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ECOSYSTEM SERVICES

ST PATRICKS PLAINS WIND FARM PTY LTD – ST PATRICKS PLAINS WIND FARM ENVIRONMENTAL IMPACT STATEMENT, 29 JUNE 2023
ADDITIONAL INFORMATION REQUIREMENTS PART 1 – AGENCY COMMENTS

Comment 41:

The noise impacts for the operation phase seem to be focused on human based metrics at the moment.

DCCEEW notes that the EIS discusses the previous use of a 1km buffer to eagle nests and that this has been used as a default disturbance buffer. However, the Department considers where site specific data are available and indicative of a greater buffer distance, then the site specific data should be used to inform the site avoidance and mitigation measures.

Information required:

1. Provide consideration of the following information in relation to the Tasmanian Masked Owl, the Ptunarra Brown butterfly, the two quoll species and the Tasmanian devil:
    a) Expand on the potential noise impacts to fauna, in particular the potential for disturbance on nesting and breeding fauna;
    b) Provide an overview of the noise disturbance effect levels for the protected matters identified and identify if modelled noise levels may residually impact fauna, including on breeding success or juveniles of species;
    c) Using the data contained in the EIS and the additional information requested, provide reasoning as to the potential or otherwise to apply a buffer based on residual noise levels (modelled) from turbines rather than a "line of sight" buffer to limit noise impacts on protected matters and the cumulative impacts for the species with Cattle Hill.
2. Discuss the potential noise impacts from the proposed action for faunal species that have been confirmed to nest or breed or are likely to breed within the 1 km buffer area. In particular, identify if faunal species are likely to abandon these breeding areas and recolonise once the operational noise is established (similar to the TWTE) or whether the species will abandon the site completely.

Authors: Phil Barker (masked owl), Morgan Humphrey (dasyurids and butterfly),
and Grant Daniels (overall review and contributions)

Background – Potential sources of noise impacts and context of requests

Sources of potential noise disturbance from the operation of a windfarm and wind turbine generators (WTGs) are the mechanical operation of turbines (gear box, generator and bearings), aerodynamic noise (produced as wind passes over blades), and noise from human and vehicle presence as part of operations. Much of the noise generated by turbines is from the sound of the blade cutting through the air and is similar to the sound of wind.

Existing background noise levels at St Patricks Plains (SPP) were determined to be in the range of 23 to 43 dB. Due to lack of surrounding development, the background noise at SPP is likely to be dominated by the sound of wind; therefore, periods of maximum noise from the turbines will be highly correlated with the prevailing wind speed and wind noise, which the individuals on site can already be assumed to have some ecological resilience to on account of occupying a naturally windy location. Nonetheless, with the additional contribution to existing noise, ongoing noise levels within the windfarm site can be expected to be higher than present as a result of the operation of turbines.

Depending on the power and height of turbines, noise levels at the rotor can exceed 100 dB but decline steeply with distance from the tower[1]. Predicted maximum operational noise for the SPP site has been modelled in the EIS, and references herein to noise levels and potential area/s of impact refer to the results of these models. The noise level contours predicted in the EIS indicate that the whole turbine field sits within the 45 dB contour at a distance of about 250 m from the nearest turbines; the 40 dB contour is at about 500 m, and the 35 dB contour is generally at about 1 km from the edge of the turbine field.

For the SPP windfarm, the Tasmanian EPA has set the background noise limit for the operation to a maximum of 35 dB at adjacent residences, and as such this has been the focus of previous assessments of noise impacts. DCCEEW requested additional information on potential impacts of operational noise to fauna, to inform buffer zones for site avoidance and mitigation measures (if required). Threatened species identified by DCCEEW include the Tasmanian masked owl *(Tyto novaehollandiae castanops)*, Tasmanian devil *(Sarcophilus harrisii),* spotted-tailed quoll *(Dasyurus maculatus maculatus),* eastern quoll *(Dasyurus viverrinus)* and ptunarra brown butterfly *(Oreixenica ptunarra)*. DCCEEW make reference to the 1 km eagle nest disturbance buffer in relation to potential noise impacts on these species, but given this is a nest buffer not a turbine buffer, our response focusses on general potential noise impacts, not just impacts within the vicinity of eagle nests, as this is seen as more pertinent to the species queried – the reference to a line-of-sight buffer is thus only considered to apply to eagle nest buffers and is not directly influential in relation to potential noise impacts for other species.

Responses

Potential noise impacts to fauna – sub-comment 1a

Chronic exposure to stressors can induce physiological changes in hormone expression, metabolism and immune function, affecting survival and reproductive success in some species. As these effects are highly species-specific, and there has been limited research on physiological responses to noise for the species of interest, recommendations are largely drawn from expected behavioural responses based on the species' ecology and where possible studies of equivalent lifeforms.

[1] Katinas et. al, 2016

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Most noise-related impacts to wildlife involve behavioural changes, as noise exposure can interrupt cue detection necessary for predator avoidance, social communication (vocalisations), and prey detection[2]. It is possible that the constant environmental noise from WTGs could have some impact on audible cue detection for the species of interest in areas close to the towers, though this may not necessarily represent a disturbance factor for all species nor indeed a detrimental one – with the predators for instance potentially benefiting if cue detection is disrupted for their prey.

Disturbance from noise is not listed as a primary threat to any of the species of interest (based on listed threats in EPBCA conservation advice, listing statements, *etc.*), although studies on the impacts of long-term noise exposure may be lacking for it to be definitively excluded as a threat. For Tasmanian devils, the Species Management Profile on the NRE Threatened Species Link refers to noise being something to avoid in relation to the potential to disturb breeding and suggests additional buffering of dens (beyond the potential distance of direct physical impacts) may be appropriate (*i.e.* on a case by case basis) but does not provide substantiating evidence as to why or as to what thresholds are applicable[3]. We are aware of no such recommendations for either species of quoll, masked owl, or for the ptunarra brown butterfly.

Due to variations in ecology and therefore response/s to noise disturbance, sub-comments 1b, 1c, and 2 are addressed separately below for each taxonomic Order.

Mammals – Tasmanian devil, eastern quoll & spotted-tailed quoll

Noise disturbance effect levels – sub-comment 1b

The majority of studies that have gone into meta-analyses on noise impacts on mammals are from North America and Europe, with limited specific information on the species in question for this assessment. Broadly, chronic exposure to anthropogenic noise has been found to have negative effects on some terrestrial mammals where levels are greater than 40 dB, though there is considerable variation in noise tolerance between species[4]. Above 65 dB, detrimental effects can occur on gene expression, development, physiological stress and immune function in some terrestrial mammals (in laboratory studies) [5].

Noise modelling for the SPP site predicts the envelope in which potential maximum operational noise exceeds 40 dB will be limited to within approximately 500 m from the WTGs, suggesting that the area of potential impact on noise-sensitive mammal species would be restricted to a relatively small portion of the site.

Research on impacts to terrestrial mammals from noise generation specific to WTG operation is limited, with WTG studies typically focusing on the interruption of communication signals and predator cues in avifauna. As such, effects on behaviour, distribution or physiology of mammals within windfarms are not well covered in the literature, and the impacts on Australian marsupials have not been directly studied – it is unclear whether this is due to lack of opportunity or insufficient cause for study. In the absence of literature on WTG noise impacts for mammals, highway traffic is a reasonably well-researched area of

[2] Francis and Barber, 2013
[3] Threatened Species Section, 2023(a)
[4] Shannon, et. al., 2016
[5] Kight CR and Swaddle, 2011

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anthropogenic noise which could be a proxy for the effects of chronic noise exposure on devils and quolls.

Noise levels at highway verges reach up to 80 dB; a review of fauna presence along highways in NSW found lower species diversity at road edges, potentially indicating some marsupial species avoid areas close to highways, which could be due to noise sensitivity (noting manifold anthropogenic influences in such cases can make determining proximal causes of impact difficult)[6]. In Tasmania, devils and both species of quoll appear to show tolerance of ongoing noise exposure from highways, frequently utilising roads and highway verges for foraging and movement, as can be seen from spotlight surveys and road mortalities (including subadults)[7] - each of the species can also be found sheltering (and potentially denning) in potential den sites in relatively close proximity (< 100 m) to highway noise[8]. These aspects appear to indicate that persistent or intermittent anthropogenic noise (road traffic) is not a significant deterrent on foraging, general movement or juvenile dispersal for these species, and may not render den/shelter sites inviable.

One example of the direct effect of windfarm noise on a carnivorous mammal has been found for the European badger *(Meles meles),* in which elevated cortisol (stress) levels have been found within 1 km of turbines[9]. Unlike devils and quolls, badger presence is negatively associated with the presence of paved roads[10], suggesting a difference in noise (or general anthropogenic) sensitivity between the species, and as such the marsupial carnivores in question at SPP may not experience the same physiological response.

With specific regard to denning/breeding activity, although noise disturbance has been suggested to be a potential impact upon breeding success for devils[11], we are aware of no recorded cases of reproductive failure or abandonment caused by disturbance independent of vegetation removal for devils or quolls - noting such responses to disturbance have been recorded on multiple occasions for sensitive breeding species, such as eagles[12].

Sudden, erratic and acute sounds can be perceived as a threat, prompting a stress response[13]. Previous observations suggest that wild devils experience increased stress in response to man-made metallic sounds[14], and it is reasonable to assume that both the eastern and spotted-tailed quoll may react similarly to sudden or acute sounds. In contrast however, WTG operation is characterised by a more constant and sustained environmental noise and thus would be unlikely to trigger acute stress reactions of this kind.

Eastern quolls and Tasmanian devils demonstrate tolerance of anthropogenic noise disturbance in breeding locations, frequently denning in areas of human use (e.g., farmhouses and residential buildings), as well as agricultural areas where surrounding land contains suitable habitat. Spotted-tailed quolls are generally associated with areas of less human disturbance, although this has been attributed to reliance on suitable denning habitat and presence of prey

[6] Pocock and Lawrence, 2005
[7] Andersen et. al, 2017; Jones, 2000
[8] North Barker, unpublished data
[9] Agnew et. al, 2016
[10] Agnew et. al, 2016
[11] Owen and Pemberton, 2005; Threatened Species Section, 2023(a)
[12] Threatened Species Section, 2023(b)
[13] Francis and Barber, 2013
[14] Kingston et. al, 2014

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habitat rather than avoidance of anthropogenic activity[15]. In addition, for all of the species, noise perception within den sites is likely to be lower than outside noise levels, particularly for underground burrows and those embedded in dense mediums likely to buffer noise (e.g. logs, rock piles). Overall, there appears to be limited reason or evidence to suggest the expected levels of operational noise could have a detrimental impact on denning activity or success.

Residual noise levels and areas of disturbance – sub-comment 1c

Areas of potential impact from noise disturbance on the denning behaviour of noise-sensitive species can be expected to fall within the 40 dB contour approximately 500 m from the WTGs. There is no evidence however to support the Tasmanian devil or either of the quoll species according to the definitions of noise-sensitive species based on the available studies cross-referenced with species ecology and distribution (with these being considered sufficient to remove scientific uncertainty). Based on this, there is not considered to be sufficient reason (including uncertainty) for devil or quoll dens to have noise-specific disturbance buffers in excess of the 50 m buffer proposed to apply for all disturbance and clearance impacts.

The noise assessment presented in the EIS has determined there is no potential cumulative noise impacts from Cattle Hill and SPP (using the approval threshold contour for each windfarm, the other windfarm must have a noise contour which is 10 dB lower without any overlap, demonstrating that cumulative operational noise consideration is not applicable – see Figures 3 and 4 of Appendix 4 in the EIS); given the expected noise levels between the two windfarms are well below the potential threshold that might affect a noise-sensitive fauna species, and given there is no suggestion these species are noise-sensitive at the predicted levels, there can be no potential for cumulative operational noise of both windfarms to impact denning/breeding behaviour of quolls and devils in intervening or internal habitats.

Impacts of disturbance – sub-comment 2

Noting that the 1 km buffer referenced by DCCEEW appears to be referring to the disturbance buffer proposed around eagle nests, not a buffer around turbines in relation to noise disturbance, we instead focus on the potential noise impact buffer around turbines.

On average, the modelled 40 dB noise contour extends approximately 500m from the turbines (*i.e.* an area of approximately 79 ha around each turbine), extending slightly further in some places, particularly where several turbines are clustered and noise contours overlap. This area within the modelled 40 dB contour is considered most likely to have potential for detrimental noise impacts on noise-sensitive mammals (noting we haven't concluded there are reasonable grounds for treating the species in question at SPP as noise-sensitive). The total area within the modelled 40 dB contour is minor compared to the ranges of the species in question. For instance, given the large home range sizes for spotted-tailed quolls (370 – 2500 ha) and devils (1300 – 5700 ha)[16], and their tendency to utilise multiple den sites outside of breeding periods (noting the extent of potential denning habitat on site and the number of potential den sites recorded in the form of wombat burrows), if individuals were impacted to some degree by noise within the 40 dB area around turbines, the animals would be expected to still have access to ample alternative suitable denning habitat within their home ranges and would be unlikely to abandon the area from use entirely (if at all) nor be subject to a limit on

[15] Glen and Dickman, 2006

[16] Hamer, 2019

key resources. If for some reason the species were noise-sensitive at a den site, individuals could be expected to select dens outside of the 40 – 45 dB contour regions while still utilising these noise-affected regions as foraging habitat. The pattern could be expected to be the same for eastern quolls, other than that they generally have smaller home ranges (35 – 370 ha)[17], which could mean that noise-impacted animals could be required to shift their range if affected dens were located close to WTGs and the individuals could not tolerate this. The probability of the entire range of breeding individuals being within the 40 dB contour around turbines and having no alternative habitat is considered to be very unlikely given that the eastern quoll was only recorded in a relatively small proportion of the site (suggesting relatively low overall density, with the NVA report noting the site may contain localised concentrations) and the fact potential habitat is widespread across the site. Furthermore, the fact all species are known to den around anthropogenic disturbances, including examples of denning/sheltering around occupied buildings and where exposed to highway traffic noise, suggests that any of these premises around potential dens being impacted by operational noise are very unlikely. Based on these considerations, buffering den sites an additional amount for potential den disturbance from operational noise is not considered to be warranted.

Tasmanian masked owl

Noise disturbance effect levels – sub-comment 1b

Owls have highly developed hearing to serve them as nighttime perch hunters who listen for the rustling sounds of prey on the ground and in trees. Accordingly, they could be presumed to be among the most sensitive of fauna to noise disturbance. And so, it is pertinent to consider the construction and operational noise levels predicted to occur at SPP.

Senzaki et al (2016) considered the effect of road noise on the ability of two species of owl to detect prey. Using responses to recorded play backs of prey rustling and an average background noise level of 32 dB, they determined that prey detectability was affected at 40 dB, being lower by about 17 % and diminished further with louder noise interference.

Much of the habitat at SPP between the towers and the predicted 35 dB contour is potential masked owl foraging habitat, although the extensive non-forest areas within this contour in the north lack perch trees and so are less likely to be utilised for hunting. If the results of Senzaki et al hold for masked owl, then some impact of foraging efficiency may occur within these contours. It should be reiterated that at SPP, masked owls already experience noise of up to 43 dB at some locations, presumably in windy conditions.

Studying 3 owl species in a landscape with locations emitting chronic noise associated with industry, Shonfield et al (2017)[18] found no evidence that occupancy of sites at a home range scale was affected by the presence of industrial noise sources or roads. Because of potential problems hunting, as demonstrated by Senzaki and others, Shonfield et al had predicted that owls would avoid these areas at this large scale. The results may indicate that the rate of diminution of noise level in large territories would have little overall impact on owl hunting success in the territories. There was also no effect on the detection probability of two of the owls from chronic or intermittent noise. However, owl detections occurred away from the centre of noise fields, possibly indicating areas within their ranges that were unused or less frequently used, noting this can also occur naturally if habitat or prey variables are not uniform.

[17] Hamer, 2019

[18] Shonfield and Bayne, 2017

Frohlich and Ciach (2018)[19] found that the distribution of nests of the long-eared owl (which is also an acoustic predator) is affected by noise, with nests being in quieter locations compared to random. However, the long-eared owl doesn't nest in tree hollows. The masked owl uses deep tree hollows for nests. The relative noise level in masked owl hollows compared to ambient hasn't been measured, but the tree can be expected to provide considerable insulation from noise in the nest cavity. In addition, the location of expected nesting habitat (as discussed below) is expected to provide adequate separation from turbines to further dissipate sound.

Residual noise levels and areas of disturbance – sub-comment 1c

At SPP, the areas with the highest likelihood of supporting mature trees with hollows suitable for the masked owl occur at more than 500 m from turbines in the vast majority of cases and are generally more than 1 km away from the closest turbines. These distances will experience noise levels outside of the tree hollows below 40 dB, which is within the range of background noise levels predicted in the EIS. If a nest is present and is buffered by a minimum of 150 m to a turbine (as is proposed), it would fall within the 45 dB contour, which extends to about 250 m from turbines. At that distance, the nest cavity would still experience noise considerably below the ambient operational level but may still result in masked owl relocating away from the noise field.

No other Tasmanian windfarms have reported monitoring the impact of noise from windfarm operation on owls (nor indeed other fauna). Based on the circumstances at SPP and on the empirical data reported above, a buffer between turbines and masked owl nests larger than the 150 m committed to in the EIS is not necessary.

Impacts of disturbance – sub-comment 2

If masked owl find the noise levels disturbing to hunting or nesting, they are very likely to modify the hunting pattern and select nest sites sufficiently distant from turbines to ameliorate the disturbance by noise and in doing so will reduce the potential for collision with the turbine blades.

The typical size of a masked owl territory of about 1500 – 2000 ha will preclude any overlap with masked owl territories associated with Cattle Hill windfarm, which is nearly 10 km west. The size of masked owl home ranges at SPP is likely to allow the birds to continue to hunt and to nest successfully. So, if each territory is able to accommodate the operational noise environment with no residual impact on hunting efficiency and nest productivity, it would also preclude any cumulative impact with regard to Cattle Hill.

Ptunarra brown butterfly

Noise disturbance effect levels – sub-comment 1b

Little is known of ptunarra brown butterfly behavioural ecology beyond habitat selection and breeding period, which may make it difficult to predict how the species will respond to chronic noise exposure from WTGs. However, when looking at other Lepidoptera noise responses, monarch butterfly caterpillars respond physically to sudden, loud noises (> 75 dB), though quickly habituate to frequent or constant noise of the same amplitude[20], suggesting tolerance to sustained noise beyond the predicted operational levels for SPP. Thus, if this is consistent

[19] Frohlich and Ciach, 2018

[20] Taylor and Yack, 2019

for ptunarra brown butterfly (which is reasonable to assume), constant noise of WTG operation may be unlikely to prompt a physical reaction.

Environmental noise can disrupt communication in invertebrates by masking auditory signalling. It is unknown if ptunarra brown butterflies utilise auditory communication which could be disrupted by constant environmental noise. Noise perception in Lepidoptera is predominantly associated with predator detection, and a primary threat to ptunarra brown butterflies is predation by European wasps. Diurnal Lepidoptera hearing is most sensitive at frequencies around 150 - 200 Hz, which is likely due to the flight sound of aerial invertebrate predators at these frequencies (e.g. European wasps). As such, lower frequencies of noise produced by WTGs may mask the sound of wasp flight, which would create the potential for noise to disrupt anti-predator responses of ptunarra brown butterflies. Reduction in predator response behaviour may affect survival of butterfly larvae or breeding adults if there are high numbers of predatory wasps. However, monitoring and control of European wasps within the site is a commitment outlined in the EIS to mitigate potential increase in wasp presence due to construction and clearance impacts – therefore this will also ameliorate potential impacts associated with noise and predation and as such is not considered to warrant additional targeted mitigation beyond the existing butterfly and wasp monitoring and management proposal.

Residual noise levels and areas of disturbance – sub-comment 1c

The potential impact on anti-predator response is considered to be the only conceivable impact from operational noise on this species. Cumulative impacts from the Cattle Hill development are not considered to be plausible given the distance separating the developments and the expected dissipation of operational noise. Within the site, the commitment to monitor and control European wasps is considered to be sufficient to mitigate any possible impacts from altered anti-predatory responses and thus is not considered to warrant additional buffering in relation to potential operational noise impacts.

Impacts of disturbance – sub-comment 2

Given the commitment to monitor and control European wasps, it is considered to be highly unlikely that operational noise will result in this species abandoning breeding habitat temporarily or permanently due to operational noise. The proposed monitoring of ptunarra brown butterflies post-construction may also be used to confirm this and/or inform if ongoing threat mitigation is warranted.

Conclusions

None of the species considered here for potential impacts from operational noise are considered to warrant noise-specific disturbance buffers (beyond what is already proposed for general disturbance and impacts) nor considered likely to be subject to noise-specific impacts warranting additional targeted mitigation.

- Presence of devils and quolls in areas of high anthropogenic noise disturbance, including evidence of breeding in areas of human use, indicates that these species would be unlikely to abandon an area due to noise disturbance.
- Foraging success of masked owls may be impacted by noise disturbance > 40 dB, and as such they may adjust hunting and nesting areas to avoid areas where they experience noise disturbance. However, areas with the highest likelihood of mature, hollow

bearing trees are at typically at least 500 m from turbines, where predicted operational noise does not exceed 40 dB. Given their large home ranges, any affected masked owls will be able to continue to hunt and nest successfully throughout most of their previous range, and avoidance of hunting near turbines may decrease potential for collision with turbine blades.

- Predator detection by ptunarra brown butterflies may be reduced in areas close to turbines, as operational sounds may mask the sound of European wasps, a recognised threat to the species. However, the proposed monitoring of both ptunarra brown butterflies and European wasps (including control measures) is considered to be sufficient to mitigate this potential impact.

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