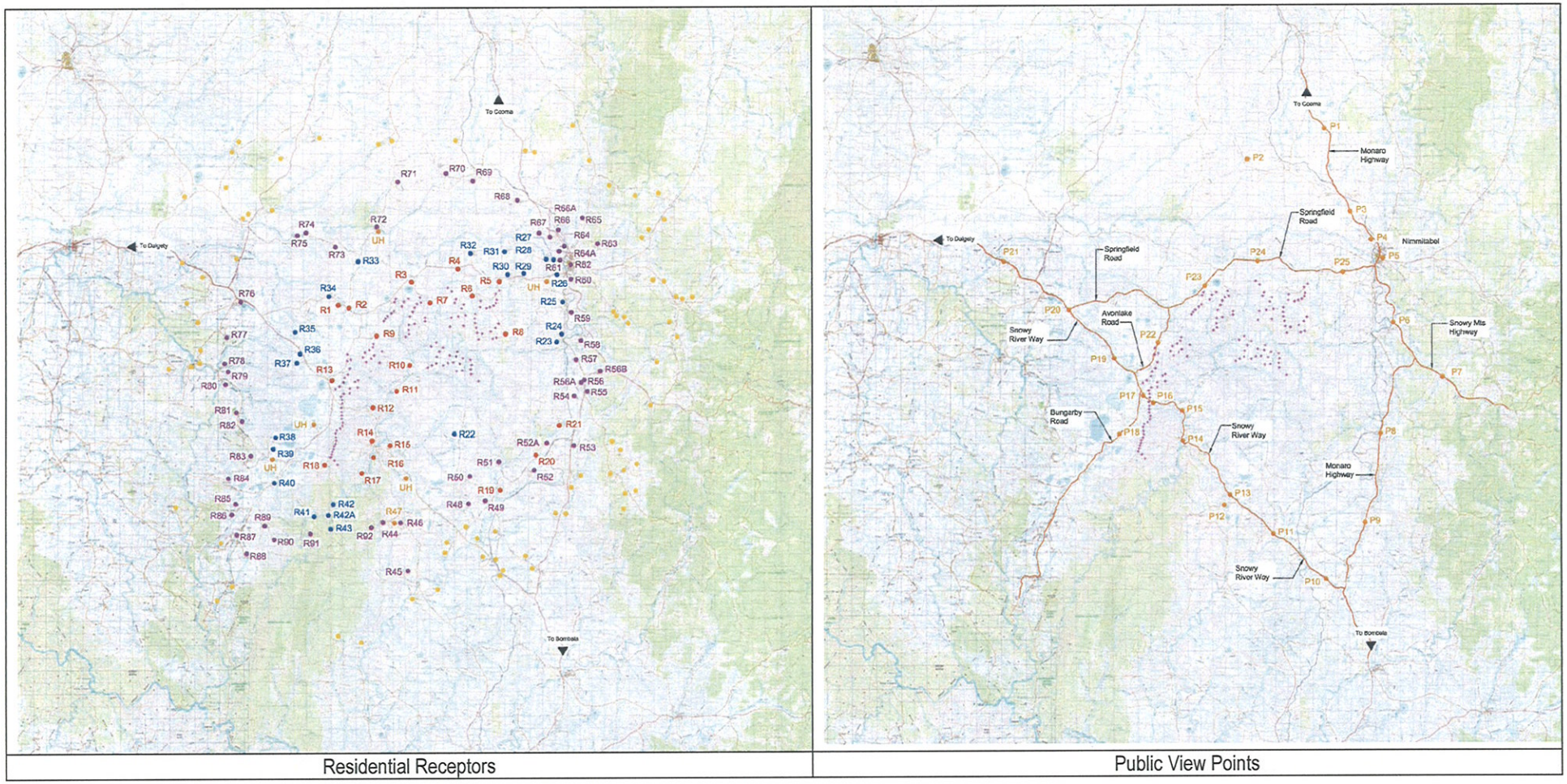

Residential Receptors | Public View Points

Figure 8: Residential Receptors and Public View Points within 10 kilometres of the Project (Wind Prospect Pty Ltd, November 2009)
Note: original number of turbines shown (as exhibited)

- 71 out of the 94 residential receptors (including five "associated" dwellings and the township of Nimmitabel) and 18 out of the 25 public viewpoints (including the township of Nimmitabel, the Peak lookout and views from the Monaro Highway and Snowy Mountains Highway) are likely to experience a **low to nil** visual impact.

With respect to landscape values, the Proponent's assessment has identified seven broad landscape elements which occur within the general 10 kilometre view shed of the project comprising: undulating grasslands, river valley and drainage lines, broad river valley, simple slopes and ridgeline areas, upland wetland and plateau, timbered areas (cultural and remnant native) and settlements.

The Proponent has assessed the sensitivity of each landscape element to wind farm development considering a combination of factors including:

- landform and scale (with the absence of strong topographic variety and scale in the area generally associated with lower landscape sensitivity);
- settlement and human influence (with the more dispersed settlement pattern and low evidence of industrial development in the area generally associated with a higher sensitivity to change);
- movement (with the low frequency of human/ traffic movement and general stillness of the area associated with a higher sensitivity to change);
- rarity (with the landscape elements in the area generally considered to be well represented and consistent with similar features in the broader Southern Tablelands region and therefore associated with lower landscape sensitivity); and
- connection with adjacent landscapes (where the generally continuity of landscape features in the area and contribution to a wider landscape associated with higher landscape sensitivity).

In considering the above, the Proponent has characterised each of the landscape elements within the project view shed to be of medium sensitivity with a moderate capacity to accommodate the visual changes associated with the project turbines.

Wind Turbines – Blade Glint, Shadow Flicker and Night Lighting

At present there are no assessment guidelines governing shadow flicker in New South Wales. However, the standard specified in the Victorian Planning Guideline *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria September 2009* (of ensuring that the duration of shadow flicker does not exceed more than 30 hours per year at any dwellings) is considered to also be acceptable for the New South Wales situation. Based on its assessment, the Proponent has concluded that shadow flicker would extend a maximum of 1040 metres from turbines associated with the project and has predicted that five receptors (all associated dwellings including one currently uninhabited dwelling, Avon Lake) have the potential to experience some level of shadow flicker from the project. Of these, only one receptor (Benbullen) is predicted to experience shadow flicker levels greater than 30 hours per annum.

With respect to blade glint, the Proponent has identified that this issue can be effectively managed through the use of low reflectivity matt finishes and has committed to the use of such finishes as part of the detailed design for the project. Based on its aviation hazard assessment, the Proponent has determined that aviation hazard lighting at night time would not be warranted for turbines associated with the project on the basis that:

- there is no mandatory requirement by the Commonwealth Civil Aviation Safety Authority (CASA) for the provision of obstacle lighting at wind farms remote from surrounding aerodromes (i.e. > 30 kilometres away);
- not all operational wind developments include aviation hazard lighting (e.g. Capital Wind Farm in Bungendore New South Wales) on the basis of their degree of risk to aviation safety;
- the turbines associated with the project are not considered to pose a high risk to aviation safety as the turbines would not infringe on the instrument approach airspace of nearest aerodromes (approximately 35 kilometres away), the project is located within a remote mountainous area with low aviation activity and the turbine heights associated with the project at their highest elevation would still be lower than surrounding mountainous terrain for which pilots are required to plan for when flying in the area; and
- there are already lit towers atop of higher terrain than the project turbines in the vicinity of the project (i.e. Brown Mountain approximately seven kilometres to the east and Hudson Peak approximately 11 kilometres to the north) to delineate the height of obstacles in the area to pilots.

Notwithstanding the above, the Proponent has committed to determining final night lighting requirements for the turbines as part of detailed design in consultation with CASA. Should night lighting be required at the turbines, the Proponent's visual assessment has concluded that this is unlikely to pose a significant visual impact on surrounding receptors as residents would mostly be indoors at night time and motorist views are likely to be transitory. The Proponent has committed to design night lighting to minimise intensity and glare impacts as far as possible, in consultation with CASA, should turbine lighting be required.

Ancillary Infrastructure

The Proponent has concluded that the remainder of project components would pose negligible visual impacts on surrounding receptors and the landscape on the basis of:

- the project being designed to minimise disturbance footprint - including undergrounding of the majority of transmission cabling (with the exception of up to four kilometres of overhead transmission lines) and co-locating of features (e.g. access roads and undergrounded cables) to minimise disturbance "scar"/ footprint within the landscape;
- the small scale of above ground infrastructure - including single spun concrete pole design for the overhead transmission lines which are similar in scale to already existing domestic distribution lines in the area and relatively small scale substation infrastructure;
- large set back distances to nearest receptors (all "associated") - being two kilometres from the substation and one kilometre from the nearest section of the overhead lines; and
- availability of measures to further mitigate visual impacts (where required) – including screen planting around the substation building, appropriate night lighting design at the substation (including low intensity and appropriately mounted lights) and rehabilitation of up to six metres of the total disturbance width of the access roads.

Submissions

The key concern raised by private submitters on the project related to visual impacts associated with the wind turbines. This included visual impacts to surrounding non-associated dwellings (including the number and height of turbines, distance to dwellings and cumulative impacts from the transmission line connection to the existing grid) and impacts to existing landuse and future development potential on surrounding properties. A single submission noted that the Proponent's assessment had not taken into account impacts to an existing uninhabited building located within a neighbouring property, which had the potential to be upgraded in the future to a habitable dwelling. A number of submitters suggested compensation on the grounds of visual impacts to existing dwellings and to future development potential and associated reductions to property values. An additional key concern raised in the majority of public submissions related to the landscape values of the area, many of which considered the area to display "unique" and "pristine" landscape values. Concern was also raised regarding the large visual catchment of the project (i.e. visibility from a wide area) and of its potential to obscure views of the Snowy Mountains and to impact on vistas along tourist drives.

In its original submission, Bombala Council raised concern that the project would affect the land value and development potential of allotments within sight of turbines and recommended compensation to all non-associated properties within 10 kilometres of turbines. Council also recommended a set back distance of one kilometre between the project and nearest non-associated property boundaries on the basis of amenity impacts. These comments were subsequently withdrawn by Council in later correspondence to the Department. Notwithstanding, Bombala Council has retained its request for a minimum setback of one kilometre from either side of the Snowy River Way to protect the scenic values of this "designated tourist route". Furthermore, along with Cooma-Monaro Council, Bombala Council has recommended that the proposed community contributions for the project be increased to reflect the unique characteristics of the Monaro environment and the visual prominence of the project.

Consideration

The Department is satisfied that the visual impacts of the ancillary infrastructure associated with the project (substation, internal overhead transmission line etc) are unlikely to be significant for the reasons outlined in the Proponent's assessment (as identified in the preceding sections) and can be managed through the implementation of appropriate urban and landscaping design and rehabilitation measures. The Department has recommended conditions of approval requiring appropriate visual treatment of ancillary infrastructure (including

landscaping) and for the rehabilitation of disturbed areas as far as practicable to minimise and mitigate visual impacts from the disturbance footprint of the project. In consideration of the above, the Department has focused its assessment on the potential visual impacts of the wind turbines.

In relation to the overhead transmission line connection to the grid, the Department notes that this would be subject to separate assessment under Part 5 of the EP&A Act. Notwithstanding, due to differences in scale, location and landform between the two elements (i.e. the transmission line having a maximum height of 26 metres compared to 152 metres for the turbines, the transmission line traversing a generally easterly route compared to the turbines westerly location and the transmission line being generally confined to lower land areas compared to the elevated ridgelines of the turbines), the Department considers that there would be low potential for individual receptors to experience cumulative visual impacts from both elements.

Impacts to Existing Dwellings

The Department notes that all of the dwellings identified in the Proponent's assessment as likely to experience high visual impact from the project are "associated" receptors, who have reached a commercial agreement with the Proponent. Consequently, the Department's consideration has focused on non-associated receptors. In this regard, the Department notes that the vast majority of non-associated dwellings surrounding the project site would be located a considerable distance from the project (i.e. only two dwellings within three kilometres of nearest turbines and a single dwelling within two kilometres) (refer Figure 9). Whilst a number of submitters have raised concerns regarding the number and height of turbines that would be visible at individual receptors, the Department considers that for the vast majority of non-associated dwellings (i.e. those greater than 3 kilometres away) the distance between the dwellings and turbines would be sufficient to ensure that the turbines would not significantly intrude on the visual amenity of the dwellings by dominating foreground views. In this respect the Department notes that visibility does not necessarily correspond to level of impact. Whilst a greater number of turbines may be visible to these receptors, the Department notes that at distance the scale of the turbines would be less and would allow for greater landscape context, and therefore would pose less intrusion on visual amenity than in the case of turbines in closer proximity which have greater potential to dominate foreground views (even though fewer turbines may be visible).

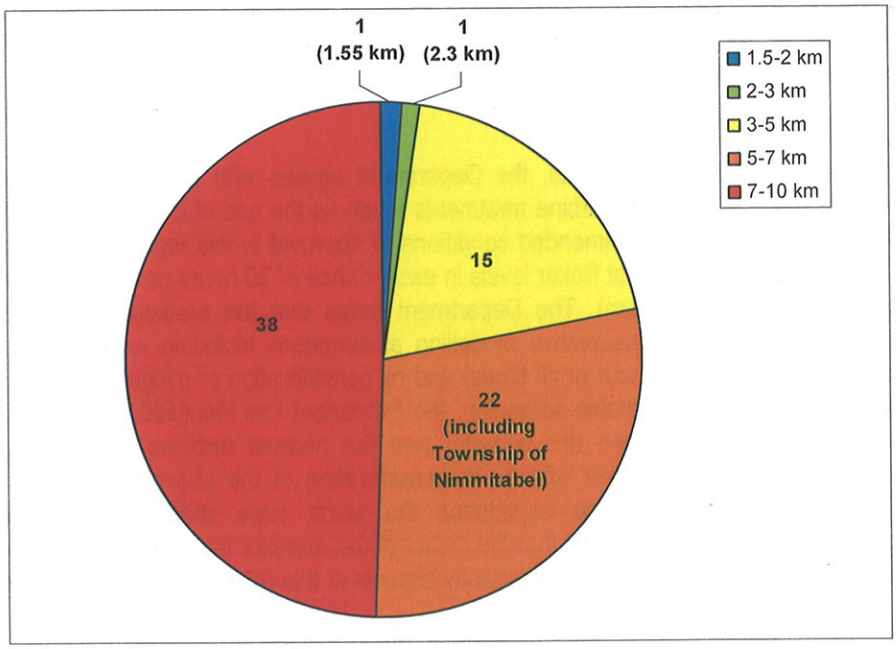

Figure 9: Distance of Non-Associated Dwellings to Nearest Turbines

In this context the Department considers that a reduction in the allowable height of the turbines (from 152 to 125 metres) as requested by certain submitters is likely to result in negligible benefit, as at the distances involved the difference in height is unlikely to be sufficiently perceptible to provide material benefit. Conversely, the Department accepts that limiting the height of turbines would materially affect the Proponent's ability to maximise the wind resource at the site, which has the potential to affect the viability of the project. In this regard, the Department accepts the Proponent's assertion that turbine numbers and heights have increased (at least in part)

to compensate for the relocation of the project to lesser yielding areas to the west, in order to increase setback distances from neighbouring receptors to the east. In this respect, the Department accepts that the final project design demonstrates genuine effort by the Proponent to maximise setback distances from neighbouring dwellings so as to minimise visual intrusion and other amenity impacts on these receptors, balanced with measures to maximise the economic profitability of the project. Whilst a number of submitters have requested a further one kilometre setback from property boundaries, the Department does not consider that further extension is warranted on the basis that acceptable visual amenity standards are considered to be achievable at neighbouring dwellings by the already proposed set back distances to these dwellings.

With respect to the two non-associated receptors ("Woodbine" – R30 and "Mia Mia" – R29), which are proposed to be located closest to the proposed turbines (i.e. 1.55 and 2.3 kilometres, respectively), the Department accepts the turbines have the potential to have a greater dominating influence on foreground views at these dwellings, due to their closer proximity (less so at Mia Mia than at Woodbine). Notwithstanding, the Department notes that the location of the turbines relative to the receptors are such that neither of these dwellings are expected to experience visual intrusion in multiple directions or be "hemmed in" by turbines without any visual relief in any direction. Furthermore, the Department notes that in the case of both dwellings, the Proponent's assessment has identified intervening landform and vegetation which has the potential to at least partially screen views of the turbines. The Proponent's assessment has identified that in the case of Woodbine (the closest dwelling) intervening topography and landscape plantings have the potential to screen the majority of views of the turbines from this dwelling. The Department considers that there would be opportunity to further supplement existing screening through targeted landscaping. In this regard (whilst acknowledging submitter concerns regarding poor growing conditions in the Monaro), the Department considers that the existence of landscape planting at surrounding dwellings in the area demonstrates that such planting is achievable subject to appropriate care and would not result in significant change to the surrounding landscape beyond that posed by existing plantings.

In consideration of the above, the Department is satisfied that although located closer to the turbines, visual impacts at Woodbine and Mia Mia are unlikely to be significantly intrusive and able to be managed through other measures, and such specific modification to the project would not be warranted. To ensure that residual impacts are minimised as far as practicable to all surrounding non-associated receptors predicted to be impacted by the project, the Department has recommended conditions of approval requiring appropriate screen planting at these dwellings (where this is agreed to by the landowner) including long-term monitoring and maintenance requirements to maintain the condition of the plantings.

Blade Glint, Shadow Flicker and Night Lighting

With respect to potential blade glint impacts, the Department agrees with the Proponent that this can be effectively managed through appropriate turbine treatments (such as the use of low sheen and matt finishes) to ensure negligible impacts and has recommended conditions of approval in this regard. With respect to shadow flicker impacts, the Department notes that flicker levels in exceedance of 30 hours per annum is only predicted at a single associated receptor (Benbullen). The Department notes that the predictions represent "theoretical maximum" levels based on highly conservative modelling assumptions including worst case turbine position relative to the sun (which would not occur at all times) and nil consideration of mitigating factors such as cloud cover and screening. In relation to available screening, the Proponent has identified that significant intervening vegetation (wind breaks) exists between this receptor and the nearest turbines which is likely to provide considerable screening from turbine flicker effects. In consideration of the above factors, the Department is satisfied that the dwelling is unlikely to experience the worst case shadow flicker levels predicted. Notwithstanding, the Department understands that the owner of the receptor has reached commercial agreement with the Proponent and expects that any residual amenity impacts at this receptor would be accounted for in such agreements.

With respect to night lighting, the Department agrees with the Proponent that there are grounds for aviation hazard lighting to not be required for the project turbines, however acknowledges that a final determination cannot be made on this until aviation hazard risks for the project have been confirmed in consultation with CASA following detailed design. Should aviation hazard lighting be required for the project, the Department considers that all reasonable effort should be made to ensure that lighting requirements are designed to be minimally intrusive as possible (in consultation with CASA), and has recommended conditions in this regard. The Department also notes that appropriate screen planting would also be effective in mitigating night lighting effects

and has recommended conditions of approval requiring consideration of potential intrusive effects from night lighting in implementing screen planting at neighbouring receptors.

In consideration of the above, the Department is satisfied that the visual impacts of the project to surrounding non-associated dwellings can be appropriately managed. On this basis, the Department does not consider there to be grounds for the recommendation of financial compensation to any individual receptor on the basis of visual impacts. The Department notes that this does not preclude any landowner from reaching an independent agreement with the Proponent at any time.

Impacts to Undeveloped Land

The Department notes that the main undeveloped (non-associated) properties surrounding the project site comprise large scale commercial grazing properties and is satisfied that the visual impacts of the project would not pose a significant impediment to continued agricultural use on these properties (noting that wind farms have been successfully integrated with rural landuse in the past with grazing occurring right up to the base of turbines and employees working in the vicinity of turbines). A single submission raised concerns regarding the potential for animals to be affected by the "movement" of the turbines (taken to be concern regarding shadow flicker impacts). Under worst case, shadow flicker levels are predicted to extend a maximum 1040 metres from the base of the turbines and therefore have the potential to extend into some neighbouring properties in the case where turbines are located close to adjacent boundaries. Notwithstanding, the Department is satisfied based on past examples of the successful integration of wind farm development with rural landuse that shadow flicker is unlikely to pose a significant impediment to animal husbandry within the land (noting that flickering would not occur 100% of the time and would reduce with increased distance from the turbine, with the draft *South Australian Planning Bulletin for Wind Farms, August 2002* indicating that shadow flicker would be insignificant at separation distances of greater that 500 metres). In this context the Department does not consider that the visual impacts of the turbines would constrain the carrying out of agricultural landuse at neighbouring properties such as to affect its agricultural land value and warrant compensation on these grounds. With respect to a minimum setback distance requested by some submitters to be imposed between turbines and neighbouring properties (varying between one and five kilometres), the Department considers that as landuse on neighbouring properties is not expected to be constrained by the position of turbines as currently proposed, modification to the position of the turbines is not warranted.

In relation to existing dwelling entitlements at surrounding undeveloped properties, the Department is satisfied that although the presence of the turbines would not necessarily preclude future development, it may necessitate additional design consideration in locating future dwellings to minimise views of the turbines should this be preferred (noting that not all residents dislike views of turbines). This may take the form of facing the living areas of the dwelling away from the turbines or landscaping to screen views. Noting that many of the properties which surround the project comprise large scale agricultural blocks, the Department considers that the size of the properties (in comparison to small lifestyle allotments) would provide flexibility for locating a future dwelling in areas of the property that are visually screened from nearest turbines. Further, the Department notes that whilst dwelling entitlements exist on currently undeveloped land there is no certainty that these entitlements would be acted on in the near future given existing restrictions at many properties including limited connection to utility services (sewerage, water and electricity) and road access. In consideration of the above matters, the Department is satisfied that the project would not pose an unacceptable impediment to the future development of dwellings in surrounding properties such as to warrant compensation. Similarly, as the current proposed position of the turbines are not expected to impose a significant burden on the future development rights of neighbouring properties, the Department does not consider that modification to turbine positions are warranted.

A single submission noted that the Proponent's assessment had not taken into account impacts to an existing uninhabited building located within a neighbouring, uninhabited agricultural property to the south, which had the potential to be upgraded in the future to a habitable dwelling. The building site is located approximately 2.5 kilometres to the south of the nearest turbines in the Boco cluster (refer Figure 10). The submitter requested a minimum setback distance of 3.5 kilometres from the nearest turbines to this site. The Department considers that the visual intrusion on this site (if developed in future to a habitable dwelling) would be comparable to that predicted for existing non-associated receptors Woodbine and Mia Mia (given similar setback distances), however it would have the advantage of being able to be designed from the outset to take into account views of the turbines as discussed above (e.g. facing the living areas of the dwelling away from the turbines or

landscaping to screen views). In this regard, the Department is satisfied that the project would not preclude the future development of a dwelling at the site. The Department considers that whilst the submitter has raised the possibility of this site being converted into a dwelling in the future, there is no certainty on timing (given existing restrictions on site such as limited access to utilities and the requirement for further approval such as development certification) or whether an alternative location within the property may be preferred in the future (given the available size of the property). In consideration of the above, the Department does not consider that modification to turbine positions to increase setback distances is warranted.

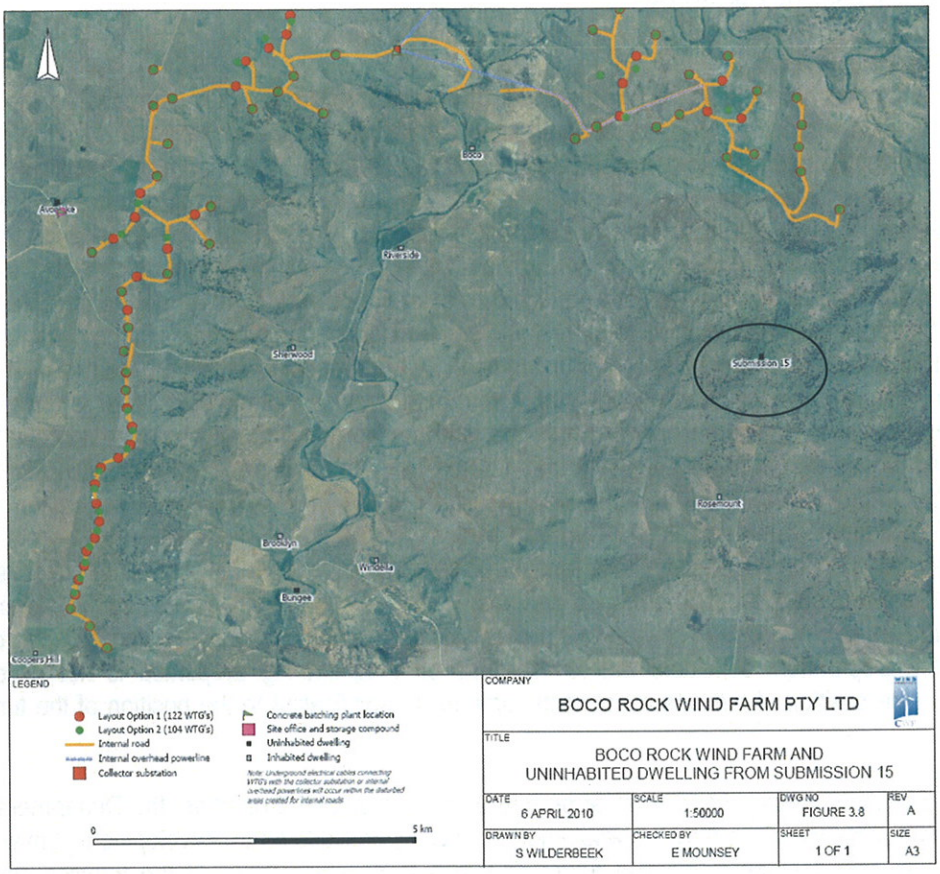

Figure 10: Location of Uninhabited Building (Wind Prospect Pty Ltd, May 2010)

Impacts to Landscape and Public Views

The Proponent's Environmental Assessment considered that the project would result in a moderate level of impact to characteristic landscape elements in the area as well as to representative public viewpoints. Public submissions received on the project raised particular concerns that the Proponent's assessment had not adequately recognised or assessed the unique nature of the Monaro landscape or impacts to the Monaro landscape as a whole (rather than discreet elements). Specific concern was raised that the sense of isolation and untouched nature of the landscape (considered by submitters to be minimally modified since European settlement) would be affected by the presence of turbines indicating human influence. Submitters considered that the scale of the project's view shed would compromise these qualities of the landscape over a large area and have the potential to obscure views of the Snowy Mountains. In response to concerns raised in submissions, the Proponent acknowledged in its Preferred Project Report, that specific landscape elements associated with the Monaro (i.e. the "treeless grassy plains") have limited representation on a State-wide context although noting that smaller areas do occur around Goulburn, Braidwood, Bathurst and Guyra. However, overall the Proponent considered that the landscape elements identified within the project's view shed were broadly similar to like landscapes in the Monaro and wider Southern Tablelands region and therefore of moderate landscape significance. The Proponent estimated (based on worst case ZVI mapping) that the project's view shed had the potential to extend over 10% of the Monaro area (approximately 148,500 hectares).

The Department accepts that several features of the Monaro landscape are highly valued by submitters as representing the uniqueness of the region's landscape values. In particular, several public submitters have

characterised the area as a largely natural landscape with limited modification since European settlement. Whilst vegetation communities may still broadly resemble pre-European landscapes of grassland dominated communities structurally, the Department considers that floristically there is evidence of considerable modification to original vegetation communities including changes to pasture species and low recruitment rates of woodland vegetation from historic and ongoing landuse practices such as grazing. This is evidenced in the Proponent's flora and fauna assessment (refer Section 5.1). In this context the Department does not consider that the Monaro landscape is representative of an especially or uniquely unmodified landscape on a regional or State-wide basis.

Notwithstanding the above, the Department acknowledges that the grassland dominated tree-less character of vast stretches of the area is a characteristic landscape feature of the area, which has limited representation in other parts of the Southern Tablelands or on a State wide basis (as noted in the Proponent's assessment). Further, the Department accepts that the low level of development in the area coupled with grassland dominated vegetation and montane climate, lends the region a character of isolation which has the potential to be impacted by the presence of turbines, which are a clear representation of human influence. Notwithstanding the above, the Department notes that the Proponent's assessment has indicated that the view shed of the project would be limited to only a relatively small part of the Monaro region (approximately 10%). Particularly at distance (where the scale of the turbines would be significantly reduced and appear in the context of wider landscape views), the Department considers that the project would pose limited influence on broader landscape views and values. Whilst accepting that specific landscape elements of the Monaro (the "tree-less grassy plains") have limited representation on a regional and State wide basis, the Department is satisfied that the project would not impact on the only areas of the Monaro characterised by this feature and that other landscape elements within the view shed of the project (such as river valley and drainage lines, broad river valley, simple slopes and ridgeline areas, cultural and remnant native timbered areas and settlements) are broadly similar to like landscape elements in the Southern Tablelands and therefore not representative of especially rare landscape features on a regional or State-wide basis.

With respect to public view points, the Department considers that given the distance of the project area from the Snowy Mountain region and Kosciuszko National Park (approximately 40 to 60 kilometres to the west) and to Mount Kosciuszko itself (approximately 74 kilometres) any views of this region would be limited to very far distance horizon views. As the project area is not characterised by highly distinct and strong views of the Snowy Mountain region, the Department is satisfied that the turbines would have negligible effect in disrupting these views. The Department is also satisfied that the turbines would not pose significant or dominating intrusion on the township of Nimmitabel given its distance from the project site (six kilometres) and the presence of intervening landform, buildings and vegetation, which the Proponent's assessment has identified would significantly screen views of the project. Similarly, significant landscape impacts are considered to be unlikely from the "Peak" lookout due to its distance from the project (9.8 kilometres), which would enable the turbines to be viewed in context to the wider landscape. Widespread views of the project from the lookout may also be a positive in attracting visitor usage of the lookout, who may wish to gain a complete view of the project itself.

With respect to views from surrounding roads, the Department is satisfied given the largely transient nature of views from moving vehicles that road side views are unlikely to be significantly affected by the project and may in fact provide a point of interest to visitors to the area. Bombala Council has suggested a minimum turbine setback distance of one kilometre from either side of the Snowy River Way, on the basis of visual intrusion to this "designated tourist route". Given the scale of the turbines at near distances and the transient nature of views from vehicles, the Department does not consider that the location of turbines within one kilometre or just outside of one kilometre would make a material difference to the viewing experience of motor vehicles such as to warrant modification to the project. The Department notes that the proximity of specific turbines to the roadside may in fact provide a point of interest to visitors to the area and may provide the opportunity for the development of a roadside viewing platform or similar.

In consideration of the above factors, the Department considers that the project's impacts on landscape values as a whole would be acceptable. Whilst accepting that some residual impacts to landscape amenity may remain (particularly at a local level), the Department does not consider that these residual impacts would outweigh the project's broader public interest with respect to renewable energy generation. To offset residual amenity impacts, the Proponent has committed to annual contributions amounting to $2500 per turbine, to fund local community initiatives. Bombala and Cooma-Monaro Council have suggested that the level of contributions proposed is not

sufficiently commensurate with the unique landscape values of the area which would be affected by the project. The Department notes that the community contribution levels imposed for past wind farm development such as the Kyoto Energy Project (in relation to residual amenity impacts) have been calculated at approximately $850 per megawatt. The contribution rates proposed by the Proponent are higher than this and would result in additional contributions of approximately $75,000 per annum compared to the rate of $850 per megawatt. The Department is therefore satisfied that the contributions proposed by the Proponent already account for any additional landscape values associated with the region and do not warrant increase.

The Department notes that the community contributions from the project (which would total between $260,000 and $305,500 per annum depending on the turbine layout and equate to between $5.2 and $6.11 million over the life of the project, which would be 20-25 years) would fund local community projects including infrastructure upgrades, community enhancement projects and opportunities for local economic and tourist development. These measures have the potential to provide significant local benefit including generating new economic and social opportunities for the community. The Department is therefore satisfied that the local benefits generated by these measures would adequately offset any residual social and amenity impacts associated with the project and has incorporated the requirement for community contributions into its recommended conditions of approval.

5.3 Noise and Vibration

Issue

Operational Noise – Wind Turbines

Noise generated by the operation of wind turbines is assessed in New South Wales in accordance with the South Australian Environmental Protection Authority *Wind Farms Environmental Noise Guidelines February 2003* (SA Guidelines). Noise generated by wind turbines increases as wind speeds increase. However, as background noise levels are also affected by increased wind speed, the noise generated by wind turbines at a higher speed may be fully or partially masked by a corresponding increase to background noise levels at the receiver from windy conditions. In recognition of this relationship between wind speed and background noise, the SA guidelines specifies operational noise limits with consideration to applicable background noise levels at receptors.

The SA Guidelines requires that the noise generated by the operation of wind turbines do not exceed a noise level of 35 dB(A) L_{Aeq} or the background noise level by more than 5 dB(A) (whichever is greater) at surrounding "non-associated" landowners. The 2003 SA Guideline does not identify specific noise limits for "associated" landowners noting that this is subject to agreement between parties as part of commercial negotiations. The Proponent has proposed a noise limit of 45 dB(A) for associated dwellings, consistent with the World Health Organisation (WHO) recommendations for external noise levels. The Proponent has identified that it has reached a noise agreement with respect to each of the dwellings, that surround the site and that are owned by associated landowners (i.e. 18 in total, three of which are uninhabited/ uninhabitable).

The Proponent has undertaken an operational noise assessment consistent with the requirements of the SA Guideline considering: wind speeds measured on site (extrapolated to hub height) correlated with background noise levels at representative receivers; differences between day and night time background noise levels in determining applicable noise criteria; sound power levels from representative wind turbine models; and conservative environmental factors which could increase noise propagation such as downwind propagation and ground based temperature inversion conditions. The Proponent has predicted noise impacts at receptors (associated and non-associated) within six kilometres of the project on the basis that if noise criteria is met at these nearest receptors, then exceedances would not be expected at receptors located further away.

Based on its assessment, the Proponent has identified that the project would not exceed relevant criteria at any of the 34 non-associated dwellings located within six kilometres of the site from either wind turbine layout (refer Figure 11). Furthermore, no exceedance of adopted WHO criteria is predicted at any associated receptors within this distance (including those currently uninhabited) from either wind turbine layout (refer Figure 11). Notwithstanding, the Proponent's assessment identified that there may be specific conditions when receptors may experience reduced noise amenity such as annoyance impacts from modulation effects (i.e. the "whooshing" sound caused by different wind speeds or wind gradients forming between the top and bottom of the rotor blades during stable atmospheric conditions - also known as "Van Den Berg effects"). The Proponent has committed to monitoring noise levels during operation and implementing an approach of adaptive management where noise

impacts are identified. The adaptive approach proposed includes documenting noise complaints through a complaints line or other means, investigating the nature of the complaint including conditions when noise impact occurs and implementing measures to minimise the impact including sector management (i.e. slowing down or shutting down of specific turbines during periods of likely worst impact, such as specific weather conditions) or providing acoustic attenuation at the receiver.

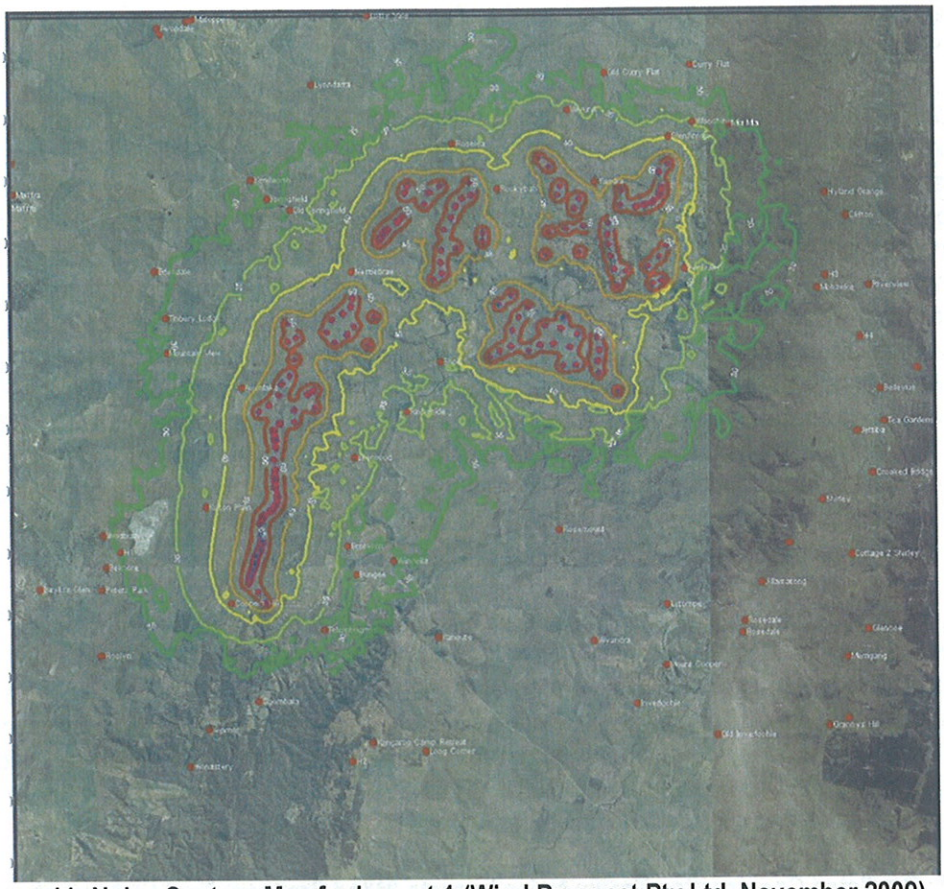

Figure 11: Noise Contour Map for Layout 1 (Wind Prospect Pty Ltd, November 2009)
Note: original number of turbines shown (as exhibited)

The SA Guideline does not require assessment of low frequency or infra sound generated by wind turbines (which comprises sound energy at the lower end of the human spectrum of hearing - below 200 hertz). The Proponent has drawn on overseas research (DEFRA, 2002; DTI, 2006; HGC Engineering, 2006) to conclude that low frequency and infra-sound generation by modern wind turbine generators are significantly below perception thresholds and consequently the project would not result in perceptible low frequency noise impacts at nearby residences.

Operational Noise – Ancillary Infrastructure

Noise generated by the operation of stationary facilities is assessed in New South Wales in accordance with the *NSW Industrial Noise Policy* (EPA, 2000) (INP). The Proponent has therefore assessed the substation component of the project consistent with the requirements of the INP. Under the INP the most stringent project specific noise limit that can apply to a sensitive receiver is 35 dB(A) for $L_{Aeq(15\ minute)}$ noise and 45 dB(A) for peak noise events ($L_{A1\ (1\ minute)}$) in the night time period. The noise limits under the INP apply to all receivers (associated and non-associated). The Proponent's assessment has predicted a noise level of 28 dB(A) $L_{Aeq(15\ minute)}$ at the nearest exposed receptor (Nestlebrae – currently uninhabited), under worst case meteorological enhancement and noise propagation conditions, which is considered well within INP criteria and consequently no specific noise mitigation measures are proposed.

Noise generated by the operation of overhead transmission lines mainly relate to corona noise (the faint buzzing or crackling noise heard along the lines under mild rain conditions or following a long dry spell from dust build up) and aeolian noise (harmonic hum produced from vibration due to wind across lines and insulators). The Proponent has indicated that due to their low voltage (i.e. 33 kilovolt) and distances to nearest receptors (one

kilometre), noise generated by the proposed overhead transmission lines on site is unlikely to be perceptible at nearest sensitive receptors subject to implementation of standard design (e.g. appropriate wire tension, and low-noise conductors). The potential for noise impacts from the 132 kilovolt connection to the existing electricity grid would be assessed as part of the separate Part 5 assessment for that proposal.

Other Noise and Vibration Impacts

The Proponent has also assessed the potential construction and traffic related noise associated with the project and potential ground borne and blasting vibration impacts.

Whilst the total period of construction for the project is expected to last approximately 18 to 24 months, the Proponent has identified that works close to nearest receptors are likely to be intermittent and in the order of only a few weeks at a time as construction would be spread across the site. On this basis, the Proponent has employed noise goals applying to a construction period of "less than 4 weeks" as specified in the *Environmental Noise Control Manual* (EPA, 2004) (i.e. background + 20 dB(A)) in its construction noise assessment. As with its operational noise assessment, the Proponent has predicted construction noise impacts to receptors (associated and non-associated) within six kilometres of the project. The Proponent's assessment, which considered a worst case scenario of multiple machinery and machinery operating at full load has indicated that relevant construction noise goals would be achieved at all but six nearest receptors, all which are "associated" dwellings and three of which are currently uninhabited, with exceedances of between four and 12 dB(A) predicted. The Proponent has also assessed potential noise generation from mobile batching plants during the construction of the project, also applying noise criterion for a construction period of "less than 4 weeks". The Proponent's assessment indicates that relevant construction noise goals would be achieved at all receptors apart from a single "associated" (and currently uninhabited) receptor, where an exceedance of 12 dB(A) is predicted.

With respect to traffic noise, the Proponent's assessment has focused on traffic generated during construction which is expected to be the most significant source of traffic volumes associated with the project (with operational volumes expected to be insignificant). The Proponent's assessment has predicted that construction traffic volumes associated with the project are likely to increase existing road traffic noise levels by between 0.5 and 7.5 dB(A), depending on the road, however has suggested that the road traffic noise criteria specified in the *Environmental Criteria for Road Traffic Noise* (NSW EPA, 1999) is likely to be met at roadside dwellings if moderately set back from the road (i.e. up to 55 metres) (refer Table 5 below).

Table 5: Predicted Construction Traffic Noise Impacts (Wind Prospect Pty Ltd, November 2009)

Proposed Access Road	VPD Current	VPD Projected Maximum Construction Traffic	Projected increase in existing road traffic noise level	ECRTN classification	ECRTN requirement	Approximate distance at which ECRTN requirement is achieved
Monaro Highway	1907	240	0.5 dBA	Freeway / Arterial	$L_{eq(15hr)}$ 60 dBA	25 m
Springfield Road	200	Up to 240	3.5 dBA	Local	$L_{eq(1hr)}$ 55 dBA	55 m
Snowy River Way	114	Up to 240	5 dBA	Local	$L_{eq(1hr)}$ 55 dBA	40 m
Avon Lake Road	< 50	Up to 240	7.5 dBA	Local	$L_{eq(1hr)}$ 55 dBA	35 m
Yandra Road	< 30	Less than 100	6 dBA	Local	$L_{eq(1hr)}$ 55 dBA	20 m
Boco Road	< 30	Less than 100	6 dBA	Local	$L_{eq(1hr)}$ 55 dBA	20 m

The Proponent has identified that the use of vibratory rollers during access road establishment and the use of rock breakers during the establishment of turbine tower foundations have the potential to generate ground borne vibration during construction. Furthermore, the project is likely to require infrequent blasting (approximately one blast per 2-3 days for a period of two weeks at each turbine) to clear large rock outcrops during turbine foundation establishment. With respect to ground borne and blasting related vibration impacts during construction, the Proponent has indicated that due to anticipated distances between nearest sensitive receptors and construction sites (i.e. 730 metres to closest receptor), both "human comfort" and "building damage" assessment criteria for

vibration and blasting are expected to be easily met at all nearest sensitive receptor. With respect to operational impacts, the Proponent has drawn on overseas research (Snow, 1997) into vibration generated by the operation of wind turbine generators (which found that vibration signals measured at 100 metres from a turbine are significantly lower than the most stringent criteria in *BS 6472:1992 Evaluation of Human Exposure to Vibration in Buildings*, which DECCW "human comfort" criteria are based on) to conclude that vibration generated from wind turbines is not significant and unlikely to be perceptible at nearby dwellings due to their distance from turbines.

Submissions

A single public submission queried responsibilities for noise compliance monitoring. A second submission raised the issue of compensation for surrounding (non-associated) landowners as a result of impacts from wind turbines including noise impacts. An additional submission noted that the Proponent's assessment had not taken into account impacts to an existing uninhabited building located within a neighbouring property, which had the potential to be upgraded in the future to a habitable dwelling. Noise was not raised as an issue of concern in any public authority submissions.

Consideration

Operational Noise – Wind Turbines

The Department is satisfied that the Proponent has undertaken a robust and representative assessment of the operational noise impacts of the project's wind turbine generators and based on this assessment is satisfied that either layout of the project can be designed and operated to achieve acceptable operational noise outcomes at nearby receptors, both associated and non-associated (including those currently uninhabited). The Department notes that the removal of three additional turbines, since the Proponent's original noise assessment, is likely to further reduce impacts at receptors close to the Springfield cluster compared to that predicted. To ensure that the final project design (including likely micro-siting refinements) does not result in noise levels any greater than those predicted by the Proponent's assessment, the Department has recommended conditions of approval requiring the Proponent to prepare a detailed design noise report consistent with the requirements of the SA Guideline prior to the commissioning of the wind turbines, to confirm the noise impacts of the final turbine layout and design. Furthermore, the Department has recommended stringent compliance monitoring requirements following the commencement of operation of the project to confirm the performance of the project, including requirements to investigate and take appropriate remediation action where a non-compliance is identified. Appropriate remediation action would take the form of either at source measures (i.e. design changes or sector management) or at receiver measures (i.e. acoustic shielding or similar in the case that all reasonable and feasible at receiver measures have been exhausted).

With respect to low frequency noise impacts, which has generated significant concern amongst members of the public in relation to recent wind farm proposals, the Department is satisfied, based on the consensus of research both in Australia (i.e. literature reviews undertaken in the development of the SA Guideline) and overseas (as reported by the Proponent), that modern wind turbines are unlikely to be a source of significant low frequency noise generation such as to result in adverse health impacts. On this basis, the Department is satisfied that subject to modern design standards, the wind turbines associated with the Boco Rock Wind Farm project are unlikely to pose a significant risk of low frequency noise impacts to surrounding receptors.

With respect to compensation on the grounds of noise impacts to neighbouring (non-associated) properties, the Department notes that the Proponent's assessment has demonstrated that the project can be designed to achieve compliance with applicable noise amenity criteria in NSW at all neighbouring non-associated dwellings. On this basis, the Department is satisfied that the project would not significantly impact on the noise amenity of surrounding dwellings such as to warrant compensation. With respect to undeveloped land, the Department notes that the main undeveloped properties surrounding the project site comprise large scale commercial grazing properties. The Department is satisfied that the noise generated by the proposal would not pose an impediment to continued agricultural landuse (noting that wind farms have been successfully integrated with rural landuse in the past with grazing occurring right up to the base of turbines and employees working in the vicinity of turbines) and on this basis does not consider that compensation would be warranted with respect to project related noise impacts on surrounding agricultural landuse.