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3rd February 2016

Ed Mounsey
CWP Renewables

Dear Ed,

REVISED SAPPHIRE WIND FARM 109 WTG WIND FARM EMI ASSESSMENT

This letter updates a previous Electromagnetic Interference (EMI) assessment report¹ as a result of CWP Renewables' proposed amendments to Sapphire Wind Farm based on a revised turbine layout of 109 wind turbines and allowing for current wind turbine technology.

1. Development to be Considered

It is noted that the proposed wind farm development consolidates the currently approved two project layout into a single layout. The assessment will assume the following infrastructure:

Wind turbine generators (WTGs)

Sapphire Wind Farm: up to 109 WTGs

up to 200 metres from ground to blade tip

Rotor diameter of up to 140 metres

The coordinates of the turbines for the current 109 turbine layout are shown in Attachment E

2. Guidelines

The NSW Department of Planning and Environment (DPE) conditions of approval for the Sapphire project and Statement of Commitments in the project's Environmental Assessment have been considered (see Attachment A for conditions and commitments relevant to EMI). Guidance has also been taken from Appendix F of the Environment Protection and Heritage Council's (EPHC) draft National Wind Farm Development Guidelines.

3. Desktop Assessment of Radiocommunications Systems

Using Data from the latest Australian Communications & Media Authority's (ACMA) RADCOM Database checks were repeated on radiocommunication services within the wind farm and within at least a 50 km corridor around the wind farm boundaries to determine if any of the towers or turbines will obstruct line-of-site paths or have any other likely detrimental effect on these services. It is considered that a 50 km radius corridor should be explored to ensure that

¹ Lawrence Derrick and Associates Report Sapphire Wind Farm, NSW – Buffer Zones from Radio Facilities 25/02/2011

VHF or UHF links are captured in the analysis as path lengths of 100 km or more sometimes exist. Clearance criteria have been re-developed for any paths, which traverse the site.

Active Electromagnetic Interference from the turbine power generators is not normally a problem with modern turbines and this issue has not be investigated.

A reference² issued by Ofcom in the UK on clearance zones to be maintained between point to point radio paths and turbines indicates that a clearance of the 2nd Fresnel zone radius should be maintained for microwave systems. It further suggests avoiding the unpredictable effects in the near-field distance close to the link terminals and also excessive reflection/scattering zones.. For microwave systems a 2nd Fresnel clearance has been adopted in most analyses sighted for the moving turbine blade case. For VHF and UHF point to point systems (frequencies below 1000 MHz) it is less clear cut what clearance criteria should be maintained however correspondence with Bacon, the Author of the reference below, suggests a criteria of 0.6 of the 1st Fresnel clearance at least for line of sight systems could be adopted.

4. Desk Top Assessment of Domestic Television and Radio Reception

A key issue for TV reception is the closeness of houses to the turbines, whether TV signal levels are currently satisfactory and the relative orientation to the turbines and the TV transmitting stations to the houses.

The magnitude and geographical location of any impairment to TV or sound broadcasting has been considered based on relevant ITU³ Documents and reports on overseas and Australian experience of wind farm impacts on broadcasting services. From map studies and ACMA details of TV and sound broadcasting stations in the area, predictions of any possible effects will be based on the terrain, location of dwellings and the sound and TV broadcasting services utilised by the local residents.

It is considered that the prediction of turbine effects on TV reception at individual dwelling locations is not precise and results of studies will be based on a probability that TV reception may be impaired in certain areas. Factors involved include the terrain profile to TV stations and the turbines, actual TV station locations used and the condition of the resident's antenna system. The cumulative effects of turbines can be estimated with the interference signals additive on a power basis however these will be also on a probability basis. Wind direction changes will also be a factor in interference levels experienced at a particular location.

Review of reports of overseas and local experience with operational wind farms indicates that AM radio broadcasting reception has not been reported as a problem either from the theoretical or actually observed point of view. FM radio broadcasting impairment as a result of turbines has been reported only in a laboratory simulation but there have been no reports of any field problems. A further search of the literature will be made as part of this study to confirm that radio broadcasting interference is not an issue.

² Bacon, D.F. (2002) "Fixed-link wind-turbine exclusion zone method: A proposed method for establishing an exclusion zone around a terrestrial fixed radio link outside of which a wind turbine will cause negligible degradation of the radio link performance.",
Published on Radiocommunications Agency Website, www.radio.gov.uk, Version: 1.1.

³ ITU International Telecommunications Union

There are two TV repeater stations existing in the general area which receive their input signals off air from the main TV stations. Although the TV repeater stations are listed on the ACMA database there is no indication of their signal source which could be via satellite or from main TV stations. As turbines on the path could impact on the quality of the received signal and hence impact on the transmitted signal, these paths have been identified from other ACMA information.

5. Power Line and Sub Station EMI issues

Consideration has been given to potential EMI issues related to High Voltage (HV) power lines and substations built for the wind farm and to the impact on radio/TV reception at nearby dwellings as a result of the support structures for overhead power lines. In general, with standard easement distances and line design and construction, the limits for EMI specified by the relevant Australian Standard would be met. On Electric and Magnetic field issues related to human exposure the Electricity Authorities guidelines would be specified.

6. Results of the Re assessment

The reanalysis of the radio link mapping, using the latest ACMA data, indicates that there are no other links existing near the wind farm beyond the three links identified in previous reports (shown in the table below). Zoomed radio link maps derived from the ACMA data are shown in Attachments B and C.

Using the increased tip height and rotor diameters, adequate clearance exist for two of the three links. The third link, operated by the Ambulance Service of NSW, is a 400 MHz link which was identified in the previous analysis. Although this link does not have Fresnel Zone clearance under normal radio path conditions, interference is considered to be unlikely given the low frequency of operation of the link and the low proportion of the link Fresnel zone cross sectional area that would be traversed by the wind turbine blades.

A vertical path profile analysis of the Ambulance Service link path has shown the link to be terrain obstructed, potentially resulting in lower received signal levels and making the link more susceptible to wind turbine interference. However, in recent correspondence with Simon Morgan, Service Manager of Telecommunications for the Ambulance Service of NSW, Mr. Morgan states that the organisation do not expect any performance issues with this link. He states that in the event of interference being experienced after wind farm construction, the Ambulance Service has agreed to use an alternative link from another existing radio communications site which would avoid any link traversing the wind farm. See Attachment D for correspondence.

LINK A – B (ACMA Link ID's)	Licensee	TOTAL CORRIDOR WIDTH Metres Note 1	SITE A COORDS AMG 66 Z56	SITE B COORDS AMG 66 Z56
55450-6909	NSW Electricity Networks	1400m	E315220 N6783350	E372915 N6679480
6863-6864	Soul Pattinson Telecommunications Pty Limited	205m	E365950 N6707332	E309241 6705419N
250528-6915	Ambulance Service of NSW	452m	E359788 N6748135	E330600 N6690360

Note 1: Total width buffer zone centered on radio ray line for 2nd Fresnel zone clearances at path mid point. The buffer zone includes a rotor diameter of 140m and thus the buffer distance is centered on the WTG.

The link mapping did not indicate that there are any additional radiocommunication sites which are too close to the wind farm or to turbines which would cause any detrimental effects.

Any potential TV or radio reception issues remain as previously reported as no new TV/Radio transmission facilities were identified in the area. The two TV repeater station input paths have sufficient clearance to turbines to not cause interference.

It has been determined that Sapphire Wind Farm will be able to meet its Conditions of Approval and Statement of Commitments relevant to EMI (listed in Attachment A). In regard to Condition 16, it is not considered necessary at this stage to consult with the NSW Government Telecommunications Authority or other Radio Communications Licensees (other than the Ambulance Service of NSW) as adequate clearances exist to other radio facilities and point to point paths. No amendment of the revised 109 WTG layout is required to achieve Commitment 42 and regarding Commitment 48, the Ambulance Service of NSW has agreed that no mitigation is required prior to construction and that they will be able to use an alternate link if any interference is experienced.

Yours sincerely

A handwritten signature in black ink, appearing to read 'L. J. Derrick'. The signature is written in a cursive style with a large, sweeping initial 'L'.

L. J. Derrick

B, E, (Elec.)

ATTACHMENT A - Conditions of Approval and Commitments relevant to EMI

Conditions of Consent

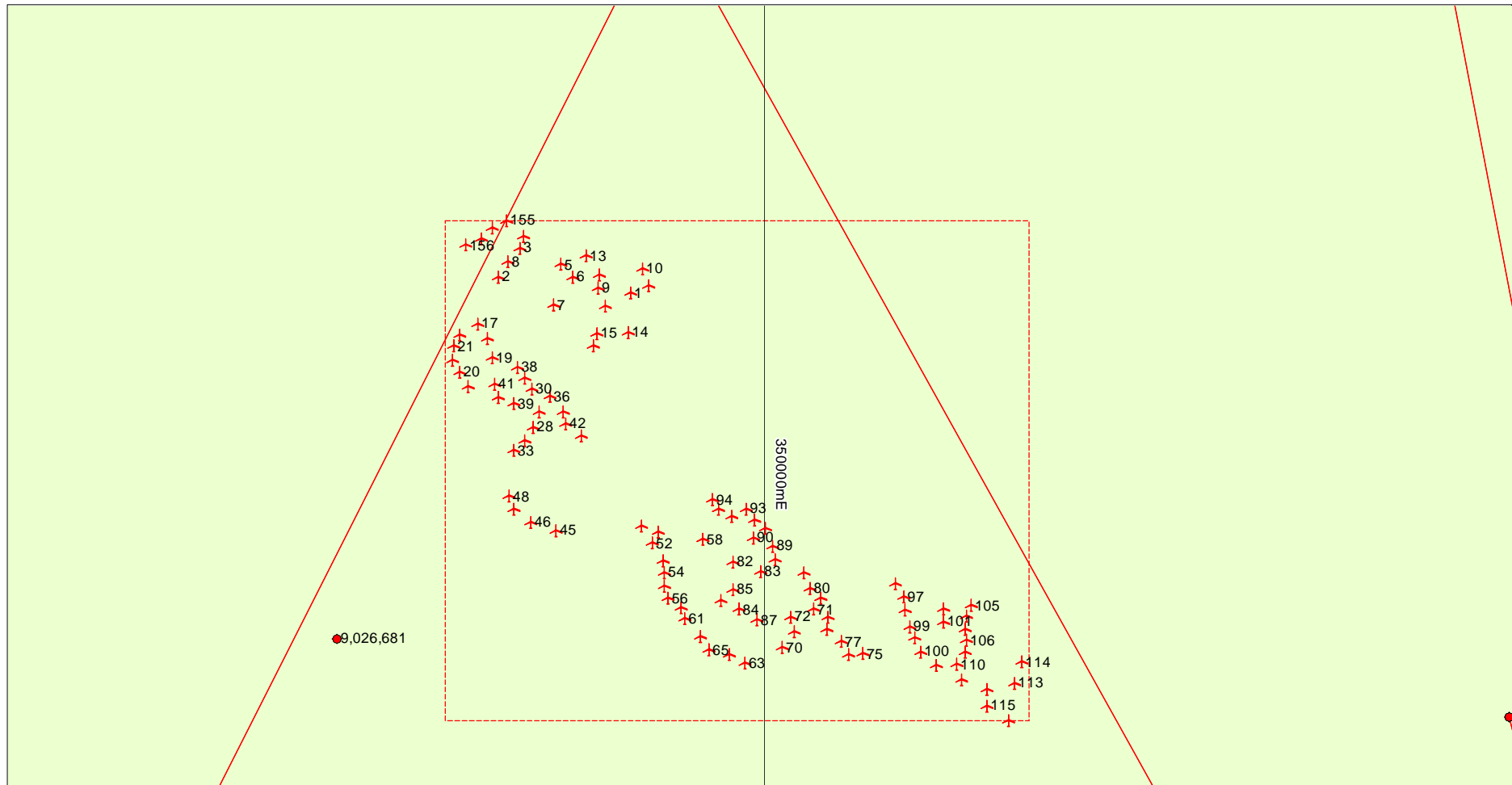
C16.	<p>Prior to the commencement of construction, the Proponent shall:</p> <p>(a) consult with the NSW Government Telecommunications Authority and other registered communications licensees (including emergency services) to ensure that risks to these services are minimised as far as feasible and reasonable. This may include the installation of additional radio sites or services to ensure coverage of radio communications are not degraded;</p> <p>(b) in the event that any disruptions to radio communication service links (installed before construction of the Project) arise as a result of the Project, the Proponent shall undertake appropriate remedial measures in consultation with the NSW Government Telecommunications Authority and relevant licensees to rectify any issue, including arranging the deployment of temporary measures in order to maintain effective coverage whilst more permanent measures are effected, within three months of the problem being identified, and at the expense of the Proponent;</p> <p>(c) consider remedial measures, including:</p> <p>(i) modification to or relocation of the existing antennae;</p> <p>(ii) installation and maintenance of additional radio sites or services;</p> <p>(iii) installation of a directional antennae; and / or</p> <p>(iv) installation of an amplifier to boost the signal strength.</p>
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Statement of Commitments

	Impact	Objective	Mitigation Task
42	Deterioration of signal strength	Minimise deterioration	Amend planned WTG positions if necessary and feasible within the Approval Conditions, to create corridors to ensure minimal interference on links.
43	Deterioration of signal strength	Minimise deterioration	Use of primarily non-metallic WTG blades, to minimise disruption.
44	Deterioration of signal strength	Minimise deterioration	Where practical, use equipment complying with the Electromagnetic Emission Standard AS/NZS 4251.2:1999.
45	Deterioration of signal strength	Minimise deterioration	A system for recording any complaints on interference, to allow for further investigations with the affected party, to reach an amicable solution.
46	Deterioration of signal strength	Minimise deterioration	<p>General mitigation methods for radio-communication include:</p> <ul style="list-style-type: none"> • Modifications to or relocation of existing antennae; • Installation of a directional antennae; and • Installation of an amplifier to boost the signal.
47	Deterioration of signal strength	Minimise deterioration	<p>If television interference is experienced and reported by an existing receiver in the vicinity of the Project, the source and nature of the interference would be investigated by the Proponent. Should the cause of interference be attributed to the Project, then the Proponent will put suitable mitigation measures in place after consultation and agreement with the effected landowner or television broadcaster. These could include:</p> <ul style="list-style-type: none"> • Re-orientation of existing aerials to an alternative transmitter;

			<ul style="list-style-type: none"> • Provision of a land line between the affected receiver and an antenna located in a suitable reception area; • Provision of satellite or digital TV where available; and • Installation of a new repeater station in a location where interference can be avoided (this is more complex for digital but also less likely to be required for digital television).
48	Deterioration of signal strength	Minimise deterioration	Mitigate for any potential impacts on the NSW Ambulance link (ACMA Link ID's 6863-6864) prior to construction.

ATTACHMENT B – VHF/UHF RADIO LINKS 55450 – 6909 (NSW Elec, Networks) and 250525 – 6915 (Ambulance NSW)



Attachment D – Correspondence with the Ambulance Service of NSW

Subject:RE: Sapphire Wiind Farm and Inpact on Emmaville - Mount Topper 400 MHz Link

Date:Sun, 8 Nov 2015 04:15:14 +0000

From:Morgan, Simon <SMorgan@ambulance.nsw.gov.au>

To:Laurie Derrick <lderrick@bigpond.com>

CC:Ed Mounsey <ed.mounsey@wpcwp.com.au>, PEPPER, John <JPepper@ambulance.nsw.gov.au>

Hi Laurie,

I have discussed this matter with John Pepper and he recalls the discussions back with Bill Tripcony.

We are of the opinion that the wind farm will not impact our link from Emmaville to Mt. Topper so this won't impede your project.

Our network in the New England region is currently under review for replacement so the wind farm will be taken into consideration for future network design.

If Ambulance does experience issues on the link we will relocate the Mt Topper end to ben Lomond as previously discussed.

Regards

Simon Morgan

Service Manager Telecommunications | **Operational Logistics**

State HQ, Balmain Road, Rozelle NSW 2039

p: 02 9320 7830 | m: 0407 293597 | smorgan@ambulance.nsw.gov.au

www.ambulance.nsw.gov.au



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From: Laurie Derrick [<mailto:lderrick@bigpond.com>]

Sent: Monday, November 02, 2015 3:21 PM

To: Morgan, Simon
Cc: Ed Mounsey
Subject: Sapphire Wiind Farm and Inpact on Emmaville - Mount Topper 400 MHz Link

Hi Simon,

Thank you for ringing me back and discussing the above issue which was the subject of correspondance with Bill Tripcony in 2011. Now that the wind farm proposal is proceeding again Wind Prospect CWP have asked me to follow up on the possibile ways of minimising any distirbance to the link's performance. It would be appreciated if you would advise on the feasibility of moving the Emmaville link - Mount Topper Link to Emmaville - Ben Lomond as proposed by Bill Tripcony if this is still considered necessary. A copy of the previous correspondance is shown below. A path profile I generated for the Emmaville to Mount Topper path suggests that it is somewhat obstructed. Please let me know if any more details of the Sapphire Wind Farm are required.

Regards

Laurie Derrick
Lawrence Derrick & Associates
03 98893443
0417308525

----- Forwarded Message -----

Subject:FW: Sapphire wind farm
Date:Thu, 12 May 2011 15:54:09 +0930
From:Adrian Maddocks <adrian.maddocks@wpcwp.com.au>
To:Laurie Derrick <lderrick@bigpond.com>

Hi Laurie,

I hope you are well.

I've been in touch with Bill at the NSW Ambulance to discuss the turbine we've placed in the link path, which we will propose to remove if necessary. Unfortunately he feels that the other turbines in the vicinity of the link will cause him problems, despite me sending him your report to reassure him that the separation distances from turbines would be acceptable. Interestingly he's not asked us to cover any costs (if any?) associated with moving the link.

Do you have anything to add which may reassure Bill that all will be well? Is it worth you speaking directly with him about the project? Let me know if there's anything further we can do to reassure him.

Regards,
Adrian

Adrian Maddocks
Senior Development Manager

Wind Prospect CWP Pty Ltd

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From: TRIPCONY, Bill [<mailto:BTripcony@ambulance.nsw.gov.au>]

Sent: Thursday, 12 May 2011 2:52 PM

To: Adrian Maddocks

Subject: Sapphire wind farm

Adrian,

I have discussed the layout of the wind farm with my technical staff and we are of the opinion that there are too many turbines close to the link path (see the attached word document) that may affect the operation of the path.

We believe that our only alternative is to apply to the ACMA to move the link path from Mt Topper to Ben Lomand as shown in the PDF attachment. This path is longer but is 6km away from the closest turbine.

Bill Tripcony
Telecommunications Manager

Ph 9320 7830
Fax 9320 7801

Attachment E Coordinates of Turbines in the Current 109 Turbine Layout

MGA94 ZONE 56

WTG ID	X (l)	Y (l)
1	347266.4067	6716525.172
2	344448	6716872
3	344926.0349	6717491.084
4	344998	6717747
5	345798	6717147
6	346048	6716872
7	345625.3111	6716269.025
8	344648	6717197
9	346577.5164	6716638.846
10	347523	6717047
11	347648	6716697
12	346598	6716922
13	346323.7272	6717322.28
14	347223	6715697
15	346548	6715672
16	346473	6715397
17	344023	6715872
18	344223	6715572
19	344323	6715147
20	343623	6714847
21	343498	6715397
22	343623	6715647

23	343473	6715097
24	343823	6714547
28	345198	6713672
29	345323	6713997
30	345173	6714497
33	344774.331	6713167.394
34	345018.21	6713396.713
36	345542.3679	6714321.27
37	345023	6714722
38	344873	6714947
39	344798	6714172
40	344448	6714297
41	344373	6714597
42	345898	6713747
43	345848	6713997
44	346223	6713497
45	345673	6711472
46	345148	6711647
47	344798	6711922
48	344673	6712197
52	347723	6711197
53	347973	6710822
54	347998	6710572
55	347998	6710297
56	348073	6710022
57	347848	6711447

58	348794	6711276
59	347498	6711572
60	348339.9991	6709830.595
61	348428.5721	6709583.98
62	348750.0484	6709222.932
63	349698	6708647
64	349373	6708822
65	348923	6708922
70	350498	6708972
71	351173	6709797
72	350664.3235	6709622.277
73	350748	6709322
74	351458.0069	6709627.487
75	352223	6708847
76	351898	6708822
77	351748	6709097
78	351454.5335	6709353.084
79	351323	6710022
80	351096.7681	6710240.551
81	350945.673	6710556.635
82	349451.4735	6710804.998
83	350035.0131	6710600.064
84	349573	6709797
85	349448	6710222
86	349198	6709972
87	349953.8751	6709563.14

88	350351.0971	6710839.732
89	350285.1015	6711138.449
90	349873	6711322
91	349898	6711697
92	350142.463	6711527.373
93	349726.4549	6711926.99
94	349003.3984	6712128.382
95	349149.2833	6711937.343
96	349420.2124	6711770.617
97	353073	6710047
98	353098	6709772
99	353198	6709422
100	353432.6591	6708880.801
101	353923	6709522
102	353923	6709797
103	354398	6709372
104	354423	6709647
105	354523	6709872
106	354423	6709122
107	354398	6708872
108	352897.7909	6710348.575
109	353299.9725	6709173.626
110	354198	6708622
111	354323	6708297
112	353774.289	6708605.514
113	355441.0416	6708220.708

114	355598	6708672
115	354842.81	6707728.265
116	354848	6708097
117	355298	6707422
155	344632.9974	6718072.997
156	343760.9994	6717550.003
157	344316.0024	6717905.001
158	344086.0011	6717689.005
159	346737.3299	6716251.985