12 March 2021

Matthew Sprott
Director Resource Assessment
NSW Department of Planning, Industry and Environment
12 Darcy St
Parramatta, NSW, 2124

Re: Luddenham Quarry Modification 5: Response to request for additional information

Dear Matthew,

1 Introduction

The letter provides a response to the NSW Department of Planning, Industry and Environment (DPIE)'s letter dated 10 February 2012 requesting additional information in response to matters raised in advice from government agencies in relation to *Luddenham Quarry Modification 5* Submissions Report (EMM 2020a) (the 'MOD 5 Submissions Report'). The letter also provides a response to matters raised by DPIE including a record of stakeholder engagement carried out since the provision of the MOD 5 Submissions Report to DPIE.

2 Responses to agency advice

This letter provides a summary of each matter raised by the following agencies followed by a response:

- DPIE;
- Environment Protection Authority (EPA);
- Liverpool City Council (LCC);
- Transport for NSW (TfNSW);
- Western Sydney Planning Partnership;
- Environment, Energy and Science (EES);
- Western Sydney Airport (WSA); and
- Department of Infrastructure, Transport, Regional Development and Communication (DITRDC).

Responses to advice from Rural Fire Service; Mining, Exploration and Geosciences (MEG); and Heritage NSW (Aboriginal) are not required, as these agencies either provided no comments or stated that they had nothing further to raise, subject to certain conditions being imposed on any development consent, should it be granted.

2.1 Department of Planning, Industry and Environment

2.1.1 Land use context

The additional information requested needs to recognise that the land use context for the current application differs to that which applied at the time of the original Luddenham Quarry development application, and that the surrounding area is transitioning from a rural-residential fringe area to a more intensively developed employment hub. This context is reflected in the additional comments, particularly those relating to noise and air quality impacts and rehabilitation.

The modification application primary seeks to change the site access arrangements but would not change the fundamental nature of the quarry operations. The quarry has operated for more than ten years and will remain compatible with the existing rural residential and agricultural land uses to 2024.

We acknowledge that the future land use context for the quarry has changed since the quarry was originally approved. Quarry operations are approved to continue to 2024. During this time, the dominant change to the surrounding area will be the ongoing construction of the WSA.

Chapter 3 of the Modification Report (EMM 2020b) contained a detailed consideration of the then Draft Western Sydney Aerotropolis Plan (WSPP 2019) and the modification's compatibility with this plan and proposed agribusiness zoning. As described in Section 2.4 of the finalised Aerotropolis Plan (WSPP 2020a), land uses and urban forms will evolve as the Aerotropolis changes. Land uses, buildings and structures will change from short- to medium-term uses to longer-term advanced and creative industry uses. The Aerotropolis Plan acknowledges that new enabling industries such as building materials production, to facilitate construction of the Aerotropolis, may be permitted subject to interface mitigation treatments and an ability for the site to transition to higher order uses compatible with airport operations over time.

The continued operation of the quarry represents an existing "enabling" industry providing an economic basis on which the site can be developed to provide innovative resource recovery solutions in the medium- to long-term, and long-term commercial/industrial uses following rehabilitation (refer Section 2.1.3 for further discussion on rehabilitation).

The draft Aerotropolis Precinct Plan (WSPP 2020b) *Section 2.2 Place-based opportunities and constraints* also recognises the need to allow existing quarries and extractive industries to continue to operate.

The environmental assessments carried out as part of the modification application have considered this changing land use context, most notably the Air Quality Impact Assessment (EMM 2020d) which included the construction of the WSA in the cumulative assessment; and the Noise Impact Assessment (EMM 2020e) which highlighted the need to consider the changing land use in the vicinity of the of the quarry in developing appropriate noise assessment criteria for MOD 5.

2.1.2 Impacts to residential receptors

The EPA recommends that reasonable and feasible noise and air quality mitigation measures be implemented to reduce impacts to sensitive residential receptors. In this regard and with reference to clause 12A of the State Environmental Planning Policy (Mining, Petroleum, and Extractive Industries) 2007, the Department requires that appropriate mitigation measures be provided to ensure the objectives included in the Department's Voluntary Land Acquisition and Mitigation Policy 2018 are met to protect human health, preserve amenity and control intrusive noise. You should advise of any negotiated agreements established with the potentially impacted nearby landowners with existing use rights.

As discussed in Section 2.2.1, the noise amenity area receiver categorisation for the quarry and neighbouring land is industrial due to the relevant zoning being Agribusiness, a type of industrial land zoning. Accordingly, as outlined in the Modification Report, the industrial amenity criterion of 65 dB $L_{Aeq,period}$ applies to the quarry. Legal advice has been received which confirms this approach (refer Appendix A).

Notwithstanding, it is also noted that reactivated quarry operations will also comply with the application of the suburban amenity noise levels as recommended in the EPA advice on the MOD 5 Submissions Report, ie Noise Policy for Industry (NPfI) amenity noise levels for "hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks" (NPfI 2017) +5 dB, which would result in a noise criteria of $L_{Aeq,period}$ 60 dB for residences during the daytime period, which is the only relevant period of operations for the quarry.

MOD 5 quarrying operations satisfy the amenity targets as recommended in the EPA's advice for existing residential assessment locations for all assessment locations including existing residential dwellings. Accordingly, the Voluntary Land Acquisition and Mitigation Policy 2018 (VLAMP) will not be triggered by MOD 5.

The MOD 5 Noise and Vibration Impact Assessment (EMM 2020e) considered reasonable and feasible noise mitigation measures noting that the quarry is an approved operation. These measures include the existing site earth bunds to the west and north of the quarry footprint and stockpiling area for noise abatement and locating the quarry crushing/processing operations to maximise distance separation and acoustic shielding. The extended stockpile area proposed as part of MOD 5 has been sited to be within these noise bunds.

The proposed modification would primarily change the site access, bringing road trucks closer to R3 and R6 with no increase in the consented quarry life. In particular, the access road will be sealed reducing noise levels from trucks compared to an unsealed access road. We believe that all reasonable and feasible noise mitigation measures have been applied to the remaining quarry activities, in particular to the activities subject to the proposed modification.

Similarly, the Air Quality Impact Assessment (EMM 2020d) considered reasonable and feasible air quality mitigation measures. These measures are documented in Section 7.1 of (EMM 2020d) and include sealing of the access road between Adams Road and the weighbridge, operation of a water cart and a site-wide vehicle speed limit of 20 kilometres per hour (kph) on unsealed roads and 40 kph on the sealed site access road. We believe that all reasonable and feasible air quality mitigation measures have been applied to the remaining quarry activities, in particular to those subject to the proposed modification.

2.1.3 Quarry rehabilitation

The Department also shares the WSAA's concerns about the proposed approach to the rehabilitation of the quarry, including the lack of a firm commitment around how the quarry void will be backfilled and the timing of these activities. It is requested that you review this approach, particularly given the proximity to and timing of the Western Sydney Airport operational phase and your stated intent to redevelop the site in line with its intended use as part of the Agribusiness precinct.

The principal objective of MOD 5 is to provide a new approved access for quarry from Adams Road as the previously approved access route on Commonwealth land is within the WSA development footprint. Importantly, MOD 5 does not increase the size of the quarry void footprint, production rate or the quarry life.

As noted in Section 4.1.1 of the Submissions Report there is currently no approval to infill the quarry void. When the original DA and EIS were lodged in 2003, that original proposal envisaged that the void would be filled with inert waste. However, because it was recognised that there was a significant time gap between commencement of quarrying and commencement of rehabilitation by filling, the original proposal proposed that a separate application would be lodged for the infilling and rehabilitation closer to the time when it was to be undertaken. The development consent issued by the Minister and the Department's Assessment Report in 2004 recognised that the approval of the extraction did not resolve the long-term rehabilitation. Hence the development consent proposed a stop-gap measure in conditions 33 and 36. Condition 33 provides for the preparation of a Site Rehabilitation Plan, which was undertaken in 2009 and provides for battering and treatment of the slopes of the final void, while Condition 36 required a report on final land use and treatment

of the final void. In essence, these provisions address the situation where there was no subsequent application to the fill the void.

CPG and KLF are committed to filling the quarry void as expeditiously as possible following the extraction of a regionally significant resource to allow the site to be put to a long term use consistent with the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (the Aerotropolis SEPP)'s zoning of the subject property. It is acknowledged, that a disused quarry void will sterilise over 50% of the subject property from productive land use aligned with the Aerotropolis SEPP and would constitute a potential risk to the operation of the airport.

CPG and KLF intend to lodge a future modification application to modify the quarry consent to allow infilling of the quarry void with construction and demolition waste as envisaged by the original environmental impact assessment. As outlined in Section 4.1.2 of the Submissions Report, pending approval of this future modification application, infilling activities (including installation of an appropriate liner and a leachate collection system) will commence following completion of extraction in December 2024. The rate of filling is unknown at this stage and will be dependent on market forces and the demand for resource recovery as the Aerotropolis develops. It is anticipated, however that the void could take in the order of 15 years to fill subject to market conditions.

CPG and KLF's commitment to fill the quarry void may be further evidenced through their investment in developing a concept master plan for the final agribusiness land use of the subject property (refer Figure 2.1) and commissioning of a concept design and filling strategy (CDFS) (InSitu 2020). Preliminary environmental assessment of infilling activities has also been carried out to inform the cumulative air quality impact assessment for the proposed Advanced Resource Recovery Centre (ARRC) (SSD-9505).

Figure 2.1 Concept master plan of final land use

2.1.4 Stakeholder consultation

Please also include a record of any further stakeholder engagement undertaken since the provision of the Submissions Report or any formal agreements reached with third parties which assist with addressing the identified residual issues.

Stakeholders consulted since the provision of the MOD 5 Submissions Report to DPIE are summarised in Table 2.1.

Table 2.1 Stakeholder consultation

Stakeholder	Consultation method	Outcome
DPIE	Meeting held 4 March 2021 with the DPIE Resource and Industry Assessment Teams	Meeting to discuss the information required to allow assessment of MOD5.
LCC	Email correspondence and meetings 18 December 2020 and 10 February 2021	Meetings to discuss scope of MOD 5 road upgrades required to facilitate the lifting of the existing Adams Road load limit. Refer Section 2.3.
TfNSW	Email correspondence and meeting held 12 February 2021.	Meeting to discuss proposed MOD 5 road upgrades and ARRC road upgrades - particularly with respect to the Elizabeth Drive/Adams Road intersection. Refer Section 2.4.
WSA	Email correspondence and meetings held 18 January 2021 and 19 February 2021.	Meeting discussed the MOD 5 application, the ARRC and quarry infilling, including the status of the applications, traffic, aircraft safety, air quality and site rehabilitation.
DITRDC	Meeting held 19 February 2021	Meeting with WSA and applicants to discuss the MOD 5 application, the ARRC and quarry infilling, including the status of the applications, traffic, air quality, aircraft safety and site rehabilitation.
Air Services Australia	Meeting held 17 December 2020 and email correspondence	Meeting and email correspondence regarding the ARRC development.
Resources Regulator	Email correspondence	Consultation to progress the mining lease application.
Property owner of R3	Email and phone message	Attempts have been made to re-engage with the property owner of R3 since the provision of the Modification Report to DPIE. To date attempts have been unsuccessful.
Property owner of R6	Email and phone consultation	Consultation with the property owner of R6 has been carried out since the provision of the Modification Report to DPIE. This consultation was aimed at progressing a negotiated agreement. This property owner declined to enter into discussions. It is noted VLAMP will not be triggered by MOD 5.

2.2 Environment Protection Authority

2.2.1 Noise

The EPA does not accept the Proponent's assertion that the existing residential dwellings with existing land-use rights that surround the proposed development would constitute a circumstance where the 'isolated residences in an industrial zone' provisions within the NPfI would apply. This provision was framed around existing legacy type situations and was not a measure that was contemplated to remove residential amenity rights because of a recent land rezoning. The proposal should be assessed against the applicable residential project noise triggers levels (PNTLs) derived in accordance with the NPfI. When assessed against the PNTLs presented in the Noise Impact Assessment (NIA), the impacts expected at nearby residential receivers exceed those that EPA would normally consider allowing under an environment protection licence. Feasible and reasonable noise mitigation measures have not been considered in the NIA due to the Proponent's assertions that the existing residences should be treated as industrial receivers.

The EPA asks that DPIE:

- Consider the Proponent's assertion that the existing residences should not be treated as residential receivers due to the rezoning embedded in the ASEPP. The DPIE's attention should be directed to the fact that the ASEPP permits home occupations and workers dwellings. These types of receivers, if realised, would attract an assessment against the amenity levels in the NPfI for "Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks". Given the changing nature of land use patterns that would be promoted by the ASEPP, the EPA would accept a base residential zoning of suburban + 5dB to inform the amenity levels for these types of uses. The EPA contends that this approach should at least be afforded to existing residences with existing land-use rights given that the market forces that will ultimately transform the land uses in the area will take significant time. This approach would assist in resolving potential temporal land use conflicts promoted by the rezoning.
- Clarify if the ASEPP is a relevant planning consideration, as suggested by the Proponent, and whether the proposed use is permissible under the ASEPP.
- The EPA recommends the Proponent:
  - Consider feasible and reasonable noise mitigation measures with the aim of reducing noise impacts to existing residences near the proposal / premises.

i Noise criteria

As noted in Section 2.1.2, the noise amenity area receiver categorisation for the quarry and neighbouring land is industrial due to the relevant zoning being Agribusiness, a type of industrial land zoning. Accordingly, as outlined in the Modification Report, the industrial amenity criterion of 65 dB $L_{Aeq,period}$ applies to the quarry. Legal advice has been received which confirms this approach (refer Appendix A).

Notwithstanding, it is also noted that reactivated quarry operations will also comply with the application of the suburban amenity noise levels as recommended in the EPA's advice on the MOD 5 Submissions Report. Suburban amenity levels would result in a noise criteria of $L_{Aeq,period}$ 60 dB for residences during the daytime period.

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, the project amenity noise level for a new industrial development is typically the recommended amenity noise level (outlined in Table 2.2 of the NPfI) minus 5 dB. This approach is based on a receiver being impacted by multiple industrial sites (or noise sources). However, in accordance with the NPfI (Section 2.4) cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the period of quarrying (ie to 2024). As the site is the only industry impacting the assessment locations, the relevant amenity noise level was assigned as the project amenity noise level for the development.

The daytime period industrial amenity noise level would equate to $L_{Aeq,15min}$ of 68 dB and the suburban amenity noise level would equate to $L_{Aeq,15min}$ of 63 dB in accordance with the NPfI. The predicted noise levels at assessment locations with reference to industrial and suburban amenity levels are presented in Table 2.2.

Table 2.2 Predicted operational noise levels – ISO9613

Assessment location	Classification	Period	**Industrial Amenity target** dB $L_{Aeq,15min}$	**Suburban Amenity target, dB** $L_{Aeq,15min}$	**Site noise level, dB** $L_{Aeq,15min}$ Predicted future [calculated existing]	**Compliance**
R1	Residential	Day	68	63	41 [36]	Yes
R2	Residential	Day	68	63	43 [38]	Yes
R3	Residential	Day	68	63	53 [48]	Yes
R4	Residential	Day	68	63	46 [41]	Yes
R5	Residential	Day	68	63	45 [40]	Yes
R6	Residential	Day	68	63	52 [47]	Yes
R7	Residential	Day	68	63	41 [36]	Yes
R8	Residential	Day	68	63	41 [36]	Yes
AR1	Active recreation	When in use	58	58	49 [44]	Yes
C1	Commercial	When in use	68	68	51 [46]	Yes

Calculated levels from previous quarry operations are in brackets [] based on MOD5 predictions and previous schedule of plant 5dB lower.

A review of Table 2.2 with industrial and suburban amenity target levels confirms the day operation of the MOD 5 quarrying operations satisfy the respective industrial and suburban amenity targets for existing residential assessment locations for all assessment locations.

ii Application of the Aerotropolis State Environmental Planning Policy

We understand that EPA's comment regarding the permissibility of the proposed modification under the Aerotropolis State Environmental Planning Policy (ASEPP) is directed to the Department of Planning, Industry and Environment (DPIE).

iii Feasible and reasonable noise mitigation measures

Feasible and reasonable noise mitigation measures were considered as part of the noise impact assessment noting that the quarry is an approved operation. These measures include the existing site earth bunds for noise abatement and locating the quarry crushing/processing within these earth bunds to maximise acoustic shielding.

As described above, the modelling predicts that noise levels from quarry operations satisfy the suburban and industrial amenity targets. We believe that all reasonable noise mitigation measures have been applied to the proposed modification that will allow quarrying operations to continue to the end of the approved period (December 2024) and no additional mitigation is required for daytime quarry operations.

2.2.2 Air quality

i Worst case assessment

The Submissions Report states that additional assessment representative of the proposed peak daily truck movements has been undertaken. The updated results predict additional exceedances at the closest receptors to the boundary of the proposal.

Although some justification is provided to suggest that once the earthworks stages of the WSA are completed there will not be additional exceedances due to the proposal, it is noted that the cumulative assessment and updated results do not include the impacts from the proposed operations of the ARRC that will be located at the same premises. Hence this issue has been partially addressed.

The EPA recommends that the Proponent:

- Provide the predicted ground level concentrations for the scenario including peak daily truck movements, and source/premises contributions to predicted exceedances
- Provide the ground level concentrations for the revised modelling accounting for peak daily operations including accounting for the ARRC. This should include a contemporaneous assessment for the most impacted receptors (i.e. R3, R6, R1, C1).

The cumulative assessment of the quarry and the ARRC is discussed in Section 2.2.2iv including reference to air quality impacts on the WSA.

Air quality modelling provided in the MOD 5 Submission Report predicted that peak day quarry operations would result in one additional day over the impact assessment criterion for 24-hour average PM_{10} at assessment locations R3 and R6. As provided in the above box, EPA has requested that results for the peak day scenario are presented for all assessment locations and that source/premise contributions are identified. The predicted ground level PM_{10} and $PM_{2.5}$ concentrations for all assessment locations for the normal day and peak day scenarios are presented in Table 2.3 below.

Table 2.3 Predicted incremental and cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations

	Maximum 24-hour PM_{10} (µg/m³) (number of additional days above goal shown in brackets)					Max 24-hour $PM_{2.5}$ (µg/m³) (number of additional days above goal shown in brackets)				
	Increment		Background plus WSA[1]	Cumulative		Increment		Background plus WSA[1]	Cumulative	
	Normal day	Peak day		Normal day	Peak day	Normal day	Peak day		Normal day	Peak day
Criterion	-	-	-	**50**	**50**	-	-	-	**25**	**25**
R1	1.0	1.1	47.3	47.6	47.7	0.2	0.2	23.9	24.1	24.1
R2	2.2	2.4	47.3	47.7	47.8	0.5	0.5	23.9	24.0	24.0
R3	10.2	11.1	47.7	49.9	**50.1 (1)**	1.9	2.1	24.1	24.5	24.5
R4	3.2	3.5	47.7	48.3	48.3	0.7	0.7	24.1	24.1	24.1
R5	2.6	2.8	47.7	48.2	48.2	0.7	0.7	24.1	24.1	24.1
R6	5.5	6.0	47.7	50.0	**50.2 (1)**	1.4	1.6	24.1	24.4	24.5
R7	1.4	1.5	47.7	47.9	47.9	0.4	0.4	24.1	24.1	24.1
R8	1.2	1.3	47.3	47.5	47.5	0.3	0.3	23.9	23.9	23.9
C1	8.0	8.7	47.7	49.8	50.0	1.6	1.7	24.1	24.3	24.3
AR1	8.6	9.4	47.7	49.6	49.8	1.6	1.8	24.1	24.2	24.2

1. Background plus WSA' refers to the background on the day of the maximum cumulative prediction, which does not necessarily correspond to the day on which the maximum increment is predicted to occur. For example, at R3, the maximum normal day increment is 10.2 µg/m³ (on 31 July). However, on the day of the predicted maximum normal day cumulative (17 July), a 'Background plus WSA' contribution of 47.7 µg/m³ applies and a maximum normal day increment of 2.2 µg/m³ (not shown on table) so a maximum cumulative normal day concentration of 49.9 µg/m³ is predicted.

The background plus the contribution from bulk earthworks at the Western Sydney Airport (WSA) on the peak day are provided in Table 2.3.

The modelling predicts that there will be marginal exceedances (50.1 µg/m^3 for R3 and 50.2 µg/m^3 for R6) of the 24-hour average PM_{10} criterion on one day of the year. No exceedances of the 24-hour average $PM_{2.5}$ criterion are predicted.

The relative source contributions to PM_{10} concentrations at R3 and R6 on this peak day are shown in Figure 2.2.

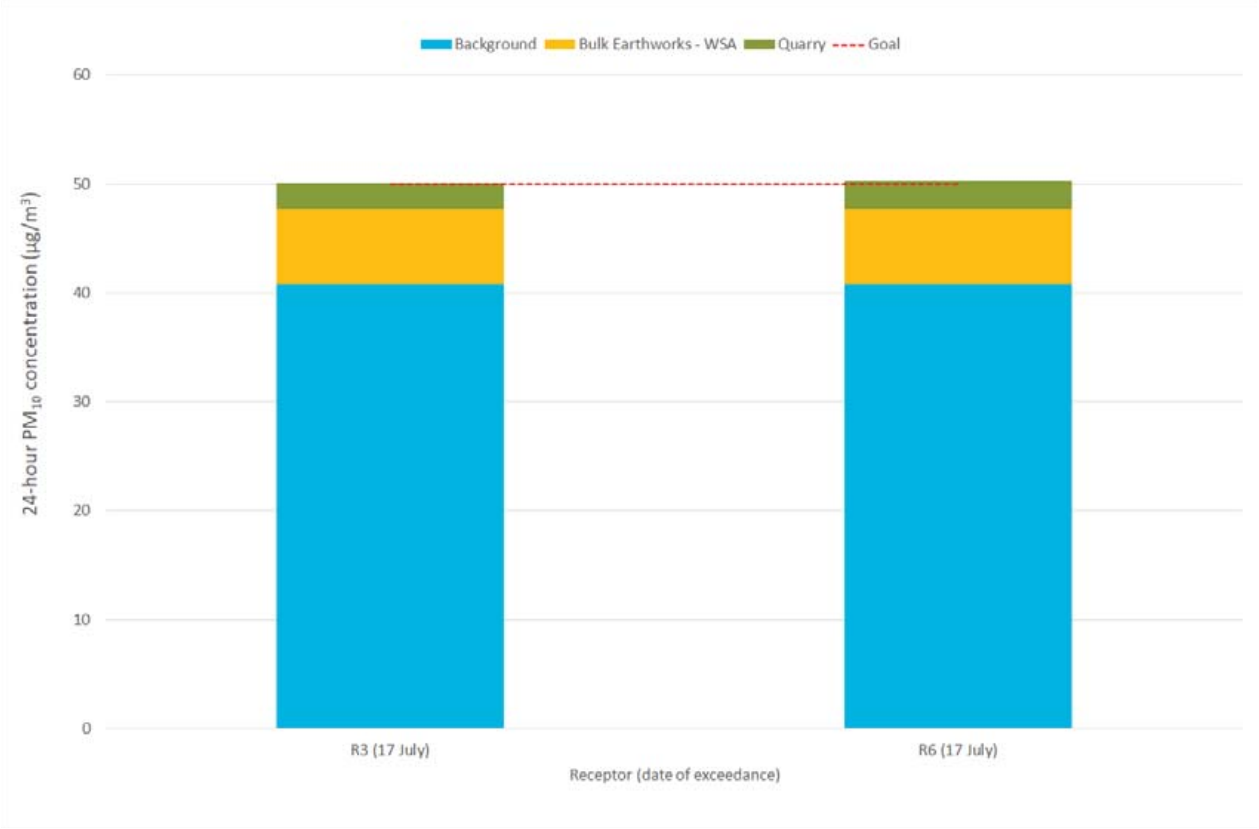


Figure 2.2 Contribution to exceedances for cumulative 24-hour PM_{10} concentration – peak day

The MOD 5 Submission Report (Section 4.4.1) assessed the likelihood of the exceedances at R3 and R6 occurring. It found that there as a very low chance this will occur. Further discussion is provided below.

The ARRC Air Quality Impact Assessment Addendum (ARRC AQIA Addendum) (EMM 2021) contained in Appendix B, provides a cumulative air quality assessment (quarry + WSA bulk earthworks + background). This added the maximum predicted 24-hour PM_{10} concentration for bulk earthworks (the worst possible day) to every day of the background dataset before being combined with the quarry increment. For the exceedances to occur at R3 and R6, the quarry peak day would have to occur on the same day as the highest predicted impact from WSA bulk earthworks (6.9 µg/m^3), while also coinciding with a high background day.

The construction schedule for the WSA indicates that 'early earthworks' are already completed, with the next phase of bulk earthworks completed by Q3 2021 and the final phase completed by Q3 2022. The WSA AQIA (PEL 2016) reports that emissions for bulk earthworks were estimated based on the total material for earthworks and acknowledges that not all this material would be handled in one year but rather in stages over several years.

However, to provide a worst-case scenario it was assumed for modelling that all material would be handled in one year. Therefore, the bulk earthworks scenario presented in PEL (2016) is an unrealistic scenario (rather than worst case) as it assumes that approximately 3 years' worth of earthworks would occur in a single year.

The bulk earthworks contribution to 24-hour PM_{10} concentrations should therefore be significantly less than 6.9 µg/m^3. Even reducing the assumed WSA bulk earthworks contribution by 0.2 µg/m^3 would reduce the cumulative 24-hour PM_{10} concentrations so even if the peak contributions occurred on a high background day (as discussed above above), the 24-hour PM_{10} criterion would be predicted to be met on all days of the year.

Further, from Q3 2022 onwards, the construction would focus on airport infrastructure and the predicted maximum daily increment is approximately half that of bulk earthworks (3.7 µg/m^3) at the Hubertus Club. It is noted that the same unrealistic assumption is applied in PEL (2016) for airport infrastructure (ie all material handling occurs in one year).

In summary, although the peak day scenario predicts one additional day marginally over the impact assessment criterion for 24-hour average PM_{10} at assessment locations R3 and R6, the likelihood of this eventuating is minimal, because:

- it is unlikely that a peak day scenario for product transportation would correspond with the same day as the maximum increment from the WSA construction and on a day when background concentrations are already elevated;
- the maximum predicted increment from the WSA construction has been significantly overestimated in PEL (2016) by assuming all bulk earthworks would occur in a single year; and
- there would be a small number of days in the year when the peak day scenario for product transportation would occur.

ii Best practice

The Proponent's assessment has not demonstrated that all proactive mitigation measures to manage predicted exceedances have been considered.

Whilst the proposed measures could be considered best practice, it is not clear if additional measures (including other mitigation measures) have been considered. It is unclear if any consideration has been given to a revised site layout (i.e. changing the location of the sources) and design (e.g. sealing roads). These changes are likely to help reduce the predicted impacts at the assessed receptors, including those receptors along the access road where the largest increments are predicted.

The EPA recommends that the Proponent:

Assess additional control strategies that could be implemented to manage predicted exceedances, this should include consideration of:

a. Revision of the site layout and location of sources contributing to any exceedances

b. Sealing of unsealed haul roads

The EPA note that although the proposed measures could be considered best practice, they recommend that additional dust mitigation measures should be considered to manage predicted exceedances, including revisions of the site layout and sealing of unsealed haul roads.

As discussed above, although an exceedance for the peak day scenario is predicted on one day of the year, it is unlikely that this exceedance will occur.

Therefore, revisions to the site layout and/or sealing of unsealed haul roads are not considered reasonable further mitigation measures. It is noted that the application is for a modification to an approved quarry. The modification does not seek to modify the site layout other than as required to access the quarry from Adams Road. There are no other options to access the site. As part of the proposed modification, the site access road will be sealed (to the weighbridge).

In summary, the quarry can continue to operate with minimal risk of air quality exceedances without revisions to the site layout and sealing of unsealed haul roads.

iii Reactive management

The Proponent's assessment has not sufficiently assessed how proposed reactive management measures could manage the predicted large increment and exceedances.

Further, the EPA considers that the Submissions Report does not provide a detailed analysis to demonstrate how these mitigation measures in a) and b) above can avoid the predicted additional exceedances. A project related source apportionment or source contribution analysis can be used to:

- help understand what sources (activities) are driving the predicted exceedances,
- demonstrate that proposed increase in the levels of wet suppression can mitigate the emissions from the source (activities) contributing to additional exceedances, and
- demonstrate that operational changes based on meteorological conditions can reduce the emissions from source(s) driving the additional exceedances.

Lastly, the estimated emissions inventory assumed an "ongoing" 50% level of control (i.e. watering) for crushing and screening activities. This means that watering must be undertaken when these activities are being carried out and not "as required" as stated in the Submissions Report.

The EPA recommends that the Proponent:

Demonstrates that any proposed reactive management strategies are sufficient to manage predicted exceedances. Consideration should be given to:

a. The analysis of those sources contributing/driving the additional exceedances and the effect of the proposed reactive management strategies

b. Demonstrating that operational changes based on meteorological conditions are sufficient to reduce the emissions from source(s) driving the additional exceedances

c. Parameters that affect the emissions from the most significant sources contributing to additional exceedances

Although exceedances for the peak day scenario are unlikely, reactive dust management would be implemented to minimise dust emissions and prevent potential exceedances.

Reactive dust management for a small site such as the quarry is straightforward based on ongoing visual monitoring during operations and daily inspections of the site by the quarry manager. The visual monitoring and daily inspections would include the following:

- inspection of the sealed access road for high silt loading;
- observation and reporting on excessive dust being generated at source (wheel generated dust, excavators, wind erosion) – by assessing the level dust rises off the ground surface;
- observation and reporting on water cart activity and effectiveness; and
- observation and reporting of any visible dust leaving the site.

A Dust Inspection Checklist will be used to maintain a record of compliance and effectiveness of controls. Non-conformance (excessive dust at source or dust leaving the site) would trigger reactive response as follows:

- if paved road silt loading is high and wheel generated dust is above the wheel arches then the road would be cleaned using a street sweeper or water cart;
- if wheel generated dust is above the wheel arches on unsealed roads the application rate of water would be increased; and
- if excessive dust is being generated by excavators or loaders, the water cart would be deployed to dampen material being handled or activity ceased if necessary.

The advantage of this approach is to control the dust at its source before it leaves the site and contributes to off-site exceedances. In addition to the implementation of daily reactive dust management, planning for adverse weather conditions will allow preparatory measures to be put in place such as:

- have surfaces moist prior to the on-set of hot and windy conditions;
- plan for additional water spraying;
- cease certain activities or reduce activity levels;
- re-schedule deliveries or product dispatch; and
- schedule maintenance for plant and equipment to reduce dust generating activities.

Full details on reactive management and preparatory measures will be outlined in the Air Quality Management Plan.

iv Cumulative assessment with Advanced Resource Recovery Centre

Since operations for both the quarry and the ARRC will occur concurrently and will take place within the same premises, The EPA still considers that the assessment should include an assessment of potential cumulative impacts from the two operations.

The EPA recommends that the Proponent:

a) Provides additional information to include the potential cumulative impacts from the concurrent operation of the proposed quarry and the ARRC. If the ARRC is expected to operate at a reduce capacity whilst the quarry is still operational, a modelling scenario reflective of the expected processing rates should be included.

The reactivation of the quarry is independent of approval of the ARRC and therefore should be considered independently of the ARRC. Notwithstanding, it is noted that the cumulative impacts associated with the concurrent operation of MOD 5 and the operation of the ARRC were considered in the ARRC AQIA prepared by EMM (2020f) as part of the environmental impact statement for the ARRC (ARRC EIS). EPA has reviewed and provided comment on this report.

Since the submission of the ARRC EIS, there have been refinements to the operational assumptions for the site, primarily in relation to truck movements and proposed equipment operating within the ARRC. Accordingly an ARRC Addendum AQIA (EMM 2021) has been prepared and will be submitted to DPIE with the ARRC Submissions Report in early 2021. This ARRC Addendum AQIA is appended as Appendix B of this letter.

The ARRC Addendum AQIA included an assessment of the following cumulative scenarios:

- Cumulative scenario 1: ARRC operations + quarry extraction + background + construction of WSA;
- Cumulative scenario 2: ARRC operations + background + operation of WSA; and
- Cumulative scenario 3: ARRC operations + background + operation of WSA + quarry infilling.

There are no exceedances of the impact assessment criterion for annual average PM_{10} for all cumulative scenarios. For all cumulative assessment scenarios, there is an exceedance of the impact assessment criterion for annual average $PM_{2.5}$ at R3 (8.6 µg/m³ for Scenario 1, 8.3 µg/m³ for Scenario 2 and 8.5 µg/m³ for Scenario 3).

For 24-hour PM_{10} concentrations, there are additional days over the impact assessment criterion for Scenario 1 at R3 (three additional days) and no additional days over the impact assessment criteria for Scenario 2 or

Scenario 3 (with quarry infilling). For 24-hour $PM_{2.5}$ concentrations, there are two additional days over the impact assessment criterion for all scenarios at R3.

There are no exceedances of the impact assessment criterion for annual average TSP or annual average dust deposition for any cumulative scenario.

It is noted that R3 is currently vacant and the property owner intends to develop the property for commercial purposes in line with the recent rezoning to Agribusiness under the Aerotropolis SEPP. There are no predicted exceedances at other assessment locations for MOD 5.

2.2.3 Surface water

The Submissions Response did not provide any details of the sampling depth. Water quality within the Water Management Dam and the Quarry Pit could change with depth. Salt or thermal stratification could occur within the storages where lack of mixing at depth reduces oxygen concentrations and increases the likelihood of the release nutrients and metals previously bound to sediment when disturbed.

The water quality results outlined above indicate the potential for non-trivial harm to receiving waters if discharged from the Quarry Pit and Water Management Dam. If the Proponent seeks to discharge the water from either storage, a Discharge Characterisation and Water Pollution Impact Assessment will be required. This would include additional water quality monitoring to address the water quality risks associated with potential stratification within the Quarry Pit.

The Submissions Response indicates the applicant is in discussion with the adjoining neighbour WSA to pump the existing water within the Quarry Pit to a dam at WSA. This water would be reused for dust suppression. EPA notes that the operators of the WSA site would need to ensure that the water is of a suitable quality for the end use and that potential water pollution risks are appropriately managed. The Proponent has not confirmed that WSA will be able to accept the Quarry Pit water.

There are no details for the disposal for the accumulated water within the Water Management Dam.

i Revised water balance

Due to the prolonged wet weather associated with the current La Nina, WSA has not required the water that has accumulated in the quarry void for dust suppression for WSA construction work as envisaged in the MOD 5 Submissions Report. This situation is unlikely to change in the short term. Discussions are ongoing with WSA with the view of providing WSA water in the future during quarry operations.

Further discussions have been carried out with the future quarry operator who has confirmed they are able to recommence extraction operations leaving the water in situ, noting the water has accumulated in areas of the quarry pit which have already been fully extracted. The water in the pit will be used for dust suppression and will mitigate the shortfall in dust suppression water (13.4 ML in a dry rainfall year) identified in the water balance presented in the MOD 5 Submissions Report which assumed the pit would be dewatered prior to recommencement of operations (refer Section 4.4.3(ii) of the MOD 5 Submissions Report).

To account for the significant change in assumptions informing the water balance (ie the void will not be dewatered prior to quarry operations restarting), the water balance has been updated to include the following:

- changes to the pumping rules from the quarry pit to the water management dam to maintain a minimum of 1.5 ML in the dam (equivalent to the minimum design volume required for the water management dam and the sediment zone volume for the quarry pit determined in Section 4.5 of the MOD 5 Surface Water Assessment (EMM 2020g));

- initial storage of 45 ML of water within the quarry pit based on site observations, LiDAR data and depth measurements on site; and
- a change in water management strategy to allow storage of water within the quarry pit below 45 m AHD.

The distribution of water across the site, estimated by the revised water balance model for typical dry (10th percentile), median (50th percentile) and wet (90th percentile) rainfall years, is presented in Figure 2.3, Figure 2.4 and Figure 2.5 respectively.

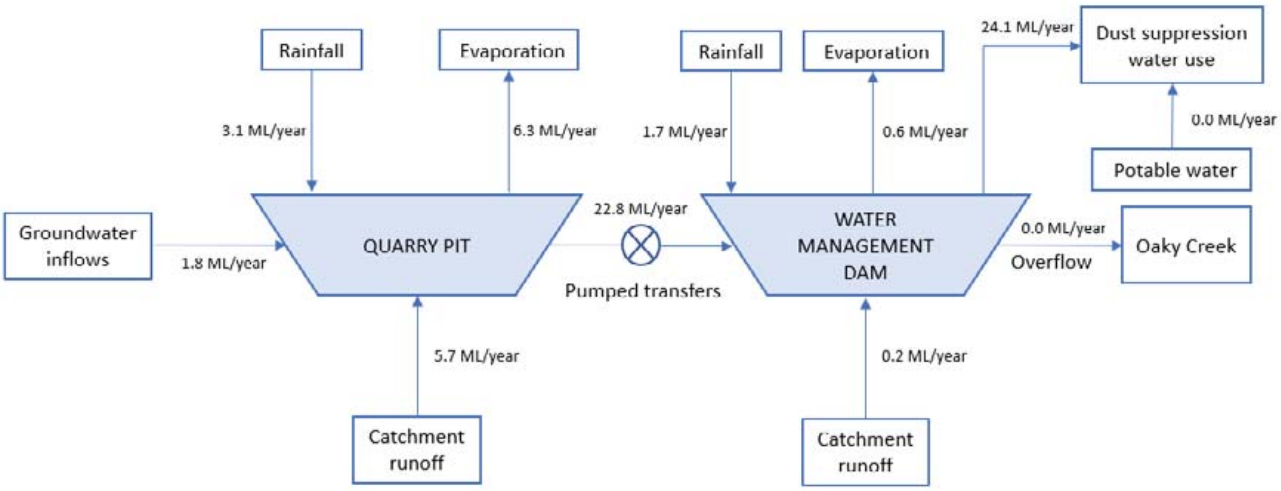


Figure 2.3 Revised water balance results – typical dry rainfall year

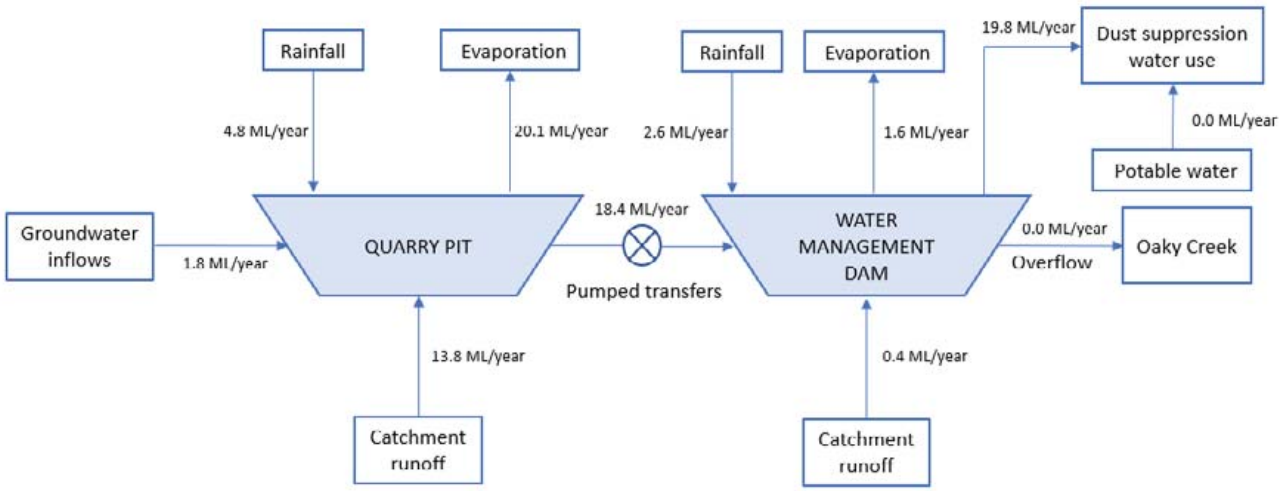


Figure 2.4 Revised water balance results – typical median rainfall year

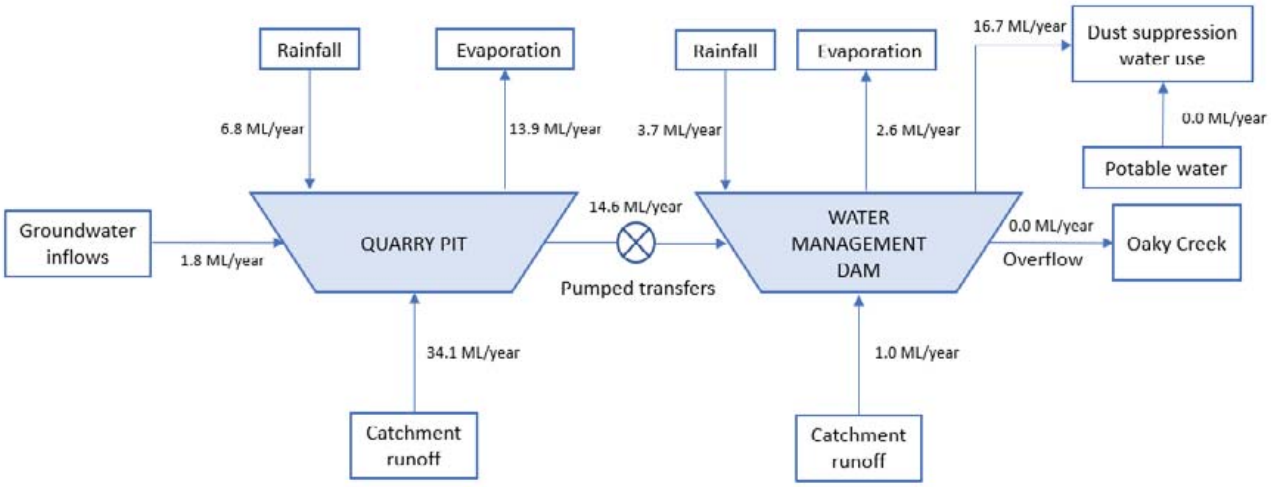


Figure 2.5 Revised water balance results – typical wet rainfall year

Table 2.4 provides a summary of the overall inputs and outputs of the water management system for a typical dry (10th percentile), median (50th percentile) and wet (90th percentile) rainfall year.

The revised water balance results indicate that 100% of the demand for dust suppression can be supplied by harvested catchment runoff and the water currently stored within the quarry pit. No potable water use was modelled to be required in the revised water balance. The change in water management strategy to allow the storage of water within the quarry pit below 45 m AHD also resulted in a reduction in overflow frequency and volume predicted by the revised water balance.

Table 2.4 Summary of revised annual water balance results

	Typical dry rainfall year	Typical median rainfall year	Typical wet rainfall year
	ML/year	ML/year	ML/year
INPUTS			
Rainfall and runoff	10.7	21.6	45.6
Groundwater inflows into quarry pit	1.8	1.8	1.8
Potable water supply	0.0	0.0	0.0
Total inputs	12.5	23.4	47.4
OUTPUTS			
Evaporation	6.9	21.7	16.5
Dust suppression	24.1	19.8	16.7
Discharge to Oaky Creek	0.0	0.0	0.0
Total outputs	31.0	41.5	33.2

Overflows of the water management dam were predicted to occur on less than 1% of the days modelled over the 131 year historical rainfall record simulated. The maximum discharged predicted by the water balance was 3.6 ML/day. Overflows will typically occur intermittently over several days during wet weather periods when there are several days of material rainfall. Overflow discharges to Oaky Creek will occur via the water management dam spillway when the dam is full (noting that saline water will not be pumped from the void to the water management dam). On average, overflow events were predicted to occur less than once per year, which is consistent with the requirements of *Managing Urban Stormwater Volume 2E Mines and Quarries* (DECC 2008). Overflows are expected to cease shortly after the wet weather conditions end and runoff subsides. Importantly, overflows are only expected to occur when streamflow in receiving watercourses is naturally elevated.

Should there be any future plans to discharge, a surface water characterisation in consultation with the EPA will be carried out.

ii Irrigation

It should be noted that irrigation is currently approved under the existing planning consent in accordance with the irrigation management plan (EPIC Mining 2015). This management plan will be revised as required by the consent within 3 months of the approval of MOD 5.

iii Site water characterisation

Notwithstanding the high unlikelihood of overflows (refer Section 2.2.3i above), additional water sampling and field measurements have been carried out to further characterise the water within the quarry void, water management dam and Oaky Creek. This has included measuring the electrical conductivity (EC) at various depths in the water) in the quarry pit (ie EC profiling) to determine if EC stratification is occurring.

a EC profiling

EC profiling of the quarry pit was undertaken by using a pressure-transducer logger to measure water depth, temperature and EC. The logger was deployed to target the deepest area of the pit by anchoring rope lines on the northern and eastern side of the pit. The logger was moved into position near the target location, then allowed to drop to the pit floor and rest for a few minutes before being retrieved. This was repeated multiple times to receive a series of data points with depth, temperature and EC.

Measurements from all tests are shown in Figure 2.6. The deepest measurement was at 5.1 m where EC was ranged between 6,500 and 6,650 µS/cm. EC closer to the water surface tended to be slightly higher but in a similar range, between 6,550 and 6,950 µS/cm.

The results of the EC profiling indicate that there is no evidence that EC increases with water depth in the pit void. Conversely, the results suggest EC levels are slightly higher closer to the surface (ie within the first metre of water).

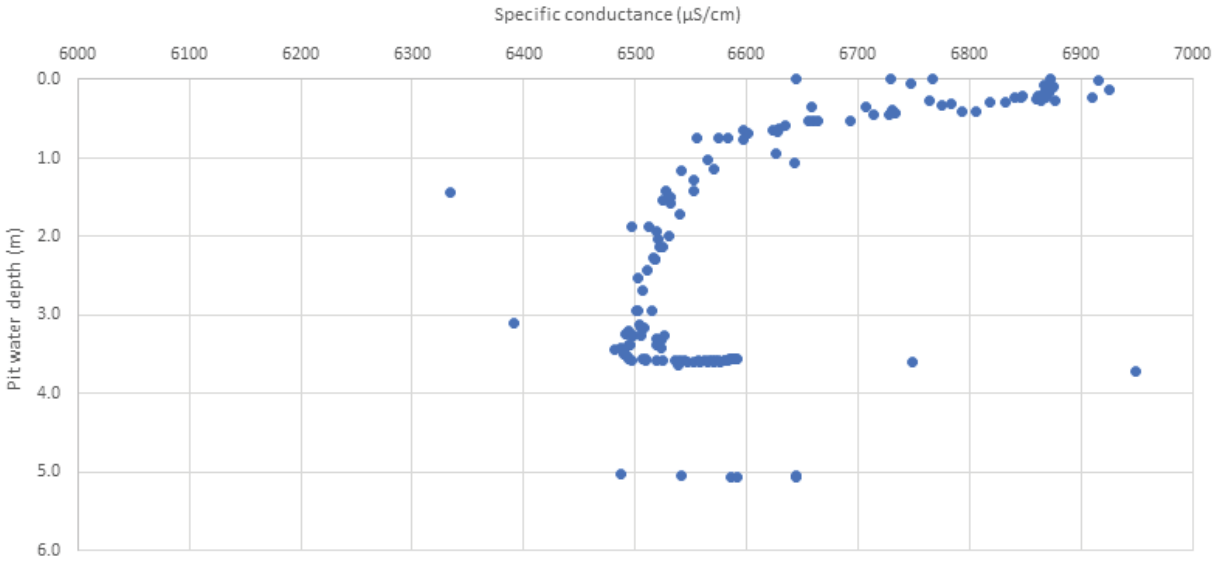


Figure 2.6 EC with reference to pit depth

b Surface water sampling

Further surface water sampling was conducted on the 12 February 2021. The laboratory analysis of the water sampling is contained in Appendix C. The results of the water quality analysis from the pit water and water management dam were generally comparable to the previous sampling carried out in October 2020 which was reported in the MOD 5 Submissions Report. EC levels were comparable however nitrate concentrations have decreased since the October sampling event.

Water quality in Oaky Creek was generally poorer compared to the October sampling event. Water in the quarry void and water management dam generally had lower turbidity and metals concentrations compared to Oaky Creek water but had elevated EC and nitrate concentrations compared to Oaky Creek.

2.3 Liverpool City Council

2.3.1 Adams Road upgrades

The Modification requires access off Adams Road, which currently has a load limit. Hence road upgrade is required. The Applicant is discussing with Council its requirements for the access arrangement and associated road upgrade.

As discussed in Section 4.10.1(i) of the MOD 5 Submissions Report a Pavement Investigation (Durkin 2020) was carried out to confirm the existing condition of the road pavement and remaining structural life of Adams Road. Following consultation with Council this Pavement Investigation has been updated to include a road surface condition analysis and to outline road upgrade requirements (Durkin 2021). The updated report has been forwarded to Council and is appended to this letter as Appendix D. Based on the recommendations of this report the following upgrades are proposed as part of MOD 5:

- crack filling and sealing will be carried out prior to the recommencement of quarrying operations to address existing longitudinal cracking between Elizabeth Drive/Adams Road intersection and 40 m south of this intersection;

- a structural treatment such as insitu stabilisation or equivalent will be carried out from 40 m north of the quarry site access to 40 m south of the quarry site access to address existing base issues in this area;

- resealing of the road surface will be carried out 40 m north of the site access to 40 m south of the site access with a two coat application of 14 mm C170 or equivalent followed by 7 mm S45R or equivalent to accommodate heavy vehicles into the site access. In this area, seal will extend into the unsealed road shoulder by 500 mm; and

- between 90 m south of the Elizabeth Drive intersection and 275 m south of the Elizabeth Drive intersection, the existing seal or new sealed areas (as per above recommendations) will be extended into the unsealed shoulder by 500 mm to reduce future edge break/drop issues which are currently developing.

Consultation with Council with regard to lifting the Adams Road load limit is ongoing.

2.3.2 Land use zoning and permissibility

Since Council's previous comments, the site has been rezoned under the SEPP (Western Sydney Aerotropolis) 2020 to Agribusiness and Environment and Recreation.

The Western Sydney Planning Partnership has also released draft Precinct Plans which apply to the development site. Despite the application for the Mod being lodged prior to rezoning and release of draft Precinct Plans, it is suggested that the permissibility of the quarry activation and future intent of the site needs to be considered in the assessment of the application.

As an approved development, the quarry may continue to operate and may be modified, provided it is substantially the same development, under the existing rights provisions under Section 4.66 of the EP& A Act and Part 5 of the EP&A Regulation.

2.3.3 Wastewater

As outlined in its previous submission, Council does not generally support sewage pump-out facilities. Part 1, Section 15, Clause 6 of the Liverpool Development Control Plan 2008 stipulates that development or subdivision proposals relying on pump-out systems will not be approved by Council. Pump-out systems are not considered to be economically or environmentally sustainable systems due to the high costs associated with the removal of effluent which can result in unauthorised discharge into the environment.

There is no mains sewer available to service the quarry, or the residences and businesses in the surrounding area.

The quarry is an approved State significant development (SSD). The currently approved wastewater system for the quarry is for a pump out septic system located adjacent to the former main office and ablution block on Commonwealth land. Due to the development of the Western Sydney Airport, the former septic system is no longer available for use. Accordingly, new amenities will be established in the site entry infrastructure area.

Temporary demountable amenities are proposed due to the short remaining life of the quarry (with extraction ceasing in December 2024) and because there will be a low number of site personnel (around 12 employees during normal operating conditions with a maximum of 15 employees during peak operations). Wastewater from these amenities will either be contained in a temporary chemical closet (ie a port-a-loo) or be discharged to a septic holding tank. It is expected that a septic tank will require pump out around every three months. The cost of this pump out will be borne by the applicant as part of operational costs.

2.4 Western Sydney Planning Partnership

2.4.1 Draft Aerotropolis Precinct Plan

On page 13 of the Submissions report the proponent notes the 'draft Aerotropolis Precinct Plan for the Agribusiness precinct envisages the subject property will form part of a "neighbourhood hub" or "employment hub" with the precinct plan indicating commercial warehouse type development on the subject property.' The above claim by the Proponent is not correct. The below overlay of the cadastre on the draft precinct plan for this area of the Agribusiness Precinct shows for No.275 Adams Road, Luddenham (Lot 3 D.P. 623799 - site denoted by a star) with an employment zone centre approximately three blocks to the west of the site (shown in the salmon colour).
Nevertheless, the future filling of the site when it is rehabilitated can facilitate a future street network and development in accordance with the draft precinct plan and land use as provided by the Aerotropolis SEPP. While this application only addresses the short-term use of the site until 2024, the long-term vision of the site could meet the intent of this section of the Plan. As such, further information from the Proponent should be requested to address this matter.

The MOD 5 Submissions report should have stated that the quarry is close to a proposed employment zone. Notwithstanding, Figure 7 of the Draft Aerotropolis Precinct Plan (WSPP 2020b) indicates an intended commercial land use with warehouse style developments shown on the subject property on Page 11 of the Overview of the Agribusiness Precinct Plan (WSPP 2020c) consistent with the final intended land use of the rehabilitated quarry as outlined in the Final Land Use Report (Appendix L of the Modification Report) and summarised in Section 1.1 of the MOD 5 Submissions Report (Stage 3).

2.4.2 Application assessed against the Western Sydney Aerotropolis Plan (WSAP)

The WSAP establishes a vision, objectives and principles for the development of the Aerotropolis.

The Submission Report suggests, 'Section 2.4 of the final Western Sydney Aerotropolis Plan (2020) (Aerotropolis Plan) retains the key theme of enabling industries transitioning to higher order uses over time' 'the continued operation of the quarry represents an existing "enabling" industry providing an economic basis on which the site can be developed to provide innovative resource recovery solutions in the medium to long-term, and long-term agribusiness land uses achieving the objectives of the Aerotropolis Plan to transition land use to a high-value job creating uses that are compatible with future airport operations.'

While this application only addresses the short-term use of the site until 2024, the long-term vision of the site could meet the intent of this section of the Plan. As such, further information from the Proponent should be requested to address this matter.

As noted by WSPP, the proposed reactivation of the quarry is the first stage of enabling the economic rehabilitation and development of the site. The principal objective of MOD 5 is to provide a new approved access for quarry from Adams Road as the previously approved access route on Commonwealth land is within the WSA development footprint. As the quarry is currently approved, the MOD 5 application does not rely on the granting of any further development consents.

CPG and KLF intend to lodge a future modification application to modify the quarry consent to allow infilling of the quarry void with construction and demolition waste as envisaged by the original environmental impact assessment.

The development of the ARRC is subject to a separate application (for which a Submissions Report) is currently being prepared). Further applications will be required to develop the long-term commercial activities envisaged for the site.

2.5 Transport for NSW

2.5.1 Elizabeth Drive / Adams Road intersection

CPG and KLF acknowledge TfNSW's concerns raised in the meeting on 12 February 2021 regarding the right hand turn into Adams Road from Elizabeth Drive and TfNSW's preference for quarry heavy vehicles to use the new The Northern Road/Adams Road intersection, which has recently been constructed, to access the broader road network.

In response to TfNSW's concerns, CPG and KLF have carried out a transport options analysis to evaluate different heavy vehicle access and road upgrade options. Further discussions have also been held with Mulgoa Quarries, the proposed quarry operator, to confirm the expected quarry heavy vehicle destinations.

As noted in Section 2.7 of the MOD 5 Modification Report, the reactivated quarry will have a maximum of 10 heavy vehicle movements an hour (ie 5 inbound and 5 outbound movements). Currently approximately 40 trucks a day (80 movements) are approved to access the site and an average (not maximum) of 8 vehicle movements per hour. A review of weighbridge records as part of MOD 4 (withdrawn) found traffic generally below approved average but maximum movements were up to 132 movements (Stanbury Traffic Planning 2017). MOD 5 proposes to formalise maximum product truck movements to 100 movements per day.

Mulgoa Quarries has confirmed that quarry trucks will have fixed destinations and haulage routes with trucks traveling between the quarry and the following locations:

- PGH Bricks Cecil Rd, Cecil Park;
- PGH Bricks Townson Road, Schofields; and
- Mulgoa Quarries 44 Tyrone Place Erskine Park.

All of the above locations are accessed via Elizabeth Road, east of the Elizabeth Drive/Adams Road intersection with all heavy vehicles travelling to and from the quarry via Elizabeth Drive east of the Elizabeth Drive/Adams Road intersection. There will be no requirement for quarry heavy vehicles to approach Adams Road from the west and therefore no need for quarry heavy vehicles to turn right from Elizabeth Drive into Adams Road. The expected heavy vehicle routes and destinations are shown in Figure 2.7.

Currently there is a 3-tonne load limit along the length of Adams Road. CPG and KLF propose to upgrade Adams Road between the quarry access road and Elizabeth Drive (about 340 m, including about 40 m south of the access road to provide full coverage at the Adams Road/access road intersection) to allow the load limit on this section of road to be lifted.

We understand that the southern end of Adams Road, between The Northern Road and Anton Road will be upgraded and the load limit to allow heavy vehicles to access to airport facilities. It is not proposed to upgrade Adams Road between the quarry access and Anton Road (about 700 m) as part of the MOD 5. We understand it is not proposed to upgrade this section between the quarry access and Anton Road as part of the development of WSA.

Accordingly, the updated transport strategy for MOD 5 is summarised as follows and is shown in Figure 2.8:

- Elizabeth Drive/Adams Road intersection:
  - quarry trucks only from along Elizabeth Drive east of the intersection of Adams Road; and
  - no intersection upgrades (right-hand turn into Adams Road not required for MOD 5).
- Adams Road pavement upgrades between about 40 m south of the quarry access road and Elizabeth Drive (approximately 340 m).

It is noted, that while the applicants previously considered constructing a 90 m long dedicated left turn lane on Elizabeth Drive for westbound traffic turning from Elizabeth Drive into Adams Road, this is no longer proposed due to the low incoming heavy vehicle numbers (5 trucks per hour during peak operations) and the potential for this upgrade to conflict with upgrades to the Elizabeth Drive/Adams Road intersection required for the ARRC.

Use of Adams Road south of the quarry access and The Northern Road/Adams Road is not feasible for MOD 5 for the following reasons:

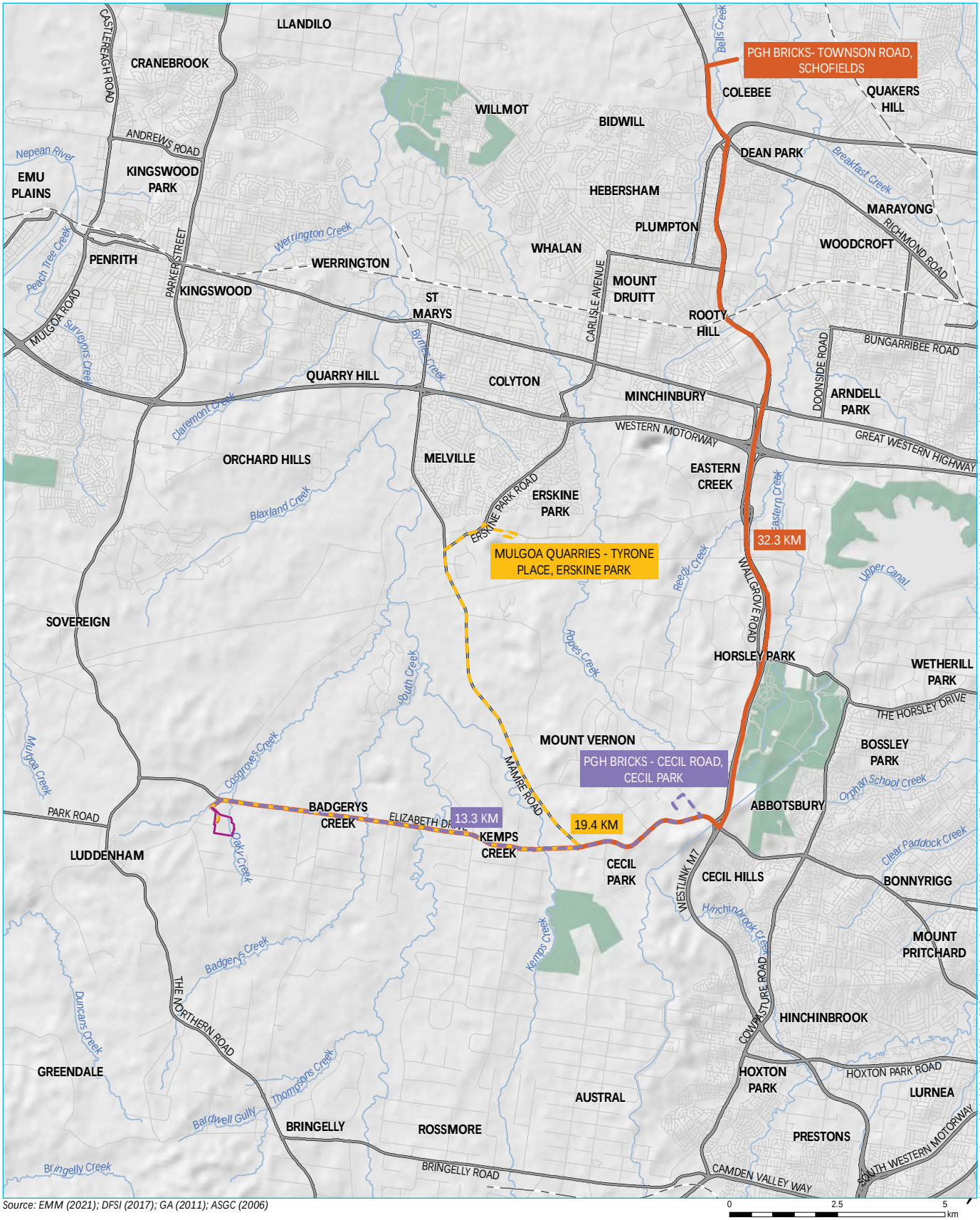
- all extraction needs to be completed by 31 December 2024 providing an increasingly narrow period to extract an approved regionally significant resource following the completion of any required road works;

- an additional 700 m of pavement upgrades would be required between the quarry access road and Anton Road to allow the load limit to be lifted for quarry heavy vehicles to travel to and from the south on Adams Road;

- there is uncertainty of timing of the upgrades to Adams Road south of Anton Road;

- there is the potential for temporary closure of Adams Road south of the quarry due to the upgrades south of Anton Road which would require quarry operations to cease if quarry heavy vehicles were restricted from using the Elizabeth Drive/Adams Road intersection; and

- the travel distances to the brickworks and Mulgoa's depot using Adams Road south of the quarry are approximately 5 km longer.



Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006)

0 2.5 5 km

GDA 1994 MGA Zone 56

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KEY

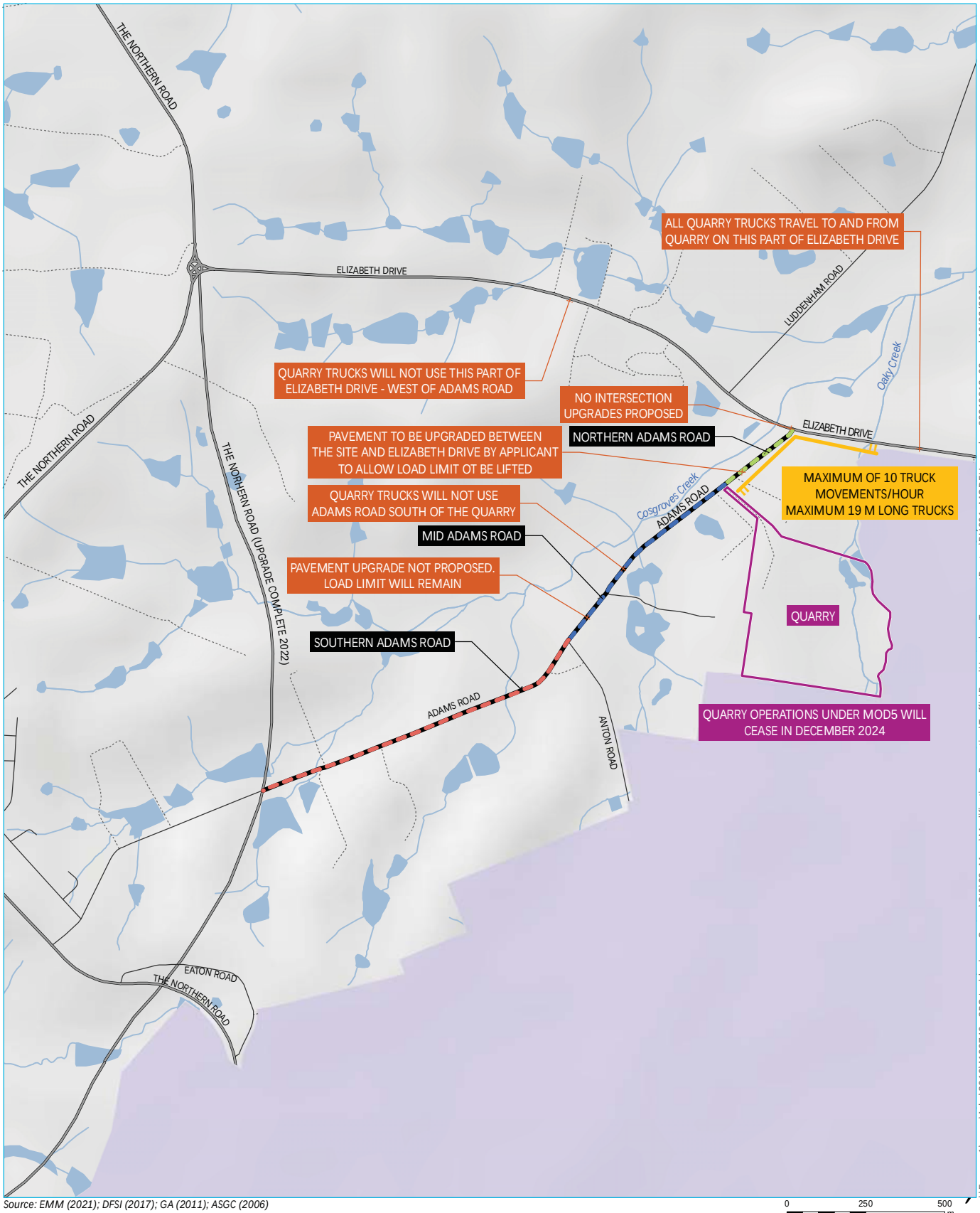
- Rail line
- Major road
- Minor road
- Named watercourse
- NPWS reserve
- Study area
- Heavy vehicle route
- Mulgoa Quarries - Tyrone Place, Erskine Park
- PGH Bricks - Cecil Road, Cecil Park
- PGH Bricks - Townson Road, Schofields

Heavy vehicle destinations and routes

Luddenham Quarry - Modification 5

Figure 2.7

EMM creating opportunities



Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006)

0 250 500 m

GDA 1994 MGA Zone 56

KEY

- Study area
- Western Sydney airport
- Waterbody
- Major road
- Minor road
- Track
- Watercourse/drainage line

Adams Road sections

- Adams Road - Mid
- Adams Road - North
- Adams Road - South

MOD 5 transport strategy

Luddenham Quarry - Modification 5
Figure 2.8

EMM creating opportunities

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2.5.2 Sight distance

TfNSW has reviewed the submitted information and understands that the applicant has performed a stopping sight distance (SSD) assessment based on a passenger vehicle with the design speed of 90 km/h. It is suggested that the SSD should be undertaken conservatively based on the truck figures.

As outlined in Section 4.5.2 of the Submissions Report, the minimum stopping sight distance (SSD) providing for a general minimum 2 second driver reaction time on an 80 km/h road is 131 m for trucks and 114 m for cars. The sight distance for the eastbound traffic on Elizabeth Drive on approach to Adams Road meets the minimum requirement of 131 m, as stipulated in Austroads (2016) for heavy vehicles to safely turn right out of Adams Road onto Elizabeth Drive noting there will be a maximum of five trucks an hour making this turn during peak operations. As noted in Section 2.5.1, no quarry heavy vehicles will be required to turn right into Adams Road from Elizabeth Drive.

2.5.3 Clarification on size of quarry vehicles

It is also noted that the applicant proposes to upgrade the Adams Road, between the subject property access road and Elizabeth Drive in Stage 1 (Quarry Reactivation) for potential use by B-double vehicle. As such, the intersection of Elizabeth Drive and Adams Road should also be upgraded to accommodate the movement of B-double vehicles. A swept path diagram demonstrating a B-double vehicle able to manoeuvre at the intersection of Elizabeth Drive and Adams Road intersection without encroachment should be submitted to TfNSW for review.

To clarify, quarry trucks associated with quarry operations will be restricted to a maximum length of 19 m unless the Elizabeth Drive/Adams Road intersection and Adams Road/site access intersection are upgraded, either as part of the ongoing upgrades to the surrounding road network by TfNSW or LCC, as part of the development of the Aerotropolis or as part of the ARRC Project (if approved). A swept path diagram demonstrating that a 19-m long vehicle can manoeuvre the Elizabeth Drive/Adams Road intersection without encroachment is contained in Appendix E.

MOD 5 does not propose to upgrade the Elizabeth Drive/Adams Road intersection, due to the comparably low number of quarry vehicles using the intersection. As outlined in Section 4.5.1 of the MOD 5 Submissions Report, during 2024, the forecast baseline traffic at this intersection will be 1,282 during the AM peak and 1,669 during the PM peak respectively of which only 10 movements in each peak period will be quarry-related.

Notwithstanding, it is proposed to upgrade portions of Adams Road pavement, between the site access and the Elizabeth Drive/Adams Road intersection as part of MOD 5 to accommodate the MOD 5 development heavy vehicle movements. Details of recommended road upgrades are summarised in Section 2.3.1 above and contained in Section 2.4 of the revised Pavement Investigation (Durkin 2021) contained in Appendix D. Consultation with Council will be ongoing as part of the Section 138 (of the *Roads Act 1993*) application and the application to lift the load limit on the northern section of Adams Road.

2.5.4 Works Authorisation Deed

It is requested that the applicant be conditioned to:

- prior to issuing any Construction Certificate of Stage 1, prepare a concept design for the measure to mitigate the impact on the Elizabeth Drive and Adams Road intersection with consultation with TfNSW.

- prior to issuing Occupancy Certificate of Stage 1, execute the WAD (Works Authorisation Deed) with TfNSW for the approved mitigation works at the Elizabeth Drive and Adams Road intersection

As noted above, MOD 5 does not propose upgrades to the Elizabeth Drive/Adams Road intersection accordingly, a WAD with TfNSW will not be required.

2.6 Environment Energy Science

2.6.1 Fauna Relocation Plan

EES recommends a Fauna Relocation Plan (FRP) is developed to address the transfer of any native aquatic fauna from the quarry pit prior to dewatering of the pit and this is included as a condition of consent. The FRP should be prepared by a suitably qualified and experienced ecologist to ensure the safe and efficient relocation of any fauna that may be observed during proposed works. A suitably qualified ecologist should be present during the dewatering of the final water from the depression and sump around the dewatering pipe inlet (about 10 m by 10 m). The water quality of the proposed relocation sites (including salinity) should be like the quarry pit.

It is noted that dewatering of the quarry pit is approved under the current consent. Notwithstanding, the applicants commit to the preparation of a Fauna Relocation Plan (FRP), in accordance with this comment, prior to dewatering of the final water from the depression and sump around the dewatering pipe inlet (about 10 m by 10 m).

2.6.2 Removal of trees within approved quarry footprint

The proponent must commence, as soon as possible, collecting seed from native trees to be removed and growing local provenance trees and/or sourcing local native provenance plant species, so that local provenance trees are available to be planted and the trees are advanced in size to improve the urban tree canopy and local biodiversity.
Native trees that are to be removed as part of this proposal shall be reused, including tree hollows and tree trunks (greater than 25-30 centimetres in diameter and three metres in length), and root balls to enhance habitat within the Oaky Creek riparian corridor. This detail to be documented in the CEMP

As outlined in the Submissions Report and MOD 5 BDAR (EMM 2020h), no native vegetation will be impacted as a result of MOD 5 with the exception of two trees mapped as poor condition PCT 1800 within the currently approved quarry footprint and stockpile area (Photograph 2.1).

Photograph 2.1 Trees within approved stockpile and extraction areas

These trees are within the approved footprints of the existing consent and they are approved to be removed. Therefore, their removal should not be a consideration in the assessment for MOD 5.

Notwithstanding, the collection of seed from these trees, if this was possible given the condition of the trees, is not believed to be proportionate to the level of biodiversity impact.

As outlined in the BDAR and MOD 5 Submissions Report, when the two trees within the currently approved footprint are removed, native tree trunks greater than approximately 25 cm in diameter and 3 m in length will be placed within the Oaky Creek riparian corridor to enhance habitat.

2.6.3 Pre-clearance fauna surveys

EES recommends a condition of consent is included which requires pre-clearance fauna surveys to be undertaken by a qualified ecologist prior to clearing the native trees on site to determine the presence of resident native fauna using nests, dreys etc. Any resident native fauna potentially impacted by the removal of the trees should be relocated (preferably prior to removing the trees) to an appropriate nearby location and in a sensitive manner under the supervision of a qualified ecologist/licensed wildlife handler.

As described, the two trees within the currently approved quarry footprint to be removed as part of MOD 5 are of poor condition and are separated from other areas of native vegetation on the site. These trees are not considered to provide suitable habitat to native fauna. No hollows were observed in these trees during field surveys carried out to inform the MOD 5 and ARRC BDARs. Accordingly, a requirement for a pre-clearance fauna survey requiring attendance by a qualified ecologist is not believed to be appropriate.

2.7 Western Sydney Airport

2.7.1 Site rehabilitation Plan and Final Land Use Plan

Our request that there be a single and clear Site Rehabilitation Strategy stands. This strategy would need to clarify the approach to rehabilitation, as well as detail on the timeframes for activities. The rehabilitation should not rely any other approval for filling / rehabilitation. The Concept Design and Filling Strategy included at Appendix E of the submissions report, whilst providing some high level design information, is a report that was prepared in relation to the proposed State Significant Development application for the Resource Recovery Centre (RC) and is based upon residual waste materials from the RCC being used to fill the void.
The rehabilitation should be assessed in regards to environmental impacts.

MOD5 does not seek approval to infill the quarry void. As discussed in Section 2.1.3, there is currently no obligation in the consent or statutory obligation to fill the void. As noted in Section 2.1.3, CPG and KLF intend to lodge a future modification application to modify the quarry consent to allow infilling of the quarry void with construction and demolition waste as envisaged by the original environmental impact assessment.

In accordance with Schedule 5 Condition 9 of the consent, all plans and policies required by the quarry consent are to be reviewed and updated as necessary to the satisfaction of DPIE.

The *Final Land Use Report* (Modification Report Appendix L) was prepared to fulfill the requirements of Schedule 4 Condition 36 of the consent. This report and the *Concept Design and Filling Strategy* (Submissions Report Appendix E) provide a strategy for infilling the quarry such that the whole of the site can be developed for long-term uses compatible with the Aerotropolis SEPP and draft Precinct Plan. However as described above, this infilling requires separate development approval. This will require assessment of the environmental impacts of using residual waste materials from the ARCC being used to fill the void.

Following the preparation of the required environmental impact assessment and receipt of development approval, the infilling strategy would be developed into a detailed Site Rehabilitation Plan.

In the interim, a mining operations plan (MOP) will be prepared as part of the reactivation of the quarry. The MOP will need to consider and mitigate any potential impacts on the WSA construction activities prior to December 2024. The MOP will also need to be approved by the Resources Regulator prior to the recommencement of quarry activities. The MOP will need to describe the rehabilitation of the quarry. Until infilling of the quarry is approved, this will need to include measures to leave a stable, non-polluting and safe void.

2.7.2 Cumulative impacts

The Proponent is required to consider any cumulative effect with other existing or likely future activities, including on air quality. This assessment should be undertaken both between the applications and in comparison to other air quality impacts in the area, including Western Sydney Airport. Should the application be approved, conditions would need to be in place regarding:
- Assessment of cumulative impacts associated with the simultaneous operations of the quarry / ARRC.
- Assurance that the proposal would meet the relevant air quality standards.
- Timing of the proposed works to ensure that they are completed within a pre-determined timeframe.

The MOD 5 Modification Report contains cumulative impact assessments, particularly for traffic and air quality. The traffic impact assessment for MOD 5 was carried out using Transport for NSW (TfNSW) supplied Strategic Travel Forecasting Model (STFM). The STFM includes historical traffic levels (ie including existing land uses such as the approved quarry) and the traffic levels forecast generated by the staged WSA and Aerotropolis development.

The cumulative air quality impacts associated with the concurrent operation of MOD 5 and the operation of the ARRC were considered in the AQIA prepared by EMM as part of the EIS for the ARRC. Since the submission of the ARRC EIS, there have been refinements to the operational assumptions for the ARRC, primarily in relation to truck movements and proposed equipment operating within the ARRC. Accordingly, an ARRC Addendum AQIA has been prepared (see Section 2.2.2iv and Appendix B).

2.7.3 Road upgrades

WSA notes that TfNSW has requested the intersection of Elizabeth Drive and Adams Road be upgraded with right turn treatments provided. The Submissions Report notes that "the Elizabeth Drive / Adams Road intersection does not need to be upgraded as part of the MOD 5 application", and that it is proposed to upgrade the intersection as part of the AARC application if it is approved". This is despite the assessment (Table 4.6) of the report demonstrating that a right hand turn lane is already required at this location. Appropriate road and intersection upgrades should be undertaken to ensure safe movement of vehicles.

Adams Road also currently has a 3 tonne limit, meaning that development cannot be approved without an adequate upgrade to Adams Road being in place. Therefore, in addition to the upgrade of the intersection between Elizabeth Drive and Adams Road, this upgrade should be extended south as far as the site boundary such that vehicles can safely arrive to and depart from the site to the regional road network

The MOD 5 revised transport strategy is presented in Section 2.5.1 of this letter.

2.7.4 Stockpiles

Should development consent be granted for this modification application, a condition should be provided that stockpiles of material associated with quarry activities must be removed at the completion of quarry extraction activities (i.e. 31 December 2024).

The existing consent provides that quarrying operations may be carried out on the site until 31 December 2024. Stockpiles may be retained on site during the rehabilitation phase. It is noted that the quarry consent will continue to apply in all other respects other than the right to conduct quarry operations until the site has been rehabilitated to the satisfaction of DPIE.

2.8 Department of Infrastructure, Transport, Regional Development and Communications

2.8.1 Impacts on Western Sydney Airport

The Department is generally accepting of the responses made by the applicant. However, we have a concern about section 4.2.1 of the Submissions Report, where the applicant has discussed the Obstacle Limitation Surface instead of addressing our comments that the works should have no detrimental impact on the Airport site where they may cause an issue for the Airport in meeting the requirements of the Construction Environmental Management Plans (CEMP's). Wording from our letter below:

'While the proposed activity is not on the Airport Site, the development could consider the Airport regulatory framework, including the Airport Plan 2016; Airport (Environmental Protection) Regulations; and Construction Environmental Management Plans (CEMPs). The Proponent should consider cumulative impacts of developments in the area, for example, for air quality and soil and water quality management.'

To be specific there are a number of potential environmental impacts on the airport site from the proposed Luddenham Quarry activity.
- these relate to noise and vibration issues, causing air, water and/or soil pollution resulting in serious environmental harm, material environmental harm or environmental nuisance respectively at an airport site.
- If the off-airport quarry was causing soil, (ground) water or air pollution impacts on the airport site that exceed the schedules or what were inconsistent with the relevant WSA CEMP objectives, this could trigger action by the Department to determine if section 131B, 131C or 131D of the Airports Act were being breached.

The modification report was accompanied by robust air quality, noise, traffic and water technical assessments which assessed the potential impacts of the proposed modification on the surrounding environment including the WSA site. These assessments did not identify any impacts from the reactivation of the quarry which would cause detrimental impact or environmental nuisance on the WSA site during construction of the WSA.

It is noted that the quarry is downstream of the WSA and any discharge of water from the quarry site to Oaky Creek would be carried out in accordance with the Environment Protection Licence (EPL) noting that the revised water balance (refer Section 2.2.3 found discharges to Oaky Creek would be unlikely considering in pit storage of water).

The noise and vibration impact assessment outlined that the safe working distances for vibration intensive plant would be met for human comfort and cosmetic damage for land uses surrounding the quarry site.

The cumulative air quality assessment considered the concurrent operation of the quarry with the construction of the WSA (refer Section 2.2.2). It is noted that an approved air quality monitoring program as required by the existing consent will be implemented in consultation with DPIE and the EPA. Similarly, the noise management plan as required by the existing consent will be updated following approval of MOD 5.

Both the air quality monitoring plan and noise management plan will have a complaints procedure and appropriate contingency and mitigation measures. The results of the air quality monitoring and noise monitoring will be made available to WSA and members of the public as per Schedule 5 Condition12 of the existing quarry consent.

Quarrying is approved and will require a small earthmoving fleet. It will not include any potentially polluting activities other than the small risk of minor spills or leaks associated with the operation of any earthmoving equipment. These will be managed through standard environmental management measures.

3 Closing

We trust that this letter provides the information requested but please do not hesitate to contact the undersigned if you need any further information.

Yours sincerely

Janet Krick
Associate Environmental Planner
jkrick@emmconsulting.com.au

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Appendix A

Zoning and noise criteria advice

MinterEllison

12 March 2021

PRIVATE & CONFIDENTIAL

Michael Coombes
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PO Box 177
Bondi Junction NSW 1355

Dear Michael

Luddenham Quarry – Zoning and Noise Criteria

1. Introduction

1.1 We refer to your request for advice in relation to the development of 275 Adams Rd, Luddenham, also known as Lot 3 in DP 623799 (**Site**).

1.2 In particular, we have been asked to provide advice on the appropriate project noise level criteria for the proposed Resource Recovery Centre at the Site with regard to a nearby dwelling house at Lot 281 DP 571171 (**Neighbouring Land**).

2. Short Answer

2.1 The noise amenity area receiver categorisation for Site and Neighbouring Land is industrial and not residential. As explained below, the key reason for this is because the standard is set by land zoning. In this instance, the relevant land is zoned Agribusiness, which is a species of industrial land zoning.

3. Noise amenity area

3.1 The basis for noise policy in NSW is the *Noise Policy for Industry* (2017) prepared by the NSW Environment Protection Authority (**Guidelines**).

3.2 The Guidelines are self-described as not being a statutory document. Instead, the document is a one which "*...provides a process for predicting noise levels and determining achievable statutory noise limits… for consent…*" (see p. iii). The Guidelines put forward limits for project noise, such as noise from a facility such as the RRC, and not road transport noise.

3.3 The Guidelines set amenity criteria for total noise from all sources at a receiver of the project amenity level for industrial developments, which is the recommended amenity noise level for a particular land use minus 5 dB(A). The recommended amenity noise levels are set out in Table 2.2 of the Guidelines. Some of these levels are as follows:

- Residential Rural: 50 dB(A) in the day and 45 dB(A) at night.
- Residential Suburban: 55 dB(A) in the day and 45 dB(A) at night.
- Commercial: 65 db(A).
- Industrial Premises: 70 dB(A).
- Industrial Interface: Add 5 dB(A) to the applicable residential level.

3.4 The notes to the table of amenity noise levels states (at p. 12):

> • Industrial interface – an area that is in close proximity to existing industrial premises and that extends out to a point where the existing industrial noise from the source has fallen by 5 dB or an area defined in a planning instrument. Beyond this region the amenity noise level for the applicable category applies. This category may be used only for existing situations (further explanation on how this category applies is outlined in Section 2.7).
>
> • Commercial – commercial activities being undertaken in a planning zone that allows commercial land uses
>
> • Industrial – an area defined as an industrial zone on a local environment plan; for isolated residences within an industrial zone the industrial amenity level would usually apply.

3.5 To determine the particular land use of a receiver, the policy provides "guidance" in Table 2.3. This Table is qualified as follows: "*...however, careful judgement based on site-specific circumstances and consultation with the relevant planning / licensing authority may be required in some circumstances.*" The categories listed are only residential and refer to the categories of residential zones contained in the *Standard Instrument – Local Environmental Plan* (**Standard Instrument**). In other words, if one is trying to determine whether a residential category applies, one should have recourse to the Standard Instrument. Interestingly, the Guidelines do not extend this principle to other categories, as Table 2.3 makes clear.

3.6 It is important to reiterate at this point that the key variable used to determine whether a residential receiver category applies is the relevant land's zoning.

3.7 Both the RRC land and the neighbouring dwelling potentially impacted are zoned 'Agribusiness' under the *State Environmental Planning Policy (Western Sydney Aerotropolis) 2020* (**SEPP**).

3.8 There is no equivalence for an Agribusiness Zone in the Standard Instrument. In these circumstances, the appropriate course of action is to determine the character of the Agribusiness Zone, and to consider that against those categories in the Guidelines (and through the Guidelines, the Standard Instrument).

3.9 To do this, we must have recourse to the ordinary meaning of 'Agribusiness' – an undefined word. In *Australian Leisure and Hospitality Group Pty Ltd v Director of Liquor Licensing* [2012] WASC 463, Hall J held at [22] that:

> "*If it is intended that a word in a statute will be used in a specific way that may not accord with ordinary usage such an intention is generally reflected in a definition in the statute. Absent such a definition, the ordinary meaning should prevail unless there is something in the context to suggest that another meaning is intended.*"

3.10 Here, an ordinary meaning of the term 'Agribusiness' is the appropriate one.

3.11 As the NSW Court of Appeal noted in *Norrie v New South Wales Registrar of Births, Deaths and Marriages* [2013] NSWCA 145 at [84], a dictionary may be used to identify this ordinary meaning.

3.12 The Concise Oxford Dictionary defines "*agribusiness*" as the "*group of industries dealing with farming produce and services [f. AGRICULTURE + BUSINESS]*" (emphasis added).

3.13 On the basis of the dictionary definition, a zone for Agribusiness is a zone for a subset of industry and hence the land appropriately falls within the industrial category in the Guidelines. As the above definition makes clear, the Agribusiness zone is quite distinct from the residential land zonings identified in Table 2.3 of the Guidelines. This Agribusiness zoning has applied to the Site and Neighbouring Land since the commencement of the SEPP on 1 October 2020 (see cl 2(1) of the SEPP). As a matter of logic it follows that, for the purposes of the Guidelines and Tables 2.2-2.3, since 1 October 2020 Agribusiness zoned land such as the Site and Neighbouring Land should be considered industrial.

Yours faithfully
MinterEllison

John Whitehouse
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Appendix B

ARRC AQIA Addendum

Luddenham Advanced Resource Recovery Centre

Addendum air quality impact assessment

Prepared for Coombes Property Group & KLF Holdings Pty Ltd
March 2021

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Luddenham Advanced Resource Recovery Centre

Addendum air quality impact assessment

Report Number

J190749 RP29a

Client

Coombes Property Group & KLF Holdings Pty Ltd

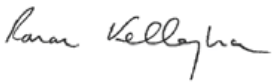
Date

2 March 2021

Version

v2 Final

Prepared by



Ronan Kellaghan
Associate - Air Quality
2 March 2021

Approved by

Scott Fishwick
National Team Leader - Air Quality
2 March 2021

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Appendices

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1 Introduction

EMM Consulting Pty Ltd (EMM) prepared an Air Quality Impact Assessment (AQIA) for the Luddenham Advanced Resource Recovery Centre (ARRC) development application (EMM 2020). The AQIA presented a quantitative assessment of potential air quality impacts, with an emphasis on emissions of particulate matter (PM), the key pollutant associated with the ARRC.

The purpose of this Addendum Air Quality Assessment (Addendum AQIA) report is to present updated air quality modelling results for the ARRC. The updated modelling results are required to address changes to the operational assumptions for the site and to response to specific submissions received from the Department of Planning, Industry and Environment (DPIE) and the NSW Environment Protection Authority (EPA).

1.1 Scope of this report

The Addendum AQIA forms part of the overall Submissions Report prepared by EMM (2021) and should be read in conjunction with the Submissions Report for a complete response to all submissions. The specific submissions addressed by this Addendum AQIA are summarised in the following sections.

1.1.1 Revisions to the air quality modelling

The EPA provided a submission on the modelling results and the management of potential exceedances resulting from the operation of the premises, as follows:

> The EPA recommends the AQIA be revised to:
> i) Identify additional mitigation measures to manage predicted exceedances, and:
> – reduce $PM_{2.5}$ annual average contributions from the premises;
> – reduce 24-hour average $PM_{2.5}$ and PM_{10} contributions from the premises;
> ii) Revise the assessment accounting for the additional mitigation measures identified in;
> – to reduce incremental ground level concentrations;
> iii) Demonstrate that particulate matter emissions have been reduced as far as practicable.

Since the submission of the EIS, there have been refinements to the operational assumptions for the site, primarily in relation to truck movements and proposed equipment operating within the ARRC. The revised operational assumptions are relevant to the management of predicted exceedances and requirement for additional mitigation in the EPA's submission. The revised emission assumptions and modelling results are presented in Section 2 and are discussed in the context of the EPA's submission below.

For detailed responses to EPA's submission, please refer to the Submissions Report.

1.1.2 Western Sydney Airport receptor locations

DPIE provided a submission on the assessment locations for the Western Sydney Airport (WSA) as follows:

> The AQIA further states that the air quality associated with the proposed Western Sydney Airport were considered in the air quality modelling, and included the future terminal areas, runaway area, fuel farm area and airport infrastructure area. Please incorporate the Airport modelling receptor locations in site figures relating to the assessment locations for air quality within the EIS and AQIA

This Addendum AQIA provides a figure showing the WSA modelling locations included in the AQIA and updated modelling for WSA assessment locations (refer Chapter 3).

1.1.3 Assessment of odour impact

DPIE provided a submission on the assessment of odour impacts associated with the ARRC as follows:

> It is understood that general solid waste (putrescible) will not be accepted at the development. The AQIA states that as no putrescible waste will be accepted at the RRF and no sources of odour emissions identified from the RRF operations, odour was not quantitively assessed in the EIS. A quantitative assessment of odour impacts, as per the SEARs requirements should be provided to provide baseline data and conservatively assess and provide mitigation measures for potential odour impacts to future sensitive receptors, including the Western Sydney Airport and approved/future developments in the vicinity.

This Addendum AQIA provides modelling results for odour, presented in Section 4.

2 Updates to the modelling results

2.1 Changes to the ARRC emission inventory

Since the submission of the EIS, changes have been made to the assumptions for truck movements in and out of the site. The majority of waste (approximately 400,000 tonnes (t)) will be brought in by truck and dog, semi-trailer and B-doubles, with an average load of between 30 to 50 t. The emission inventory was therefore updated to account for a revised split for truck movements, as follows:

- 200,000 tonnes per annum (tpa) bulk waste transfer from other KLF facilities with an average incoming load of 35 t;
- 200,000 tpa of bulk general solid waste/excavated materials with an average incoming load of 35 t; and
- 200,000 tpa of waste from construction, industrial and commercial sites with average incoming loads of 5 t (eg skip bins).

The revised assumptions result in a change to the total number of truck movements to site (as the larger incoming loads require less trips) and consequently result in a small decrease to the emission estimates for wheel generated dust from access roads.

More significantly, the allocation of emissions from truck movements across the day has also been updated to reflect the operations of the site more accurately. The previous modelling presented in the EIS assumed an even split of truck movements across the day and night; however, this does not reflect how the site would operate, with the majority of truck movements occurring during the day. The revised modelling presented in this memo therefore assumes that 80% of the truck movements occur between the hours of 6 am and 6 pm with the remaining trucks (20%) entering from 6 pm to 6 am. This is consistent with how other KLF facilities operate.

Finally, the emission estimates for diesel have been revised in response to EPA's submission on reducing emissions from non-road diesel equipment. The proponent has confirmed that most of their existing fleet is US EPA Tier 4 compliant and they have committed to using similar equipment for the ARRC. Emission estimates for diesel are therefore updated using US EPA Tier 4 emission factors (0.02 g/kWh).

The revised emission inventories are presented in Appendix A.

2.2 Emission inventory for quarry infilling

The cumulative scenarios presented in the EIS have been updated to account for quarry infilling (noting this development stage is subject to a separate future approval). An emission inventory has been developed for quarry infilling based on the following assumptions:

- 300,000 tpa of incoming external waste would travel via the site access road and around the northern and eastern perimeter of the site and enter the quarry pit via the existing ramp;
- an addition 60,000 tpa of internal waste from the ARRC would be transported from the ARRC around the eastern perimeter of the site and enter the quarry pit via the existing ramp;
- external waste would be transported in trucks with an average load of 35 t;
- internal waste would be transported in dump trucks with an average load of 38 t;

- trucks would unload in the pit and waste would be rehandled and spread using a front-end loader and compacted using a compactor;
- 3.4 hectares of the pit would be active for wind erosion;
- water carts would operate on the haulage routes and would dampen waste for spreading; and
- diesel consumption would be approximately half that of the operational quarry.

The assumptions are taken from or consistent with the Concept Design and Filling Strategy (InSitu Advisory 2020) and would be refined further through detailed design as part of a future development application.

A summary of the estimated emissions for quarry infilling compared with the quarry extraction scenario is presented in Table 2.1. The table also presents emission estimates for the ARRC (as presented in the EIS) and the revised estimates based on the changes described in Section 2.1.

The emission inventory for infilling is presented in Appendix A.

Table 2.1 Calculated emissions for development stages

Development stage	TSP (kg/year)	PM_{10} (kg/year)	$PM_{2.5}$(kg/year)
Luddenham Quarry	34,666	10,327	1,437
Quarry infilling	19,845	5,898	801
ARRC (as presented in EIS)	7,786	1,573	578
ARRC (revised estimate)	7,655	1,221	314

2.3 Revised modelling results – residential / commercial

The cumulative scenarios presented in the EIS have been updated to account for quarry infilling.

Cumulative results are presented as follows:

- Cumulative scenario 1: ARRC increment + quarry extraction + background + construction of WSA;
- Cumulative scenario 2: ARRC increment + background + operation of WSA; and
- Cumulative scenario 3: ARRC increment + background + operation of WSA + quarry infilling.

2.4 Annual average PM_{10} and $PM_{2.5}$

The predicted ARRC increment and cumulative annual average PM_{10} and $PM_{2.5}$ concentrations are presented in Table 2.2. The highest predicted ARRC increment for annual average PM_{10} is 2.2 µg/m³ at assessment location R3 (EIS prediction: 3.9 µg/m³). The next highest predicted ARRC increment (0.6 µg/m³) occurs at R6 (EIS prediction: 1.1 µg/m³). There are no exceedances of the impact assessment criterion for annual average PM_{10}.

The highest predicted ARRC increment for annual average $PM_{2.5}$ is 0.8 µg/m³ also at assessment location R3 (EIS prediction: 1.3 µg/m³). The next highest predicted ARRC increment (0.2 µg/m³) occurs at R6 (EIS prediction: 0.4 µg/m³).

For all cumulative assessment scenarios, there is an exceedance of the impact assessment criterion for annual average $PM_{2.5}$ at R3 (8.6 µg/m³ for Scenario 1, 8.3 µg/m³ for Scenario 2 and 8.5 µg/m³ for Scenario 3).

It is noted that R3 is currently vacant and the property owner intends to develop the property for commercial purposes in line with the recent rezoning to Agribusiness under the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (Aerotropolis SEPP).

Table 2.2 Predicted incremental and cumulative annual average PM_{10} and $PM_{2.5}$ concentrations

	PM_{10} (µg/m³)						$PM_{2.5}$ (µg/m³)					
	Increment			Cumulative			Increment			Cumulative		
	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal				**25 µg/m³**						**8 µg/m³**		
R1	0.1	0.1	0.1	19.0	18.7	18.8	<0.1	<0.1	<0.1	7.5	7.4	7.5
R2	0.2	0.2	0.1	19.2	18.8	18.9	0.1	0.1	0.0	7.5	7.5	7.5
R3	2.2	1.8	0.9	22.9	20.8	21.8	0.8	0.4	0.2	**8.6**	**8.3**	**8.5**
R4	0.1	0.3	0.2	19.3	18.8	18.9	<0.1	0.1	<0.1	7.6	7.5	7.6
R5	0.1	0.2	0.1	19.2	18.8	18.9	<0.1	0.1	<0.1	7.6	7.5	7.5
R6	0.6	1.3	0.6	20.8	19.3	19.9	0.2	0.3	0.1	8.0	7.7	7.9
R7	<0.1	0.1	0.1	19.0	18.7	18.8	<0.1	<0.1	<0.1	7.5	7.5	7.5
R8	0.1	0.1	<0.1	18.9	18.7	18.7	<0.1	<0.1	<0.1	7.4	7.4	7.4
C1	0.3	1.4	0.6	20.6	19.0	19.6	0.1	0.3	0.1	7.9	7.6	7.7
AR1	0.2	1.2	0.5	20.3	18.9	19.4	0.1	0.3	0.1	7.8	7.6	7.7

2.5 24-hour average PM_{10} and $PM_{2.5}$

The predicted ARRC increment and cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations are presented in Table 2.3. Exceedances of the impact assessment criteria are shown in bold, and the number of additional days above the criteria are shown in brackets.

The highest predicted ARRC increment for 24-hour average PM_{10} is 6.3 µg/m³, at assessment location R3 (EIS prediction: 9.1 µg/m³). The next highest predicted ARRC increment (3.6 µg/m³) occurs at assessment location R6 (EIS prediction: 5.0 µg/m³).

The highest predicted ARRC increment for 24-hour average $PM_{2.5}$ is 1.9 µg/m³, at assessment location R3 (EIS prediction: 3.2 µg/m³). The next highest predicted ARRC increment (1.0 µg/m³) occurs at R6 (EIS prediction: 2.1 µg/m³).

The cumulative daily-varying 24-hour average results at each receptor are derived as follows:

- Cumulative Scenario 1: The 2017 Bringelly daily monitoring data is combined with the maximum predicted 24-hour average concentration from the construction of WSA, added to every day of the background dataset. The project-only predicted increment for each day is then added to this background plus WSA contribution and then combined with the predicted increment for the Luddenham Quarry on the same day;

- Cumulative Scenario 2: The 2017 Bringelly daily monitoring data is combined with the maximum predicted 24-hour average concentration from the operational phase of WSA, added to every day of the background dataset. The project-only predicted increment for each day is then added to this background plus WSA contribution; and

- Cumulative Scenario 3: The 2017 Bringelly daily monitoring data is combined with the maximum predicted 24-hour average concentration from the operational phase of WSA, added to every day of the background dataset. The project-only predicted increment for each day is then added to this background plus WSA contribution and then combined with the predicted increment for the quarry infilling on the same day.

There are six existing exceedances of the daily PM_{10} criterion in the 2017 background dataset. With the additional contribution from the construction and operation of the WSA, there are another two exceedances of the daily PM_{10} criterion (total of eight existing exceedances across all receptors assumed for background). Therefore, for PM_{10}, the 9th highest cumulative concentrations are presented. For $PM_{2.5}$, there are two existing exceedances of the daily $PM_{2.5}$ criterion in the 2017 background dataset. With the additional contribution from the construction and operational phase of the WSA, no additional exceedances would occur. Therefore, the third highest cumulative concentrations are presented for 24-hour average $PM_{2.5}$ for both scenarios.

As shown in Table 2.3, for 24-hour PM_{10} concentrations, there are additional days over the impact assessment criterion for Scenario 1 at R3 (three additional days) and no additional days over the impact assessment criteria for Scenario 2 or Scenario 3 (with quarry infilling). For 24-hour $PM_{2.5}$ concentrations, there are two additional days over the impact assessment criterion for all scenarios at R3.

It is noted that R3 is currently vacant and the property owner intends to develop the property for commercial purposes in line with the recent rezoning to Agribusiness under the Aerotropolis SEPP.

Table 2.3 Predicted incremental and cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations

	PM_{10} (µg/m³) (number of additional days above goal shown in brackets)						$PM_{2.5}$ (µg/m³) (number of additional days above goal shown in brackets)					
	Increment			Cumulative			Increment			Cumulative		
	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal				**50 µg/m³**						**25 µg/m³**		
R1	0.5	1.0	0.7	47.8	44.8	44.9	0.2	0.2	0.1	23.5	23.0	23.0
R2	0.8	2.2	1.1	47.9	44.9	44.9	0.3	0.5	0.2	23.3	22.8	22.9
R3	6.3	10.2	4.2	**50.7 (3)**	48.1	48.5	2.1	1.9	1.0	**25.1 (2)**	**25.1 (2)**	**25.4 (2)**
R4	0.9	3.2	1.3	47.8	45.8	45.9	0.3	0.7	0.3	23.7	23.8	23.9
R5	0.4	2.6	0.9	47.8	45.8	45.9	0.2	0.7	0.3	23.7	23.8	23.8
R6	3.6	5.5	3.0	48.9	46.3	46.6	1.1	1.4	0.7	24.1	24.0	24.1
R7	0.5	1.4	0.5	47.8	45.8	45.8	0.2	0.4	0.2	23.6	23.8	23.8
R8	0.5	1.2	0.6	47.7	44.7	44.8	0.2	0.3	0.1	23.2	22.8	22.8
C1	1.7	8.0	4.7	48.7	46.4	46.6	0.6	1.6	0.7	23.9	23.9	24.0
AR1	1.1	8.6	4.3	48.5	46.3	46.4	0.5	1.6	0.6	23.8	23.9	23.9

2.6 Annual average TSP and dust deposition

The predicted ARRC increment and cumulative annual average TSP and dust deposition are presented in Table 2.4. The highest predicted ARRC increment for annual average TSP is 11.6 µg/m³ at assessment location R3 (down from the EIS prediction of 16.7 µg/m³). There are no exceedances of the impact assessment criterion for annual average TSP for any scenario.

The highest predicted ARRC increment for annual average dust deposition is 0.7 g/m^2/month also at assessment location R3 (down from the EIS prediction of 0.8 g/m^2/month). There are no exceedances of the impact assessment criterion for annual average dust deposition for any scenario.

Table 2.4 Predicted incremental and cumulative annual average TSP and dust deposition

	TSP (µg/m³)						Dust deposition (g/m²/month)					
	Increment			Cumulative			Increment			Cumulative		
	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal				**90 µg/m³**						**2 g/m²/month**		**4 g/m²/month**
R1	0.3	1.0	0.2	51.0	50.0	50.3	<0.1	0.1	<0.1	1.7	1.6	1.6
R2	0.8	2.1	0.4	52.6	50.5	50.9	0.1	0.1	<0.1	1.8	1.7	1.7
R3	11.6	26.1	3.4	87.4	61.3	64.7	0.7	1.5	0.3	3.8	2.3	2.6
R4	0.3	0.9	0.4	51.0	50.0	50.4	<0.1	<0.1	<0.1	1.7	1.6	1.6
R5	0.2	0.7	0.3	50.6	49.9	50.2	<0.1	<0.1	<0.1	1.6	1.6	1.6
R6	2.9	7.7	1.6	60.2	52.6	54.2	0.2	0.4	0.2	2.2	1.8	1.9
R7	0.1	0.4	0.1	50.2	49.8	50.0	<0.1	<0.1	<0.1	1.6	1.6	1.6
R8	0.2	0.6	0.1	50.5	49.9	50.0	<0.1	<0.1	<0.1	1.6	1.6	1.6
C1	1.2	3.5	1.5	54.4	50.9	52.5	0.1	0.2	0.1	1.8	1.7	1.8
AR1	0.8	2.2	1.2	52.8	50.5	51.8	<0.1	0.1	0.1	1.7	1.6	1.8

3 Future airport receptors

Air quality predictions at future receptors associated with the Western Sydney Airport have been modelled. The updated air quality predictions are presented in Table 3.1, Table 3.2 and Table 3.3 at three discrete receptor points for each of the future terminal area, runway area, fuel farm area and airport infrastructure area. The updated air quality predictions reflect the changes to the operational assumptions and the revised cumulative scenario (quarry infilling).

As requested in DPIE's submission, the airport receptor assessment locations are shown in Figure 3.1.

Air quality predictions are presented for Scenario 2 and Scenario 3. Air quality predictions for Scenario 1 are not presented as quarry extraction would be completed in 2024, prior to the start of airport operations in 2026.

The modelling results presented in in Table 3.1, Table 3.2 and Table 3.3 show:

- there would be no exceedances of the annual average impact assessment criteria for PM_{10} and $PM_{2.5}$ at the airport terminal, runway or infrastructure areas;
- there would be no exceedances of the annual average impact assessment criteria for PM_{10} at the airport terminal, runway, infrastructure or fuel farm areas.
- exceedances of the annual average impact assessment criteria for $PM_{2.5}$ are limited to the fuel farm area for Scenario 3;
- exceedances of the 24-hour average impact assessment criteria for PM_{10} and $PM_{2.5}$ are limited to the fuel farm area (2–4 additional days over the impact assessment criteria) for Scenario 3; and

It is noted that the health-based air quality criteria for particulate matter are designed to offer protection for periods of exposure ranging from 24-hours to annual averages. It is expected that exposure risk at the Fuel Farm area would be minimal as employees would not spend significant periods of time within this area.

Furthermore, modelling predictions are based on a conservatively high rate of quarry infill. The quarry infill scenario will be refined and mitigated if needed in a future development application.

Table 3.1 Predicted incremental and cumulative annual average PM_{10} and $PM_{2.5}$ concentrations for airport receptors

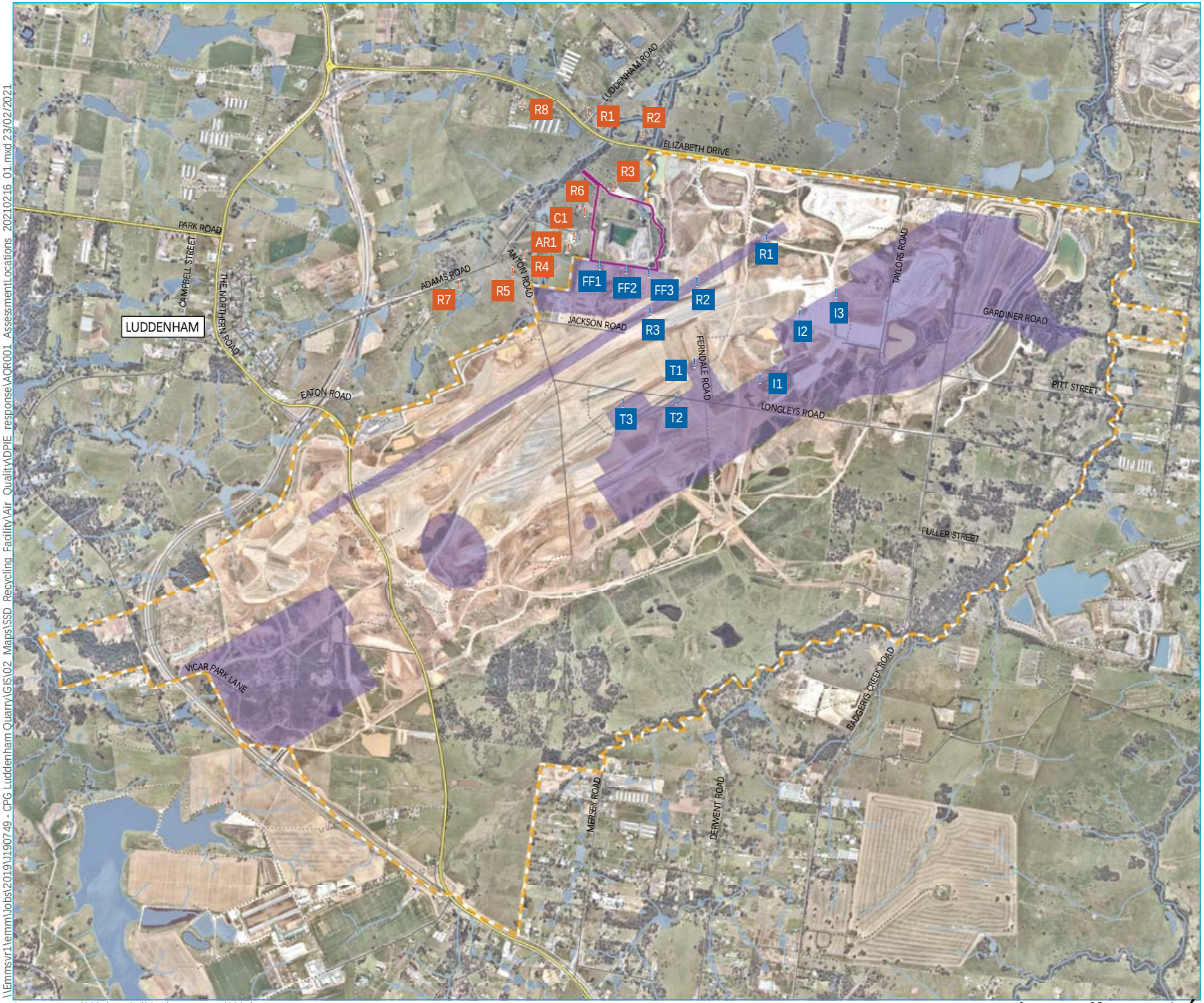
	PM_{10} (µg/m³)				$PM_{2.5}$ (µg/m³)			
	Increment		Cumulative		Increment		Cumulative	
	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal			**25 µg/m³**				**8 µg/m³**	
Terminal R1	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Terminal R2	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Terminal R3	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Runway R1	<0.1	0.1	18.7	18.9	<0.1	<0.1	7.5	7.5
Runway R2	0.1	0.3	18.8	19.1	<0.1	0.1	7.5	7.6
Runway R3	0.1	0.3	18.8	19.1	<0.1	0.1	7.5	7.6
Fuel farm R1	0.2	2.2	18.9	21.2	0.1	0.3	7.6	7.9
Fuel farm R2	0.3	3.1	19.0	22.1	0.1	0.5	7.6	**8.1**
Fuel farm R3	0.2	3.5	18.9	22.4	0.1	0.5	7.6	**8.1**
Infrastructure R1	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Infrastructure R2	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Infrastructure R3	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5

Table 3.2 Predicted incremental and cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations for airport receptors

	PM_{10} (µg/m³) (number of additional days above goal shown in brackets)				$PM_{2.5}$ (µg/m³) (number of additional days above goal shown in brackets)			
	Increment		Cumulative		Increment		Cumulative	
	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal			**50 µg/m³**				**25 µg/m³**	
Terminal R1	0.8	1.6	45.8	45.9	0.4	0.4	23.8	23.8
Terminal R2	0.7	1.5	45.8	45.9	0.3	0.3	23.8	23.8
Terminal R3	0.5	1.1	45.8	45.9	0.2	0.2	23.8	23.8
Runway R1	0.9	2.0	45.8	45.9	0.4	0.4	23.8	23.8
Runway R2	0.8	5.3	45.8	46.2	0.4	0.8	23.8	23.8
Runway R3	1.1	4.6	45.9	46.0	0.5	0.7	24.0	23.8
Fuel farm R1	1.3	10.0	45.9	49.0	0.5	1.2	24.0	24.4
Fuel farm R2	1.7	16.0	45.9	**55.2 (2)**	0.6	2.6	23.9	25.0
Fuel farm R3	2.0	23.7	45.8	**55.4 (4)**	0.9	3.0	23.8	**25.5 (2)**
Infrastructure R1	0.4	1.3	45.8	45.9	0.2	0.2	23.8	23.8
Infrastructure R2	0.5	1.0	45.8	45.9	0.3	0.2	22.1	22.1
Infrastructure R3	0.2	1.8	45.8	45.9	0.1	0.3	22.1	22.1

Table 3.3 Predicted incremental and cumulative annual average TSP and dust deposition for airport receptors

	TSP (µg/m³)				Dust deposition (g/m²/month)			
	Increment		Cumulative		Increment		Cumulative	
	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal		**90 µg/m³**				**2 g/m²/month**	**4 g/m²/month**	
Terminal R1	0.1	0.2	49.8	50.0	<0.1	<0.1	1.6	1.6
Terminal R2	0.1	0.1	49.8	49.9	<0.1	<0.1	1.6	1.6
Terminal R3	0.1	0.2	49.8	50.1	<0.1	<0.1	1.6	1.6
Runway R1	0.2	0.3	49.9	50.2	<0.1	<0.1	1.6	1.6
Runway R2	0.3	0.7	50.0	50.7	<0.1	0.1	1.6	1.7
Runway R3	0.3	0.8	50.0	50.8	<0.1	0.0	1.6	1.7
Fuel farm R1	1.0	6.4	50.7	57.1	<0.1	0.6	1.6	2.2
Fuel farm R2	1.2	8.7	50.9	59.7	0.1	0.7	1.7	2.4
Fuel farm R3	0.9	10.1	50.6	60.7	<0.1	0.8	1.6	2.4
Infrastructure R1	0.1	0.1	49.8	49.9	<0.1	<0.1	1.6	1.6
Infrastructure R2	0.1	0.2	49.8	50.0	<0.1	<0.1	1.6	1.6
Infrastructure R3	0.1	0.1	49.8	49.9	<0.1	<0.1	1.6	1.6



KEY

- Subject property
- Western Sydney Airport
- Proposed airport infrastructure
- Assessment location
- Airport receptor
- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line

Source: EMM (2021); DFSI (2017); Nearmap (2021)

0 0.5 1 km

GDA 1994 MGA Zone 56

\\Emmsvr1\emm\Jobs\2019\190749 - CPG Luddenham Quarry\GIS\02 Maps\SSD Recycling Facility\Air Quality\DPIE response\AQR001 AssessmentLocations 20210216 01.mxd 23/02/2021

Air quality assessment locations

Luddenham Advanced Resource Recovery Centre
Air Quality Impact Assessment
Figure 3.1

EMM creating opportunities

4 Odour assessment

4.1 DPIE submission

A conservative worse case odour assessment is presented to address DPIE's submission (below) to account for potential odour emissions from the ARRC and future activity of quarry infilling.

> It is understood that general solid waste (putrescible) will not be accepted at the development. The AQIA states that as no putrescible waste will be accepted at the RRF and no sources of odour emissions identified from the RRF operations, odour was not quantitively assessed in the EIS. A quantitative assessment of odour impacts, as per the SEARs requirements should be provided to provide baseline data and conservatively assess and provide mitigation measures for potential odour impacts to future sensitive receptors, including the Western Sydney Airport and approved/future developments in the vicinity.

4.2 Assessment of odour impacts

The criteria used to assess odour impacts are "odour units" (ou) which are effectively the number of dilutions required for a sample of odorous air to reach the odour detection threshold (below which odour would not be perceptible). The odour nuisance level can be as low as 2 ou and as high as 10 ou (for less offensive odours), whereas an odour assessment criterion of 7 ou is likely to represent the level below which 'offensive' odours should not occur.

The Technical Framework for Assessment and Management of Odour from Stationary Sources in NSW (NSW DECC 2006) recommends that, as a design criterion, no individual should be exposed to ambient odour levels of greater than 7 ou. NSW EPA (2016) prescribes odour goals which take into account the population density for a particular area. The most stringent odour goal of 2 ou is acceptable for the whole population and therefore appropriate for densely populated areas. A summary of the NSW EPA's population-based odour assessment criteria is presented in Table 4.1. Odour goals are compared against the 99th percentile of dispersion modelling predictions and for averaging periods known as a 'nose response average'[1].

Table 4.1 Impact assessment criteria for complex mixtures of odorous air pollutants

Population of affected community	Odour units (ou), nose response time average, 99th percentile
2	7
10	6
30	5
125	4
500	3
Urban (2000) and / or schools and hospitals	2

The population of the community in the vicinity of the ARRC is likely to be less than 30, which would correspond to an odour goal of 5 ou. The transient population for the future operation at the WSA may be higher, therefore the more stringent odour goal of 2 ou may be more appropriate for some areas of the WSA (ie terminal building), although it is noted that exposure would be unlikely as limited time would be spent outside the terminal building.

[1] nose response average refers to the instantaneous perception of odours by the human nose and is derived using peak-to-mean ratios, described in Section 3

It is expected that the odour environment in the vicinity of the fuel farm and runways would be dominated by odour from aviation fuel.

4.3 Odour emissions

The incoming waste would not generally be odorous therefore odour impacts during operation of the ARRC are not expected. Notwithstanding, a proportion of the incoming waste would be organic (wood waste, garden waste, paper and cardboard) and therefore has the potential to generate odour for the quarry infilling scenario (from the decomposition of residual organic waste that was not able to be recycled). The ARRC would aim to recover as much of this organic waste as possible, and therefore only a small volume of degradable waste is expected to be returned to the quarry void. Notwithstanding, a conservative worse case odour assessment is presented which accounts for potential odour emissions from the ARRC facility and from the quarry infilling.

Odour emissions from the ARRC are estimated using an emission factor of 25.1 ou.m^3/tonne/second (The Odour Unit 2018). This emission factor is applied to derive an odour emission rate (OER, expressed as ou.m^3/s) for the ARRC warehouse based on an hourly processing rate of 71.4 tonnes per hour. This results in a total warehouse OER of 1793 ou.m^3/s which is assumed to emit evenly across the four entry/exit doors.

To derive odour emission rates for quarry infilling, odour emission data for putrescible waste landfills were reviewed for sites where relatively recent odour monitoring was conducted. A summary of these data is provided in Table A.5. As limited putrescible waste would be directed for quarry filling, the approach taken for this assessment is to use lowest specific odour emission rate (SOER, expressed as ou.m^3/m^2/s) reported in Table A.5, which were all putrescible waste landfills.

There are limited odour data available for non- putrescible waste landfills, however odour measurements were taken at the active tip face of the Bingo Eastern Creek Recycling Park, which accepts similar waste to that proposed for the ARRC. The odour measurement at the active tip face for this site is comparable to the lowest SOER for the active tip face at the putrescible waste landfills reported in Table A.5 , thereby validating the approach for this assessment.

The quarry pit is split into three operational areas for modelling, as follows:

- active tip face, with an area of ~1,350 m^2 and an odour emission rates of 0.4 ou.m^3/m^2/s;
- daily cover, with an area of ~5,350 m^2 and an odour emission rates of 0.03 ou.m^3/m^2/s; and
- intermediate cover, with an area of ~55,330 m^2 and an odour emission rates of 0.019 ou.m^3/m^2/s.

4.4 Odour modelling results

4.4.1 Peak-to-mean ratios

The instantaneous perception of odours by the human nose occurs over very short timescales (~ 1 second), but dispersion model predictions are typically made for a one hour averaging period. To estimate the effects of plume meandering and concentration fluctuations perceived by the human nose, it is possible to multiply dispersion model predictions by a correction factor called a “peak-to-mean ratio”. The peak-to-mean ratio (P/M60) is defined as the ratio of peak 1-second concentrations to mean 1-hour average concentrations. To estimate peak 1-second concentrations from hourly averaged odour concentrations, a peak-to-mean ratio (P/M60) of 2.3 has been applied in accordance with Table 6.1 of NSW EPA 2016.

4.4.2 Results

The results of the odour modelling are presented in Table 4.2. All receptors are below the odour goal of 5 ou, with most receptor locations at or below 1 ou (the theoretical level at which no odour would occur). The exception is the fuel farm area, which is adjacent to the quarry boundary, however the predicted odour concentration at these locations is less than the design criterion of 7 ou, therefore nuisance odour impacts are unlikely. Furthermore, it is expected that the odour environment in the vicinity of the fuel farm would be dominated by odour from aviation fuel. The predicted odour at fuel farm area is predominantly from quarry infilling, which will be considered further in a future development application.

Table 4.2 Predicted odour impacts for all receptors

Receptor	Odour concentration (ou) 99th percentile, nose response average
R1	<1
R2	1
R3	3
R4	1
R5	1
R6	2
R7	<1
R8	<1
C1	2
AR1	2
Terminal R1	<1
Terminal R2	<1
Terminal R3	<1
Runway R1	<1
Runway R2	1
Runway R3	1
Fuel farm R1	4
Fuel farm R2	6
Fuel farm R3	3
Infrastructure R1	<1
Infrastructure R2	<1
Infrastructure R3	<1

5 Conclusion

Changes to the operational assumptions for the site has required updates to the air quality modelling predictions presented in the EIS. Furthermore, the cumulative scenarios presented in the EIS have been revised to account for quarry infilling.

Revised modelling results predict that air quality and odour impacts from the proposed operation of the ARRC would not adversely impact local air quality. Exceedances of the impact assessment criteria are limited to receptor R3, which is currently vacant and the property owner intends to develop the property for commercial purposes in line with the recent rezoning to Agribusiness.

Modelling predictions for a number of future airport receptors indicate that there would be no air quality impact for the operation of the WSA, with exceedances of the impact assessment criteria limited to the fuel farm area where exposure risk would be minimal.

6 References

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Appendix A

Revised dust emissions inventory and odour emission estimates

A.1 Revised emission inventories for ARRC (changes to truck movements and diesel emissions)

Table A.1 Revised TSP emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Haulage																	
Waste trucks in - waste transfer	795.6	2,457	VKT/y	1.08	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	70	Water flushing/street sweeping
Waste trucks in - construction waste	684.2	17,200		0.13	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	6.4		7.4		70	
Waste trucks in - bulk waste	795.6	2,457		1.08	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0		7.4		70	
Waste trucks out - waste transfer	233.0	2,457		0.32	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	15.0		7.4		70	
Waste trucks out - construction waste	145.2	17,200		0.03	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	1.4		7.4		70	
Waste trucks out - bulk waste	270.9	2,857		0.32	kg/VKT	200,000	t/y	35.0	t/load	0.500	km/trip	15.0		7.4		70	
Product trucks in	699.0	7,371		0.32	kg/VKT	600,000	t/y	35.0	t/load	0.430	km/trip	15.0		7.4		70	
Product trucks out	1,831.8	5,657		1.08	kg/VKT	600,000	t/y	35.0	t/load	0.330	km/trip	50.0		7.4		70	
Material handling and processing in shed																	
Internal haul - waste trucks	755.6	10,320	VKT/y	0.4881	kg/VKT	600,000	t/y	25.0	t/load	0.430	km/trip	23.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Internal haul - product trucks	894.3	8,571	VKT/y	0.6955	kg/VKT	600,000	t/y	35.0	t/load	0.500	km/trip	32.5		7.4	road surface silt loading (g/m2)	85	
Trucks unloading waste in warehouse	36.7	600,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	Enclosure and water sprays
Excavator sorting / picking	36.7	600,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Non-recyclable material - rehandle	3.7	60,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Recyclable material - conveyor/transfer	165.2	540,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	5	transfe r points					85	
Recyclable material - screening	89.1	540,000	t/y	0.0043	kg/t											85	
Recyclable material - rehandle	33.0	540,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Crushing concrete/masonry	12.2	135,000	t/y	0.0125	kg/t											85	

Table A.1 Revised TSP emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Shredding timber	24.3	270,000	t/y	0.0125	kg/t											85	
Future processing - shredding tyres	1.8	20,000	t/y	0.0125	kg/t											85	
Future processing - sand screening at wash plant	16.5	100,000	t/y	0.0043	kg/t											85	
Future processing - rehandle	14.7	120,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	2	times rehandle					85	
Rehandle processed material to stockpile bins	24.8	405,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
FEL wheel generated dust	22	7,500	VKT/y	0.0200	kg/VKT	600,000	t/y	4.0	t/load (wt ave)	0.050	km/trip	1.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Product - rehandle to truck	36.7	600,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Wind erosion (shed)																	
Shed area	11.9	1.4	ha	850	kg/ha/yr											99	Enclosure
Miscellaneous																	
Onsite diesel consumption	20.5	311	kL/annum	0.07	kg/kL												
Total (kg/yr)	**7,655**																

Table A.2 Revised PM_{10} emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Haulage																	
Waste trucks in - waste transfer	140.8	2,457	VKT/y	0.1910	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	70	Water flushing/street sweeping
Waste trucks in - construction waste	121.1	17,200		0.0235	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	6.4		7.4		70	
Waste trucks in - bulk waste	140.8	2,457		0.1910	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0		7.4		70	
Waste trucks out - waste transfer	48.0	2,457		0.0559	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	15.0		7.4		70	
Waste trucks out - construction waste	29.9	17,200		0.0050	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	1.4		7.4		70	
Waste trucks out - bulk waste	48.0	2,857		0.0559	kg/VKT	200,000	t/y	35.0	t/load	0.500	km/trip	15.0		7.4		70	
Product trucks in	123.7	7,371		0.0559	kg/VKT	600,000	t/y	35.0	t/load	0.430	km/trip	15.0		7.4		70	
Product trucks out	324.2	5,657		0.1910	kg/VKT	600,000	t/y	35.0	t/load	0.330	km/trip	50.0		7.4		70	
Material handling and processing in shed																	
Internal haul - waste trucks	33.7	10,320	VKT/y	0.0937	kg/VKT	600,000	t/y	25.0	t/load	0.430	km/trip	23.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Internal haul - product trucks	27.5	8,571	VKT/y	0.1335	kg/VKT	600,000	t/y	35.0	t/load	0.500	km/trip	32.5		7.4	road surface silt loading (g/m2)	85	
Trucks unloading waste in warehouse	17.4	600,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Excavator sorting / picking	17.4	600,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Non-recyclable material - rehandle	1.7	60,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	Enclosure and water sprays
Recyclable material - conveyor/transfer	15.6	540,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	5	transfer points					85	
Recyclable material - screening	30.0	540,000	t/y	0.0004	kg/t											85	
Recyclable material - rehandle	15.6	540,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Crushing concrete/masonry	5.5	135,000	t/y	0.0003	kg/t											85	
Shredding timber	10.9	270,000	t/y	0.0003	kg/t											85	
Future processing - shredding tyres	0.8	20,000	t/y	0.0003	kg/t											85	

Table A.2 Revised PM_{10} emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Future processing - sand screening at wash plant	5.6	100,000	t/y	0.0004	kg/t											85	
Future processing - rehandle	3.5	120,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	2	times rehandle					85	
Rehandle processed material to stockpile bins	11.7	405,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
FEL wheel generated dust	4.3	7,500	VKT/y	0.0038	kg/VKT	600,000	t/y	4.0	t/load (wt ave)	0.050	km/trip	1.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Product - rehandle to truck	17.4	600,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Wind erosion (shed)																	
Shed area	6.0	1.4	ha	425	kg/ha/yr											99	Enclosure
Miscellaneous																	
Onsite diesel consumption	20.5	311	kL/annum	0.07	kg/kL												
Total (kg/yr)	**1,221**																

Table A.3 Revised $PM_{2.5}$ emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Haulage																	
Waste trucks in - waste transfer	36.9	2,457	VKT/y	0.0501	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	70	Water flushing/street sweeping
Waste trucks in - construction waste	31.8	17,200		0.0062	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	6.4		7.4		70	
Waste trucks in - bulk waste	43.0	2,457		0.0501	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0		7.4		70	
Waste trucks out - waste transfer	10.8	2,457		0.0147	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	15.0		7.4		70	
Waste trucks out - construction waste	6.7	17,200		0.0013	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	1.4		7.4		70	
Waste trucks out - bulk waste	10.8	2,857		0.0147	kg/VKT	200,000	t/y	35.0	t/load	0.500	km/trip	15.0		7.4		70	
Product trucks in	32.5	7,371		0.0147	kg/VKT	600,000	t/y	35.0	t/load	0.430	km/trip	15.0		7.4		70	
Product trucks out	85.1	5,657		0.0501	kg/VKT	600,000	t/y	35.0	t/load	0.330	km/trip	50.0		7.4		70	
Material handling and processing in shed																	
Internal haul - waste trucks	8.2	10,320	VKT/y	0.0227	kg/VKT	600,000	t/y	25.0	t/load	0.430	km/trip	23.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Internal haul - product trucks	6.6	8,571	VKT/y	0.0323	kg/VKT	600,000	t/y	35.0	t/load	0.500	km/trip	32.5		7.4	road surface silt loading (g/m2)	85	
Trucks unloading waste in warehouse	2.6	600,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Excavator sorting / picking	2.6	600,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Non-recyclable material - rehandle	0.3	60,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	Enclosure and water sprays
Recyclable material - conveyor/transfer	2.4	540,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	5	transfe r points					85	
Recyclable material - screening	2.0	540,000	t/y	0.00003	kg/t											85	
Recyclable material - rehandle	2.4	540,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Crushing concrete/masonry	1.0	135,000	t/y	0.00005	kg/t											85	
Shredding timber	2.0	270,000	t/y	0.00005	kg/t											85	
Future processing - shredding tyres	0.2	20,000	t/y	0.00005	kg/t											85	

Table A.3 Revised $PM_{2.5}$ emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Future processing - sand screening at wash plant	0.4	100,000	t/y	0.00003	kg/t											85	
Future processing - rehandle	0.5	120,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	2	times rehandle					85	
Rehandle processed material to stockpile bins	1.8	405,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
FEL wheel generated dust	0.0	7,500	VKT/y	0.00000	kg/VKT	600,000	t/y	4.0	t/load (wt ave)	0.050	km/trip	1.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Product - rehandle to truck	2.6	600,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Wind erosion (shed)																	
Shed area	0.9	1.4	ha	64	kg/ha/yr											99	Enclosure
Miscellaneous																	
Onsite diesel consumption	19.9	311	kL/annum	0.06	kg/kL												
Total (kg/yr)	**314**																

A.2 Quarry infill scenario

Table A.4 TSP, PM_{10} and $PM_{2.5}$ emissions inventory for Quarry infill scenario

Activity	TSP Emission estimate (kg/year)			Intensity	Unit	Emission Factor			Unit		Variable									Control %	Control
	TSP	PM_{10}	$PM_{2.5}$			TSP	PM_{10}	$PM_{2.5}$													
Hauling - external trucks entering via access road - sealed	1,520.2	291.8	70.6	3,857	VKT/y	1.31	0.25	0.06	kg/VKT	7.4	Road silt loading (g/m²)	0.5	km/trip	8,571	Loads/y	55	loaded weight (t)	35	tonnes per load	0.7	Water flushing/street sweeping
Hauling - external trucks entering via access road - unsealed	4,342.4	1,115.8	111.6	6,000	VKT/y	2.89	0.74	0.07	kg/VKT	5.0	% silt content	0.7	km/trip	8,571	Loads/y	55	loaded weight (t)	35	tonnes per load	0.75	Watering
Hauling - internal trucks from ARRC	891.6	229.1	22.9	1,105	VKT/y	3.23	0.83	0.08	kg/VKT	5.0	% silt content	0.7	km/trip	1,579	Loads/y	70	loaded weight (t)	38	tonnes per load	0.75	
Unloading waste	102.8	48.6	7.4	360,000	t/y	0.0004	0.0002	0.00003	kg/t	2.6	Average wind speed (m/s)	5	Moisture content (%)							0.3	
Rehandle	102.8	48.6	7.4	360,000	t/y	0.0004	0.0002	0.00003	kg/t	2.6	Average wind speed (m/s)	5	Moisture content (%)							0.3	
FEL/compactor movements	3,472.2	892.2	89.2	14,560	VKT/y	0.48	0.12	0.01	kg/VKT	5.0	% silt content	1	Average weight (t)			8	speed in km/h	1,820	FEL hours	0.5	Watering
Hauling - external trucks exiting via access road - unsealed	2,951.2	758.3	75.8	6,429	VKT/y	1.84	0.47	0.05	kg/VKT	5.0	% silt content	0.8	km/trip	8,571	Loads/y	20	empty weight (t)	35	Truck capacity (t)	0.75	Watering
Hauling - external trucks exiting via access road - sealed	481.5	92.4	22.4	3,429	VKT/y	0.47	0.09	0.02	kg/VKT	7.4	Road silt loading (g/m²)	0.4	km/trip	8,571	Loads/y	20	empty weight (t)	35	Truck capacity (t)	0.7	Water flushing/street sweeping
Hauling - internal trucks back to ARRC	626.9	161.1	16.1	1,105	VKT/y	2.27	0.58	0.06	kg/VKT	5.0	% silt content	0.7	km/trip	1,579	Loads/y	32	empty weight (t)	38	Truck capacity (t)	0.75	Watering
Active pit	2,023.0	1,011.5	151.7	3.4	ha	850	425	64	kg/ha/y											0.3	Sheltering
Grader (road maintenance)	3,200.4	1,118.2	99.2	10,400	VKT/y	0.62	0.22	0.02	kg/km	8	speed of graders in km/h	1,300	grader hours							0.5	Watering
Onsite diesel consumption	130.4	130.4	126.4	198	kl/yr	0.66	0.66	0.64	kg/kL												
Total (kg/yr)	**19,845**	**5,898**	**801**			1.31	0.25	0.06	kg/VKT												

A.3 Review of odour emissions and rates for modelling

Table A.5 Review of odour emissions data and odour emission rates for modelling

Source	Whytes Gully[1]	Spring Farm[4]	Woodlawn[2]	Lucas Heights[3]	SOER used for modelling
Active tip face	1.115	0.424	0.7	*26-40	0.424
Daily cover	1.023	0.069		0.03	0.03
Intermediate cover	0.035	0.019	0.3		0.019

Note: * measured using upwind/downwind transect method and therefore not comparable to other sources and sites which were measured using an isolation flux hood

[1] PAEHolmes, 2012

[2] Heggies, 2010

[3] GHD, 2015

[4] Pacific Environment, 2013

Appendix C

Surface water laboratory analysis

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2105076**	Page	: 1 of 6
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Patrick Carolan	Contact	: Sepan Mahamad
Address	: 6/146 Hunter Street Newcastle 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: 02 4907 4800	Telephone	: +61 2 8784 8555
Project	: J190749	Date Samples Received	: 12-Feb-2021 18:20
Order number	: ----	Date Analysis Commenced	: 12-Feb-2021
C-O-C number	: ----	Issue Date	: 19-Feb-2021 18:24
Sampler	: Patrick Carolan		
Site	: ----		
Quote number	: EN/112/20 Primary work		
No. of samples received	: 8		
No. of samples analysed	: 8		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	OC_US	PIT1	WMD	OC_Pond	OD_DS
				Sampling date / time	12-Feb-2021 12:50	12-Feb-2021 12:10	12-Feb-2021 13:40	12-Feb-2021 13:50	12-Feb-2021 17:10
Compound	CAS Number	LOR	Unit		ES2105076-001	ES2105076-002	ES2105076-003	ES2105076-004	ES2105076-005
					Result	Result	Result	Result	Result
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		929	5990	1770	748	773
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		472	3720	936	385	412
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		22	8	6	11	40
EA045: Turbidity									
Turbidity	----	0.1	NTU		42.5	2.3	4.9	27.5	67.9
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	107	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		38	256	169	16	16
Total Alkalinity as CaCO3	----	1	mg/L		38	363	169	16	16
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		51	366	21	30	36
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		241	1460	456	202	200
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		18	30	24	10	8
Magnesium	7439-95-4	1	mg/L		8	136	40	6	7
Sodium	7440-23-5	1	mg/L		142	1040	258	120	126
Potassium	7440-09-7	1	mg/L		2	22	14	2	2
ED093F: SAR and Hardness Calculations									
Total Hardness as CaCO3	----	1	mg/L		78	635	225	50	49
^ Sodium Adsorption Ratio	----	0.01	-		7.00	18.0	7.49	7.41	7.85
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.04	<0.01	<0.01	<0.01	0.02
Arsenic	7440-38-2	0.001	mg/L		<0.001	0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		0.014	<0.001	0.019	0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		0.059	<0.001	0.006	0.047	0.038
Nickel	7440-02-0	0.001	mg/L		0.004	<0.001	0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		0.012	<0.005	0.007	<0.005	<0.005

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	OC_US	PIT1	WMD	OC_Pond	OD_DS
				Sampling date / time	12-Feb-2021 12:50	12-Feb-2021 12:10	12-Feb-2021 13:40	12-Feb-2021 13:50	12-Feb-2021 17:10
Compound	CAS Number	LOR	Unit		ES2105076-001	ES2105076-002	ES2105076-003	ES2105076-004	ES2105076-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.01**	<0.01	**0.05**	<0.01	**0.10**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	**0.12**	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.42**	**3.64**	<0.01	**0.29**	**0.22**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.42**	**3.76**	<0.01	**0.29**	**0.22**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.2**	**1.2**	**1.0**	<0.1	**0.2**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.6**	**5.0**	**1.0**	**0.3**	**0.4**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.04**	**0.13**	**0.03**	**0.01**	**0.04**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**8.62**	**56.0**	**16.7**	**6.64**	**6.71**
ø Total Cations	----	0.01	meq/L		**7.78**	**58.5**	**16.1**	**6.26**	**6.51**
ø Ionic Balance	----	0.01	%		**5.09**	**2.12**	**1.85**	**2.94**	**1.54**
EP025: Oxygen - Dissolved (DO)									
Dissolved Oxygen	----	0.1	mg/L		**8.8**	**10.5**	**9.8**	**8.6**	**8.0**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Sed Pond	PIT1_D	PIT2	----	----
				Sampling date / time	12-Feb-2021 17:00	12-Feb-2021 16:00	12-Feb-2021 12:25	----	----
Compound	CAS Number	LOR	Unit		ES2105076-006	ES2105076-007	ES2105076-008	--------	--------
					Result	Result	Result	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		870	6000	5990	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		488	3790	3620	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		33	10	7	----	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		11.1	2.6	3.7	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		64	122	118	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		79	246	260	----	----
Total Alkalinity as CaCO3	----	1	mg/L		142	369	378	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		1	358	362	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		199	1460	1480	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		21	32	31	----	----
Magnesium	7439-95-4	1	mg/L		19	136	134	----	----
Sodium	7440-23-5	1	mg/L		116	1040	1030	----	----
Potassium	7440-09-7	1	mg/L		13	22	22	----	----
ED093F: SAR and Hardness Calculations									
Total Hardness as CaCO3	----	1	mg/L		131	640	629	----	----
^ Sodium Adsorption Ratio	----	0.01	-		4.41	17.9	17.9	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Arsenic	7440-38-2	0.001	mg/L		0.002	<0.001	<0.001	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L		0.021	0.012	0.014	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L		0.059	0.001	0.002	----	----
Nickel	7440-02-0	0.001	mg/L		0.008	0.004	0.006	----	----
Zinc	7440-66-6	0.005	mg/L		0.008	0.006	0.008	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Sed Pond	PIT1_D	PIT2	----	----
				Sampling date / time	12-Feb-2021 17:00	12-Feb-2021 16:00	12-Feb-2021 12:25	----	----
Compound	CAS Number	LOR	Unit		ES2105076-006	ES2105076-007	ES2105076-008	--------	--------
					Result	Result	Result	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	----	----
Iron	7439-89-6	0.05	mg/L		**1.21**	<0.05	<0.05	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.07**	**0.05**	**0.04**	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	**0.12**	**0.12**	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	**3.62**	**3.57**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**3.74**	**3.69**	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.9**	**1.0**	**1.3**	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.9**	**4.7**	**5.0**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.03**	<0.01	**0.02**	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**8.47**	**56.0**	**56.8**	----	----
ø Total Cations	----	0.01	meq/L		**7.99**	**58.6**	**57.9**	----	----
ø Ionic Balance	----	0.01	%		**2.93**	**2.25**	**0.96**	----	----
EP025: Oxygen - Dissolved (DO)									
Dissolved Oxygen	----	0.1	mg/L		**12.1**	**11.0**	**11.2**	----	----

Appendix D

Pavement investigation

Pavement Investigation

Adams Road, Luddenham NSW 2745

Prepared for:
EMM Consulting
20 Chandos Street, St Leonards NSW 2065

Prepared by:
Durkin Construction Pty Ltd

Report ID: D18219-PIR001-H

Revision: H

Date Issued: 25/02/2021

Table of Content

Document Control

REPORT ID	REV NO.	DATE ISSUED	AUTHOR	REVIEWER	VERSION
D18219-PIR001	A	07/09/2020	J. Zhang	J. Loney	For Review
D18219-PIR001	B	24/09/2020	J. Zhang	J. Loney	Added FWD data and analysis
D18219-PIR001	C	02/10/2020	J. Zhang	J. Loney	Added additional FWD data and analysis
D18219-PIR001	D	18/11/2020	J. Zhang	J. Loney	Updated the pavement analysis based on the new traffic data provided by EMM Consulting
D18219-PIR001	E	18/12/2020	J Loney	-	Added Surface Treatment Section
D18219-PIR001	F	18/02/2021	J Loney	-	Updated Section 4.2
D18219-PIR001	G	24/02/2021	J Loney	-	Updated Section 4.2
D18219-PIR001	H	25/02/2021	J Loney	-	Updated Section 4.2

Reference Documents

Austroads Guide to Pavement Technology Part 2: Pavement Structural Design, 2017, Austroads, NSW (AGPT02-17)

Austroads Guide to Pavement Technology Part 5: Pavement Evaluation and Treatment Design, 2019, Austroads, NSW (AGPT05-19)

1.0 Introduction

At the request of ***EMM Consulting***, a project level pavement investigation was conducted by ***Durkin Construction*** *(DC)* on Adams Road, Luddenham. The scope covers the section of road within 340 metres from Elizabeth Drive. The objective of the investigation was to investigate the existing condition of the pavement and provide an estimate on remaining structural life.

This pavement investigation comprised of shallow borehole investigation, Falling Weight Deflectometer (FWD) testing, Dynamic Cone Penetrometer (DCP) testing and sampling of pavement material for laboratory testing. The borehole locations are highlighted below in Figure 1.0.1. Detailed borehole location map is attached in Appendix A.

Figure 1.0.1 – Scope of Works (Overview)

2.0 Field Investigation

2.1 Borehole Investigation

The fieldwork consisted of drilling five (5) no. 150mm diameter shallow pavement boreholes to 1.5m depth. The borehole locations were selected in staggered locations within the scope given by ***EMM Consulting***. All materials were logged as per guidelines in AS1726-2017 using the field tactile method.

Dynamic Cone Penetrometer (DCP) Tests were carried out as per AS1289.6.3.2 from the top of the subgrade to 1.5m depth or refusal at each borehole location to determine the in-situ subgrade CBR.

A summary of the findings from each borehole is shown below in Table 2.1.1. Detailed borehole logs are attached in Appendix B.

BOREHOLE LOCATION	DEPTH OF PAVEMENT MATERIAL (mm)	PAVEMENT MATERIAL DESCRIPTION	CBR FIELD DCP TESTS [%]
BH1	0-65	ASPHALT	-
	65-270	SANDY GRAVEL (CEMENT TREATED)	-
	270-1500	SILTY CLAY	4
BH2	0-20	SPRAYED SEAL	-
	20-225	GRAVELLY SAND (CEMENT TREATED)	-
	225-1500	SILTY CLAY	6
BH3	0-25	SPRAYED SEAL	-
	25-245	GRAVELLY SAND (CEMENT TREATED)	-
	245-1500	SANDY CLAY	8
BH4	0-20	SPRAYED SEAL	-
	20-160	GRAVELLY SAND (CEMENT TREATED)	-
	160-1500	SANDY CLAY	19
BH5	0-15	SPRAYED SEAL	-
	15-260	GRAVELLY SAND (CEMENT TREATED)	-
	260-490	GRAVELLY SAND	-
	490-1500	SANDY CLAY	8

Table 2.1.1 – Summary of Field Investigations

See Appendix C for DCP test reports.

2.2 Borehole Investigation Photos

Figure 2.2.1 – BH1: Pavement Surface Condition

Figure 2.2.2 – BH1: Existing Pavement Structure

Figure 2.2.3 – BH1: Existing Pavement Materials (Top to Bottom)

Figure 2.2.4 – BH2: Pavement Surface Condition

Figure 2.2.5 – BH2: Existing Pavement Structure

Figure 2.2.6 – BH3: Existing Pavement Materials (Top to Bottom)

Figure 2.2.7 – BH3: Pavement Surface Condition

Figure 2.2.8 – BH3: Existing Pavement Structure

Figure 2.2.9 – BH3: Existing Pavement Materials (Top to Bottom)

Figure 2.2.10 – BH4: Pavement Surface Condition

Figure 2.2.11 – BH4: Existing Pavement Structure

Figure 2.2.12 – BH4: Existing Pavement Materials (Top to Bottom)

Figure 2.2.13 – BH5: Pavement Surface Condition

Figure 2.2.14 – BH5: Existing Pavement Structure

Figure 2.2.15 – BH5: Existing Pavement Materials (Top to Bottom)

2.3 Falling Weight Deflectometer Testing

Falling Weight Deflectomer (FWD) Testing was carried out on 22nd September and 1st October 2020 during day shift to investigate the existing pavement condition and to estimate the pavement remaining life. A 40kN (566kPa) plate loading was used as per AGPT05-19 recommendations. A test was carried out every 10m along both outer wheel paths (OWP), and along the Northbound Inner Wheel Path (IWP).

The maximum deflections at each test point are plotted in Figure 2.3.1 below. Based on the findings from the field boreholes, the base material is believed to be cement modified but not in a bound state. For FWD testing and analysis this pavement material has been treated as unbound granular with thin bituminous surfacing (AGPT05-19).

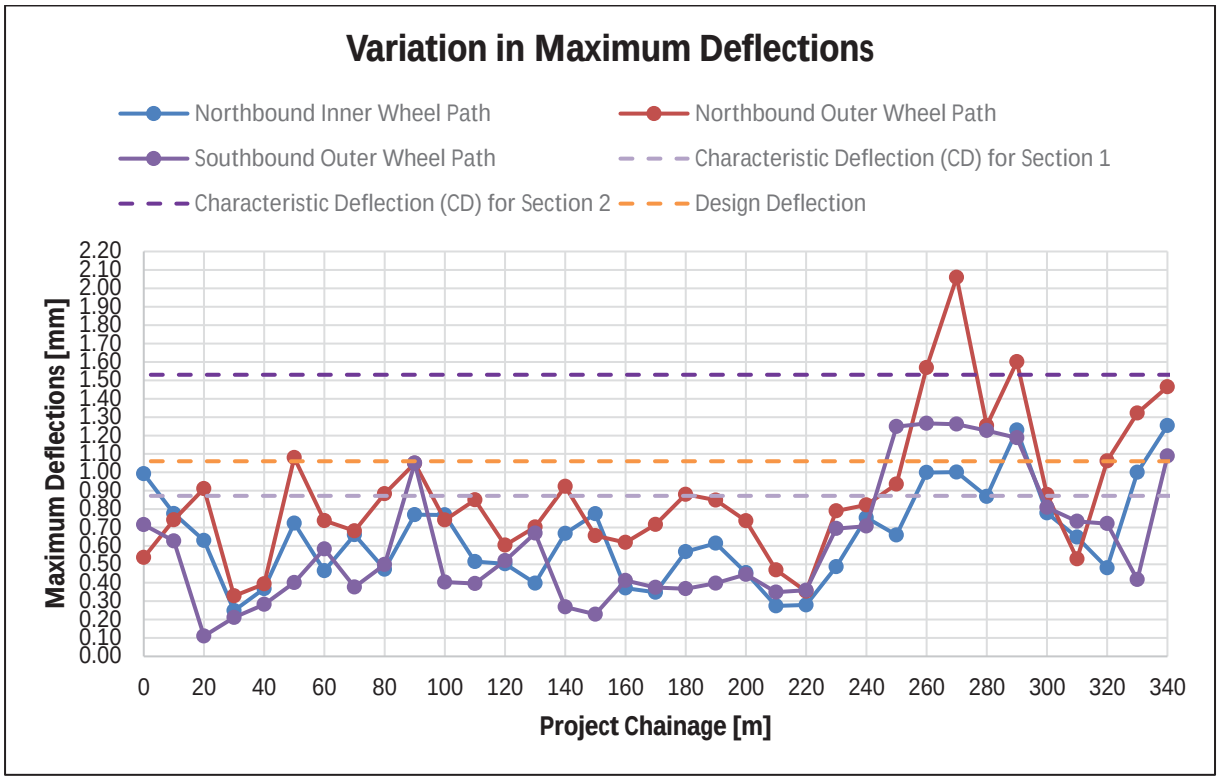


Figure 2.3.1 – Variation in Maximum Deflection along project

As seen in Figure 2.3.1, the maximum deflections are generally consistent between wheel paths along the length of the scope with a clear step change in maximum deflections at CH250. CH0 was taken from Elizabeth Drive end of the scope. The section with high deflections are in the area which is next to the development site access between CH250-290m. A design deflection based on 20 years of existing traffic loading has been calculated as per AGPT05-19 which has been used as a reference for the existing pavement performance.

The pavement is recommended to be divided into 2 sub-sections based on the FWD data. Section 1 is between Chainage 0 and 250m and Section 2 is between Chainage 250m and 340m. A corrected characteristic deflection (CD) for each sub-section of pavement has been calculated for anlaysis. For each sub section, this has been calculated as the average maximum deflection plus 1.3 times the standard deviation. Seasonal and temperature correction factors have also been added based on AGPT05 recommendations.

The CD for section 1 is below the design deflection which indicates an adequate pavement structural performance (Remaining structural life is greater than the 20 year design loading) . In contrast to section 1, the CD for section 2 exceeds the design traffic by 0.47mm which indicates the pavement has already reached the end of its structural deisgn life.

	Section Start	Section End	Average Maximum Deflection [mm]	Standard Deviation	Corrected Characterisitc Deflection [mm]
Section 1	0	250	0.41	0.16	0.87
Section 2	250	290	0.75	0.26	1.53

Figure 2.3.2 – Characterisitc deflection of each sub-section

See Appendix D for detailed FWD reports.

3.0 Laboratory Testing

Laboratory soaked CBR tests were requested for each subgrade sample collected from site. A summary of the laboratory testing results is shown below in Figure 3.1. All testings were carried out by Durkin's NATA accredited laboratory to Australian Standard.

BOREHOLE LOCATION	DEPTH OF SAMPLE (mm)	SAMPLE DESCRIPTION	CBR LAB 4-DAY SOAKED [%]
BH1	270-1500	Silty CLAY	12.0
BH2	225-1500	Silty CLAY	14.0
BH3	245-1500	Sandy CLAY	7.0
BH4	160-1500	Sandy CLAY	6.0
BH5	490-1500	Sandy CLAY	16.0

Figure 3.1 – Summary of Laboratory Testing Results

A design subgrade CBR of 6.0% is recommended for this project. See Appendix E for the detailed laboratory test reports.

4.0 Existing Pavement Analysis

4.1 Structural Analysis

A traffic volume survey was undertaken by EMM Consulting on Adams Road between 27th November and 3rd December 2019. This data shows an Annual Average Daily Traffic (AADT) of 2099 with 7.2% heavy vehicles (HV%) – 151 heavy vehicles per day. All the parameters in Table 4.1 below have been adopted for the estimation of the remaining life of the extisting pavement (in years).

Design Parameter	Value
Annual Average Daily Traffic (**AADT**)	2,099
Average Percentage of Heavily Vehicles (**HV%**)	7.2
Direction Factor (**DF**)	0.5
Lane Distribution Factor (**LDF**)	1.0
Average Number of Axle Groups Per Heavy Vehicle ($\mathbf{H_{HVAG}}$)	2.5
Average Number of Equivalent Standard Axles Per Heavy Vehicle Axle Group (**ESA/HVAG**)	1.0
Growth Rate [%]	2.0

Table 4.1 – Traffic Loading Parameters

The additional traffic given by EMM Consulting has been used for analysis for the estimate of the reduction of pavement remaining life in both scenarios. The existing pavement traffic has 151 heavy vehicles per day. The Modification 5 scenario would increase this by 100 to 251 and the State Significant Development (SSD) scenario would increase this by 559 to 710. The load distribution of each additional heavy vehicle is assumed to be similar to that assumed for the existing heavy vehicles for this analysis.

A summary of estimated remaining life for each scenario is shown below in Table 4.2. The estimated remaining life has been capped at 20 years for this analysis. Figure 9.2 of AGPT05-19 has been used to estimate remaining life based on the FWD deflections.

Scenario for Analysis	Design Traffic Loading over 20 years (ESA)	Section 1 (CH0-250m) – Estimated Remaining Life (Years)	Section 2 (CH250-340m) – Estimated Remaining Life (Years)
Existing Traffic Loading	1.7×10^6	20	0
Modification 5 (MOD 5)	2.8×10^6	11	0
State Significant Development (SSD)	7.9×10^6	2	0

Table 4.2 – Summary of Estimated Pavement Remaining Life

4.2 Surface/Wearing Course Analysis

The section of Adams Road, Luddenham under investigation is currently comprised of a 14mm spray sealed surface except for the first 40m from Elizabeth Drive which currently has a dense grade asphalt surface. Overall, the surface condition is good in the sprayed seal areas but there are issues in the dense grade asphalt surface. There are also issues present in base layers from CH250-340 and possibly in the first 40m dense grade section.

CH0-40 (520m²)

This area currently has a dense grade asphalt wearing course. At the interface with the sprayed sealed pavement there is significant longitudinal cracking present as shown in Figures 4.2.1 and 4.2.2. The FWD deflections in this area were low so it is believed these cracks are caused by shrinkage cracking in underlying cement treated base, differential settlement, expanding subgrade, or other construction related issues. It is recommended that crack filling/sealing is carried out immediately on the impacted areas. If carried out, the crack sealing should reduce the rate of deterioration and the areas could be re-sheeted at the end of development in 2024.

Figure 4.2.1 – Longitudinal Cracking CH35

Figure 4.2.2 – Longitudinal Cracking CH30

CH40-250 (1,800m²)

From CH40-250 the surface course is comprised of a 14mm sprayed seal surface. This sprayed seal surface appears to be in a good condition currently and should be able to accommodate the MOD 5 development heavy vehicle movements.

Figure 4.2.3 – Sprayed Seal Surface with edge drop off CH150.

CH250-340 (800m²)
The pavement surface is visibly in a similar condition as CH40-250 in this area but the FWD deflection results indicate a poorer structural performance which is believed to be caused by a weaker base layer (as subgrade results were consistent). There is noticeably poorer surface drainage in this area, and it is possible that high moisture ingress is occurring in this section.

The base issues combined with the fact the entrance/exit to the development will be in this section indicates that it may require treatment prior to 2024 (end of development works). A deeper structural treatment such as insitu stabilisation will be required in the vicinity of the site access with resurfacing with a two-coat application of 14mm C170 followed by 7mm S45R.

CH90-275
The existing seal or new seal should be extended into the unsealed shoulder by 300mm to reduce future edge break/drop off issues which are currently developing. This is an issue along the northern pavement edge in this area as there is an edge drop off from the pavement to the gravel shoulder which is an area where heavy vehicles are likely to pull off the road.

Summary
The above recommended road maintenance activities should increase the service life of the road to at least year 2024 (the required end of quarry operations) and will also have positive long-term impacts for other road users and surrounding developments (for example traffic generated by the proposed Resource Recovery Facility).

APPENDIX A

Borehole Locating Map

Adams Road, Luddenham (From Elizabeth Drive + 300m)

APPENDIX B

Borehole Logs

DURKIN

Borehole No.
BH1
Page 1 of 1

Engineering Log - Borehole

Project No.: D18219

Client:	EMM Consulting	Commenced:	26/08/2020
Project Name:	Adams Road, Luddenham	Completed:	26/08/2020
Hole Location:	Adams Road, Luddenham	Logged By:	JZ
Hole Position:	CH 20.5m O/S 3.6m SCL	Checked By:	JL

Drill Model and Mounting:	Mechanical Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	150 mm	Bearing:	270°	Datum:	AHD	Operator:	SC/TN

Drilling Information								Soil Description					Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
							0.0			ASPHALT: AC14	D			
							0.1		GP	Sandy GRAVEL: Non Plastic, 20mm NS, Poorly Graded, Sub Rounded, Brown, Dry	D			0.07: Cement treated material
				SA101 B 0.27-1.50 m			0.2							
				DCP Test Started 0.38 m			0.3		CI	Silty CLAY: Medium Plasticity, Brown, Moist, Soft				0.27: Organic material
							0.4							
							0.5							
							0.6							
							0.7							
							0.8							
			Not Encountered				0.9				M	S		
							1.0							
							1.1							
							1.2							
							1.3							
							1.4							
							1.5			Hole Terminated at 1.50 m Target depth				
							1.6							

Method
AS - Auger Screwing
RR - Rock Roller
WB - Washbore

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

DURKIN

Borehole No.
BH2
Page 1 of 1

Engineering Log - Borehole

Project No.: D18219

Client:	EMM Consulting	Commenced:	26/08/2020
Project Name:	Adams Road, Luddenham	Completed:	26/08/2020
Hole Location:	Adams Road, Luddenham	Logged By:	JZ
Hole Position:	CH 95.5m O/S 1.8m NCL	Checked By:	JL

Drill Model and Mounting:	Mechanical Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	150 mm	Bearing:	270°	Datum:	AHD	Operator:	SC/TN

Drilling Information								***Soil Description***					***Observations***
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
							0.0			SPRAYED SEAL: 14mm	D			
							0.1		SP	Gravelly SAND: Non Plastic, 14mm NS, Poorly Graded, Sub Rounded, Brown, Dry	D			0.02: Cement treated material
				SA201 B 0.23-1.50 m			0.2		CI	Silty CLAY: Medium Plasticity, Brown, Moist, Soft				0.23: Organic material
				DCP Test Started 0.33 m			0.3							
							0.4							
							0.5							
							0.6							
							0.7							
							0.8							
							0.9				M	S		
							1.0							
							1.1							
							1.2							
							1.3							
							1.4							
							1.5			Hole Terminated at 1.50 m Target depth				
							1.6							

Not Encountered

Method
AS - Auger Screwing
RR - Rock Roller
WB - Washbore

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

DURKIN

Borehole No.
BH3
Page 1 of 1

Engineering Log - Borehole

Project No.: D18219

Client:	EMM Consulting	Commenced:	26/08/2020
Project Name:	Adams Road, Luddenham	Completed:	26/08/2020
Hole Location:	Adams Road, Luddenham	Logged By:	JZ
Hole Position:	CH 170.5m O/S 1.8m SCL	Checked By:	JL

Drill Model and Mounting:	Mechanical Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	150 mm	Bearing:	270°	Datum:	AHD	Operator:	SC/TN

Drilling Information								Soil Description						Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
							0.0			SPRAYED SEAL: 14mm	D			0.00: Polishing in wheelpaths and minor longitudinal cracking 0.03: Cement treated material
							0.1		SP	Gravelly SAND: Non Plastic, 14mm NS, Poorly Graded, Sub Rounded, Brown, Dry	D			
				SA301 B 0.25-1.50 m DCP Test Started 0.29 m			0.2							
							0.3		Cl	Sandy CLAY: Medium Plasticity, Brown-Red, Moist, Firm				
							0.4							
							0.5							
							0.6							
							0.7							
							0.8							
			Not Encountered				0.9				M	F		
							1.0							
							1.1							
							1.2							
							1.3							
							1.4							
							1.5			Hole Terminated at 1.50 m Target depth				
							1.6							

Method
AS - Auger Screwing
RR - Rock Roller
WB - Washbore

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

DURKIN

Borehole No.
BH4
Page 1 of 1

Engineering Log - Borehole

Project No.: D18219

Client:	EMM Consulting	Commenced:	26/08/2020
Project Name:	Adams Road, Luddenham	Completed:	26/08/2020
Hole Location:	Adams Road, Luddenham	Logged By:	JZ
Hole Position:	CH 245.5m O/S 1.8m NCL	Checked By:	JL

Drill Model and Mounting:	Mechanical Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	150 mm	Bearing:	270°	Datum:	AHD	Operator:	SC/TN

Drilling Information								Soil Description					Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
							0			SPRAYED SEAL: 14mm	D			0.00: Polishing in wheelpaths 0.02: Cement treated material
									SP	Gravelly SAND: Non Plastic, 14mm NS, Poorly Graded, Sub Rounded, Brown, Dry	D			
				SA401 B 0.16-1.50 m DCP Test Started 0.23 m			0.1							
							0.2		CL	Sandy CLAY: Low Plasticity, Brown-Yellow, Dry, Firm				
							0.3							
							0.4							
							0.5							
							0.6							
							0.7							
							0.8				D	F		
							0.9							
							1.0							
							1.1							
							1.2							
							1.3							
							1.4							
							1.5			Hole Terminated at 1.50 m Target depth				
							1.6							

Not Encountered

Method
AS - Auger Screwing
RR - Rock Roller
WB - Washbore

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

DURKIN

Borehole No.
BH5
Page 1 of 1

Engineering Log - Borehole

Project No.: D18219

Client:	EMM Consulting	Commenced:	26/08/2020
Project Name:	Adams Road, Luddenham	Completed:	26/08/2020
Hole Location:	Adams Road, Luddenham	Logged By:	JZ
Hole Position:	CH 320.5m O/S 2.0m SCL	Checked By:	JL

Drill Model and Mounting:	Mechanical Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	150 mm	Bearing:	270°	Datum:	AHD	Operator:	SC/TN

Drilling Information								Soil Description						Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
							0.0			SPRAYED SEAL: 14mm	D			0.00: Polishing in wheelpaths 0.02: Cement treated material
									SP	Gravelly SAND: Non Plastic, 14mm NS, Poorly Graded, Sub Rounded, Brown, Dry	D			
							0.3		SP	Gravelly SAND: Non Plastic, 14mm NS, Poorly Graded, Sub Rounded, Brown, Moist	M			
			Not Encountered	SA501 B 0.49-1.50 m DCP Test Started 0.54 m			0.5		CL	Sandy CLAY: Low Plasticity, Brown-Red, Dry, Firm	D	F		
							1.5			Hole Terminated at 1.50 m Target depth				

Method
AS - Auger Screwing
RR - Rock Roller
WB - Washbore

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

APPENDIX C

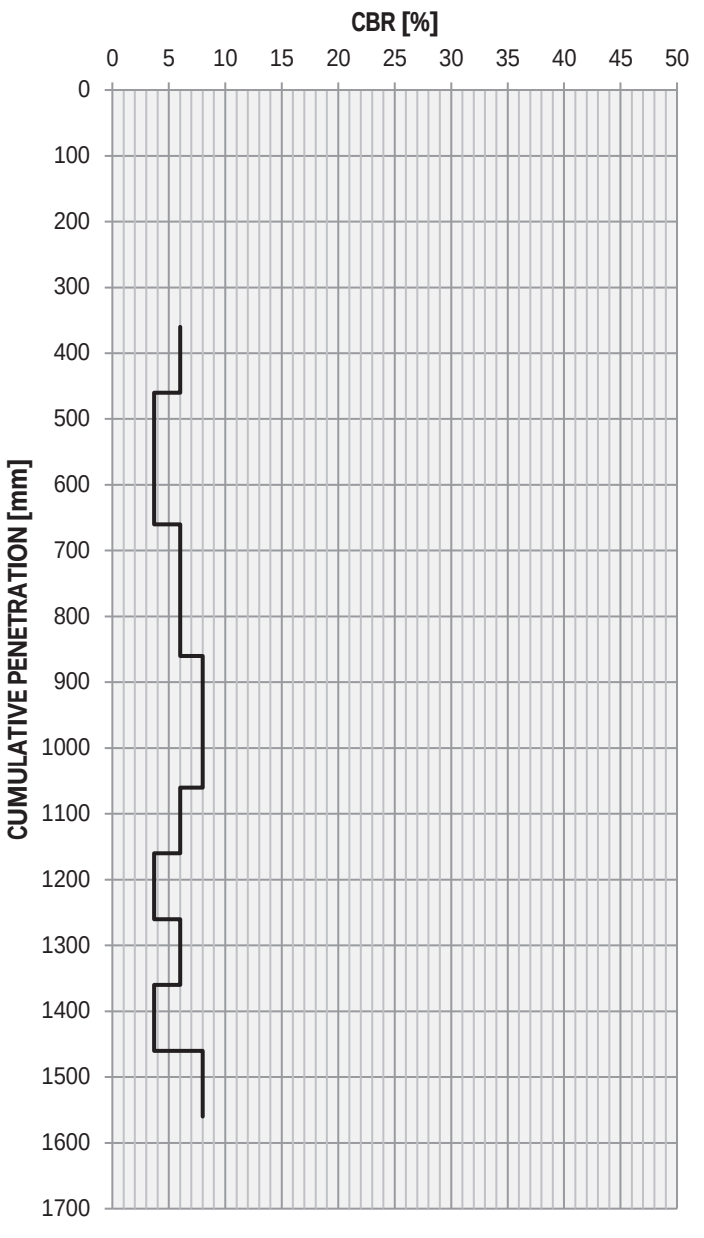
DCP Test Report

DURKIN

DETERMINATION OF PENETRATION RESISTANCE OF A SOIL				AS 1289.6.3.2
JOB NUMBER	SITE LOCATION			REPORT NUMBER
D18219	Adams Road, Luddenham			D18219-DCP-001
DATE OF TEST	CLIENT			REPORT BY
26/08/2020	EMM Consulting			JZ
BOREHOLE NUMBER	NORTHING / CHAINAGE	EASTING / OFFSET	DEPTH DCP STARTED AT [mm]	DROP WEIGHT
BH1	20.5m	3.6m SCL	360	9.0kg/510mm
SOIL DESCRIPTION		MOISTURE CONDITION	RL OF GROUND SURFACE	WATER TABLE LEVEL
Silty Clay		Moist	N/A	Unknown

NUMBER OF BLOWS	CUMULATIVE PENETRATION [MM]	CBR - Fig 5.3 Austroads 2014 [%]	COMMENTS
-	360	-	
3	460	6	
2	560	4	
2	660	4	
3	760	6	
3	860	6	
4	960	8	
4	1060	8	
3	1160	6	
2	1260	4	
3	1360	6	
2	1460	4	
4	1560	8	

GRAPHICAL REPRESENTATION OF RESULTS



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WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

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APPROVED SIGNATORY

James Loney - Pavement Engineer
NATA Accreditation Number: 18612

DURKIN

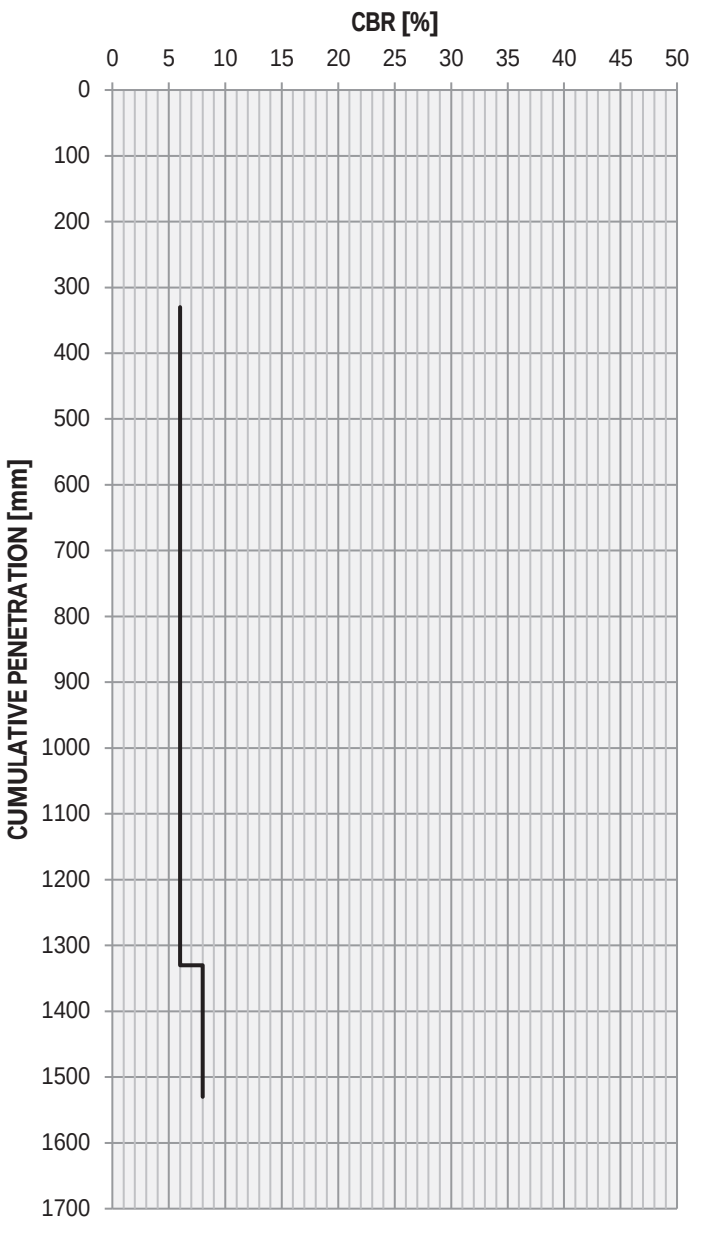
DETERMINATION OF PENETRATION RESISTANCE OF A SOIL

AS 1289.6.3.2

JOB NUMBER	SITE LOCATION			REPORT NUMBER
D18219	Adams Road, Luddenham			D18219-DCP-002
DATE OF TEST	CLIENT			REPORT BY
26/08/2020	EMM Consulting			JZ
BOREHOLE NUMBER	NORTHING / CHAINAGE	EASTING / OFFSET	DEPTH DCP STARTED AT [mm]	DROP WEIGHT
BH2	95.5m	1.8m NCL	330	9.0kg/510mm
SOIL DESCRIPTION		MOISTURE CONDITION	RL OF GROUND SURFACE	WATER TABLE LEVEL
Silty Clay		Moist	N/A	Unknown

NUMBER OF BLOWS	CUMULATIVE PENETRATION [MM]	CBR - Fig 5.3 Austroads 2014 [%]	COMMENTS
-	330	-	
3	430	6	
3	530	6	
3	630	6	
3	730	6	
3	830	6	
3	930	6	
3	1030	6	
3	1130	6	
3	1230	6	
3	1330	6	
4	1430	8	
4	1530	8	

GRAPHICAL REPRESENTATION OF RESULTS



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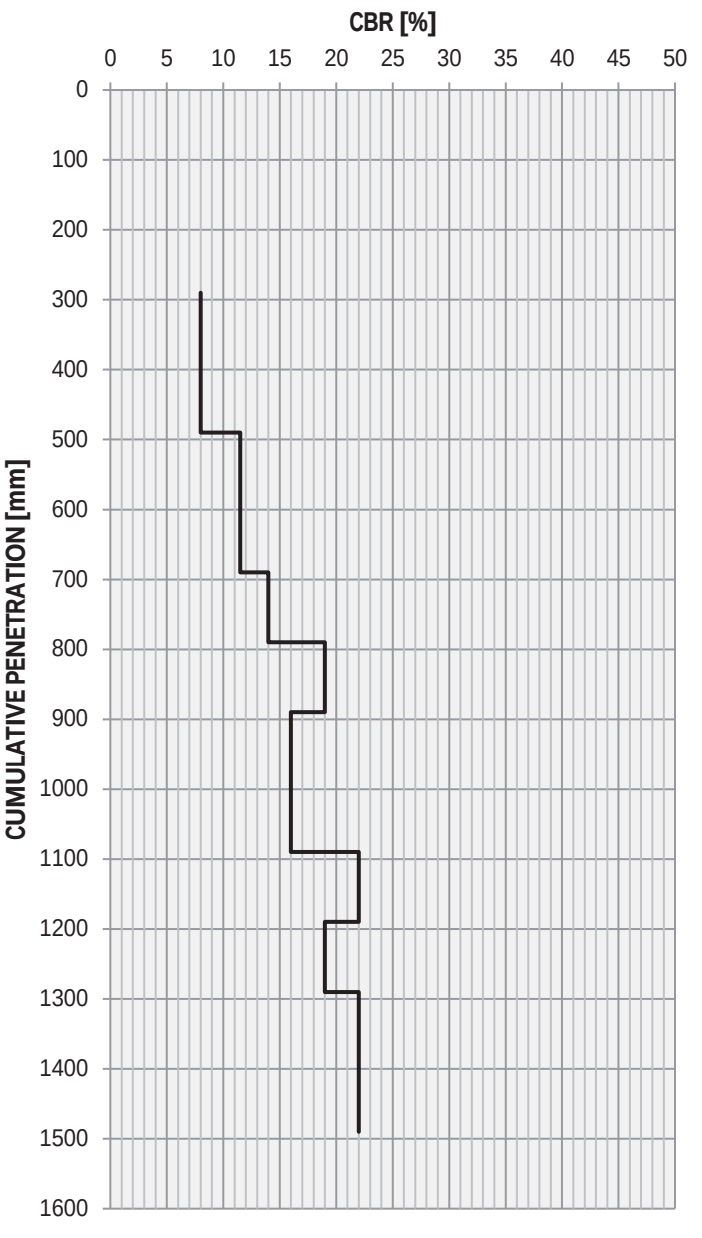
DETERMINATION OF PENETRATION RESISTANCE OF A SOIL				AS 1289.6.3.2
JOB NUMBER	SITE LOCATION			REPORT NUMBER
D18219	Adams Road, Luddenham			D18219-DCP-003
DATE OF TEST	CLIENT			REPORT BY
26/08/2020	EMM Consulting			JZ
BOREHOLE NUMBER	NORTHING / CHAINAGE	EASTING / OFFSET	DEPTH DCP STARTED AT [mm]	DROP WEIGHT
BH3	170.5m	1.8m SCL	290	9.0kg/510mm
SOIL DESCRIPTION		MOISTURE CONDITION	RL OF GROUND SURFACE	WATER TABLE LEVEL
Sandy Clay		Moist	N/A	Unknown

NUMBER OF BLOWS	CUMULATIVE PENETRATION [MM]	CBR - Fig 5.3 Austroads 2014 [%]	COMMENTS
-	290	-	
4	390	8	
4	490	8	
5	590	12	
5	690	12	
6	790	14	
8	890	19	
7	990	16	
7	1090	16	
9	1190	22	
8	1290	19	
9	1390	22	
9	1490	22	

GRAPHICAL REPRESENTATION OF RESULTS



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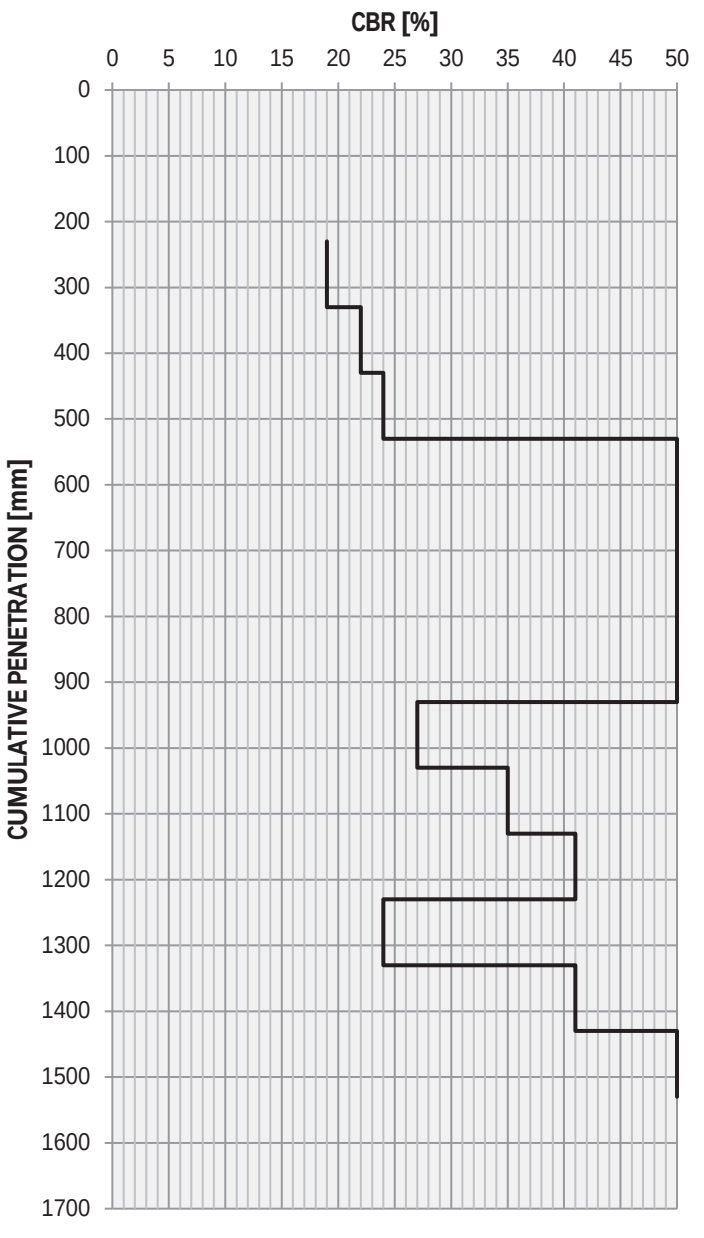
DURKIN

DETERMINATION OF PENETRATION RESISTANCE OF A SOIL				AS 1289.6.3.2
JOB NUMBER	SITE LOCATION			REPORT NUMBER
D18219	Adams Road, Luddenham			D18219-DCP-004
DATE OF TEST	CLIENT			REPORT BY
26/08/2020	EMM Consulting			JZ
BOREHOLE NUMBER	NORTHING / CHAINAGE	EASTING / OFFSET	DEPTH DCP STARTED AT [mm]	DROP WEIGHT
BH4	245.5m	1.7m NCL	230	9.0kg/510mm
SOIL DESCRIPTION		MOISTURE CONDITION	RL OF GROUND SURFACE	WATER TABLE LEVEL
Sandy Clay		Dry	N/A	Unknown

NUMBER OF BLOWS	CUMULATIVE PENETRATION [MM]	CBR - Fig 5.3 Austroads 2014 [%]	COMMENTS
-	230	-	
8	330	19	
9	430	22	
10	530	24	
17	630	50	
17	730	50	
19	830	50	
23	930	50	
11	1030	27	
13	1130	35	
15	1230	41	
10	1330	24	
16	1430	41	
21	1530	50	

GRAPHICAL REPRESENTATION OF RESULTS



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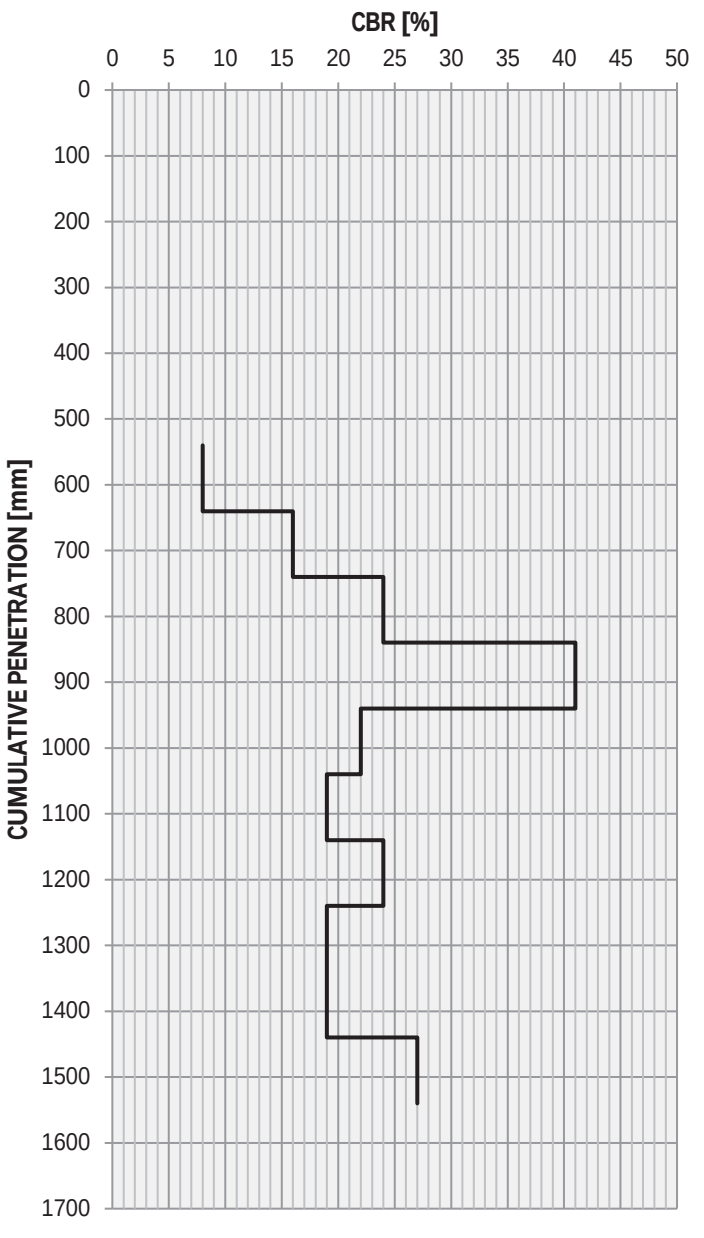
DURKIN

DETERMINATION OF PENETRATION RESISTANCE OF A SOIL				AS 1289.6.3.2
JOB NUMBER	SITE LOCATION			REPORT NUMBER
D18219	Adams Road, Luddenham			D18219-DCP-005
DATE OF TEST	CLIENT			REPORT BY
26/08/2020	EMM Consulting			JZ
BOREHOLE NUMBER	NORTHING / CHAINAGE	EASTING / OFFSET	DEPTH DCP STARTED AT [mm]	DROP WEIGHT
BH5	320.5m	2.0m SCL	540	9.0kg/510mm
SOIL DESCRIPTION		MOISTURE CONDITION	RL OF GROUND SURFACE	WATER TABLE LEVEL
Sandy Clay		Dry	N/A	Unknown

NUMBER OF BLOWS	CUMULATIVE PENETRATION [MM]	CBR - Fig 5.3 Austroads 2014 [%]	COMMENTS
-	540	-	
4	640	8	
7	740	16	
10	840	24	
15	940	41	
9	1040	22	
8	1140	19	
10	1240	24	
8	1340	19	
8	1440	19	
11	1540	27	

GRAPHICAL REPRESENTATION OF RESULTS



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James Loney - Pavement Engineer
NATA Accreditation Number: 18612

DURKIN

APPENDIX D

FWD Test Reports

FWD/HWD Report

Durkin Construction Pty Ltd
Silverwater Laboratory
Unit 3, 50-52 Derby Street Silverwater NSW 1811
Phone: (02) 9712 0308
Fax: (02) 9647 1984
Email: info@durkinconstruction.com.au

Job Number: D18219 **Report Number:** D18219-Adams
Project Name: Adams Road, Luddenham

Date Tested: 22/09/2020 **Client:** EMM Consulting **Filters Applied:** None
Time Tested: 10:09-11:08 **Contact:** Abdullah Uddin **Operator:** D. Carollo
Target Load: 40kN / 566kPa **GPS Model / Datum:** BX982 / GDA **Test Equipment:** HWD-175

Chainage	Lane	Wheel Path	GPS Location		Peak Load [kPa]	FWD Deflection Results [µm] Offset from Load [mm]									Normalised Deflection Results [µm] Offset from Load [mm]									Temperature [°C]		FWD/HWD [mm]			Remaining Life [Years]	Pavement Condition
																										D_{max}				
			Lat	Long		0	200	300	450	600	750	900	1200	1500	0	200	300	450	600	750	900	1200	1500	Surface	Air	D_{MAX}	Corrected	CF		
0	NB	IWP	-33.86906	150.71818	544	680	502	394	267	182	136	96	67	51	708	522	410	278	189	142	100	70	53	34.2	25.8	0.71	0.99	0.19	20	
10	NB	IWP	-33.86913	150.71822	524	513	368	292	212	162	135	100	66	47	554	397	316	229	174	145	108	71	51	34.8	26.4	0.55	0.78	0.16	20	
20	NB	IWP	-33.86921	150.71819	539	428	370	321	256	204	169	124	78	53	449	389	337	269	214	177	130	82	56	35.3	26.1	0.45	0.63	0.06	20	
30	NB	IWP	-33.86928	150.71812	510	160	144	136	121	110	100	84	64	50	177	159	151	134	122	111	93	71	55	36.7	26.0	0.18	0.25	0.02	20	
40	NB	IWP	-33.86933	150.71803	529	245	223	206	172	140	119	92	66	49	262	239	221	184	149	127	99	71	52	37.0	25.1	0.26	0.37	0.02	20	
50	NB	IWP	-33.86939	150.71794	571	521	394	332	255	208	182	146	101	69	516	390	329	253	206	180	145	100	69	36.3	24.8	0.52	0.72	0.13	20	
60	NB	IWP	-33.86944	150.71786	549	322	270	242	198	165	139	106	69	47	332	279	249	205	170	144	109	71	48	35.4	24.8	0.33	0.47	0.05	20	
70	NB	IWP	-33.86950	150.71778	560	466	409	349	297	237	207	168	111	70	471	414	353	300	240	209	170	112	70	36.3	24.8	0.47	0.66	0.06	20	
80	NB	IWP	-33.86955	150.71769	545	325	292	272	236	208	184	147	102	68	338	303	282	245	216	191	152	106	71	25.8	25.1	0.34	0.47	0.03	20	
90	NB	IWP	-33.86960	150.71761	577	560	399	321	241	190	158	123	85	64	549	392	315	236	187	155	120	83	63	38.5	26.4	0.55	0.77	0.16	20	
100	NB	IWP	-33.86965	150.71751	562	544	454	413	342	281	234	173	110	70	548	457	415	344	283	235	174	111	70	38.4	24.6	0.55	0.77	0.09	20	
110	NB	IWP	-33.86970	150.71743	559	363	329	301	261	221	187	143	90	52	367	333	304	264	224	190	144	91	53	27.6	25.0	0.37	0.51	0.03	20	
120	NB	IWP	-33.86975	150.71735	546	346	308	281	240	207	181	142	92	63	359	319	291	248	214	188	147	95	65	35.3	25.7	0.36	0.50	0.04	20	
130	NB	IWP	-33.86980	150.71726	541	271	238	220	190	168	147	118	78	55	284	249	230	199	176	154	123	82	58	36.0	25.1	0.28	0.40	0.03	20	
140	NB	IWP	-33.86986	150.71718	593	499	407	327	233	165	126	80	48	35	477	388	312	222	157	120	77	46	34	35.5	25.5	0.48	0.67	0.09	20	
150	NB	IWP	-33.86991	150.71709	567	554	450	394	315	271	246	200	131	83	553	449	393	315	271	246	199	131	83	35.8	25.6	0.55	0.77	0.10	20	
160	NB	IWP	-33.86996	150.71701	555	260	223	202	167	136	114	83	53	35	265	227	205	170	138	116	85	54	36	36.0	25.6	0.26	0.37	0.04	20	
170	NB	IWP	-33.87002	150.71692	552	242	208	187	151	123	103	76	47	30	248	213	191	154	126	106	77	48	31	36.1	25.5	0.25	0.35	0.03	20	
180	NB	IWP	-33.87007	150.71683	557	400	365	343	291	248	210	157	90	55	406	371	349	296	252	213	159	91	56	35.8	26.0	0.41	0.57	0.04	20	
190	NB	IWP	-33.87012	150.71674	560	434	360	322	264	207	168	121	71	41	438	364	325	267	209	169	123	72	41	37.1	25.9	0.44	0.61	0.07	20	
200	NB	IWP	-33.87017	150.71666	556	319	288	258	213	176	148	111	68	42	325	293	263	217	179	150	113	69	43	33.7	25.5	0.32	0.46	0.03	20	

210	NB	IWP	-33.87023	150.71657	571	197	155	139	115	97	82	65	40	30	195	154	137	114	96	81	64	40	30	29.8	25.7	0.20	0.27	0.04	20	
220	NB	IWP	-33.87028	150.71649	557	196	160	146	123	106	91	73	48	33	199	162	148	125	108	92	74	49	34	36.2	25.9	0.20	0.28	0.04	20	
230	NB	IWP	-33.87033	150.71640	541	332	269	243	203	167	142	107	67	45	347	282	254	212	174	149	112	70	47	37.4	25.6	0.35	0.49	0.07	20	
240	NB	IWP	-33.87038	150.71632	572	543	412	328	249	199	163	121	75	49	538	408	324	247	197	162	120	74	48	36.9	24.8	0.54	0.75	0.13	20	
250	NB	IWP	-33.87044	150.71623	596	495	369	300	225	164	129	85	51	34	470	351	284	214	155	123	81	48	32	36.3	25.6	0.47	0.66	0.12	20	
260	NB	IWP	-33.87049	150.71615	593	747	552	449	340	268	223	166	108	70	713	526	428	325	256	213	158	103	67	36.2	24.8	0.71	1.00	0.19	20	
270	NB	IWP	-33.87054	150.71607	582	734	522	406	290	224	183	137	87	59	714	508	394	282	218	178	133	85	57	36.2	25.1	0.71	1.00	0.21	20	
280	NB	IWP	-33.87059	150.71598	579	634	493	403	296	221	175	124	77	53	620	482	394	289	216	171	121	76	51	36.3	24.6	0.62	0.87	0.14	20	
290	NB	IWP	-33.87064	150.71590	595	922	647	519	378	288	230	163	102	67	877	615	493	360	274	218	155	97	63	24.9	23.5	0.88	1.23	0.26	8	
300	NB	IWP	-33.87069	150.71581	557	547	450	392	301	237	191	137	83	54	556	457	398	306	241	194	139	85	54	36.2	23.8	0.56	0.78	0.10	20	
310	NB	IWP	-33.87074	150.71572	577	471	351	299	237	190	157	116	70	47	462	345	293	232	186	154	114	69	46	30.3	23.6	0.46	0.65	0.12	20	
320	NB	IWP	-33.87080	150.71564	566	343	253	216	177	145	125	97	65	47	343	253	216	177	145	125	97	65	47	28.4	23.7	0.34	0.48	0.09	20	
330	NB	IWP	-33.87085	150.71555	598	754	473	367	256	194	158	110	72	50	713	447	347	242	183	150	104	68	47	34.9	24.0	0.71	1.00	0.27	20	
340	NB	IWP	-33.87090	150.71547	601	950	673	543	401	281	216	146	92	65	895	634	511	378	265	204	138	87	62	33.2	24.5	0.89	1.25	0.26	7	
0	NB	OWP	-33.86905	150.71815	538	364	318	279	220	176	146	108	75	55	383	335	293	231	185	153	114	78	58	34.0	24.2	0.38	0.54	0.05	20	
10	NB	OWP	-33.86911	150.71821	541	506	424	362	272	205	166	116	71	48	529	443	378	284	214	174	121	74	51	35.3	24.3	0.53	0.74	0.09	20	
20	NB	OWP	-33.86918	150.71819	562	646	480	390	268	189	151	102	67	50	650	483	393	270	190	152	103	67	50	35.5	23.9	0.65	0.91	0.17	20	
30	NB	OWP	-33.86925	150.71812	540	224	195	177	151	130	114	93	67	50	234	205	186	158	136	119	98	71	53	34.8	23.5	0.23	0.33	0.03	20	
40	NB	OWP	-33.86930	150.71804	537	267	239	200	154	134	122	96	70	56	281	251	211	163	141	129	101	74	59	35.8	23.6	0.28	0.39	0.03	20	
50	NB	OWP	-33.86936	150.71796	553	753	584	479	358	287	241	175	102	66	770	597	490	366	294	246	179	104	68	35.1	23.6	0.77	1.08	0.17	18	
60	NB	OWP	-33.86942	150.71787	575	535	422	357	265	199	162	117	84	59	526	416	352	261	196	159	115	82	58	31.9	23.9	0.53	0.74	0.11	20	
70	NB	OWP	-33.86946	150.71779	556	478	443	403	314	267	228	176	104	65	487	451	410	319	271	232	179	106	66	35.3	23.7	0.49	0.68	0.04	20	
80	NB	OWP	-33.86951	150.71769	564	628	489	398	308	245	202	144	89	67	631	490	399	309	246	202	144	89	67	23.1	24.9	0.63	0.88	0.14	20	
90	NB	OWP	-33.86957	150.71761	584	772	650	507	344	239	183	132	81	59	748	630	491	333	232	177	128	78	57	36.2	25.3	0.75	1.05	0.12	20	
100	NB	OWP	-33.86962	150.71752	550	514	432	358	255	195	158	116	75	54	528	445	368	263	201	163	119	77	56	35.7	23.6	0.53	0.74	0.08	20	
110	NB	OWP	-33.86968	150.71744	569	610	456	381	267	202	160	110	65	46	607	453	378	265	201	159	109	65	45	26.0	23.6	0.61	0.85	0.15	20	
120	NB	OWP	-33.86972	150.71735	561	427	362	319	257	207	175	127	79	50	431	365	322	259	209	177	128	79	50	34.6	24.7	0.43	0.60	0.07	20	
130	NB	OWP	-33.86978	150.71727	568	503	408	365	328	285	249	198	129	94	501	406	363	327	284	248	197	128	94	35.6	24.0	0.50	0.70	0.09	20	
140	NB	OWP	-33.86983	150.71718	575	669	574	494	362	263	214	134	81	54	659	565	486	356	259	211	132	79	53	34.5	23.7	0.66	0.92	0.09	20	
150	NB	OWP	-33.86988	150.71709	580	480	372	287	208	160	127	91	56	39	468	363	280	203	156	124	89	55	38	35.1	23.6	0.47	0.66	0.10	20	
160	NB	OWP	-33.86993	150.71701	584	456	418	391	333	259	215	163	98	47	441	405	379	323	251	208	158	95	46	36.0	23.8	0.44	0.62	0.04	20	
170	NB	OWP	-33.86999	150.71692	568	513	417	333	250	186	148	99	56	35	511	415	332	250	186	147	99	55	35	27.8	23.9	0.51	0.72	0.10	20	
180	NB	OWP	-33.87004	150.71684	569	632	540	461	358	260	197	123	60	39	628	537	458	356	258	196	122	60	38	35.8	23.7	0.63	0.88	0.09	20	
190	NB	OWP	-33.87009	150.71675	579	620	481	380	255	179	144	102	61	41	606	471	372	249	175	141	100	60	40	35.9	24.1	0.61	0.85	0.13	20	
200	NB	OWP	-33.87016	150.71666	603	560	458	363	276	204	154	108	64	45	526	430	341	259	191	145	101	60	43	33.8	24.5	0.53	0.74	0.10	20	
210	NB	OWP	-33.87020	150.71658	560	332	281	228	180	149	127	94	58	38	335	284	231	182	151	128	95	59	39	30.1	24.5	0.34	0.47	0.05	20	

220	NB	OWP	-33.87025	150.71649	565	252	202	173	147	122	107	83	57	40	252	202	173	147	122	107	83	57	40	34.6	25.0	0.25	0.35	0.05	20	
230	NB	OWP	-33.87030	150.71640	564	562	438	335	240	178	142	105	65	43	564	439	337	241	179	142	106	65	43	36.2	24.4	0.56	0.79	0.12	20	
240	NB	OWP	-33.87036	150.71632	572	593	458	346	240	176	137	92	66	44	587	453	342	238	174	136	91	65	43	34.5	24.6	0.59	0.82	0.13	20	
250	NB	OWP	-33.87041	150.71623	599	707	526	398	255	164	120	74	41	32	668	497	376	241	155	113	70	39	31	34.3	24.2	0.67	0.94	0.17	20	
260	NB	OWP	-33.87047	150.71614	594	1175	833	656	474	356	286	201	113	75	1120	794	625	452	339	272	192	108	72	34.1	23.7	1.12	1.57	0.33	1	
270	NB	OWP	-33.87052	150.71606	600	1558	1132	853	586	431	337	232	141	95	1469	1068	805	553	406	318	219	133	90	32.5	23.6	1.47	2.06	0.40	0	
280	NB	OWP	-33.87057	150.71597	598	946	724	541	353	230	173	121	76	52	895	686	512	334	217	164	114	72	49	34.3	24.5	0.89	1.25	0.21	7	
290	NB	OWP	-33.87062	150.71588	586	1183	841	644	429	303	228	160	102	72	1142	812	622	414	293	220	154	98	69	22.8	24.2	1.14	1.60	0.33	1	
300	NB	OWP	-33.87068	150.71580	577	640	520	434	328	245	200	141	87	58	627	510	426	321	241	196	138	86	57	34.9	23.9	0.63	0.88	0.12	20	
310	NB	OWP	-33.87073	150.71571	559	373	335	305	254	209	177	134	83	53	378	339	309	257	212	179	135	84	54	28.0	23.0	0.38	0.53	0.04	20	
320	NB	OWP	-33.87078	150.71563	616	825	534	385	253	183	148	105	72	50	758	490	354	233	168	136	96	66	46	25.0	22.9	0.76	1.06	0.27	20	
330	NB	OWP	-33.87084	150.71554	641	1068	676	495	324	237	181	125	80	55	943	597	437	286	209	160	111	71	49	34.4	23.1	0.94	1.32	0.35	5	
340	NB	OWP	-33.87089	150.71546	594	1097	840	687	510	394	309	223	139	93	1045	800	654	486	375	295	212	133	89	31.2	23.0	1.04	1.46	0.24	2	
0	SB	OWP	-33.86912	150.71841	530	478	325	247	160	104	75	51	35	26	510	347	263	170	111	80	55	37	28	34.1	26.1	0.51	0.72	0.16	20	
10	SB	OWP	-33.86917	150.71832	521	412	313	251	175	131	105	79	55	41	448	340	273	190	142	114	86	60	44	36.7	26.1	0.45	0.63	0.11	20	
20	SB	OWP	-33.86923	150.71824	533	74	65	61	56	53	50	45	38	31	79	69	65	60	56	53	47	40	33	37.0	25.9	0.08	0.11	0.01	20	
30	SB	OWP	-33.86928	150.71816	542	144	121	112	101	93	85	74	58	46	151	127	117	106	97	89	77	61	48	37.7	26.2	0.15	0.21	0.02	20	
40	SB	OWP	-33.86933	150.71807	533	190	163	149	131	118	107	88	69	53	202	173	159	140	126	114	93	74	56	38.7	26.5	0.20	0.28	0.03	20	
50	SB	OWP	-33.86939	150.71799	539	273	227	203	175	157	142	117	86	64	286	239	214	183	165	149	123	90	67	41.2	26.7	0.29	0.40	0.05	20	
60	SB	OWP	-33.86944	150.71790	531	391	317	275	229	184	143	116	84	60	417	337	293	244	197	152	124	89	64	40.3	26.3	0.42	0.58	0.08	20	
70	SB	OWP	-33.86950	150.71781	557	264	243	223	186	154	130	101	69	48	269	247	226	189	156	132	102	70	49	40.0	26.1	0.27	0.38	0.02	20	
80	SB	OWP	-33.86955	150.71773	548	345	275	246	203	170	146	113	72	49	356	284	254	210	175	151	116	75	51	40.1	26.0	0.36	0.50	0.07	20	
90	SB	OWP	-33.86960	150.71764	562	744	630	562	444	351	280	181	118	72	749	634	566	447	354	282	182	118	73	38.5	26.3	0.75	1.05	0.12	20	
100	SB	OWP	-33.86965	150.71755	546	278	237	211	174	149	134	109	81	56	288	245	218	180	154	139	113	84	58	37.3	26.6	0.29	0.40	0.04	20	
110	SB	OWP	-33.86971	150.71747	558	279	251	229	198	170	149	120	84	58	282	255	232	200	172	151	122	85	59	39.0	26.3	0.28	0.40	0.03	20	
120	SB	OWP	-33.86976	150.71738	550	361	324	295	247	210	182	143	95	60	371	333	303	254	216	188	148	97	61	38.1	26.5	0.37	0.52	0.04	20	
130	SB	OWP	-33.86981	150.71729	576	486	394	344	281	229	189	140	85	52	478	387	338	277	225	186	138	84	51	38.5	26.2	0.48	0.67	0.09	20	
140	SB	OWP	-33.86987	150.71721	547	185	172	160	141	124	110	89	62	43	192	178	166	146	128	114	92	64	44	39.2	26.2	0.19	0.27	0.01	20	
150	SB	OWP	-33.86992	150.71712	557	161	148	138	121	107	96	78	56	41	163	150	140	123	109	97	79	57	41	39.7	26.0	0.16	0.23	0.01	20	
160	SB	OWP	-33.86997	150.71704	542	282	270	242	205	174	152	122	88	63	294	282	253	214	181	159	127	92	66	38.8	26.2	0.29	0.41	0.01	20	
170	SB	OWP	-33.87003	150.71695	542	256	241	226	196	174	154	121	84	54	267	251	236	205	182	161	126	88	56	39.3	26.7	0.27	0.37	0.02	20	
180	SB	OWP	-33.87008	150.71686	557	258	227	209	178	152	131	100	64	41	262	230	213	181	155	133	101	65	42	39.9	26.7	0.26	0.37	0.03	20	
190	SB	OWP	-33.87014	150.71677	555	278	248	226	194	163	140	110	74	52	284	253	230	198	166	143	112	76	53	40.5	26.6	0.28	0.40	0.03	20	
200	SB	OWP	-33.87019	150.71669	544	305	282	259	225	194	168	129	82	49	318	293	269	234	202	175	135	85	51	40.1	26.1	0.32	0.45	0.02	20	
210	SB	OWP	-33.87024	150.71660	541	238	202	179	144	118	99	74	47	31	249	211	187	151	123	104	77	49	33	40.8	26.0	0.25	0.35	0.04	20	
220	SB	OWP	-33.87030	150.71651	558	253	233	216	180	152	131	105	69	50	256	236	219	183	154	133	107	70	51	41.4	26.0	0.26	0.36	0.02	20	

230	SB	OWP	-33.87035	150.71643	551	483	413	367	301	248	210	158	98	59	496	424	377	309	254	216	162	101	60	39.1	26.2	0.50	0.69	0.07	20	
240	SB	OWP	-33.87040	150.71634	573	511	432	381	304	244	199	143	84	49	505	427	377	301	241	197	142	83	49	40.0	26.4	0.50	0.71	0.08	20	
250	SB	OWP	-33.87045	150.71625	586	923	793	678	531	417	337	242	142	84	891	766	655	513	403	325	234	138	81	40.0	26.7	0.89	1.25	0.13	7	
260	SB	OWP	-33.87051	150.71617	555	886	745	611	437	308	232	144	79	51	903	760	623	445	314	236	147	81	52	39.9	27.4	0.90	1.27	0.14	7	
270	SB	OWP	-33.87056	150.71608	566	900	749	597	396	276	211	144	85	55	900	749	597	396	276	211	144	85	55	39.1	27.1	0.90	1.26	0.15	7	
280	SB	OWP	-33.87061	150.71599	543	840	711	610	475	357	285	194	113	72	875	741	636	495	372	297	203	118	75	38.1	26.6	0.88	1.23	0.13	8	
290	SB	OWP	-33.87066	150.71590	572	856	652	520	356	244	182	117	72	51	847	645	514	352	241	180	115	71	50	38.5	26.5	0.85	1.19	0.20	10	
300	SB	OWP	-33.87071	150.71582	558	569	492	421	326	252	204	143	83	54	578	499	427	330	255	207	145	84	55	38.7	26.5	0.58	0.81	0.08	20	
310	SB	OWP	-33.87077	150.71573	580	537	405	296	195	137	105	70	42	33	524	395	289	190	134	103	69	40	32	38.9	26.2	0.52	0.73	0.13	20	
320	SB	OWP	-33.87082	150.71565	601	547	439	386	305	239	196	135	76	42	515	414	364	287	225	184	127	72	40	39.1	26.0	0.51	0.72	0.10	20	
330	SB	OWP	-33.87088	150.71556	569	299	255	223	175	141	118	89	58	46	298	253	222	174	140	118	88	57	45	38.6	26.1	0.30	0.42	0.04	20	
340	SB	OWP	-33.87093	150.71548	577	792	600	489	342	241	198	148	94	70	777	589	480	335	237	194	145	92	69	37.5	26.6	0.78	1.09	0.19	17	
																								Average	35.5	25.2	0.51	0.71	0.10	
																								Standard Deviation	4.0	1.1	0.25	0.35	0.08	
																								CV	0.11	0.05	0.48	0.48	0.78	

Seasonal Correction Factor	Temperature Deflection Correction Factor	Deflection Standardisation Factor	Design Traffic
1.3	0.98	1.1	1.68E+06

Corrected Characteristic Deflection [mm] - Section 1	0.87
Corrected Characteristic Deflection [mm] - Section 2	1.53
Design Deflection [mm]	1.06

Notes:

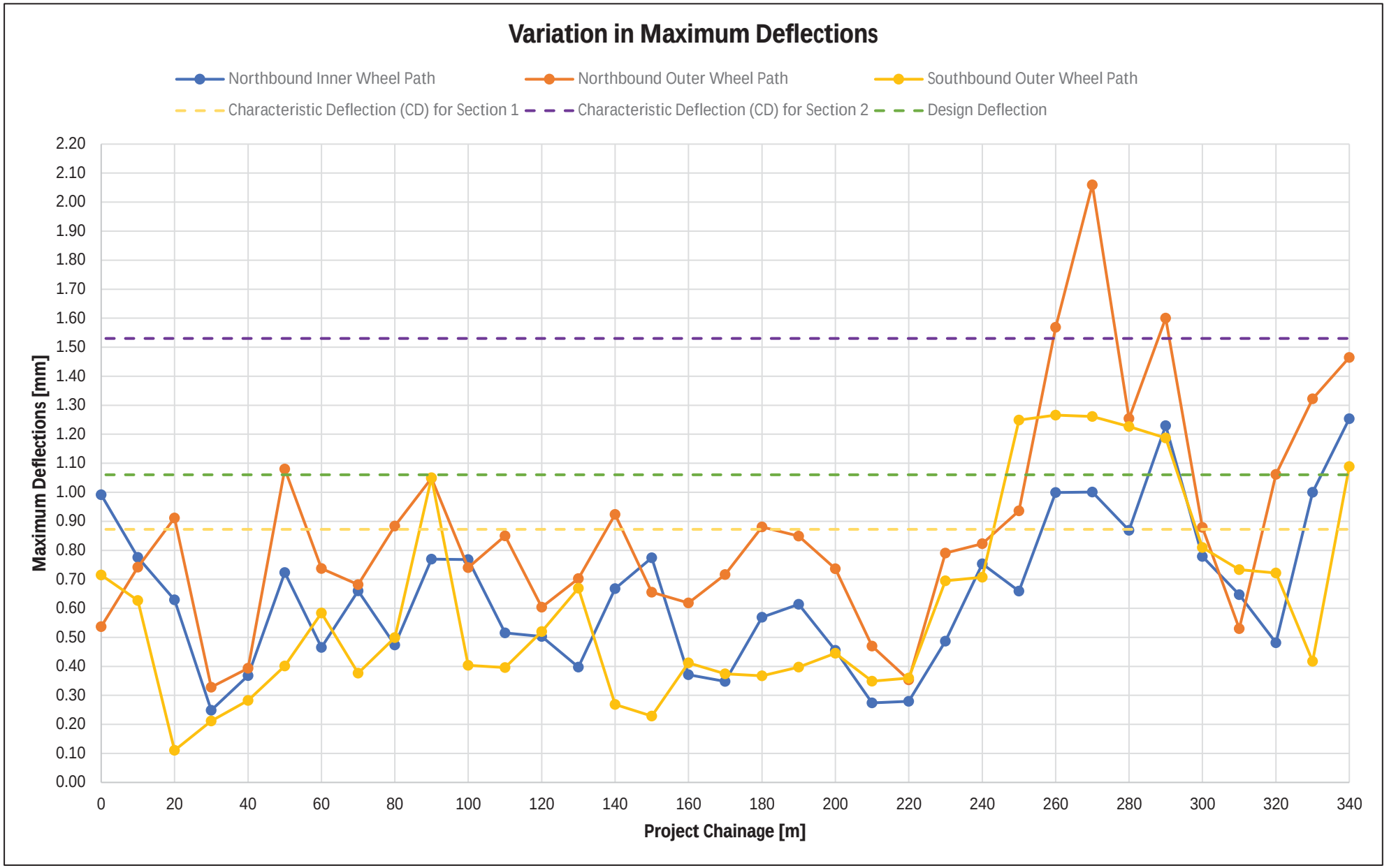
COL - Centre of Lane, IWP - Inner Wheelpath, OWP - Outer Wheelpath, NB - North Bound, SB - South Bound, EB - East Bound, WB - West Bound, PL - Left Parking Lane, PR - Right Parking Lane, TL - Left Traffic Lane, TR - Right Traffic Lane, OS - Outer Shoulder, IS - Inner Shoulder, FL - Fast Lane, SL - Slow Lane, CR - Crocodile Cracking, HO - Pothole, SR - Ravelling, DR - Rutting, SS - Stripping, PA - Patching

Chainage 0 is taken from North end

The estimated remaining life is only applicable to granular pavements with thin bituminous surfacing [AGPT05-19]

Report By: **Jack Zhang**
Pavement Engineer

Approved By: **James Loney**
Pavement Technology Manager / Senior Pavement Engineer


Variation in Maximum Deflections
Northbound Inner Wheel Path
Northbound Outer Wheel Path
Southbound Outer Wheel Path
Characteristic Deflection (CD) for Section 1
Characteristic Deflection (CD) for Section 2
Design Deflection
Maximum Deflections [mm]
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
Project Chainage [m]

APPENDIX E

Laboratory Test Reports

Material Test Report

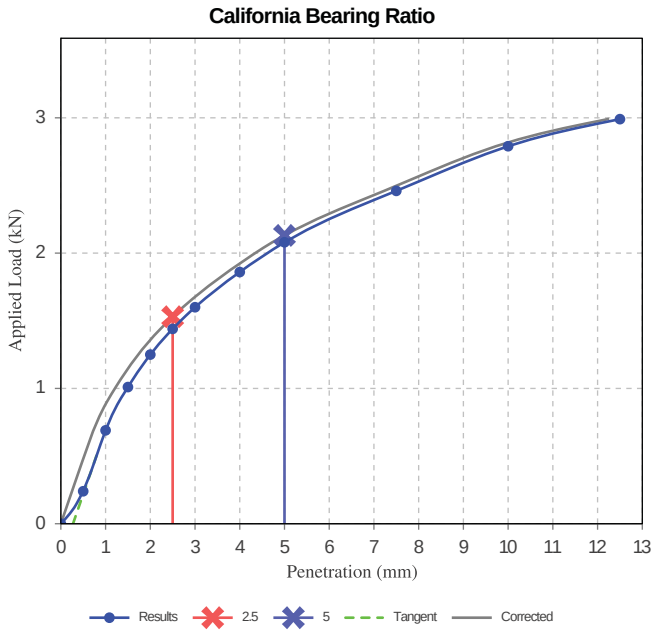
Durkin Construction Pty Ltd
Silverwater Laboratory
Unit 3, 50-52 Derby Street Silverwater NSW 1811
Phone: (02) 9712 0308
Fax: (02) 9647 1984
Email: jack@durkinconstruction.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Jack Zhang
NATA Accredited Laboratory Number: 18612

Report Number: **D18219-1**
Issue Number: 1
Date Issued: 07/09/2020
Client: EMM Consulting
Ground floor, 20 Chandos Street, St Leonards NSW 2065
Contact: Abdullah Uddin
Project Number: D18219
Project Name: Adams Road, Luddenham, NSW
Project Location: Adams Road, Luddenham, NSW
Client Reference: D18219 - D18219
Work Request: 942
Sample Number: 20-942A
Date Sampled: 25/08/2020
Dates Tested: 27/08/2020 - 31/08/2020
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Site Selection: Selected by Client
Sample Location: **BH1 , Depth: 270-1500mm**
Lot No: **BH1**
Material: Silty Clay
Material Source: BH

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**12**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.85		
Optimum Moisture Content (%)	14.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	98.0		
Moisture Content at Placement (%)	14.2		
Moisture Content Top 30mm (%)	17.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	72.2		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

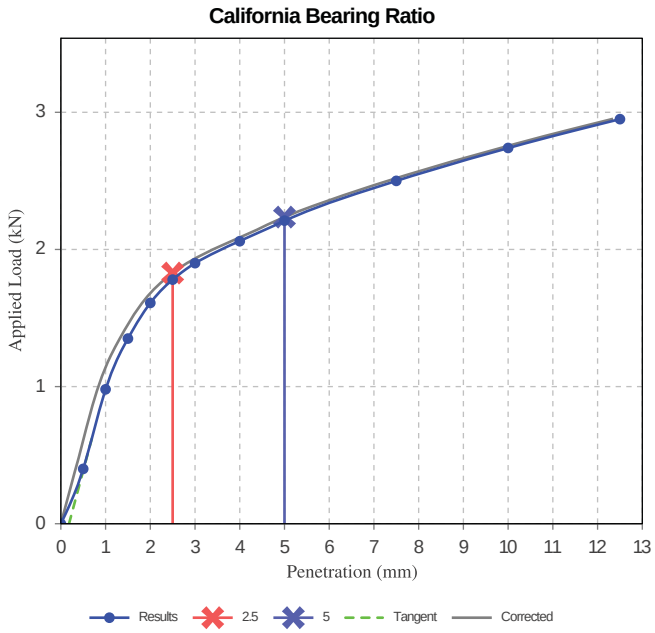
Durkin Construction Pty Ltd
Silverwater Laboratory
Unit 3, 50-52 Derby Street Silverwater NSW 1811
Phone: (02) 9712 0308
Fax: (02) 9647 1984
Email: jack@durkinconstruction.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Jack Zhang
NATA Accredited Laboratory Number: 18612

Report Number: **D18219-1**
Issue Number: 1
Date Issued: 07/09/2020
Client: EMM Consulting
Ground floor, 20 Chandos Street, St Leonards NSW 2065
Contact: Abdullah Uddin
Project Number: D18219
Project Name: Adams Road, Luddenham, NSW
Project Location: Adams Road, Luddenham, NSW
Client Reference: D18219 - D18219
Work Request: 942
Sample Number: 20-942B
Date Sampled: 25/08/2020
Dates Tested: 27/08/2020 - 31/08/2020
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Site Selection: Selected by Client
Sample Location: **BH2 , Depth: 225-1500mm**
Lot No: **BH2**
Material: Silty Clay
Material Source: BH

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**14**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.77		
Optimum Moisture Content (%)	16.0		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	99.5		
Moisture Content at Placement (%)	16.1		
Moisture Content Top 30mm (%)	19.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	72.2		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

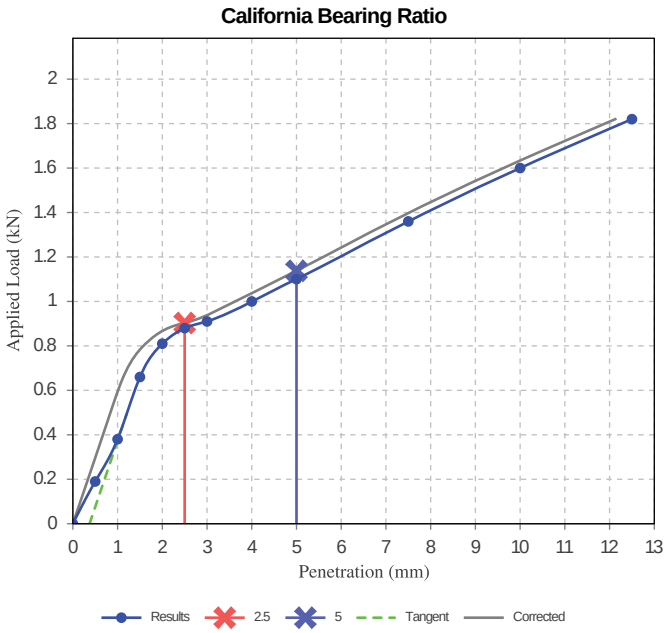
Durkin Construction Pty Ltd
Silverwater Laboratory
Unit 3, 50-52 Derby Street Silverwater NSW 1811
Phone: (02) 9712 0308
Fax: (02) 9647 1984
Email: jack@durkinconstruction.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Jack Zhang
NATA Accredited Laboratory Number: 18612

Report Number: **D18219-1**
Issue Number: 1
Date Issued: 07/09/2020
Client: EMM Consulting
Ground floor, 20 Chandos Street, St Leonards NSW 2065
Contact: Abdullah Uddin
Project Number: D18219
Project Name: Adams Road, Luddenham, NSW
Project Location: Adams Road, Luddenham, NSW
Client Reference: D18219 - D18219
Work Request: 942
Sample Number: 20-942C
Date Sampled: 25/08/2020
Dates Tested: 27/08/2020 - 31/08/2020
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Site Selection: Selected by Client
Sample Location: **BH3 , Depth: 245-1500mm**
Lot No: **BH3**
Material: Sandy Clay
Material Source: BH

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**7**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.78		
Optimum Moisture Content (%)	19.0		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	100.0		
Moisture Content at Placement (%)	19.2		
Moisture Content Top 30mm (%)	23.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	72.2		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

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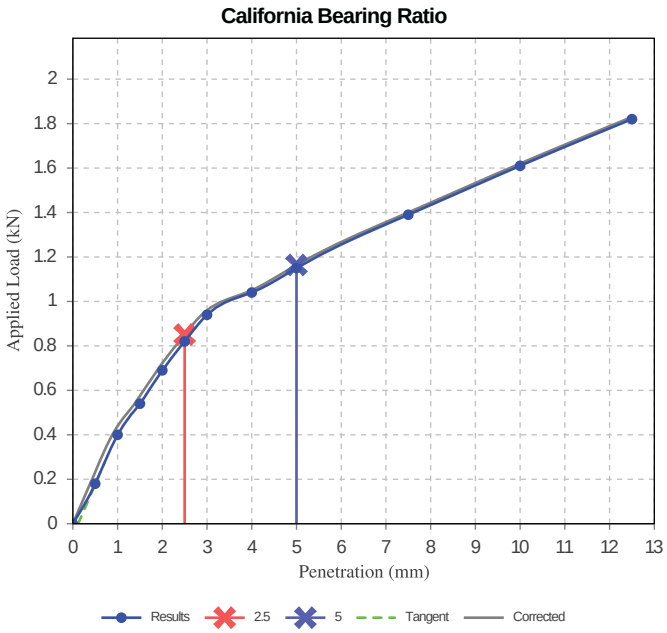
Approved Signatory: Jack Zhang
NATA Accredited Laboratory Number: 18612

Report Number: **D18219-1**
Issue Number: 1
Date Issued: 07/09/2020
Client: EMM Consulting
Ground floor, 20 Chandos Street, St Leonards NSW 2065
Contact: Abdullah Uddin
Project Number: D18219
Project Name: Adams Road, Luddenham, NSW
Project Location: Adams Road, Luddenham, NSW
Client Reference: D18219 - D18219
Work Request: 942
Sample Number: 20-942D
Date Sampled: 25/08/2020
Dates Tested: 27/08/2020 - 31/08/2020
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Site Selection: Selected by Client
Sample Location: **BH4 , Depth: 160-1500mm**
Lot No: **BH4**
Material: Sandy Clay
Material Source: BH

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**6**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.78		
Optimum Moisture Content (%)	16.0		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	100.5		
Moisture Content at Placement (%)	16.0		
Moisture Content Top 30mm (%)	21.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	72.2		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

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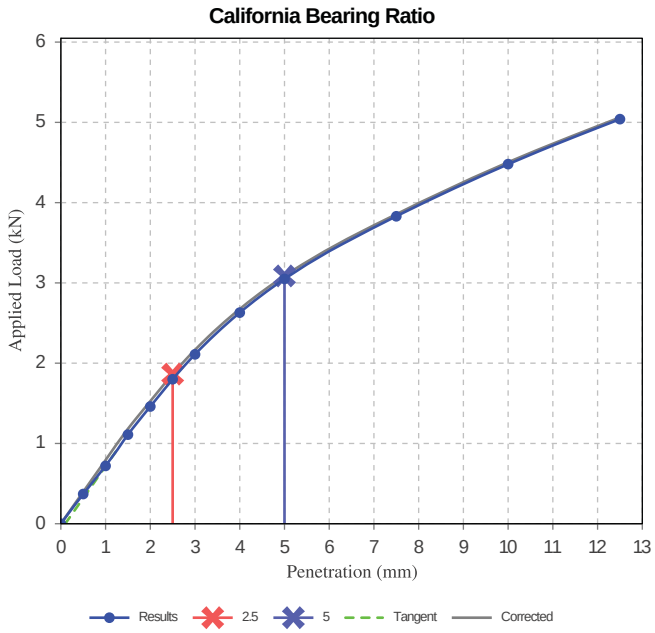
Email: jack@durkinconstruction.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Jack Zhang
NATA Accredited Laboratory Number: 18612

Report Number: **D18219-1**
Issue Number: 1
Date Issued: 07/09/2020
Client: EMM Consulting
Ground floor, 20 Chandos Street, St Leonards NSW 2065
Contact: Abdullah Uddin
Project Number: D18219
Project Name: Adams Road, Luddenham, NSW
Project Location: Adams Road, Luddenham, NSW
Client Reference: D18219 - D18219
Work Request: 942
Sample Number: 20-942E
Date Sampled: 25/08/2020
Dates Tested: 27/08/2020 - 31/08/2020
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Site Selection: Selected by Client
Sample Location: **BH5 , Depth: 490-1500mm**
Lot No: **BH5**
Material: Sandy Clay
Material Source: BH

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**16**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.90		
Optimum Moisture Content (%)	11.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Moisture Content at Placement (%)	11.6		
Moisture Content Top 30mm (%)	13.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	72.2		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

Report Number: **D18219-1**
Issue Number: 1
Date Issued: 07/09/2020
Client: EMM Consulting
Ground floor, 20 Chandos Street, St Leonards NSW 2065
Contact: Abdullah Uddin
Project Number: D18219
Project Name: Adams Road, Luddenham, NSW
Project Location: Adams Road, Luddenham, NSW
Client Reference: D18219 - D18219
Work Request: 942
Dates Tested: 27/08/2020 - 27/08/2020

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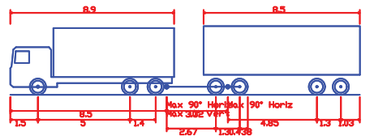
Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content	Material
20-942A	BH1 , Depth: 270-1500mm	19.1 %	Silty Clay
20-942B	BH2 , Depth: 225-1500mm	21.5 %	Silty Clay
20-942C	BH3 , Depth: 245-1500mm	18.7 %	Sandy Clay
20-942D	BH4 , Depth: 160-1500mm	13.7 %	Sandy Clay
20-942E	BH5 , Depth: 490-1500mm	8.7 %	Sandy Clay

Appendix E

Swept path 19 m-in-length

COMMENTS

A3



19M TRUCK AND DOG	
Overall Length	19.000m
Overall Width	2.600m
Overall Body Height	3.738m
Min Body Ground Clearance	0.427m
Track Width	2.500m
Lock-to-lock time	4.00s
Wall to Wall Turning Radius	12.000m

NOTES:
Swept path shows vehicle wheel path (red), body overhang (black) and 500 mm clearance (green)

EMM creating opportunities

SYDNEY | Suite 01
Ground Floor
20 Chandos Street,
St Leonards NSW 2065

Phone # 02 9493 9500

www.emmconsulting.com.au

REV	DATE	COMMENT	DRAWN	REVIEWED
6	12/03/21	FOR INFORMATION	EL	AU
5	04/03/20	FOR INFORMATION	EL	AU
4	27/02/20	FOR INFORMATION	EL	AU
3	26/02/20	FOR INFORMATION	EL	AU
2	21/02/20	FOR INFORMATION	EL	AU
1	12/02/20	FOR INFORMATION	EL	AU

PROJECT:
Luddenham Quarry

DRAWING TITLE:
Intersection of Elizabeth Drive with Adams Road

19m Truck and Dog Manoeuvrability

CLIENT:	CPG
DRG. #:	EMM-103b
PROJECT #:	J190749
SCALE:	1:250

REV: 6