BEFORE THE COMMISSIONER ON BEHALF OF THE DUNEDIN CITY COUNCIL

UNDER	the Resource Management Act 1991
IN THE MATTER	an application for resource consent of LUC-2015-469
BY	Blueskin Energy Limited
	Applicant

BRIEF OF EVIDENCE OF DIANE JEAN LUCAS

GALLAWAY COOK ALLAN
LAWYERS
DUNEDIN

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Introduction

1. My name is Diane Jean Lucas. I am a landscape architect for the company Lucas Associates, based in Christchurch. I founded this practice in 1979.

2. My qualifications include a BSc in Natural Sciences (Otago), and a Masters in Landscape Architecture (Landscape Planning, Lincoln University). I am a Registered NZILA Landscape Architect, a Fellow of the NZILA, and have 40 years' experience in the industry. I am a certified resource management hearings commissioner.

3. I have undertaken landscape and natural character assessments for various parts of New Zealand at district, regional and national scales.

4. I am familiar with wind turbines, having viewed various models in different settings and at varying distances. I have previously assessed wind turbine and windfarm proposals elsewhere in Otago as well as in Canterbury, Wellington, Manawatu, Hawkes Bay and Auckland. I received a NZILA Landscape Planning Gold Award 2008 for Environment Court evidence regarding one of the Hawkes Bay windfarms I assessed.

5. I am familiar with the landscape context to the proposal, from involvement in State Highway 1 realignment through the Kilmog area in 1975, landscape assessments of local coastal landscapes a decade ago, and, since 2013 consideration and recommendations regarding iterations of a Blueskin Energy proposal.

6. I have assessed the proposed wind cluster for Blueskin Energy and last year prepared the report "Blueskin Energy Wind Cluster, Porteous Hill, Landscape Assessment" that accompanied the application.

7. I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

8. Blueskin Energy Ltd seek to install 3 wind turbines within an envelope located on Porteous Hill, above Warrington and seaward of The Kilmog section of State Highway 1, north of Dunedin. The site is located within Dunedin District and the Otago Region.

9. I provided a landscape assessment of the initial proposal last year. I have read the peer review of Mike Moore, a registered landscape architect. I have read a number of the submissions and the s.42A report, including the landscape assessment of Barry Knox. I note that the proposal has been refined in response to various assessments. I now address it as a non-complying activity as per the Dunedin City District Plan (DCDP), and note the replacement plan.

Proposal

10. An envelope is sought within which to place 3 turbines. Following project refinements, the 3 turbines will be identical, three-blade and reach a maximum of 90 metres from ground level to a blade tip. Photomontages were attached to my 2015 report featuring the Gamesa G58 turbine with a 55 m hub height and 83 m full height. A range of turbines were being considered at that time, to a maximum of 125 m at blade tip. I understand that none of the turbines currently under consideration are higher than 90m to blade tip. The height limit has therefore been reduced to that level.

11. The tower and rotor of each turbine will be coloured light grey. The surface finish selected will minimise glare.

12. Following refinements since undertaken, I attach 4 new photomontages with Enercon E53 turbines and a hub height of 60 m. that are to replace earlier simulations. I ask that you please delete from my 2015 attachments **simulation 1** (page 9), the view from the SH1 - Pryde Road corner, and also **simulation 4** (page 15) from Warrington. Simulation 3 from Coast Road has been supplemented with a photomontage from along Church Road.

Site and Location

13. The wind cluster site on Porteous Hill is a gentle pastoral hill summit above, and some 2.5 km inland to the north of, the Blueskin Bay shore. I provide a description in my landscape assessment report, and an analysis of the landscape character that addresses accepted landscape bio-physical, perceptual and associative attributes, and do not repeat it here.

Effects

14. Considering the council technical reports, plus further information and project refinements since my earlier assessment, I have revisited some locations and revised my assessment of effects accordingly. I address adverse effects in terms of a **5-point scale: highly significant - significant - moderate - minor - negligible**.

15. As per the operative Dunedin City District Plan (DCDP), relevant objectives and policies for consideration of the activity in the Rural Zone have been considered, particularly Section 6, Rural, and Section 14, Landscape. I have assessed the proposal in relation to these sections to address potential visual and landscape effects.

Rural Section

Objective 6.2.2 Maintain and enhance the amenity values associated with the character of the rural area

16. I address the key elements of rural character that are noted in the DCDP to include:

    (a) the predominance of natural features over human made features;

    (b) the high ratio of open space relative to the built environment;

    (c) significant areas of vegetation in pasture, crops, forestry and indigenous vegetation.

    (a) **the predominance of natural features over human made features**

17. Considering the landscape of and associated with Porteous Hill, the rural character is comprised dominantly of a complex of natural landforms

together with an overlay of vegetation. As well as patches of remnant and recovering natural vegetation, the composition and patterning of vegetation is predominantly human induced. The pastoral paddocks, plus shelter, woodlot and amenity plantings are obviously human made features of this landscape. Along with the scattering of structures - including houses, farm buildings, yards, fences, overhead utility structures and signage - structural elements are highly dispersed and together compete for attention. Some areas, such as the Porteous Hill summit, are largely devoid of existing structures. Others, such as the lower slopes, display a scattering of residences, and concentrations such as at Warrington. With the proliferation of housing and associated utilitarian and amenity plantings, the human made features and the natural features together form the rural character and amenity of this landscape. They jostle for attention and dominance.

18. Considering the proposed wind cluster, the turbines would introduce 3 human made features of very different character and considerably larger scale. The turbines would add further to the current landscape complexity. Located on the open and gentle hill summit, standing tall on simple slim towers pinioned into the pasture and adequately spaced, the turbines would emphasise the hill summit feature. The limited number, their size and spacing in relation to their and the hill scale, means they will not clutter the hill. The juxtaposition and contrast between cluster and hill would provide a new dimension to the rural character. The cluster design enables the hill to retain its integrity as a natural feature, and its predominance as the core of this landscape.

(b) **the high ratio of open space relative to the built environment**

19. The local landscape involves varying degrees of open space. The upper slopes and summit to the hill exhibit a high ratio of open space. Introducing the wind cluster activity would change its character. However, due to the turbine proportions, with the rotors operating high above the well-spaced group of slender masts that emerge from the flat summit, the open space across the land is minimally disrupted. The openness flows through the group, and the openness of the overall Porteous Hill landscape is not significantly affected. The group is spaced to read as a coherent unit but with each turbine respectfully spaced. With

just three turbines added, with their three-blade aesthetic, the high ration of the extensive open space relative to the built environment would be largely retained.

(c) **significant areas of vegetation in pasture, crops, forestry and indigenous vegetation**

20. Stands of large trees are scattered over the ridges and slopes up to the summit, and groves of indigenous cover are more commonly nestled in the gullies and slumps. Pasture extends between.

21. Introduction of just turbines involves very small built footprints into pasture, and will not reduce the dominantly vegetated landscape. With a light footprint and lifted high above on poles, with just 3 turbines introduced, the rural character will be maintained.

22. Considering the nature, scale, intensity and location of the proposed wind cluster activity, the amenity values of this rural landscape will be maintained.

Policy 6.3.6 Avoid, remedy or mitigate the adverse effects of … structures …. on the amenity of adjoining properties.

23. Considering the introduction of the turbines on the hill summit involves consideration of the amenity that may be enjoyed on the properties that encircle the site. Eight rural holdings of various sizes adjoin the site. As well as those extending down southwards from Porteous Road, these properties encircle Porteous Hill, fronting SH1 (the Waikouaiti-Waitati Road), Pryde Road or the Coast Road and extending up to the summit to adjoin the site.

24. Whilst the houses on the adjoining lots are typically located considerably down-slope, and plantings frequently disrupt viewshafts, the amenity experienced on the associated lands will be affected by the turbines located above.

25. Pryde Road properties adjoin the site at mid-slope along the northern flank. My 2015 assessment included simulation 2 (page 11) which provided a view toward this boundary to 90 Pryde Road (wrongly labelled 22 Pryde Road). I attach further views, photos 5 - 8. Whilst the

22 Pryde Road property has afforestation activity alongside SH1 from Pryde Road south, the rest of the property around the north-west of Porteous Hill is open pastoral land.

26. I have viewed and considered the proposal in relation to the Pryde Road properties that adjoin. The steep hill-slope rises up behind the houses and the site boundary is located on the shoulder above, from which the hill summit rises steeply. Located to the north, the houses are oriented away from the hill. In addition, substantial vegetation is evident enclosing the houses and within areas beyond, screening the hill, which, along with the contour, will limit the visibility of the towers. However there are certainly areas of these properties where at least Turbine 2 will be highly visible, and the other turbines may also be visible.

27. For lands of 90 Pryde Road, where not screened by trees, Turbine 2 proposed on the summit above would appear as a substantial structure on the hill. The photomontage from the Pryde Road - SH1 corner provides an indication of the likely visibility from the 22 Pryde Road land. The movement of the rotor will increase the visual presence of the turbines. Given the proximity, the scale and the structural character of the turbines, I assess the effects on the amenity of the two adjoining Pryde Road rural sites to be significant.

28. House orientation, contour and vegetation limit visibility from the houses. Thus for the two houses adjoining to the north, the effect on their amenity is lessened to a moderate rating.

29. Adverse effects on amenity from the presence of the turbines can potentially be further mitigated for the properties through establishment of strategically located plantings, to provide additional screening of the proposed structures for some viewshafts.

30. To the south near Porteous Road, two further sites extend from SH1 up to the site and a further property, 110 Porteous Road, extends from below Porteous Road up to the site. Whilst forestry and contour disrupts some hill views, there are open pastoral areas which allow limited turbine views. My panorama 2 (2015 attachments, page 3) showed a view down over these lands from the site.

31. The lands adjoining the site on the east and south involve three larger rural holdings. They are predominantly pastoral with various native remnant and regenerating cover, plus a few shelter plantings. The visibility of the turbines will be partly constrained by contour and vegetation, but they will be particularly visible from some ridges on the flanks to Porteous Hill.

32. People's homes and the immediate environs, the curtilage, are frequently the most sensitive location for consideration of amenity. For houses on all the properties that adjoin the site, perhaps only the house beside SH1 at 2197 Waikouaiti-Waitati Road, would provide a direct view to any turbines. Whilst likely viewed somewhat from gardens, the site information suggests other houses on the adjoining lands are not oriented to view the hill summit. The turbines would not be in their primary outlook.

33. The turbines will be coloured light grey with a surface finish to reduce glare. Located on the hill summit, primarily viewed in silhouette against the sky, often fog and cloud-associated, a light grey colour is most appropriate.

34. Being large structures when observed in proximity, the lower length and base of the towers could be shaded darker. Turbine design being considered allows for graduated green shading on the lower section. Introducing green colouring to the turbines is not supported. A camouflage or blending in approach with green colour applied would not be appropriate. However, visual mitigation for the amenity of adjoining lands could involve graduated grey shading for the lower section of each mast. The lower third of each mast might be gradually darkened from the light grey above down to a mid-tone grey at ground level. I consider such shading would provide useful mitigation for adjoining land owners with views onto the site.

35. In full sunlight, I have elsewhere observed shadow flicker adversely affecting a home. I was pleased to earlier consider and discard the likelihood of shadow flicker affecting households given the Blueskin turbine locations. The potential for houses to experience shadow flicker has since been further assessed by Enercon, and their assessment

(Appendix 1) reinforces mine, that the turbine locations, terrain and house locations are such that they will not be affected by shadow flicker.

36. As the turbines are a small group and identical, spatially separated yet related, for some views however their blades will be seen as overlapping. A method of mitigating effects where this is highly significant is to synchronise the turbines. However I assess that the effect in this location is not highly significant and that synchronisation is not warranted.

37. The turbines are required to be lit with red lights on the hub, thus at about 60 m above the ground. From much of the adjoining lands, including from any houses from which turbines would be visible, all are located well below hub height. Thus if the lights are shielded, they will not be evident at night, and the adverse effects of lights on their night-time amenity will be avoided.

38. The amenity values of the adjoining lands includes the aesthetic coherence of the acoustic environment, the soundscape. The expected sound generation from the 3 turbines has been assessed by Dr Chiles and Enercon and one of the houses has been found to be potentially adversely affected. The modelling indicates a slight exceedance for the house location at 90 Pryde Road. With the house oriented away and the turbines visually screened, the effects of this sound on amenity values is assessed to be less than for that acoustic effect to accompany a direct view to turbines. I assess the effect of the turbines on the soundscape of the houses on the adjoining lands to be minor.

39. Wind generation requires an exposed and elevated site. Thus the generators are likely to be visible from neighbouring lands. However these lands fall away steeply somewhat lessening visibility. Various tree cover provides further screening. Houses are located downslope and typically within shelter plantings or oriented away from the site. Whilst alternative sites for the wind cluster were considered (Lucas 2015 map attachments page 14), this Porteous Hill site is assessed to avoid and mitigate some effects on the amenity of adjoining owners through the combination of terrain, vegetation and house locations.

40. For the rural land of the 8 properties, when visible in reasonably close proximity the turbines will affect the amenity values. The character will be changed. Whether the structures are perceived to contribute to or to detract from their amenity will depend on a viewer's attitude to their presence.

41. As "amenity values" address people's appreciation of the pleasantness and aesthetic coherence, viewers' opinions will undoubtedly vary. As has been found with wind turbines elsewhere, changing from what has long existed to introduce something entirely new can initially be perceived as unpleasant, but can later be enjoyed, accepted, ignored or merely tolerated.

42. Overall, given the site character, the considered design of the proposal and mitigation incorporated, due to the site's elevation and the scale of the structures, there will be moderate effects on the amenity value of the adjoining lands.

6.7.13 Visual Impact

43. In terms of the visual impact in the landscape I have assessed the effects of the wind cluster on the character of the:

- Rural Landscape
- Visual Amenity, and
- Significant Views.

44. I addressed these aspects in my previous assessment (2015, from page 9), and, whilst avoiding repetition of that material, from consideration of the design refinements and further information now available, I provide some revisions and additions.

Rural Landscape

45. The coastal rural landscape from Brinns Point to Heyward Point pivots at Blueskin Bay, and Porteous Hill stands to the north forming an important skyline feature which I described in my assessment report last year.

46. The rural landscape is highly complex with an intricate pattern of vegetation and structures. The complexity and character of the terrain, and the attraction of the coast, has resulted in extensive small lot development. Much of the mosaic character is utilitarian in character, with conifer shelter plantings prominent. Along with myriad structures and their curtilages grouped and sprinkled around the coastal mid- and lower slopes, the overall character is of lesser naturalness.

47. Located on Porteous Hill, the group of three towers with rotors above will be highly visible around much of this rural landscape. Wind turbines are an occasional attribute in various rural landscapes around the country. The three, tall slim towers proposed would allow the continuity of the rural landscape to flow largely undisrupted. I assess the proposal would have negligible effect on the ruralness of the landscape.

Visual Amenity

48. Addressed in my 2015 assessment (from page 10), I recognise that the introduction of the turbines will change the visual character of Porteous Hill. It will change the contribution of Porteous Hill to the wider coastal landscape.

49. For the landscape enjoyed from the state highway, in addition to the glimpses of turbines that will be available whilst passing Porteous Hill on SH1, the wind cluster will also be highly visible when travelling north toward and around Blueskin Bay (attachment photo 9). From the north Porteous Hill appears as a gentle cone with a complex array of shelter plantings and forestry scattered on the slopes, including on both the coastal and the inland skyline. The earthflow patterned terrain of this northern flank is scarcely legible due to the complex utilitarian landcover overlain. Hence Porteous Hill does not read as a distinctive cone in the landscape.

50. Considering the aesthetic coherence of this Porteous Hill - Blueskin Bay landscape, whilst highly rural in character the aesthetic value is not high. The tree patterning and its intrusion onto the skyline silhouette of the hill result in a low rating for aesthetic coherence.

51. The turbines located some 5 km distant will appear in silhouette on the skyline. This view from state highway one is a primary view of the site and proposal. The visual amenity will be changed. The addition of the 3 turbines will change Porteous Hill from somewhat indistinct to a landmark. The turbines will have an easily recognisable character. The 3 identical tall elegant turbines atop the hill would not reduce the coherence of the hill landform, nor of the vegetated character. The installation would accentuate the broad cone form. The broad cone would be complemented by the tall turbine structures. Their narrow bases pinion the rotors aloft allowing the hill landform below to retain its integrity. The turbines will contribute to the appreciation of the hill. As appreciated from SH1, I assess that any adverse effects on the aesthetic coherence of Porteous Hill, and on its visual amenity, will be minor.

52. Considered at closer range, from Warrington, as I described last year (page 11) and referenced simulation 5 (Viewpoint 5, 2015 page 17). With the refinements since, whilst recognising the envelope concept, a revised photomontage is provided (attachment photomontage Viewpoint 5).

53. As described previously, the complexity of the terrain and vegetation on the slopes and skyline above, and the scatter of buildings and utilities lessen the visual amenity. The addition of turbines to the summit will change the visual amenity. Whilst visibility from within the settlement will vary, in particular due to screening by vegetation and contour, from out toward the spit as in the photomontage, a turbine less than 3 km away will be highly visible and the others likely partly visible.

54. Given the landcover complexity and dispersed settlement character, the effects of the turbines on the visual amenity of Warrington are assessed as minor.

55. Addressing the wider coastal landscape associated with the site, such as the shores and hill slopes to the south of the Bay through to Heyward Point, Porteous Hill forms a gentle cone above slumped lands with a working landscape character. (see 2015 photo attachments pages 18 - 20, simulations 6 - 8). In clear daylight, the turbines will be visible

positioned on the summit, less than 100 m high on the 400 m high hill and set back more than 2 km from the coast.

56. The cluster design, with just 3 mid-size, three-blade turbines will result in a landmark installation that will complement the working landscape character. I assess the effects on visual amenity to be minor.

57. Considered from north of Porteous Hill, the turbines will be variously visible, such as from Church Road that, north of Hammond Hill, links SH1 with the coast. The previous simulation (2015 attachment page13, Viewpoint 3), is now replaced with a refined photomontage (attached Viewpoint 3).

58. Viewed above the north-east hill slopes and Slaughterhouse Bush, the 3 turbines are clearly visible on the open summit.

59. Considering visual amenity, and the aesthetic coherence attribute, the structures do not conflict with or intrude on the natural hill landform and its natural remnant and regenerating vegetation patterning. Porteous Hill very clearly retains its aesthetic coherence. The windfarm is clearly legible and the proportions, form and number of turbines demonstrate high aesthetic coherence. The windfarm atop reads as respectful, as standing lightly on the solid summit.

60. Assessing the effects of the proposal on the north east landscape, as demonstrated from Church Road, the effects on visual amenity will be minor.

61. Similarly, further to my description in the assessment report (page 11) and the photomontage (Viewpoint 2 attached), due to the predominant coastal orientation and terrain complexity, experienced from along Coast Road overall the wind cluster would have only minor effects on visual amenity.

Significant Views

62. I addressed significant views in my 2015 landscape assessment (from page 12), and I do not repeat that here. Considering effects on visual amenity above, I have addressed the approach from Dunedin and the

significant view across Blueskin Bay to the site. I assess any adverse effects on this very significant view to be minor.

63. Considering views from the highway when passing the site, the forestry plantings alongside largely prevent any public enjoyment eastward as they drive alongside Porteous Hill. With only glimpses available, any adverse effects on highway views are assessed to be minor.

64. Considering views from Warrington, as assessed previously, and considering the revised photomontage (viewpoint 1, page 4), I address the effects on this significant public viewpoint. Variously visible due to contour and vegetation, the turbines set back within just 3 km, in silhouette up on the hilltop, tall, pale and rotating, will be highly visible from parts of Warrington. Located above this low key settlement that disperses into the working rural landscape above, they introduce new contrasting elements which will be perceived differently by different people. Due to their visibility, their visual effects would be moderate, but the significance of this visibility will differ. The landmark character and sustainability symbolism will be perceived positively by some. Overall, I consider that the adverse effects are not likely to be experienced as significantly adverse.

65. Considering significant views from the coast and hills to the east, as described and analysed previously (2016 pp.13-14), I assess that whilst the turbines will be visible over an extensive area, and create a landmark, any adverse effects on significant views will be minor to negligible.

Coastal Landscape

66. Tall structures up to 90 m high located on the summit to a coastal hill, in clear daylight they be visible around the coast between Potato Point and Brinns Point. The turbines are proposed just inland of the North Coast Coastal Landscape Protection Area (CLPA). Due to their wide visibility, the CLPA provisions have been considered.

67. Addressed at the broad scale as a coastal landscape, the summit to Porteous Hill can be considered to be contribute to the coastal environment. As experienced from the wider coastal context, the

windfarm on the summit can therefore be considered in terms of its effects on the natural character, natural landscape ad natural features of this broader environs.

68. Due to the working landscape and lived in character, Porteous Hill is assessed to not have very high or outstanding natural character, nor be a highly natural or outstanding landscape or feature. Thus consideration of effects as per NZCPS Policies 13 (1)(b) and Policy 15 (b), significant adverse effects are to be avoided, remedied or mitigated.

69. As provided previously, the coastal landscape has been characterised as per land typing (Policy 15 (c)), and the defined attributes assessed along with the effects of the proposal. The biophysical, perceptual and associative attributes have each been considered in my previous landscape assessment. As a result of the iterative design process, the resultant proposal for three mid-size, 3-blade identical grey turbines placed on Porteous Hill, avoids and mitigates significant adverse effects on the natural character, the natural landscape, and the natural features of the broader coastal environs. The effects on the natural character of the coastal landscape are assessed to be minor.

Recommendations

70. I assess the proposal to be appropriate with effects landscape and visual overall being minor.

71. However there are some instances where adverse effects are assessed as of greater significance. An iterative design process has been undertaken and further refinements could potentially be included to further reduce adverse effects. Some are suggested below.

72. There is opportunity to explore the introduction of strategic plantings located to limit important viewshafts from around Porteous Hill. In selecting the locations and species, care would be required to not exacerbate bird strike for valued species.

73. The turbines are to be a light grey colour which is appropriate. However toward ground level, to reduce the visual contrast with the land, the

lower third of the tower could be graduated to a deeper grey toward the ground.

74. If there are particular views where multiple turbines appear overlapping and this results in significant adverse effects, the potential for synchronisation can be explored. However I am not aware of any views that would justify such mitigation.

D J Lucas

4 May 2016

APPENDIX 1

ENERCON shadow assessment

Project:
Dunedin (NZ)

IC16020PO
Blue Skin

Description:
This calculation was made without visiting the site and is only based on information provided by the customer. The results represent a calculation for the customer only and are not to be submitted to authorities.

Licensed user:
ENERCON GmbH Aurich
Dreekamp 5
DE-26605 Aurich
04941/927-0
Henriette Labsch / Site Assessment
Calculated:
30.03.2016 16:17/3.0.651

SHADOW - Main Result

Calculation: Additional/Total Shadow Flickering: D01 - 3x ENERCON E-53 (60m hh)

Assumptions for shadow calculations

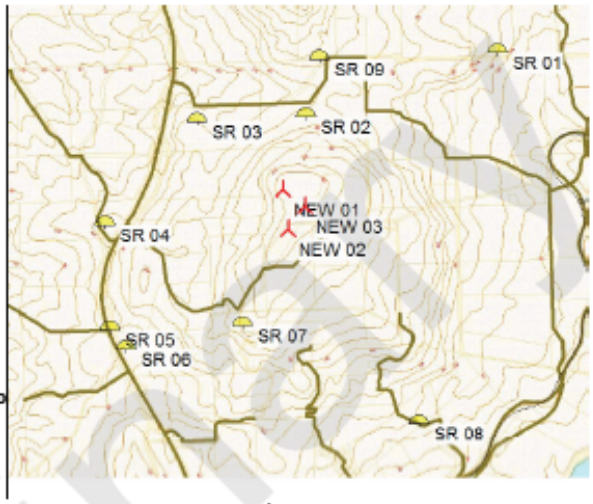
Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_ONLINEDATA_0.wpo
Obstacles not used in calculation
Eye height: 2,0 m
Grid resolution: 10,0 m

All coordinates are in
Geo [deg,min]-WGS84



Scale 1:40.000
New WTG
Shadow receptor

WTGs

	Longitude	Latitude	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
NEW 01	170°34,9390' E	-45°41,3550' S	390,0	ENERCON GmbH E-53 ...	Yes	ENERCON GmbH	E-53-800	800	52,9	60,0	996	29,0
NEW 02	170°34,9570' E	-45°41,4860' S	390,0	ENERCON GmbH E-53 ...	Yes	ENERCON GmbH	E-53-800	800	52,9	60,0	996	29,0
NEW 03	170°35,0380' E	-45°41,4120' S	386,3	ENERCON GmbH E-53 ...	Yes	ENERCON GmbH	E-53-800	800	52,9	60,0	996	29,0

Shadow receptor-Input

No.	Name	Longitude	Latitude	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
SR 01	139 Pryde Road	170°35,9670' E	-45°40,9340' S	172,8	0,1	0,1	2,0	0,0	0,0	Fixed direction
SR 02	90 Pryde Road	170°35,0600' E	-45°41,1250' S	294,4	0,1	0,1	2,0	0,0	0,0	Fixed direction
SR 03	22 Pryde Road	170°34,5530' E	-45°41,1290' S	235,3	0,1	0,1	2,0	0,0	0,0	Fixed direction
SR 04	2197 Waikouiaiti-Waitati Road	170°34,1040' E	-45°41,4550' S	230,0	0,1	0,1	2,0	0,0	0,0	Fixed direction
SR 05	2142 Waikouiaiti-Waitati Road	170°34,1060' E	-45°41,7960' S	215,0	0,1	0,1	2,0	0,0	0,0	Fixed direction
SR 06	2100 Waikouiaiti-Waitati Road	170°34,1740' E	-45°41,8630' S	197,9	0,1	0,1	2,0	0,0	0,0	Fixed direction
SR 07	110 Porteous Road	170°34,7240' E	-45°41,7970' S	345,9	0,1	0,1	2,0	0,0	0,0	Fixed direction
SR 08	58 Reservoir Road	170°35,5210' E	-45°42,1350' S	137,4	0,1	0,1	2,0	0,0	0,0	Fixed direction
SR 09	Quarry on Pryde Road	170°35,1380' E	-45°40,9390' S	303,4	0,1	0,1	2,0	0,0	0,0	Fixed direction

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
SR 01	139 Pryde Road	0:00	0	0:00
SR 02	90 Pryde Road	0:00	0	0:00
SR 03	22 Pryde Road	0:00	0	0:00
SR 04	2197 Waikouiaiti-Waitati Road	0:00	0	0:00
SR 05	2142 Waikouiaiti-Waitati Road	0:00	0	0:00
SR 06	2100 Waikouiaiti-Waitati Road	0:00	0	0:00
SR 07	110 Porteous Road	0:00	0	0:00
SR 08	58 Reservoir Road	0:00	0	0:00
SR 09	Quarry on Pryde Road	0:00	0	0:00

Project:
Dunedin (NZ)

IC16020PO
Blue Skin

Description:
This calculation was made without visiting the site and is only based on information provided by the customer. The results represent a calculation for the customer only and are not to be submitted to authorities.

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ENERCON GmbH Aurich
Dreekamp 5
DE-26605 Aurich
04941/927-0
Henriette Labsch / Site Assessment
Calculated:
30.03.2016 16:17/3.0.651

SHADOW - Main Result

Calculation: Additional/Total Shadow Flickering: D01 - 3x ENERCON E-53 (60m hh)

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
NEW 01	ENERCON GmbH E-53 800 52.9 !O! hub: 60,0 m (TOT: 86,4 m) (19)	0:00	
NEW 02	ENERCON GmbH E-53 800 52.9 !O! hub: 60,0 m (TOT: 86,4 m) (20)	0:00	
NEW 03	ENERCON GmbH E-53 800 52.9 !O! hub: 60,0 m (TOT: 86,4 m) (21)	0:00	

Project:
Dunedin (NZ)

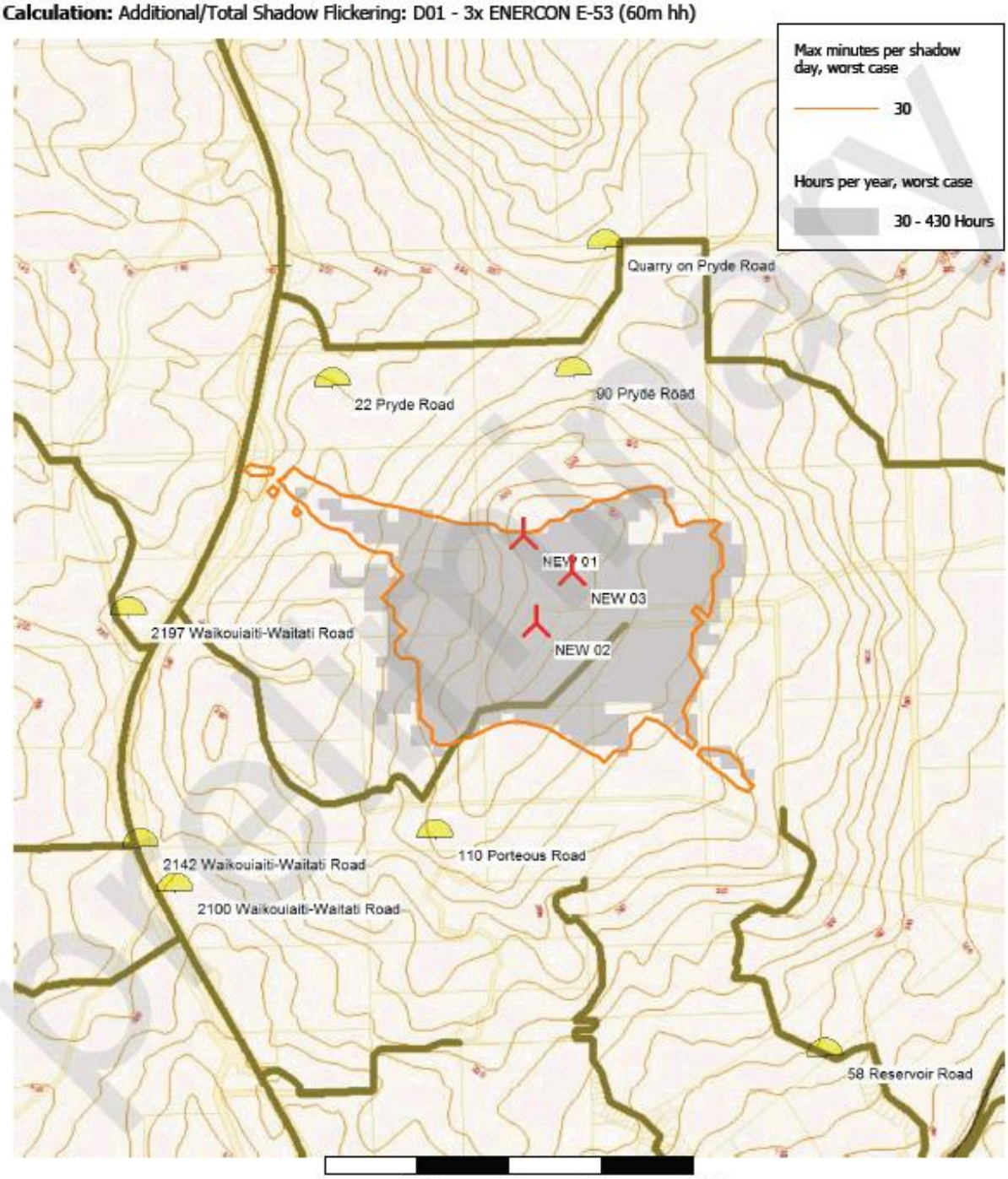
IC16020PO
Blue Skin

Description:
This calculation was made without visiting the site and is only based on information provided by the customer. The results represent a calculation for the customer only and are not to be submitted to authorities.

Licensed user:
ENERCON GmbH Aurich
Dreekamp 5
DE-26605 Aurich
04941/927-0
Henriette Labsch / Site Assessment
Calculated:
30.03.2016 16:17/3.0.651

SHADOW - Map

Calculation: Additional/Total Shadow Flickering: D01 - 3x ENERCON E-53 (60m hh)



Map: map Dunedin , Print scale 1:15.000, Map center Geo WGS84 East: 170°34,9472' E South: -45°41,4266' S

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_ONLINEDATA_0.wpo (1)