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11 March 2021

Roger Kennard
Accent Superannuation Pty Ltd
Via email: roger.kennard@burgtec.com

RE: Peer Review of Kariong Sand and Soil Supplies Air Quality Impact Assessment Response to Submissions

Dear Roger,

Todoroski Air Sciences (TAS) has reviewed the *Kariong Sand and Soil Supplies Air Quality Assessment – RTS* prepared by Northstar Air Quality (dated 10 December 2020) on behalf of five nearby landowners of Acacia Road and Debenham Road, Somersby (Lot 3 239 Debenham Rd East, Somersby, 252 Debenham Rd East, Somersby, 242 Debenham Rd East, Somersby, 10 Acacia Rd, Somersby, 12 Acacia Rd, Somersby).

This review of the response to submissions (RTS) follows the peer review undertaken by TAS (dated 22 September 2020) of the *Kariong Sand and Soil Supplies – Proposed Development Air Quality Impact Assessment* (**Northstar Air Quality, 2020a**).

The original TAS review comments are presented below (blue), the response to the issue taken from the RTS is presented immediately below (*grey and italicised*) and is followed by the TAS further comment (black). Whilst it is noted that the RTS appears to incorrectly quote the original TAS peer review on occasions e.g. omitting parts of a comment or concentrating on different parts of different sentences., the meaning of the quoted items is not significantly changed by this. For completeness and to provide the context, the full comments made in the original review are presented here.

Modelling approach is not ideal

The AQIA has assessed potential air quality impacts associated with the Project using the AERMOD air dispersion model.

Whilst it is a US Regulatory model and is used widely, AERMOD does not produce especially reliable results when modelling area sources such as wind erosion, and it is not a model recommended by the reviewer for modelling ground based sources of dust emissions, as occur in this case. It is noted that AERMOD was not the first choice of the AQIA modeller, rather this model was a last choice option selected to deal with meteorological issues identified during the government review process (see further below).

AERMOD is a widely used dispersion model in NSW, Australia and globally.

As identified and confirmed by the reviewer, the choice of the AERMOD dispersion model in the AQIA resulted from a number of issues which arose in the generation of appropriate meteorological data. A review of the USEPA AERMOD implementation guide (USEPA, 2019) indicates that:

"..concentration predictions for area sources may be overestimated under very light wind conditions.." and "..this is not expected to be a problem for meteorological data collected using standard wind instruments since instrument thresholds are generally too high.." (pp 23).

As discussed in the AQIA, meteorological data adopted in the assessment was from the Gosford AWS, which uses standard instrumentation and therefore, the concern raised by the reviewer is not likely to be an issue. Furthermore, should it be an issue then air pollutant concentrations are likely to have been over-predicted resulting in a conservative approximation of impacts being presented in the AQIA.

AERMOD has been adopted by numerous air quality practitioners in NSW when assessing the potential impacts of ground-based dust sources (e.g. (Ramboll ENVIRON, 2017a), (Ramboll ENVIRON, 2017b), (EMM, 2019)). These studies have been subject to appropriate regulatory review and the modelling approach has been deemed to be acceptable by the NSW regulatory bodies.

Contrary to the thrust of the RTS statements about overestimation, it is pointed out that the non-representative Gosford data that were used is biased towards significantly higher wind speeds than would occur at the site, and using the Gosford data in lieu of site representative, lower wind speed data would, per the RTS's own statements above, lead to underestimations of the Project impact.

While it appears to be agreed that AERMOD is widely used but is not ideal for representing area sources, the RTS only canvasses that this model may overestimate impacts from area sources under low wind conditions, does not address the issue that such low wind speed conditions are excluded by the selection of the Gosford data, and does not tackle the other key aspect of generally poor model performance when modelling area sources under all other wind conditions.

Given the use of high-biased wind speed data, and the other issues raised, this issue remains unresolved.

Construction

For the construction phase, the *IAQM Guidance on Assessment of Dust from Demolition and Construction* has been used. In general, the construction period should be relatively short given the minimal site infrastructure proposed, and any construction impacts would be governed by the practices of the builders, rather than anything discussed in an air quality assessment.

However this is not the case for the operation, where the impacts can be greatly affected by the design of the plant, it's position relative to receptors and the mitigation measures to be employed in the design.

The review comment relating to construction impacts is not acknowledged in the RTS.

Meteorological modelling data used in the modelling is not representative of the locality

The Meteorological (and air dispersion) modelling approach was revised from the previous AQIA approach following evaluation of the meteorological modelling outputs.

The assessed meteorological modelling approaches included: TAPM with no data assimilation, TAPM with data assimilation and WRF modelling used as input to CALMET with no data assimilation. The AQIA deemed none of these approaches to adequately represent the observation data recorded at the Gosford AWS station. The AQIA does not detail why it would be expected and necessary for the weather conditions at the project site to closely match those at Gosford AWS. However it was then decided to use observational weather data as input into the AERMET meteorological model as it was possible to make these data closely match the conditions at Gosford AWS. (This also meant the AERMOD model was used for the air dispersion modelling).

The observation data were input in AERMET and include data from Gosford automatic weather station (AWS) (approximately 6km away), Williamtown RAAF (87km away) and Sydney Airport (53km away).

The AERMET generated windrose is presented in **Figure 2** and for comparison, **Figure 3** presents the Gosford AWS windroses. The AERMET windrose shows similar wind patterns to the Gosford data.

It is to be noted that the Gosford AWS station is located in flat terrain near sports fields, north of a large body of water, and south of a steep wooded ridge which runs approximately east-west. On the other hand, the project site is positioned on the western ridgeline or plateau at a significantly greater elevation to the Gosford meteorological station, and does not have elevated terrain to the north, or flat level terrain nearby or to the south.

Due to these significantly different geographical features, the winds at the project site will be significantly different to those as Gosford AWS. These different features will necessarily cause the project site and monitoring station to experience significant meteorological conditions, that is, wind speed and wind direction will be affected by different anabatic and katabatic processes, differing nearby land surfaces and will be subject to different southerly and northerly flow and wind speeds.

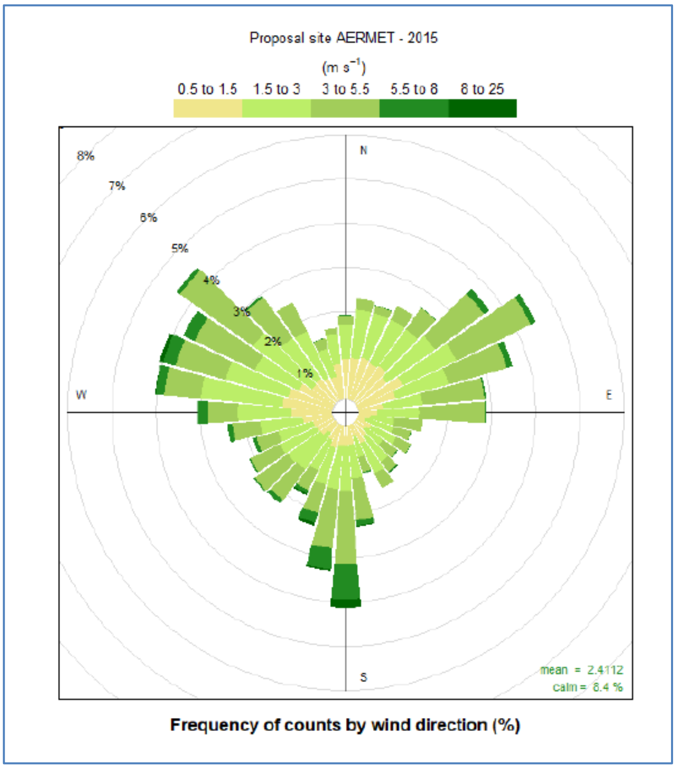


Figure 1: AERMET generated windrose

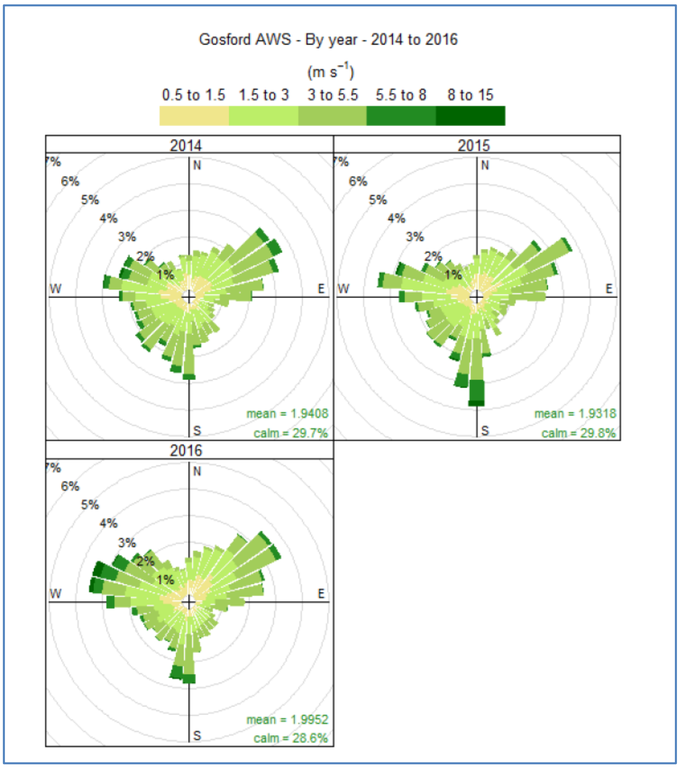


Figure 2: Gosford AWS windrose

The features in the observed Gosford AWS windrose can be directly related to the geographical features near the weather station; the large flat body of water to the south means that strong southerly winds are more likely (as we see in the windrose), the steep wooded ridge to the north will block northerly winds, and enhance NW and NE winds (as is the case) (see **Figure 4)**. It is important to note that there are no such features at the project site (see **Figure 4)**, hence there will be different wind conditions, and there is no reason to expect similar wind conditions at the project site to those at Gosford AWS. However, the AERMET modelling shows no significant differences between the site windrose and the Gosford AWS windrose.

This means the AERMET data used in the air dispersion modelling is not representative of the project location. This is acknowledged in the AQIA which says *"Although the data do not represent site specific conditions (i.e. at the project site), no data is available to allow an assessment of that meteorological environment"*. It is important to note that unrepresentative meteorological data may cause invalid or incorrect dust modelling results.

Meteorological modelling by the reviewer has been made for a location near to the project site, shown as "CALMET Extract" in **Figure 4**. These data can be used for a relative comparative assessment of the meteorological environment near the project site. A windrose showing the reviewer's results is presented in **Figure 5**, and is provided to indicate the weather conditions which are more likely to be experienced near the project site as may be expected due to the geographical features near the project site. It is also noted that due to differing geographical features in the area, there will also be some difference between different locations along the plateau or ridgeline also, however these local geographical differences would be smaller than those between the project site and the location of the Gosford AWS.

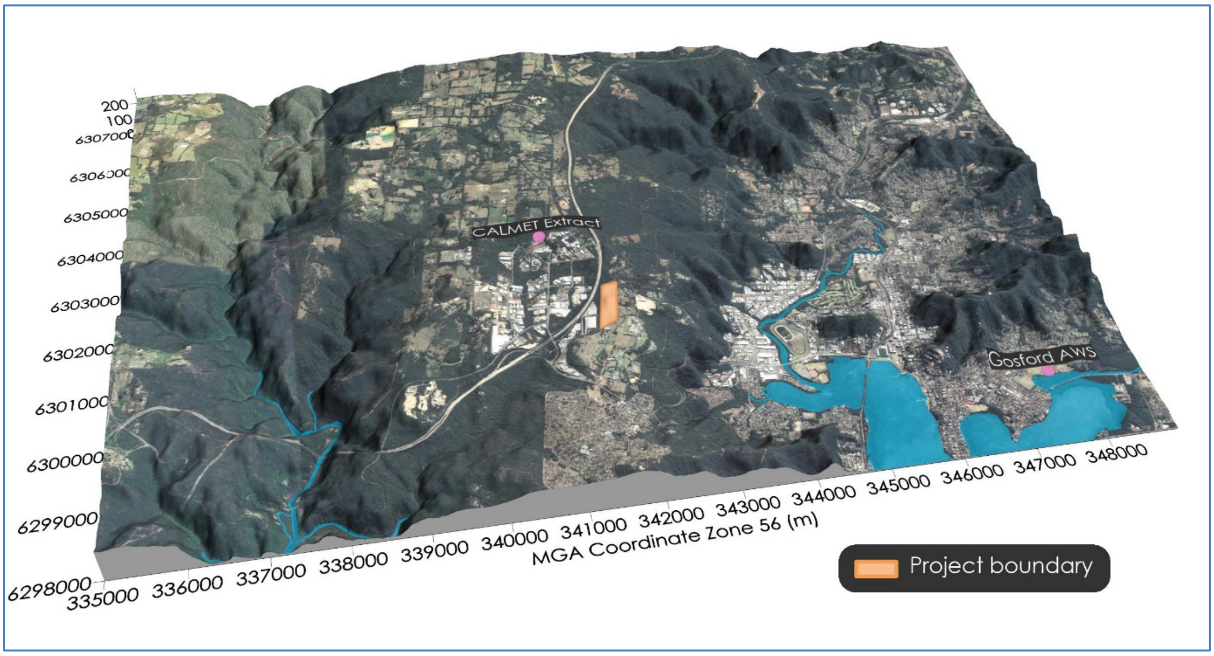


Figure 3: Geographical features of the area, location of Gosford AWS, Project site and "CALMET Extract"

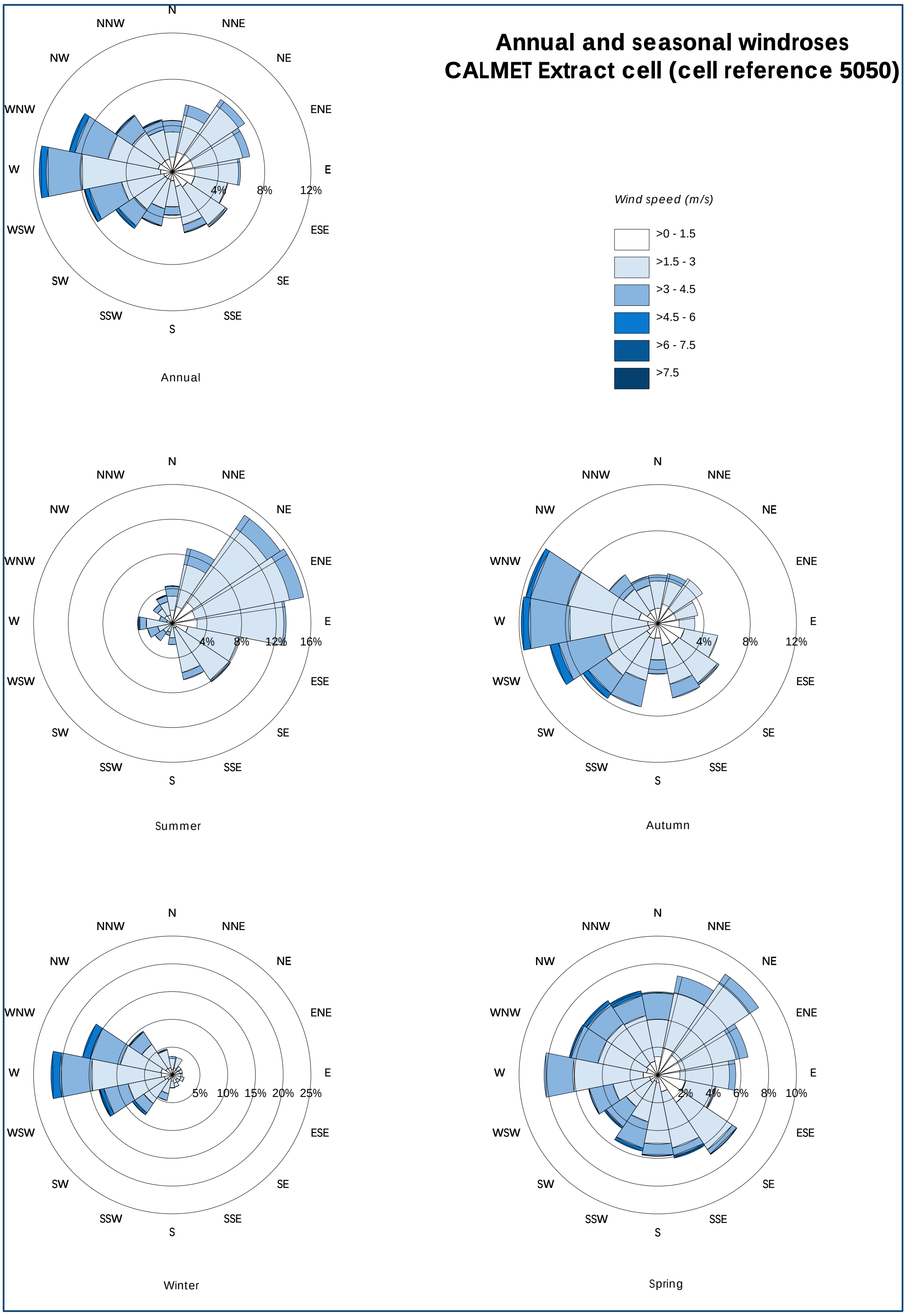


Figure 4: Indicative windrose at "CALMET Extract" location, likely more representative of the project site.

The indication from the above is that relative to the modelled winds, there are likely to be less southerly winds and more westerly winds present near the project site, i.e. more winds towards the nearest receptors. This is especially the case in the winter time, which generally tends to coincide with the poorest air dispersion.

Thus, the weather inputs and model used have potential to lead to invalid or incorrect results.

As discussed in detail in the AQIA, the meteorological data adopted in the performance of the assessment were a result of numerous meteorological modelling sensitivity exercises, where model outputs could not be adequately validated against the limited observations in the area (i.e. Gosford AWS). It is acknowledged that these data are not representative of the site, and they are not presented as such in the AQIA.

It is noted that the reviewer has provided a 'CALMET extract' of a meteorological model output for the project site and states that these would be 'likely more representative of the project site'. However, without adequate validation of those modelling results with observations, that statement cannot be supported to any degree and the data presented by the reviewer may be no more reflective of site conditions than that presented in the AQIA. Interestingly, the reviewer's presented annual wind rose for the project site compare well with that modelled in the original AQIA (2018) using no data assimilation and the TAPM model. However, that model did not validate well against observations at Gosford AWS which prompted NSW EPA to request an alternative meteorological modelling approach/method.

As previously indicated, the proponent proposes to install and operate a meteorological monitoring station at the project site, and observations would be able to be used as either input to, or validation for, any subsequent meteorological modelling exercises performed. This would provide confidence that the meteorological inputs to dispersion modelling adequately reflect site conditions, once the proponent seeks modification of the approval to move from 100 000 tpa to throughputs of 150 000 tpa and subsequently 200 000 tpa.

There are obvious, large, significantly different geographical features and influencing factors between the site and at the Gosford AWS, and these features will result in significant differences in the wind flows at the site relative to the Gosford AWS. Validating meteorological predictions at the Project with Gosford AWS, (i.e. with the aim of making them similar) is not logical or valid.

It is appreciated that the Reviewer's comments may be at odds with how the EPA request has been interpreted/ acted on by the consultant, and also that the comments broadly align with the consultants original meteorological modelling. However, any reliable meteorological data for this location will not show the biases that arise at the Gosford location, as outlined in the original comments, simply because the locality does not have the large influencing factors that are present at Gosford.

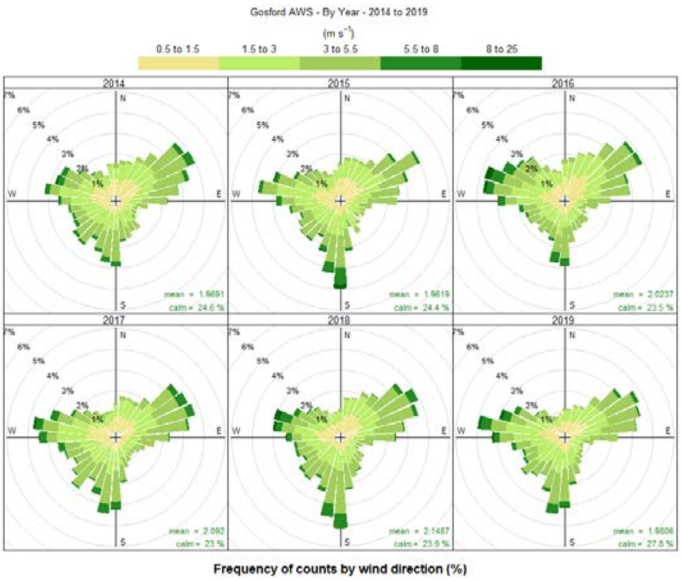
There is an onus on the consultant to use the most valid data, and to achieve this, they may need to modify how they have responded to the EPA advice. (i.e it is not clear that the EPA actually expects that the site data would be similar to that at Gosford).

As it stands, the RTS does not apply any robust logic to justify the meteorological modelling approach adopted, and the approach is unacceptable as it will lead to underestimation of impacts.

In addition, the selected meteorological data are not compared to long term climate data of at least five years (EPA Approved Methods Section 4.1 Minimum Requirements). The year 2015 was selected based on a comparison of 2014 to 2016 data (three years). Monitoring at Gosford AWS began in 2013 however there is no available long-term climate data. According to BOM Gosford AWS Daily Weather Observations, long term averages relevant to the Gosford AWS station can be compared to the Gosford (Narara Research Station) (AWS) (closed May 2013), Sydney Airport AMO (open), and Peats Ridge (Waratah Road) (closed June 2015).

See response 4 above.

Meteorological monitoring commenced at Gosford AWS in 2013 and therefore data for full calendar years were available from 2014 to 2016 at the time of the assessment being performed. More recent data has been examined (2017 to 2019) with those wind roses presented below. These indicate that the selection of the modelling year of 2015 is valid and entirely appropriate. There is little inter-annual variability in the meteorological observations and the selection of any of the years 2014 to 2019 would have made little material difference to the results of the assessment.



As previously discussed, the proponent has committed to included full enclosure of materials processing activities.

Dispersion modelling has also been re-performed to include a number of adjustments as previously noted, and compliance with the NSW EPA air quality criteria is still achieved (refer Appendix B).

As previously discussed, the proponent will also install a meteorological monitoring station at the site, with site-specific data used in any updated air quality modelling assessment to remove any uncertainty associated with those inputs.

Typically, a statistical analysis may be used to determine an appropriate meteorological modelling year. This is because visual examination of wind roses will often not reveal potential bias in the actual results caused by using data from one year relative to another. Nevertheless, the selection of which year to use is a moot point at this time given that the meteorological data are not representative of the site.

Whilst it is noted that the wind patterns during 2015 appear to be generally consistent with the annual wind roses presented for the latest six years, this is not relevant as none of the six years of data is representative of the site location.

The commitment for an on-site meteorological station is also acknowledged. The use of on-site data in future approvals is supported.

Modelled sources and emissions appear to be significantly underestimated, and are not best practice

Annual average and peak maximum (for 24-hour impacts) have been assessed, which is appropriate. However, the annualised peak values used to develop the emission rates do not appear to reasonably reflect the likely additional activity on a peak day, relative to an average day. In general, it is unlikely that for this type of activity, which is governed by the day to day fluctuations in the construction industry, the peak activity rate would be close to the average rate of activity over the year. This indicates that there may be potential for underestimation of the peak 24-hour average dust impacts.

Emissions estimation and dispersion modelling have been re-performed. Emissions inventories and dispersion modelling results are presented in Appendix B. A comparison of calculated maximum 24-hour and annual average emissions indicates that the emissions during the worst-case day are:

- *Haulage - 1.2 times higher than average*
- *Materials handling – 2.2 times higher than average*
- *Materials processing – 2.5 times higher than average*

The above levels of conservatism have been modelled on each and every day of the assessment year, and are considered to be appropriate. Following approval of the project at a 100 000 tpa throughout, detailed information would be collated by the proponent to allow characterisation of peak activity rates in any updated AQIA.

To be clear, the originally reviewed emissions inventory for the peak 24-hour scenario did not appear to apply the actual 669,000 tonne per annum processing rate (some 3.3 fold higher than average) when calculating 24-hour average emission rates. The originally proposed 3.3 fold increase above average rates of activity (i.e. 3.3 times higher than 200,000 tonne per annum) is appropriate, as described and also considered reasonable by the NSW EPA in page 9 of the RTS.

For example, in the annual emissions inventory the activity rate for the first source "Unloading material in tip and spread waste receival building" is 200,000 tonnes and in the 24-hour emissions inventory the activity rate is stated as being 933 tonnes. The activity rate in the emissions inventories does not specify the time period, however it is assumed to be yearly in the annual inventory and daily in the 24-hour inventory. Based on this assumption, an annual processing rate of 340,545 tonnes per annum can be calculated (i.e. 933 tonnes per day x 365 days in a year = 340,545 tonnes per annum). The applied upscaling factor used in the original assessment was 1.7 times higher than average, is generally too low to be practical and is much less than the 3.3 fold upscaling, based on a 669,000 tonne 24-hour activity rate that was claimed to have been used.

The upscaling factor of 1.2 is not considered reasonable or plausible, given that in the Reviewer's experience, for this type of industry, at this scale, and on such a site the upscaling that arises for the 24-hour activity rate is generally 2 to 5 times higher than the average activity rate. This upscaling arises because there can often be large project contracts which require swift processing of large quantities of material in a short time, and also other periods with low activity.

The rationale for now adopting a significantly lower throughput for the peak 24-hour scenario (1.2 instead of 3.3 (or even 1.7)) in response to the Reviewer's concern about underestimation is unclear. No evidence is given as to why it may be plausible to use a significantly lower value that the 3.3 factor previously endorsed by the EPA, and considered appropriate by the reviewer.

While the RTS states that there are no predicted cumulative exceedances of the 24-hour average criteria (based on the very low upscaling rate), the maximum 24-hour average incremental impacts at receptors presented in Table 3 indicate that the Project would have a relatively high impact at the nearest receptors (up to 22.6µg/m^3 PM_{10}).

The insufficiently low upscaling means that the predicted impacts would underestimate the 24-hour average impacts (potentially several fold), which renders the assessment of impacts unreliable.

This issue highlights the need to revise the assessment using plausible 24-hour activity rates, and also that the development of a Trigger Action Response Plan as outlined in the RTS will be important to ensure acceptable 24-hour average levels are achieved at the nearest residences.

Whilst it does not appear significant, it is noted that there appears to be a typographical error in the 24-hour emissions inventory. Very low numbers are presented under the controlled emissions header which is stated as being in kg/year, whereas it appears that it may be kg/day.

Other assumptions applied in the emissions calculations also underestimate the likely emissions.

Silt loading for paved roads was 0.6 g/$m^{2,}$ and in addition, a 30% control factor is used. The resultant emissions per vehicle kilometre travelled (VKT) are only approx. 33g/VKT, (whereas approximately 20 to 30 times more emissions are likely, e.g approximately 1,000g/VKT). The adopted emission rate for material hauling is for public roads, not industrial roads, and is especially not appropriate for representing industrial roads made of concrete rubble where heavy trucks and equipment will spill material, track material and grind the surface rubble into a fine silt. A more suitable silt loading representative of this type of road would be between 8 and 20g/m^2, and this will greatly increase the modelled emissions (as outlined above) and the predicted impacts given that this will become a significant site dust source. The impacts are likely to especially increase for the most affected receptors which the site roads are relatively closer to.

The 30% control factor applied to further reduce the emissions for this type of road cannot be achieved as it is not possible to sweep such a road surface or to use water flushing to remove the silt after sweeping to loosen it. In general, watering such a road simply tends to cause the silt to track further out onto public roads and can exacerbate, rather than alleviate the problem.

The claimed best practice design for the project is not consistent with the type of road proposed.

To address this issue, emissions estimation and dispersion modelling have been re-performed. Dispersion modelling results and emissions inventories are presented in Appendix B and Appendix C, respectively. Emissions associated with paved and unpaved road surfaces have been calculated, with silt contents as outlined in issue 3 above.

The 30 % control factor has been applied to the paved haulage routes and is associated with water flushing/use of water carts for dust suppression which has been justified previously.

Parts of the project site would be constructed of a sealed asphalt surface, with other parts being recycled crushed concrete with a geotextile membrane. The recycled crushed concrete would comply with the Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage (IPWEA, 2010) Class R1 material. The roads would not be made of concrete rubble, but of processed 26.5 mm recycled concrete.

Following approval of the project at a 100 000 tpa throughput, detailed review of the emissions controls would be performed in conjunction with air quality monitoring data and visual observations. Should additional treatment/management be required to ensure that off-site air quality meets required guidelines, this would be investigated and applied.

The RTS states that a silt loading of 8.2g/m^2 for paved roads was adopted in the remodelling. This is significantly higher than the 0.62g/m^2 value previously adopted. However, the 30% control factor applied for watering of paved roads is not justifiable for a crushed concrete rubble road, and would translate to an equivalent silt loading of less than 5.6g/m^2. (Note that the 30% control applies to the emitted emissions, and more than a 30% reduction in the silt loading is required for equivalency).

The reviewer notes that the range of silt loadings for such roads on similar sites that he has encountered range from approximately 8g/m^2 to 20 g/m^2, however this is for controlled, fully sealed roads, with regular sweeping and watering done repeatedly throughout the day.

This road will be made of processed concrete rubble, sized to 26.5mm. Such a road cannot be swept and the material it is made from will rapidly break up and generate dust due to the grinding action of the plant and truck wheels. Such a road is not consistent with best practice, and it will not (as has been assumed) generate dust levels below the low end of the range for a controlled sealed road that is swept and watered.

A 30% control factor (30% reduction) in emissions for material moved from the supplies bunker for sale by end loader (FEL) is applied. This is incorrect. Furthermore, the emissions generated by the FEL when transporting this material across the site are omitted. The 30% "controlled" plus the excluded emissions will be significant, especially as the loaders will spill significant material along the way, have intimate and significant wheel contact with the material and track it about, and due to frequent turning they will grind the surface causing significant surface silt.

Table 4 of the National Pollutant Inventory EETM for Mining (NPI, 2012) indicates that an emission reduction factor of 30 % is applicable to all activities in table 2 of (NPI, 2012) when associated with wind breaks.

However, these control factors have been removed in the updated modelling assessment.

Wheel generated emissions are wind independent and these emissions are not affected by wind breaks, but this is no longer relevant as the control factor has been removed.

However, the RTS does not specify whether emissions from front end loaders transporting materials across the site have now been included in the revised emissions inventory. This needs to be clarified, or the assessment updated as appropriate.

Whilst more commonly used in Western Australia than in NSW, the wind erosion factor approach is reasonable, however the factor is applied to a much smaller area than proposed. It appears that wind erosion is only modelled to arise from 1.59 ha, whereas the approximate operational area is 3.9ha. This is an approximate 2.5 fold underestimation of the most significant source of emissions at the site. Noting that the weather data used also appears to underestimate the westerly winds which blow towards the most impacted receptors (and the wind erosion occurs under such conditions), this can mean that there may be a large underestimation of the predicted dust impact at receptors.

The estimation of wind erosion has been performed in the updated dispersion modelling to reflect the entire 3.9 ha site.

The issue associated with anticipated wind conditions at the project site has been dealt with above. The reviewer comments regarding the likely wind regime at the project site are based on unvalidated and unsighted modelled data.

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The operational area with the potential for dust emissions to occur from wind erosion appears to have been appropriately updated in the revised modelling.

It is noted that there appears to be a slight difference in the emission rates calculated for the annual and 24-hour modelling scenarios. This may be a rounding error arising from hectares being reported to one decimal place for the annual scenario compared with three decimal places in the peak 24-hour modelling scenario.

No further response is sought.

The issue associated with anticipated wind conditions at the project site has been dealt with above. The reviewer comments regarding the likely wind regime at the project site are based on unvalidated and unsighted modelled data.

The issue is not dealt with, and it will lead to underestimated impacts. The reviewer's comments are based on sound logic and reason, and refer to meteorological modelling as corroborating evidence, not primary evidence of the facts. Please refer to the comments further above regarding the meteorology.

There is a doubling up of control factors in many cases, and this makes the emission implausibly low. An example is the tipping of every load in the 3-sided enclosure. Closer examination shows that this level of control (70%) is not realistic for this "enclosure", and that there would be quite limited shielding offered in this case given there are three short walled adjacent tipping bays, and the frontal opening spans all three and is very wide. The mechanism by which a 3-sided enclosure provides benefit is that the stockpile is hemmed in on three sides (i.e. piled up the sides of 3 walls), giving it a much smaller surface area than the same material pile out in the open. Yet, the entire purpose of the receivals bay in this case is to take the entire pile and spread it thinly on the ground, greatly increasing the dust emissions relative to any normal pile. This will result in more emissions overall than a normal uncontrolled pile (not a total 85% reduction as has been assumed).

This is incorrect. Emission controls factors are multiplicative, and the application of multiple (but different) controls on one source is appropriate and standard practice and has been adopted. Full discussion is provided in response to issues 2 and 3 above.

Full justification of the multiplicative emissions controls adopted can be viewed in response to issues 2 and 3 above.

The RTS has missed the point of the comments. It is not claimed that emissions controls cannot be multiplicative. The issue raised predominately concerns the design of the facility and also the management of materials at the receival bays and questions the veracity of the control factors applied to adequately represent the likely emissions of dust from this source.

Further description of the proposed design of the three-sided enclosures and spread out materials surface area has not been provided in the RTS to justify the adoption of the control factors that would be achievable due to the relatively poor design of the facility, and the proposed manner of handling materials at the facility.

The issue is unresolved and there remains significant underestimation.

A further example is the application of a 77.7% watering control factor for water sprays on the crusher, and an additional 70% control factor for an enclosure, resulting in a total of 93.3% control. Closer examination shows that the enclosure is like a tunnel as it is open at each end and has what appear to be material conveyors protruding out of the sides. Thus, the key dust generating parts of the crusher are not in the enclosure, and the proposed enclosure provides limited shielding benefit, or no such benefit when winds along the axis of the crusher. Overall, it appears this source may be underestimated by up to approximately three-fold, relative to normal, controlled crusher emissions.

Emission controls associated with materials processing are presented in response to issue 2 above. A 50 % control factor has been applied relating to the use of water sprays during processing which is entirely appropriate (NPI, 2012).

Full details of the proposed enclosure around processing activities, and the level of emissions control is presented in response to issue 2.

The RTS however also notes that no controls have been applied to the loading of material to the hopper, as this would be outside of the enclosure and that there would be a drop rubber curtain between the loading hopper and crushing activities to contain particulate within the building.

Crushing activities appear to have a revised combined control efficiency of 85%., despite the key dust generating part of the process being outside of the "enclosure", and (appearing to be) uncontrolled. This does not appear to be consistent with the design proposed, and appears to underestimate the potential emissions.

Similar such issues arise with other modelled processes.

The present industry standard control measure for the material spreading and related activities is to conduct these fully indoors with fixed water spays onto the unloading pad and/or direct hand watering as per currently proposed local industry practice (e.g. similar to the proposed Bingo facility across the road, which is referred to in the AQIA).

The entire design of this facility represents relatively poor practice and falls well short of best practice in terms of current design and emissions performance practices applied for new facilities. The road surfaces, the tipping bay and crusher issues outlined above, are notable examples. Other examples are the site design and layout featuring crossing travel paths of materials and trucks which cause additional silt track out, the many open bays of material, the numerous double handling steps, excessively long transport distance of material with heavy plant due to the poor shape and layout, and a range of other relatively poor practice aspects of the proposal.

The AQIA has been performed on the facility design and layout presented in the EIS and demonstrates that predicted impacts do not exceed the relevant criteria. Furthermore, the reviewer has not taken into consideration the purpose and functions of the facility, and has made broad and generalised observations in relation to the design of the facility with respect to potential impacts on air quality. We believe these statements are unsubstantiated and misleading.

We wish to highlight that the purpose of the development is to provide an integrated recycling facility for sand, soil and building materials. Comments in relation to how the site is designed to protect air quality is given as follows:

a) Landscape materials supply area: The front section of the site is designed to function as a discreet landscape supplies and storage area, where vehicles enter via the weighbridge over an asphalt pavement, then manoeuvre to be loaded with landscape supplies. This area is located in close proximity to the site entrance to minimise vehicle travel distances. Storage bunkers are three sided to contain all materials, have bay mounted sprinklers to keep the surfaces of piles moist and to minimise dust at all times. Further mitigation measures of using water to *be applied to the recycled concrete pavement is proposed as an operational control to further minimise dust generation. The positioning of the landscape materials supply area in this location also prevents vehicles from accessing the waste management and recycling operations, which is important to minimise traffic generation, movement on the recycled concrete pavement areas, and improve site safety.*

b) Waste tipping and spreading building: All waste delivered to the site is via vehicles accessing the site and travelling over a fully sealed asphalt pavement through to the tip and spread building. No vehicle access is required over the recycled concrete pavement (which may generate dust). This building has three fully enclosed sides, and is supported by a full ceiling mounted dust suppression system. This process will enable the detection and removal of non-compliant waste materials, that could otherwise impact on recycling operations and product quality.

c) Waste storage area: The waste storage area is located at the southern side of the site, at maximum distance from residential receptors. Waste is storage on a fully sealed asphalt pavement, to minimise dust generation from vehicle movements, with concrete block bays on three sides for effective containment of all materials to minimise wind erosion. Bays are further supported by a bay mounted sprinkler system, which will keep the surfaces of piles moist to prevent wind erosion.

d) Secondary sorting warehouse: A fully enclosed building is proposed to receive, sort and separate building waste through a semi-automated processing plant. Dust suppression within the building is enhanced through the use of a ceiling mounted misting system.

e) Processing area: A now fully enclosed building around the concrete crushing building is proposed, with internal misting, enclosed conveyors and enclosed bunkers for containment of aggregate material. A rubber drop curtain is proposed for the front face of the bunkers, to further minimise erosion and dust impacts, whilst still allowing plant access for moving bulk materials to storage bays. Note that limited operational plant and equipment will operated in this area, which will be conducted on a recycled crushed concrete pavement. The mulcher building now is fully enclosed, with internal misting, enclosed conveyors and an enclosed bunker for containment of mulch material. A rubber drop curtain is proposed for the front face of the bunker, to further minimise erosion and dust impacts, whilst still allowing plant access for moving bulk materials to storage bays.

f) Blending area: Mobile plant and equipment will be used in this area to blend materials for transport to storage bays for sale. All equipment to be fitted with water sprays for dust suppression.

The AQIA further highlights the best practice air quality mitigation measures to ensure that the operation is managed in a manner to protect air quality at all times. Continuous monitoring through an on-site air quality monitoring and weather station will further assist the operator to measure, monitor and control operations to ensure that air quality criteria are met at all times.

It is noted that there have been improvements in the design of some parts, and providing an outline for the functional rationale for the design is appreciated. However, there is a clear requirement in NSW to minimise dust from such activities via best practice, and the design of the facility is integral to this. Yet the design issues raised have not been addressed, and the proposal as revised does not represent best practice.

For example, the issues with the excessively open tipping area and the crushed concrete rubble roads is outlined above. Storage piles, if relatively passive, can be controlled to a higher level than most other activities, but have been located outdoors and furthest from receptors, making it necessary to position the more intense dust generating activities closer to receptors. The key issue of the design forcing the crossing of "clean and dirty" travel paths is significant, and will cause excess contamination and track out, but is ignored. The materials tipping and sorting area, and the crusher are not fully enclosed, the "dirty' parts protrude from the "enclosure". The open sided shed is not commensurate with a 3-sided enclosure, etc.

Overall, the design of the facility is poor in regard to minimising dust, as can be seen by direct comparison with design of the Bingo site (formerly proposed) across the road. The Bingo facility for example, had tipping, sorting and handling activities fully within an actual building with closable doors, and all roads were fully sealed allowing them to be swept, washed and flushed.

The reviewer's fundamental issue that the site is poorly designed, and that this leads to unnecessarily higher emissions is not adequately addressed. For example, why must the clean and dirty travel paths cross, why cannot sealed roads, (which can be swept and flushed) be used instead of roads made of processed concrete rubble? How will material track-out be prevented when trucks must travel over dirty areas, on roads that cannot be swept, and the road itself, due to its design, is a significant generator of dust.

The many sources of dust are shown to operate for limited hours per day, and these limited hours result in less total emissions (relative to the same rate of activity occurring in every hour of the day). However, while it is known that the modelling is conducted for every hour of the day, it is unclear if the modelled emissions are released over only the operating hours of the day for each source, or in every hour of the day. There is potential to further underestimate the dust impacts by approximately a factor of two if these limited emissions were spread over all hours. It would be reasonable for this to be clarified or corrected if necessary.

Modelling of all emissions sources, other than wind erosion sources (which have been assumed to occur 24 hours per day), have been modelled based on the operational hours of the project (i.e. 7 am to 6 pm for delivery of waste materials and product sales, and 8 am to 5 pm for processing of waste). The updated emissions inventories presented in Appendix C provide this information.

The RTS provides an emissions inventory which adequately identifies the operational hours for each modelled Project source. No further response is sought.

Modelled receptors

It is noted that not all of the existing and likely future receptors have been modelled. Notably, the proposed dwelling at Lot 3 239 Debenham Rd East, Somersby is not considered, nor is the juvenile corrections centre, where there may be many young persons present at any time. The corrections centre may warrant some additional consideration, given that inmates may be present for long periods and may be unable to leave for any respite.

Two receptors represent potential impacts at the correction centre (Receptor I6 and I9) as indicated in Table 6 of the AQIA. Debenham Road East could not be identified on any maps, and the reviewer was contacted to confirm the location referenced in the peer review, although no reply was received.

Impacts have been predicted at receptor R1 (242 Debenham Rd South) which is adjacent to (and closer to the project site than) 239 Debenham Road South and can be used as a reasonable proxy for those potential impacts.

Impacts have also been predicted at receptor I1 (244 Debenham Rd North) which is adjacent to 239 Debenham Rd North, and can be used as a reasonable proxy for those potential impacts given that it is located nearby.

Incremental impacts at all locations surrounding the project site can be determined from review of the contour plots presented in Appendix B.

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The reviewer is unaware of any contact made in this regard, which is unfortunate, as this could have been avoided. Nevertheless, it is understood that Lot 3 239 Debenham Rd East is an approved rebuilding of a residence, located approximately as shown at "untitled placemark" in the figure below.

Further details can be found by entering the term Gosford City Council DA and the address into a Google internet search engine. For example:

https://www.google.com/search?rlz=1C1GCEA_enAU803AU803&sxsrf=ALeKk01GXm5oTbWdwzqGKfebknQVc6-H_Q%3A1615429149547&ei=HX5JYMnilNrbz7sP_7CmmAk&q=Gosford+City+Council+DA+239+debenham+road&oq=Gosford+City+Council+DA+239+debenham+road&gs_lcp=Cgdnd3Mtd2l6EAxQmIkBWI-OAWCnoQFoAXAAeACAAYYCiAHbBZIBBTAuMy4xmAEAoAEBqgEHZ3dzLXdpesABAQ&sclient=gws-wiz&ved=0ahUKEwiJ5fjElqfvAhXa7XMBHX-YCZMQ4dUDCA0

The DA for the dwelling states *" The subject site is located to the eastern side of the M1 – Pacific Motorway and was originally part of a single allotment with Lot 1 of DP261507, however the property was split in two with the construction of the M1 – Pacific Motorway"*. It is understood that this is why the lot address uses the term "East".

Annual average result contours are not provided, thus it cannot be determined if this lot would be more impacted than others.

The 24-hour dispersion modelling contour plots in the RTS indicate that I1 would experience similar incremental impacts to the receptor at 239 Debenham Rd. However, it is clear from the shape of the contour that the maximum impacts are likely to occur on a different day, and thus I1 cannot be used as a proxy for this location. This again highlights the issue with the bias in the Wyong background data, and also the large underestimation in 24-hour impacts due to insufficient activity rates for a peak day of activity.

Receptor I6 appears to be suitable to represent impacts at the corrections facility.

Background dust monitoring data

There are no air quality monitoring data collected nearby to the project site. This is a relatively common issue affecting many air assessments. The nearest available air quality monitoring data are measured at the OEH

Wyong station, approximately 20km north of the site. Whilst the nearest available background data from Wyong are used, it is noted that the project site is quite different to the Wyong monitoring location, and this may cause some potential for bias.

It is generally accepted that OEH monitoring stations, being specifically located to avoid "hot spots" such as main roads or industrial activities will record lower concentrations of air pollutants (dust in this case) than may arise in more urbanised or industrial areas.

The Wyong monitoring station is located north of a horse track, but south and southeast of low-lying wetlands/ well vegetated land and a golf course. Due to this, it is reasonable to expect the station will record some of the lowest dust levels when winds are from the north to north west, i.e. blowing over the golf course and wetland/ vegetated area. These wind directions are towards some of the nearest and most affected receptors to the project site. There is bare land and industrial activity north and north-northwest of the Project site.

Whilst there is uncertainty regarding the exact background dust levels at the site, on balance, using the best available information and considering the above, it is reasonable to assume that the Wyong monitoring data would underestimate the likely background dust levels at this site, and even more so when winds blow towards the nearest, most impacted receptors.

As outlined in Appendix A of the AQIA, a review of air quality monitoring locations within 50 km of the project site is provided. Three air quality monitoring stations (AQMS) were identified, with one being Wyong (approximately 20 km away), and the other two being located in the Sydney Metropolitan region, both over 40 km away.

In the performance of AQIA in NSW, the adoption of air quality monitoring data from a location which directly mirrors the conditions as outlined in the reviewer comments at the site under assessment is extremely rare. NSW DPIE currently operates 79 AQMS which measure PM_{10} continuously, which represents an average of one AQMS per approximately 10 000 square kilometres (km^2), with the majority of those AQMS being located in the most populated areas of the State.

The adoption of air quality monitoring data, often collected at significant distances from proposed projects, to represent conditions at those locations is a routinely adopted approach in NSW. The use of data from a site as close as 20 km away would be considered to be an unusual and a preferable situation for projects outside of the Sydney Metropolitan region.

As previously indicated, the proponent has committed to performing air quality monitoring following approval of the project at 100 000 tpa throughput. These site-specific data would be used in any subsequent AQIA when seeking scale up approval to operate at 150 000 tpa and 200 000 tpa.

The response adds more context to peripheral aspects of the review comments but does not directly address the core issue raised of potential underestimation of the background levels (due to the conditions at the location of the nearest best available data), particularly when winds blow towards the nearby receptors. An analysis of the background data used per wind direction might have been considered as part of the response, or some other reasonable factor to compensate for this issue, such as including other emission sources in the modelling.

The issue appears to be compounded by the apparent underestimation of the cumulative impacts of the adjacent quarry (outlined below).

It is understood that site specific air quality monitoring will be established at the Project to assess the performance of the Project and would be used in subsequent AQIA for future scale-up approvals.

Cumulative impacts

Whilst two similar nearby facilities are identified to have potential to add to cumulative impacts, only one is considered, and not by direct modelling.

The proposed Bingo Facility across the road from the proposed site is noted in the AQIA to be fully enclosed, to represent best practice, and thus have minimal scope for any cumulative impacts. However, this highlights that the proposed development is not fully enclosed and is therefore not consistent with current industry best practice (as claimed throughout the AQIA). If it is the case as stated in the AQIA that an additional best practice facility across the road does not add any significant level of dust, it follows that the proposal must have much higher impacts than a best practice facility.

The emissions from the proposed Bingo Facility are not calculated or factored into the assessment as they are not available in the public domain. This will lead to underestimated cumulative impacts, especially at Receptor 1 and also the unassessed likely future receptor at Lot 3 239 Debenham Rd East.

SSD-9265 (the proposed Resource Recovery Facility at 83 Gindurra Road) has been withdrawn and no cumulative impacts would be anticipated. It is understood that a development application for a 'warehouse and distribution facility' is now proposed at that location, and cumulative impacts associated with a development of this time would likely be minimal and do not warrant a quantitative cumulative assessment.

The RTS confirms that the application for Bingo Facility has been withdrawn. It is noted that it has been replaced with low-impact warehousing, as might be more appropriate in this locality and proximity to receptors and objectors.

Issues with the modelling of the existing quarry area are outlined further below.

The RTS does not address the issue of best practice, as for example made in comparison with the (previously) proposed Bingo Facility. While it is understood that a key change is that the Project design is to include the "*…full enclosure of all materials processing activities…*", this appears to be at odds with what is actually stated at *Appendix 3 – Updated Crusher and Mulcher bld plans* which indicate that the crusher hopper and mulcher hopper are not within an enclosure, and this is further confirmed in the RTS on Page 7 where it says *"No controls have been applied to the loading of material to the hopper, as this would be outside of the enclosure."* . It is also evident that the tipping and sorting area is also not fully enclosed.

The emissions from the nearby (not adjacent as claimed) Gosford Quarry are included on the basis of an assumed 26% addition to the site impacts only. However, because the emissions from this quarry are not directly modelled it means that the predicted cumulative impacts at the nearest most impacted receptors which are located between the two sites may not be adequately represented. The most impacted receptors cannot experience impacts from both sites at the same time, but may experience impacts from either site more often, i.e. from the proposal when winds have westerly components, and from the quarry when winds have easterly components.

This can lead to significantly different, and possibly higher impacts than presented, especially when one also considers the likely bias in the background data (previously outlined).

Impacts associated with the Quarry operation have been modelled as discussed in response to issue 1.

An updated dispersion modelling assessment has been performed which includes the impact on annual average PM_{10} and $PM_{2.5}$ resulting from the operation of the quarry. Given the major uncertainties associated with the activities being performed, activity rate, and operational hours etcetera, an approach has been taken where the full 5.7 hectare (ha) area of the site is assumed to be available for wind erosion, and the sawing, loading and transport of sandstone occurs on every day of the year. Emissions from all activities have been spread over the 5.7 ha area of the site and the annual average impacts at all receptors have been modelled. Results for annual average PM_{10} associated with the Quarry operation are presented in Appendix B which demonstrate that increments are less than (<) 0.1 µg·m-3 at all receptor locations.

Impacts associated with shorter term (i.e. 24 hour) time periods have not been modelled given the uncertainty which would be required to be included within the assessment, and the limited value that would be provided by such an assessment. Given that the closest receptors to the project site are located between the project site and the quarry, it is more likely that those receptors may be impacted by either operation (but not both operations) in the short term and therefore an assessment of short-term impacts is not considered to be either possible, or warranted.

A modelled increment for the quarry of less than 0.1µg/m^3 for annual average TSP, PM_{10} and $PM_{2.5}$ at any receptor appears to be implausibly low considering the size of the quarry and the close proximity of the residences to the quarry. The RTS does not appear to contain an emissions inventory for the nearby Quarry operations and thus it cannot be determined if broadly sensible emission rates were modelled to determine potential cumulative impacts.

It appears that there is a large error in the modelling. For example, the wind erosion emissions from the site are estimated to be a (very) large fraction of the total emissions (more than 40% of the total), and will contribute approximately 40% or more to the annual average impact (i.e. >40% of the Project TSP annual average impact of 9µg/m3 is 3.6µg/m^3, or 36 times times higher than the quarry impact). However, the quarry exposed area, which is the source of wind erosion, is approximately 6.5 Ha (roughly double the 2.7Ha modelled for the site). The quarry and Project are roughly a similar distance from the nearest receptors thus the wind erosion impacts from the quarry should be approximately double those of the site given it has double the wind erosion area. However, the impacts are approximately 1/36th of those from the Project, suggesting an underestimation of approximately 75 fold.

Otherwise, we also point out that it is entirely reasonable to expect that the receptors between the Project and nearby quarry could be downwind of both sites in the same 24-hour period, noting that the wind direction commonly changes in a 24-hour period.

The RTS does not respond to the issue that the maximum cumulative 24-hour impacts have been adequately assessed.

It is considered that the cumulative impacts are likely to be underestimated when considering the background data and the approach taken.

Based upon the above discussion and considering the withdrawal of the application for SSD-9265, the assessment of potential cumulative impacts is considered to be appropriate given the information available at the current time.

The potential issue with the background data is not addressed, and the cumulative modelling of the quarry is implausibly low, thus this issue has not been adequately addressed. Please refer to the previous specific comments on these issues.

Discussion

It is noted that the meteorological data used are not representative of the site, and in the reviewer's opinion, this, along with the model choice, has potential to lead to a significant underestimate of the likely level of dust at receptors. The degree of any underprediction cannot be estimated reliably.

The emissions inventory appears to be far too low for a large number of key emission sources. Wind erosion emissions presented in the AQIA are the dominant source of dust from the site by a large margin, but appear to be underestimated by a factor of approximately 2.5 times, given that the actual operational area is stated to be 3.9 ha, but only 1.59 ha appear to be modelled. This will directly lead to significantly underestimated impacts at receptors and may be exacerbated further by the likely under-representation of westerly winds in the modelling. Such winds would blow these dominant dust emissions towards the most impacted receptors.

For this type of activity, the material haulage emissions are generally one of the largest sources of dust, or at least are similar to the total wind erosion emissions. However, in this case, the haulage emissions appear to be underestimated by a factor of approximately 20 to 30 times due to applying an emissions factor for low-traffic public road emissions and a further 30% control factor in addition to reduce the levels further (instead to using an emissions factor for industrial roads). This also has potential to exacerbate any underpredictions at the most impacted receptors which are generally near to the haul roads.

Material handling emissions are also underestimated due to incorrect assumptions regarding excess control factors, for example relating to 3-sided enclosures.

Based on previous experience with many such activities, the reviewer considers there may be an approximate three-fold underestimation in the AQIA in this case, relative to the likely emissions from this site. This would lead to an approximately similar scale of underestimation in the maximum level of predicted dust impact at receptors.

If this underestimation, and the other potential issues in the AQIA approach were to be corrected it is very likely that unacceptable dust impacts would be predicted, as might be expected in this case when considering the large scale of the development in relatively close proximity of many residential receptors, and the overall generally poor design of the facility which does not reflect industry standards or best practice.

Without additional information to support and justify these unqualified statements, we cannot provide any meaningful comment. Every site and operation is different, and comparison of total emissions from one site with another should be made with care.

It is noted that the assumptions regarding wind erosion have been appropriately revised, and a significantly higher (but still low) emission rate is now used for wheel generated dust, however the fundamental design issues and the of use of high control efficiencies in the modelled emission rates have not been adequately addressed/justified, nor have issues relating to the meteorological data, background data and other contributing sources.

The review comments are not unqualified, they provide specific details in regard to how and why underestimations arise and provide specific details in regard to the issues raised.

The reviewer notes that the comparative comments made are cognisant that there is a general range of potential emissions from such sites which arise primarily due to differing designs and the local climatic/ wind conditions. The core issue here is that the design of the site is relatively poor, the emissions are underestimated, and there are a range of other unresolved factors that can lead to a significant underprediction of impacts.

Upon consideration of the various specific issues raised there is no reasonable likelihood that the modelled impacts for the proposal would not underestimate impacts. This happens to be consistent with the reviewer's experience at other similar sites.

It is recommended that the issues be fully addressed; this will quantify the extent and significance of the total effects of the various underestimations.

Overall, the proposal does not provide a realistic assessment of the likely impacts or propose a suitable design consistent with good or best practice. Given the key shortcomings identified in this report, and the relatively close proximity of receptors, it is concluded that unacceptable impacts are likely to occur at the nearby receptors if this proposal is approved.

The reviewer's comments provide a strong case for site specific monitoring of both air quality and meteorology at the project site, which is what has been proposed by the proponent. In addition, the staged approach to approvals (100 000 tpa, 150 000 tpa and 200 000 tpa) provides ample opportunity for the impacts of the project to be clearly characterised, assessed and managed (if required) prior to scale up of the project to accept and process additional materials.

The key changes in project design include the full enclosure of all materials processing activities as requested by NSW EPA. An AQMP would be provided for the project prior to operation which would include a Trigger Action Response Plan to ensure that any off-site impacts are appropriately managed through the pro-active implementation of controls, or modification or cessation of activities. The use of site-specific air quality and meteorological monitoring to inform such a pro-active response is considered to represent best practice for operations of this nature.

Updated dispersion modelling has been performed which confirms that the project can be operated to not result in exceedances of the air quality criteria at all surrounding receptor locations.

The review comments do not support the case for approving the facility as presently proposed or conducting monitoring after the fact for a staged ramp-up in activity. The review indicates that there may be unacceptable impacts, (potentially even for activity rates close to the lowest first stage activity rate of 100,000 tpa). The proposal is not enclosed, and it is not commensurate with best practice especially in the context of the relatively close receptors and the other issues raised.

These issues need to be addressed before it might be reasonable to approve a staged ramp-up strategy, as for example it may be determined that the proposal, as presently designed, may be unacceptable with activity rates near to the minimum proposed activity rate.

It is agreed that the Project would benefit from site-specific meteorological and ambient air quality monitoring and the implementation of a Trigger Action Response Plan.

Please feel free to contact us if you would like to clarify any aspect of this letter.

Yours faithfully,
Todoroski Air Sciences

References

Northstar Air Quality (2020a)

"Kariong Sand and Soil Supplies – Proposed Development Air Quality Impact Assessment", prepared for Jackson Environment & Planning Pty Ltd by Northstar Air Quality, June 2020.

Northstar Air Quality (2020b)

"Kariong Sand and Soil Supplies – Air Quality Assessment – RTS", prepared for Jackson Environment & Planning Pty Ltd by Northstar Air Quality, December 2020.

Todoroski Air Sciences (2020)

"Peer Review of Kariong Sand and Soil Supplies Air Quality Impact Assessment", prepared for Todoroski Air Sciences, September2020.

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