Before Independent Hearings Commissioners
appointed by the Northland Regional Council

under: the Resource Management Act 1991

in the matter of: an application by Meridian Energy Limited for resource consents for earthworks, associated stormwater diversion and discharges and vegetation clearance for the construction of a solar farm at Ruakākā, Northland (APP.045356.01.01)

between: **Meridian Energy Limited**
Applicant

and: **Northland Regional Council**
Consent Authority

Statement of Evidence of Dr Sarah Flynn (Ecology)

Dated: 19 July 2024

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STATEMENT OF EVIDENCE OF DR SARAH FLYNN

INTRODUCTION

1 My full name is Sarah Megan Flynn.

2 I am an Ecologist and Senior Principal at Boffa Miskell Limited (*Boffa Miskell*).

3 I hold the qualifications of Bachelor of Science (Botany), Masters of Science with Honours (Botany) and PhD (Environmental Science) from the University of Auckland. I have worked as a professional ecologist for 27 years. My areas of specialisation are botany and plant ecology.

4 In the course of my work I have prepared numerous ecological assessments including for major infrastructure projects, undertaken district-wide surveys to identify Significant Natural Areas, undertaken a variety of projects pertaining to ecosystem restoration and management, and provided ecology-related strategic and policy advice for a wide range of clients around New Zealand, including local authorities, land developers, infrastructure and power sectors.

5 I am an experienced expert witness and have presented evidence in numerous council and Environment Court hearings.

6 I was engaged by Meridian Energy Limited (*MEL*) in October 2021 as part of the team of Boffa Miskell ecologists who undertook ecological assessments of Site 1A for the BESS consent. I have been a member of the ecology project team working on the MEL solar farm project (the *Proposal*) since February 2022.

7 I visited the Proposal sites on three occasions in May 2022, March 2023 and June 2024. I compiled vegetation descriptions of Site 1A and assisted **Ms Tanya Cook** with wetland delineation assessments on Site 1A.

CODE OF CONDUCT

8 Whilst this is a Council hearing, I acknowledge that I have read and agree to comply with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note 2023. My qualifications as an expert are set out above. Other than where I state that I am relying on the advice of another person, I confirm that the issues addressed in this statement of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

SCOPE OF EVIDENCE

9 My evidence provides an assessment of the ecological values of flora and fauna of the site and the effects of the Proposal. In my evidence I address the following matters:

9.1 ecological survey methodology;

9.2 values and significance of identified ecological features;

9.3 assessment of ecological effects;

9.4 ecological effects management; and

9.5 response to section 42A report.

10 My evidence is intended to be read in conjunction with that of the other ecology and hydrology specialists:

10.1 **Ms Cook** describes wetland delineation evaluations in detail in her statement of evidence.

10.2 **Dr Lee Shapiro** provides further specific assessments related to threatened bird species, especially wetland birds and their habitats.

10.3 **Mr Stephen Fuller** reviews the wetland assessments and provides further evidence on wetland restoration.

10.4 **Ms Mandy McDavitt** describes the hydrogeological conditions at Sites 1 and 3 and the key hydrogeological factors for successful wetland restoration.

SUMMARY OF EVIDENCE

11 My assessment describes the ecological values of flora and fauna at each of the three Project Sites, and the effects of the Proposal on these features and values.

12 Site 1 is within an area of consolidated duneland that has been modified by farming. Dune topography is still evident and patches of wetland are present in low lying 'dune swales'. Most wetlands present are degraded and dominated by exotic vegetation communities.

13 Small remnants of indigenous-dominated wetland are present in Site 1A, two of which are ecologically significant according to RPSN criteria. Open water bodies occur in the lowest-lying dune swales, the largest of which (in the south-eastern quarter of Sites 1B/1C) are ecologically significant according to RPSN criteria. Ecologically significant kanuka forest and shrubland covers 5 ha of stable duneland on the south-eastern margin of Site 1A.

14 Sites 2 and 3 are well maintained pasture on peatland and podzol soils. No significant terrestrial or wetland features are present in Sites 2 or 3.

15 All watercourses within the three sites are farm drainage channels, most of which were constructed by the 1950s.

16 Ground contouring to level and prepare the sites for construction of the solar farm will result in the loss of 2.07 ha of open water bodies, including 1.11 ha of significant avifauna habitat; 0.75 ha of indigenous dune swale wetland, including 0.57 ha of significant indigenous wetland; and 13.7 ha of exotic-dominated dune swale wetland.

17 In accordance with the effects management hierarchy, project development included a review of prospective sites the surrounding landscape, and refinement of the project envelope through an iterative process of design reviews informed by ecological evaluation and constraints mapping. The kanuka forest and shrubland and an area of open water on Site 1B /1C that is consistently used as habitat for threatened avifauna were identified as priority areas, and avoided.

18 Significant residual adverse ecological effects of the Proposal include the permanent removal of 17.06 ha of wetlands, almost entirely from Site 1. These residual adverse effects are to be offset by creation, enhancement and restoration of 18.78 ha of wetlands within Sites 1B/1C and 3. The objectives of the proposed reinstatement and enhancement are to replace the full extent of wetlands removed, and ensure the restored wetlands have better habitat and ecological function than those that are to be removed.

19 The adequacy of the proposed offset was evaluated using DOC's Biodiversity Offset Accounting Model (*BOAM*) based on the "ecological condition x area" of impacted and offset features. I consider the proposed offset is appropriate in the circumstances of the Proposal where predominantly low value wetland areas will be replaced with a feature that supports higher biodiversity values.

20 I consider that the proposed offset meets all principles for aquatic offsetting of natural inland wetlands set out in Appendix 6 of the NPS-FM. I note that Mr Warden, the Council's ecological specialist, proposes the use of a ratio to ensure adequate compensation, however this is not consistent with Principle 3 for aquatic offsetting, which specifies the use of a "quantitative loss-gain calculation".

21 I disagree with Mr Warden, that wetland features to be lost are nationally endangered and irreplaceable ecosystems. Naturally uncommon ecosystems are prioritised for conservation because they contain distinctive biodiversity, and the risk of biodiversity loss is greater due to their natural scarcity. Hence, the emphasis is on protecting features that retain indigenous biodiversity. With respect

to the Proposal sites, other than the small area of indigenous wetland within Site 1A, wetland features present within Site 1 are all extensively modified to the point that they are no longer representative of a naturally uncommon indigenous dune swale ecosystem.

22 **Mr Fuller's** evidence addresses Mr Warden's concern regarding the viability and long term restoration outcomes of the proposed offset. In contrast, I consider that the long term prognosis for wetland features within Site 1 if the status quo remains is poor.

23 Overall, I consider that the recreation of wetland habitats in Sites 1 and 3 will avoid, remedy and offset the ecological effects identified, such that the overall effects on ecological values will be minor, and will produce positive biodiversity benefits in the short to medium term.

METHODOLOGY

Sites assessed

24 Ecological assessments were undertaken across three sites between Ruakākā township and Marsden Point that MEL seeks to use for the Proposal **(Figure 1)**. The nomenclature used to refer to each of the sites is as follows:

24.1 **Site 1** (105 ha) is located to the southwest of the Marsden Point Oil Refinery and bordered by State Highway 15A to the west, Rama Road to the north, Bream Bay to the east and Allis Bloy Place to the south. This site is divided into three parts for the purposes of the ecological assessment.

(a) **Site 1A:** North-eastern portion of Site 1.

(b) **Site 1B:** Central portion of Site 1.

(c) **Site 1C:** South-western portion of Site 1.

24.2 **Site 2** (41 ha) is located adjacent to Port Marsden Highway (State Highway 15) and McCathie Road.

24.3 **Site 3** (55 ha) is located adjacent to Marsden Point Road and McCathie Road.

Vegetation assessments

25 Vegetation descriptions were compiled during walk-over surveys of each of the three sites in June 2022, identifying and photographing vegetation community assemblages and mature trees, using ESRI fieldmaps and a GPS enabled tablet. Vegetation features and communities were then mapped using ArcGIS.

26 Wetland communities in Site 1 were assessed in detail using a combination of 2x2 vegetation plots, roaming transects and rapid

visual assessments to characterise vegetation cover, along with test pits to determine soil type and depth to water table. **Ms Cook** provides further details of wetland delineation assessments in her evidence.

Aquatic assessments

27 The main watercourses were walked during site visits and habitat availability and quality were assessed. Watercourses identified as intermittently or continually flowing were assessed using the Rapid Habitat Assessment method. Potential barriers to fish passage were assessed using the NIWA Fish Passage Assessment Tool[1]. Any biota observed were noted.

28 Fish records were compiled from a 2020 mudfish survey on Site 1[2], and New Zealand Freshwater Fish Database observations within 5 km of all sites. No other formal surveys of freshwater fauna were undertaken in the wetlands or watercourses present on the sites.

Birds

29 Records of bird species in a 20 km radius of the sites was compiled from ebird and inaturalist databases.

30 Preliminary site visits and a desktop review of aerial imagery identified that Site 1 had more prospective habitat for cryptic wetland birds compared to Sites 2 and 3, so this site received greater survey effort. The two stormwater ponds between Sites 2 and 3 were also surveyed.

31 Avifauna surveys were undertaken in March, September and October 2023 and in January, May and July 2024. Surveys included point counts along transects covering all diurnal and tidal periods, and 5 minute counts at representative sample sites. Peak tidal periods were targeted multiple times to determine the sites' value for coastal and wader species. Playback surveys were undertaken near suitable habitat features to target cryptic wetland species. Playback was used for Pūweto / spotless crake (*Zapornia tabuensis*), Kotoreke / marsh crake (*Porzana pusilla affinus*), Mohu-perurū / banded rail (*Gallirallus phillippensis assimilis*), and Mātātā / fernbird (*Bowdleria punctata* vealeae). Acoustic recorders were also deployed over 16 days in September-October 2023. Survey locations are shown in **Figures 2 and 3** attached to my evidence.

32 During all site visits a list of bird species seen and/or heard was compiled.

Lizards

33 The Department of Conservation's (*DOC*) herpetofauna database records for the surrounding landscape within 10 km of the sites

[1] NIWA fish Passage Assessment Tool; Fish Passage Assessment Tool (niwa.co.nz), accessed on 12 May 2023.

[2] Wildland Consultants Ltd, 2022

were compiled and mapped. A desktop assessment of all sites was undertaken using aerial imagery to assess availability of suitable habitat for potential lizard populations in the vicinity of the sites.

34 Skink surveys were undertaken throughout rank grassland and gorse shrubland in Site 1A identified as potential lizard habitat. Surveys were undertaken using tracking tunnels with inked tracking cards and ground-based artificial cover objects (*ACOs*) made from onduline roof tiles. Survey equipment was deployed in November 2022 and left undisturbed for eight weeks before being inspected on five separate occasions between December 2022 and February 2023. A further tracking tunnel survey was undertaken in riparian vegetation along Bercich Drain in Site 1A from February-March 2024.

35 Two evening spotlighting surveys were undertaken in March 2023 and February 2024 within kānuka forest and shrubland adjacent to Site 1A, which offers potentially favourable habitat for arboreal geckos.

36 Skink surveys in Sites 1B, 1C, 2 and 3 were undertaken in February – May 2023. ACOs and tracking tunnels were installed in areas of rank grassland, scrub and woody debris.

Bats

37 DOC's bat database[3] records within 25 km of the sites were compiled and mapped. A desktop assessment was undertaken using aerial imagery in GIS to assess availability of potential bat habitat and proximity to known bat populations and habitats in the surrounding landscape.

38 An acoustic bat activity survey and roost tree and habitat assessments were undertaken in January 2024. A bat ecologist inspected potential habitat features within the sites and deployed 22 bat recorders across the sites for 20 nights, targeting features preferred by long-tailed bats for roosting, foraging and commuting. Recordings were analysed for bat vocalisations.

Evaluation methods and iterative project design

39 To assist with constraints mapping and project design, the ecological values of the sites were described with respect to their importance as habitat for indigenous flora and fauna, and with respect to ecosystem value and threat status.

40 The ecological significance of vegetation and fauna habitats was evaluated using criteria set out in the Regional Policy Statement for Northland (*RPSN*) and Whangarei District Plan. I note that this

[3] Based on most recent data available, which was extracted from database and supplied by DOC on 10 March 2022.

evidence focuses on the RPSN given the regional consents hearing context.

41 The effects of the Proposal were evaluated with respect to the extent, quality and significance of ecological features removed, and to potential indirect effects on indigenous fauna.

42 Several design iterations were worked through with the wider MEL project team to identify opportunities to avoid or minimise effects on ecological features with moderate or higher values, and to mitigate adverse effects through restoration and enhancement opportunities within the Proposal sites.

ECOLOGICAL CONTEXT

43 In the following paragraphs I provide an explanation and summary of existing ecosystem classifications for the sites and surrounding area, including the Significant Natural Areas[4] report, Threatened Environments[5] and Naturally Uncommon Ecosystems[6] classifications.

Significant Natural Areas

44 The Proposal sites are located in the Waipu Ecological District, in the Eastern Northland Ecological Region.

45 The DOC Protected Natural Areas Programme survey of Waipa Ecological District identified several Significant Natural Areas (*SNAs*) near the Proposal sites and in surrounding areas (**Figure 4**). There are no SNAs identified in the Proposal area.

46 The RPSN identifies the need to avoid, remedy or mitigate adverse effects on significant ecological areas and habitats, including (among other features) indigenous wetland and duneland ecosystems and habitats that are particularly vulnerable to modification.

Threatened Environments

47 The Threatened Environments Classification classifies the whole of New Zealand's land mass into distinct physical environments, and identifies environments where very little of the original indigenous vegetation or habitat remains, and/or a low proportion of what remains is legally protected. A map of threatened environments in the general vicinity of Ruakākā/ Marsden Point is attached to my evidence **(Figure 5)**. I note that this classification was developed at a national scale, and is somewhat generalised.

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[4] Department of Conservation Protected Natural Areas Programme survey of Waipa Ecological District (Lux et al., 2007).

[5] https://www.landcareresearch.co.nz/tools-and-resources/mapping/threatened-environment-classification/; Walker et al., 2015

[6] Williams et al., 2007; Holdaway et al., 2012; Wiser et al., 2013

48 **Site 1** is a mix of threat category 1 (<10% indigenous cover left) and threat category 2 (10-20% indigenous cover left).

49 **Sites 2 and 3** are located in what would have once been extensive peat wetland, with a threat category of 1 (<10% indigenous cover left), however there are no remnant indigenous ecosystems remaining on these sites.

Naturally Uncommon Ecosystems

50 Naturally uncommon ecosystems are terrestrial ecosystems that were rare before humans arrived in New Zealand. Among others, these include active sand dunes, stable sand dunes and dune slacks.

51 Lux et al. (2007) identified that 20% of dune systems remain in the Waipu Ecological District, the majority of which is highly modified, eg, dominated by introduced plant species, damaged by vehicle access and impacts of land use.

ECOLOGICAL FEATURES AND VALUES

Vegetation and habitat

Site 1

52 Site 1 is located on the north-eastern corner of Marsden Point, immediately south of the Marsden Refinery site. From the eastern boundary of Site 1, coastal duneland and Marsden Point Beach is part of an area of "High Natural Character" in the RPSN.

53 Site 1 is within an area of consolidated duneland that encompasses Marsden Point and land southwest of Northport (identifiable as 'recent sand' in the soil map attached as **Figure 6** to my evidence). The landform within and surrounding Site 1 has been modified by farming and development over the last century, the undulating dune topography is still evident within Site 1. In general, the topography is flat to gently undulating to the north and west, with distinct consolidated dune topography becoming more pronounced towards the coast.

54 Patches of wetland are present throughout Site 1, formed in low lying 'dune swales' at a time when the groundwater table persisted at or above the soil surface. Accordingly, soils are a combination of recent sands, with lenses of 'mesic organic' (i.e., peat-derived) soils in areas where wetlands originally formed. These wetlands are palustrine marsh and/or swamp (i.e., rain and groundwater-fed, with mineral and peat substrates).

55 Historic aerial imagery[7] indicates that Site 1 was converted to agricultural land over the course of several years from about 1940, with a herringbone drainage system visible in 1950. Subsequent imagery shows that drainage did not much alter the persistence or

[7] Retrolens.nz

extent of distinct dune swale wetland features, though the vegetation cover within them changed.

56 For the purposes of site assessments, Site 1 was divided into three portions (Site 1A, 1B and 1C). I describe the ecological features and characteristics in each of these areas below.

Site 1A

57 Site 1A has been retired from grazing for some years. Rank grassland covers modified and eroded residual dune crests and slopes, with wetlands in the low-lying dune swales.

58 South-east of Bercich Drain, an informal four-wheel drive track has been constructed in Site 1A, which passes through and around the wetland features described below. Numerous vehicle tracks also intersect the adjacent Ruakākā Dunelands outside the site.

Indigenous-dominated wetlands

59 As noted above, Site 1A encompasses all the indigenous wetland features present in Site 1. There are five discrete areas of indigenous-dominated wetland, ranging from 100 m^2 to 4,000 m^2, and covering a total of 0.75 ha.

60 Vegetation comprises dense beds of mostly native rushes and reeds, and areas of standing water. Dominant species include rautahi (*Carex lessoniana*)*,* jointed twig rush *(Machaerina articulata),* baumea (*Machaerina rubiginosa)* and kuawa (*Schoenoplectus tabernaemontani*). Other native species present include native willow weed (*P. decipiens*), wīwī (*Juncus edgariae*), sharp spike sedge (*Eleocharis acuta*), giant umbrella sedge *(Cyperus ustulatus)*, and giant rush *(Juncus pallidus).*

61 Two substantial patches of *C. fascicularis,* an At Risk – Declining species, are present within the largest two (indigenous wetland features in the south-eastern corner of Site 1A.

Exotic-dominated wetlands

62 Within Site 1A, broom sedge (*Carex scoparia*), an invasive exotic sedge, forms a dense sward across large areas of exotic wetland in Site 1A, though it does not appear to tolerate inundation well.

63 Yorkshire fog (*Holcus lanatus*) and common pasture weeds are also widespread and locally dominant throughout areas of exotic-dominated wetland in Site 1A. Species include creeping buttercup *(Ranunculus repens),* soft rush *(Juncus effusus)*, Mercer grass *(Paspalum distichum)*, exotic umbrella sedge (*Cyperus eragrotis*) and sharp-fruited rush (*Juncus acuminatus*).

64 Marsh bedstraw (*Galium palustre*) is locally abundant, and water pepper (*Persicaria hydropiper)* seasonally dominates areas where shallow standing water persists (*Persicaria* dies back in winter).

65 Small patches of native wetland plants are interspersed through some parts of the exotic wetlands, mainly including willow weed (occupying areas of shallow surface water alongside water pepper). Wīwī, sharp spike sedge, baumea, giant umbrella sedge, and kuawa occur among patches of broom sedge. *Carex fascicularis* is also present as individual plants or small clumps of 3 to 4 plants adjacent to historical drainage channels and the Bercich Drain.

Open water habitat

66 Areas of open water were identified in dune slacks within Site 1A during 2022 and 2023 surveys, mainly southward of Bercich Drain. As **Ms Cook** explains in her evidence, this period was substantially wetter than normal. The mapped extent of these features is 1.11 ha, but I understand **Ms Cook** found the area of open water to be greatly diminished in her recent site visits (March, May and June 2024). I consider that in normal conditions, water levels will be subject to seasonal variation, with the extent of standing water greatly reduced in drier months/years.

67 Both the native and exotic *Persicaria* species grow abundantly in the littoral zone of these waterbodies, infilling areas that were previously flooded. Extensive growths of broom sedge and soft rush surround the intermittently wet margins of these features, while gorse and kikuyu cover adjacent banks. Local patches of native wetland reeds and sedges are interspersed around the margins of these open water bodies.

Riparian Vegetation

68 Riparian vegetation containing cabbage trees, karo, taupata, exotic conifers and gorse extends along much of the northern side of the Bercich Drain in Site 1A. Swards of pohuehue cover the vegetation canopy in places. Pampas and woolly nightshade are common. Native sedges (principally giant umbrella sedge and *Carex* species) and rank grass form the ground cover along the drain margin.

Terrestrial Vegetation

69 Much of Site 1A is in rank kikuyu grassland, which gives way to Yorkshire fog in places during colder and wetter periods.

70 Approximately 5 ha of a ~15 ha remnant stand of kānuka forest and shrubland (5 – 8m tall), is located within the coastal margin of Site 1A. The remainder of the stand extends onto adjacent Crown land. Kānuka forms a fragmented, open canopy, with gorse patches interspersed throughout. Beneath the kānuka there is minimal understorey and a ground cover of native meadow rice grass and bracken.

71 The inland margin of the kānuka stand is well-defined, with an abrupt transition to gorse-woolly nightshade scrub, which covers slopes and slacks of adjacent consolidated dunes. The whole of the remnant kānuka stand is encompassed within the Ruakākā

Dunelands SNA (and is also identified as being within the 'Coastal Environment' in the RPSN).

72 A mature pine shelterbelt separates Site 1A and 1B. Clumps of weedy scrub containing gorse, Sydney golden wattle, black wattle, arum lily and madeira vine, are interspersed among areas of rank grassland and on the margins of wetland features.

Sites 1B and 1C

73 The whole of Site 1B and 1C is used for grazing cattle. Areas of flat to gently undulating land are maintained in exotic pasture.

74 Patches of exotic-dominated wetland and open water are present in shallow depressions and dune swales. No areas of indigenous-dominated wetland are present within Sites 1B or 1C. Stock have access to all wetland features in Site 1B and 1C, which are moderately to severely pugged and grazed.

Exotic-dominated wetlands

75 All wetlands within Sites 1B and 1C are exotic-dominated. I consider that the absence of indigenous plants (other than native willow weed) from these wetlands, and the predominance of 'pasture weed' species is likely due to historic clearance and periodic cultivation for pasture renewal.

76 In general, the community assemblage follows a gradient of wetness. Conspicuous and well-defined areas of exotic wetland are mostly covered with abundant swards of soft rush, interspersed with patches of water pepper and willow weed in areas of lower relief.

77 The transitional zone surrounding the swales of soft rush contains a changeable assemblage, mostly of Mercer grass, creeping buttercup, Yorkshire fog, dock and creeping bent, intergrading with a variable cover of kikuyu and other pasture grasses and herbs. Buttercup and Yorkshire fog are common in intermittently wet to moist sites. Mercer grass and creeping bent rapidly invade and persist in sites where other vegetation has died back due to temporary inundation.

78 As **Ms Cook** explains in her evidence, this 'transitional' herb community is very responsive to site conditions, and the relative proportions of 'wet tolerant' and other plants can change over the course of a few weeks. These exotic grassland and herbfield assemblages comprise the areas of uncertain wetland extent that is the focus of **Ms Cook's** evidence.

Open water habitat

79 Two large, linear ponds containing open water are present in the dune swales on the south-eastern side of Sites 1B and 1C. The two large features were mapped as 1.94 ha and 1.11 ha respectively, though as in Site 1A, **Ms Cook** found the area of open water to be greatly diminished in her recent (June 2024) site visit, and I consider that these features are not likely to be entirely flooded

year-round. A number of smaller open water features are mapped (mostly in the southern half of Site 1C), though these features are definitely seasonal and may be more akin to the 'exotic wetland' features I describe above in normal rainfall conditions. The total area of mapped open water within Sites 1B and 1C is approximately 3.6 ha.

80 Emergent soft rush and native willow weed are present in the littoral zone of these waterbodies (the extent of which fluctuates seasonally), and floating aquatic plants *(Azolla pinnata* and duckweed*)* are also present.

81 A farm track intersects ponds in Site 1C. Stock have access to the ponds in both Site 1B and 1C.

Terrestrial Vegetation

82 Improved pasture (mainly composed of ryegrass and clover, with a variety of other herbs and grasses) covers the majority of Sites 1B and 1C. Kikuyu is present and becomes seasonally dominant in places.

83 A few mature exotic trees ranging in height from about 5 to 20 m are interspersed throughout the site. The remains of residential gardens are present in Site 1C.

Site 2

84 Site 2 is well maintained, kikuyu-dominated pasture (also containing rye grass and clover), intersected by a series of deep drainage channels. Soils within Site 2 are classed as 'pan podzol', indicative of the site's likely original podocarp forest cover and high rainfall. Soil profiles sampled during site surveys found a well-developed peat-dominated O horizon (surface layer). The land is classed as arable with moderate limitations (Class 3 Highly Productive Land), most suitable for intensive grazing.

85 A few small exotic-dominated wetland features are present within Site 2, in low-lying depressions containing shallow water or saturated soil. As in Site 1, vegetation comprises wet-tolerant 'pasture weeds', with a variable composition depending on degree of wetness.

86 Exotic hedgerows of gorse, hawthorn, boxthorn and conifers, interspersed with occasional native trees such as puriri and totara are present between field borders and along property boundaries, along with the remains of a residential garden. A stand of large (>20m) pines and patch of sparse gorse scrub is present at the northern end of Site 2, while a large conifer shelterbelt defines the southern property boundary.

Site 3

87 Site 3 is well maintained, kikuyu-dominated pasture, intersected by a series of deep drainage channels. Soils within Site 3 are 'mesic

organic' (i.e., peat-derived). Site 3 is classed as arable with moderate limitations (Class 3 Highly Productive Land), most suitable for intensive grazing.

88 As with Site 2, Site 3 contains scattered small, exotic-dominated wetland features in low-lying depressions.

89 Scrub borders drainage channels to the south of the site, and around a constructed farm pond to the east of the site. Kānuka, manuka, harakeke and gorse are the main species present. A few hedgerows are present around the house and farm buildings, and between farm races on the east of the site. Ornamental trees and gardens, including some large native and exotic trees, are established around the house, and numerous exotic trees (mainly pines and poplars) are interspersed across the site.

Freshwater Values

90 All watercourses within the three sites are farm drainage channels, most of which were constructed by the 1950s.

91 Bercich Drain is the large main channel that runs the length of Site 1, in a northeast – southwest direction. A large Unnamed Drain runs along the western boundary of Site 3.

92 Both the Bercich and Unnamed Drain have a well-defined channel, contain surface water more than 48 hours after a rain event and are shown on 1:50,000 scale topographical maps as blue lines, and therefore meet the definition of a River under the Proposed Regional Plan for Northland (*PRPN*) and RMA. It is likely that both of these are continually flowing. Both these large drains are excluded from the definition of an Artificial Watercourse in the PRPN as they intersect an area that was historically natural wetland.

93 Some small drains in Site 1 are within natural wetlands and are therefore excluded from the definition of an Artificial Watercourse, but are classed as ephemeral watercourses based on the PRPN definition. These drains flow to Bercich Drain.

94 Bercich Drain flows eastward from Site 1 for ~ 1. 7 km before discharging to Ruakākā Beach. The last ~ 250 metres of this watercourse is piped and it is likely that fish passage to the sea is restricted at times by low flows and coastal sand impoundment.

95 The Unnamed Drain on the edge of Site 3 discharges to Ruakākā River via a culvert under McCathie Road. This drain is likely to be tidally influenced at times. Other minor drains from Site 2 also flow under McCathie Road and discharge into the Ruakākā River.

96 Both Bercich Drain and the Unnamed Drain are straight, soft-bottomed channels. Bercich Drain is 4 - 5 m wide and the Unamed Drain is 2 – 2.5 m wide. Both drains contain aquatic and wetland

plants, but are evidently maintained through periodic excavation. The water was observed to be peat stained and turbid in both drains with slow-flowing water (typically 50 cm – 1 m deep) on most site visits.

97 The Unnamed Drain is fenced along its entire length on both sides to exclude stock, with limited riparian vegetation. Sections of Bercich Drain in Sites 1A and part of 1C are inaccessible to stock, but cattle can access the watercourse in Site 1B and the remainder of Site 1C, and drain margins are heavily grazed in these areas.

98 Habitat quality assessments in Bercich Drain scored 41.5 in Site 1A and 29 in Sites 1B and 1C. The Unnamed Drain had habitat quality score of 37.5. This indicates that these two watercourses have fair (moderate) quality and habitat availability for freshwater invertebrates and fish in their current state. No barriers to fish passage were found in either of the main drains (Bercich and Unnamed Drain).

99 All other watercourses are small drainage channels, periodically dry, soft-bottomed and vegetated with exotic rushes and herbs.

100 A total of 10 native fish species and two exotic species have been recorded in the NZ Freshwater Fish Database within 5 km of the sites, however, there were no fish records within 1 km of the sites.

101 The only fish species recorded from Site 1 were shortfin eels, caught during the mudfish survey. Wildland Consultants (2022) concluded that black mudfish are unlikely to be present within Site 1.

102 A school of īnanga (At Risk – Declining) were observed in the Unnamed Drain in Site 3. Mosquito fish were also observed in several of the smaller drains on Site 3.

Birds

103 Database records of bird sightings included twenty-nine native bird species within a 20 km radius that utilise freshwater bodies and/ or wetlands as their primary habitat. Five of these species are threatened, five have a threat status of At-Risk – Declining, and four have a status of At-Risk – Recovering.

104 Field surveys undertaken for the Proposal recorded 30 native bird species seen or heard within the three sites. Of these, six species use freshwater bodies and/ or wetlands as their primary habitat and have a threat status ranking, including matuku and weiweia (threatened), mohu-pererū and pihoihoi (At Risk – Declining, kāruhiruhi / pied shag (At Risk – Recovering) and kawau / black shag (At Risk – Relict).

105 **Dr Shapiro** provides further details of observations and site values with respect to matuku, weweia and other cryptic wetland birds.

Lizards

106 The Herpetofauna database has numerous records of shore skink throughout the Bream Bay dunelands, and these could be present within vegetation and habitats in Site 1A. Patches of suitable habitat for copper skink are available across all sites. Copper skink and shore skink both have a threat status of At Risk – Declining (Hitchmough et al., 2021).

107 The Herpetofauna database contained no records for indigenous geckos in surrounding land within 10 km of the sites, though Lux et al. (2007) reported a 1992 observation of an elegant gecko in the Ruakākā Dunelands.

108 Lizard surveys undertaken in the 2022-2023 field season did not detect any indigenous lizards. All sites contained abundant populations of exotic plague skinks.

109 One elegant gecko (At Risk – Declining), was found on a kānuka tree surrounded by gorse on the coastal side of the kānuka shrubland, outside of the site boundary, in February 2024. The presence of a gecko in an individual kānuka amongst gorse suggests that these lizards may move through gorse scrub in order to access favourable habitat patches.

Bats

110 Long-tailed bats, which are Threatened - Nationally Critical (O'Donnell et al., 2023), preferentially roost in small cavities of old, large trees, but have also been observed to utilise other features such as loose bark, hollow limbs, or epiphyte growth for roosting.

111 Long-tailed bats range widely and are known to use linear habitat features (for example, waterways, shelterbelts or edges of vegetation margins) to commute and forage (O'Donnell, 2000; Borkin & Parsons, 2009) and cross agricultural landscapes.

112 Monitoring has been undertaken for long-tailed bats at various locations within 25 km of the Proposal sites (i.e., within a night's flying distance) within the past 5 years. The nearest locations where long tailed bats have been recorded are Brynderwyn Hills Forest, Otaika Valley Bush and Pukenui Forest, (approximately 20, 18 and 20 km respectively from the sites). The nearest mature native forests to the sites are Takahiwai and Ruakākā, which are 1.5 and 4 km away respectively. Both provide high quality habitat for bats in close proximity to the sites. It is unknown whether bats are present in these forests, as neither have been surveyed.

113 Grazed pasture, wetlands and shrubland habitats do not provide suitable habitat for bat roosting. However, wetlands are productive foraging habitat for insectivorous, and the hedgerows and tree lines provide landscape connectivity. Roost habitat assessments found that the shelterbelts provide high quality roosting and foraging

habitat within Sites 1 and 2 for long tailed bats. Within Site 3 the potential roosting opportunities are confined to isolated groups of trees and the overall habitat is low /moderate.

114 No bats were detected on site in acoustic surveys during the January 2024 survey. Within the long-tailed bat life cycle, January can include the late stages of pregnancy, non-volant young being present in roosts, and young beginning to fly. The lack of any recorded calls within any of the three sites at this time suggests that if bats are using the sites, it is likely to be in very low numbers.

Summary

115 Maps identifying key ecological features within each of the subject sites are attached to my evidence **(Figures 7 and 8)**.

ECOLOGICAL SIGNIFICANCE

Mapped Significant Natural Areas

116 The kānuka forest and shrubland on Site 1A is part of the Ruakākā Dunelands SNA (Whangarei District Council online maps)[8]. The kānuka forest and shrubland within Site 1A is located in a Threatened Environment (less than 10% of indigenous vegetation remaining), and located within dunes, a naturally uncommon ecosystem (Holdaway et al., 2012; Williams et al., 2007; Wiser et al., 2013). Elegant gecko (At Risk – Declining) are present in this vegetation.

117 The online maps do not identify any other SNAs within any of the three Proposal sites.

Wetlands and open water bodies

Northland Regional Plan / Northland Regional Policy Statement

118 The PRPN specifies that a 'significant wetland' is a natural wetland that triggers the significance criteria in the Regional Policy Statement for Northland (2016) (*RPSN*).

119 Appendix 5 of the RPSN sets out criteria for determining the ecological significance of indigenous vegetation and significant habitats of indigenous fauna in terrestrial, freshwater and marine environments.

120 RPSN Appendix 5 criterion 2(a) specifies that wetlands are deemed to meet significance criteria for Rarity and Distinctiveness if:

120.1 they comprise indigenous ecosystems or indigenous vegetation types, *and*

[8] Draft Significant Natural Area Maps (arcgis.com) accessed on 16 May 2023.

120.2 are examples of the wetland classes that trigger Appendix 5 criteria, *or*

120.3 exceed specified area thresholds (in the case of the features present, this includes swamp greater than 0.4 ha, and shallow water less than 2 m deep and greater than 0.5 ha in area).

121 The largest patch of indigenous wetland within Site 1A (~4,000m^2) meets criterion 2(a). This feature and the next largest (~1,700 m^2) also meet Appendix 5 criterion 2(b) for rarity and distinctiveness, because they contain patches of an At Risk plant *(Carex fascicularis).* These features also provide suitable roosting habitat for matuku, as **Dr Shapiro** notes in his evidence.

122 The two large open water bodies within Site 1B and 1C exceed the size threshold for wetlands with respect to rarity and distinctiveness, but are not an indigenous ecosystem or an indigenous vegetation type, so do not meet Criterion 2(a). These features do trigger Appendix 5 criterion 2(b) for rarity and distinctiveness and 4(a) & 4(c) for ecological context because matuku and weweia (both threatened) have been observed within them on multiple occasions, and they form part of a network of habitat features that these species use.

123 Incidental observations of threatened and At-Risk avifauna (matuku and banded rail) have also been noted on the margin of the open water body on Site 1A, though only while water levels were unusually high. No threatened or At Risk birds were observed in Site 1A during formal surveys.

124 **Dr Shapiro** provides further details of the habitat values of the open water bodies and other ecological features in his evidence.

125 None of the areas of exotic-dominated wetland meet any Appendix 5 ecological significance criteria, as they are not indigenous ecosystems or indigenous vegetation types, and do not provide suitable habitat for threatened or At-Risk flora or fauna.

126 Small indigenous – dominated wetlands within Site 1A do not support populations of threatened, At Risk or uncommon taxa, and are too small to meet the size threshold for ecological significance in the RPSN.

Bercich and Unnamed Drains

127 The Unnamed Drain within Site 3 meets NRPS Appendix 5 criterion 2(b) for rarity and distinctiveness, as inanga (an At Risk species) were observed within the watercourse. Bercich Drain does not meet any significance criteria.

Terrestrial vegetation and habitat

128 With the exception of the kānuka forest and shrubland mapped as SNA, no terrestrial vegetation or habitats within any of the Proposal sites meet the thresholds for ecological significance specified in the RPSN.

Summary

129 Table 1 (overleaf) sets out a summarised list of ecological features present at all three Proposal sites and their ecological significance according to RPSN criteria.

Table 1: Summary of ecological features present within the proposed Sites, and ecological significance according to RPSN and WDP criteria.
** = potential but not confirmed.*

Ecological feature	Ecological Significance under RPSN	Explanation
Kānuka dominated forest and shrubland	Yes	Meets RPSN criteria 1(a) for Representativeness and 2(a) and 2(b) for rarity/distinctiveness. Naturally uncommon indigenous ecosystem (stable dunes). Indigenous habitat or sequence which is rare in Waipu Ecological District
Grazed pasture	No	Values are limited by heavy modification, would offer avifauna habitat if restored and managed
Gorse shrubland, rank grassland and debris	No	Viable habitat of indigenous fauna (lizards)
Open water habitats	Yes	Large open water bodies in Sites 1b and 1C meet RPSN criteria 2(b) for Rarity/distinctiveness and 4(c) for Ecological Context (multiple observations of matuku and weweia in these features). Matuku observed in open water habitat in Site 1A during a flood event (and banded rail heard on a single occasion), but not on other occasions.
Indigenous wetlands in dune swales	Yes – 2 discrete features in Site 1A)	The largest indigenous wetland feature meets RPSN size threshold criteria 2(a) for Rarity/distinctiveness The two largest indigenous wetland features meet RPSN criterion 2(b) for Rarity/distinctiveness because they contain an At Risk plant, and provide roosting habitat for matuku. All indigenous wetlands are examples of a nationally uncommon ecosystem (dune swale/ stabilised dunes)
Exotic wetlands in dune swales	No	Values are limited by heavy modification, some opportunities for wetland revegetation, and limited avifauna habitat if managed and restored.
Bercich Drain	No	Foraging habitat for avifauna; viable habitat for freshwater fauna
Unnamed Drain on edge of Site 3	Yes	Meet RPSN criteria 2(b) for rarity/distinctiveness (school of inanga observed in the watercourse) Viable habitat of indigenous fauna
Mature native and exotic trees (prospective bat roosts)	No	No bats recorded, but offers potential viable habitat of for long-tailed bats

ECOLOGICAL EFFECTS OF PROPOSAL

130 The Proposal is described in the application and planning evidence of **Mr Brett Hood**. The primary impact on ecological features is ground contouring to level and prepare the sites for construction of the solar farm; and solar panel placement covering 170 ha over the three Proposal sites, along with ancillary infrastructure. Pasture will be established beneath the solar arrays, and this will be maintained with low-intensity sheep grazing.

Effects Management Hierarchy

131 Policy 4.4.1 of the PRPN requires that subdivision, use and development avoids, remedies or mitigates adverse effects on significant ecological areas and habitats so they are no more than minor, including:

131.1 Indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists;

131.2 Areas of indigenous vegetation and habitats of indigenous fauna, that are significant using the assessment criteria in Appendix 5 (of the RPSN);

131.3 Areas set aside for full or partial protection of indigenous biodiversity under other legislation

131.4 Areas of predominantly indigenous vegetation;

131.5 Habitats of indigenous species that are important for recreational, commercial, traditional or cultural purposes; and

131.6 Indigenous ecosystems and habitats that are particularly vulnerable to modification, including wetlands, dunelands, northern wet heathlands, headwater streams, floodplains and margins of freshwater bodies, spawning and nursery areas.

132 Policy 4.4.1 notes that if adverse effects cannot be reasonably avoided, remedied or mitigated then it may be appropriate to consider biodiversity offsetting followed by environmental biodiversity compensation.

NPS-FM provisions

133 Policy 6 of the National Policy Statement for Freshwater Management 2020 (*NPS-FM*) sets the policy direction with respect to wetlands, requiring no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted. In terms of specific requirements, section 3.22(1) allows loss of values and extent to occur if required for specified infrastructure, provided there is a functional need for the specified infrastructure in that location, and effects are managed through applying the effects management hierarchy; i.e,

133.1 adverse effects are avoided as far as practicable; then

133.2 minimised as far as practicable; then

133.3 remedied as far as practicable; then

133.4 where more than minor residual adverse effects remain, aquatic offsetting is provided where possible;

133.5 otherwise aquatic compensation is provided, or the activity is avoided.

134 The same requirements apply under Regulation 45(6) of the National Environmental Standards for Freshwater 2020.

135 In accordance with the RPSN and NPS-FM policy direction and requirements, the project development included a detailed site selection process, which **Mr Sherman** describes in his evidence. As shown in the soils classification map attached **(Figure 6)** the Project Sites are fairly typical of the surrounding land, with a similar pattern of recent sandy and mesic soils (derived from dune swales) on land to the north and north-west, while soils to the west and south-west are peat-dominated. As shown in the map of potential solar farm sites in the Marsden Point area attached to **Mr Hood's** evidence, peat soils predominate over all prospective sites considered.

136 The attached 'Threatened Environments' map **(Figure 5)** identifies that the whole of the Marsden Point/ Ruakākā area has either the same or a higher 'threatened environment' classification than the proposed sites.

137 Following site selection, the project envelope was refined through an iterative process of design reviews, informed by ecological evaluation, constraints mapping (primarily wetland extent and ecologically significant features and habitats), and workshops with the ecology and construction teams (see paragraphs 45 -52 of **Mr Sherman's** evidence).

138 As **Mr Sherman** explains, a variety of configurations were reviewed to as far as possible avoid, minimise and remedy effects on natural inland wetlands. As outlined in paragraphs 53-55 of **Mr Sherman's** evidence, the need for a minimum solar array, and constraints to placing solar panels on Site 3, required the loss of either the significant indigenous wetland features within Site 1A, or the largest area of open water on Site 1B /1C that provides habitat for threatened avifauna. On balance, the area of open water was deemed higher value due to the regular presence of mātuku and weweia, along with a variety of other wetland birds.

139 I have summarised key ecological effects and proposed effects management measures in Table 2 overleaf.

Table 2: Summary of ecological effects and proposed effects management measures.

Ecological feature	Values affected	Effects	Effects management
Open water bodies	• Moderately intact wetland hydrology; • High value for avifauna, including threatened species; • Intact dune swale geomorphology; • Degraded condition due to clearance, and stock access in 1B & 1C.	2.07 ha removed from Site 1A, 1B, 1C, including 1.11 ha of significant avifauna habitat in Site 1B/1C	• 2.05 ha open water in dune swale on Site 1B/1C retained and restored as indigenous dune swale wetland; • 7.05 ha of indigenous wetland (with open water habitat) created and restored in and around dune swale on Site 1B/1C; • 11.73 ha of open water and indigenous peat wetland recreated and enhanced in Site 3 to provide varied wetland community assemblage and avifauna habitat. • Stock will be excluded from all wetland features. • Establishment of vegetated buffer around all wetland margins will minimise disturbance to wetland interior and enhance habitat complexity across the wetland/dryland ecotone. • Protection and restoration of 5 ha of degraded kanuka forest and shrubland to increase habitat quality and complexity within remnant indigenous duneland ecosystem. • A Native Bird Management and Monitoring Plan will be developed and implemented to ensure works the vicinity of potential breeding and nesting habitat for cryptic wetland bird species will be undertaken outside of the main breeding/nesting season (typically August to February), and that risks to all indigenous birds during construction are managed.
Indigenous wetlands	• Intact wetland hydrology; • Intact dune swale geomorphology; • Rare/distinctive indigenous wetland type; • Moderate species and habitat diversity; invasive sedge locally abundant.	0.75 ha removed from Site 1A, including 0.57 ha of significant indigenous wetland	
Exotic wetlands	• Wetland hydrology modified, effects of drainage evident, limited restoration potential; • Modified dune swale geomorphology; • Low flora and fauna diversity; • Degraded condition due to clearance, and stock access in 1B & 1C.	13.7 ha removed (mainly from Sites 1B & 1C)	
Effects of solar array on Avifauna	Dabchick and other water birds	Low likelihood of collision risk due to birds mistaking panels for open water.	Monitoring, and species-specific mitigation if required, in response to observations made during the monitoring programme

Ecological feature	Values affected	Effects	Effects management
Herpetofauna	No native herpetofauna found in project footprint	Low likelihood that a small number of native lizards will be killed or displaced during works.	Protection, enhancement and pest control of kanuka forest and shrubland and associated duneland will improve habitat values for pacific gecko and other species that may be present. Lizard salvage and translocation of any native lizards found to suitable habitat.
Exotic trees	• May be used by native birds for nesting during breeding season. • No bats detected in the vicinity of the Project Sites. Possibility that small numbers of bats may use suitable trees for roosting.	Low likelihood that native birds will be killed or displaced during tree felling works. Low likelihood that roosting long tailed bats will be killed or displaced during tree felling works.	Pre-clearance checks of trees for bats and nesting birds prior to felling, as per bat roost and bird nesting protocols.
Watercourses and drains	• Watercourses (including Bercich Drain and the Unnamed Drain) provide habitat for native fish, and foraging habitat for wetland birds. • Minor drainage channels are accessible to stock and have ephemeral flow and poor water quality.	Culverts will be required for road crossings across Bercich Drain and the Unnamed Drain. Removal of riparian vegetation adjacent to Bercich Drain in within Site 1A. Minor drains may be removed, redirected and/or consolidated.	• Stock will be excluded from all drainage channels. Cattle will be replaced with sheep at a low stocking density, reducing nutrient inputs. • Design and installation of culverts in Bercich Drain on Site 1 and the Unnamed Drain on the edge of Site 3 will follow be in accordance with New Zealand Fish Passage Guidelines. • Ecological management plan will specify best ecological practice for drain maintenance activities. • As currently proposed, the Unnamed Drain will be naturalised and incorporated into the wetland creation and enhancement within Site 3, including provision of spawning habitat for īnanga.

140 In summary, the kānuka forest and shrubland and largest area of open water are avoided and remedied, while effects on threatened avifauna are remedied through habitat restoration and enhancement within Site 1B/ 1C, and effects on fauna arising from site clearance and construction are minimised through management protocols.

141 Significant residual adverse ecological effects of the Proposal include the permanent removal of 17.06 ha of wetlands, almost entirely from Site 1. Ecological features to be removed include:

141.1 13.7 ha of exotic-dominated wetlands in dune swales (mainly from Site 1);

141.2 All indigenous wetlands (0.75 ha in total, including two ecologically significant features, all from Site 1A); and

141.3 2.77 ha of open water bodies in dune swales, including 1.11 ha which is ecologically significant.

142 These residual adverse effects are to be offset by recreation, enhancement and restoration of wetlands within Sites 1B/1C and 3. A total area of 18.78 ha of wetland reinstatement and enhancement is proposed, as set out in Table 2. Concept plans for the wetland features to be created are attached to my evidence **(Figures 9 and 10)**.

143 Detailed wetland design, including extent, water level and hydrological regime will be incorporated into a Wetland Restoration and Management Plan (*WRMP*). This plan will be prepared in consultation with Patuharakeke Te Iwi Trust Board, and will include:

143.1 Detailed wetland design, including water depth, size, layout, catchment area and staging;

143.2 Wetland and riparian plant species to be planted, including density, size and layout, including connections to adjacent habitat; and

143.3 Maintenance and monitoring, including ongoing pest plant and animal control.

144 The recreated wetlands will be designed to support a mosaic of habitats, including dense tall reed-rush vegetation, lower-growing rushes and sedges, shallows, and deeper areas of open water, to provide foraging, roosting/resting, breeding, and nesting habitat, with particular focus on matuku-hūrepo and weweia. Saline influence and fish passage will be considered and catered for in the wetland design for the proposed wetland on Site 3.

145 In his evidence, **Mr Fuller** comments on the likely effectiveness of the wetland restoration proposed and provides examples of similar projects he has been involved with to demonstrate the viability of

this approach. **Mr Shapiro** also provides examples of successful wetland construction and enhancement projects that now provide habitat for matuku and a variety of other wetland birds.

Offset Evaluation

146 The offset feasibility (likelihood of success) was scored as high, due to the proposed offset sites already being identified, a clear understanding of the wetland habitat characteristics to be recreated and the requirements to achieve this outcome, the short-anticipated lag time between the loss and restoration, and the well documented benefits of pest control for wetland avifauna.

147 DOC's Biodiversity Offset Accounting Model (*BOAM*) was used to confirm the adequacy of the proposed offset relative to the impacted wetlands. The commonly used currency of "ecological condition x area" formed the basis of the calculation. Ecological condition was scored using semi-quantitative methods set out in Clarkson et al (2004)[9].

148 The BOAM calculator produced a total "condition x area" score of 53.93 for the impacted wetlands, and a score of 75.12 for the proposed offset. This is because the habitat quality and condition of the majority of wetland features to be removed is poor, while the more intact indigenous features are small in extent.

149 The objectives of the proposed reinstatement and enhancement are to replace the full extent of wetlands removed, and ensure the restored wetlands have better habitat and ecological function than those that are to be removed.

150 As Mr Fuller details in his evidence, the proposed wetland recreation enhancement and restoration is viable from an engineering and an ecological perspective.

Principles for aquatic offsetting

151 Appendix 6 of the NPS-FM sets out principles that apply to the use of aquatic offsetting for the loss of extent or values of natural inland wetlands and rivers.

152 I have assessed the performance of the proposed wetland construction, restoration and enhancement measures with respect to the NPS-FM aquatic offsetting principles in Table 3 overleaf.

Table 3: Evaluation of project against offsetting principles.

[9] Clarkson, B.R., Sorrell, B.K., Reeves, P.N., Champion, P.D., Partridge, T.R. and Clarkson, B.D., 2004. Handbook for monitoring wetland condition. *Coordinated monitoring of New Zealand wetlands. A Ministry for the Environment SMF funded project. Ministry for the Environment, Wellington*.

Offsetting principles	Performance of proposed wetland enhancement
1. Adherence to effects management hierarchy: steps to avoid, minimise, and remedy adverse effects are demonstrated to have been sequentially exhausted.	Project scoping and development identified ecological constraints and implemented EMH through an iterative design process.
2. When aquatic offsetting is not appropriate: where extent or values cannot be offset to achieve no net loss, for example due to the irreplaceability or vulnerability of the extent or values affected, or because replacement is not technically feasible within an acceptable timeframe.	Features to be replaced are mostly exotic-dominated wetlands with low biodiversity values and moderate potential habitat values for wetland fauna. Small remnant indigenous wetlands are of high value due to their rarity and ecological context but can be reinstated within the same ecosystem and within a short timeframe; open water bodies of better habitat quality can be recreated locally and within a short timeframe.
3. No net loss and preferably a net gain: This is demonstrated by a like-for-like quantitative loss/gain calculation, and is achieved when the extent or values gained at the offset site (measured by type, amount and condition) are equivalent to or exceed those being lost at the impact site.	The extent of wetland to be reinstated exceeds the extent of wetland area to be lost, and will be of equivalent or better value with respect to biodiversity, habitat quality and habitat complexity. Recreated and restored foraging and breeding habitat, and predator management within these features, will improve the viability of threatened fauna populations that utilise the sites and surrounding area.
4. Additionality: An aquatic offset achieves gains in extent or values above and beyond gains that would have occurred in the absence of the offset.	None of the proposed gains would occur in the absence of the Proposal.
5. Leakage: Aquatic offset design and implementation avoids displacing harm to other locations (including harm to existing biodiversity at the offset site).	No displacement of harm is anticipated.

6. Long-term outcomes: An aquatic offset is managed to secure outcomes of the activity that last at least as long as the impacts, and preferably in perpetuity.	Enhanced ecological values achieved through the Proposal are anticipated to be permanent.
7. Landscape context: An aquatic offset action is undertaken where this will result in the best ecological outcome, preferably close to the impact site or within the same ecological district.	The recreated, restored and enhanced wetlands are adjacent or near to the impact site.
8. Time lags: The delay between loss of extent or values at the impact site and the gain or maturity of extent or values at the offset site is minimised so that the calculated gains are ideally achieve within the consent period.	Wetland recreation and enhancement to the point where functional habitat is present can be achieved within a timeframe of less than 5 years.
9. Science and mātauranga Māori: The design and implementation of an aquatic offset is a documented process informed by science where available, and mātauranga Māori at place.	Methods proposed for wetland reinstatement, restoration and enhancement are well known, widely used and successful, and there are opportunities to integrate mātauranga Māori.
10. Tangata whenua or stakeholder participation: Opportunity for the effective and early participation of tangata whenua or stakeholders is demonstrated when planning aquatic offsets, including their evaluation, selection, design, implementation, and monitoring.	Patuharakeke have endorsed the proposal for wetland reinstatement in Site 3 and indicated their willingness to participate in the design and implementation of the Proposal.
11. Transparency: The design and implementation of an aquatic offset, and communication of its results to the public, is undertaken in a transparent and timely manner.	The Proposal has been publicly notified.

RESPONSE TO SECTION 42A REPORT

153 In this section I respond to Appendix A of the Section 42A Report, the Ecological Review by Rural Design 1984 Limited, authored by

Mr Jack Warden. I note that some of the submissions opposing the Proposal raise ecological matters. I consider that the matters raised in submissions have been addressed in my evidence above or are addressed in this section.

154 Mr Warden (P7, para 1 and reiterated throughout his report) refers to the wetland features within Site 1 as dune slack wetlands that are "rare and nationally threatened ecosystem types and are considered irreplaceable". Mr Warden explains (P17, paras 1 & 2) that the irreplaceability of these features is due to their reliance on ecological, geological and hydrological conditions, and notes that they are a rare ecosystem in the Waipu Ecological District (Lux et al, 2007) and a 'Nationally Endangered' ecosystem (Holdaway et al., 2012) and a habitat for several 'At Risk' and 'Threatened' flora and fauna.

155 As such, Mr Warden does not consider that the Proposal meets Principle 2 for aquatic offsetting (irreplaceability) as set out in the NPS-FM.

156 I note that the wetland landform present in Site 1 is "dune swale" according to Johnson & Gerbeaux (2004), which they describe (p43) as *"peaty wetlands that form between old beach ridges that have consolidated and risen relative to sea level and as the coast has built seaward."* Johnson & Gerbeaux (2004) distinguish dune swales from dune slack landforms (p. 44), which *"lie close to the sea and become ponded by rainfall or by incursions of the highest tides",* and are typically ephemeral.

157 Manaaki Whenua similarly specifies that dune slacks (in the strict sense) are found in association with active sand dunes, and are *"small, nutrient-enriched, vegetated, moist depressions between shore dunes or in a sandbank, especially those which periodically hold slack (scarcely moving) water at times of highest tides (Johnson & Rogers 2003)*". Dune swales are referred to as dune slack ecosystems "in a broader sense".

158 Dune swales were not included in the list of Williams et al (2007) "Physical environments and vegetation structure of New Zealand's historically rare ecosystems" that formed the basis of Manaaki Whenua's naturally uncommon ecosystems, though stable sand dunes were (with a note that "rarity at a national scale may be questionable").

159 I agree that dune slacks and dune swales are both naturally uncommon ecosystem types, and intact examples containing characteristic vegetation and flora are rare in both cases. However, I note that these features are distinct, and that the former is much more limited in extent than the latter.

160 I disagree with the notion that either dune slacks or dune swales are fundamentally irreplaceable, as both derive from processes that are

well understood and not especially complex. For example, Murphy et al (2018)[10] describes underlying principles and methods for dune wetland restoration, and reports results of successful recreation of a variety of dune slack wetlands in Tawhirihoe Scientific Reserve, Manuwatū (though these were mostly in active duneland).

161 Naturally uncommon ecosystems[11] are given priority because they arise due to unusual environmental conditions and hence contain distinctive biodiversity, while their relative scarcity has resulted in a disproportionate loss of these features.

162 Accordingly, the Ministry for the Environment and DOC identified indigenous vegetation associated with both threatened environments and naturally uncommon ecosystems as national priorities for biodiversity protection:

162.1 *National Priority 1: To protect indigenous vegetation associated with land environments, (defined by Land Environments of New Zealand at Level IV), that have 20 percent or less remaining in indigenous cover.*

162.2 *National Priority 2: To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.*

163 As identified for both of these national priorities (and reflected in the RPSN significance criteria), the emphasis is on protecting features that retain indigenous vegetation, recognising that a large proportion of these land environments no longer support the indigenous biodiversity once associated with them.

164 Other than the small area of indigenous wetland within Site 1A, the dune swale features within Site 1 contain little or no indigenous vegetation and are very degraded due to drainage (a requirement of Whangerei District Council) and grazing by cattle.

165 I do not agree that partly drained, exotic-dominated dune swale habitats within Site 1 (most of which no longer contain any of their original indigenous biodiversity) still constitute a rare ecosystem, or are irreplaceable.

166 In my opinion, the biota, hydrosystem, peat structure and nutrient status of dune swale features present within Site 1 are all extensively modified to the point that they are no longer representative of an indigenous dune swale ecosystem. In my

[10] Murphy, A.L., Singers, N.J. and Rapson, G.L., 2019. Created dune slack wetlands effectively host rare early successional turf communities in a dynamic dunefield, New Zealand. *Journal of Coastal Conservation*, *23*, pp.203-225.

[11] Wiser SK, Buxton RP, Clarkson BR, Hoare RJB, Holdaway RJ, Richardson SJ, Smale MC, West C, Williams PA 2013. New Zealand's naturally uncommon ecosystems. In Dymond JR ed. Ecosystem services in New Zealand – conditions and trends. Manaaki Whenua Press, Lincoln, New Zealand.

opinion, Mr Warden's references to these features as "complex" and "a diverse mosaic" (p21, paras 1 & 2) characterise them in terms of what they once were, but do not acknowledge the reality of what is now present. I do not agree that the flora and values present in small indigenous wetland fragments in Site 1A can be extrapolated to degraded, exotic-dominated features across the wider site due to "interconnectedness" (p19, para 5). I note that Lux (2007) did not include dune swale features on Site 1 among recommended areas for protection, though the stand of kānuka forest and shrubland was included (which is to be protected through the Proposal).

167 As **Mr Fuller** describes in his evidence, the physical structure and hydrological conditions of dune swale features can be recreated along the coastal edge of Site 1, and will support indigenous wetland vegetation characteristic of dune-impounded wetlands (in their early successional phase as swamp), and provide high quality fauna habitat. As both **Mr Fuller** and **Dr Shapiro** explain, based on previous examples of similar wetland recreation and enhancement projects, no substantive time lag is anticipated between commencement of construction works at Site 1 and reinstatement of wetland habitat within both Sites 1 and 3, therefore no adverse effects on threatened avifauna are anticipated. **Mr Fuller** further addresses matters pertaining to uncertainty and timeframes for wetland establishment in his evidence.

168 As **Dr Shapiro** explains in his evidence, the presence of At Risk and Threatened avifauna on Site 1 is not due to the presence of the exotic-dominated dune swale wetlands, but rather the presence of open water bodies which offer foraging habitat for these species. While one At Risk indigenous plant is recorded from Site 1, its distribution is very localised within the Site and it does not occur throughout the majority of the wetland features present.

169 In contrast, I consider it very unlikely that the exotic-dominated wetland features now present within Site 1 would revert to an indigenous wetland ecosystem of any kind in the absence of active restoration and management, and areas subjected to ongoing grazing will continue to degrade. I consider this point relevant to Mr Warden's concern regarding long term restoration outcomes (p18, para 1), as he notes a number of concerns regarding the long term viability of the proposed wetland at Site 3. I consider that a prospective restoration of the exotic-dominated wetlands at Site 1 is both unlikely to occur, and would be constrained due to drainage requirements for the site, and the industrial zoning of surrounding land.

170 Mr Warden does not consider the proposed offset is equivalent with respect to 'landscape context' (p19, para 1), as Site 3 does not contain the same current or historic ecosystem types. In my opinion, this is an academic distinction as the current ecosystem types present on both sites are exotic-dominated. I do note that Site 3 is peatland overlying sand, and though the substrates in

Site 3 are much older, they would have formed in a similar fashion to those in Site 1. I also note that proposed offset includes 9.31 ha of indigenous wetland recreation and restoration within dune swales in Site 1. The remaining 11.3 ha of wetland to be created within Site 3 will be located in peatland, also recognised as a threatened environment.

171 In Sections 3.3 – 3.6 of his report, Mr Warden raises various matters concerning the approach to assessment of ecological value, significance and ecological effects provided with the application, but I understand his key concerns are that:

171.1 he considers effects to be more than minor and potentially significant, mainly due to a difference of opinion with respect to the ecological values of the wetland features identified on Site 1;

171.2 he has doubts about the viability of the wetland recreation, enhancement and restoration proposed as an offset, and disagrees as to its appropriateness;

171.3 he disagrees with the use of the BOAM model for determining the size of the proposed offset, and notes that (unreferenced) international literature supports the use of ratios (that multiply the extent of area lost) to ensure adequate compensation.

172 I have addressed matters pertaining to paragraph 158.1 in the preceding paragraphs. I would also add that Mr Warden's criticism of the approach taken in Boffa Miskell's Ecological Effects Assessment (p19, para 3) is in my view unfounded. The non-statutory EIANZ framework provides the overall framework for an ecological assessment, while ecological significance criteria in Appendix 5 of the NRPS provide the basis for the evaluating Section 6c matters in particular. Undertaking the assessment in this manner is Boffa Miskell's standard, and accepted, practice for ecological work across the country.

173 **Mr Fuller** and **Dr Shapiro** address the viability of the proposed offset with respect to paragraph 158.2.

174 I note with respect to paragraph 158.3 that the NPS-FM, Appendix 6, Principle 3 for aquatic offsetting specifies the use of a "quantitative loss-gain calculation" (i.e., not a ratio). As I have discussed in detail in my evidence, I consider the proposed offset is appropriate in the circumstances of the Proposal where a predominantly lower value wetland area will be replaced with a higher value outcome.

175 Mr Warden (p27 para 5) concludes that the discrepancy between RDL and BML assessments concerning the natural inland wetland extent on Site 1 is a pivotal issue for the ecological assessment.

While I agree that the matter of extent has implications with respect to the adequacy of effects management measures proposed, I do not agree that it has much bearing on application of the effects management hierarchy, or on ecological value/significance assessments. As I note in my description of wetland features and values earlier in my evidence, in my opinion it is important to keep in mind that the areas in contention are the most marginal in terms of wetland characteristics (i.e., wet-tolerant species assemblage, persistence and hydroperiod, substrate, habitat and functions). While a determination of extent is relevant because of the NPS-FM policy direction to maintain wetland extent and value, the current values of the areas in question are very low, so a revision to their extent would not change the overall assessment of value or significance. I note that **Ms Cook's** evidence outlines the wetland delineation undertaken in detail and responds to this aspect of Mr Warden's review.

176 Mr Warden (p28 para 2) offers the suggestion that adverse ecological effects of the Proposal could be avoided or minimised by locating the proposed solar arrays elsewhere, e.g., Site 3, or directly adjacent farmland which he regards as "relatively free of ecological constraints", though he acknowledges that ecological values and effects have not been assessed for this site. I note that this area of farmland also contains dune swales (as shown in the soil map in **Figure 4**) and areas that appear to be wetland on aerial imagery. **Mr Sherman** addresses the suitability of Site 3 for Solar arrays in his evidence.

177 Overall, I do not consider that the Ecological Review has raised any matters or concerns that are not sufficiently addressed in the Ecological Effects Assessment included with the application or the evidence produced by myself, **Ms Cook**, **Dr Shapiro**, **Mr Fuller** and **Ms McDavitt** for this hearing. I remain of the opinion that the recreation of wetland habitats in Sites 1 and 3 will avoid, remedy and offset the ecological effects identified, such that the overall effects on ecological values will be minor, and will produce positive biodiversity benefits in the short to medium term.

19 July 2024

Sarah Megan Flynn

Boffa Miskell

www.boffamiskell.co.nz

0 500 m

1:20,000 @ A4

Data Sources: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

Site Boundary

Consented BESS area

RUAKĀKĀ ENERGY PARK

Site Overview

Date: 15 August 2023 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: Tanya.Cook@boffamiskell.co.nz | Drawn: HCo | Checked: TCo

Figure 1

SITE 1A

SITE 1B

SITE 1C

Boffa Miskell

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0 150 m

1:5,000 @ A3

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- 5MBC
- 20 minute point survey
- Dawn/dusk survey
- ARD
- Drainage channels
- Site boundary

Vegetation Features

- Kānuka dominated shrubland
- Exotic scrub
- Exotic shelterbelts/hedgerows
- Wetlands
- Riparian vegetation

RUAKAKA BIRD SURVEYS

Bird Survey Locations

Date: 28 November 2023 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: Tanya.Cook@boffamiskell.co.nz | Drawn: HCo | Checked: JBe

Figure 2

Boffa Miskell

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0 200 m

1:7,000 @ A3

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- 5MBC
- 20 minute point survey
- Dawn/dusk survey
- ARD
- Drainage channels

Vegetation Features

- Dead exotic hedgerow
- Exotic shelterbelts/hedgerows
- Exotic scrub
- Native scrub
- Wetlands

RUAKAKA BIRD SURVEYS

Bird Survey Locations

Date: 01 December 2023 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: Tanya.Cook@boffamiskell.co.nz | Drawn: HCo | Checked: JBe

Figure 3

Boffa Miskell

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0 500 m

1:30,000 @ A4

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, Land Environments New Zealand (LENZ)

Projection: NZGD 2000 New Zealand Transverse Mercator

RUAKĀKĀ SOLAR FARM CONSENT HEARING

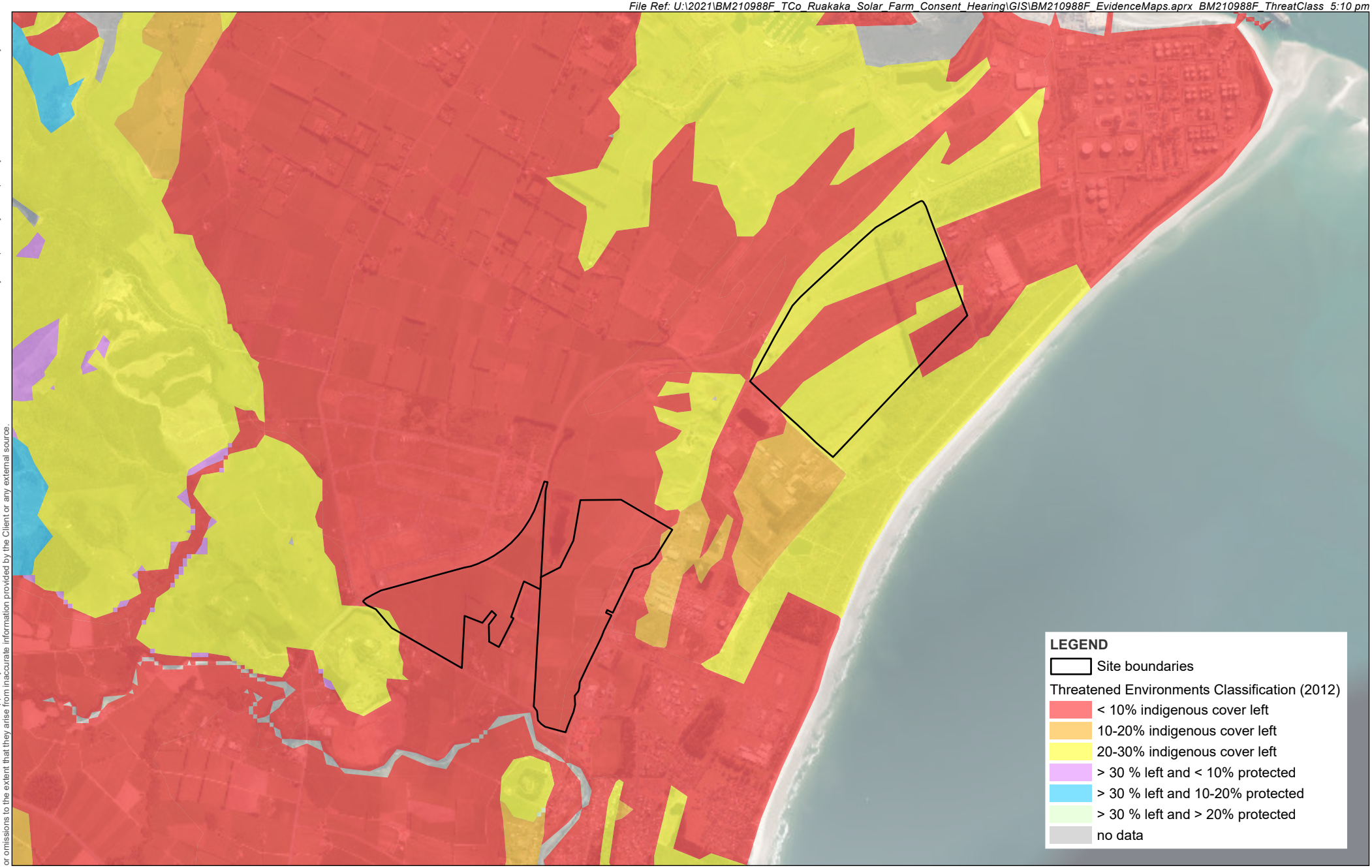
Significant Natural Areas

Date: 18 July 2024 | Revision: 0

Plan prepared for Meridian by Boffa Miskell Limited

Project Manager: Tanya.Cook@boffamiskell.co.nz | Drawn: HCo | Checked: SFI

Figure 4



Boffa Miskell

www.boffamiskell.co.nz

0 500 m

1:30,000 @ A4

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, Land Environments New Zealand (LENZ)

Projection: NZGD 2000 New Zealand Transverse Mercator

RUAKĀKĀ SOLAR FARM CONSENT HEARING

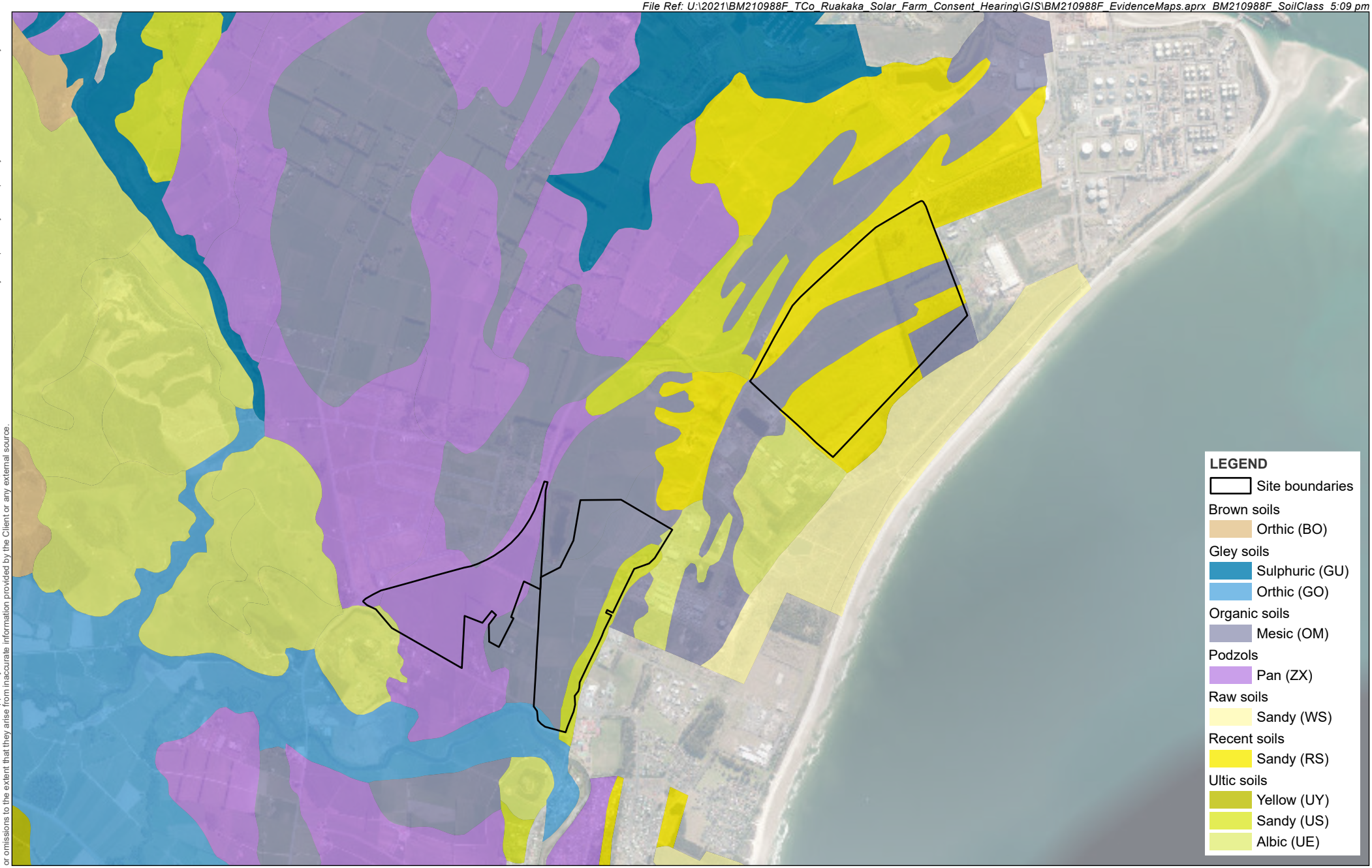
Threatened Environments Classification

Date: 18 July 2024 | Revision: 0

Plan prepared for Meridian by Boffa Miskell Limited

Project Manager: Tanya.Cook@boffamiskell.co.nz | Drawn: HCo | Checked: SFI

Figure 5



Boffa Miskell

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0 500 m

1:30,000 @ A4

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, Land Environments New Zealand (LENZ)

Projection: NZGD 2000 New Zealand Transverse Mercator

RUAKĀKĀ SOLAR FARM CONSENT HEARING

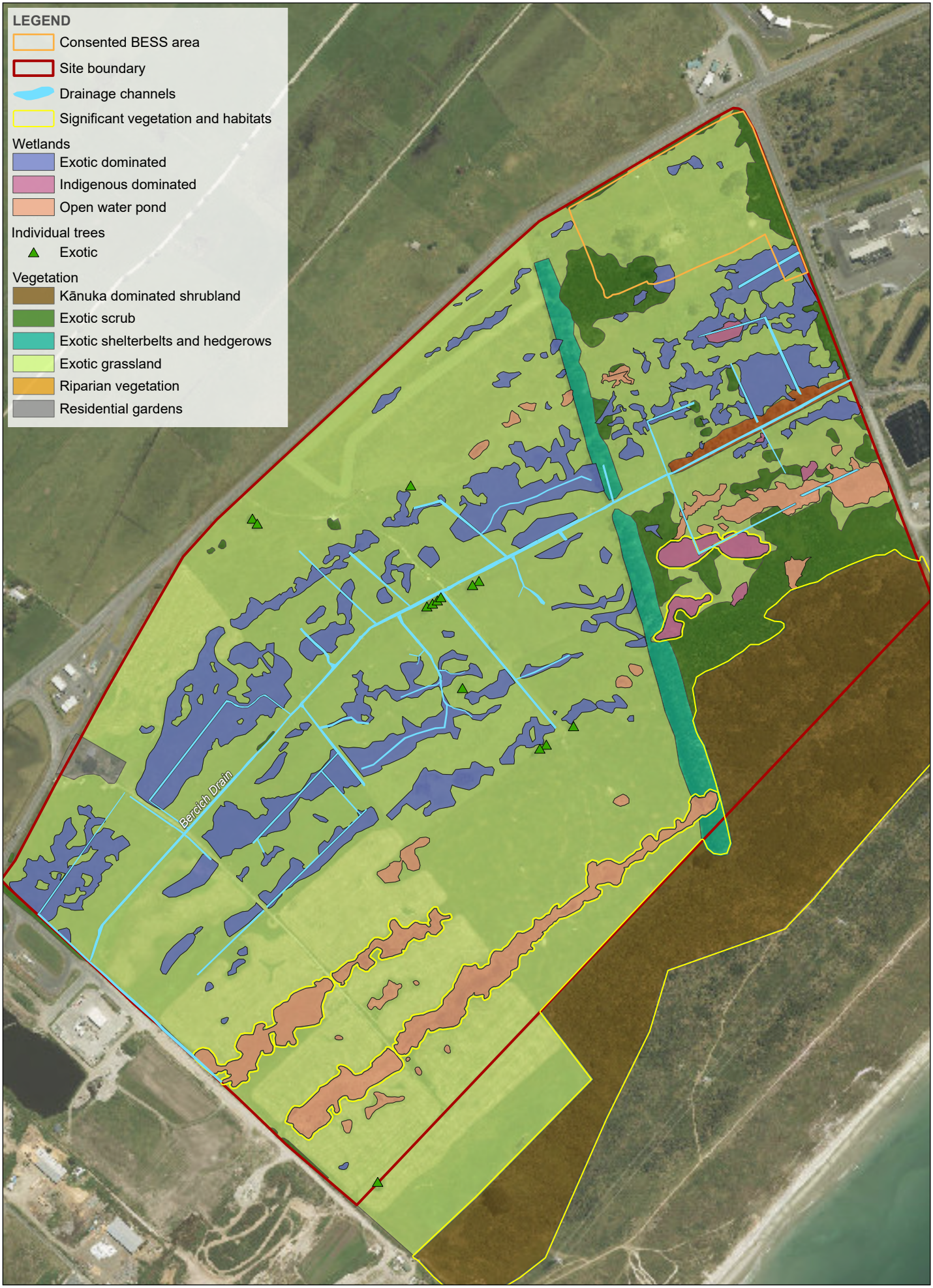
New Zealand Soil Classification

Date: 18 July 2024 | Revision: 0

Plan prepared for Meridian by Boffa Miskell Limited

Project Manager: Tanya.Cook@boffamiskell.co.nz | Drawn: HCo | Checked: SFl

Figure 6



Boffa Miskell

www.boffamiskell.co.nz

0 150 m

1:7,000 @ A4

RUAKĀKĀ SOLAR FARM CONSENT HEARING

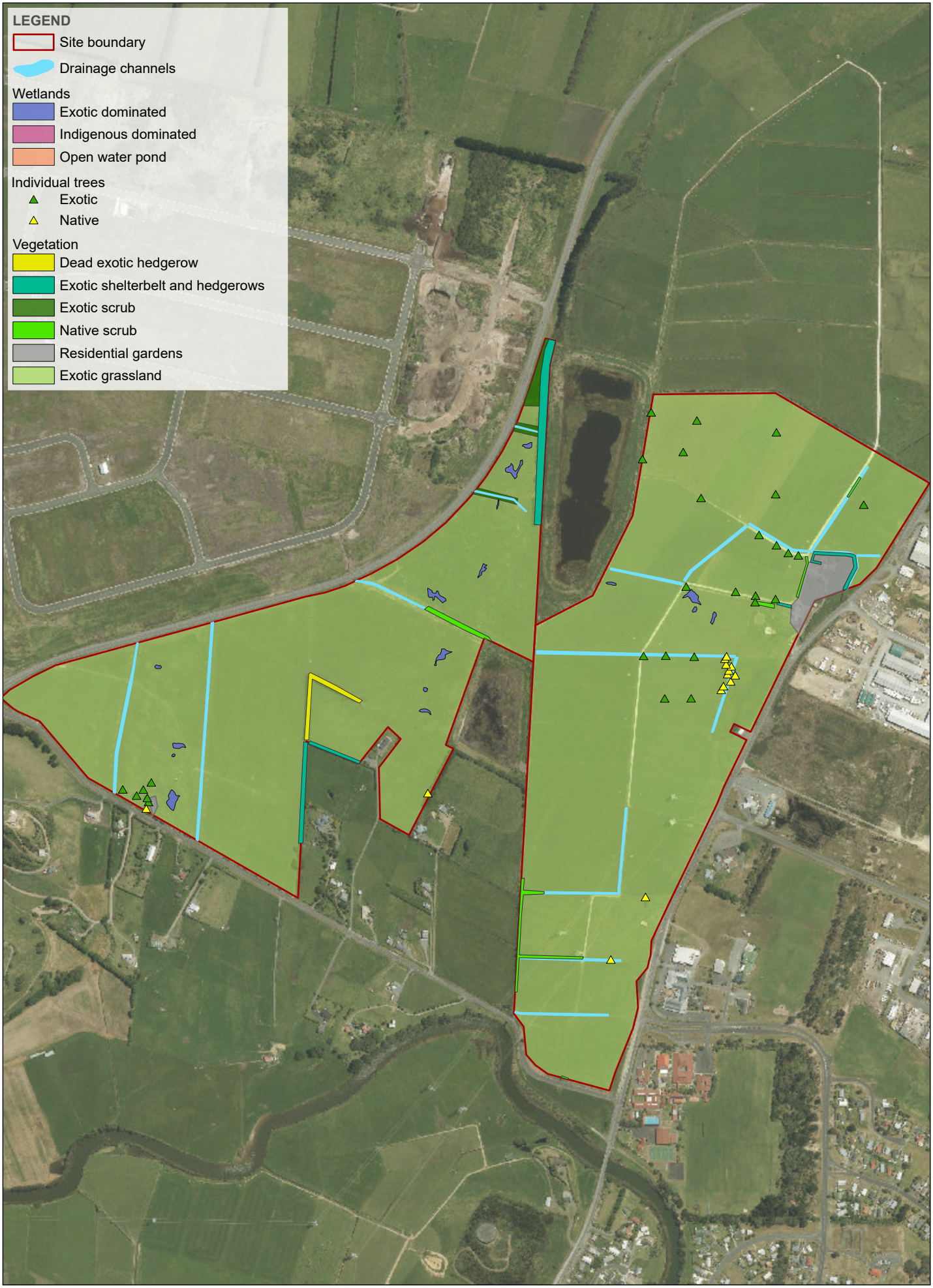
Site 1: Ecological Features

Date: 18 July 2024 | Revision: 0

Plan prepared for Meridian by Boffa Miskell Limited

Project Manager: Tanya.Cook@boffamiskell.co.nz | Drawn: HCo | Checked: TCo

Figure 7



Boffa Miskell

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0 250 m

1:10,000 @ A4

RUAKĀKĀ SOLAR FARM CONSENT HEARING

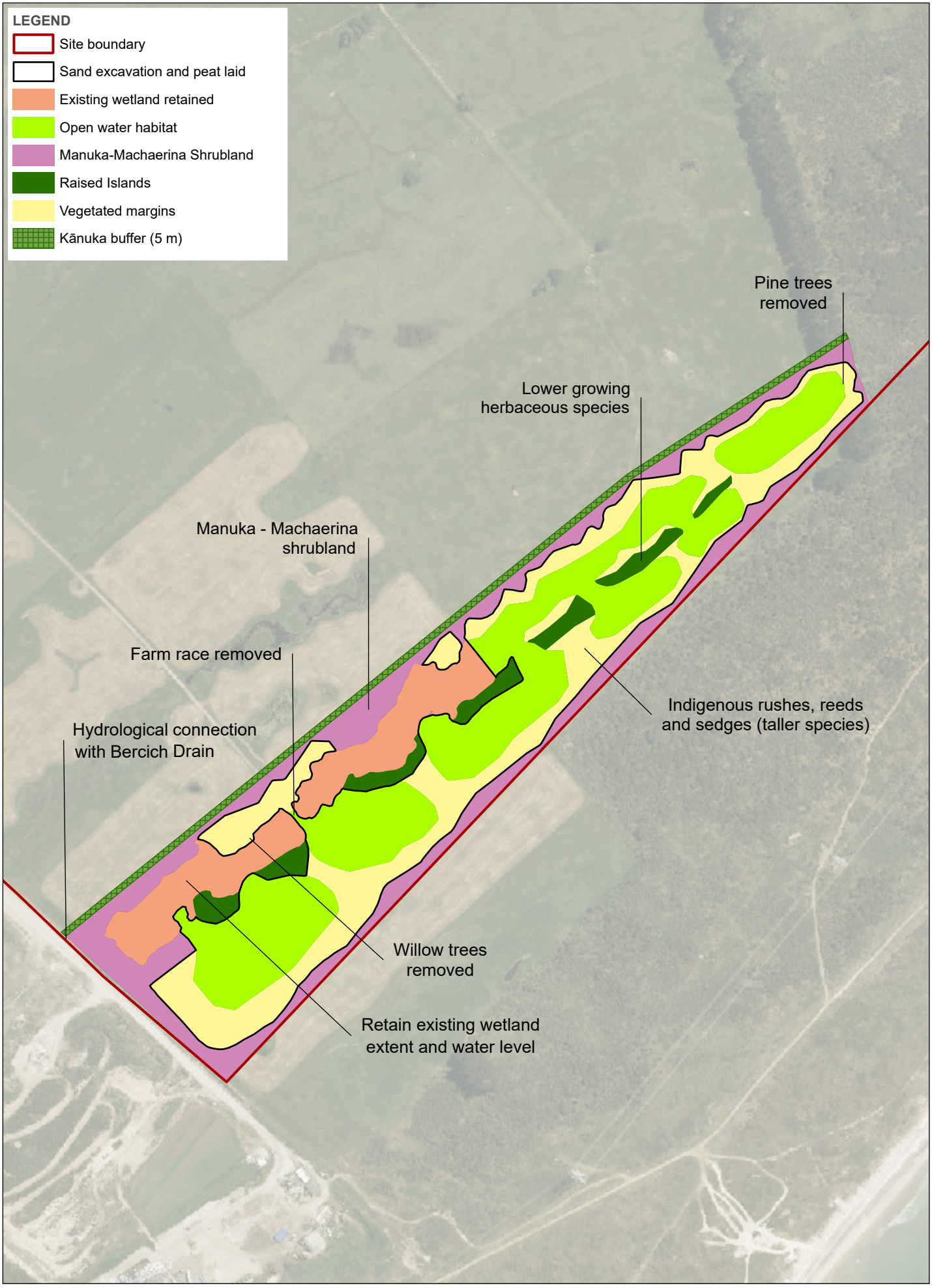
Sites 2 and 3: Ecological Features

Date: 18 July 2024 | Revision: 0

Plan prepared for Meridian by Boffa Miskell Limited

Project Manager: Tanya.Cook@boffamiskell.co.nz | Drawn: HCo | Checked: TCo

Figure 8



Boffa Miskell

www.boffamiskell.co.nz

0 100 m

1:4,000 @ A4

RUAKĀKĀ SOLAR FARM CONSENT HEARING

Site 1 Wetland Restoration

Date: 18 July 2024 | Revision: 0

Plan prepared for Meridian by Boffa Miskell Limited

Project Manager: Tanya.Cook@boffamiskell.co.nz | Drawn: HCo | Checked: TCo

Figure 9

INDICATIVE WETLAND CONCEPT

0 50 100 150 200 m

scale 1 : 2500 @ A3

Ref: 1338_PlantingConcept_20230724

LITTORALIS
LANDSCAPE ARCHITECTURE

PLANTING CONCEPT SOUTH EAST SITE 3

Figure 10 RUAKĀKĀ ENERGY PARK