



**Planning &  
Environment**  
Resources & Geoscience

# ***Marulan South Limestone Mine***

## ***Continued Operations Project (SSD 7009)***

***Division of Resources & Geoscience***

*Resource & Economic Assessment*  
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# Introduction

State significant development is regulated under the Environmental Planning and Assessment Act 1979, which requires a proponent to apply to the Department of Planning and Environment for development consent, supported by an Environmental Impact Statement (EIS).

This Resource & Economic Assessment conducted for the Marulan South Limestone Mine – Continued Operations Project (the Project or Modification) by the Division of Resources & Geoscience (the Division) is designed to review the resource/reserve estimates stated in the proponent’s EIS and whether the Project will deliver significant social and economic benefits to NSW from the efficient development of the resource and that resource recovery is optimised and waste minimised. It is also to ensure an appropriate return to the State from developing the resource. As such the Division has conducted an independent calculation of the royalty to be generated over the life of the Project.

The objects of the *Mining Act 1992* are to encourage and facilitate the discovery and efficient development of coal and mineral resources in NSW. Of particular relevance to this Resource & Economic Assessment are:

Section 3A Objects:

- (a) to recognise and foster the significant social and economic benefits to NSW that result from the efficient development of mineral resources, and
- (d) to ensure an appropriate return to the State from mineral resources.

The relevant section of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 is Part 3, Clause 15: Resource Recovery requires that resource recovery is efficient, optimised and minimises waste.

# Project Overview

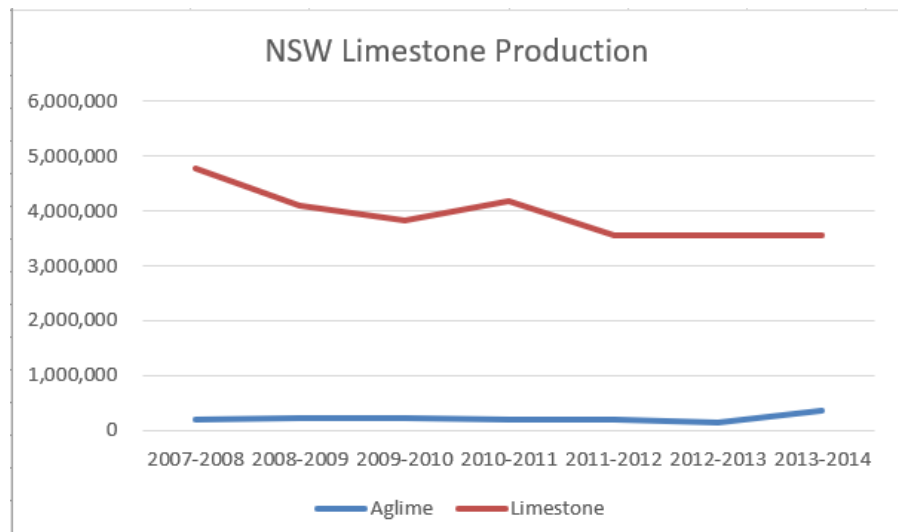
Boral Cement Limited (Boral) owns and operates the Marulan South Limestone Mine (the mine or Marulan South). It is a longstanding open cut mine that has produced up to 3.38 million tonnes per annum (Mtpa) of limestone-based products for the cement, steel, agriculture, construction and commercial markets. The mine is located 10 kilometres southeast of the village of Marulan and 35 kilometres east of Goulburn.

The mine operates under Consolidated Mining Lease 16 (Act 1992) (CML 16), Mining Lease 1716 (Act 1992) (ML 1716) and a combination of development consents issued by Goulburn Mulwaree Council and continuing use rights. Due to changes to the *Mining Act 1992* and the Environmental Planning & Assessment Act (EP&A Act), when mining moves beyond the area covered by the current Mining Operations Plan, a development consent under the EP&A Act will need to be in place.

Marulan South has been an important limestone mine since the 1830s. Since 1953 two pits, north and south, have been in continuous operation. In 1987, Boral Limited (now Boral Cement Limited) purchased both operating companies as a wholly owned subsidiary. Production then increased to more than 2.5 Mtpa effectively creating a single mine. In recent years, production has averaged slightly over 3 Mtpa. Since 2015, the last of the “centre ridge” between the north and south pits has been mined out, creating one pit.

The mine is located on an existing railway line, with products easily accessible to Sydney. Marulan South is the largest limestone mine in NSW and dominates supply of limestone for the Sydney cement market. It is also an important source of flux for steelmaking, with Port Kembla being the only market in recent times. Limestone of various purity is blended (with tuff/clay/shale, sandstone) according to the desired end-product. Other NSW producers, including Jacksons near Attunga, mainly service local markets and produce smaller volume products and/or agricultural lime, for example Mudgee Dolomite and Lime.

An EIS has been prepared for assessment by the Department of Planning and Environment, Planning Services Division to satisfy the provisions of Part 4 of the EP&A Act. Boral is seeking approval to continue mining operations, including a 30-year mine plan to extract 120 Mt of limestone, associated overburden emplacement areas and a mine water supply dam. There will be a slight increase in the sought maximum consented production rate to 4.2 Mtpa, around 4 Mtpa of limestone and up to 0.2 Mtpa of shale.



**Figure 1. NSW Limestone production 2007 to 2014.**

# Size and Quality of Resource

Of primary interest to the Marulan South limestone mine is the Bungonia Limestone, which consists of several generally parallel north-south striking beds dipping to the west:

- Eastern Limestone which is the oldest, easternmost and thickest unit
- Mt Frome Limestone which is younger, lies to the west of the Eastern Limestone and is made up of three sub-parallel sub-units (Upper Limestone, Middle Limestone and Lower Limestone).

The proposed 30-year mine plan will access approximately 120 Mt of limestone down to a depth of 335m. Due to the 70-150m separation of the Eastern and Middle limestones, the 30-year mine plan avoids mining the interburden between these two limestones where practical. This will create a smaller second, north-south oriented west pit with a ridge between it and the main north pit.

About 90 Mt has been defined in the Eastern Limestone and 30 Mt in the Mount Frome (or middle) limestone, allowing for dilution (non JORC). Limestone is generally of suitable quality (>90%  $\text{CaCO}_3$ ) for most cement products. Approximately one third of the 640 Mt in-situ limestone in the district is considered unavailable for mining, due to visual amenity impacts on the Bungonia Gorge.

In 2015, Boral's geological technical consultant provided a reasoned and conservative estimate (using JORC methodology) of +200 Mt of in-situ Eastern Limestone (to 120 metres depth) and +18 Mt of Mount Frome Middle Limestone (to 90 metres depth). The upper 30 metres (25%) of Eastern Limestone could be considered equivalent to the JORC Measured class, the next lower 30 metres Indicated (25%) and the lower 60 metres Inferred (50%).

The current estimate of about 90 Mt in the Eastern Limestone, and about 30 Mt in the Mount Frome limestone (allowing for dilution – non JORC – Table 1) was based on drilling from 2015 - 2018. Drilling of the western portion in 2018, the extension to the current main pit, returned assay results averaging  $\text{CaCO}_3$  92.6%,  $\text{MgCO}_3$  0.7%,  $\text{SiO}_2$  4.9% and  $\text{Fe}_2\text{O}_3$  0.8% (good quality).

The Mount Frome limestone is generally less pure than the Eastern Limestone, but nonetheless includes limestone suitable for white cement and some high-quality products.

**Table 1. Marulan South 30-year projected limestone and overburden quantities.**

Area	Volume (in-situ)						Tonnes (in-situ)		Tonnes (diluted)		
	Dom	Waste	SG	Dom	Ore	SG	Waste	Ore	Dil	Waste	Ore
	(Mm3)	(t/m <sup>3</sup> )		(Mm3)	(t/m <sup>3</sup> )		(Mt)	(Mt)	(%)	(Mt)	(Mt)
<b>Eastern limestone:</b>											
South Pit - S	32		2.6	1	4	2.6		10	10%	1	9
South Pit - N	32	18	2.6	2	10	2.6	47	26	10%	50	23
North Pit - S	33	12	2.6	3	15	2.6	31	39	10%	35	35
North Pit - mid	34	8	2.6	4	7	2.6	21	18	10%	23	16
North Pit - N	35		2.6	5	2	2.6		5	10%	0	5
North Pit - stockpile	35	3	2.6	6	1	2.6	8	3	10%	8	3
		<b>41</b>			<b>39</b>		<b>107</b>	<b>101</b>		<b>117</b>	<b>91</b>
<b>Mt Frome limestone:</b>											
Lower - South pit				9	0	2.6		0	10%	0	0
Middle - S pit & N Pit S				7	8	2.6		21	10%	2	19
Middle - North Pit N				72	5	2.6		13	10%	1	12
Upper - S pit & N pit S				8	0	2.6		0	10%	0	0
					<b>13</b>			<b>34</b>		<b>3</b>	<b>31</b>
<b>Total:</b>		<b>41</b>			<b>52</b>		<b>107</b>	<b>135</b>		<b>120</b>	<b>122</b>

A 'high grade' limestone is one generally taken to contain >95% calcium carbonate (CaCO<sub>3</sub>) and <1% magnesium carbonate (MgCO<sub>3</sub>). Silica, alumina and iron minerals would have individual concentrations <1%. However, material for cement manufacture can contain 90% CaCO<sub>3</sub> and less.

The Eastern Limestone appears to be of high quality with typical analyses averaging

- >97.1% CaCO<sub>3</sub>
- <1.1% MgCO<sub>3</sub>.

The limestone resource is generally of sufficient quality (>90% CaCO<sub>3</sub>) for most cement products. Dolomitic limestone (magnesium-rich), which is deleterious for cement manufacture, is not abundant. However, such material may be suitable as flux for steelmaking, as key deleterious materials include SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, and SO<sub>3</sub>.

The Mount Frome Limestone is less pure overall but is suitable for both white and off-white cement manufacture and includes material of suitable quality for fine limestone products.

The Mount Frome Limestone averages:

- CaCO<sub>3</sub> 92.6%
- MgCO<sub>3</sub> 0.7%
- Al<sub>2</sub>O<sub>3</sub> 1.3%
- SiO<sub>2</sub> 4.9%
- SO<sub>3</sub> 0.007
- K<sub>2</sub>O 0.6%



- $\text{Fe}_2\text{O}_3$  0.8%

Additional drilling of the Mount Frome limestone is needed, especially to the north and is proposed by the proponent.

The limestone resource around Marulan South is estimated for extracted during the 30-year project period. Mining will deepen the pit in the north. Parts of the present pit are at maximum angle, so in addition to “glory holing” at the bottom of the pit, mining of the Eastern Limestone requires a push back of the west wall. Mining of the Mount Frome limestone will involve a new, narrow pit, parallel and to the west of the main pit. However, extraction of northern parts of the Mount Frome limestone will require waste emplacements and some infrastructure to be moved. A key recent discovery has been the comparatively very shallow westerly dips of the western side of the northern limestone. This should enhance the economics of the northern part of the mine.

The northern part of the mine also contains ~3 Mt of granodiorite. This total is included in the overburden and aids the economics of the operation.

### **Conclusion – limestone resources**

While generalised in nature, the resources of limestone quoted are considered appropriate for the commodity in this case.

### **Requests — Clay/shale and structural clay**

No estimate of clay and shale and *in-situ* has been provided.

**Clay/shale and structural clay are Prescribed Minerals. Their quantities also materially affect the limestone resource. As such, a statement as to the expected tonnages *in-situ* and their location should be provided.**

# Resource Recovery

The proposed 30-year mine plan is for the extraction of approximately 120 Mt of limestone over this period. Production is proposed to increase from up to 3.38 Mtpa of limestone and up to 0.2 Mtpa of shale, to 4 Mtpa of limestone and 0.2 Mtpa of shale for up to 30 years. These figures should reasonably be extracted at a 1:1 or better strip ratio. The extraction of the limestone will require the removal of approximately 108 Mt of overburden during the 30-year period. This material will be emplaced within existing and proposed overburden emplacement areas.

However, extraction of parts of the Mount Frome limestone will mean waste emplacements and some infrastructure must be moved. During the fifth year of Stage 1, the current stockpile and reclaim area at the northern end of the north pit will be relocated to allow for the northward extension of the pit.

Resource recovery is generally simple, limited only by interburden, including dilution from voids, clay and other lenses. This material constitutes up to 10 percent of the volume *in situ*. In production, such material is blended for various products, based mainly on analyses of material from blast holes and visual estimation.

# *Economic Benefits of the Resource*

Over the life of the Project the Division has estimated that the value of the limestone and shale produced would be around \$2.2 billion in current dollars, with the net present value of this revenue stream of around \$0.94 billion at a real discount rate of 7 percent.

The main product to be produced from the Project is limestone with a small amount of shale also produced. The currently operating Marulan South mine has been selling their products into established domestic markets for many decades. There have been no exports products produced from the existing Marulan site and likewise there will be no export products from the Project. The largest customer from the Project will be the Boral Berrima Cement Works (Berrima Cement) which will take over two million tonnes of limestone or around 50% of the total Project product tonnage. Berrima Cement has been an established customer of the existing mine for many decades, while this plant currently produces around 60 percent of total NSW cement products, and around 30 percent of concrete sold in Sydney. The Project will enable the cement works to continue producing this vital product for both the Sydney and regional NSW construction industry. The Project will also sell nearly 0.5 million tonnes of limestone to the Bluescope steelworks at Port Kembla, again an established customer of the existing mine. The Bluescope steelworks is a very important part of the regional economy of the Wollongong area, with the Project ideally located to continue to supply limestone at a cost competitive price into the plant for another 30 years. The other large customer of the Project is the neighbouring Peppertree Quarry which will utilise one million tonnes of manufactured sand to mix with its own sand to produce a high limestone content sand. The benefit of this product is that the higher the limestone content of manufactured sand, the less cement is required to produce the resultant concrete mix. The remaining limestone (less than 15 percent) will be sold to a variety of customers in NSW with a small percentage (less than 1 percent) sold to Queensland and Victorian customers.

The Project, if approved, would provide continued direct full-time employment for 118 mine site employees and 73 offsite employees for around 30 years (these jobs are ongoing jobs and not additional to the existing operation). The Division estimates that these direct mine jobs would result in around an additional 750 indirect jobs in both mine and non-mine related services. Capital investment for the Project would be of the order of \$111 million. Operating expenditure for the Project would be of the order of \$900 million over the Project life. As a large proportion of the operating expenditure over the life of a mine is wages paid to

mine workers, a significant amount of this expenditure would be spent in the regional economy of Marulan, Goulburn and surrounding localities.

The Division also notes from the Economic Assessment prepared by the Proponent's economic consultant, Gillespie Economics, that the Project would deliver the following net benefits to the regional economy (Goulburn Mulwaree LGA) in 2018 dollars, if approved:

- \$82 million in annual direct and indirect regional output or business turnover.
- \$48 million in annual direct and indirect regional value added.
- \$14 million in annual direct and indirect household income.

The Division also notes from the Economic Assessment that the Project would deliver the following net benefits to the NSW economy in 2018 dollars, if approved:

- \$137 million in annual direct and indirect regional output or business turnover.
- \$74 million in annual direct and indirect regional value added.
- \$27 million in annual direct and indirect household income.

# *Royalty Calculation*

The Project will produce limestone and shale and as such a royalty rate of \$0.40/tonne applies to limestone production, and \$0.35/tonne applies to shale production. There are no allowable deductions for limestone or shale.

An important aspect of future royalty calculation for the project is estimation of future annual production. The Proponent has estimated that if the Project is approved, around 118 million tonnes of limestone would be economically mined from Maruland South, and around four million tonnes of shale. The Division is of the opinion that the average production rates of 4 Mtpa of limestone and 0.14 Mtpa of shale for a period of 30 years are achievable from the Project area.

Using the above parameters, the Division has calculated that in a typical full production year the state will receive around \$1.65 million per annum of additional royalty and \$49 million over the life of the Modification. The net present value of this royalty stream would be \$20 million using a 7% real discount rate.

# Assessment Approvals

Table 1 – Divisional Approvals

Position	Signature or CM9 approval	Date
Approving Officer: Dr Kevin Ruming Director Strategic Resource Assessment (02) 4063 6689	Approved in CM9	1/05/2019
Approving Officer: Tamsin Martin Director Resources Planning & Programs (02) 4063 6584		24/04/2019
Endorsing Officer: Dr David Blackmore A/Executive Director Resource Operations (02) 4063 6632		6/5/19