Proposed quicklime plant and limestone quarry at Nowergup, near Wanneroo

Swan Portland Cement Ltd

Report and recommendations of the Environmental Protection Authority

Environmental Protection Authority
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Summary and recommendations

Swan Portland Cement Ltd propose to quarry limestone and construct and operate a quicklime plant in the Nowergup area, approximately 13 km north of Wanneroo. The company currently manufactures cement and quicklime at Rivervale.

The proposal was referred to the Environmental Protection Authority in August, 1990 and the level of assessment was set at Consultative Environmental Review. Swan Portland Cement Ltd prepared a Consultative Environmental Review which was released over a four week period in May and June, 1991. During this time eighteen private and seven government submissions were received by the Authority. The proponent organized two public meetings at the initially proposed plant site, one before and one after the review period.

The Authority has assessed the potential environmental impacts of the proposal, both as described in the Consultative Environmental Review, and as modified by the proponent subsequent to the public review period, when the location of the plant site was changed.

Environmental issues such as conservation of rare flora populations of *Eucalyptus "argutifolia"*, rehabilitation of quarried areas, protection of the groundwater resources, noise, dust, gaseous emissions, traffic and visual impacts on the surrounding residents, have been considered in the assessment. Many of these issues have been addressed by the proponent with a comprehensive set of commitments. As a result of relocating the proposed plant site to a more acceptable location in the south-eastern sector of the leases, major potential environmental impacts have been resolved. The Authority commends Swan Portland Cement Ltd for their efforts in identifying these issues, and for their flexible approach in dealing with them.

Based on its assessment of the proposal and additional information provided by the proponent in response to questions raised as a result of the assessment process, the Authority makes the following conclusions and recommendations:

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Swan Portland Cement Ltd to quarry limestone and to construct and operate a quicklime plant at Nowergup, as outlined in the Consultative Environmental Review and subsequently modified during the process of interaction between the proponent, the Environmental Protection Authority, and government agencies, and those members of the public who were consulted, is environmentally acceptable.

In reaching this conclusion, the Authority identified the main issues requiring detailed consideration as:

- **conservation of native vegetation, particularly *Eucalyptus "argutifolia"*;**
- **rehabilitation of the quarried area;**
- **protection of water resources;**
- **noise and dust impacts from the quarrying operations;**
- **noise, dust and gaseous emissions from the quicklime plant;**
- **visual impacts from the plant and quarry; and**
- **traffic and other social impacts.**

The Environmental Protection Authority considers that these and other issues, such as planning considerations, have been addressed and are manageable, either by changes to the proposal by the proponent during assessment, the environmental management commitments given by the proponent, or by the Environmental Protection Authority's recommendations in this report.

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed, subject to the proponent's modified commitments (Appendix 1) and the Environmental Protection Authority's recommendations in this report.

Recommendation 2

The Environmental Protection Authority recommends that the Department of Conservation and Land Management, in consultation with the Department of Planning and Urban Development and the Department of Mines, should prepare a management programme for *Eucalyptus "argutifolia"*, which should consider the future land use of Swan Portland Cement Ltd's lease and the protection of the populations of *Eucalyptus "argutifolia"*, after quarrying ceases in the lease area.

Recommendation 3

The Environmental Protection Authority recommends that the proponent be required to ensure that the introduced noise from the project does not cause the noise in the surrounding residential areas to exceed:

- **50dB(A) from 7am to 7pm Monday to Saturday;**
- **45dB(A) on Sunday and from 7pm to 10pm Monday to Saturday; and**
- **40dB(A) from 10pm to 7am every day.**

These levels should not be viewed as normal operating levels for the project. They are the upper limits above which action will be taken by the Environmental Protection Authority. The Environmental Protection Authority considers that noise below these levels is not unreasonable provided it does not include tonal components, impulses or other intrusive characteristics.

Recommendation 4

The Environmental Protection Authority recommends that the proponent should prepare and implement an Environmental Management Programme to the satisfaction of the Environmental Protection Authority. This programme should enable the proponent to detect, manage and report any impacts on the environment which are not addressed by other recommendations in this report. Plans to be prepared as part of the Environmental Management Programme should include, but not necessarily be limited to:

- **clearing of native vegetation;**
- **conservation of *Eucalyptus "argutifolia"*;**
- **rehabilitation of quarried sites and haul roads;**
- **water quality protection;**
- **dust impacts associated with the quarrying and transportation operations;**
- **auditing of Greenhouse gas emissions;**
- **visual impacts and landscaping;**
- **social impacts; and**
- **periodic reporting of monitoring results and consequential changes to environmental management.**

The timing of the preparation and review of these plans should be to the satisfaction of the Environmental Protection Authority.

The quicklime plant will be a prescribed premises under Part V of the Environmental Protection Act (1986) and accordingly the proponent will be required to obtain a Works Approval prior to constructing the plant and a Licence prior to operating the plant. Normal industry performance standards will be set by the Authority.

Recommendation 5

The Environmental Protection Authority recommends that the pollution control aspects associated with the plant, including the monitoring and reporting of compliance with requirements for noise, dust, and gaseous emissions, should be controlled through conditions imposed by a Works Approval and subsequently, a Licence, under the Environmental Protection Act (1986).

The Authority points out that Swan's compliance with Ministerial Conditions and the conditions of the Works Approval and Licence will be periodically audited. Pollution control limits and other conditions for the quicklime plant will periodically reviewed and may be modified by the Authority in the light of operating experience.

1. Introduction

Swan Portland Cement Ltd propose to quarry limestone, and construct and operate a quicklime plant in the Nowergup area, approximately 13 km north of Wanneroo (Figure 1). The company currently manufactures cement and lime at Rivervale, close to the central business district of Perth.

The proposal was referred to the Environmental Protection Authority in August, 1990 and the level of assessment was set at Consultative Environmental Review. Concern was expressed by the Department of Conservation and Land Management about the company's intentions to quarry limestone on leases within that Department's proposed extensions to the Yanchep National Park. The proposal was subsequently modified by Swan Portland Cement Ltd to incorporate only the leases in the Nowergup area. The Consultative Environmental Review was released for a four week review period in May 1991, with submissions closing on 6 June 1991. Two public meetings were held at the initially proposed plant site near Wesco Road, one before and one after the review period.

The Authority has assessed the potential environmental impacts of the proposal, both as described in the Consultative Environmental Review, and as modified by the proponent subsequent to the public review period when the location of the plant site was changed.

Environmental issues, such as clearing of native vegetation, conservation of rare flora populations of *Eucalyptus "argutifolia"*,[1] rehabilitation of quarried areas, protection of the groundwater resources, noise, dust, gaseous emissions, traffic and visual impacts on the surrounding residents, have been considered in the assessment. Many of these issues have been addressed by the proponent with a comprehensive set of commitments (Appendix 1). Potentially major social and planning impacts have been addressed, mainly by relocating the plant site to a more acceptable location in the south-eastern sector of the leases (Figure 2).

2. The proposal

2.1 Need for project

The market demand for quicklime and associated products in Western Australia is about 750,000 tonnes per annum, of which Swan Portland Cement Ltd (Swan) presently supplies about 30,000 tonnes per annum from its Rivervale site. About 60% of the quicklime is used by the alumina industry, 25% in gold processing, and 10% in mineral sands processing. The remainder is used in steel manufacture, building, agricultural and environmental applications.

The State has recognised the strategic importance of lime deposits close to existing industry and infrastructure in its planning procedures. The Department of Planning and Urban Development has designated a large area in the Nowergup district as a Basic Raw Materials Priority Area for limestone extraction.

This is the second proposal to be referred to the Authority since 1989 to build major quicklime production facilities, reflecting the growing demand for quicklime in the State. Most of the current production of quicklime in Western Australia depends on limesand deposits in the environmentally sensitive Cockburn Sound. Land-based limestone deposits, although harder and normally higher in free silica content, can now be upgraded through the introduction of new technology, to produce quicklime that can also be lower in contaminants (such as magnesium) than the marine-based deposits.

[1] The official botanial name of *Eucalyptus argutifolia* is yet to be confirmed.

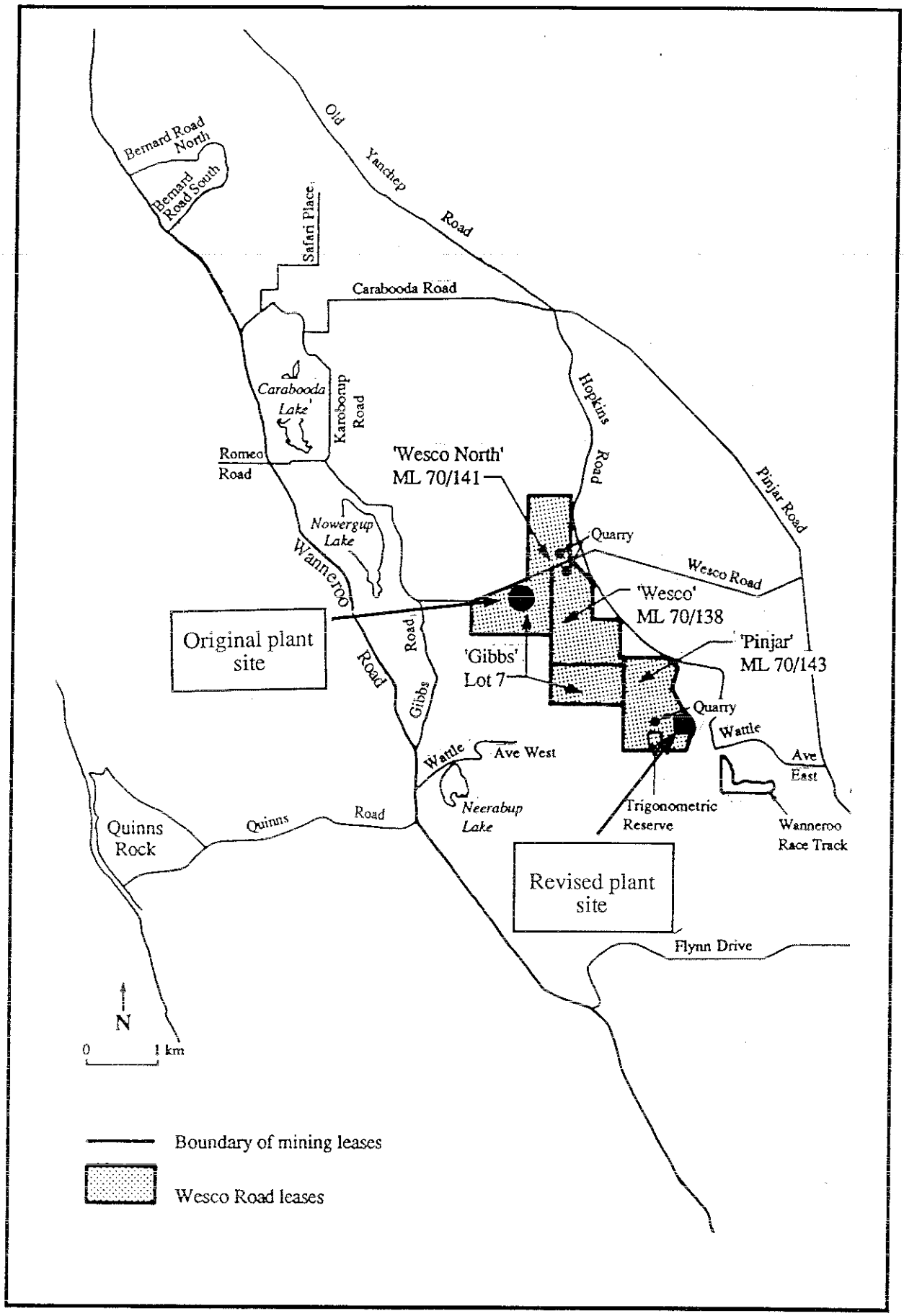

Figure 1. Location map (Source: Swan's CER).

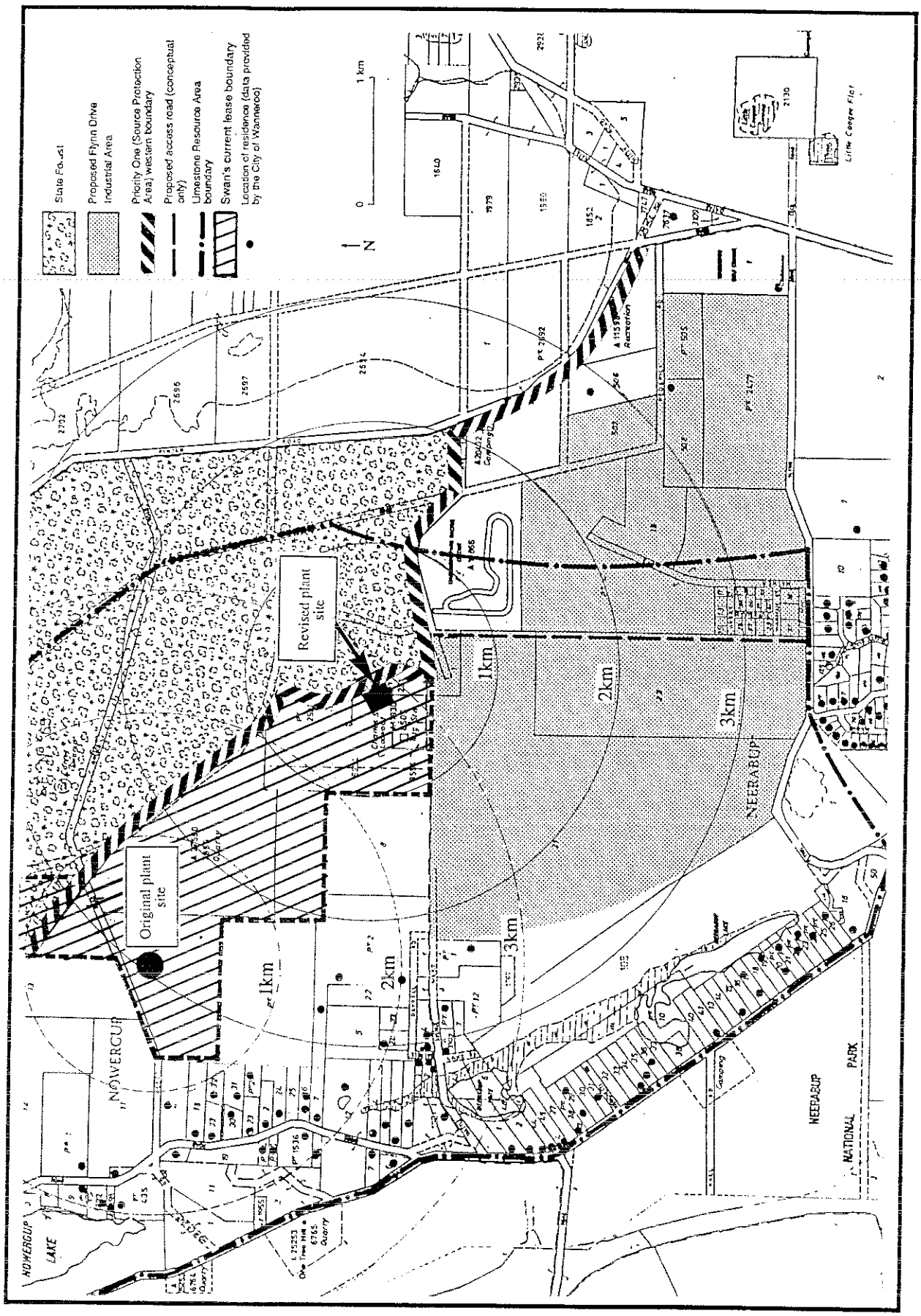

Figure 2. Proximity of proposed plant sites to residences (Source: Modified from Swan's response to submissions).

2.2 Modifications to proposal as outlined in Consultative Environmental Review

2.2.1 Environmental problems of Wesco Road plant site

It became apparent to Swan during the public review that there were major environmental and social problems associated with the location of the quicklime plant off Wesco Road, as proposed in the Consultative Environmental Review (CER). These issues are discussed below:

- **Traffic**

  The shortest route to the Wesco Road plant site for most vehicles would have been along Gibbs Road, which is also the main access route for more than 20 residences, and is used for the school bus route. Despite Swan's commitment to divert quicklime tankers from Gibbs Road, the company would not have been able to prevent the construction and operating workforce from using this route. Gibbs Road currently has difficulty handling local traffic, which includes numerous trucks carting limestone through the area. Traffic associated with a quicklime plant on Wesco Road would have contributed significant additional noise and safety impacts on the local community.

- **Visual impacts**

  The most prominent component of the quicklime plant would be the calciner, which would stand 65m high (equivalent to about a 17 storey building). Although situated at 65m above Australian Height Datum (AHD) behind a ridge to the west (92m AHD), a plant near Wesco Road would still be visible to nearby residents, who are located on the west side at elevations ranging from 25 to 45m AHD. This situation would worsen with time, as the ridge shielding the plant would be mined out for limestone, and as the area becomes more populated.

- **Proximity of plant to residences**

  Major concerns were expressed by local residents about the impact of the proposal, particularly relating to the potential impacts of noise and dust emissions. This was despite Swan's assurances that the pollution aspects of the plant could be controlled within the limits likely to be set by the Environmental Protection Authority. The site at Wesco Road would have been 0.8 km from the nearest residence; another 40 residences, mainly in the Gibbs Road area, would have been located within 2.5 km of the plant (Figure 2). The proximity of current residences and possible future residential development could possibly have restricted the company's ability to expand the plant capacity at a later stage.

- **Planning considerations**

  The Department of Planning and Urban Development have advised that the policy for basic raw materials resource areas is based on the principle of sequential use. Once limestone extraction has taken place, the land would be used for other purposes. The Department of Planning and Urban Development stated in its submission to the Authority that the long term intended sequential use for the land covered by Swan's proposal is Urban (residential). The need to preserve a buffer around the plant at the original site would sterilise a large area from future urban development. The duration of the land sterilisation would equate to the life expectancy of the plant, which could be many years after the limestone resource of the leases was exhausted (in about 30 years time).

  In recognition of the potential environmental problems associated with the original plant site, Swan notified the Authority on 17 July, 1991 that they had determined that the south-eastern sector of the leases was their new preferred plant site location. After further discussions, Swan subsequently notified the Authority on 2 October, 1991 of a slight change in the position, such that the proposed plant site was moved 150 metres west and was located completely within the company's Pinjar lease.

2.2.2 Changes to proposal arising from relocation of plant site

The following changes to the proposal as outlined in the CER have resulted from relocating the plant site selection from Swan's property near Wesco Road to the Pinjar mining lease in the south-east of the area (Figure 2):

- **Conservation of native vegetation**

  The southern most population of *E. "argutifolia"* (Population D) would be approached by quarrying within 6 years of commissioning. The previous quarry strategy, with the quicklime plant off Wesco Road,would have meant approaching a central group of *E. "argutifolia"* (Population C) within 12 months of project approval. This population would now not be approached for about 20 years (refer to section 3).

- **Groundwater protection**

  The revised plant site is located immediately west of the Priority One zone of the Gnangara Mound Crown Land Groundwater Protection Area. The Water Authority of Western Australia has advised that groundwater could be abstracted by Swan from the Leederville Formation in this area, instead of near Wesco Road, subject to various conditions (refer to section 5.3).

- **Proximity to residents**

  The nearest residence to the new plant site is about 2.5 km away from the plant, with most other residences at least 3.5 km away (Figure 2).

- **Transport routes**

  Access routes to the plant site for the constructional and operational workforce and the quicklime tankers would be via Wattle Avenue East, Pinjar Road and Flynn Drive, until a more direct access route is constructed to the site from Flynn Drive (Figure 2). The Wesco Road extension from Gibbs Road to Wanneroo Road would not be required.

- **Gas and electricity supply routes**

  The routes for the gas and electricity services would change and would be determined by the State Energy Commission of Western Australia, prior to referral of the routes to the Environmental Protection Authority for assessment.

- **Quarrying schedule**

  Quarrying would commence in the area closest to the plant site, in the south eastern part of the lease, and then progress northwards.

2.3 Quarry operations

Swan propose to quarry high grade limestone at a rate of 450,000 tonnes per annum from within an area of 430 hectares of contiguous mining leases and freehold land at Nowergup. The economic limestone resource is estimated at 40.8 Mt, which is sufficient to supply the company's proposed quicklime plant requirements for at least 30 years.

The higher grade limestone occurs as a prominent north-westerly trending ridge, elevated some 40 metres above the surrounding area. The limestone quarried for the quicklime plant would probably have a grade ranging from 75 to 85 % calcium carbonate. The calcium carbonate occurs primarily as a matrix, cementing particles of quartz sand and residual shell fragments.

Quarrying would commence adjacent to the plant site in the south-eastern sector of the lease and is planned to be a day-time operation. Removal of vegetation, topsoil and overburden would be followed by ripping and dozing of the limestone down to a maximum depth of 30 metres below the present land surface. The stockpiled limestone would be loaded and carted to the quicklime plant. About 250 ha of the 430 ha site would be excavated, with most haul roads being located within the quarried outline. The proponent does not intend to store bulk fuel on site for the quarry, as heavy earthmoving machinery would be refuelled using mobile tankers from off-site.

Progressive rehabilitation would involve back-filling the pit with silica reject material from the plant, before respreading the topsoil and overburden. Pit floors would be ripped if necessary, to assist infiltration of rain water. Self-sustaining native vegetation would be used to re-establish the area.

2.4 Quicklime plant

As noted above, the location of the proposed 4 hectare plant site was changed during the assessment process to an area in the south-eastern extremity of the leases.

Swan propose to produce 230,000 tonnes per annum of quicklime (calcium oxide) by drying and calcining the 450,000 tonnes per annum of limestone produced from the quarry. Other major raw material requirements for the plant would be 4 terajoules of natural gas per day, up to 500 kilolitres of water per day, and 5 megawatts of electrical power. Water would be supplied from a bore sunk into the Leederville Formation, not the Yarragadee Formation as stated in the CER. Compressed air at 700 kPa pressure would be generated on site.

The limestone received at the plant would be crushed and then conveyed to a storage building with a capacity of 6000 tonnes. Limestone drawn from the building would be dried and milled before classification into size ranges. The coarse fraction would undergo a beneficiation process to increase the calcium carbonate content, while the rejected siliceous material would be directed to storage bins prior to disposal. The beneficiated product would be combined with the fine fraction and calcined at a temperature of about 1100°C, driving off carbon dioxide gas and producing calcium oxide (quicklime). The quicklime would be held in storage silos before being dispatched from the plant to the market in sealed mobile tankers,which would generate about 60 vehicle movements per day.

2.5 Waste products

Gaseous emissions arising from the burning of natural gas, drying and calcining limestone, and the cooling waters would be directed through an electrostatic precipitator and vented through a dust collection stack at a rate of 112,050 normal cubic metres per hour. Stack emissions would consist of carbon dioxide (20% by weight), water vapour (16%), nitrogen (55%), and oxygen (9%).

Solid waste products would be restricted to silica rejects from the beneficiation plant. This material would be generated at a rate of 75,000 to 80,000 tonnes per annum and would consist mainly of quartz and calcium carbonate in the size range 0.075 to 0.840 mm. The silica rejects would be returned to the quarry and used in the rehabilitation of the pit floor or, should suitable markets be found, sold for use in other products.

No waste water would be produced by the process, although cooling water would be recycled and directed to an impermeable tank for recirculation. Ablution wastes would be directed to a biological waste treatment system, which would be located on the Priority Three groundwater protection zone.

3. Existing environment

The topography of the area is characterised by north-westerly trending limestone ridges standing about 30 to 40 metres above the surrounding countryside. Similarly oriented chains of lakes and wetlands lie 3 to 4 km east and west of the lease area.

The lease area is bounded to the east by State Forest, comprised mainly of pine plantations (Figure 2). Adjacent to the south-west and north-west boundaries are large rural properties (20 to 40 ha), whereas on the western boundary, particularly in the Gibbs Road area, property sizes are smaller (2.5 to 10 ha). Land use in the latter area is quite diverse, with a corresponding increase in the density of residences, compared with the other areas.

A large area south of the leases and north of Flynn Drive is proposed for industrial activity, with a fledgling industrial area off Mather Drive. The Wanneroo Park Racing Circuit is located immediately south-east of the lease, and is used intermittently, at times attracting large numbers of people and generating substantial noise.

Quarrying of limestone and small scale manufacture of quicklime has occurred in the area for many years. Swan currently operate a quarry in the northern part of the lease area, just south of Wesco Road . Limestone is quarried from this site at a rate of 250,000 tonnes per annum, and carted via Gibbs Road to the Rivervale works. Swan would transfer this activity to the southern end of the leases and cease using Gibbs Road for cartage, should the current proposal proceed.

An archaeological and ethnographic survey for Aboriginal sites was conducted within the area in 1990. According to the proponent, interviews and site inspections with the traditional owners did not identify any sites of spiritual or other ethnographic significance within the lease area. The Department of Aboriginal Sites at the Western Australian Museum has indicated to the Authority that an adequate ethnographic and archaeological survey had been completed and reported in the CER.

The vegetation of the lease area consists of dense shrubland with scattered small populations of emergent eucalypts. Predominant large plants include species of *Acacia, Allocasuarina, Calothamnus, Dryandra, Grevillea, Hakea, Hibbertia, Leucopogon, Melaleuca* and *Xanthorrhoea*. Deeper sands overlying limestone along the eastern and south-western sections of the lease contain banksia open woodlands and marri (*Eucalyptus calophylla)* woodlands.

The gazetted rare species *Eucalyptus "argutifolia"* occurs within the lease area. *E. "argutifolia"* is a small mallee, endemic to Western Australia and known only to occur in ten populations of about 230 plants in the area between Hill River and Wanneroo. Four populations of *E. "argutifolia"* (A, B, C and D) made up of 109 plants have been identified through botanical surveys over the lease area. The distribution of these populations is known to the Department of Conservation and Land Management, however knowledge of their precise location is restricted. Most of the populations are located on the eastern side of the ridge, in shallow pockets of soil. Surveys have failed to find other populations of *E. "argutifolia"* in the general area around the leases. Swan does not intend to mine the populations of *E. "argutifolia"* and has developed management plans to ensure their survival.

Several other species on the Department of Conservation and Land Management Priority Species List also occur in the lease area. *E. "petrensis"* (Priority 3) is better represented at several other localities in the Northern and Central Forest Regions, and *E. foecunda* (Priority 5) occurs more extensively in other Forest Regions.

Two species of native fauna (*Macropus fuliginosus* and *Menetia greyii)* have been recorded in close proximity to the lease area, although no specific fauna surveys have been carried out on the leases by the proponent.

Most of the 430 hectare lease area lies over the Groundwater Priority Three zone of the Gnangara Groundwater Mound. However, part of the lease proposed to be quarried north of Wesco Road is situated within the Priority One zone.

4. Public consultation and submissions

The proponent invited potentially affected residents to two open days, which were held on site near Wesco Road. Representatives from Swan, the Wanneroo City Council, the Department of State Development, the Social Impact Unit and the Environmental Protection Authority attended the open days, to address questions about the proposal and its assessment.

The first open day was held in January, 1991 and was attended by about 30 people. The proposed site for the quicklime plant at the time was near Wesco Road. Issues raised were related to the use of Gibbs Road for transport of quicklime and limestone by large trucks, air emissions including noise and dust from the quarry and plant, and doubts about the compatibility of the industry within a semi-rural environment.

Upon release of the CER in May, 1991, residents in the area were given a summary of the CER and landowners of properties directly adjacent to the site were given a complete copy of the CER document. Eighteen private submissions (including a group submission from twenty nine people), and seven submissions from government authorities were received by the Authority (Appendix 3). Permission was given for all but two of the submissions to be forwarded directly to the proponent.

In response to concerns raised in submissions (Appendix 2), the proponent decided to investigate an alternative plant site in the south eastern sector of the lease area. A second open day was held in July,1991 and approximately forty local residents attended. Impacts relating to quarrying (noise, hours of operation) and dust emissions from the plant were discussed. The majority of those who attended appeared satisfied that their concerns had been adequately addressed and that the alternative site was a better location for the plant.

The proponent's public consultation programme has been sound and comprehensive. The Authority commends Swan for its efforts in identifying the major issues of concern to local residents, and for making genuine efforts to resolve these issues, particularly by being prepared to relocate the proposed quicklime plant to a more acceptable site.

5. Environmental impacts and management

The Environmental Protection Authority has identified a number of environmental impacts associated with the proposal. Based on its assessment of the proposal and additional information provided by the proponent in response to questions raised as a result of the assessment process, the Authority makes the following conclusions and recommendations:

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Swan Portland Cement Ltd to quarry limestone and to construct and operate a quicklime plant at Nowergup, as outlined in the Consultative Environmental Review and subsequently modified during the process of interaction between the proponent, the Environmental Protection Authority, and government agencies, and those members of the public who were consulted, is environmentally acceptable.

In reaching this conclusion, the Authority identified the main issues requiring detailed consideration as:

- **conservation of native vegetation, particularly *Eucalyptus "argutifolia"*;**
- **rehabilitation of the quarried area;**
- **protection of water resources;**
- **noise and dust impacts from the quarrying operations;**
- **noise, dust and gaseous emissions from the quicklime plant;**
- **visual impacts from the plant and quarry; and**
- **traffic and other social impacts.**

The Environmental Protection Authority considers that these and other issues, such as planning considerations, have been addressed and are manageable, either by changes to the proposal by the proponent during assessment, the environmental management commitments given by the proponent, or by the Environmental Protection Authority's recommendations in this report.

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed, subject to the proponent's modified commitments (Appendix 1) and the Environmental Protection Authority's recommendations in this report.

The Authority believes that any approval for the proposal based on this assessment should be limited to five years. Accordingly, if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the Authority.

The Authority notes that during the detailed implementation of proposals, it is often necessary to make minor and non-substantial changes to the designs and specification which have been examined as part of the Authority's assessment. The Authority considers that subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

5.1 Conservation of native flora

5.1.1 Conservation of *Eucalyptus "argutifolia"*

Swan has prepared specific management proposals and made a number of commitments to protect the four populations of *E. "argutifolia"* occurring within the lease area, should their proposal proceed. ie

- Areas of the leases containing populations of *E. "argutifolia"* would not be quarried and would be protected from damage to the satisfaction of the Environmental Protection Authority (Commitment 7).
- Swan would ensure that no physical damage to any population of *E. "argutifolia"* would occur as a result of its quarrying or associated operations, and would endeavour to prevent damage from other causes. A quarry management plan addressing the management of *E. "argutifolia"* and other flora, water, and rehabilitation techniques would be prepared in consultation with the Department of Conservation and Land Management to the satisfaction of the Department of Mines and the Environmental Protection Authority (Commitment 8).
- Quarrying would not be undertaken within 10 metres of any stem, plant or population of *E. "argutifolia"*. No batter slope steeper than 1:3 would be established within 80 metres of any stem, plant or population, apart from the access road near Population C (Commitment 9).
- All areas within 80 metres of the *E. "argutifolia"* populations, apart from the access road near Population C, would be fully rehabilitated in order to re-establish indigenous species on the batter slopes. Rehabilitation would commence within 12 months of the cessation of quarrying in the area, and would be conducted as described in Section 6.3.10 of the CER (Commitment 10).
- A 1.5 metres barrier fence would be constructed around each *E. "argutifolia"* population, to restrict vehicular movement in the area. Fencing would be erected at least 1 year before quarrying approached within 200 metres of any population of *E. "argutifolia"* (Commitment 11).
- Swan would fund electrophoretic[2] studies to establish the genetic relationship of individual plants within and between populations of *E. "argutifolia"* (Commitment 12)
- As the subsequent populations of *E. "argutifolia"* would not be approached by quarrying for a considerable time after Population D, it would be possible to assess the results of long-term monitoring of the first population. Should it then be considered necessary, management measures could be revised in consultation with the Department of Conservation and Land Management (Commitment 13).
- Consideration would be given to the establishment from seedlings of *E. "argutifolia"* in the areas adjacent to existing populations, but this would not be undertaken without the agreement of CALM (Commitment 14).

[2] A method which uses gels to extract genes from tissue and electon microscopy to generate images for comparison.

- A monitoring programme meeting the requirements of the Environmental Protection Authority would be established to monitor the rehabilitation of the quarry area, including the populations *E. "argutifolia"*. Details of the monitoring programme are provided in Section 7 and, in particular, Table 7.1 of the CER (Commitment 15, refer to Appendix 4 of this report).

The Authority notes that these management proposals have been developed by Swan in conjunction with the Department of Conservation and Land Management, and that the commitments would be made legally binding by the Minister for the Environment, should he approve the proposal.

In response to submissions (Appendix 2), Swan has stated that it would modify its quarry operations to ensure the long-term conservation of all *E. "argutifolia"* populations, if necessary. Such modifications could include changes to buffer areas, batter slopes, barrier fencing, quarry schedules or rehabilitation schedules.

Swan have justified a slope batter of 1:6 and a "no mining buffer" of 10 metres around populations of *E. "argutifolia"* on the basis of their experience with their quarry in the northern part of the lease, where vegetation in very close proximity to quarry faces has been unaffected, despite no buffer being retained.

The Authority believes that prior to the commencement of any clearing activity, the proponent should prepare a conservation management plan in consultation with the Department of Conservation and Land Management and to the satisfaction of the Environmental Protection Authority, as part of an overall Environmental Management Programme and with the objective of specifically addressing the conservation of *E. "argutifolia"*. The subsequent implementation and regular review of such a plan to the satisfaction of the Authority should provide adequate protection for the species from any harmful effects of the quarrying operation (see Recommendation 4).

The Department of Conservation and Land Management produces Wildlife Management Programmes for the management of flora and fauna, including endangered rare flora. These programmes include management objectives, and strategies for achieving these objectives. Research, such as the electrophoretic studies proposed by Swan, provides a basis for determining management strategies, and helps in determining priorities on such issues as land reservations, to conserve rare flora populations.

Recommendation 2

The Environmental Protection Authority recommends that the Department of Planning and Urban Development, in consultation with the Department of Conservation and Land Management and the Department of Mines, should prepare a management programme for *Eucalyptus "argutifolia"*, which should consider the future land use of Swan Portland Cement Ltd's lease and the protection of the populations of *Eucalyptus "argutifolia"*, after quarrying ceases in the lease area.

5.1.2 Clearing of native vegetation

Swan estimate that after 30 years of quarrying, approximately 250 hectares of native vegetation on the 430 hectares site would be unavoidably cleared, to allow for extraction of the limestone. The rate of clearing for quarrying is expected to be 4 to 5 hectares per year initially, rising to 8 to 10 hectares per year should planned expansion take place. The proponent has endeavoured to minimize impacts where possible by keeping haul roads within the quarry boundaries.

In recognition of the conservation value of remnant native vegetation in close proximity to the Metropolitan Area, the Authority believes that Swan should restrict the extent of clearing for its proposal to the minimum required at any one time, and that the company should take steps to conserve native vegetation where possible. The Authority notes the proponent's commitment to retain native vegetation, where practicable, during site clearing operations for the plant site.

The Authority considers that, prior to the commencement of any clearing activity for the proposed plant site and quarry, Swan should prepare a clearing management plan as part of the Environmental Management Programme, in consultation with the Department of Conservation and Land Management and to the satisfaction of the Environmental Protection Authority, and that this plan should be implemented and reviewed regularly to the satisfaction of the Environmental Protection Authority (see Recommendation 4).

5.2 Rehabilitation and decommissioning

Swan's stated primary objectives for rehabilitation of the quarried site are to stabilise the surface of the disturbed areas and to re-establish the area with self-sustaining native vegetation.

The proponent is committed to progressive rehabilitation of the quarry area. Within 12 months of the completion of quarrying, final contouring of the area which has been backfilled with silica reject material would be completed to the satisfaction of the Environmental Protection Authority. No more than 20 hectares of the quarry (excluding haul roads and the plant site) would be cleared but not rehabilitated at any one time.

The Authority considers that Swan should formulate plans, in consultation with the Department of Conservation and Land Management and the Department of Mines, to carry out trials in the first few years of rehabilitation, to determine the optimum method of rehabilitation. Factors that should be taken into account include (but are not limited to) various levels of silica reject material, pit slopes, ripping of pit floors, amount and storage time of topsoil and overburden, fertiliser rates and types, supplementing with light brush from surrounding vegetation, seed rates of locally occurring flora adapted to the limestone habitat, use of native legumes, and establishment of *E. "argutifolia"*.

The Authority considers that, prior to any clearing taking place, the proponent should prepare plans for rehabilitation as part of the overall Environmental Management Programme, in consultation with the Department of Conservation and Land Management and to the satisfaction of the Environmental Protection Authority (see Recommendation 4). The plans should be subsequently implemented and reviewed regularly to the satisfaction of the Environmental Protection Authority and the Department of Mines (on Vacant Crown Land) and the City of Wanneroo (on private land).

The proponent is committed, where practical, to use vegetation and topsoil which is cleared during the construction phase of the plant in the rehabilitation of disturbed areas within the plant site and quarry.

The Authority accepts that it is not practical for Swan to detail specific plans for the rehabilitation of the plant site, bearing in mind its life expectancy is in excess of 30 years, and the end use of the land is not clear at this stage. The Authority notes the proponent's commitment to leave the plant site in an unpolluted, stable, free-draining, vegetated condition, free of potential hazards and to the satisfaction of the Environmental Protection Authority. The Authority notes that Standard Ministerial Conditions of approval incorporate a clause covering decommissioning and rehabilitation of the site and environs to the satisfaction of the Environmental Protection Authority.

5.3 Protection of water resources

Any proposal to operate a quarry or manufacturing plant in the Nowergup area has the potential to impact upon the groundwater resources of the area, particularly where large quantities of fuel and oil are used. Much of Perth's drinking water comes from groundwater and many local residents rely on the groundwater for their livelihood and roof catchments for drinking water.

As noted previously, most of the lease area which is proposed to be quarried is within the Priority Three zone of the Gnangara Mound Crown Land Groundwater Protection Area and the proposed (revised) plant site is in the Priority Three zone, immediately west of the Priority One zone boundary.

The Authority notes that part of the proposed quarry area on Mining Lease 70/141 in the north-east of the lease area is within the Priority One zone. Although this area is unlikely to be quarried for at least 20 years, the proponent should note the importance of this area for protection of groundwater.

The Priority One zone is the subject of a draft Environmental Protection Policy, which is being prepared by the Authority and will be released for public review. Issues that will be addressed by the policy were foreshadowed in a public discussion paper titled "Protection of the Groundwater, Wetlands and Associated Ecosystems of the Swan Coastal Plain", which was released by the Authority in June, 1990. The objectives of the draft policy are to maintain the quantity and quality of the groundwater resources of the Gnangara Mound for the purposes of public water supply, and to protect the ecosystems of wetlands and vegetation which depend on the groundwater. Any new proposals within this area that could be incompatible with these objectives, including limestone quarrying and quicklime manufacture, would require assessment by the Authority.

Swan should ensure that any proposed quarrying for limestone in the Priority One zone within their mining lease is consistent with the Environmental Protection Policy in place at the time. Written permission from the Water Authority of Western Australia should be obtained prior to any clearing activity in this area, as part of the clearing management plan for the Environmental Management Programme mentioned previously. The Authority considers that no bulk fuel storage should be maintained in this area and no refuelling and servicing of mobile equipment should be carried out in the Priority One zone, unless written permission is provided by the Water Authority of Western Australia.

The proposal is likely to have minimal impact on the quantity of groundwater available in the superficial aquifer. Clearing of vegetation for the plant and quarry could increase the recharge of rain water to the superficial aquifer to a small degree, until rehabilitation has established a vegetative cover equivalent to that which exists now. Although the proposed operation would require a considerable amount of water, mainly for cooling of hot gases in the plant prior to release to the atmosphere and for dust suppression on the haul roads and around the quarry, this water would be abstracted by Swan from the deeper Leederville formation. In their submission, the Water Authority of Western Australia has indicated that they would be prepared to issue a licence for Swan to draw water up to 180,000 kilolitres per annum from the Leederville Formation, subject to a number of conditions related to metering of water usage, bore construction standards, charging for water (subject to a change in legislation), and monitoring of the superficial formation 50 metres downstream of the plant. Swan are committed to an examination of practical means of reducing their demand for water through recycling and improvements in process technology.

Swan have made a number of management proposals and commitments in the CER and in response to public submissions, with the objective of protecting the quality of local water catchments from any aspect of their operation.

Swan are committed to removing all solid refuse and construction material wastes from the site and disposing of them in accordance with the requirements of the City of Wanneroo. The silica rejects placed within the quarry would be insoluble and would not have any detrimental effect on the quality of the groundwater in the superficial aquifer.

Swan are committed to constructing and operating a biological waste treatment system for domestic effluent in accordance with appropriate regulations, and to the satisfaction of the Environmental Protection Authority. Although the treatment system would be located within the Priority Three zone, the Authority considers it should be positioned as far as possible away from the western boundary of the Priority One zone. A treatment system likely to meet the requirements of the Authority would need to need to be designed such that the effluent leaving the system is environmentally acceptable in terms of microbial and nutrient levels New technology aimed at meeting such objectives is currently being trialled.

The quicklime process does not produce waste water and cooling waters would be recycled through an impervious tank. The proposed quarry and quicklime plant are downstream of the Water Authority of Western Australia's current and proposed groundwater bore fields, and therefore any pollution is unlikely to reach these sources of groundwater. The Authority

considers that, given the nature of the proposal, it is unlikely that any potential dust fall-out from the plant or quarry reaching the roof catchments of local residents would pose a threat to the quality of their drinking water supplies.

Swan indicate that a small amount of fuel would be needed to be stored on the plant site for occasional machinery use, however such storage would be above ground and surrounded by an impervious bund. The proponent does not intend to maintain bulk fuel storage facilities for earthmoving machinery at the quarry site, as they would be refuelled using mobile tankers brought in from off-site. The Authority considers that Swan should ensure that the fuel storage, refuelling, servicing and parking of mobile equipment should be carried as far as possible away from the Priority One zone boundary.

The Water Authority of Western Australia has identified a number of measures that should be undertaken by Swan to protect the quality of the groundwater system. No quarrying should occur within 2.5 metres of the highest known water table. At the plant site, restrictions on the storage of hazardous or toxic substances, sufficient containment of fuel storage tanks above ground and in impervious structures, and appropriate disposal of gas pipeline test waters should be carried out to the satisfaction of the Water Authority of Western Australia and the Environmental Protection Authority.

The Authority concludes that the impact of the proposal on water systems is environmentally acceptable and could be managed by the proponent, subject to:

- the project being constructed and operated in the manner described by the proponent in the CER and responses to submissions;
- modified commitments provided by Swan in response to submissions; and
- preparation of a water quality protection plan in consultation with the Water Authority of Western Australia, prior to the commencement of any clearing activity for the proposed plant site and quarry. Swan should prepare the plan as part of the Environmental Management Programme, in consultation with the Water Authority of Western Australia, and to the satisfaction of the Environmental Protection Authority, and that this plan should be implemented and reviewed regularly to the satisfaction of the Environmental Protection Authority (see Recommendation 4).

5.4 Noise

Noise from the mobile machinery in the quarry, cartage of limestone and quicklime by trucks, and the quicklime plant construction and operation has potential to impact on the surrounding rural community, particularly at night. Swan initially presented background noise levels for the area and sound modelling for the quarry and plant at Wesco Road in the CER. As a consequence of the change in plant site, the company presented to the Authority new noise modelling work, which illustrates the effect of worst case-scenarios. These are presented in Table 1.

The modelled data is based on sound power limits of 85 dB(A) at 1 metre to all items of equipment in the plant and 117 dB(A) at 1 metre to items of mobile equipment at the quarry.

The new data indicate that noise from the quicklime plant at the revised site with no quarrying operations would generally not be audible during the day or the night. Quarrying operations combined with plant operations during the day would be occasionally audible (up to 40 dB(A)) but are unlikely to cause annoyance to residents. However, quarrying at night combined with the plant would be audible most of the time, and could therefore be potentially annoying to residents.

Table 1. Predicted maximum noise levels eminating from operations at the closest residence.

Operation	Plant Noise	Background Noise* dB(A)	Background & Plant Noise dB(A)
Plant only (day light hours)	16	30 - 38	33 - 38
Plant and quarry (day light hours)	16 - 36	30 - 38	33 - 40
Plant only (night time hours)	16	24 - 30	25 - 30
Plant and quarry (night time hours)	16 - 36	24 - 30	25 - 37

* Background noise is the L90 noise level

The Authority notes that relocation of the plant has not only resulted in the nearest residence changing from 0.8 km to about 2.5 km from the plant boundary, but that the number of residences in close proximity (2.5 km) has been reduced from about forty residences to one (refer to Figure 2); ie the potential for noise impacts from the plant, either individually or cumulatively with the quarry operations, is now much lower than when it was sited near Wesco Road.

Swan has made a number of commitments to manage noise impacts on residents:

- All construction machinery would be fitted with appropriate noise suppression devices. Construction noise levels would comply with the requirements of the Department of Occupational Health, Safety and Welfare. In addition, noise levels would comply with the allowable community noise levels as set out in the Noise Abatement (Neighbourhood Annoyance) Regulations, 1979 (Commitment 5).
- All potential noise-generating equipment associated with the quicklime plant would incorporate effective sound-proofing measures, such as mufflers and a range of enclosures, to minimize noise emissions (Commitment 27).
- Quarrying would not be undertaken outside daylight hours, except in exceptional circumstances (Commitment 28).
- All mobile equipment, such as dozers and trucks, would be fitted with silencers to reduce tonal and impulsive noise emissions (Commitment 29).
- Quarrying would not be undertaken any closer than 200m from the western-most boundary of the Gibbs lease (Commitment 30).
- A monitoring programme would be established to monitor noise emissions resulting from quarrying activities and quicklime plant operations (Commitment 31).
- Swan would meet all appropriate noise emission requirements set by the EPA (Commitment 32).

Should noise levels from the quarry be excessive, Swan have scope within their operations to further reduce noise levels. These include better silencers on machinery and varying the location and timing of quarrying, and the number of machines in any one pit.

Bulk quicklime tanker movements and travelling of haul trucks between the quarry and the plant were not taken into account in the modelling. However the noise levels are anticipated to be minimal and should not be audible most of the time, due to the more remote location of the plant.

Swan do not plan to quarry at night, except under exceptional circumstances, and are committed to meeting noise emission requirements set by the Authority. In their response to submissions, Swan have indicated that quarrying outside normal hours is unlikely because of the 6,000 tonne stockpile to be maintained at the plant, which would be sufficient for 4 to 5 days production. Night-time noise impacts from quarrying activities could be minimised by only using the dozers in daylight hours, and restricting quarrying activities at night to loading and cartage of limestone to the plant. The Authority believes that should night-time quarry operations be necessary, monitoring of noise levels by Swan would be essential, at least in the first instance.

Recommendation 3

The Environmental Protection Authority recommends that the proponent be required to ensure that the introduced noise from the project does not cause the noise in the surrounding residential areas to exceed:

- **50dB(A) from 7am to 7pm Monday to Saturday;**
- **45dB(A) on Sunday and from 7pm to 10pm Monday to Saturday; and**
- **40dB(A) from 10pm to 7am every day.**

These levels should not be viewed as normal operating levels for the project. They are the upper limits above which action will be taken by the Environmental Protection Authority. The Environmental Protection Authority considers that noise below these levels is not unreasonable provided it does not include tonal components, impulses or other intrusive characteristics.

Should justifiable complaints about noise from the project be received by the Environmental Protection Authority, the proponent will be required to address plant noise through the conditions of Works and Licensing for the plant, and quarrying and transport issues through the Environmental Management Programme.

5.5 Dust

The proposal has the potential to generate dust pollution outside the lease boundary during plant construction, quarrying activities, limestone haulage and quicklime plant operations.

The Authority notes that Swan is committed to various measures to minimise dust emissions, including:

- Retention of native vegetation, where practicable, during clearing operations of the plant site (Commitment 2).
- Application of water from tankers during site preparation and construction activities (Commitment 4).
- Installation of an electrostatic precipitator at the plant to ensure dust levels (from the stack) are kept below 100 micrograms per normal cubic metre (Commitment 21).
- Installation at the plant of mist water sprays, dust collection units, covering of conveyors and limestone stockpiles, and sealing of internal roads (Commitment 22).
- Application of water from mobile tankers to the quarry and haul roads when considered necessary (Commitment 23).
- Quarrying would not be undertaken any closer than 200 metres from the western-most boundary of the Gibbs lease (Commitment 30).

Swan's opinion, which is based on the experience of other quicklime and cement plants operating in Australia and overseas, is that, under normal operating conditions, electrostatic precipitators would be more efficient than bag-houses for the control of particulate emissions at the quicklime plant.

In response to concerns about the effectiveness of electrostatic precipitators in the event of a power failure, Swan estimate that about 2 to 3kg of limestone dust would be released at each

power outage. Should this be the case and considering the likely frequency of power cuts to the plant and the nature of the material released, it is the Authority's opinion that such impacts on the surrounding environment are likely to be small. The revised siting of the plant ensures that, in such an event, there are unlikely to be any measurable dust impacts at surrounding residences.

Swan proposes to monitor dust emissions, using high volume sampling devices, near the western boundary of the leases and to the north-east of the plant. Monitoring is planned to be cyclic (24 hours per day, 6 day cycle) and more intensive over the first 6 months following plant commissioning and commencement of quarrying activities (refer to Appendix 4).

The Authority's air quality objectives with regard to particulate matter (dust) concentrations are as follows:

	Averaging period	Standard (µg/Nm3)	Limit (µg/Nm3)
Quicklime Plant and limestone quarry	24 hours	150	260
Anywhere	15 minutes	-	1000
Nearby residential areas	24 hours	90	150

The objectives do not imply that each dust source in the area can generate that level of dust. The levels stated relate to the cumulative emissions for an area and represent a threshold for dust levels.

The Authority concludes that dust emissions from the limestone quarry and quicklime plant are likely to be manageable to the extent that they do not cause an unacceptable impact on the environment. Dust emissions associated with the quicklime plant construction and operation will be controlled under the provisions of Works Approval and Licence conditions. In order that dust impacts associated with the limestone quarrying and cartage are monitored and managed correctly, the Authority believes the proponent should prepare,implement and regularly review a dust management plan as part of the Environmental Management Programme, in consultation with and to the satisfaction of the Environmental Protection Authority (see Recommendation 4).

5.6 Gaseous emissions

The quicklime plant would release considerable quantities of gases to the atmosphere. The generation of nitrogen oxides and carbon dioxide are an unavoidable consequence of the burning of natural gas and the calcination of the limestone.

The emission of nitrogen oxides has the potential to contribute to photochemical smog sometimes experienced in the Perth metropolitan area. Both nitrous oxide and carbon dioxide are Greenhouse gases.

Swan anticipate that the hot gases released from the stack (65 metres AHD) would rise to a height of 400 to 500 metres before cooling to ambient air temperature could occur and dispersion takes place. The behaviour of the plume would vary, but it is Swan's opinion that under most atmospheric conditions, the plume would not be visible or cause a significant environmental impact.

Low emission rates of nitrogen oxides are predicted by Swan. Prior to the granting of Works Approval, the company should model the emissions of nitrogen oxides to determine ground level concentrations, and report this information to the Authority. In addition, the Environmental Protection Authority is commencing its metropolitan air shed study, which is designed to monitor gases which contribute to the potential formation of photochemical smog, with a view to developing appropriate management programmes. When the plant is commissioned, the company should forward emissions data for nitrogen oxides to the Authority, in a form appropriate for the study.

The Government of Western Australia is committed to a 20% reduction in the production of Greenhouse gases by the year 2005, using 1988 as a baseline. It is difficult to manage such reductions on a project by project basis, and the Government's Greenhouse strategy must be done on an overall state-wide basis. As a step in developing a strategy, the Environmental Protection Authority requires proponents whose projects will generate considerable quantities of Greenhouse gases to carry out an annual audit of releases. This information will enable the Government to develop an appropriate strategy.

The proponent estimates that 260,000 tonnes per annum of carbon dioxide would be released to the atmosphere from the quicklime process, and that this would increase Western Australia's emissions of carbon dioxide from fossil fuels and industrial processes to the atmosphere by 1% in the short term. The Authority notes that, if quicklime was not manufactured in Western Australia to meet local requirements, it would need to be imported, meaning that an equivalent amount of Greenhouse gases would be generated elsewhere in the world.

The Authority questions the proponent's perception that there would be a net reduction in carbon dioxide levels in the atmosphere in the medium term, as a result of this proposal. Most of the lime to be produced by Swan would be used in the alumina industry for recausticisation of carbonated caustic liquors. The primary source of carbonate in the alumina liquor stream is derived from carbon compounds in the bauxite, and not from the atmosphere. For other uses of quicklime (see section 2.1), it is debatable whether calcium bicarbonate would play a major part in the reaction of the quicklime, as argued by the proponent.

The Authority considers that the proponent should undertake annual audits of Greenhouse gases emitted by the quicklime plant as part of the Environmental Management Programme, and that this audit information be provided to the Authority (see Recommendation 4).

The Authority concludes that gaseous emissions from the quicklime process are manageable and therefore likely to be environmentally acceptable. Ground level concentrations of nitrogen oxides should be monitored and controlled by Swan within those limits which will be specified by the Authority in Licence conditions.

5.7 Visual impacts

Potential visual impacts would arise from the construction of the plant (clearing of vegetation), plant operations (stack plume, lighting at night), plant presence (calcining tower), and operating quarries and haul roads.

The visual impact of quarrying is sometimes unavoidable, however the Authority would point out that, with thoughtful planning and development, many unsightly visual impacts can be minimised. The proponent's attention is drawn to a recent publication by the Department of Mines of Western Australia, titled "Environmental Management of Quarries". The Authority notes Swan's intentions to minimize visual impacts with commitments to keep haul roads within quarry outlines and to limit the time and area of the quarry to be left open prior to rehabilitation.

The major visual impact of the operation would be the rectangular calcining tower, which would be equivalent to a 17 storey building, standing 65 metres above ground level. The cylindrical exhaust stack would be integrated into the side of the tower, and project slightly above the main structure. Re-siting of the plant to the south-east sector of the leases has significantly reduced the visual impact of the plant. Views of the plant from residences to the west would be limited by distance, the limestone ridge, and the trig station reserve which would not be quarried.

The proponent is committed to screen all external lighting at the plant and direct it inwards to minimize interference to residents. Due to the height of the calcining tower, Swan indicate that some lighting may be required by aviation authorities for safety purposes.

The location of the revised site has considerably more vegetation than the Wesco Road site. This factor, combined with the proponent's willingness to retain as much of the vegetation as possible, would provide a ready-made visual screen that could be enhanced with further

landscaping using native vegetation. Swan should address this issue in the Environmental Management Programme (see Recommendation 4).

The Authority concludes that the visual impacts of the plan, although significant, have been reduced by re-siting of the plant, and are therefore acceptable and manageable.

5.8 Planning considerations

The extraction of limestone from the leases is considered appropriate by the Department of Planning and Urban Development, as they are within the Basic Raw Materials Priority Area covered by the Basic Raw Materials Policy. The original location of the quicklime plant off Wesco Road did not accord with the planning intentions of the area, and the Department of Planning and Urban Development indicated to the Authority that it was unlikely that the proposal would have been supported by the State Planning Commission. The Authority notes that relocation of the plant site to the south east, although not in the designated industrial area off Flynn Drive, should allay most of the Department of Planning and Urban Development's concerns and result in a number of planning advantages. ie:

- It would be within the already noise affected area of the Wanneroo Motor Sports tracks.
- A location of the industrial type activity of the quicklime plant would be more in keeping with future character of the industrial development and could generate subsidiary activities.
- The present rural and future intended residential character of the nearby areas would be less impacted on and for a shorter time.
- Good temporary access via Wattle Avenue East, Pinjar Road and Flynn Drive to Wanneroo Road, and good, unobtrusive access via a possible north-south alignment from Flynn Drive.

The Authority considers that Swan should sequence their quarrying activities, where possible, such that the timing has minimum impact on the use of the land for subsequent uses. The approach preferred by the Department of Planning and Urban Development would be for Swan to commence quarrying in the north and contract operations back to the plant site in the south-east. The Authority notes that such a strategy could present difficulties to the proponent, when trying to balance out other environmental and cost factors at the same time. The Authority believes that Swan and the Department of Planning and Urban Development should develop a mutually agreeable strategy, to ensure that the company's operations do not cause an unacceptable impact on future end-use of surrounding areas.

The Authority notes, as previously discussed, that parts of the plant site and quarry lie within the Priority One zone of the Gnangara Groundwater Protection Zone. Although the Authority concludes that these potential impacts are manageable and acceptable, the proponent will need to consult with the Department of Planning and Urban Development concerning their planning intentions for the areas.

5.9 Social impacts

Potential social impacts of the proposal are generally of a local nature, and are related to employment, transport systems, pollution (noise, dust, visual impacts) and planning considerations.

Negative social impacts associated with the original proposal have been resolved by relocating the plant site, as discussed earlier. The community's concerns about safety and noise associated with traffic have been addressed, since most of the traffic is likely to use routes to the south and east of the plant. The proponent's intention to expand operations at Nowergup are unlikely to cause concern at the revised site. Swan have stated that they have no plans to transfer the cement manufacturing operations at Rivervale to Nowergup.

The proponent suggests that the local community would benefit considerably from the proposal. Much of the construction and operating workforce would be derived locally, and there would be an increased demand for local goods and services, promoting indirect employment.

The proponent has undertaken to conduct an environmental and social monitoring programme for the proposal. The proponent sees limited opportunities for local input to the monitoring programme, apart from providing monitoring results upon request. The proponent has undertaken to form a community liaison committee if the need arises. This may be a forum for passing on monitoring results.

The proponent should involve local residents in both the monitoring and management of local impacts in a pro-active way. The commitment to social impact monitoring should include consultation with local residents, and the ability to address their concerns. The Authority believes that Swan should inform local residents of the proposal's progress, particularly during construction and early operational phases.

The Authority believes that Swan should address social impact issues in the Environmental Management Programme (see Recommendation 4).

5.10 Monitoring

Details on the proponent's programme for monitoring of environmental and social impacts are provided in the CER and response to submissions. Appendix 4 summarises the proponent's planned monitoring programme. Monitoring aspects are discussed under appropriate headings elsewhere in this report.

The Authority believes that Swan's proposed monitoring program is generally acceptable but should be modified to conform with the requirements of the Environmental Management Programme and the Works Approval and Licence.

Recommendation 4

The Environmental Protection Authority recommends that the proponent should prepare and implement an Environmental Management Programme to the satisfaction of the Environmental Protection Authority. This programme should enable the proponent to detect, manage and report any impacts on the environment which are not addressed by other recommendations in this report. Plans to be prepared as part of the Environmental Management Programme should include, but not necessarily be limited to:

- **clearing of native vegetation;**
- **conservation of *Eucalyptus "argutifolia"*;**
- **rehabilitation of quarried sites and haul roads;**
- **water quality protection;**
- **dust impacts associated with the quarrying and transportation operations;**
- **auditing of Greenhouse gas emissions;**
- **visual impacts and landscaping;**
- **social impacts; and**
- **periodic reporting of monitoring results and consequential changes to environmental management.**

The timing of the preparation and review of these plans should be to the satisfaction of the Environmental Protection Authority.

The quicklime plant will be a prescribed premises under Part V of the Environmental Protection Act (1986) and accordingly the proponent will be required to obtain a Works Approval prior to constructing the plant and a Licence prior to operating the plant. Normal industry performance standards will be set by the Authority.

Recommendation 5

The Environmental Protection Authority recommends that the pollution control aspects associated with the plant, including the monitoring and reporting of compliance with requirements for noise, dust, and gaseous emissions, should be controlled through conditions imposed by a Works Approval and subsequently, a Licence under the Environmental Protection Act (1986).

The Authority points out that Swan's compliance with Ministerial Conditions and the conditions of the Works Approval and Licence will be periodically audited. Pollution control limits and other conditions for the quicklime plant will periodically reviewed and may be modified by the Authority in the light of operating experience.

The Authority believes that any approval for the proposal based on this assessment should be limited to five years. Accordingly, if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the Authority.

The Authority notes that during the detailed implementation of proposals, it is often necessary to make minor and non-substantial changes to the designs and specification which have been examined as part of the Authority's assessment. The Authority believes that subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

6. Conclusion

The Environmental Protection Authority concludes that the proposal by Swan Portland Cement Ltd to quarry limestone and to construct and operate a quicklime plant at Nowergup, as outlined in the Consultative Environmental Review and subsequently modified during the process of interaction between the proponent, the Environmental Protection Authority, and government agencies and those members of the public who were consulted, is environmentally acceptable. Accordingly, the Environmental Protection Authority recommends that the proposal could proceed, subject to the proponent's modified commitments (Appendix 1) and the Environmental Protection Authority's recommendations in this report.

Appendix 1

List of environmental management commitments by Swan Portland Cement Ltd

Commitment 1	All solid refuse and construction material wastes would be removed from site and disposed of in accordance with the requirements of the City of Wanneroo.
Commitment 2	Where practicable, native vegetation would be retained during site clearing operations within the revised plant site.
Commitment 3	Where practicable, vegetation and topsoil cleared during the construction phase would be used in the rehabilitation of disturbed areas within the revised plant site and the quarry.
Commitment 4	Dust suppression measures, including application of water from tankers, would be used to minimize dust generation during site preparation and construction activities.
Commitment 5	All construction machinery would be fitted with appropriate noise suppression devices. Construction noise levels would comply with the requirements of the Department of Occupational Health, Safety and Welfare. In addition, noise levels would comply with the allowable community noise levels as set out in the Noise Abatement (Neighbourhood Annoyance) Regulations, 1979.
Commitment 6	Swan would undertake an examination of practical means of reducing the demand for water through recycling and improvements in process technology.
Commitment 7	Areas of the leases containing populations of *E. "argutifolia"* would not be quarried and would be protected from damage to the satisfaction of the EPA.
Commitment 8	Swan would ensure that no physical damage to any population of *E. "argutifolia"* would occur as a result of its quarrying or associated operations, and would endeavour to prevent damage from other causes. A quarry management plan addressing the management of *E. "argutifolia"* and other flora, water, and rehabilitation techniques would be prepared in consultation with CALM to the satisfaction of the Department of Mines and the EPA.
Commitment 9	Quarrying would not be undertaken within 10m of any stem, plant or population of *E. "argutifolia"*. No batter slope steeper than 1:3 would be established within 80m of any stem, plant or population, apart from the access road near Population C.
Commitment 10	All areas within 80m of the *E. "argutifolia"* populations, apart from the access road near Population C, would be fully rehabilitated in order to re-establish indigenous species on the batter slopes. Rehabilitation would commence within 12 months of the cessation of quarrying in the area, and would be conducted as described in Section 6.3.10 of the CER.
Commitment 11	A 1.5m barrier fence would be constructed around each *E. "argutifolia"* population, to restrict vehicular movement in the area. Fencing would be erected at least 1 year before quarrying approached within 200m of any population of *E. "argutifolia"*.
Commitment 12	Swan would fund electrophoretic studies to establish the genetic relationship of individual plants within and between populations of *E. "argutifolia"*.

Commitment 13 As the subsequent populations of *E. "argutifolia"* would not be approached by quarrying for a considerable time after Population D, it would be possible to assess the results of long-term monitoring of the first population. Should it then be considered necessary, management measures could be revised in consultation with CALM.

Commitment 14 Rehabilitation of the quarry area would be progressively undertaken to the satisfaction of the EPA, as detailed in Section 6.3.10. of the CER. Rehabilitation would essentially involve the backfilling of silica reject material and the spreading of topsoil over the quarry floor and slopes. Topsoil may be supplemented by the placement of light brush from surrounding vegetation. Consideration would be given to the establishment from seedling of *E. "argutifolia"* in the areas adjacent to existing populations, but this would not be undertaken without the agreement of CALM.

Commitment 15 A monitoring programme meeting the requirements of the EPA would be established to monitor the rehabilitation of the quarry area, including the populations of *E. "argutifolia"*. Details of the monitoring programme are provided in Section 7 and, in particular, Table 7.1 of the CER.

Commitment 16 The biological waste treatment system for domestic effluent would be constructed and operated in accordance with the appropriate regulations of the *Health Act, 1911,* and to the satisfaction of the EPA.

Commitment 17 The plant would incorporate a wide range of safeguards such as fire protection, instrument monitoring, back-up systems and provisions for emergency shut-downs. Where appropriate, personnel involved in the operation of the quicklime plant would be issued with protective clothing and safety equipment. The City of Wanneroo and the Bush Fires Board would be consulted for advice on the prevention and suppression of fires.

Commitment 18 Gibbs Road would no longer be used by the proponent to transport limestone to Rivervale, once the Pinjar lease quarry and quicklime plant became operational.

Commitment 19 In the short term, and until access between the revised plant site and Flynn Drive has been constructed, Swan is prepared to use Wattle Avenue East, Pinjar Road and Flynn Drive to Wanneroo Road for the transportation of quicklime if necessary.

Commitment 20 Prior to the development of the North Wesco lease, negotiations would be held with the City of Wanneroo concerning possible temporary diversion of Wesco Road and other measures to avoid conflict with public road users.

Commitment 21 An electrostatic precipitator would be installed to ensure the levels of suspended particulates from the quicklime plant were below the limit of 100 mg/Nm^3 recommended by the National Health and Medical Research Council.

Commitment 22 Measures to be implemented at the quicklime plant to prevent dust generation would include the installation of mist water sprays and dust collection units, covering of conveyors and limestone stockpiles, sealing of internal roads, and retention of vegetation (where practicable) within the plant site.

Commitment 23 When considered necessary, water from mobile tankers would be applied to the quarry and haul roads to reduce dust levels.

Commitment 24 A monitoring programme would be established to monitor the air quality (particulate load and gases, and total suspended particulates). Details of the monitoring programme are provided in Section 7 and, in particular, Table 7.1 of the CER.

Commitment 25 Oil traps and impermeable bunding would be used to contain spills of fuels, oils, lubricants and chemicals. Oil trap sludges, spent containers and waste lubricants would be recycled or disposed of in accordance with the requirements of the City of Wanneroo and the Health Department.

Commitment 26 A monitoring programme would be established to monitor groundwater, the details of which are provided in Section 7 of the CER and in Response 2.2.

Commitment 27 All potential noise-generating equipment associated with the quicklime plant would incorporate effective sound-proofing measures, such as mufflers and a range of enclosures, to minimize noise emissions.

Commitment 28 Quarrying would not be undertaken outside daylight hours, except in exceptional circumstances (refer Response 5.6).

Commitment 29 All mobile equipment, such as dozers and trucks, would be fitted with silencers to reduce tonal and impulsive noise emissions.

Commitment 30 Quarrying would not be undertaken any closer than 200m from the westernmost boundary of the Gibbs lease.

Commitment 31 A monitoring programme would be established to monitor noise emissions resulting from quarrying activities and quicklime plant operations. The details of the programme are provided in Section 7 of the CER.

Commitment 32 Swan would meet all appropriate noise emission requirements set by the EPA.

Commitment 33 All external lighting would be screened and would be directed inwards to minimize interference with residents.

Commitment 34 Specific details of decommissioning are yet to be formulated; such details would be developed nearer to the end of the plant life. The plant site would be left in an unpolluted, stable, free-draining, vegetated condition, free from potential hazards and to the satisfaction of the EPA.

Commitment 35 Social impact monitoring would be undertaken to address issues raised by members of the public. Details of this monitoring, together with the process through which these issues would be addressed, are provided in Section 7 of the CER and Response 8.7.

Appendix 2

Response by Swan Portland Cement Ltd to issues raised in public submissions on Consultative Environmental Review.

1. Issues arising from plant site relocation

As a result of submissions received during the public review process, and further discussions with officers of the Environmental Protection Authority (EPA), Social Impact Unit (SIU) and the Department of State Development, Swan Portland Cement Limited (the proponent) informed the EPA on the 15 July, 1991 that it wished to relocate the plant site to the south east sector of the leases. After further discussions, Swan subsequently notified the Authority on 2 October, 1991 of a slight change in the position, such that the proposed plant site was moved 150 metres west and was located completely within the company's Pinjar lease.

1.1 The proponent is requested to document the changes to the original CER arising from the plant move.

The revised plant site would result in the following changes to the CER:

- The route of the natural gas pipeline between the Pinjar gas turbine station and the plant as indicated in Figure 4.4 of the CER may change and could possibly be routed along Pinjar Road. The actual route would be determined by the State Energy Commission of Western Australia (SECWA).

- The route of transmission lines to supply power to the revised plant site would change. The route of the power lines would be determined by SECWA.

- Abstraction of groundwater for the plant would occur near the revised plant site rather than at the original plant site.

- The construction and operation of the plant at the revised site would not require the establishment of the planned extension of Wesco Road westward from Gibbs Road to Wanneroo Road. Access to the revised plant site from Wanneroo Road would initially be provided by Pinjar Road, Flynn Drive and Wattle Avenue East until a new road is constructed between the plant site and Flynn Drive. This new access road would either connect directly with Flynn Drive or link into Mather Drive. The route of either option is mostly confined to land owned by the Industrial Land Development Authority (ILDA) and the City of Wanneroo. Quicklime product would be transported in B-trains, or bulk tankers, along this new road to Flynn Drive and Wanneroo Road.

- The indicative schedule of quarrying, as presented in Table 4.1 in the CER, would change. Due to the revised plant site, quarrying would commence in the southern section of the Pinjar lease before working northwards through the Wesco, Gibbs and Wesco North leases. The estimated life of the Wesco Road quarries would remain the same as that stated in the CER.

- Limestone would continue to be transported to the plant by 35t trucks along haul roads within the leases. However, due to the revised plant site, the haul roads would be established from the south, rather than toward the original plant site.

1.2 Provide a map detailing the newly proposed plant site location and access, particularly in relation to property boundaries, residences, current and future land use and surface contours.

Three maps have been prepared – these are attached to the end of this document.

Figure 1 shows the original plant site, the revised plant site, the proposed conceptual access route to the revised plant site, the boundaries of the lease area, the location of residences (as

provided by the City of Wanneroo), cadastral details, the Water Authority's Priority One (Source Protection Area) boundary, the limestone resource area and the State Forest boundary.

Figure 2 shows surface contours at 10m intervals over the general area. The EPA has already been shown detailed (1m) contour plans of the Wesco Road lease area.

Figure 3 shows the future land use zoning of the area as proposed by the DPUD draft Northwest Corridor Structure Plan.

1.3 What is the rationale for the plant site relocation? What alternative sites are available?

Submissions received by the EPA during the four-week public review period indicated that the majority of local residents did not object to the project, only to the location of the quicklime plant. Most residents indicated that their preferred alternative plant site was either in the Flynn Drive Industrial Area or in the southeast corner of Swans leases. Although the proponent believes that the plant could be constructed and operated at the original site without any significant impacts on the surrounding environment, it has taken the views of the residents into consideration by relocating the plant in the southeast corner of the leases.

The Flynn Drive Industrial Area option was not considered due to the following reasons:

- additional costs associated with limestone and silica rejects transport from the leases to the industrial area;
- adverse environmental impacts on public roads associated with limestone haulage;
- perceived incompatibility with the intended light industry to be established in the proposed Flynn Drive Industrial Area;
- proximity to residents at Carramar Park.

The views expressed by attendees at the second Public Information Day, held at the original site on Saturday 6 July, were almost universally supportive of the proposed revised plant site and accepted the fact that quarrying was the intended activity in the resource area.

The revised plant site would result in a number of positive environmental impacts when compared with the original plant site. These positive impacts are indicated in Response 1.4.

Although not indicated in the Department of Planning and Urban Development (DPUD) Draft Northwest Corridor Structure Plan, it has been informally indicated that the long-term future land use of the Wesco Road lease area would probably be urban development. The establishment of the quicklime plant at the original site in an area allocated for future urban development is not considered to be in accordance with planning intentions in the area. The location of the plant at the revised plant site would be more in accordance with planning intentions.

During discussions with the EPA, it was indicated that any future proposal to increase the capacity of the plant, referred to in Section 1.4 and 4.5 of the CER, would be more environmentally acceptable and more likely to gain EPA approval at the revised plant site than at the original plant site. Because the proponent will refer a proposal to increase plant capacity sometime in the future, this was an important reason for revising the plant site.

The revised plant site would not rely on the planned extension of Wesco Road westward from Gibbs Road to Wanneroo Road. If the extension did not proceed, for any one of a number of reasons, the proponent would incur higher annual operating costs through higher product transport costs due to longer distances. The revised plant site reduces the risk of this scenario occurring.

The revised plant site also marginally improves the economics of quicklime transportation through being slightly closer to the proponent's main markets.

1.4 Identify any positive and negative environmental impacts arising from the move and discuss how adverse impacts would be managed.

The revised plant site would result in a number of positive environmental impacts including:

- a greater 'buffer' distance between Gibbs Road residents and the plant would be established;
- the nearest known resident would be 2.5 km from the revised plant site compared with about .8 km from the original plant site;
- the revised plant site would have a greater buffer distance than the 1 km distance recommended by the Victorian EPA for a cement manufacturing establishment in excess of 150,000 t/a;
- less than ten residents are located in the region of the revised plant site compared with about 60 in the Gibbs Road region near the original plant site;
- the topography and position at the revised plant site provides a better visual screen than that at the original plant site;
- due to the distance, topography and adjacent land uses, predicted noise emissions from the plant at the revised site would be below background noise levels and unlikely to be audible;
- existing roads which provide access to the revised plant site are more suitable in terms of accommodating project-related traffic during the construction phase and pose less of a risk to public safety than Gibbs Road;
- the revised plant site is more in accordance with the planning intentions for the area than the original plant site due to its proximity to the future light industrial area at Flynn Drive and the Wanneroo Raceway.

The revised plant site would have no significant adverse environmental impact; as indicated above, the resiting would further reduce the likelihood of environmental impacts which may have occurred at the original plant site. However, the following points are considered relevant:

- the same plant area (4 ha) would be required at both sites, although additional area would be required to provide access to and from the plant;
- the area to be cleared at the revised plant site would be compensated by retention of the vegetation at the original plant site;
- any environmental impacts resulting from the increased distance and alternative route of the natural gas pipeline would be addressed by SECWA;
- similarly, any environmental impacts resulting from supplying power to the revised plant site would be addressed by SECWA;
- the environmental impacts and management associated with the construction and operation of the proposed road between the revised plant site and Flynn Drive would also be addressed separately following referral to the EPA.

2. Water

2.1 Identify what parts of the proposal have the potential to pollute the groundwater system. What measures, including monitoring, is Swan prepared to carry out and commit to, to ensure that the quality of the groundwater is protected?

There is little potential to pollute the groundwater system in the region as the quicklime plant would produce no wastewater. All cooling water would be delivered and recycled through an impervious recirculating tank. Should it be necessary for any on-site fuel storage tanks, they would be above-ground and be surrounded by an impervious containment bund. This would

ensure that any leakage from tanks could be easily detected, contained and recovered. There is little need to store large volumes of fuel at the plant site. Refuelling and servicing of B-trains and bulk tankers would be undertaken off-site. Quarry machinery would be refuelled from mobile tanks.

No toxic or hazardous substances which exceed 20 L would be stored at the leases (including the plant site), other than those specifically described in the CER, without prior written approval from the Water Authority.

The CER indicates that a monitoring programme would be established to monitor groundwater. The details of the proposed monitoring are provided in Section 7 of the CER. In accordance with requirements of the Water Authority, the proponent would establish a monitor bore 50m downstream from the plant. The well would extend to the base of the superficial formation and have a fully slotted screen below the watertable.

In some submissions the public raised concerns that the project may impact on their water supply and quality:

2.2 What impacts are likely to occur to the groundwater recharge rate and quality in the area due to the removal of limestone and backfilling with silica?

The impact of clearing and quarrying on groundwater is addressed in Section 6.3.3 of the CER. Quarrying would result in marginally higher rates of groundwater recharge due to reduced interception losses and increased permeability of the quarry surface. This increase is expected to be small due to the relatively small area of enhanced recharge. Backfilling with silica reject material would result in small increases in the permeability of the ground surface compared with the original (pre-quarry) ground surface. This would lead to a small and temporary increase in the rate of groundwater recharge. Rehabilitation of the quarried area would result in the establishment of a vegetative cover which would help groundwater recharge rates return to pre-quarry rates. The silica rejects would be insoluble and would therefore have no impact on the quality of existing groundwater.

Many local residents rely on rainwater catchments (off roofs) for drinking purposes.

2.3 What assurances can Swan provide to residents that their drinking water will not be polluted by the quicklime plant and quarry operations?

Particulates from the quicklime plant and dust from the quarrying operations do not pose any direct or indirect health risk to drinking water supplies.

As there was unlikely to be any detrimental effect from particulate emissions from the quicklime plant when it was to be located in the Gibbs lease, the probability of any effects to the residents from the revised plant site would be even less as a result of the increased distance.
As indicated in Section 6.3.5 of the CER, a number of measures, including the application of water from mobile tankers over the quarry floor and haul roads, would serve to reduce the potential for dust from the quarry operations during summer.

3. Flora and fauna conservation

3.1 What impact would the proposed change in plant site location have on the conservation of E. "argutifolia"?

The revised site for the quicklime plant would have no direct impact on the conservation of *E."argutifolia"*. The revised quarrying strategy (refer Response 1.1) would result in quarrying approaching Population D before Population C. Population D, which is located on the Pinjar lease, would now be approached within 6 years of plant commissioning. The quarry strategy,

as proposed in the CER, would have approached Population C within 12 months of project approval. This would now be extended to 20 years.

Quarrying would not approach nearer than 10m of any population of *E."argutifolia"*. The batter slope and other details relating to the conservation of *E."argutifolia"* populations would be determined in conjunction with CALM at least 12 months prior to quarrying approaching within 100m of any population.

3.2 Provide a summary statement, detailing how many plants of E."argutifolia" are thought to exist in total, and how many there are in the area to be quarried in this proposal.

As stated in Section 5.2.1 of the CER, the various sizes of known *E."argutifolia"* populations are as follows:

• Wilbinga Peak	2–3 plants
• Wabling Hill	2–3 plants
• Parrot Ridge	
- eastern	80 plants
- northwestern	25 plants
- southwestern	10 plants
• Hill River and Seabird	unknown
• Wesco Road leases	
- Population A	4 plants
- Population B	40 plants
- Population C	30 plants
- Population D	35 plants

Therefore a total of 228–230 plants are known, of which 109 occur in the Wesco Road leases.

No populations of *E. "argutifolia"* would be quarried in the Wesco Road leases.

3.3 What degree of commitment can Swan provide to modify its mining activities if E."argutifolia" is affected? How can 'affected' be defined, given that actual plant death may take years? What sort of modifications are likely?

Commitments 9–15 of Section 9.2.2 of the CER state the proposed management commitments to ensure the conservation of populations of *E."argutifolia"*. Environmental commitments such as these are legally binding. The proponent would modify its quarrying operations to ensure the long-term conservation of all *E."argutifolia"* populations.

The term 'affected' is defined as any obvious deterioration in the health of the plants, which can be directly attributable to quarrying operations and not to other effects such as drought conditions, natural diseases, insect attack, fire, natural senescence or damage from people outside the control of the proponent.

Modification to quarrying to protect populations of *E."argutifolia"* could include changes to any of the following:

- buffer area
- batter slopes
- barrier fencing
- quarry schedules
- rehabilitation schedules.

3.4 Provide more details on any proposed investigations relating to E."argutifolia", including the electrophoretic studies. What would be the likely objectives of the studies and what organisations would be consulted?

Specific details of the electrophoretic studies to be funded by the proponent would be determined in consultation with CALM.

The objective of these studies would be to obtain some baseline information on the genetic variation within the species, and between the populations, over its known range.

CALM have indicated in a letter to the proponent, dated 25 October 1990, that such work should involve:

- The selection of several populations from across the distribution of the species. Genetic analysis of a subsample of individual stems from observable clumps or plants. Analysis of the results of the genetic variation from within and between clumps to determine whether clumps are indeed discrete plants.
- If the clumps are shown to be discrete plants, conduct genetic analysis of each clump or plant from each known population. Analysis of the results to ascertain whether the variation is within each population, and across the species range.

As yet, no consideration has been given to which organization or person would do the work.

3.5 What are the environmental justifications for the slope batter of 1.6 and a no-mining buffer of 10 metres around populations of E."argutifolia"?

Vegetation reliant for summer survival on moisture stored above the water table and physically protected would only be affected by quarrying if an insufficient volume of soil is retained. As the zone of effect of quarrying on the water content of the limestone is estimated to extend only 3–4m from the quarry face, vegetation without root exploration within the 3–4m would not be affected by quarrying. Hence provision of a buffer zone between the vegetation and the quarry face, which includes the 3–4m area of expected root exploration, plus a 6m buffer zone, would allow survival of vegetation physically protected from the quarrying operations. Therefore a 10m buffer from the *E."argutifolia"* would provide a significant protective zone.

The conservative nature of this buffer distance is supported by observations at existing quarries in the Pinjar lease where vegetation up to the quarry face has been unaffected by past quarry operations. This indicates adequate water (and nutrient) availability in these extreme situations where no buffer has been retained.

As indicated in Section 6.3.8 of the CER, no batter slope would be steeper than 1:3. This batter slope would ensure stability and safety of the quarry sides.

3.6 What is the population estimate for other priority species in the area? How does the mining out of this area affect the overall conservation status of each priority species?

The estimated population sizes of *Eucalyptus petrensis* and *Eucalyptus foecunda* within the Wesco Road leases are unknown. However, an indication of their relative abundance is shown in Appendix B and C of the CER. CALM officers have been shown maps with the marked location of these priority listed species with the leases.

E.petrensis (Priority code 3) is found elsewhere in CALM's Northern Forest and Central Forest regions, such as at Burns Beach, Seabird and Yalgorup. *E. foecunda* (Priority code 5) occurs more extensively in CALM's Greenough, Northern Forest, Metropolitan and Central Forest Regions, such as at Lancelin, Seabird, Yanchep, Reabold Hill and Lake Preston. Therefore these priority listed species are not limited to the Wesco Road leases. By definition, some of these plants are already represented in reserve/conservation areas.

3.7 Museum records show that at least one rare species is recorded near the leases, and is likely to become extinct. Therefore, what is the rationale for Swan in claiming that there will be no impact on fauna when ground studies have not been done to establish what is present with the lease area?

The nearest recorded occurrence of the rare species was about 6 km from the Wesco Road leases. It was found in a habitat which is not present within the leases.

The value of a 'snapshot' fauna survey was not considered sufficient to enable any conclusion on the presence or otherwise of rare species. The principal impact of quarrying on fauna would be temporary loss of habitat. Mobile fauna would move into adjacent bushland following disturbance. Due to the presence of domestic cats and dogs and utilization of the general area by people, it is expected that adjacent areas to the leases would not be fully utilized and that ecological niches would be available.

4. Clearing and rehabilitation

4.1 Clarify what area would be cleared at any one time, and for how long an area would be cleared before rehabilitation takes place.

The area being quarried at any one time would depend on the blending requirements of the quicklime plant. It is expected that, on average, no more than 20 ha of quarry on the 431 ha lease area would be open at any one time. This excludes the area of the plant site and access and haul roads.

The estimated length of time from quarrying to final contouring of areas backfilled with silica reject material and the commencement of rehabilitation is unlikely to exceed two years. Rehabilitation would be undertaken progressively and would commence as soon as practicable after the completion of backfilling.

4.2 Does Swan propose to rip the pit floors prior to rehabilitation? What is the environmental justification for the proposed procedure?

Section 6.3.10 of the CER states that 'ripping prior to deposition of the silica rejects is not considered necessary, as the limestone is likely to already contain fractures'. Should it be apparent that the limestone base is not extensively fractured, then ripping with a dozer would be conducted. The presence of 'natural' fractures, or artificial fractures established by ripping, assists rehabilitation through improving plant root penetration and drainage regimes.

4.3 Does Swan plan to include species diversity and composition in its monitoring programme on rehabilitation?

Yes.

4.4 What changes to rehabilitation procedures would be necessary to accommodate end-use of the land for urban residential purposes?

The rehabilitation programme, as outlined in Sections 6.3.8 and 6.3.10 of the CER, is not proposed to be significantly altered to accommodate future residential land use. Some changes to the end-of-quarry batter slopes would be considered in order to facilitate residential development. Quarrying would provide a more suitable topography for residential development than that presently available in the unquarried areas of the leases.

5. Noise

5.1 Clarify what the typical background noise levels (L90) are for the nearest residences. Are these background levels likely to be different in winter? Are background levels likely to be lower between 10 pm and 4 am than those shown in Figure 5.2?

A background noise survey was undertaken during December 1990 in the Wesco Road–Gibbs Road area (refer Section 5.3.6 of the CER). The background L90 noise variation during the day was between about 30 dB(A) and 38 dB(A). During the night, L90 noise variation was between about 22 dB(A) and 30 dB(A). These L90 background noise levels do not include those at the original plant site in the Gibbs lease. These background noise levels and the daytime - night-time variations in background noise levels are typical of the noise levels that would be expected in a semi rural setting such as that at Nowergup. The noise levels recorded would also be applicable to all of the various residential locations. It is not considered likely that noise levels would vary significantly during the winter months or during the early hours of the morning. The noise monitoring programme would establish baseline background noise levels prior to commissioning of the quicklime plant.

5.2 What are the anticipated noise levels from the operation at the nearest residence for typical and worse case scenarios (specify) during:

(i) day-light hours when quarrying occurs?
(ii) day-light hours when there is no quarrying (eg. weekends)?
(iii) night-time when quarrying occurs?
(iv) night-time when there is no quarrying of the area.

Compare these noise levels to background levels (Q5.1) and comment on their audibility by any affected residents and on what impact this could have on the rural amenity.

For the revised plant site, with an 85dB(A) noise limit applied to all equipment, and with an overall sound power limit of 117 dB(A) applied to noise emissions from all mobile equipment, the maximum noise levels emanating from operations at the closest residences are predicted to be:

Operation	Plant Noise	Background Noise* dB(A)	Background & Plant Noise dB(A)	Comments
Day-light hours (no quarrying)	16	30 - 38	33 - 38	Not audible
Day-light hours (quarrying)	16 – 36	30 - 38	33 - 40	Occasionally audible
Night-time hours (no quarrying)	16	24 - 30	25 - 30	Not audible
Night-time hours (quarrying)	16 – 36	24 - 30	25 - 37	Audible

* ***Background noise is the L90 noise levels***

When the plant is operating by itself, it would not be audible at any of the residential locations since the noise emission from the plant would be well below established background noise levels. It should be stated that noise levels such as these are added logrithmically, not arithmetically.

When the quarry is being operated during the day, there would be instances when the background noise reduces sufficiently for the noise from quarrying activity to be audible. This situation already occurs in the general area due to the presence of a number of other quarries and limestone block cutting operations.
Under the current proposal, quarrying is not planned to be undertaken outside normal working hours.

5.3 What scope is there for Swan to reduce the noise impacts on residents should noise levels exceed EPA guidelines?

The quicklime plant and quarrying operations would not exceed current limits set by the EPA.

Noise from quarrying operations could be reduced by any of the following measures:

- install better noise reducing devices (silencers) on all machinery;
- limit quarrying operations in areas adjacent to the nearest residents between set times, such as during the middle of the day;
- limit the number of machinery operating in the areas adjacent to the nearest residence;
- establish and operate simultaneously more than one pit.

5.4 Has the noise modelling taken into account truck movements between the plant and quarry face, and B-trains carrying lime from the plant to markets? If not, what is the likely effect?

The noise modelling took into account general truck movements within the quarry and at the dump pad of the plant site.

B-train, or bulk tanker, movements within the plant site and along the access route, together with haul truck movements between the quarry and the plant site, were not taken into account. Noise levels due to truck movements would be less than those predicted for the worst case scenarios of all equipment operating at the closest quarry site to the various residences. Noise levels would be less audible from the revised plant site due to the increased distance from residents.

5.5 What are the likely reductions in noise levels resulting from:

(i) no quarrying any closer than 200 metres from the western boundary of the Gibbs lease?

(ii) the buffering effect of the excavation in the pit?

(iii) the buffering effect of the ridges between the quarrying activities and the residences?

The likely reductions in noise levels would be:

(i) Between 3dB and 4 dB at the nearest residence;

(ii) Less than 2 dB at the nearest residence;

(iii) The noise attenuation due to the effect of ridges between the quarry and the residences has been incorporated in the noise calculations presented.

5.6 Many residents were concerned about noise impacts outside normal work hours, particularly at night-time. What are the circumstances and frequency that would necessitate quarrying activities at night? What measures can be taken to minimize noise levels during such an event? Would monitoring of noise levels be carried out during this time to gauge the impact on residents? What mobile equipment (loaders, dozers) would operate at the plant at night, under normal circumstances?

Under the current proposal, quarrying is not planned to be undertaken outside normal working hours. The only circumstances that may require quarrying outside normal working hours would be insufficient stockpiles of limestone for night-time plant operations due to major breakdowns.

However it is most unlikely that there would be any need for quarrying outside of normal hours.

There are a number of reasons why quarrying outside normal hours would not be necessary. These include the following:

- the inclusion of a 6,000t capacity limestone stockpile within the plant area. This stockpile is sufficient to supply the plant for about 4 or 5 days without the need for restocking from the quarry;
- a large supply of limestone would always be available on the floor of the quarry. This would enable limestone in an emergency, to be hauled to the quicklime plant by truck without the need for dozers to operate;
- dozers could establish these quarry stockpiles during the daytime without the need for night-time operation of the dozers.

Therefore quarry machinery (particularly dozers) need only operate during the day to ensure a sufficient supply of limestone is available for the quicklime plant.

The measures that could be taken to minimize noise levels during such an event include:

- installing appropriate silencers to all earthmoving machinery; and
- quarrying in areas as far away from residences as possible.

As it is not intended to quarry at night, noise monitoring is not considered necessary. However, should such activities become necessary, EPA approval would be required. Such an approval may stipulate the need for noise monitoring during night-time quarry operations.

Under normal circumstances, no dozers, front-end loaders or trucks would operate at the quicklime plant.

5.7 Explain apparent inconsistencies between Table 6.1 (highest noise level at nearest residence) and Figure 6.2 (noise contours from modelling) eg. Figure 6.2(d) suggests noise levels for scenario 4 to be about 52 dB(A), not 45 to 48 dB(A). The correct location of Selwoods' residence suggest that under scenario 7 (Figure 6.2 (g)) there would be a noise level of 60 dB(A). The proposed attenuation of noise emissions may not be sufficient to meet EPA guidelines.

Based on the correct locations of the residences, noise levels in scenario 7 would be up to 60 dB(A). However, with a reduction of sound power level for each mobile equipment item to the level given below, the noise levels at the closest residence when the quarry and plant are operating would be reduced to between 45 dB(A) and 50 dB(A). The total sound power level for mobile equipment under this scenario was 124 dB(A), compared with 117 dB(A) in Response 5.2.

	Octave band sound power level in dB(A)						
	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Each mobile equipment item	109	109	108	110	109	102	96

When the factors indicated in Response 5.5 are taken into account, the predicted noise levels are more likely to be 40–45 dB(A).

5.8 Is Swan prepared to modify its monitoring programme to provide more frequent noise readings (eg. weekly/monthly) during the early stages of plant and quarry operations? How accessible would such information be to local residents?

The proponent would consider the practicality of undertaking noise monitoring on a monthly basis for the first six months following commissioning of the quicklime plant. The results of noise monitoring would be available upon request after the monthly monitoring for the first six months has been completed and then after the completion of each regular six monthly monitoring.

The EPA would receive copies of the results of noise monitoring undertaken on an annual basis.

6. Dust

6.1 What are the relative efficiencies of electrostatic precipitators (ESPs) and bag house facilities for controlling the release of fines to the atmosphere from the waste gas stack?

ESPs are more efficient compared with bag-houses for the control of particulate emissions during the manufacture of quicklime. When the risk of bag rupture, the higher maintenance requirements of bag-houses and the effectiveness of ESPs used in the manufacture of quicklime are taken into account, ESPs are considered to be a better means of minimizing particulate emissions. Quicklime and cement plants with bag-houses operating in the US are significantly less effective in reducing particulate emissions than similar plants which operate with ESPs throughout the world.

6.2 Under normal operating conditions, what impact would dust emissions have on surrounding land uses, particularly horticulture and floriculture?

Dust emissions from the quicklime plant would have no impact on surrounding land uses. Even when located at the Gibbs site, surrounding land uses would not have been affected by the plant.

6.3 What are the likely environmental impacts (in terms of dust emissions) of an electric power failure or a plant shut down? How much dust is likely to be emitted? How frequently and for what duration is this likely to occur? How would it affect nearby land use activities?

In the event of an electric power failure, the entire plant, including the calciner, would shutdown. Due to the rate of feed into the calciner, the normal retention time within the calciner and the settling of some particulates within the ESP (even when no power is available), it is estimated that about 2–3kg of limestone dust matter would be released at each power outage. The effect of this outside the lease area is expected to be negligible.

The frequency and duration of power failure in the area is unknown and is dependent entirely on SECWA. The quicklime plant would be on a high voltage grid separate from the low voltage grid fed to residents in the Nowergup area.

The resiting of the plant site to the southeast corner of the leases would result in a lower risk of impacts on nearby land use activities than when the plant was originally proposed at the Gibbs site.

6.4 Will Swan have emergency power for the control of dust emissions from the ESPs in the event of power failure? What emergency procedures will the company have in place to cope with such an event?

No emergency power would be available in the event of power failure. No specific emergency procedures would be required as the entire quicklime production process would shutdown following any power failure. The plant would have a range of safety features built into the design to ensure maximum safety to the workers and to the public.

6.5 Does Swan propose to undertake dust sampling at the lease boundaries, particularly on the western side of the leases? What parameters will be measured?

High volume samplers would be used to monitor total suspended particulates. These high volume samplers would be located upstream and downstream of the quicklime plant. Depending on access to power, one high volume sampler would be located in the vicinity of the western boundary of the leases, the other would be located to the northeast of the plant. Monitoring would be undertaken intensively over the first six months following commissioning of the plant and the commencement of quarrying in the Pinjar lease. The results would then be presented to the EPA and the monitoring reviewed and revised, if considered appropriate.

6.6 Clarify the intention of the company with respect to sealing of conveyors, i.e. Section 4.9 quotes 'a semi-enclosed belt conveyor system' whereas Section 4.10.2 states 'all conveyors in plant area would be sealed'.

The conveyor between the crushed limestone storage building and the grinding mill feed bin would be semi-enclosed. This would allow quick and easy access for maintenance purposes. All other conveyors would be entirely covered and sealed. The maintenance requirements of these sealed conveyors is less than those for the semi-enclosed conveyor system.

7. Gaseous emissions

7.1 Clarify where the emission concentration of nitrogen oxides (stated in the CER to be less than 100 mg/Nm^3) would be measured on the plant. How does this compare to emissions from similar industries? How does it compare to other standards or guidelines?

The emission concentrations of nitrogen oxides as stated in the CER are stack concentrations, not ground level concentrations. The rationale for not calculating ground-level concentrations was that the stack concentrations of nitrogen oxides would be so low that the ground-level concentrations would be negligible. The limit to be imposed by the EPA for this plant is derived from a code of practice adopted by the cement industry which is considered to be particularly stringent.

The National Health and Medical Research Council equivalent guideline for nitrogen oxides is 350 mg/Nm^3 for gaseous fuels.

7.2 By stating that there would be a net reduction in atmospheric carbon dioxide levels of approximately 100,000 t/a, the CER infers that the proposal will actually enhance the environment with respect to greenhouse gas emissions. Is this really the case? When are these net reductions in carbon dioxide likely to occur? i.e. Define 'short and medium term' in years.

As stated in Section 6.2.3 of the CER, the combustion of natural gas and the calcination of limestone would produce an emission from the stack of about 260,000 t/a of carbon dioxide. It is acknowledged that the manufacture of quicklime inherently involves the production of significant volumes of carbon dioxide.

The CER also indicates that, in the short or medium term, a reduction of atmospheric carbon dioxide would result. The speed and extent of the reduction in atmospheric carbon dioxide is dependent on the end-use of the lime product.

The phrase 'short to medium term' was intended to describe the time require for lime to be used and for the waste products of its use to reach a steady state in the environment. The time required would vary with the details of use and disposal—for some uses it would be days; for others, years.

A description of the inorganic carbon cycle (which describes the reaction of lime with atmospheric carbon dioxide to form bicarbonate) is provided in:

- Manahan, S.E. *Environmental chemistry*. 3rd edition. Boston, Mass. Willard Grant Press.

A more rigorous description is included in:

- Stumm, W., and Morgan J.J. *Aquatic Chemistry*. 2nd edition. New York. Wiley.

7.3 Will emissions such as nitrogen oxides have any detrimental effect on surrounding land uses, particularly water quality and polythene membranes covering greenhouses?

In the volumes to be emitted, nitrogen oxides would have no detrimental effect on surrounding land uses, particularly in relation to the quality of drinking water or to the polythene membranes of greenhouses.

8. Project operation and social impacts

8.1 How does the nature and size of the proposed quarry operation and quicklime facility compare to Swan's existing activities? i.e. How much quicklime is currently produced and limestone carted to the Rivervale works? Does all of this limestone come from the Wesco Road quarry? Will all cartage of limestone to Rivervale from Swan's leases (including the limestone carted from the Wesco lease area) cease when the quicklime plant comes into production?

The current proposal is for the quarrying of 450,000 t/a of limestone to produce 230,000 t/a of quicklime. The Rivervale operations currently receive about 250,000 t/a of limestone from the Wesco Road leases and about 150,000 t/a of limestone from the Spearwood area. The Rivervale operations produce 200,000 t/a of cement.

Limestone from the Wesco Road leases is quarried only from the Wesco lease as defined in Figure 1.1 of the CER.

As stated in Commitment 21, Section 9.2.5 of the CER, should the quicklime plant become established, limestone for lime manufacture would no longer be required at Rivervale. However, limestone for cement manufacture in the short term would continue to be required at Rivervale. Limestone for cement manufacture at Rivervale would be transported along the same route as that described in Response 1.1. Gibbs Road would not be used for the transport of limestone to Rivervale once the proposed new road linking the quicklime plant with Flynn Drive is completed and quarrying in the Pinjar lease commences. The Wesco lease would no longer be used to supply limestone to Rivervale once quarrying commences at the Pinjar lease to supply the proposed quicklime plant. Limestone would then be delivered to Rivervale from the Pinjar lease.

8.2 To what ultimate capacity does Swan see the Nowergup quicklime operation being expanded to in the next 10 years?

The capacity of the quicklime plant is proposed to be increased from 230,000 t/a to 450,000 t/a. Although no time-frame has been developed for this proposed expansion, it could be formally proposed within 5–10 years after the proposed quicklime plant is commissioned. As stated in the CER, any proposed increases in the rate of quicklime production and/or quarrying would require referral to the EPA for environmental assessment.

8.3 Is it likely that the existing cement making operations at Rivervale would be transferred to the Nowergup area?

The Rivervale cement manufacturing operations would not be transferred to the Nowergup in the foreseeable future. No proposal for such a move has been postulated. The manufacture of quicklime at the Rivervale plant would cease once the quicklime plant at Nowergup became operational.

8.4 It is considered that, apart from the construction workforce, most of the employees for the new plant and quarry would probably come from Rivervale. Are there any advantages to the community if this is the case?

The operational workforce at the Nowergup quicklime plant would include some of the experienced personnel from the Rivervale plant. However, the majority of the workforce would be employed from the local area. It is expected that the quarry workforce would be recruited from the available labour force or from local contractors.

The local community would benefit from the creation of an increased demand for local goods and services, providing an economic injection into local businesses, resulting in additional indirect employment. This fact was clearly recognized by several participants to the two Public Information Days who queried the likely future demand for such goods and services as landscaping/nursery supplies, earthmoving machinery requirements and limestone supply.

8.5 Computation of figures given in the CER for the limestone resources (40.8 Mt) and the production rate (450,000 to 900,000 t/year) suggest that the life of the quarry is somewhere between 45 and 90 years. Clarify why this is in disagreement with the 30 year life for the quarries stated in the CER. Is this because the ultimate expansion of the plant is anticipated to be somewhat greater than the stated 460,000 t/year?

The estimated life of the quarries in the Wesco Road leases of 30 years takes into account the following:

- continued quarrying, in the short term, to supply the Rivervale operations (250,000 t/a);
- possible future increases in this quarrying rate to supplement the Spearwood limestone resources which are nearly depleted (possibly an additional 150,000 t/a);
- proposed quarry rates stated in the CER (450,000 t/a);
- increases in the quarrying rate in order to supply the proposed expansion of the quicklime plant (900,000 t/a);
- future market requirements beyond 900,000 t/a.

8.6 Should other limestone resources in the immediate area become available to Swan, would this affect the ultimate size of the plant?

No.

8.7 Local residents requested input to the management of impacts through the on-going provision of information, establishment of a liaison committee, and input to monitoring. How does the proponent intend to meet these requests?

The measures to be implemented to address any issues of concern raised by local residents during the construction and operational phases have been stated in Section 7 of the CER.

Any request for information by local residents would be acted upon by the nominated community liaison person or by their appointee. In addition, should the local residents see the need, a community liaison committee would be formed. The committee could contain representatives of the local community and Swan, together with an appropriate officer from the City of Wanneroo and (initially) the SIU. If needed, this committee could be initiated when project approval has been granted.

The opportunity to provide input to the proposed monitoring of air quality (stack testing, ambient air quality), groundwater, noise, rehabilitation and *E."argutifolia"* are limited. These would be undertaken by the proponent or by appropriate suitably qualified consultants. The findings of these monitoring programmes could be made available to interested local residents upon request or through the community liaison committee.

9. Commitments

9.1 ***It would appear that some commitments as made in the CER may no longer be relevant due to the change in plant site location, (eg. part of commitments 22 and 26), and others could be more specific in terms of what is being committed to (eg. commitment 21). Other commitments, although of importance in demonstrating good intentions for responsible management of the proposal, are of little environmental significance (eg. commitments 1 and 5). Accordingly, Swan are requested to cull out those commitments that are not relevant to the environmental aspects of the proposal and submit a consolidated list of environmental management commitments to the Authority.***

A consolidated list of environmental commitments developed from the CER and from the responses to public submissions, is as follows:

See Appendix 1 of this report.

Messrs E J & E Adams
Ms M H Thng
Messrs W L & H C Kendrick
Ms R W Hansen
Mr J Brown
Mr L Crouch
Mr N Tetley
Mr A Leach
Messrs R & P Leach
Mr B Canute
Mr N Hardman
Messrs P & L Gammer
Messrs S & P Hart
Ms S Geluk
Mr B McCarthy
Mr K Roberts
Mr P Watt
Messrs W & H Kendrick
Messrs T & H Sutherland
Mr J Selwood
Mr M Tedesco
Messrs P & S Green
Mr D Tedesco
Messrs J & M Tate
Mr C Zager
Mr A Goad
Mr F Hill
Mr D Cambell
Mr R McLeod
Mr J Goudge
Mr R Anderson
Mr I Raiter
Mr R Hansen
Mr P Green
Mr T Lambert
Healey's Store Pty Ltd
Messrs N & O Hardman
Messrs B & W Robinson
Messrs W &S Selwood
Messrs J & P Dudleston
Messrs C L & K MacKay
Mr C J Brown
Mr J H Watts
City of Wanneroo
Department of Mines
Department of Planning and Urban Development
Department of Aboriginal Sites
Department of Conservation and Land Management
Water Authority of Western Australia
Main Roads Department

Appendix 4

Conceptual monitoring programme, as proposed by Swan Portland Cement in the Consultative Environmental Review

Appendix 4 **Conceptual monitoring programme for the quicklime project (Table 7.1 in CER)**

Parameter	Equipment	Location	Frequency	Data	Frequency of reporting	Reporting to
Plant operation						
Air quality						
• Stack testing	Lear Siegler GS80	Cooling tower	Monthly	Particulate load and gases	Six monthly or annually (subject to EPA requirements)	EPA (subject to licence conditions)
• Ambient air quality	High volume samplers	Upstream and downstream of plant	Cyclic (24 hours on 6 day cycle)	Total suspended particulates	Annually (subject to EPA requirements)	EPA (subject to licence conditions)
Groundwater	Water samples	Water Authority bore wells	Subject to Water Authority licence conditions	Subject to Water Authority licence conditions	Subject to Water Authority licence conditions	Water Authority (subject to licence conditions)
Noise	Sound level meter	Adjacent to residences and lease area	Six monthly	Sound power levels	Annually (subject to EPA requirements)	EPA (subject to licence conditions
Quarrying and rehabilitation						
Rehabilitation	Visual assessment	Quarried area that has been rehabilitated	Annually	Rate of cover establishment, stability of quarry slopes, success of rehabilitation methods	Annually (subject to EPA requirements)	EPA/CALM (subject to licence conditions)
E. "argutifolia"	Visual and photographic assessment	*E. "argutifolia"* buffers	January, April and September each year for 4 years	General health of all plants and signs of stress	After each survey (subject to EPA requirements)	CALM (subject to licence conditions)