CEMEX Australia Pty Ltd

Statement of Environmental Effects Proposed Minor Modifications to Lynwood Quarry, Marulan

January 2009

Umwelt
Environmental Consultants

Statement of Environmental Effects

Proposed Minor Modifications of Lynwood Quarry, Marulan

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

CEMEX Australia Pty Ltd

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Executive Summary

CEMEX Australia Pty Ltd (CEMEX), formerly Readymix, was granted development consent on 21 December 2005 (DA-128-5-2005) (Consent) by the New South Wales (NSW) Minister for Planning for the construction and operation of Lynwood Quarry (Quarry). The Quarry site is located west of Marulan, in the Southern Tablelands region of NSW and will provide a long-term supply of high quality construction material into the Sydney, regional and local markets. The supply to the Sydney market will replace CEMEX's current production from the Penrith Lakes Scheme, which is likely to be exhausted around 2012-2013.

Shortly after the approval of the Lynwood Quarry Project (the Project), the Sydney region market demand for construction materials slowed, changing the timing drivers for the construction of the Project. The remaining resources at the Penrith Lakes Scheme were also reforecast and it is now predicted that sufficient resources will remain until 2012-2013 (as opposed to the previous forecast of 2009-2010 predicted at the time the development application for the Project was submitted). .

Since the approval of the Project in late 2005, CEMEX has been progressing the implementation of the Project, including obtaining the necessary supplementary approvals; and reviewing the concept design and construction staging of the Quarry infrastructure. However, construction works at the site have not yet commenced.

As part of the review process, several opportunities have been identified to improve the Project by modifying the originally approved concept design. Several of these changes have been driven by the identification of a fault along the western boundary of the approved Quarry footprint. The key changes proposed to the Project include modifying the layout of site infrastructure (including the crushing and screening plant) and a reduction in the western extent of the Quarry footprint.

CEMEX is seeking approval to modify the design of the Project in accordance with Section 96(1A) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The proposed modifications, as demonstrated in this Statement of Environmental Effects (SEE), will involve minimal environmental impacts. The proposed modifications will not change the approved disturbance footprint of the Project and will not substantially change the impact of the Project on the environment or community. The proposed modifications will also result in some improved environmental outcomes including:

- the retention of more of the natural channel of Lockyersleigh Creek, including the retention of an area of riparian vegetation found to provide habitat for the threatened squirrel glider;

- a reduction of the impact of the Project on the Joarimin Creek riparian corridor, including reducing the number of roads crossing the main channel of Joarimin Creek adjacent to the rail loop from two to one and no longer requiring diversion of secondary flow paths of Joarimin Creek; and

- the use of an in-pit primary crusher will reduce the extent of haulage required for primary raw feed, reducing potential impacts associated with haulage including noise generation, dust generation and energy use.

In the event that development consent is obtained for the proposed modifications, the Project will be substantially the same Project as that originally approved in the Consent for the following reasons:

- the overall nature of the Project, being a hard rock quarry producing up to 5 million tonnes per annum of saleable quarry product and using both rail and road transportation, remains unchanged;
- there will be no change in production limits or product type;
- the overall disturbance footprint of the Project has not changed;
- the Quarry footprint is smaller, but otherwise in the same location as originally approved in the Consent; and
- the infrastructure components are consistent with those originally approved and are in the same general locality, with only the proposed layout changing.

The Project will provide significant benefits to the local area, region and State of NSW including;

- providing a long-term, high quality supply of construction materials into the Sydney and regional markets. This supply is needed to replace existing quarries that are nearing the end of their resources and is essential for the security and economic viability of the Sydney construction industry;
- when operating at full capacity, the Project will provide direct employment for approximately 115 people at the Quarry, plus additional flow-on employment, including improving security of employment for personnel working in CEMEX's Sydney region concrete business; and
- major economic benefits in the form of capital expenditure ($140M to $195M), wages (estimated direct $9.1M per annum, and indirect $6.7M per annum), annual operating expenditure, and through payment of State and Commonwealth taxes and fees.

As identified in the Environmental Impact Statement Proposed Lynwood Quarry, Marulan (EIS), the Project had the strong support of the local community. Approximately 80% of respondents to a random phone survey approved of the proposal and the majority of respondents (79%) indicating that they believed that the benefits the Quarry would bring to the area would outweigh any of the disadvantages. CEMEX's ongoing consultation with the local community since this time has continued to reinforce the community's strong interest in and support for the Project.

In considering the balance of the potential impacts of the proposed modifications on the environment and community, and the benefits of and necessity of the proposed changes, it would be reasonable to conclude that the benefits of the proposed modifications outweigh the impacts.

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1.0 Introduction

CEMEX Australia Pty Ltd (CEMEX), formerly Readymix, is one of the leading suppliers of construction material products in Australia, operating over 80 quarries, over 200 fixed concrete plants and a fleet of over 900 concrete delivery trucks. In excess of 3000 people are currently employed by CEMEX, which operates in all mainland states and territories of Australia. Existing CEMEX quarries provide products for a diverse range of customers and applications throughout Australia, including rail ballast, aggregates, gravels, road pavement materials, manufactured and natural sands and armour stone. These products are essential to building and maintaining Australia's modern communities.

CEMEX was granted development consent on 21 December 2005 (DA-128-5-2005) (Consent) by the New South Wales (NSW) Minister for Planning, for the construction and operation of Lynwood Quarry (Quarry). The Quarry site is located west of Marulan, in the Southern Tablelands region of NSW (refer to **Figure 1.1**). The Quarry will provide a long-term supply of high quality construction material into the Sydney, regional and local markets. The supply to the Sydney market will replace CEMEX's current production from the Penrith Lakes Scheme, which is likely to be exhausted around 2012-2013.

Shortly after the approval of the Lynwood Quarry Project (the Project), the Sydney region market demand for construction materials slowed, changing the timing drivers for the construction of the Project. The remaining resources at the Penrith Lakes Scheme were also reforecast and sufficient resources are now predicted to remain until 2012-2013 (as opposed to the previous forecast of 2009-2010 predicted at the time the development application for the Project was submitted).

Since the approval of the Project in late 2005, CEMEX has been progressing the implementation of the Project including obtaining all necessary supplementary approvals and reviewing the concept design and construction staging of the Quarry infrastructure. However, construction works at the site have not yet commenced.

As part of the review process, several opportunities have been identified to improve the Project by modifying the originally approved concept design. Several of these changes have been driven by the identification of a fault along the western boundary of the approved Quarry footprint. The key changes proposed to the Project include modifying the layout of site infrastructure including the crushing and screening plant, and a reduction in the western extent of the Quarry footprint. A detailed description of the proposed modifications is provided in **Section 2.0**.

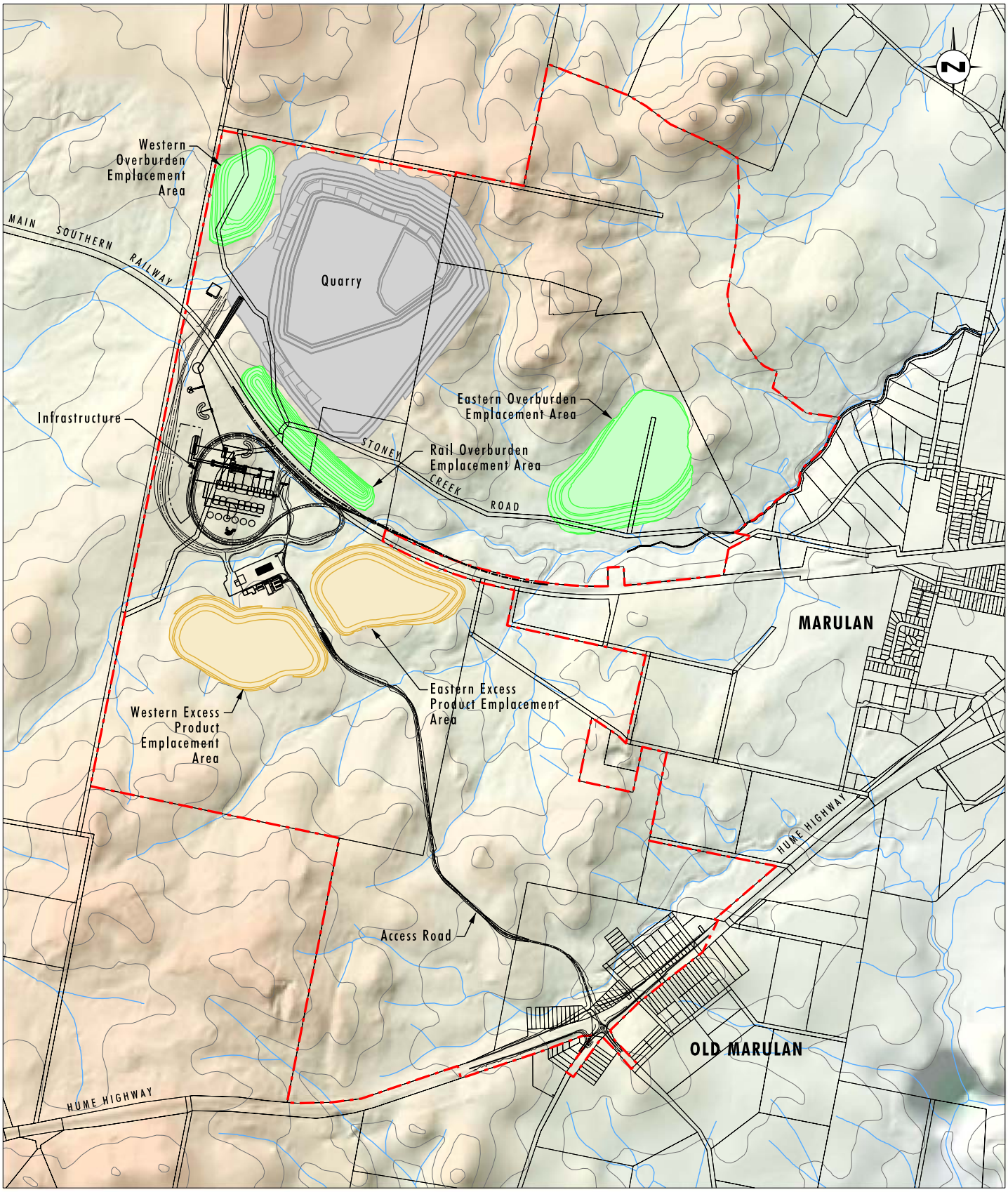
CEMEX is seeking approval to modify the design of the Project in accordance with Section 96(1A) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This Statement of Environmental Effects (SEE) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of CEMEX to assess the potential environmental impacts of the proposed modifications. The SEE will be a supporting document to the Modification Application lodged with the Department of Planning (DoP).

1.1 Overview of the Approved Project

The currently approved Project was planned to be constructed over a two year period with approval granted for 30 years of quarry operations. The location and extent of the approved 30 year quarry pit is shown on **Figure 1.2**, including the approved locations of overburden and excess product emplacement areas, and Project infrastructure. Key infrastructure approved as part of the Project includes:

FIGURE 1.1

Locality Plan



Source: Readymix
Base Source: LPI 2004

0 0.5 1 1.25km
1:25 000

Legend
Project Area

FIGURE 1.2

Approved Conceptual 30 Year Quarry Plan and Associated Infrastructure

- a crushing and screening plant;
- a rail loop and train loading facility;
- a truck loading facility and access road (including Hume Highway interchange); and
- various other infrastructure including a pre-coat plant, workshop, laboratory, office and amenity buildings, wheel wash station, weighbridge and other minor infrastructure.

The Quarry has approval to produce up to five million tonnes per annum (Mtpa) of saleable quarry product over the approved initial 30 year quarrying period. The target resource has an expected life in excess of 90 years.

The Quarry has approval to transport all of the 5 Mtpa of product from the Project via the dedicated train loading facility, with up to 1.5 Mtpa of the total 5 Mtpa also approved to be delivered to markets by road transport via the Hume Highway.

Some of the material extracted as part of the quarrying process will not be suitable for processing and sale. Consequently, approval was obtained for emplacement areas as part of the Project. Due to quarry planning constraints and the potential for resource sterilisation, in-pit dumping will not be possible during the initial 30 year quarry plan, so out-of-pit emplacement areas were approved. The approved locations of these emplacement areas are shown on **Figure 1.2**.

Approval was granted for the Quarry to operate twenty-four hours per day, seven days per week. As part of the Project design, CEMEX committed to limiting the operating hours for some activities, to reduce potential noise impacts.

1.1.1 Implementation Progress to date

Since approval was granted for the Project in December 2005, significant progress has been made towards Project implementation. Key achievements to date have included:

- preparing and gaining approval of the required environmental management plans, including the Environmental Management Strategy for the Project (Umwelt, 2007a);
- obtaining the required Aboriginal heritage investigation and impact permits – the Aboriginal archaeology excavation program commenced in 2007 and is ongoing;
- obtaining the required Section 60 permit (*Heritage Act 1977*) for the Old Marulan State Heritage Register (SHR) Area - the main excavation within the SHR area was completed in late 2007 with analysis works ongoing;
- obtaining the required approvals under the then *Rivers and Foreshores Improvement Act 1948*;
- obtaining the Environment Protection Licence (EPL) required for the Project;
- undertaking extensive discussions with the NSW Roads and Traffic Authority (RTA) regarding the design of the Highway Interchange. The draft detailed design report for the interchange was submitted for RTA approval in 2008, with the RTA's final comments currently being incorporated into the design;

- progressing the required RTA Works Authorisation Deed for the Highway Interchange, with the deed expected to be completed in late 2008 or early 2009;
- finalising the purchase of additional land required for the Hume Highway Interchange;
- undertaking further engineering design for the implementation of the Project, including liaison with the Australian Rail Track Corporation regarding the haul road and conveyor overpasses of the Main Southern Railway;
- further detailed exploration and geotechnical investigations, along with a detailed site survey, have been completed as part of the detailed engineering design;
- the required external water supply for the Project has been secured;
- undertaking negotiations with relevant landholders for an easement for the construction of a pipeline between the external water source and Lynwood Quarry;
- lodging applications for closure of Crown Road Reserves and the public road within the Project Area. These applications have been approved with the purchase of this land currently being progressed;
- finalising negotiations for construction of the new Country Energy zone sub-station for the Marulan township on CEMEX property, with some Country Energy construction activities having commenced on the property; and
- the proposed buffer zone on the western side of the Quarry discussed in the EIS has been purchased.

1.2 Description of the Site and Surrounds

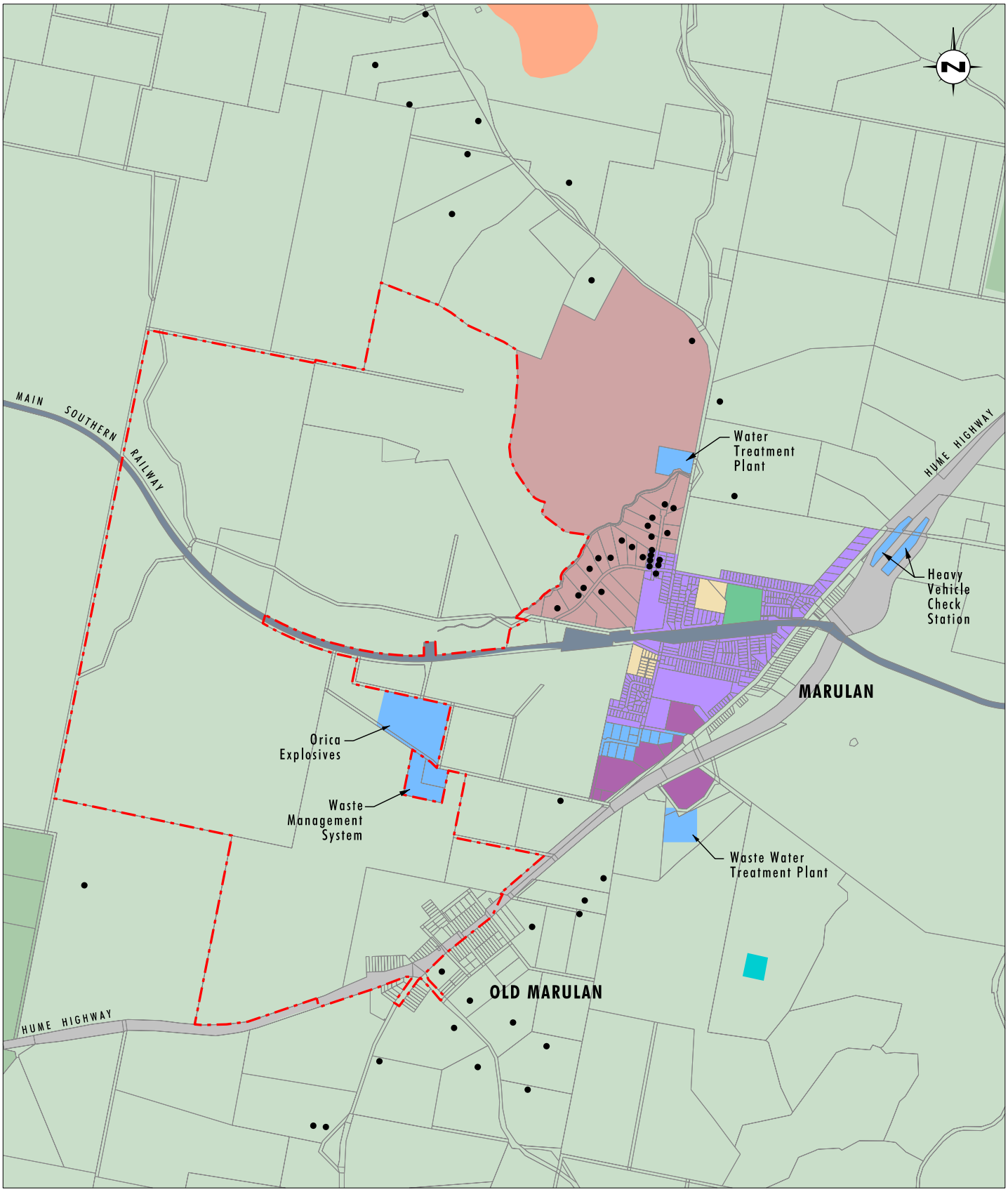
1.2.1 Project Area and Surrounding Land Use

The Project Area has historically been used for agricultural land uses, primarily grazing, with managed grazing currently ongoing on part of the Project Area. In line with feedback from the local community, CEMEX is committed to providing for appropriately managed ongoing agricultural land uses on parts of the site that are not required for quarrying activities and where these uses will not adversely impact on environmental values.

Agriculture is also the predominant land use surrounding the Project Area. Other land uses within the vicinity of the Project Area are the residential area of Marulan, located approximately 1 kilometre to the east, rural residential areas to the north-east adjoining the Project Area, small areas of industrial land, an existing hard rock quarry approximately 2 kilometres to the north, transport corridors and associated services. Another quarry, the Gunlake Quarry, has also recently been approved and will be located approximately 1.5 kilometres to the north of the Project Area. The land use surrounding the Project Area is shown on **Figure 1.3**.

1.2.2 Overview of Environmental Features

The Project Area lies within the catchments of Joarimin, Lockyersleigh and Marulan Creeks. Joarimin and Lockyersleigh Creeks drain to the Wollondilly River which is part of the Warragamba Dam catchment area, forming part of Sydney's drinking water supply. Marulan Creek is part of the Shoalhaven River system which also contributes to Sydney's drinking



Base Source: LPI 2004

0 0.5 1 1.75km
1:35 000

Legend

- Project Area
- Grazing
- Residential
- Rural Residential
- Industrial
- Business Highway Service
- Recreation
- Intensive Agriculture
- Open Space
- Pine Tree Plantation
- Highway
- Railway
- Quarry
- Residences

FIGURE 1.3

Existing Land Use

water supplies. The topography of the Project Area generally consists of undulating ridges separated by drainage valleys, with elevations ranging from 710 mAHD in the north, to around 630 mAHD near Joarimin Creek (refer to **Figure 1.4**).

Annual average rainfall for Marulan is 665 millimetres and is slightly summer dominant. Annual average evaporation is, however, well in excess of rainfall, being 1205 millimetres. Average wind speeds are relatively high, particularly in autumn, winter and spring when westerly winds are dominant. Summer winds are predominantly from the east.

The majority of the Project Area has been previously cleared, however, remnant vegetation exists in portions of the north of the Project Area. The balance of the Project Area consists of cleared grazing land with small patches of vegetation. The vegetation was generally found during studies completed as part of the EIS to have been heavily modified by past and ongoing agricultural activities and was considered to be reasonably representative of regional vegetation communities and condition.

1.3 Land Ownership and Schedule of Lands

CEMEX owns all of the land within the Project Area except for:

- several small parcels of Crown land adjacent to the Hume Highway;
- a small area of Crown land associated with the bed of Joarimin Creek;
- a number of Crown road reserves;
- a section of the road reserve of Stoney Creek Road, which is owned by Council; and
- a section of the Hume Highway where the approved interchange intersection will be located (refer to **Figure 1.3**).

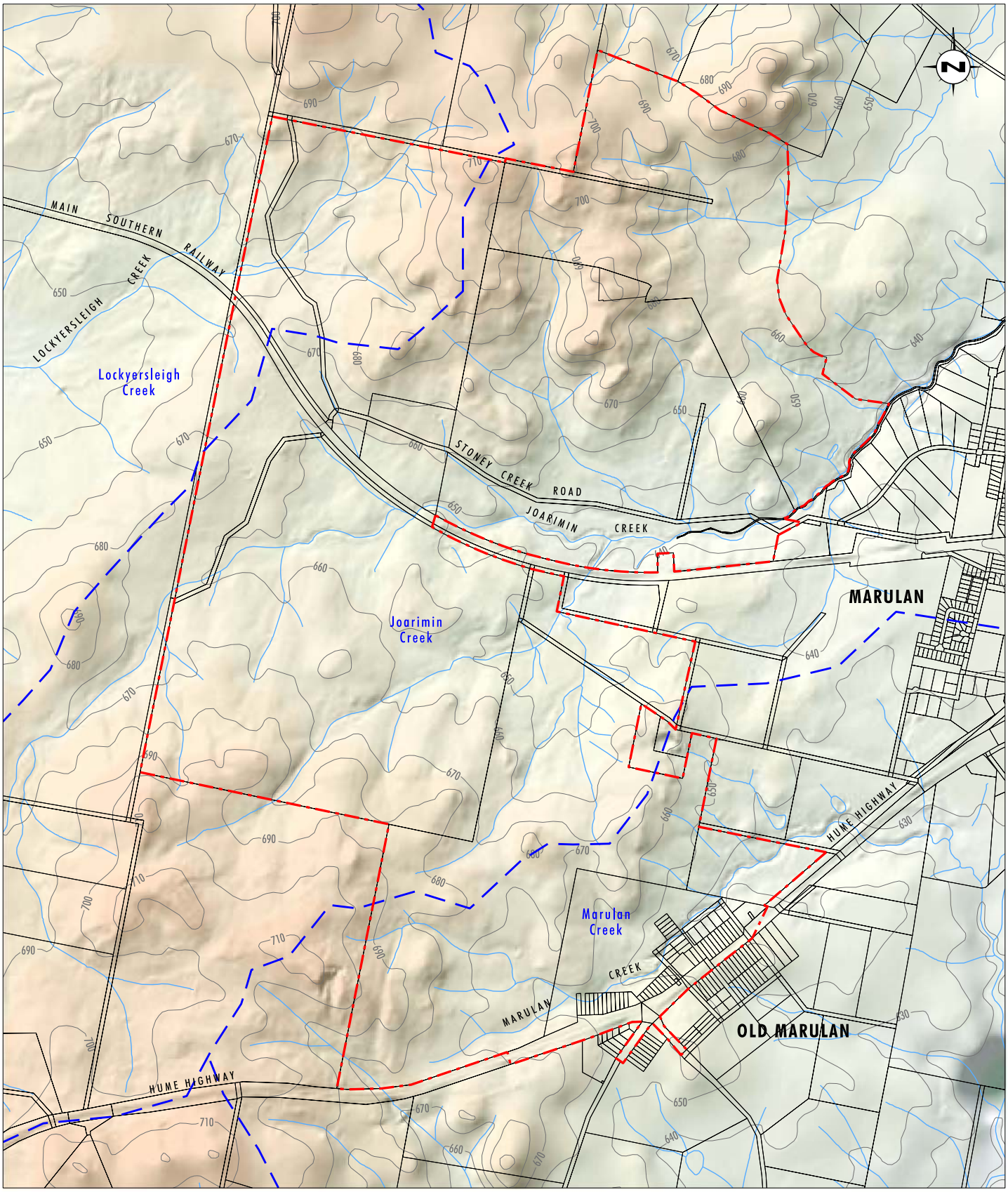
Full property descriptions for land within the Project Area are provided in **Appendix 1**. The Project Area shown on **Figure 1.3** corresponds to the approved DA boundary.

Since the approval of the Project in 2005, CEMEX has also purchased the land adjoining the western boundary of the Project Area. This land was purchased to provide an appropriate buffer between the Quarry and privately owned land to the west. CEMEX already owned significant buffer lands surrounding the proposed Quarry in all other directions.

1.4 Consultation

Since the approval of the Project in 2005, CEMEX has undertaken ongoing consultation with relevant government agencies including:

- consultation with DoP regarding approval of the various environmental management plans;
- consultation with Goulburn-Mulwaree Council regarding land use planning issues and the planned implementation of the Project ;



Base Source: LPI 2004

0 0.5 1 1.25km
1:25 000

Legend

- Project Area
- Catchment Boundary
- Contour (10m Interval)
- Creek / Drainage Line

FIGURE 1.4

Topography and Drainage

- consultation with the Department of Environment and Climate Change (DECC) regarding the Aboriginal archaeological investigations and associated permits, environmental management plans and obtaining the required EPL for the Quarry operation;

- consultation with DoP's Heritage Branch regarding the required historical heritage investigations and associated permits, in particular regarding the investigation works within the Old Marulan SHR area;

- consultation with the Department of Water and Energy regarding the Riparian Area Management Plans, the works required in drainage lines and the associated permits, and permits associated with external water supply to the Project;

- consultation with the Department of Lands regarding closure of the Crown Road reserves within the Project Area; and

- consultation with the RTA regarding the detailed design and construction of the interchange on the Hume Highway.

CEMEX is also committed to being an integral part of the Marulan community and has therefore implemented a community involvement program for the Project. This has included:

- ongoing consultation with the local community regarding the status of the Project which has involved the delivery of periodic newsletters to Marulan and surrounding areas;

- a community open day and a community presentation being held as part of the historical heritage investigations undertaken in the Old Marulan SHR area. As part of this investigation process there has been ongoing consultation with the Marulan Historical Society;

- a sponsorship program which has included supporting Marulan Public School for projects such as sponsoring a gymnastics program for all students, purchase of a school notice board, purchase of 12 laptop computers and providing new storage areas for school equipment; and

- ongoing consultation with the registered Aboriginal stakeholders for the Project, including the implementation of the Cultural Heritage Management Committee for the Quarry.

Specifically in regard to the proposed modifications, CEMEX met with DoP on 21 October 2008. At this meeting CEMEX presented an overview of the status of the Project, the proposed modifications, approval path and approach to this environmental assessment.

2.0 Description of Proposed Modifications

Detailed geotechnical investigations undertaken as part of the detailed design process identified a fault along the western edge of the approved 30 year Quarry footprint. The presence of this fault has resulted in increased alteration/weathering of the target hard rock resource and was predicted to potentially result in long term stability issues for the western wall of the Quarry pit. This area of increased alteration/weathering also affected the approved location of the primary crusher which was planned to be located in a slot cut into the rock, providing for stability during the crushing process. Due to the extent of alteration/weathering of the rock in the area of the primary crusher, this location was no longer considered suitable, requiring a redesign of the crushing and screening plant. CEMEX took this opportunity to review the design of all infrastructure associated with the Project, however, the general locality and components of the infrastructure remain unchanged. Further details of the proposed changes to the layout of the Quarry infrastructure are provided in **Section 2.2**.

The identification of the fault also necessitated a change to the western extent of the Quarry, requiring CEMEX to review the design and staging of the Quarry. The western extent of the Quarry has moved approximately 200 metres to the east, however, the remainder of the extraction footprint has remained consistent with that currently approved. The maximum depth of the Quarry will remain unchanged. The revised Quarry design is discussed further in **Section 2.1**.

Table 2.1 provides a comparison of the currently approved Quarry development to the proposed modifications. As shown in **Table 2.1**, the key features of the Project remain unchanged.

Table 2.1 - Comparison of Currently Approved Lynwood Quarry Development and the Proposed Modifications

Major Project Components/Aspects	Currently Approved Lynwood Quarry	Proposed Modifications
Quarry Life	Quarry operations to cease on 1 January 2038	No change
Limits on Production	5 Mtpa saleable product	No change
Maximum Transportation of Product by Rail	5 Mtpa	No change
Maximum Transportation of Product by Road	1.5 Mtpa	No change
Total Disturbance Footprint	As shown in EIS	No change
Quarry Footprint	As shown in EIS	Consistent except for reduced western extent. Maximum depth unchanged.
Overburden and Excess Product Emplacement Areas	As shown in EIS	No change
Infrastructure	As shown in EIS	Infrastructure components are as approved. Revised layout of Quarry infrastructure proposed as discussed in **Section 2.2.**

Table 2.1 - Comparison of Currently Approved Lynwood Quarry Development and the Proposed Modifications (cont)

Major Project Components/Aspects	Currently Approved Lynwood Quarry	Proposed Modifications
Hours of Operation	24 hours per day, 7 days per week. Restrictions on some operations to minimise potential noise impacts.	No change
Employment	Employment at maximum production of approximately 115 people (including road transport drivers).	No change
Construction Phase	Approximately two years of construction. Peak employment of approximately 140 people. Approval for transport of up to 100,000 tonnes of product per annum by road prior to completion of interchange.	No change

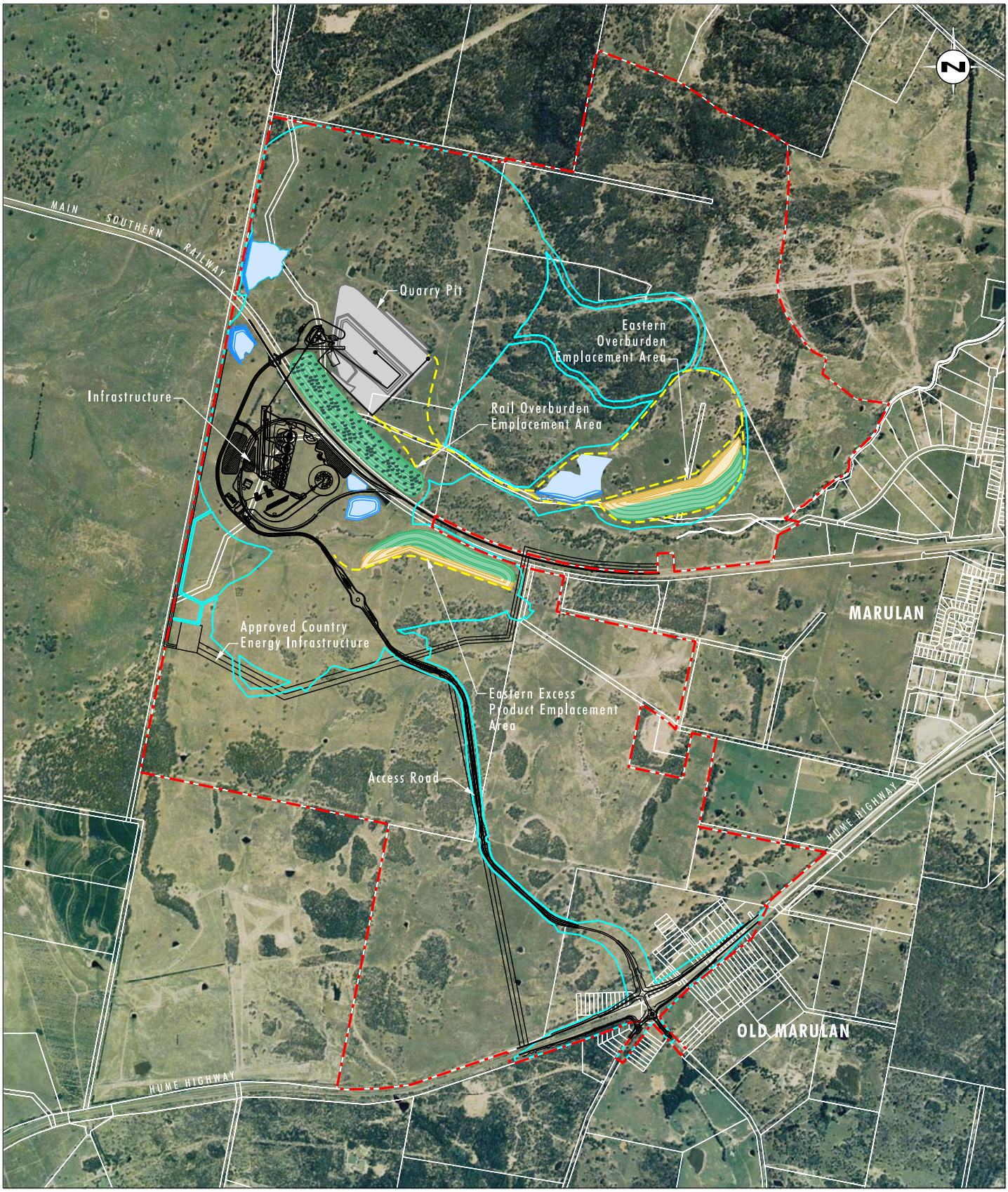
2.1 Conceptual Quarry Plan

As discussed in **Section 2.0**, the Quarry footprint has been reduced in its western extent, although the remainder of the footprint remains consistent with that previously approved. The change in the western extent has necessitated changes in the progression of the quarry pit and revised stage plans for years 5, 10, 20 and 30 are provided as **Figures 2.1** to **2.4** respectively. The location and design of the approved overburden emplacement areas and excess product emplacement areas will not change from that approved, with the order of use of these emplacement areas also unchanged.

Due to the reduction in construction activity in the Sydney area, the Quarry is currently forecast to start at lower sales volumes than identified in the EIS. The Quarry's rate of growth may also be slower as a result. Hence, while the quarrying equipment fleet will remain generally consistent with that described in the EIS, there will be a reduction in the extracted rock (primary raw feed) load and haul fleet in some phases of the Quarry development due to the change to an in-pit primary crusher and the potential for initial Quarry operations to be at a smaller scale than previously envisaged (refer to **Section 2.2**).

2.2 Quarry Infrastructure

The revised layout of Quarry infrastructure is shown on **Figure 2.1**. A more detailed figure of the main infrastructure area is provided as **Figure 2.5**. The infrastructure components remain unchanged from those currently approved, with the overall location of the infrastructure similar. As indicated in **Table 2.1**, the overall disturbance footprint of the Project remains unchanged and the revised infrastructure layout will not result in additional ground disturbance beyond that currently approved. The key changes to Project infrastructure are outlined in the following sections.



Base Source: LPI 2004, CEMEX Pty Ltd (Aerial Photo March 2005)

0 0.5 1 1.25km
1:25 000

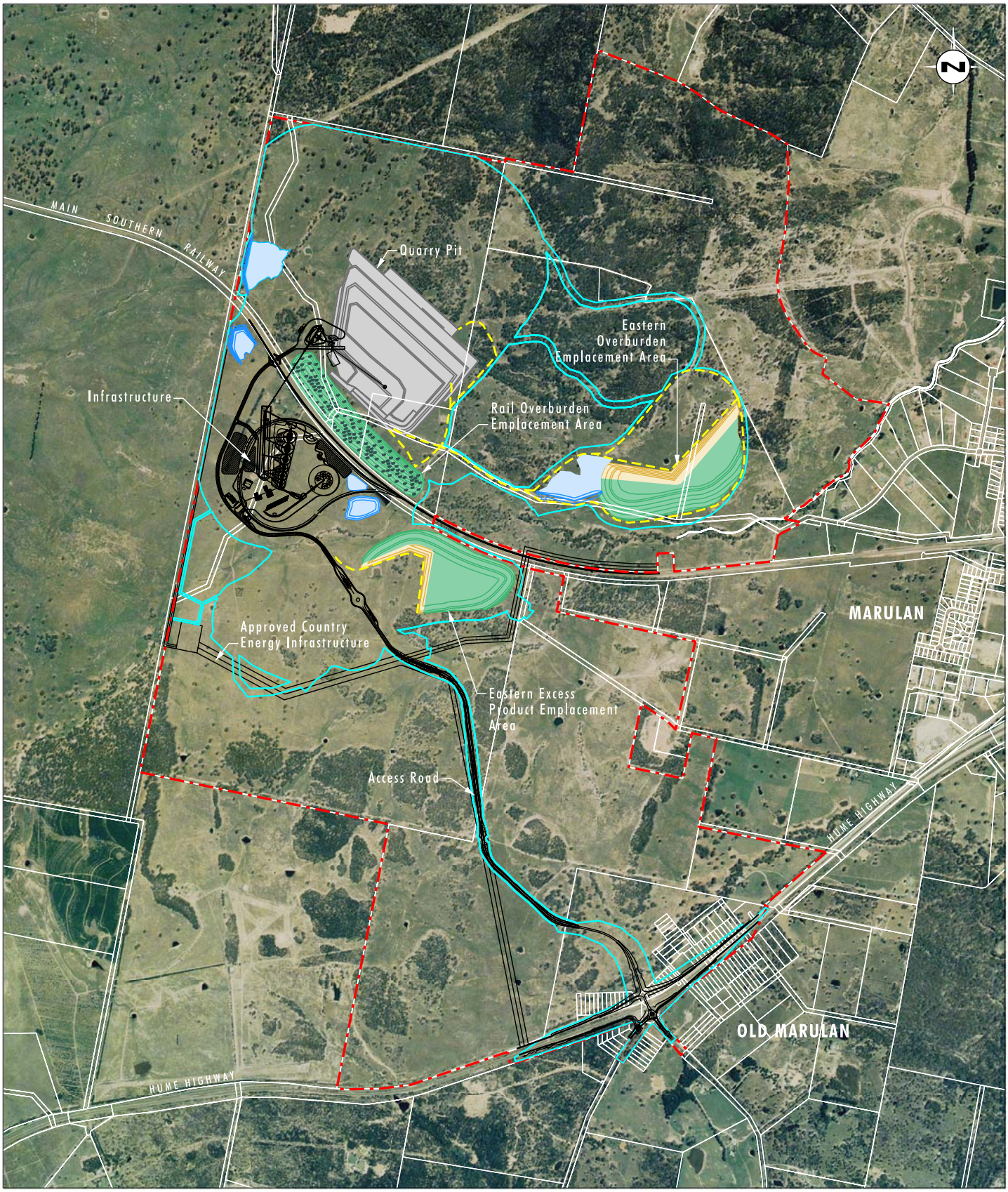
Legend

- Project Area
- Haul Road
- Approved Disturbance Footprint
- Quarry Pit
- Emplacement Area
- Rehabilitated Area
- Dam

FIGURE 2.1

Proposed Year 5 Quarry Plan

File Name (A4): R17_V1/2238_198.dgn



Base Source: LPI 2004, CEMEX Pty Ltd (Aerial Photo March 2005)

0 0.5 1 1.25km
1:25 000

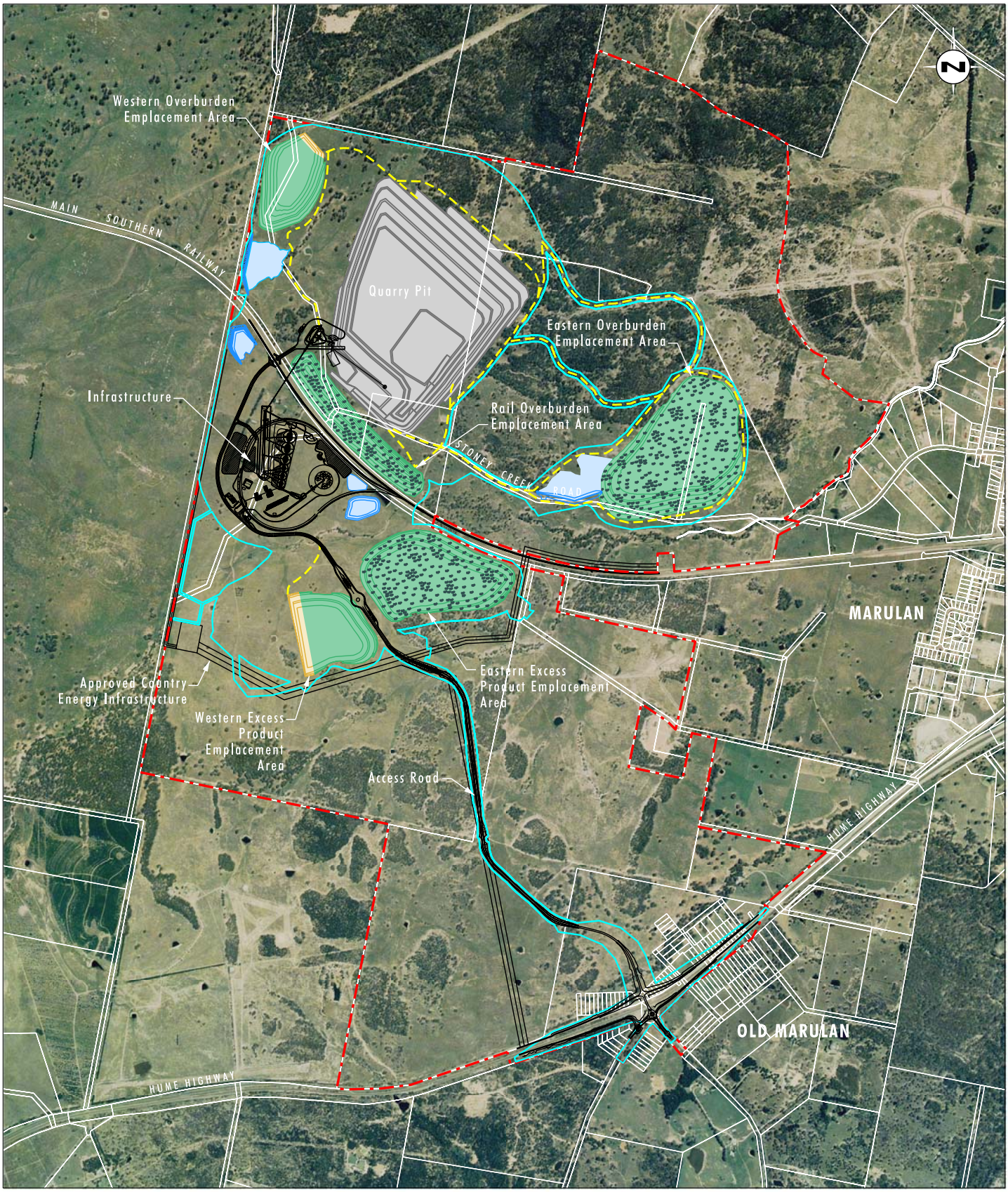
Legend

- Project Area
- Haul Road
- Approved Disturbance Footprint
- Quarry Pit
- Emplacement Area
- Rehabilitated Area
- Dam

FIGURE 2.2

Proposed Year 10 Quarry Plan

File Name (A4): R17_V1/2238_199.dgn



Base Source: LPI 2004, CEMEX Pty Ltd (Aerial Photo March 2005)

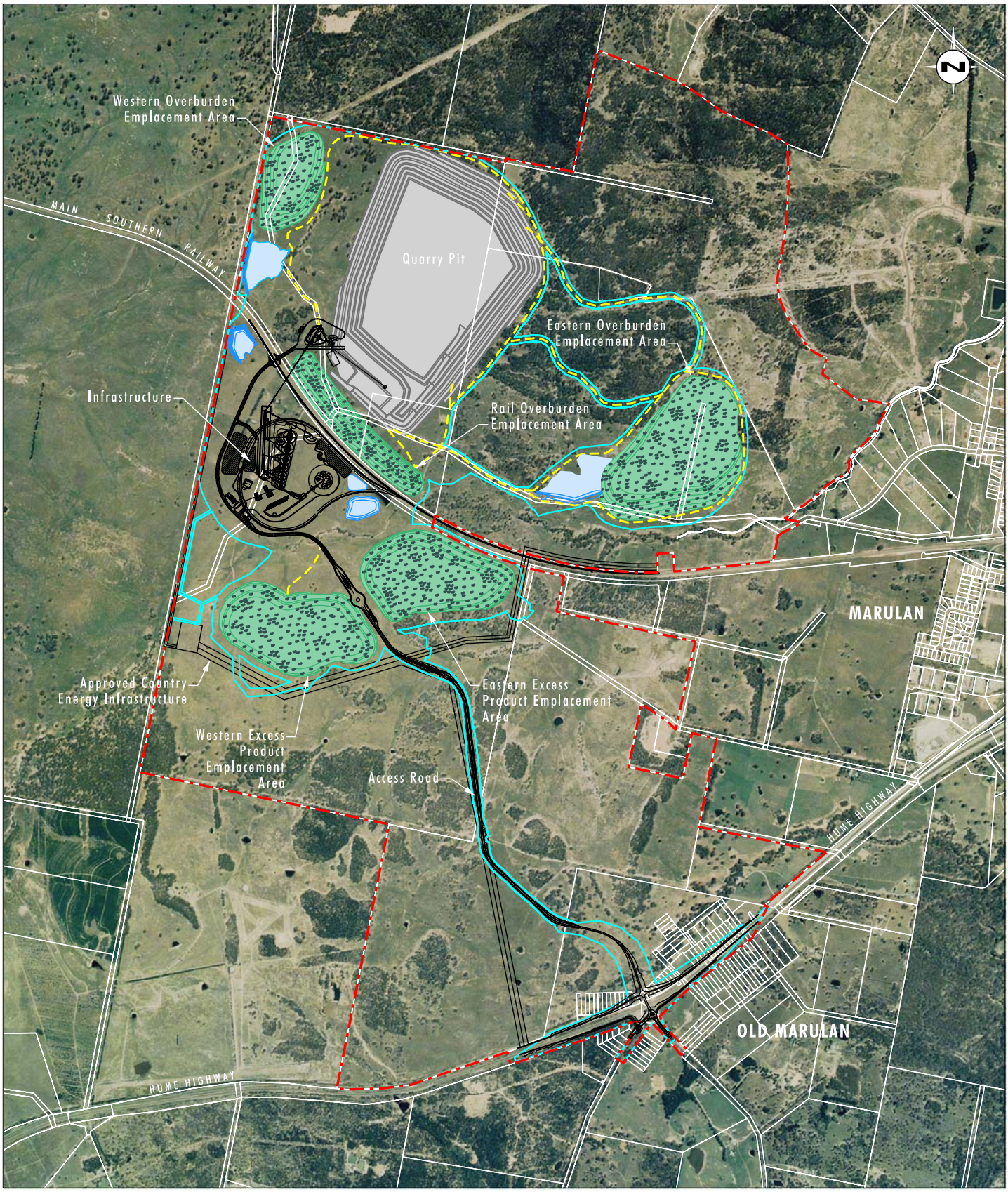
0 0.5 1 1.25km
1:25 000

Legend

- Project Area
- Haul Road
- Approved Disturbance Footprint
- Quarry Pit
- Emplacement Area
- Rehabilitated Area
- Dam

FIGURE 2.3

Proposed Year 20 Quarry Plan



Base Source: LPI 2004, CEMEX Pty Ltd (Aerial Photo March 2005)

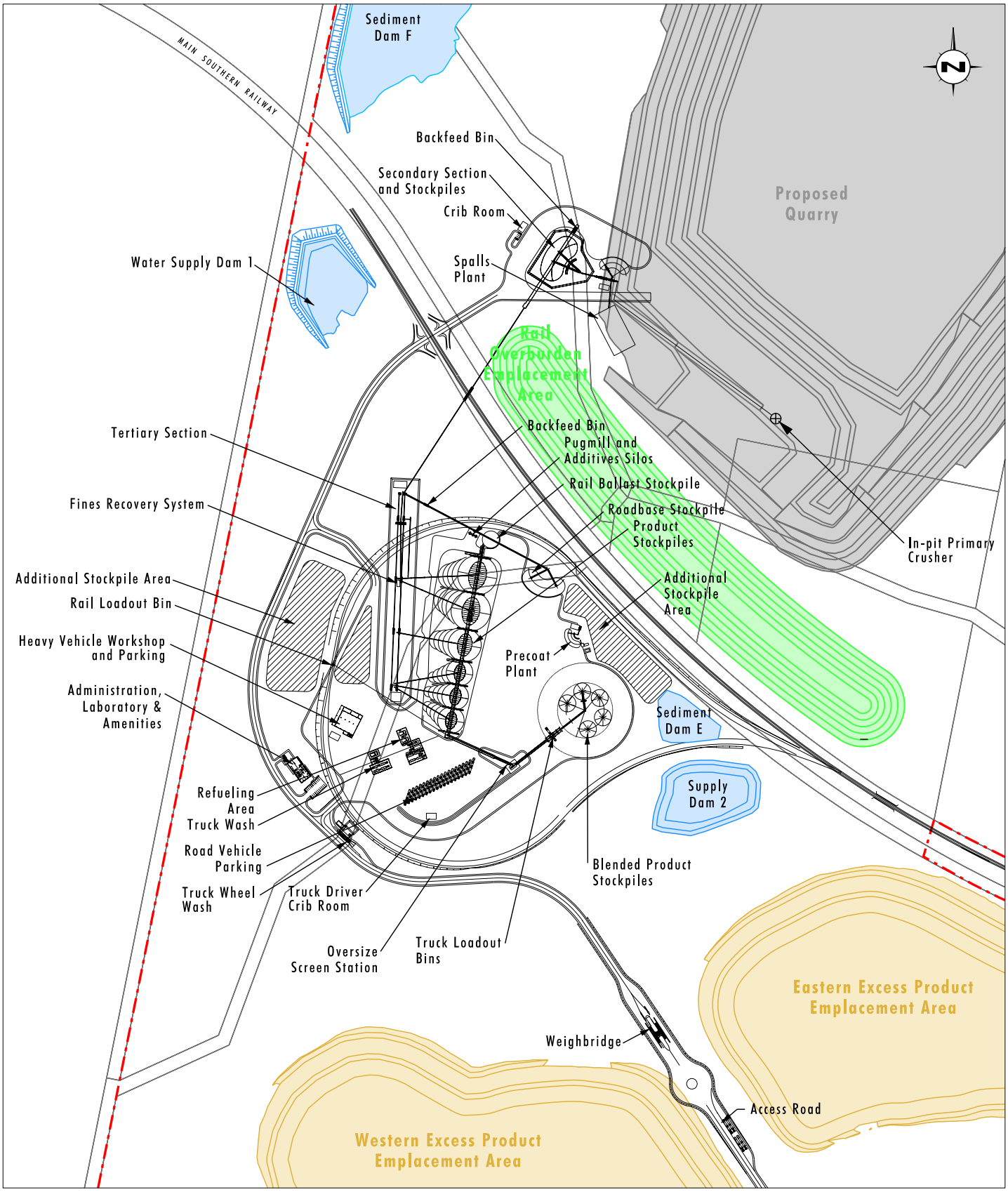
0 0.5 1 1.25km
1:25 000

Legend

- Project Area
- Haul Road
- Approved Disturbance Footprint
- Quarry Pit
- Emplacement Area
- Rehabilitated Area
- Dam

FIGURE 2.4

Proposed Year 30 Quarry Plan



Source: CEMEX Pty Ltd
Base Source: LPI 2004

0 100 200 400m
1:8000

Legend

Project Area

FIGURE 2.5

Revised Infrastructure Layout

Primary Crusher

An in-pit primary crusher will be used, as opposed to the fixed out-of-pit primary crusher described in the EIS. In the early years of the Project there will be up to two mobile in-pit crushers (refer to **Figure 2.1**), with a fixed in-pit crusher being installed later in the quarry life (refer to **Figures 2.2** to **2.4**). This change will also result in a reduction in the size of the mobile equipment quarrying fleet as in early years the mobile crushers will be moved to be adjacent to the extraction face and loaded directly by front-end-loader. Once the fixed in-pit crusher is established a haulage fleet will be required, however, this fleet will operate within the pit, reducing haulage distance and providing greater shielding of truck noise.

Crushing and Screening Plant

The layout of the remainder of the crushing and screening plant has been modified to reflect the change of primary crusher. This includes the relocation of the secondary crusher and associated plant elements to the northern side of the Main Southern Railway. The layout of the remainder of the crushing and screening plant components has also been revised, however, they remain located adjacent to or within the rail loop as per the concept design in the EIS. The design of the earthen pads on which the plant sits has also been revised to reduce the extent of earthworks required during the construction phase of the Project.

Quarry Infrastructure

The layout of the Quarry infrastructure has been revised as indicated on **Figures 2.1** and **2.5**. Key changes include:

- relocation of the workshop and other associated facilities to within and adjacent to the rail loop;
- change in arrangement of the truck loading facility;
- relocation of the haul road and conveyor crossing over the Main Southern Railway;
- changes to internal roadways, including reducing the number of crossings over Joarimin Creek adjacent to the rail loop from two to one; and
- relocation of one of the water storage dams to south of the Main Southern Railway as a result of the revised haul road layout.

The rail loading facility and rail loop remain unchanged.

As previously discussed, the overall components of Quarry infrastructure proposed as part of the modifications are substantially unchanged from that currently approved. The nature of operation of each of these components will be consistent with that outlined in the EIS.

Hume Highway Interchange

The EIS provided a conceptual design for the interchange intersection required to provide access from the Quarry site onto the Hume Highway. The final design of the interchange was to be determined in close consultation with the RTA, which needed to approve the final design of the interchange. CEMEX has had extensive ongoing consultation with the RTA regarding the interchange since the approval of the Project, resulting in some minor changes to the interchange design from that shown in the EIS. The revised concept design is shown on **Figure 2.6**. The revised interchange design has only minor changes from the EIS concept and the construction footprint remains unchanged from the EIS. The final design of the interchange will be determined in consultation with and approved by, the RTA.

Base Source: LPI 2004, Readymix

0 100 200 250m
1:5000

Legend
Project Area

FIGURE 2.6

Revised Hume Highway Interchange Design

2.3 Quarry Production and Product Delivery

As indicated in **Table 2.1**, the maximum production from Lynwood Quarry will remain at 5 Mtpa saleable product as currently approved. Due to current market conditions, however, the ramp-up to maximum production may be slower than originally envisaged.

Section 3.5.10 of the EIS identified that, depending on market demands, the construction of the crushing and screening plant may be staged. Accordingly, it is currently considered likely that the construction of the quarry plant and infrastructure will be staged depending on market demand. This may include initially limiting production to 1.5 Mtpa and solely utilising road haulage for product delivery, and delaying the construction of the rail loading facility until market demand is sufficiently improved to justify the capital cost of the rail facility. However, should market conditions improve, the Quarry may ramp-up to maximum production over a period of several years as originally envisaged.

Due to the potential for staged construction, CEMEX also seeks approval to deliver quarry product by road to all markets. This will include delivery of quarry product by road to CEMEX's facilities within the Sydney region, along with other markets. Consistent with current approvals, once the Hume Highway interchange is constructed, all product road transport will access the Hume Highway via the interchange. As the volume of product approved for road haulage will remain unchanged, there will be no change to traffic volumes from the Quarry.

2.4 Alternatives

The key alternative that requires consideration is the 'do nothing' alternative, that is, proceeding with the Project as currently approved. This alternative is not considered appropriate as the identification of a fault on the western edge of the quarry pit has necessitated changes to the design of the quarry and the primary crusher arrangement. These changes are required to safely and effectively implement the Project. It is acknowledged that the Project could proceed without some of the remaining proposed changes. However, these changes provide substantial operational benefits to CEMEX and as demonstrated in **Section 4.0**, are of minimal environmental impact In these circumstances, it is considered that the 'do nothing' alternative is not an appropriate alternative.

3.0 Planning Context

The following section contains details of the relevant Commonwealth and State planning provisions and a discussion of the application of these planning provisions to the Project.

3.1 Commonwealth Legislation

3.1.1 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval of the Commonwealth Minister for the Environment, Heritage and the Arts is required for any action that may have a significant impact on matters of national environmental significance. These matters are:

- World Heritage properties;
- National Heritage Places;
- Ramsar wetlands;
- cetaceans, migratory species, threatened species, critical habitats or ecological communities listed in the EPBC Act;
- Commonwealth land, marine areas or reserves; and
- nuclear actions.

The only provisions of this legislation, which are potentially relevant to the Project, relate to potential impacts on migratory species, threatened species, or ecological communities listed under the EPBC Act. As outlined in **Section 2.0**, the proposed modifications do not require any change to the currently approved disturbance footprint. Therefore, the proposed modifications will not impact on migratory species, threatened species, or ecological communities listed under the EPBC Act and the approval of the Commonwealth Minister for the Environment, Heritage and the Arts is not required for the Project.

3.1.2 Native Title Act 1993

The *Native Title Act 1993* (NT Act) is administered by the National Native Title Tribunal. The Tribunal is responsible for maintaining a register of native title claimants and bodies to whom native title rights have been granted. The NT Act prescribes that native title can be extinguished under certain circumstances, including the granting of freehold land. Areas of land within the Project Area where native title may not have been extinguished include Crown land.

A native title claim over the Marulan area, including the land within the Project Area, was lodged in 1997 by the Gundungurra Tribal Council Aboriginal Corporation. The notification of the claim is complete and it is currently subject to mediation. Accordingly, the appropriate processes under the *Native Title Act 1993* in relation to this Project must be undertaken so that the Project complies with the requirements of the Act. Essentially this will involve negotiating with the relevant Native Title Claimant for any areas of land that have not had the native title rights extinguished, to validate the future acts required for the Project.

3.2 State Legislation

3.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act is administered by DoP and by local government at a local level. It is the primary legislation governing environmental planning and assessment for the State of NSW.

The objectives of the EP&A Act relevant to the Project encourage:

- the proper management, development and conservation of natural and artificial resources;
- the promotion and co-ordination of the orderly and economic use and development of land;
- the protection of the environment; and
- ecologically sustainable development.

Approval is sought for the proposed modifications under Section 96(1A) of the EP&A Act. The Minister for Planning will be the consent authority for the modification application.

Modifications sought under Section 96(1A) must:

- be of minimal environmental impact; and
- be substantially the same development for which the consent was originally granted.

As demonstrated in **Section 4.0**, the proposed modifications are considered to be of minimal environmental impact. Key considerations in this assessment are that the proposed modifications will not change the approved disturbance footprint of the Project and will not substantially change the impact of the Project on the environment or community. As highlighted in **Section 4.0**, the Project will also result in some improved environmental outcomes, in particular reduced impacts on the riparian corridors of Lockyersleigh and Joarimin Creeks.

The Project as modified, is also considered to be substantially the same Project as that originally approved in the Consent because:

- the overall nature of the Project, being a hard rock quarry producing up to 5 Mtpa of quarry product and using both rail and road transportation, remains unchanged;
- there will be no change in production limits or product type;
- the overall disturbance footprint of the Project has not changed;
- the quarry footprint is smaller, but otherwise in the same location as originally approved in the Consent; and
- the infrastructure components are consistent with those originally approved in the Consent and are in the same general locality, with only the proposed layout changing.

Therefore, it is considered that the Minister for Planning can lawfully approve the proposed modifications under Section 96(1A) of the EP&A Act.

3.2.2 Summary of Other State Legislation

A summary of the other State Acts potentially applicable to the Project is included in **Table 3.1**, with an indication of the requirements specific to the proposed modifications.

Table 3.1 - Summary of State Legislation and Relevance to the Proposed Modifications

Act	Specific Approval Required for Proposed Modifications	Comments
Protection of the Environment Operations Act 1997	Yes	CEMEX obtained the EPL for the Project. Should the proposed modifications be approved, the EPL will need to be modified to accommodate the proposed changes.
Water Management Act 2000	Yes	Approvals under Part 3A of the former *Rivers and Foreshores Improvement Act 1948* have been obtained for works within riparian zones. These permits remain in place, however, the nature of the works within the riparian zones of Joarimin Creek and Lockyersleigh Creek have changed and a Controlled Activity Approval under the *Water Management Act 2000* will be required for these works.
Water Act 1912	Yes	A Part 5 licence is required for the quarry pit. The Part 5 licence will need to be obtained for the revised quarry pit layout.
Fisheries Management Act 1994	No	A permit under this Act is not required as a Controlled Activity Approval will be obtained under the *Water Management Act 2000* for all works within creeks.
National Parks and Wildlife Act 1974	No	The proposed modifications will not result in any change to the currently approved disturbance footprint for the Project. Therefore, there will be no additional permit requirements related to this Act beyond those associated with the currently approved Project and which are substantially progressed.
Threatened Species Conservation Act 1995	No	A licence under this Act is not required for any activity undertaken in accordance with a development consent granted under the EP&A Act. The proposed modifications will not result in any change to the currently approved disturbance footprint for the Project and will therefore not have a significant impact on any threatened species, populations or ecological communities.
Crown Lands Act 1989	No	The proposed modifications will not result in any additional requirements under this Act. CEMEX has substantially progressed the approvals required for the Project under this Act.
Heritage Act 1977	No	The proposed modifications will not result in any change to the currently approved disturbance footprint for the Project. Therefore, there will be no additional permit requirements related to this Act beyond those associated with the currently approved Project and which are substantially progressed.

Table 3.1 - Summary of State Legislation and Relevance to the Proposed Modifications (cont)

Act	Specific Approval Required for Proposed Modifications	Comments
Dams Safety Act 1978	Yes	As outlined in the Lynwood Quarry EIS, a number of dams will be constructed as part of the Project. Some changes to the design and location of site dams will occur as part of the proposed modifications. CEMEX will consult with the Dams Safety Committee to confirm whether or not any of the dams will be prescribed dams.
Native Vegetation Act 2003	No	The provisions of this Act do not apply to designated development under the EP&A Act and therefore do not apply to the Project.
Aboriginal Land Rights Act 1983	No	CEMEX is not aware of any land rights claims made over the Crown land within the Project Area at the time of preparation of this SEE. Therefore Part 6 of the Act is not relevant to this assessment.
Environmentally Hazardous Chemicals Act 1985	No	CEMEX does not propose to store, transport or use any chemicals currently subject to a Chemical Control Order (CCO) under this Act. Should such chemicals be required during the life of the Project, CEMEX will manage the chemicals in accordance with the relevant CCO, including obtaining any appropriate licences.

As indicated in **Table 3.1**, in addition to approval under Section 96(1A) of the EP&A Act, the following approvals will be required for the proposed modifications:

- a Controlled Activity Approval under the *Water Management Act 2000;*
- a Part 5 licence under the *Water Act 1912* for the revised quarry pit;
- a licence variation to the existing EPL under the *Protection of the Environment Operations Act 1997*; and
- approval under the *Dams Safety Act 1978* for the proposed site dams, if required following consultation with the Dams Safety Committee.

3.3 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) are environmental planning instruments created by the State government. The SEPPs that are potentially relevant to the Project are discussed in the following sections.

3.3.1 SEPP Major Projects (Major Projects SEPP)

The Major Projects SEPP identifies development to which the development assessment and approval process under Part 3A of the EP&A Act applies. Extractive industries that extract more than 200,000 tonnes of extractive materials per year; or which extract, from a total resource of more than 5 Mt, are Major Projects under the SEPP. Therefore, the provisions

of the SEPP apply to the Project. However, this Project is seeking a modification to an existing development consent under Section 96(1A) of Part 4 of the EP&A Act. Therefore the Part 3A assessment and approval process will not be used for this Project.

3.3.2 SEPP Mining, Petroleum Production and Extractive Industries (Extractive Industries SEPP)

The Extractive Industries SEPP was gazetted in February 2007. The SEPP outlines where various extractive industries activities are permissible both with and without development consent. The SEPP also defines mining, petroleum production and extractive industries developments that are prohibited, exempt or complying developments. The SEPP identifies that extractive industries are permissible with development consent on land for which development for the purposes of agriculture or industry may be carried out (with or without development consent).

As discussed in **Section 3.5**, the Project Area is subject to three zonings, with extractive industries permissible in one of these zonings under the provisions of the *Mulwaree Local Environmental Plan 1995*. However, agriculture is permissible in the remaining two zones and therefore in accordance with the provisions of the Extractive Industries SEPP, the Project is permissible with development consent.

3.3.3 State Environmental Planning Policy 33

SEPP No. 33 – Hazardous and Offensive Development requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. The aim of this policy is to link the permissibility of a proposal to its safety and pollution control performance. The assessment process establishes whether the proposal is potentially hazardous or offensive and if this is not the case, SEPP 33 is not applicable.

The Project was determined, as part of the original environmental assessment and approval process, not to be a hazardous or offensive development. As the nature and components of the proposed modifications are of a minimal environmental impact the proposed modifications will not change this assessment.

3.3.4 State Environmental Planning Policy 44

SEPP No. 44 – Koala Habitat Protection applies to the extent that a Council is restricted from granting development consent for proposals on land identified as core koala habitat, without the preparation of a plan of management. The EIS identified that there is no core koala habitat in the Project Area and therefore the provisions of this SEPP do not apply.

3.3.5 State Environmental Planning Policy 55

SEPP No. 55 – Remediation of Land aims to provide a state wide planning approach to the remediation of contaminated land, and to reduce the risk of harm to human health and the environment, by consideration of contaminated land as part of the planning process. Under the SEPP, a consent authority must not consent to the carrying out of development on land unless it has considered potential contamination issues.

As identified in the EIS, there are no known areas of contaminated land within the Project Area and SEPP 55 does not place any constraints on the Project. This assessment remains valid.

3.4 Regional Environmental Planning Policies

3.4.1 Drinking Water Catchments Regional Environmental Plan No. 1

The Drinking Water Catchments Regional Environmental Plan No. 1, (REP) aims to create healthy water catchments that will deliver high quality water while sustaining diverse and prosperous communities. The REP requires developments to demonstrate that they will have a neutral or beneficial effect on water quality. The EIS demonstrated that the approved Project would have a neutral or beneficial effect on water quality. As the nature of the Project, key components, development approach and disturbance footprint have not changed, this assessment remains valid. However, the potential impacts of the proposed modifications on surface waters have been reassessed and are provided in **Section 4.2**. This assessment concludes that the Project as modified, will continue to have a neutral or beneficial effect on water quality.

3.4.2 Sydney to Canberra Corridor Strategy

The NSW government released a revised strategy for the Sydney to Canberra corridor in 2008, replacing the former *Sydney to Canberra Corridor Strategy* (DoP, 1995). The primary purpose of the new strategy, known as the *Sydney – Canberra Corridor Regional Strategy* (DoP, 2008) (Strategy), is to accommodate and manage growth while ensuring that the rural landscapes and environmental settings that define the Region's character are not compromised (DoP, 2008).

The Strategy estimates that 1,650 new jobs will be needed in the Goulburn Mulwaree LGA over the next 25 years (DoP, 2008). Developments such as the Quarry will play a major role in meeting such demand. The Strategy recognises the significant resources of extractive materials in the region and the significant contribution that these resources make to the economy of the region. It states that, 'these extractive resources are a key strategic economic resource for the Region and Sydney' (DoP, 2008) and aims to protect access to these resources through the strategic planning process.

It is considered that the Project is compatible with the Strategy as it provides significant economic benefits and employment opportunities for the region, and will supply important construction materials to the Sydney region market, whilst appropriately managing environmental impacts, including not significantly impacting on surrounding land uses.

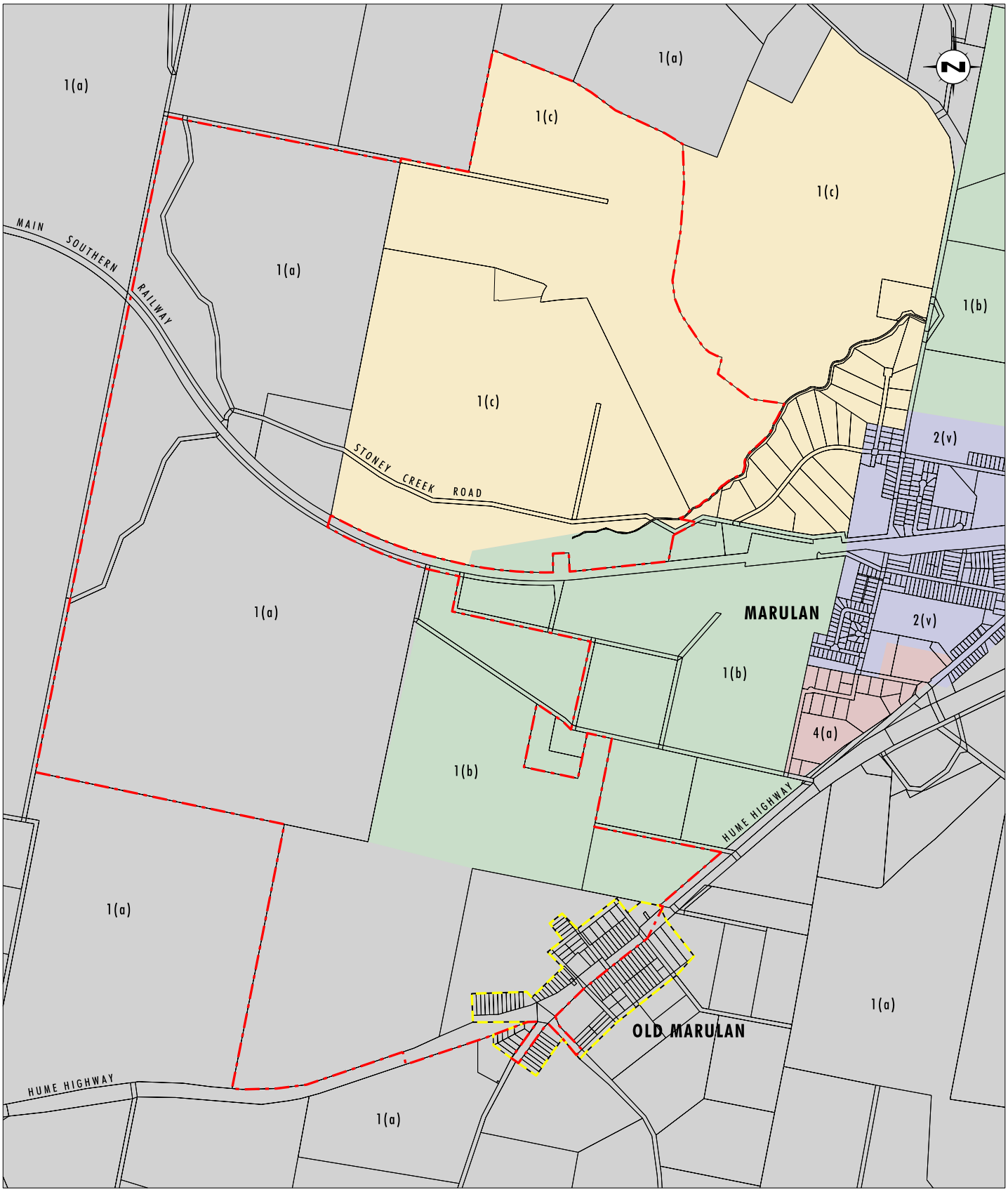
3.5 Local Planning

3.5.1 Mulwaree Local Environmental Plan

The local environmental planning instrument relevant to the Project is the *Mulwaree Local Environmental Plan 1995* (LEP). The LEP covers the former Mulwaree Shire which was incorporated as part of the Goulburn Mulwaree LGA in 2004. Currently, the LEP remains in force for this part of the Goulburn Mulwaree LGA.

As identified in the Lynwood Quarry EIS, the Project Area is subject to three separate zonings under the Mulwaree LEP 1995 (refer to **Figure 3.1**). The zoning of the site has remained unchanged since this time. These three zones are:

- 1(a) – General Rural;



Source: Mulwaree Shire Council, 1995
Base Source: LPI 2004

0 0.5 1 1.25km
1:25 000

Legend

Project Area
SHR Boundary Old Marulan Township

FIGURE 3.1

Zoning

- 1(b) – Rural - Urban Investigation; and
- 1(c) – Rural Small Holdings.

The majority of land subject to quarrying and associated activities as part of the Project is zoned 1(a) (refer to **Figure 3.1**). Extractive industries are permissible on land zoned 1(a) with development consent. Extractive industries are not permissible on land zoned 1(b) and 1(c), however, because at the time the Project was approved it constituted State Significant Development, the Minister for Planning approved the Project in accordance with then Section 76 (8)(c) of the EP&A Act.

Agriculture is permissible in both the 1(b) and 1(c) zonings and therefore, extractive industries are permissible in these zonings under the provisions of the Extractive Industries SEPP (refer to **Section 3.3.2**). Therefore, the Project with the proposed modifications is permissible with development consent.

Goulburn Mulwaree Council is currently in the process of developing a new LEP to apply to the Goulburn Mulwaree LGA. CEMEX has held ongoing discussions with Council and DoP regarding how the new LEP will reflect the approved Lynwood Quarry. CEMEX expects that the new LEP, once gazetted, will appropriately reflect the approved Project.

4.0 Environmental Assessment

4.1 Preliminary Environmental Assessment

As discussed in **Section 2.0**, the majority of the currently approved Project will remain unchanged. Consequently, for the majority of environmental aspects, there will be no change in the potential impacts of the Project from those identified in the EIS and which are currently approved. A preliminary environmental assessment was therefore completed for the proposed modifications to identify the environmental aspects which required detailed assessment as part of this SEE. The findings of the preliminary environmental assessment are provided in **Table 4.1**, with reference to each of the environmental aspects potentially relevant to the Project, including those considered in the EIS.

Table 4.1 – Preliminary Environmental Assessment for Proposed Modifications

Environmental Aspect	Preliminary Environmental Assessment	Further Assessment Required for Proposed Modifications?
Soils, land capability and agricultural suitability	The proposed modifications will not result in any change to the approved disturbance footprint of the Project. Therefore, the impact of the Project on soils, land capability and agricultural suitability will not change from that of the currently approved Project. Soil erosion issues are addressed as part of the surface water assessment.	No
Topography	The nature of impact of the Project on the existing topography will not change substantially from the currently approved Project. The only changes associated with the proposed modifications relate to a reduction in the western extent of the quarry pit and minor changes to the constructed landform within the infrastructure areas. These changes do not change the impact assessment findings as outlined in the EIS.	No
Land use	The proposed modifications will not result in any change to the nature of the Project or the approved disturbance footprint of the Project. As demonstrated in the remainder of **Section 4.0**, the proposed modifications will not result in any significant changes to the offsite impacts of the Project. Therefore, the impact of the proposed modifications to the Project on land use will not change.	No
Public infrastructure	The proposed modifications will not result in significant changes to the interaction of the Project with public infrastructure, as: • the disturbance footprint will not change from that currently approved; • there are no changes to impacts on services and service infrastructure requirements; • road and rail transport movements will remain unchanged; • the changes to the design of the interchange are minor and have been undertaken in close consultation with the RTA; and • the change in location of the bridge and conveyor over the Main Southern Railway do not alter their interaction with rail traffic.	No

Table 4.1 – Preliminary Environmental Assessment for Proposed Modifications (cont)

Environmental Aspect	Preliminary Environmental Assessment	Further Assessment Required for Proposed Modifications?
Groundwater	The location and maximum depth of the quarry pit have not changed from that currently approved, however, the western extent has been reduced. The potential for the Project to impact on groundwater otherwise remains unchanged. Therefore, it is considered likely that the groundwater impacts of the proposed modifications to the Project will be consistent with those of the currently approved Project.	No
Surface Water	The proposed modifications will result in minor changes to the interaction of the Project with surface waters.	Yes, refer to **Section 4.2**
Ecology	The proposed modifications will not result in any change to the approved disturbance footprint of the Project. Therefore, the impact of the proposed modifications to the Project on ecology will not change from that of the currently approved Project.	No
Air Quality	The changes in design of the quarry pit and quarry infrastructure have the potential to change the air quality impacts of the Project.	Yes, refer to **Section 4.3**
Noise	The changes in design of the quarry pit and quarry infrastructure have the potential to change the noise impacts of the Project.	Yes, refer to **Section 4.4**
Blasting	There will be no change in blasting impacts as a result of the proposed modifications as the location of the quarry pit has not changed and there are no changes proposed to blasting practice.	No
Aboriginal Archaeology	The proposed modifications will not result in any change to the approved disturbance footprint of the Project. Therefore, the impact of the proposed modifications to the Project on Aboriginal archaeology will not change.	No
Historical Heritage	The proposed modifications will not result in any change to the approved disturbance footprint of the Project. Therefore, the impact of the Project on historical heritage will not change from that of the currently approved Project. There have, however, been significant heritage investigations undertaken since the granting of the development consent in 2005. This provides the opportunity to update the heritage management requirements for the Project as discussed in **Section 5.1**.	No
Visual Amenity	The relocation of some Project infrastructure has minimal potential to alter the visual impacts of the Project, however, some minor changes will occur. These changes are discussed in **Section 4.5**.	Yes, refer to **Section 4.5**

Table 4.1 – Preliminary Environmental Assessment for Proposed Modifications (cont)

Environmental Aspect	Preliminary Environmental Assessment	Further Assessment Required for Proposed Modifications?
Hazard	As discussed in **Section 3.3**, the existing Lynwood Quarry Project was determined as part of the original environmental assessment and approval process to not be a hazardous or offensive development. As the nature and components of the Project are not proposed to change as a result of the proposed modifications, the proposed modifications will not change this assessment outcome.	No
Greenhouse Gas and Energy	The proposed modifications have the potential to change the energy use of the Project and consequently the greenhouse gas emissions.	Yes, refer to **Section 4.6**
Rehabilitation	Rehabilitation of the Quarry will remain generally consistent with that currently approved, however, the change in design of the quarry pit will result in some minor changes.	Yes, refer to **Section 4.7**
Socio-economic Assessment	The socio-economic impacts of the Project will remain substantially unchanged, however, as the amenity aspects of the Project have some potential to change, the socio-economic impacts require review.	Yes, refer to **Section 4.8**

As indicated in **Table 4.1**, the following environmental aspects require further assessment in relation to the proposed modifications to the Consent:

- surface water – refer to **Section 4.2**;
- air quality – refer to **Section 4.3**;
- noise – refer to **Section 4.4**;
- visual amenity – refer to **Section 4.5**;
- greenhouse gas and energy – refer to **Section 4.6**;
- rehabilitation – refer to **Section 4.7**; and
- socio-economic – refer to **Section 4.8**.

4.2 Surface Water Assessment

4.2.1 Potential Surface Water Impacts

The Project Area is located within the catchments of Lockyersleigh, Joarimin and Marulan Creeks (refer to **Figure 1.4**). As part of the EIS, a detailed surface water assessment was completed, including identification of the required surface water management controls. A summary of the key impact assessment findings for the approved Project, as outlined in the EIS, is provided in **Section 4.2.2**.

The features of the proposed modifications to the Project that have the potential to impact on surface waters and on the water management requirements for Lynwood Quarry are discussed in detail in **Section 4.2.3**. In summary, the key potential changes include:

- the proposed changes to the footprint of the quarry pit will reduce the impact of the Project on Lockyersleigh Creek, reducing the extent of the required creek diversion and allowing for more of the existing natural channel to be retained;

- the proposed changes to the infrastructure layout will result in less disturbance to Joarimin Creek (immediately upstream of the Main Southern Railway) with the previously approved removal of secondary flow channels (i.e. realignment of the flow paths) no longer required. The modified infrastructure design also reduces the number of roads crossing the main channel of Joarimin Creek adjacent to the rail loop from two to one;

- the proposed modifications will not result in any changes to surface water management within the Marulan Creek catchment area; and

- the changes to the quarry pit and infrastructure layouts will have only minor impacts on the overall Quarry water balance and requirements of the Quarry water management system.

4.2.2 Surface Water Impacts of Approved Project

The Project was designed to control of surface runoff from the site and to use water captured within the Quarry water management system for production purposes. This was predicted to result in a decrease in annual flow volumes immediately downstream of the Quarry on both Joarimin and Lockyersleigh Creeks. However, the required water management controls were designed to not increase the flood flows, velocities or depths in Joarimin or Lockyersleigh Creeks from the existing situation. In Marulan Creek, a slight increase in flood level immediately downstream of the Project Area of up to 6 millimetres during the 20 year average recurrence interval (ARI) storm event was predicted to occur (Umwelt, 2005).

The approved realignment of Joarimin Creek immediately upstream of the Main Southern Railway was predicted to result in decreased peak flows and velocities in the reaches downstream of the realignment. This realignment was not predicted to result in any increase in flood flows, velocities or levels downstream of the Project Area (Umwelt, 2005).

The EIS also identified that environmental flows, sufficient to ensure that similar volumes of water are stored in the small water holes that exist in the creek system would be maintained in the downstream reaches of Joarimin Creek. These flows were predicted to be maintained by the substantial catchment areas that will remain undisturbed and free flowing at the boundary of the Project Area.

As part of the approved Project, runoff from all disturbed areas within the Year 30 Quarry footprint will be controlled on-site for treatment, ensuring sediment transport off-site is minimised and maintained below pre-development pollution loads. The EIS predicted a net reduction in pollutant loads of phosphorus and nitrogen from the Project Area by up to 2 tonnes per year and 199 kilograms per year respectively. The design of the water management system for the Project also ensured that any oil/fuel spillages will be contained on-site, with no impact on downstream water quality.

The EIS also identified the impact of the Project on the Wollondilly River. Impacts on the Wollondilly River were estimated as a reduction in annual flow volumes of less than or equal to 0.1%. On this basis, the EIS concluded that the Quarry Project would not result in a

significant adverse cumulative impact on water quality or quantity in the Wollondilly River system or the Warragamba Dam catchment.

Groundwater modelling undertaken for the EIS predicted that the final void of the approved quarry pit would become an evaporative sink with the final water level unlikely to rise above temporary pools in the base of the quarry, which was 80 metres below the final 'spill level' of approximately 640 mAHD. As a result, the EIS concluded that water quality in the final void had negligible potential to impact on the water quality of the surrounding drainage system.

4.2.3 Potential Impacts with the Proposed Modifications

The key aspects of the design and operation of the water management system for the Project remain unchanged. In particular, the overall disturbance footprint of the Project and the design of the emplacement areas are unchanged, and the majority of water management controls remain unchanged. The changes to the water management system required as a result of the proposed modifications to the Project are outlined and assessed below. Except where specified, the water management controls to be implemented as part of the proposed modifications remain as described in the EIS, the Lynwood Quarry Water Management Plan (Umwelt, 2007b) and the three Riparian Area Management Plans prepared for the Project (Umwelt, 2007c, 2007d and 2007e). However, the Water Management Plan and the Riparian Area Management Plans for Joarimin Creek and Lockyersleigh Creek will need to be updated, should the proposed modifications be approved.

The overall design of the water management system (in particular the Quarry water management controls and sediment and erosion controls) will remain unchanged. As such the impacts of the Project on downstream water quality will remain unchanged. The assessment contained in the EIS, demonstrating that the Project is predicted to have a neutral or beneficial effect on water quality, also remains unchanged.

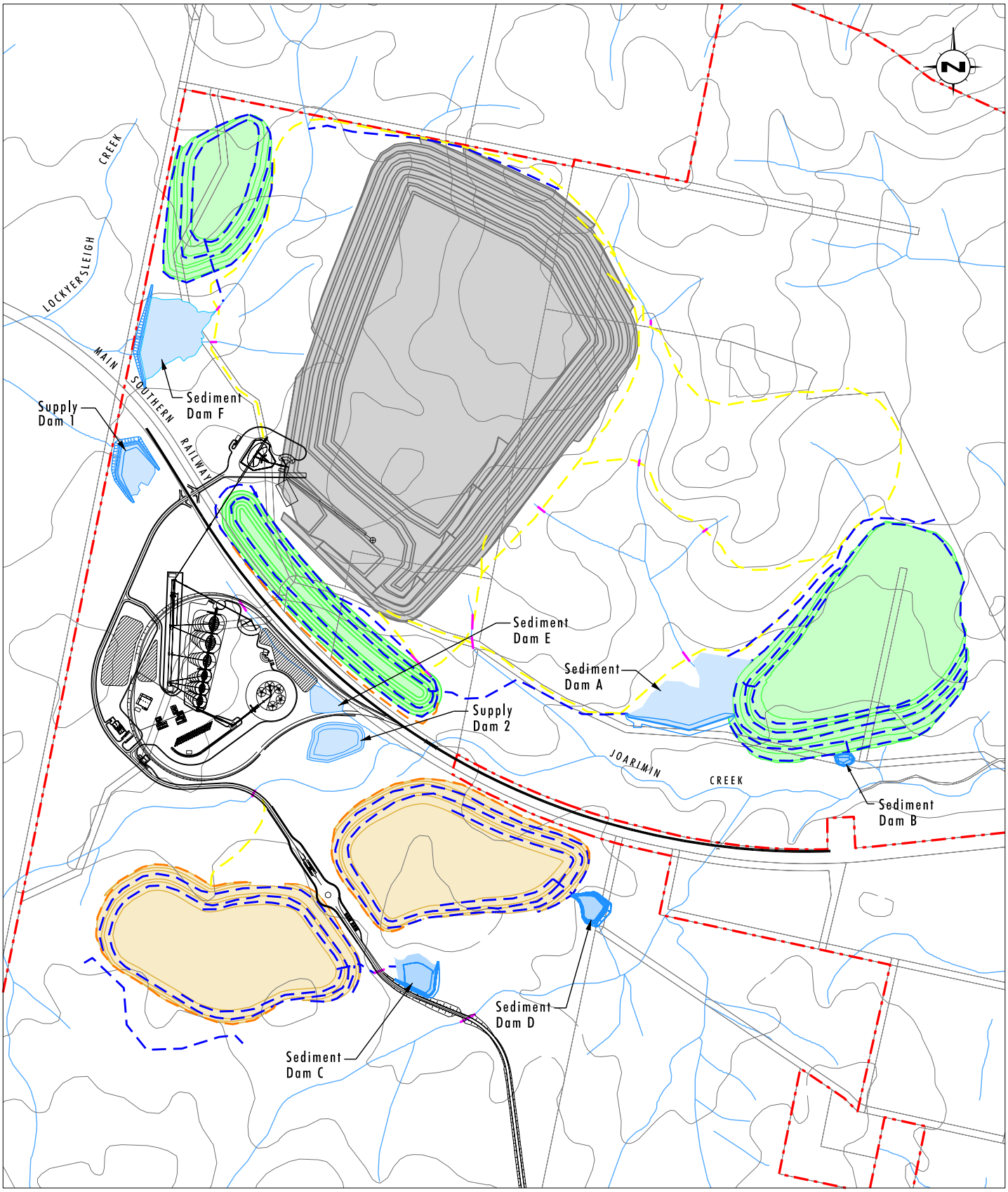
Lockyersleigh Creek

As discussed in **Section 4.2.1**, the proposed reduction in the western extent of the quarry pit will mean that the extent of Lockyersleigh Creek requiring diversion will be reduced. The retention of more of the natural channel of Lockyersleigh Creek provides an improved environmental outcome, with this change also allowing the retention of an area of riparian vegetation found to provide habitat for the threatened squirrel glider (Umwelt, 2005). The revised drainage design for the Lockyersleigh Creek riparian area as a result of the proposed modifications is shown on **Figure 4.1**.

A review of hydrodynamic flood models (XP-Storm) prepared for the EIS to assess potential downstream hydrodynamic impacts in Lockyersleigh Creek indicates that the proposed changes to the drainage design associated with Lockyersleigh Creek will not increase peak flow rates, velocities or flood levels downstream of the Project Area from those identified in the EIS. In addition, the modelling indicates that in-channel velocities will remain within the existing ranges experienced in Lockyersleigh Creek and its tributaries.

Joarimin Creek

As discussed in **Section 4.2.1**, the proposed changes to the infrastructure layout adjacent to Joarimin Creek will result in less disturbance to the creek. This includes no longer needing to realign the flow path of Joarimin Creek immediately upstream of the Main Southern Railway as required for the currently approved Project. The modified infrastructure design also reduces the number of roads crossing the main channel of Joarimin Creek adjacent to the rail loop from two to one. The proposed modifications will therefore reduce the overall impact of the Project on Joarimin Creek, providing an improved environmental outcome. The



Base Source: LPI 2004, CEMEX Pty Ltd

0 0.25 0.5 0.75km
1:15 000

Legend

- Project Area
- Catch Drain
- Sedimentation Fence
- Culvert
- Haul Road

FIGURE 4.1

Proposed Water Management Controls - Year 30

revised surface water controls proposed along Joarimin Creek as a result of the proposed modifications are shown on **Figure 4.1**.

A review of hydrodynamic flood models (XP-Storm) prepared for the EIS to assess potential downstream hydrodynamic impacts in Joarimin Creek indicates that the proposed changes to the drainage design will not increase peak flow rates, velocities or flood levels downstream of the Project Area from those identified in the EIS. In addition, the modelling indicates that in-channel velocities will remain within the existing ranges experienced in the creek and its tributaries.

Marulan Creek

There are no significant changes to the infrastructure required within the Marulan Creek catchment area. As such, the proposed modifications will not result in any changes to surface water impacts in the Marulan Creek catchment.

Quarry Water Balance and Water Management System

The proposed modifications, although resulting in a reduction in the quarry pit footprint, will not reduce the overall catchment area for the Quarry water management system. In addition, the maximum production levels from the Quarry will not change and the components of the crushing and screening plant and their water demand remain consistent with that which is currently approved. It is therefore considered that the water balance, and associated water storage and off-site water sourcing requirements for the Quarry will remain similar to the assessment contained in the EIS (Umwelt, 2005). It should also be noted that as discussed in **Section 1.1.1**, since the approval of the Project in 2005, CEMEX has secured an appropriate off-site water supply for the Project.

In regard to water management of the final void, as the footprint of the quarry pit is reduced, the final void water levels are expected to remain at similar or lower levels than the levels predicted in the EIS. As such, the proposed reduction in the footprint of the quarry pit is not expected to result in any change to the final void water management assessment included in the EIS.

Additional Surface Water Management Requirements

The water management controls to be implemented as part of the modified Project will be as outlined in the EIS, the Lynwood Quarry Water Management Plan (Umwelt, 2007b) and the three Riparian Area Management Plans prepared for the Project (Umwelt, 2007c, 2007d and 2007e). The only changes required to these approved management measures relate to the requirement to update the Water Management Plan and the Riparian Area Management Plans for Joarimin Creek and Lockyersleigh Creek to reflect the revised surface water management designs within these riparian corridors. These designs need to be revised to reflect the reduced impact of the proposed modifications to the Project on these catchments. Should the proposed modifications be approved, CEMEX will revise and resubmit these plans for approval in accordance with the requirements of the Consent.

4.3 Air Quality Assessment

A detailed Air Quality Assessment was completed for the Project by Holmes Air Sciences (HAS) and included in the EIS. To assess the potential air quality impacts of the proposed modifications, a revised assessment has been completed for the Project by HAS. The Air Quality Assessment is provided as **Appendix 2**, with a summary of the key findings included below.

4.3.1 Existing Air Quality Environment

CEMEX established an air quality monitoring network within and surrounding the Project Area in July 2004. This network includes both high volume air samplers (HVAS) measuring PM_{10} and dust deposition gauges. As part of the EIS, this monitoring network was used to calculate background air quality concentrations for assessment purposes in accordance with DECC guidelines. Ongoing air quality monitoring has occurred since the preparation of the EIS and the background air quality concentration has been reviewed as part of the current Air Quality Assessment (refer to **Appendix 2**). This update has identified that the background concentrations for total suspended particulates (TSP) and PM_{10} remain unchanged, with the background dust deposition level reducing slightly by 0.1 g/m^2/month.

Based on the expanded period of background monitoring, the following background concentrations have been applied at the nearest residences for impact assessment purposes:

- annual average TSP of 33 $\mu g/m^3$;
- annual average PM_{10} of 13 $\mu g/m^3$; and
- annual average dust deposition of 1.6 g/m^2/month.

4.3.2 Air Quality Criteria and Assessment Methodology

The relevant air quality criteria for the Project are those specified in Condition 12 of Schedule 3 of the Consent. These criteria are consistent with current DECC criteria.

The Air Quality Assessment undertaken for the proposed modifications has been completed in accordance with DECCs *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005). The assessment has also used the same general approach as the modeling prepared for the EIS so that any changes resulting from the proposed modifications can be identified. A detailed description of the assessment methodology used is provided in **Appendix 2**.

Three representative operational years were selected for modeling, being years 5, 10 and 30. These years were selected as they are considered to represent the range of operational phases that will be experienced at the Quarry. Point calculations were made for the same residential receiver locations used in the EIS.

4.3.3 Air Quality Assessment Findings

The Air Quality Assessment has found that the predicted air quality impacts for the proposed modifications are substantially the same as for the currently approved Project, with only minor changes in predicted dust levels (refer to **Appendix 2**). For most residential receivers, the predicted air quality impacts are actually reduced when compared to the EIS predictions. This is likely to be due to the reduced haulage of material associated with the proposed use of an in-pit crusher.

The assessment also demonstrates that the Project with the proposed modifications is predicted to comply with the relevant air quality criteria at all surrounding residential receivers. In summary:

- the maximum 24-hour average PM_{10} concentrations due to the Project are below the 50 $\mu g/m^3$ goal at all residences;

- annual average PM_{10} concentrations due to the Project are below the 30 $\mu g/m^3$ goal at all residences. If an annual average background PM_{10} of 13 $\mu g/m^3$ is added to the model predictions, concentrations at all residences are still below the 30 $\mu g/m^3$ goal;

- annual average TSP concentrations due to the Project are below the 90 $\mu g/m^3$ goal at all residences. If an annual average background TSP of 33 $\mu g/m^3$ is added to the model predictions, concentrations at all residences are still below the 90 $\mu g/m^3$ goal; and

- the predicted contribution of the Quarry to dust deposition levels is below the 2 g/m^2/month criteria at all residences. Model predictions at residences are also below the 4 g/m^2/month goal when an existing background dust deposition level of 1.6 g/m^2/month is added.

As a further comparison of the predicted air quality impacts of the approved Project to the impacts of the proposed modifications, comparative contour plots of the predicted air quality impacts are provided on **Figures 4.2** to **4.5** for year 30. As indicated on **Figures 4.2** to **4.5**, the air quality impacts for the proposed modifications are largely consistent with the predicted impacts of the approved Project with only slight variations in impacts predicted. Therefore, the proposed modifications are not considered likely to result in a significant change to the air quality impacts of the Project.

4.3.4 Air Quality Management

The Project was designed to incorporate a range of air quality controls. These controls, slightly modified in the case of the primary crusher which will no longer be located within a box cut, will also be implemented as part of the proposed modifications to the Project. Consistent with the EIS, the controls to be implemented will include:

- maintenance of a significant buffer of CEMEX owned land;

- enclosing conveyors on the top and on one side;

- enclosing the crushing and screening plant and the fitting of a dust extraction system;

- dust suppression sprays or dust collection systems on the primary crusher(s);

- fitting drills with either water sprays or dry dust collection devices;

- controlling stockpiles of fine material with water sprays;

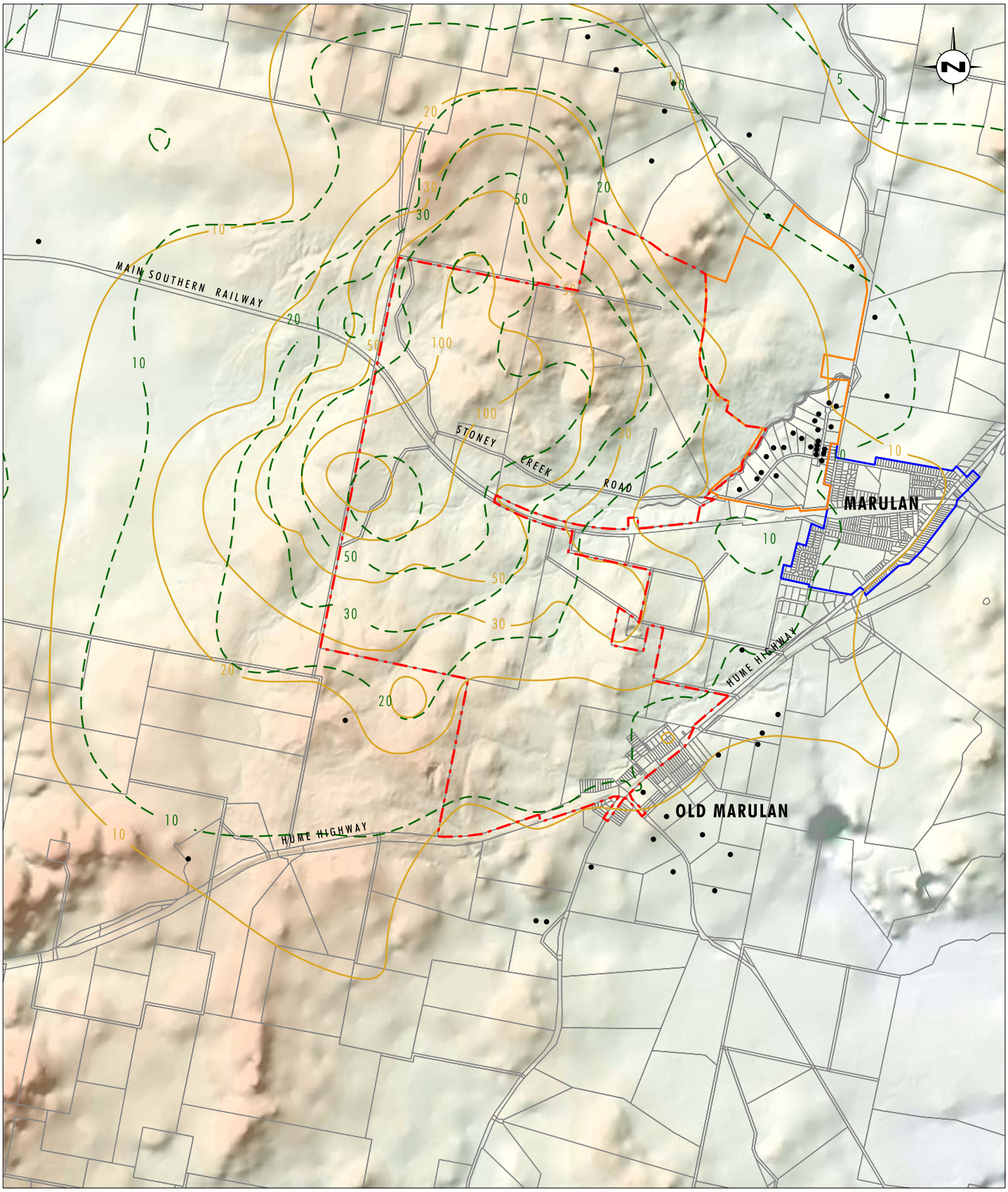
- confining traffic to identified haul road routes;

- removal and rehabilitation of unnecessary roads;

- keeping exposed areas to a minimum;

- watering of haul roads;

- cleaning of areas which could become sources of wind blown dust due to build-up of settled fine material;



Source: Holmes Air Sciences, 2005 (Refer to Appendix 5)
Base Source: LPI 2004

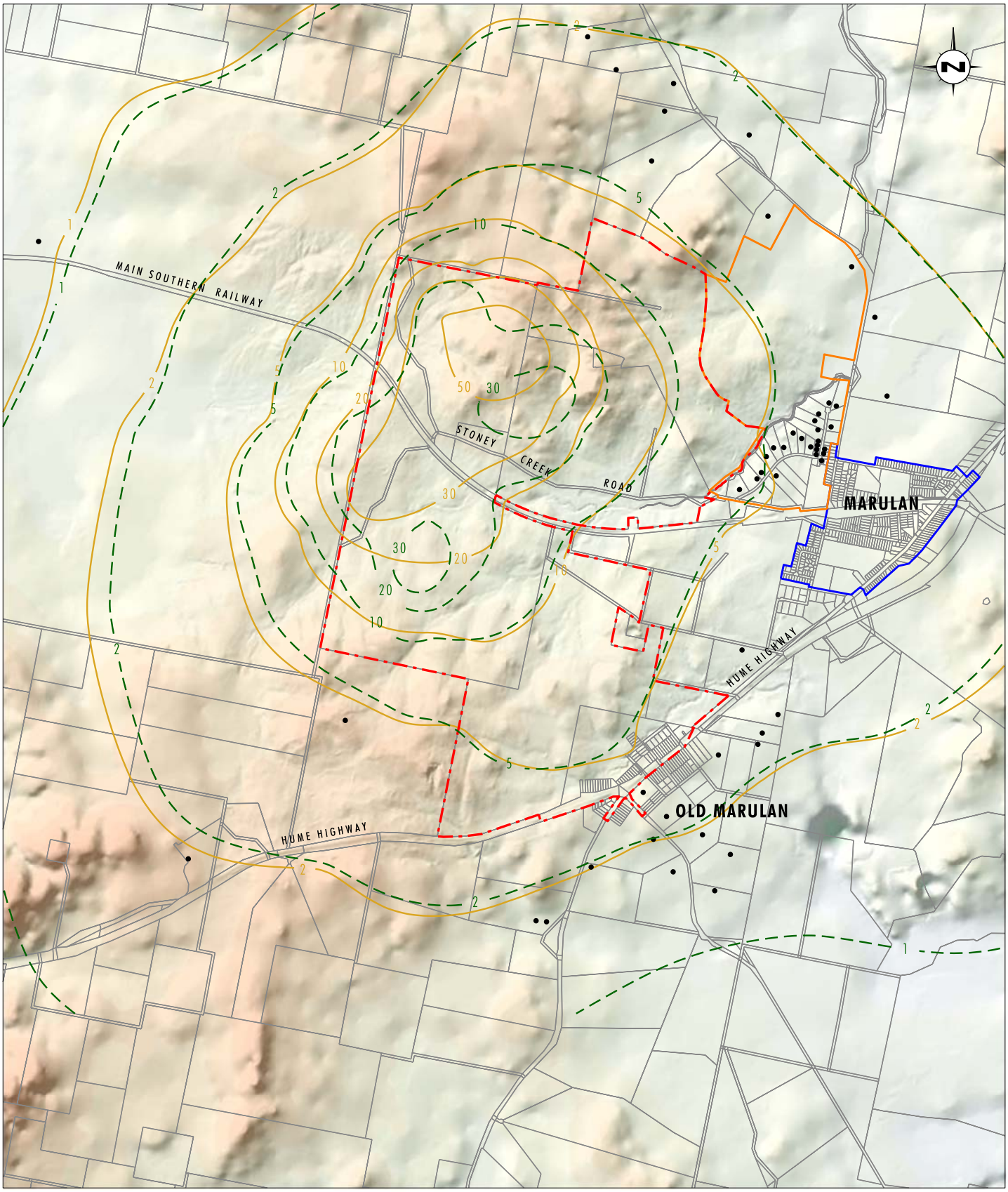
0 0.5 1 2km
1:42 000

Legend

- Project Area
- Approved Project Year 30 PM10- $\mu g/m^3$
- Proposed Modified Project Year 30 PM10 - $\mu g/m^3$
- Residence
- Marulan Residential Area
- Marulan Rural Residential Area

FIGURE 4.2

24-hour Average PM10
Contours Year 30



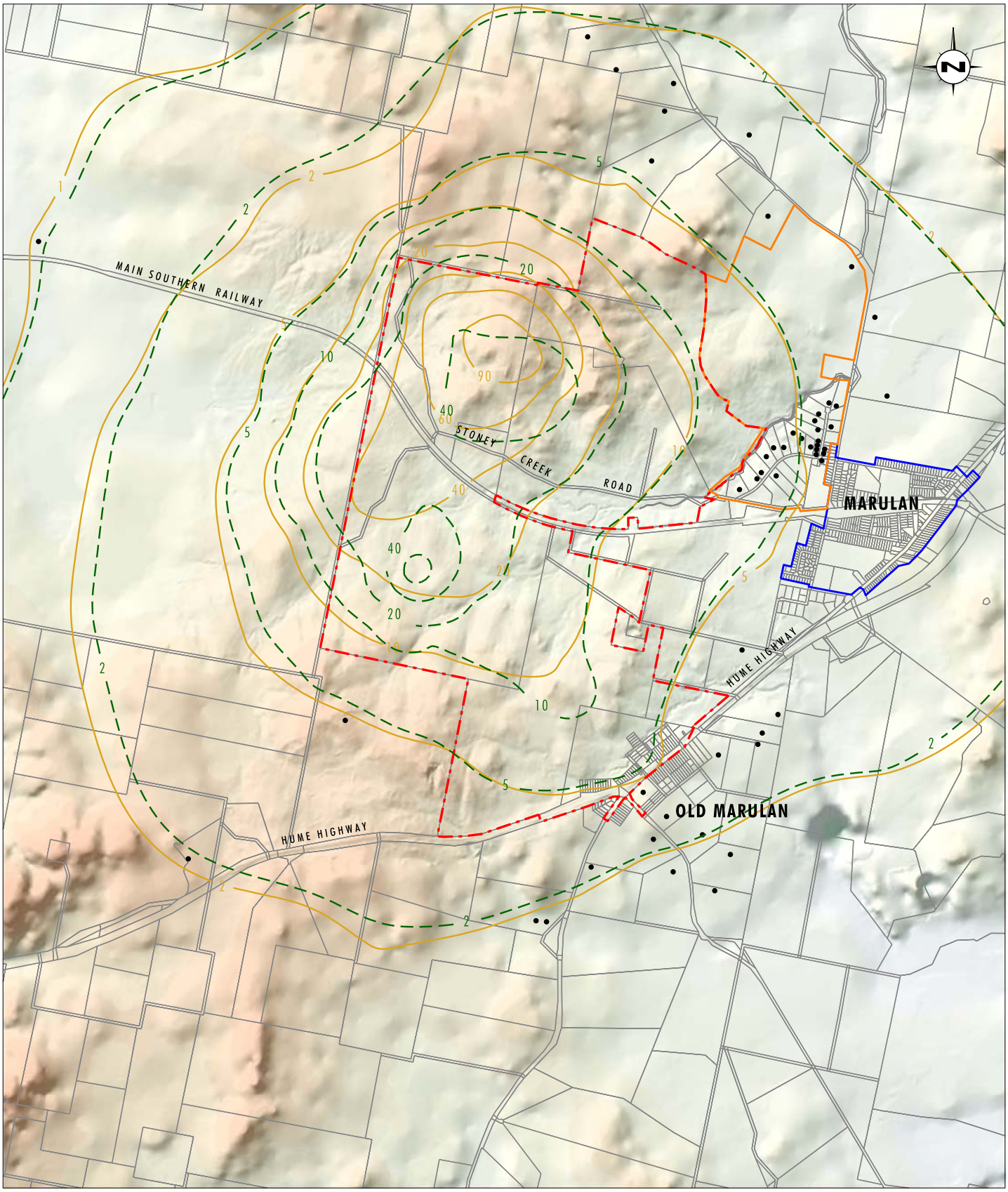
Source: Holmes Air Sciences, 2005 (Refer to Appendix 5)
Base Source: LPI 2004

Legend

- Project Area
- Approved Project Year 30 PM10 - $\mu g/m^3$
- Proposed Modified Project Year 30 PM10 - $\mu g/m^3$
- Residence
- Marulan Residential Area
- Marulan Rural Residential Area

FIGURE 4.3

Annual Average PM10 Contours Year 30



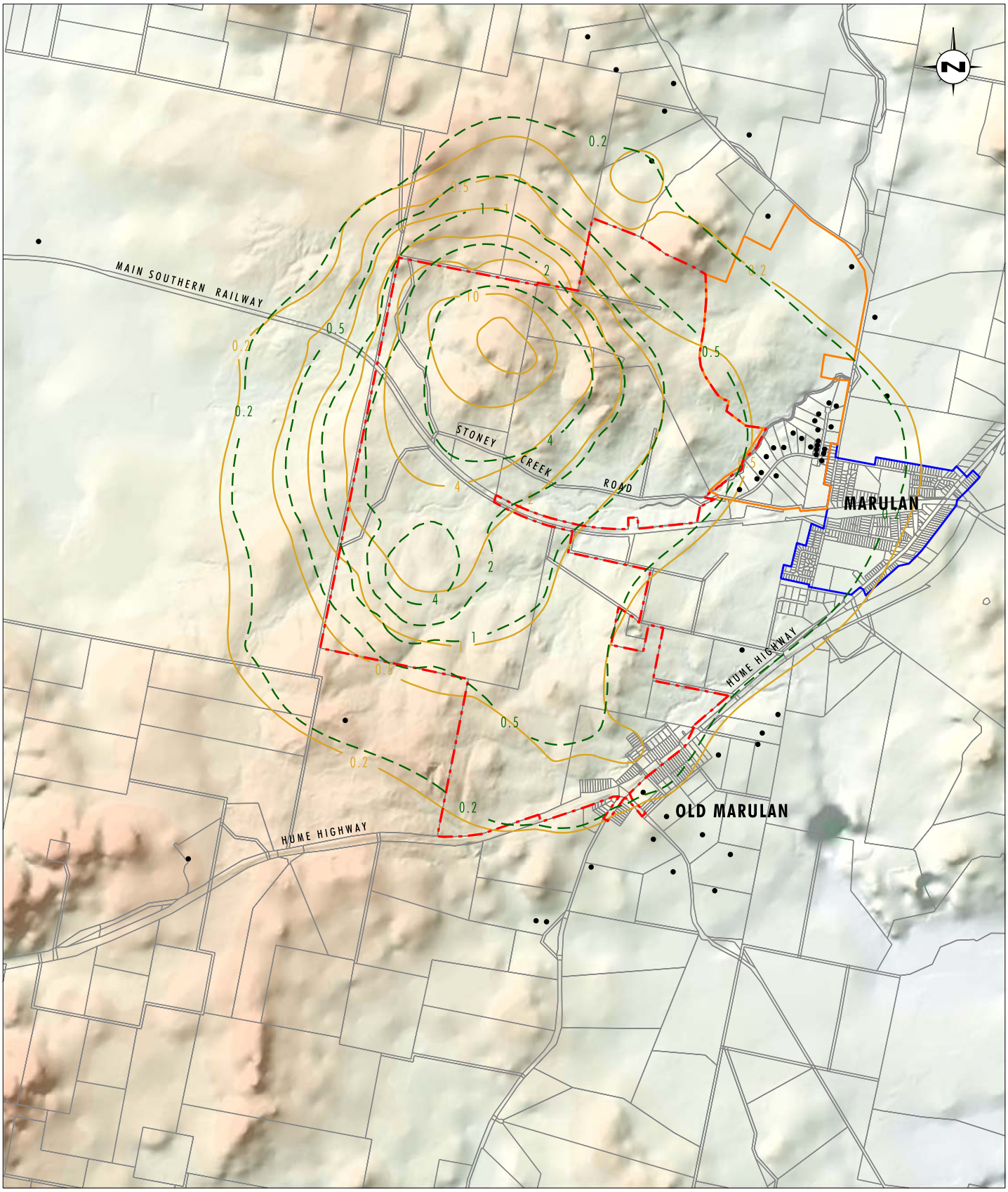
Source: Holmes Air Sciences, 2005 (Refer to Appendix 5)
Base Source: LPI 2004

Legend

- Project Area
- Approved Project Year 30 TSP - $\mu g/m^3$
- Proposed Modified Project Year 30 TSP - $\mu g/m^3$
- Residence
- Marulan Residential Area
- Marulan Rural Residential Area

FIGURE 4.4

Annual Average TSP Contours Year 30



Source: Holmes Air Sciences, 2005 (Refer to Appendix 5)
Base Source: LPI 2004

Legend

- Project Area
- Approved Project Year 30 Dust Deposition - g/m^2/month
- Proposed Modified Project Year 30 Dust Deposition - g/m^2/month
- Residence
- Marulan Residential Area
- Marulan Rural Residential Area

FIGURE 4.5

Annual Dust Deposition Contours Year 30

- reviewing meteorological conditions prior to blasting to minimise the exposure of residences to dust emissions; and

- daily assessment of meteorological conditions to identify wind conditions that may be conducive to excessive dust generation – for example, very high winds.

In accordance with Condition 14 of Schedule 3 of the Consent, CEMEX prepared an Air Quality Monitoring Program for the Project in consultation with DECC and approved by the Director-General of DoP. Ongoing air quality monitoring for the Project will be implemented in accordance with this approved Air Quality Monitoring Program.

4.4 Noise Assessment

A detailed Noise Impact Assessment was completed for the Project by Heggies Pty Ltd (Heggies) and included in the EIS. This Noise Impact Assessment was completed in accordance with the NSW Industrial Noise Policy (INP) (EPA, 2000). The proposed modifications will result in changes to the quarry pit, the primary crusher arrangements, the layout of the remaining site infrastructure and to the operation of in-pit mobile equipment. These changes have the potential to alter the noise impacts from the Project and therefore an assessment of noise impacts associated with the proposed modifications to the Project was completed.

The Noise Impact Assessment for the proposed modifications was completed by Heggies and is included as **Appendix 3**. A summary of the key findings of the assessment is included below.

4.4.1 Noise Criteria

The noise criteria for the Project are specified in Condition 3 of Schedule 3 of the Consent. These criteria were generally derived from the Project specific noise levels (PSNLs) determined for the Project as part of the EIS process and in accordance with the INP. A significant number of the consent noise goals are, however, lower than the PSNLs as DECC's general terms of approval for the Lynwood Quarry consent contained noise limits based primarily on noise impact predictions contained in the EIS as opposed to using the PSNLs. Therefore, the noise criteria as stipulated in the Consent and as used in this assessment of noise impacts associated with the proposed modifications of the Consent, are more stringent than the PSNLs for the Project calculated in accordance with the NPI. A table containing the noise criteria for the Project is provided in **Appendix 3**.

4.4.2 Assessment Methodology

Modeling of the predicted noise levels from the revised Project was undertaken in accordance with the INP and in a manner that was generally consistent with the modeling approach undertaken for the original noise assessment included in the EIS. The assessment included calculation of single point noise calculations for the same residential receiver locations used in the EIS assessment. The meteorological conditions modeled were also consistent with those used in the EIS assessment.

Three representative operational years were selected for noise modeling being years 5, 10 and 30. These years were selected as they are considered to represent the range of operational phases that will be experienced at the Quarry and re-considered the worst case scenarios identified in the original assessment.

4.4.3 Noise Impact Assessment Findings

The Noise Impact Assessment for the proposed modifications has identified that the noise impacts from the Quarry, with the proposed modifications, are predicted to comply with the consent noise criteria under both calm and adverse meteorological conditions (refer to **Appendix 3**). The assessment also concluded that the proposed changes to the operation and layout of the Quarry are predicted to result in insignificant changes to the noise levels generated by the Project.

4.4.4 Noise Management

The Project was designed to incorporate a range of noise management measures to minimise the potential for noise impacts on surrounding residential receivers. These noise management measures, as outlined in the EIS, will be implemented as part of the proposed modifications.

4.5 Visual Assessment

The key features of the Project that will be visible from surrounding residential areas will be the overburden and excess product emplacement areas. These emplacement areas will be progressively rehabilitated so that the visual impacts are reduced to the minimum duration possible. There are no changes proposed to the emplacement areas as part of the proposed modifications.

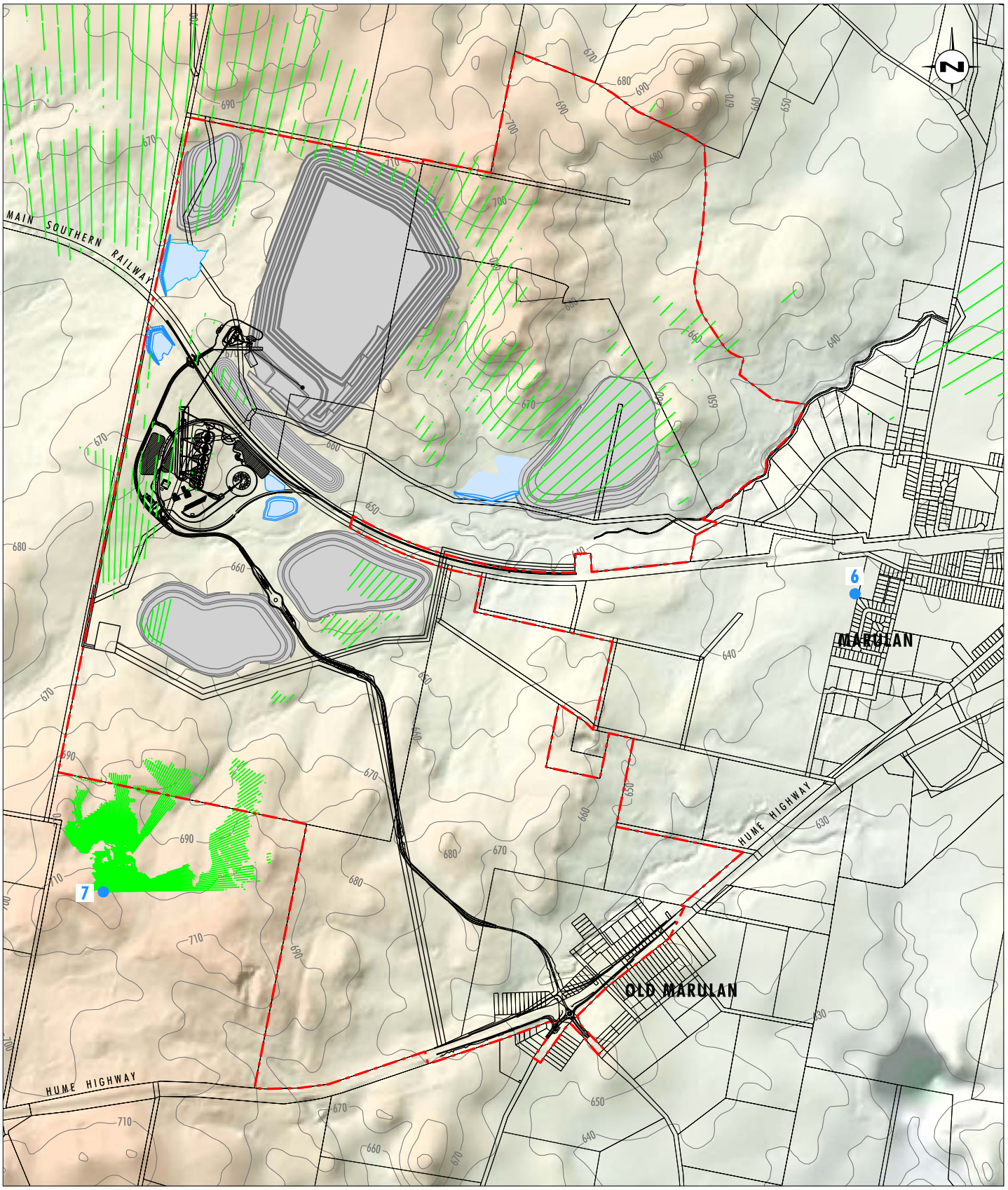
The only aspect of the proposed modification that has potential to alter the visibility of the Project is the relocation of Project infrastructure. The components, general nature (such as construction type and height) and general location of the Project infrastructure will remain unchanged, however, the infrastructure layout will be revised.

A detailed visual assessment was completed as part of the EIS. This assessment found that the visibility of Project infrastructure will be limited from the majority of surrounding residential locations, with only one residence to the south (identified as Assessment Point 7 in the EIS, refer to **Figure 4.6**) having views of the infrastructure area. As indicated on **Figure 4.6**, this residence, which is located on an elevated area of land to the south of the Project Area, will have potential views across the majority of the Quarry and associated works. These views are expected to be partially shielded by intervening vegetation. EIS Assessment Point 6 (refer to **Figure 4.6**), which is located on the western margins of Marulan near the Main Southern Railway was also identified as having potential long distance views of the most elevated points in the infrastructure area.

As the components, general nature and general location of the Project infrastructure will remain unchanged, the proposed modifications to the Project are not expected to significantly alter the visual impacts from those identified in the EIS. In accordance with the EIS, the buildings in the infrastructure area will be coloured in natural tones to reduce potential visual impacts.

Views of Project infrastructure and the quarry pit will also be available to commuters traveling along the Main Southern Railway. However, as identified in the EIS, the duration of these views will be very short due to the speed of the trains. The proposed modifications are not expected to alter the nature of these impacts.

In summary, the proposed modifications are not expected to significantly alter the visibility of the Project or the nature of impact of the Project on the existing visual amenity.



Base Source: LPI 2004, CEMEX Pty Ltd

0 0.5 1 1.25km
1:25 000

Legend

- Project Area
- Assessment Point
- Areas visible from Location 7

FIGURE 4.6

Project Visibility from Residence to South

4.6 Greenhouse Gas and Energy Assessment

The proposed changes to the layout of the crushing and screening plant, quarry pit and in-pit mobile equipment operation has the potential to change the energy use and greenhouse gas emissions resulting from the Project. The potential for the 1.5 Mtpa of product delivered by road to go to the Sydney metropolitan market also has the potential to alter energy use and greenhouse gas emissions. A greenhouse gas and energy assessment was therefore undertaken for the proposed modifications by SEE Sustainability. The assessment is included in **Appendix 4**, with a summary of the key findings included below.

The greenhouse gas and energy assessment completed based upon the methodologies outlined in:

- the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) Greenhouse Gas Protocol 2004 (GHG Protocol); and
- the Australian Government Department of Climate Change (DoCC) National Greenhouse Accounts (NGA) Factors, January 2008 *(replacing the Australian Greenhouse Office Factors and Methods Workbook)*.

The GHG Protocol defines three 'scopes' of emission categories. These are:

- Scope 1 – energy use from sources owned or operated by the organisation;
- Scope 2 – purchased electricity, heat, cooling or steam; and
- Scope 3 – electricity transmission and distribution losses, energy used in the production of fuels used for electricity generation and transport, and the energy used in the transportation of products.

The key findings of the assessment relating to energy use with the proposed modifications at maximum production of 5 Mtpa include:

- total predicted energy consumption (including product transport) is 839,708 GJ per annum. This is dominated by diesel use which represents 86.3% of total consumption;
- on-site diesel consumption at the Quarry represents 10% of total predicted energy consumption by the Project, rail transport represents 39.4% and road transport represents 36.9%;
- predicted electricity usage represents 13.7% of total energy consumption; and
- the predicted energy intensity for the Project at maximum production, measured as energy consumption (including product transport) per unit of output, is 0.168 GJ/tonne of product.

The key findings of the assessment relating to greenhouse gas emissions with the proposed modifications operating at maximum production of 5 Mtpa include:

- predicted emissions associated with on-site energy use (i.e. Scope 1 and 2) are 34,569 tonne CO_2 equivalent (TCO_2-e) or 39% of the total emissions associated with the Project;
- predicted emissions associated with product transport (i.e. Scope 3) are 48,126 TCO_2-e or 54.4% of the total emissions associated with the Project;

- predicted consumption of diesel (on-site and product transport) represents approximately 61.5% of total emissions;
- predicted consumption of electricity represents approximately 38.2% of total emissions;
- predicted use of explosives represents less than 1% of total emissions; and
- the predicted greenhouse emissions from the Project with the proposed modifications represent approximately 0.015% of Australia's total greenhouse gas emissions of around 576 million TCO_2-e per annum (DoCC, National Greenhouse Inventory 2006).

When comparing these assessment findings to the EIS assessment, the following key findings are evident:

- predicted electricity consumption from quarry equipment is substantially the same, with a very small decrease predicted;
- predicted on-site diesel consumption has decreased by approximately 7.5% due to the change to an in-pit primary crusher and the resultant reduction in haulage distance of primary raw feed;
- predicted emissions associated with on-site energy consumption (i.e. Scope 1 and 2) have decreased slightly (34,569 TCO_2-e compared with 35,132 TCO_2-e);
- predicted Scope 3 emissions from road transport of product have increased from 17,718 TCO_2-e to 23,252 TCO_2-e;
- predicted emissions due to rail transport have reduced slightly due to a change in emission factors since the EIS assessment;
- predicted total Scope 3 emissions have increased from 49,254 TCO_2-e to 53,985 TCO_2-e; and
- total predicted emissions associated with the Project (i.e. Scope 1, 2 & 3 emissions) have slightly increased from 84,386 TCO_2-e to 88,554 TCO_2-e.

As indicated above, the total predicted greenhouse gas emissions for on-site activities are predicted to decrease due to the predicted reduction of diesel use associated with the in-pit primary crusher. However, due to the change in assumptions relating to product haulage destination (i.e. possibly sending all road transported product to Sydney), total predicted greenhouse gas emissions have increased. The final destination of product transported by road will be market driven and therefore, using this assumption may over predict actual emissions due to road transportation and should be considered a worst case prediction.

4.7 Rehabilitation

In accordance with Condition 44 of Schedule 3 of the Consent, a detailed Rehabilitation and Landscape Management Plan (Umwelt, 2006) has been prepared for the Project. This plan provides a detailed description of the planned approach to rehabilitation of the Quarry, including the rehabilitation of the quarry pit. The only aspect of the proposed modifications which has the potential to revise the rehabilitation strategy outlined in the Rehabilitation and Landscape Management Plan is the reduction in size of the quarry pit. No changes are proposed to rehabilitation completion criteria or final land use.

The Rehabilitation and Landscape Management Plan provides a description of the strategies that will be used to rehabilitate the quarry pit. These strategies will be applied to the modified pit and will include:

- battering back the upper benches which occur in highly weathered material to remove the bench landform and achieve a more stable sloping landform. The shaped areas will be topsoiled and seeded with a native species and cover crop mix;

- rehabilitation of the remaining quarry benches will be completed by placing an approximately one metre thick layer of overburden on the quarry bench. The overburden will then be covered with available topsoil; and

- seeding of the quarry benches with a native tree species mix. Sub-drilling completed for each bench will result in an approximate one metre depth of cracking of the bench floor from drilling and impact by quarry equipment. Consequently, it is considered that the approximate one metre depth of overburden plus the ability of trees to extend roots to a depth of at least one metre into the underlying rock substrate should achieve acceptable levels of tree stability.

As for the previous quarry pit design, the floor of the quarry pit will not be rehabilitated as it would be cost prohibitive to reclaim the overburden from the emplacement areas and place it in the pit. In addition, the quarry pit floor will be periodically inundated, making establishment of vegetation in this area difficult. The total resource has a life well in excess of 30 years and should CEMEX be granted approval to extend the Quarry beyond the initial 30 year period, in-pit dumping of overburden and excess product is likely during such later stages, enabling rehabilitation of at least part of the quarry floor.

The EIS and the Rehabilitation and Landscape Management Plan included a conceptual final rehabilitation plan for the Quarry, should the Quarry cease operations at the end of the currently approved Quarry life. The only change to this plan resulting from the proposed modifications is a change to the extent and internal layout of the quarry pit. A revised conceptual final rehabilitation plan for the modified Quarry Project is included as **Figure 4.7**.

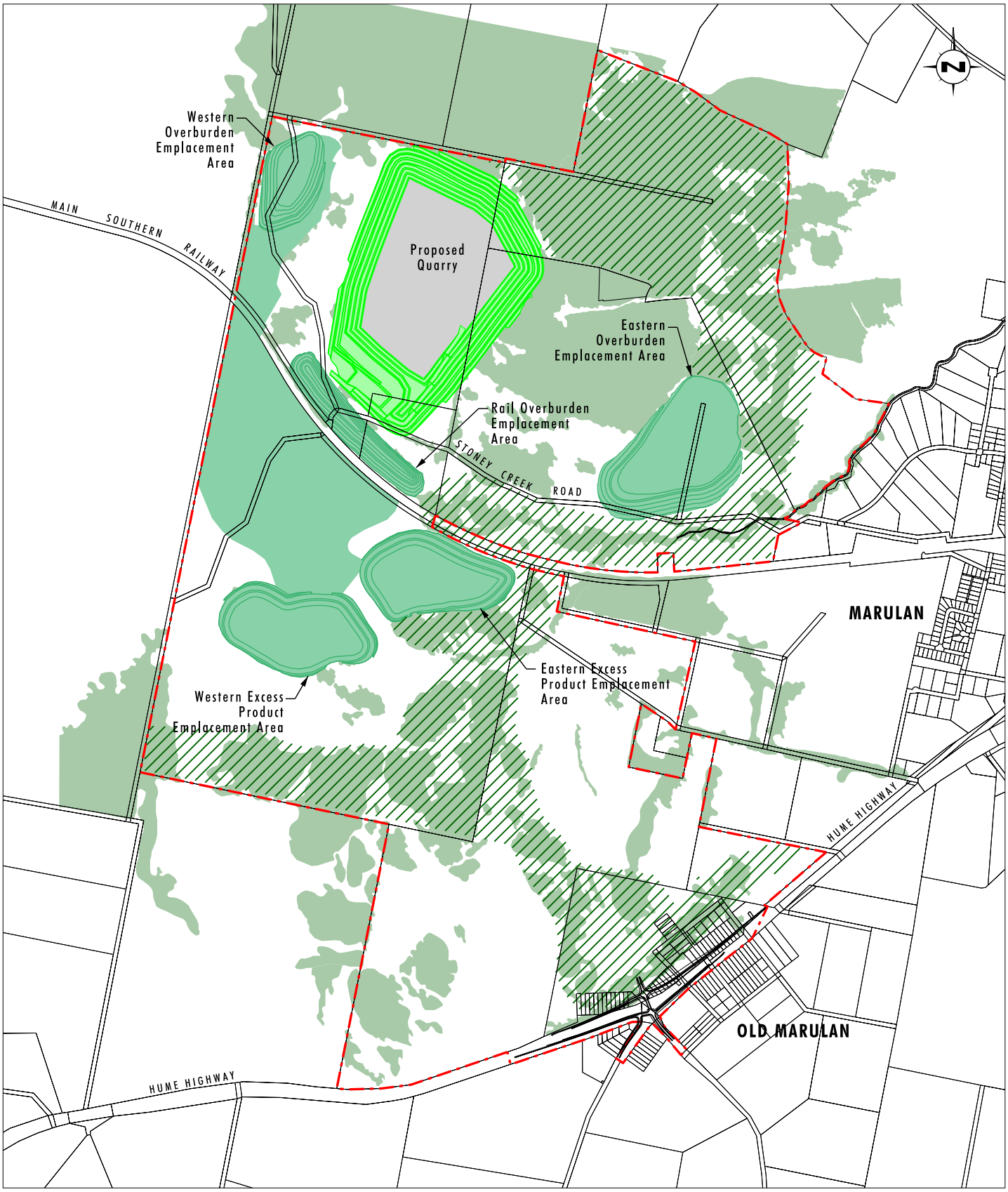
4.8 Socio-economic Assessment

The approved Project, once implemented, will provide significant socio-economic benefits. The key benefits include:

- the Project will provide a long-term, high quality supply of construction materials into the Sydney and regional markets. This supply is needed to replace supply from existing quarries that are nearing the end of their resources and is essential for the security and economic viability of the Sydney construction industry;

- when operating at full capacity, the Project will provide direct employment for approximately 115 people at the Quarry (including road transport drivers), flow-on employment for an estimated 129 people and security of employment for personnel working in CEMEX's Sydney region concrete business; and

- the Project will also provide major economic benefits in the form of capital expenditure ($140M to $195M), wages (estimated direct $9.1M per annum, and indirect $6.7M per annum), annual operating expenditure, and through payment of State and Commonwealth taxes and fees.



Base Source: LPI 2004

0 0.5 1 1.25km
1:25 000

Legend

- Project Area
- Existing Vegetation
- Rehabilitated Area
- Rehabilitated Quarry Batters
- Assisted Natural Regeneration (Habitat Corridor Function Enhancement)

FIGURE 4.7

Year 30 Conceptual Final Rehabilitation

A detailed social impact assessment was completed as part of the EIS, including a detailed community involvement program. This program demonstrated that the Project, at the time of EIS preparation, had the strong support of the local community with key findings including:

- the majority of the local community was supportive of the Project, with approximately 80% of respondents to a random phone survey approving of the proposal;
- nearly all respondents (92%) believed the proposed Quarry would make an important contribution to the local economy and that it would not detract from the area (78%); and
- the majority of respondents (79%) believed that the benefits a quarry would bring to the area would outweigh any of the disadvantages.

Since the approval of the Project, CEMEX has been involved with the community on an ongoing basis through preparation of periodic community newsletters, sponsorship programs and open days associated with ongoing site activities such as the historical heritage investigations.

In regard to the proposed modifications, the environmental assessment findings provided in this SEE have identified that the proposed modifications will not result in any significant changes to the environmental and community impacts of the Project. The socio-economic impacts of the proposed modifications therefore remain consistent with those of the existing approved Project. Due to the potential for market driven staging of the construction of the Project, the peak construction workforce may be lower than that predicted in the EIS, reducing the peak demand on short-term accommodation in the local area.

5.0 Environmental Management Controls and Monitoring

A comprehensive Environmental Management Strategy (Umwelt, 2007a) has been prepared for Lynwood Quarry to provide the framework for environmental management of the Project. The Strategy was prepared in accordance with Condition 1, Schedule 5 of the Consent and has been approved by DoP.

The Strategy provides the framework for environmental management during the construction and operation of the Quarry to ensure compliance with consent conditions and other legal requirements. It builds on the environmental management controls outlined in the EIS. The Strategy also provides the framework for ongoing community involvement in the Project and identifies communication mechanisms between the Project and the local and wider community.

The Strategy was developed generally in accordance with ISO 14001, the international standard for environmental management systems and is consistent with the CEMEX Safety, Health and Environment (SHE) Management System. Implementation of this Strategy will assist CEMEX to minimise the environmental impacts of the Project by facilitating continual improvement in environmental performance. The Strategy promotes proactive environmental management and identifies how the Quarry will seek to maintain and build on its good relationship with the local community and other key stakeholders.

Building on the Strategy and in accordance with the Consent, the following environmental management plans have also been prepared for the Project:

- a Water Management Plan which includes:
  - a water balance;
  - an Erosion and Sediment Control Plan;
  - a Surface Water Monitoring Program;
  - a Ground Water Monitoring Program; and
  - a surface and groundwater response plan to address any potential adverse impacts associated with the development;
- an Aboriginal Heritage Management Plan;
- a Rehabilitation and Landscape Management Plan, including Riparian Area Management Plans; and
- an Environmental Monitoring Program which incorporates:
  - a Noise Monitoring Program;
  - a Blast Monitoring Program;
  - an Air Quality Monitoring Program; and
  - the Surface Water Monitoring Program and Groundwater Monitoring Program from the Water Management Plan.

A Construction Traffic Management Plan will also be prepared prior to the commencement of construction.

The proposed changes to the approved Project do not change the overall environmental management approach for the Project, with all of the above existing management plans proposed to be implemented for the revised Project. As the changes required to the majority of these plans to reflect the proposed modifications are minor only and will not change the management approach, it is proposed that the majority of plans be revised to accommodate the minor modifications, if approved, at the next scheduled review. However, due to the proposed changes to the surface water management designs for Joarimin and Lockyersleigh Creeks, the Water Management Plan and the Joarimin Creek and Lockyersleigh Creek Riparian Area Management Plans will need to be updated.

5.1 Heritage Management

Conditions 38 to 42 of the Consent relate to historic heritage investigations and management. These conditions have been largely superseded by the progress made in regard to historic heritage investigations since the consent was granted. In particular, CEMEX has obtained the Section 60 permit required under the *Heritage Act 1977* and the field investigation program required under this permit has been completed. This work included completion of an extensive archaeological investigation program, which involved community open days and presentations to local community groups. The interpretation of the findings and reporting required under the permit is ongoing.

The status of the heritage works provides an opportunity to update the development consent to reflect the progress made on the Project.

6.0 Conclusion and Justification

As discussed in **Section 4.8**, the Project will provide significant benefits to the local area, region and State of NSW. The Project will provide a long-term, high quality supply of construction materials into the Sydney and regional markets. This supply is needed to replace supply from existing quarries that are nearing the end of their resources and is essential for the security and economic viability of the Sydney construction industry. When operating at full capacity the Project will also provide direct employment for approximately 115 people at the Quarry, plus additional flow-on employment, including providing improved security of employment for personnel working in CEMEX's Sydney region concrete business.

The Project will provide major economic benefits in the form of capital expenditure ($140M to $195M), wages (estimated direct $9.1M per annum, and indirect $6.7M per annum), annual operating expenditure, and through payment of State and Commonwealth taxes and fees.

As identified in the Lynwood Quarry EIS, at the time of EIS preparation the Project had the strong support of the local community, with approximately 80% of respondents to a random phone survey approving of the proposal and the majority of respondents (79%) indicating that they believed that the benefits the Quarry would bring to the area would outweigh any of the disadvantages. CEMEX's ongoing consultation with the local community since this time has continued to reinforce the community's strong interest in and support for the Project.

The proposed modifications to the Project will not change any of the benefits of the Project as identified in the EIS and, as demonstrated in this SEE, will involve minimal environmental impact. The proposed modifications will also result in some improved environmental outcomes including:

- the retention of more of the natural channel of Lockyersleigh Creek, including the retention of an area of riparian vegetation found to provide habitat for the threatened squirrel glider (Umwelt, 2005);

- a reduction of the impact of the Project on the Joarimin Creek riparian corridor, including reducing the number of roads crossing the main channel of Joarimin Creek adjacent to the rail loop from two to one and no longer requiring diversion of secondary flow paths of Joarimin Creek; and

- the use of the in-pit primary crusher will reduce the extent of haulage required for primary raw feed, reducing potential impacts associated with haulage including noise generation, dust generation and energy use.

As discussed in **Section 3.2**, and as demonstrated in this SEE, the proposed modifications are considered to be of minimal environmental impact. Key considerations in this assessment are that the proposed modifications will not change the approved disturbance footprint of the Project and will not substantially change the impact of the Project on the environment or community. As discussed above, the Project will also provide some improved environmental outcomes.

The Project, as modified, is also considered to be substantially the same Project as that originally approved because:

- the overall nature of the Project, being a hard rock quarry producing up to 5 Mtpa of quarry product and using both rail and road transportation, remains unchanged;

- there will be no change in production limits or product type;

- the overall disturbance footprint of the Project has not changed;
- the quarry footprint is smaller, but otherwise in the same location as originally approved; and
- the infrastructure components are consistent with those originally approved and are in the same general locality, with only the proposed layout changing.

On considering the balance of the potential impacts of the proposed modifications on the environment and community, and the benefits of and the need for the proposed changes, it would be reasonable to conclude that the benefits of the proposed modifications outweigh the impacts.

7.0 References

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APPENDIX 1

Property Descriptions for Land within Project Area

Lot and DP Numbers for Land Affected by Consent Modification Application – CEMEX Lynwood Quarry

Land Descriptions at Time of Lodging Original Application		Current Land Description		
Lot	**Deposited Plan**	**Lot**	**Deposited Plan**	**Owner**
112	750029	112	750029	Cemex
229	750029	2	1116876	Cemex
230	750029	230	750029	Cemex
294	750029	294	750029	Cemex
3 – 4	1036993	3 – 4	1036993	Cemex
1 & 2	1074819	1	1074819	Cemex
3	1074819	1	1117910	Cemex
1 and 3	1074107	1 and 3	1074107	Cemex
10	700579	10	700579	Cemex
7001	1025603	7001	1025603	Crown Land
7002	1025604	7002	1025604	Crown Land
	2153 – 3040		2153 - 3040	Crown Land
2 – 15	196132	2 – 15	196132	Cemex
1/Section 8	758653	1/Section 8	758653	Crown Land
1-5/Section 12	758653	1-5/Section 12	758653	Cemex
1-9/Section 7	758653	1-9/Section 7	758653	Cemex
2-4/Section 5	758653	2-4/Section 5	758653	Cemex
1/Section 5	758653	1/Section 5	758653	Crown Land
Part 7 and Part 8/Section 1	758653	Part 7 and Part 8/Section 1	758653	Cemex
10/Section 10	758653	10/Section 10	758653	Crown Land
10 – 11	111641	10 – 11	111641	Cemex
1 – 2	214304	1 – 2	214304	Cemex
1 – 14	797340	1 – 14	797340	Cemex
Part Stoney Creek Road		Part Stoney Creek Road		
Part Main Southern Railway Line		Part Main Southern Railway Line		
Part Hume Highway		Part Hume Highway		
Part Marulan South Road		Part Marulan South Road		
Part Jerrara Road		Part Jerrara Road		
Part Joarimin Creek		Part Joarimin Creek		
Crown land and Crown road reserves within the DA area		Crown land and Crown road reserves within the DA area		

APPENDIX 2

Air Quality Assessment

AIR QUALITY IMPACT ASSESSMENT: PROPOSED CHANGES TO SITE INFRASTRUCTURE LOCATIONS AND PIT EXTENTS FOR LYNWOOD QUARRY, MARULAN

14 December 2008

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1. INTRODUCTION

CEMEX Australia Pty Limited (CEMEX –formerly Redymix) is seeking approval for minor modifications to an approved hard rock quarry near Marulan in the Southern Tablelands region of NSW (refer to **Figure 1**) known as Lynwood Quarry. In May 2005, Holmes Air Sciences prepared an air quality assessment for Umwelt (Australia) Pty Limited who were in turn acting on behalf of CEMEX to prepare an Environmental Impact Statement (EIS) for the project. The project was subsequently approved by the NSW Minister for Planning in December 2005.

Since that time, further detailed project design has been undertaken and as a result changes are proposed to some of the approved site infrastructure and also to the extent of the quarry pit. The purpose of this report is to quantitatively assess the air quality impacts of this new arrangement and determine whether or not the new project complies with the relevant air quality criteria.

The assessment is based on the use of a computer-based dispersion model to predict ground-level dust concentrations and deposition levels in the vicinity of the quarry. To assess the effect that the dust emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality goals.

The assessment follows the procedures outlined by the NSW Department of Environment and Climate Change (DECC, formerly the Department of Environment and Conservation [DEC]) in their guidance document titled "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (**DEC, 2005**).

This report is not intended to reiterate the bulk of the material covered in the original assessment, but rather to outline the proposed changes and present the modelling results predicted for those changes.

In summary, the report provides information on the following:

- A description of the changes to the quarrying activities including extraction, processing and transportation operations.
- Air quality goals that need to be met to protect air quality.
- The expected dispersion and dust fallout patterns due to emissions from the quarry and a comparison between the predicted dust concentration and fallout levels and the relevant air quality criteria.

Three modelling scenarios have been assessed for the new proposal. These are Year 5, Year 10 and Year 30. These years were selected as they were considered to be representative of the range of operations at the quarry.

2. NEW PROJECT DESCRIPTION

The approved hard rock quarry is located primarily on a property known as "Lynwood". **Figure 1** shows the location of the Project Site with the town of Marulan approximately one kilometre to the east of the nearest works and the Hume Highway to the south. Landuse surrounding the site is agricultural to the north, west and south, with rural residential land adjoining the property boundary to the northeast and the township of Marulan to the east. The terrain of the project area is shown in **Figure 2**.

Production rates and methods of extraction remain unchanged from the original 2005 assessment. **Figure 3** shows the new 30 year extents of the quarry including overburden,

product stockpiles and the new locations of the site facilities. Although in a slightly different arrangement and orientation, some of the facilities will remain where they were originally. The main changes will be:

- the relocation of the secondary crushing and screening plant components to the northern side of the Main Southern Railway Line; and
- the use of an in-pit crusher (up to two mobile in-pit crushers will be used in early years, with a fixed in-pit crusher in later years) as opposed to an out-of-pit primary crusher.

3. AIR QUALITY GOALS

Table 1 and **Table 2** summarise the air quality assessment criteria that are relevant to this project. The air quality goals relate to the total dust burden in the air and not just the dust from the project. In other words, some consideration of background levels needs to be made when using these goals to assess impacts. The estimation of appropriate background levels will be discussed further in **Section 4.2.3**.

Table 1 – Air quality assessment criteria for particulate matter concentrations

POLLUTANT	STANDARD / GOAL	AVERAGING PERIOD	AGENCY
Total suspended particulate matter (TSP)	90 µg/m^3	Annual mean	National Health & Medical Research Council
Particulate matter < 10 µm (PM_{10})	50 µg/m^3	24-hour maximum	DEC
	30 µg/m^3	Annual mean	DEC long-term reporting goal
	50 µg/m^3	(24-hour average, 5 exceedances permitted per year)	National Environment Protection Council

The quarrying operations will also result in the emission of crystalline silca. At this time there are no ambient air quality assessment criteria that are relevant to these emissions. The assessment of this potential impact is discussed in **Section 8.**

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. **Table 2** shows the maximum acceptable increase in dust deposition over the existing dust levels. The criteria for dust fallout levels are set to protect against nuisance impacts (**NSW EPA, 2001**).

Table 2 – NSW DEC criteria for dust fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

4. EXISTING ENVIRONMENT

4.1 Meteorological Data

The Gaussian dispersion model used for this assessment, ISCST3, requires information about the dispersion characteristics of the area. In particular, data are required on wind speed, wind direction, atmospheric stability class[1] and mixing height[2]. Data collected by Holmes Air Sciences at the property known as "Wangi" was used in the 2005 assessment and for consistency will be used in this assessment also. This site is approximately 8 km to the southwest of the Lynwood site and these data have been processed into a form suitable for use in the ISCST3 dispersion model. In 2000 there was 100% data recovery from this site and **Figure 4** shows the windroses compiled from these data.

To use the wind data to assess dispersion it is necessary to also have available data on atmospheric stability. A stability class was assigned to each hour of the meteorological data using sigma-theta according to the method recommended by the US EPA (**US EPA, 1986**). **Table 3** shows the frequency of occurrence of the stability categories expected in the area.

It can be seen from **Table 3** that there are similarities between the calculated occurrence of each of the stability classes for both sites. The most common stability class was determined to be D class which would suggest that the dispersion conditions would be such that dust emissions would disperse rapidly for a significant proportion of the time.

Table 3 – Frequency of occurrence of stability at "Wangi"

Stability Class	"Wangi" (2000)
A	7.1
B	7.9
C	15.8
D	39.0
E	15.7
F	14.5
Total	**100**

4.2 Existing Air Quality

Air quality standards and goals refer to pollutant levels which include the contribution from specific projects and existing sources. To fully assess impacts against all the relevant air quality standards and goals (refer to **Section 3**) it is necessary to have information or estimates on

[1] In dispersion modelling stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme, as used in this study, there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

[2] The term mixing height refers to the height of the turbulent layer of air near the earth's surface into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

existing dust concentration and deposition levels in the area in which the project is likely to contribute to these levels.

A monitoring program has been established in the area as part of the project which includes the measurement of dust deposition and dust concentration (as PM_{10}). **Figure 5** shows the location of the monitoring sites. The monitoring commenced in June 2004.

The project area is predominantly grassland although some areas are well vegetated with tall trees. Sources of particulate matter in the area would include traffic on unsealed roads, local building and construction activities, animal grazing activities and to a lesser extent traffic from the Hume Highway. The Johniefelds quarry to the north, is too far away to significantly affect air quality at Marulan, and the effects of these emissions, to the extent that they occur, would of course be captured by the existing monitoring program.

4.2.1 Dust Deposition

Dust deposition is monitored using dust deposition gauges at eight locations around the Lynwood site (refer to **Figure 5** for the locations). Dust deposition gauges use a funnel and bottle to measure the rate at which dust settles onto the surface over periods approximating one month.

Data annual averages for each of the eight gauges are shown in **Table 4**. Eight months of data were available for the original study but since that time significantly more data have been collected. These measurements include the effects of all background sources relevant to that location.

Table 4 – Annual average dust deposition data for Lynwood Quarry

Year	Insoluble Solids (g/m^2/month)							
	D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**
2004	1.0	2.2	0.9	0.9	0.9	3.2	0.7	0.9
2005	1.4	3.7	1.3	1.2	1.4	5.9	1.2	1.5
2006	1.0	4.8	1.5	2.0	1.3	11.7	1.5	1.1
2007	2.4	2.6	1.2	1.0	1.9	6.4	1.4	1.1
2008	2.3	7.5	1.8	1.8	2.0	16.0	1.1	1.7
Average	**1.6**	**4.2**	**1.3**	**1.4**	**1.5**	**8.6**	**1.2**	**1.3**

The data in **Table 4** show that six of the eight sites reported average levels below the DECC 4 g/m^2/month dust fallout criterion. However, gauges D2 and D6 experience noticeably higher deposition levels compared with the other sites. The reason for the relatively elevated readings at D6 is likely to be the proximity of the unsealed road, which run reasonably close to the site. It is not clear whay the D2 levels are high, although at both sites there are some months where levels are unusually high and may indicate a problem with the sample collected. Very high monthly values preceded and followed by more reasonable values generally indicate a problem with either the sample or the gauge itself. As will be shown in the following section, the maximum 24-hour PM_{10} concentrations experienced in the area are not significantly high as to conclude there is some more general source of these elevated levels. It is likely to be a local source relevant to that location alone and not an indication of levels in the general area.

In terms of estimating an existing background deposition level (**Section 4.2.3**) the values for D2 and D6 have been removed from the sample as they are not likely to be representative of general conditions in the area.

4.2.2 Dust Concentration

Measurements of PM_{10} concentrations commenced in the area in June 2004. A second high volume air sampler measuring PM_{10} was installed in December 2004. The locations of these monitoring sites are shown as HVAS1 and HVAS2, respectively, in **Figure 5**. These air samplers record a 24-hour sample, every six days.

Data collected from the high volume air samplers installed for this project are summarised in **Table 5**. The highest 24-hour average PM_{10} concentration since monitoring began was from HVAS 1 with 61.4 µg/m^3 on 17 June 2004. This is above the 50 µg/m^3 DECC 24-hour maximum goal suggesting that there are existing sources of dust in the area which contribute to elevated concentrations. As meteorological monitoring began on 18 June 2004 it is difficult to determine the reason for the elevated level however strong westerly winds persisted for a few days after 18 June 2004 so it was possible that wind blown dust from exposed land caused elevated dust concentrations. The maximum values for the remaining years are relatively low at both sites compared to HVAS 1 in 2004.

Annual average PM_{10} concentrations are well below the DECC criterion of 30 µg/m^3 for both sites in all years.

Table 5 – Measured PM_{10} levels at Lynwood Quarry

Year	PM_{10} (µg/m^3)			
	HVAS Site 1		HVAS Site 2	
	Maximum	Annual average	Maximum	Annual average
2004	61.4	13.2	-	-
2005	34.6	11.6	25.7	12.1
2006	24.4	11.3	23.3	9.7
2007	33.0	8.2	18.0	5.0
2008	27.8	8.2	14.8	3.9

4.2.3 Estimates of Background Levels

For the purposes of establishing the existing air quality, a value of 13 µg/m^3 has been taken to be the annual average PM_{10} background level to apply over the entire study area. This is the maximum annual average over the monitoring period and so is a conservative estimate of background conditions. Assuming that PM_{10} constitutes 40% of the TSP, an annual average background TSP level would be 33 µg/m^3.

From the monitoring data available it has been assumed that the following background concentrations apply at the nearest residences:

- Annual average PM_{10} of 13 µg/m^3
- Annual average TSP pf 33 µg/m^3
- Annual average dust deposition of 1.6 g/m^2/month

In addition, the DECC guidelines require an assessment against 24-hour PM_{10} concentrations. This assessment adopts the approach that the predicted 24-hour average PM_{10} concentration from the development should be less than 50 µg/m^3 at the nearest residences. A background concentration estimate is therefore not required for the short-term assessment.

5. ESTIMATED DUST EMISSIONS

Dust emissions arise from various activities at quarries. Total dust emissions due to the quarry have been estimated by analysing the activities taking place at the quarry during three selected stages of operation. The operations which apply in each case have been combined with emission factors developed, both within NSW and by the US EPA, to estimate the amount of dust produced by each activity. There have been significant revisions to the US EPA emission factors for quarry operations in 2003. The emission factors applied are considered to be the most up to date methods for determining dust generation rates. The fraction of fine, inhalable and coarse particles for each activity has been taken into account in the dispersion modelling.

The most significant dust generating activities from the quarry operations have been identified and the dust emission estimates during the three operational scenarios are presented in **Table 6**. Emissions were calculated using the same methods and equations as in the original assessment.

Table 6 – Estimated dust emissions due to proposed modified Lynwood Quarry operations

Activity	*TSP emission rate (kg/y)*		
	Year 5	***Year 10***	***Year 30***
Dozer stripping topsoil	9,380	5,320	-
Loading topsoil to trucks	137	78	-
Hauling topsoil to stockpiles	2,062	1,578	-
Dumping topsoil to stockpiles	137	78	-
Drilling rock and overburden	9,272	9,272	9,272
Blasting rock and overburden	1,623	1,623	1,623
FEL loading overburden to trucks	1,644	1,960	-
Hauling overburden to emplacement area	24,751	39,839	-
Dumping overburden to emplacement area	1,644	1,960	-
Dozer shaping overburden dump	17,472	17,472	-
FEL loading rock to trucks	-	13,287	13,287
Hauling rock to hopper	-	134,400	187,600
FEL Loading rock to hopper	7,972	13,287	13,287
Primary crushing and screening	5,107	8,512	8,512
Secondary crushing and screening	102,614	171,024	171,024
Tertiary crushing and screening	102,614	171,024	171,024
Loading to product stockpiles	5,712	9,519	9,519
Loading product to road trucks	792	792	792
Transport product off-site (sealed rd)	67,200	67,200	67,200
Loading product to trains by conveyor	792	1,848	1,848
Wind erosion from exposed pit areas	106,210	218,388	537,019
Wind erosion from product stockpiles	10,343	10,343	10,343
Wind erosion from Rail OEA	-	-	-
Wind erosion from Eastern OEA	21,003	41,768	-
Wind erosion from Western OEA	-	-	-
Wind erosion from Eastern EOEA	17,901	34,608	-
Wind erosion from Western EOEA	-	-	53,463
Loading excess product to trucks from plant	558	930	930
Hauling excess product to emplacement area	8,400	14,000	8,400
Dumping excess product to emplacement area	558	930	930
Dozer shaping excess product emplacement area	17,472	17,472	17,472
Grading roads	21,566	21,566	21,566
TOTAL DUST (kg)	**564,936**	**1,030,078**	**1,305,111**

Of the years selected for the assessment Year 30 is estimated to generate the most dust. This is predominantly due to the large amount of exposed area subject to wind erosion.

6. APPROACH TO ASSESSMENT

In August 2001, DEC published new guidelines for the assessment of air pollution sources using dispersion models (**NSW EPA, 2001**). The guidelines specify how assessments based on the use of air dispersion models should be undertaken. They include guidelines for the preparation of meteorological data, the way in which emissions should be estimated and the relevant air quality criteria for assessing the significance of predicted concentration and deposition rates from the proposal. The approach taken in this assessment follows as closely as possible the

approaches suggested by the guidelines and is described in detail in the original assessment in 2005.

Operations were represented by a series of volume sources located according to the location of activities for the modelled scenario. **Figure 6** shows the location of the modelled sources for each assessment year. Estimates of emissions for each source were developed on an hourly time step taking into account the activities that would take place at that location. Thus, for each source, for each hour, an emission rate was determined which depended upon the level of activity and the wind speed. It is important to do this in the ISCST3 model to ensure that long-term average emission rates are not combined with worst-case dispersion conditions which are associated with light winds. Light winds at a quarry site would correspond with periods of low dust generation (because wind erosion and other wind dependent emissions rates will be low) and also correspond with periods of poor dispersion. If these measures are not taken then the model has the potential to significantly overstate impacts.

Dust concentrations and deposition rates have been predicted over an area 8 km by 8 km. Local terrain has been included in the modelling.

The modelling has been performed using the meteorological data discussed in **Section 4.1** and the dust emission estimates from **Section 5**. Most activities are proposed to occur during daylight hours however Load an haul of primary raw feed will occur until 10 pm and the crushing, screening and loadout activities have been modelled for 24-hours per day. Dust emissions from wind erosion sources have been modelled for 24 hours per day in all modelling scenarios. Model predictions have been made at 115 discrete receptors located in and around the project area. The locations of these receptors have been chosen to provide finer resolution closer to the quarry dust sources and nearby residences.

A calibration study was undertaken as part of the EIS for the Warkworth mine in the Hunter Valley (**Holmes Air Sciences, 2002**), in order to investigate the possible overprediction of short-term concentrations by the ISCST3 model. The calibration was done by comparing the predicted maximum 24-hour average PM_{10} concentrations in the period 1 November 2000 to 31 October 2001 at the several mine operated monitors. The maximum measured PM_{10} concentration and TSP concentrations at four sites over the same period were then determined by inspection of the monitoring data records. The TSP concentrations have been converted to equivalent PM_{10} concentrations assuming that PM_{10} constitutes 40% of the TSP in this area.

As was shown in the 2005 air quality assessment for this project, the average extent of over prediction was a factor of 2.6. That is, unadjusted model predictions overpredict 24-hour PM_{10} concentrations by 260%. This factor has been used in this assessment to adjust the model predictions downwards and obtain a calibrated prediction of the worst-case 24-hour PM_{10} concentrations for the three years assessed.

The model ISCST3 has been the most widely used model in NSW for assessing the dust impacts of extractive industries. AUSPLUME is the DECC's model of choice but it has had limited use in dust modelling applications. Comparisons of model predictions (refer to **Holmes Air Sciences, 2003** for example) have shown that AUSPLUME predicts almost 50% lower than uncorrected ISCST3 predictions of maximum 24-hour average concentrations. Annual average predictions using AUSPLUME are slightly lower than ISCST3 predictions. This supports the use of a correction factor for the maximum 24-hour PM_{10} concentration predictions using ISCST3. This approach is consistent with the approach used for the original assessment of air quality impacts in 2005 for the approved quarry.

7. ASSESSMENT OF IMPACTS

7.1 Introduction

This section provides an interpretation of the predicted dust concentrations and deposition levels.

Dust concentrations and deposition rates due to the selected years of assessment have been presented as isopleth diagrams showing the following:

1. Predicted maximum 24-hour average PM_{10} concentration
2. Predicted annual average PM_{10} concentration
3. Predicted annual average TSP concentration
4. Predicted annual average dust deposition

The maximum 24-hour average contour plots do not represent the dispersion pattern for any particular day, but show the highest predicted 24-hour average concentration that occurred at each location regardless of when it occurred. The maxima are used to show concentrations which can possibly be reached under the modelled conditions. It should be noted that the contour plots show predicted concentrations and deposition levels due only to Lynwood quarry dust sources. That is, the predictions do not include contributions from existing non-quarry sources.

Model predictions for each assessment year have also been presented in tabular form for the nearest residences and potential future residential locations that are not on Cemex owned land (**Table 7**). **Figure 7** shows the identification label given to each assessment location. Interpretation and analysis of the model predictions for each assessment scenario are provided below.

7.2 Assessment Criteria

The air quality criteria used for deciding which properties are likely to experience air quality impacts are those specified in the DECC's modelling guidelines (refer to **Table 1** and **Table 2**).

The criteria are:

- 50 $\mu g/m^3$ for 24-hour PM_{10} for the quarry considered alone
- 30 $\mu g/m^3$ for annual average PM_{10} due to the quarry and other sources
- 90 $\mu g/m^3$ for annual average TSP concentrations due to the quarry and other sources
- 2 g/m^2/month for annual average deposition (insoluble solids) due to the quarry considered alone
- 4 g/m^2/month for annual predicted cumulative deposition (insoluble solids) due to the quarry and other sources.

7.3 Assessment of Impacts

Dispersion model predictions for the each stage of the quarry operations are presented in **Figures 8** to **10**. **Table 7** provides a summary of results for the nearest residences and also provides a comparison between the predicted dust levels the approved quarry compared to the proposed modified site layout. The residences and potential future residential locations have been selected to represent the most potentially affected areas for various wind directions.

It can be seen in **Table 7**, that the predictions for the current layout scenario are not significantly different to those predictions made in 2005. In fact, in most cases the dust levels are predicted to be lower for the new site layout. This is likely to be due to the fact there there will be less haulage of material due to the in-pit crusher.

Comparing the model predictions with air quality goals the following conclusions can be made:

- Maximum 24-hour average PM_{10} concentrations due to the operations are below the 50 $\mu g/m^3$ goal at all selected residences.
- Annual average PM_{10} concentrations due to the operations are below the 30 $\mu g/m^3$ goal at all residences. If an annual average background PM_{10} of 13 $\mu g/m^3$ is added to the model predictions, concentrations at all residences are still below the 30 $\mu g/m^3$ goal.
- Annual average TSP concentrations due to the operations are below the 90 $\mu g/m^3$ goal at all residences. If an annual average background TSP of 33 $\mu g/m^3$ is added to the model predictions, concentrations at all residences are still below the 90 $\mu g/m^3$ goal.
- The predicted contribution of the quarry to dust deposition levels are below the 2 g/m^2/month criteria at all residences. Model predictions at the nearest residences are also below the 4 g/m^2/month goal when an existing background dust deposition level of 1.6 g/m^2/month is added.

Model predictions have been presented as contour plots, shown in **Figures 8** to **10**. It can be seen from these figures that air quality impacts to the east of the site would generally be higher than those predicted to the west. The westerly winds that are common in the area would be driving this pattern.

The assessment includes cumulative effects since the background monitoring data includes the effects of all existing sources.

Table 7 – Model predictions at selected locations due to quarry operations

Location	Year 5		Year 10		Year 30	
	Approved layout	Proposed layout	Approved layout	Proposed layout	Approved layout	Proposed layout
Predicted maximum 24-hour average PM_{10} concentrations ($\mu g/m^3$). Goal = 50 $\mu g/m^3$						
R1	7.5	4.1	9.7	6.9	8.3	7.2
R2	10.0	6.5	16.4	11.6	13.8	14.5
R3	17.8	8.4	17.8	14.6	14.7	12.3
R4	16.1	7.3	16.7	11.1	16.8	12.3
R5	22.3	9.2	24.8	16.8	21.6	18.2
R6	15.5	6.3	14.5	9.7	13.8	9.2
R7	10.2	8.4	10.7	9.4	11.4	10.3
R8	14.1	5.8	13.9	9.3	13.4	9.3
Predicted annual average PM_{10} concentrations ($\mu g/m^3$). Goal = 30 $\mu g/m^3$ (Model predictions with estimated background (13 $\mu g/m^3$) are shown in parentheses)						
R1	0.7 (13.7)	0.4 (13.4)	1 (14)	0.7 (13.7)	0.9 (13.9)	0.9 (13.9)
R2	2.5 (15.5)	1.7 (14.7)	4 (17)	3.0 (16.0)	3.7 (16.7)	3.7 (16.7)
R3	4.9 (17.9)	3.6 (16.6)	6.5 (19.5)	5.1 (18.1)	5.5 (18.5)	5.3 (18.3)
R4	3.4 (16.4)	2.3 (15.3)	4.2 (17.2)	3.4 (16.4)	4.2 (17.2)	4.0 (17.0)
R5	4.9 (17.9)	3.4 (16.4)	8 (21)	6.0 (19.0)	7.1 (20.1)	7.2 (20.2)
R6	3.2 (16.2)	2.2 (15.2)	4 (17)	3.2 (16.2)	3.6 (16.6)	3.4 (16.4)
R7	2.9 (15.9)	2.4 (15.4)	3.4 (16.4)	3.0 (16.0)	3.3 (16.3)	3.2 (16.2)
R8	4.4 (17.4)	3.2 (16.2)	5.6 (18.6)	4.5 (17.5)	4.8 (17.8)	4.6 (17.6)
Predicted annual average TSP concentrations ($\mu g/m^3$). Goal = 90 $\mu g/m^3$ (Model predictions with estimated background (33 $\mu g/m^3$) are shown in parentheses)						
R1	0.7 (33.7)	0.5 (33.5)	1.2 (34.2)	0.8 (33.8)	1 (34)	1.0 (34.0)
R2	2.8 (35.8)	1.8 (34.8)	4.5 (37.5)	3.4 (36.4)	4.2 (37.2)	4.2 (37.2)
R3	6 (39)	4.5 (37.5)	8 (41)	6.4 (39.4)	6.4 (39.4)	6.2 (39.2)
R4	3.8 (36.8)	2.6 (35.6)	4.7 (37.7)	3.8 (36.8)	4.7 (37.7)	4.5 (37.5)
R5	5.5 (38.5)	3.8 (36.8)	9.1 (42.1)	6.7 (39.7)	8.2 (41.2)	8.2 (41.2)
R6	3.6 (36.6)	2.5 (35.5)	4.5 (37.5)	3.6 (36.6)	4.1 (37.1)	3.8 (36.8)
R7	3.3 (36.3)	2.7 (35.7)	4 (37)	3.4 (36.4)	3.8 (36.8)	3.7 (36.7)
R8	5.1 (38.1)	3.7 (36.7)	6.7 (39.7)	5.4 (38.4)	5.5 (38.5)	5.3 (38.2)
Annual average dust deposition (g/m^2/month). Goal : 2 for Project only, 4 with estimated background (Model predictions with estimated background (1.6 g/m^2/month) are shown in parentheses)						
R1	0.03 (1.73)	0.02 (1.62)	0.05 (1.75)	0.03 (1.63)	0.05 (1.75)	0.05 (0.65)
R2	0.1 (1.8)	0.06 (1.66)	0.2 (1.9)	0.12 (1.72)	0.21 (1.91)	0.20 (1.80)
R3	0.46 (2.16)	0.37 (1.97)	0.71 (2.41)	0.56 (2.16)	0.5 (2.2)	0.47 (2.07)
R4	0.16 (1.86)	0.10 (1.70)	0.22 (1.92)	0.16 (1.76)	0.26 (1.96)	0.24 (1.84)
R5	0.22 (1.92)	0.15 (1.75)	0.52 (2.22)	0.31 (1.91)	0.55 (2.25)	0.52 (2.12)
R6	0.19 (1.89)	0.14 (1.74)	0.28 (1.98)	0.22 (1.82)	0.26 (1.96)	0.24 (1.84)
R7	0.17 (1.87)	0.13 (1.73)	0.22 (1.92)	0.18 (1.78)	0.23 (1.93)	0.21 (1.81)
R8	0.36 (2.06)	0.26 (1.86)	0.53 (2.23)	0.42 (2.02)	0.4 (2.1)	0.37 (1.97)

8. CRYSTALLINE SILICA

8.1 Introduction

Silica (SiO_2) is a naturally occurring mineral composed of silicon and oxygen. It exists in crystalline and amorphous forms depending on the structural arrangement of the oxygen and silicon atoms. Only the crystalline forms are known to be fibrogenic[3] and only the respirable particles (those which are capable of reaching the gas exchange region of the lungs) are considered in determining health effects of crystalline silica.

There are a number of size-based descriptors used in describing particulate matter and it is useful to define these for the following discussion. The descriptors are:

- PM_{10} – particles with an equivalent aerodynamic diameter of less than approximately 10 µm. The largest of these are inhalable.
- PM_7 – particles with an equivalent aerodynamic diameter of less than approximately 7 µm. The largest of these can reach the thoracic region of the respiratory system.
- PM_4 – particles with an equivalent aerodynamic diameter of less than approximately 4 µm. The largest of these can reach the alveoli.
- $PM_{2.5}$ – particles with an equivalent aerodynamic diameter of less than approximately 2.5 µm. These are the fine particle fraction.

Particles described as PM_7 are a sub-component of PM_{10}, PM_4 particles are a sub-component of PM_7 and PM_{10}, and $PM_{2.5}$ particles are a sub-component of PM_4, PM_7 and PM_{10}.

The three most common types of crystalline silica are quartz, tridymite and cristobalite. Human exposure to crystalline silica occurs most often during occupational activities that involve the working of materials containing crystalline silica products (e.g. masonry, concrete, sandstone) or use or manufacture of crystalline silica-containing products. Activities that involve cutting, grinding or breaking of these materials can result in the liberation of particles in PM_{10}, PM_7, PM_4 and $PM_{2.5}$ size ranges. Ambient crystalline silica dust can occur due to natural, industrial and agricultural activities.

Repeated and prolonged exposure to relatively high concentrations of crystalline silica can cause the disease known as silicosis. This respiratory disease is characterised by scarring and hardening of the lung tissue and it reduces the ability of the lungs to extract oxygen from the air. Occurrences of silicosis are highly correlated to occupations where particles of crystalline silica are released to the atmosphere (e.g. mining, quarrying, foundries, sandblasting). Silicosis is becoming less common in industrialised nations due to the stringent controls on airborne dust and the use of protective devices.

8.2 Assessment Criteria

General community (non-occupational) exposure to respirable crystalline silica is typically well below the national exposure standards and consequently is unlikely to present significant risks to public health. The World Health Organization's Concise International Chemical Assessment Document on Crystalline Silica, Quartz (**CICAD, 2000**) states that "*there are no known adverse health effects associated with the non-occupational exposure to quartz*".

[3] Fibrogenic dust is dust which may cause an increase of fibrotic (scar) tissue after deposition in the gas exchange region of the lung.

The proportion of crystalline silica within the dust that will be liberated by the Lynwood quarry is not known. However testing on the source rock shows that it has a crystalline silica content of between 35 and 40%. Not all of this will be liberated to the air during the quarrying operations. For estimation of crystalline silica impacts it has been assumed that 35% of the PM_{10} emissions are crystalline silica and the model predictions have been assessed for the year of maximum dust generation (Year 30).

In Australia, the occupational exposure standards for respirable crystalline silica are defined by the National Occupational Health and Safety Commission (NOHSC). The national exposure standard for respirable crystalline silica is 100 $\mu g/m^3$ (Time Weighted Average (TWA))[4]. Although the occupational standard is not applicable to the assessment of the ambient air quality, provided the standard is met for workers near the source, the risk of silicosis among people living in surrounding areas would generally be very small.

The NSW DECC has not set any impact assessment criteria for crystalline silica. The Victorian EPA has adopted an ambient assessment criterion for mining and extractive industries of 3 $\mu g/m^3$ (annual average as $PM_{2.5}$) (**VEPA, 2007**). This has been derived from the Reference Exposure Level (REL)[5] set by the California EPA Office of Environmental Health Hazard Assessment of 3 $\mu g/m^3$ (annual average as PM_4) (**OEHHA, 2005**).

The **US EPA (1996)** examined the non-cancer epidemiological literature on crystalline silica induced diseases. From the extensive data available, which examined the medical histories of thousands of miners, they concluded that the cumulative risk of developing silicosis is zero for cumulative exposures of less than 1000 $\mu g/m^3$.years.

Cumulative exposure is the average respirable crystalline silica concentration a person is exposed to over a period of time, multiplied by the number of years exposed. For example, an exposure of 1000 $\mu g/m^3$.years, would be experienced by an individual exposed to 14.3 $\mu g/m^3$ (annual average PM_4) per year for 70 years. For cumulative exposures less than 1000 $\mu g/m^3$.years, the US EPA concludes that the risk of developing silicosis is zero.

8.3 Impact Assessment

The methodology defined by the US EPA has been applied to the predicted impacts at the nearby residences to Lynwood Quarry, to determine the cumulative risk.

The California EPA REL applies to PM_4 and therefore the predicted impacts of PM_{10} concentrations need to be adjusted to PM_4 concentrations before they can be compared with the standard. In our analysis we have assumed that the crystalline silica fraction of PM_{10} is the same for PM_4. Therefore, it has been assumed that 35% of PM_{10} emissions from quarrying activities are crystalline silica. This is a conservative assumption as not all of the crystalline silica will be released from the rock during these activities.

[4] TWA - the average airborne concentration of a particular substance when calculated over a normal eight-hour working day, for a five-day working week

[5] RELs are used by the California Environmental Protection Agency as indicators of potential adverse health effects. A REL is a concentration level (g/m^3) or dose (mg/kg/day) at (or below) which no adverse health effects are anticipated for a specified time period. RELs are generally based on the most sensitive adverse health effect reported in the medical and toxicological literature. RELs are designed to protect the most sensitive individuals in the population by the inclusion of margins of safety.

As noted above, in order to compare the predicted impacts with the Californian EPA REL it is necessary to estimate the PM_4 concentrations of crystalline silica arising from the Project. The ratio of PM_4/PM_{10} assumed here is 0.3 (**SPCC, 1986**), therefore the predicted annual average PM_{10} concentrations have been converted to annual average PM_4 concentrations by multiplying by the ratio of PM_4/PM_{10} (that is, 0.3). The crystalline silica content has been estimated by multiplying this value by the conservatively estimated average crystalline silica in the PM_{10} emissions (that is, 0.35).

The predicted crystalline silica concentrations using the method described above are shown in **Figure 11**. At the most affected residence the predicted annual average PM_{10} concentration was 7.17 $\mu g/m^3$. Therefore, the estimated annual average respirable (PM_4) concentration of crystalline silica was 0.752 $\mu g/m^3$ [7.17 $\mu g/m^3$ x 0.3 x 0.35 = 0.752 $\mu g/m^3$]. This is less than the Californian REL of 3 $\mu g/m^3$.

As exposure to crystalline silica is primarily an occupational health hazard, very little monitoring has been conducted to measure ambient concentrations. Data collected in Victoria estimated the background concentration to be 0.7 $\mu g/m^3$ (**Toxikos, 2005**). This is comparable to the ambient level in a Californian rural area of 0.6 $\mu g/m^3$ (**OEHHA, 2005**). In the absence of any local data, it has been assumed the background level of 0.7 $\mu g/m^3$ as measured in Victoria applies in the Project area. The cumulative risk related to the exposure of crystalline silica is therefore as presented below.

Existing background respirable crystalline silica	=	0.7 $\mu g/m^3$
Increase in respirable crystalline silica at most affected receptor	=	0.752 $\mu g/m^3$
Total annual respirable crystalline silica	=	1.452 $\mu g/m^3$

Based on the assumption that the quarry has a proposed life of 30 years, the respirable crystalline silica exposure during the operation of the quarry is 43.6 $\mu g/m^3$.years [1.425 $\mu g/m^3$ x 30 years].

If an individual were to live for the remaining 40 years of their assumed 70 year lifetime in the same area without the quarry operating, the exposure to respirable crystalline silica would be 28 $\mu g/m^3$.years [0.7 $\mu g/m^3$ x 40 years].

The total lifetime exposure from background concentrations and the proposed project combined would be 71.56 $\mu g/m^3$.years [43.6 $\mu g/m^3$.years + 28 $\mu g/m^3$.years].

As discussed above, the US EPA concluded that the cumulative risk of developing silicosis is zero for cumulative exposures of less than 1000 $\mu g/m^3$.years. The estimated total lifetime cumulative exposure for the proposed Project is approximately 14 times lower than this, even with the very conservative estimates used.

9. CONCLUSIONS AND RECOMMENDATIONS

This report has assessed the air quality impacts associated with the proposed modifications to the approved Lynwood Quarry near Marulan. This operation was originally assessed by Holmes Air Sciences in 2005 and this current report was to determine if the proposed changes in layout and extent of the pit would change the outcome of that assessment.

Dispersion modelling has been used to predict off-site dust concentration and dust deposition levels due to emissions from the proposed modified project. The dispersion modelling took account of the local meteorology and terrain information and used dust emission estimates to predict the air quality impacts for three operational scenarios. The scenarios were selected to cover a range of quarry production, overburden extraction and pit location combinations.

Background air quality monitoring data have been collected for the project which indicated that existing short-term dust concentrations were for the great majority of the time well below DECC's assessment criteria, but could be above air quality goals on occasions. The existing sources of dust in the area were difficult to determine, but distant sources would likely have contributed significant quantities of wind blown dust during the extended dry period which has coincided with the monitoring period in which these elevated levels occurred.

The assessment concluded that:

- air quality goals were not predicted to be exceeded at nearby residences due to the proposed modified quarry operations;
- particulate matter concentrations arising from non-Project related sources such as bushfires and regional dust storms, may continue to result in elevated short-term concentrations on occasions;
- the proposed changes to the layout of on-site infrastructure and the extent of the pit are not anticipated to cause adverse impacts off-site, in fact the predictions show decreases in ground level concentrations in most cases compared to the existing approved quarry operations; and
- the cumulative risk of developing silicosis was determined to be zero. The estimated total lifetime cumulative exposure for the proposed project is approximately 14 times lower than the US EPA standard, even with the very conservative estimates used.

The dispersion model predictions indicated that some increases to off-site dust concentration and dust deposition levels would be detectable due to operation of the quarry. It will be important to monitor the change in air quality that may arise from the operation of the quarry and it is recommended that the current air quality monitoring program continue once the quarry commences operation. The focus of the monitoring program should be on air quality at residential locations once quarrying commences so some gauges that are currently on-site should be relocated to residential locations.

10. REFERENCES

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APPENDIX A
JOINT WIND SPEED, WIND DIRECTION AND STABILITY CLASS FREQUENCY TABLES

JOINT WIND SPEED, WIND DIRECTION AND STABILITY CLASS FREQUENCY TABLES:

STATISTICS FOR FILE: C:\Jobs\LynQ2008\metdata\maru100.isc
MONTHS: All
HOURS : All
OPTION: Frequency

PASQUILL STABILITY CLASS 'A'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.001025	0.003529	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004554
NE	0.002277	0.004212	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006489
ENE	0.002049	0.003188	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005237
E	0.002277	0.003188	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005464
ESE	0.000569	0.003985	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004554
SE	0.000797	0.002732	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003529
SSE	0.000911	0.001594	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002505
S	0.001138	0.002846	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003985
SSW	0.001025	0.002505	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003529
SW	0.000911	0.002505	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003415
WSW	0.000911	0.002618	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003529
W	0.001138	0.001708	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002846
WNW	0.001025	0.002732	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003757
NW	0.001594	0.002618	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004212
NNW	0.000569	0.001935	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002505
N	0.000797	0.002846	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003643
CALM									0.006944
TOTAL	0.019012	0.044740	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.070697

MEAN WIND SPEED (m/s) = 1.75
NUMBER OF OBSERVATIONS = 621

PASQUILL STABILITY CLASS 'B'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000228	0.001935	0.003643	0.000000	0.000000	0.000000	0.000000	0.000000	0.005806
NE	0.000569	0.001025	0.003529	0.000000	0.000000	0.000000	0.000000	0.000000	0.005123
ENE	0.000228	0.002163	0.003415	0.000000	0.000000	0.000000	0.000000	0.000000	0.005806
E	0.000569	0.001821	0.002960	0.000000	0.000000	0.000000	0.000000	0.000000	0.005351
ESE	0.000569	0.001138	0.002846	0.000000	0.000000	0.000000	0.000000	0.000000	0.004554
SE	0.000342	0.001708	0.002277	0.000000	0.000000	0.000000	0.000000	0.000000	0.004326
SSE	0.000000	0.001594	0.001025	0.000000	0.000000	0.000000	0.000000	0.000000	0.002618
S	0.000228	0.001935	0.001935	0.000000	0.000000	0.000000	0.000000	0.000000	0.004098
SSW	0.000228	0.001708	0.001480	0.000000	0.000000	0.000000	0.000000	0.000000	0.003415
SW	0.000342	0.000911	0.002277	0.000000	0.000000	0.000000	0.000000	0.000000	0.003529
WSW	0.000114	0.001708	0.002732	0.000000	0.000000	0.000000	0.000000	0.000000	0.004554
W	0.000455	0.000797	0.003074	0.000000	0.000000	0.000000	0.000000	0.000000	0.004326
WNW	0.000569	0.001480	0.002732	0.000000	0.000000	0.000000	0.000000	0.000000	0.004781
NW	0.000683	0.001708	0.002505	0.000000	0.000000	0.000000	0.000000	0.000000	0.004895
NNW	0.000569	0.002163	0.004098	0.000000	0.000000	0.000000	0.000000	0.000000	0.006831
N	0.000797	0.002618	0.003415	0.000000	0.000000	0.000000	0.000000	0.000000	0.006831
CALM									0.002391
TOTAL	0.006489	0.026412	0.043944	0.000000	0.000000	0.000000	0.000000	0.000000	0.079235

MEAN WIND SPEED (m/s) = 2.85
NUMBER OF OBSERVATIONS = 696

PASQUILL STABILITY CLASS 'C'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000569	0.001821	0.004212	0.006148	0.000000	0.000000	0.000000	0.000000	0.012750
NE	0.000455	0.001366	0.002618	0.003301	0.000000	0.000000	0.000000	0.000000	0.007741
ENE	0.000683	0.001935	0.002505	0.002277	0.000000	0.000000	0.000000	0.000000	0.007400
E	0.000683	0.002505	0.003188	0.002846	0.000000	0.000000	0.000000	0.000000	0.009221
ESE	0.000228	0.000911	0.002960	0.002391	0.000000	0.000000	0.000000	0.000000	0.006489
SE	0.000342	0.001252	0.002391	0.001252	0.000000	0.000000	0.000000	0.000000	0.005237
SSE	0.000000	0.001594	0.001480	0.003074	0.000000	0.000000	0.000000	0.000000	0.006148
S	0.000000	0.001252	0.002049	0.003529	0.000000	0.000000	0.000000	0.000000	0.006831
SSW	0.000569	0.002618	0.004212	0.003074	0.000000	0.000000	0.000000	0.000000	0.010474
SW	0.000569	0.002505	0.004895	0.002618	0.000000	0.000000	0.000000	0.000000	0.010587
WSW	0.000455	0.002277	0.004212	0.002163	0.000000	0.000000	0.000000	0.000000	0.009107
W	0.000683	0.002846	0.004781	0.003985	0.000000	0.000000	0.000000	0.000000	0.012295
WNW	0.000797	0.002960	0.004781	0.006375	0.000000	0.000000	0.000000	0.000000	0.014913
NW	0.000114	0.001252	0.004554	0.005464	0.000000	0.000000	0.000000	0.000000	0.011384
NNW	0.000683	0.002277	0.004326	0.005123	0.000000	0.000000	0.000000	0.000000	0.012409
N	0.000683	0.001480	0.004326	0.006603	0.000000	0.000000	0.000000	0.000000	0.013092
CALM									0.002163
TOTAL	0.007514	0.030852	0.057491	0.060223	0.000000	0.000000	0.000000	0.000000	0.158242

MEAN WIND SPEED (m/s) = 3.93
NUMBER OF OBSERVATIONS = 1390

PASQUILL STABILITY CLASS 'D'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.003529	0.002732	0.005578	0.003643	0.004554	0.002391	0.000569	0.000114	0.023110
NE	0.003415	0.002163	0.003985	0.001821	0.004781	0.001594	0.000455	0.000114	0.018329
ENE	0.002618	0.003757	0.003074	0.001252	0.001480	0.000342	0.000114	0.000000	0.012637
E	0.001935	0.003871	0.002505	0.000911	0.001935	0.001025	0.000228	0.000000	0.012409
ESE	0.002391	0.004554	0.002505	0.001252	0.001025	0.000342	0.000114	0.000114	0.012295
SE	0.001366	0.003074	0.003415	0.001025	0.001708	0.000455	0.000228	0.000114	0.011384
SSE	0.000228	0.003871	0.003301	0.001025	0.002277	0.000911	0.000228	0.000000	0.011840
S	0.001366	0.004781	0.005009	0.001821	0.002391	0.001708	0.000683	0.000228	0.017987
SSW	0.002277	0.007741	0.006034	0.002732	0.002960	0.001594	0.000455	0.000228	0.024021
SW	0.006034	0.008766	0.006831	0.001935	0.001025	0.000342	0.000455	0.000228	0.025615
WSW	0.004554	0.008424	0.008538	0.002277	0.001935	0.001366	0.000228	0.000228	0.027550
W	0.006489	0.013092	0.011726	0.007628	0.003643	0.001708	0.000797	0.000455	0.045537
WNW	0.004895	0.012295	0.011270	0.006148	0.008083	0.003871	0.001935	0.000228	0.048725
NW	0.003074	0.005920	0.007741	0.005123	0.007172	0.003188	0.000797	0.000569	0.033584
NNW	0.001138	0.004554	0.007058	0.002277	0.004440	0.002960	0.001366	0.000455	0.024249
N	0.003074	0.003188	0.008766	0.002505	0.006034	0.003074	0.001138	0.000114	0.027892
CALM									0.012523
TOTAL	0.048383	0.092782	0.097336	0.043374	0.055442	0.026867	0.009791	0.003188	0.389686

MEAN WIND SPEED (m/s) = 4.04
NUMBER OF OBSERVATIONS = 3423

PASQUILL STABILITY CLASS 'E'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.005009	0.003985	0.000683	0.000000	0.000000	0.000000	0.000000	0.000000	0.009677
NE	0.004212	0.004212	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.008538
ENE	0.004326	0.001821	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.006375
E	0.003074	0.002049	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005123
ESE	0.002277	0.002846	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.005237
SE	0.001025	0.001594	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.002732
SSE	0.001025	0.001935	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.003074
S	0.002732	0.002277	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.005237
SSW	0.002732	0.004668	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.007741
SW	0.005351	0.003643	0.000455	0.000000	0.000000	0.000000	0.000000	0.000000	0.009449
WSW	0.005009	0.006944	0.001708	0.000000	0.000000	0.000000	0.000000	0.000000	0.013661
W	0.009221	0.010360	0.005351	0.000114	0.000000	0.000000	0.000000	0.000000	0.025046
WNW	0.007058	0.006489	0.001821	0.000342	0.000000	0.000000	0.000000	0.000000	0.015710
NW	0.005692	0.004326	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.010246
NNW	0.003074	0.004212	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.007400
N	0.002732	0.005009	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.007855
CALM									0.014117
TOTAL	0.064549	0.066371	0.011726	0.000455	0.000000	0.000000	0.000000	0.000000	0.157218

MEAN WIND SPEED (m/s) = 1.63
NUMBER OF OBSERVATIONS = 1381

PASQUILL STABILITY CLASS 'F'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.005464	0.002732	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008197
NE	0.004326	0.001366	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005692
ENE	0.003415	0.001138	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004554
E	0.003871	0.000797	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004668
ESE	0.001708	0.001366	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003074
SE	0.002960	0.001025	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003985
SSE	0.002049	0.001025	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003074
S	0.003529	0.001366	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004895
SSW	0.005237	0.001935	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007172
SW	0.006375	0.001821	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008197
WSW	0.008994	0.000911	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.009904
W	0.009904	0.002505	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012409
WNW	0.008766	0.002960	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.011726
NW	0.008197	0.002163	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010360
NNW	0.003529	0.002277	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005806
N	0.003757	0.004781	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008538
CALM									0.032673
TOTAL	0.082081	0.030168	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.144923

MEAN WIND SPEED (m/s) = 1.04
NUMBER OF OBSERVATIONS = 1273

ALL PASQUILL STABILITY CLASSES

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.015824	0.016735	0.014117	0.009791	0.004554	0.002391	0.000569	0.000114	0.064094
NE	0.015255	0.014344	0.010246	0.005123	0.004781	0.001594	0.000455	0.000114	0.051913
ENE	0.013320	0.014003	0.009221	0.003529	0.001480	0.000342	0.000114	0.000000	0.042008
E	0.012409	0.014230	0.008652	0.003757	0.001935	0.001025	0.000228	0.000000	0.042236
ESE	0.007741	0.014800	0.008424	0.003643	0.001025	0.000342	0.000114	0.000114	0.036202
SE	0.006831	0.011384	0.008197	0.002277	0.001708	0.000455	0.000228	0.000114	0.031193
SSE	0.004212	0.011612	0.005920	0.004098	0.002277	0.000911	0.000228	0.000000	0.029258
S	0.008994	0.014458	0.009221	0.005351	0.002391	0.001708	0.000683	0.000228	0.043033
SSW	0.012067	0.021175	0.012067	0.005806	0.002960	0.001594	0.000455	0.000228	0.056352
SW	0.019581	0.020150	0.014458	0.004554	0.001025	0.000342	0.000455	0.000228	0.060792
WSW	0.020036	0.022883	0.017190	0.004440	0.001935	0.001366	0.000228	0.000228	0.068306
W	0.027892	0.031307	0.024932	0.011726	0.003643	0.001708	0.000797	0.000455	0.102459
WNW	0.023110	0.028916	0.020606	0.012864	0.008083	0.003871	0.001935	0.000228	0.099613
NW	0.019353	0.017987	0.015027	0.010587	0.007172	0.003188	0.000797	0.000569	0.074681
NNW	0.009563	0.017418	0.015597	0.007400	0.004440	0.002960	0.001366	0.000455	0.059199
N	0.011840	0.019923	0.016621	0.009107	0.006034	0.003074	0.001138	0.000114	0.067851
CALM									0.070811
TOTAL	0.228028	0.291325	0.210496	0.104053	0.055442	0.026867	0.009791	0.003188	1.000000

MEAN WIND SPEED (m/s) = 2.95
NUMBER OF OBSERVATIONS = 8784

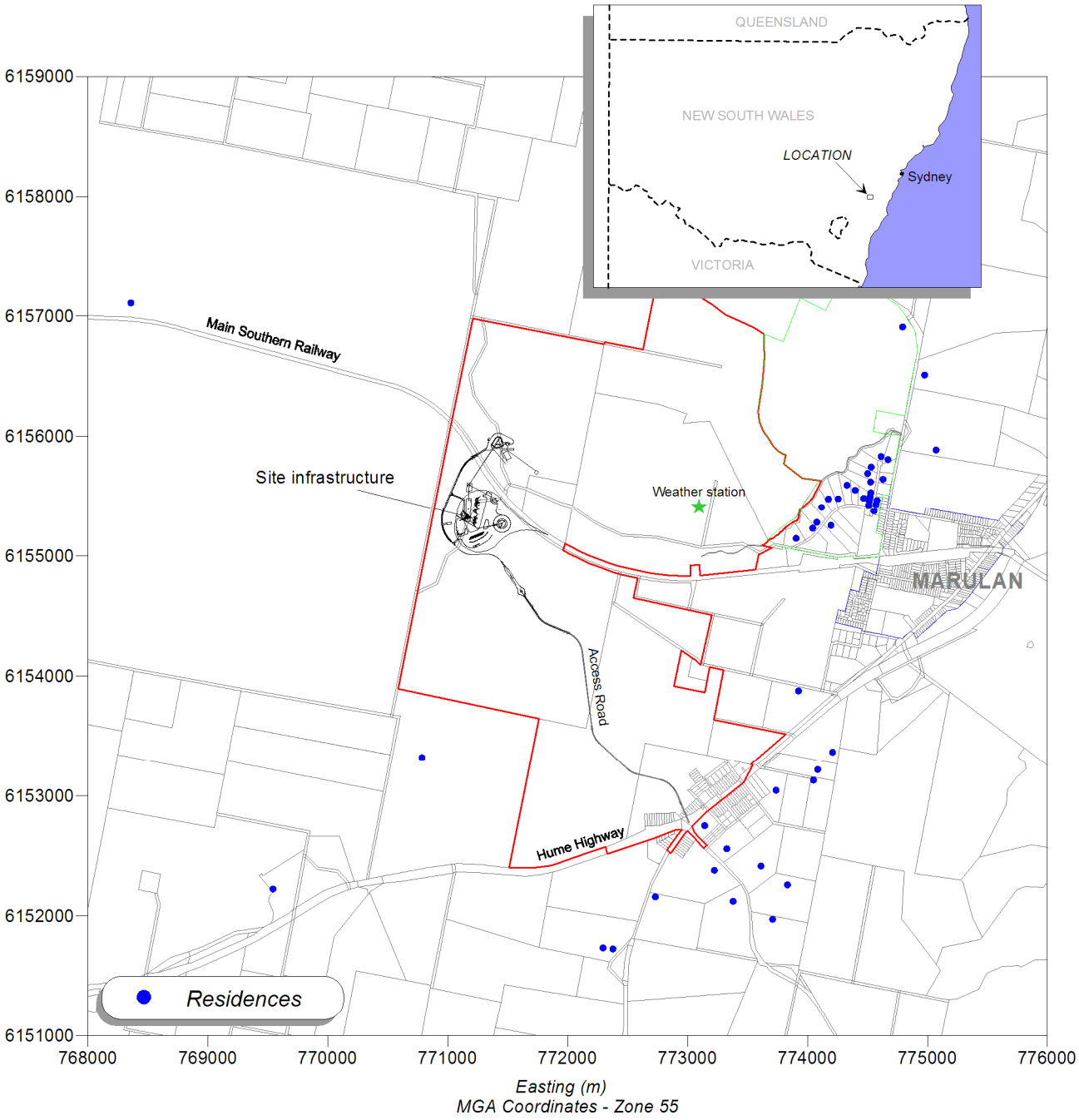
FREQUENCY OF OCCURENCE OF STABILITY CLASSES

A : 7.1%
B : 7.9%
C : 15.8%
D : 39.0%
E : 15.7%
F : 14.5%

STABILITY CLASS BY HOUR OF DAY

Hour	A	B	C	D	E	F
01	0000	0000	0000	0153	0110	0103
02	0000	0000	0000	0140	0111	0115
03	0000	0000	0000	0146	0118	0102
04	0000	0000	0000	0140	0116	0110
05	0000	0000	0000	0148	0108	0110
06	0015	0011	0017	0162	0080	0081
07	0036	0039	0061	0130	0043	0057
08	0054	0060	0102	0118	0008	0024
09	0075	0055	0147	0089	0000	0000
10	0071	0063	0149	0083	0000	0000
11	0064	0080	0136	0086	0000	0000
12	0074	0069	0129	0094	0000	0000
13	0069	0078	0124	0095	0000	0000
14	0063	0079	0113	0111	0000	0000
15	0053	0066	0146	0101	0000	0000
16	0030	0059	0132	0131	0010	0004
17	0013	0027	0098	0188	0030	0010
18	0004	0010	0036	0227	0057	0032
19	0000	0000	0000	0223	0088	0055
20	0000	0000	0000	0201	0085	0080
21	0000	0000	0000	0175	0110	0081
22	0000	0000	0000	0171	0106	0089
23	0000	0000	0000	0154	0096	0116
24	0000	0000	0000	0157	0105	0104

FIGURES



Location of proposed 'Lynwood' hard rock quarry

FIGURE 1

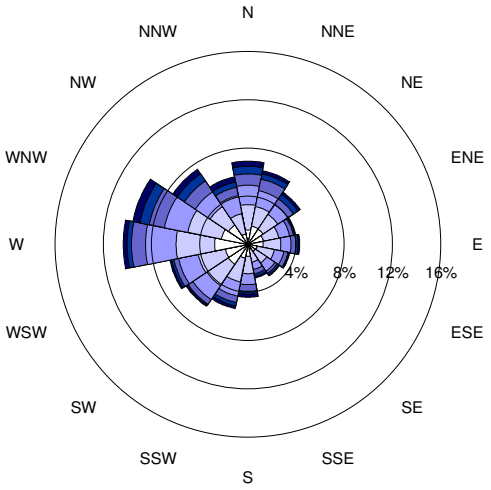
Pseudo 3-dimensional representation of the project area

FIGURE 2

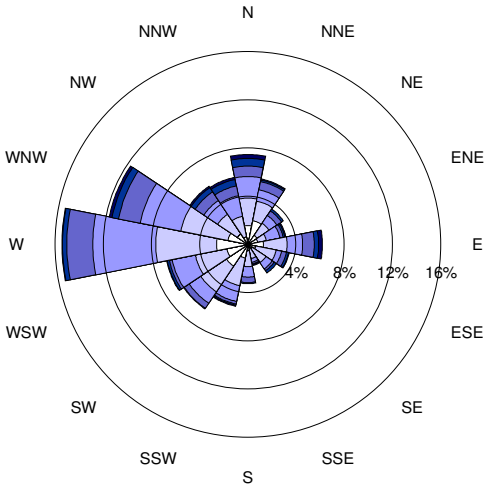
Quarry extents and site facilities

FIGURE 3

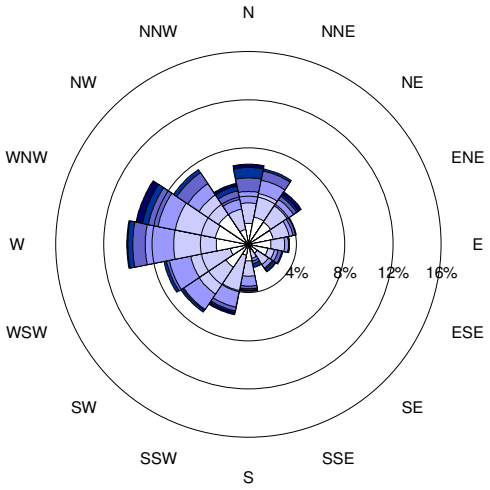
Annual and seasonal windroses for 'Wangi' Marulan (2000)



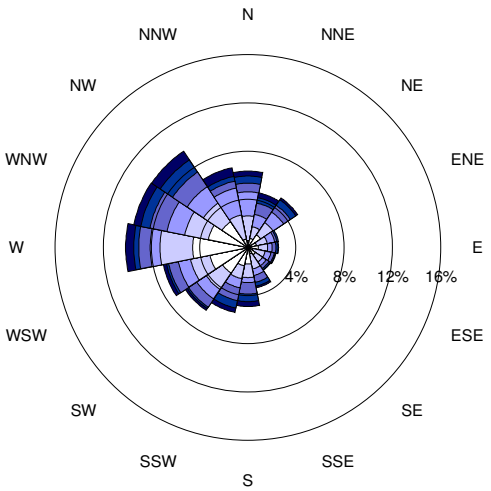
Annual
Calms = 8.0%



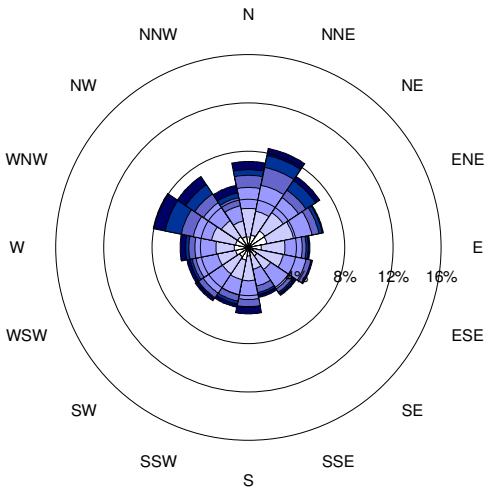
Summer
Calms = 5.6%



Autumn
Calms = 10.7%

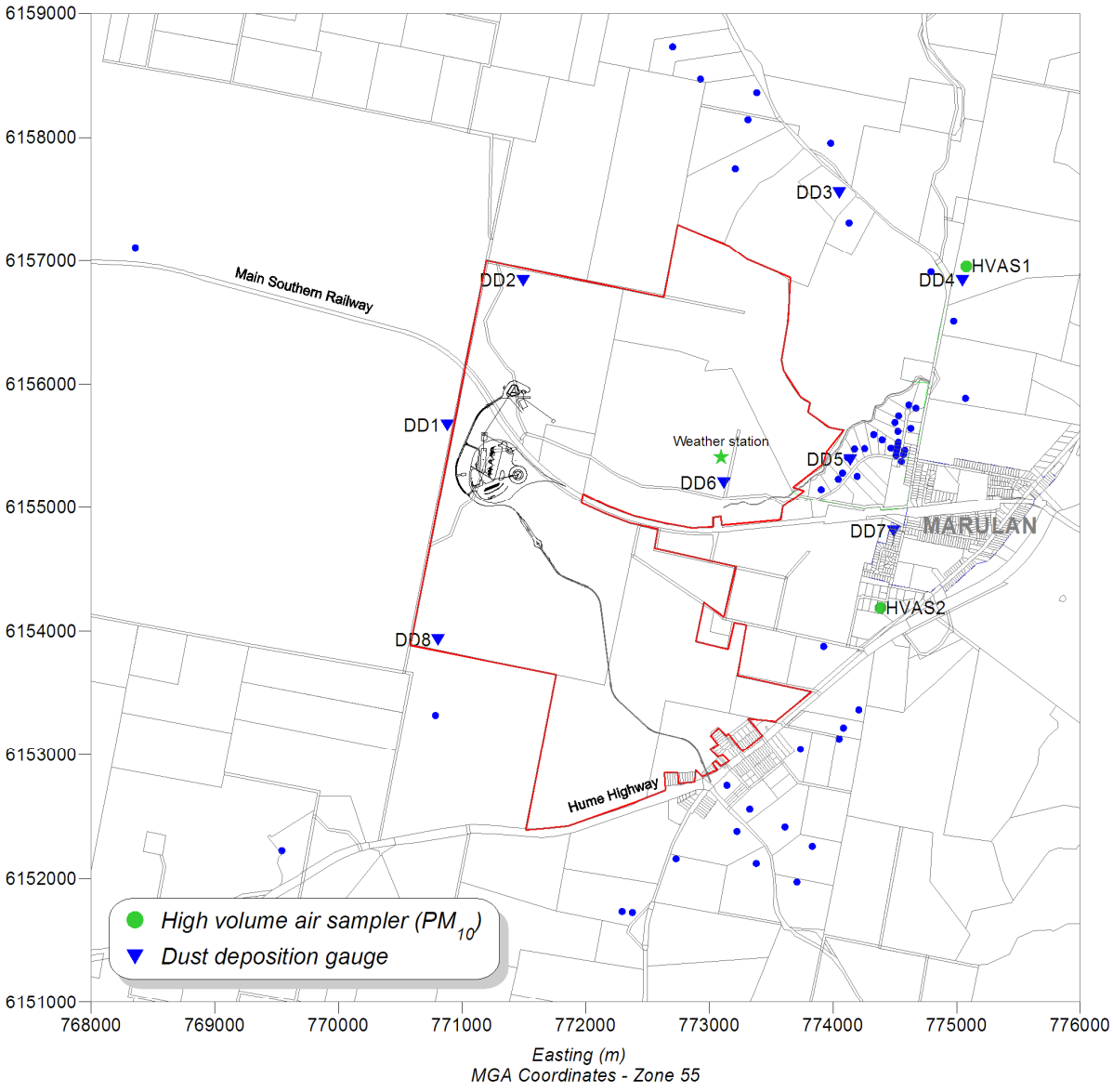


Winter
Calms = 11.1%



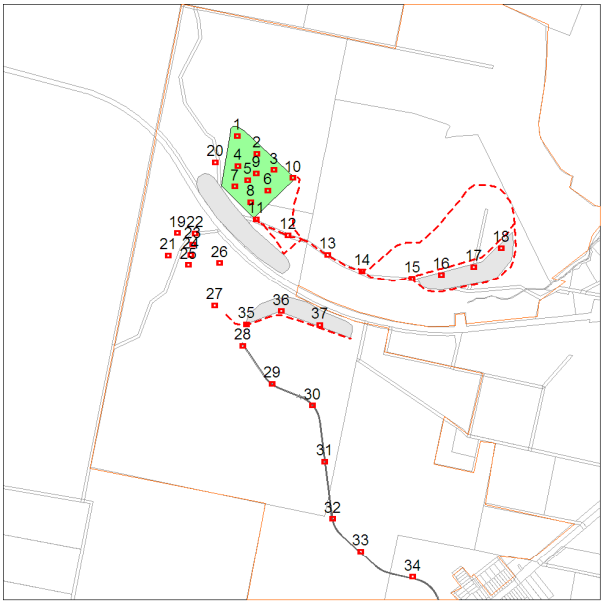
Spring
Calms = 4.4%

FIGURE 4

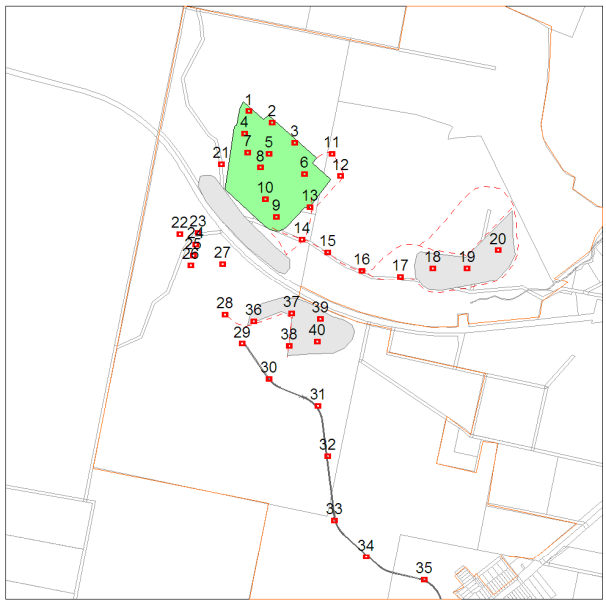


Monitoring for Lynwood quarry

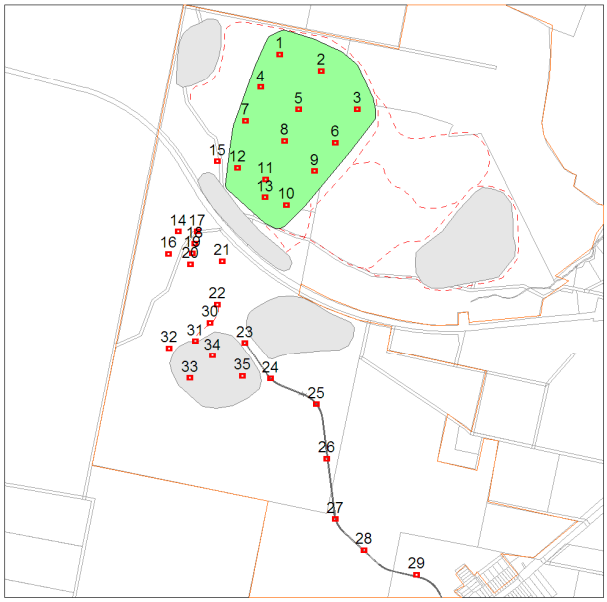
FIGURE 5



Year 5



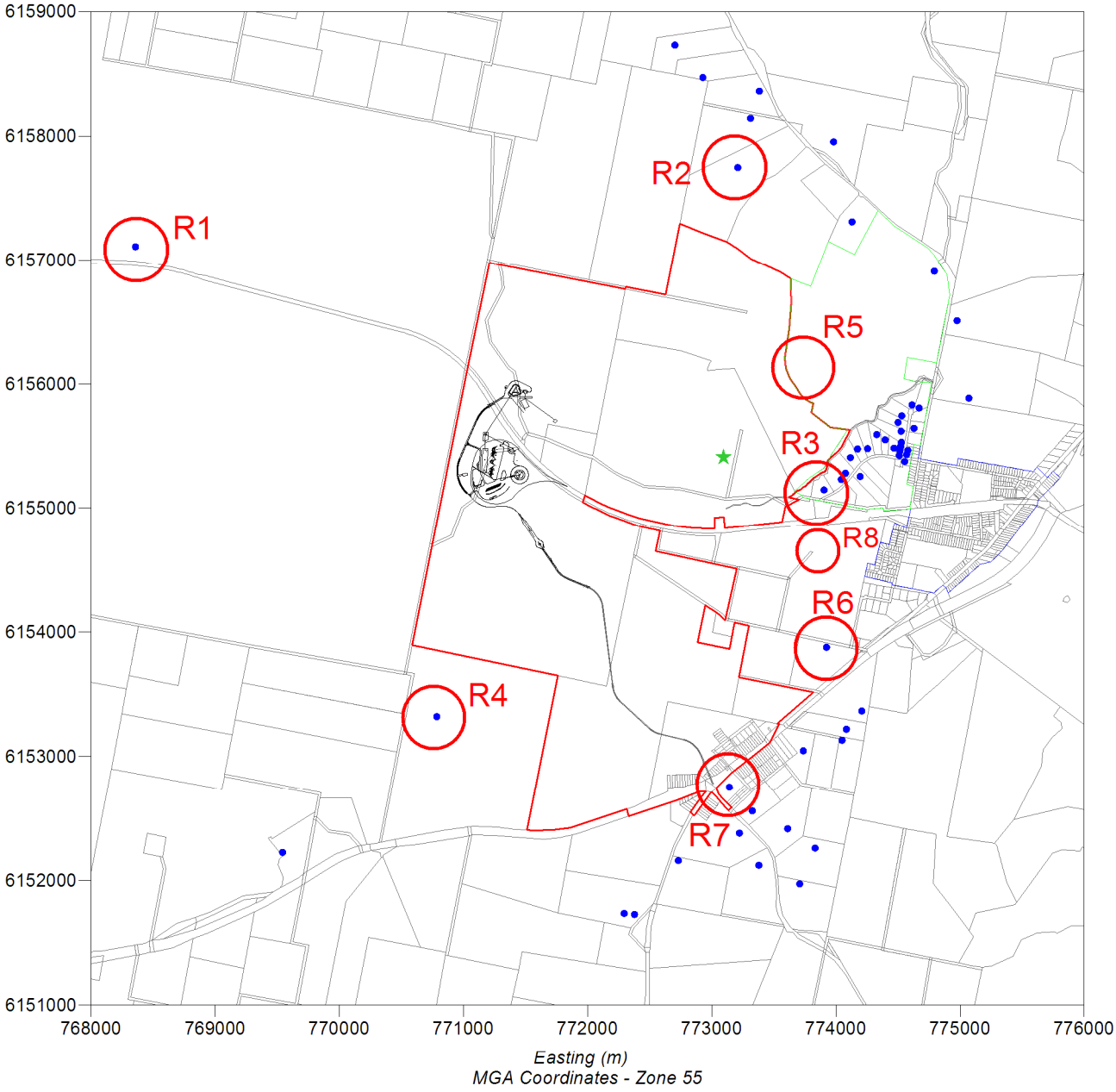
Year 10



Year 30

Modelled dust dources during stages of quarry

FIGURE 6

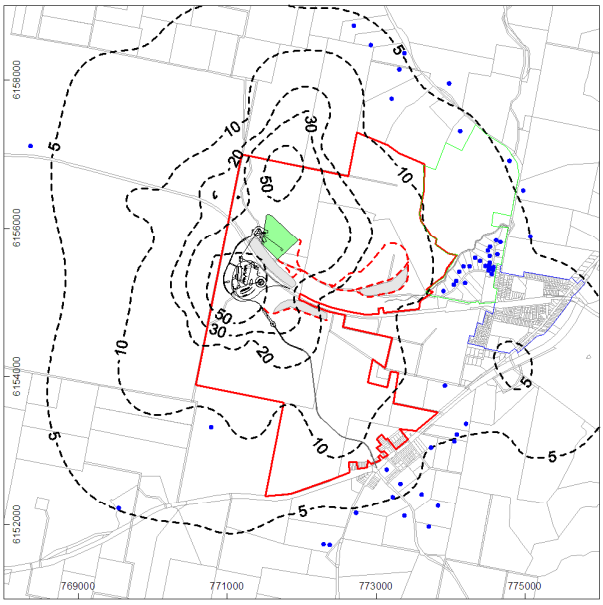


Note: "R5" and "R8" chosen to represent possible future residential locations

Residences selected for the purposes of the assessment

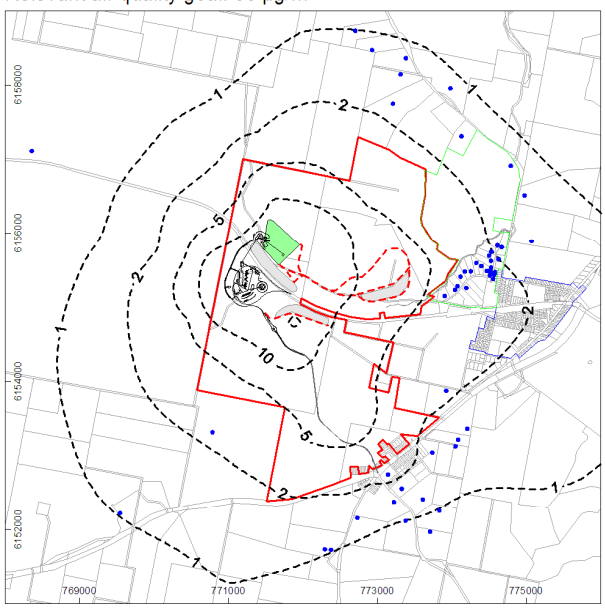
FIGURE 7

Relevant air quality goal: 50 µg/m^3



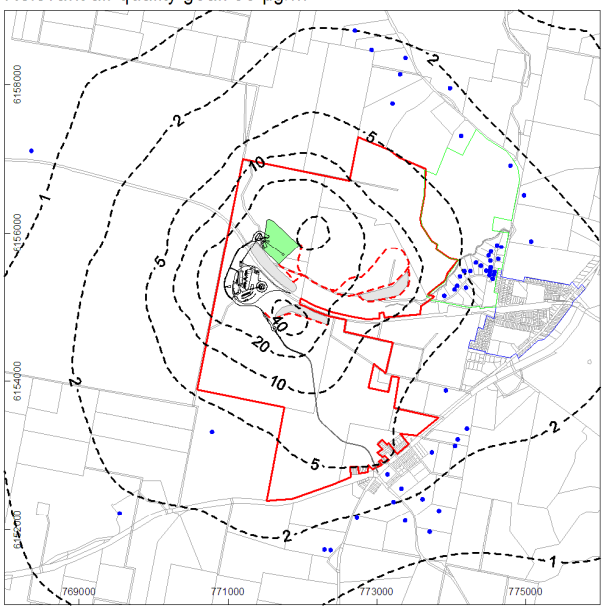
Maximum 24-hour average PM_{10} - µg/m^3

Relevant air quality goal: 30 µg/m^3



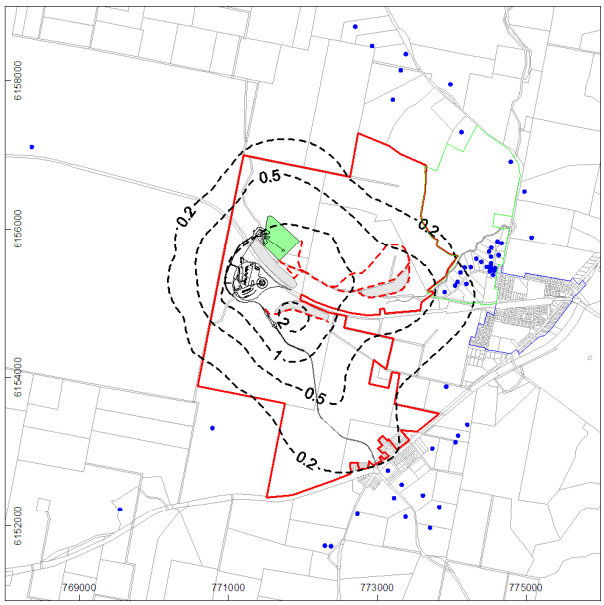
Annual average PM_{10} - µg/m^3

Relevant air quality goal: 90 µg/m^3



Annual average TSP - µg/m^3

Relevant air quality goal: 2 g/m^2/month

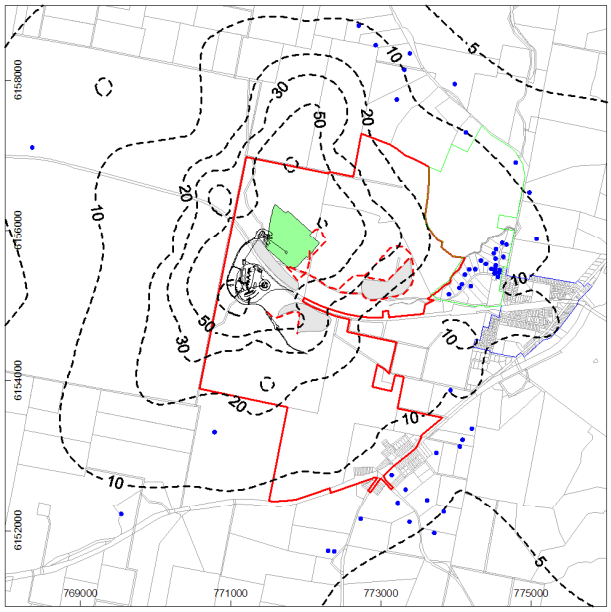


Annual average dust deposition - g/m^2/month

Dispersion model predictions for Year 5 quarry operations

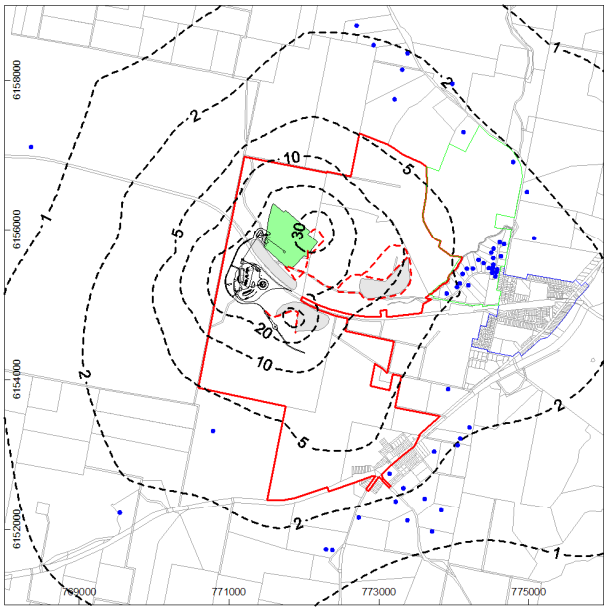
FIGURE 8

Relevant air quality goal: 50 µg/m^3



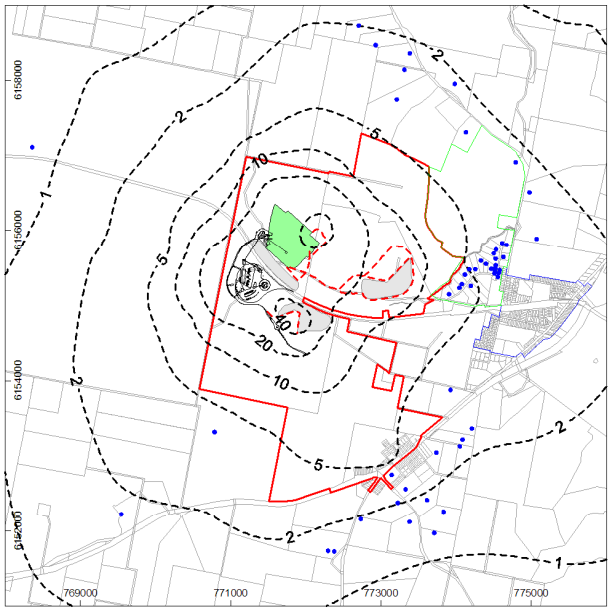
Maximum 24-hour average PM_{10} - µg/m^3

Relevant air quality goal: 30 µg/m^3



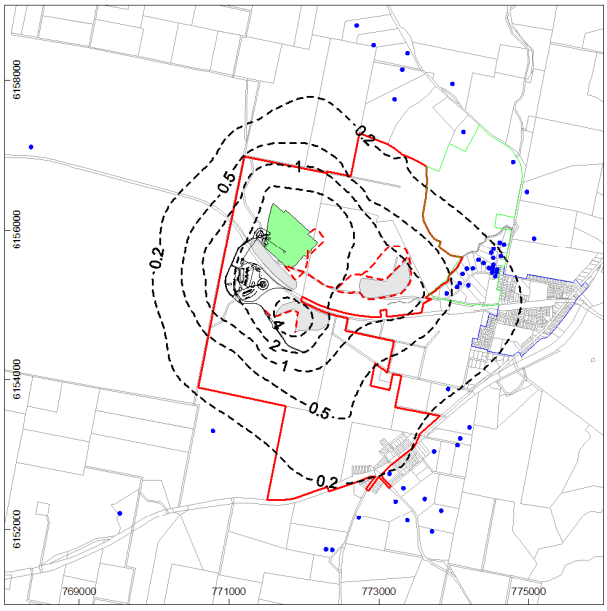
Annual average PM_{10} - µg/m^3

Relevant air quality goal: 90 µg/m^3



Annual average TSP - µg/m^3

Relevant air quality goal: 2 g/m^2/month

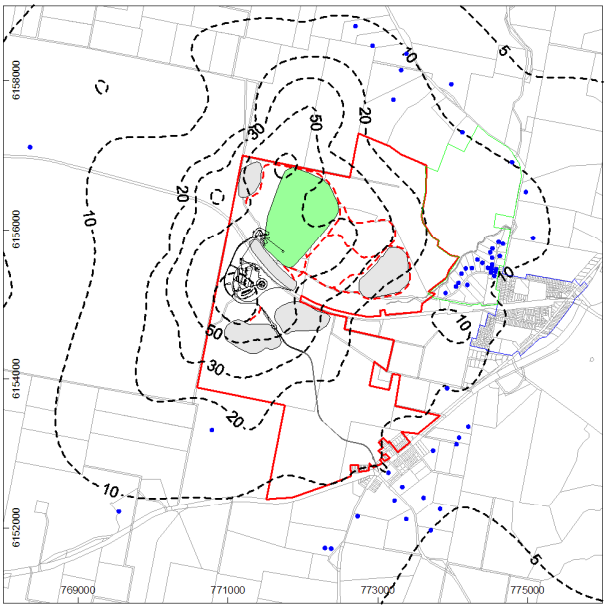


Annual average dust deposition - g/m^2/month

Dispersion model predictions for Year 10 quarry operations

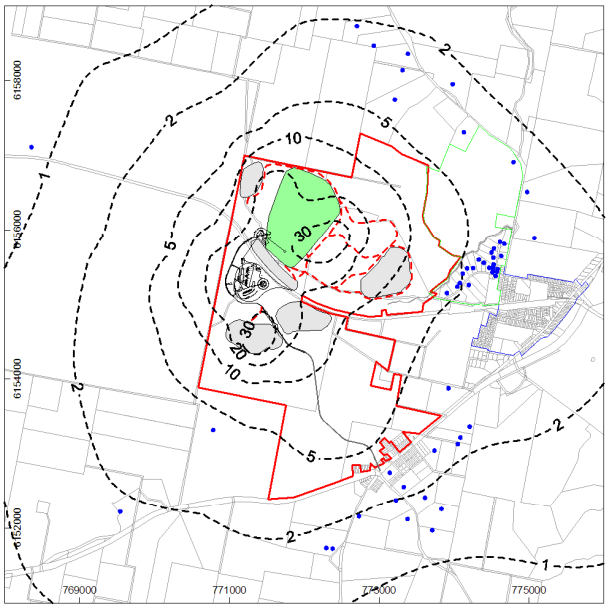
FIGURE 9

Relevant air quality goal: 50 µg/m^3



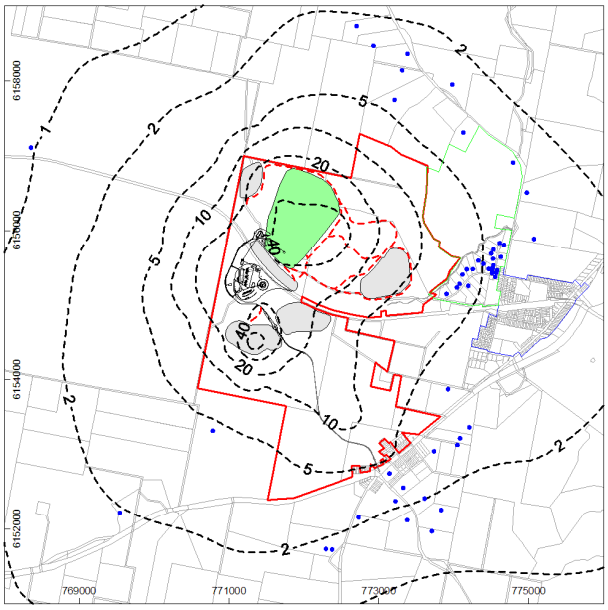
Maximum 24-hour average PM_{10} - µg/m^3

Relevant air quality goal: 30 µg/m^3



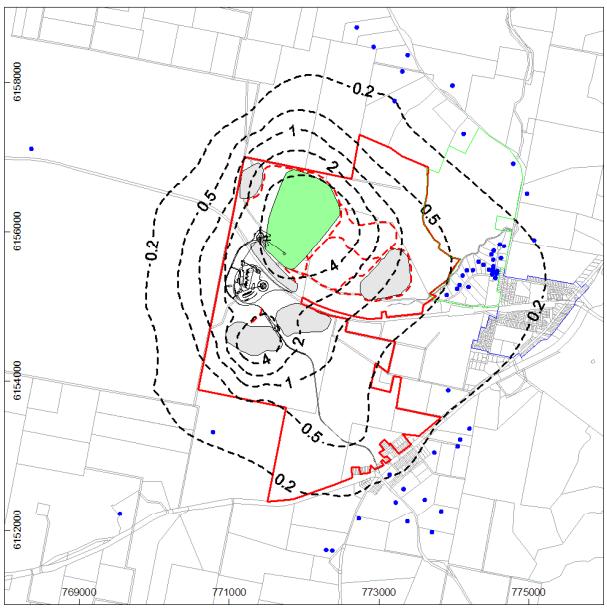
Annual average PM_{10} - µg/m^3

Relevant air quality goal: 90 µg/m^3



Annual average TSP - µg/m^3

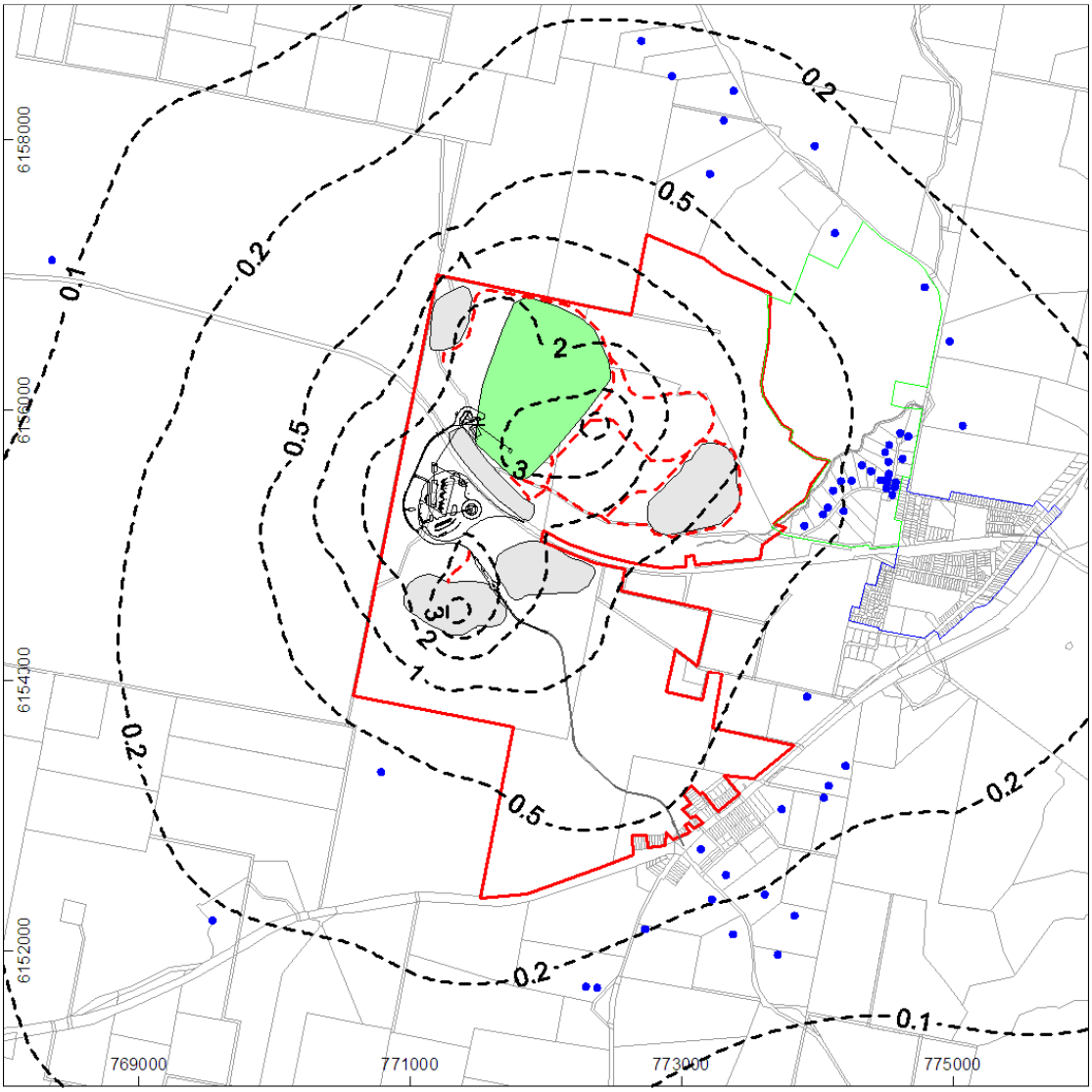
Relevant air quality goal: 2 g/m^2/month



Annual average dust deposition - g/m^2/month

Dispersion model predictions for Year 30 quarry operations

FIGURE 10



Predicted annual average silica concentration for Year 30 quarry operations - µg/m^3

FIGURE 11

APPENDIX 3

Noise Impact Assessment

HEGGIES

9 December 2008

30-1938LR2 Addendum 20081209.doc

Umwelt (Australia) Pty Ltd
PO Box 838
Toronto NSW 2284

Attention: John Merrell

Dear John

Addendum to Lynwood Quarry Noise and Blasting Impact Assessment

1 Introduction

Heggies Pty Ltd (Heggies) has been requested by Umwelt (Australia) Pty Ltd to provide additional noise modelling for the Lynwood Quarry due to changes in the original infrastructure layout and minor changes to the quarry pit layout. This assessment will serve as an addendum to Heggies Report 10-3142R1 *"Lynwood Quarry Noise and Blasting Impact Assessment"*.

2 Assessment of Noise Impacts

2.1 Proposed Modifications

As part of the detailed engineering design required to allow the construction of the project, several opportunities have been identified to improve the project by modifying the originally proposed project design. The key changes proposed to the project include:

- The western extent of the approved quarry footprint has been reduced. The revised quarry footprint will be within the currently approved quarry footprint;
- The layout of the crushing and screening plant has been modified. Some facilities currently approved to be located south of the Main Southern railway are proposed to be relocated to the north of the railway;
- An in-pit primary crusher will be used as opposed to the fixed out-of-pit primary crusher planned as part of the currently approved project. In the early years of the project there will be up to two mobile in-pit crushers, with a fixed in-pit crusher being installed later in the quarry life. This change will also result in a reduction in the size of the mobile equipment quarrying fleet;
- Some other minor changes to project infrastructure are proposed to work more effectively with the changes to the quarry pit and crushing and screening plant layout; and
- Minor changes are proposed to the design of the interchange intersection to be constructed on the Hume Highway, following detailed consultation with the NSW Roads and Traffic Authority.

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Incorporating New Environment Graeme E. Harding & Associates Eric Taylor Acoustics

The maximum production from the quarry along with the rail and road haulage limits will remain unchanged. The design of the out-of-pit emplacement areas will also remain unchanged. The overall components of quarry infrastructure proposed as part of the modified project will remain consistent with that currently approved, with the proposed modifications relating to changes in the layout of these components.

2.2 Operational Noise Modeling

Due to the changes to the quarry layout and operations, noise modeling was performed for the operational scenarios for years 5, 10 and 30. These scenarios were selected as they are representative of the worst case scenarios for the project.

A computer model was used to predict noise emissions from the subject development. The Environmental Noise Model (ENM) used has been produced in conjunction with the Department of Environment and Climate Change (DECC). A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Mobile and fixed noise sources were assumed to be the same as provided in Heggies report 10-3142R1, with the exception of changes due to the proposed modification.

The meteorological parameters used in the noise model for predicting noise emission levels for operation of the quarry at potentially affected receivers are shown in **Table 1.**

Table 1 Noise Modelling Parameters

Assessment Condition	Temperature (°C)	Wind Speed (m/s)	Relative Humidity (%)	Temperature Gradient (°C/100m)
Calm	**20**	**Calm**	**65**	**0**
Evening Prevailing Westerly Wind	10	2.5	80	0
Night Prevailing Westerly Wind	4	2.5	90	0
Temperature Inversion	4	Calm	90	3
Temperature Inversion and Drainage Flow from the South East	4	2.0	90	3
Temperature Inversion and Drainage Flow from the North West	4	2.0	90	3

Under conditions of temperature inversion, drainage flow was considered to occur from the project area either to the south-east or to the north-west as dictated by the surrounding topography.

2.3 Noise Mitigation and Management

Several mitigation methods have been investigated in order to minimise the noise impact on surrounding receiver locations. Mitigation in the form of engineering or management controls have been adopted and included in the noise modelling process. These mitigation methods are the same as described in the Heggies report 10-3142R1 and are as follows:

Engineering controls

- All crushing and screening facilities are enclosed by buildings, except for the primary crusher, and spalls plant.
- The pug mills are enclosed by a building.
- The scalps screen has a rubber screen deck.

- Train and truck loading bins are lined on the base to reduce impact noise when bins are being loaded from empty.
- Trucks dumping the leading row of overburden on the eastern overburden emplacement area will have attenuation to a maximum sound power level of 111 dBA when dumping.

Management Controls

- The spalls plant will operate during the daytime only.
- The grader will operate during the daytime only.
- The overburden removal and emplacement fleet will operate during the daytime only.
- When operating on the eastern emplacement areas, the majority of operations occurring on the top of the emplacement areas will occur behind an earth mound created by the first row of dumping.
- The load and haul fleet will operate during the daytime and evening only.
- No dumping will occur on the leading edge of either the eastern overburden emplacement area or the eastern excess product emplacement area will occur while the dozer is operating on the leading face of either the aforementioned emplacement areas.
- The number of finished product trucks at night shall be limited to 32 movements per hour.

2.4 Noise Modeling Results

Predicted noise levels for plant operations for both calm and prevailing weather conditions for year 5, 10 and 30 are shown in **Table 2, Table 3,** and **Table 4** respectively. Predicted noise levels presented under the influence of a temperature inversion were the highest predicted noise levels obtained from either modeling under temperature inversion scenario or modeling under a temperature inversion with a drainage flow.

Table 2 Operational Noise Modelling Results for Year 5

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)			Project Specific Noise Criteria $L_{Aeq(15minute)}$ (dBA)
		Calm	Prevailing Wind	Temperature Inversion	
Location 1	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	31	35
Location 2	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	<30	35
Location 3	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	<30	35
Location 4	Daytime	<30	N/A	N/A	35
	Evening	<30	31	N/A	37
	Night	<30	31	31	35
Location 5	Daytime	30	N/A	N/A	35
	Evening	<30	32	N/A	35
	Night	<30	32	32	35
Location 6	Daytime	35	N/A	N/A	35
	Evening	<30	33	N/A	37
	Night	<30	34	34	36
Location 7	Daytime	31	N/A	N/A	38
	Evening	<30	32	N/A	38
	Night	<30	32	33	35
Location 8	Daytime	32	N/A	N/A	39
	Evening	<30	33	N/A	38
	Night	<30	33	36	36
Location 9	Daytime	31	N/A	N/A	39
	Evening	<30	37	N/A	39
	Night	<30	33	35	37
Location 10	Daytime	38	N/A	N/A	42
	Evening	38	41	N/A	42
	Night	38	40	40	40
Location 11	Daytime	31	N/A	N/A	35
	Evening	<30	32	N/A	35
	Night	<30	<30	32	35
Location 12	Daytime	34	N/A	N/A	37
	Evening	<30	30	N/A	37
	Night	<30	<30	<30	36
Location 13	Daytime	35	N/A	N/A	40
	Evening	<30	35	N/A	38
	Night	<30	35	37	37
Location 14	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	32	35

Notes For Monday to Saturday, Daytime 7.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am.
On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.

Table 3 Operational Noise Modelling Results for Year 10

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)			Project Specific Noise Criteria $L_{Aeq(15minute)}$ (dBA)
		Calm	Prevailing Wind	Temperature Inversion	
Location 1	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	31	35
Location 2	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	<30	35
Location 3	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	<30	35
Location 4	Daytime	30	N/A	N/A	35
	Evening	<30	34	N/A	37
	Night	<30	31	31	35
Location 5	Daytime	32	N/A	N/A	35
	Evening	<30	33	N/A	35
	Night	<30	32	32	35
Location 6	Daytime	34	N/A	N/A	35
	Evening	<30	34	N/A	37
	Night	<30	34	34	36
Location 7	Daytime	31	N/A	N/A	38
	Evening	<30	33	N/A	38
	Night	<30	32	33	35
Location 8	Daytime	33	N/A	N/A	39
	Evening	<30	38	N/A	38
	Night	<30	33	35	36
Location 9	Daytime	32	N/A	N/A	39
	Evening	<30	35	N/A	39
	Night	<30	33	35	37
Location 10	Daytime	38	N/A	N/A	42
	Evening	38	40	N/A	42
	Night	38	40	40	40
Location 11	Daytime	31	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	32	35
Location 12	Daytime	34	N/A	N/A	37
	Evening	<30	35	N/A	37
	Night	<30	<30	<30	36
Location 13	Daytime	36	N/A	N/A	40
	Evening	<30	38	N/A	38
	Night	<30	35	37	37
Location 14	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	35	35

Notes For Monday to Saturday, Daytime 7.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am.
On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.

Table 4 Operational Noise Modelling Results for Year 30

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)			Project Specific Noise Criteria $L_{Aeq(15minute)}$ (dBA)
		Calm	Prevailing Wind	Temperature Inversion	
Location 1	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	31	35
Location 2	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	<30	35
Location 3	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	<30	35
Location 4	Daytime	<30	N/A	N/A	35
	Evening	<30	30	N/A	37
	Night	<30	31	31	35
Location 5	Daytime	<30	N/A	N/A	35
	Evening	<30	32	N/A	35
	Night	<30	32	32	35
Location 6	Daytime	<30	N/A	N/A	35
	Evening	<30	33	N/A	37
	Night	<30	34	34	36
Location 7	Daytime	<30	N/A	N/A	38
	Evening	<30	32	N/A	38
	Night	<30	32	33	35
Location 8	Daytime	<30	N/A	N/A	39
	Evening	<30	33	N/A	38
	Night	<30	33	34	36
Location 9	Daytime	<30	N/A	N/A	39
	Evening	<30	32	N/A	39
	Night	<30	33	34	37
Location 10	Daytime	38	N/A	N/A	42
	Evening	37	40	N/A	42
	Night	37	40	40	40
Location 11	Daytime	31	N/A	N/A	35
	Evening	<30	31	N/A	35
	Night	<30	<30	32	35
Location 12	Daytime	<30	N/A	N/A	37
	Evening	<30	30	N/A	37
	Night	<30	<30	<30	36
Location 13	Daytime	<30	N/A	N/A	40
	Evening	<30	35	N/A	38
	Night	<30	35	36	37
Location 14	Daytime	<30	N/A	N/A	35
	Evening	<30	<30	N/A	35
	Night	<30	<30	35	35

Notes For Monday to Saturday, Daytime 7.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am.
On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.

2.5 Sleep Disturbance

Noise modeling conducted in Heggies report 10-3142R1 for sleep disturbance included using the L_{A1} noise level of a truck loading and train loading from each of the loading bins using the ground contours for the year one scenario. The loading of trucks and the rail bins was considered to have the most potential to cause sleep disturbance impacts. As there will be no change to this operation the predicted sleep disturbance levels will remain unaffected.

3 Conclusion

Based on the foregoing, the estimated year 5, 10 and 30 operational noise levels do not exceed the respective criteria for daytime, evening and night-time periods at all residential locations. The proposed changes to the operation and layout of Lynwood Quarry would result in insignificant changes to the noise levels generated by the development.

The cumulative noise impact of the Lynwood Quarry in conjunction with other industrial developments in the area would not change as a result of this proposal over that calculated in the previous assessment.

I trust that the preceding is suitable for you current requirements. If you need further information please contact me on Ph 4908 4500 or email john.cotterill@heggies.com.

Regards

John Cotterill
Heggies Pty Ltd

APPENDIX 4

Greenhouse Gas and Energy Assessment

Greenhouse Gas Emissions and Energy Consumption Assessment

CEMEX Lynwood Quarry Project

Prepared by

SEE Sustainability Consulting

January 2009

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1. Introduction

A Greenhouse Gas and Energy Assessment was prepared for the proposed modifications to the CEMEX Lynwood Quarry Project (the Project). This assessment replaces an assessment prepared for the original DA for the Project, and incorporates the changes for which approval is sought.

This assessment of Scope 1, 2 and 3 greenhouse emissions reviews the main sources of greenhouse gases from the Project including:

- direct emissions of CO_2 from the combustion of diesel in mobile equipment used on site (Scope 1);
- direct emissions of CO_2 from the use of explosives on-site (Scope 1);
- indirect emissions of CO_2 from the consumption of electricity on-site (Scope 2); and
- indirect emissions of CO_2 from the combustion of diesel for product transport by road and rail from the Project (Scope 3).

The greenhouse assessment is based upon the methodologies outlined in:

- the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) Greenhouse Gas Protocol 2004 (GHG Protocol); and
- the Australian Government Department of Climate Change (DoCC) National Greenhouse Accounts (NGA) Factors, January 2008 *(replacing the Australian Greenhouse Office Factors and Methods Workbook)*.

The Scope 1, 2 and 3 Greenhouse Gas and Energy Assessment has been prepared using information provided by CEMEX regarding:

- estimated annual electricity consumption;
- estimated on site annual diesel consumption;
- estimated product destinations and transport distances via road and rail.

The GHG Protocol defines three “scopes” of emission categories as listed below:

- Scope 1 – energy use from sources owned or operated by the organisation;
- Scope 2 – purchased electricity, heat, cooling or steam; and
- Scope 3 – electricity transmission and distribution losses, energy used in the production of fuels used for electricity generation and transport and the energy used in the transportation of products.

Scope 1 and 2 are required to be included in an assessment report, whilst Scope 3 is optional. All three scopes have been completed for this project in order to provide a comprehensive assessment.

Consistent with the methodologies previously described, Scope 3 emissions not included in the greenhouse inventory for the assessment are:

- disposal of waste generated;
- disposal (end of life) of products sold;
- employee business travel;
- employees commuting to and from work;

- extraction, production and transport of other purchased materials and goods;
- out sourced activities; and
- transport of materials and waste off site.

(DoCC, *National Greenhouse Accounts (NGA) Factors*, 2008, p5-6)

For environmental assessments completed for approvals under the *Environmental Planning and Assessment Act*, the Director General's Requirements typically call for Scope 3 emissions associated with the end use of the product to be considered. For example, in coal mining the emissions associated with burning the coal are considered. However, in this case the stone products do not have energy values or associated emissions, so Scope 3 emissions associated with the end use of the products have not been considered.

2. Greenhouse Gas Emissions and Energy Consumption Assessment

Estimates of energy use and greenhouse emissions at a production rate of 5 Mtpa saleable product are shown in **Tables 1** and **2** respectively, based on 3.5 Mtpa transported via rail and 1.5 Mtpa transported via road.

2.1. Assumptions

Estimates of diesel consumption for mobile equipment and electricity consumption for material handling were used to calculate total energy consumption, using data provided by CEMEX based on the project design and its experience at other operations, as follows:

- On-site diesel consumption at 5 MTpa = 2,184 kL pa;
- On-site electricity consumption at 5 MTpa = 31,898,703 kWh pa;
- Explosives (emulsion) consumption at 5 MTpa = 1,659Tonnes pa.

Diesel consumption from product transport by rail was based on:

- 380 km round trip to Sydney unloading facility;
- Fuel efficiency of 0.008748906 L/Tkm (same as used for previous assessment).

Diesel consumption from product transport by road was based on:

- All road transport going to Sydney metropolitan destinations as shown in Table 3;
- Fuel efficiency of 0.505 L/km (same as used for previous assessment).

Emissions factors were obtained from the Australian Government Department of Climate Change (DoCC) National Greenhouse Accounts (NGA) Factors, January 2008 *(replacing the Australian Greenhouse Office Factors and Methods Workbook)*.

Table 1 – Predicted Annual Energy Use at Maximum Production

	Product Tonnes per annum	Emissions Source	Scope 1 Usage (Direct)	Scope 2 Usage (Indirect)	Scope 3 Usage (Indirect)	Total Usage	Units	Energy Content / Unit	Total Energy in GJ	% of Energy	GJ/T Product
Quarry Site	5,000,000	Electricity		31,898,703		31,898,703	kWh	0.0036	114,835	13.7	0.023
		On-Site Diesel	2,184			2,184	kL	38.6	84,302	10.0	0.017
		Explosives (emulsion)	1,659			1,659	Tonnes	0	-	0.0	0.000
		Quarry Total	**3,843**	**31,898,703**	**-**	**31,902,546**			**199,138**	**23.7**	**0.040**
Road Transport	1,500,000	Diesel			8,018	8,018	kL	38.6	309,494	36.9	0.206
Rail Transport	3,500,000	Diesel			8,577	8,577	kL	38.6	331,075	39.4	0.095
		Total							**839,708**	**100.0**	**0.168**

Table 2– Predicted Annual Greenhouse Emissions at Maximum Production

	Product Tonnes per annum	Emissions Source	Total Energy in GJ	Emissions Factor for Scope 1 (Direct)	Scope 1 Emissions in TCO2e (Direct)	Emissions Factor for Scope 2 (Indirect)	Scope 2 Emissions in TCO2e (Indirect)	Emissions Factor for Scope 3 (Indirect)	Scope 3 Emissions in TCO2e (Indirect)	Total Emissions in TCO2e (Full Fuel Cycle)	% of Emissions	TCO2e/T Product
Quarry Site	5,000,000	Electricity	114,835	0		0.89	28,390	0.17	5,423	33,813	38.2%	0.007
		On-Site Diesel	84,302	2.7	5,897			0.2	437	6,334	7.2%	0.001
		Explosives (emulsion)	-	0.17	282				-	282	0.3%	0.000
		Quarry Total	**199,138**		**6,179**		**28,390**		**5,860**	**40,428**	**45.7%**	**0.008**
Road Transport	1,500,000	Diesel	309,494		-			2.9	23,252	23,252	26.3%	0.016
Rail Transport	3,500,000	Diesel	331,075		-			2.9	24,874	24,874	28.1%	0.007
		Total	**839,708**		**6,179**		**28,390**		**53,985**	**88,554**	**100.0%**	**0.018**

Table 3 – Assumptions Regarding Daily Deliveries to Plants in the Sydney Metropolitan Area for 1.5 MTpa for Assessment Proposes

Plant No.	Plant	Average Loads / Day	Round Trip km
5411	Alexandria	11	326
5412	Artarmon	29	350
5413	Blacktown	18	333
5414	Brookvale	6	370
5415	Caringbah	2	332
5424	Emu Plains	9	344
5428	Erskine Park	11	341
5416	Hornsby	7	368
5417	Hurstville	5	310
5418	Lidcombe	22	343
5419	Liverpool	4	280
5420	Narellan	3	238
5421	Pendle Hill	14	328
5423	Windsor	5	374
5527	Humes Rooty Hill	4	310
400746	Downer Rosehill	12	340
	Total	**162**	

Note: The above assumptions regarding product delivery by road are for assessment proposes only and destinations and number of deliveries may change from that shown above.

3. Summary of Assessment

Energy Consumption:

- Total energy consumption (including product transport) is 839,708 GJ and is dominated by diesel use which represents 86.3% of total consumption;
- On-site diesel consumption at the quarry represents 10% of total energy consumption by the Project, rail transport represents 39.4% of total energy consumption, and road transport represents 36.9% of total energy consumption. Total diesel use is 724,871 GJ (18,779 kL);
- Electricity represents 13.7% of total energy consumption;
- Energy intensity measured as energy consumption (including product transport) per unit of output is 0.168 GJ/tonne of material.

Greenhouse Gas Emissions:

- Total annual greenhouse emissions (including product transport) are 88,554 TCO_2-e;
- Scope 1 and 2 emissions associated with on-site energy use are 34,569 TCO_2-e or 39.0% of the total emissions associated with the Project;
- Scope 3 emissions associated with product transport are 48,126 TCO_2-e or 54.4% of the total emissions associated with the Project;
- Total Scope 3 emissions are 53,985 TCO_2-e or 61.0% of the total emissions;
- Emissions from the consumption of diesel (on-site and product transport) represent approximately 61.5% of total emissions;
- Emissions from the consumption of electricity represent approximately 38.2% of total emissions;

- Emissions from the use of explosives represent less than 1% of total emissions;
- The predicted greenhouse emissions from the proposed modified Lynwood Quarry represent approximately 0.015% of Australia's total greenhouse gas emissions of around 576 million TCO_2-e p.a. (DoCC, National Greenhouse Inventory 2006).

4. Impact of Maximum Rail Transport Scenario

The Project currently has approval to allow transport of the entire 5 Mtpa saleable product to Sydney markets by rail, should CEMEX so desire based on future markets. Tables 1 and 2 are based on 3.5 Mtpa by rail and 1.5 Mtpa by road as this is considered a worst-case energy and greenhouse option. A comparison assessment is included below for a 5 Mtpa by rail case.

The option of transporting 100% of the product from Lynwood Quarry to Sydney by rail would result in a decrease in energy use and associated greenhouse emissions. Energy consumption would decrease by 167,605 GJ to 672,103 GJ (20% reduction) and greenhouse emissions would decrease by 12,592 TCO_2-e to 75,962 TCO_2-e (14% reduction).

This calculation does not consider the effects of additional road transport from the Sydney rail terminal, which is subject to a separate approval.

5. Changes from Previous Greenhouse Gas Assessment

The following is a summary of the changes to the energy consumption and greenhouse gas assessment from the previous assessment:

- Updated emission factors have been used. The previous assessment used emissions factors from the AGO Factors and Methods Workbook 2004, which has been superseded by the Australian Government Department of Climate Change National Greenhouse Accounts (NGA) Factors, January 2008. In some cases the new emissions factors are different;
- Electricity consumption from quarry equipment changed from 31,899,000 to 31,898,703 kWh pa for a production level of 5 MTpa, based on data provided by CEMEX;
- Estimated on-site diesel consumption decreased due to the change to the use of an in-pit crusher as opposed to a fixed out-of-pit primary crusher. Expected on-site diesel consumption has therefore decreased from 2,359kL to 2,184kL per annum;
- The above three changes result in lower predicted emissions associated with on-site energy consumption (i.e. Scope 1 and 2 emissions) of 34,569 TCO_2-e compared with 35,132 TCO_2-e from the previous assessment;
- Road transport destination assumptions have changed to reflect the transportation of 1.5 MTpa to Sydney metropolitan sites by road. Previously it was assumed that the 1.5 MTpa allocated for road transport would be to local area destinations, Illawarra, ACT and Southern Sydney. Therefore, Scope 3 emissions from road transport have increased from 17,718 TCO_2-e to 23,252 TCO_2-e;
- Rail transport assumptions are unchanged but a change to emission factors has resulted in a slight decrease in emissions from 25,731 TCO_2-e to 24,874 TCO_2-e;
- Therefore Scope 3 emissions associated with product transport have increased from 43,449 TCO_2-e to 48,126 TCO_2-e;
- Total Scope 3 emissions have increased from 49,254 TCO_2-e to 53,985 TCO_2-e;
- Total emissions associated with the project (i.e. Scope 1, 2 & 3 emissions) have increased from 84,386 TCO_2-e to 88,554 TCO_2-e.

6. References

Australian Government Department of Climate Change (DoCC)*, National Greenhouse Accounts (NGA) Factors,* January 2008, Canberra.

Australian Government Department of Climate Change (DoCC), *National Greenhouse Inventory 2006*, 2008 Canberra.

World Business Council for Sustainable Development and World Resources Institute, *Greenhouse Gas Protocol,* 2004, Washington DC.

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