Appendix A

Community and organisation submissions summary

Respondent type (I - individual, O-organisation)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	O	O	I	I
No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
City	Marulan	Towrang	Big Hill	Big Hill	Brayton	Marulan	Towrang	Marulan	Big Hill	Marulan	Towrang	Towrang	Big Hill	DUPLICATE	Towrang	Marulan	Brayton	Towrang	Big Hill	Big Hill	Big Hill	Towrang			Towrang	Greenwich Park	Towrang	Big Hill	Marulan	Towrang	Towrang	Towrang	Towrang	Towrang		Marulan	Brayton	Brayton		Marulan	Greenwich Park	Marulan	Marulan		Marulan		Towrang		Marulan	Towrang
Matter																																																	
Economics																																																	
Inadequate contributions from quarry to Council for haulage									1																																							
Economic analysis of alternative haulage route Option 4 is incorrect/incompleted								1							1	1																																
Quarry establishment expenditure is inadequate considering total anticipated turnover																											1																				
Economic contributions to the use of the Marulan South Interchange constructed by Holcim																																														1		
Inadequate/insufficient assessment of economic benefits against principles of ecologically sustainable development																																															1		
Noise and vibration																																																	
Noise impacts from truck movements								1							1	1		1	1	1		1	1																1	1										1
Noise impacts from crusher - general		1	1	1	1	1	1	1			1	1	1		1		1	1				1	1	1	1	1	1	1	1	1	1	1	1			1	1		1	1				1	1			1
Noise impacts - general																																							1	1					1					
Noise impacts - blasting																																							1	1										
Inadequate/inappropriate methods used for noise assessment																								1																							1		
Noise impacts - cumulative (incl. Other quarries)																																											1						
Insufficient blasting data																																																1		
Vibration impacts - property damage																																										1							
Air quality																																																	
Increase in dust emissions - health impacts		1	1																					1	1				1										1	1									
Increase in dust emissions -impacts to livestock																													1																			
Increase in dust emissions - general impacts								1							1	1			1	1			1													1	1		1	1			1		1			1	1
Increase in greenhouse gas emissions																		1				1					1	1											1				1					1	1
Inaccurate air quality data																																											1						
Ecology																																																	
Insufficient assessment of imapcts to biodiversity																																																1	
Visual																																																	
General visual impacts																1																							1										
Light pollution																			1				1																										
Water																																																	
Water licensing and usage - impacts to local watercourses													1																																				
Traffic and transport																																																	
Increased truck movements - safety impacts	1	1	1	1	1			1	1				1		1	1	1		1	1	1	1	1	1		1	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Increased truck movements - traffic impacts				1	1						1	1										1					1	1		1		1	1	1														
Increased truck movements - road kill				1	1				1				1			1			1							1											1				1	1		1				
Increased truck movements - road maintenance issues									1				1					1		1	1		1	1	1	1	1	1					1	1				1	1	1	1	1	1	1				1
Increased truck movements - road maintenance issues (damage to vehicles)									1											1	1				1		1	1													1			1				
Increased truck movements - general impacts						1	1																																										
Inadequately assessed transport options								1		1																	1																		1			1		
Drivers not adhering to road rules									1																				1						1	1	1		1	1	1		1					
Traffic and transport analysis does not include a TMP																																															1		
Traffic and transport analysis does not consider greenhouse gas emissions																																															1		
Social																																																	
Proposal will lead to decrease in property values	1															1		1	1										1							1			1	1			1							
Reduced quality of life	1															1		1				1					1											1	1					1					
Insufficient level of stakeholder engagement	1						1	1		1														1	1		1															1			1	1			
Insufficient consultation with Holcim								1																			1									1						1			1				
Lack of project knowledge/understanding/empathy from directors during consultation																																											1						

Respondent type (I - individual, O-organisation)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	O	O	I	I
No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
City	Marulan	Towrang	Big Hill	Big Hill	Brayton	Marulan	Towrang	Marulan	Big Hill	Marulan	Towrang	Towrang	Big Hill	DUPLICATE	Towrang	Marulan	Brayton	Towrang	Big Hill	Big Hill	Big Hill	Towrang			Towrang	Greenwich Park	Towrang	Big Hill	Marulan	Towrang	Towrang	Towrang	Towrang	Towrang		Marulan	Brayton	Brayton		Marulan	Greenwich Park	Marulan	Marulan		Marulan		Towrang		Marulan	Towrang
Matter																																																	
Indirect impacts on businesses																						1																												
Other matters																																																	
EIS contains incorrect information																																				1								1						
Operating hours not adhered to																																		1														
Increased roadisde litter																																							1			1						
Does not satisfy the objectives of the RU1 Primary Produciton or RU 2 Rural Landscape zones																																														1		

Appendix B

DPE community meeting presentation, 30 June 2016

Gunlake Quarry Extension Project

Community Meeting

Thursday 30 June 2016

Planning & Environment

Introductions – who's in the room

- Angela Felton (Department of Planning and Environment)
- Howard Reed & Margaret Kirton (Department of Planning and Environment)
- Louise Wakefield & Scott Martin (Goulburn Mulwaree Council)
- Ed O'Neil (Gunlake)
- Andrew Wiltshire (EMM)
- Lauren Donohoe & Catherine Haskins (OPF Consulting)

Planning & Environment

Tonight's agenda

- Howard will share a short presentation of the Department's assessment process and he and Margaret will answer any questions about this process.
- Then we want to hear from you. Any concerns, views you want to share? We will capture the feedback and report back to you.

Planning & Environment

What's happened so far

- Environmental Assessment Requirements issued by Department of Planning and Environment (July 2015, revised October 2015)
- Environmental Impact Statement first submitted in February 2016 (inadequate)
- Environmental Impact Statement revised and resubmitted in March 2016
- Project exhibited between 4 April and 20 May 2016

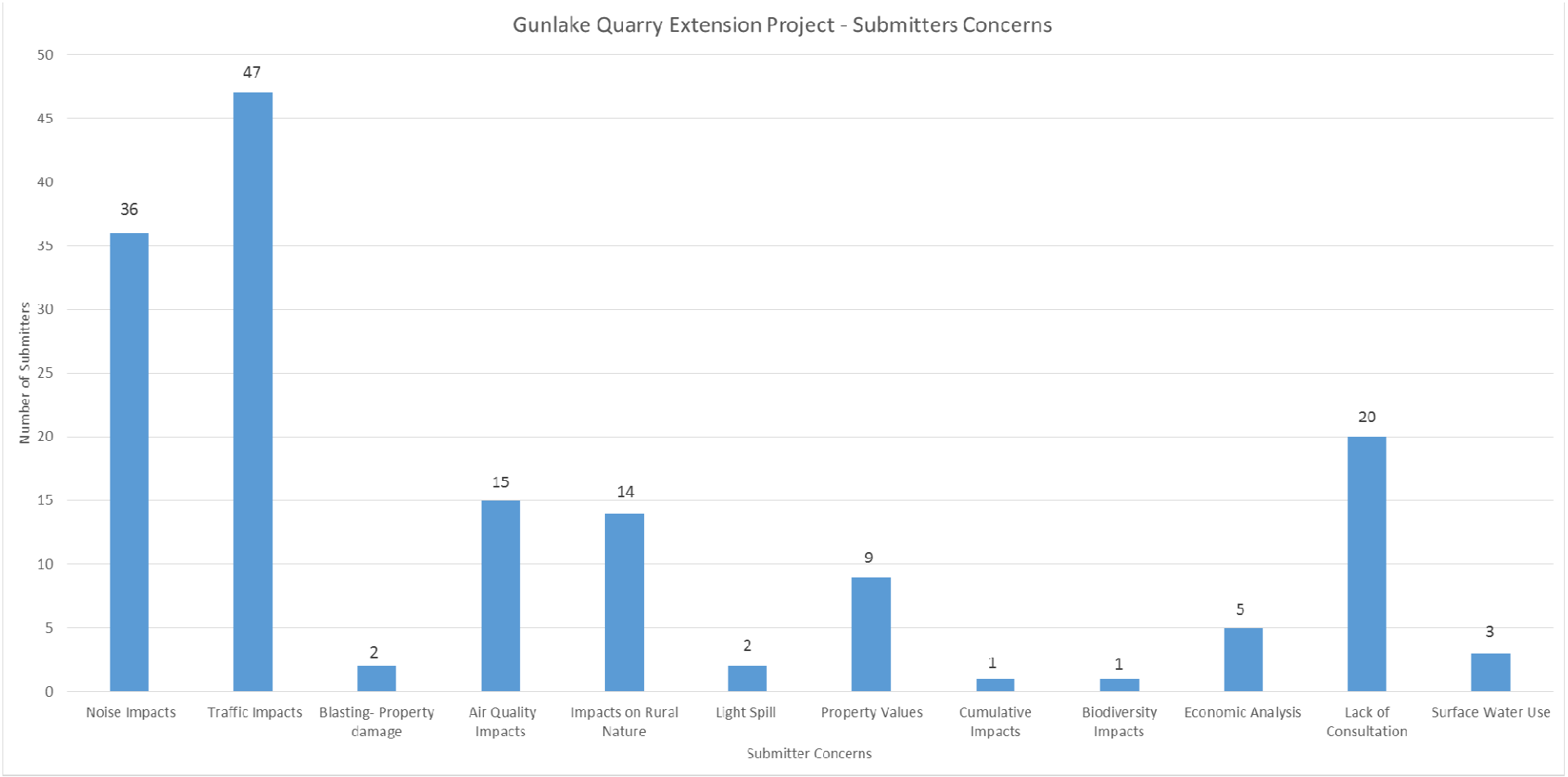
Planning & Environment

Submissions

- 46 submissions from the local community
- 1 submission from the Towrang Community Progress Group
- 1 submission from Holcim
- 8 agency submissions

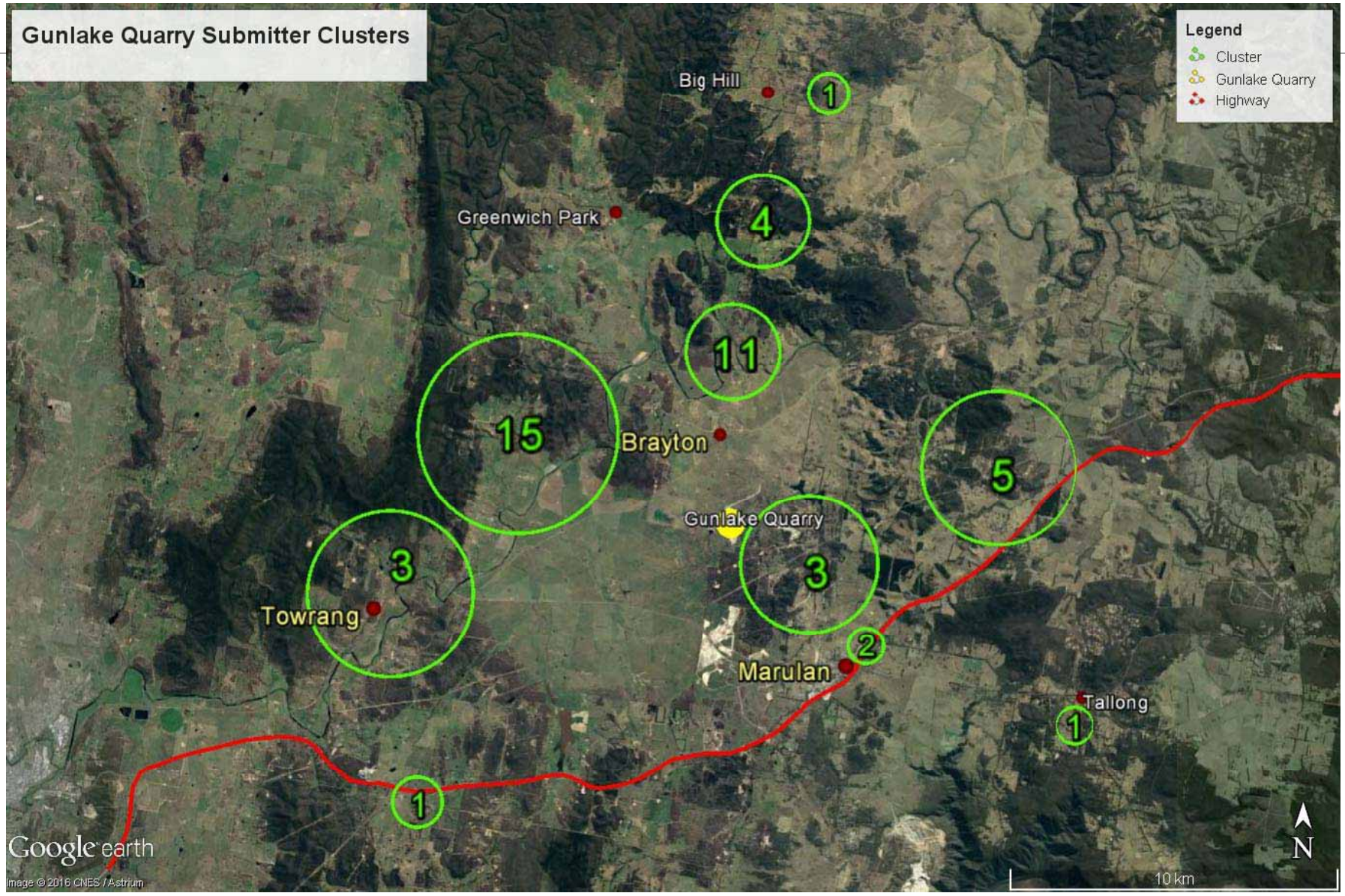
Planning & Environment

Main Issues Raised in Community Submissions



Planning & Environment

Approximate Location of Submitters



Planning & Environment

What happens next

- Gunlake submits its Response to Submissions – expected to take at least another month
- Department prepares an Assessment Report
- Project is submitted to the Planning Assessment Commission (PAC) for determination

Planning & Environment

Planning Assessment Commission Process

- The Commission is likely to hold a public meeting about 4 weeks after it receives the assessment report
- Submitters will be advised of the date of the meeting
- People may make written submissions to the Commission or speak at the meeting
- Commission will determine the application

Planning & Environment

Over to you

Questions about the assessment process?

Any other comments or issues?

Planning & Environment

Wrap Up

- A record of the issues raised at this meeting will be placed on the Department's website
- The issues raised will be considered in the Department's assessment report
- If you have any further questions, please feel free to contact Margaret Kirton at the Department at any time (9228-6289)

Planning & Environment

Thank you!

Appendix C

Community meeting summary

Gunlake Quarry Extension Project (SSD 7090)
Issues raised at the Community Meeting at Marulan
Thursday 30 June 2016

Attendees

- Department of Planning and Environment (DPE) - Howard Reed, Angela Felton and Margaret Kirton
- Goulburn Mulwaree Council - Louise Wakefield and Scott Martin
- Gunlake - Ed O'Neil (Director), Andrew Wiltshire (EMM Consultants), Lauren Donohue and Catherine Haskins (OPF Consulting)
- More than 50 members of the local community

Introduction

Angela Felton welcomed the members of the community, introduced staff from DPE and explained the principal purpose of the meeting, namely for DPE officers to listen to the community's views about the recently exhibited Gunlake Quarry Extension Project.

Overview of Assessment Process

Howard Reed gave an overview of the assessment process. He:

- outlined the processes that have already occurred (ie environmental assessment requirements issued by Department, environmental impact statement (EIS) prepared by Gunlake and EIS exhibited by the Department);
- provided a summary of the main issues raised in the 47 community submissions received during the exhibition of the EIS; and
- explained the next steps in the process (ie Gunlake will lodge its Response to Submissions (RTS) report, the Department will prepare an assessment report for the consideration of the Planning Assessment Commission (PAC), the PAC will determine the project).

DPE responses to Community Questions about the Assessment Process

In response to questions from members of the community about the PAC, Howard Reed advised that:

- the PAC has a large number (9 permanent and 13 casual) of members, each of whom has with significant expertise and experience in environmental planning, law or a technical field such as transport, appointed by the Minister for Planning;
- it is likely that 3 members of the PAC will be appointed to a panel to determine (ie approve or reject) the Gunlake extension project;
- the PAC is likely to hold a public meeting in Marulan;
- the PAC will consider all submissions received to date and will also accept additional written and verbal submissions;
- the PAC operates independently at arm's length from the Department and the Minister, and has its own Secretariat; and
- the PAC occasionally appoints its own independent experts to advise it on specific issues.

Comments made by Community Members about the Gunlake Quarry Extension Project

- The carbon footprint of the project is significant (with the greenhouse gas emissions associated with the project having the potential to negate all the benefits of the Commonwealth Government's solar panel program) – this issue should be considered by an independent expert.
- The NSW environmental assessment system should not allow proponents to pay consultants to prepare environmental impact assessments, as such assessments are

inherently biased. In light of this, independent experts are needed to consider ESD issues associated with the project.

- One of the transport options presented in the EIS would require roads to be constructed over private property. This option cannot be considered genuine when the private landowners have not been approached about this option. As well, private landowners could not be forced to sell their land to Gunlake for this private road option.
- Whilst there is general community support for the Gunlake quarry and the employment it brings, the amenity impacts associated with the proposed extension outweigh the economic benefits of the project.
- Gunlake should engage with the community like Holcim (which owns the Lynwood Quarry) has done and should commit to actions to minimise its impacts on the amenity of the local community like Holcim has done.
- People who live near Towrang can hear and are annoyed by noise from Gunlake's primary crusher on early frosty mornings.
- Gunlake should enclose its primary crusher, particularly as an acoustic shed is a relatively low cost item.
- Operational noise should be mitigated on the quarry site, not at people's homes.
- Double glazing is not effective and requires people to be indoors, when they have chosen to live in a rural environment.
- Trucks on Brayton Road already create significant surface damage to the road, this would worsen as a result of the project.
- Lynwood trucks should not be allowed to transport products from Lynwood to the Johnniefelds Quarry for processing and mixing. The air quality and noise impacts of this is not properly regulated by State or local government. The crushers at Johnniefelds are old and very loud.
- If trucks from Johnniefelds are added to the proposed Gunlake truck movements (max. 690 per day) then there could be 1000 trucks per day travelling on the Bypass Road.
- Quarries around Marulan tend to blame each other for noise and air quality issues.
- Concern was raised about whether cumulative impacts from existing and proposed quarries will be adequately assessed.
- The Bypass Road should never have been built – the haul route should always have been on private land.
- Brayton Road should never have been designated as a B-double route.
- The speed limit along Brayton Road should be reduced from 100 k/h to 80 k/h.
- The impact of increased truck movements on Sydney's traffic has not been considered.
- The Bypass Road is unsafe – being too steep in parts, subject to fog and with bad visibility on the crest of the hill, particularly if there is sun glare.
- The steepness of part of the Bypass Road greatly increases the noise from trucks which struggle to crest the hill.
- The steep hill also results in a significant safety issue, with residents advising that a B-double once stalled near the crest of the hill and then had no option but to reverse all the way down.
- Gunlake trucks are driven too quickly from the quarry to the highway, as evidenced by the times used in the traffic assessment in the EIS.
- The proposed acceleration lane onto the Hume Highway would result in reduced and less safe access for property owners near the intersection of the Bypass Road.
- The extension project would result in a lot more native animals being killed by trucks.
- Concern was raised that Gunlake was not directed (by the Department's letter requesting the RTS) to look at the potential for a private road to the Hume Highway.

- Compensation should be paid to people who suffer reduced amenity as a result of the quarry.
- Some people are very severely affected by the trucks associated with the existing and proposed development and should be offered pre-quarrying market value compensation for their properties.
- A rail option is economically feasible, particularly over the long term.
- Gunlake originally had a 500,000 tpa production limit. Concern was raised that Gunlake will keep submitting applications to increase the size of the quarry and the number of truck movements.
- If rail is not warranted now, with a 2 million tonne production rate proposed, when will it be warranted?
- If rail is economically viable for Lynwood, why is it not viable for Gunlake?
- At the proposed production rate, the quarry could potentially be extracting rock for 90 years and 99% of this rock will be transported to Sydney. This supports the case for rail transport.
- Gunlake only proposes to spend $3.25 million for the project. This is not enough when the environmental impacts of the project are considered.
- Dust from the existing operations has a significant impact on nearby residents, particularly in terms of its impacts on water quality in household tanks.
- The EIS's air quality assessment focussed on PM_{10} particles, it should have considered $PM_{2.5}$ as well, as $PM_{2.5}$ has more health impacts.
- $PM_{2.5}$ is measured at Camden and Canberra – it should also be measured at a half way point like Marulan.
- The issue of silica has not been adequately addressed, particularly given that the hard rock at Gunlake is 33% quartz. Silicosis is a bigger health issue than asbestosis.
- The final void at Gunlake could have long-term impacts on water quality and should not be used as a tip. More consideration should be given to final rehabilitation of the site.

NB - These comments were made by individual members of the community and <u>should not be taken</u> to necessarily reflect the opinion of the broader community or the Department

During the meeting, a show of hands followed some questions. The show of hands suggested that a half to two thirds of the people present at the meeting would support the project if impacts associated with operational noise and transport noise could be resolved to the satisfaction of the community.

Appendix D

Community consultation factsheets

The Gunlake Extension Project Factsheet No. 1

Overview

Gunlake Quarry is a hard rock quarry operated by Gunlake Quarries Pty Limited (Gunlake). It is located approximately 7 kilometres (km) north-west of Marulan in the Goulburn Mulwaree local government area. Gunlake Quarry has been operating since 2009 and Gunlake is proposing to extend these operations.

Gunlake seeks a new development consent that allows:

- 2 million tonnes per annum (Mtpa) of saleable products to be produced;
- an increase in truck movements to an average of 440 movements (ie 220 deliveries) per day;
- extension of the quarry pit footprint to approximately 49 hectares;
- 24 hour per day primary crushing;
- additional overburden emplacement to accommodate the increase in production; and
- blasting twice weekly.

Gunlake is also seeking to maintain the approval for all aspects of the existing operations under Project Approval 07-0074.

A detailed environmental impact statement (EIS) is being prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs), issued by the Department of Planning and Environment on 2 July 2015.

Consultation

Community engagement is an important part of Gunlake's ongoing commitment to Marulan, Towrang, Greenwich Park, Big Hill and surrounding areas.

Gunlake has engaged with a number of stakeholders during the early stages of the project, including State government agencies, Goulburn Mulwaree Council and the community.

Further consultation is planned with all of these stakeholders.

Project benefits

Gunlake will continue to make key contributions benefiting the local area. These include:

- continued employment of 50 people, including truck drivers. The expanded quarry would employ about 77 people with a direct annual economic benefit of about $5 million;
- capital road works: Gunlake has spent $3.3 million to date on local roads, while Brayton Road is currently being upgraded by Council using Gunlake's contributions under Section 94 of the *Environmental Planning and Assessment Act 1979*; and
- ongoing s94 contributions to Council (estimated to be $18.9 million over 30 years) that will substantially exceed (by about $7 million over 30 years) the costs of additional road maintenance required as a result of the use of local roads by quarry trucks.

Potential impacts of the proposed extension

Key matters raised during community consultation to date have been the potential impacts of the project on roads and traffic, noise levels and air quality.

Transport

Truck movements are recognised as the biggest potential impact on the community and will be assessed in detail. A "truck movement" is a journey in one direction - so to deliver one load of product requires two truck movements.

At present, about 89% of truck movements are along Brayton Road/Bypass Road/Red Hills Road, the primary haul route, and less than 11% of truck movements are along Brayton Road and through Marulan, the secondary haul route.

Truck movements will gradually increase over 5 to 10 years. Holcim's Johnniefelds Quarry is expected to be shut before full production at Gunlake Quarry is reached. At maximum production there will be, on average, one truck movement every three minutes so, on average, there will be three trucks on the primary haul route at any one time.

At full production, about 94% of truck movements will be along the primary haul route and less than 6% of truck movements will be along the secondary haul route. There will be no change in the number of truck movements through Marulan as a result of the project.

In response to community feedback on safety, trucks have recently been instructed to travel at a maximum speed of 80 km/h between Gunlake Quarry and the Hume Highway.

A common question from stakeholders has been whether material from the quarry can be transported by rail. In response, a transport options study will be undertaken to determine the viability of transporting product to Sydney destinations by train.

Noise

The project will increase production and processing, and the associated truck movements, and so will increase noise emissions.

It is important to note that increases in noise emissions do not result in a linear increase in perceived additional noise. For example, doubling noise emissions will generally only increase noise levels at receivers by about 3 dB. Quarry and traffic noise levels will be comprehensively assessed in the EIS, as required in the SEARs. This will include:

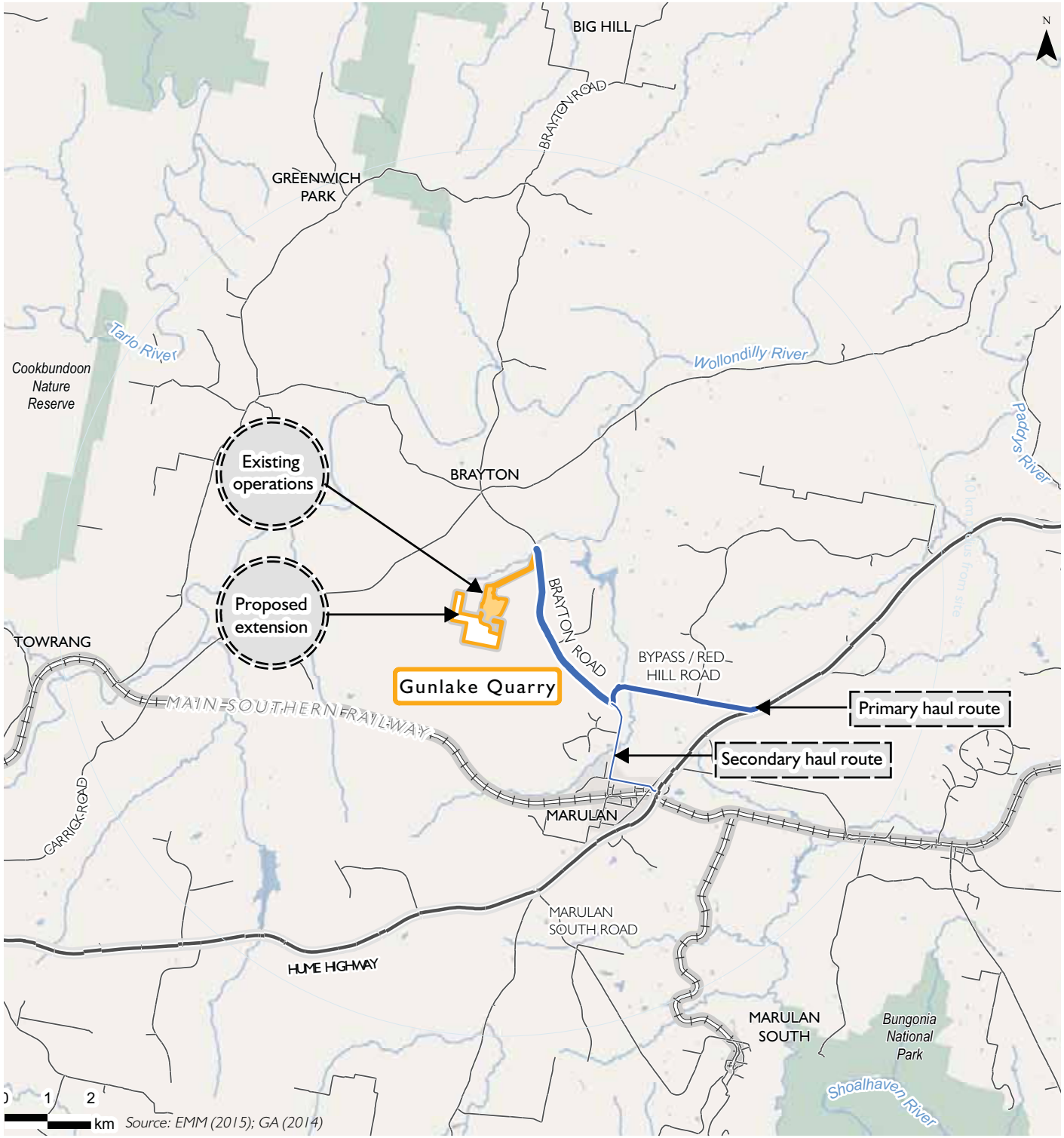
- measuring noise levels for the equipment currently operating at the quarry (completed);
- additional background noise monitoring along Brayton Road (completed);
- modelling noise levels at all residences within 3 km of the processing plant or within 600 m of the Brayton Road/Bypass Road/Red Hills Road route and selected residences along the Brayton Road/George Street/Interchange underpass route;
- modelling of noise levels from trucks; and
- modelling of the cumulative noise levels from quarries in the area.

Air quality

The project will increase dust-generating activities, as a result of increased processing, and the larger pit area.

Air quality (including dust levels) will be comprehensively assessed in the EIS, as required in the SEARs. This will include:

- determining emissions from additional open areas and equipment;
- site-specific material characterisation;
- quantitatively modelling of total suspended particulates, PM_{10}, $PM_{2.5}$, dust deposition, respirable crystalline silica and diesel emissions (nitrous oxides);
- extending the assessment area to include residences within 600 m of the primary haul route - this will include assessment of diesel fumes and dust from trucks; and
- modelling of the cumulative air quality impacts of quarries in the area.



Project development and the approval process

An overview of the project and the SEARs can be viewed and downloaded from the Department of Planning and Environment's Major Project website: (http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7090).

The project has been classified as State Significant Development under the *Environmental Planning and Assessment Act 1979*.

EMGA Mitchell McLennan Pty Limited (EMM) is preparing a detailed EIS for the proposed extension. The EIS will address the matters detailed above as well as a suite of other matters, such as biodiversity, water and social impacts. The EIS will include assessments undertaken in accordance with the SEARs and cotemporary policies and guidelines.

Gunlake is working with EMM to ensure that the project design and proposed environmental management measures will avoid or minimise impacts as far as possible. The EIS and associated specialist studies will include detailed assessment of the community matters raised during consultation.

Want more information?

If you want more information on the Gunlake Extension Project, or to register your interest in the project, please contact Ed O'Neil:

02 4841 1344

ed@gunlake.com.au

www.gunlake.com.au

EMM

The Gunlake Extension Project
Factsheet No. 2

Overview

An environmental impact statement (EIS) has been prepared to accompany a development application (DA) for the Gunlake Extension Project. The EIS assesses the impacts of the project (including the existing quarry) and provides management measures to address these impacts. While the EIS considers all environmental aspects of the Extension Project, this factsheet focuses on traffic and noise which consultation found were the primary community concerns.

The EIS is currently on public exhibition and available to view on Department of Planning & Environment's Major Projects website:

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7090

A hardcopy is also available to view at the Goulburn Mulwarree Council offices at 184–194 Bourke Street, Goulburn.

Transport options review

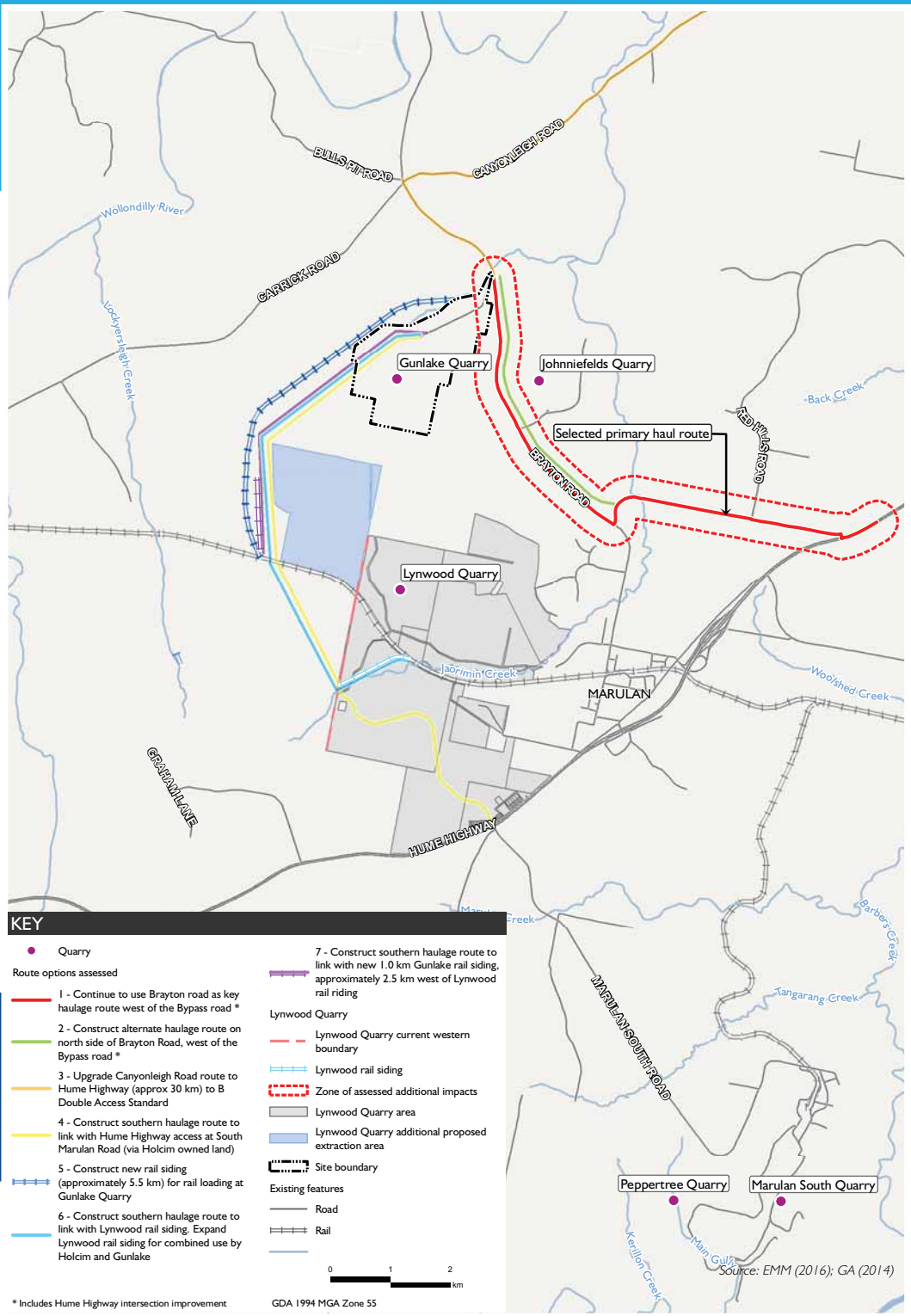
Options for the transport of quarry products were reviewed in response to Council and community concerns regarding the increased truck movements on the primary haul route. A range of seven potential road and rail transport options were considered in detail (see figure).

The analysis of the three rail/road options (Options 5–7) found that none of them are economically viable, even at the lowest capital cost estimates. Furthermore, rail transport of product from the quarry would increase congestion on an already congested train network, particularly at rail distribution hubs in Sydney. The road-only options (Options 1–4) have a much lower capital cost than the rail/road options. Of the road-only options, Options 2–4 were discounted based on the balance of their capital cost and the additional environmental impacts (eg air quality, noise, ecology and visual) that would occur in where impacts have previously been avoided.

Analysis of options and impact assessment

The analysis of all options resulted in the selection of Option 1, the current primary haul route (Brayton Road/Bypass Road/Red Hills Road), as the best product transport option for the Extension Project. The impacts associated with this option will be restricted to the zone of assessed additional impacts, shown on the figure. The traffic and traffic noise levels will increase in this zone. However with the implementation of the management measures described in the EIS, the impacts will remain below applicable levels stipulated in the relevant NSW policies. Whereas Options 2–7 would result in impacts in areas outside this zone. There will be no change to traffic levels on other local roads.

The EIS predicts that noise levels at residences as a result of the Extension Project and other local quarries will satisfy the relevant noise criteria.



Want more information?

If you want more information on the Gunlake Extension Project, or to register your interest in the project and ongoing operations at the quarry, please contact Ed O'Neil:

02 4841 1344

ed@gunlake.com.au

www.gunlake.com.au

The Gunlake Extension Project
Factsheet No. 3

The Gunlake Quarry Extension Project Environmental Impact Statement (EIS) was placed on public exhibition between 4 April and 20 May 2016. A wide range of government agencies and public submissions were received.

With the assistance of a range of experts, we are preparing a response to submissions report addressing the matters raised. The report will include an update on consultation, additional project information, the results of additional assessments and additional mitigation measures.

This factsheet highlights the work being conducted as part of the response to submissions and outlines some of the additional mitigation measures.

Consultation

As expressed in the public submissions, some community members have been dissatisfied with the level of consultation regarding the proposed extension project. In response, we have appointed community engagement specialists, OPF Consulting, to become the Community Liaison Team for the quarry.

The Community Liaison Team is here to listen to your views, get answers to your questions and to help us identify how we can improve our performance, and ultimately, our standing across the whole of the community in which we work. Engaging the team helps us to deliver on our community responsibilities more effectively.

The Community Liaison Team has already used multiple methods to inform the community of their presence and to offer individual meetings. They attended the public meeting in Marulan on 30 June this year and handed-out contact cards. The team has emailed and telephoned residents who made submissions and has also hand-delivered letters to community members.

As a result, there have been meetings with 20 residents from Marulan, Big Hill, Greenwich Park and Towrang. The detailed community feedback provided to the team has been invaluable in helping us identify the mitigation measures outlined below.

Thank you to those who have taken time out of your day to meet with the Community Liaison Team. We encourage you to contact them if you have any questions. They will continue to keep the community informed of any quarry related news through a Gunlake Community eNewsletter. Residents are encouraged to register on the Gunlake website (gunlake.com.au) to receive these newsletters.

Other organisations we have engaged with recently regarding the extension project include:

- Goulburn Mulwaree Council
- Lafarge Holcim
- Pacific National (train operators)
- SADA Group (providers of rail services)
- CFCL Australia (providers of rail services)
- Department of Planning and Environment
- Office of Environment and Heritage

Further assessments

Planning and environment consultants, EMM Consulting (EMM) is preparing the response to submissions report. Further assessments that are nearing completion that will be appended to the response to submissions report are:

- rail transport study (Hatch)
- road transport study (EMM)
- transport economics review (Gillespie Economics)
- road safety audit (Lyle Marshall & Associates)

Rail and road transport

Rail and road transport studies have been prepared by Hatch and EMM. Hatch is a global engineering firm with extensive experience in the development of major projects, including rail infrastructure while EMM has in-house transport expertise and specialises in impact assessment.

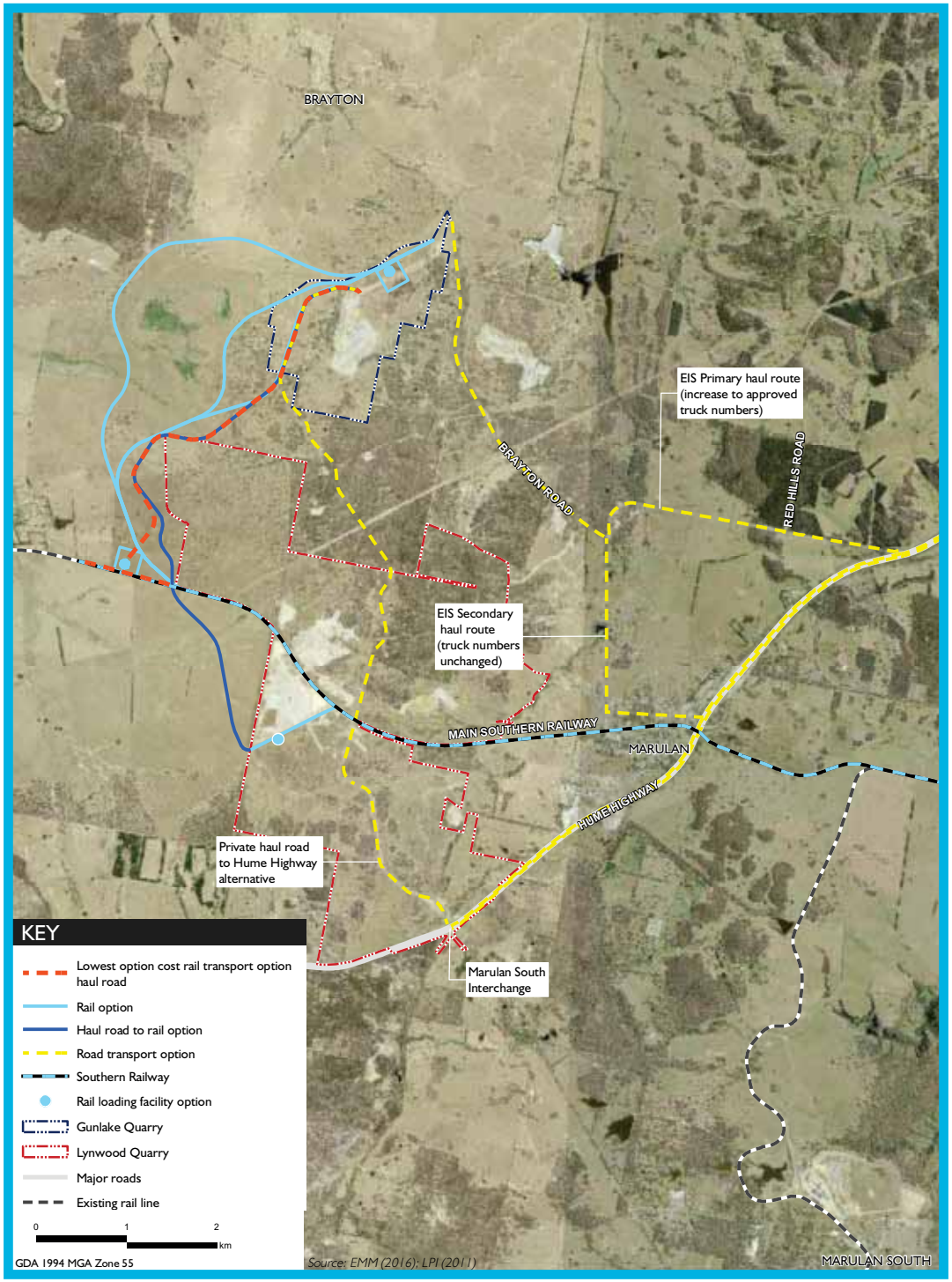
The studies compare the transport of quarry products by 18 different rail transport options as well as a private haul road through Lafarge Holcim's Lynwood Quarry to Marulan South Interchange with the ongoing use of public roads as proposed in the EIS.

Key findings of these studies are:

- We have met with Lafarge Holcim and the use of the Lynwood Quarry rail siding has been included in the assessment of rail options.
- The lowest-cost rail option would be to construct a private haul road from Gunlake Quarry to a new siding on the Main Southern Railway west of the Lynwood Quarry Granite Pit. This option would be substantially more expensive to build than all of the existing and proposed quarry infrastructure combined.
- If a rail transport option were adopted, some road transport would also be required (as occurs at Lynwood Quarry). The rail study assumed 0.5 million tonnes per year would need to be transported by road, leaving 1.5 million tonnes per year to be transported by rail.
- Biodiversity impacts - native vegetation will need to be cleared to construct a rail spur or a private haul road south of Gunlake Quarry. A private haul road between the quarry and Marulan South Interchange would require the greatest area of vegetation to be cleared (about 6 hectares).
- Aboriginal heritage impacts - there is a high potential for Aboriginal sites to be disturbed by the construction of a rail spur or a private haul road but very low potential for Aboriginal sites to be disturbed by the proposed public road upgrades described below.
- Noise impacts - the NSW noise criteria are different for trucks on public roads compared to trucks on a private haul road. Although the applicable criteria would be met by trucks using the private haul road and public roads, trucks using the private haul road would be more audible from the west, particularly during temperature inversions.
- Visual/lighting impacts - the trucks using the northern end of a private haul road would be visible from some nearby residences and the residences on elevated areas north and south of Towrang.
- Safety – the road safety audit recommended road improvements along Brayton, Bypass and Red Hills roads. As part of the extension project, we will implement the road safety audit recommendations and provide further improvements to these roads to address issues raised during consultation.

Privately owned land between Gunlake Quarry and the Main Southern Railway/Marulan South Interchange would need to be purchased or a long-term access agreement would need to be reached with the owner. We have been told by the owners that this land is not available. There is no mechanism that would allow us to compulsorily acquire access to this land.

Based on these studies, product transport by rail or on a private haul road through Lafarge Holcim's Lynwood Quarry are not viable for the extension project. The studies used to reach this conclusion will be provided in the response to submissions report.



Additional road upgrade commitments

Given the current transport route is the only viable transport option, if the extension project is approved, we will:

- upgrade the intersection of the quarry access road with Brayton Road
- construct an acceleration lane on Brayton Road south of the quarry intersection
- widen the shoulders on Bypass Road (Ambrose Rd) on the approach to the Brayton Road intersection
- improve the Red Hills Road and Hume Highway intersection
- construct an acceleration lane on the Hume Highway as soon as we gain approval from RMS
- reduce the proposed maximum number of daily truck movements from 690 to 590 per day
- undertake a number of general improvements along the transport route such as better line marking and increased signage
- work with Goulburn Mulwaree Council to submit an application to RMS to reduce the speed limit on the transport route to 80 km/h

Enclosing the primary crusher

The EIS included an assessment of noise levels in areas surrounding the quarry. This assessment was undertaken in accordance with Environment Protection Authority (EPA) methods and found that noise levels from the extended quarry will meet applicable Project Specific Noise Levels (PSNLs) at residences further than approximately 2.5 km from the quarry. However, as for all projects, compliance with these PSNLs does not mean that the operation will be inaudible at more distant locations.

The submissions and feedback clearly indicate to our Community Liaison Team that the distinctive sound of the primary crusher is of most concern to the residents to the south-west, west and north-west of the quarry, particularly if 24-hours per day operation of the crusher is approved. We will address these concerns by enclosing the primary crusher within four months of approval of the extension project. We will not operate the primary crusher at night until it is enclosed.

Next steps

The assessments and the response to submissions report will be finalised in the coming weeks.

We have met with the Community Consultative Committee (CCC) to further explain the findings in the response to submissions report.

The EIS, all public submissions and the response to submissions report will be used by the Department to prepare their final assessment report which will be submitted to the independent Planning Assessment Commission (PAC). The PAC will then examine all the materials provided and determine whether to approve or refuse the extension project application.

The response to submissions report will be available on the Department's Major Project Website (majorprojects.planning.nsw.gov.au). The Gunlake Community eNewsletter will advise subscribers when it is uploaded.

Contact

If you have any questions about the extension project, Gunlake Quarry or this factsheet, please contact our Community Liaison Team on 0438 738 104 between 8 am and 7 pm Monday to Friday or 9 am to 12 pm on Saturday. You can also get in touch via email at community@gunlake.com.au.

We encourage you to register for the community newsletter to receive the latest information and updates on the quarry first hand. Visit our website at gunlake.com.au to sign up.

Want more information?

0438 738 104

community@gunlake.com.au

www.gunlake.com.au

Appendix E

Rail transport study

61 Petrie Terrace, Brisbane, QLD, 4000
Phone: +61 7 3166 7777

H352011 **Gunlake Quarries Rail Transport Study**

Transmittal: **H352011-TR-00005-AU01**
Date: 2016-09-12
Authorised by: Alex Peij

Transmittal Issue Reason
Issued for Use

To: **Gunlake Quarries**
Address:
Attn: Stephen Bridger, Electronic Delivery

Title: **Issued for Use - Report - Gunlake Quarries Rail Transport Study**

Copy to:

Ed O'Neil	Gunlake Quarries - Issued for Use - Electronic Delivery
Ken Devencorn	Hatch - Issued for Information - Electronic Delivery
Alex Peij	Hatch - Issued for Information - Electronic Delivery
Joel Walsh	Hatch - Issued for Information - Electronic Delivery

Number of Documents: 1

Project Document No *Other Document Number*	Rev	Title	Status	Grade	File Type	System Ver
H352011-00000-224-230-0001	3	Report - Gunlake Quarries Rail Transport Study	Approved for Use		pdf	5

Document Review Grade Codes:
C1 - Proceed to next submission and status
C2 - Proceed with exceptions as noted to next submission and status
C3 - Do Not Proceed. Revise as noted and resubmit next submission and status
C4 - Complete. No further submission required

Transmittal created by: Butler, Judy

Report

Gunlake Quarries Rail Transport Study

H352011-00000-224-230-0001

Commercial in Confidence

2016-09-09	3	Approved for Use	J. Walsh	A. Peij	K. Devencorn	Not Required
DATE	REV.	STATUS	PREPARED BY	CHECKED BY	APPROVED BY	APPROVED BY
				Discipline Lead	Functional Manager	Client

Table of Contents

List of Tables

List of Figure

List of Appendices

1. Executive Summary

Gunlake Quarries owns and operates a basalt quarry near Marulan, NSW, which is currently producing approximately 750,000 tonnes per annum. All of Gunlake Quarries', product is transported by road, with approximately 70% of the product travelling to Sydney to supply 3 (increasing to 5) concrete plants operated by Gunlake Concrete.

Gunlake Quarries is currently progressing through the State approvals process for the Gunlake Quarry Extension Project (SSD 7090), which proposes to increase quarry production from 750,000 tonnes per annum to 2,000,000 tonnes per annum.

The Environmental Impact Statement for the project included a Transport Options Review (Appendix D of the EIS documentation), which concluded that an increase in the existing trucking operations was the preferred means of transporting the increased production from the quarry.

The NSW Department of Planning and Environment subsequently required Gunlake to 'undertake further work to ensure it has identified the lowest-cost option for transporting all or some of its products by rail (following consultation with Holcim) and provide a detailed analysis of the costs and benefits associated with this option compared to the costs and benefits of transporting its products by road under the company's preferred option. The analysis should include a comparison of the costs of the two scenarios with regard to the full range of economic, social and environmental costs, including the external costs of traffic congestion, carbon emissions and road accidents'.

Hatch was engaged to undertake a Rail Transportation Study to identify and evaluate potential rail solutions for the transportation of approximately 1.5Mtpa of products to Gunlake's existing and proposed concrete plants in Sydney. The study also provided a basis for evaluating and comparing additional road-based transport options. Capital and operating costs were obtained from Hatch's extensive estimating data-base, and supplemented by commercial discussions which were initiated between Gunlake and potential service providers including Lafarge Holcim (potential shared use of loading facilities at Lynwood Quarry and unloading facilities at Rooty Hill Distribution Centre), Pacific National (rail haulage), and other potential haulage operators and owners of potential unloading facilities.

Over 30 different transport options were considered. Given that some options were essentially sub-options of others, the analysis compared 20 primary options with the existing 'BASE' case road transport option. Of the 20 options considered in detail, Options 1-2 are additional road options, with Options 3-20 (18 in total) rail-based options.

The extent of options results from the identification and placement of rail loading and unloading infrastructure. At the quarry end, 3 primary loading facility options were assessed (loading facility at the quarry, loading facility north of the mainline, shared use/adjacent construct of a loading facility at Lynwood Quarry), each with further options assessed in terms of connection to the quarry by either, haul road, conveyor, or extended rail spur.

At the Sydney end, Hatch conducted a study to identify both existing and potential rail unloading sites in western Sydney, taking into account the need to subsequently distribute to the 3 existing and 2 proposed Gunlake concrete plants. Desktop analysis and subsequent

site visits identified 3 potential sites at Glendenning (shared use/adjacent construct of Rooty Hill Distribution Centre), Silverwater and Smeaton Grange (Glenlee). The options analysis is based on the logic that a 1.5Mtpa operation could only ever develop 1 unloading facility; hence subsequent trucking to each of the 5 plants was assessed for each unloading facility individually.

The options analysis methodology is shown systematically in the diagram below;

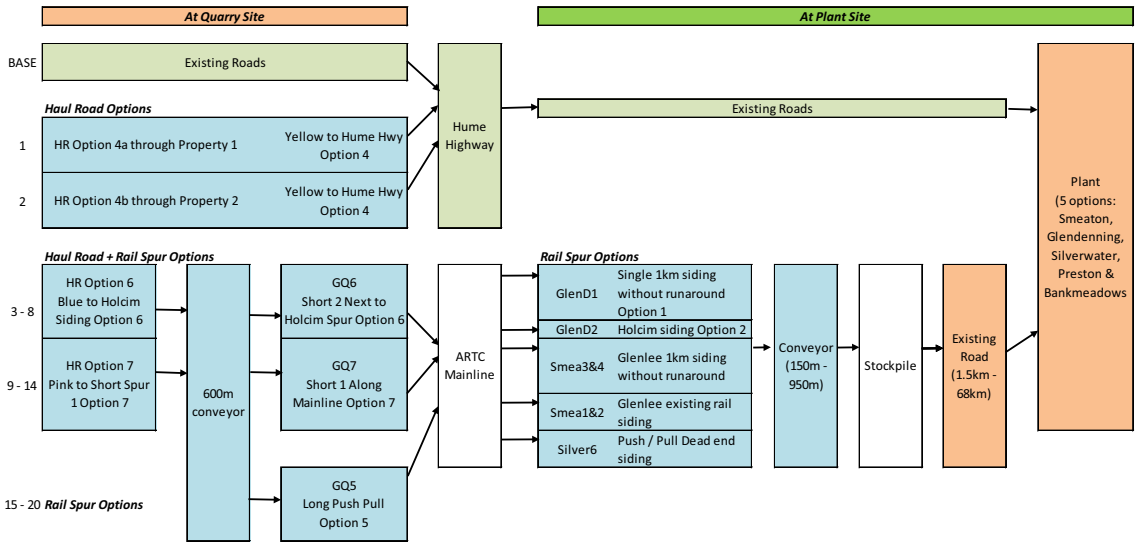


Figure 1-1: Gunlake Quarries Transportation Options

The table below provides additional information for each option:

Table 1-1: Options Description

Option ID	QUARRY END				SYDNEY END		
	ROAD TRANSPORT	sketch ref	RAIL SPUR	LOADING CONVEYOR	RAIL SPUR	UNLOADING CONVEYOR	ROAD TRANSPORT
BASE	Existing Brayton Rd		N/A: All by Road	N/A	N/A	N/A	Quarry to Plants
1	New Haul via Sth Marulan	HR4a	N/A: All by Road	N/A	N/A	N/A	Quarry to Plants
2	New Haul via Sth Marulan	HR4b	N/A: All by Road	N/A	N/A	N/A	Quarry to Plants
3	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Glendenning (Opt 1)	450m	Glendenning to Plants
4	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Glendenning (Opt 2)	950m	Glendenning to Plants
5	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Smeaton Grange Opt 3/4	250m	Smeaton Grange to Plants
6	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Smeaton Grange Opt 1	250m	Smeaton Grange to Plants

Option ID	QUARRY END				SYDNEY END		
	ROAD TRANSPORT	sketch ref	RAIL SPUR	LOADING CONVEYOR	RAIL SPUR	UNLOADING CONVEYOR	ROAD TRANSPORT
7	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Smeaton Grange Opt 2	550m	Smeaton Grange to Plants
8	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Silverwater	150m	Silverwater to Plants
9	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Glendenning (Opt 1)	450m	Glendenning to Plants
10	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Glendenning (Opt 2)	950m	Glendenning to Plants
11	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Smeaton Grange Opt 3/4	250m	Smeaton Grange to Plants
12	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Smeaton Grange Opt 1	250m	Smeaton Grange to Plants
13	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Smeaton Grange Opt 2	550m	Smeaton Grange to Plants
14	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Silverwater	150m	Silverwater to Plants
15	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Glendenning (Opt 1)	450m	Glendenning to Plants
16	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Glendenning (Opt 2)	950m	Glendenning to Plants
17	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Smeaton Grange Opt 3/4	250m	Smeaton Grange to Plants
18	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Smeaton Grange Opt 1	250m	Smeaton Grange to Plants
19	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Smeaton Grange Opt 2	550m	Smeaton Grange to Plants
20	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Silverwater	150m	Silverwater to Plants

It should be noted that each of the rail loading and unloading facilities would face significant commercial and approvals challenges, however, in order to ensure an 'apples-to-apples' comparison with road transport, the probable delays associated with these rail facilities have not been taken into account. In addition, only the land required for the facilities (and connection to them at the quarry end) has been costed into the Net Present Cost analysis; it has been assumed that Gunlake would be able to on-sell or beneficially use any excess land that had to be purchased in the probable event that current owners would not provide a partial sale or easement. Excess land and potential land premiums have been shown separately on the Capital Investment chart.

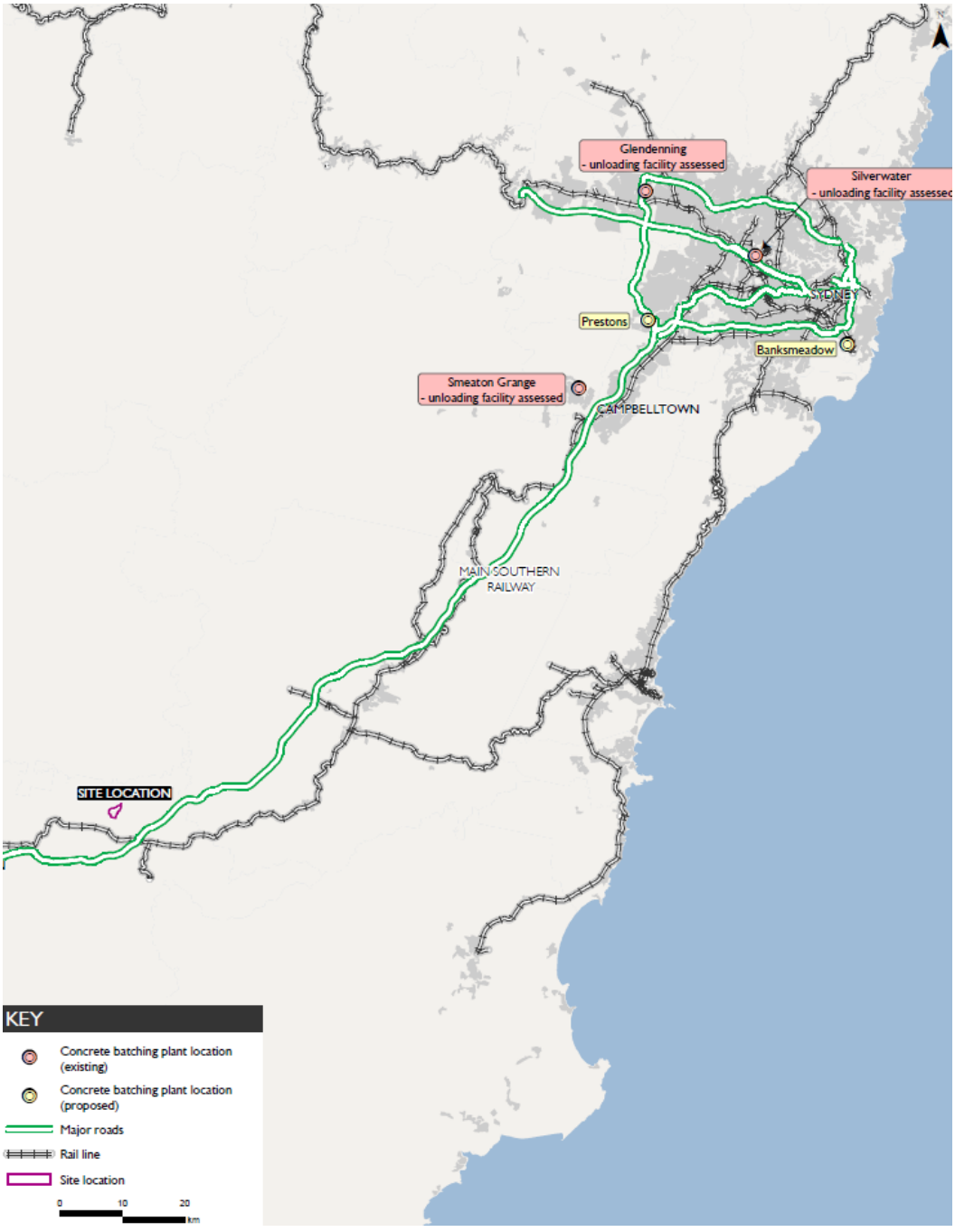


Figure 1-2: Gunlake Quarry and Concrete Plant Location Map

Hatch undertook concept/pre-feasibility designs of the required infrastructure associated with each option, prepared a detailed bill of quantities with associated materials take-offs, and costed these using its detailed estimating data bases. The capital costs associated with each option are shown below;

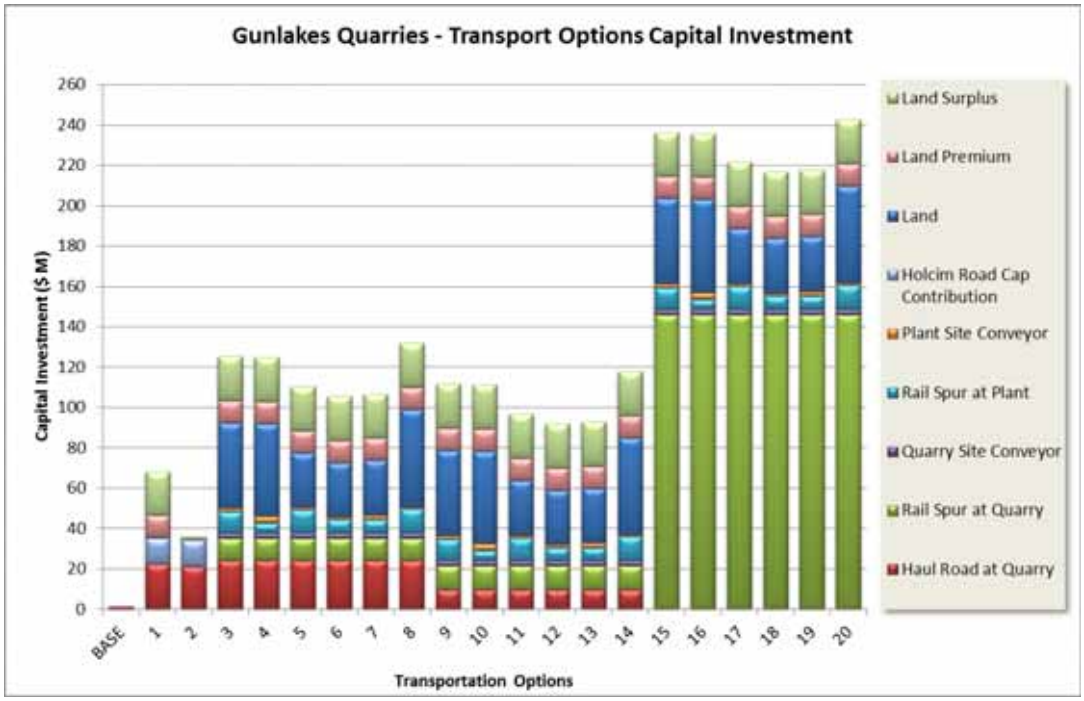


Figure 1-3: Capital Cost Estimates for Each Option

Operational and maintenance costs associated with each option were then prepared, first by analyzing the maintenance and operating costs of the loading and unloading infrastructure itself (and for road, associated maintenance and/or contributions), then adding the operating costs of either trucking or rail haulage operations provided from potential service providers and cross-checked to first principles.

The analysis then considered the capital, operating and maintenance costs for each option over a 20 year period using a 7% discount rate in accordance with government guidelines. In addition to this, the costs of externalities associated with each option were assessed; primarily pollution, greenhouse gas, noise, environment and crash costs (i.e. an economic measure of potential road or rail accidents). These were costed against each option by applying unit rates generally consistent with the Australian Transport Council National Guidelines, supplemented by acknowledged professional reports.

The resultant Present Value Costs for each option are presented below, identifying the separation between direct costs and externalities.

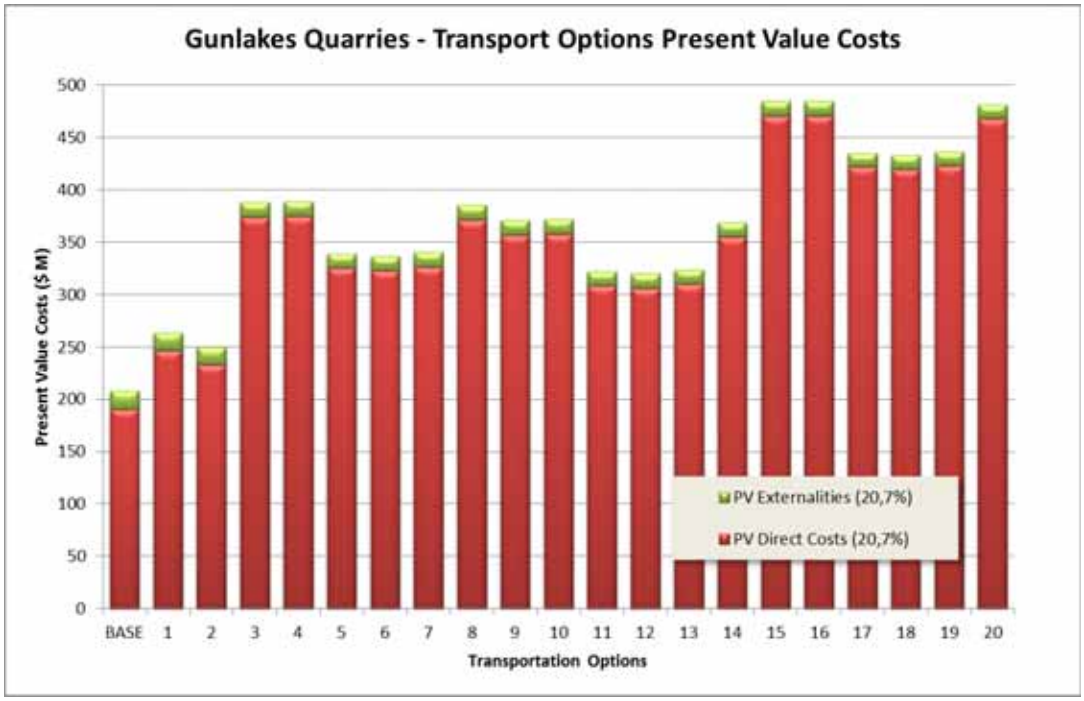


Figure 1-4: Present Value (at 20 years, 7%)

In summary, the analysis confirmed that for the proposed 1.5Mtpa operation, the net present cost of the preferred BASE case road transport option is in the order of $100m lower than the lowest-cost option (options 12-14) for transporting the products by rail. This is the case with and without taking into account the higher costs of the road transport externalities.

Notwithstanding this, Gunlake requested a number of separate sensitivity analyses. Indicatively, the model showed that the rail-only case could not be materially improved by splitting the task between road and rail, as the rail infrastructure (and hence capital) requirements for a 1.5Mtpa operation and 1.0Mtpa operation are very similar. On the upside, the minimum rail facilities with associated adjustments to stockpiling and stacking could cater for approximately 3.5Mtpa, however indicative modeling suggests that road vs rail net present costs (including externalities) remains in favor of road due to the relative high operating costs associated with loading/unloading onto rail and the conveyor systems necessitated by any rail option.

Hatch is not in a position to comment on how an additional $100m in Net Present Costs of transport would affect the overall Quarry Extension Project Economics. It should be noted that the Net Present Cost analysis does not take into account the feasibility of raising the additional capital required for the rail operations.

This report is supported by a detailed proprietary estimating data base and associated commercial model which cannot be made public for intellectual property reasons.

Notwithstanding this, this Executive Summary has been prepared for public distribution to provide an overall analysis of the road and rail transport options in the terms of Net Present Cost (capital and operating), together with externalities costs (i.e. estimates of the social and environmental costs), which are widely used to inform commercial business decisions and government assessments

2. Introduction

Hatch has been engaged by Gunlake Quarries to identify a possible rail solution to move 1.5Mtpa of material from the quarry near Marulan NSW to Sydney – primarily the western suburbs. The objective was to find and assess a suitable, yet cost effective rail solution to move the product. The rail solutions were then compared to alternative haul road transport solutions and the current road transport route "Base Case". Included in these options assessments, it was explored what the expected cost and arrangement would be to share the use of Hoclim's existing infrastructure.

Gunlake Quarries' current operations consist of moving up to 750,000t of quarry material by road based transport. They have applied to increase their operations to approx. 2Mtpa, of which 1.5Mtpa would be transported north to Sydney - primarily the western suburbs. As such, this report is a like-for-like comparison involving the transportation of 1.5Mtpa using road or rail.

This report explores the different options available for the transport of the quarry material and has been linked back to an economic and a cost benefit assessment, looking at the Net Present Cost that takes into account both the capital and operational costs.

3. Transportation Options

The movement of quarry material from Gunlake Quarries near Marulan, south west of Sydney, to a total of 5 different batching plants in Sydney was investigated as part of this study. In total 20 options were investigated and compared with the Base Case, which involves the transportation of quarry material from the quarry site by trucks via Brayton Road, along the Hume Highway and to 5 batching plants at Smeaton Grange, Glendenning, Silverwater, Preston (proposed) and Banksmeadow (proposed).

With the exception of the 7.5km long rail spur options 15 to 20, all other rail options involve the combination of a haul road and a rail spur at the quarry site. For each rail option the quarry material is transported to a stockpile area, from where the product is then transported by road to the batching plant(s). For each rail option, materials handling equipment including conveyor systems will be required to feed the quarry material in and out of each train.

The options are summarized in the diagram below:

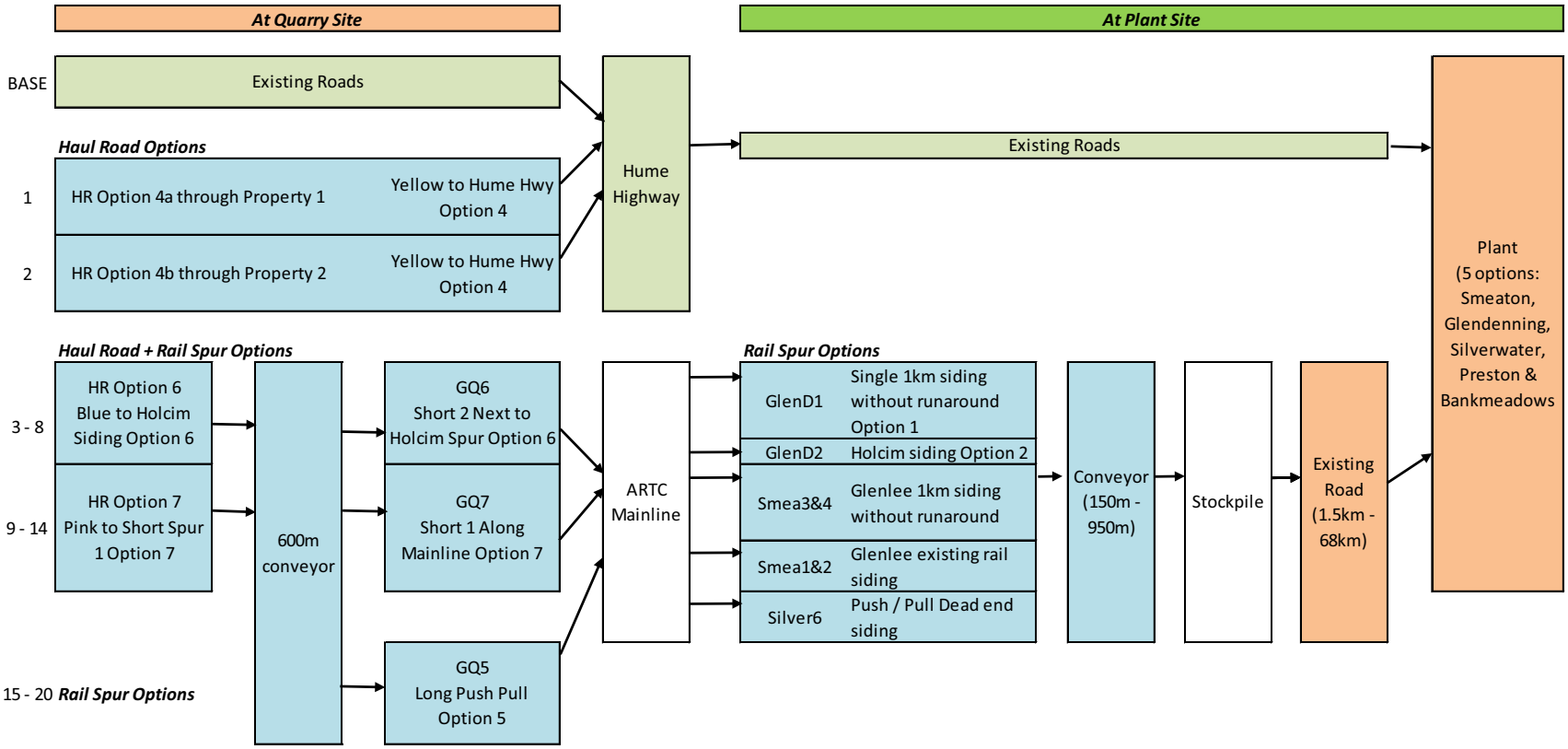


Figure 3-1: Gunlake Quarries Transportation Options

The table below provides additional information for each option:

Table 3-1: Options Description

Option ID	QUARRY END				SYDNEY END		
	ROAD TRANSPORT	sketch ref	RAIL SPUR	LOADING CONVEYOR	RAIL SPUR	UNLOADING CONVEYOR	ROAD TRANSPORT
BASE	Existing Brayton Rd		N/A: All by Road	N/A	N/A	N/A	Quarry to Plants
1	New Haul via Sth Marulan	HR4a	N/A: All by Road	N/A	N/A	N/A	Quarry to Plants
2	New Haul via Sth Marulan	HR4b	N/A: All by Road	N/A	N/A	N/A	Quarry to Plants
3	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Glendenning (D 1)	450m	Glendenning to Plants
4	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Glendenning (D 2)	950m	Glendenning to Plants
5	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Smeaton Grange 3 & 4	250m	Smeaton Grange to Plants
6	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Smeaton Grange 1	250m	Smeaton Grange to Plants
7	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Smeaton Grange 2	550m	Smeaton Grange to Plants
8	New Haul to Lynwood	HR 6	Shared/side Lynwood	600m conveyor	Silverwater	150m	Silverwater to Plants
9	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Glendenning (D 1)	450m	Glendenning to Plants
10	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Glendenning (D 2)	950m	Glendenning to Plants
11	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Smeaton Grange 3 & 4	250m	Smeaton Grange to Plants
12	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Smeaton Grange 1	250m	Smeaton Grange to Plants
13	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Smeaton Grange 2	550m	Smeaton Grange to Plants

Option ID	QUARRY END				SYDNEY END		
	ROAD TRANSPORT	sketch ref	RAIL SPUR	LOADING CONVEYOR	RAIL SPUR	UNLOADING CONVEYOR	ROAD TRANSPORT
14	New Haul to Nth Mainline	HR 7	New Gunlake Nth Mainline	600m conveyor	Silverwater	150m	Silverwater to Plants
15	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Glendenning (D 1)	450m	Glendenning to Plants
16	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Glendenning (D 2)	950m	Glendenning to Plants
17	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Smeaton Grange 3 & 4	250m	Smeaton Grange to Plants
18	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Smeaton Grange 1	250m	Smeaton Grange to Plants
19	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Smeaton Grange 2	550m	Smeaton Grange to Plants
20	N/A: Spur at Quarry		New Gunlake at Quarry	600m conveyor	Silverwater	150m	Silverwater to Plants

4. Quarry End Rail Spur and Loading Facility

For the proposed options the following base assumptions have been made, and are detailed below;

- Total volume of produce to be moved by rail – 1.5Mtpa; volumes assumed to ramp up from 500,000 tonnes in Year 1 and increasing by 100,000 tonnes each year until the targeted 1.5Mtpa is reached
- Typical train length of approx. 500m – comprising of 2 diesel locomotives with 40 wagons
- Typical rail spur will be approx. 1km to 1.2km in length
- Train operation will be a push-pull (locomotive on each end of the train) allowing for the train to enter a rail siding, the driver changing ends and leaving in the reverse direction
- Approx. payload for a train is 2720t. Using this and adding approx. 15% for service cancelation and or uplift. That requires 630 trains/year, using 330day/year to include track closures, will require 2 trains a day
- Loading and unloading is expected to be 2500t to 3000t an hour
- Adequate train paths will be made available on the Sydney network

4.1 Quarry End Rail Spur Options

Three rail spur options have been considered; these options have been described as follows;

- Long Spur –1 (GQ5)
- Short Spur North – (GQ6)
- Short Spur South – (GQ7)

Table 4-1: Quarry Rail Spur Options

Spur option	Spur description	Length	Major structure requirement	Major haul road requirement
RS (GQ5)	This option consists of a rail spur leaving the existing rail corridor approx. 2.km NW of Holcim's current spur location. This alignment has 3 sub options, due to earthworks requirements associated with maintaining the necessary rail grading of the mainline to the loading location the longer alignment has been found to be the preferred option	7.5 to 6km	Two water crossings will be required, depending on final alignment arrangement; will determine if large culvert system or bridge will be required.	None
RS (GQ6)	Single line siding coming off the mainline, approx. 2km north of Holcims siding	1 to 1.2km	None	Yes – see below
RS (GQ7)	Duplication of the rail siding located at the Holcims rail siding	1 to 1.2km	Road over rail bridge	Yes – see below

General arrangement drawings have been provided in Appendix A for the options listed in the table above.

4.2 Quarry End Haul Road Options

Three main haul road options have been considered, and from the three main alignment corridors, sub options have been identified. These options are outlined below.

4.2.1 Western Haul Road

This haul road alignment will form the base for each of the haul road options indicated to run west of Gunlake's Quarry. The options are described as follows;

- Haul road to Short Spur North –Haul Road Option 7
- Haul road to Holcim's current spur –Haul Road Option 6
- Haul road to Hume Highway South through Lynwood Quarry – Haul Road Option 4a and Option 4b

Table 4-2: Quarry Haul Road Options West

Route option	End point	Length	Major structure requirement	Pavement requirement
Option 7	new short spur (GQ6)	4.7km	None	New 9m wide road
Option 6 *(refer note below)*	south of Holcim's current rail spur and train loading facility (GQ7)	8km	Road over rail bridge	New 9m wide road
Option 4a	Connection point to the Hume Hwy off Marulans Rd overpass	10.6km	Road over rail bridge	7.1km on new 9m wide road, with 3.5km use of Holcims road
Option 4b	Connection point to the Hume Hwy off Marulans Rd overpass	8.7km	Road over rail bridge	6.6km on new 9m wide road, with 2.1km use of Holcims road

The high cost in acquiring the property west of the Lynwood Quarry Additional Proposed Extraction Area may necessitate a more challenging eastern alignment (more earthworks) but offset by lower property acquisition costs. This has not been assessed.

4.3 Quarry Side Wagon Loading Operation

For the wagon loading facility, two alternative options were considered; loading the wagons with the use of a front end loader, and a dedicated overhead/rail loading system. The use of the front end loaders directly loading into wagons was quickly dismissed due to its inherent short comings, of inaccurate loading weights, slow speed and safety concerns, with unnecessary heavy vehicle interaction. Therefore this report only examined a dedicated overhead/rail loading system.

4.3.1 Overhead/rail Load-out Arrangement

For the loading operation, two methods where again assessed;

- Bucket re-claimer – above ground re-claiming operation
  - This option has a bucket re-claimer running on a half circle rail system. Material is dumped into approximate location via haul truck and front end loaders. Re-claimer feed to above ground conveyer system to the train loader.
- Surface level shoot – shoot leading to below ground conveyor system
  - This options, has a shoot operation, whereby a front end loader pushes material to a below ground hopper, connected to a conveyer system that transports the product to the train loader. This system was dismissed quickly due to high cost related to large underground works.

For the train loader, the material is placed into an overhead hopper, with a valve which is opened to fill the wagon. Product volume is controlled by weight sensors to ensure correct weight in each wagon.

5. Sydney Side Rail Spur, Loading and Storage

Hatch undertook an analysis of the potential sites for new and existing rail unloading facilities in Sydney. Due to constraints and impacts of such an operation, less the 5 sites were deemed as potentially feasible. Where large house resumptions and major road and bridge works would be necessary these locations have been dismissed. Hatch selected the 3 most feasible options and conducted site inspections for each.

The arrangement of the unloading facilities took into consideration the range of products expected to be transported.

5.1 Rail Siding

Three main locations for the rail siding have been considered. Viability of each site was considered by type of rail alignment (high frequency passenger), traffic, and proposed land requirements necessary to undertake unloading and associated stockpiling. The three locations considered are listed below, and for each of the sites, alternatives/layout arrangements have been provided.

The expectation would be that only one rail siding would be considered to move quarry material to a designated location, and from this location distribution to each of the 5 batching plans would then be conducted by road based transport.

5.1.1 Glendenning - Rooty Hill

Option 1 – Dedicated spur

This option would run a dedicated spur off the main rail corridor, traveling away from the corridor, running parallel alongside the existing overhead power transmission line, utilizing the same corridor to reduce the land acquisition requirement. The spur would be approx. 1km in length with an unloading facility placed mid-length. Material would be transported via overland conveyor to a proposed stockpile site. Sketch “Glendenning Unloading Facility Option 1” in Appendix C provides general arrangement of this option.

Option 2 – Extension of Holcims spur

This option would extend Holcim's current runaround road, place an unloading facility to the East of the existing one, and then move the material via overland conveyor to the same designated stockpile location as option 1. Sketch "Glendenning Unloading Facility Option 2" in Appendix C provides a general arrangement of this option.

5.1.2 Silverwater - Rose Hill Gardens Parramatta

This option utilizes an existing spur alignment to the north of Rose Hill race course. For the initial site visit to this site, the track is in poor condition, and appears to be disused for a number of years. Permanent fencing has been placed across the track. Under this option it is expected that this spur line would need to be rebuilt. This option considers that at the end of the current spur, a new section is added. This new section would run south for approx. 1km, with the unloader located halfway. The use of an overland conveyer similar to that of the Rooty Hill option would apply - an additional idea regarding this option would be to run a secondary conveyer directly to the batching plant located nearby. Sketch "Silverwater Unloading Facility" in Appendix C illustrates the proposed option.

5.1.3 Smeaton Grange - Glenlee

Option 1 – New passing loop

This option consists of placing a new dedicated passing loop off the existing mainline. The passing loop would have the unloader located approximately halfway, utilizing the same overland conveyer and stacking/stockpiling arrangements as the other options.

Option 2 – Use of existing spur

As this spur is currently a dual track, this option considers placing an unloader on one of the tracks. Moving and storing the material would use similar overland conveyer and stacking/stockpiling arrangements as the other options. The land availability would determine the location of the stockpiles. Sketch "Smeaton Grange Unloading Facility" in Appendix C illustrates both of these proposed options.

5.2 Sydney Side Wagon Unloading Operation

For the wagon unloading facility, the typical arrangement used at Holcim's Rooty Hill Distributions Centre, has been adopted, where the train is unloaded via a side/bottom dump operation. Once the material is dumped, it would travel from the underground hopper, via a conveyer system to a stacker (again using a stacker on a half circle rail) and associated stock piles. Distribution from this point is assumed to be via truck.

6. Stock Pile Requirements

For the stock pile requirements, a general size of approximately 5ha has been used for each of the options; this is inclusive of both loading and unloading locations. This was seen to provide the best like for like comparison between options, and considered necessary to facilitate supplying the 5 batching plants with quarry material.

The requirement for stockpiles necessitates the acquisition of land. This has been assessed for each option. The assumed land acquisition rate (in $/square metre) and the required land area for each option is shown in the table below:

Table 6-1: Stockpile Land Requirements

Option ID	Land Acquisition Rate ($/sqm)	Land Acquisition Area (sqm)	Stockpile Land Acquisition Cost ($ M)
BASE	750	-	-
1	750	-	-
2	750	-	-
3	750	56,000	42.0
4	750	61,000	45.8
5	450	60,000	27.0
6	450	60,000	27.0
7	450	60,000	27.0
8	800	60,000	48.0
9	750	56,000	42.0
10	750	61,000	45.8
11	450	60,000	27.0
12	450	60,000	27.0
13	450	60,000	27.0
14	800	60,000	48.0
15	750	56,000	42.0
16	750	61,000	45.8
17	450	60,000	27.0
18	450	60,000	27.0
19	450	60,000	27.0
20	800	60,000	48.0

Note, no discussions have been held with land holders with regard to availability and price of land for this project. In addition, for the purpose of this assessment the assumption was made that the exact land area will be able to be purchased and therefore no surplus land will need to be on-sold.

7. Costing

From the development of all the options, costing for each of the independent components has been completed. This includes both the capital and operational costs associated with each of the components. Each of the transport solutions has then been compared against the others in terms of Net Present Cost. The section below goes through the individual cost components as well as the combined solutions.

7.1 Capital costing

7.1.1 Haul Road Infrastructure

Each haul road was costed to a sufficient detail to facilitate a comparison between options.

Table 7-1: Haul Road Requirements

Option ID	Haul Road at Quarry	Length (km)	Capital Cost ($ M)	Comment
BASE	Brayton Road	-	1.50	Using existing road, new acceleration lane on to the Hume Hwy
1	HR Option 4a	7.10	22.30	Western option through property 1
2	HR Option 4b	6.60	21.29	Eastern option through property 2
3	HR Option 6	8.00	24.12	
4	HR Option 6	8.00	24.12	
5	HR Option 6	8.00	24.12	
6	HR Option 6	8.00	24.12	
7	HR Option 6	8.00	24.12	
8	HR Option 6	8.00	24.12	
9	HR Option 7	4.70	9.67	
10	HR Option 7	4.70	9.67	
11	HR Option 7	4.70	9.67	
12	HR Option 7	4.70	9.67	
13	HR Option 7	4.70	9.67	
14	HR Option 7	4.70	9.67	
15	N/A	-	-	No haul road required
16	N/A	-	-	No haul road required
17	N/A	-	-	No haul road required
18	N/A	-	-	No haul road required
19	N/A	-	-	No haul road required
20	N/A	-	-	No haul road required

Refer to Appendix D for a detailed breakdown of these capital cost estimates.

7.1.2 Rail Infrastructure

Each rail spur at the quarry end as well as at the plant end was costed to a sufficient detail to facilitate a comparison between options.

Table 7-2: Rail Spur Requirements

Option ID	Rail Spur at Quarry	Length (km)	Capital Cost ($ M)	Rail Spur at Plant	Length (km)	Capital Cost ($ M)	Comment
BASE	N/A	N/A	N/A	N/A	N/A	N/A	No rail spur required
1	N/A	N/A	N/A	N/A	N/A	N/A	No rail spur required
2	N/A	N/A	N/A	N/A	N/A	N/A	No rail spur required
3	GQ6	1.00	11.01	GlenD1	1.00	10.54	
4	GQ6	1.00	11.01	GlenD2	0.20	4.84	GlenD2 involves a 200m extension only
5	GQ6	1.00	11.01	Smea3&4	1.00	11.25	
6	GQ6	1.00	11.01	Smea1&2	1.50	6.42	
7	GQ6	1.00	11.01	Smea1&2	1.50	6.42	
8	GQ6	1.00	11.01	Silver6	2.50	11.86	
9	GQ7	1.00	11.70	GlenD1	1.00	10.54	
10	GQ7	1.00	11.70	GlenD2	0.20	4.84	
11	GQ7	1.00	11.70	Smea3&4	1.00	11.25	
12	GQ7	1.00	11.70	Smea1&2	1.50	6.42	
13	GQ7	1.00	11.70	Smea1&2	1.50	6.42	
14	GQ7	1.00	11.70	Silver6	2.50	11.86	
15	GQ5	7.50	146.11	GlenD1	1.00	10.54	
16	GQ5	7.50	146.11	GlenD2	0.20	4.84	
17	GQ5	7.50	146.11	Smea3&4	1.00	11.25	
18	GQ5	7.50	146.11	Smea1&2	1.50	6.42	
19	GQ5	7.50	146.11	Smea1&2	1.50	6.42	
20	GQ5	7.50	146.11	Silver6	2.50	11.86	

Refer to Appendix D for detailed breakdown of these capital cost estimates.

7.1.3 Material Handling Infrastructure

Each rail spur requires bulk materials handling equipment including conveyor systems to facilitate the loading and unloading of quarry material.

For each option, these items have been costed to a sufficient detail to facilitate a comparison between options.

Table 7-3: Materials Handling Requirements

Option ID	Length of Conveyor at Quarry (m)	Capital Cost ($ M)	Length of Conveyor at Plant end (m)	Capital Cost ($ M)	Comment
BASE	N/A	N/A	N/A	N/A	No conveyor system required
1	N/A	N/A	N/A	N/A	No conveyor system required
2	N/A	N/A	N/A	N/A	No conveyor system required
3	600	2.70	450	1.94	
4	600	2.70	950	3.46	
5	600	2.70	250	1.38	
6	600	2.70	250	1.38	
7	600	2.70	550	2.29	
8	600	2.70	150	1.03	
9	600	2.70	450	1.94	
10	600	2.70	950	3.46	
11	600	2.70	250	1.38	
12	600	2.70	250	1.38	
13	600	2.70	550	2.29	
14	600	2.70	150	1.03	
15	600	2.70	450	1.94	
16	600	2.70	950	3.46	
17	600	2.70	250	1.38	
18	600	2.70	250	1.38	
19	600	2.70	550	2.29	
20	600	2.70	150	1.03	

Refer to Appendix D for detailed breakdown of these capital cost estimates.

7.1.4 *Land Requirements*

To facilitate the construction of haul roads or rail spurs, land corridors will be required. The assumption was made that for haul roads, an average corridor width of 20m will be required; for rail corridors this was assumed to be 30m. The land acquisition cost for these transportation corridors was assumed to be at a rate of $2,000 per acre, however we have been advised that two landowners adjacent to the quarry are unwilling sellers and as such some options may not be feasible. We understand these landowners cannot be forced to sell. All options with the exception of the Base Case and Option 2 involves going through a large 11,000 acre property with a potential $11m price tag. Option 2 involves going through a smaller 600 acre property with a potential price tag of $0.6m. For the purposes of this cost-benefit analysis, we have applied a 50% non-recoverable premium to the acquisition of these properties. Any surplus land not required for the transportation corridors are assumed to be on-sold at market rates.

7.1.5 *Total Capital Investment Required*

The total capital investment required for each option is summarized in the table below. Note, with Options 1 and 2, the use of Holcim's haul road involves a cost. This is likely to involve a capital contribution to the grade separation interchange of $11.7M plus a capital contribution to the internal haul road of $1.35M, i.e. a total of $13.05M capital contribution. In addition to this particular capital contribution, an ongoing access fee is expected and this is included in the operational cost estimates.

Table 7-4: Capital Cost

Option ID	Haul Road ($ M)	Rail Spurs ($ M)	Con-veyors ($ M)	Land ($ M)	Land Premium ($ M) (a)	Holcim Road Capital ($ M)	TOTAL Capital Cost ($ M)	Land Surplus ($ M)	Total Capital Outlay ($ M)
BASE	1.50	-	-	-	-		1.50	-	1.50
1	22.30	-	-	0.07	11.00	13.05	46.42	21.93	68.35
2	21.29	-	-	0.07	0.60	13.05	35.00	1.13	36.14
3	24.12	21.55	4.64	42.11	11.00		103.42	21.89	125.31
4	24.12	15.85	6.15	45.85	11.00		102.98	21.90	124.88
5	24.12	22.26	4.08	27.11	11.00		88.56	21.89	110.45
6	24.12	17.43	4.08	27.12	11.00		83.75	21.88	105.63
7	24.12	17.43	4.99	27.12	11.00		84.66	21.88	106.55
8	24.12	22.86	3.73	48.13	11.00		109.84	21.87	131.71
9	9.67	22.24	4.64	42.08	11.00		89.63	21.92	111.55
10	9.67	16.55	6.15	45.82	11.00		89.19	21.94	111.12
11	9.67	22.95	4.08	27.08	11.00		74.78	21.92	96.70
12	9.67	18.13	4.08	27.08	11.00		69.96	21.92	91.88
13	9.67	18.13	4.99	27.08	11.00		70.87	21.92	92.79
14	9.67	23.56	3.73	48.10	11.00		96.06	21.90	117.96

Option ID	Haul Road ($ M)	Rail Spurs ($ M)	Con-veyors ($ M)	Land ($ M)	Land Premium ($ M) (a)	Holcim Road Capital ($ M)	TOTAL Capital Cost ($ M)	Land Surplus ($ M)	Total Capital Outlay ($ M)
15	-	156.65	4.64	42.13	11.00		214.42	21.87	236.29
16	-	150.95	6.15	45.87	11.00		213.97	21.88	235.86
17	-	157.36	4.08	27.13	11.00		199.56	21.87	221.43
18	-	152.54	4.08	27.14	11.00		194.75	21.87	216.61
19	-	152.54	4.99	27.14	11.00		195.66	21.87	217.52
20	-	157.97	3.73	48.15	11.00		220.84	21.85	242.69

(a) We have been advised that 2 landowners adjacent to the quarry are unwilling sellers and as such some options may not be feasible. We understand these landowners cannot be forced to sell. For the purposes of this cost-benefit analysis, we have applied a 50% non-recoverable premium to these properties.

The capital cost assessment is also illustrated in following graph:

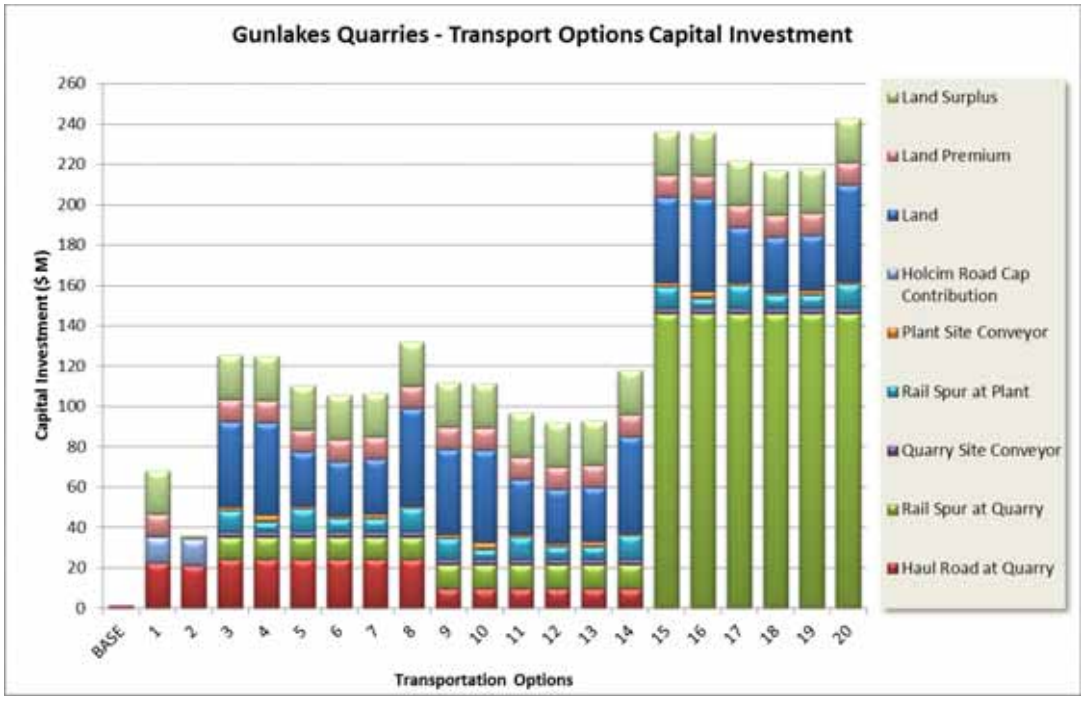


Figure 7-1: Capital Cost Estimates for each option

Note Figure 7-1 above includes the Surplus Land Capital Cost associated with the acquisition of land, which is expected to be on-sold at market rates. This is to show the total capital outlay associated with each option.

7.2 Operational Costing

The cost to maintain and operate the haul roads, rail spurs, conveyor systems, loading and unloading facilities is summarized below. These estimates are based on the full 1.5Mtpa volume. Note, the cost to *transport* the quarry material by truck or rail is not included here. These are separately detailed in Table 7-6.

Table 7-5: Annual Operating / Maintenance Cost

Option ID	Haul Road ($ 000)	Rail Spurs ($ 000)	Conveyors ($ 000)	Loading & Unloading ($ 000)	TOTAL Maintenance / Operating Cost ($ 000)
BASE	375.0 (a)	-	-	-	375.0
1	685.5	-	-	-	685.5
2	683.0	-	-	-	683.0
3	40.0	20.0	1,532.5	3,600.0	5,192.5
4	40.0	12.0	1,691.0	3,600.0	5,343.0
5	40.0	20.0	1,512.6	3,600.0	5,172.6
6	40.0	25.0	1,376.1	3,600.0	5,041.1
7	40.0	25.0	1,674.4	3,600.0	5,339.4
8	40.0	35.0	1,370.7	3,600.0	5,045.7
9	23.5	20.0	1,532.5	3,600.0	5,176.0
10	23.5	12.0	1,691.0	3,600.0	5,326.5
11	23.5	20.0	1,512.6	3,600.0	5,156.1
12	23.5	25.0	1,376.1	3,600.0	5,024.6
13	23.5	25.0	1,674.4	3,600.0	5,322.9
14	23.5	35.0	1,370.7	3,600.0	5,029.2
15	-	85.0	1,532.5	3,600.0	5,217.5
16	-	77.0	1,691.0	3,600.0	5,368.0
17	-	85.0	1,512.6	3,600.0	5,197.6
18	-	90.0	1,376.1	3,600.0	5,066.1
19	-	90.0	1,674.4	3,600.0	5,364.4
20	-	100.0	1,370.7	3,600.0	5,070.7

(a) S94 contributions @ $0.25 per tonne

Visually illustrating the above table, the graph below highlights the key differences in operational costs between the different options.

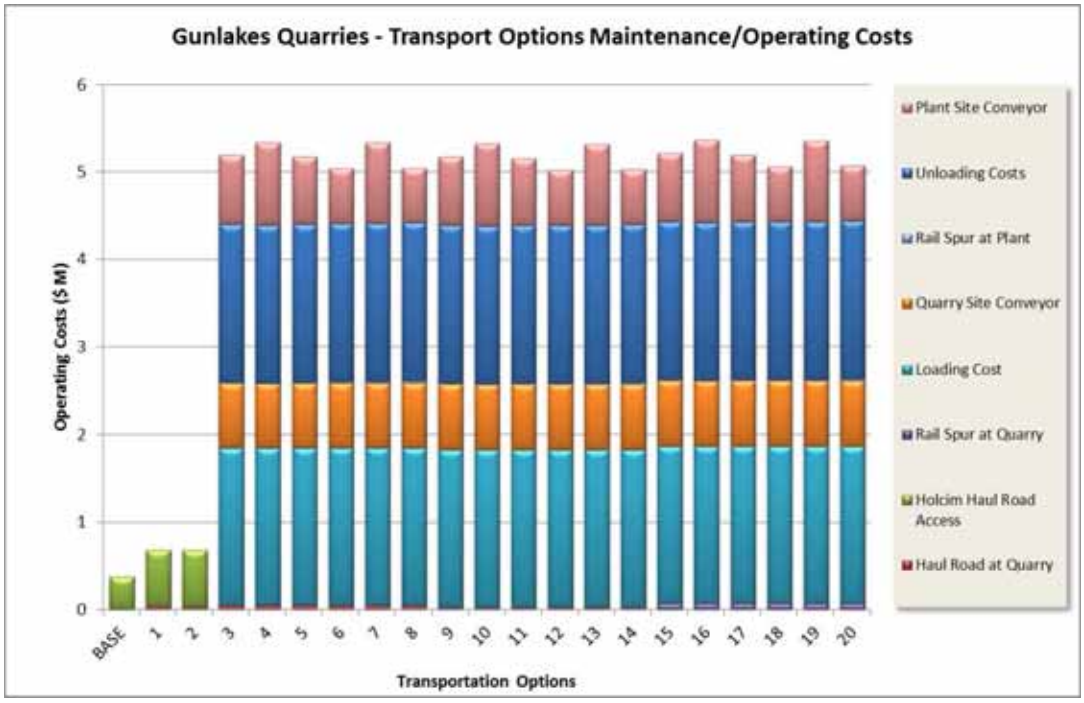


Figure 7-2: Operating & Maintenance Cost Estimates for each Option (Excluding Transportation Costs)

The cost to transport (by road or rail) has been separately estimated to determine the total operating costs for each option. These estimates are based on the full 1.5Mtpa volume. The assumption is made that the quarry material is equally distributed to the 5 batching plants at Smeaton Grange, Glendenning, Silverwater, Preston and Bankmeadows. These estimates have been cross-checked for consistency with rates quoted via confidential discussions between Gunlake Quarries and potential service providers.

Table 7-6: Transportation Costs

Option ID	Total Distance by Road (km) (a)	Total Distance by Rail (km) (a)	Road Transport ($ M)	Rail Transport ($ M)	Total Transport ($ M)
BASE	151.8	-	26.6	-	26.6
1	154.9	-	27.2	-	27.2
2	153.0	-	26.9	-	26.9
3	40.9	197.0	7.2	25.4	32.6
4	40.9	196.2	7.2	25.3	32.5
5	54.8	140.0	9.6	18.1	27.7
6	54.8	143.5	9.6	18.5	28.1
7	54.8	143.5	9.6	18.5	28.1
8	42.2	187.5	7.4	24.2	31.6

Option ID	Total Distance by Road (km) (a)	Total Distance by Rail (km) (a)	Road Transport ($ M)	Rail Transport ($ M)	Total Transport ($ M)
9	37.6	197.0	6.6	25.4	32.0
10	37.6	196.2	6.6	25.3	31.9
11	51.5	140.0	9.0	18.1	27.1
12	51.5	143.5	9.0	18.5	27.5
13	51.5	143.5	9.0	18.5	27.5
14	38.9	187.5	6.8	24.2	31.0
15	32.9	203.5	5.8	26.3	32.0
16	32.9	202.7	5.8	26.1	31.9
17	46.8	146.5	8.2	18.9	27.1
18	46.8	150.0	8.2	19.4	27.6
19	46.8	150.0	8.2	19.4	27.6
20	34.2	194.0	6.0	25.0	31.0

(a) Average distance to Smeaton Grange, Glendenning, Silverwater, Preston and Bankmeadows.

Visually illustrating the above table, the graph below demonstrates the split in operational costs between the different options.

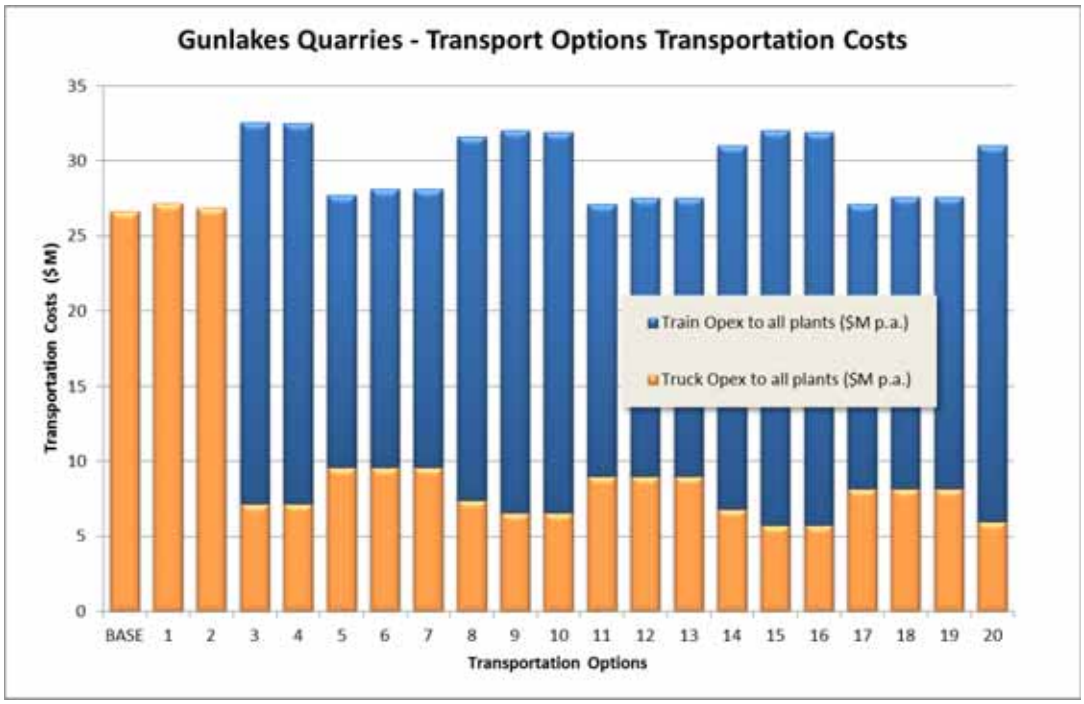


Figure 7-3: Transportation Costs for each Option

8. Economic Analysis

A present value cash flow analysis was undertaken to enable each option to be compared with the others. The following assumptions were used with regard to this assessment:

- Assessment period 20 years
- All costs expressed in 2016 constant prices
- Construction costs assumed to be spread evenly over the first 2 years of assessment
- Land acquisition costs assumed to occur in the first year of assessment
- Land requirements have been based on the assumption of an average corridor width requirement of 20m and 30m for road and rail respectively
- Land acquisition costs for the development of stockpile arrangements were assumed to be:
  - $450 per sqm at Glendenning
  - $750 per sqm at Smeaton Grange
  - $800 per sqm at Silverwater
- Land acquisition costs for haul road and rail spur development were assumed to be $2000 per acre. We have been advised that two landowners adjacent to the quarry are unwilling sellers and as such some options may not be feasible. We understand these landowners cannot be forced to sell. For the purposes of this cost-benefit analysis, we have applied a 50% non-recoverable premium to these properties.
- It has been assumed that any land purchased but not used (i.e. surplus to requirements) is on-sold at market rates.
- Discount rate of 7% to determine the present value of all costs
- Annual volume of quarry material of 1.5 million tonnes, assumed to be reasonably evenly spread over each year; volumes assumed to ramp up from 500,000 tonnes in Year 1 and increasing by 100,000 tonnes each year until the targeted 1.5 million tonnes is reached
- P50 costings of haul road, rail spurs and conveyor systems
- Capital cost estimates for the haul road, rail spurs and conveyor systems include allowances for principals/contractors costs, contingencies and escalation during construction
- Cost of externalities were based on following assumed costs (expressed in cents per net tonne km):

Table 8-1: Cost of Externalities (c / net tonne km)

	Urban Road	Rural Road	Urban Rail	Rural Rail
Freight Air Pollution	0.970	0.010	0.330	0.000
Greenhouse Gas	0.070	0.070	0.030	0.030
Noise	0.260	0.026	0.140	0.010
Water	0.100	0.060	0.010	0.010
Nature & Landscape	0.260	0.110	0.080	0.030
Urban Separation	0.220	0.000	0.080	0.000
Sub-total	**1.880**	**0.276**	**0.670**	**0.080**
Crash Cost	0.400	0.400	0.038	0.038
Total	**2.280**	**0.676**	**0.708**	**0.118**

- The above unit rates generally reflect the ATC National Guidelines *1 whereas the Road Crash Cost Savings unit rates were based on the Booz Allen and Hamilton *2 estimated crash costs for road and rail freight.
- The proportion of urban versus rural operation, for the purposes of determining the weighted average externalities costs, was determined for each option.
- No assessment was made for travel time savings between the different options

For each option, where applicable, capital cost estimates for the following major items have been included in the assessment:

- Haul road at the quarry end
- Rail spur at the quarry end
- Conveyor system at the quarry end (to link to the rail loading), estimated to be approximately 600m in length
- Rail spur at the plant site
- Conveyor system at the plant site (to link to the rail unloading), varying between 150m and 950m, depending on option
- For haul road options 4a and 4b only, a capital contribution to the Holcim haul road

For each option, where applicable, operating cost estimates for the following major items have been included in the assessment:

- Maintenance of the haul road at the quarry end
- Maintenance of the rail spur at the quarry site

[1] Australian Transport Council, National Guidelines for Transport System Management in Australia, Volume 3 Appraisal of Initiatives, Appendix C
[2] Booz Allen Hamilton 2001, cited in Freight Australia 2003, The Future of Rail Freight Services in Victoria: a proposal to the Government of Victoria from Freight Australia, 21 March 2003

- Maintenance and operating costs of the conveyor system at the quarry end (to link to the rail loading)
- Maintenance of the rail spur at the plant site
- Maintenance and operating costs of the conveyor system at the plant site (to link to the rail unloading)
- S94 contributions for local road maintenance (Option 1 only)

For each option, where applicable, road and rail transportation cost estimates from the quarry to each of the three plant options have been determined. These were calibrated to the quoted rates, and expressed as $0.117 and $0.086 per net tonne km for the road and rail components respectively. The graph below illustrates the different between all the options.

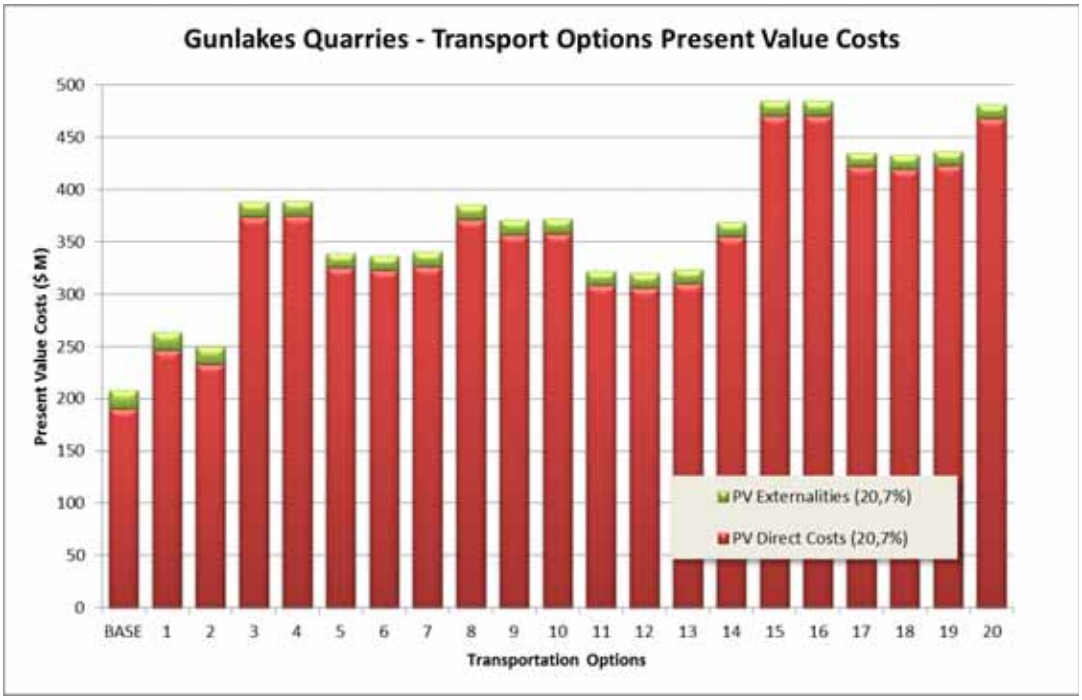


Figure 8-1: Present Value (at 20 years, 7%)

Sensitivities have been applied to the period and the discount rate. These are presented below.

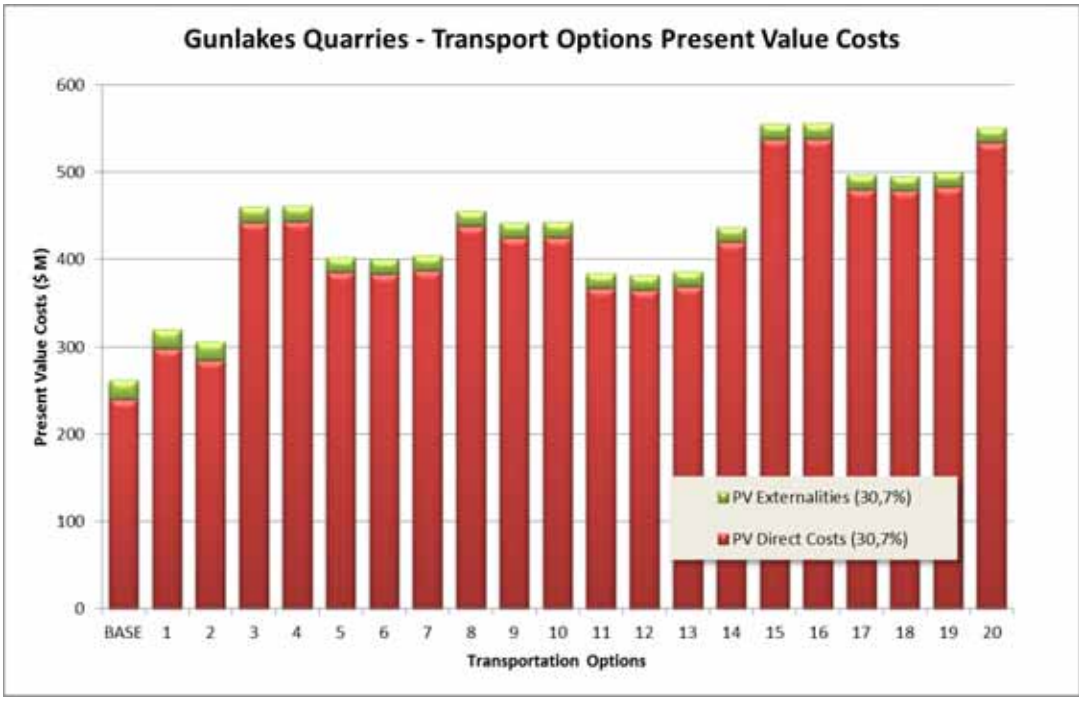


Figure 8-2: Present Value (at 30 years, 7%)

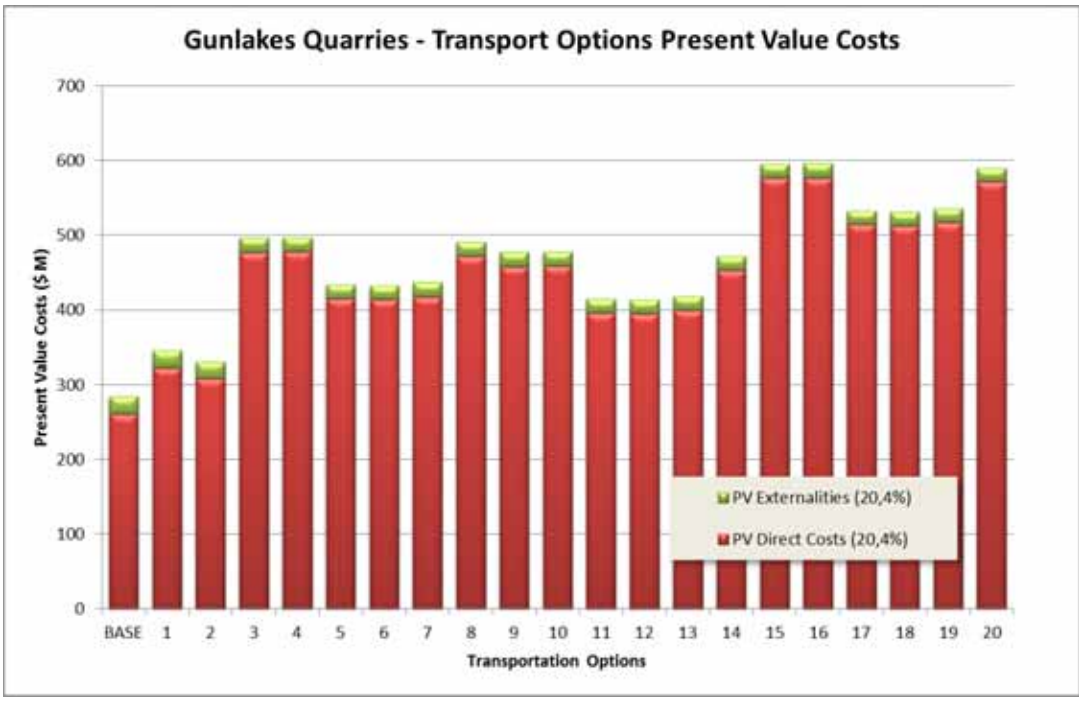


Figure 8-3: Present Value (at 20 years, 4%)

The present value assessment illustrates that the BASE case road only operation has the lowest overall cost. The additional externalities costs that the road based options carry were insufficient to skew the results in favor of rail based solutions. The high capital costs associated with these rail based solutions is a significant impost.

9. Conclusion

In summary, the analysis confirmed that for the proposed 1.5Mtpa operation, the preferred BASE case road transport option has a net present cost in the order of $100m less than the lowest-cost option (options 11-13) for transporting the products by rail, after taking into account the higher costs of the road transport externalities.

Notwithstanding this, Gunlake requested a number of separate sensitivities to be run through the model. Indicatively, the model showed that the rail only case could not be materially improved by splitting the task between road and rail, as the rail infrastructure (and hence capital) requirements for a 1.5Mtpa operation and 1.0Mtpa operation are very similar.

Hatch is not in a position to comment on how an additional $100m in Net Present Costs of transport would exactly affect the overall Quarry Extension Project Economics; however it is assumed this would be significant. It should also be noted that the Net Present Cost analysis does not take into account the feasibility of raising the additional capital required for the rail operations.

Appendix A
General Arrangement Quarry Spur

Rail Route A was selected for costing due to lowest cost.

Rail Routes B & C are shorter in length, however due to the terrain, earthworks are extensively more.

Brayton

Canyonleigh Rd.

Carrick Rd.

Rail Route A (7.5km)

Proposed Load Out Facility and Sediment Basin

Rail Route B (6.2km)

Rail Route C (6.2km)

Gunlake Quarry

Brayton Rd.

Lynwood Quarry Additional Proposed Extraction Area

3 x 1 in 16 turnouts

Lynwood Quarry

Lynwood Quarry Load Out Facility

Railway (Macarthur to Albury)

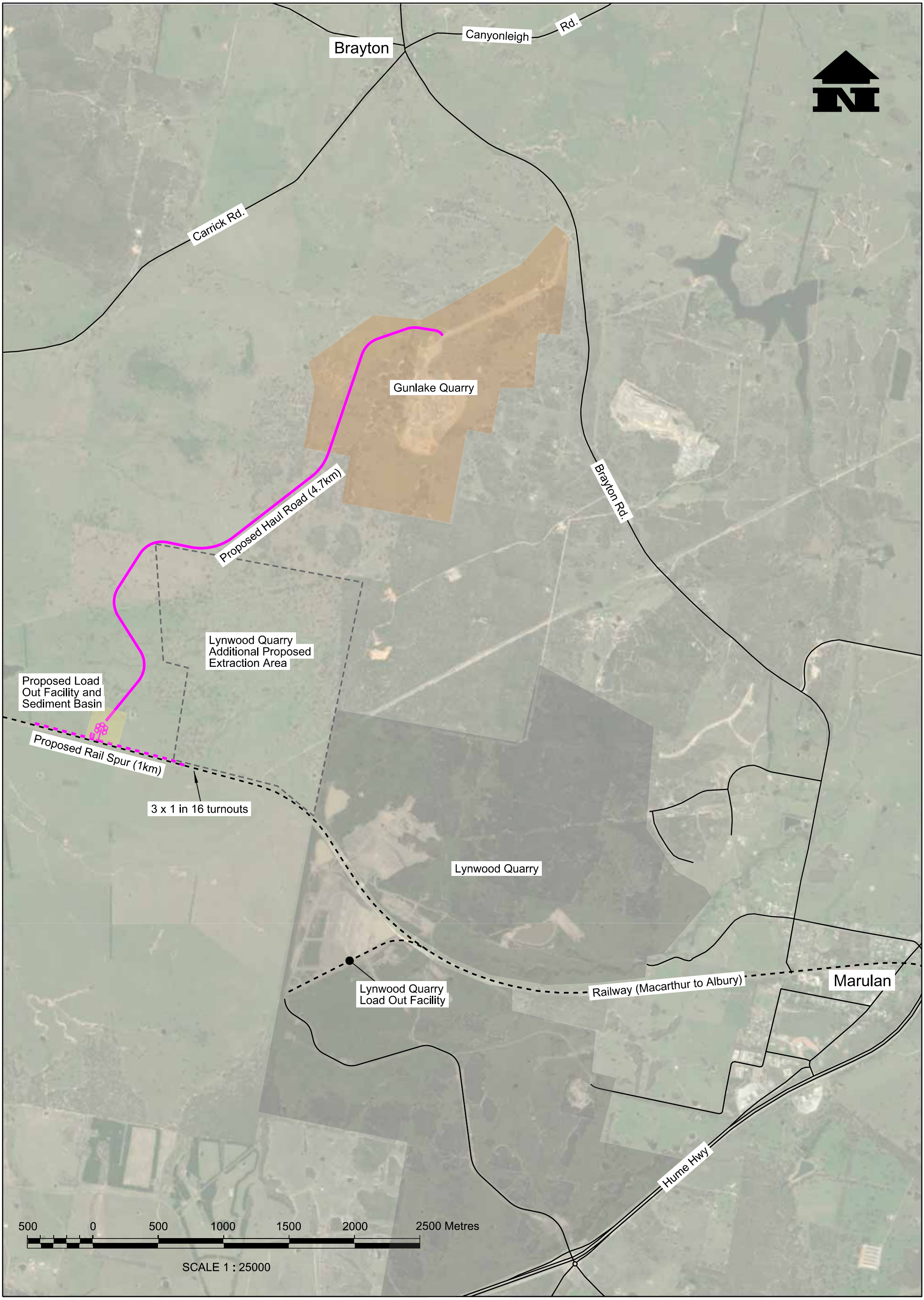
Marulan

Hume Hwy

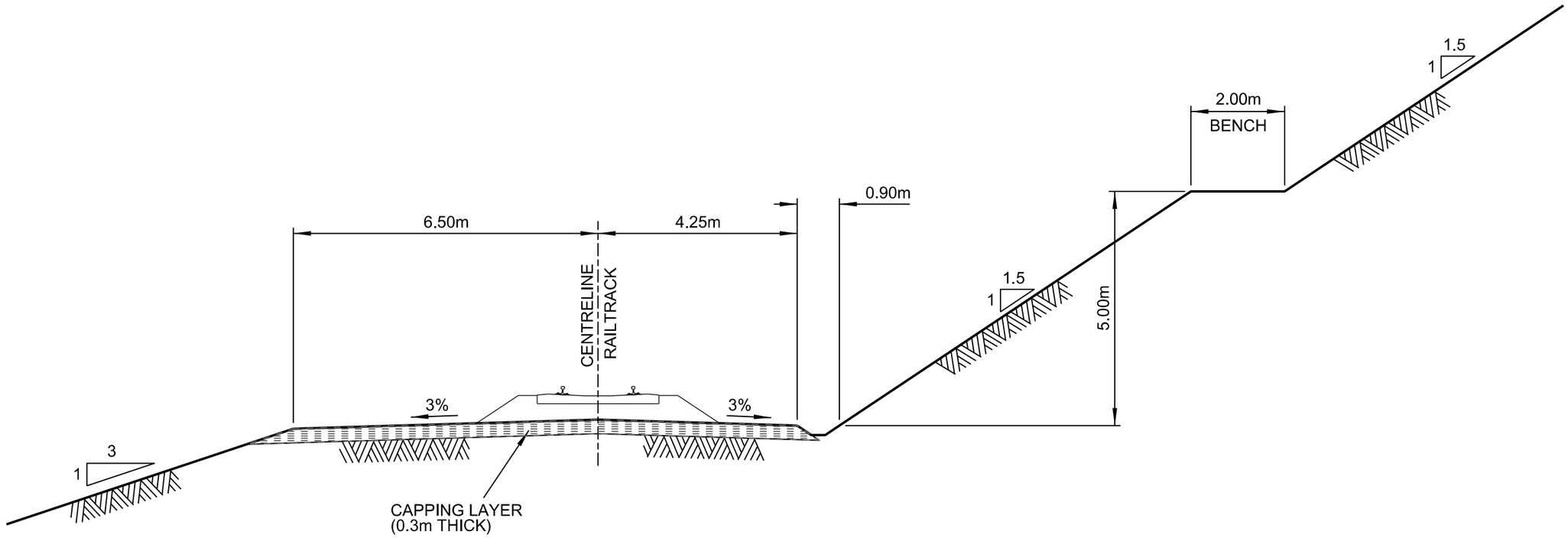
500 0 500 1000 1500 2000 2500 Metres

SCALE 1 : 25000

OPTION 5 - RAIL TO GUNLAKE QUARRY

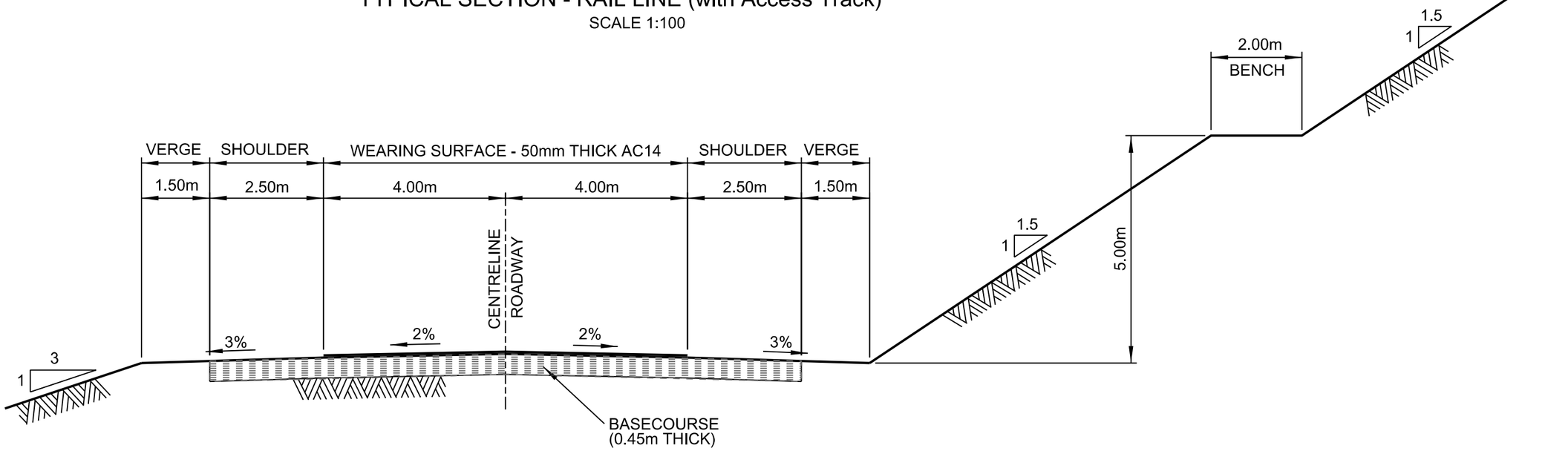


OPTION 7 - HAUL ROAD TO MAINLINE LOAD OUT FACILITY



TYPICAL SECTION - RAIL LINE (with Access Track)

SCALE 1:100



TYPICAL SECTION - ACCESS and HAUL ROADS

SCALE 1:100

2 1 0 2 4 6 8 10 Metres

SCALE 1 : 100

TRANSPORT CORRIDOR - TYPICAL SECTIONS

Appendix B
General Arrangement Quarry Side Haul Roads

Brayton

Canyonleigh Rd.

Carrick Rd.

Earthworks are very similar between options 4A & B, both require a bridge of the mainline.
Major differences between the options is the access through two different land owners, purchase prices of land $/ac is the same, however land size is different A being larger.

Gunlake Quarry

Brayton Rd.

Lynwood Quarry Additional Proposed Extraction Area

Option 4B - Proposed Haul Road (6.6km).

Proposed Rail Overpass (18m Long)

Lynwood Quarry

Option 4A - Proposed Haul Road (7.1km)

Lynwood Quarry Load Out Facility

Railway (Macarthur to Albury)

Marulan

Existing Access Track

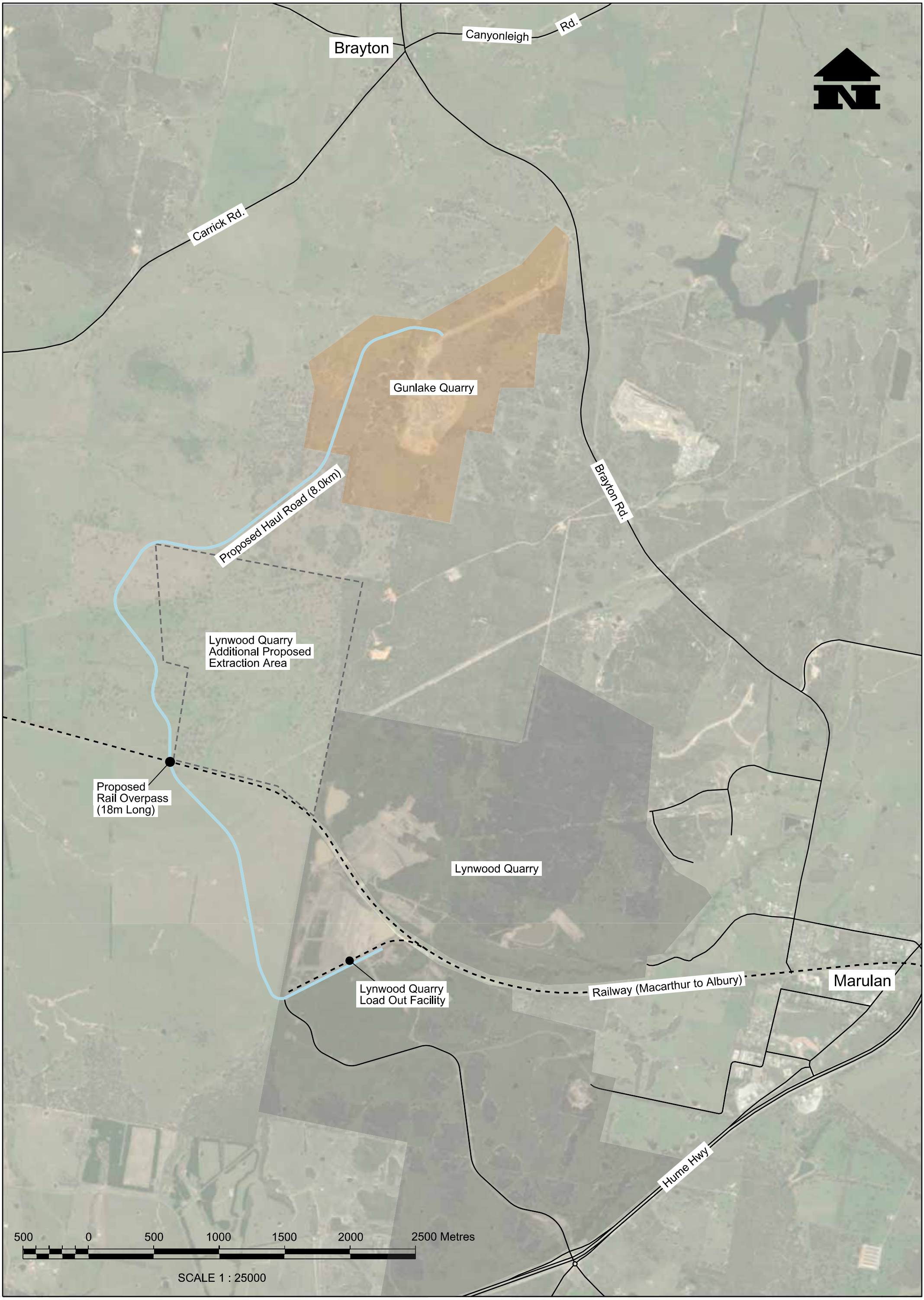
Option 4A (3.5km)
Option 4B (2.1km)

Hume Hwy

500 0 500 1000 1500 2000 2500 Metres

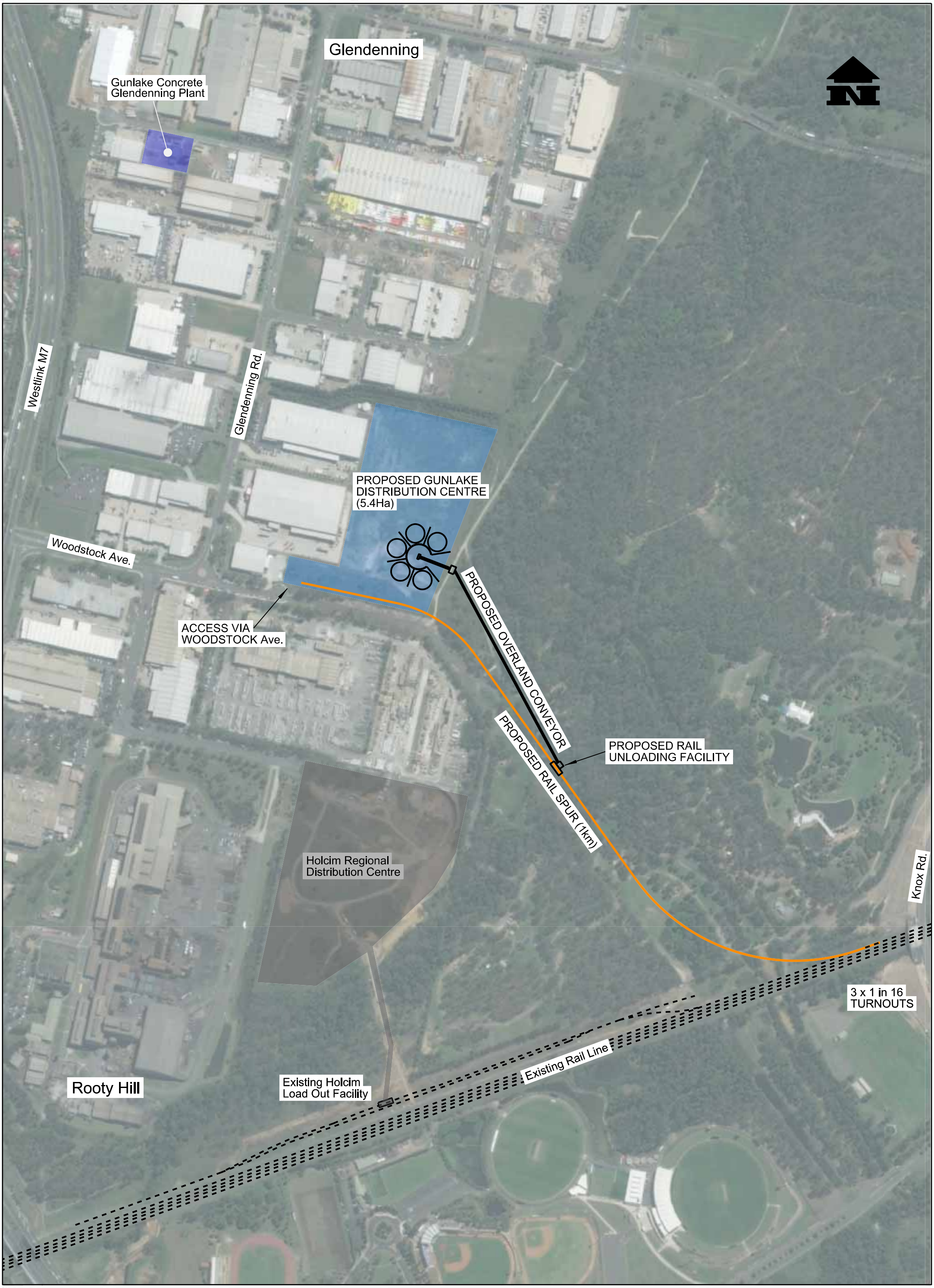
SCALE 1 : 25000

OPTION 4 - HAUL ROAD TO HUME HIGHWAY



OPTION 6 - HAUL ROAD TO LYNWOOD LOAD OUT FACILITY

Appendix C
General Arrangement Sydney side Spur



GLENDENNING UNLOADING FACILITY OPTION 1

GLENDENNING UNLOADING FACILITY OPTION 2

200 100 0 200 400 600 800 1000 Metres

SCALE 1 : 10000

SILVERWATER UNLOADING FACILITY

11.9km to Gunlake Concrete Smeaton Grange Plant

OPTION 1 ACCESS ROAD.
UPGRADE EXISTING ROAD (1.1km)

OPTION 1 & 2.
RAIL UNLOADING STATION
BUILT ON EXISTING SOUTHERN
TRACK

OPTION 2 ACCESS ROAD.
UPGRADE EXISTING ROAD (1.6km).
NEW ROAD (60m).

OPTION 1
PROPOSED
DISTRIBUTION
CENTRE (10.7Ha)

OPTION 2.
PROPOSED NEW RAIL TRACK (320m).
EXISTING TURNOUT TO BE
REFURBISHED & RELOCATED.

OPTION 2
PROPOSED
DISTRIBUTION
CENTRE (11.9Ha)

Existing Rail Line (Macarthur to Albury)

OPTION 3.
NEW 1 in 12
TURNOUT

OPTION 3 ACCESS ROAD.
UPGRADE EXISTING ROAD (2.3km).

OPTION 4.
NEW 1 in 12
TURNOUT

OPTION 4 ACCESS ROAD.
UPGRADE GLENLEE ROAD (1km).
UPGRADE HUME HIGHWAY OVERPASS (80m).

Nepean River

OPTION 3
PROPOSED
DISTRIBUTION
CENTRE (13.8Ha)

Glenlee Road

OPTION 4
NEW ACCESS
ROAD (0.5km).

OPTION 3.
PROPOSED NEW
RAIL TRACK (1km)

OPTION 4
PROPOSED
DISTRIBUTION
CENTRE (11.6Ha)

Hume Highway

10.6km to Gunlake Concrete
Smeaton Grange Plant

OPTION 4.
PROPOSED NEW
RAIL TRACK (1km)

Menangle Road

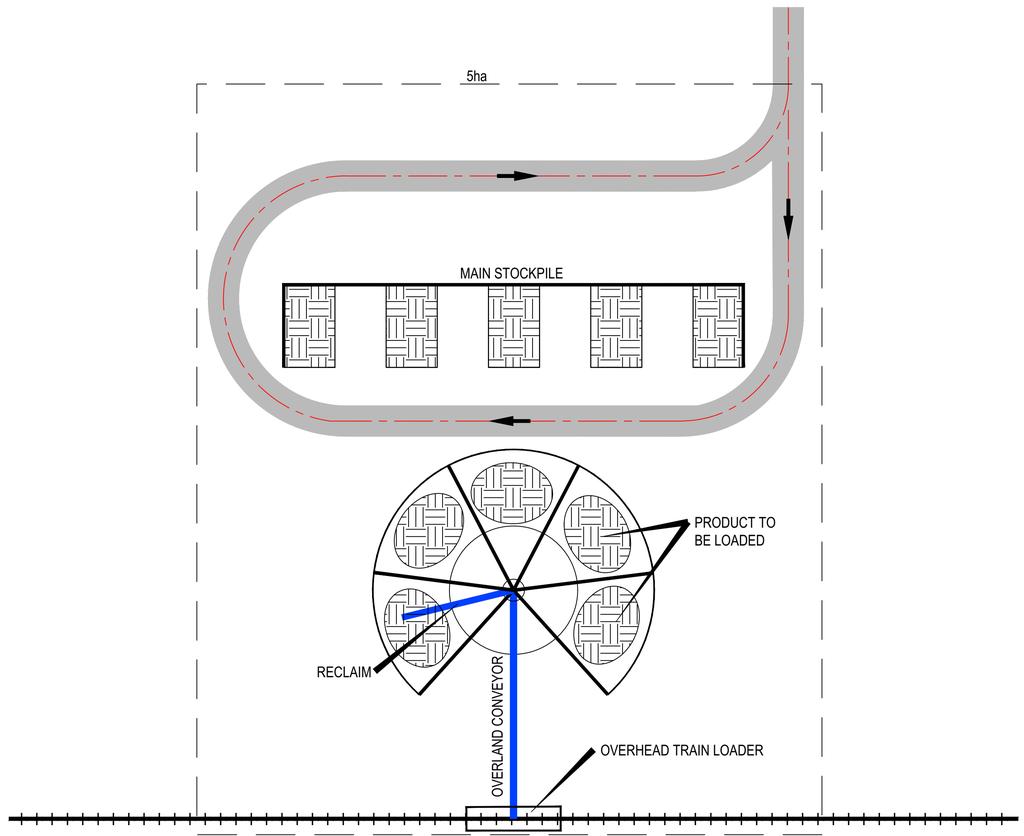
Menangle Park

200 100 0 200 400 600 800 1000 Metres

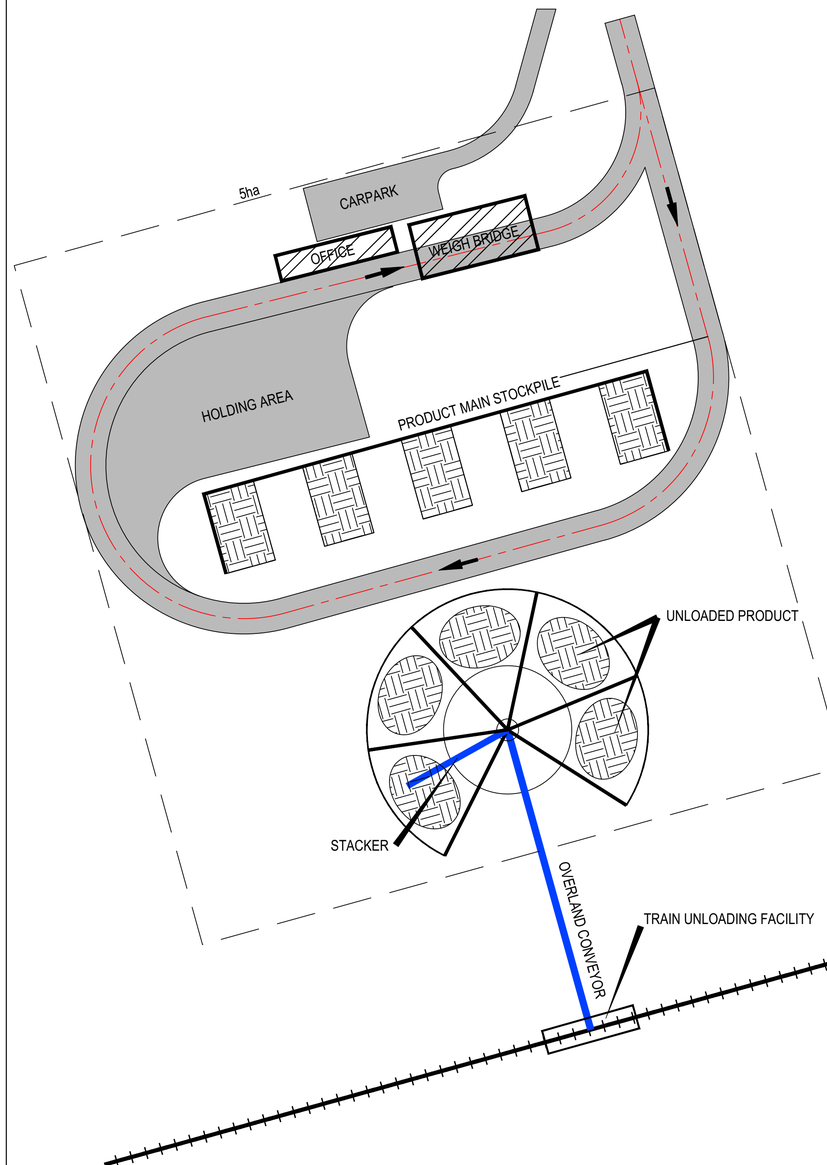
SCALE 1 : 10000

bing

SMEATON GRANGE UNLOADING FACILITY
OPTIONS 1, 2, 3 & 4



TYPICAL LOADING ARRANGEMENT



TYPICAL UNLOADING ARRANGEMENT

GLENDENNING LOADING AND UNLOADING TYPICAL ARRANGEMENTS

Appendix D
Capital Costing

Rail and Road

Gunlakes Quary Project - Haul Road Options P50 Costings

		Gunlake Quarry Site Road Options					
		HR Option 4a	HR Option 4b	HR Option 6	HR Option 7	HR Option 1 & 2	HR Option 3
		Yellow to Hume Hwy Option 4 (Property 1)	Yellow to Hume Hwy Option 4 (Property 2)	Blue to Holcim Siding Option 6	Purple to Short Spur 1 Option 7	Red / Green to Brayton Road Option 1 & 2	Orange to Hume Hwy Option 3
Item	Description	HR Option 4a	HR Option 4b	HR Option 6	HR Option 7	HR Option 1 & 2	HR Option 3
	Gunlake Haul Road						
	Route Length (m)	7,100	6,600	8,000	4,700	4,100	30,000
	Road Width (m)	9	9	9	9	9	9
11000.00	L6 - Project Wide Support						
11010.00	Traffic Management (other than local roads)	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
11020.00	Temporary Fencing	$ -	$ -	$ -	$ -	$ -	$ -
11030.00	Early Site Works						
	Project Wide Support	**$ 10,000**	**$ 10,000**	**$ 10,000**	**$ 10,000**	**$ 10,000**	**$ 10,000**
11099.00	L6 - RM Costs						
11600.00	Stakeholder compensation	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000
11400.00	Protection Officers	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Note	Other RM costs in overheads (staffing etc)						
	Rail Manager Costs	**$ 7,000**	**$ 7,000**	**$ 7,000**	**$ 7,000**	**$ 7,000**	**$ 7,000**
12000.00	L6 - Design						
12010.00	Design	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
21100.00	Geotechnical investigation	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000
	Design	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**
14000.00	L7 - Utilities						
14010.00	Services Locating	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14100.00	Power Relocations	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14200.00	Water Relocations	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14300.00	Sewer Relocations	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14250.00	Stormwater Relocations	$ -	$ -	$ -	$ -	$ -	$ -
14400.00	Comms Relocations	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14500.00	Gas Relocations	$ -	$ -	$ -	$ -	$ -	$ -
14550.00	RM Services in corridor	$ -	$ -	$ -	$ -	$ -	$ -
	Enabling Works	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**
	Haul Road	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
15100.00	Haul Road Alignment						
15105.00	Provision for Traffic (% allowance)	$ -	$ -	$ -	$ -	$ -	$ 195,745
20001.00	L7 - Clear & Grub and Preparation						
20010.00	Clear & Grub	$ 105,435	$ 98,010	$ 118,800	$ 69,795	$ 60,885	$ 202,500
20020.00	Strip & Stockpile Topsoil	$ 57,975	$ 53,892	$ 65,324	$ 38,378	$ 33,479	$ 111,348
20050.00	Demolition of Existing Works	$ -	$ -	$ -	$ -	$ -	$ -
20300.00	Misc works including Environmental for Construction Works	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
	Clear & Grub and Preparation	**$ 178,410**	**$ 166,902**	**$ 199,124**	**$ 123,173**	**$ 109,364**	**$ 524,593**
15110.00	Total General Earthworks	$ 621,012	$ 577,279	$ 699,732	$ 411,093	$ 358,613	$ 1,574,397
22250.00	Construction Water	$ 1,500	$ 1,500	$ 1,000	$ 1,000	$ 1,000	$ 1,500
	RSS wall	$ -	$ -	$ -	$ -	$ -	$ -
15111.00	Demolition	$ -	$ -	$ -	$ -	$ -	$ -
15115.00	Unbound Pavements	$ 5,859,630	$ 5,446,980	$ 6,602,400	$ 3,878,910	$ 3,383,730	$ 2,475,900
15121.00	Concrete Pavements	$ -	$ -	$ -	$ -	$ -	$ -
	Box Culverts						
	Small RCBC (eg. 600 x 300 to 1500 x 1200)	$ -	$ -	$ -	$ -	$ -	$ -
	Medium RCBC (eg. 1800 x 1200 to 2400 x 2100)	$ -	$ -	$ -	$ -	$ -	$ -
	Large RCBC (eg. 3000 x 2100 to 4800 x 2400)	$ -	$ -	$ -	$ -	$ -	$ -
	Pipe Culverts						
	Small RCP (eg. 450 mm to 900 mm dia)	$ 306,720	$ 285,120	$ 345,600	$ 203,040	$ 177,120	$ 1,296,000
	Medium RCP (eg. 1050 mm to 1650 mm dia)	$ -	$ -	$ -	$ -	$ -	$ -
	Large RCP (eg. 1800 mm to 2100 mm dia)	$ -	$ -	$ -	$ -	$ -	$ -
15135.00	Sprayed Bituminous Surfacing - Council Road & Main Roads	$ 581,490	$ 540,540	$ 655,200	$ 384,930	$ 335,790	$ 2,457,000
15145.00	Road Furniture	$ -	$ -	$ -	$ -	$ -	$ -
15155.00	Pavement Marking	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 25,000
15156.00	Landscaping	$ -	$ -	$ -	$ -	$ -	$ -
15170.00	Road Lighting	$ -	$ -	$ -	$ -	$ -	$ -
	Boundary Fencing	$ 568,000	$ 528,000	$ 640,000	$ 376,000	$ 328,000	$ -
	Other Misc Road Realignment	$ -	$ -	$ -	$ -	$ -	$ -
	Haul Road 1 Alignment	**$ 7,943,352**	**$ 7,384,419**	**$ 8,948,932**	**$ 5,259,973**	**$ 4,589,253**	**$ 7,829,797**
	Total Roads	**$ 8,121,762**	**$ 7,551,321**	**$ 9,148,056**	**$ 5,383,145**	**$ 4,698,616**	**$ 8,354,390**
	Bridge 1						
	Earthworks	$ 800,000	$ 800,000	$ 800,000			
2652.00	Bridge abutment protection Type 2 - Abutment A	$ 325,000	$ 325,000	$ 325,000	$ -	$ 25,000	$ -
2652.00	Bridge abutment protection Type 2 - Abutment B	$ 325,000	$ 325,000	$ 325,000	$ -	$ 25,000	$ -
	Bridge Deck Area (total length x width)	$ 1,800,000	$ 1,800,000	$ 1,800,000	$ -	$ 900,000	$ -
	Other Misc Bridge	$ 1,125,000	$ 1,125,000	$ 1,125,000	$ -	$ 75,000	$ -
	Rail Bridge 1	**$ 4,375,000**	**$ 4,375,000**	**$ 4,375,000**	**$ -**	**$ 1,025,000**	**$ -**
	Bridge 2						
2652.00	Bridge abutment protection Type 2 - Abutment A	$ -	$ -	$ -	$ -	$ 25,000	$ -
2652.00	Bridge abutment protection Type 2 - Abutment B	$ -	$ -	$ -	$ -	$ 25,000	$ -
	Bridge Deck Area (total length x width)	$ -	$ -	$ -	$ -	$ 900,000	$ -
	Other Misc Bridge	$ -	$ -	$ -	$ -	$ 75,000	$ -
	Rail Bridge 2	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,025,000**	**$ -**
	Bridges	**$ 4,375,000**	**$ 4,375,000**	**$ 4,375,000**	**$ -**	**$ 2,050,000**	**$ -**
-	**Total Structures**	**$ 4,375,000**	**$ 4,375,000**	**$ 4,375,000**	**$ -**	**$ 2,050,000**	**$ -**
80040.00	Final Cleanup & Handover	$ -	$ -	$ -	$ -	$ -	$ -
80050.00	**Final Commissioning**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
#TOT	**Total for project**	**$ 12,563,762**	**$ 11,993,321**	**$ 13,590,056**	**$ 5,450,145**	**$ 6,815,616**	**$ 8,421,390**
10%	Design & Approvals	1,256,376	1,199,332	1,359,006	545,015	681,562	842,139
15%	Preliminaries & Supervision	1,884,564	1,798,998	2,038,508	817,522	1,022,342	1,263,208
20%	Contractor's Margin	2,512,752	2,398,664	2,718,011	1,090,029	1,363,123	1,684,278
20%	Contingency	2,512,752	2,398,664	2,718,011	1,090,029	1,363,123	1,684,278
12.5%	Escalation (during construction)	1,570,470	1,499,165	1,698,757	681,268	851,952	1,052,674
	Total	**$ 22,300,678**	**$ 21,288,145**	**$ 24,122,350**	**$ 9,674,008**	**$ 12,097,719**	**$ 14,947,967**

Gunlakes Quary Project - Rail Options P50 Costings

		Glendenning Options		Smeaton Rail Options		Silver-water Rail Options	Gunlake Quarry Site Rail Options		
		Option 1	Option 2	Option 3 & 4	Option 1 & 2	Option 6	Option 5	Option 7	Option 6
		Single 1km siding without runaround Option 1	Holcim siding Option 2	Glenlee 1km siding without runaround	Glenlee existing rail siding	Push / Pull Dead end siding	Long Push Pull Option 5	Short 1 Along Mainline Option 7	Short 2 Next to Holcim Spur Option 6
		GlenD1	GLenD2	Smea3&4	Smea1&2	Silver6	GQ5	GQ7	GQ6
Item	Description	GlenD1	GLenD2	Smea3&4	Smea1&2	Silver6	GQ5	GQ7	GQ6
	Gunlake Rail Siding								
	Route Length (m)	1,000	200	1,000	1,500	2,500	7,500	1,000	1,000
11000.00	L6 - Project Wide Support								
11010.00	Traffic Management (other than local roads)	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000
11020.00	Temporary Fencing	$ 110,295	$ -	$ 110,295	$ -	$ 275,738	$ 827,213	$ 110,295	$ 110,295
11030.00	Early Site Works								
	Project Wide Support	**$ 130,295**	**$ 20,000**	**$ 130,295**	**$ 20,000**	**$ 295,738**	**$ 847,213**	**$ 130,295**	**$ 130,295**
11099.00	L6 - RM Costs								
11600.00	Stakeholder compensation	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000
11400.00	Possessions & Track Protection Officers	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000
Note	Other RM costs in overheads (staffing etc)								
	Rail Manager Costs	**$ 22,000**	**$ 22,000**	**$ 22,000**	**$ 22,000**	**$ 22,000**	**$ 22,000**	**$ 22,000**	**$ 22,000**
12000.00	L6 - Design								
12010.00	Design	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000
21100.00	Geotechnical investigation	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000
	Design	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**
14000.00	L7 - Utilities								
14010.00	Services Locating	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14100.00	Power Relocations	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14200.00	Water Relocations	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14300.00	Sewer Relocations	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14250.00	Stormwater Relocations	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
14400.00	Comms Relocations	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
14500.00	Gas Relocations	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
14550.00	RM Services in corridor	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Enabling Works	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**	**$ 25,000**
20000.00	L6 - Rail Civil Works								
20001.00	L7 - Clear & Grub and Preparation								
20010.00	Clear & Grub	$ 37,500	$ 3,000	$ 37,500	$ -	$ 56,250	$ 281,250	$ 37,500	$ 37,500
20020.00	Strip & Stockpile Topsoil	$ 20,620	$ 1,650	$ 20,620	$ -	$ 30,930	$ 154,650	$ 20,620	$ 20,620
20050.00	Demolition of Existing Works	$ -	$ -	$ -	$ 200,000	$ 200,000	$ -	$ -	$ -
20300.00	Misc works including Environmental for Construction Works	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000
	Clear & Grub and Preparation	**$ 83,120**	**$ 29,650**	**$ 83,120**	**$ 225,000**	**$ 312,180**	**$ 460,900**	**$ 83,120**	**$ 83,120**
21000.00	L7 - Access Works								
21010.00	Access/Haul Road Development	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
21050.00	Rail Corridor Boundary Fencing	$ 203,600	$ -	$ 203,600	$ -	$ 152,700	$ 1,527,000	$ 101,800	$ 203,600
21200.00	Misc Xings etc								
21150.00	Local Roads (Haul Routes) Maintenance	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Access Works	**$ 203,600**	**$ -**	**$ 203,600**	**$ -**	**$ 152,700**	**$ 1,527,000**	**$ 101,800**	**$ 203,600**
22000.00	L7 - Earthworks								
22010.00	Total Cut (including cut to spoil)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
22020.00	Total Fill	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Less Capping Layer Allowance	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Total Earthworks	$ 621,984	$ 707	$ 621,984	$ -	$ 313,643	$ 56,797,741	$ 1,379,144	$ 887,034
22025.00	OVM Supply & Placement (Extra Over)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
22210.00	Removal and replacement of unsuitable material at base of embankments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
22211.00	Geotextile fabic under embankments	$ 5,050	$ 1,010	$ 5,050	$ -	$ 12,625	$ 37,875	$ 5,050	$ 5,050
22212.00	Levee bank	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
22240.00	Earthworks testing requirements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
22250.00	Construction Water	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 4,000	$ 1,000	$ 1,000
22260.00	Extra Over for lime stabilisation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Earthworks	**$ 628,034**	**$ 2,717**	**$ 628,034**	**$ 1,000**	**$ 327,268**	**$ 56,839,616**	**$ 1,385,194**	**$ 893,084**
23000.00	L7 - Final Forming								
23010.00	Capping layer (top 600 material) including final forming	$ 1,470,000	$ 294,000	$ 1,470,000	$ -	$ 1,837,500	$ 11,025,000	$ 1,470,000	$ 1,470,000
23030.00	Topsoil & haymulching	$ 65,375	$ 5,230	$ 65,375	$ -	$ 98,063	$ 490,313	$ 65,375	$ 65,375
	Final Forming	**$ 1,535,375**	**$ 299,230**	**$ 1,535,375**	**$ -**	**$ 1,935,563**	**$ 11,515,313**	**$ 1,535,375**	**$ 1,535,375**
24000.00	L7 - Slope Protection								
	Retaining wall Rail works	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
25000.00	L7 - Drainage								
25001.00	Box Culverts								
25002.00	Small RCBC (eg. 600 x 300 to 1500 x 1200)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
25002.00	Medium RCBC (eg. 1800 x 1200 to 2400 x 2100)	$ -	$ -	$ -	$ -	$ -	$ 510,000	$ -	$ -
25002.00	Large RCBC (eg. 3000 x 2100 to 4800 x 2400)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
25030.00	Pipe Culverts								
	Small RCP (eg. 450 mm to 900 mm dia)	$ 120,000	$ -	$ 120,000	$ -	$ 120,000	$ 400,000	$ 120,000	$ 120,000
	Medium RCP (eg. 1050 mm to 1650 mm dia)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Large RCP (eg. 1800 mm to 2100 mm dia)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Drainage	**$ 120,000**	**$ -**	**$ 120,000**	**$ -**	**$ 120,000**	**$ 910,000**	**$ 120,000**	**$ 120,000**
	Total Rail Civil Works	**$ 2,570,129**	**$ 331,596**	**$ 2,570,129**	**$ 226,000**	**$ 2,847,710**	**$ 71,252,829**	**$ 3,225,489**	**$ 2,835,179**
30000.00	Track								
30001.00	Trackwork (Mainline)								
30010.00	Trackwork material supply and delivery (Track CL length)	$ 564,500	$ 112,900	$ 564,500	$ 846,750	$ 1,637,050	$ 4,233,750	$ 564,500	$ 564,500
30011.00	Supply of ballast material	$ 173,090	$ 34,618	$ 173,090	$ 259,635	$ 501,961	$ 1,298,175	$ 173,090	$ 173,090
30020.00	Site Mobilisation - Demobilisation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
30030.00	Site Management	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Construct rail track	$ 211,080	$ 42,216	$ 211,080	$ 316,620	$ 612,132	$ 1,583,100	$ 211,080	$ 211,080
	Temporary Works								
	Enabling Works								
30060.00	Track Commissioning								
	Trackwork (Mainline)	**$ 948,670**	**$ 189,734**	**$ 948,670**	**$ 1,423,005**	**$ 2,751,143**	**$ 7,115,025**	**$ 948,670**	**$ 948,670**
30070.00	Turnouts - 1 in 7	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
30070.00	Turnouts - 1 in 8	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
30070.00	Turnouts - 1 in 10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
30070.00	Turnouts - 1 in 12	$ 400,000	$ 400,000	$ 800,000	$ -	$ 400,000	$ 400,000	$ 400,000	$ 400,000
30070.00	Turnouts - 1 in 16	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
30075.00	Monumenting	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
30080.00	Enabling Works / Construct Temporary Turnouts	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
30090.00	Other Project Specific Items	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
30140.00	Wet Weather Allowance - Track	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Other Misc Track	$ 1,066,086	$ 1,066,086	$ 1,066,086	$ 1,066,086	$ -	$ 1,066,086	$ 1,066,086	$ 1,066,086
	Other Trackwork	**$ 1,466,086**	**$ 1,466,086**	**$ 1,866,086**	**$ 1,066,086**	**$ 400,000**	**$ 1,466,086**	**$ 1,466,086**	**$ 1,466,086**
	Total: Track	**$ 2,414,756**	**$ 1,655,820**	**$ 2,814,756**	**$ 2,489,091**	**$ 3,151,143**	**$ 8,581,111**	**$ 2,414,756**	**$ 2,414,756**
55000.00	L6 - Signalling and Communications								
	Signalling and Communications design	150,000	130,000	150,000	162,500	62,500	312,500	150,000	150,000
	New Equipment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Modifications	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Level Crossings - New Equipment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Communication Systems and Requirements	$ 100,000	$ 20,000	$ 100,000	$ 150,000	$ 250,000	$ 750,000	$ 100,000	$ 100,000
	Power Supply and Distribution	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Miscellaneous	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ -	$ 500,000	$ 500,000	$ 500,000
	Total Signalling and Communications	**$ 750,000**	**$ 650,000**	**$ 750,000**	**$ 812,500**	**$ 312,500**	**$ 1,562,500**	**$ 750,000**	**$ 750,000**
#TOT	**Total for project**	**$ 5,937,180**	**$ 2,729,416**	**$ 6,337,180**	**$ 3,619,591**	**$ 6,679,091**	**$ 82,315,652**	**$ 6,592,539**	**$ 6,202,230**
10%	Design & Approvals	593,718	272,942	633,718	361,959	667,909	8,231,565	659,254	620,223
15%	Preliminaries & Supervision	890,577	409,412	950,577	542,939	1,001,864	12,347,348	988,881	930,334
20%	Contractors Margin	1,187,436	545,883	1,267,436	723,918	1,335,818	16,463,130	1,318,508	1,240,446
20%	Contingency	1,187,436	545,883	1,267,436	723,918	1,335,818	16,463,130	1,318,508	1,240,446
12.5%	Escalation (during construction)	742,147	341,177	792,147	452,449	834,886	10,289,457	824,067	775,279
	Total OUTTURN	**$ 10,538,494**	**$ 4,844,714**	**$ 11,248,494**	**$ 6,424,774**	**$ 11,855,386**	**$ 146,110,282**	**$ 11,701,757**	**$ 11,008,958**

Material Handling

Gunlake Quarry: Installed Cost Estimate

CAPEX Area	Estimate Description	Detail	Qty	Unit	Total $A	Unit Cost $A	OoM OPEX per Year 95$/h+equip	Operating 0.14$/kWh	95$/h+equip
Outloading Options									
Glendenning, Option 1									
	Dump Station	Incl. belt feeder	1	No.	$155,000	$155,000	$144,245	$1,400	$145,645
	Transfer Point	Simple	2	No.	$29,000	$14,500			
	Transfer Point	Stacker	1	No.	$35,500	$35,500			
	Conveyor	1m, Grade	300	m	$900,000	$3,000	$154,284	$7,560	$161,844
	Conveyor	1m, Below Grade	50	m	$300,000	$6,000	$144,245	$4,200	$148,445
	Conveyor	1m, Inclined	100	m	$350,000	$3,500	$144,773	$2,100	$146,873
	Stacker	Radial	1	No.	$175,000	$175,000	$180,966	$3,150	$184,116
					$1,944,500				**$786,922**
Glendenning, Option 2									
	Dump Station	Incl. belt feeder	1	No.	$155,000	$155,000	$144,245	$1,400	$145,645
	Transfer Point	Simple	3	No.	$43,500	$14,500			
	Transfer Point	Stacker	1	No.	$35,500	$35,500			
	Conveyor	1m, Grade	200	m	$600,000	$3,000	$154,284	$7,560	$161,844
	Conveyor	1m, Grade	600	m	$1,800,000	$3,000	$149,000	$9,520	$158,520
	Conveyor	1m, Below Grade	50	m	$300,000	$6,000	$144,245	$4,200	$148,445
	Conveyor	1m, Inclined	100	m	$350,000	$3,500	$144,773	$2,100	$146,873
	Stacker	Radial	1	No.	$175,000	$175,000	$180,966	$3,150	$184,116
					$3,459,000				**$945,442**
Silverwater									
	Dump Station	Incl. belt feeder	1	No.	$155,000	$155,000	$144,245	$1,400	$145,645
	Transfer Point	Simple	1	No.	$14,500	$14,500			
	Transfer Point	Stacker	1	No.	$35,500	$35,500			
	Conveyor	1m, Below Grade	50	m	$300,000	$6,000	$144,245	$4,200	$148,445
	Conveyor	1m, Inclined	100	m	$350,000	$3,500	$144,773	$2,100	$146,873
	Stacker	Radial	1	No.	$175,000	$175,000	$180,966	$3,150	$184,116
					$1,030,000				**$625,079**
Smeaton, Option 1									
	Dump Station	Incl. belt feeder	1	No.	$155,000	$155,000	$144,245	$1,400	$145,645
	Transfer Point	Simple	1	No.	$14,500	$14,500			
	Transfer Point	Stacker	1	No.	$35,500	$35,500			
	Conveyor	1m, Below Grade	50	m	$300,000	$6,000	$144,245	$4,200	$148,445
	Conveyor	1m, Inclined	200	m	$700,000	$3,500	$145,830	$6,440	$152,270
	Stacker	Radial	1	No.	$175,000	$175,000	$180,966	$3,150	$184,116
					$1,380,000				**$630,475**
Smeaton, Option 2									
	Dump Station	Incl. belt feeder	1	No.	$155,000	$155,000	$144,245	$1,400	$282,145
	Transfer Point	Simple	2	No.	$29,000	$14,500			
	Transfer Point	Stacker	1	No.	$35,500	$35,500			
	Conveyor	1m, Grade	300	m	$900,000	$3,000	$154,284	$7,560	$161,844
	Conveyor	1m, Below Grade	50	m	$300,000	$6,000	$144,245	$4,200	$148,445
	Conveyor	1m, Inclined	200	m	$700,000	$3,500	$145,830	$6,440	$152,270
	Stacker	Radial	1	No.	$175,000	$175,000	$180,966	$3,150	$184,116
					$2,294,500				**$928,819**
Smeaton, Option 3									
	Dump Station	Incl. belt feeder	1	No.	$155,000	$155,000	$144,245	$1,400	$282,145
	Transfer Point	Simple	1	No.	$14,500	$14,500			
	Transfer Point	Stacker	1	No.	$35,500	$35,500			
	Conveyor	1m, Below Grade	50	m	$300,000	$6,000	$144,245	$4,200	$148,445
	Conveyor	1m, Inclined	200	m	$700,000	$3,500	$145,830	$6,440	$152,270
	Stacker	Radial	1	No.	$175,000	$175,000	$180,966	$3,150	$184,116
					$1,380,000				**$766,975**
Smeaton, Option 4									
	Dump Station	Incl. belt feeder	1	No.	$155,000	$155,000	$144,245	$1,400	$282,145
	Transfer Point	Simple	1	No.	$14,500	$14,500			
	Transfer Point	Stacker	1	No.	$35,500	$35,500			
	Conveyor	1m, Below Grade	50	m	$300,000	$6,000	$144,245	$4,200	$148,445
	Conveyor	1m, Inclined	200	m	$700,000	$3,500	$145,830	$6,440	$152,270
	Stacker	Radial	1	No.	$175,000	$175,000	$180,966	$3,150	$184,116
					$1,380,000				**$766,975**
Inloading									
Gunlake Quarry, NSW									
	Loadout Hopper		1	No.	$120,000	$120,000	$95,106	$1,400	$96,506
	Conveyor	1m, Elevated	100	m	$450,000	$4,500	$144,773	$2,100	$146,873
	Conveyor	1m, Elevated	100	m	$450,000	$4,500	$144,773	$2,100	$146,873
	Conveyor	1m, Inclined	400	m	$1,400,000	$3,500	$156,397	$14,840	$171,237
	Transfer Point	Simple	1	No.	$14,500	$14,500			
	Transfer Point	Reclaimer	1	No.	$35,500	$35,500			
	Reclaimer	Radial	1	No.	$225,000	$225,000	$180,966	$3,150	$184,116
					$2,695,000				**$745,606**

Incl. All Conveyors Cladded, Structures, Civils, Excavations, Footings, Construction Plant & Equipment, Drives, Gearboxes, Dust Suppression, Electrical & Instrumentation

Appendix F

Road options assessment

Gunlake Quarry Extension Project

Road Options Assessment

Prepared for Gunlake Quarries Pty Ltd | 22 September 2016

Gunlake Quarry Extension Project

Road options assessment

Prepared for Gunlake Quarries Pty Ltd | 22 September 2016

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

T +61 2 9493 9500
F +61 2 9493 9599
E info@emmconsulting.com.au

www.emmconsulting.com.au

Gunlake Quarry Extension Project

Final

Report J14119RP17 | Prepared for Gunlake Quarries Pty Ltd | 22 September 2016

Approved by	**P. Towler**
Position	Associate Director
Signature	
Date	22 September 2016

Document Control

Version	Date	Prepared by	Reviewed by
V1	20/9/2016	P. Towler	N. Armit
V2	22/9/2016	P. Towler	-

T +61 (0)2 9493 9500 | F +61 (0)2 9493 9599

Ground Floor | Suite 01 | 20 Chandos Street | St Leonards | New South Wales | 2065 | Australia

www.emmconsulting.com.au

Table of contents

Table of contents *(Cont'd)*

Tables

Figures

Photographs

1 Introduction

1.1 Background

Gunlake Quarry is a hard rock quarry operated by Gunlake Quarries Pty Ltd (Gunlake). The quarry currently operates under New South Wales (NSW) Project Approval 07-0074 issued by the Minister for Planning in September 2008 under Part 3A of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). The current approval permits the production of 750,000 tonnes of saleable products per year until 30 September 2038.

The Gunlake Quarry Extension Project (the extension project) seeks to extend the quarry footprint and increase the quarry production rate over 30 years.

Approval for the extension project is being sought under Part 4 of the EP&A Act as a State significant development (SSD) and under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The *Gunlake Quarry Extension Project Environmental Impact Statement* (EIS) (EMM 2016a) was placed on public exhibition for seven weeks from 4 April to 20 May 2016.

Currently, quarry products destined for markets north of the quarry are transported along Brayton Road to the purpose built Bypass Road that connects Brayton Road to Red Hills Road and the northbound lanes of the Hume Highway — this is the 'primary transport route'. Products for markets south of the quarry are transported along Brayton Road, through the northern edge of Marulan to the Brayton Road/George Street/Hume Highway interchange — this is the 'secondary transport route'.

As described in the EIS, it is proposed to transport quarry products along these routes, increasing the number of trucks along the primary transport route with the number of trucks along the secondary transport route remaining the same. The EIS considered the impacts along the secondary transport route. As there would be no additional impacts along the secondary transport route, this *Road Options Assessment* only considers the primary transport route.

1.2 Road and rail transport options assessment

The EIS included a *Transport Options Review* (EMM 2016b, EIS Appendix D) that considered the transport of quarry products by rail and road. It considered four road-only transport options and three rail/road transport options.

A number of submissions made in response to the public exhibition of the EIS requested further assessment of quarry product transport. The following reports provide this additional assessment:

- *Gunlake Quarries Rail Transport Study* (Hatch 2016);
- *Review of Cost Benefit Analysis of Gunlake Quarry Rail Transport Study Prepared by Hatch* (Gillespie Economics 2016a);
- *Stage 5 Road Safety Audit, Transport from Gunlake Quarry Entrance to Hume Highway* (Lyle Marshall & Partners and McLaren Traffic Engineering 2016); and
- this *Road Options Assessment*.

Quarry products will be transported to a range of destinations, however about 1.5 Mtpa will be transported to the Sydney area and the remaining 0.5 Mtpa would need to be transported to destinations that could not be supported by rail. The Hatch (2016) analysis of rail and road options considers the transport of 1.5 Mtpa to allow all of the options to be compared. The costs for transporting 2.0 Mtpa would increase but would be similar for a private haul road and primary transport route so do not affect the comparison of these two options. The other assumptions used for designing and costing the options are provided in Hatch (2016).

The benefit cost assessment of the construction and use of a private haul road found that this is not an economically viable option (Gillespie Economics 2015a). However, given that the difference in net present costs of the 'base case' (use of the primary transport route) and the lowest-cost private haul road was smaller than the difference between the lowest-cost rail options and the base case, the potential environmental and social impacts of the roads options are considered in detail in this *Road Options Assessment*.

1.3 Road-only transport options assessment

The *Transport Options Review* (EMM 2016b, EIS Appendix D) considered the road-only transport options presented in Table 1.1.

Table 1.1 Transport Options Review (EMM 2016b) - road-only transport options

Option	Option description	
1	**Primary transport route** Continue to use Brayton Road (north of Bypass Road), Bypass Road and Red Hills Road as the primary transport route to the northbound lanes of the Hume Highway. **Secondary transport route** Continue to use Brayton Road and George Street as the secondary transport route to other destinations.	These are the transport routes proposed in the EIS and are further assessed in Chapter 3.
2	**Private haul road adjacent to Brayton Road** Construct an alternative dedicated haul route (about 4 km long) on the east side of Brayton Road, north of the Bypass Road.	This option would remove trucks from the 4 km long section of Brayton Road north of Bypass Road close to the quarry entrance. Trucks would need to cross Brayton Road to reach the dedicated haul route. The trucks would continue to use Bypass Road and Red Hills Road to access the Hume Highway. This option would require the acquisition of properties along the east side of Brayton Road. Significant vegetation clearance would be required to construct the dedicated haul route. Traffic noise impacts would be similar to the use of the Brayton Road. This option would result in a range of additional impacts and would not provide significant benefits, so has not been considered further.

Table 1.1 Transport Options Review (EMM 2016b) - road-only transport options

Option	Option description	
3	**Canyonleigh Road route** Use Canyonleigh Road route Brayton Road to the Hume Highway.	This option would require the use of about 30 km of local roads compared to about 8 km of local roads for the primary transport route. Major road upgrades would be required to make this road suitable for trucks. This option would result in a range of additional impacts and would not provide significant benefits, so has not been considered further.
4	**Private haul road through Lynwood Quarry** Construct a new private haul road (about 9 km long) south of Gunlake Quarry, through Lynwood Quarry to the Marulan South Interchange on the Hume Highway.	This option was further developed by Hatch (2016) and is considered in detail in Chapter 2.

Therefore, this *Road Options Assessment* considers:

- the primary transport route (Figure 1.1); and
- a private haul road through Lynwood Quarry (Figure 1.2).

1.4 Private haul road options

The *Gunlake Quarries Rail Transport Study* (Hatch 2016) includes consideration of private haul road options to transport products from Gunlake Quarry to the Marulan South Interchange and onto the Hume Highway. Hatch (2016) considers two haul roads through Lynwood Quarry:

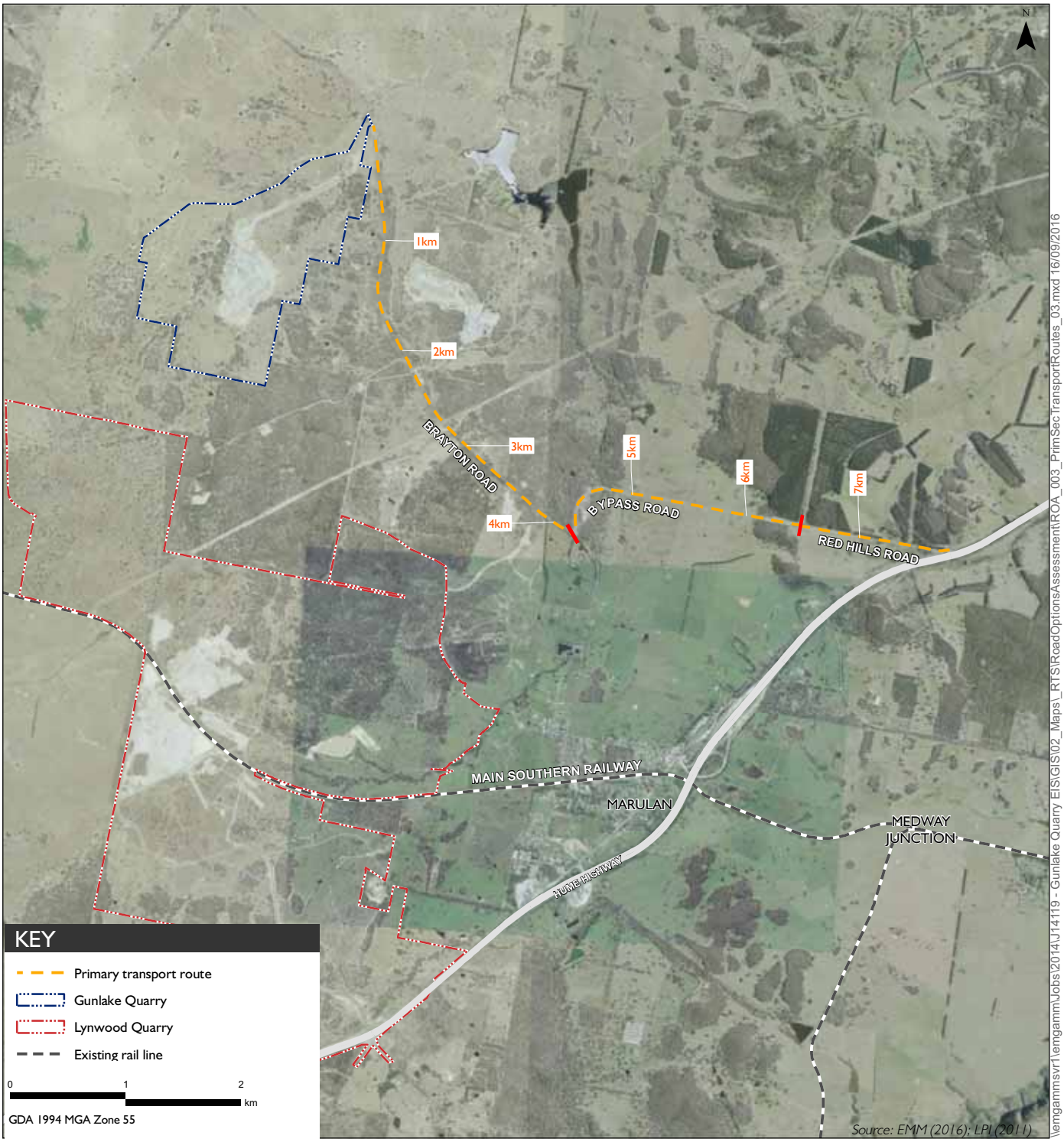
- Option 1: private haul road from the Gunlake Quarry processing area travelling west of the Lynwood Quarry Granite Pit to the Lynwood Quarry access road through to Marulan South Interchange; and
- Option 2: private haul road from the Gunlake Quarry processing area travelling east of the Lynwood Quarry Granite Pit to the Lynwood Quarry access road through to Marulan South Interchange.

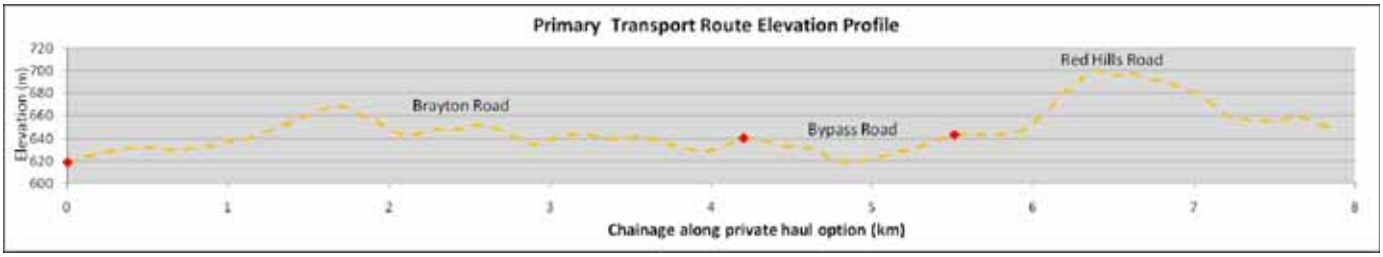
Options 1 and 2 are shown in Appendix B of Hatch (2016) (shown as Option 4A and 4B respectively).

Only Option 2 has been assessed in further detail in this report because it:

- would be shorter (8.7 km versus 10.6 km);
- traverses far less private land (not including land owned by Lafarge Holcim);
- would have lower amenity impacts to the west from where the majority of submissions were received and would not come close to the historic Lockyersleigh property; and
- would be less expensive to build and operate.

Therefore this *Road Options Assessment* compares the primary transport route (the 'base case') to Option 2.

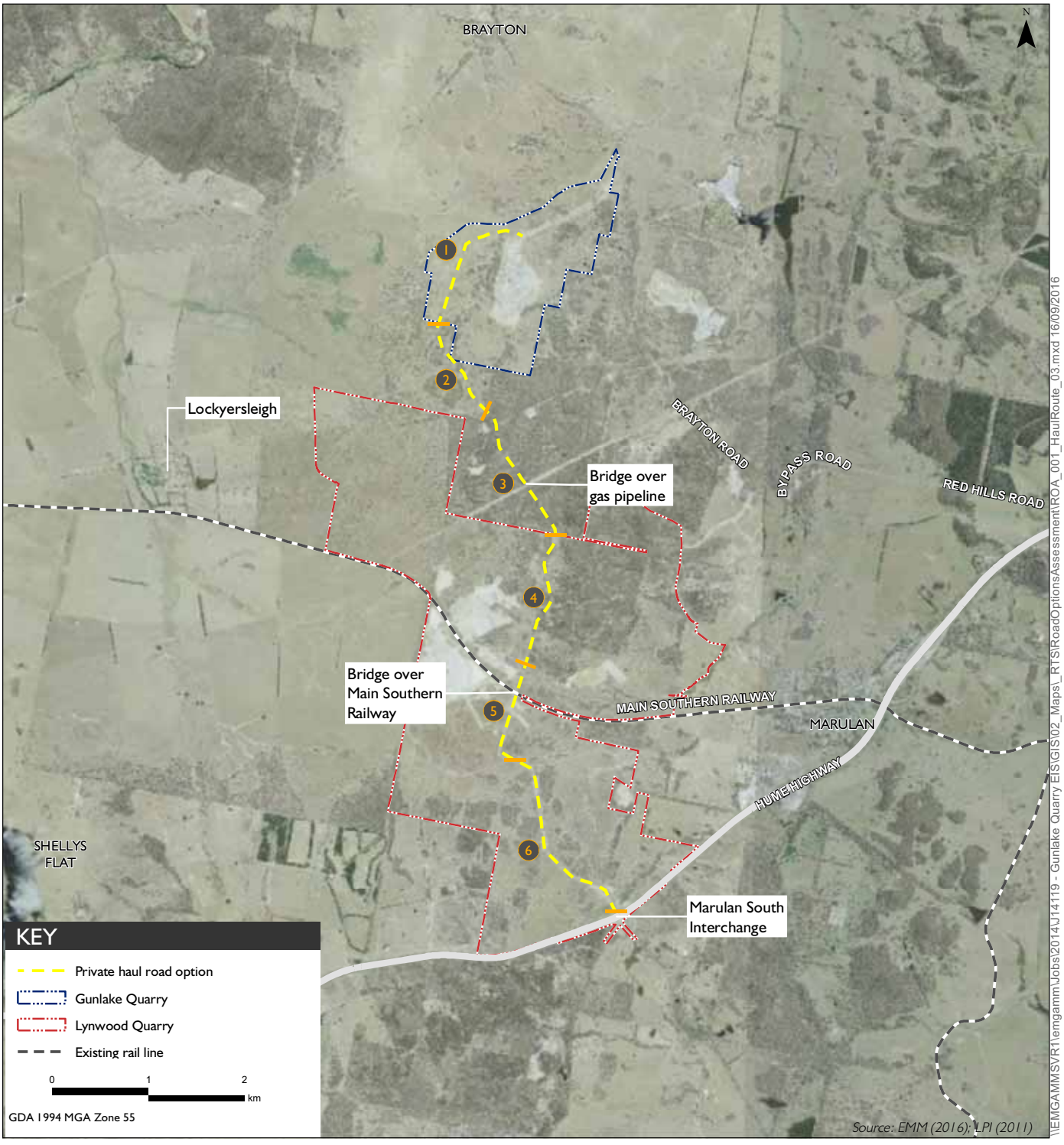


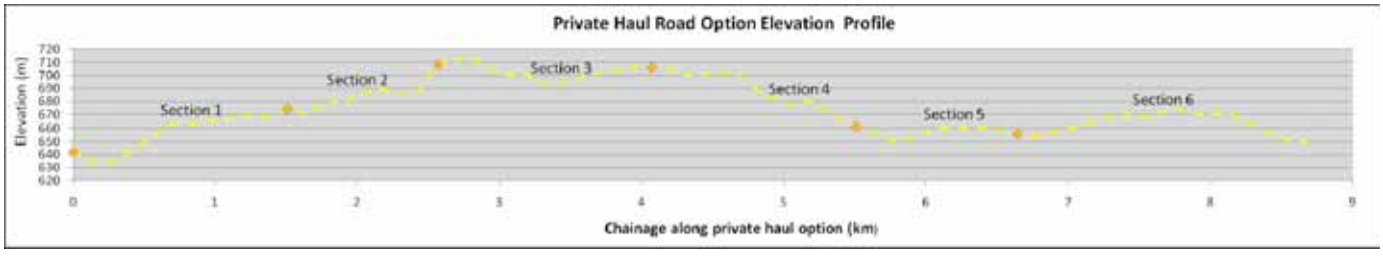


NB: Elevation is vertically exaggerated on profile

Primary transport route
Road options assessment
Gunlake Quarry Extension Project
Figure 1.1

EMM





NB: Elevation is vertically exaggerated on profile

Private haul road route option

Road options assessment
Gunlake Quarry Extension Project
Figure 1.2

EMM

2 Private haul road option

This chapter provides an overview of the private haul road option, summarises the costs (from Hatch (2016)) and assesses the environmental and social impacts of the construction and use of a private haul road.

2.1 Private haul road route description

The private haul road route (Hatch (2016) Option 2) would extend 8.7 km from the Gunlake Quarry processing area to the Marulan South Interchange on the Hume Highway (Figure 1.2). An overview of the key features of the route is provided in Table 2.1. The private haul road route has been divided into six route sections based on the land ownership and current land use.

Table 2.1 Private haul road route - overview

Route section	Length (km)	Land ownership[1]	Topography - outbound (north to south)	Disturbance footprint (ha)[2]	Land use	Vegetation
1	1.5	Gunlake	Uphill with ~32 m vertical rise	-	Gunlake Quarry - largely within the proposed extension area footprint	Largely cleared
2	1.0	Private	Uphill with ~29 m vertical rise	1.47	Pasture	Scattered trees
3	1.5	Private	Uphill with ~2 m vertical rise up to the top of a ridge ~20 m vertical drop to a gully ~ 14 m vertical rise up to the top of a ridge	2.17	Generally undeveloped weekender property	Woodland
4	1.4	Lafarge Holcim	~42 m vertical drop to a gully	1.94	Lynwood Quarry area	Scattered trees
5	1.2	Lafarge Holcim	Undulating terrain	1.70	Lynwood Quarry tracks	Largely cleared
6	2.1	Lafarge Holcim	Undulating terrain	-	Lynwood Quarry access road (road truck usage)	Existing haul road
Total	**8.7**	**-**	**-**	**7.28**	**-**	**-**

Notes: 1. Excluding Crown Land road reserves.

2. Assumes an area 15 m wide will need to be cleared to allow road construction and for clear areas beside the road.

2.2 Land ownership

There are three main land ownership types along the private haul road route:

- land owned by Gunlake;
- privately owned land that Gunlake would need to purchase or secure a commercial arrangement to guarantee access for 30 years; and
- land owned by Lafarge Holcim that Gunlake would need a commercial arrangement to guarantee access for 30 years.

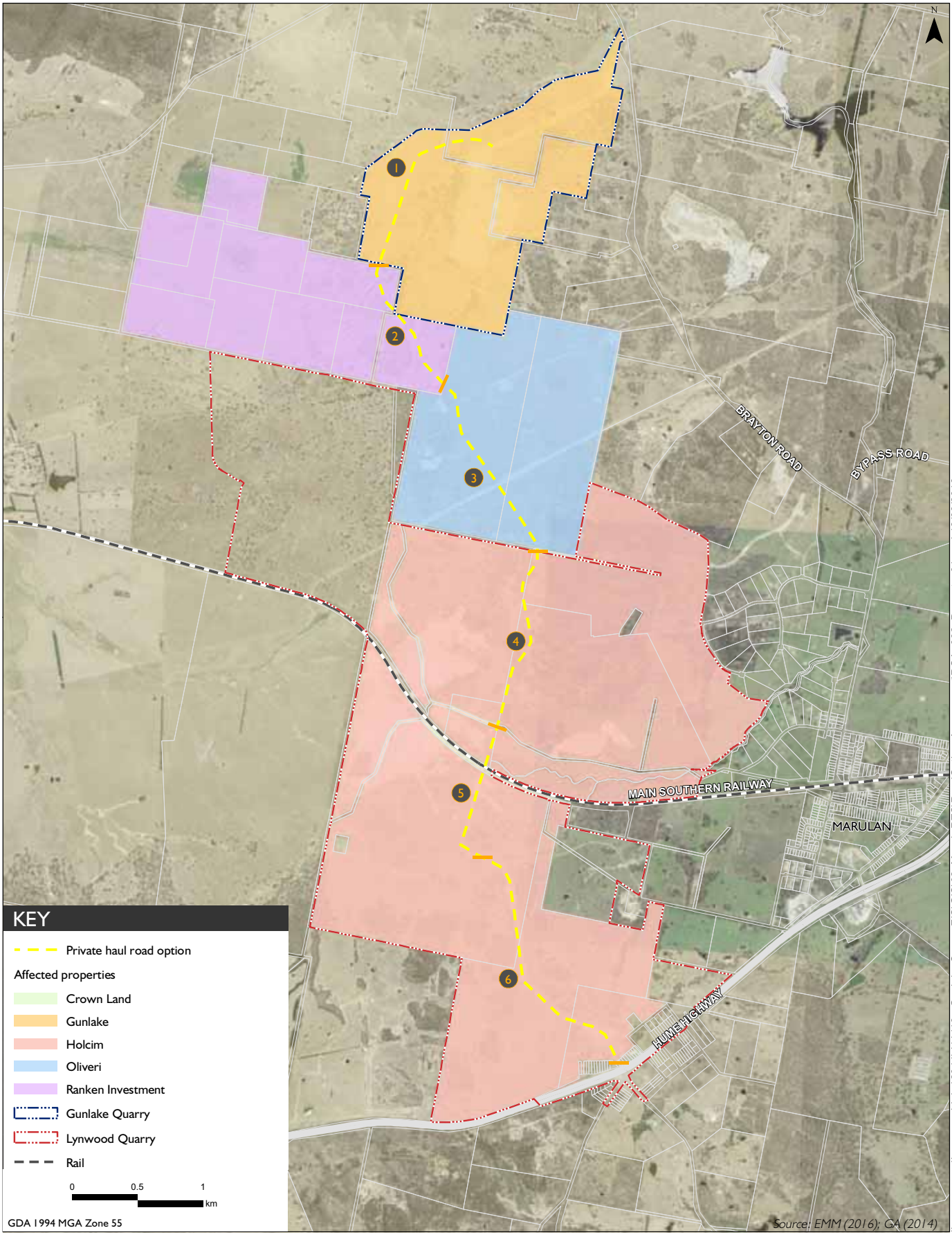
There are also small areas of Crown Land associated with road reserves within Gunlake Quarry and Lynwood Quarry.

The land parcels traversed by the private haul road route are listed in Table 2.2 and shown in Figure 2.1. At a minimum, whole lots would initially need to be purchased. The land vendor may insist that adjoining lots or the entire property would have to be purchased by Gunlake. There no legal mechanisms for the compulsory acquisition of the private land required for a private haul road.

There are no route alignments that avoid Ranken Investment land and Oliveri land while remaining east of the recently approved Lynwood Quarry Granite Pit.

Table 2.2 Private haul road route - land ownership

Route section	Lot/DP	Lot area (ha)	Ownership
1	Lot 13/DP1123374	221.8	Gunlake
2	Lot 72/DP750003	24.2	Ranken Investment
2	Lot 75/DP750003	29.0	Ranken Investment
3	Lot 214/DP750053	121.2	Oliveri
3	Lot 215/DP750053	109.0	Oliveri
3	Lot 3/DP1036993	2.0	Crown Land
4	Lot 1/DP1074819	176.1	Holcim
4	Lot 1/DP1117910	146.0	Holcim
4	Lot 112/DP750029	15.2	Holcim
4	Lot 230/DP750029	127.1	Holcim
4	Lot 2/DP1155889	0.8	Crown Land
5	Lot 5/DP1140546	2.7	Crown Land
5 &6	Lot 2/DP1116876	257.5	Holcim
6	Lot 294/DP750029	30.2	Holcim
6	Lot 3/DP1074107	163.3	Holcim
6	Lot 8/DP797340	0.1	Crown Land



Private haul road route - land ownership

Road options assessment
Gunlake Quarry Extension Project
Figure 2.1

2.3 Consultation

Gunlake met with Lafarge Holcim on 9 June 2016 to discuss access to the Lynwood Quarry to allow rail loading from, or adjacent to, Lafarge Holcim's rail loading facility or to access the Marulan South Interchange which requires access through Lynwood Quarry. Lafarge Holcim required Gunlake to sign a confidentiality agreement regarding these discussions so details of these and subsequent discussions cannot be provided. However, Hatch (2016) incorporated Lafarge Holcim's design and operational requirements within the Lynwood Quarry area in the design of the options.

Any activities or works within Lynwood Quarry associated with the transport of Gunlake Quarry products would require modification of the Lynwood Quarry Development Approval 128-5-2005 or a new approval.

Gunlake also discussed potential land acquisition with the two other private landowners on the private haul road route. Both indicated that their land is not for sale.

2.4 Private haul road design

A private haul road would need to be constructed to a similar standard of the public roads that form the primary haul route, with a sealed pavement 9 m wide. A corridor about 15 m wide would need to be cleared to allow for road construction and to provide a safe zone either side of the road when operating.

2.5 Costs

2.5.1 Capital costs

Preliminary private haul road design and capital costing are provided in Hatch (2016). These consider:

- construction works:
  - enabling and early site works;
  - tree clearing and soil removal;
  - bulk earthworks (eg cut and fill);
  - construction of a new bridge over the Main Southern Railway (in route section 5);
  - construction of an unsealed road;
  - road sealing (sprayed bituminous surfacing); and
  - fencing.
- other costs:
  - refining the alignment and engineering design;
  - environmental assessments and approvals;
  - project and construction management;
  - contractors margin and contingencies; and
  - escalations during construction.

The costs of these items is estimated to be $21.3 million (Hatch 2016).

In addition, Gunlake Quarries would have to contribute to Lafarge Holcim's haul road in route section 6 and to Lafarge Holcim's original construction costs for the Marulan South Interchange. This is estimated to be $13.1 million in total. Therefore, the total capital cost of a private haul road is estimated to be $34.4 million.

Land would need to be acquired in route section 2 (Ranken Investments) and route section 3 (Oliveri). Gunlake have approached both landowners and neither are proposing to sell their land. Therefore, a premium would need to be offered to secure a sale. The Hatch (2016) economic modelling assumes that the majority of this land could be on-sold at market rates to recoup some of these costs.

2.5.2 Operating costs

The annual operating costs for the private haul road option are estimated (Hatch 2016) to be:

- transportation costs (Gunlake Quarry to Gunlake's concrete batching plants in Sydney): $26.9 million; and
- contributions to Lafarge Holcim for use of a private haul road: $0.68 million.

2.5.3 Present value cost

The total present cost of the private haul road option would be $44 million more than the base case (ie use of the primary transport route).

2.6 Environmental impacts

Notwithstanding that a private haul road is not economically viable, the environmental (including social) impacts of a private haul road are described below.

2.6.1 Land use

There are three main land uses along the private haul road route:

- Quarrying: route sections 1, 4, 5 and 6 (Gunlake Quarry and Lynwood Quarry);
- Pasture: route section 2; and
- Weekender property (generally undeveloped): route section 3.

The haul road would be a land use consistent with quarrying activities in route sections 1, 4, 5 and 6. However, road trucks need to be separated from off-road haul trucks carrying quarried rocks and overburden. This requires separate roads for road trucks and off-road haul trucks in route sections 1, 4 and 5.

There is pasture in route section 2. Stock would need to be excluded from the haul road so the parts of the lots to the east of the haul road would be unlikely to be able to practically support grazing. This would remove about 14.15 ha from agricultural production. However, given that grazing has a relatively low agricultural return and that the price paid for these lots would be very high, there would be minimal economic consequences from this loss.

The weekender property in route section 3 is largely undeveloped and wooded and does not have any active economic uses. There are old sand extraction areas, access roads and a dam on the western portion of the property. There are sheds in the north-eastern corner of the property. The property is traversed by a trunk gas pipeline. The development of a private haul road though this property would not significantly impact on these land uses, although would need to be designed to allow ongoing access to the southern and western portions of the property and would need to be engineered to cross the gas pipeline.

2.6.2 Biodiversity

Construction of a private haul road would require clearing of native vegetation along much of the route. The resulting impacts to biodiversity are considered below.

The following desktop resources were used to assess the likely biodiversity impacts for each of the private haul road route sections;

- *Gunlake Quarry Extension Project, Biodiversity Assessment Report* (EMM 2016c, EIS Appendix I);
- *Proposed Lynwood Quarry, Ecological Assessment* (Umwelt 2005); and
- *Lynwood Quarry Extraction Area Modification, Biodiversity Report* (Umwelt 2015a).

The majority of the private haul road route has been included within the study areas of the above assessments, albeit with surveys effort targeted to the respective impact areas. Where there were gaps in the vegetation mapping, aerial imagery has been used to extrapolate the mapped vegetation communities. The *South East NSW Native Vegetation Classification and Mapping* (SCIVI. VIS_ID 2230) was also considered. However, the project-specific vegetation mapping is considered to be most accurate.

Threatened species recorded, or that was considered to potentially to occur in the area by the assessments listed above, were also considered to be likely to occur along the private haul road route given that similar habitat and vegetation communities are present.

i Vegetation

The following native vegetation types are likely to occur along the private haul road route.

a. Broad-leaved Peppermint - Red Stringybark Grassy Open Forest

Broad-leaved Peppermint - Red Stringybark Grassy Open Forest is an open forest with a sparse shrub layer and grassy groundcover, typically occurring on gentle midslopes to steep upper slopes. This community is not part of any Endangered Ecological Community (EEC) listing, however provides potential habitat for a range of threatened fauna species.

The derived native grassland (DNG) form of the community is dominated by native grasses, with some native forbs and herbs present. Examples of this community along the northern section of the private haul road route (route section 1) had a high weed component with patches of the noxious weed Serrated Tussock (EMM 2016c). The DNG is likely to be of relatively low value to fauna.

b. Box Gum Woodlands

Box Gum Woodlands habitat occurs in the lower lying parts of the private haul road route, generally in association with creeks or drainage lines on deeper alluvial soils. The Box Gum Woodlands contain some large hollow-bearing trees which provide shelter and breeding opportunities for hollow dependent mammals, reptiles and birds, with the potential to support threatened species.

The derived grassland form of the community is dominated by native grasses, with some native forbs and herbs present. Weeds are often prevalent. There are also a number of pasture weeds with patches of Serrated Tussock (EMM 2016c) along route section 1.

Both the woodland and DNG forms of this community are likely to meet the *Threatened Species Conservation Act 1995* (TSC Act) listing for White Box Yellow Box Blakely's Red Gum Woodland EEC (Box Gum Woodland).

The woodland form is also likely to meet the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listing for White Box Yellow Box Blakely's Red Gum Grassy Woodland CEEC. The DNG within several parts of the private haul road route do not meet this listing owing to a lack of floristic diversity (EMM 2016c).

c. Tableland Grassy Box-Gum Woodland

The Tableland Grassy Box-Gum Woodland community was dominated by Yellow Box with Red Stringybark within the private haul road route, although in several areas Blakely's Red Gum and Broad-leaved Peppermint were dominant (Umwelt 2005). The shrub stratum is typically spare with a dense grassy ground cover. Umwelt (2005) considered that this community was not part of the Box Gum Woodland EEC. However further interrogation and surveys would be required to determine if portions of this community meet the EEC determinations under the TSC and EBPC Acts, given the presence of characteristic species. This community may provide habitat for threatened fauna.

d. Tableland Low Woodland

The Tableland Low Woodland community was recorded on poor soils typically with rocky substrates. The understory was typically sparse, although occasionally low shrubs and forbs were present. This community may provide habitat for a range of threatened fauna.

e. Western Tablelands Dry Forest

An open Eucalypt forest dominated by Blue-leaved Stringybark, with few other canopy species present. A mid stratum of Black She-oak (*Allocasuarina littoralis*) may also be present. Ground stratum is typically open with a variety of low shrubs, sedges and forbs. This community may provide habitat for a range of threatened fauna.

ii Threatened Flora

No threatened flora have been recorded within the portions of the private haul road route surveyed to date. One threatened species, Paddys River Box (*Eucalyptus macarthurii*), listed as Vulnerable under the TSC Act, was recorded during the Lynwood Quarry investigation (Umwelt 2005). However, this was outside of the private haul road route and was likely planted. The Hoary Sunray, listed as Endangered under the EPBC Act, has been recorded within close proximity to private haul road route. Up to six threatened flora species are considered as having the potential to occur within the private haul road route based on the habitats present.

iii Threatened Fauna

Thirteen threatened fauna species have been recorded close to the private haul road route (Table 2.3) and are highly likely to occur within the route. The Large-eared Pied Bat (*Chalinolobus dwyeri*) and Squirrel Glider (*Petaurus norfolcensis*) are species credit species, which would require offset credits to be generated in accordance with the *Framework for Biodiversity Assessment* (FBA) (OEH 2014).

Table 2.3 Private haul road route - threatened fauna recorded in the vicinity

Common Name	Scientific name	TSCA Status	EPBC Act Status
Mammals			
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	
Little Bentwing bat	*Miniopterus australis*	V	
Eastern-Bentwing Bat	*Miniopterus schreibersii oceanensis*	V	
Eastern Freetail Bat	*Mormopterus norfolkensis*	V	
Squirrel Glider	*Petaurus norfolcensis*	V	
Birds			
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	
Glossy Black-cockatoo	*Calyptorhynchus lathami*	V	
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V
Varied Sittella	*Daphoenositta chrysoptera*	V	
Square-tailed Kite	*Lophoictinia isura*	V	
Scarlet Robin	*Petroica boodang*	V	
Speckled Warbler	*Pyrrholaemus sagittatus*	V	
Diamond Firetail	*Stagonopleura guttata*	V	

Notes: 1.EPBC and TSC Act Status: V – Vulnerable.

iv Potential Impacts

The key potential biodiversity impacts for each section of the haul road are summarised in Table 2.4.

Table 2.4 Private haul road route - key potential biodiversity impacts

Route section	Length (km)	Key potential impacts	Relative magnitude of impact/offset requirements
1	1.5	• 0.06 ha of Box Gum Woodland EEC (TSC and EPBC Act listed); • 0.09 ha of Box Gum DNG EEC (TSC Act Listed); and • 2.1 ha of Stringybark Open Forest DNG (native pasture) with occasional scattered trees.	Moderate – small area of EECs and large areas of DNG with relatively low biodiversity value.
2	1.0	• 0.68 ha of Box Gum Woodland EEC (TSC and EPBC Act listed); • 0.23 ha of Box Gum DNG EEC (TSC Act Listed); • 0.45 ha of Stringybark Open Forest DNG (native pasture) with occasional scattered trees; and • 0.15 ha of Tableland Low Woodland.	High – more substantial proportions of EECs and greater areas of potential habitat for threanted fauna.
3	1.5	• 2.25 ha of Tableland Grassy Box Gum Woodland (potential EEC).	High – entire area is forested with remnant vegetation with potential habitat for threatened fauna.
4	1.4	• 1.13 ha of Western Tablelands Dry Forest; • 0.45 Tableland Grassy Box Gum Woodland (Potential EEC); and • 0.53 ha of derived pasture (condition unknown).	High – EECs present and areas of potential habitat for threatened fauna.
5	1.2	• 0.11 ha of Tableland Grassy Box Gum Woodland (potential EEC); • 0.23 ha of derived pasture (condition unknown); and • potential for track widening to impact on a small number of scattered tree.	Moderate – small area of potential EECs, otherwise minimal disturbance due to presence of existing tracks.
6	2.1	No vegetation clearance required Impacts such as vehicle strike during operations (as for all route sections).	Low – no clearance required due to the presence of existing road.

Construction of the private haul road route would require clearing of about 1.1 ha of EEC, 3.3 ha of potential EEC and 3.8 ha of other native vegetation, of which about 2.3 ha is within the extension project disturbance area.

The highest biodiversity constraints are present within route sections 2, 3, and 4. The majority of the native vegetation along the private haul road route is likely to require offsetting in accordance with the FBA. There may be areas of derived grassland which does not require offsetting if the quality is very poor, ie low diversity of native species and a high weed component. The highest credits are most likely to be generated by the Box Gum Woodland EEC.

The woodland areas are likely to provide habitat for threatened species including species credit species which will requires offsets under the FBA. Derived native grassland may also provide potential habitat for threatened species. However further work would be required to determine the quality of habitat within the impact area.

A private haul road would be close to areas of native vegetation along about 7.2 km of the route which will result in some road kill.

2.6.3 Aboriginal heritage

Construction along the private haul road route would disturb about 7.28 ha (see Table 2.1). The potential for impacts to Aboriginal heritage is considered below.

An Aboriginal Heritage Information Management System (AHIMS) search (24 August 2016) of the broad area surrounding the private haul road route (approximately 2.4 km by 7.4 km) returned 122 items (Table 2.5 and Figure 2.2).

Table 2.5 Private haul road route area - identified Aboriginal heritage sites

Aboriginal site type	Percentage of sites	Number of sites
Isolated find[1]	45.9%	56
Isolated find with potential archaeological deposit (PAD)	1.6%	2
Modified tree	9.0%	11
Open camp site	36.9%	45
Open camp site with PAD	0.8%	1
PAD	4.1%	5
Stone arrangement	1.6%	2
Total	**100%**	**122**

Note: 1. AHIMS records listing the site as an 'artefact' with no description, no count or recorded as a single artefact, have been categorised as an isolated find. Sites with more than one artefact have been categorised as an 'open camp site'.

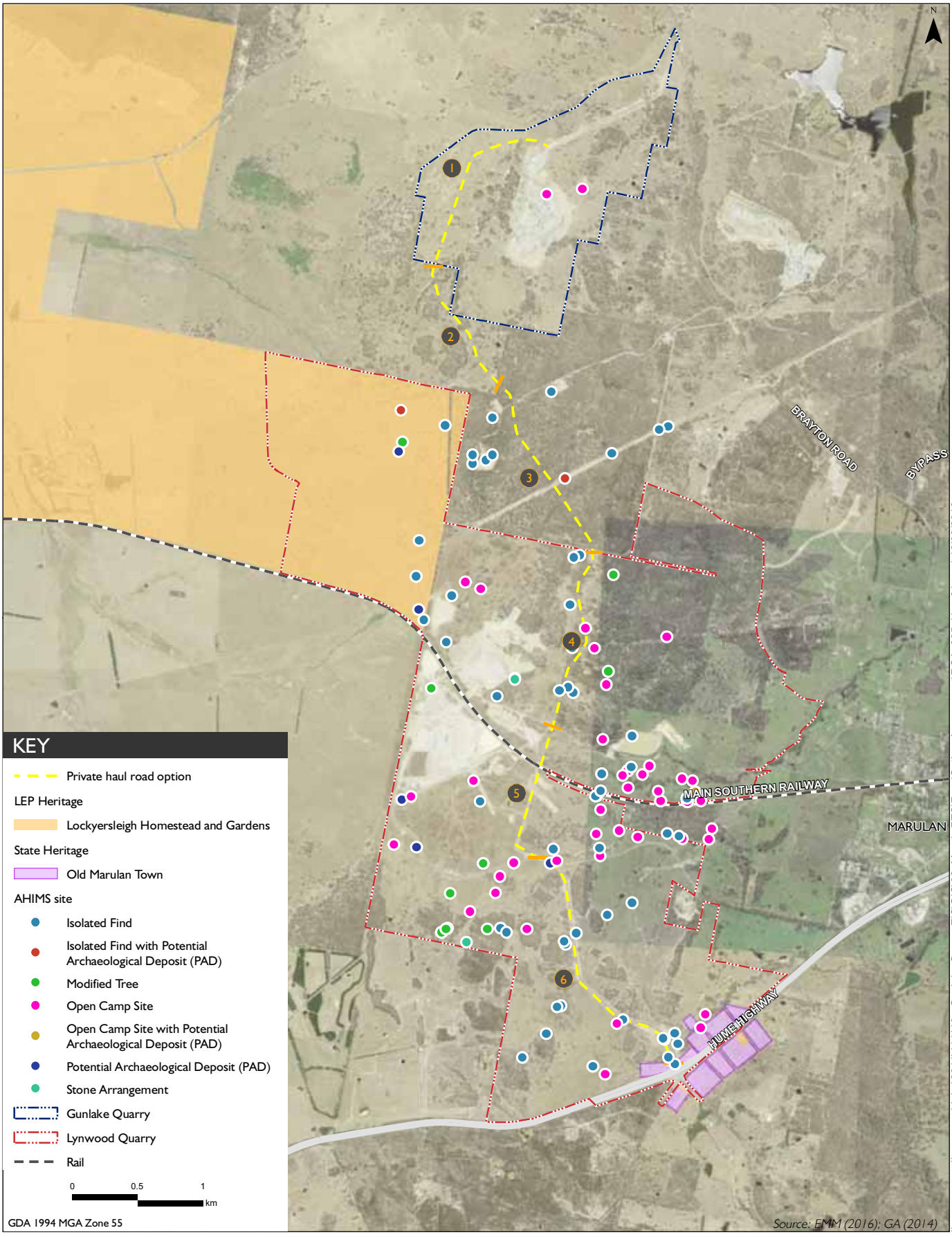
The density of previously identified Aboriginal heritage sites generally increases toward the southern end of the private haul road route. In part, this is likely to be because:

- more of the landscape is cleared in the southern part of the route and the most prevalent site type, artefact scatters (including isolated finds and open camp sites) are most easily identified on cleared land such as that within Lynwood Quarry;
- cleared land of native vegetation typically includes surface erosion, scolds and the like which increase the potential for identification of surface artefact scatters; and
- the southern end of the private haul road route (route sections 4 to 6) has undergone a range of intensive archaeological investigations as part of environmental assessments for the quarry.

Predictive models of the likely occurrence of Aboriginal heritage sites are described in Umwelt (2015b) and EMM (2016d).

It is proposed to disturb the majority of the private haul road route in the Gunlake Quarry area (route section 1) as part of the extension project. This area has relatively low density of Aboriginal sites (EMM 2016d, EIS Appendix M). Test excavation at Gunlake Quarry established that there is a paucity of subsurface artefacts within the landscape as a result of shallow soil profiles severely truncated by erosion.

The section of the private haul road route immediately south of Gunlake Quarry (route section 2) contains scattered trees. While the landscape is similar to the landscape surrounding Lynwood Quarry, the recent detailed archaeological investigations (EMM 2016d) indicate there are fewer Aboriginal sites in the Gunlake Quarry area compared to those in the Lynwood Quarry area. Therefore, construction in route section 2 of the private haul road route has a moderate possibility of impacting Aboriginal heritage sites such as isolated finds and open camp sites.



Heritage sites

Road options assessment

Gunlake Quarry Extension Project

Figure 2.2

While the area north of Lynwood Quarry (route section 3) is wooded, a number of Aboriginal heritage sites have been identified in cleared areas. Based on the predictive model described in Umwelt (2015b) and EMM (2016d), it can be reasonably extrapolated that the density of Aboriginal sites within the wooded areas would be comparable to those in the Lynwood Quarry area. Construction in route section 3 of the private haul road route is highly likely to impact numerous Aboriginal heritage sites.

2.6.4 Historic heritage

The potential for impacts to historic heritage as a result of the construction and operation of a private haul road is considered below.

There are two listed heritage items within 2 km of the private haul road route (Figure 2.2 and Table 2.6).

Table 2.6 Private haul road route area - identified historic heritage sites

Item name	Address	Property description	Significance	Item no.
Lockyersleigh Homestead, Garden	1092 Towrang Road	Lot 1, DP 574255	Local	I033
Old Marulan Town	Multiple, Marulan, Goulburn Mulwaree, NSW 2430	Multiple	State	00127

Lockyersleigh Homestead and Lockyersleigh Garden are listed in the *Goulburn Mulwaree Local Environmental Plan* 2009 and the Register of the National Estate (RNE) (non-statutory). The private haul road route would not impact any portion of the Lockyersleigh items. Any potential impacts to views and vistas to and from Lockyersleigh are screened by trees or by the already established Lynwood Quarry infrastructure. There would be a minor heritage impact to Lockyersleigh from truck noise from the private haul road route.

Construction of the Marulan South Interchange impacted Old Marulan Town. However, appropriate management measures were employed at the time and there are unlikely be any additional impacts as a result of development or use of a private haul road.

2.6.5 Noise and vibration

The NSW *Road Noise Policy* (DECCW 2011) provides criteria for the assessment of noise from vehicles travelling on public roads. However, truck noise from a private haul road would be assessed against the NSW *Industrial Noise Policy* (EPA 2000) based on the calculated Project Specific Noise Limit (PSNL), which is an $L_{Aeq15\text{-}min}$ of 35 dB for the extension project (EMM 2016e, EIS Appendix K).

Traffic noise associated with the extension project was assessed in the EIS (EIS Appendix K Section 5.9). The noise levels at residences at various distances from the private haul road route can be used to estimate noise levels at various distances from the haul road route. To a first order approximation, the PSNL would be achieved within about 800 m of the private haul road route. There are no residences within this distance to the route so the PSNLs would be satisfied. While the criteria would be met, trucks using a private haul road would be audible from the west, eg from residences around Towrang, particularly during temperature inversions.

2.6.6 Air quality and greenhouse gases

A private haul road would need to be sealed for safety, to prevent excessive dust generation and to reduce maintenance costs so trucks using a private haul road would not significantly impact air quality.

Greenhouse gas emissions (Scope 3 emissions) from the transport of quarry products by road are considered by Ramboll (2016) (EIS Appendix L). Greenhouse gas emissions were estimated to be 24,775 tonnes CO_2-e/annum for the transport of 1.5 Mtpa of products and 33,033 tonnes CO_2-e/annum for the transport of 2.0 Mtpa of products. The greenhouse gas emissions would be marginally greater than 24,775 tonnes CO_2-e/annum for a private haul road due to the marginal increase in travel distance.

2.6.7 Surface and groundwater

The private haul road route crosses the upper reaches of Chapmans Creek and would need to be designed accordingly. With the incorporation of appropriate runoff controls, a private haul road would not have a significant impact on surface water or groundwater.

The haul road would need to be sealed (see Section 2.6.6) so water would not be needed for dust suppression.

2.6.8 Social

i Safety

Public vehicles will not be able to access a private haul road. Therefore, safety considerations associated with trucks delivering quarry products (or returning empty to the quarry) will only apply for the Hume Highway and roads around the product destinations, including the motorway network in Sydney.

ii Visual

A view-shed analysis for trucks travelling on route sections 1 and 2 of the private haul road route has been prepared (Figure 2.3). Trucks travelling through route section 3 would be shielded by the adjacent trees and it has been assumed that trucks travelling along route sections 4 to 6 would be visually in keeping with Lynwood Quarry activities.

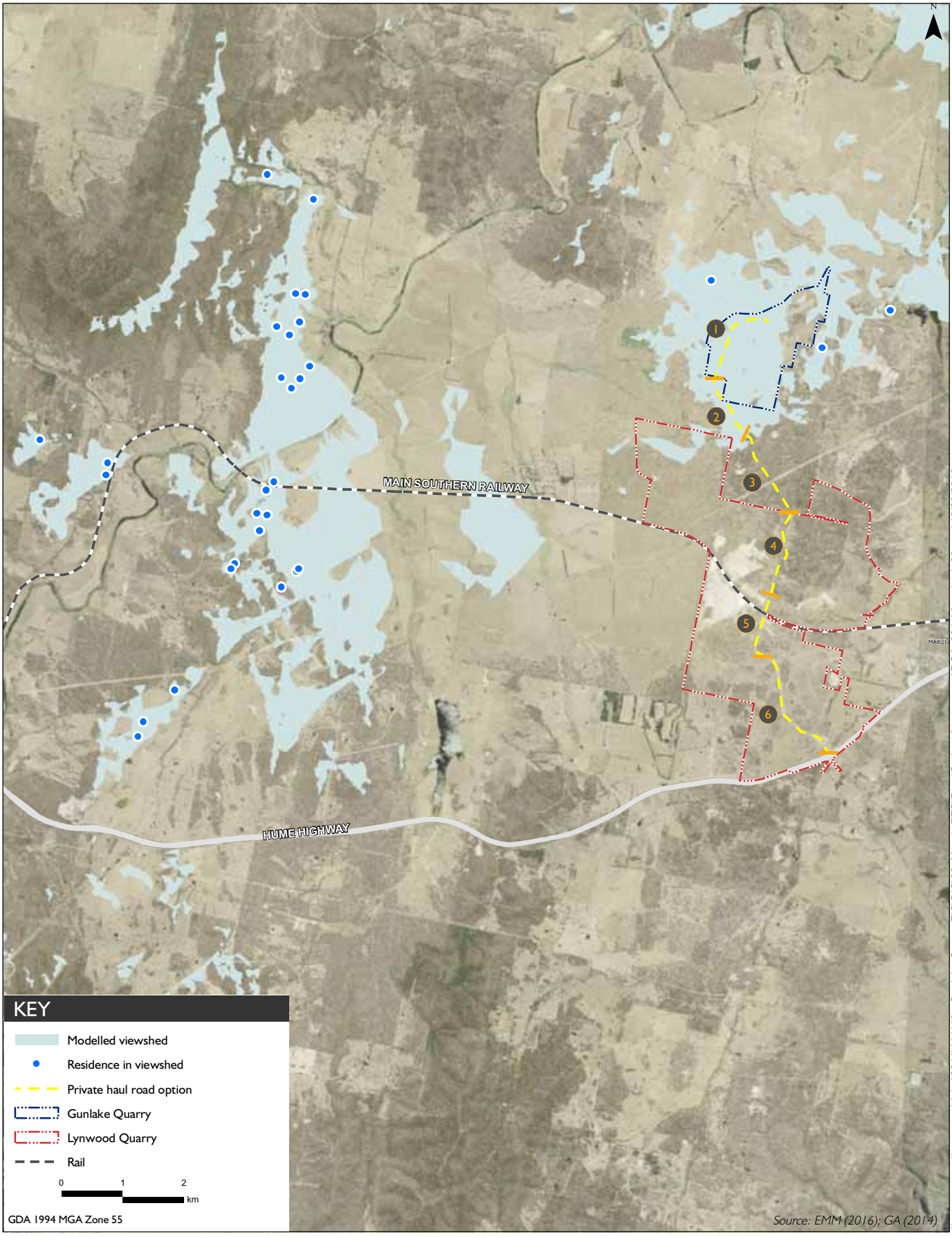
The trucks using the northern end of the private haul road route (route sections 1 and 2) would be visible from:

- Residence R4 (Gunlake owned) north-west of the Gunlake Quarry processing area;
- Residences R1 (Gunlake owned) , R2 (private) and R3 (Gunlake owned) east of the quarry; and
- some of the residences on elevated areas west of Towrang Road.

The lights of trucks leaving the quarry would shine towards Towrang on the northern-most sections of the private haul road route. The lights of returning trucks would shine towards R1, R2, R3 and R4. Visual screening along the northern sections of the private haul road route would reduce visual impacts.

iii Summary

There would be increased noise levels, truck visibility and lighting impacts on areas west of the private haul road route. However, applicable criteria would be met.



\\emgammsvr1\emgammJobs\2014\J114119 - Gunlake Quarry EIS\GIS\02_Maps_RTS\RoadOptionsAssessment\ROA_004_Viewshed_02.mxd 16/09/2016

Viewshed analysis - Sections 1 and 2 of private haul road route

Road options assessment
Gunlake Quarry Extension Project
Figure 2.3

EMM

3 Primary transport route

The primary transport route proposed in the EIS accesses the Hume Highway via Brayton Road/Bypass Road/Red Hills Road. An overview of the key features of the route is provided in Table 3.1 and the route is shown in Figure 1.1.

Table 3.1 Primary transport route - overview

Section	Length (km)	Land ownership	Topography - outbound (west to east)	Additional footprint[1] (ha)	Land use
Primary route					
Brayton Road (north of Bypass Road)	4.2	Goulburn Mulwaree Council	Uphill with vertical rise of ~48 m Undulating with a overall fall of ~39 m	0.07	Existing public road
Bypass Road	2.3	Goulburn Mulwaree Council	Downhill with a fall of ~20 m Uphill with vertical rise of ~23 m	0.06	Existing public road
Red Hills Road	1.3	Goulburn Mulwaree Council	Uphill with vertical rise of ~58 m Downhill with an overall fall ~49 m to the Hume Highway	0.15[2]	Existing public road

Notes: 1. Approximate area required for road upgrades.
2. Hume Highway acceleration lane.

3.1 Proposed transport route improvements

Comparison of a private haul road and primary transport route has assumed that Gunlake will implement the following improvements as part of the extension project that build on the corrective actions recommended in the road safety audit (Lyle Marshall & Partners and McLaren Traffic Engineering 2016), see Section 3.5.7:

1. Upgrade the intersection of the quarry access road with Brayton Road:
   - asphalt the intersection; and
   - construct an acceleration lane on Brayton Road south of the quarry intersection (Gunlake have previously installed a deceleration lane).
2. Widen both shoulders on Bypass Road (Ambrose Rd) for 400 m on the approach to Brayton Road.
3. Improve the Red Hills Road and Hume Highway intersection:
   - provide physical separation between the lanes on either side of the road; and
   - construct an acceleration lane on the Hume Highway as soon as Roads and Maritime Services (RMS) approval is received (rather than in 2025 as proposed in the EIS).

4. General improvements along the transport route such as better line marking and increased signage:

   - marking hidden driveways;

   - regarding school buses; and

   - prohibiting the use of air brakes by in-bound trucks.

5. Work with Goulburn Mulwaree Council (Council) to submit an application to RMS to reduce the speed limit on the transport route to 80 km/h.

6. Reduce the proposed maximum number of daily truck movements from 690 to 590 per day.

7. Conduct random inspections on the transport route to ensure compliance with the Drivers Code of Conduct.

8. Work with Council to identify hazards in the clear zone for 80 km/h travel, including a risk assessment and costing to correct or reduce the risk.

9. Work with Council to determine appropriate guide post spacing based on an analysis of the frequency of heavy fogs.

3.2 Consultation

Gunlake have liaised extensively with the Council regarding upgrading the roads along the primary transport route and the ongoing maintenance of these roads. Most recently, Gunlake met with the Council on 4 and 12 August 2016 to discuss and refine the proposed upgrades (see Section 3.1). The Council has provided in principal support for these upgrades.

It is noted that the Council states in its submission (17 May 2016):

> However, Council does acknowledge that Gunlake partially funded the upgrade of Brayton Road in 2015. Part of the Council resolution dated 16 December 2014 stated:
>
> Council accepts the contribution without prejudice from Gunlake Quarry on the condition that Council will not require further capital road upgrade monies for Bypass and Brayton Roads from any expansion of Gunlake Quarry in the next 5 years. This condition does not preclude Council from make submission on any other matters associated with any expansion of Gunlake Quarry including the requirement that Gunlake Quarry continue to contribute to maintenance of Brayton and Bypass Roads by way of cents per tonnes carted across these two roads.

Roads and Maritime Services has not been consulted further. Their submission (17 May 2016) only identified the construction of the acceleration lane on Hume Highway "prior to any increase in traffic [which] would address RMS' concerns regarding road safety". Gunlake have committed to this measure as part of the extension project.

The Gunlake Community Liaison Team have consulted with the landholders along the primary transport route by:

- the provision of information by letter drops and the Gunlake website;

- the distribution of Factsheet 3 focussing on transport options: 1 September 2016;

- one-on-one meetings with residents: ongoing; and
- holding a Community Consultative Committee (CCC) meeting: 30 September 2016.

The key matters raised are summarised in Section 3.5.7.

3.3 Land ownership

The primary transport route is on public roads owned by the Council. No land acquisition would be required for the proposed upgrades.

3.4 Costs

3.4.1 Capital costs

Hatch (2016) was prepared based on the only capital cost in the base case being the acceleration lane on the Hume Highway as proposed in the EIS ($1.5 million). The impact of these additional upgrade costs on the primary transport route costs are described below.

Gunlake have the estimated capital cost of the additional upgrades to the primary transport route (see Section 3.1) to be $0.4 million. As for the cost estimate for a private haul road, this includes engineering design; environmental assessments and approvals; project and construction management; contractors margin and contingencies; and escalations during construction.

As described in Gillespie Economics (2016a), this does not materially affect the economic comparison of the options.

3.4.2 Operating costs

The annual operating costs for using the primary transport route are estimated (Hatch 2016) to be:

- Transportation costs (Gunlake Quarry to Gunlake Concrete's concrete batching plants): $26.9 million; and
- Section 94 contributions for road maintenance: $0.4 million (for the transport of 1.5 Mtpa along the primary transport route at $0.25/tonne).

3.4.3 Present value cost

The total present cost of the primary transport road option would be $44 million less than the lowest-cost private haul road option.

3.5 Environmental impacts

The environmental impacts of the use of the primary haul route are assessed in the EIS (EMM 2016a). These are summarised below along with further assessment of the proposed road improvements.

3.5.1 Land use

The primary transport route uses public roads that are designed for the movement of people and goods. The costs of the construction of Bypass Road and the upgrade of Red Hills Road in 2012 were paid by Gunlake. Since the completion of the works on Bypass Road and Red Hills Road, the Council has upgraded Brayton Road specifically as it is used by trucks from Gunlake and Johnniefelds quarries. Gunlake's Section 94 contributions have been in excess of the cost of these upgrades.

3.5.2 Biodiversity

There may be minor additional disturbance to areas adjacent to the road to allow the proposed improvements to the primary haul route:

- acceleration lane at the quarry entrance (about 0.07 ha of exotic grasses, containing Paspalum (*Paspalum distichum*) and Plantain (*Plantago lanceolata*)), shown in Photograph 3.1;
- widening at the intersection of Brayton Road and Bypass Road (about 0.06 ha within the existing cleared shoulder); and
- acceleration lane on the Hume Highway (about 0.15 ha of exotic grasses (Paspalum, Whiskey Grass (*Andropogon virginicus*) and Plantain) with shrubs (Coastal Wattle (*Acacia longifolia subsp. sophorae*) and Sydney Green Wattle (*Acacia parramattensis*) and Spiny-headed Mat Rush (*Lomandra longifolia*)) planted on a formed batter slope as part of rehabilitation of Hume Highway construction), shown in Photograph 3.2.

Photograph 3.1 Exotic grassland in proposed acceleration land at the quarry entrance

Photograph 3.2 Planted shrubs in the proposed acceleration lane on the Hume Highway

A total of about 0.22 ha of largely exotic road-side vegetation will need to be cleared to construct the proposed improvements to the primary haul route.

The primary transport route is bordered by native vegetation along about 6.7 km. The additional truck movements may result in some additional road kill. Although, additional traffic may deter animals from the roadway as appears to occur on large roads such as the Hume Highway.

3.5.3 Aboriginal and historic heritage

As described above, there may be minor additional disturbance to areas adjacent to the road to allow the proposed improvements to the primary haul route.

As these small areas are immediately adjacent to the pavement of the existing roads, it is unlikely that there are significant Aboriginal heritage sites that will be disturbed by the proposed road improvements. There are no identified areas of historic heritage in these areas.

3.5.4 Noise and vibration

A detailed assessment of traffic noise along the primary transport route was conducted as part of the EIS (EMM 2016e, EIS Appendix K). This included monitoring of existing traffic noise and tube counts of vehicle numbers and types simultaneously.

As described in EIS Section 11.3.7:

> The future (total) road traffic noise levels are predicted to satisfy the RNP [Road Noise Policy, DECCW (2011)] day and night criteria at all nearest privately owned receivers on each section of the [primary and secondary] transport routes.

The *Industrial Noise Policy* (EPA 2000) does not apply to traffic on public roads.

3.5.5 Air quality and greenhouse gases

The *Air Quality and Greenhouse Assessment* (Ramboll 2016, EIS Appendix L) considered the potential air quality impacts from trucks on the primary transport route at residences along the route. The assessment found:

> Dispersion model predictions for the proposed Gunlake Quarry extension project show that the proposed changes to operations would not result in any exceedances of the impact assessment criteria for key pollutants, including PM_{10} [particulate matter - 10 micrometers], $PM_{2.5}$, TSP [total suspended particulates], RSC [respirable crystalline silica] and dust deposition.

Greenhouse gas emissions (Scope 3 emissions) from the transport of quarry products by road were estimated to be 24,775 tonnes CO_2-e/annum for the transport of 1.5 Mtpa and 33,033 tonnes CO_2-e/annum for the transport of 2.0 Mtpa (Ramboll 2016).

3.5.6 Surface and groundwater

There will be no impact to surface or groundwater as a result of the additional trucks using the primary transport route.

3.5.7 Social

The social impacts of the use of the primary transport route include amenity impacts (noise and visual impacts), potential impacts to road users impacts and broader impacts raised during consultation. These are discussed below, along with the key items raised during community consultation.

i Road safety

a. Potential for interaction

The *Gunlake Quarry Extension Project Transport Assessment* (EMM 2106f, EIS Appendix J) examined the existing traffic volumes using the primary transport route (Table 3.2).

Table 3.2 Primary transport route - current traffic volumes

Location	Annual average daily traffic			Maximum hourly volume
	All vehicles	Heavy vehicles	Light vehicles	All vehicles
Brayton Road between Gunlake Quarry and Bypass Road	720	326	394	56
Bypass Road	398	221	177	45

Source: EMM (2106f) Table 2.1 and Table 2.2.

The primary transport route has low traffic volumes (including existing quarry traffic), during the busiest times there is less than one vehicle movement per minute or one vehicle every two minutes on each side of the road. Based on the annual average daily traffic, there is one light vehicle movement on each side of the road every 7 minutes. Traffic volumes are lower on Bypass Road than on Brayton Road north of Bypass Road.

The proposed maximum number of daily truck numbers has been reduced to 590 movements, of which up to 38 movements may be on the secondary transport route. However assuming all 590 movements are all on the primary transport route, there will be one truck movement every 2.4 minutes on average which is one truck on each side of the road every 4.8 minutes.

At a maximum speed of 80 km/hour, vehicles will travel the full distance of the primary transport route in approximately 7 minutes. During this time, a non-project vehicle will pass about 3 oncoming trucks on average. There will be far less occasions when a non-project vehicle will catch-up with, or be caught-up by, a truck when travelling in the same direction given that all vehicles will be travelling at about 80 km/h for the majority of the time.

b. Road safety audit

A road safety audit was conducted of the primary transport route by Lyle Marshall & Partners and McLaren Traffic Engineering as part of the response to submissions assessments (Lyle Marshall & Partners and McLaren Traffic Engineering 2016). The report found:

> Brayton Road Reconstruction Stage 4 from Johnniefields Quarry (Holcim) to Ambrose Road (Bypass Road) has been designed to comply with the Goulburn Mulwaree Council DCP 2009 – Engineering Requirements.
>
> The proposed Gunlake Quarry expansion project will increase the average number of truck movements daily from 164 to 440.
>
> The Bypass Road was designed in accordance with the Gouldburn Mulwaree Council DCP 2009 - Engineering Requirements and a speed of 80 Km/hour.
>
> The design speed for Brayton Road Reconstruction and Red Hills Road east rehabilitation is not stated but the design standards are identical and comply with the Goulburn Mulwaree Council DCP 2009 - Engineering Requirements the percentage of heavy vehicle movements to total traffic in 2025 is expected to range between 50 and 78 per cent. With the expected closure of Johnniefileds Quarry the number of heavy vehicle movements daily will be about 400 in the Bypass Road and Red Hills Road east and about 500 on Brayton Road.
>
> The default speed limit on Brayton Road is 100 Km/hour. Speed measurements on all sections of the haul road route in 2015 showed that the 85th percentile speed was close to 100 Km/hour. The Gunlake Truck Driver Speed Limit Notice issued to drivers' states that drivers must not exceed 80 Km/hour.
>
> There have been no crashes recorded on the haul road route to Hume Highway over the past 5 years.
>
> The perceptions of residents who live along the route or travel the route to Marulan is that the road is too narrow and unsafe for the volume of heavy vehicles and the default speed limit of 100 Km/hour.
>
> In the opinion of the auditors there are a number of safety deficiencies due to poor delineation that can be corrected.

The risk ranking of Safety Issues in Tables 4.1, 4.2 4.3 and 4.4 in Austroads Guide to Road Safety Part 6: Road Safety Audits indicates that an off road or vehicle / vehicle collision would have serious consequences, the frequency improbable (less than once in 10 years) the resulting Level of Risk is medium. The Treatment approach is for the risk to be reduced or corrected if the cost is moderate.

The corrective actions recommended by Lyle Marshall & Partners and McLaren Traffic Engineering (2016) and the proposed actions by Gunlake Quarries are provided in Table 3.3.

Table 3.3 Road safety audit - recommended corrective actions

Item	Recommended corrective action	Proposed action
1	"Prepare a Truck Driver Code of Conduct to include all speed restrictions in the Truck Driver Induction Forms and speed limit notice, ban overtaking and anti-social behaviour and include Gunlake drug and alcohol policy."	Update Truck Driver Code of Conduct accordingly.
2	"Investigate GPS technology and fit equipment to monitor truck speed on the Transport route from Hume Highway at random intervals."	Fit and monitor GPS technology to Gunlake owned trucks.
3	"Install dividing barrier lines BB (two-way) with RRPM's in accordance with RMS Delineation Guidelines Sections 4 and 15 along the full 7.7 Km length of the haul road from Gunlake Quarry to Hume Highway to prohibit overtaking."	Work with the Council to install centre double white lines along the appropriate sections of the primary haul route.
4	"Install E1 edge lines on the pavement edges with RRPM's in accordance with RMS Guidelines Sections 4 and 15."	Work with the Council to install edge lines along the appropriate sections of the primary haul route.
5	"Carry Out" a Detail Survey of all hazards in the Clear Zone at 80 Km/hour, a risk assessment and costing to correct or reduce the risk.	Work with the Council to commission survey, risk assessment and costing.
6	"Increase guide post spacing to 60 metres, if the number of heavy fogs warrants."	Work with the Council todDetermine appropriate guide post spacing based on an analysis of the frequency of heavy fogs.
7	Goulburn Mulwaree Council to make a formal submission to RMS to lower the speed limit to 80 Km/hour and install 80 Km/hour speed limit signs.	Work with the Council on submission to RMS.

As described in Section 3.1, a number of road improvements additional to the corrective actions recommended by the road safety audit are proposed.

c. Road safety improvements

The road upgrades and decreased speed limit will substantially improve the safety on the route as:

- all vehicles will only be able to travel on Bypass Road at the design speed of 80 km/h;
- separation between vehicles travelling in opposite directions will be improved:
  - by increasing the road width of Bypass Road (ie within 400 m of Brayton Road);
  - by providing a physical barrier in the centre of Red Hills Road on the approach to the intersection with the Hume Highway;

- separation between vehicles travelling in the same direction will be improved:
    - by trucks using the existing deceleration lane prior turning into Gunlake Quarry;
    - by trucks using a new acceleration lane after turning out of into Gunlake Quarry;
    - by the installation of the acceleration on the Hume Highway;
- unsafe overtaking will be made illegal through the use of appropriate central double lines;
- the road edges will be better delineated by line marking and appropriately spaced marker posts;
- stopping distances will be decreased by about 30% as a result of the decreased speed limit; and
- the minor amounts of gravel that are tracked onto Brayton Road from the spray-sealed quarry intersection will be reduced by sealing the intersection with asphalt.

ii Road congestion

The route is not currently congested and has the capacity for the proposed additional truck movements. The *Transport Assessment* (EIS Appendix J) found that all intersections will continue to operate with a high "level of service", ie level of service A or B, with the exception of the intersection of Red Hills Road with the Hume Highway in the absence of an acceleration lane. Gunlake have now committed to construct the acceleration lane as soon as RMS approval is received (see Section 3.1).

The *Transport Assessment* considered a maximum of 690 truck movements per day. As Gunlake have committed to reducing the maximum to 590 truck movements per day (see Section 3.1), the *Transport Assessment* conclusions are conservative.

iii Travel times

Prior to 2013, vehicles travelling from Brayton and the surrounding area that wanted to join the Hume Highway and travel north, drove the full length of Brayton Road, through Marulan and joined the highway at the Marulan Interchange. Once Gunlake Quarries completed the Bypass Road in 2013, these vehicles travelled on the Bypass Road, reducing their travel distance by 5.9 km, and their travel time by at least four minutes.

Decreasing the speed limit from 100 km/h to 80 km/h along the primary transport route for all vehicles will increase travelling time on the full length of the route by approximately one minute. This will have a minimal impact on overall travel times.

iv Visual

Views from residences to the primary transport route are generally screened by intervening vegetation. There is little visual impact from trucks on a public road given that seeing trucks on a road is consistent with the viewer's expectations. The visual impacts along the primary transport route will not change as a result of increased truck numbers.

v Amenity impacts

The quarry currently has approval to transport products along the primary transport route 24 hours/day except 6.00 pm Saturday to 2.00 am Monday. It is not proposed to change these hours as part of the extension project.

Truck noise at residences along the primary transport route will remain below EPA criteria for the assessment of traffic noise.

The nearest residence to the primary haul route is 108 m from the road. Trucks will pass residences along the route more frequently which will result in some decrease in amenity, particularly when outside during leisure time, although all NSW noise assessment criteria will be met.

vi Property values

Responses to concerns regarding property values are provided in Chapter 6 of the *Response to Submissions* report (EMM 2016g).

vii Other social impacts

The key items raised during consultation regarding the use of the primary transport route (see Section 3.2) and proposed responses are summarised in Table 3.4.

Table 3.4 Key issues raised during community consultation following public exhibition of the EIS

Issue	Response
Product transport	
An alternative transport method (rail or private haul road) should be adopted	Alternative transport methods have been examined in detail. There are no viable rail or private haul road transport alternatives to the ongoing use of the transport routes proposed in the EIS.
Brayton Road and Bypass Road intersection safety	The approach to this intersection will be upgraded.
Brayton Road safety	A number of measures will improve safety on Brayton Road. These will include reducing the speed limit for all vehicles, additional signage and random inspections to ensure compliance with the Drivers Code of Conduct.
Brayton Road and Gunlake Quarry access road intersection safety	This intersection will be upgraded.
Red Hill Road and Hume Highway intersection safety	This intersection will be upgraded.
Red Hill Road and Bypass Road (Ambrose Road) intersection safety	A stop sign will be installed on the northern approach to this intersection.
Safety issues of steep gradient of Bypass Road (Ambrose Road)	A number of measures will improve safety on this section of road. Installation of additional guide posts (if warranted) will improve safety during heavy fogs.
Stone chips from road/trucks	There will be less opportunity for stones to be lifted by trucks in the widened sections of the road and the outer truck wheels will be less likely to run on the unsealed shoulder with the improved edge marking.
Road kill	The primary transport route will be adjacent to slightly less areas of native vegetation than a private haul road so slightly less road kill is expected.
Roadside litter	Gunlake has installed anti-litter signage along the quarry transport routes. The Drivers Code of Conduct will be updated to incorporating litter prevention practice.

Table 3.4 Key issues raised during community consultation following public exhibition of the EIS

Issue	Response
Noise	
Truck noise in early morning	No changes to transport hours are proposed. Traffic noise levels resulting from the extension project are predicted to satisfy the Road Noise Policy day and night criteria at all privately owned residences along the transport route.
Truck noise from trucks avoiding the Heavy Vehicle Safety Stations by using Red Hills north of Bypass Road and Bypass Road	Gunlake agrees that this is an inappropriate use of the northern section of Redhills Road by trucks. These trucks have no association with Gunlake Quarry's activities.
Economic	
Decreased property values	See Chapter 6 of the main Response to Submissions report.

A number of suggested improvements to the primary transport route were made by community members during consultation. These suggestions and responses are summarised in Table 3.5.

Table 3.5 Transport related community suggestions

Suggestion	Response
Product transport	
Gunlake Quarry entrance: • remove trees to increase visibility; • sweep gravel; and • widen Brayton Road/provide turn lanes at the entrance.	These measures are proposed. However, gravel sweeping will not be required with the installation of a full asphalt seal at the quarry entrance to replace the current asphalt spray seal. Maintenance of Brayton Road will remain a Council responsibility. The Council will determine the economic benefits of increasing the pavement strength to lengthen the period between required road maintenance.
Install rattle/cattle grid at entrance to remove rocks from the trucks before they enter the road.	Trucks are loaded at the quarry in a manner that minimises product falling outside of the tray. Trucks travel about 1.4 km on the quarry access road before reaching the entrance. This gives ample opportunity for any gravel outside of the tray to be shaken off within the quarry boundary. Gravel at the quarries entrance is associated with the current spray seal that will be replaced by a full asphalt seal.
Widen roads and allow somewhere to pull over.	Road widening will occur in sections.
Re-do markings.	Road lines will be re-marked as required as part of the general road improvements proposed.
Reduce speed limit of all roads to 80 km/h.	Speed limit of 80 km/h is proposed.
Reduce speed limit on Brayton Road to 70 km/h.	Not proposed.
Install cameras to monitor bad behaviour and catch bad truck drivers.	Gunlake will undertake random checks along the primary and secondary transport routes to ensure compliance with the Truck Driver Code of Conduct.
Extensive upgrades to Brayton Rd to address quality of road surface and road width.	Brayton Road has been recently upgraded by Council. Additional upgrades are proposed as part of the extension project. Maintenance of Brayton Road will remain a Council responsibility. The Council will determine the economic benefits of increasing the pavement strength to lengthen the period between required road maintenance.

Table 3.5 Transport related community suggestions

Suggestion	Response
Use a rail or different road option used to transport products.	Rail and road options have been assessed in detail. There are no economically viable product transport options other than to use the primary and secondary transport routes as proposed in the EIS.
Install signage or something to stop trucks using their air breaks.	This signage is proposed. Truck drivers will be educated regarding the acceptable use of air brakes on local roads.
Install signage for hidden driveways on Brayton road.	This measure is proposed.
Install signage regarding school bus route.	Gunlake has installed additional school bus route signage.
Driver education regarding littering.	Gunlake has installed anti-litter signage along the quarry transport routes. The Drivers Code of Conduct will be updated to incorporating litter prevention practices.
Social	
Establish enforceable valuation guarantees for property values along the primary transport route.	It is not proposed to establish these guarantees.

4 Conclusion

A summary comparing a private haul road to Marulan South Interchange and the primary transport route is provided in Table 4.1.

Table 4.1 Private haul road and the primary transport route summary

Aspect	Private haul road	Primary transport route
Route length (Gunlake Quarry to Hume Highway)	8.7 km	7.7 km
Land ownership	Five owners (Gunlake Quarries, Ranken Investment, Oliveri, Lafarge Holcim and Crown Lands). Purchase or access agreements would be required with Ranken Investment, Oliveri and Lafarge Holcim.	All roads currently owned by Council.
Land use	Quarries, agriculture and undeveloped land.	Public roads.
Noise	Applicable EPA assessment criteria would be met.	Applicable EPA assessment criteria would be met.
Air quality	Applicable EPA assessment criteria would be met.	Applicable EPA assessment criteria would be met.
Greenhouse gas emissions	Scope 3 (transport) greenhouse gas emissions: 24,775 tonnes CO_2-e/annum along the entire transport route.	Scope 3 (transport) greenhouse gas emissions: marginally greater than 24,775 tonnes CO_2-e/annum due to marginal increase in travel distance.
Biodiversity	Construction of the private haul road route would require clearing of about 8.2 ha of native vegetation: • 1.1 ha of EEC; • 3.3 ha of potential EEC; and • 3.8 ha of other native vegetation. of which about 2.3 ha is within the extension project disturbance area	Improvements to the primary transport route would require clearing of up to 0.07 ha of exotic vegetation and 0.15 ha of native vegetation planted during Hume Highway construction rehabilitation.
Heritage	A range of impacts to Aboriginal heritage items expected, particularly in the currently wooded section of the route and within Lynwood Quarry.	Impacts unlikely.
Visual	The trucks using the northern end of a private haul road would be visible from some nearby residences and the residences on elevated areas north and south of Towrang.	No change.
Safety	No interaction between haul trucks and other vehicles on the Marulan sections of the transport route.	Increased potential for interaction between haul trucks and other vehicles (still low) - additional safety measures proposed.
Social	Increased noise levels, truck visibility and lighting impacts on areas west of the private haul road route. However, applicable criteria would be met.	Travel time increase: 1 minute along the length of the route. Some amenity impact from noise.

Table 4.1 Private haul road and the primary transport route summary

Aspect	Private haul road	Primary transport route
Incremental capital cost	$35.7 million	$0.4 million
Operating costs[1]	$27.6 million	$27.0 million
Economic benefit to NSW	The extension project would have a net cost to the community of $17 million to $28 million (30 years and 7% discount rate, Gillespie Economics 2016a).	The extension project would have a net benefit to the community of $16 million to $27 million (30 years and 7% discount rate, Gillespie Economics 2016a).
Commercial risk to Gunlake	The inability to secure the access to private properties along the private haul road route would prevent development of the extension project. A secure agreement to allow transport of products through Lynwood Quarry for 30 years would need to be reached with Lafarge Holcim, Gunlake's largest competitor.	The public road system provides Gunlake a commercially secure method of transporting products from the quarry, allowing ongoing investment in the quarry.

Notes: 1. Based on the transport of 1.5 Mtpa.

There would be a range of construction and operational environmental impacts as a result of and using a private haul road from Gunlake Quarry to Marulan South Interchange, particularly to biodiversity and Aboriginal heritage. There would also be some operational impacts from operation along the primary transport route although, based on NSW Government criteria, these would be minor.

The incremental cash costs along the primary transport route over the life of the extension project are estimated to be between $306,000 and $650,000, although the latter is likely to be an overestimate (Gillespie Economics 2016a). Given that all NSW assessment criteria will be met at residences along the route will be met, the site-specific externality costs on people living and travelling along the route will be minimal. To avoid the externality costs of the use of the primary transport route, the additional cost of the lowest-cost private haul road would be $44 million (present value, 7% discount rate and 30 years). This is clearly not justified.

Given that the cost of the lowest-cost private haul road far exceeds the costs (including externalities) of the use of the primary transport route, the most effective approach is to ensure that safety along this route is maximised. This will be achieved through the proposed additional improvements to the primary transport route.

References

Allhomes 2016, *Property and Past Sales Reports* (data derived from the Department of Finance and Services, Land and Property Information 2016) viewed 20 July 2016, http://www.allhomes.com.au/ah/research/property-and-past-sales.

Department of Environment, Climate Change and Water (DECCW) 2011, *NSW Road Noise Policy*.

EMM Consulting (EMM):

- 2016a, *Gunlake Quarry Extension Project Environmental Impact Statement*. Report prepared for Gunlake Quarries.
- 2016b, *Transport Options Review*. Report prepared for Gunlake Quarries.
- 2016c, *Biodiversity Assessment Report*. Report prepared for Gunlake Quarries.
- 2016d, *Gunlake Quarry Extension Project Aboriginal Cultural Heritage Assessment Including the Results of an Archaeological Test Excavation*. Report prepared for Gunlake Quarries.
- 2016e, *Noise and Vibration Assessment*. Report prepared for Gunlake Quarries.
- 2016f, *Gunlake Quarry Extension Project Transport Assessment*. Report prepared for Gunlake Quarries.
- 2016g, *Response to Submissions*. Report prepared for Gunlake Quarries.

Environment Protection Authority (EPA) 2000, *NSW Industrial Noise Policy*.

Gillespie Economics 2016a, *Review of Cost Benefit Analysis of Gunlake Quarry Rail Transport Study Prepared by Hatch*. Report prepared for Gunlake Quarries.

Gillespie Economics 2016b, *Gunlake Quarry Extension Project Economic Assessment*. Report prepared for Gunlake Quarries.

Hatch 2016, *Gunlake Quarries Rail Transport Study*. Report prepared for Gunlake Quarries.

Lyle Marshall & Partners and McLaren Traffic Engineering 2016, *Stage 5 Road Safety Audit, Transport from Gunlake Quarry Entrance to Hume Highway*. Report prepared for Gunlake Quarries.

Office for Enviuronment and Heritage (OEH) 2014, *Framework for Biodiversity Assessment* (FBA).

Ramboll 2016, *Gunlake Quarry Air Quality Impact and Greenhouse Gas Assessment*. Report prepared for Gunlake Quarries.

Umwelt:

- 2005, *Proposed Lynwood Quarry, Ecological Assessment.* Report prepared for Readymix Holdings Pty Limited.

- 2015a, *Lynwood Quarry Extraction Area Modification, Biodiversity Report*. Report prepared for Holcim (Australia).

- 2015b, *Environmental Assessment for Lynwood Quarry Extraction Area Modification [Aboriginal Heritage]*. Report prepared for Holcim (Australia).

SYDNEY
Ground floor, Suite 01, 20 Chandos Street
St Leonards, New South Wales, 2065
T 02 9493 9500 F 02 9493 9599

NEWCASTLE
Level 5, 21 Bolton Street
Newcastle, New South Wales, 2300
T 02 4927 0506 F 02 4926 1312

BRISBANE
Level 4, Suite 01, 87 Wickham Terrace
Spring Hill, Queensland, 4000
T 07 3839 1800 F 07 3839 1866

Appendix G

Road safety audit

GUNLAKE QUARRIES PTY LIMITED

STAGE 5 ROAD SAFETY AUDIT
TRANSPORT ROUTE FROM
GUNLAKE QUARRY ENTRANCE
TO HUME HIGHWAY.

PREPARED JOINTLY BY ACCREDITED ROAD SAFETY AUDITORS FROM:

LYLE MARSHALL & PARTNERS PTY LTD
Consulting Engineers,
Transportation & Environmental Planners
Suite 31, 401 Pacific Highway
ARTARMON NSW 2064
Phone: (02) 9436-0086
Fax: (02) 9419-0082
EMAIL: lyle@lylemarshall.com.au

AND

M^{c}LAREN TRAFFIC ENGINEERING
SHOP 7, 720 OLD PRINCES HIGHWAY,
SUTHERLAND NSW 2232
Phone: (02) 8355-2440
EMAIL: mclarenc@ozemail.com.au

Job No.: 1671
Report No.: 16/16

AUGUST, 2016

CONTENTS

APPENDICES:

1.0 PROJECT INFORMATION AND TRAFFIC VOLUMES

1.1 Extension Project and Product Haulage

The quarry has approval to produce **750,000** tonnes of saleable product per annum. There are an average of **164** truck movements (**82** truck loads) each day. The peak truck loading rate is **11** truck loads per hour.

Approval is sought to expand the operation to produce 2 million tones per annum of saleable product. This will require an increase in daily truck movements to an average of **440** (220 laden trucks) and a maximum of **590** truck movements. It is expected that the maximum will occur **10** times a year. The maximum hourly truck loading rate could increase to **29** truck loads per hour.

The quarry has approval to operate its trucks **24** hours a day from **2:00am** Monday to **6:00pm** on Saturday but the truck movements generally occur between **5:00am** and **6:00pm**. Hence, there is the opportunity to increase truck movements without increasing peak hour loading rates.

1.2 Existing Traffic Volumes on Transport Routes

The existing average weekday traffic volumes and heavy vehicle volumes on the haul route from Gunlake Quarry to the Hume Highway are as follows:-

Table 1.2 Existing ADT Traffic Volumes

HAUL ROUTE SECTION	Year	ADT All Traffic	Heavy Vehicles	Proportion of Heavy Vehicles
Brayton Road (east of Gunlake Quarry)	2015	516	213	41%
Brayton Road (west of Bypass Road)	2015	720	326	45%
Brayton Road (east of Bypass Road)	2015	448	99	22%
Bypass Road (north of Brayton Road)	2015	398	221	56%
Gunlake Quarry access road	2015	238	168	71%
Johnniefields Quarry access road	2015	160	112	70%

Note: The 2015 ADT in Brayton Road west of Gunlake Quarry was 278 and included 45 heavy vehicles.

1.3 Future Traffic Volumes 2025

The predicted future traffic volumes on the transport route from Gunlake Quarry to the Hume Highway assuming a **2%** growth in general traffic, Gunlake Quarry operating with **440** truck movements daily and closure of the Johnniefields Quarry are as follows based upon **Tables 5.1** and **5.2** (**Ref 1** Transport Assessment by EMM Consulting.

1.3 (Continued)

Table 1.3 Future Traffic Volumes 2025

Haul Route Section	2015 Daily (all traffic)	2015 Daily (heavy vehs.)	Reduced Johnniefield traffic (all vehs.)	Reduced Johnniefield traffic (heavy vehs.)	10 year traffic growth (all traffic)	10 year traffic growth (heavy vehs.)	2025 daily traffic (all traffic)	2025 daily traffic (heavy vehs.)	Per Cent Heavy Vehicles
Quarry Access Road	238	168	0	0	330	276	568	444	78.2
Brayton Rd east of Gunlake Quarry	516	213	0	0	386	276	902	489	54.2
Brayton Rd (west of the Bypass Road)	720	326	-160	-112	79+330	0+276	969	490	50.6
Bypass Road (north of Brayton Road)	398	221	-106	-102	35+276	0+276	603	395	65.5
Brayton Road (east of the Bypass Road)	448	99	-54	-10	70	0	464	89	19.2

The increased truck movements generated by Gunlake Quarry will all travel on the Bypass Road to and from the Hume Highway.

1.4 Speed of Traffic on Transport Routes

Automatic tube counters were placed in the Bypass Road (Ambrose Road), Brayton Road (east) south of the bypass Road and Brayton Road west of the Bypass Road for **1 week in August 2015.** The **85th percentile** speed for light and heavy vehicles was as follows:-

Table 1.4 Speed of Traffic.

ROAD	ADT	85th Percentile Speed	% of Vehicles Exceeding 80 Km/hr.
Ambrose Road	397	96 Km/hour	72%
Brayton Road east of Bypass Road.	447	98 Km/hour	57%
Brayton Road west of Bypass Road	278	103 Km/hour	72%

1.5 Transport Route Reconstruction

1.5.1 Brayton Road Reconstruction – Stage 4. 1792 metres from Junction Bypass Road to Johnniefields Quarry.

The design parameters are noted on **Sheet 2** (**Ref 12**) and are as follows:-

Table 1.5.1

Seal width	:	7m
Carriageway Width	:	9m
Shoulders	:	1m
Basecourse Thickness	:	150
Sub-base thickness	:	150
Seal	:	Two Coat 14/7
Shoulder thickness	:	150
DESA	:	3×10^6
CBR	:	5 assumed
Delineation	:	Centreline with RPM's
	:	Edgelines
Cut and Fill Batters		1 in 3

The audit inspection found that there were no edgelines and no RPM's on the BB centerlines and separation lines. There are roadside hazards in the Clear Zone e.g. pipe culvert Headwalls, trees, embankment batters steeper than **1** in **3.**

1.5 (Continued)

1.5.2 Bypass Road Construction (Ambrose Road) From Junction at Brayton Road to Junction with Red Hills Road - 2513 metres.

The design parameters are noted on **Sheet 16** of the **WAE** drawings (**Ref. 13**) and are as follows:-

Table 1.5.2

Seal width	:	7m
Carriageway Width	:	8m
Shoulders	:	0.5m sealed
Basecourse Thickness	:	200
Sub-base thickness	:	200
Shoulder thickness	:	400
Seal	:	Two Coat 14/7
DESA	:	2.85×10^6
CBR	:	35
Delineation	:	Centrelines marked. No RPM's on BB barrier lines and SI separation lines and EI edgelines
Design Speed	:	80 Km/Hr.
Fill Batters		1 in 3

The **WAE** Drawings show fill batters of **1** in **2**.

1.5.3 Red Hills Road, Road Rehabilitation. Hume Highway to Ambrose Road – 890 metres Sheet 1 and 12 (Ref. 11)

Table 1.5.3

Seal width	:	7m
Carriageway Width	:	9m
Shoulders	:	1m
Basecourse Thickness	:	150
Sub-base thickness	:	150
Shoulder thickness	:	150mm
Seal	:	Two Coat 14/7
DESA	:	3×10^6
CBR	:	14
Delineation	:	BB barrier lines, SI separation line, EI edge line RRPM raised pavement markers.
Design Speed	:	Not stated.
Fill Batters		1 in 3

The audit inspection found that there were no edge lines and no RRPM's on the BB barrier lines and S1 separation line. The cross sections show **1** in **1** batters in run-out area.

1.5 (Continued)

1.5.4 Conclusions:

The carriageway width, shoulder width and shoulder seal comply with the Goulburn Mulwaree DCP 2009 - Engineering Requirements Section 7.2.2 (**Ref 4**).

The crash data (**Ref 3**) shows that there were no reported crashes in the 5 year period on the haul road system to Hume Highway.

1.6 Public Submissions Following Exhibition of EIS for Gunlake Quarry Extension Project SSD – 7090

The 27 written submissions from the exhibition period provided to the audit team raised the following traffic and road safety issues:-

- Bypass road inadequate and dangerous for current truck movements.
- Traffic safety problem due to increase in truck traffic from 164 to 440 per day.
- Unsafe to pick up / drop-off children on School Bus Route due to increase in trucks. Brayton Road and Bypass Road are on the School Bus Route.
- Hazard with wildlife kills on road.
- EIS dismissed alternative transport operations without adequate investigation. Option 4 considered to be viable.
- Truck noise at night on 500 metre steep 12 per cent grade on Bypass Road.
- Safety. Narrow road pavement. Poor delineation. 100 Km/hour speed limit. Excessive speed of trucks.
- Inconsiderate truck driver behaviour.
- Poor state of road. Potholes due to heavy trucks. Inadequate road maintenance.
- Limited visibility due to fog. Risk of fog high for 6 months.
- Trucks generate dust, noise and diesel fumes.

2.0 BACKGROUND INFORMATION AND REFERENCES

The following documents provided by Gunlake Quarries as part of the consultation process have been reviewed for the preparation of this Road Safety Audit together with the relevant Austroads Guidelines, Australian Standards and RMS Guidelines.

1. Transport Assessment for Gunlake Quarry Extension Project 10th February 2016 by EMM Consulting.
2. Transport Options Review for Gunlake Extension Project 2 February 2016 by EMM Consulting.
3. Crash Data for Goulburn Mulwaree LGA for 5 year period ending 21/9/2015 from Transport for NSW.
4. Goulburn Mulwaree Council DCP2009 - Engineering Requirements Section 7.2.2.
5. Public submissions to Department of Planning and Environment following exhibition of EIS for Gunlake Quarry Extension Project.
6. Letter dated 17/5/2016 from RMS Southern Region to Department of Planning and Environment regarding SSD 7090 Gunlake Quarry Extension Project.
7. Gunlake Docket Delivery Sheet for 29/6/2015. 67 truck loads 5:27am to 3:53PM.
8. Gunlake Drug and Alcohol Policy.
9. Gunlake Quarries Truck Driver Induction (3 Forms) and Gunlake Truck Driver Speed Limit Notice. October 2015.
10. NSW Transport RMS Standards (PBS) Heavy Vehicle Combinations.
11. Red Hills Road, Marulan. Hume Highway to Joarimin Road. Road Rehabilitation. Design Drawings Sheets 1 to 12 Drawing No. R931.
12. Brayton Road, Marulan. Reconstruction – Stage 4 from Ambrose Road to Holcim (Johnniefields Quarry).
13. Work as Executed Drawings Sheets 1 to 18 Ref 1035 Laterals Engineering Joarimin Road.
14. AS 1742.2 – 2009 Manual of Uniform Traffic Control Devices Part 2 : Traffic Control Devices for General Use. Section 4 Pavement Markings and Delineation.
15. RMS Delineation Guidelines Section 4 Longitudinal Markings and Section 15 – Raised Pavement Markers.
16. NSW Transport Roads and Traffic Authority Guidelines for Road Safety Audit Practices July 2011.
17. AS 1742.2 2008 Manual of Uniform Traffic Control Devices Part 4 : Speed Controls.
18. Austroads Guide to Road Safety Part 6: Road Safety Audit.
19. Austroads Guide to Road Design – Part 6: Roadside Design, Safety and Barriers.

3.0 AUDIT TEAM

Lyle Marshall and Partners Pty Ltd and McLaren Traffic Engineering were commissioned by Gunlake Quarries Pty Ltd to conduct a **Stage 5 Audit** of the recently upgraded Section of Brayton Road between Johnniefields Quarry and Bypass Road and the line marking and signposting on Brayton Road from the entrance to Gunlake Quarries and Johnniefields Quarry, the Bypass Road and Red Hills Road East to Hume Highway. Access to the Hume Highway and the proposed acceleration lane was not included.

The team comprised the following personnel:-

Lyle Marshall, BE, M.Eng. Sc, Dip Env Stud, F.I.H. & T., C. P. ENG., NPER (Civil), M.I.E.Aust., .M.A.I.T.P.M.

Lyle Marshall is the principal of Lyle Marshall and Associates, has undertaken the IPWEA training programme for Road Safety Auditors and is an accredited Level 2 auditor, has completed the NSW Transport Training Course Programme “Road Safety Auditing for Leaders” September 2013 and has many years experience in road design for urban and rural projects, traffic engineering transportation planning, accident investigation and road safety audits. He is the Lead Auditor for this study.

Craig McLaren, BE Civil, Grad Dip. Traffic Eng. M.A.I.T.P.M.

Nominated Road Safety Auditor who has undertaken IMEA Road Safety Accreditation Course and is an accredited Level 3 Auditor. Director of McLaren Traffic Engineering with over 30 years experience as a senior traffic engineer. Experience in traffic impact assessment, local area traffic management studies, parking studies, road safety audits, accident analysis and geometric design.

The accreditations of both Principals and their relevant experience are included under CV’s

4.0 INITIAL CONSULTATION

The initial consultation was held with Andrew Wade at the office of Gunlake Quarries Marulan at *11:00am on 21/6/2016* followed by an inspection of the transport route to the Hume Highway.

The audit includes the upgrading of Brayton Road from Johnniefields Quarry to the Bypass Road (Ambrose Road) but was extended to include pavement marking, signposting and guide posts on the transport route from Gunlake Quarry entrance to the Hume Highway. Access to the Hume Highway and the proposed acceleration lane was not included as the RMS had carried out a number of observations of trucks entering the highway and submitted a letter dated 17th May 2016 to the Department of Planning and Environment stating their concerns and design requirements for the acceleration lane to be constructed by Gunlake Quarries Pty Ltd.

5.0 DOCUMENT REVIEW, ROUTE INSPECTIONS AND FINDINGS AND CORRECTIVE ACTIONS

5.1 Document Review

The Bypass Road was designed for 80 Km/hour The design speed for Brayton Road reconstruction and Red Hills Road rehabilitation is not stated but the design drawings were prepared by Goulburn Mulwaree Shire Council. The Design drawing Sheet 21 for Brayton Road reconstruction shows BB barrier lines and RRPM's, S1 separation line and RRPM's and E1 edge lines. The edge lines and RRPM's have not been installed. The design drawing Sheet 12 for Red Hills Road east rehabilitation shows BB barrier lines with RRPM's and E1 edge lines. The BB barrier lines were not marked for the full road length but replaced in part by double one-way barrier lines that allow over taking manoeuvres. There are no RRPM's and no edge lines. Edge lines are required when roadside hazards occur close to the pavement edge and for contrast between the pavement and shoulder when shoulders are sealed.

Gunlake Quarries has a self imposed 80 km/hour speed limit on all of its heavy vehicles. It is relevant to note that the purpose of Speed Management is "*to contribute to road safety, mobility and amenity on public roads by providing a system of speed limits that are compatible with the speed environment*". It is noted that a default speed limit of 100 Km/hour applies in rural areas in the absence of a speed zone.

The roadside development through which the transport route to Hume Highway passes is farmland with 2 significant quarries that currently generate Gunlake 84 plus Holcim 56 = 140 heavy truck loads per day. The average number of loaded trucks from Gunlake Quarries will increase from 82 to 220 per day. There are in addition trucks generated by other developments outside the area that operate on the haul road route.

5.2 Route Inspection

The transport route inspections were carried out by Lyle Marshall and Craig McLaren in a motor vehicle fitted with a video camera. At bus stops, large culverts and roadside obstructions such as culvert headwalls, trees and table drains in the Clear Zone, inspections were made on foot. The daylight inspections commenced at 2:30pm and ended at 3:16pm.

The sections of the transport route from Gunlake Quarry to the Hume Highway are:-

Section	
1	**Gunlake Quarry Access Road** Chainage 00. Entrance road to Johnniefields Quarry (Holcim) Ch 2.2 Km.
2	**Brayton Road Reconstruction Stage 4** From entrance Road to Johnniefields Quarry Ch 2.2Km. To Tee Junction at Bypass Road (Joarimin Road or Ambrose Road) Chainage 4.2 Km.
3	**Ambrose Road (Bypass Road)** Starts at Brayton Road Chainage 4.20 Km. Ends Tee Junction with Red Hills Road north Chainage 6.45 Km.
4.	**Red Hills Road east Rehabilitation**. Start chainage 6.45 Km. End Hume Highway Chainage 7.75 Km.

5.2 (Continued)

Brayton Road Eastbound Inspection

Section 1: Eastbound Inspection Gunlake Quarry Road to Johnniefields Quarry

Ch 00	**Start -** Gunlake Quarry Road.
Ch 50m	School Bus Route warning sign on left. Dividing barrier lines BB (two-way). Guide posts regularly spaced. Reflectors on first 6 guide posts – not visible at night. Clean or replace reflectors. Dividing barrier lines BB (two-way) end.
Ch 300m	Crest. Dividing barrier line (one-way) BS. Overtaking eastbound.
Ch 500m	Dividing separation line S1.
Ch 750m	Dividing barrier line (one-way) BS Overtaking westbound.
Ch 850m	School bus route warning sign on left.
Ch 900m	Dividing barrier lines BB (two-way) *start*.
Ch 950m	Dividing lines BB end and replaced by dividing separation line. S1.
Ch 1.35 Km	Driveway access on right. Horizontal curve sealed road width 8.1 metres. No edgelines. Narrow shoulders.
Ch 1.60 Km	Dividing barrier lines BB (two-way).
Ch 1.65 Km	Dividing barrier line (one-way) BS. Overtaking eastbound.
Ch 1.75 Km	Dividing separation line S1.
Ch 2.00 Km	Dividing barrier line (one-way) BS. Overtaking westbound. Steep embankment on left in Clear Zone.
Ch 2.2 Km	Entrance to Johnniefields Quarry (Holcim).

Section 2 Eastbound Inspection Brayton Road – Stage 4 Reconstruction.

Ch 2.2 Km	Dividing barrier lines BB (two-way).
Ch 2.35 Km	Guardrail on left. Steep embankment.
Ch 2.5 Km	School bus *drop off / pick up bays* on both sides. No bus stop signs. Residential driveway to No. 459 on right. Guardrail on left ends at start of Bus Bay. **Photo P1**.
Ch 2.7 Km	Driveway to No. 436 on left. Exposed culvert headwalls in Clear Zone. **Photo P2**. Table drain close to edge of carriageway. **Photo P3**. Culvert Headwall on right at entrance to sub-station. No guide posts on culvert headwalls.
Ch 2.80 Km	Narrow road sign on approach to large culvert.
Ch 2.9 Km	Major culvert under Brayton Road.
Ch 2.95 Km	School Bus Stop sign on left. Dividing barrier line BS (one-way) overtaking *west*bound
Ch 3.0 Km	Dividing barrier line BS (one-way) overtaking *east*bound **Photo Video V1**.
Ch 3.1 Km	Dividing separation line S1. **Photo Video V2**.
Ch 3.4 Km	Culvert in Brayton Road.
Ch 3.45 Km	Minor pipe culvert in driveway. Headwalls exposed in Clear Zone (2m offset from edge of bitumen).
Ch 3.7 Km	Dividing barrier lines BB (two-way). Side road junction sign ahead on left. **Photo Video V3**.
Ch 3.9 Km	Culvert with headwalls.
Ch 4.0 Km	Tee Junction warning sign.
Ch 4.2 Km	Bypass Road (Ambrose Road).

5.2 (Continued)

Eastbound Inspection. Bypass Road (Ambrose Road) Section 3

Ch 4.2 Km	Start
Ch 4.25 Km	Dividing barrier lines. BB faded.
Ch 4.55 Km	65 Km/hour speed restriction sign on left. Curve to right.
Ch 4.60 Km	Joarimin Creek Road junction. Potholes at junction.
Ch 4.65 Km	Dividing barrier lines unclear. **Photo Video V4**.
Ch 4.83 Km	Major culvert in Bypass Road with guardrail both sides. Dividing barrier line B5 (one-way) overtaking eastbound.
Ch 4.90 Km	Dividing separation line S1starts. **Photo Video V5**.
Ch 5.40 Km	Pipe culvert headwall in driveway on left. Exposed in Clear Zone.
Ch 5.6 Km	Potholes in pavement.
Ch 5.75 Km	Guardrail on left. Steep drop off. Dividing separation line S1. Steep 12% gradient**. Photo Video V6**.
Ch 6.25 Km	Side road warning sign.
Ch 6.45 Km	Side road junction Red Hills Road north and east. Give Way line faded in side road. BB lines faded.

Note: Potholes are being repaired with deep lift asphalt by Council in the maintenance program.

Red Hills Road East Section 4.

Ch 6.45 Km	Start.
Ch 6.95 Km	Dividing barrier lines BB (two-way) end. Dividing barrier line BS (one-way). Overtaking eastbound. **Photo Video V7**.
Ch 7.05 Km	Dividing separation line S1 ends.
Ch 7.35 Km	Dividing barrier line BS (one-way). Overtaking. Westbound.
Ch 7.40 Km	Curve warning sign on left.
Ch 7.60 Km	**Photo Video V8** Dividing barrier lines faded.
Ch 7.65 Km	25 Km/hour Advisory Speed sign on left. Dividing barrier lines BB faded. Unclear.
Ch 7.75 Km	Hume Highway. End Section 4.

WESTBOUND INSPECTION

Westbound Inspection – Red Hills Road East – Section 4.

Ch 00	Start.
Ch 0.10 Km	Guardrail starts on left. Video **Photo V9**. Dividing barrier lines BB faded. Unclear.
Ch 0.20 Km	Dividing barrier lines BS (one-way). Overtaking westbound. Steep drop off on left.
Ch 0.55 Km	Dividing barrier lines BS (one-way). Overtaking eastbound
Ch 0.95 Km	Crest. Steep drop off on right.
Ch 1.15 Km	Dividing barrier lines BB (two-way) continue to side road.
Ch 1.30 Km	Junction with Red Hills Road north and Joarimin Road – Guardrail on left.

5.2 (Continued)

Westbound Inspection. Bypass Road (Ambrose Road) – Section 3.

Ch 1.30 Km	Start.
Ch 1.37 Km	Rock filled gabions start on left in deep cutting.
Ch 1.65 Km	Rock lined table drain eroded on left.
Ch 3.0 Km	No advisory speed on curve sign on left side. Curve to left.
Ch 3.4 Km	Tee Junction sign for Brayton Road.
Ch 3.5 Km	Intersection at Brayton Road. Sight board D4 in Brayton Road. Give Way sign.

Westbound Inspection. Brayton Road Section 2 to Johnniefields Quarry.

Ch 3.5 Km	Start.
Ch 3.6 Km	**Photo Video V10.** School bus route sign ahead on left.
Ch 3.65 Km	School bus route warning sign on left side.
Ch 3.75 Km	School bus route sign but no message.
Ch 3.80Km	Culvert with guardrail on both sides.
Ch 3.95 Km	Culvert with guardrail on both sides.
Ch 4.20 Km	Bus stop off road near entrance to No. 353 and No. 355. No bus stop sign.
Ch 4.30 Km	Culvert with guardrail on both sides.
Ch 4.45 Km	Culvert with guardrail on both sides.
Ch 4.55 Km	Culvert with guardrail on both sides.
Ch 4.65 Km	House on left No. 394.
Ch 4.75 Km	School bus sign with no message. Add words “School Bus Route”.
Ch 4.80 Km	Major culvert in Brayton Road with guardrail on both sides.
Ch 4.95 Km	Pipe culvert with headwalls in driveway on left in Clear Zone.
Ch 5.00 Km	Culvert in driveway at sub-station on left.
Ch 5.25 Km	Bus stops on left and right sides.
Ch 5.30 Km	House on left.
Ch 5.35 Km	Guardrail on right ends.
Ch 5.45 Km	Access Road to Johnniefields Quarry. End. **Photo Video V11**.

Westbound Inspection. Brayton Road – Section 1. Johnniefields Quarry to Gunlake Quarry.

Ch 5.45 Km	Start
Ch 5.6 Km	Driveway access on left to Nos. 497 and 499.
Ch 5.9 Km	Driveway on left.
Ch 6.35 Km	Driveway on left on outside of bend. Convex safety mirror on right side. Dividing barrier lines BS (one-way) clear. Overtaking westbound. **Photo Video V12**
Ch 7.1 Km	Driveway to No. 653.
Ch 7.7 Km	Access Road to Gunlake Quarry on left with Stop Sign at Brayton Road. Potholes in access road. **Photo Video V13**. End Section 1.

Note: Potholes are being repaired with deep lift asphalt by Council in the maintenance program.

5.2 (Continued)

NIGHT AUDIT

Inspection Eastbound - Section 1.

Ch 00	Access road to Gunlake Quarry. Red Reflectors on the first 6 guideposts are not visible. May be dirty or faded.
Ch 2.2 Km	Access Road to Johnniefields Quarry. End.

Inspection Westbound - Section 1.

Ch 00	Access Road to Johnniefields Quarry. Start.
Ch 2.2 Km	Access Road to Gunlake Quarry. Road delineation poor at night.

Inspection Eastbound - Gunlake Quarry to Hume Highway
Start 5:30pm – End 5:45pm.

Ch 00	Gunlake Quarry Access Road.
Ch 7.7 Km	Hume Highway. End. Delineation poor at night.

5.3 Findings and Corrective Actions

Brayton Road Reconstruction Stage 4 from Johnniefields Quarry (Holcim) to Ambrose Road (Bypass Road) has been designed to comply with the Goulburn Mulwaree Council DCP 2009 – Engineering Requirements.

The proposed Gunlake Quarry expansion project will increase the average number of truck movements daily from 164 to 440**.**

The Bypass Road was designed in accordance with the Gouldburn Mulwaree Council DCP 2009 - Engineering Requirements and a speed of 80 Km/hour. The design speed for Brayton Road Reconstruction and Red Hills Road east rehabilitation is not stated but the design standards are identical and comply with the Goulburn Mulwaree Council DCP 2009 - Engineering Requirements

5.3 (Continued)

The percentage of heavy vehicle movements to total traffic in *2025* is expected to range between 50 and 78 per cent. With the expected closure of Johnniefileds Quarry the number of heavy vehicle movements daily will be about 400 in the Bypass Road and Red Hills Road east and about 500 on Brayton Road.

The default speed limit on Brayton Road is 100 Km/hour. Speed measurements on all sections of the haul road route in 2015 showed that the 85th percentile speed was close to **100** Km/hour. The Gunlake Truck Driver Speed Limit Notice issued to drivers' states that drivers must *not exceed* 80 Km/hour.

There have been no crashes recorded on the haul road route to Hume Highway over the past 5 years

The perceptions of residents who live along the route or travel the route to Marulan is that the road is too narrow and unsafe for the volume of heavy vehicles and the default speed limit of 100 Km/hour.

In the opinion of the auditors there are a number of safety deficiencies due to poor delineation that can be corrected.

The risk ranking of Safety Issues in **Tables 4.1**, **4.2 4.3** and **4.4** in **Austroads Guide to Road Safety Part 6:** Road Safety Audits indicates that an *off road or vehicle / vehicle collision would have serious consequences,* the frequency improbable (*less* than **once in 10** years) the resulting **Level of Risk** is **medium**. The Treatment approach is for the risk to be *reduced or corrected* if the cost is moderate.

Corrective Actions

1. Prepare a Truck Driver Code of Conduct to include all speed restrictions in the Truck Driver Induction Forms and speed limit notice, ban overtaking and anti-social behaviour and include Gunlake drug and alcohol policy.
2. Investigate GPS technology and fit equipment to monitor truck speed on the Transport route from Hume Highway at random intervals.
3. Install dividing barrier lines **BB** (two-way) with **RRPM's** in accordance with **RMS Delineation Guidelines Sections 4** and **15** along the full **7.7** Km length of the haul road from Gunlake Quarry to Hume Highway to prohibit overtaking.
4. Install **E1** edge lines on the pavement edges with **RRPM's** in accordance with **RMS** Guidelines **Sections 4** and **15**.
5. "Carry Out" a Detail Survey of all hazards in the Clear Zone at 80 Km/hour, a risk assessment and costing to correct or reduce the risk.
6. Increase guide post spacing to 60 metres, if the number of heavy fogs warrants.
7. Goulburn Mulwaree Council to make a formal submission to RMS to lower the speed limit to 80 Km/hour and install 80 Km/hour speed limit signs.

6.0 COMPLETION MEETING

A completion meeting by telephone was held with Mr Ed O'Neill on 12/8/16 to discuss the finings and corrective actions.

7.0 FORMAL STATEMENT

The undersigned declare that they have reviewed the material and data provided, carried out an inspection of the 7.7 Km Transport Route from Gunlake Quarries entrance road to the Hume Highway in both directions, identified the safety deficiencies and listed a number of corrective actions for treatments to reduce the frequency and severity of any harm due to the identified deficiencies.

The Road Safety Audit Report and findings have been forward to the Client representative Andrew Wade for consideration and follow up action.

. . . . . .

Lyle Marshall
Lead Auditor

. . . . . .

Craig McLaren
Auditor

APPENDIX A

Video Photo V1: **Brayton Road eastbound towards Bypass Road . Dividing barrier line one-way BS 27/6/2016 CH 3.0 km.**

Video Photo V2: **Brayton Road eastbound. Dividing separation line S1. CH 3.1 km**

Video Photo V3: **Brayton Road eastbound towards tee junction with Bypass Road. Dividing barrier lines BB (two-way). CH 3.70 km Side road junction sign W2-4B on left.**

Video Photo V4: **Bypass Road east of Joarimin Creek sign. Dividing Barrier lines unclear. No edgelines. CH 4.65 Km.**

Video Photo V5: Dividing separation line S1 (about 800 metres west of steep 12% gradient that commences at Chainage 1680. CH4.90 Km.

Video Photo V6: Dividing separation line S1 on steep 12% gradient in Bypass Road eastbound. Guardrail on left. Steep drop off CH 5.75 Km.

Video Photo V7: **View eastbound on Red Hills Road east, east of tee intersection with Red Hills Road north. Dividing barrier line (one-way) BS overtaking eastbound CH 6.95**

Video Photo V8: **View eastbound on Red Hills Road east about 100 metres from Hume Highway tee intersection. Dividing barrier lines BB faded. Hard to see. CH 7.60Km.**

Video Photo V9: **Guardrail on left on curve to right and crest ahead. Dividing barrier lines BB faded. Ch 0.10 Km**

Photograph V10: **View westbound on Brayton Road about 100 metres west of tee intersection with Bypass Road. School bus route sign on left. Dividing barrier lines BB (two way) faded. Ch 3.60 Km**

Video Photo V11: **Brayton Road westbound at entrance to Johnniefields Quarry (Holcim sign on right). Dividing barrier lines BB (two-way) Ch 5.45 Km**

Video Photo V12: **Safety mirror on right side. Driveway on left. Dividing Barrier lines BS (one-way) clear.. CH 6.35 Km.**

Video Photo V13: **Brayton Road westbound neare entrance to Gunlake Quarry. Dividing barrier lines BB (two-way) east of entrance road. Stop sign in Quarry road at Brayton Road. CH 7.70 Km. 27-06-2016**

PHOTO P1 **View west of Brayton Road from bus stop on northern side. Unclear where edge of shoulder seal joins edge of through lane.**

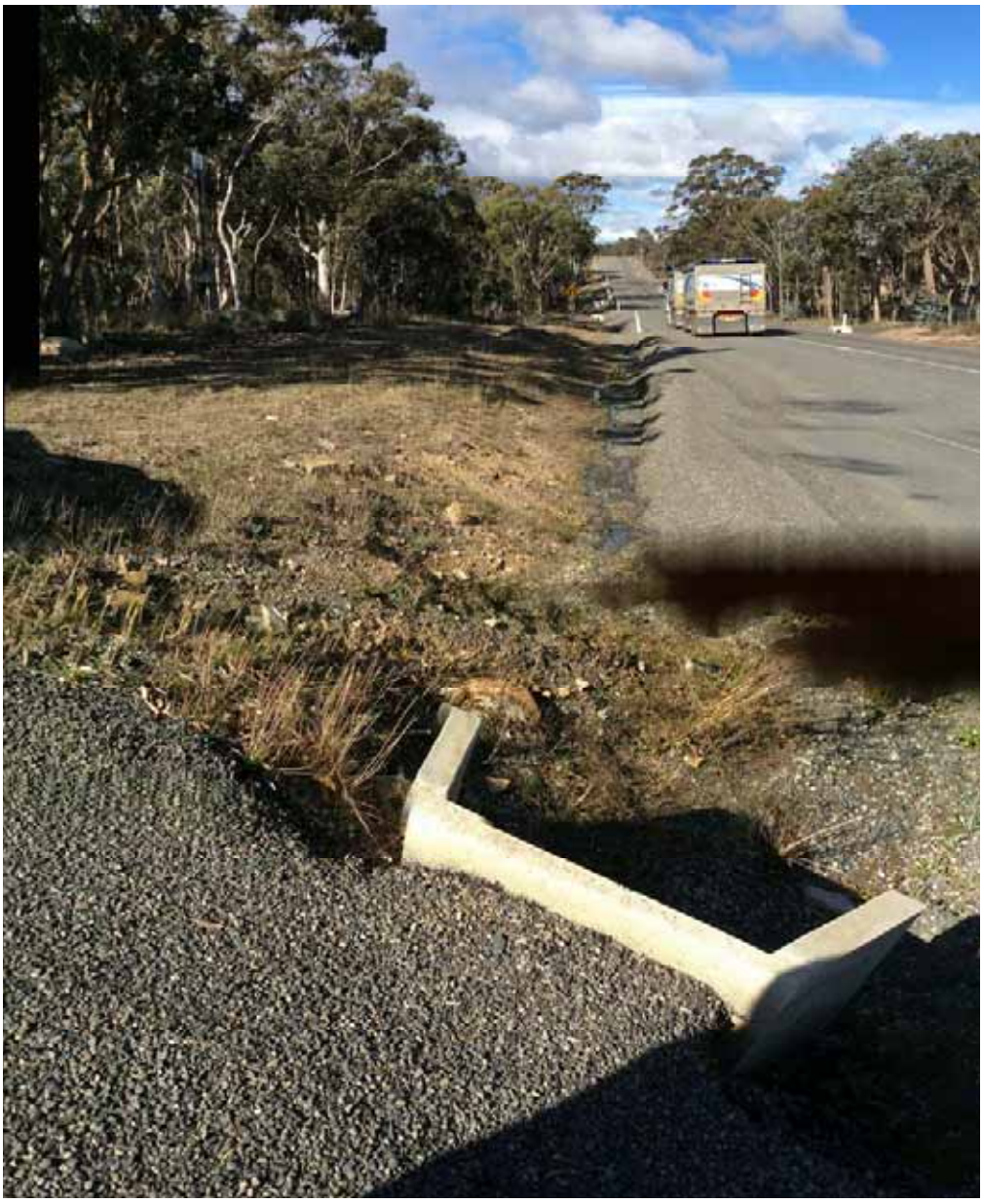


Photo P2: **Headwall in pipe crossing at driveway entrance in clear zone on northern side of Brayton Road. Unclear where sealed shoulder joins edge of through lane CH 2.70 Km.**

Photo P3 **Table drain and batters in clear zone on northern side of Brayton Road. Barrier lines faded. Narrow Road sign in advance of guardrails at road culvert. No edgelines Ch 2.70Km.**

CURRICULUM VITAE

LYLE MARSHALL

BE (Civil).
M.Eng.Sc. (NSW)
Dip.Env.Stud.
F.I.H. & T. (London)
M.I.E. Aust. M.A.I.T.P.M.
C.P.ENG., NPER
Level 2 Accreditation Road Safety Auditor

QUALIFICATIONS:

Bachelor of Engineering (Civil)
University of Adelaide, S.A.

Master of Engineering Science
(Highway Engineering)
University of NSW.

Diploma in Environmental Studies
Macquarie University.

Professional Engineer, Civil Division,
Board of Professional Engineers of Queensland.
Attended short course in Port and Industrial Pavements 2001
Accredited IPWEA Road Safety Auditor.

PROFESSIONAL AFFILIATIONS

Member of Association of Consulting Engineers Australia
Member of Institution of Engineers, Australia
Fellow Institution Highways and Transportation, London
Member Australian Institute of Traffic Planning and Research
Chairman of SAA Committee CE-1 Off Street Car Parking.
Chartered Professional Engineer
National Professional Engineers Register No. 338415

PAPERS AND PUBLICATIONS:

Co-author of Paper "Understanding and Observance of Parking Signs", 10th ARRB Conference Sydney 1980.

Author of Paper "Design of Western Distributor - Stage One", presented to Institution of Engineers, Australian Civil Engineering Branch, Sydney Division August, 1968. (Unpublished)

Co-author of paper "Friction in Pre-stressing Ducts" presented at Fifth Biennial Conference. Concrete Institute of Australia, September, 1971.

PROFESSIONAL EXPERIENCE

Principal of the firm established in April, 1974. Has undertaken traffic and parking studies for many industrial / commercial/retail/residential, hotels / Licensed Clubs/Child Care Centres developments and drive-in establishments; town centre traffic studies, parking studies in Baulkham Hills Town Centre, Wagga Wagga, Manly, Randwick, City of Sydney and other centres. Local area traffic management studies in Strathfield, Warrawong, Manly, Ashfield and Port Macquarie, St Mary's, Oxley Park, Carlton, Arncliff and Bardwell Park. Traffic accident studies, road safety audits on State Roads and urban and rural roads.

Investigations and design for large civil development projects involving road and drainage design for industrial and residential roads, main roads and state highways. Road pavement design, design of heavy duty pavements for container terminals, design of heavy duty concrete pavements for materials recycling facility and service station, investigation of pavement failures, earthworks, site regrading, soil and water management, erosion control for stormwater and water supply canals and drainage studies. Flood Risk management studies.

Detailed structural design of bridges, earth retaining structures, industrial buildings, residential buildings, miscellaneous structures; investigation and assessment of hydraulic structures including bridges, culverts, syphons, regulators, off-takes and escapes. Benefit/cost studies and feasibility studies. Planning studies, environmental impact assessments and statements. Project management of land development projects.

Has provided expert advice on a wide range of traffic matters including accidents, expert evidence on civil engineering matters including pavement failures, residential and commercial developments in flood prone areas, has appeared on many occasions as an expert witness in traffic matters before the Land and Valuation Court, Local Government Appeals Tribunal, Land and Environment Court, Licensing Courts, District Courts and the Supreme Court in NSW and ACT, and has acted for state organizations and many local government and private organisations.

EXPERIENCE PRIOR TO COMMENCING FIRM

- Associate of P G Pak Poy & Associates Pty Ltd and foundation manager of Sydney branch office. Project Manager for civil and structural design of urban and rural highway and bridge projects, multi storey parking garage, office buildings, prestressed concrete design for major buildings, surface parking areas. Traffic studies of suburban town centres, regional shopping centres, hotel and motel developments, service stations and large commercial developments.

  Economic feasibility studies for regional shopping centres, large residential subdivisions and parking stations.

  Town planning investigations for district centres, large commercial developments, regional shopping centres, planning and investigation of new townships, large residential subdivisions and tourist resort complexes, central business district developments and industrial projects. Civil design for residential subdivisions, industrial subdivisions. Experience in environmental impact assessment.

- Associate and project manager with De Leuw Cather & Company, Sydney. Projects included design and specifications for a major cargo terminal in Sydney and foundation settlement studies and preliminary design, contract plans and documents for pre-stressed concrete bridges and miscellaneous structures for extension of Mitchell Freeway in Perth.

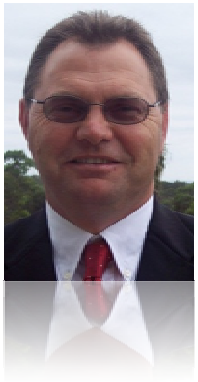
  Project engineer for design and contract documents for first stage of western distributor and for geometric and preliminary design of expressway roads and ramps in Sydney, and steel, reinforced and pre-stressed concrete expressway bridges in Melbourne.

- Previously associate and manager for structural design, Willing and Partners, Sydney and Port Moresby. Responsible for design of multi storey buildings, earthworks, urban and rural roads, drainage, water reticulation, foreshore reclamation and reinforced and pre-stressed concrete bridges.

- Engineer supervising bridge construction section, Public Works Department, Tasmania. Projects including highways, bridges, mechanical installation for swing spans, marine structures including steel and reinforced concrete jetties, breakwaters and steel work fabrication and erection for public buildings.

- Project engineer with the Roads and Aerodromes Design Section of the Commonwealth Department of Works on construction of major airports and marine structures including lighthouses and jetties. Design engineer for roads, car parks and drainage works.

Craig McLaren (Director)



Craig is an acknowledged traffic consultant since the company inception in 1995. The company's primary function has been to serve both the public and private sectors focusing on traffic impact assessments, transport planning, special event transport planning, local area traffic management, road safety and expert evidence at Land and Environment Court, Supreme Court and the Commission of Inquiry.

Qualifications

Bachelor of Civil Engineering, UNSW, 1985

Graduate Diploma in Traffic Engineering, University of New South Wales, 1991

Accredited Level 3 Road Safety Auditor, 1998

Traffic Control Plan Certifier (Orange Card), 2012

Affiliations:

Member, Australian Institute of Traffic Planning and Management - AITPM

Member, Institute of Transportation Engineers USA (Australian Branch) – ITE

Experience:

MCLAREN TRAFFIC ENGINEERING

1995 to date:

Director and experienced traffic engineer responsible for the conduct of all facets of traffic impact assessment ranging from report preparation, design advice and giving evidence at the Land and Environment Court.

SINCLAIR KNIGHT MERZ

1994 to 1995:

Executive Traffic Engineer. Responsible for the conduct of all facets of traffic impact assessment ranging from report preparation, design advice and giving evidence at the Land and Environment Court.

TRANSPORTATION PLANNING WORKSHOP

1989 to 1994:

Senior Associate. Responsible for the conduct of a vast number of traffic impact assessment report and gained invaluable experience in giving expert evidence before the Land and Environment Court.

ROADS AND TRAFFIC AUTHORITY, NSW

1988 to 1989:

Traffic Engineer, Traffic Engineering Section, involved in traffic/transport research, policy development and assisting councils in the application of the Authority's guidelines.

OVE ARUP TRANSPORTATION PLANNING

1985 to 1988:

Traffic Engineer. Involved in the preparation of traffic impact reports for a wide range of projects.

GUTTERIDGE HASKINS & DAVEY

1980 to 1982:

Trainee Civil Engineer. Involved in assisting with road and subdivision design and field surveying.

Papers at Conferences

"Safe & Liveable Communities, Can You Have Both?" Georgia Institute of Transportation Engineers, St Simons Island, Georgia USA July 1999.

Appendix H

Transport cost benefit analysis review

Gillespie Economics

Environmental and Resource Economics: Environmental Planning and Assessment

13 Bigland Ave, Denistone NSW
2114 Telephone (02) 98048562
Facsimile (02) 9804 8563
Mobile 0419448238
Email gillecon@bigpond.net.au

9 September 2016

Ed O'Neil
Managing Director
Gunlake Quarries
PO Box 209 Marulan 2579

Dear Ed

Re: Review of Cost Benefit Analysis of Gunlake Quarry Rail Transport Study Prepared by Hatch

As requested, Gillespie Economics has examined the abovementioned report. Attachment 1 provides consideration of the incremental costs and benefits of the least-cost private haul road and rail transport options and the implications for the net social benefits of the Extension Project.

Regards

Dr Rob Gillespie
Principal

ATTACHMENT 1 - ECONOMIC ANALYSIS OF GUNLAKE QUARRIES TRANSPORT OPTIONS

1.0 Introduction

Gunlake Quarries is proposing to extend its existing quarry operation from annual production of 750,000 tonnes per annum (tpa) to 2,000,000 tpa. It has already invested $30M into its infrastructure and capital equipment to support its existing operation and is able to expand production with minimal additional capital investment, apart from some additional expenditure on capital equipment and mitigation measures.

Alternative transport options were assessed in Appendix D of the Environmental Impact Statement (EIS). It was concluded that "future product transport for Gunlake Quarry would be difficult and expensive to serve effectively using rail transport". Continued road transportation along Brayton Road, Bypass Road and Red Hills Roads to access the Hume Highway was proposed.

The NSW Department of Planning and Environment (DPE) considered that insufficient quantitative analysis was undertaken and requested that Gunlake:

"*undertake further work to ensure it has identified the lowest-cost option for transporting all or some of its products by rail (following consultation with Holcim) and provide a detailed analysis of the costs and benefits associated with this option compared to the costs and benefits of transporting its products by road under the company's preferred option. The analysis should include a comparison of the costs of the two scenarios with regard to the full range of economic, social and environmental costs, including the external costs of traffic congestion, carbon emissions and road accidents*".

In this respect, Hatch has prepared the Gunlake Quarry Rail Transport Study that analyses numerous transportation options, including an economic analysis that compares the capital, operating and externality costs of 20 options (2 road and 18 rail options) relative to the Base Case proposed in the EIS of continued road transportation. This report analyses and interprets the results of that Cost Benefit Analysis (CBA) undertaken by Hatch.

2.0 Context

As identified by the Productivity Commission (2006) the types of freight that rail and road carry differ. Rail is best suited to heavy bulk commodities with regular, large volumes and long-haul cargoes. Rail accordingly dominates the bulk freight task (especially the carriage of coal and other minerals) and also the long-haul east–west corridor across Australia.

Road freight is more flexible than rail and is especially suited to use by business of just-in-time stock management such as concrete batching plants, smaller inventories and door-to-door delivery, which require more frequent and generally smaller, shorter-haul deliveries (Productivity Commission, 2006).

As a result of the inherent differences in the service characteristics of road and rail, only a small proportion of the total freight task is considered to be contestable across the two modes — most estimates are around 10–15 per cent (Productivity Commission, 2006). In urban areas, the combination of often dispersed origins and destinations, comparatively short distances and small shipment volumes means freight is most effectively carried by road (BITRE, 2009).

The comparatively short distances for transport of product from Gunlake Quarry, dispersed destinations for quarry product, comparatively small shipment volumes, range of quarry products and variability in day to day customer demand, make the option of rail freight questionable and limits any potential future transport cost savings which might otherwise be achieved by using a 'line haul' rail based transport option.

Notwithstanding, Hatch has prepared an analysis, including a CBA, of 20 alternatives to the road transport Base Case .

3.0 Cost Benefit Analysis

CBA estimates the costs and the benefits of a Project to a defined community. Where the present value of benefits exceed the present value of the costs, a project provides net benefits to the community as a whole and is desirable from an economic efficiency perspective. Projects where there are net costs, reduce the welfare of the community and are undesirable from an economic efficiency perspective.

CBA can be undertaken of entire projects and/or components of projects. A CBA was undertaken of the Gunlake Quarry Extension Project as a whole, incorporating the preferred road transportation option. This found that the Project would have net benefits to the NSW community of between $16M and $27M, present value, in addition of the benefits of the current quarry operations (i.e. production of 750,000 tpa).

CBA can also be undertaken of the product transport component of the Project alone. The question to be addressed is whether rail transportation or private haul road options would have net benefits or net costs, relative to the proposed road transportation, and hence increase or decrease the net benefits of the overall Project.

Gunlake Quarries are committing to an additional $0.4M in road upgrades along Brayton Road, Bypass Road and Red Hills Roads as part of the Extension Project, a net present cost of $0.35 million (7% discount rate). This it too small to materially change the estimate of the net social benefits of the Extension Project or the net production benefits of $21 million.

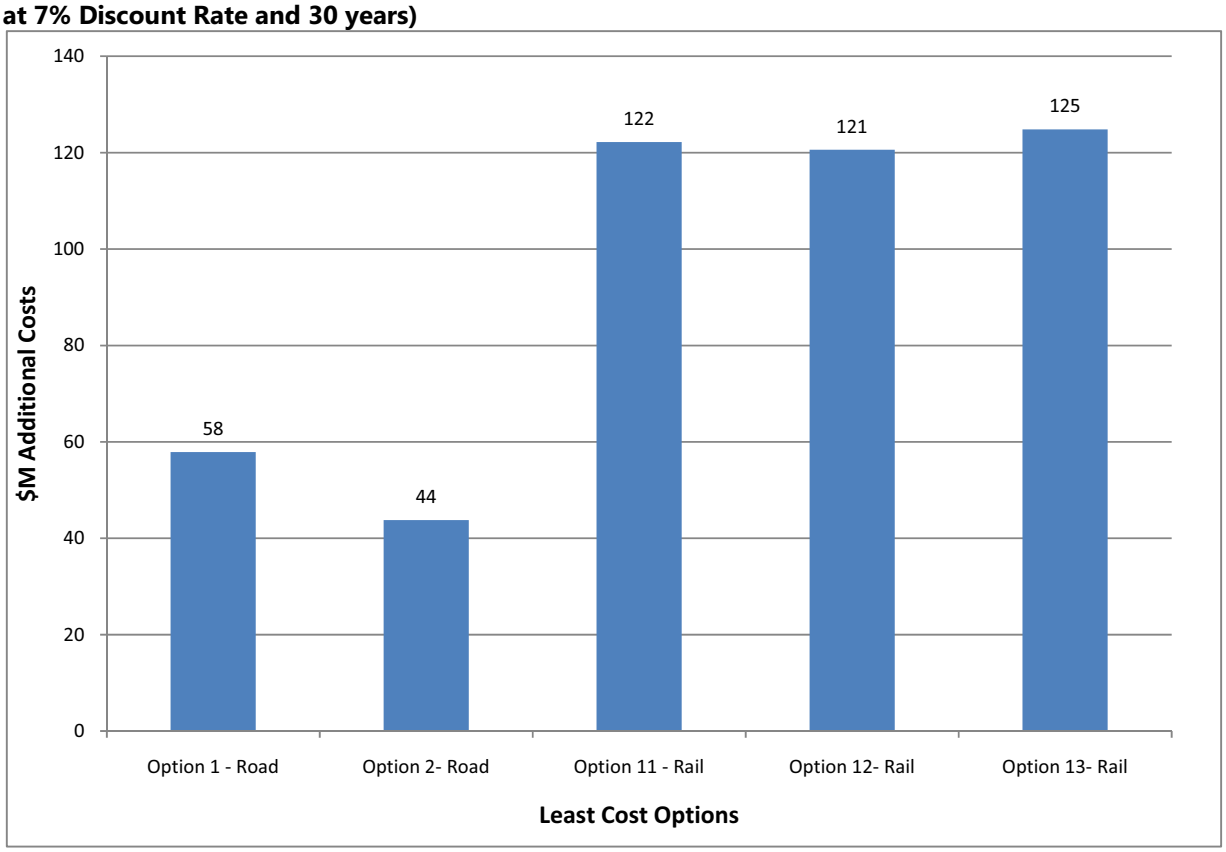
4.0 Hatch Study

The Hatch Study estimates the present value of the capital/operating costs and externality costs of the base case (road transport route proposed in the EIS) and 20 alternatives. This Section focuses on a the additional costs of the least cost rail options and least cost private haul road options, relative to the base case.

This analysis shows that the lowest cost rail options (options 11–13) have an additional present value[1] cost of $121M to $125M, relative to the base case road transportation and the lowest cost private haul road options (options 1-2) have an incremental present value cost of $44M to $58M. They are not desirable from an economic efficiency perspective as they have net costs relative to the base case. Refer to Figure 1.

[1] 30 years and 7% discount rate consistent with the parameters of the CBA of the Extension Project reported in the EIS.

Figure 1 - Additional Cost of Least Cost Rail Options and Private Haul Road Options (Present Value at 7% Discount Rate and 30 years)



Source: Hatch (2016)

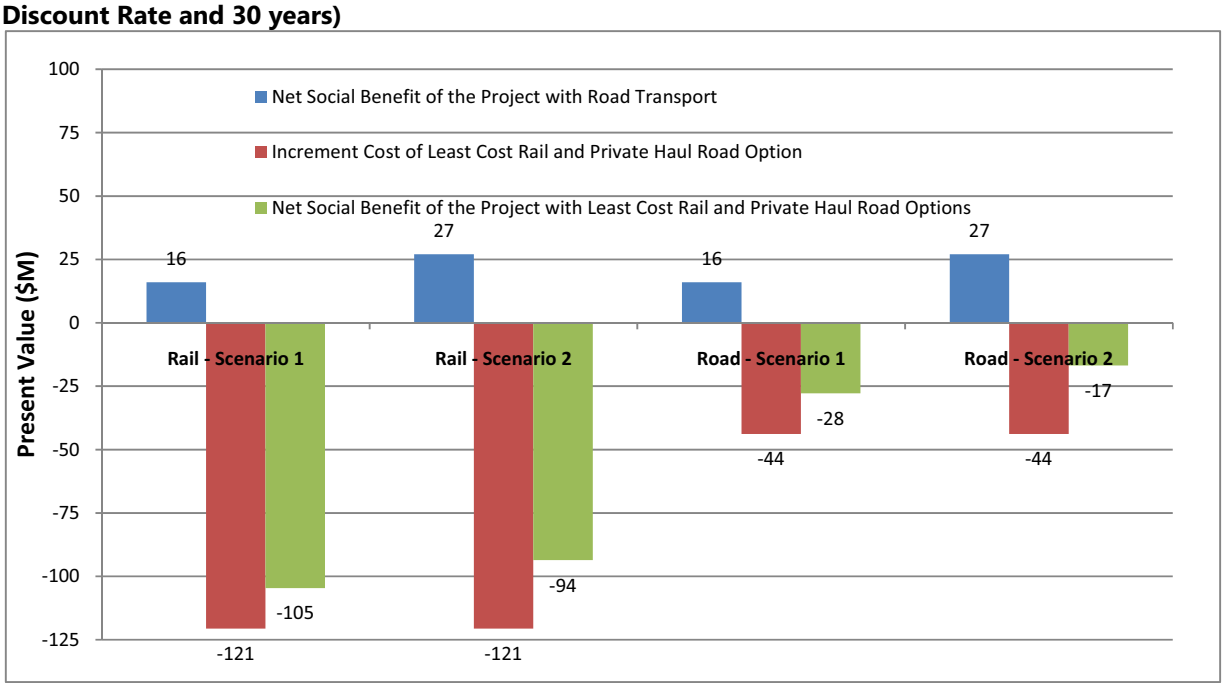
The Economic Assessment for the Project as a whole (Gillespie Economics, 2016) found that "the Extension Project is estimated to have net social benefits to NSW of between $16M and $27M, present value at 7% discount rate and hence is desirable and justified from an economic efficiency perspective."

When combined with the estimated net benefits of the Extension Project (which incorporated road transport), adoption of the lowest cost rail option (option 12) would result in the Project shifting from having a net benefit to the NSW community of between $16M (Scenario[2] 1 in Figure 2) and $27M (Scenario 2 in Figure 2), present value, to having a net cost to the community of $94M to $105M.

When the least cost private haul road option (option 2) is combined with the estimated net benefits of the Extension Project (which incorporated road transport), the Project would shift from having a net benefit to the NSW community of between $16M (Scenario 1 in Figure 2) and $27M (Scenario 2 in Figure 2), present value, to having a net cost to the community of $17M to $28M.

[2] Scenario 1: net community benefits exclude employment benefits and Scenario 2: net community benefits include employment benefits (see Gillespie Economics (2016) for details).

Figure 2 - Net Social Benefit of the Project to NSW with Least Cost Rail Option (Present Value at 7% Discount Rate and 30 years)



Notwithstanding, the rail and private haul road transportation options are also hypothetical since implementation would require agreement from several landholders in relation to land acquisition and other commercial arrangements to secure access for 30 years. None of the land is for sale and Gunlake has no compulsory acquisition rights. Gunlake would most likely pay a high premium over actual land values.

In practice, externalities of freight transport are difficult to measure and existing estimates are subject to considerable variation (Productivity Commission, 2006). The consideration of externalities in the Hatch Study is based on unit values per tonne km of freight sourced from the Australian Transport Council (2006) National Guidelines for Transport System Management in Australia and a study by Booz Allen Hamilton (2001) of road and rail freight crash costs (the economic value of damages caused by vehicle crashes.) The use of per tonne km externality and crash costs is a common approach to addressing externalities in the road transportation and transport infrastructure CBA by agencies such as NSW Roads and Maritime Services, Infrastructure NSW and Infrastructure Australia.

These approaches are particularly useful for consistently accounting for vehicle operating costs, travel time valuation and crash and safety costs. However, environmental externalities such as impacts on nature and landscape, urban separation, noise, air quality etc tend to be very location specific. Their existence depends on the characteristics of impacted land and the location of sensitive receptors. In this respect, the lowest cost rail and private haul road options would pose a number of site specific potential environmental, social and cultural impacts including potential biodiversity and Aboriginal heritage impacts caused by clearing, and impacts on exposed receptors such as traffic noise.

5.0 Size of Safety, Noise and Dust Issues

An impetus for the above investigation was concerns over safety, noise and dust associated with escalation of truck movements along a 7.7km length of along Brayton Road, Bypass Road and Red Hills Road.

Some indication of the potential magnitude of safety issues along this section of road can gained from application of the per tonne km crash cost assumption in the Hatch Report, and other publications, to the transport movements associated with the Project.

Focusing on the incremental tonnage km over time and applying crash costs for road freight of 0.4 c/net tonne km (Booze Allen Hamilton, 2001), the incremental crash costs over the life of the Project along Brayton Road, Bypass Road and Red Hills Road are estimated at $306,000, present value (at 7% discount rate and 30 years).

Laird (2014) suggests crash costs for road freight of 0.85 c/net tonne km. Based on this higher valuation the incremental crash costs over the life of the Project along Brayton Road, Bypass Road and Red Hills Road are estimated at $650,000, present value (at 7% discount rate and 30 years). Even these may be an overestimate of crash cost externalities since the Productivity Commission (2006) identifies that accident costs associated with road freight "are internalised to a significant degree through a variety of mechanisms. These include liability laws (insurance adds about 2¢ per net tonne kilometre for interstate freight), road safety programs, expenditure which improves the safety of roads, initiatives in road design, road rules enforcement, measures to influence driver behaviour (including fatigue regulations), motor vehicle design and safety features, and drivers' concern about road safety."

With regard to potential noise impacts of increased road transport from the Project, the Noise and Vibration Assessment Report for the Project (EMM, 2016) found that the future (total) road traffic noise levels are predicted to satisfy the Road Noise Policy day and night criteria at all nearest privately owned receivers on each section of the transport routes.

The Air Quality and Greenhouse Gases Assessment Report for the Project (Ramboll, 2016) found that dispersion model predictions for the Extension Project predict that the proposed changes to operations will not result in any exceedances of the impact assessment criteria for key pollutants, including PM_{10}, $PM_{2.5}$, total suspended particulates (TSP), respirable crystalline silica (RSC) and dust deposition.

Consequently, the site specific externality impacts from road transportation on people living and travelling along Brayton Road, Bypass Road and Red Hills Roads to access the Hume Highway are likely to be minimal and the cost to avoid them altogether on this stretch of road is around $121M, present value, using rail transport and $44M using a private haul road.

Considering the costs and benefits to the community using CBA, the cost of the lowest-cost rail and private haul road options far exceed the costs (including externalities) of the use of Brayton Road, Bypass Road and Red Hills Road. The most effective approach is to ensure that safety along Brayton Road, Bypass Road and Red Hills Roads is maximised. In this respect, the review of safety along Brayton Road, Bypass Road and Red Hills Roads has identified a number of ways to improve safety.

6.0 Financial Analysis

CBA analysis is concerned with the incremental economic costs and the benefits of a project to a community. Financial analysis compares benefits and costs to a single entity (in this case Gunlake Quarry). While CBA incorporates some financial costs and benefits it does not identify the financial viability of a project.

No financial analysis has been undertaken as part of the proposal and none is required to be prepared for an EIS as the NSW Department of Planning and Environment has previously identified that the financial viability of projects is a risk assumed by the project owners.

Gunlake Quarry Extension Project as described in the EIS for approval is considered to be financially viable. However, quarries operate in a competitive market where price is set by the market. Consequently, their viability is sensitive to the costs of production. While some submissions have pointed to an estimated $1.4B of gross revenue over the life of the Project as an indicator of the ability of the Project to absorb additional freight costs, this is undiscounted gross revenue and has no regard to the capital and operating costs of production. A very small percentage of revenue i.e. less than 15% is considered to be operating profit, from which depreciation costs and company tax must be deducted. Road haulage is generally undertaken by contractors and hence profits from road haulage accrues to these contractors, not Gunlake.

The Gunlake Quarry Extension Project Economic Assessment (Gillespie Economics, 2016) identified net production benefits from the Project of $21M, present value. This comprises company tax plus residual net production benefits and is based on economic rather than financial methods. Nevertheless, it provides an imperfect and overstated (as it includes company tax payable) indicator of the incremental financial net present value of the Project.

As identified in Figure 1 most of the incremental $121M (present value) of cost of the cheapest rail options and $44M (present value) of the cheapest private road option is capital and operating costs, which would be borne by the proponent. This additional cost is greater than the estimated financial benefits of the Project and would make the Project financially unviable.

7.0 References

Australian Transport Council (2006) *National Guidelines for Transport System Management in Australia*, Commonwealth of Australia.

Booz Allen Hamilton (2001) cited in Freight Australia (2003) *The Future of Rail Freight Services in Victoria: a proposal to the Government of Victoria from Freight Australi*a, 21 March 2003.

Bureau of Infrastructure, Transport and Regional Economics (2009) *Information Sheet 34, Road and Rail Freight: Competitors or Complements*, Bureau of Infrastructure, Transport and Regional Economics, Canberra.

EMM Consulting (2016) *Gunlake Quarry Extension Project Noise and Vibration Assessment,* prepared for Gunlake Quarries.

Gillespie Economics (2016) *Gunlake Quarry Extension Project Economic Assessment,* prepared for Gunlake Quarries.

Hatch (2016) *Report Gunlake Quarries Rail Transport Study*, prepared for Gunlake Quarries.

Laird, P. (2014) *Too many loads on our roads when rail is the answer*, University of Wollongong Research Online Faculty of Engineering and Information Sciences - Papers.

Productivity Commission (2006) *Road and Rail Freight Infrastructure Pricing*, Productivity Commission Inquiry Overview No. 41, 22 December 2006.

Ramboll (2016) Gunlake Quarry Air Quality Impact and Greenhouse Gas Assessment, prepared for Gunlake Quarries.

Appendix I

Supplementary biodiversity information

Table I.1 Plot data

			Cover abundance[1]									
FAMILY	**Common name**	**Scientific name**	**Plot 14**	**Plot 15**	**Plot 16**	**Plot 17**	**Plot 18**	**Plot 19**	**Plot 20**	**Plot 21**	**Plot 22**	**Plot 23**	**Plot 24**
Acanthaceae	Blue Trumpet	*Brunoniella australis*											1
Apiaceae	Stinking Pennywort	*Hydrocotyle laxiflora*				1	2	3				2	3
Apiaceae	Carrot Weed	*Daucus glochidiatus*											1
Asteraceae	Yellow Buttons	*Chrysocephalum apiculatum*	1	4		1	2			3			
Asteraceae	Spearthistle	*Cirsium vulgare*[2]			2			1	2				
Asteraceae	Native Carrot	*Cotula australis*		1		1					1	2	
Asteraceae	A Fleabane	*Conyza sp.*[2]											2
Asteraceae	Bears Ear	*Cymbanotus lawsonianus*			1		1	1	1		1		
Asteraceae	Catsear	*Hypochaeris radicata*[2]	3	3	2	2			1	2		2	2
Asteraceae	Creeping Cudweed	*Euchiton japonicus*											2
Asteraceae	Blue Bottle Daisy	*Lagenophora stipitata*				1				1	1		
Asteraceae	Scotch Thisle	*Onopordum acanthium*[2]								3		2	
Asteraceae	Variegated Thistle	*Silybum marianum*[2]					2	1				2	
Asteraceae	Button Burrweed	*Soliva anthemifolia*[2]	3						2		2	2	
Asteraceae	Prickly Sowthistle	*Sonchus asper*[2]											1
Asteraceae	A Dandelion	*Taraxacum sp.*[2]					1						
Campanulaceae	Tufted Bluebell	*Wahlenbergia communis*											1
Caryophyllaceae	Chilean Whitlow Wort	*Paronychia brasiliana*[2]	2	3	2	1	2	3		1	2		
Convulvulaceae	Kidney Weed	*Dichondra repens*			2	1	3	2			2		
Convulvulaceae		*Dichondra sp.A*											1
Crassulaceae	Australian Stonecrop	*Crassula sieberiana*		1									
Cyperaceae	Slender Flat Sedge	*Cyperus gracilis*	4	1	2	1	2	2	2	2			

Table I.1 Plot data

			Cover abundance[1]									
FAMILY	**Common name**	**Scientific name**	**Plot 14**	**Plot 15**	**Plot 16**	**Plot 17**	**Plot 18**	**Plot 19**	**Plot 20**	**Plot 21**	**Plot 22**	**Plot 23**	**Plot 24**
Cyperaceae	Common Fringe Sedge	*Fimbrostylis dichotoma*				1							
Dilleneaceae	Hoary Guinea Flower	*Hibbertia obtusifolia*		1			1						1
Ericaceae - Epacridoideae	Native Cranberry	*Astroloma humifusum*						2					2
Ericaceae - Epacridoideae	Peach Heath	*Lissanthe strigosa*		3		3	2		1	2	2		
Euphorbiaceae	Caustic Weed	*Chamaesyce drummondii*											1
Fabaceae - Faboideae		*Bossiaea prostrata*					1						
Fabaceae - Faboideae	Slender Tick Trefoil	*Desmodium varians*				1		2					
Fabaceae - Faboideae		*Glycine tabacina*						1					
Fabaceae - Faboideae		*Glycine microphylla*											3
Fabaceae - Faboideae	A Medic	*Medicago sp*[2]	1									2	
Fabaceae - Faboideae	White Clover	*Trifolium alba*[2]								2		2	1
Fabaceae - Faboideae	Yellow Suckling Clover	*Trifolium dubium*[2]			1				1	2			
Fabaceae - Mimosoideae	Black Wattle	*Acacia mearnsii*				1							
Geraniaceae	Common Storksbill	*Erodium cicutarium*[2]				1	2	1	2	3		2	
Geraniaceae		*Geranium homeanum*				2	3	2	2	2			2
Geraniaceae	Native Geranium	*Geranium solanderi*			2								
Haloragaceae	Rough Raspwort	*Haloragis aspera*											4
Juncaceae		*Juncus usitatus*		1							2		
Lomandraceae	Wattle Mat Rush	*Lomandra filiformis ssp coriacea*	1		1	1	2	2	1	2			3
Malvaceae	Red-flowered Mallow	*Modiola caroliniana*[2]		1									

Table I.1 Plot data

			Cover abundance[1]									
FAMILY	**Common name**	**Scientific name**	**Plot 14**	**Plot 15**	**Plot 16**	**Plot 17**	**Plot 18**	**Plot 19**	**Plot 20**	**Plot 21**	**Plot 22**	**Plot 23**	**Plot 24**
Myrtaceae	Cabbage Gum	*Eucalyptus amplifolia*					1						
Myrtaceae	Blakely's Red Gum	*Eucalyptus blakelyi*		1	4	3		3			2		
Myrtaceae	Argyle Apple	*Eucalyptus cinerea*											4
Myrtaceae	Narrow-leaved Stringybark	*Eucalyptus eugenioides*					1						2
Myrtaceae	Red Stringybark	*Eucalyptus macroryncha*				3	4	4					
Oxalidaceae		*Oxalis perannans*	2	1	1	1	1			1			
Oxalidaceae		*Oxalis sp.*				1							
Plantaginaceae	Plantain	*Plantago lanceolata*[2]		1		1		1	1				2
Plantaginaceae	Trailing Speedwell	*Veronica plebeia*				1		1					
Poaceae	A Wiregrass	*Aristida sp.*				1	1				3		
Poaceae	Red-leg Grass	*Bothriochloa macra*											3
Poaceae	A Wallaby Grass	*Rytidosperma fulvum*				1	2						2
Poaceae	Speargrass	*Austrostipa scabra ssp scabra*	2			1	2				4	2	
Poaceae	Windmill Grass	*Chloris truncata*				1							
Poaceae	Barbed Wire Grass	*Cymbonotus lawsonianus*											1
Poaceae	A Plumegrass	*Dichelachne sp.*											2
Poaceae	Panic Veldtgrass	*Ehrardta erecta*[2]	2			1			2		3	2	
Poaceae	Paddock Lovegrass	*Eragrostis leptostachya*	1	3	3				4	2			
Poaceae	Serrated Tussock	*Nassella trichotoma*[2]	3		5	5	5	5		5	3	5	2
Poaceae	Hairy Panic	*Panicum effusum*			2	1	3						
Poaceae	Kangaroo Grass	*Themeda australis*				2	2			1			2
Poaceae	Weeping Meadow Grass	*Microlaena stipoides*											2

Table I.1 Plot data

			Cover abundance[1]									
FAMILY	**Common name**	**Scientific name**	**Plot 14**	**Plot 15**	**Plot 16**	**Plot 17**	**Plot 18**	**Plot 19**	**Plot 20**	**Plot 21**	**Plot 22**	**Plot 23**	**Plot 24**
Poaceae		*Urochloa sp.*[2]											2
Polygonaceae	Sheep Sorrel	*Acetosella vulgaris*[2]	2	3	3	2	2	2	2	2		2	2
Polygonaceae	Berry Saltbush	*Einadia hastata*		1				1					
Polygonaceae	Climbing Saltbush	*Einadia nutans*				1	2						
Polygonaceae		*Einadia polygonoides*				1	2				2		
Pteridaecae	Bristly Cloak Fern	*Cheilanthes distans*				1	2						
Pteridaecae	Poison Rock Fern	*Cheilanthes sieberi*			1	1		2			2		3
Rosaceae	Blackberry	*Rubus fruticosis*[2]			1		1					1	
Rosaceae		*Rubus anglocandicans*[2]											2
Rubiaceae	Common Woodruff	*Asperula conferta*	1		1	1	1						1
Solanaceae	Forest Nightshade	*Solanum prinophyllum*	1			1		1				1	
Solanaceae		*Solanum chenopodiodes*[2]											1

Notes *1. Cover abundance key: 1=<5% cover, few individuals, 2=<5% cover, many individuals, 3= 6=25% cover, 4=26-50% cover, 5= 51-75% cover, 6= 76-100% cover.*

2. Denotes introduced species.

Table I.2 Transect data for the impact area

Site attribute	Transect 2	Transect 4	Transect 14	Transect 15	Transect 16	Transect 17	Transect 18	Transect 19	Transect 20	Transect 21	Transect 22	Transect 23	Transect 24
Number of native plant species	24	10	8	11	13	29	23	16	6	9	11	4	23
Native overstorey cover	29	2	0	2.5	0	21.5	3.8	18.5	0	0	0	0	10
Native midstorey cover	0	0	0	0	0	0	0	0	0	0	0	0	0
Native groundcover (grasses)	20	100	20	0	10	10	40	20	60	10	50	0	60
Native groundcover (shrubs)	0	0	0	0	0	10	10	0	0	0	10	0	0
Native groundcover (other)	0	0	40	50	20	20	10	20	10	10	0	10	80
Exotic plant cover	70	30	90	50	90	70	100	60	60	90	40	80	0
Number of trees with hollows	0	0	0	0	0	0	0	0	0	0	0	0	0
Proportion of overstorey species occurring as regeneration	1	0	0	0.3	0.3	0.30	0.3	0.3	0.3	0.3	0.3	0.3	1
Total length of fallen logs	5	20	0	0	0	4	32	35	3	1	0	1	7

Table I.3 Data underpinning offset calculations

Variable	Impact area calculations	Offset area calculations
IBRA subregion	Bungonia - Hawkesbury Nepean	Bungonia - Hawkesbury Nepean
Percent native vegetation cover in the outer assessment circle before development	86-90%	86-90%
Percent native vegetation cover in the outer assessment circle after development	76-80%	86-90%
Percent native vegetation cover in the inner assessment circle before development	76-80%	76-80%
Percent native vegetation cover in the inner assessment circle after development	31-35%	86-90%
Strategic location	N/A	Riparian buffer area on both sides of a 3rd order stream
Connectivity width before development	>100-500m	N/A
Connectivity width after development	0-5m	N/A
Condition of overstorey vegetation before development	Projected foliage cover at benchmark	
Condition of overstorey vegetation after development	Projected foliage cover at benchmark	N/A
Condition of midstorey/groundcover vegetation before development	Projected foliage cover of midstorey/groundcover vegetation at benchmark	N/A
Condition of midstorey/groundcover vegetation after development	Projected foliage cover of midstorey/groundcover vegetation at benchmark	N/A
Mitchell landscape	Wollondilly - Bindook Tablelands and Gorges	Wollondilly - Bindook Tablelands and Gorges
Patch size	501 ha	501 ha
Patch size score	12	12
Geographic habitat features selected	Land within 40 m of heath, woodland or forest Land within 100 m of stream or creek banks Land containing surface rocks (embedded or loose)	Land within 40 m of heath, woodland or forest Land within 100 m of stream or creek banks Land containing surface rocks (embedded or loose)
Geographic habitat features de-selected	Land within 250 m of termite mounds or rock outcrops Land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels Land within 1 km of rock outcrops or clifflines	Land within 250 m of termite mounds or rock outcrops Land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels Land within 1 km of rock outcrops or clifflines
Changes to predicted threatened species	None	None
Species credit species recorded	None	None

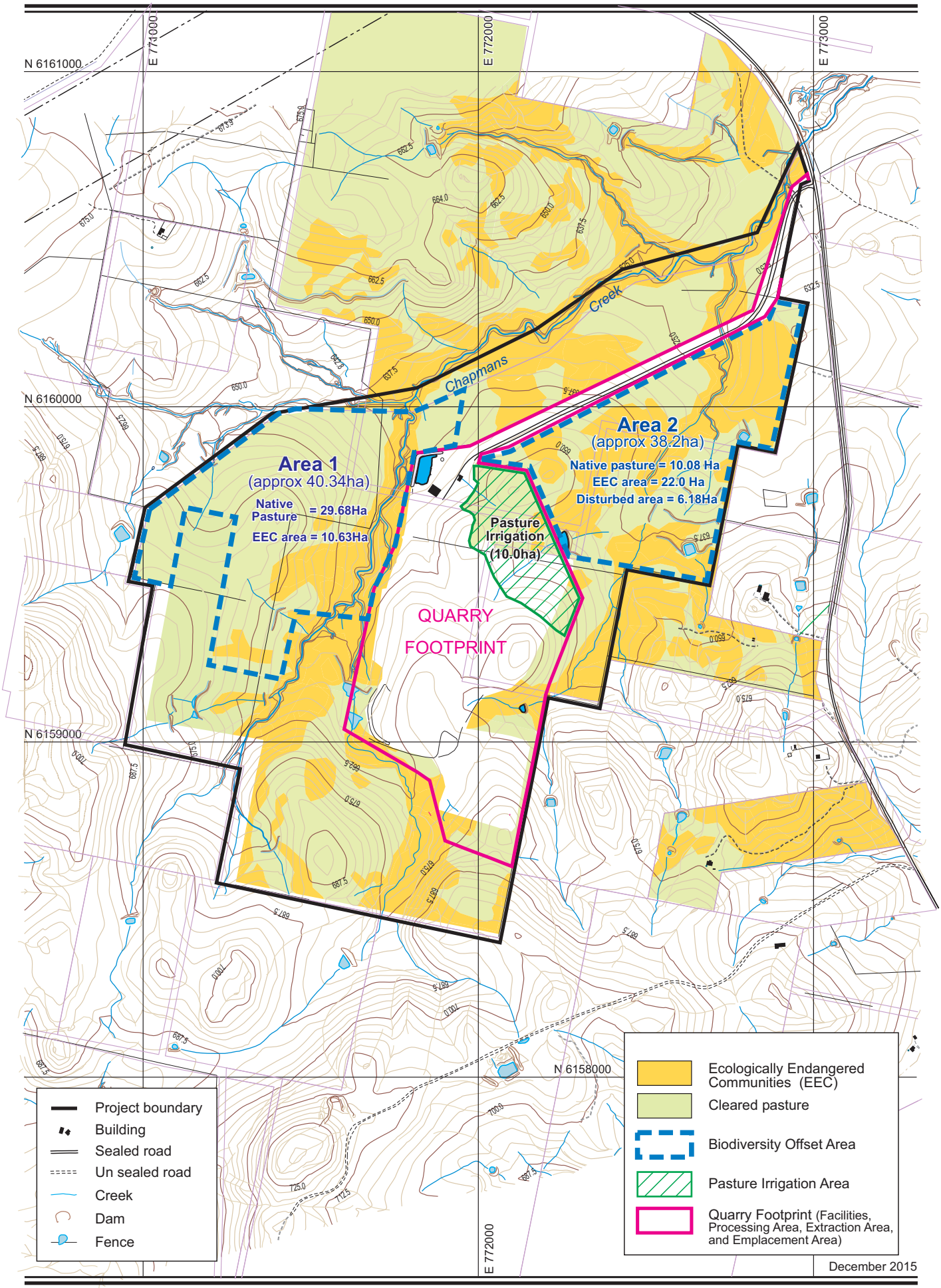


FIGURE 2
Gunlake Quarry
Biodiversity Offsets

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	196/2016/3850MP
Proposal name :	Gunlake Quarry extension project
Assessor name :	Katie Whiting
Assessor accreditation number :	196
Tool version :	v4.0
Report created :	20/09/2016 16:19

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
1	22.60	HN614_Moderate/Good	Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	Moderate/Good	Yes	1	7.59	57.97	0.00	57.97	373	373	Barking Owl	50.00	3.00	373
1	22.60	HN614_Moderate/Good_Derived grassland	Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	Moderate/Good_Derived grassland	Yes	2	8.24	22.46	0.00	22.46	185	185	Barking Owl	33.33	3.00	185
1	22.60	HN514_Moderate/Good	Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	Moderate/Good	Yes	3	4.57	39.13	0.00	39.13	0	160	Barking Owl	33.33	3.00	160
1	22.60	HN514_Moderate/Good_Derived grassland	Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	Moderate/Good_Derived grassland	Yes	4	33.47	18.84	0.00	18.84	0	662	Barking Owl	38.89	3.00	662

BioBanking Credit Calculator

Species credits

Proposal ID :

Proposal name :

Assessor name :

Assessor accreditation number :

Tool version : v4.0

Report created : 20/09/2016 16:19

Scientific name	Common name	Species TG value	Identified population?	Can Id. popn. be offset?	Area / number of loss	Negligible loss	Red flag status	Number of credits
			No					

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 20/09/2016 Time: 4:24:29PM Calculator version: v4.0

Biobank details

Proposal ID:	196/2016/3851B
Proposal name:	Gunlake Quarry biodiversity offset package
Proposal address:	715 Brayton Rd Marulan
Proponent name:	Gunlake Quarries
Proponent address:	715 Brayton Road Marulan
Proponent phone:	4841 1344
Assessor name:	Katie Whiting
Assessor address:	SUITE 1 20 CHANDOS ST St Leonards NSW 2065
Assessor phone:	02 9493 9500
Assessor accreditation:	196

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	119.99	1,364.00
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	55.52	617.00
Total	175.51	1,981

Credit profiles

1. Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion, (HN514)

Number of ecosystem credits created	1,364
IBRA sub-region	Bungonia - Hawkesbury/Nepean

2. Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion, (HN614)

Number of ecosystem credits created	617
IBRA sub-region	Bungonia - Hawkesbury/Nepean

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	Exclude commercial apiaries
Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	Exclude miscellaneous feral species
Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	Feral and/or over-abundant native herbivore control
Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	Fox control
Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	Slashing
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	Exclude commercial apiaries
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	Exclude miscellaneous feral species
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	Feral and/or over-abundant native herbivore control
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	Fox control
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	Slashing

EMM

www.emmconsulting.com.au

SYDNEY
Ground Floor, Suite 1, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500 F 02 9493 9599

NEWCASTLE
Level 5, 21 Bolton Street
Newcastle NSW 2300
T 02 4927 0506 F 02 4926 1312

BRISBANE
Level 4, Suite 1, 87 Wickham Terrace
Spring Hill Queensland 4000
T 07 3839 1800 F 07 3839 1866