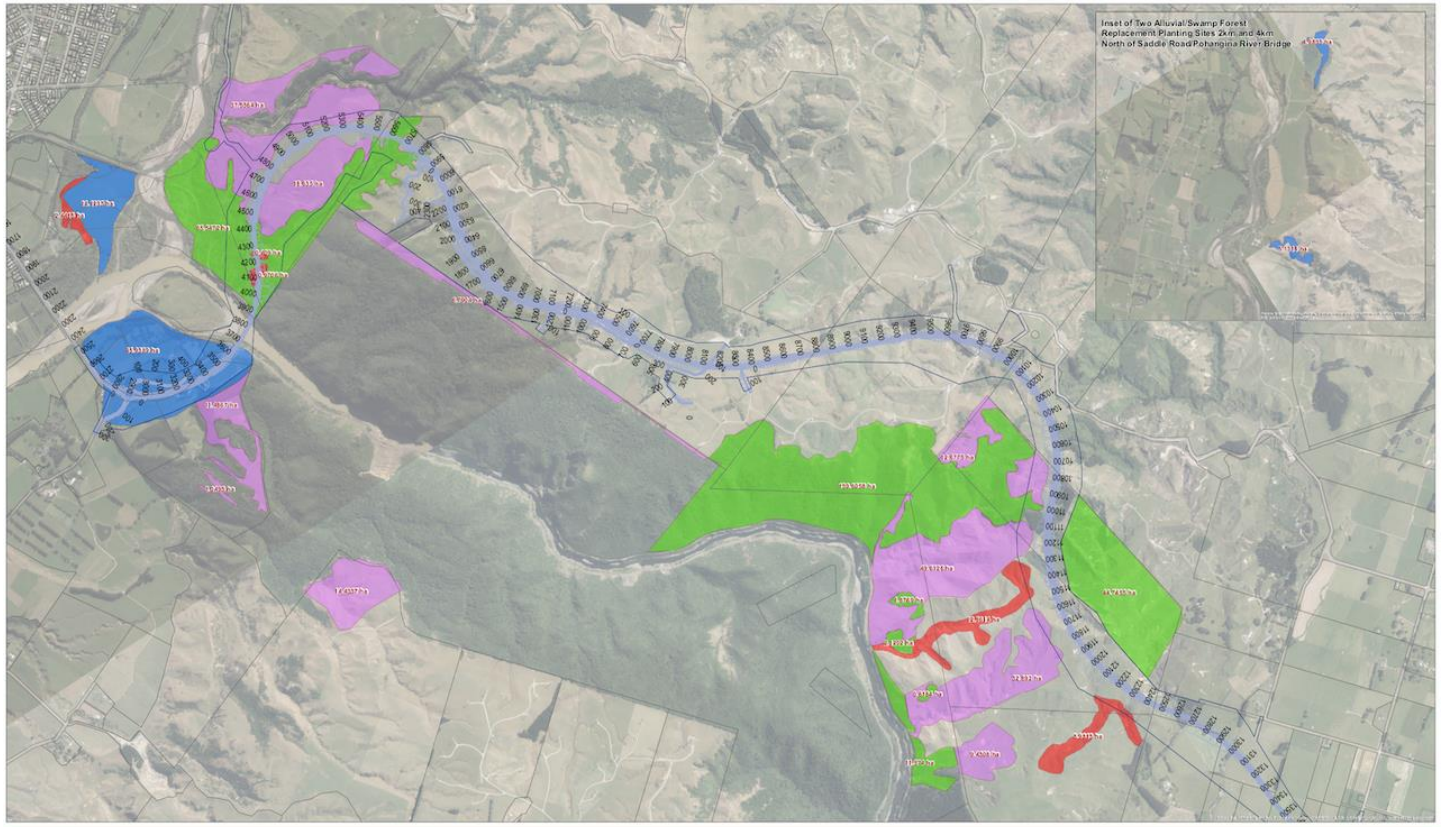
Ecosystem type	Area actually/ potentially affected (ha)	ECR	Replacement planting requirement (ha)[20]
Secondary Broadleaved Forests with Old-Growth Signatures	3.07	5	15.35
Old-Growth Treelands	0.41	5	2.05
Kānuka Forests	1.59	5	7.95
Advanced Secondary Broadleaved Forests	0.98	5	4.88
Secondary Broadleaved Forests and Scrublands	16.46	3	49.38
Mānuka, Kānuka Shrublands	4.04	1.5	6.06
Divaricating Shrublands	0.33	3	0.99
Replacement planting total area			86.66
Swamp maire mitigation planting are to be at the rates of 1:100 for damage (but retention); and 1:200 for unforeseen permanent loss			
Ramarama mitigation planting is to be at the rate of 1:100 for permanent loss			
Old-Growth Forests (Alluvial)^	0.15	12	1.80
Old-Growth Forests (Hill Country)^	1	10	10.00
Raupo-Dominated Seepage Wetlands (High Value)	0.13	4	0.52
Indigenous-Dominated Seepage Wetlands (Moderate Value)	1.12	3	3.36
Exotic-Dominated Seepage Wetlands (Low Value)	2.74	1.5	4.11
Replacement planting total area			19.79

Other treatments in the package of positive effects	Area required (ha)
Retirement, protection and canopy gap planting	c. 32[21]
A programme of additional pest control in perpetuity over the entire replacement planting and retirement, protection and gap planting treatment areas, or a similar suitable alternative pest control project	138.45

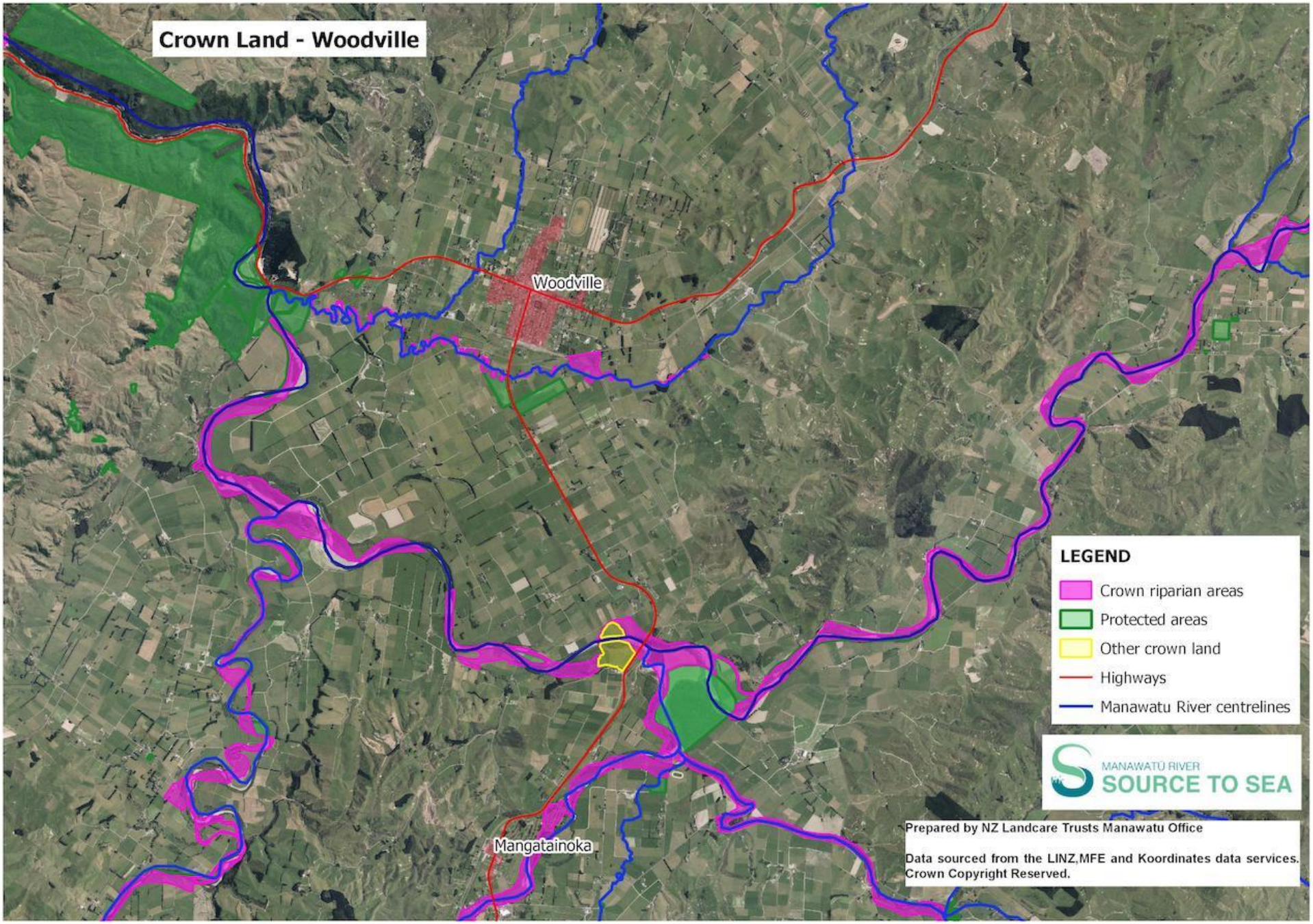
[20] As above, these areas assume no further avoidance is achieved at detailed design.

[21] This quantity should include all indigenous forest that is unaffected by the project works in the wider vicinity of CH4000–4400. See Figure 6.A.9 for the extent of the retirement, protection and canopy gap treatment area. All of this area that remains post-detailed design should be retired, protected, and gap planted.

APPENDIX C – REVISED POTENTIAL RESTORATION AREA MAP



APPENDIX D – POTENTIAL WETLAND AND ALLUVIAL RESTORATION AREAS (MAPPED BY STAKEHOLDER)


Crown Land - Woodville
Woodville
Mangatainoka
LEGEND
Crown riparian areas
Protected areas
Other crown land
Highways
Manawatu River centrelines
MANAWATŪ RIVER
SOURCE TO SEA
Prepared by NZ Landcare Trusts Manawatu Office
Data sourced from the LINZ,MFE and Koordinates data services.
Crown Copyright Reserved.