

6 Consultation

6.1 Kiama Municipal Council

Boral consulted with Council as part of the pre-DA process to inform the intention of proposed modification, discuss the planning approval pathway and key environmental issues associated with the proposed modification. Following a meeting with the Council in October 2018, Council has agreed in principal to receive a modification application under Section 4.55 of the EP&A Act.

6.2 NSW EPA

Boral consulted with the NSW EPA in 2019 to provide project related information, to inform the indicative timing for lodgement of the DA for the proposed modification and provide opportunity for comment and further future consultation following submission. No formal comments or specific concerns were raised by the NSW EPA at that time. Further consultation with the NSW EPA will be undertaken by Boral following DA submission.

6.3 NSW Department of Industry – Land & Water

Boral consulted with the NSW Department of Industry – Land & Water (DoI Land & Water) in October/November 2018 to provide project related information and seek feedback on the planning approval pathway. DoI Land & Water advised that they prefer to provide feedback during the DA modification exhibition process. Further consultation with DoI Land & Water will be undertaken by Boral following DA submission.

6.4 NSW Roads and Maritime Services

Boral consulted with the NSW Roads and Maritime Services (RMS) in October/November 2018 to provide project related information and seek feedback on traffic related assessment requirements. RMS provided formal response to this request in November 2018, which has been considered during preparation of the TIA (refer Appendix C).

6.5 Community consultation

Communication and stakeholder engagement has been undertaken in support of this modification application. Focused activities have occurred across February and March 2019 and are ongoing.

Elected Councillors and administrative officers were first briefed on the project on 6 February 2019. This session offered KMC an insight into the purpose and intent of the modification, as well as an overview of the accompanying approach to consultation.

The initial phase of the public engagement process was aimed at raising local awareness about the modification and its objectives whilst identifying issues of importance to the community. Engagement has been carried out using a variety of tools as listed in Table 6.1. Approximately 300 people were directly contacted during initial engagement, including by way of a letterbox 'drop' and 'door knock' of houses near to the quarry, which was undertaken on 6 February 2019. In each instance, residents received a letter notifying them of the impending modification application and a copy of a 'frequently asked questions' (FAQs) document about the project (refer Appendix B).

The State and federal representatives for the region have also been updated about the modification and community engagement approach. Neither raised any specific concerns or issues about the proposal, but indicated an interest in its outcomes.

As a response to the letterbox ‘drop’ and ‘door knock’ activities, a site tour was organised for residents of Hutchinson Street bounding the southern side of the site. This took place on 28 February 2019 and was attended by four neighbours. The Editor of the free local fortnightly newspaper, *The Bugle*, was also shown around the quarry on the same day. This resulted in editorial coverage in two editions of *The Bugle* newspaper and its associated online Facebook page. The potential reach of these two channels is approximately 12,000 (*Bugle* circulation figures).

An overview presentation on the project was given to the Kiama North Precinct Committee at its meeting of 13 March 2019. This session was also attended by the Convenor of the Central Precinct Committee who has since been provided with further information on matters raised by the Committee’s members.

Table 6.1 Historic Community consultation format and feedback on project aspects

Contact method	Noise	Trucks	Rail	Operating hours	Dust	Land use	Access point	Flora and fauna	Purity of fill
Email	x	x	x	x	x				
Phone call	x	x	x	x	x		x		
Door knock	x	x	x		x			x	
Site visit (group)	x	x	x	x	x		x	x	
Council meeting (group)		x	x			x			
Local MPs									
Media		x	x			x	x		x
Letter box drop									

6.5.1 Responses to matters raised

Following the initial engagement activities, only a small number of stakeholders made contact with the project team by phone, email or during face-to-face interview to express concern. Responses were generally received from local residents nearby to the quarry.

Table 6.1 shows the number of actual contacts or potential reach of each channel used in the initial engagement phase and the general topics of feedback given.

The nominated matters have been reaffirmed in activities carried out subsequent to the initial engagement period, with the primary focus around the following:

- Rail

Although reported generally, this matter was of specific importance to a small number of Hutchinson Street residents. Their concerns centre on the potential for noise of trains arriving, shunting, loading and unloading, particularly during night hours.

Residents in other parts of the neighbouring area also expressed concern about the potential for further noise along the rail corridor, however these concerns were not as specific as those reported from Hutchinson Street.

Rail noise impacts have been considered as part of the noise impact assessment provided as Appendix F as summarised in Section 7.4.

- Road access

Some community members have queried why Boral cannot utilise the existing access off the Princes Highway via the Bombo interchange located north of the quarry site rather than via Panama Street.

The Bombo interchange provides access to the adjacent Sydney Trains quarry site, however Boral does not have any legal capacity to access its quarry site using the Sydney Trains access point.

- Boral's legal and consented truck access route into the quarry is via Panama Street, and therefore access to the site for rehabilitation activities associated with the proposed modification would be via Panama Street. Truck movements

Truck movements were raised generally, with specific concerns dependant on the location of the respondent. Those from Hutchinson Street who had previous experience of truck movements associated with the historic operation of the quarry expressed concern about the potential for trucks to block access to their street in the event of an incident. There was also heightened sensitivity to truck movements noted as a result of previous road construction work nearby (Princes Highway upgrade of mid 2000s). Whereas residents to the north of the quarry indicated concern about truck movements in the event that an alternative access was provided into Boral's site across the adjoining privately-owned land (not part of this modification).

Road traffic impacts have been considered as part of the traffic impact assessment provided as Appendix C as summarised in Section 7.1.

- Noise

Some residents voiced concern about the potential for excessive noise from transportation and filling operations at the quarry, including comments regarding operational hours associated with the project, questions about how many trucks would be allowed, and what routes they would likely take. Particular concern was expressed about the potential for truck-related noise on the steep section of Riverside Drive near Panama Street.

Noise impacts, including those associated with proposed operations, road and rail noise, have been considered as part of the noise impact assessment provided as Appendix F as summarised in Section 7.4.

- Dust

Many respondents reported that consistent dust emissions from the neighbouring currently active quarry operations (Sydney Trains) settle in their properties. Accordingly, concern was apparent that the dust situation could be exacerbated by the proposal.

Air quality impacts have been considered as part of the air quality impact assessment provided as Appendix D as summarised in Section 7.2.

6.5.2 Post lodgement engagement

Boral's engagement and consultation program in support of this modification application is continuing across the lodgement and public exhibition phase.

Ongoing consultation will be undertaken in accordance with a Stakeholder Engagement Strategy that has been developed for the project, which includes the release of information to keep residents updated on progress of the proposal. Community feedback sessions and continuing liaison with individuals and groups with whom contact was initiated during the early engagement program, will continue during exhibition.

7 Environmental assessment

7.1 Traffic

The TIA (EMM 2019a) assessed potential traffic impacts to the road network associated with the proposed modification. It has been prepared in accordance with the relevant governmental assessment requirements, guidelines and policies including the NSW Roads and Maritime Services' *Guide to Traffic Generating Developments* (RTA 2002). The TIA was prepared in consultation with relevant government agencies including Council.

7.1.1 Approved / historic operations

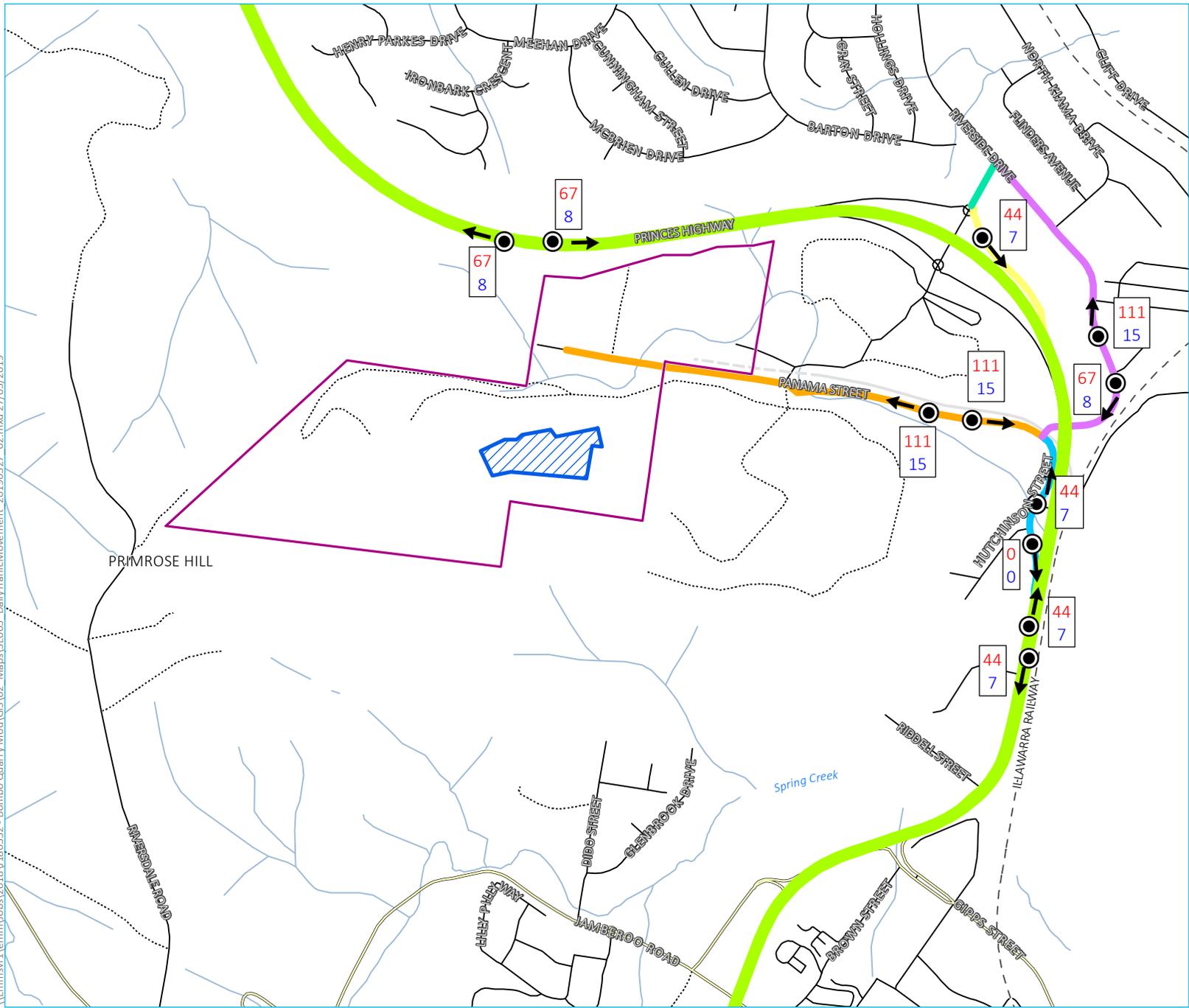
Historic operations of the quarry took place 24 hours per day, 7 days per week, and on average 275 days per year. Historic records at the quarry indicate that peak production approximated the current EPL extraction limit of 500,000 tpa, which equates to on average 65 truck dispatches per day or 130 truck movements per day (assuming use of 28 t capacity semi-trailers). On occasion, it is estimated that the quarry would have dispatched a peak of up to 82 trucks per day (164 truck movements) to account for fluctuations in supply demand over time. In addition, the concrete batching plant consent allows for an additional 46 truck dispatches per day (92 truck movements per day). On average, a total of up to 222 truck movements per day would have been generated at the quarry, with a peak of up to 256 truck movements per day.

The typical traffic distribution for historic quarry operations would have varied over time and included material delivery to the Sydney metropolitan region to the north, and infrastructure projects to the south, which may have included RMS Kiama bypass, and the RMS Princes Highway Kiama to Gerringong and Gerringong to Berry upgrades. Historic concrete batching plant operations would also have supplied concrete to similar local markets. The average truck distribution on the road network adopted as the baseline for approved/historic operations were assumed to be 60% total movements to/from the north and 40% to/from the south.

The assumed number of employees associated with historic operations is up to 15 full time equivalent staff, which equates to 30 light vehicle movements per day. Historic distribution of light vehicle movements was assumed to have been 50%/50% north/south.

Historic quarry and concrete batching plant daily traffic movements are summarised in Table 7.1 and Figure 7.1.

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- KEY**
- Site boundary
 - Pit sump
 - Bombo rail siding (existing)
 - Bombo rail siding (to be reinstated)
 - Main southern railway line
 - Main road
 - Local road
 - Vehicular track
 - Watercourse/drainage line
 - Waterbody
 - Access road
 - Princes Highway
 - Panama Street
 - Hutchinson Street
 - Riverside Drive
 - Bombo Interchange
 - Quarryman Road
 - Historic daily traffic volume
 - 000 Heavy vehicle count
 - 000 Light vehicle count

Historic daily traffic movement

Bombo quarry modification
Statement of environmental effects
Figure 7.1

Source: EMM (2019); DFSI (2017); GA (2015)



Table 7.1 Historic quarry and CBP daily traffic movements

Road	Quarry truck movements	CBP truck movements	Employee and visitor related car movements	Total traffic movements (car/truck)
Princes Highway (northbound) – north of Bombo Interchange	39	28	8	8/67
Princes Highway (southbound) – north of Bombo Interchange	39	28	8	8/67
Princes Highway (southbound only) – at Bombo Interchange	26	18	7	7/44
Riverside Drive (northbound)	65	46	15	15/111
Riverside Drive (southbound)	39	28	8	8/67
Princes Highway (northbound) – south of Hutchinson Street off-ramp	26	18	7	7/44
Princes Highway (southbound) – south of Hutchinson Street off-ramp	26	18	7	7/44
Hutchinson Street (northbound)	26	18	7	7/44
Hutchinson Street (southbound)	0	0	0	0/0
Panama Street (westbound)	65	46	15	15/111
Panama Street (eastbound)	65	46	15	15/111

7.1.2 Existing environment

Current daily traffic volume data from RMS (years 2006 to 2017 inclusive) for the Princes Highway was used as background traffic data. As Bombo Quarry’s operations were suspended in 2014, the RMS data from years 2014 to 2017 excludes traffic associated with operation of Bombo Quarry, including operation of the concrete batching plant.

An intersection traffic survey of the Hutchinson Street/Panama Street/Riverside Drive intersection was conducted on 17 October 2018 for each of the three hourly morning and afternoon peak periods, results of which are presented in Table 7.2. These traffic volumes exclude any traffic associated with Bombo Quarry, which was not operational at the time.

Table 7.2 Summary of October 2018 surveyed peak hourly and heavy vehicle traffic volumes

Road	Direction	AM peak (6:45 am to 7:45 am)			PM peak (3:45 pm to 4:45 pm)		
		Total vehicles	Heavy vehicles	% of heavy vehicles	Total vehicles	Heavy vehicles	% of heavy vehicles
Riverside Drive	Eastbound	47	7	14.4%	80	1	1.8%
Riverside Drive	Westbound	10	1	9.7%	19	0	0%
Hutchinson Street	Northbound	41	5	11.9%	78	1	1.8%
Hutchinson Street	Southbound	6	0	0%	18	0	0%
Panama Street	Eastbound	6	1	16.0%	2	0	0%
Panama Street	Westbound	4	1	25.0%	1	0	0%

Detailed SIDRA intersection analysis indicated that during both morning and afternoon peak times, the Hutchinson Street/Panama Street/Riverside Drive intersection is performing at Level of Service (LOS) A, with ample capacity for future growth.

There were no reported traffic accidents on Panama Street between 2013 and 2017. Some vehicle crashes were recorded near Bombo Quarry, which were primarily on the Princes Highway, Bombo Interchange, and Riverside Drive.

7.1.3 Traffic impacts

i Daily incremental changes on road network

Fill material may be transported to the site via road from either the north or south via Panama Street. Trucks would be unloaded to dedicated onsite material stockpiles for subsequent transfer to the quarry pit or direct to the pit for spreading and compaction.

The existing quarry development consent places no restrictions on quarrying operations including truck movements. Notwithstanding, unlimited transportation of fill material is not being sought as part of the proposed modification. Rather, the proposal for transportation of imported fill material via road would be capped consistent with peak historical operations and associated traffic volumes from the site, which was on average up to 222 truck movements per day; and on occasion, a peak of up to 256 truck movements per day. The likely daily receipt of spoil trucks from major government infrastructure projects for rehabilitation/backfilling of the quarry is anticipated will be relatively constant due to the uniform rate of progress of tunnelling machines. Therefore, an average of 222 truck movements per day was considered a likely consistent daily spoil receipt rate for the purpose of the assessment. It is anticipated that suitable fill material may be sourced from multiple locations, and therefore road transport routes will vary over time and traffic may originate from both north and south of the site. The predominant sources of suitable material are anticipated to be the numerous large infrastructure projects currently underway or planned to commence within the next few years within the Sydney metropolitan region. Therefore, the dominant spoil transport route will be from the north, and was assumed to be:

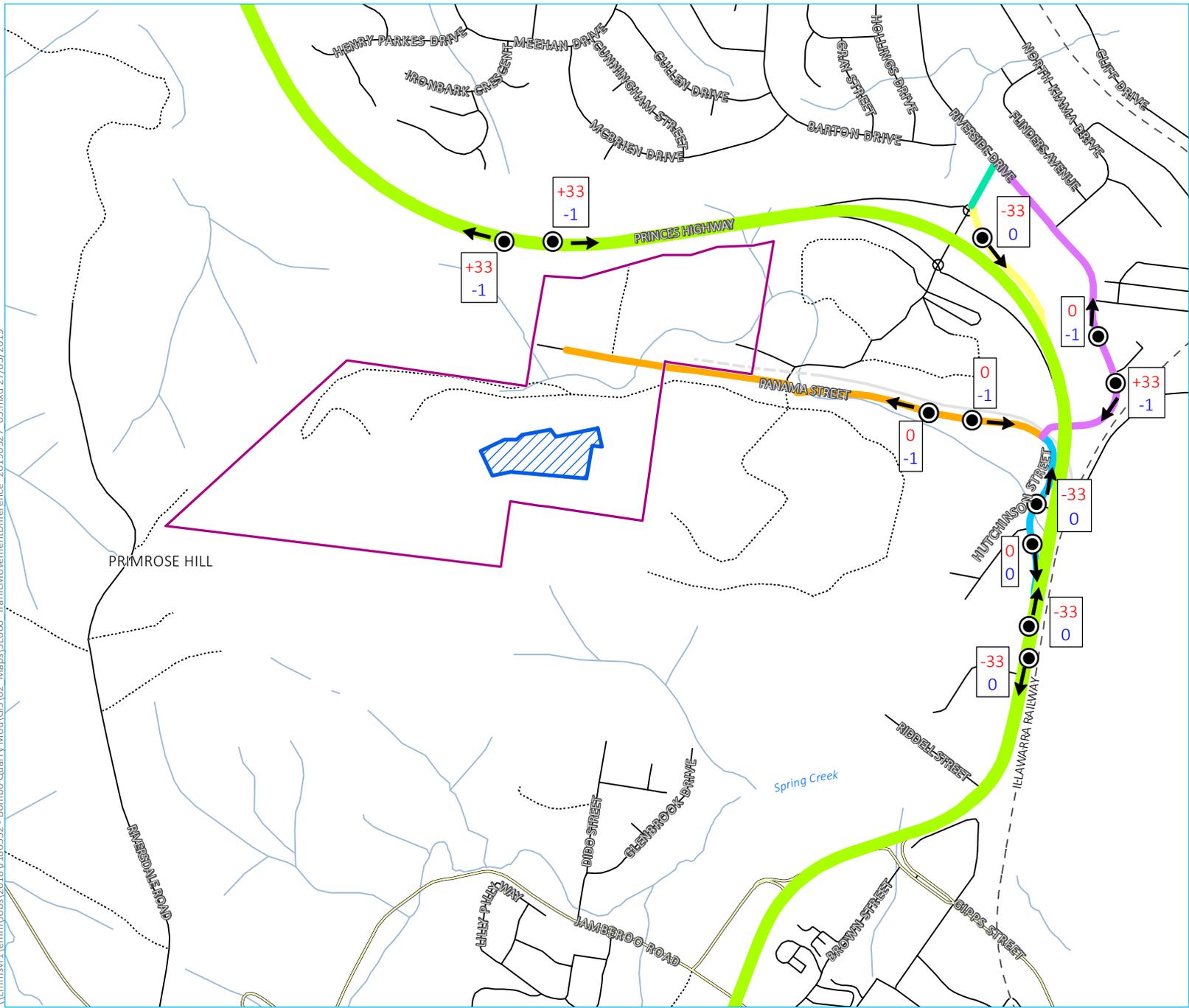
- 90% from the north along the Princes Highway, Riverside Drive and onto Panama Street; and
- 10% from the south along the Princes Highway, Hutchinson Street and onto Panama Street.

This change to the traffic distribution is likely to result in some incremental increase in heavy vehicle volumes on some roads, while other roads will have reduced movements.

A minor number of light vehicle movements associated with rehabilitation would be generated by employees and visitors travelling to and from the site. This is estimated at up to 14 light vehicles per day, which represents 28 daily light vehicle movements. The origin and destinations of the site employee and visitor traffic associated with the rehabilitation activity is assumed to be a 50%/50% north/south split.

The existing, historic/baseline and proposed daily traffic volumes are summarised in Table 7.3. The change in traffic distribution on road network between historic and proposed operations are illustrated in Figure 7.2.

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- KEY**
- Site boundary
 - Pit sump
 - Bombo rail siding (existing)
 - Bombo rail siding (to be reinstated)
 - Main southern railway line
 - Main road
 - Local road
 - Vehicular track
 - Watercourse/drainage line
 - Waterbody
 - Access road
 - Princes Highway
 - Panama Street
 - Hutchinson Street
 - Riverside Drive
 - Bombo Interchange
 - Quarryman Road
- Estimated change in daily traffic volumes
- 000 Heavy vehicle count difference
 - 000 Light vehicle count difference

Change in traffic distribution on road network

Bombo quarry modification
Statement of environmental effects
Figure 7.2

Source: EMM (2019); DFSI (2017); GA (2015)



Table 7.3 Existing, historic/baseline and proposed daily traffic volumes

Road	Existing daily traffic (all vehicles) exclude Bombo Quarry traffic	Existing daily traffic (heavy vehicles) exclude Bombo Quarry traffic	Historic / baseline quarry operations ²	Proposed quarry rehabilitation ³	Incremental change in historic/baseline vs proposed (vehicle numbers and %) (LV/HV ⁴)	
Princes Highway, south of Hutchinson St off-ramp (southbound)	18,731	1,255 ¹	7/44	7/11	0/-33	No change/-75%
Princes Highway, south of Hutchinson St off-ramp (northbound)	20,131	1,349 ¹	7/44	7/11	0/-33	No change/-75%
Princes Highway, north of Bombo Interchange (southbound)	13,398	898 ¹	8/67	7/100	-1/+33	-13%/+49%
Princes Highway, north of Bombo Interchange (northbound)	13,196	884 ¹	8/67	7/100	-1/+33	-13%/+49%
Riverside Drive (northbound)	635	40	15/111	14/111	-1%/0	-7%/No change
Riverside Drive (southbound)	145	5	8/67	7/100	-1/+33	-13%/+49%
Hutchinson Street (southbound)	120	0	0	0	No change	No change
Hutchinson Street (northbound)	595	30	7/44	7/11	0/-33	No change/-75%
Panama Street (eastbound)	40	5	15/111	14/111	-1/0	-7%/No change
Panama Street (westbound)	25	5	15/111	14/111	-1/0	-7%/No change

Notes:

1. In the absence of RMS data, existing heavy vehicle volumes have been estimated as 6.7% traffic on the Princes Highway.
2. The traffic distribution of historic/baseline quarry operation is 50/50 north and south for light vehicle, and 60/40 north and south for heavy vehicles.
3. The traffic distribution of proposed quarry rehabilitation is 50/50 north and south for light vehicle, and 90/10 north and south for heavy vehicles.
4. LV = light vehicle, HV = heavy vehicle

Compared to the historical Bombo quarrying and concrete batching plant operations, the following impacts are anticipated as a result of the proposed modification:

- Light vehicle movements will likely be similar or slightly reduced during rehabilitation activities.
- Bombo Quarry related heavy vehicle movements on the Princes Highway (south of Hutchinson Street off-ramp) are likely to reduce by -75%. Similarly, heavy vehicle movements on Hutchinson Street (northbound) are also likely to reduce by -75%. No Bombo Quarry related light and heavy vehicles will travel on Hutchinson Street southbound as there is no access to the Princes Highway in this direction.
- The daily heavy vehicles generated from the proposed modification on the Princes Highway (north of Bombo Interchange) are likely to increase by +49%, which is equivalent to +66 daily heavy vehicle movements, compared to historic quarrying operations.
- Riverside Drive will be likely to experience no change in the northbound heavy vehicle movements but will have an increase of +49% in the southbound heavy vehicle movements, which is equivalent to +33 daily heavy vehicle compared to historic quarry operations.
- There will be no changes compared to historic heavy vehicle volumes on Panama Street.
- Overall, the sections of the project-related road network that will be likely to experience an increase of heavy vehicle volumes as a result of the proposed modification will be the Princes Highway (north of Bombo Interchange) and Riverside Drive (southbound). Other associated sections of the road network will have a general reduction of light and heavy vehicle movements relative to the historic quarry operation, including the Princes Highway (south of Bombo Interchange) and Hutchinson Street (northbound).

ii Peak hourly site access intersection performance

For most quarry sites, the morning peak hour percentage is generally between 10% to 15% of daily traffic and the afternoon peak hour percentage is much lower at around 3% to 5%. A worst-case assumption of 15% was adopted for the purposes of this assessment.

As such, the distribution of light and heavy vehicle movements for the proposed importation/rehabilitation activities is therefore assumed as follows:

- 14 light vehicles in total = 2 light vehicles during AM and PM peak hours; and
- 111 heavy vehicles in total = 17 heavy vehicles during AM peak hours, and 17 heavy vehicles during PM peak hours.

The outcomes of the SIDRA intersection analysis for both the morning and afternoon peak hourly level of service and other operational results are shown in Table 7.4.

Table 7.4 Summary of existing and proposed site access intersection operations

Intersection	Peak hour	Existing year 2017 traffic			Proposed future traffic		
		LOS	DOS	DEL	LOS	DOS	DEL
Hutchinson Street/Panama Street/Riverside Drive	Morning peak hour (6:45 am – 7:45 am)	A	0.041	5.7	A	0.045	7.2
	Afternoon peak hour (3:45 pm – 4:45 pm)	A	0.075	5.5	A	0.080	6.7

Note: LOS – Level of Service, DOS – Degree of Saturation, DEL – Vehicle Delay by time (second)

The SIDRA analysis results for the site access intersection show the intersection is currently operating at a very low DOS and there will be negligible traffic delay or other impacts from the future project traffic using the intersection, where the intersection LOS will remain at A, for all the morning and afternoon peak traffic scenarios considered. The future DOS also complies with the desirable maximum degree of saturation for an intersection with sign-controls.

The intersection has ample capacity to accommodate future traffic volume increases; upgrade/improvement works at this intersection is not required to accommodate proposed future traffic.

iii Cumulative traffic impact on road network

The TIA incorporated a cumulative traffic impact considering the future Bombo Quarry trucks entering and leaving the quarry and travelling along the route to and from Sydney, as well as future Sydney Trains trucks sharing the same route to and from Sydney. The analysis assumed both proposals are approved and would utilise the same route, with assessment based on 2017 traffic conditions.

Sydney Trains, on behalf of Rail Corp, has obtained SEARs for the preparation of an EIS to support an application to quarry rail ballast within Dunmore Quarry. No further documentation, such as a TIA, was publicly available at the time the TIA was prepared. Additional truck traffic generation for the Sydney Trains proposal was assumed to be an additional eight trucks per hour travelling each way to and from the Sydney Trains site during the morning and afternoon peak period on weekdays, which is equivalent to 160 heavy vehicle movements per day. The same traffic assumption approach was adopted by EMM in the 2018 Dunmore Quarry Modification 11 and Dunmore Quarry Traffic Impact Assessment in 2012.

The cumulative traffic impacts for movements on the Princes Highway, north of Panama Street, are summarised in Table 7.5.

Table 7.5 Cumulative traffic volumes on Princes Highway

Road	Year 2017 daily traffic (all vehicles)	Year 2017 daily traffic (heavy vehicles)	With proposed Bombo Quarry Modification and Sydney Trains proposal	All vehicle increases (%)
Princes Highway, south of Hutchinson Street off-ramp (southbound)	18,731	1,255	+178	+0.95%
Princes Highway, south of Hutchinson Street off-ramp (northbound)	20,131	1,349	+178	+0.88%

Table 7.5 Cumulative traffic volumes on Princes Highway

Road	Year 2017 daily traffic (all vehicles)	Year 2017 daily traffic (heavy vehicles)	With proposed Bombo Quarry Modification and Sydney Trains proposal	All vehicle increases (%)
Princes Highway, north of Bombo Interchange (southbound)	13,398	898	+267	+1.99%
Princes Highway, north of Bombo Interchange (northbound)	13,196	884	+267	+2.02%

Source: Dunmore Quarry Traffic Impact Assessment (EMM 2018)

The cumulative traffic impact on the Princes Highway due to combined operational traffic of the proposed modification and Sydney Trains proposal is considered minimal.

7.1.4 Conclusion

The proposed modification will result in some change to the traffic distribution compared to historic quarry operations, which will likely result in some incremental increase in heavy vehicle volumes on some roads, while other roads will have reduced movements. Average daily heavy vehicle movements on the Princes Highway (south of Hutchinson Street off-ramp) and Hutchinson Street (northbound) are likely to reduce by -75%. Average daily heavy vehicle movements on the Princes Highway (north of Bombo Interchange) is likely to increase by +49%, equivalent to +66 heavy vehicle movements. Riverside Drive (southbound) is likely to experience no change in northbound heavy vehicle movements and an increase of +49% in southbound average daily vehicle movements. There will be no changes to heavy vehicle volumes on Panama Street and light vehicle movements will likely be similar or slightly reduced during rehabilitation activities compared to historic operations.

The future performance of the site access intersection at Hutchinson Street/Panama Street/Riverside Drive will remain at its current LOS A, with ample capacity for future traffic growth. Therefore, the traffic impacts associated with the proposed modification will not have a significant impact on traffic delay, network and intersection operations.

7.2 Air quality

The AQIA (EMM 2019b) assessed potential air quality impacts associated with the proposed modification. It was prepared in general accordance with the guidelines specified by the NSW EPA in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016).

7.2.1 Assessment criteria

The EPA’s impact assessment criteria for particulate matter pollutants, as documented in the above guideline, are presented in Table 7.6. The assessment criteria for PM₁₀ and PM_{2.5} are consistent with revised National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) national reporting standards (National Environment Protection Council [NEPC], 1998; NEPC, 2015).

Table 7.6 Impact assessment criteria for particulate matter

PM metric	Averaging period	Assessment criteria
TSP	Annual	90 µg/m ³
PM ₁₀	24 hour	50 µg/m ³
	Annual	25 µg/m ³
PM _{2.5}	24 hour	25 µg/m ³
	Annual	8 µg/m ³
Dust deposition	Annual	2 g/m ² /month (project increment only)
		4 g/m ² /month (cumulative)

Notes: µg/m³: micrograms per cubic meter; g/m²/month: gram per square meter per month

The Approved Methods for Modelling classifies TSP, PM₁₀, PM_{2.5} and dust deposition as ‘criteria pollutants’. Assessment criteria for ‘criteria pollutants’ are applied at the nearest existing or likely future off-site sensitive receptor and compared against the 100th percentile (ie the highest) dispersion modelling prediction. Both the incremental and cumulative impacts need to be presented, requiring consideration of existing ambient background concentrations for the criteria pollutants assessed.

7.2.2 Existing environment

The National Pollutant Inventory (NPI) database identifies seven reporting sources of air pollution emissions in the surrounding 10 km from the quarry. Of these NPI reporting sources, four listed hard rock quarry operations have the potential to generate emissions of particular matter, which include:

- Albion Park Quarry;
- Sydney Trains Bombo Quarry;
- Boral Dunmore Quarry; and
- Bass Point Quarry.

With the exception of the adjacent Sydney Trains Bombo Quarry, the identified operations are unlikely to directly influence baseline air quality at the residences surrounding Bombo Quarry.

There are no meteorological measurements conducted at the quarry, nor is there a requirement to do so in the applicable development consent and EPL. Therefore, monitoring data from the following resources was collated to determine the meteorological and climate environments of the local area:

- Bureau of Meteorology (BoM) automatic weather station (AWS) locations at Kiama (Bombo Headland), located 1.5 km to the east of the quarry, and Albion Park (Wollongong Airport), located 11 km to the north-northwest of the quarry;
- NSW Office of Environment and Heritage (OEH) air quality station (AQS) at Albion Park South, located 10 km to the north-northwest of the quarry; and
- BoM climate station at Kiama Bowling Club, 2.5 km south of the quarry.

i **PM₁₀**

A time series of 24-hour average PM₁₀ concentrations at the Albion Park South AQS show fluctuations in concentrations throughout the years 2013 to 2017 inclusive. Two exceedances were recorded in October 2013, which coincided with the extensive bushfires that occurred across NSW at that time. At all other times throughout years 2013 to 2017, the recorded levels were within the EPA criterion. Based on the location of the Albion Park South AQS, the likely contributing sources to recorded PM₁₀ concentrations are sea spray, neighbouring quarrying operations and urban emission.

The distribution of recorded concentration, as presented in Table 7.7, is comparable across all five years and it is therefore considered that all years provide a presentative dataset for baseline purposes.

Table 7.7 Statistics for PM10 concentrations – OEH Albion Park South AQS – 2013 to 2017

Year	Maximum	95th percentile	90th percentile	75th percentile	Median	Average	Days > 50 µg/m ³
	24-hour average PM ₁₀ concentration (µg/m ³)						
2013	69.0	32.3	24.9	17.5	12.3	14.2	2
2014	48.3	29.6	25.9	19.9	15.1	16.1	0
2015	41.2	26.0	22.1	17.3	12.2	13.3	0
2016	43.1	30.3	25.6	19.4	12.8	14.7	0
2017	44.6	30.2	25.9	19.1	12.9	15.3	0

The 2017 calendar year PM₁₀ dataset from the Albion Park South AQS has been adopted to represent baseline conditions.

ii **PM_{2.5}**

The Albion Park South AQS commenced measurement of PM_{2.5} concentrations in March 2015. To complete the five-year period of data analysis, hourly PM_{2.5} concentrations for 2013 and 2014 from the NSW OEH Wollongong AQS, located 26 km north of the quarry, were also reviewed. A time series of recorded 24-hour average PM_{2.5} concentrations at the Wollongong (2013 to 2014 inclusive), and Albion Park South (2015 to 2017 inclusive) also shown records that fluctuate throughout the presented period. Recorded PM_{2.5} concentrations were generally below the EPA criterion. Five exceedances were recorded in October and November 2013 which coincided with the extensive bushfires that occurred across NSW at that time. Two exceedances were also recorded in May 2016, which were classed as exceptional events attributed to hazard reduction burns (OEH, 2017).

The distribution of recorded concentration presented in Table 7.8 shown comparable nature of 2014 to 2017, therefore, it is considered that the years 2014 through to 2017 provide the most appropriate representation of background PM_{2.5} concentrations.

Table 7.8 Statistics for PM_{2.5} concentrations – OEH Wollongong and Albion Park South AQS – 2013 to 2017

Year	Maximum	95th percentile	90th percentile	75th percentile	Median	Average	Days > 25 µg/m ³
	24-hour average PM _{2.5} concentration (µg/m ³)						
2013	88.4	15.1	12.7	8.9	6.2	7.3	5
2014	17.3	12.8	11.5	8.9	6.1	6.5	0
2015	21.1	12.5	10.8	7.7	5.3	6.0	0
2016	30.7	12.8	10.9	8.3	6.0	6.4	2
2017	19.3	11.2	10.3	7.4	5.6	6.4	0

Notes: Monitoring of PM_{2.5} at the Albion Park South AQS commenced in March 2015. PM_{2.5} data from Wollongong AQS presented for 2013 and 2014.

The 2017 calendar year PM_{2.5} dataset from the Albion Park South AQS has been adopted to represent baseline conditions.

iii TSP

There are no measurements of TSP at the quarry. The typical ratio between annual average PM₁₀ and TSP concentrations is between 0.4 and 0.5. In the absence of locally sourced TSP monitoring data, a ratio of 0.4 has been applied to the annual average PM₁₀ concentration for 2017 from the Albion Park South AQS, returning a TSP background concentration of 38.3 µg/m³.

iv Dust deposition

Boral has three dust deposition gauges installed in the vicinity of the quarry currently recording dust levels:

- Site 3 – Seabreeze Apartments - Glenbrook Street, Kiama (offsite to the south of quarry boundary);
- Site 4 - Honey Farm - end Riverdale Drive (offsite to northwest of quarry boundary); and
- Site 7 - John Holland North Kiama Bypass (onsite to west of CBP and stockpiling area).

Boral provided records of dust deposition rates recorded at the three locations in the vicinity of the quarry. For all years of monitoring, the applicable impact assessment criterion was not exceeded at any monitoring location. The highest annual average dust deposition level recorded for the 2017-2018 period was 2.5 g/m²/month at Site 4, which was adopted as background for the assessment.

v Summary of adopted background conditions

The baseline air quality conditions for the quarry area, based on the analysis presented in the preceding sections, are summarised in Table 7.9.

Table 7.9 **Adopted background air quality conditions**

Pollutant	Averaging period	Value	Unit
TSP	Annual	38.3	
PM ₁₀	24-hour	Daily varying	
	Annual	15.3	µg/m ³
PM _{2.5}	24-hour	Daily varying	
	Annual	6.4	
Dust deposition	Month	2.5	g/m ² /month

vi **Existing and neighbouring operations**

In order to understand the magnitude of historical impacts from approved operations at the site and the Sydney Trains Bombo Quarry, emission estimation and dispersion modelling has been conducted for the following sources:

- quarry operations at the maximum approved extraction and processing rate of 500,000 tpa;
- Boral CPB operations at the approved maximum daily traffic rate of 46 movements per day; and
- Sydney Trains Bombo Quarry operations at the maximum approved extraction and processing rate of 2,000,000 tpa.

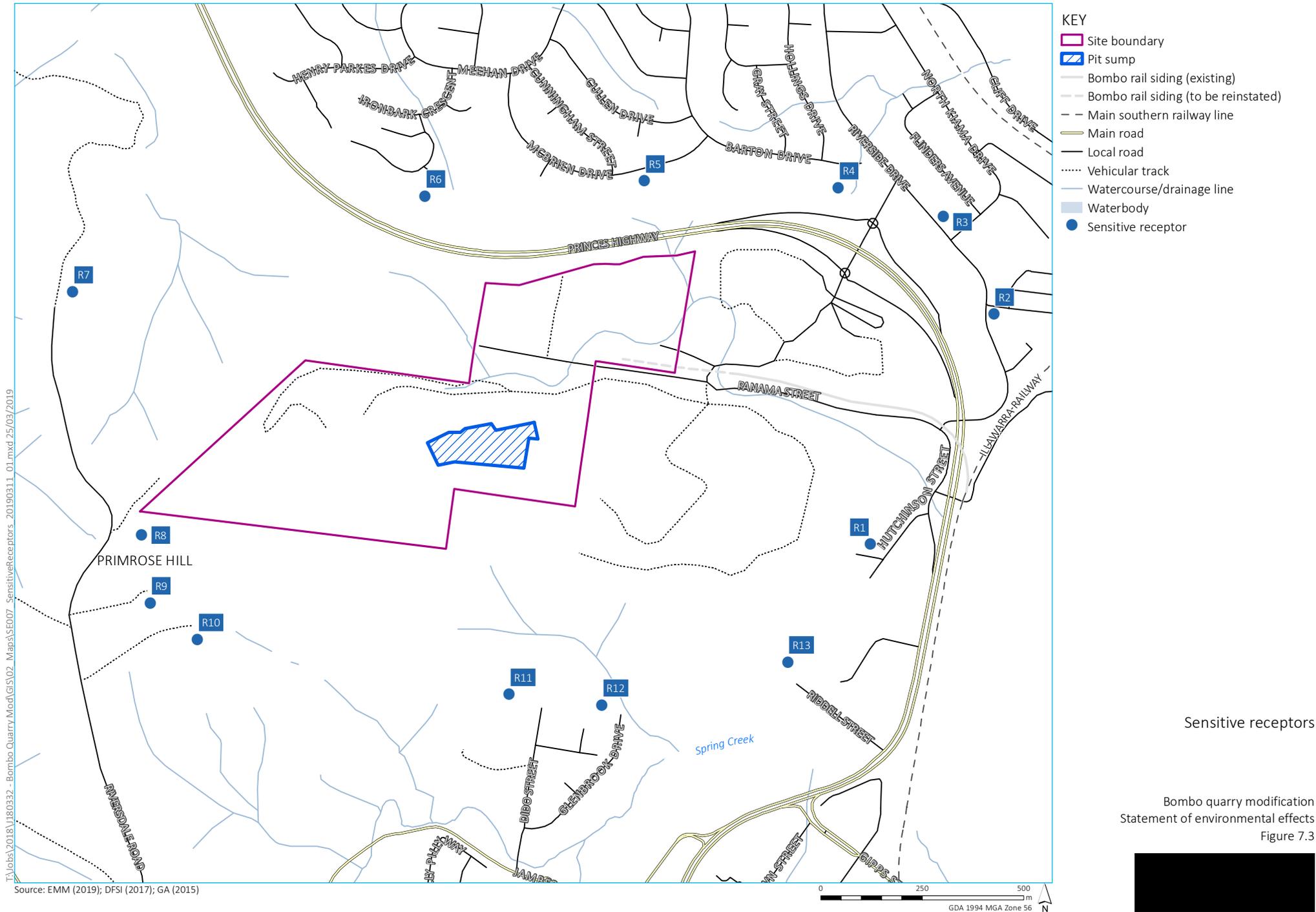
Predicted cumulative TSP, PM₁₀ and PM_{2.5} concentrations and dust deposition levels associated with the three existing operations are summarised in Table 7.10. These predicted cumulative concentrations are considered a baseline for approved operations, and used for comparison with modelling results for proposed worst case material importation activities at the quarry.

Table 7.10 Cumulative (existing approved operations + background) concentration and deposition results

Receptor ID	Predicted cumulative concentration ($\mu\text{g}/\text{m}^3$) or deposition rate ($\text{g}/\text{m}^2/\text{month}$)						
	TSP		PM ₁₀		PM _{2.5}		Dust deposition
	Annual	24-hour maximum	Annual	24-hour maximum	Annual	Annual	
Criterion	90	50	25	25	8	4	
R1	41.2	45.1	16.2	19.4	6.5	2.6	
R2	42.6	44.7	16.6	19.4	6.6	2.8	
R3	42.3	44.7	16.5	19.4	6.6	2.7	
R4	49.8	44.9	18.3	19.5	6.9	3.2	
R5	45.5	44.7	18.6	19.5	6.9	2.9	
R6	39.8	44.6	16.2	19.3	6.5	2.5	
R7	38.1	44.6	15.4	19.3	6.4	2.4	
R8	38.2	44.6	15.4	19.3	6.4	2.4	
R9	38.2	44.6	15.4	19.3	6.4	2.4	
R10	38.3	44.6	15.5	19.3	6.4	2.4	
R11	40.9	46.1	16.3	19.6	6.6	2.6	
R12	42.3	48.9	16.6	20.1	6.6	2.7	
R13	41.2	47.0	16.2	19.6	6.5	2.6	

7.2.3 Assessment locations

A number of sensitive receptor assessment locations, chosen as representative of the surrounding environment, were selected for prediction of air quality impacts associated with emission sources at the quarry site. Representative assessment locations considered in the AQIA are presented in Table 7.11 and Figure 7.3. All locations are residential and are consistent with those used for the NIA for the proposed modification.



Sensitive receptors

Bombo quarry modification
Statement of environmental effects
Figure 7.3

Table 7.11 Assessment locations

ID	Receptor Type	Address	Easting (m, MGA56s)	Northing (m, MGA56s)
R1	Residential	4 Dundas Street, Bombo	303177	6162955
R2	Residential	28 Darien Avenue, Bombo	303481	6163517
R3	Residential	34 Riverside Drive, Kiama Downs	303356	6163755
R4	Residential	86 Barton Drive, Kiama Downs	303097	6163825
R5	Residential	19 McBrien Drive, Kiama Downs	302620	6163842
R6	Residential	13A Michael Crescent, Kiama Downs	302079	6163805
R7	Residential	Riversdale Road, Jamberoo	301212	6163571
R8	Residential	Riversdale Road, Jamberoo	301381	6162977
R9	Residential	Riversdale Road, Jamberoo	301403	6162811
R10	Residential	Riversdale Road, Jamberoo	301518	6162722
R11	Residential	25 Dido Street, Kiama	302287	6162588
R12	Residential	37 Glenbrook Drive, Kiama	302515	6162562
R13	Residential	Riddell St, Bombo	302973	6162667

7.2.4 Air quality impacts

The atmospheric dispersion modelling was completed using the AMS/US-EPA regulatory model (AERMOD) (US-EPA, 2004). In addition to the 13 individual receptor locations, particulate matter concentrations were predicted over a 5.5 km by 5.5 km domain featuring nested grids.

The result of cumulative impacts at each of the sensitive receptor assessment locations surrounding the quarry for the worst case material delivery option (being Option 2 Wagon delivery as described in Section 2.2.2 of the AQIA included as Appendix D) have been summarised in Table 7.12.

Table 7.12 Cumulative (Wagon Option 2 material delivery + Boral CBP + Sydney Trains Bombo Quarry + background) concentration and deposition results

Receptor ID	Predicted cumulative concentration ($\mu\text{g}/\text{m}^3$) or deposition rate ($\text{g}/\text{m}^2/\text{month}$)						
	TSP		PM ₁₀		PM _{2.5}		Dust deposition
	Annual	24-hour maximum	Annual	24-hour maximum	Annual	Annual	
Criterion	90	50	25	25	8	4	
R1	42.4	46.6	16.5	19.5	6.6	2.8	
R2	42.5	44.7	16.5	19.5	6.6	2.9	
R3	42.5	44.7	16.5	19.4	6.6	2.8	
R4	49.3	44.7	18.1	19.5	6.9	3.3	
R5	45.3	44.7	17.7	19.5	6.8	3.0	
R6	40.8	44.7	16.2	19.3	6.5	2.7	
R7	38.3	44.6	15.4	19.3	6.4	2.5	
R8	38.5	44.6	15.5	19.3	6.4	2.5	
R9	38.4	44.6	15.5	19.3	6.4	2.5	
R10	38.8	44.6	15.6	19.3	6.4	2.6	
R11	41.3	47.8	16.3	19.9	6.6	2.8	
R12	42.3	49.1	16.6	20.2	6.7	2.8	
R13	41.3	47.4	16.2	19.7	6.6	2.7	

The predicted cumulative concentrations for all pollutants and averaging periods presented in Table 7.12 are below the applicable EPA assessment criterion at all representative receptor locations for both peak day (12,000 tpd) and average day (9,000 tpd) material importation operations at the quarry.

In order to understand the significance of proposed material delivery activities and associated impacts, a comparison between the corresponding cumulative modelling results for approved maximum production rate activities at the quarry (Table 7.10) and the Wagon Option 2 (Table 7.12) was conducted. The relative change in predicted cumulative results between the two site configurations is presented in Figure 7.4. The following points are noted:

- cumulative concentrations under the Wagon Option 2 activities will decrease or remain similar to cumulative concentrations from existing approved operations at the quarry at the residential receptors to the north of the quarry site (receptor 3, 4 and 5);
- cumulative concentrations under the Wagon Option 2 activities will increase at the receptors to the south-east and south of the quarry (receptor 1, 11, 12 and 13);
- the predicted change at all receptors, increase or decrease, is less than 5% and is therefore considered minor; and
- the results of the modelling indicate that the proposed worst case material delivery emissions return air quality impacts that are comparable to existing consented operations.

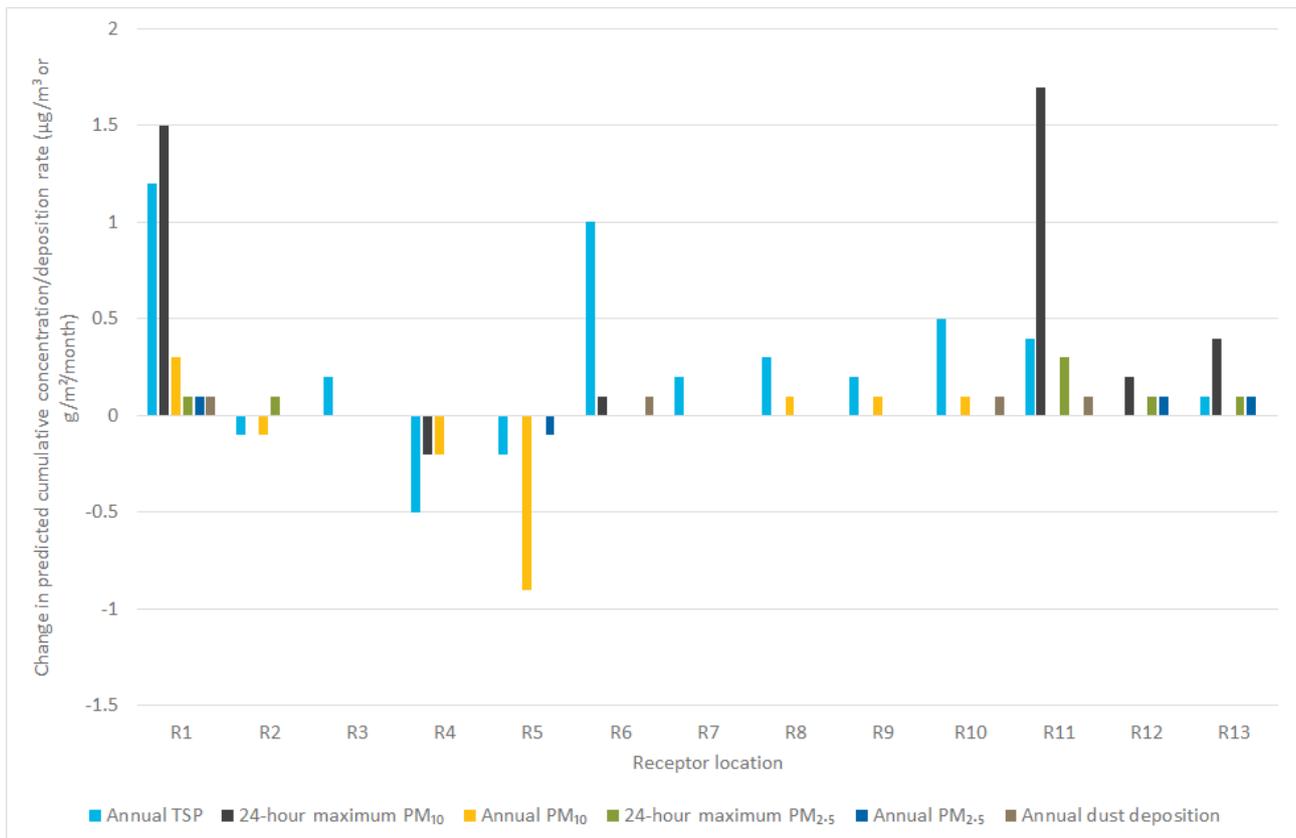


Figure 7.4 Change in predicted cumulative concentrations and deposition rates at surrounding receptors – Wagon Option 2 activities versus approved quarry activities

Particulate matter emissions during the proposed material importation operations will be controlled primarily through the use of water carts and sprays to unpaved roads, material stockpiling and emplacement areas and crusher operations.

Mitigation of impacts will also be achieved through time of day restrictions for material emplacement operations within the pit. By restricting the majority of emplacement operations to between the hours of 7 am and 10 pm, the hours of the day that typically have poorer pollution dispersion potential (ie late night and early morning hours) will be avoided as much as practicable.

The proposed mitigation measures and operational restrictions are effective for the purpose of minimising air quality impacts to the surrounding environment.

Boral would maintain the existing network of dust deposition gauges at the quarry throughout the life of the material importation project and results of dust deposition monitoring would be reported on the Boral website, consistent with current reporting requirements for the quarry.

7.2.5 Conclusion

Emissions of TSP, PM₁₀ and PM_{2.5} associated with the historical approved operations at the quarry were estimated and modelled to establish a reference baseline for impacts to the surrounding environment under existing approvals. Additionally, the neighbouring Sydney Trains Bombo Quarry operations were also estimated and modelled for cumulative assessment purposes.

A qualitative review of emission sources associated with assorted material importation options was undertaken, with the Wagon Option 2 identified as the worst case for air quality impact potential.

All atmospheric dispersion modelling predictions of air pollution emissions for historical and proposed activities was undertaken using the AERMOD dispersion model.

The results of the dispersion modelling conducted indicated that the proposed worst-case material importation activities would not result in any exceedance of applicable cumulative impact assessment criteria at any surrounding receptor location. Further, the comparison of these results with model predictions for historical approved operations at the quarry indicates that the activities proposed as part of the modification are unlikely to result in a significant change at any of the surrounding assessment locations.

Proposed mitigation measures (principally water carts and water sprays) and operational time restrictions were incorporated into the emission calculations and dispersion modelling conducted. On the basis of the low magnitude of predicted impacts, it is considered that the proposed mitigation measures are appropriate for the management of particulate matter emissions and impacts during material importation activities.

7.3 Water quality

The SWA (EMM 2019c) assessed potential surface water impacts associated with the proposed modification including consideration of impacts to existing watercourses and the downstream receiving environment. It was prepared in accordance with the relevant governmental assessment requirements, guidelines and policies, including consideration of the need for a controlled activity approval for works on waterfront land under the provisions of the NSW *Water Management Act 2000* (WM Act). The SWA was prepared in consultation with relevant government agencies including Council and the Natural Resources Access Regulator (NRAR).

7.3.1 Approved / historic operations

The quarry is currently licensed under EPL 313, which places limits on discharges to waters downstream of the quarry. Specifically, Boral is required to *'maintain any operate pollution control structures and treatment works as specified in the Water Pollution Control Plan submitted for this premises. See plan number F003-01-032 REV 0.'* This means any discharge from the quarry to occur as a result of stormwater from a rainfall event that exceeds the design capacity of the pollution control ponds, and that all practical measures to avoid or minimise water pollution have otherwise been taken.

The existing consent places no conditions or limitation on surface water drainage, and surface water drainage systems within and extending downstream of the quarry through the adjacent Sydney Trains site have been extensively modified over time to suit quarrying operations. All drainage lines within the site boundary have been subject to modification.

In consultation with the EPA and Council, a dewatering plan was prepared for the site in response to the accumulation of stormwater in the quarry void that necessitated dewatering to maintain safe water levels. Dewatering was undertaken during the period March 2018-August 2018 in accordance with the plan, which incorporated discharge of accumulated water via a suction pump and temporary poly pipe to the established drainage system through the quarry, which incorporates a series of open channels/culverts and underground pipe sections and discharges to the ocean at Bombo Beach. Discharge water was subject to the water quality discharge conditions of EPL 313 and water quality monitoring was undertaken for the duration of dewatering.

There are no known historical issues associated with poor water quality within the quarry, or resulting from discharges from the quarry. Discharged water was generally compliant with EPL licence conditions, with a small number of exceedances observed as follows:

- there were two minor exceedances in pH at the licenced discharge point (LDP). These exceedances were marginal;
- between 15 June 2018 and 14 August 2018, three consecutive temperature exceedances were recorded at the LDP. These occurred during winter and are therefore reasonably assumed to be due to colder ambient temperature; and
- limits on dissolved oxygen (DO) at the LDP exceeded discharge parameters three times during the dewatering phase. These exceedances were marginal.

Whilst a higher number of exceedances were detected at the pit upstream of the LDP (Point 1), these were generally not detected downstream at either the LDP or the Bombo Beach discharge point (Point 3), which indicates that existing water management systems and practices are effective in managing water quality.

7.3.2 Existing environment

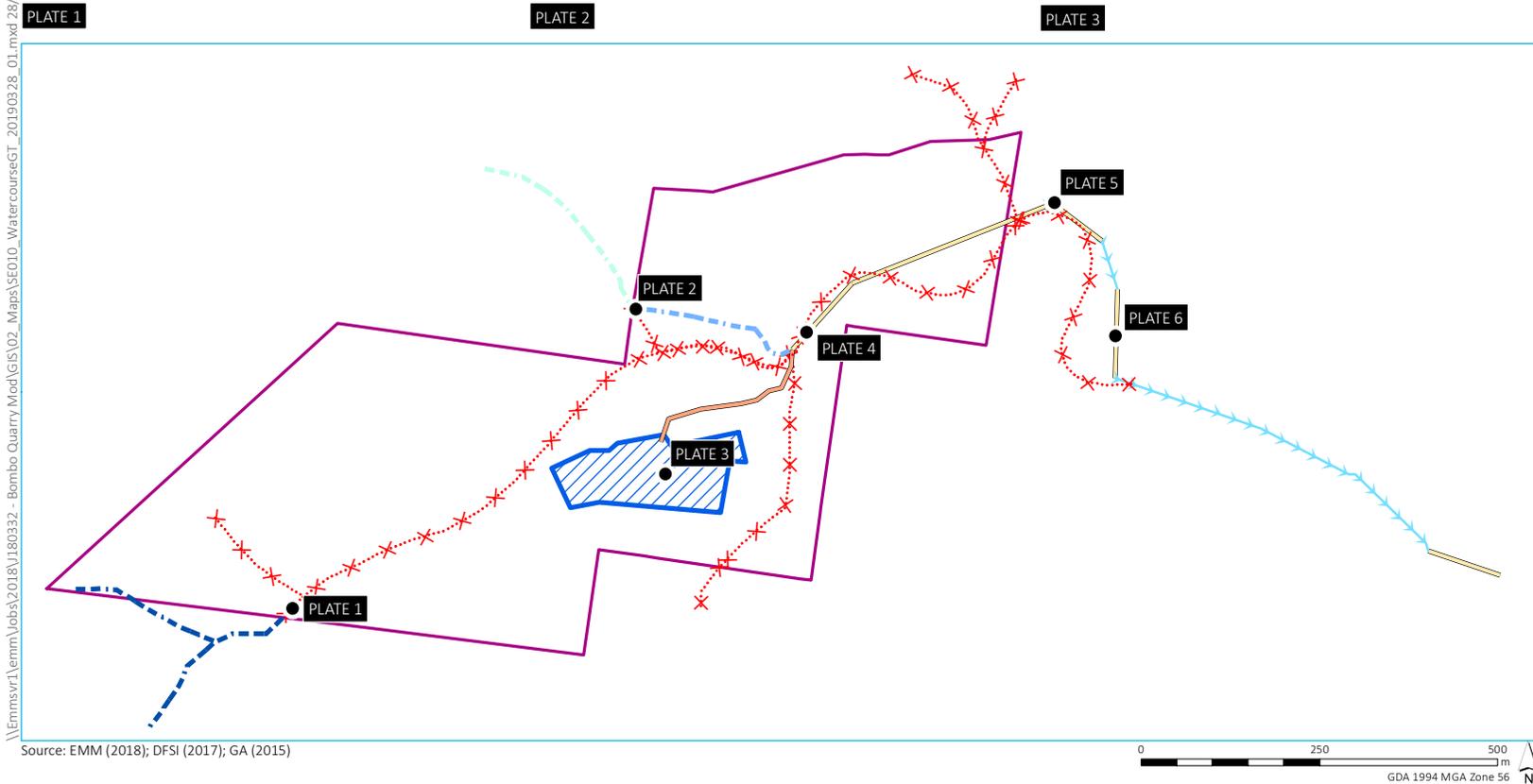
Both DoI Land & Water and Council have available watercourse mapping which covers the quarry and surrounds. However, there are inconsistencies exist between the DoI-Land & Water and Council mapping and both DoI-Land & Water and Council watercourse mapping do not accurately reflect current site conditions, given the extraction and supporting activities and associated modifications to watercourses that have occurred over time.

A site inspection was conducted on 12 December 2018 to ground-truth the location and arrangement of existing drainage elements within the quarry and extending downstream to the Princes Highway. The outcomes of the site inspection and confirmed current drainage system are shown in Figure 7.5.

The key findings of this investigation were:

- the existing drainage system was observed to be generally consistent with arrangements set out in the dewatering plan; and
- all existing open channel reaches within the site boundary been relocated and/or heavily modified by historic quarry activities and form part of the quarry's water management system, and no longer occur as shown by current DoI-Water/Council watercourse mapping.

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- KEY**
- Site boundary
 - Pit sump
 - Water management system based on observations
 - Indicative rainfall-dependent watercourse (LEP)
 - Indicative modified watercourse (EMM)
 - Indicative watercourse (LEP & DPI)
 - Watercourse does not exist
 - Piped drainage
 - Remnant reaches of open channel
 - Temporary dewatering pipe
 - Plate

Outcomes of watercourse ground-truthing exercise

Bombo quarry modification
Statement of environmental effects
Figure 7.5

PLATE 4

PLATE 5

PLATE 6



7.3.3 Water quality impacts

The potential sources of impact to surface water resources arising directly from the proposed modification are:

- disturbance of remnant watercourses, potentially triggering the need for controlled activity approval under the WM Act;
- water quality; and
- flooding.

i Impacts to watercourses

As discussed in Sections 7.3.1 and 7.3.2, all existing open channel reaches within the site boundary have been relocated and/or heavily modified by historic quarrying activities and form part of the quarry's water management system, and no longer occur as shown by current DoI-Water/Council watercourse mapping.

Accordingly, controlled activity approval under the provisions of the WM Act is not considered to be required for further works within the quarry as part of its ongoing rehabilitation.

Design and staging of rehabilitation works will need to consider appropriate measures to manage sourcing and erosion along drainage lines through the quarry in order to prevent erosion of compacted fill and transport of sediment downstream.

Design of ultimate watercourse treatments and associated riparian corridors will need to be considered as part of future planning for long term surface water management for redevelopment of the area, beyond rehabilitation of the quarry.

ii Impacts to water quality

Potential impacts to water quality associated with the proposed modification is summarised in Table 7.13.

Table 7.13 Summary of potential impacts to water quality

Activity	Description	Risks to water quality
Placement of an increased volume of fill to achieve the desired final landform.	Extents of filling will be increased across the quarry to suit the rehabilitation objectives.	<ul style="list-style-type: none"> Primary risk to water quality is associated with exposure of soils and potential erosion and mobilisation of sediment into receiving watercourses. This could also occur as a result of poor ground cover revegetation or lack of other suitable surface stabilisation.
Import of fill from offsite to supplement stockpiled overburden.	Fill to comprise VENM/ENM, to a maximum of 4.5 million m ³ over anticipated 5 to 8 year period.	<ul style="list-style-type: none"> VENM/ENM is suitable for use as engineering fill provided applicable EPA resource recovery order/exemptions are met. Additional risk over and above use of stockpiled overburden is considered negligible.
Reinstatement of rail spur and associated handling facilities.	Rail spur and associated handling facility was previously partially dismantled and will require reinstatement.	<ul style="list-style-type: none"> Primary risk to water quality is associated with ground disturbance and exposure of soils and potential erosion and mobilisation of sediment into receiving watercourses. This could also occur as a result of poor ground cover revegetation or lack of other suitable surface stabilisation. Contamination of surface water as a result of accidental spillage of materials such as fuel, lubricants, herbicides and other chemicals used to support construction activities could also adversely impact water quality.
Ongoing management of road/rail delivery stockpile areas and transport of fill material within the quarry.	Existing established delivery / stockpile areas and haul routes with higher throughput due to increased filling.	<ul style="list-style-type: none"> Primary risk to water quality is associated with scouring of stockpiles and material spillage along haul routes with mobilisation of sediment into receiving watercourses. Contamination of surface water as a result of accidental spillage of materials such as fuel, lubricants, herbicides and other chemicals used to support construction activities could also adversely impact water quality.

Potential risks to water quality identified in Table 7.13 are considered minor and manageable provided that appropriate erosion and sediment control (ESC) measures are designed and implemented as part of the rehabilitation phase, and form part of an Environmental Management Plan (EMP) for the quarry.

iii Impacts to flooding

As part of the void rehabilitation proposal, surface water collected in the void will be re-used for suitable onsite activities such as moisture conditioning and dust suppression. As the infilling occurs and ground levels change, a sump (or retention basin) will be maintained to capture and store excess stormwater.

Stored stormwater will be monitored and continue to be discharged in a controlled manner to Bombo Beach in accordance with the EPL. Therefore, the ongoing management of stormwater during the rehabilitation process would mitigate any potential for adverse flooding impacts downstream.

Flooding conditions and potential impacts on downstream property and infrastructure would be addressed as part of final landform design and future planning for longer term surface water management for redevelopment of the whole locality, including the Sydney Trains site, beyond the rehabilitation phase of the quarry.

7.3.4 Conclusion

Three potential surface water impacts associated with the proposed modification were identified:

- disturbance of remnant watercourses, potentially triggering the need for controlled activity approval under the WM Act;
- water quality; and
- flooding.

All existing open channel reaches within the quarry site boundary have been relocated and/or heavily modified by historic quarrying activities and are considered to form part of the quarry's water management system. As such, controlled activity approval under the provisions of the WM Act is not considered to be required for further works within the quarry as part of its ongoing rehabilitation.

The main risks to water quality will occur as a result of an increase in the volume and extent of fill material required to achieve the desired final landform within the quarry; reinstatement of the rail spur; operation of delivery stockpile areas; and transport of fill material within the quarry. These activities are likely to increase ground disturbance and exposure of soils with potential erosion and mobilisation of sediment into receiving watercourses. Contamination of surface water as a result of accidental spillage of materials such as fuel, lubricants, herbicides and other chemicals used to support construction activities could also adversely impact water quality.

Design and staging of rehabilitation works will need to consider appropriate measures to manage scouring and erosion along drainage lines through the quarry in order to prevent erosion of compacted fill and transport of sediment downstream.

Proposed key management measures to minimise the potential for adverse water quality impacts include implementation of erosion and sediment control measures; progressive revegetation or stabilisation of disturbed areas to minimise exposed soils to the extent possible; stabilisation of drainage lines; and implementation of procedures for hazardous material storage and spill management. The current Water Pollution Control Plan will also require updating to reflect current site conditions and proposed rehabilitation activities.

The proposed modification will continue to monitor and discharge stored stormwater in a controlled manner to Bombo Beach in accordance with the EPL. Therefore, the ongoing management of stormwater during the rehabilitation process would mitigate any potential for adverse flooding impacts downstream.

7.4 Noise and vibration

The NIA (EMM 2019d) assessed potential noise impacts from the proposed rehabilitation activities. It has been prepared in consultation with relevant government agencies including Council.

7.4.1 Assessment criteria

The current approval and EPL do not contain noise limits for the site.

Noise from industrial sites or processes in NSW are regulated by the local Council, DPE and/or the EPA. Usually there is a licence and/or development consent conditions stipulating noise limits. These limits are normally derived from operational noise levels applied at assessment locations. They are based on EPA guidelines (ie Noise Policy for Industry (NPfI) (EPA, 2017)) or noise levels that can be achieved at a specific site following the application of all reasonable and feasible noise mitigation.

EPA provides two separate noise trigger levels: intrusiveness and amenity. The fundamental difference being intrusiveness noise levels apply over 15 minutes in any period (day, evening or night), whereas the amenity noise levels apply to the entire assessment period (day, evening or night).

i Intrusive noise levels

The intrusive noise trigger levels require that $L_{Aeq,15\text{ minute}}$ noise levels from the site during the relevant operational periods (ie day, evening and night) do not exceed the rating background level (RBL) by more than 5 dB.

The NPfI recommends that the intrusive noise trigger level for evening be set at no greater than the intrusive noise level for daytime and that the intrusive noise level for night time should not be greater than the intrusive noise level for day or evening.

The noise levels adopted for each receiver area as follows and as shown in Table 7.14:

- noise levels measured at NM1 have been adopted for R7, R8, R9 and R10;
- noise levels measured at NM2 have been adopted for R11, R12 and R13; and
- noise levels measured at NM3 have been adopted for R1 to R6 inclusive.

Table 7.14 Project intrusiveness noise levels

Assessment location	Period ¹	Adopted RBL, dB	Project intrusiveness noise level dB, $L_{Aeq,15\text{ minute}}$
R7, R8, R9 and R10	Day	35	40
	Evening	34	39
	Night	30	35
R11, R12 and R13	Day	46	51
	Evening	39	44
	Night	33	38
R1, R2, R3, R4, R5 and R6	Day	50	55
	Evening	41	46
	Night	37	42

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am.

ii Amenity noise levels

The amenity noise trigger level is based on noise levels specific to the land use. The noise levels relate only to industrial noise and exclude road or rail noise. Where the measured existing industrial noise approaches recommended amenity noise level, it needs to be demonstrated that noise levels from new industry will not contribute to existing industrial noise such that amenity noise levels are exceeded.

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 new industrial developments is the recommended amenity noise level minus 5 dB. The corresponding project amenity noise levels for the site are provided in Table 7.15.

Table 7.15 Project amenity noise levels

Assessment location	Indicative area	Time period ¹	Recommended amenity noise level, $L_{Aeq, period}$	Project amenity noise level dB, $L_{Aeq, period}$
Residential: R7 to R10	Rural	Day	50	45
		Evening	45	40
		Night	40	35
Residential: R1 to R6, R11 to R13	Urban	Day	60	55
		Evening	50	45
		Night	45	40

Source: NSW NPfl (EPA 2017).

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am.

iii Project noise trigger level

The project noise trigger level (PNTL) is the lower of the calculated intrusive or amenity noise level and is provided in Table 7.16 for all assessment locations. This is the level that will be used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.

To standardise the time periods for the intrusiveness and amenity noise levels, the $L_{Aeq, 15 \text{ minute}}$ has been assumed to be equal to the $L_{Aeq, period} + 3$ decibels (dB). This is consistent with NPfl methodology.

Table 7.16 Project noise trigger levels

Assessment location	Period ¹	Intrusive noise level dB,	Amenity noise level dB,	Project noise trigger level (PNTL), dB(A)
		$L_{Aeq, 15 \text{ minute}}$	$L_{Aeq, 15 \text{ min}}$	
R7, R8, R9, R10	Day	40	48	40
	Evening	39	43	39
	Night	35	38	35
R11, R12 and R13	Day	51	58	51
	Evening	44	48	44
	Night	38	43	38
R1, R2, R3, R4, R5 and R6	Day	55	58	55
	Evening	46	48	46
	Night	42	43	42

Note: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am.

iv Sleep disturbance

Historic operations at the site occurred during the night-time period (10 pm to 7 am) as will the proposed operations. Hence, an assessment of the potential for sleep disturbance is required.

The NPfI suggests that a detailed maximum noise level event assessment should be undertaken where night-time noise levels at a residential location exceed:

- $L_{Aeq,15\text{ minute}}$ 40 dB or the prevailing RBL plus 5 dB (whichever is the greater); and/or
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB (whichever is the greater).

Guidance regarding potential for sleep disturbance is also provided in the NSW EPA's Road Noise Policy (RNP). The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP provides the following conclusions from the research on sleep disturbance:

- maximum internal noise levels (L_{Amax}) below 50 to 55 dB are unlikely to awaken people from sleep; and
- one or two noise events per night, with maximum internal noise levels (L_{Amax}) of 65 to 70 dB, are not likely to affect health and wellbeing significantly.

It is commonly accepted by acoustic practitioners and regulatory bodies that a facade including a partially open window will reduce external noise levels by 10 dB. Therefore, external noise levels in the order of 60 to 65 dB calculated at the facade of a residence is unlikely to awaken people according to the RNP.

The sleep disturbance screening criteria at residential assessment locations is presented in Table 7.17.

Table 7.17 Sleep disturbance screening criteria at residences

Assessment location	Adopted Night RBL, dB	Night time noise level event screening criteria, dB	
		$L_{Aeq,15\text{ minute}}$	L_{Amax}
R7, R8, R9, R10	30	40	52
R11, R12, R13	33	40	52
R1, R2, R3, R4, R5, R6	37	42	52

v Road traffic noise criteria

The principle guidance to assess the impact of the road traffic noise on assessment locations is in the NSW EPA's RNP. Table 7.18 presents the road noise assessment criteria for residential land uses nearest to roads that are potentially affected by an increase in traffic, reproduced from Table 3 of the RNP for road categories relevant to the project.

Table 7.18 Road traffic noise assessment criteria for residential land uses

Road Category	Type of project/development	Assessment criteria – dB	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{Aeq,15hr}$ 60 (external)	$L_{Aeq,9hr}$ 55 (external)

Additionally, the RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to +2 dB.

In addition to meeting the assessment criteria (Table 7.18), any significant increase in total traffic noise at the relevant residential assessment locations must be considered. Residential assessment locations experiencing increases in total traffic noise levels above those presented in Table 7.19 should be considered for mitigation.

Table 7.19 Road traffic relative increase criteria for residential land uses

Road Category	Type of project/development	Total traffic noise level increase – dBA	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/sub-arterial roads and transit ways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{eq(15-hr)}+12$ dB (external)	Existing traffic $L_{eq(9-hr)}+ 12$ dB (external)

vi Rail traffic noise

Environmental noise assessment requirements for rail traffic generating developments which utilise the public rail network are provided in the Rail Infrastructure Noise Guideline (RING) (EPA 2013). However, given the low volumes of proposed rail traffic compared to existing rail traffic volumes, the increase in average rail noise levels at the nearest residences to the rail line will be negligible and further consideration in reference to the RING is not required.

As required by the NPfl, noise from rail activity within the site boundary (ie train manoeuvring on-site and unloading activity) has been incorporated into the operational noise model for the site and assessed with reference to the relevant noise limits established in accordance with the NPfl.

7.4.2 Existing environment

A number of sensitive receptor assessment locations, chosen as representative of the surrounding environment, were selected for the purpose of predicting potential noise impacts. Representative assessment locations considered in the NIA are listed in Table 7.11. All locations are residential and are consistent with those used for the AQIA for the project.

In order to establish the existing ambient noise environment of the area, unattended noise monitoring was conducted at three representative residential assessment locations on Riversdale Road (R8, west), Evans Place (near R12, south) and Hutchinson Street (near R1, east). The location of noise monitoring is representative of the nearest sensitive receivers and was selected after a detailed inspection of the area.

Noise monitoring was conducted in general accordance with the procedures described in Australian Standard AS 1055-1997 *Acoustics - Description and Measurement of Environmental Noise* and the NPfl (EPA, 2017).

The results of long-term unattended noise monitoring are summarised in Table 7.20.

Table 7.20 Unattended long-term noise monitoring results

ID	Location	Measured background noise level, RBL, dB			Measured L_{Aeq} , dB		
		Day	Evening	Night	Day	Evening	Night
NM1	128 Riversdale Road, Jamberoo (R8)	<35	34	<30	48	43	47
NM2	6 Evans Place, Kiama	46	39	33	59	48	48
NM3	14 Hutchison Street, Bombo	50	41	37	58	52	51

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night is the remaining periods (10 pm to 7 am).

Observations made during operator-attended noise monitoring confirm that the ambient noise levels at all locations predominantly consists of road traffic noise from the Princes Highway, wildlife (birds and insects), neighbouring industries and domestic activities. The logging results are representative and suitable for the determination of noise goals for the site.

An additional road traffic noise measurement of 30-minute duration was taken at Bombo Hill Reserve in order to assess the existing road traffic noise environment of Riverside Drive.

The results of the attended noise monitoring are provided in Table 7.21.

Table 7.21 Attended short-term noise monitoring results

Location	Date / Start time	Measured sound pressure levels, dB (re 20 uPa), 15 min				Comments
		L_{A10}	L_{Aeq}	L_{A90}	L_{Amin}	
NM1 (R8)	14/9/2018 10:30am	55	52	46	42	Domestic activities – lawnmower dominant, birdsong intermittent, distant Princes Highway traffic (~42dB)
NM2	14/9/2018 11:30am	54	52	47	44	Domestic activities – neighbouring lawnmower, conversations, birdsong intermittent, distant Princes Highway traffic (~48dB)
NM3	14/9/2018 12:45pm	61	59	55	51	Princes Highway traffic (~60dB), aircraft flyovers (~52dB), Sydney Trains Quarry – FEL movements (~52dB, lasting 30 seconds), birdsong intermittent.
Bombo Hill Reserve ¹	14/9/2018 1:57pm	54	50	42	40	Distant ocean noise (~40dB), intermittent birdsong (40-46dB), constant distant highway traffic (40-45). 28 Northbound car pass-bys (average 54dB) 1 truck pass-by (58dB), 18 southbound pass-bys (average 54dB).

Notes: 1. All measurements were 15 minutes in duration, except for Bombo Hill Reserve which was 30 minutes in duration to measure road traffic noise.

The results of the attended noise monitoring, as well as observations made during measurements, indicate that the existing background noise level is dominated by road traffic noise from the Princes Highway, with domestic activities, wildlife and neighbouring industries also contributing at times.

7.4.3 Noise impacts

In addition to the historical approved quarry operations, four operational scenarios have been assessed and are representative of likely, typical operations at the site over the life of the project. These scenarios are summarised as follows:

1. historical approved quarry operations;
2. container based spoil delivery and transfer to void via haul trucks;
3. wagon-based spoil delivery and transfer to void via haul trucks; and
4. all spoil delivered via road truck directly to void.

Crushing at the site will occur on a campaign basis and be restricted to daytime hours only. In addition, operations will be restricted to only unloading of trucks and/or trains during night-time hours.

Consideration has been given to all the proposed options for spoil delivery and void transfer options. Results of preliminary analysis indicated that void transfer options including haul trucks would provide a worst-case scenario in relation to potential noise emissions from site.

Typical maximum noise level events and associated maximum noise levels include the following:

- trucks delivering spoil directly into the void up to L_{Amax} 126 dB; or
- trains manoeuvring on site up to L_{Amax} 122 dB.

These events represent the likely highest maximum noise level events from the site.

i Project noise predictions

Predicted noise levels for each operational scenario considered are presented in Table 7.22 for all assessment locations. Noise levels provided in Table 7.22 are shown in bold where noise emissions are predicted to be above the PNTL. Levels are also shaded grey where noise emissions are predicted to be greater than 2 dB above the PNTL.

Table 7.22 Predicted operational noise levels

Assessment Location	Approved / historical operations			Wagon delivery				Container delivery				Truck only delivery				PNTL D/E/N
	Day	Eve	Nt	Day (inc crusher)	Day (exc crusher)	Eve	Nt	Day (inc crusher)	Day (exc crusher)	Eve	Nt	Day (inc crusher)	Day (exc crusher)	Eve	Nt	
R1	47	49	50	42	42	44	42	42	41	44	42	37	33	36	<30	55/46/42
R2	46	49	49	42	41	44	41	42	40	43	41	39	35	38	31	55/46/42
R3	46	49	49	40	39	42	40	40	39	42	39	35	31	34	31	55/46/42
R4	54	57	57	45	44	47	44	45	44	47	41	42	39	42	34	55/46/42
R5	53	53	55	47	46	45	47	46	46	45	46	40	38	40	34	55/46/42
R6	45	45	48	44	42	39	39	44	42	39	38	42	38	36	<30	55/46/42
R7	40	40	44	40	37	33	33	40	37	33	32	38	34	30	<30	40/39/35

Table 7.22 Predicted operational noise levels

Assessment Location	Approved / historical operations			Wagon delivery				Container delivery				Truck only delivery				PNTL
	Day	Eve	Nt	Day (inc crusher)	Day (exc crusher)	Eve	Nt	Day (inc crusher)	Day (exc crusher)	Eve	Nt	Day (inc crusher)	Day (exc crusher)	Eve	Nt	
R8	52	52	55	53	49	45	35	53	49	45	33	53	48	45	33	40/39/35
R9	42	42	46	43	41	37	34	43	41	37	33	43	39	35	<30	40/39/35
R10	43	43	47	44	41	38	34	44	41	38	33	43	39	36	<30	40/39/35
R11	44	45	48	43	40	43	37	43	40	43	36	42	36	39	<30	51/44/38
R12	37	40	41	37	34	37	<30	37	34	37	<30	36	31	34	<30	51/44/38
R13	38	41	41	37	34	37	30	37	34	37	<30	36	30	33	<30	51/44/38

Notes: D/E/N = Day / Evening / Night

Results of noise modelling are summarised as follows:

- noise emissions from approved and historical operations are predicted to exceed the PNTLs at all locations during the night time and at the three nearest residences during the day;
- noise emissions from proposed activities are predicted to be generally similar or less than those for approved / historical operations. This is primarily due to the reduced quantity of processing plant proposed for use compared to previous operations, as well as the operational restrictions that Boral has committed to during evening and night-time periods (ie crushing at the site will occur on a campaign basis and be restricted to daytime hours only; and operations will be restricted to only unloading of trucks and/or trains during night-time hours);
- the wagon and container options are generally similar in terms of predicted noise emissions at the assessment locations. Noise emissions from the truck-only option are generally similar to or less than those for both the wagon and container options; and
- noise emissions are predicted to be above the PNTL at several assessment locations from all proposed operational scenarios. Noise emissions are predicted to be highest at assessment locations R8, R9 and R10 (west of the void) given the proximity of these locations. The main contributors to off-site noise emissions are the crushing plant, screen and mobile plant used in the void.

Based on the results of noise modelling, the main contributors to site noise emissions are crushing and screening activity and the use of mobile equipment in the void. In addition to the operational restrictions already included, the following noise mitigation measures were incorporated into the noise model:

- 5 m earth bund in the south-west corner of the site to provide acoustic shielding to mobile equipment operating in the void;
- localised acoustic shielding around the mobile crusher and screening plant (this could take the form of temporary noise barriers and/or earth bunding); and
- results of noise modelling including the noise mitigation described above are presented in Table 7.23.

Table 7.23 Predicted operational noise levels – including additional mitigation

Assessment Location	Wagon delivery				Container delivery				Truck only delivery				PNTL
	Day (inc crusher)	Day (exc crusher)	Eve	Nt	Day (inc crusher)	Day (exc crusher)	Eve	Nt	Day (inc crusher)	Day (exc crusher)	Eve	Nt	D/E/N
R1	43	42	44	42	43	41	44	42	39	33	36	<30	55/46/42
R2	41	39	42	36	41	39	42	35	39	36	39	31	55/46/42
R3	39	38	41	36	39	38	41	34	35	31	34	<30	55/46/42
R4	44	43	46	41	44	43	45	34	42	39	42	34	55/46/42
R5	45	44	44	41	45	43	44	36	42	38	40	34	55/46/42
R6	46	42	39	39	45	42	39	38	44	38	36	<30	55/46/42
R7	37	37	33	33	37	36	33	32	34	33	<30	<30	40/39/35
R8	49	47	44	36	49	47	44	34	49	47	44	33	40/39/35
R9	43	41	37	34	43	40	37	33	42	39	35	<30	40/39/35
R10	41	41	37	34	41	41	37	33	39	39	36	<30	40/39/35
R11	44	40	43	37	44	40	43	36	43	37	39	<30	51/44/38
R12	38	34	37	<30	38	34	37	<30	37	31	34	<30	51/44/38
R13	38	35	37	32	38	34	37	32	37	31	33	<30	51/44/38

The implementation of additional noise mitigation measures is predicted to reduce noise levels at the potentially most affected assessment locations by up to 4 dB. Noise emissions from proposed activities are predicted to meet the PNTL at 10 of the 13 assessment locations. Residual noise impacts are predicted at the nearest assessment locations being the three rural residences located west of the void.

The predicted residual noise impacts are summarised as follows:

- R8: residual noise impacts are predicted to be significant during day (including crusher operation) and evening periods with negligible noise impact predicted during the night;
- R9: residual noise impacts are predicted to be marginal during the daytime when the crusher is operating. Negligible impacts are predicted during all other periods;
- R10: residual noise impacts are predicted to be negligible during all periods at this location and therefore do not require further mitigation; and
- residual noise impacts are not predicted at all other assessment locations; i.e. R1 to R7 and R11 to R13.

Based on the above predicted residual noise impacts the following recommendations are provided:

- after commencement of proposed operations at the site noise validation monitoring should be undertaken. Noise levels during typical delivery, processing and placement activities should be quantified to validate the predicted noise levels in this NIA;
- consultation with the resident at R8 and R9 regarding consideration of additional at-receiver treatments if results of noise monitoring indicate noise impacts at these locations; and

- consideration of real-time noise monitoring at R8 if results of initial noise monitoring indicate noise impacts to assist in the management of noise emissions from the site.

ii Sleep disturbance predictions

Maximum noise levels from the proposed modification are predicted to be similar to the approved and historical operations given the similar nature of operations. The highest maximum noise levels predicted at the nearest residential assessment locations for worst-case meteorological conditions are L_{Amax} 55 dB at R1 from trains arriving on site and L_{Amax} 54 dB at R8 from trucks unloading in the void. These levels are marginally above (3 dB and 2 dB respectively) the relevant screening criteria for sleep disturbance impacts.

However, predicted maximum noise levels are below those levels that are likely to awaken people (i.e. 60-65 dB) with reference to the research summarised in the RNP.

Hence, sleep disturbance impacts are predicted to be unlikely as a result of the proposed modification. Notwithstanding, Boral will actively manage the site to minimise maximum noise level events during the night-time period.

iii Road traffic noise predictions

The nearest residential facades potentially affected by an increase in road traffic volumes as a result of the proposed modification are located on Hutchison Street, south of the site access road and Riverside Drive.

Conservative assumptions have been made for the purpose of road traffic noise assessment to provide a potential worst-case in terms of potential road traffic volumes on proposed traffic routes. The night-time period will provide the limiting scenario in terms of road traffic noise due to more stringent road traffic noise criteria and the potential for highest heavy-vehicle traffic volumes associated with the proposed modification. If the night-time road traffic noise criteria is predicted to be achieved it will follow that the daytime road traffic noise criteria will also be achieved.

For the purpose of predicted night-time road traffic noise, the assumptions have been made based on the traffic volumes reference from the TIA (EMM 2019a), and that all of the proposed heavy vehicle movements associated with the proposed modification will occur during the night time period (this is unlikely operational scenario however has been assumed to provide potential worst-case scenario). The road traffic volumes for noise modelling at night time is provided in Table 7.24.

Table 7.24 Road traffic volumes for noise modelling - Night-time (10pm – 7am)

Road (traffic speed)	Existing (excluding Boral)				Future including proposed Boral traffic			
	Northbound		Southbound		Northbound		Southbound	
	All traffic	% heavy	All traffic	% heavy	All traffic	% heavy	All traffic	% heavy
Hutchison Street (50 km/h)	89	5%	18	0%	102	17%	18	0%
Riverside Drive (55 km/h)	95	6%	22	3%	223	60%	137	85%

Road traffic noise levels predicted at the nearest receivers (facades facing the road) to the relevant roads are shown in Table 7.25.

Table 7.25 Road traffic noise results – night-time

Road	Speed	Receiver type / distance from road	Existing (2018) noise levels L _{Aeq,period} , dB	Noise levels including proposed modification L _{Aeq,period} , dB	Criteria L _{Aeq,period} , dB	Predicted increase from existing, dB
Hutchison Street	50 km/h	Residence (22 m)	43.0	45.6	55	2.6
Riverside Drive	55 km/h	Residence (12 m)	46.2	52.4	55	6.2

Road traffic noise levels associated with the proposed modification are predicted to meet the relevant road traffic noise criteria. Given that the above predictions are based on conservative assumptions it is noted that road traffic noise associated with the proposed modification is likely to be lower than the resulted presented in Table 7.25 most of the time.

7.4.4 Conclusion

Noise emission levels from proposed rehabilitation activities were predicted using computer modelling and were based on acoustically worst-case operational scenarios, landform and meteorological conditions. Results of noise modelling indicated that the predicted noise emissions from the proposed modification are generally less than those for approved operations. Notwithstanding this, noise emissions from the proposed modification are predicted to be above the PNTL at several assessment locations and, as such, the following noise mitigation measures were incorporated into the noise model for the site:

- operational restrictions during the more sensitive parts of the day; crusher used only during the day and operations limited to unloading activity during the night-time period;
- 5 m earth bund in the south-west corner of the site to provide acoustic shielding to mobile equipment operating in the void; and
- localised acoustic shielding around the mobile crusher and screening plant (this could take the form of temporary noise barriers and/or earth bunding).

Results of noise modelling inclusive of the recommended noise mitigation measures indicated that noise emissions would comply with the PNTL at most of the assessment locations. The exceptions being R8, R9 and R10 (isolated residences located west of the void) where residual impacts were predicted. The following recommendations are provided as a result of the residual impacts:

- after commencement of proposed operations at the site noise validation monitoring should be undertaken. Noise levels during typical delivery, processing and placement activities should be quantified to validate the predicted noise levels in this NIA;
- consultation with the resident at R8 and R9 regarding consideration of additional at-receiver treatments if results of noise monitoring indicate noise impacts at these locations; and
- consideration of real-time noise monitoring at R8 if results of initial noise monitoring indicate noise impacts to assist in the management of noise emissions from the site.

Sleep disturbance impacts are predicted to be unlikely as a result of the proposed modification. Notwithstanding, Boral will actively manage the site to minimise maximum noise level events during the night-time period. Further, impacts from traffic noise (road and rail) associated with the project are predicted to be negligible.

7.5 Other environmental consideration

The following environmental factors outlined in Table 7.26 were assessed in accordance to Clause 36, Schedule 3 of the EP&A Regulations.

Table 7.26 Consideration of Clause 36 against the proposed modification

Clause reference	Consideration against the proposed modification
a) the impact of the existing development having regard to factors including:	
i) previous environmental management performance, including compliance with the conditions of any consents, licences, leases or authorisation by a public authority and compliance with any relevant codes of practice.	<p>Bombo Quarry has had no regulatory action from Council or the EPA.</p> <p>Boral undertakes internal environmental audits and monitoring programs to ensure compliance against environmental and consent obligations. Recommended actions from these audits are implemented to ensure ongoing compliance.</p> <p>Boral holds EPL 313 for the quarry. The EPL is administered by the EPA and licenses the extraction of between 100,000 to 500,000 tpa of quarry material.</p> <p>There have been no exceedances of dust and noise criteria recorded by the onsite gauges. Bombo Quarry ceased operation since 2014 and no blasting has occurred on site since March 2012.</p> <p>In consultation with the NSW EPA and Council, a dewatering plan was prepared for the site in response to the accumulation of stormwater in the quarry void that necessitated dewatering to maintain safe water levels. Dewatering was undertaken during the period March 2018-August 2018 in accordance with the plan, which incorporated discharge of accumulated water via a suction pump and temporary poly pipe to the established drainage system through the site, which incorporates a series of open channels/culverts and underground pipe sections and discharges to the ocean at Bombo beach. Discharge water was subject to the water quality discharge conditions of EPL 313 and water quality monitoring was undertaken for the duration of dewatering. No dewatering is currently being undertaken at the site.</p>
ii) rehabilitation or restoration of any disturbed land.	<p>From December 2004 to late 2004, the southern portion of the main pit was partly filled with VENM sourced from the adjoining Kiama Bypass road project, which was completed under the terms of the development consent and the support of Council.</p> <p>The proposed modification seeks to import fill material from outside the quarry to achieve enhanced rehabilitation outcomes that will facilitate the highest and best future use of the site.</p>
iii) the number and nature of all past changes and their cumulative effects.	<p>DA 10.1971.97.1 was modified in 1979 (DA. 10.1971.97.2) to vary the finished batters from 1.5:1 to 1:1.</p> <p>No further modification was recorded.</p>
b) the likely impact of the proposed alterations or additions having regard to factors including:	

Table 7.26 Consideration of Clause 36 against the proposed modification

Clause reference	Consideration against the proposed modification
i) the scale, character or nature of the proposed modification in relation to the development.	<p>The proposed modification includes:</p> <ul style="list-style-type: none"> • update consent details to correctly describe title and applicant details; • amend approved rehabilitation batter slopes; and • allow for the importation of fill material to be used for rehabilitation. <p>No changes to the site layout or disturbance footprint are proposed. Enhanced rehabilitation would be achieved by importing fill material from outside the quarry. The scale and nature of the proposed activities are similar to those undertaken during historical operations.</p> <p>Under the proposed modification, the operational procedures of the quarry will remain substantially the same as the approved operations; the key difference being that historically material was extracted, processed and exported from the site, whereas the proposed modification will involve importation, processing and placement/infilling within the site.</p> <p>Transportation of extracted material was undertaken via both road and rail during historical operation, which varied in intensity over time in response to market demands. Similarly, the proposed modification will import material via road and/or rail, which will also vary in intensity over time, dependent on availability of suitable material from the spoil generating market. Road and rail movements will generally be of a similar scale to those that occurred during peak historical operations.</p>
ii) the existing vegetation, air, noise and water quality, scenic character and special features of the land on which the development is or is to be carried out and the surrounding locality.	<p>The area subject to activities associated with the proposed modification is already approved for quarrying activities. The site has been subject to a long period of quarrying activity and therefore has been highly modified over time.</p> <p>Modification works will be contained to the existing highly disturbed quarry void and operational areas. Areas are heavily denuded and as such no additional flora and fauna assessment was considered necessary as part of the consent modification.</p>
iii) the degree to which the potential environmental impacts can be predicted with adequate certainty.	<p>The main potential environmental impacts of the proposed modification include those associated with air quality, noise, traffic and water quality. These potential impacts have been quantified and considered in reference to relevant criteria as summarised in Section 7.</p>
iv) the capacity of the receiving environment to accommodate changes in environmental impacts.	<p>The proposed modification will result in few changes to predicted environmental impacts for key aspects including air quality, noise and water quality, and those that are predicted are not significant compared to historic operations.</p>
c) any proposed modifications:	
i) to mitigate the environmental impacts and manage any residual risk.	<p>The environmental management currently in place will continue throughout the period of quarry rehabilitation activities, which include:</p> <ul style="list-style-type: none"> • adhere to the current quarry consent placed on hours of operation; • operation of all pollution control structures and treatment works as specified in a Water Pollution Control Plan developed for the site; • environmental monitoring and reporting as required by the EPL; and • use of water carts and sprays to unpaved roads. <p>Additional mitigation measures to manage any residual risks include:</p> <ul style="list-style-type: none"> • implementation of an ESCP or similar as part of the rehabilitation phase; • placement of a 5 m earth bund in the south-west corner of the site to provide acoustic shielding; • localised acoustic shielding around the mobile crusher and screening plant; and • consultation with residents regarding residual noise impacts.

Table 7.26 Consideration of Clause 36 against the proposed modification

Clause reference	Consideration against the proposed modification
ii) to facilitate compliance with relevant standards, codes of practice or guidelines published by the Department or other public authorities.	<p>Boral regularly undertakes internal environmental audits to monitor environmental performance against obligations including development consent conditions and EPL conditions. Recommended actions from these audits are implemented to ensure ongoing compliance.</p> <p>Monitoring and reporting will continue to be implemented during activities associated with the proposed modification in accordance with consent conditions and other relevant approvals.</p>

In consideration of the EP&A Regulation Clause 36 factors, the proposed modification would not significantly increase the environmental impacts of the total development compared with the approved development and, therefore, is for alterations or additions and is not designated development under the EP&A Act.

8 Commitments

The chapter summarises the commitments made to manage and/or mitigate potential environmental impacts arising from the project. These commitments include management, mitigation, monitoring and/or compensation measures to be implemented for the life of the project.

8.1 Summary of commitments

A summary of the environmental management and mitigation measures described in specific aspects of the project are provided in Table 8.1.

Table 8.1 Summary of commitments

Aspect	Mitigation measure
Air quality	<p>Water carts will be used on unpaved roads.</p> <p>Water sprays will be used on transfer points.</p> <p>Time of day restrictions for material emplacement operations will be implemented within the pit. By restricting the majority of emplacement operations to between the hours of 7 am and 10 pm, the hours of the day that typically have poorer pollution dispersion potential (ie late night and early morning hours) will be avoided as much as practicable.</p> <p>The existing network of dust deposition gauges at the quarry will be maintained throughout the life of the material importation project.</p> <p>Results of dust deposition monitoring will be provided on the Boral website, consistent with current reporting requirements for the quarry.</p>
Surface water	<p>Erosion and sediment control measures will be implemented.</p> <p>Progressive revegetation or stabilisation of disturbed areas to minimise exposed soils to the extent possible will be undertaken.</p> <p>Stabilisation of drainage lines will be undertaken.</p> <p>A procedure for hazardous material storage and spill management will be implemented.</p> <p>Operation of all pollution control structures and treatment works will be specified in a Water Pollution Control Plan developed for the site.</p>
Noise	<p>Crusher use will be restricted to during the day only and operations limited to unloading activity during the night-time period.</p> <p>A 5 m earth bund in the south-west corner of the site will be constructed to provide acoustic shielding to mobile equipment operating in the void.</p> <p>Localised acoustic shielding around the mobile crusher and screening plant (eg temporary noise barriers and/or earth bunding) will be implemented.</p> <p>Consultation will be undertaken with residents regarding residual noise impacts.</p>

9 Conclusion

The proposal involves the modification to development consent DA 10.1971.97.2 to allow for the importation of clean fill material (VENM/ENM) at the quarry to take advantage of substantial quantities of suitable material being generated by large infrastructure construction projects in the Sydney metropolitan area.

The quarry has specifically been identified for its potential future use as industrial, commercial or residential land (or a combination of these) in numerous State and local strategic plans. It has potential to be redeveloped as a strategically master planned site to be utilised for a range of purposes that supports the aims and objective identified in these plans. The proposed modification supports construction of a final landform that will support the highest and best possible future land use of the site and contribute to the government's strategic aims and objectives. Further, the proposed importation of fill material is consistent with importation activities that were undertaken at the site in 2003-2004, during which the southern portion of the main pit was partially filled with VENM sourced from the adjacent Kiama Bypass road project. This was undertaken under the provisions of the development consent and with the support of Council.

The scale and nature of the proposed rehabilitation activities are similar to those undertaken during historical operations. Under the proposed modification, the operational procedures of the quarry will remain substantially the same as the approved operations; the key difference being that historically material was extracted, processed and exported from the site, whereas the proposed modification will involve importation, processing and placement/infilling within the site.

The proposed modification is substantially the same development compared to the historic operations and will result in few changes to predicted environmental impacts for key aspects including air quality, noise, traffic and water quality. The proposal does not seek to increase the traffic, noise or dust generated by the approved operations, and will result in improved environmental performance for noise and air quality during rehabilitation.

The rehabilitation activities will extend for an estimated period of five to eight years, and thereby any residual impacts will be temporary. Further, the proposed modification will result in improved environmental conditions in the longer term.

Abbreviations

AAQ	Ambient Air Quality
AQIA	Air Quality Impact Assessment
AQS	air quality station
AWS	automatic weather station
BoM	Bureau of Meteorology
CBP	concrete batching plant
DA	Development Application
DO	dissolved oxygen
Dol-Land & Water	Department of Industry-Land & Water
DPE	Department of Planning and Environment
ENM	excavated natural material
EP&A Act	<i>Environmental Planning and Assessment ACT 1979</i>
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ESCP	erosion and sediment control plan
LGA	local government area
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NIA	Noise Impact Assessment
NPI	National Pollutant Inventory
OEH	Office of Environment and Heritage
PM ₁₀	Particulate matter less than 10 microns in aerodynamic diameter
PM _{2.5}	Particulate matter less than 2.5 microns in aerodynamic diameter
POEO Act	<i>Protection of Environment Operations Act 1997</i>
PRIMP	pollution incident response management plan
RMS	Roads and Maritime Services
SEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
SWA	Surface Water Assessment

TfNSW	Transport for New South Wales
TIA	Traffic Impact Assessment
tpa	tonne per annum
TSP	Total suspended particulates
US-EPA	United States Environmental Protection Agency
VENM	virgin excavated natural material
WM Act	<i>Water Management Act 2000</i>

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