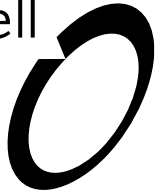


Boffa Miskell



# Waiuku Wind Farm

Preliminary Landscape, Visual and Coastal Natural Character Effects  
Prepared for LET Capital Number 3 Limited Partnership

28 February 2023









## Document Quality Assurance

**Bibliographic reference for citation:**

Boffa Miskell Limited 2023. *Waiuku Wind Farm: Preliminary Landscape, Visual and Coastal Natural Character Effects*. Report prepared by Boffa Miskell Limited for LET Capital Number 3 Limited Partnership.

Prepared by:	Boyden Evans Landscape Architect / Partner Boffa Miskell Limited	
	Pen Moore Graphics Supplement Technical Services Manager	
	Emma McRae Landscape Architect / Associate Principal Boffa Miskell Limited	
Reviewed by:	Emma McRae Landscape Architect / Associate Principal Boffa Miskell Limited	
Status: FINAL	Revision / version: [5]	Issue date: 28 February 2023

**Use and Reliance**

This report has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Boffa Miskell does not accept any liability or responsibility in relation to the use of this report contrary to the above, or to any person other than the Client. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate, without independent verification, unless otherwise indicated. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.



Boffa Miskell is proudly a  
Toitū net carbonzero certified consultancy



# CONTENTS

<b>1.0</b>	<b>Introduction</b>	<b>1</b>
1.1	Scope of the report	1
1.2	Project Description	1
1.3	Approach	2
<b>2.0</b>	<b>Existing Environment</b>	<b>3</b>
2.1	Landscape Context	3
2.2	Landscape Character	4
2.3	Protected Landscapes	5
2.4	The Coastal Environment and Areas of High Natural Character	7
2.5	Potential Cumulative Effects	8
2.6	Visual Catchment	8
<b>3.0</b>	<b>Relevant Statutory Provisions</b>	<b>10</b>
3.1	Summary	10
<b>4.0</b>	<b>Site Description</b>	<b>11</b>
<b>5.0</b>	<b>Feasibility Appraisal</b>	<b>12</b>
5.1	Introduction	12
5.2	Landscape Effects	13
5.3	Visual Effects	14
5.4	Shadow Flicker	15
5.5	Effects on Coastal Natural Character	16
5.5	Associative Landscape Effects	17
<b>6.0</b>	<b>Conclusions and Recommendations</b>	<b>17</b>
<b>7.0</b>	<b>References</b>	<b>18</b>

Graphic Supplement (bound separately)



# 1.0 Introduction

## 1.1 Scope of the report

Boffa Miskell Limited (BML) has been engaged by LET Capital Number 3 Limited Partnership in November 2022 to undertake a Preliminary Landscape, Visual and Coastal Natural Character Effects Study (the Study) for a proposed 18 turbine wind farm (the Proposed Development) at a Site (the Site) located approximately 7 km north of Port Waikato (**Figure 1**). The Site covers approximately 500ha of land and is zoned Rural within the Waikato District Plan. Part of the Site is also identified as being within the Coastal Environment.

The scope of the following Study is to provide a high-level appraisal of the potential landscape, visual amenity and coastal natural character effects on the immediate and surrounding environment character arising from the Proposed Development. The overall aim is to determine whether the proposal is likely to have significant adverse environmental effects and identify mitigation measures that should be considered when progressing the more detailed layout and design of the wind farm.

The study is based on findings from desktop investigations and a Site visit to the area on 13<sup>th</sup> December 2022 and should be read as a preliminary appraisal. A full landscape, visual and coastal natural character assessment will be required to support the consent application to the Environmental Protection Authority.

The Study does not consider the impacts or effects on tangata whenua values, from a Te Ao Maori perspective. A Cultural Impact Assessment (CIA) and a Landscape, Visual and Coastal Natural Character Effects Assessment are separate but complementary studies. Information provided in a CIA would be incorporated into a full landscape assessment to contribute to the understanding and appreciation of a landscape in a general sense.

## 1.2 Project Description

The Waiuku Wind Farm will have an installed generation capacity of up to 80 MW, comprising a maximum of 18 wind turbines with a maximum tip height of 190m and a minimum of 30m turbine tip to ground level (**Figure 2**). The project Site occupies 500 ha. across three separate landowner properties. The estimated electricity output is approximately 326 GWh per annum. For the purposes of this assessment, the Vestas V136 turbine with a blade length of 65m on a tower of 120m has been used. This is a turbine model that meets the maximum tip height and is suitable for the Site.

Each turbine will have a ground mounted transformer, externally housed adjacent to each turbine. The turbines will be connected to a central electrical collector via a network of 33 kV underground cables. The collector station will be approximately 60m x 50m in area. An operations and maintenance building (approximately 40m x 15m and 8m high) is also proposed near the middle of the wind farm. Two permanent wind monitoring masts up to 100m tall (equivalent to likely turbine hub height) on concrete foundations and supported by guy wires are proposed.

The wind farm is proposed to connect into the National Grid via Transpower's existing electrical substation at Glenbrook via the existing Counties Energy 33kV network. An alternative connection is being investigated via a new standalone 33kV transmission line from the Site to the substation at Glenbrook.

Options to erect a temporary concrete batching plant, approximately 100m x 75m and 10m tall is being considered together with transporting concrete to the Site from an existing off-Site concrete batching plant.

## 1.3 Approach

### 1.3.1 Objectives of Preliminary Assessment

The objectives of this preliminary assessment Study are:

- establish the landscape, visual and coastal natural character baseline context of the Site and wider study area;
- appraise the likely landscape, visual and coastal natural character effects arising as a result of the Proposed Development;
- identify any key issues and constraints to the Proposed Development;
- Identify whether the Proposed Development has the potential to result in significant adverse environmental effects.

### 1.3.2 Methodology

This preliminary assessment has been undertaken with reference to *Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines*<sup>1</sup> and the Quality Planning Landscape Guidance Note (Boffa Miskell Limited)<sup>2</sup> and its signposts to examples of best practice, including: the New Zealand Institute of Landscape Architects Best Practice Note 10.1<sup>3</sup> and the UK guidelines for landscape and visual impact assessment<sup>4</sup>.

To focus the assessment, a Zone of Theoretical Visibility (ZTV) was prepared for the turbine tip height. These ZTVs provide an understanding of where the proposed development would theoretically be visible from, or where views of the turbines would not be available. It is important to note that ZTVs do not reflect the screening effect of vegetation or built structures and so the visibility shown on the ZTVs is more extensive than actual visibility on the ground. Therefore, the ZTVs indicate a worst-case scenario.

Based on the ZTVs coverage, a preliminary study area of 20 km from the turbines was selected to ensure that all key viewers and landscapes were considered.

---

<sup>1</sup> Formally approved at Tuia Pito Ora/ NZILA 5 May 2021 AGM and published July 2022.

<sup>2</sup> <http://www.qualityplanning.org.nz/index.php/planning-tools/land/landscape>

<sup>3</sup> Best Practice Note Landscape Assessment and Sustainable Management 10.1, NZILA

<sup>4</sup> Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, 2013



Initially, a desktop study was undertaken to establish the baseline context of the Proposed Development. This considered physical components of the landscape (i.e. land cover, vegetation, nature of topography etc) as well as the landscape character and values of the area, including identification of any protected or identified landscapes within the study area. Visual elements and viewer locations were also identified and include dwellings, settlements, transportation corridors and recreational trails and high points. The desktop study also included a review of the relevant district and regional planning provisions of the Site.

A Site visit was conducted on the 13 December 2022 to verify the desktop study findings and to gain further understanding about the landscape character and values of the Site, and the wider area and the nature of viewers who may be affected by the proposed development. The Site visit was completed during mostly overcast and showery weather conditions.

An analysis was then prepared to identify how each of the identified landscape, visual and coastal natural character resources within the study area would be potentially affected by the Proposed Development.

### 1.3.3 Layout of the report

The report is presented as follows:

- Section 2: Existing Environment – describes the existing characteristics and qualities of the landscape and the Site, as the key viewers found within the study area; and
- Section 3: Relevant Statutory Provisions in terms of landscape, visual and coastal natural character aspects – sets out the key statutory provisions (national, regional and district) which will inform the decision making process;
- Section 4: Site Description;
- Section 5: Feasibility Appraisal – presents a preliminary appraisal of the likely effects arising from the proposed development on the landscape and visual resource;
- Section 6: Conclusions and Recommendations – summarises key findings from the preliminary investigation and recommends changes and actions to reduce significant adverse landscape, visual and natural character effects.

## 2.0 Existing Environment

### 2.1 Landscape Context

The Site is located on the west coast approximately 7km north of Port Waikato and 9km south of Waiuku, to the north of the Waikato River mouth, a key landscape feature in the area, and to the north of the Waiuku State Forest, an extensive area of plantation pine forestry between the Waikato River mouth and the proposed Waiuku Wind Farm Site. This forest surrounds a large sand mine at the river mouth (**Figure 1**).

A landscape and visual effects assessment and a natural character assessment were carried out as part of the Awhitu Wind Farm resource consent application (Isthmus, 2003, Boffa Miskell

Ltd, 2004). Both studies considered the wider coastal landscape context, including the area proposed for the Waiuku Wind Farm.

These assessments provide useful landscape and coastal natural character descriptions, which will be helpful when completing the substantive assessment for the Waiuku Wind Farm. The Boffa Miskell assessment subdivides the coast from Port Waikato to Manukau Harbour entrance into a series of landscape units and provides a description and assessment for each of these and thus provides a helpful contextual base line derived from the field work and investigations that were carried out.

The conclusions in both studies as to level of landscape, visual and coastal natural character effects acknowledges the changes that will result from the development of the Awhitu Wind Farm and concludes that while there will be landscape, visual and coastal natural character effects these are not significantly adverse.

Another aspect to consider is that the landscape context today is different to when these earlier studies were carried out in 2003 and 2004; the Awhitu Wind Farm forms part of the existing environment, despite currently there has been only a single turbine erected. Conversely, cumulative landscape, visual and coastal natural character effects as the result of a second wind farm along this stretch of coast will be addressed as part of the substantive assessment.

## 2.2 Landscape Character

The Site and surrounding area forms a part of the Northern Hills Landscape Character Area as identified within the Waikato Landscape Study (Boffa Miskell Ltd, 2018). The coastline of this area comprises fixed remnant sand dunes formed during the early tertiary period resulting in the round steep sided dune landforms. Given the permeable sand substrate, few surface streams or waterways drain toward the coast in this area. This has resulted in several perched lakes which have been identified as having moderate to high wildlife values.

The coastline in which the Site is situated displays a range of landforms including elevated iron sand drifts and low-lying wetlands separated by steep prominent ridges. At the coastal edge, the beach profile ends abruptly, with steep coastal cliffs which represent the eroding face of the former dune landform. At the top of the dune face is a characteristically abrupt edge with a flatter, undulating terrain falling away to the east, a result of the very strong and erosive westerly wind that has historically pushed the dunes around 3-5km inland. Settlement of the northern coastal cliffs is centred around Karioitahi Beach with the next settlement being Port Waikato and Sunset Beach. Access to the northern coastal cliffs is limited to Karioitahi Beach and the predominant land use is agricultural grazing for dairy, sheep, and dry-stock farming.

Sand mining operations extend along the northern edge of the Waikato River mouth and are encompassed in production forestry. Further inland, the Waikato River delta and river flats extend some 4km north of the river, encompassing Otawa and Aka Aka and to the south of the river including the area around the volcanic cone, Onepoto.

Waiuku is the nearest settlement of size to the Site, with the towns of Glenbrook, Patumahoe and Pukekohe to the north and northeast. South of the river lie the settlements of Port Waikato and Sunset Beach, with the rugged landscape of the Te Tehe range forming their backdrop.

## 2.3 Protected Landscapes

There are two Outstanding Natural Features or Landscapes (ONFLs) and five Special Amenity Landscapes located within the wider study area for the Proposed Development. ONFLs are defined by the NZILA Practice Note<sup>5</sup> as “a natural landscape that is particularly notable at a local, district, regional or national scale”. A landscape will be considered outstanding if it is “conspicuous, eminent, remarkable or iconic” within the context of the area concerned – the district if the assessment is being undertaken for a district plan and the region if it is for a regional policy statement or plan<sup>6</sup>.

The term Significant Amenity Landscape (SAL) has been used in the Waikato Landscape Study to identify significant natural features and landscapes that do not meet the quality threshold for ‘Outstanding’ in terms of their values. These areas were identified due to their relatively high landscape value, which in the view of the study team lies just below or around the threshold for ONFL identification.

The ONFLs and SALs located within the wider study area are described in the Table below, and their location is illustrated on **Figure 3**. These ONFLs and SALs are situated either in association with the Waikato River or further south of it.

Table 3.2 Outstanding Natural Features /Significant Amenity Landscapes within the Study Area		
Name	Classification	Protected Values Relevant to the LVEA
Okariha Sand Spit	Outstanding Natural Feature	<ul style="list-style-type: none"> <li>Some modification but retains natural patterns and remains a highly dynamic feature of the Waikato River mouth and west coast</li> <li>Adjacent to the settlement of Port Waikato the natural patterns and processes are highly expressive. The aesthetic coherence is of moderate to high value. The area is of moderate to high levels of vividness.</li> <li>Shared and recognised values are moderate to high with historic heritage values associated with the adjoining settlement.</li> </ul>
Te Tehe Bush	Significant Amenity Landscape	<ul style="list-style-type: none"> <li>Moderate to high natural science factors with the rarity of its coastal bush of its type in the District. The natural processes and patterns are of high and moderate levels respectively.</li> <li>Moderate to high levels of vividness and memorability as a result of the position above Port Waikato and the natural patterns. The aesthetic coherence of the natural vegetation and landform is of moderate to high value.</li> <li>Moderate shared and recognised values with recreational access to the area</li> </ul>

<sup>5</sup> Best Practice Note Landscape Assessment and Sustainable Management 10.1, NZILA

<sup>6</sup> <https://www.environmentguide.org.nz/issues/landscape/protection-of-landscapes-and-features/what-is-an-outstanding-natural-feature-or/#:~:text=The%20NZILA%20Practice%20Note%20defines,%2C%20regional%20or%20national%20scale!.&text=The%20NZILA%20Best%20Practice%20Guidance,Biophysical%20elements%2C%20patterns%20and%20processes>

**Table 3.2 Outstanding Natural Features /Significant Amenity Landscapes within the Study Area**

Name	Classification	Protected Values Relevant to the LVEA
Kawa Dunes	Significant Amenity Landscape	<ul style="list-style-type: none"> <li>• Extending some way inland the sand sheets and dune incursions are highly dynamic, representative of the natural processes and formative processes</li> <li>• High levels of legibility of the formative processes with the dunes remaining dynamic and changing on a daily basis. The aesthetic coherence is high within each feature and collectively moderate as a result of intermediary agricultural land use.</li> <li>• Low to moderate levels of shared and recognised values. High to very high levels of cultural heritage values associated with prolific pre-European occupation along this coastal edge.</li> </ul>
Waikato River and Wetlands	Outstanding Natural Feature	<ul style="list-style-type: none"> <li>• Downstream the river’s natural geomorphology processes remain dominant with the wetlands and river delta.</li> <li>• Native bush clad margins and wetlands have high ecological value.</li> <li>• Braided river delta supporting wetlands and intertidal habitat remain in a largely unmodified state, excluding the whitebaiting huts and maimai.</li> <li>• The river delta provides a highly memorable feature that is highly expressive of its formative processes.</li> <li>• Transient values are high along the braided river delta with tidal and seasonal change in flora and fauna apparent.</li> <li>• Well recognised for its geological history and importance to the Waikato Plains, the river is iconic in many forms of media, logos and promotional material. Of all the features within the Waikato District the river is the most iconic.</li> <li>• Recognised of utmost importance to Waikato-Tainui and many hapu which reside along the banks of the river.</li> <li>• Iconic to the Region and the District the river features prominently in media, logos and promotional material.</li> </ul>
Alexandra Redoubt Bush	Significant Amenity Landscape	<ul style="list-style-type: none"> <li>• Formative processes are less evident at a localised scale. Modification to the natural vegetation cover is evident at Kaiapo Flats and Pukekawa. Native bush clad margins have moderate to high ecological value.</li> <li>• Moderate aesthetic coherence with isolated native bush surrounding heritage Site. Moderately expressive of the geological processes. Highly expressive of the cultural influences resulting in the current land formations</li> <li>• Very high historical heritage values associated with the Site. Shared and recognised values attributed to the historical heritage of the Site.</li> </ul>

**Table 3.2 Outstanding Natural Features /Significant Amenity Landscapes within the Study Area**

Name	Classification	Protected Values Relevant to the LVEA
Onewhero Tuff Ring	Significant Amenity Landscape	<ul style="list-style-type: none"> <li>Highly modified land cover through productive land use. Remains representative of the volcanic geology of the area with a distinctive defined</li> <li>Moderate to high aesthetic coherence of the geological feature. The legibility and expressiveness of the geological history is apparent through its defined formation of the crater rim. The land use highlights the land formation significant to this feature</li> <li>Moderate to low associative values at a District level with local associations to the landscape of higher value</li> </ul>
Pukekawa	Significant Amenity Landscape	<ul style="list-style-type: none"> <li>A volcanic scoria cone well defined with a preserved crater. High natural science factors with low biotic values.</li> <li>Moderate aesthetic coherence with the preservation of the landform. The legibility and expressiveness of the geological history is apparent through its defined formation of the volcanic cone. The land use highlights the land formation significant to this feature.</li> <li>Pukekawa retains significant cultural value to tangata whenua. Recognition of the geological volcanic cone is less evident as a result of modification.</li> </ul>

## 2.4 The Coastal Environment and Areas of High Natural Character

The term ‘natural character’ occurs within the first of eight matters of national importance under Section 6 of the Resource Management Act (RMA). Within the RMA, sustainable management of natural and physical resources requires the preservation of natural character of wetlands, rivers and their margins.

In terms of natural character, the highest degree of naturalness occurs where there is the least amount of human induced modification. Structures, such as those required for a wind farm can adversely change and alter the natural character of an area. The significance of this effect is dictated by the size, location, and sensitivity of the receiving environment.

The Waikato Landscape Study identifies areas of High and Very High Natural character within the Waikato Region which have been mapped in accordance with the requirement outlined within Policy 13 of the 2010 NZCPS. Areas of Outstanding Natural character have also been considered and mapped in the Study.

The Site lies within the Port Waikato Coastal Terrestrial Area, as defined in the Study, which “extends from the northern part of the district’s West Coast southwards to Port Waikato and includes the Waikato River mouth and Okariha Sand Spit. The landform is gently undulating and consistent in character and form with the remaining part of this coastline that extends further north (Awhitu Peninsula, which falls in Auckland Council).”

The Study identifies that the Port Waikato Coastal Terrestrial areas has a moderate level of natural character overall due to the areas' modification for rural production and presence of other human modification in the form of dwellings and accommodation. It does however have moderate-high Abiotic values due to the presence of natural processes throughout the coastal edge, sand country and coastal spit formation. The Okariha Sand Spit (see **Figures 1 and 3**) has been identified as an area of High Natural Character due and has the following Key Values:

- Dynamic dune system with dominant dune patterns uniquely influenced by fluvial and coastal processes. These processes remain unmodified. Largest example of river mouth dune system along the Waikato West coast.
- Native dune species are prevalent mixed with exotic weed species.
- Highly dynamic and dominant coastal processes with a large dune system that extends in a full sequence from the coastline to the river edge.
- A strong sense of the natural systems of the river are apparent through the intertidal movements and sand accretion and erosion at the distal end of the sand spit.
- Dunes remain intact with minor patterns of modification from vehicle and pedestrian movement throughout.
- Forms an integral part of the coastal dune and cliff faces of the northern extent of the Waikato and Waikato River system.

To provide some context, the natural character assessment carried out as part of the Awhitu Wind Farm investigations (Boffa Miskell, 2004) concluded that the wind farm would have effects on the natural character of that section of the Awhitu Peninsula where it is situated but these would not be significantly adverse.

## 2.5 Potential Cumulative Effects

Given the consented and partly constructed Awhitu Wind Farm is located north of the proposed Waiuku Site, there is the potential for cumulative effects with the construction of a second wind farm along this stretch of coast. Awhitu Wind Farm, an 18- turbine wind farm consented in 2005 is located approximately 6km to the north of the Waiuku Wind Farm Site (see **Figure 1**).

Currently, only one of the 90m tall Awhitu turbines has been erected; however, there is evidence of earthworks and construction of foundations at several of the other turbine Sites. It is understood that further turbines will be erected on the Awhitu Site over the next three years. The Waiuku Wind Farm proposes turbines with a maximum 190m tip height, which is over twice the height of the 90m tip height of the Awhitu turbines (**Figure 4**).

## 2.6 Visual Catchment

A Zone of Theoretical Visibility (ZTV) map was prepared as part of this preliminary investigation for the Waiuku Wind Farm to identify the potential extent of the visual catchment (**Figure 5A**). A second ZTV map, combining the visual catchments of both the Waiuku and Awhitu Wind Farm Sites was also prepared to understand the degree of overlap (**Figure 5B**).

The term 'Zone of Theoretical Visibility' (ZTV) is used to describe the area over which a development can theoretically be seen and is based on a Digital Terrain Model (DTM) and

overlaid on an appropriate map base. ZTVs are calculated by computer, using any one of several software packages and based upon a digital terrain map (DTM) that represents topography.

ZTV mapping is based entirely on 'bare ground' topographic data, it does not consider the screening effects of intervening vegetation or structures in the landscape. The level of reliability of the contour information will influence the accuracy of the mapping. ZTV mapping does, however, consider factors relating to the curvature of the earth and light refraction. While ZTV is a useful assessment tool, it is important to recognise it has limitations depending on the level of information and detail that has been used to generate it.

ZTV relates to two factors:

- Visibility maps represent where a development may be seen theoretically – that is, it may not actually be visible due to localised screening of trees and other vegetation and structures, which are not represented by the DTM; and
- The maps indicate potential visibility only - that is, the areas within which there may or will be a line of sight. They do not convey the nature or significance of visual effects, for example whether visibility will result in positive or negative effects and whether these will be significant or not.

### 2.6.1 Settlement

The main areas of settlement within the Study Area are located to the north and northeast of the Site. Waiuku is the nearest settlement of size to the Site, lying 9km north, with the towns of Glenbrook, Patumahoe and Pukekohe (11, 15 and 17km away respectively) to the north and northeast. Karioitahi Beach is the only small beach settlement on the stretch of coast to the north of the Site, around 4km north of the nearest turbines. South of the Waikato River lie the small settlements of Port Waikato and Sunset Beach.

### 2.6.2 Transportation/Recreational Routes

There is a network of roads which pass through the study area as illustrated on **Figure 1**. Within the Site and the surrounding area, access to the coastline is via small local roads which provide access to the scattered dwellings among the dune areas. To the east of the Site, on the flatter plains the road layout becomes more rectilinear with the Waiuku-Otaua Road and Masters Road providing some of the main linkages in the area between Waiuku and the wider landscape. The nearest State Highway to the Site is State Highway 1, which lies to the east of Pukekohe.

The Operative District Plan notes that road access to the coastline of the former Franklin District is extremely limited, occurring at only three locations along the entire length. The nearest location to the Site is at Karioitahi Beach to the north of the Site. Access along the coast is largely by way of off-road vehicles along the beach from road access points.”

## 3.0 Relevant Statutory Provisions

The Site is located within the Waikato District and Region. There are several planning documents that are relevant to this project. Specifically, they include:

- The Resource Management Act – notably Section 6 matters (natural character and Outstanding Natural Features and Landscapes);
- New Zealand Coastal Policy Statement;
- National Policy Statement for Renewable Electricity Generation;
- Waikato Regional Policy Statement;
- Operative Waikato District Plan; and
- Proposed Waikato District Plan (Appeals Version).

### 3.1 Summary

Outline below is a brief summary of the statutory provisions which will be taken forward in detail to the substantive assessment of effects:

- The site is located within the Waikato District and lies within the Rural Zone in the Appeals Version of the Proposed District Plan. The site is also located within the Coastal Environment, so provisions relating to natural character will need to be considered;
- Policy in the Waikato Regional Policy Statement aims to ensure that activities within the coastal environment, wetlands, and lakes and rivers and their margins are appropriate in relation to the level of natural character;
- In the Operative District Plan, the Site forms a part of the former Franklin District, so the Franklin section of the plan applies. The Site lies within the Coastal Zone and the Rural Zone and forms a part of the Awhitu Rural Management Area;
- Policy in the Waikato District Plan also aims to ensure that buildings and structures be sited and designed so that they do not visually compromise outstanding natural features or the values of significant habitats of indigenous fauna as identified in Schedule 5A, or the natural character of the coastal environment
- The Waikato Regional Coastal Plan aims to preserve the character of the natural environment, protect it from inappropriate use and development and promote restoration of natural character where it has been degraded. The substantive assessment will need to address these matters
- The site does not lie within an Outstanding Natural Feature, nor is it within an area of Outstanding Natural Character, however consideration as to how the development may affect these areas will need to be addressed in the substantive assessment
- Other key objectives and policies in these plans aim to maintain rural character, coastal character, preserve sites of indigenous biodiversity and do not compromise areas of significance to Māori, and these matters will need to be addressed.



## 4.0 Site Description

The landscape setting of the Site is predominately rural, characterised by extensive rolling pasture with few shelterbelts or groups of trees. Normal features associated with a working rural environment are evidenced in the standard farm fencing, the occasional shelterbelt, groups of mature exotic trees, farm tracks, farm buildings, including a woolshed, and several dwellings. The land cover is similar across the wider area outside the Site apart from some small exotic woodlots and the large productive pine forest to the south (Waiuku Forest).

The grazed pasture is well managed with very few areas of weeds and pest plants or rank grass. The sand geomorphology has created undulating landforms that are well stabilised by a continuous cover of pasture, apart from a few small isolated 'blowouts' exposing the underlying sand.

Other features, such as transmission lines and a telecommunication facility are also present on the Site. Two dune lakes are located with the property with farm drains traversing parts of the Site.

Three separate properties and landowners comprise the wind farm Site. There are several occupied residential dwellings located on these three properties, together with farm outbuildings. There are, however, a substantial number of residential dwellings on adjoining properties (see **Figure 8** and **Table 1** below).

The table below lists the dwellings in the wider area external to the Site, including the approximate distance from each dwelling to the closest turbine.

**Table 1: Dwellings External to Site**

Dwelling Number	Location	Distance to Closest Turbine	Comment
R1	430 Forestry Road	960m (T12)	Possibly screened by vegetation
R2	500 Forestry Road	567m (T12)	Cluster of dwellings SE of T12
R3	522 Forestry Road	460m (T12)	Cluster of dwellings SE of T12
R5	83 Motion Rd West	663m (T16)	Cluster of dwellings E of T16
R6	69 Motion Rd West	384m (T16)	Cluster of dwellings E of T16
R6A	69 Motion Rd West	440m (T16)	Cluster of dwellings E of T16
R8	102 Perry Road	518m (T16)	Turbines visible in several directions
R9	383 Maioro Road	766m (T13)	Cluster of dwellings E of turbines
R10	400 Maioro Road	612m (T13)	Cluster of dwellings E of turbines
R11	102 Motion Rd East	1125m (T16)	Possibly screened by vegetation
R12	388 Maioro Road	797m (T13)	Cluster of dwellings E of turbines
R13	350 Maioro Road	1109m (T13)	Cluster of dwellings E of turbines
R14	334 Maioro Road	1079m (T13)	Cluster of dwellings E of turbines
R15	64 Thomson Road	414m (T15)	Turbines visible in several directions
R16	25 Robertson Road	505m (T18)	Turbines visible in several directions
R18	100 Thomson Road	402m (T15)	Turbines visible in several directions

R19	111 Thomson Road	415m (T15)	Turbines visible in several directions
R20	108 Thomson Road	267m (T18)	Turbines visible in several directions
R23	164 Thomson Road	430m (T18)	Turbines visible in several directions
R24	178 Thomson Road	393m (T11)	Turbines visible in several directions
R26	42C Huarau Way	442m (T17)	Coastal – several turbines visible
R28	42A Huarau Way	260m (T17)	Coastal – several turbines visible
R29	42B Huarau Way	358m (T17)	Coastal – several turbines visible
R31	710 Whiriwhiri Rd	791m (T17)	Coastal – several turbines visible
R31A	710 Whiriwhiri Rd	940m (T17)	Coastal – several turbines visible
R32	706 Whiriwhiri Rd	900m (T18)	Coastal – several turbines visible
R33	73 Robertson Rd	304m (T18)	Possibly screened by vegetation
R34	76 Robertson Rd	337m (T18)	Turbines visible to S and E
R35	112 Robertson Rd	560m (T18)	Turbines visible to S and E
R36	59 Bird Road	648m (T14)	Cluster of dwellings north of T14
R37	48 Bird Road	800m (T14)	Cluster of dwellings north of T14
R37A	48 Bird Road	810m (T14)	Cluster of dwellings north of T14
R38	58 Bird Road	816m (T14)	Cluster of dwellings north of T14
R39	23 Bird Road	940m (T14)	Cluster of dwellings north of T14
R40	549 Whiriwhiri Road	1351m (T14)	Cluster of dwellings north of T14
R41	534 Whiriwhiri Road	1551m (T14)	Cluster of dwellings north of T14
R42	450 Bothwell Park Rd	505m (T14)	Northeast of T14
R43	399 Bothwell Park Rd	1022m (T14)	Northeast of T14
R44	358 Bothwell Park Rd	1344m (T14)	Northeast of T14
R45	612 Whiriwhiri Road	952m (T14)	Cluster of dwellings north of T14
R46	600 Whiriwhiri Road	989m (T14)	Cluster of dwellings north of T14

Also, in the current layout, turbines will be situated close to dwellings that lie within (i.e. internal) to the Site (i.e. c.500m or less). These will be excluded from being considered in the consent application. Shadow flicker could be a potential issue to consider for some of these dwellings.

Any revision to the wind farm layout to reduce potential adverse visual and shadow flicker effects on residents in dwellings external to the Site would also likely have beneficial effects to these internal dwellings.

## 5.0 Feasibility Appraisal

### 5.1 Introduction

Landscape and visual impacts result from natural or induced change in the components, character, or quality of the landscape. Usually these are the result of landform or vegetation modification or the introduction of new structures, facilities or activities. All these impacts are assessed to determine their effects on character and quality, amenity as well as on public and private views.

In this preliminary assessment, a high-level appraisal of potential effects arising from the introduction of the proposed wind farm development is presented, based on a consideration of the landscape's sensitivity and visibility in combination with the nature and scale of the development proposed.

The list below sets out each landscape and visual 'resource' which has potential to be affected by the proposed development:

- The landscape of the Site, and how direct impacts arising from the proposed development may impact upon the character and quality of the Site (i.e. vegetation removal, changes to topography);
- The landscape / rural character / coastal natural character, reflecting on how the proposed development may impact upon the distinct and recognisable pattern of elements that occur consistently in a particular landscape;
- Protected landscapes (i.e. Outstanding Natural Landscapes, Outstanding Natural Features or areas of Outstanding Natural Character); and
- Key viewers:
  - residents of scattered properties;
  - settlements;
  - road users; and
  - recreation users.

**Figure 9** shows the photo point locations, and the subsequent 6 sheets of Site Context photographs illustrate the undulating Site topography and beyond, the open pasture and limited tall vegetation and nature of the farm access tracks across the Site.

## 5.2 Landscape Effects

The Waiuku Wind Farm will create landscape effects due to the earthworks to create the access roads and tracks and to form turbine platforms and associated infrastructure. It will also have effects on landscape character (including rural character) given the introduction of up to 18 turbines to a stretch of coastal landscape where the current land use is pastoral farming, forestry, and rural lifestyle development. This land use will not change, and the overriding character will remain rural, albeit with the presence of wind turbine structures.

However, the consented Awhitu Wind Farm has already introduced a new land use to this coastal rural landscape and a review of the landscape assessments completed for the Awhitu consent application (Isthmus, 2003; Boffa Miskell, 2004) describe the potential landscape, visual and natural effects of this form of development.

In summary, the findings and conclusions extracted from these assessments noted the following:

- The level of natural character varies depending on the proximity to the coast. The level of natural character is higher closer to the coast (i.e. Coastal Dominance zone).
- The coastal environment can accommodate the Awhitu Wind Farm without undermining the qualities of the broader landscape.

- The coastal landscape has an exposed, dramatic character that expresses the force of the natural elements, but it is typical rather than an outstanding example of the hill country stretching along the entire west coast of the peninsula.
- The effects of the wind farm will have effects on the natural character of the local part of the Awhitu Peninsula, but these will not be significantly adverse.
- The underlying natural landscape and existing rural land use will remain dominant following construction of the wind farm.
- There will be significant adverse effects on the visual amenity of properties close to the wind farm, but this affects only a relatively small number of dwellings close to the Site.
- The physical effects of the wind farm will be limited to the creation of access tracks and turbine platforms. No areas of tall and/or significant vegetation will be affected.
- The physical effects (eg earthworks) are likely to be relatively minor.

The turbines proposed for the Waiuku Wind Farm will be taller and larger than those at Awhitu and this aspect needs to be addressed in the substantive assessments for the consent application (see **Figure 4**). Given the investigations completed for this preliminary assessment, several of the points noted above could equally apply, in principle, to the Waiuku proposal.

In addition to turbines there are many elements, and activities that comprise a wind farm. Further information and details on earthworks, roading, turbine platforms, the collector station<sup>7</sup> and infrastructure, including transmission will be needed to be assessed as part of the substantive landscape assessment.

### 5.3 Visual Effects

The number and proximity of dwellings external to the Waiuku Wind Farm Site is the main area of concern given the potential effects on visual amenity, including potential for shadow flicker, (refer Section 5.4). As noted in **Table 1**, many dwellings external to the Site are less than 1.0km from the closest turbine, with several less than 500m, see **Figure 8**.

While turbines will be visible from various locations along public roads and other public locations, including parts of the coast, the visual effects are unlikely to be significant given the viewing distances and separation involved, and in places localised screening by topography and vegetation.

While proximity to or visibility of one or more turbines does not automatically equate to an adverse visual effect, it does mean that detailed assessments, including preparation of visual simulations from specific dwellings will need to be included as part of the consent application. Based on assessments that Boffa Miskell have completed for other wind farms, it is likely that visual simulations from all or the most potentially affected dwellings listed in **Table 1** would need to be prepared to illustrate visibility and the level of visual effects. These simulations would form part of the assessment for the consent application and could also be used in community engagement and discussions with landowners whose properties are external to the Site.

For some properties, it may be possible to introduce tree planting or re-contouring landform to assist with mitigating visual effects and to provide visual buffers between dwellings and the turbines; these measures may also assist with ameliorating shadow flicker. However, while the

---

<sup>7</sup> The collector station for the power generated is likely to be several containers laid on a concrete pad housing various electrical control equipment.

undulating topography will assist in helping to visually integrate turbines into the landscape, the 190m height of the turbines will probably render any planting mitigation ineffective at entirely avoiding effects.

The preliminary assessment provides an opportunity to consider potential adverse effects and help guide the substantive assessments for the consent application, and before any community engagement is carried out. The inland group of turbines in the north-eastern part of the Site (i.e. turbines 12-18) is where the greatest level of adverse visual effects are likely for dwellings external to the Site. Adjustments to the layout in this part of the envelope is likely to provide the biggest reduction adverse effects and reduce the potential for the proposal to result in significant of adverse effects on the visual amenity for the affected dwellings.

For the preliminary assessment wire frame images were generated to illustrate the scale of the turbines and the relationship of the Waiuku Wind Farm turbines to those of the Awhitu Wind Farm (**Figures 10A & 10B**):

- W1: Looking the south from Boundary Road West
- W2: Looking west from the intersection of Forestry and Hoods Landing
- W3: Looking southeast from Kariotahi Beach
- W4: Looking east from approximately 6km offshore.

Once the transmission route and details of any other infrastructure requirements are finalised and confirmed these will need to be addressed in the substantive assessment and included in the visual simulations, where appropriate.

## 5.4 Shadow Flicker

Shadow flicker is caused by the rotation of turbine blades, which cast intermittent shadows that appear to 'flicker' as the sun passes behind the turbine blades. This is most apparent when the shadow passes across most typically a window of a dwelling. The duration of this effect can be calculated using the geometry of the turbine and the relative locations of the turbine and the receptor (i.e. through window or similar). The likelihood of the effect occurring, and the duration and intensity of such an effect depends upon several factors:

- the distance of the dwelling from the turbine.
- the orientation of the dwelling relative to the turbine.
- the height and rotor diameter of the turbine.
- the time of day and time of year.
- the prevailing wind direction.
- the frequency of sunshine hours (i.e. cloud free days).
- the nature of the intervening terrain between dwelling and turbine.
- the impact of any intervening vegetation and/or structures.

Shadow flicker calculations are mathematically derived and are therefore theoretical worst case scenarios. The calculations also include the following assumptions:

- i) weather conditions are such that shadows are always cast (i.e. sunny at all times of the day and throughout the year).
- ii) the rotors are facing directly towards the 'receptor' at all times, meaning they are at their "worse case" orientation (i.e. at their maximum size and sweep).

International guidelines state that acceptable levels of exposure are deemed to be either:

- Acceptable Level = 30 hours per year (modelled)
- Acceptable Level = 30 minutes per day - actual (i.e. measured).

Given the number and proximity of dwellings on the Site and in the wider adjacent area (see **Table 1**), a shadow flicker assessment would need to be undertaken as part of the substantive assessment that would be lodged as part of the consent application.<sup>8</sup> This would involve further desktop analysis using recent drone photography to refine the number of dwellings where shadow flicker is likely to be an issue, followed up with Site visits to confirm and where necessary, shadow flicker modelling and analysis carried out.

In **Table 1**, the distances between each dwelling outside the wind farm Site and the closest turbine(s). Building orientation and layout, position of windows, planting, and other structures adjacent to the dwelling are taken into account when assessing shadow flicker diagrams, which are based on a series of parameters modelled in WindFarm software.

The Zone of Influence for Shadow Flicker is modelled and calculated on 10X rotor diameter. Maps and diagrams for each dwelling would be prepared as part of the substantive assessment to describe and illustrate potential shadow flicker.

## 5.5 Effects on Coastal Natural Character

The natural character assessment completed for the Awhitu Wind Farm application concluded that there would be effects on coastal natural character, but the level of effect was related to turbine location (Boffa Miskell, 2004). The assessment subdivided the coastal environment into a series of landscape units and assessed each unit in relation to two zones, a Coastal Dominance zone immediately adjacent to the coastal edge, and an inland Coastal Influence zone.

The Waiuku Wind Farm extends over both the Coastal Dominance and Coastal Influence zones, although the Waiuku turbines are more widely spaced than the Awhitu turbines given the larger turbines proposed. For the substantive Waiuku Wind Farm assessment it would be prudent to use the landscape units delineated and the descriptions and analysis from the Awhitu investigations, which covered the coastal environment between Port Waikato and mouth of Manukau Harbour.

While the height and scale of the Waiuku turbines are significantly larger than the Awhitu turbines, the findings from the earlier assessments (Isthmus, 2003, Boffa Miskell, 2004) provide a good starting point; that is, while there will be effects on coastal natural character, it will be a matter of addressing the magnitude of effects and whether these will be significantly adverse.

The proposed Waiuku turbines will have greater adverse effect on the coastal natural character of the local environment and its immediate context than the Awhitu turbines have in relation to their local environment. This is because the Waiuku turbines are significantly taller, and the

---

<sup>8</sup> Ideally, visual simulations from individual or representative properties external to the Site should be prepared as part of the community engagement process.

physical extent of the wind farm is greater and consequently the level of influence will be greater. However, this aspect needs to be considered in the context of the broader coastal environment stretching from Port Waikato to mouth of Manukau Harbour. Final turbine positions, including the details associated with earthworks and landform re-contouring, together with the location and design of associated infrastructure will have influence the level of effects.

## 5.5 Associative Landscape Effects

In line with the recently adopted NZILA's *Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines*, the substantive landscape assessment will need to draw on the information and findings from the cultural effects assessment.

# 6.0 Conclusions and Recommendations

This preliminary assessment is based on a desktop exercise, analysis of previous landscape, visual and natural character assessments completed for the Awhitu Wind Farm consent application, and a Site visit to the Waiuku Site and surrounding area. This has provided an overview of the Proposed Development in terms of the immediate Site and its wider landscape context. It has enabled the following conclusions and recommendations to be made:

- The findings and conclusions from the Awhitu landscape-related assessments provide a useful context for the Waiuku project. The Awhitu Wind Farm, despite there currently only one turbine erected, forms part of the existing environment and this is helpful to the Waiuku application in that turbines will not be a new element in this coastal rural landscape.
- The existing rural land use and activities will continue unaffected by construction of the Waiuku Wind Farm. The rural character will prevail despite the two relatively discrete clusters of turbines in the two wind farms.
- While there will be adverse effects on the physical landscape in terms of earthworks, roading, turbine platforms and transmission, it is unlikely that these will be significant and/or will be able to be mitigated through collaborative design and mitigation measures.
- Turbines will be visible from various public roads and private dwellings, but visibility does not automatically equate to adverse visual effects.
- Based on the layout assessed, there is likely to be adverse effects on visual amenity with a substantial number of residential dwellings external to the Site significantly affected because of the proximity of turbine(s) to dwellings.
- Further investigation for the substantive assessment, including field work and Site visits, modelling, and preparation of visual simulations from selected properties, will enable the levels of visual effects (including shadow flicker) to be determined from individual dwellings and properties. Factors that may reduce the level of effects include, orientation of the individual dwellings, and local screening by existing shelterbelts and stands of trees.
- While turbines will be visible from surrounding public roads and locations, effects on visual amenity from these locations are very unlikely to be significantly adverse because of the viewing distances involved, together with localised screening by topography and vegetation.

- Potential cumulative landscape and visual effects will need to be addressed as part of the substantive assessment but given the physical and visual separation between the two wind farms, cumulative landscape, visual and natural character effects are unlikely to be significantly adverse.
- While the undulating topography may assist in helping to visually integrate turbines into the landscape, the 190m height of the turbines will render any tree planting mitigation ineffective in terms of screening or visual mitigation from nearby dwellings outside of the Site.

## 7.0 References

Boffa Miskell Ltd (2004) *Proposed Awhitu Wind Farm: Natural Character Assessment*

Boffa Miskell Ltd. (2018). *Landscape Study of the Waikato District* (Report No. T16017).

Prepared by Boffa Miskell Ltd for Waikato District Council.

Waikato District Council. (2022). *Proposed Waikato District Plan (Appeals version)*. Waikato District Council.

Waikato Regional Council. (2016). *The Waikato regional policy statement: Te Tauāki Kaupapa here ā-Rohe*. Waikato Regional Council.

Isthmus (2003) *Proposed Awhitu Wind Farm: Draft Assessment of Landscape and Visual Effects*.

NZILA (2022) *Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines*, Te Pito Ora New Zealand Institute of Landscape Architects, July 2022



# Appendix 1: Graphic Supplement

#### **About Boffa Miskell**

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Whangarei, Auckland, Hamilton, Tauranga, Wellington, Nelson, Christchurch, Dunedin, and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past five decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

---

[www.boffamiskell.co.nz](http://www.boffamiskell.co.nz)

<b>Whangarei</b>	<b>Auckland</b>	<b>Hamilton</b>	<b>Tauranga</b>	<b>Wellington</b>	<b>Nelson</b>	<b>Christchurch</b>	<b>Queenstown</b>	<b>Dunedin</b>
09 358 2526	09 358 2526	07 960 0006	07 571 5511	04 385 9315	03 548 8551	03 366 8891	03 441 1670	03 470 0460