

## Referral of a Proposal by the Proponent to the Environmental Protection Authority under Section 38(1) of the *Environmental Protection Act 1986*.

EPA REFERRAL FORM PROPONENT

## PURPOSE OF THIS FORM

Section 38(1) of the *Environmental Protection Act 1986* (EP Act) provides that where a development proposal is likely to have a significant effect on the environment, a proponent may refer the proposal to the Environmental Protection Authority (EPA) for a decision on whether or not it requires assessment under the EP Act. This form sets out the information requirements for the referral of a proposal by a proponent.

Proponents are encouraged to familiarise themselves with the EPA's *General Guide on Referral of Proposals* [see Environmental Impact Assessment/Referral of Proposals and Schemes] before completing this form.

A referral under section 38(1) of the EP Act by a proponent to the EPA must be made on this form. A request to the EPA for a declaration under section 39B (derived proposal) must be made on this form. This form will be treated as a referral provided all information required by Part A has been included and all information requested by Part B has been provided to the extent that it is pertinent to the proposal being referred. Referral documents are to be submitted in two formats – hard copy and electronic copy. The electronic copy of the referral will be provided for public comment for a period of 7 days, prior to the EPA making its decision on whether or not to assess the proposal.

## CHECKLIST

Before you submit this form, please check that you have:

	Yes	No
Completed all the questions in Part A (essential).	Х	
Completed all applicable questions in Part B.	Х	
Included Attachment 1 – location maps.	Х	
Included Attachment 2 – additional document(s) the proponent wishes	Х	
to provide (if applicable).		
Included Attachment 3 – confidential information (if applicable).		Х
Enclosed an electronic copy of all referral information, including spatial	Х	
data and contextual mapping but excluding confidential information.		

Following a review of the information presented in this form, please consider the following question (a response is optional).

Do you consider the proposal requires formal environmental impact assessment?			
Yes No	Not sure		
If yes, what level of assessment?			
Assessment on Proponent Information	tion Public Environmental Review		

# PROPONENT DECLARATION (to be completed by the proponent)

I, .... KISA HONAN (full name) declare that I am authorised

on behalf of ... HOLCIM AUSTRACIA PIL (being the person responsible for the

proposal) to submit this form and further declare that the information contained in this form is true and not misleading.

Signature:	Name (print): Lisa Honan
Position: Senior Planning and Environment Coordinator	Company: Holcim (Australia) Pty Ltd
Date: 6/11/13	

## PART A - PROPONENT AND PROPOSAL INFORMATION

(All fields of Part A must be completed for this document to be treated as a referral)

## 1 PROPONENT AND PROPOSAL INFORMATION

## 1.1 Proponent

Name	Holcim (Australia) Pty Ltd
Joint Venture parties (if applicable)	N/A
Australian Company Number (if applicable)	87 099 732 297
Postal Address (where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State)	Holcim (Australia) Pty Ltd 18 Brodie Hall Drive Bentley WA 6102
Key proponent contact for the proposal:	Lisa Honan
• name	Senior Planning and Environment
<ul> <li>address</li> </ul>	Coordinator
• phone	Holcim (Australia) Pty Ltd
• email	18 Brodie Hall Drive
	Bentley WA 6102
	Phone: 08 9212 2146
	Email: lisa.honan@holcim.com
Consultant for the proposal (if applicable):	Jenny Moro
• name	Principal Environmental Scientist
<ul> <li>address</li> </ul>	URS Australia Pty Ltd
• phone	Level 4, 226 Adelaide Terrace
• email	Perth WA 6000
	Phone: 08 9326 0137
	Email: jenny.moro@urs.com

## 1.2 Proposal

Title	Baldivis Sand Quarry Stage 1 Expansion Project
Description	Holcim (Australia) Pty Ltd (HAUS) propose to expand the approved limit of extraction of the existing Baldivis Sand Quarry Stage 1 Project (hereafter referred to as the "Expansion Project"), located within Mining Lease M70/1046 in Baldivis, approximately 50 km south of Perth, and 14 km south southeast of Rockingham, Western Australia (Figure 1). The expansion will allow HAUS to continue to supply fill sand for the Perth Metropolitan Area and South West until approval can be sought for Stage 2 of the Baldivis Sand Quarry Project located within Mining Lease Application MLA70/1241.

The expansion comprises extension of the approved Limit of Extraction 100 m north into the existing 250 m buffer located along Stakehill Road. The key components of the Expansion Project comprise (Figures 2 and 3): Extraction of up to 500,000 tonnes (t) • of sand within a Limit of Extraction area of 7.2 ha. No amendment to the approved peak daily abstraction of up to 3000 t per day, with an average of 2500 t per day. The Limit of Extraction area will extend 100 m into the existing 250 m buffer located along Stakehill Road. A buffer of approximately 150 m will remain in place adjacent to Stakehill Road. The sand would be quarried by front

The sand would be quarried by front end loader, and loaded for transportation off site. No screening or washing of sand is proposed for the Expansion Project as all sand quarried will be utilised for fill.

Transport of sand to customers within the Perth Metropolitan Area and South West along existing Stage 1 transport routes at the same or lower levels of existing Stage 1 vehicle volume and composition.

Continued abstraction of up to 150,000 kL per annum of groundwater for dust suppression in accordance with the existing Licence To Take Water [GWL 162863(2)].

Use of all other existing Stage 1 infrastructure comprising access road, weighbridge, power supply, communications, maintenance workshop, administration office, ablutions, crib room, fuelling facility, wheel wash facility and waste collection area.

Quarrying of the Expansion Project resource is expected to commence upon receipt of environmental approval.

	The Expansion Project resource, in addition to existing reserves in Stage 1, is expected to meet market demands for up to three years.
	A description of the Expansion Project is given in Section 3 of the attached Baldivis Sand Quarry Stage 1 Expansion Project Mining Proposal (hereafter referred to as the Mining Proposal). The Mining Proposal has been attached as supporting information to this Environmental Protection Authority (EPA) Referral Form.
Extent (area) of proposed ground disturbance.	The total area of land disturbance for the Expansion Project is anticipated to be 7.2 ha (Figure 2 and 3).
Timeframe in which the activity or development is proposed to occur (including start and finish dates where applicable).	Quarry operations are anticipated to commence in January 2014, upon receipt of all environmental approvals, and extend for approximately three years.
Details of any staging of the proposal.	HAUS proposes to seek environmental approval for Stage 2 of the Baldivis Sand Quarry Project located within Mining Lease Application MLA70/1241 within the next three years.
	The site has strategic importance for the State as it is listed as an Outer Region Major Sand Resource within the Statement of Planning Policy No. 2.4 – Basic Raw Materials (WAPC, 2000).
Is the proposal a strategic proposal?	The proposal is not a strategic proposal.
<ul> <li>Is the proponent requesting a declaration that the proposal is a derived proposal?</li> <li>If so, provide the following information on the strategic assessment within which the referred proposal was identified: <ul> <li>title of the strategic assessment; and</li> <li>Ministerial Statement number.</li> </ul> </li> </ul>	The proposal is not a derived proposal.
Please indicate whether, and in what way, the proposal is related to other proposals in the region.	The proposal is not related to other proposals in the region.

Does the proponent own the land on which the proposal is to be established? If not, what other arrangements have been established to access the land?	HAUS wholly owns M70/1046. Access is via an existing access road to the Explosives Reserve and an existing building to the north east of the site. Both facilities are located within Reserve 38575 held by the Department of Mines and Petroleum. HAUS and DMP share access of the access road. The existing building has been leased from DMP and is used as a site office, lunch room and for ablutions.
What is the current land use on the property, and the extent (area in hectares) of the property?	The current land use of the property is sand quarrying for the Baldivis Sand Quarry Stage 1 Project. The Stage 1 Project is located on Mining Lease M70/1046, which has a total area of 48.89 ha. The total proposed area of disturbance for the Expansion Project is 7.2 ha. The Stage 1 Project was approved by the Department of Industry and Resources (now DMP) on 24 January 2008 following submission of a Mining Proposal. The Stage 1 Project also operates under Department of Environmental Regulation (DER) Licence L8176/2007/2 and Licence To Take Water GWL 162863(2). The Stage 1 Project was also referred to the EPA under the Memorandum of Understanding between DMP and EPA and the level of environmental assessment set for the Stage 1 Project was "Not Assessed – No Advice Given" on 3 Department 2007

## 1.3 Location

Name of the Shire in which the proposal is located.	City of Rockingham
For urban areas: • street address;	Baldivis Sand Quarry Stage 1 Project (M70/1046)
<ul> <li>lot number;</li> <li>auburb; and</li> </ul>	Stakehill Road
<ul> <li>suburb, and</li> <li>nearest road intersection.</li> </ul>	Baldivis WA 6171
	Figures 1 and 2 show the location of the Expansion Project.
For remote localities:	
<ul> <li>nearest town; and</li> </ul>	
<ul> <li>distance and direction from that town to the proposal site.</li> </ul>	
Electronic copy of spatial data - GIS or CAD,	See englaged CD
parameters.	
<ul> <li>GIS: polygons representing all activities and named;</li> </ul>	
<ul> <li>CAD: simple closed polygons representing all activities and named;</li> </ul>	
<ul> <li>datum: GDA94;</li> </ul>	
<ul> <li>projection: Geographic (latitude/longitude) or Map Grid of Australia (MGA);</li> </ul>	
<ul> <li>format: Arcview shapefile, Arcinfo coverages, Microstation or AutoCAD.</li> </ul>	

## 1.4 Confidential Information

Does the proponent wish to request the EPA to allow any part of the referral information to be treated as confidential?	Not confidential.
If yes, is confidential information attached as a separate document in hard copy?	N/A

## 1.5 Government Approvals

Is rezoning of any la proposal can be implem If yes, please provide de	nd required before the ented? etails.	No.	
Is approval required from any Commonwealth or State Government agency or Local Authority for any part of the proposal?		Yes.	
ii yes, piease complete			
Agency/Authority	Approval required	Application lodged Yes / No	Agency/Local Authority contact(s) for proposal
Department for Mines and Petroleum	Mining Proposal. To seek approval under the Mining Act 1978. (see attached Mining Proposal).	Yes	Tyler Sujdovic Senior Environmental Officer Operations, Environment
Department of Environmental Regulation	Licence Amendment Application to the DER for amendment of existing Licence L8176/2007/2 to include the Expansion Project	Yes	Lindy Twycross Environmental Officer, Booragoon Office
Department of Water	Existing Licence To Take Water GWL 162863(2) in place.	Existing licence in place. No amendment required.	N/A

## PART B - ENVIRONMENTAL IMPACTS AND PROPOSED MANAGEMENT

#### 2. ENVIRONMENTAL IMPACTS

Describe the impacts of the proposal on the following elements of the environment, by answering the questions contained in Sections 2.1-2.11:

- 2.1 flora and vegetation;
- 2.2 fauna;
- 2.3 rivers, creeks, wetlands and estuaries;
- 2.4 significant areas and/ or land features;
- 2.5 coastal zone areas;
- 2.6 marine areas and biota;
- 2.7 water supply and drainage catchments;
- 2.8 pollution;
- 2.9 greenhouse gas emissions;
- 2.10 contamination; and
- 2.11 social surroundings.

These features should be shown on the site plan, where appropriate.

For all information, please indicate:

- (a) the source of the information; and
- (b) the currency of the information.

## 2.1 Flora and Vegetation

2.1.1 Do you propose to clear any native flora and vegetation as a part of this proposal?

[A proposal to clear native vegetation may require a clearing permit under Part V of the EP Act (Environmental Protection (Clearing of Native Vegetation) Regulations 2004)]. Please contact the Department of Environment and Conservation (DEC) for more information.

(please tick)	🗹 Yes	If yes, complete the rest of this section.
	🗌 No	If no, go to the next section

2.1.2 How much vegetation are you proposing to clear (in hectares)?

Clearing of 7.2 ha of revegetation in the Expansion Project Area will be required for quarry development. See Section 4.1 of the attached Mining Proposal.

2.1.3 Have you submitted an application to clear native vegetation to the DEC (unless you are exempt from such a requirement)?

Yes No If yes, on what date and to which office was the application submitted of the DEC?

No clearing approval is required as HAUS will clear revegetation within the Expansion Project Area under the 10 ha clearing allowance per tenement per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

Further details are given in Section 4.1 of the attached Mining Proposal.

2.1.4 Are you aware of any recent flora surveys carried out over the area to be disturbed by this proposal?

$\mathbf{\nabla}$	Yes		No
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**If yes**, please <u>attach</u> a copy of any related survey reports and <u>provide</u> the date and name of persons / companies involved in the survey(s).

**If no**, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

The flora and vegetation of the Expansion Project Area comprises rehabilitated vegetation. As the area was previously cleared and the seed list for the revegetation was known, no Declared Rare Flora listed under the Wildlife Conservation Act 1950, Threatened Flora or Threatened Ecological Communities listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) or Priority Flora species or Threatened Ecological Communities listed by the Department of Parks and Wildlife (DPAW) are expected to occur within the Expansion Project Area and be impacted by the Expansion Project.

HAUS has retained rehabilitation records of the rehabilitated vegetation and the following is a list of species planted during 2008:

- Agonis flexuosa (West Australian Peppermint).
- Eucalyptus gomphocephala (Tuart).
- Eucalyptus botryoides (Southern Mahogany).
- Acacia lasiocarpa (Glow Wattle).
- Eucalyptus grandis (Flooded Gum).
- Eucalyptus lehmannii (Bushy Yate).
- Corymbia calophylla (Marri).
- Callistemon phoeniceus (Lesser Bottlebrush).
- Melaleuca nesophila (Showy Honey-myrtle).
- Acacia acuminate (Raspberry Jam Wattle).

- Melaleuca lanceolata (Mouse Ears).
- Callistemon glauca (Dawson River Weeper).

Prior to rehabilitation, the area was covered with a pine plantation. This was cleared in 2007 by the Forest Products Commission (FPC) and remaining tree stumps and debris burnt by the Department of Environmental Conservation [DEC (now the DPAW)] due to the presence of the European House Borer.

A flora and vegetation survey of surrounding vegetation was undertaken in 2007 (Appendix D) for the Stage 1 Mining Proposal. Consultation with the DMP has indicated that the 2007 survey was still valid and no additional survey was required to be undertaken of the rehabilitated Expansion Project Area.

The 2007 survey identified twelve small isolated remnant vegetation areas located to the west, east and south of the Expansion Project Area covering a total area of less than 20 hectares (not located with the Mining Lease M70/1046).

Further details are given in Section 2.8 of the attached Mining Proposal.

- 2.1.5 Has a search of DEC records for known occurrences of rare or priority flora or threatened ecological communities been conducted for the site?
  - Yes ☑ No If you are proposing to clear native vegetation for any part of your proposal, a search of DEC records of known occurrences of rare or priority flora and threatened ecological communities will be required. Please contact DEC for more information.

A search of DPAW records for known occurrences of Declared Rare Flora or Priority Flora or Threatened Ecological Communities has not been undertaken as the Expansion Project Area comprises rehabilitated vegetation with a known list of planted species. None of the species planted in the Expansion Project Area (rehabilitated area) are known to be Declared Rare Flora listed under the Wildlife Conservation Act 1950, Threatened Flora or Threatened Ecological Communities listed under the EPBC Act) or Priority Flora species or Threatened Ecological Communities listed by the DPAW (see response to Question 2.1.4).

Further details are given in Section 2.8 of the attached Mining Proposal.

- 2.1.6 Are there any known occurrences of rare or priority flora or threatened ecological communities on the site?
  - Yes ☑ No If yes, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

See response to Question 2.1.5. Further details are given in Section 2.8 of the attached Mining Proposal.

None of the species planted in the Expansion Project Area are known to be Declared Rare Flora listed under the Wildlife Conservation Act 1950, Threatened Flora or Threatened Ecological Communities listed under the EPBC Act) or Priority Flora species or Threatened Ecological Communities listed by the DPAW as the area comprises rehabilitated vegetation with a known species list.

2.1.7 If located within the Perth Metropolitan Region, is the proposed development within or adjacent to a listed Bush Forever Site? (You will need to contact the Bush Forever Office, at the Department for Planning and Infrastructure)

□ No

🗹 Yes

**If yes**, please indicate which Bush Forever Site is affected (site number and name of site where appropriate).

There are five Bush Forever sites in the vicinity of the Expansion Project Area (Ministry for Planning (now Western Australia Planning Commission), 2000). These are:

- Bush Forever Site No. 277, located approximately 1 km east of the Expansion Project Area, this site comprises part of the Serpentine River and floodplain.
- Bush Forever Site No. 376, located north east of the Expansion Project Area, on the other side of Stakehill Road.
- Bush Forever Site No. 75, located approximately 700 m north west of the Expansion Project Area. This site is Churcher Swamp.
- Bush Forever Site No. 275, located approximately 1.5 km north west of the Expansion Project Area. This site is Stakehill Swamp.
- Bush Forever Site No. 278, located over 1 km west of the Expansion Project Area.

Further details are given in Section 2.10.5 of the attached Mining Proposal.

2.1.8 What is the condition of the vegetation at the site?

The flora and vegetation of the Project Area comprises rehabilitated vegetation. This site was rehabilitated in 2008 and as such the revegetation present is immature.

Further details are given in Section 2.8 of the attached Mining Proposal.

#### 2.2 Fauna

2.2.1 Do you expect that any fauna or fauna habitat will be impacted by the proposal?

(please tick)  $\bigvee$  Yes If yes, complete the rest of this section.

No **If no**, go to the next section.

2.2.2 Describe the nature and extent of the expected impact.

A 7.2 ha area of rehabilitated vegetation occurring within the Expansion Project Area will be required to be cleared. The Project Area contains no rare or significant fauna habitat types and is unlikely to support any conservation significant fauna or invertebrate species. Species of high conservation significance known from the local Baldivis area are not expected to depend on or regularly utilise the proposed Expansion Project Area. A small number of locally significant bird species not protected by legislation or listed as Priority species by DPAW, may reside within the proposed disturbance footprint and be disturbed, however these species also occur in surrounding remnant vegetation areas located outside of Mining Lease M70/1046.

As such, no direct impacts to any conservation significant fauna are anticipated as a result of the Expansion Project.

The Project is expected to have negligible impacts on local groundwater as all groundwater abstraction for dust suppression will be within the existing approved Licence To Take Water GWL 162863(2) and as such is not expected to impact any stygofauna that may be present.

To minimise indirect impacts to fauna surrounding the Expansion Project site, HAUS has an existing Fauna Management Plan as a component of the EMP for the Stage 1 Project. This will be updated and implemented for the Expansion Project. The Fauna Management Plan includes:

Avoiding direct contact with fauna where possible.

Training personnel in fauna recognition and recovery procedures in the event fauna are found onsite during operation of the Project.

In addition, to minimise indirect impacts to fauna, HAUS will update the Weed, Noise and Waste Management Plans to include the Expansion Project and implement these updated plans during operations.

Further details are given in Sections 2.9, 4.4, Appendix E and Appendix H of the attached Mining Proposal.

2.2.3 Are you aware of any recent fauna surveys carried out over the area to be disturbed by this proposal?

Yes If yes, please <u>attach</u> a copy of any related survey reports and <u>provide</u> the date and name of persons / companies involved in the survey(s).

**If no**, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

Bamford Consulting Ecologists (2013) undertook a fauna assessment of the Expansion Project Area in September 2013. This is discussed in Section 2.9 and included as Appendix E of the attached Mining Proposal.

2.2.4 Has a search of DEC records for known occurrences of Specially Protected (threatened) fauna been conducted for the site?

✓ Yes □ No (please tick)

Bamford Consulting Ecologists (2013) identified several species of conservation significance, based on review of DPAW's threatened fauna database, WA Museum's FaunaBase database and available literature that may have the potential to occur within the Expansion Project Area. These species and their likelihood of occurrence within the Expansion Project Area are presented in Table 1.

Species	Conservation Significance	Likelihood of Occurrence
Vertebrates		
Carnaby's Black-Cockatoo (Calyptorhynch uslatirostris)	EPBC Endangered <sup>1</sup> and WA Wildlife Conservation Act Schedule 1 <sup>2</sup> .	The foraging potential for Carnaby's Cockatoo is low. Therefore, the potential for Carnaby's Black-Cockatoo to occur is low.
Baudin's Black- Cockatoo (Calyptorhynch usbaudinii)	EPBC Vulnerable <sup>3</sup> and WA Wildlife Conservation Act Schedule 1.	The foraging potential for Baudin's Black-Cockatoo is minimal. Therefore, the potential for Baudin's Black-Cockatoo to occur is very low.

#### Table 1- Conservation Significant Fauna Species

<sup>&</sup>lt;sup>1</sup>Taxa facing a very high risk of extinction in the wild (EPBC Act 1999).

<sup>&</sup>lt;sup>2</sup>Rare and likely to become extinct (EPBC Act 1999).

<sup>&</sup>lt;sup>3</sup>Taxa facing a high risk of extinction in the wild in the medium-term (EPBC Act 1999).

Species	Conservation Significance	Likelihood of Occurrence			
Vertebrates					
Forest Red- tailed Black- Cockatoo (Calyptorhynch usbanksiinaso)	EPBC Vulnerable and WA Wildlife Conservation Act Schedule 1	Due to the lack of Marri trees within the proposed Project Area, the Forest Red-tailed Black- Cockatoo is unlikely to breed or forage in the Project Area. Therefore, the potential for Red- tailed Black Cockatoo to occur is low.			
Southern Brown Bandicoot/ Quenda (Isoodonobesul usfusciventer)	WA DPAW Priority 5 <sup>4</sup>	There was no evidence of the Quenda in the Project Area.			
Invertebrates					
Native Bee (Leioproctusdou glasiellus).	WA Wildlife Conservation Act Schedule 1.⁵	This species is known only from a few records on the Swan Coastal Plain including from Pearce, Forrestdale Lake Nature Reserve and Brixton Street Wetlands. It has been collected from flowers of Goodenia filiformis and Anthotiumjunciforme. Due to a lack of associated food plants, it is not expected to occur within the Expansion Project Area.			
Graceful Sun- Moth (Symenongranti osa).	WA DPAW Priority 4. <sup>6</sup>	The Graceful Sunmoth has been recorded patchily on the Swan Coastal Plain from several areas of remnant vegetation. Due to a lack of associated food plants, it is not expected to occur within the Expansion Project Area.			
Cricket (Austrosagaspi nifer)	WA DPAW Priority 3.	Recorded from heathlands between Perth and Cervantes, but the nature of these heathlands is not known. Unlikely to occur within the Expansion Project Area.			

<sup>&</sup>lt;sup>4</sup>Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent). <sup>5</sup>Rare and likely to become extinct (Wildlife Conservation Act). <sup>6</sup>Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which

sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.(DPAW 2013).

Species	Conservation Significance	Likelihood of Occurrence
Vertebrates		
Native Bee (Hyaleusglobulif erus)	WA DPAW Priority 3.	Forages on the flowers of Woollybush (Adenanthoscygnorum) and some other species. Some Woollybush is present but this is a very widespread plant that responds positively to disturbance. Unlikely to occur within the Expansion Project Area.
Native Bee (Leioproctuscon trarius)	WA DPAW Priority 3.	This species has been recorded at Forrestdale and Murdoch, however there are no records near the proposed Project Area. Unlikely to occur within the Expansion Project Area.
Native Bee (Leioproctusbilo batus).	WA DPAW Priority 2.7	This species is known only from a few records on the Swan Coastal Plain, however there are no records near the proposed Project Area. Unlikely to occur within the Expansion Project Area.
Cricket (Throscodectes xiphos).	WA DPAW Priority 1. <sup>8</sup>	Associated with Banksia Woodland which is absent from the proposed Project Area. Unlikely to occur within the Expansion Project Area.

Further details are given in Sections 2.9, 4.4, Appendix E and Appendix H of the attached Mining Proposal.

- 2.2.5 Are there any known occurrences of Specially Protected (threatened) fauna on the site?
  - If yes, please indicate which species or ☐ Yes No No communities are involved and provide copies of any correspondence with DEC regarding these matters.

No known occurrences or records of conservation significant fauna species or communities are known to occur within the Expansion Project Area.

See response to Question 2.2.4. Further details are given in Section 2.9 and included as Appendix E of the attached Mining Proposal.

<sup>&</sup>lt;sup>7</sup>Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands (DPAW 2013). <sup>8</sup> Taxa with few, poorly known populations on threatened lands (DPAW 2013).

#### 2.3 Rivers, Creeks, Wetlands and Estuaries

2.3.1 Will the development occur within 200 metres of a river, creek, wetland or estuary?

(please tick) □ Yes If yes, complete the rest of this section.
 ✓ No
 If no, go to the next section.

No defined surface water drainage channels occur within the Expansion Project Area. Drainage in the vicinity of the Project Area is generally to the east towards the Serpentine River and Floodplain. It should be noted that the Serpentine River and Floodplain is separated from the site by the Forrest Highway and it is unlikely that any surface water flow from the site would reach the Serpentine River.

A number of wetlands surround the Expansion Project Area. These comprise those managed by DPAW as Resource Enhancement (eight wetlands) and Conservation category (four wetlands) wetlands and those protected under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 (seven wetlands). None of these wetlands are listed under the Ramsar Convention on Wetlands 1971 or the Australian Directory of Important Wetlands. The closest wetland is a small Conservation Category wetland located approximately 230 m to the east of the Expansion Project site. No stream flow impacts to the nearby wetlands of conservation significance are anticipated due to the high infiltration rate of the sandy soils and the presence of the Forrest Highway preventing any flow reaching these wetlands.

No surface water quality impacts to the nearby wetlands of conservation significance due to increased sedimentation during operations are likely to occur as all rainfall and surface runoff will be collected in the active quarry area. The active quarry area will act as a detention pond collecting rainfall and surface runoff and releasing it to the local groundwater system through infiltration.

Further details are given in Sections 2.4 and 4.2 of the attached Mining Proposal.

2.3.2 Will the development result in the clearing of vegetation within the 200 metre zone?

🗌 Yes

- No **If yes**, please describe the extent of the expected impact.
- 2.3.3 Will the development result in the filling or excavation of a river, creek, wetland or estuary?

Yes

No **If yes**, please describe the extent of the expected impact.

2.3.4 Will the development result in the impoundment of a river, creek, wetland or estuary?

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Yes
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No **If yes**, please describe the extent of the expected impact.

2.3.5 Will the development result in draining to a river, creek, wetland or estuary?

2.3.6 Are you aware if the proposal will impact on a river, creek, wetland or estuary (or its buffer) within one of the following categories? (please tick)

Conservation Category Wetland	Yes	☑ No	Unsure
Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998	🗌 Yes	☑ No	Unsure
Perth's Bush Forever site	🗌 Yes	🗹 No	Unsure
Environmental Protection (Swan & Canning Rivers) Policy 1998	Yes	☑ No	Unsure
The management area as defined in s4(1) of the Swan River Trust Act 1988	Yes	☑ No	Unsure
Which is subject to an international agreement, because of the importance of the wetland for waterbirds and waterbird habitats (e.g. Ramsar, JAMBA, CAMBA)	🗌 Yes	No No	Unsure

## 2.4 Significant Areas and/ or Land Features

- 2.4.1 Is the proposed development located within or adjacent to an existing or proposed National Park or Nature Reserve?
  - $\Box$  Yes  $\Box$  No If yes, please provide details.
- 2.4.2 Are you aware of any Environmentally Sensitive Areas (as declared by the Minister under section 51B of the EP Act) that will be impacted by the proposed development?
  - $\Box$  Yes  $\blacksquare$  No If yes, please provide details.

There are a number of Environmentally Sensitive Areas offsite which correspond to the wetland areas as detailed in the response to Question 2.3. There will be no impact to these areas.

Further details are given in Sections 2.4 and 4.2 of the attached Mining Proposal.

 $<sup>\</sup>Box$  Yes  $\blacksquare$  No If yes, please describe the extent of the expected impact.

2.4.3 Are you aware of any significant natural land features (e.g. caves, ranges etc) that will be impacted by the proposed development?

 $\Box$  Yes  $\blacksquare$  No If yes, please provide details.

#### 2.5 Coastal Zone Areas (Coastal Dunes and Beaches)

2.5.1 Will the development occur within 300metres of a coastal area?

(please tick)  $\Box$  Yes **If yes**, complete the rest of this section.

- $\mathbf{\nabla}_{NO}$  If **no**, go to the next section.
- 2.5.2 What is the expected setback of the development from the high tide level and from the primary dune?
- 2.5.3 Will the development impact on coastal areas with significant landforms including beach ridge plain, cuspate headland, coastal dunes or karst?

Yes

No **If yes**, please describe the extent of the expected impact.

2.5.4 Is the development likely to impact on mangroves?

#### 2.6 Marine Areas and Biota

2.6.1 Is the development likely to impact on an area of sensitive benthic communities, such as seagrasses, coral reefs or mangroves?

Yes No If yes, please describe the extent of the expected impact.

2.6.2 Is the development likely to impact on marine conservation reserves or areas recommended for reservation (as described in *A Representative Marine Reserve System for Western Australia*, CALM, 1994)?

- 2.6.3 Is the development likely to impact on marine areas used extensively for recreation or for commercial fishing activities?
  - Yes ✓ No If yes, please describe the extent of the expected impact, and provide any written advice from relevant agencies (e.g. Fisheries WA).

 $<sup>\</sup>Box$  Yes  $\blacksquare$  No **If yes**, please describe the extent of the expected impact.

#### 2.7 Water Supply and Drainage Catchments

2.7.1 Are you in a proclaimed or proposed groundwater or surface water protection area?

(You may need to contact the Department of Water (DoW) for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

 $\Box$  Yes  $\Box$  No **If yes**, please describe what category of area.

2.7.2 Are you in an existing or proposed Underground Water Supply and Pollution Control area?

(You may need to contact the DoW for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

🗌 Yes	🗹 No	If yes,	please	describe	what	category	of
		area.					

2.7.3 Are you in a Public Drinking Water Supply Area (PDWSA)?

(You may need to contact the DoW for more information or refer to the DoW website. A proposal to clear vegetation within a PDWSA requires approval from DoW.)

Yes No **If yes**, please describe what category of area.

The Expansion Project Area lies within the Stakehill Mound groundwater flow system, which is a part of the greater Perth Basin groundwater flow system. According to the Rockingham-Stakehill Groundwater Management Plan (Department of Water, 2008), the Expansion Project Area occurs within the Churcher East groundwater subarea.

The Stakehill Mound is recharged mainly by direct rainfall infiltration, with some upward leakage from underlying aquifers and from scheme water or water obtained from the deeper aquifers. Groundwater recharge is highly variable, depending heavily on rainfall, land use and geology.

Further details are given in Section 2.5 and 4.2 of the attached Mining Proposal.

2.7.4 Is there sufficient water available for the proposal?

(Please consult with the DoW as to whether approvals are required to source water as you propose. Where necessary, please provide a letter of intent from the DoW)

✓ Yes □ No (please tick)

HAUS will continue to require water for dust suppression during operation of the Expansion Project and will utilise the existing groundwater production bore for supply. HAUS currently has a Licence To Take Water [GWL162863(2)] to abstract up to 150,000 kL per annum of groundwater for the washing of extracted sand and for dust suppression purposes. No impacts to groundwater quantity will occur as a result of the Expansion Project as all groundwater abstraction will be in accordance with the existing Licence To Take Water. The volume of groundwater abstracted will also be well below the existing allocation as only dust suppression use will be required as washing of sand will no longer be undertaken.

HAUS has an existing Groundwater Operating Strategy for the Stage 1 Project, which includes a groundwater monitoring programme.

This will continue to be implemented during operation of the Expansion Project. The Groundwater Operating Strategy is a component of the EMP for the Project (see Appendix H of the attached Mining Proposal).

Further details are given in Section 4.2 of the attached Mining Proposal.

- 2.7.5 Will the proposal require drainage of the land?
  - Yes ✓ No If yes, how is the site to be drained and will the drainage be connected to an existing Local Authority or Water Corporation drainage system? Please provide details.

No dewatering will be required as quarrying for the Expansion Project will be undertaken above the groundwater table and a distance of at least 2 m between the pit floor level and the groundwater level will be maintained during operations.

Further details are given in Section 4.2 of the attached Mining Proposal.

2.7.6 Is there a water requirement for the construction and/ or operation of this proposal?

(please tick)  $\bigvee$  Yes If yes, complete the rest of this section.

No **If no**, go to the next section.

HAUS will continue to require water for dust suppression during operation of the Expansion Project and will utilise the existing groundwater production bore for supply.

See response to Question 2.7.4. Further details are given in Section 4.2 of the attached Mining Proposal.

2.7.7 What is the water requirement for the construction and operation of this proposal, in kilolitres per year?

HAUS will not require more than the current allocated allowance of 150,000 kL per annum under the Licence To Take Water [GWL162863(2)]. In 2012, 108,965 kL (73% of the allocation) was abstracted (Golders 2012).

The majority of water used in 2012 was for washing and screening of sand. As the washing and screening plant will no longer be required for the Expansion Project, water usage is expected to be significantly less than this volume.

Further details are given in Section 3.1 and 4.2 of the attached Mining Proposal.

2.7.8 What is the proposed source of water for the proposal? (e.g. dam, bore, surface water etc.)

HAUS has an existing groundwater production bore that operates under an existing Licence To Take Water [GWL162863(2)]. This is located in the south west of the Baldivis Sand Quarry Stage 1 site. See Figure 3 and Section 2.5 and Section 4.2.2 of the attached Mining Proposal.

## 2.8 Pollution

2.8.1 Is there likely to be any discharge of pollutants from this development, such as noise, vibration, gaseous emissions, dust, liquid effluent, solid waste or other pollutants?

(please tick)  $\bigvee$  Yes If yes, complete the rest of this section.

□ No **If no**, go to the next section.

The Expansion Project will discharge noise and dust emissions and generate small quantities of domestic, industrial and hydrocarbon wastes from quarrying operations.

2.8.2 Is the proposal a prescribed premise, under the Environmental Protection Regulations 1987?

(Refer to the EPA's *General Guide for Referral of Proposals to the EPA under section 38(1) of the EP Act 1986* for more information)

Yes No **If yes**, please describe what category of prescribed premise.

The existing Baldivis Sand Quarry Stage 1 Project is a prescribed premise and currently holds an existing Category 12 Licence (L8176/2007/2). An amendment to the existing licence is required to include the Expansion Project.

A Licence Amendment Application to amend Licence L8176/2007/2 has been submitted to DER for assessment.

2.8.3 Will the proposal result in gaseous emissions to air?

 $\Box$  Yes  $\nabla$  No If yes, please briefly describe.

2.8.4 Have you done any modelling or analysis to demonstrate that air quality standards will be met, including consideration of cumulative impacts from other emission sources?

 $\checkmark$  Yes  $\square$  No **If yes**, please briefly describe.

Fugitive dust may be generated as a result of the Project due to:

- Site preparation activities such as topsoil stripping.
- Sand extraction.
- Movement of vehicles.
- Wind erosion of exposed surfaces.

Katestone Environmental Pty Ltd undertook an air quality assessment of the potential impact of particulates (dust) from the proposed Expansion Project (Appendix B of the attached Mining Proposal).

The air quality assessment involved dust modelling to predict particulate emissions from the proposed sand quarry operations to areas surrounding the site.

Outputs from the air quality model have been compared to Ambient Air Quality National Environmental Protection Measure (NEPM) guidelines and the 24-hour average total suspended particles (TSP) guideline in the Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999 (EPP Atmospheric Wastes). NEPM provides a set of ambient air standards, including PM<sub>10</sub> and PM<sub>2.5</sub>, which are designed to protect human health. These standards are widely used to assess potential health impacts from pollutants. The PM<sub>10</sub> and PM<sub>2.5</sub> standards are a maximum concentration of 50 µg/m3 (micrograms per cubic metre) over a 24 hour period for particle matter less than 10 and 2.5 micrometres, respectively.

Whilst the  $PM_{2.5}$  standard has not been adopted by the WA EPA and the Baldivis Quarry is not in the Kwinana area, both the TSP guideline and  $PM_{2.5}$  standard have also been used in this assessment.

Air dispersion modelling was carried out using the AUSPLUME Version 6.0 dispersion model (Victorian EPA). In order to accurately predict air quality impacts from the site operations the model needs to be set with site conditions. Input data to the model included:

- Topography.
- Estimation of dust emissions resulting from HAUS activities i.e. use of front-end loaders and heavy vehicles.
- Atmospheric conditions.

As wind is a key factor in determining air quality impacts, a key input is atmospheric conditions. A site specific atmospheric model has been developed utilising site based information and the Commonwealth Scientific Industrial Research Organisation (CSIRO) the Air Pollution Model (TAPM). Key considerations in the TAPM model are:

- Wind speed and direction: annual, diurnal and seasonal distributions for wind.
- Mixing height: the height above ground within which particulates or other pollutants can mix with ambient air.
- Stability class: Measure of the stability of the atmosphere.

The dust modelling was undertaken for atmospheric conditions experienced during each season of the year. Predicted particulate concentrations generated by the model were then assessed in respect to the Ambient Air Quality National Environmental Protection Measure (NEPM 2003) for  $PM_{10}$  (particulates of less than 10 µm in size).

Ambient air back levels have also been ascertained from the site from monitoring. Ambient air quality has been cumulatively taken into account with the predicted air quality impacts from the Expansion Project.

The air quality assessment has shown that under any season during the year, following watering of roads, there will be no exceedance of the NEPM  $PM_{2.5}$ ,  $PM_{10}$  or Atmospheric Wastes EPP TSP at any residences during operation of the sand quarry (see Figures 9, 10 and 11 of the attached Mining Proposal).

HAUS has implemented dust management measures described in the Dust Management Plan and HAUS' Safety, Health and Environment (SHE) Guideline 3.22 Dust Other Than Silica and SHE Guideline 4.9 for the Stage 1 Project (see Appendix H and I) of the attached Mining Proposal). The Dust Management Plan will be revised to incorporate the Expansion Project.

HAUS has also undertaken a dust monitoring programme to meet Australian Standard (AS) 3580.9.8-2001 Method for Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter for the Stage 1 Project. The dust monitoring programme features weather forecasting with an alarm system with alert SMS to the Quarry Manager for response including additional watering, stabilisation measures and stop work actions. As described in Section 2.6.3 of the attached Mining Proposal, this dust monitoring programme has been effective as very few exceedances attributable to HAUS have occurred during the operation of the Stage 1 quarry. The dust monitoring programme will be continued during operations for the Expansion Project.

Given that the predicted dust concentrations from the sand quarry at residences are below the NEPM  $PM_{2.5}$ ,  $PM_{10}$  standard or Atmospheric Wastes EPP TSP and the implementation of the Dust Management Plan, no unacceptable impacts from dust are anticipated as a result of the Expansion Project.

Further details are given in Sections 2.6, Section 4.9 and Appendix B of the attached Mining Proposal.

2.8.5 Will the proposal result in liquid effluent discharge?

☐ Yes No If yes, please briefly describe the nature, concentrations and receiving environment.

No washing of sand and discharge of washing water is proposed for the Expansion Project as only fill sand will be quarried.

Wheel washing will be undertaken at the existing Stage 1 wheel wash facility using a closed-circuit water recycling system.

Further details are given in Section 3.3 and 3.4 of the attached Mining Proposal.

2.8.6 If there is likely to be discharges to a watercourse or marine environment, has any analysis been done to demonstrate that the State Water Quality Management Strategy or other appropriate standards will be able to be met?

There will be no discharge to watercourses or marine environment.

2.8.7 Will the proposal produce or result in solid wastes?

Yes No **If yes**, please briefly describe the nature, concentrations and disposal location/ method.

Small quantities of domestic, industrial and hydrocarbon wastes will be generated during the Expansion Project. These will be disposed of as follows:

- Domestic waste will be segregated, removed and disposed of at an offsite landfill as part of the local collections by the City of Rockingham.
- Industrial waste such as tyres will be recycled or reused, where possible, or alternatively segregated, removed and disposed of at an offsite landfill by a licensed contractor.
- Hydrocarbon wastes such as accidental oil spills will be mopped up with absorbent material and segregated for removal and disposal offsite by a licensed contractor. An oil/water separator in the maintenance area is regularly cleaned and the waste removed and disposed offsite by a licensed contractor.

These management measures are included within the Stage 1 Waste Management Plan, which will be updated to include the Expansion Project and implemented during operations. The Waste Management Plan is a component of the EMP for the Project (see Appendix H of the attached Mining Proposal).

Further details are given in Sections 3.4.1.3, 4.6 and 4.7 of the attached Mining Proposal.

2.8.8 Will the proposal result in significant off-site noise emissions?

Yes An If yes, please briefly describe.

2.8.9 Will the development be subject to the Environmental Protection (Noise) Regulations 1997?

Yes No **If yes**, has any analysis been carried out to demonstrate that the proposal will comply with the Regulations?

Please attach the analysis.

Noise generated during operation of the proposed Expansion Project has the potential to impact nearby residences. The environmental noise assessment involved noise modelling (SoundPlan) to predict the propagation of noise from the Expansion Project to areas surrounding the site.

The noise modelling was undertaken for the worst case scenario of atmospheric conditions and also for "neutral" or calm conditions. Predicted noise level contours generated by the model were then assessed in respect to the Environmental Protection (Noise) Regulations 1997.

Environmental noise is governed by the Environmental Protection (Noise) Regulations 1997. These regulations stipulate the maximum allowable external noise levels to be generated during operations. The noise regulations permit the sand quarry to operate from 7.00am through to 6.00pm Monday to Saturday. The assigned noise level during operation of the sand quarry, under the regulations for this period for residential land use, is  $L_{A10}$  45 dB(A).

The environmental noise assessment has shown that without any noise control measures, HAUS may exceed the allowable noise level by up to 1 dB(A) (see Figures 12 and 13 of the attached Mining Proposal).

Through adopting best work practices, HAUS may comply with the Environmental Protection (Noise) Regulations 1997 and achieve an allowable noise level of 45 dB(A) or below.

However, it should be noted that baseline noise monitoring has indicated that the ambient noise levels (from road traffic, including lulls in traffic) may be in excess of 10 dB(A) above the assigned noise level and that noise generated from the Expansion Project will not be audible at receptors.

HAUS will implement the noise management measures described in the existing Noise Management Plan and HAUS' SHE Guideline 3.17 Noise for the Stage 1 Project. The Noise Management Plan will be revised to incorporate the Expansion Project and continue to be implemented during operations.

Further details are given in Sections 2.7, 4.9.3, Appendix C and Appendix H of the attached Mining Proposal.

2.8.10 Does the proposal have the potential to generate off-site, air quality impacts, dust, odour or another pollutant that may affect the amenity of residents and other "sensitive premises" such as schools and hospitals (proposals in this category may include intensive agriculture, aquaculture, marinas, mines and quarries etc.)?

Yes No **If yes**, please describe and provide the distance to residences and other "sensitive premises".

See response to Question 2.8.3. See Figures 9, 10 and 11 of the attached Mining Proposal. Further details are given in Sections 2.6, Section 4.9 and Appendix B of the attached Mining Proposal.

2.8.11 If the proposal has a residential component or involves "sensitive premises", is it located near a land use that may discharge a pollutant?

The Expansion Project is not located near a land use that may discharge a pollutant.

#### 2.9 Greenhouse Gas Emissions

2.9.1 Is this proposal likely to result in substantial greenhouse gas emissions (greater than 100 000 tonnes per annum of carbon dioxide equivalent emissions)?



- **If yes**, please provide an estimate of the annual gross emissions in absolute and in carbon dioxide equivalent figures.
- 2.9.2 Further, if yes, please describe proposed measures to minimise emissions, and any sink enhancement actions proposed to offset emissions.

#### 2.10 Contamination

2.10.1 Has the property on which the proposal is to be located been used in the past for activities which may have caused soil or groundwater contamination?

 $\Box$  Yes  $\blacksquare$  No  $\Box$  Unsure **If yes**, please describe.

The Expansion Project Area was historically a pine plantation which was cleared in 2007 due to the presence of the European Borer. The Expansion Project Area was then revegetated. Therefore, it is unlikely that historical activities have taken place which may have caused soil or groundwater contamination. Further details are given in Section 1.4 of the attached Mining Proposal.

2.10.2 Has any assessment been done for soil or groundwater contamination on the site?

 $\square$  Yes  $\square$  No If yes, please describe.

2.10.3 Has the site been registered as a contaminated site under the *Contaminated Sites Act 2003*? (on finalisation of the CS Regulations and proclamation of the CS Act)

 $\Box$  Yes  $\Box$  No If yes, please describe.

#### 2.11 Social Surroundings

2.11.1 Is the proposal on a property which contains or is near a site of Aboriginal ethnographic or archaeological significance that may be disturbed?

 $\checkmark$  Yes  $\square$  No  $\square$  Unsure **If yes**, please describe.

An Aboriginal heritage assessment of the tenements M70/1046 and MLA70/1241 (Stage 1 and 2 Project Areas) was conducted by Ethnosciences during May 2007 (Appendix F of the attached Mining Proposal). Following consultation with the Department of Aboriginal Affairs (DAA), the 2007 survey remains valid and has been updated where applicable with desk based searches.

A search of the Register of Aboriginal Sites (DAA 2013) found that the eastern portion of the Project Area falls inside the boundary of the Serpentine River ceremonial and mythological site (Site ID 3582) as the site file is Closed Access and denoted by two kilometre polygon on public mapping. The DAA has advised that the site is the river itself and is not intersected by the Project Area.

Due to the potential for unrecorded sites to occur within the Project Area, an archaeological reconnaissance of the tenement was undertaken in April 2007 and no archaeological sites or archaeological material was observed during the inspection. The site had been heavily disturbed in the past due to the planting of the pine plantation.

As there was also a potential for previously unrecorded ethnographic sites to occur within the Project Area, consultation was undertaken with the Traditional Owners. Two of the three Nyungar families contacted responded and an ethnographic survey of the tenement area was conducted.

No ethnographic sites were reported by the Aboriginal consultants and as previously indicated HAUS has confirmed with the DAA that the existing survey was satisfactory for the Expansion Project.

HAUS have prepared and implemented an Aboriginal Heritage Management Plan as a component of the Environmental Management Plan for the Stage 1 Project. This plan will be updated and implemented for the Expansion Project (see Appendix H of the attached Mining Proposal).

Further details are in Section 2.10.3 and Section 5.1.2 and Appendix F of the attached Mining Proposal.

2.11.2 Is the proposal on a property which contains or is near a site of high public interest (e.g. a major recreation area or natural scenic feature)?

 $\checkmark$  Yes  $\square$  No **If yes**, please describe.

There are a number of conservation areas in proximity to the Expansion Project Area. These are listed as follows:

#### Resource Enhancement Category

- Six small wetlands located to the east, south east and south.
- Serpentine Floodplain located approximately 1 km to the east.
- Beenyup Swamp located approximately 380 m to the north east.

#### Conservation Category

- Small wetland located approximately 230 m to the east.
- Churcher Swamp located approximately 800 m to the north west.
- Serpentine River and Floodplain located 1 km to the east.
- Stakehill Swamp located approximately 1.5 km to the north west.

Some of the above wetlands are also listed under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 within 2 km of the Expansion Project Area. These comprise:

- Beenyup Swamp located approximately 380 m to the north east.
- Four small wetlands to the south east.
- Churcher Swamp located approximately 800 m to the north west.
- Serpentine Floodplain located approximately 1 km to the east.

None of these wetlands are listed under the Ramsar Convention on Wetlands 1971 or the Australian Directory of Important Wetlands.

Further details are given in Section 2.4 of the attached Mining Proposal.

There are five Bush Forever sites in the vicinity of the Expansion Project Area (Ministry for Planning (now Western Australia Planning Commission), 2000). These are:

- Bush Forever Site No. 277, located approximately 1 km east of the Expansion Project Area, this site comprises part of the Serpentine River and floodplain.
- Bush Forever Site No. 376, located north east of the Expansion Project Area, on the other side of Stakehill Road.
- Bush Forever Site No. 75, located approximately 700 m north west of the Expansion Project Area. This site is Churcher Swamp.
- Bush Forever Site No. 275, located approximately 1.5 km north west of the Expansion Project Area. This site is Stakehill Swamp.
- Bush Forever Site No. 278, located over 1 km west of the Expansion Project Area.

Further details are given in Section 2.10.5 and Figure 4 of the attached Mining Proposal.

2.11.3 Will the proposal result in or require substantial transport of goods, which may affect the amenity of the local area?

 $\Box$  Yes  $\nabla$  No If yes, please describe.

Sand quarried onsite will be transported by semi-trailers, semi-trailers plus trailers and road trains from the Project to customers throughout the Perth Metropolitan Region and South West. Vehicle movements for the Expansion Project will be at the same or lower levels of existing approved Stage 1 vehicle volume and composition, therefore will not further affect the amenity of the local area.

Transcore Pty Ltd undertook a traffic impact assessment of traffic arising from the proposed sand quarry operations as part of the Stage 1 assessment.

The findings of the traffic assessment were that the volume of the traffic generated by the Stage 1 Project was low and would not have a significant impact on the capacity of the existing intersections.

The current transport route is that the majority of vehicles exit the quarry via Stakehill Road and then continue onto Baldivis Road. From Baldivis Road, approximately 80% of the traffic utilises Kwinana Freeway and 20% utilise Karnup Road East (see Figure 7 of the attached Mining Proposal). Vehicles approach the quarry utilising a similar distribution route. Local deliveries enter and exit the quarry along Stakehill Road, using Mandurah Road.

In order to manage traffic related impacts, HAUS has implemented a Transport Management Plan as a component of the Environmental Management Plan for the Stage 1 Project. This plan will be updated and implemented for the Expansion Project (see Appendix H of the attached Mining Proposal).

Further details are given in Sections 2.10.6 and 5.3.2 and Appendix G of the attached Mining Proposal.

#### 3. PROPOSED MANAGEMENT

#### 3.1 Principles of Environmental Protection

3.1.1 Have you considered how your project gives attention to the following Principles, as set out in section 4A of the EP Act? (For information on the Principles of Environmental Protection, please see EPA Position Statement No. 7, available on the EPA website)

1. The precautionary principle.	🗹 Yes	🗌 No
2. The principle of intergenerational equity.	🗹 Yes	🗌 No
3. The principle of the conservation of biological diversity and ecological integrity.	☑ Yes	🗌 No
4. Principles relating to improved valuation, pricing and incentive mechanisms.	🗹 Yes	🗌 No
5. The principle of waste minimisation.	🗹 Yes	🗌 No

3.1.2 Is the proposal consistent with the EPA's Environmental Protection Bulletins/Position Statements and Environmental Assessment Guidelines/Guidance Statements (available on the EPA website)?



#### 3.2 Consultation

- 3.2.1 Has public consultation taken place (such as with other government agencies, community groups or neighbours), or is it intended that consultation shall take place?
  - Yes No **If yes**, please list those consulted and attach comments or summarise response on a separate sheet.

Stakeholder consultation has been undertaken with DMP, DER, Office of EPA, DAA, Landcorp, City of Rockingham and neighbouring residents for the Expansion Project. A summary of the consultation undertaken, key issues raised and the Proponent's response for the Expansion Project is summarised in Section 5.2 of the attached Mining Proposal.

To continue to engage with stakeholders and the community during the operation of the Expansion Project, HAUS will continue to implement a Complaints Register and respond to any stakeholder or community issues as they arise.

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Figure 1 - Site Location

Figure 2 - Locality Map and Mining Tenure

Figure 3 - Site Layout



#### SITE LOCATION



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PTY LTD

Figure: 1 Rev. A

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#### HOLCIM (AUSTRALIA) PTY LTD

BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

#### LOCALITY MAP AND MINING TENURE



Figure:



URS


Attachment 2 – Additional Information – Mining Proposal Baldivis Sand Quarry Stage 1 Project Expansion M70/1046



# **Mining Proposal**

Baldivis Sand Quarry Stage 1 Project Expansion M70/1046

6 NOVEMBER 2013

Prepared for Holcim (Australia) Pty Ltd

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6 November 2013 URS Project No. 42908418/01/0 FINAL

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## **Appendices**

- Appendix A Mining Lease and Conditions
- Appendix B Air Quality Impact Assessment
- Appendix C Operational Noise Impact Assessment
- Appendix D Flora and Vegetation Survey
- Appendix E Vertebrate Fauna Report
- Appendix F Aboriginal Heritage Assessment Summary
- Appendix G Traffic Impact Assessment
- Appendix H Environmental Management Plan
- Appendix I SHE Policy
- Appendix J Quarry Closure Plan



## **Abbreviations**

Abbreviation	Description
AER	Annual Environmental Review
AHD	Australian Height Datum
AS	Australian Standard
bgl	Below Ground Water
cm	Centimetres
CSIRO	Commonwealth Scientific Industrial Research Organisation
DAA	Department of Aboriginal Affairs
DEC	Department of Environment and Conservation
DER	Department of Environmental Regulation
DMP	Department of Mines and Petroleum
DPAW	Department of Parks and Wildlife
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EPP	Environmental Protection Policy
FPC	Forestry Products Commission
GWL	Ground Water Licence
На	Hectare
HAUS	Holcim (Australia) Pty Ltd
hr	Hour
kL	Kilolitres
km	Kilometre
kVA	Kilovolt Ampere
I	Litres
m	Metres
Mt	Million tonnes
NEPM	National Environmental Protection Measure
NPI	National Pollution Inventory
NZS	New Zealand Standards
OEPA	Office of the Environmental Protection Authority
SHE	Safety, Health and Environment
SIA	Social Impact Assessment
t	Tonnes
ТАРМ	The Air Pollution Model
TSP	Total Suspended Particulates
μg	Micrograms
WA	Western Australia
WAPC	Western Australian Planning Commission



The department of Mines and Petroleum's (DMP) Mining Proposal Guidelines (DMP, 2006) require that a checklist is provided as part of a Mining Proposal submission. The Mining Proposal Checklist is provided below.

Q. No	Mining Proposal checklist	Y/N NA	Page No	Comments		
Public availability						
1	Are you aware that this mining proposal is publicly available?	Yes	N/A			
2	Is there any information in this mining proposal that should not be publicly available?	No	N/A			
3	If "No" to Q2, do you have any problem with the information contained in this mining proposal being publicly available?	No	N/A			
4	If "Yes" to Q2, has confidential information been submitted in a separate document/section?	N/A	N/A			
5	Has the mining proposal been endorsed? See last page Checklist.	Yes		The mining proposal has been endorsed by Lisa Honan, Senior Planning and Environment Coordinator, Holcim (Australia) Pty Ltd		
Mining	Proposal details					
6	Have you included the tenement number(s), site name, proposal overview and date in the title page?	Yes	Section 1.1			
7	Who authored the mining proposal? (Please include telephone number of author)	Michael Jones Project Environmental Scientist UBS Australia Pty Ltd				
8	State who to contact enquiries about the mining proposal	Lisa Honan Senior Planning and Environment Coordinator Holcim (Australia) Pty Ltd Ph: (08) 9212 2146				
9	How many copies were submitted to DMP?	Hard co	pies = one			
		Electro	nic = one			
10	Does this mining proposal support a lease application?	No				
11	Has a geological resource statement been included (refer section 4.3.2 of mining proposal guidelines)?	N/A	Section 1.1			
12	Will more than 10 million tonnes of ore and waste be extracted per year? State total tonnage:	No	Section 1.1	Up to 500,000t		
13	Will more than two million tonnes of ore be processed be year? State total throughout.	No	Section 1.1	Up to 500,000t		
14	Is the mining proposal located on pre-1899 Crown Grant lands? (not subject to the Mining Act)	No				
15	Is the mining proposal located on reserve land? If "Yes" state reserve types	Yes	Section 1.1	Crown Reserve 37090		



Q. No	Mining Proposal checklist	Y/N NA	Page No	Comments
16	Will the mining proposal occur within or affect a declared occupied townsite?	Yes		The Project is located in Baldivis, Perth, WA. A location plan is included as Figure 1 and 2. A description of the location is included in Section 1.3.
17	Is the mining proposal within two km of the coastline or a Private Conservation Reserve?	No		
18	Is the mining proposal wholly or partially within a World Heritage Property, Biosphere Reserve, Heritage Site or Soil Reference Site.	Yes	Section 2.10.3	A registered Aboriginal site is located within 2 km of the Project Area.
Teneme	ent Details	r	<b>F</b>	
19	Are all mining operations within granted or applied for tenement boundaries?	Yes	Section 1.1	
20	Are you the tenement holder of all tenements?	Yes	Section 1.1	
21	If "No" at 20, do you have written authorisation from the tenement holder (s) to undertake the Mining proposal activities (Refer to section 4.2.1 of the Mining Proposal Guidelines)	N/A	N/A	
22	Is "Yes" at 21, is a copy of the authorisation contained within the mining proposal?	N/A	N/A	
23	Have you checked for compliance against tenement conditions?	Y		Tenement conditions included in Appendix A.
Locatio	n and Site Layout Plans	Г <u> </u>	P	
24	Have you included location plans showing tenement boundaries and mining operations?	Yes	Figure 2 and 3	
25	Have you included site layout plans showing all mining operations and infrastructure in relation to tenement boundaries?	Yes	Figure 3	
26	Have you included Area of Disturbance Tables for all tenements impacted by mining operations?	Yes	Section 3.2	
Enviror	mental Protection Act			
27	Does the mining proposal require referral under part four or the MOU? If 'Yes' describe why in space below:	Yes	Section 1.2	The Project occurs within a declared occupied townsite.



Q. No	Mining Proposal checklist	Y/N NA	Page No	Comments
28	Has the EPA set a level of assessment? If yes state:	No		Project has been referred to the EPA. Awaiting level of assessment.
29	Is a clearing permit required? If 'No' then explain why in space below?	No	Section 4.1	HAUS proposes to clear no more than 7.2 ha, under the 10 ha limit per tenement per financial year exemption in accordance with the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.
30	If 'Yes' at Q29 then has a permit been applied for?	N/A		
31	Is a works approval required by the DEC?	Yes	Section 1.2	A Licence Amendment Application (Licence L8176/2007/2) has been submitted to the Department of Environmental Regulation (DER) to include the Expansion Project.
32	Has a Works Approval been submitted to the DEC?	N/A		
33	<b>Stakeholder Consultation -</b> Have the following stakeholders been consulted? (use N/A if not relevant)			
	Shire?	Yes		City of Rockingham
	Pastoralist?	N/A		
	DEC? Main Boads?			
			1	1



Q. No	Mining Proposal checklist	Y/N NA	Page No	Comments
	Others? (specify):	Yes	Section 5.2.	DMP (Environment Branch). DMP (Mines Safety Branch). DMP (Dangerous Goods Branch). OEPA (Mining and Industrial Branch). DAA. LandCorp. Neighbouring residents.
Enviror	mental Assessment and Management			
34	Is the mining proposal wholly or partially within DEC managed areas?	Yes	Section 1.1	
35	If 'yes' at Q34 has DEC been consulted?	Yes		
36	Is the mining proposal wholly or partially within a red book area or a bush forever site?	No	Section 2.10.5	Within 2km of Bush Forever Sites
37	Will the mining proposal impact upon a water resource area, water reserve, declared or proposed catchment, groundwater protection area, significant lake or wetland?	No	Section 2.10.5	Within 2km of Conservation Category Wetlands
38	Is a water or de-watering licence required?	Yes		Operating under an existing Groundwater Licence [GWL 162863(2)].
39	If 'Yes' at Q38 then has the licence(s) been applied for?	No		Operating under an existing Groundwater Licence [GWL 162863(2)].
40	Does the mining proposal include a new tailings storage or changes to existing tailings storage?	No		
41	Has AMD assessment been undertaken?	N/A		
42	Have flora and fauna checks been undertaken?	Yes	Section 2.8 and 2.9.	
43	Are any rare species present?	No		
44	Has preliminary closure plan been included?	Yes	Section 6 and Appendix J.	



Q. No	Mining Proposal checklist	Y/N NA	Page No	Comments
45	Do you acknowledge that the hard copies and the CD contain identical information? (this is important for DMP's electronic records system)	Yes		

#### Endorsement

I hereby certify that to the best of my knowledge the above checklist accurately reflects the information contained within this Mining Proposal.

Name: Lisa Honan

Position: Senior Planning and Environment Coordinator Holcim (Australia) Pty Ltd 18 Brodie Hall Drive Bentley WA 6102

Signed:

6/11/13

Date:

URS

Holcim (Australia) Pty Ltd (HAUS) propose to expand the approved limit of extraction of the existing Baldivis Sand Quarry Stage 1 Project (hereafter referred to as the "Expansion Project"), located within Mining Lease M70/1046 in Baldivis, approximately 50 kilometres (km) south of Perth, and 14 km south southeast of Rockingham, Western Australia. The expansion will allow HAUS to continue to supply fill sand for the Perth Metropolitan Area and South West until approval can be sought for Stage 2 of the Baldivis Sand Quarry Project location within Mining Lease Application MLA70/1241.

The expansion comprises extension of the approved Limit of Extraction 100 m north into the existing 250 m buffer located along Stakehill Road. The key components of the Expansion Project comprise:

- Extraction of up to 500,000 tonnes (t) of sand within a Limit of Extraction area of 7.2 hectares (ha).
- No amendment to the approved peak daily abstraction of up to 3000 t per day, with an average of 2500 t per day.
- The Limit of Extraction area will extend 100 m into the existing 250 m buffer located along Stakehill Road. A buffer of approximately 150 m will remain in place adjacent to Stakehill Road.
- The sand would be quarried by front end loader, and loaded for transportation off site. No screening or washing of sand is proposed for the Expansion Project as all sand quarried will be utilised for fill.
- Transport of sand to customers within the Perth Metropolitan Area and South West along existing Stage 1 transport routes at the same or lower levels of existing Stage 1 vehicle volume and composition.
- Abstraction of up to 150,000 kL per annum of groundwater for dust suppression in accordance with the existing Licence To Take Water [GWL 162863(2)].
- Use of all other existing Stage 1 infrastructure comprising access road, weighbridge, power supply, communications, maintenance workshop, administration office, ablutions, crib room, fuelling facility, wheel wash facility and waste collection area.

The Expansion Project resource, in addition to existing reserves in Stage 1, is expected to meet market demands for up to three years within this time.

HAUS and LandCorp have an established agreement framework by which the Stage 1 and Expansion site will be transferred to LandCorp following the completion of quarry operations. It is understood that LandCorp will use the land for residential development. The site is also zoned Urban Deferred under the City of Rockingham's Town Planning Scheme.

HAUS has prepared this Mining Proposal for submission to Department for Mines and Petroleum (DMP) under the *Mining Act* 1978 to seek approval for the Project.

HAUS has also submitted a Licence Amendment Application to the Department for Environmental Regulation for amendment of existing Licence L8176/2007/2 to include the Expansion Project.

HAUS has also referred the Expansion Project to the Environmental Protection Authority (EPA) under Section 38 of the Environmental Protection Act 1986 for determination of the level of environmental assessment for the Project.

No amendment of the existing Licence To Take Water [GWL 162863(2)] is required for the Expansion Project as groundwater abstraction for dust suppression will be within the approved allocation of the existing Licence To Take Water.



No clearing approval is required under the *Environmental Protection Act* 1986 as HAUS will clear revegetation within the Expansion Project Area under the 10 ha clearing allowance per tenement per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

As part of the environmental assessment undertaken, the key environmental and social issues and proposed management for the Expansion Project are described below.

### **Environmental Impacts and Management**

#### Land Clearing

Clearing of a maximum of 7.2 ha of revegetation in the buffer will be required for quarry development. Clearing of vegetation will be addressed through the 10 ha clearing allowance per tenement per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

#### **Surface Water**

No defined surface water drainage channels occur within the Project Area. Drainage in the vicinity of the Project Area is generally to the east towards the Serpentine River and floodplain. It should be noted that the Serpentine River and Floodplain is separated from the site by the Kwinana Freeway and it is unlikely that any surface flow from the site would reach the Serpentine River and Floodplain. In addition, there are a number of wetlands (Conservation and Resource Enhancement category) in the area which are listed as managed by the Department for Parks and Wildlife (DPAW). There are also several wetlands which are listed under the Environmental Protection Policy Swan Coastal Plain 1992.

As recorded in the last Annual Environmental Review (AER) for the Stage 1 Project (Holcim 2012), surface runoff rarely occurs within the Project site as the infiltration capacity of the sandy soil is rarely exceeded by the rainfall intensity.

No surface water quality impacts to the nearby wetlands of conservation significance are likely to occur as all rainfall and surface runoff will be collected in the active quarry area. The active quarry area will act as a detention pond collecting rainfall and surface runoff and releasing it to the local groundwater system through infiltration.

HAUS will ensure that the management measures described in the Stage 1 Hydrocarbon Management Plan are updated to include the Expansion Project and followed to minimise potential impacts.



#### Groundwater

The Project Area is underlain by the Rockingham Sand aquifer which is underlain by the Leederville aquifer. The Rockingham Sand aquifer is a minor, but locally important, semi-unconfined aquifer. The Leederville aquifer is a major confined aquifer underlying the Perth Region, and extends beneath a large area of the Swan Coastal Plain.

The regional flow of groundwater is to the west, towards the ocean. Local discharge is to the Serpentine River to the east and surrounding wetlands.

The current Licence To Take Water (GWL 162863(2)) has an allowance to abstract 150,000 kilolitres per year (kL/yr) for dust suppression and processing. Actual groundwater abstraction for the year 2011 was 108,965 kL or 78% of the allocated amount (Golder 2012).

HAUS will require water for dust suppression at the Expansion Project site and will utilise the current groundwater abstraction licence for supply. It is anticipated that groundwater abstraction for dust suppression for the Expansion Project will be well within the licenced allocation.

HAUS has implemented a Groundwater Operating Strategy as a component of the EMP for the Stage 1 Project. The current Groundwater Operating Strategy is still valid for the Expansion Project as no changes to the volume or use of groundwater is proposed, and the strategy will be continue to be implemented during the Expansion Project.

#### Flora and Vegetation

The flora and vegetation of the Project Area comprises rehabilitated vegetation, which acts as a screening buffer for the Stage 1 Project site. As the area was previously cleared and the seed list for the revegetation was known, no Declared Rare Flora listed under the *Wildlife Conservation Act* 1950, Threatened Flora or Threatened Ecological Communities listed under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) or Priority Flora species or Threatened Ecological Communities listed by DPAW are expected within the Project Area.

Revegetation occurring within the existing buffer will be required to be cleared for the quarrying operations (7.2 ha). Of this approximately 6.26 ha contains revegetation. This will be addressed through the 10 ha clearing allowance per tenement per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

A number of remnant vegetation areas are located surrounding the Project Area. No Declared Rare Flora listed under the *Wildlife Conservation Act* 1950, Threatened Flora or Threatened Ecological Communities listed under the EPBC Act were found within the remnant vegetation areas. Two Priority Flora species were recorded within the remnant vegetation areas.

These remnant vegetation areas will not be directly disturbed by the Project as they are located outside the Expansion Project site, however there is potential for the remnant vegetation areas to be indirectly impacted through the introduction of weeds and dieback, fire and dust.

To minimise indirect impacts to remnant vegetation areas surrounding the Project site, HAUS will update the existing Weed and Dust Management Plans to include the Expansion Project and implement these revised plans during operations.



#### Weeds and Dieback

To reduce the potential for introduction of weeds and dieback to the site and the spread of these to the remnant vegetation areas, HAUS has an existing Weed Management Plan for the Stage 1 Project as a component of the EMP for the Project. This will be updated to include the Expansion Project and will continue to be implemented during operations.

#### Fauna

A vertebrate fauna assessment of the Expansion Project Area was undertaken by Bamford Consulting Ecologists in September 2013 (Bamford 2013).

The vertebrate fauna assessment comprised a desktop review of the DPAW's threatened fauna database, WA Museum's FaunaBase database and available literature to determine those fauna species of conservation significance that are likely to occur within the area, and a site inspection to assess fauna habitat and opportunistic observations of any fauna species.

The site survey concluded that the Project Area contains no rare or significant habitat types and is unlikely to support conservation significant fauna or invertebrate species. Species of high conservation significance known from the local area are not expected to depend on or regularly utilise the proposed disturbance area. A small number of locally significant bird species may reside within the proposed disturbance footprint, but these species also occur in adjacent vegetation remnants. A fauna management plan is in place to manage impacts to fauna. As such, no direct impacts to any conservation significant fauna are anticipated as a result of the Expansion Project.

The Project is expected to have negligible impacts on local groundwater aquifers and as such is not expected to impact any stygofauna that may be present.

#### **Topsoil and Soil Profiles**

According to mapping by the WAPC Land Gate website (WAPC 2013), the Project Area is located within areas designated as having no known risk of acid sulphate soils occurring within 3 m of the natural soil surface (or deeper).

The topsoil will be stripped in a dry state to preserve soil structure and in relatively still conditions, if possible. The topsoil within the bund will be stabilised initially with a polymer application and seeded with native vegetation species indigenous to the area to reduce erosion and to discourage weeds.

#### **Domestic, Industrial Waste, and Hydrocarbon Management**

Domestic and industrial waste and hydrocarbons are currently managed under the Stage 1 Project. Management for the Expansion Project will use similar methods. During Stage 1 operations, HAUS employs the principles of reduce, reuse, recycle to minimise waste produced. Different wastes produced during the Stage 1 Project are stored and disposed as follows:

- Domestic waste is segregated, removed and disposed at an offsite landfill as part of the local collections by the City of Rockingham.
- Industrial waste such as tyres are recycled or reused, where possible, or alternatively segregated, removed and disposed at an offsite landfill by a licensed contractor.



Hydrocarbon wastes such as accidental oil spills are mopped up with absorbent material and segregated for removal and disposal offsite by a licensed contractor. An oil/water separator in the maintenance area is regularly cleaned and the waste removed and disposed offsite by a licensed contractor.

The Stage 1 EMP will be update to include the Expansion Project. Impacts to surface waters from domestic and industrial waste and hydrocarbons are discussed in the Surface Water section. Following implementation of the EMP there will be no impacts from domestic or industrial waste or hydrocarbons.

#### Dust (Air Quality)

Katestone have undertaken an air quality impact assessment of the potential impact of particulates (dust) from the proposed Project. The air quality impact assessment involved dust modelling to predict particulate emissions from the proposed sand quarry operations to areas surrounding the site. Outputs from the air quality model have been compared to National Environmental Protection Measure (NEPM) guidelines and the 24-hour average total suspended particles (TSP) guideline in the Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999 (EPP Atmospheric Wastes). Whilst the Baldivis Quarry is not in the Kwinana area, this guideline has been adopted in this assessment. Baseline dust monitoring is ongoing as part of the Stage 1 Project to evaluate dust concentrations prior to the operation of the sand quarry.

Air dispersion modelling was carried out using the AUSPLUME Version 6.0 dispersion model (Victorian EPA). The dispersion modelling was conducted over a one year period using an onsite meteorological data file generated by TAPM and 15-minute on-site observations of wind speed and wind direction. Ambient air background levels have also been ascertained from the site from on-going monitoring. Ambient air quality has been cumulatively taken into account with the predicted air quality impacts from the Expansion Project.

The draft air quality assessment has shown that under any season during the year, following watering of roads, there will be no exceedance of the NEPM  $PM_{2.5}$ ,  $PM_{10}$  or Atmospheric Wastes EPP TSP at any residences during operation of the sand quarry (Figures 4, 5 and 6).

HAUS has implemented dust management measures described in the Dust Management Plan and HAUS' Safety, Health and Environment (SHE) Guideline 3.22 Dust Other Than Silica for the Project for the Stage 1 Project. The Dust Management Plan will be revised to incorporate the Expansion Project.

HAUS has also undertaken a dust monitoring programme to meet Australian Standard (AS) 3580.9.8-2001 Method for Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter for the Stage 1 Project. The dust monitoring programme features weather forecasting with an alarm system with alert SMS to the Quarry Manager for response including additional watering, stabilisation measures and stop work actions. The dust monitoring programme will be continued during operations for the Expansion Project.

Given that the predicted dust concentrations from the sand quarry at residences are below the NEPM  $PM_{10}$  standard and the implementation of the Dust Management Plan, no unacceptable impacts from dust are anticipated as a result of the Expansion Project.



#### Noise

Noise generated during operation of the proposed Expansion Project has the potential to impact nearby residences.

The environmental noise assessment involved noise modelling (SoundPlan) to predict the propagation of noise from the Expansion Project to areas surrounding the site. The noise modelling was undertaken for the worst case scenario of atmospheric conditions and also for "neutral" or calm conditions. Predicted noise level contours generated by the model were then assessed in respect to the Environmental Protection (Noise) Regulations 1997.

Environmental noise is governed by the Environmental Protection (Noise) Regulations 1997. These regulations stipulate the maximum allowable external noise levels to be generated during operations. The noise regulations permit the sand quarry to operate from 7.00am through to 6.00pm Monday to Saturday. The assigned noise level during operation of the sand quarry, under the regulations for this period for residential land use, is  $L_{A10}$  45 dB(A).

The draft environmental noise assessment has shown that without any noise control measures, HAUS may exceed the allowable noise level by up to 1 dB(A). Through adopting best work practices, HAUS may comply with the Environmental Protection (Noise) Regulations 1997 and achieve an allowable noise level of 45 dB(A) or below.

However, it should be noted that baseline noise monitoring has indicated that the ambient noise levels (from road traffic) are in excess of 10dB(A) above the assigned noise level and that noise generated from the Expansion Project will not be audible at receptors.

HAUS will implement the noise management measures described in the existing Noise Management Plan and HAUS' SHE Guideline 3.17 Noise for the Stage 1 Project. The Noise Management Plan will be revised to incorporate the Expansion Project and continue to be implemented during operations.

#### **Visual Amenity**

To minimise potential impacts to visual amenity as a result of the Stage 1 Project, a screening bund and buffer area has been constructed along Stakehill Road. The bund has been planted with native species. While the Expansion Project will remove part of the buffer area, 150m of the screening area will remain in place which is considered sufficient for visual amenity. HAUS will construct a new bund at the approved limit of extraction for visual amenity, noise attenuation and site security.

#### **European Heritage**

No European heritage sites were identified within the Project based on the findings of review of the Australia Heritage Database, National Trust, State Register and Local Government's Municipal Inventory. The State Register and Local Government's Municipal Inventory identified four places of importance in the Baldivis area, although these are located between approximately 2km and 10 km to the north of the Expansion Project site.

No European heritage sites will be impacted as a result of the Expansion Project.



### **Aboriginal Heritage**

An Aboriginal heritage assessment of the tenements M70/1046 and MLA70/1241 (Stage 1 and 2 Project Areas) was conducted by Ethnosciences during May 2007. Following consultation with the Department of Aboriginal Affairs (DAA), the 2007 survey remains valid and has been updated where applicable with desk based searches.

A search of the Register of Aboriginal Sites (DAA 2013) found that the eastern portion of the Project Area falls inside the boundary of the Serpentine River ceremonial and mythological site (Site ID 3582) as the site file is Closed Access and denoted by two kilometre polygon on public mapping. The DAA has advised that the site is the river itself and is not intersected by the Project Area.

Due to the potential for unrecorded sites to occur within the Project Area, an archaeological reconnaissance of the tenement was undertaken in April 2007 and no archaeological sites or archaeological material was observed during the inspection. The site had been heavily disturbed in the past due to the planting of the pine plantation.

As there was also a potential for previously unrecorded ethnographic sites to occur within the Project Area, consultation was undertaken with the Traditional Owners. Two of the three Nyungar families contacted responded and an ethnographic survey of the tenement area was conducted. No ethnographic sites were reported by the Aboriginal consultants and as previously indicated HAUS has confirmed with the DAA that the existing survey was satisfactory for the Expansion Project.

HAUS have prepared and implemented an Aboriginal Heritage Management Plan as a component of the Environmental Management Plan for the Stage 1 Project. This plan will be updated and implemented for the Expansion Project.

### **Conservation Areas**

A number of Bush Forever sites and wetlands of conservation significance occur within the vicinity of the Project area. None of the Bush Forever sites are located within or adjacent to the Expansion area so will not be impacted by the Project.

There will be no direct impact on wetlands of conservation significance as none occur within the Expansion area site.

It is unlikely that any surface flow from the site would reach the Serpentine River and Floodplain. Therefore, no surface water quality impacts to the nearby wetlands of conservation significance are likely to occur.

#### **Traffic**

Sand quarried onsite will be transported by semi-trailers, semi-trailers plus trailers and road trains from the Project to customers throughout the Perth Metropolitan Region and South West. Vehicle movements for the Expansion Project will be at the same or lower levels of existing approved Stage 1 vehicle volume and composition. Transcore Pty Ltd undertook a traffic impact assessment of traffic arising from the proposed sand quarry operations as part of the Stage 1 assessment. The findings of the traffic assessment were that the volume of the traffic generated by the Stage 1 Project was low and would not have a significant impact on the capacity of the existing intersections.



The current transport route is that the majority of vehicles exit the quarry via Stakehill Road and then continue onto Baldivis Road. From Baldivis Road, approximately 80% of the traffic utilises Kwinana Freeway and 20% utilise Karnup Road East. Vehicles approach the quarry utilising a similar distribution route. Local deliveries enter and exit the quarry along Stakehill Road, using Mandurah Road.

In order to manage traffic related impacts, HAUS has implemented a Transport Management Plan as a component of the Environmental Management Plan for the Stage 1 Project. This plan will be updated and implemented for the Expansion Project.

## **Stakeholder Consultation**

HAUS have undertaken consultation with a number of stakeholders surrounding the Proposed Expansion Project and intend to continue implement a Complaints Register and respond to any stakeholder or community issues as they arise.

## **Environmental Management Plan**

HAUS has a Safety, Health and Environment Management System (SHE MS) and a site specific environemntal management plan (EMP) for the Baldivis Sand Quarry Stage 1 Project. The SHE MS is designed to provide a practical and industry specific management system. It is used to support sites across HAUS to implement, maintain and continually improve an effective SHE management program.

The EMP for the Stage 1 Project will be updated to include the Expansion Project. The updated EMP will be implemented during operations and will form part of the SHE Plan for the site.

## **Quarry Closure**

HAUS and LandCorp have an established agreement framework by which the Stage 1 and Expansion site will be transferred to LandCorp following the completion of quarry operations. It is understood that LandCorp will use the land for residential development. The site is also zoned Urban Deferred under the City of Rockingham's Town Planning Scheme.

Acknowledging the likely final end land use of the site as residential, HAUS will establish a safe and stable landform consistent with LandCorp's requirements until the site is developed.

There is a Stage 1 Quarry Closure Plan in place. This will be updated and implemented for the Expansion Project.



## **Summary of Commitments**

The construction and operation of the Project will be conducted in a manner as to ensure that environmental impacts are minimised. HAUS will implement a number of commitments to minimise associated impacts through the Mining Proposal and Environmental Management Plan. Table 1 provides a summary of these commitments.

Environmental Aspect	Management Commitment Implementation	Timeline
Environmental Management Plan	Commitment 1 - HAUS will update the existing Baldivis Sand Quarry Stage 1 Project Environmental Management Plan to include the Expansion Project and will implement during operations.	Prepared prior to commencement of operations.
Social	Commitment 2 -Holcim will continue to implement a Complaints Register and respond to any stakeholder or community issues as they arise.	Undertaken during operations.
Quarry Closure	Commitment 3 – HAUS will update the existing Baldivis Sand Quarry Stage 1 Quarry Closure Plan to include the Expansion Project and will implement during operations.	Prepared prior to commencement of operations.

#### Table 1 Summary of Commitments



## 1.1 Ownership

Holcim (Australia) Pty Ltd (HAUS) propose to expand the approved limit of extraction of the existing Baldivis Sand Quarry (hereafter referred to as the "Expansion Project"), located in Baldivis approximately 50 km south of Perth, and 14 km south southeast of Rockingham, Western Australia (Figure 1). The expansion will allow HAUS to continue to supply fill sand for the Perth Metropolitan Area and South West until approval can be sought for Stage 2 of the proposal.

The expansion comprises extension of the approved Limit of Extraction 100 m north into the existing 250m buffer located along Stakehill Road. Up to 500,000 tonnes (t) of fill sand would be quarried by HAUS over a period of up to three years.

The Stage 1 Project and expansion are located on Mining Lease M70/1046 held by HAUS. Copies of the mining lease are provided in Appendix A.

The site is also a Crown Reserve (Reserve 37090, Figure 2) set aside for Forestry purposes and is administered by the Department of Parks and Wildlife (DPAW). The Expansion Project site was previously a pine plantation which was cleared (circa 2007) prior to construction of the Stage 1 Project by the Forest Products Commission (FPC) due to the presence of the European House Borer.

The site is also zoned Urban Deferred under the City of Rockingham's Town Planning Scheme. HAUS and LandCorp have an established agreement framework by which the site will be transferred to LandCorp following the completion of quarrying operation. It is understood that LandCorp will use the land for residential development.

Native title is not applicable to the Expansion Project site as the area occurs within Peel Estate where the land was the subject of a freehold grant on 20 November 1834. As freehold grant predates 1899 and as the land was subsequently reserved for a public purpose, native title is extinguished.

An Explosives Reserve (Reserve 38575, Figure 2) administered by the Department of Mines and Petroleum (DMP) is located to the south of the Stage 1 Project and Expansion Project site. The explosive reserve is due to be relocated and the area will form Stage 2 of the Baldivis Sand Quarry (Stage 2 of the Baldivis Sand Quarry Project is located within Mining Lease MLA 70/1241 and will be developed subject to stakeholder consultation with the DMP for relocation of the explosive reserve prior to 2016). The access road to the Explosives Reserve transects the Expansion Project. HAUS has existing procedures in place for the Stage 1 Project, agreed with the DMP, comprising widening of the access road, installing a roundabout, leasing a building for use as a site office and maintaining a 100 m separation distance between the extraction area and Explosives Reserve until such time the Explosives Reserve is decommissioned. HAUS has consulted with DMP regarding the Expansion Project and will continue to operate quarrying operations in accordance with the existing procedures.

The contact details for the Proponent of the Expansion Project are provided below.

Proponent for the Project	Key Contact
Holcim (Australia) Pty Ltd	Lisa Honan
18 Brodie Hall Drive	Senior Planning and Environment Coordinator
BENTLEY WA 6102	
ABN: 87 299 732 297	



## 1.2 **Project Objectives**

HAUS proposes to develop the Expansion Project to continue to provide fill sand for the Perth Metropolitan Area and South West until approval can be sought for Stage 2 of the proposal. The resource (including both Stage 1 and 2) has strategic importance as the major long-term future concrete and construction grade sand supply as it is estimated that existing southern sand resources in the Jandakot, Kwinana and Cockburn areas will be exhausted within a few years. The Baldivis Quarry site also has strategic importance for the State as it is listed as an Outer Region Major Sand Resource within the Statement of Planning Policy No. 2.4 – Basic Raw Materials (WAPC, 2000).

The Expansion Project resource, in addition to existing reserves in Stage 1, is expected to meet market demands for up to three years. HAUS intends to seek approval for Stage 2 of the Baldivis Sand Quarry Project within Mining Lease MLA 70/1241 within this time. The key components of the Expansion Project comprise:

- Extraction of up to 500,000 tonnes (t) of sand within a Limit of Extraction area of 7.2 ha.
- No amendment to the approved peak daily abstraction of up to 3000 t per day, with an average of 2500 t per day.
- The Limit of Extraction area will extend 100 m into the existing 250m buffer located along Stakehill Road. A buffer of approximately 150 m will remain in place adjacent to Stakehill Road.
- The sand would be quarried by front end loader, and loaded for transportation off site. No screening or washing of sand is proposed for the Expansion Project as all sand quarried will be utilised for fill.
- Transport of sand to customers within the Perth Metropolitan Area and South West along existing Stage 1 transport routes at the same or lower levels of the existing Stage 1 vehicle volume and composition.
- Abstraction of up to 150,000 kL per annum of groundwater for dust suppression in accordance with the existing Licence To Take Water [GWL 162863(2)].
- Use of all other existing Stage 1 infrastructure comprising access road, weighbridge, power supply, communications, maintenance workshop, administration office, ablutions, crib room, fuelling facility, wheel wash facility and waste collection area.

The total area of land disturbance for the Expansion Project is anticipated to be 7.2 ha.

Environmental approval is required in order to commence quarry operations. HAUS is proposing to commence quarry operations in January 2014 or as soon as all environmental approvals are received.

This Mining Proposal has been prepared to seek environmental approval under the *Mining Act* 1978. This Mining Proposal has been prepared in accordance with the Guidelines for Mining Proposals in WA (DMP 2006).

HAUS has also referred the Expansion Project to the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act* 1986 and submitted a Licence Amendment Application to the Department of Environmental Regulation (DER) for amendment of existing Licence L8176/2007/2 to include the Expansion Project.



No amendment of the existing Licence To Take Water GWL 162863(2) is required for the Expansion Project as groundwater abstraction for dust suppression will be within the approved allocation of the existing Licence To Take Water.

No clearing approval is required under the *Environmental Protection Act* 1986 as HAUS will clear revegetation within the Expansion Project Area under the 10 ha clearing allowance per tenement per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

## 1.3 Location and Site Layout Plans

The Project is being undertaken on M70/1046 in Baldivis, which is located approximately 50 km south of Perth, and 14 km south southeast of Rockingham, Western Australia (Figures 1 and 2). A site layout plan is provided as Figure 3.

## 1.4 Site History

The Expansion Project Area is currently being used as part of a buffer for the Stage 1 Project.

The key components of the approved Stage 1 Project comprise:

- Quarrying, screening and washing of approximately 7 million tonnes (Mt) of sand within an
  extraction area of 30 ha over a life of eight years to produce concrete, fill and brick layers' sand.
  The sand is quarried by front end loader and, if required, screened and washed at the mobile
  screening and washing plant. Washing water is deposited to a series of sedimentation ponds for
  settling of fines. Clay fines deposited are a by-product and are regularly removed and incorporated
  into sand products for sale.
- Abstraction of groundwater for washing of sand and dust suppression. There is a Licence To Take Water [GWL 162863(2)] in place for 150,000 kL per annum. In 2012, 108,965 kL (73% of the allocation) was abstracted (Golder 2012).
- Transport of sand offsite. Up to 300 heavy vehicle movements occur each weekday and up to 150 heavy vehicle movements occur each Saturday for the transport of sand.
- Supporting infrastructure and facilities including a site office, lunch room and ablutions, a maintenance and equipment storage area, fuelling facility, weighbridge, power supply, wheel wash facility, power and communication lines and waste collection area.
- The normal operating hours for quarrying are 7am to 6pm, Monday to Friday and between 7am and 1pm on Saturday.

The Stage 1 Project was approved by the Department of Industry and Resources (now DMP) on 24 January 2008 following submission of a Mining Proposal. The Stage 1 Project also operates under DER Licence L8176/2007/2 and Licence To Take Water GWL 162863(2). The Stage 1 Project was also referred to the EPA under the Memorandum of Understanding between DMP and EPA and the level of environmental assessment set for the Stage 1 Project was "Not Assessed – No Advice Given" on 3 December 2007.

The Stage 1 Project is currently under operation, and is expected to become idle prior to commencement of works on the Expansion Project.



Stage 2 is planned to be the expansion of the project south when the existing explosive reserve is relocated.

As described in Section 1.1, the site is a Crown Reserve (Reserve 37090, Figure 2) for forestry purposes and is administered by the DPAW. The site comprised a pine plantation which was cleared prior to construction of the Stage 1 Project by the FPC due to the presence of the European House Borer.

As described in Section 1.1, there is an existing Explosive Reserve (Reserve 38575, Figure 2) located to the south of the Expansion Project and Stage 1 Project, which was opened on 16 November 1984, to replace the Woodman Point Explosives Reserve in Fremantle (Department of Minerals and Energy, 1985). It is understood that the Explosives Reserve must be decommissioned prior to the commencement of the Stage 2 Project; however the timing of the decommissioning of the Explosives Reserve has been delayed and is yet to be confirmed by DMP.

As described in Section 1.1, the site is also zoned Urban Deferred under the City of Rockingham's Town Planning Scheme. HAUS and LandCorp have an established agreement framework by which the site will be transferred to LandCorp following the completion of quarry operations.

As described in Section 1.1, an Explosives Reserve (Reserve 38575, Figure 2) administered by the DMP is located to the south of the Stage 1 Project and Expansion Project site. The access road to the Explosives Reserve transects the Expansion Project. HAUS has existing procedures in place for the Stage 1 Project agreed with DMP comprising past widening of the access road, installing a roundabout, leasing a building for use as a site office and maintaining a 100 m separation distance between the extraction area and Explosives Reserve until such time the Explosives Reserve is decommissioned.

## 1.5 Existing Facilities

Existing infrastructure that will be used for the Expansion Project comprise an access road, site office, lunch room and ablutions, crib room, groundwater bore for abstraction of water supply, a maintenance and equipment storage area, fuelling facility, weighbridge, power supply, wheel wash facility, power and communication lines and waste collection area.



## 2.1 Regional Setting

The Project Area is located on the Swan Coastal Plain and occurs within the Spearwood Dune System. The Spearwood Dune System is characterised by leached sand at the surface with yellow to reddish brown sand at greater depths underlain by limestone (Bollard, 1998). The Project Area forms part of a regional ridgeline generally running north-south. The topography of the site ranges from 11 m Australian Height Datum (AHD) at the eastern boundary of the Project Area to 22 m AHD at the south western boundary (Figure 2).

## 2.2 Geology

The Project Area is situated on the central part of the eastern onshore margin of the Perth Basin, which is separated from the Yilgarn Craton by the Darling Fault (Davidson and Yu, 2006).

The Project Area is underlain by the following geological units in descending order:

- Superficial sands of the Spearwood Dune System.
- Tamala Limestone.
- Bassendean Sand to the east of the site and Guildford Clay to the north east of the site.
- Rockingham Sand.
- Leederville Formation (Wanneroo Member).
- Yarragadee Formation (URS, 2007).

Drilling was undertaken by URS in 2005 and 2007 (URS 2005 and URS 2007) as part of the hydrogeological investigations for the Stage 1 Project. The typical geological profile as encountered during the drilling was:

- Topsoil and surface vegetation to a depth of approximately 1 m to 2 m below ground surface (bgl). The topsoil was recorded as grey/brown sand.
- Yellow and white sand, inter bedded in places, from approximately 2 m up to 30 m depth bgl. Yellow sand was generally encountered in a 3.5 m to 16 m thick layer and white sand in a 0.5 m to 10 m thick layer.
- Limestone/sandy limestone from approximately 6 m up to 30 mbgl generally in a 2 m to 6 m thick layer but was not fully penetrated. Alternatively, brown gravelly sand was found from approximately 16 m up to 25 m depth below ground surface generally in a 1 m to 2 m thick layer but was not fully penetrated. It is noted that the brown gravely sand was only seen at depth on the eastern side of the Stage 1 Project Area.

It is assumed that the geological profile within the Expansion Project Area would be similar to that encountered for the Stage 1 Project Area.

The sand resource to be quarried by HAUS comprises sand from the Spearwood Sand System. All sand below the topsoil to a depth of 7 m AHD will be quarried and used as fill.



## 2.3 Soils and Soil Profile

The Project Area is situated within the Spearwood Dune System characterised by leached sand at the surface with creamy yellow to reddish brown sand at greater depth underlain by limestone (Bollard, 1998).

The typical geological profile within the Project Area comprises topsoil underlain by yellow and white sands and limestone/sandy limestone or brown gravely sand.

According to mapping by the Western Australian Planning Commission (WAPC 2000), the Project Area is located within areas designated as no known risk of acid sulphate soils occurring within 3 m of the natural soil surface (or deeper).

A soil survey was not completed as the Expansion Project site will not be rehabilitated to native vegetation. The Expansion Project site is required to be transferred to LandCorp following cessation of quarry operations for residential development.

## 2.4 Surface Hydrology

No defined surface water drainage channels occur within the Project Area. Drainage in the vicinity of the Project Area is generally to the east towards the Serpentine River and Floodplain, as shown in Figure 4. It should be noted that the Serpentine River and Floodplain is separated from the site by the Kwinana Freeway and it is unlikely that any surface water flow from the site would reach the Serpentine River.

There are a number of wetlands in the area which are listed as managed by the DPAW. Managed wetlands are placed into categories which controls development around these wetland areas. The wetland categories are listed in EPA Guidance Statement No. 33, and shown in Table 2-1.

Management Category	General Description	Management Objectives
Conservation	Wetlands which support a high level of attributes and functions.	<ul> <li>Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including:</li> <li>Reservation in national parks, crown.</li> <li>Reserves and State owned land.</li> <li>Protection under Environmental.</li> <li>Protection Policies.</li> <li>Wetland covenanting by landowners.</li> <li>No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.</li> </ul>

#### Table 2-1 Wetland Management Categories



Management Category	General Description	Management Objectives
Resource enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions.	Priority wetlands. Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity. Protection is recommended through a number of mechanisms.

The locations and classification of wetlands are shown on the WA Atlas website (accessed 2013). This has shown the following wetland categories and Environmentally Sensitive Areas (under Section 51B of the *Environmental Protection Act* 1986) in the Baldivis area within 2 km of the Project Area:

#### **Resource Enhancement Category and Environmentally Sensitive Areas**

- Six small wetlands located to the east, south east and south (three of which are Environmentally Sensitive Areas).
- Serpentine Floodplain located approximately 1 km to the east.
- Beenyup Swamp located approximately 380 m to the north east.

#### **Conservation Category and Environmentally Sensitive Areas**

- Small wetland located approximately 230 m to the east.
- Churcher Swamp located approximately 800 m to the north west.
- Serpentine River and Floodplain located 1 km to the east.
- Stakehill Swamp located approximately 1.5 km to the north west.

In addition to the above there is an Environmentally Sensitive Area approximately 1km to the west of the Expansion Project western boundary.

Some of the above wetlands are also listed under the Environmental Protection Policy Swan Coastal Plain 1992 within 2 km of the Project Area. These comprise:

- Beenyup Swamp located approximately 380 m to the north east.
- Four small wetlands to the south east.
- Churcher Swamp located approximately 800 m to the north west.
- Serpentine Floodplain located approximately 1 km to the east.

None of these wetlands are listed under the *Ramsar Convention on Wetlands* 1971 or the Australian Directory of Important Wetlands.

As recorded in the last Annual Environmental Review (AER) for the Stage 1 Project (Holcim 2012), surface runoff rarely occurs within the Project site as the infiltration capacity of the sandy soil is rarely exceeded by the rainfall intensity. The Serpentine River and floodplain are subject to inundation.

Predicted runoff and event peak discharge are presented in Table 2-2 for the existing surface water catchments shown in Figure 4.



Catchment	Area	Average Annual Rainfall	Runoff Coefficient	Average Annual Surface Runoff	Peak Flow Rate for Average Recurrence Interval (years)		Average I (years)
	(km²)	(mm)	(C)	(m <sup>3</sup> )	1 10 100		100
						(m <sup>3</sup> /s)	
Predicted Existing	Predicted Existing Surface Runoff						
North East Local Catchment	2.35	756.7	0.15	266,736	0.67	1.44	3.07
Stage 1 Expansion Catchment	0.078	756.7	0.15	8,853	0.06	0.14	0.30

Table 2-2	Predicted	Existing	Surface	Runoff

## 2.5 Hydrogeology

Groundwater investigations of the Stage 1 and 2 Project Area were conducted by URS in 2005 and 2007 and Golder in 2007. An annual groundwater monitoring report was prepared by Golder in 2012 in accordance with Groundwater Well Licence To Take Water GWL162863(2). The following information has been taken from these studies.

The Expansion Project Area lies within the Stakehill Mound groundwater flow system, which is a part of the greater Perth Basin groundwater flow system. The Stakehill Mound is recharged mainly by direct rainfall infiltration, with some upward leakage from underlying aquifers and from scheme water or water obtained from the deeper aquifers. Groundwater recharge is highly variable, depending heavily on rainfall, land use and geology.

The Expansion Project Area is underlain by the Rockingham Sand aquifer which is underlain by the Leederville aquifer. The Rockingham Sand aquifer is a minor, but locally important, semi-unconfined aquifer. The Leederville aquifer is a major confined aquifer underlying the Perth Region, and extends beneath a large area of the Swan Coastal Plain. Aquifer testing has shown that the aquifer is very transmissive with the hydraulic conductivity of the Tamala Limestone likely to be approximately 200 m/day.

The regional flow of groundwater is to the west, towards the ocean. Local discharge is to the Serpentine River to the east and surrounding wetlands.

Groundwater monitoring has shown that groundwater levels across the site vary from approximately 0.7 to 2 m AHD or 1 to 25 m below ground level (bgl) due to undulating topography (Golder 2012). The groundwater was found to be a calcium-magnesium, sulfate-chloride type water (URS 2007) with electrical conductivity measured at 966 uS/cm for electrical conductivity and 8.18 measured for pH (Golder, 2007).



### 2.6 Climate

#### 2.6.1 Meteorology

The Perth region experiences a Mediterranean climate with warm, dry summers and cool, wet winters. The nearest weather station is the Medina Research Station, station number 9194 (www.bom.gov.au/climate) located approximately 18 km north of the Project Area. The average climate data for the station is provided in Table 2-3.

Month	Mean Daily Maximum Temperature (°C)	Mean Daily Minimum Temperature (°C)	Mean Monthly Rainfall (mm)	Mean Wind Speed 9 am (m/s)	Mean Wind Speed 3 pm (m/s)
Jan	30.6	17	121	12.7	20.8
Feb	31.5	17.6	19.6	13.3	18.2
Mar	29.4	15.9	19.5	12.7	16.4
Apr	25.6	13.3	39.9	10.9	14.4
May	22.1	10.5	98.7	8.6	11.6
Jun	19.3	9.1	145.2	9.1	12.1
Jul	18.3	8.2	147.5	9.5	12.9
Aug	18.8	8	114.2	10	15
Sep	20.3	9.1	76.4	12	15.5
Oct	22.6	10.3	40.2	13.1	18.1
Nov	25.9	13.3	32.6	13.8	20.5
Dec	28.1	15.1	12.2	13.7	20.9
Annual	Mean = 24.4	Mean = 12.3	Total = 763.9	Mean = 11.6	Mean = 16.4

#### Table 2-3 Average Climate Data for Medina Research Centre (years 1983 to 2013)

Source: www.bom.gov.au/climate

The highest mean daily maximum temperature was 31.5 ℃ in February. The lowest mean daily minimum temperature was 8 ℃ in August. The highest mean monthly rainfall was 147.5 mm in July. The lowest mean monthly rainfall was 12.2 mm during December. The regional average annual evaporation is between 1,600 and 1,800 mm (BoM, 2013).

Summer and autumn are dominated by easterly and south westerly wind regime, although in autumn the speed of these winds is dramatically reduced. Winter is dominated by northerly winds and during spring the dominant easterly and south westerly wind pattern begins to re-occur. Seasonal wind roses for an onsite meteorological profile generated by TAPM are presented in Figure 5.



### 2.6.2 Air Quality

Existing air quality in the Project Area is typical of the Perth Metropolitan Region, with the majority of air emissions originating from vehicle emissions and domestic households. According to the National Pollution Inventory (NPI), collated by the DER (DoE, 2013), current air emissions from the Baldivis area primarily originate from motor vehicles, domestic/commercial solvents/aerosols, architectural surface coatings, lawn mowing, domestic solid fuel burning, burning/wildfires, service stations, fuel combustion, railways, domestic gaseous fuel burning, cigarettes and cutback bitumen.

Air emissions reported for the Baldivis area in the NPI from 2011 to 2012 (DoE, 2013) include:

- Levels of oxides of nitrogen (NOx, incorporating nitrogen dioxide [NO<sub>2</sub>], nitric oxide [NO] and nitrous oxide [N<sub>2</sub>O]), reported as 140,000 kg.
- · Levels of carbon monoxide (CO) reported as 800,000 kg.
- Levels of particulate matter (below 10 μm) reported as 210,000 kg.
- Levels of sulphur dioxide (SO<sub>2</sub>) reported as 3,300 kg.

#### 2.6.3 Fugitive Dust

Baseline dust monitoring is ongoing as part of the existing Stage 1 Project to evaluate dust concentrations during operation of the Baldivis Sand Quarry. Monitoring commenced in May 2007, using a Tapered Element Oscillating Microbalance Analyser in accordance with Australian Standard (AS) 3580.9.8-2001 Method for Sampling and Analysis of Ambient Air.

Two monitoring stations were installed for the Stage 1 Project comprising:

- 1. The administration building located approximately 300 m north east of the Stage 1 Project boundary.
- 2. Tuart Ridge Winery located 270 m north west of the Expansion Project boundary.

Background concentrations for  $PM_{10}$  have been taken from the data obtained at the Tuart Ridge Winery and presented below in Table 2-4 (Appendix B). Total Suspended Particulates (TSP) and  $PM_{2.5}$  are not measured onsite or at the closest DER monitoring site in Rockingham. In the absence of monitoring data for TSP and  $PM_{2.5}$ , a ratio has been applied. The assessment has assumed that TSP is approximately 50% of  $PM_{10}$  and  $PM_{2.5}$  is approximately 20% of  $PM_{10}$ .



Particulate	Averaging period	Concentration (μg/m <sup>3</sup> )		
TOD	24-hour	41.8 <sup>1</sup>		
15P	Annual	37.4 <sup>1</sup>		
DM	24-hour	20.9 <sup>2</sup>		
PM <sub>10</sub>	Annual	18.7 <sup>3</sup>		
DM	24-hour	4.2 <sup>4</sup>		
PIM <sub>2.5</sub>	Annual	3.74		
Dust deposition	Assessed in isolation			
Table note:				

#### Table 2-4 **Background Air Quality Concentrations**

Assessment has assumed that TSP is approximately 50% of PM<sub>10</sub>

<sup>2</sup> The highest 70<sup>th</sup> percentile 24-hour concentration measured at Tuart Ridge Winery monitor.

<sup>3</sup> The highest annual average concentration measured at Tuart Ridge Winery monitor.

 $^4$  Assessment has assumed that  $PM_{2.5}$  is approximately 20% of  $PM_{10}$ 

Source: Katestone 2013, Appendix B

Analysis of the data reported in the Stage 1 Annual Environmental Reports from 2008 to 2011 has shown that there have been a number exceedances of the 24-hour average PM10 standard of 50 µg/m3 since operation of the monitors (Holcim 2009, 2010, 2011 and 2012). Only one of these exceedances is attributable to HAUS where problems were experienced in 2009 with a breakdown of the water cart used for dust suppression. The remainder of the exceedances were attributed to bush fires and onsite clearing of pine trees due to the presence of the European House Borer.

#### 2.7 Noise

Baseline noise monitoring was undertaken by URS on 2 October to ascertain existing ambient and current operation noise levels for the Baldivis Sand Quarry (Appendix C). The noise measurements were undertaken using short-term attended monitoring equipment at an onsite and at an offsite receptors R0 and R4 (Figure 1 of Appendix C). Receptor R0 is located approximately 225m north of the Expansion Area boundary and R4 is located 270m north west of the Expansion Area boundary. Noise measurements were typically undertaken in terms of the descriptions in Table 2-5 and measured in decibels (dB) with a tonal correction factor (A).

Measurement	Description
L <sub>A10,t</sub>	Statistical noise level exceeded 10% of the time period t, representing the typical upper noise level.
L <sub>A90,t</sub>	Statistical level exceeded 90% of the time period t,representing the background noise level.
L <sub>Aeq,t</sub>	Time averaged A-weighted sound pressure level, over time period t.
L <sub>AMAX</sub>	Maximum noise level recorded over a period of time.

#### **Noise Level Descriptions** Table 2-5



The most prominent noise sources onsite for existing Stage 1 operations were found to be the screening plant and front end loaders, however, it should be noted that the screening plant will not be in operation for the Expansion Project.

The most prominent noise source measured offsite at the sensitive receptors (R0 and R4) was road traffic noise, from traffic movements along Stakehill Road (light and heavy goods vehicles). Road traffic noise dominated background noise levels for the entirety of the noise monitoring period, which was conducted from 12pm to 3pm. Trucks entering and leaving the existing quarry site were audible from the monitoring locations, however, the observed number of quarry vehicles was considered very low when compared to existing traffic utilising Stakehill Road.

The recorded ambient existing noise at the sensitive receptors (R0 and R4) and a description of perceived noise sources are shown in Table 2-6.

Location	Time (min)	L <sub>Aeq</sub> dB(A)	L <sub>AMAX</sub> dB(A)	L <sub>A10</sub> dB(A)	L <sub>A90</sub> dB(A)	Observations
R0	15	49	66	53	39	No industrial noise audible, roadtraffic noise dominant.
R4	15	60	79	64	41	No industrial noise audible, roadtraffic noise dominant. Noise fromsite was not audible at any time, including during lulls in traffic.

#### Table 2-6 Recorded Noise and Observations

HAUS has produced a Noise Management Plan for the Stage 1 operations. The Noise Management Plan prescribed noise limits and operational hours are based on a noise impact assessment undertaken by Herring Storer in 2008 (Herring Storer, 2008).

The noise limits indicated in the Noise Management Plan define the maximum allowable external noise levels to be generated during quarrying operations. The normal operating hours for quarrying are 7am to 6pm, Monday to Friday and between 7am and 1pm on Saturdays.

The noise limit for residential land, and the assessment criteria for quarrying operations is  $L_{A10}$  45 dB corrected down by 5 dB(A) due to tonality (associated with the operation of the existing screening plant), which results in the assigned noise level of  $L_{A10}$  40 dB. Therefore the current ambient noise at the recorded receptors R0 and R4 are 13 dB (A) and 24 dB(A) above the current assessment criteria. These exceedances are attributable to observed traffic noise, and noise from the existing site activities was not observed.

No noise complaints have been received to date and it is considered that noise impacts are being effectively managed through the Environmental Management Plan (Appendix H). Management measures as described in the Environmental Management Plan include:

- Prohibiting the use of engine brakes.
- Setting speed limits onsite.
- Regularly maintaining internal haul roads to ensure a good running surface.



- Actively maintaining plant and machinery to ensure that all worn parts are replaced and that correct greasing, lubrication and replacement of acoustic covers takes place to reduce noise emissions.
- Silencers and noise attenuation will be utilised as required.
- · Complaints register.

## 2.8 Flora and Vegetation

The flora and vegetation of the Project Area comprises rehabilitated vegetation, which acts as a screen for the Stage 1 Project. Prior to rehabilitation, the area was covered with a pine plantation. This was cleared in 2007 by the Forest Products Commission (FPC) and remaining tree stumps and debris burnt by the DEC (now the DPAW) due to the presence of the European House Borer.

HAUS has retained rehabilitation records of the rehabilitated vegetation and the following is a list of species planted during 2008:

- Agonis flexuosa (West Australian Peppermint).
- Eucalyptus gomphocephala (Tuart).
- Eucalyptus botryoides (Southern Mahogany).
- Acacia lasiocarpa (Glow Wattle).
- Eucalyptus grandis (Flooded Gum).
- Eucalyptus lehmannii (Bushy Yate).
- Corymbiacalophylla (Marri).
- Callistemon phoeniceus (Lesser Bottlebrush).
- Melaleuca nesophila (Showy Honey-myrtle).
- Acacia acuminate (Raspberry Jam Wattle).
- Melaleuca lanceolata (Mouse Ears).
- Callistemon glauca (Dawson River Weeper).

None of these species is known to be Declared Rare Flora or Threatened Flora listed under the *Wildlife Conservation Act* 1950 or the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) or Priority Flora listed by DPAW.

A flora and vegetation survey of vegetation surrounding the Stage 1 Project was undertaken in 2007 (Bennett Environmental Consulting 2007) and is presented as Appendix D.

The 2007 survey identified twelve small isolated remnant vegetation areas located to the west, east and south of the Stage 1 Project Area covering a total area of less than 20 ha. The communities are presented in Figure 6 and comprise:

 Dense Low Forest of *Melaleuca rhaphiophylla* over Tall Sedges of *Lepidospermatetraquetrum* fringing the standing water with Open Herbs dominated by *Triglochinlinearis* in the water. This community occurs in two areas located south east of the Stage 1 Project Area and Expansion Project Area.


- Low Woodland A of *Eucalyptus rudis* subsp. *rudis*, *Melaleuca rhaphiophylla* and *Banksia littoralis* over Thicket of *Kunzeaglabrescens* over Low Sedges dominated by *Lepidospermadrummondii* in sandy clay. This community occurs in three areas located to the east and south east of the Stage 1 Project Area and Expansion Project Area.
- Open Low Woodland A over Open Scrub of *Kunzeaglabrescens* over Low Heath C of *Hypocalymmaangustifolium* over Very Open Low Sedges dominated by *Dasypogonbromeliifolius* in grey sand. This community occurs in a single location to the east of the Stage 1 Project Area and south east of the Expansion Project Area, along the Serpentine River and floodplain.
- Low Woodland A of *Eucalyptus rudis* subsp. *rudis* and *Melaleuca preissiana* over Thicket of *Kunzeaglabrescens* and *Jacksoniafurcellata* over Open Low Sedges dominated by *Hypolaenaexsulca* in grey sand. This community occurs in a single location to the south of Stage 1 Project Area and Expansion Project Area.
- Low Woodland A of Banksia attenuata, Banksia menziesii and Allocasuarinafraseriana, occasionally with Banksia ilicifolia over Low Heath C and Low Heath D of mixed taxa or Low Sedges in grey sand. This community occurs in four corridors; one adjacent to the eastern boundary of the Stage 1 Project Area and Expansion Project Area, two south and one to the south west of the Stage 1 Project Area and Expansion Project Area.
- Woodland of *Eucalyptus gomphocephala* over Low Woodland A of *Banksia grandis*, *Banksia attenuata*, *Banksia menziesii* and *Allocasuarinafraseriana* over Tall Grass of weed taxa in grey sand. This community occurs in one area located south of the Stage 1 Project Area and Expansion Project Area, within the Explosives Reserve.

The vegetation condition of these remnant vegetation areas ranged from excellent to degraded.

No Threatened Ecological Communities listed by DEC (now DER) or under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) were recorded within the remnant vegetation areas.

No flora species known to be Declared Rare Flora or Threatened Flora listed under the *Wildlife Conservation Act* 1950 or the EPBC Act was found within these remnant vegetation areas, which are located outside of the project tenement M70/1046.

However, two Priority Flora species as listed by DPAW, *Dillwynia dillwynioides* (Priority 3<sup>1</sup>) and *Schoenuscapillifolius* (Priority 2<sup>2</sup>) were recorded in the remnant vegetation areas, which are located outside of the M70/1046 tenement. *Dillwynia dillwynioides* was recorded in one remnant vegetation area located approximately 500 m to the east of the Stage 1 Project Area and 800 m to the south east of the Expansion Project Area. *Schoenuscapillifolius* was recorded in two remnant vegetation areas approximately 300 m and 600 m to the south east of the Stage 1 Project Area and 700 m and 1,100 m to the south east of the Expansion Project Area.

<sup>1</sup>Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them (DPAW 2013). <sup>2</sup>Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes (DPAW 2013).



38 weed species were recorded with the remnant vegetation areas. All, except one, of these weed species are identified as weeds by DPAW.

Consultation with DMP indicated that a flora and vegetation survey of the Expansion Project Area was not required as a species list was available and that the flora and vegetation survey of the surrounding remnant vegetation areas undertaken in 2007 (appendix D) was still valid.

## 2.9 Fauna

A vertebrate fauna assessment of the Expansion Area was undertaken by Bamford Consulting Ecologists (Bamford) in September 2013 and is presented as Appendix E.

The vertebrate fauna assessment comprised a desktop review of the DPAW's threatened fauna database, WA Museum's FaunaBase database and available literature to determine those fauna species of conservation significance that are likely to occur within the area, and a site inspection to assess fauna habitat and opportunistic observations of any fauna species.

The desktop survey identified nearly 300 vertebrate species potentially occurring in the general region of Baldivis (this includes seabirds), but was reviewed on the basis of available habitat to include nine frog, 40 reptile, 94 bird and 16 mammal species that could occur in the Expansion Project Area. A total of 22 native fauna species was recorded within the Expansion Project Area during the site inspection. This comprised 20 bird and two mammal species.

Bamford (2013) identified several species of conservation significance that may have the potential to occur within the Expansion Project Area. These species are listed below in Table 2-7.

Table 2-7	Conservation Significance Species in the Local Area
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Species	Conservation Significance	Likelihood of Occurrence
Vertebrates		
Carnaby's Black-Cockatoo (Calyptorhynchuslatirostris)	EPBC Endangered <sup>3</sup> and WA Wildlife Conservation Act Schedule 1 <sup>4</sup> .	The foraging potential for Carnaby's Cockatoo is low. Therefore, the potential for Carnaby's Black- Cockatoo to occur is low.
Baudin's Black-Cockatoo ( <i>Calyptorhynchusbaudinii</i> )	EPBC Vulnerable <sup>5</sup> and WA Wildlife Conservation Act Schedule 1.	The foraging potential for Baudin's Black-Cockatoo is minimal. Therefore, the potential for Baudin's Black- Cockatoo to occur is very low.



<sup>&</sup>lt;sup>3</sup>Taxa facing a very high risk of extinction in the wild (EPBC Act 1999).

<sup>&</sup>lt;sup>4</sup>Rare and likely to become extinct (EPBC Act 1999).

<sup>&</sup>lt;sup>5</sup>Taxa facing a high risk of extinction in the wild in the medium-term (EPBC Act 1999).

Species	Conservation Significance	Likelihood of Occurrence
Vertebrates		
Forest Red-tailed Black- Cockatoo ( <i>Calyptorhynchusbanksiinaso</i> )	EPBC Vulnerable and WA Wildlife Conservation Act Schedule 1	Due to the lack of Marri trees within the proposed Project Area, the Forest Red-tailed Black-Cockatoo is unlikely to breed or forage in the Project Area. Therefore, the potential for Red-tailed Black Cockatoo to occur is low.
Southern Brown Bandicoot/ Quenda ( <i>Isoodonobesulusfusciventer</i> )	WA DPAW Priority 5 <sup>6</sup>	There was no evidence of the Quenda in the Project Area.
Invertebrates		
Native Bee (Leioproctusdouglasiellus).	WA Wildlife Conservation Act Schedule 1. <sup>7</sup>	This species is known only from a few records on the Swan Coastal Plain including from Pearce, Forrestdale Lake Nature Reserve and Brixton Street Wetlands. It has been collected from flowers of <i>Goodenia filiformis</i> and <i>Anthotiumjunciforme</i> . Due to a lack of associated food plants, it is not expected to occur within the Expansion Project Area.
Graceful Sun-Moth (Symenongrantiosa).	WA DPAW Priority 4. <sup>8</sup>	The Graceful Sunmoth has been recorded patchily on the Swan Coastal Plain from several areas of remnant vegetation. Due to a lack of associated food plants, it is not expected to occur within the Expansion Project Area.
Cricket (Austrosagaspinifer)	WA DPAW Priority 3.	Recorded from heathlands between Perth and Cervantes, but the nature of these heathlands is not known. Unlikely to occur within the Expansion Project Area.

circumstances change.(DPAW 2013).



<sup>&</sup>lt;sup>6</sup>Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the <sup>7</sup>Rare and likely to become extinct (Wildlife Conservation Act).
 <sup>8</sup>Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present

Species	Conservation Significance	Likelihood of Occurrence
Vertebrates		
Native Bee (Hyaleusglobuliferus)	WA DPAW Priority 3.	Forages on the flowers of Woollybush( <i>Adenanthoscygnorum</i> )and some other species. Some Woollybush is present but this is a very widespread plant that responds positively to disturbance. Unlikely to occur within the Expansion Project Area.
Native Bee ( <i>Leioproctuscontrarius</i> )	WA DPAW Priority 3.	This species has been recorded at Forrestdale and Murdoch, however there are no records near the proposed Project Area. Unlikely to occur within the Expansion Project Area.
Native Bee (Leioproctusbilobatus).	WA DPAW Priority 2.9	This species is known only from a few records on the Swan Coastal Plain, however there are no records near the proposed Project Area. Unlikely to occur within the Expansion Project Area.
Cricket (Throscodectesxiphos).	WA DPAW Priority 1. <sup>10</sup>	Associated with Banksia Woodland which is absent from the proposed Project Area. Unlikely to occur within the Expansion Project Area.

In addition, 28 bird species (refer to Appendix E) that have been identified as declining in the Perth region may inhabit the Expansion Project Area in small populations or as visitors, however these species are not protected by legislation or listed as Priority species by DPAW.

The site survey concluded that the Expansion Project Area contains no rare or significant habitat types and is unlikely to support conservation significant fauna species. Species of high conservation significance known from the local area are not expected to depend on or regularly utilise the Expansion Project Area. A small number of locally significant bird species not protected by legislation or listed as Priority species by DPAW may reside within the proposed Expansion Project Area, however these species are expected to also occur in surrounding remnant vegetation areas.



<sup>&</sup>lt;sup>9</sup>Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands (DPAW 2013). <sup>10</sup> Taxa with few, poorly known populations on threatened lands (DPAW 2013).

## 2.10 Social Environment

#### 2.10.1 General

A Social Impact Assessment (SIA) was undertaken by Coakes Consulting from January to June 2007 for the Stage 1 Project and includes a description of the existing social environment (Coakes Consulting, 2007). The following information is sourced from the Coakes Consulting report.

Baldivis is situated in the South Metropolitan Area of Perth, within the Baldivis Ward of the City of Rockingham. The South Metropolitan Area is an urbanised coastal environment with a mixture of established and newer suburbs as well as ports and associated industrial developments.

The increased urban development of Perth's south metropolitan area has resulted in significant changes and population growth in Baldivis. In recent years, numerous housing estates have been developed, including Settlers Hills, Baldivis Central, Rivergums and The Chase. Some rural areas remain in the southern parts of Baldivis.

In line with residential development, commercial industry in the area is also expanding. The recent integration of the Kwinana Freeway and Safety Bay Road has increased access to surrounding suburbs and Perth. The Perth to Mandurah rail line and the Perth to Bunbury Highway has also increased the accessibility of Baldivis.

The following demographic profile has been taken from the 2011 census (www.abs.gov.au/census):

- Population: 15,883.
- Median Age: 29.
- Largest proportion of residents aged between 25 and 29 years, and 0 to 4 years, suggesting a prevalence of young families with children.
- Unemployment: 4.1%, compared to a state average of 4.7%. The majority of employment is technicians and trades workers. Suggests area is relatively affluent.

### 2.10.2 European Heritage

A search of the Australian Heritage Database was conducted in 2013 (<u>www.environment.gov.au/</u> heritage). The database includes places in, or under consideration for the World Heritage List; the National Heritage List; the Commonwealth Heritage List; and the Register of the National Estate. The search did not identify any heritage sites within or near the Expansion Project Area.

None of the 12 National Trust sites in Western Australia are located in the Baldivis area.

A search of the State Register and Local Government's Municipal Inventory identified four places of importance in the Baldivis area, comprising:

- Baldivis Primary School on the corner of Baldivis and Fifty Roads.
- Bush Reserve at Baldivis and Karnup Roads and surrounds.
- Group Settler's Home at 118 Fifty Rd.
- Natural Bush Reserve at the rear of Baldivis School at Fifty Rd.



None of these heritage sites occur within the Expansion Project Area and are located between approximately 2km and 10 km north of the site

### 2.10.3 Aboriginal Heritage

An Aboriginal heritage assessment of the tenement (Stage 1 and 2 Project Areas) was conducted by Ethnosciences during May 2007. Following consultation with the former Department of Indigenous Affairs (now Department of Aboriginal Affairs (DAA)), the 2007 survey remains valid. The following information has been sourced from the report, of which a summary is presented as Appendix F.

The study involved a review of the Register of Aboriginal Sites held by the DIA (now DAA) and of published and unpublished literature, to identify any known and potential Aboriginal heritage values within the Stage 1 and 2 Project Areas (Stage 2 refers to the expansion of the project once the explosive reserve has been relocated).

A search of the Register of Aboriginal Sites (DAA, 2013) found that the eastern portion of the Stage 1 and 2 Project Area falls inside the boundary of the Serpentine River ceremonial and mythological site (Site ID 3582) as the site file is Closed Access and denoted by two kilometre polygon on public mapping. The DAA has advised that the site is the river itself and is not intersected by the Stage 1 and 2 Project Areas.

Due to the potential for unrecorded sites to occur within the Stage 1 and 2 Project Area, an archaeological reconnaissance of the tenement was undertaken in April 2007 and no archaeological sites or archaeological material was observed during the inspection. The site had been heavily disturbed in the past due to the planting of the pine plantation.

As there was also a potential for previously unrecorded ethnographic sites to occur within the Stage 1 and 2 Project Area, consultation was undertaken with the Traditional Owners.

Two of the three Nyungar families contacted responded and an ethnographic survey of the tenement area was conducted. No ethnographic sites were reported by the Aboriginal consultants.

### 2.10.4 Surrounding Land Use

Baldivis comprises a combination of residential, rural and natural land use. Land neighbouring the Project Area is residential and rural, including properties with uncleared vegetation, market gardens, horse paddocks and vineyard. The closest residents are located along Stakehill Road adjacent to the north and along Harvey Road adjacent to the east of the Project site. The closest residence is located approximately 300 m north of the quarry area.

### 2.10.5 Conservation Areas

There are five Bush Forever sites in the vicinity of the Expansion Project Area (MfP, 2000), three of which contain Conservation Category wetlands (Ministry for Planning (now Western Australia Planning Commission), 2000) (Figure 4). These are as follows:

- Bush Forever Site No. 277, located approximately 1 km east of the Project Area, this site comprises part of the Serpentine River and floodplain, which is a Conservation Category wetland.
- Bush Forever Site No. 376, located north east of the Project Area, on the other side of Stakehill Road.



- Bush Forever Site No. 75, located approximately 700 m north west of the Project Area. This site is Churcher Swamp and is a Conservation Category wetland.
- Bush Forever Site No. 275, located approximately 1.5 km north west of the Project Area. This site is Stakehill Swamp and is a Conservation Category wetland.
- Bush Forever Site No. 278, located over 1 km west of the Project Area.

In addition, there are a number of wetlands of conservation significance which are discussed in Section 2.4 Surface Hydrology.

### 2.10.6 Transport Infrastructure and Traffic

The existing transport route for the Stage 1 Project is that the majority of vehicles exit the Project site via Stakehill Road and then continue onto Baldivis Road towards the Kwinana Freeway. At the freeway, 80% of vehicles turn onto the freeway and 20% continue onto Karnup Road east. Only local delivery vehicles access Stakehill Road via Mandurah Road. Transport vehicles include semi-trailers, semi-trailers with trailers and road trains. Up to 300 vehicle movements are undertaken each weekday to and from the Stage 1 site. In addition, 150 standard vehicle movements take place each day.

Transcore Pty Ltd undertook a traffic impact assessment of traffic arising from the proposed Stage 1 Project during May 2007 (Appendix G). The traffic assessment was undertaken prior to extension of the Kwinana Freeway. At that time, traffic would travel both west along Stakehill Road towards Ennis Avenue/Mandurah Road and east along Stakehill Road towards Baldivis Road and the Kwinana Freeway north. Transport movements were estimated as 300 heavy vehicle movements to and from the site and 150 standard vehicle movements. The findings of the traffic assessment were that the volume of the traffic generated by the Stage 1 Project was low and would not have a significant impact on the capacity of the existing intersections.

Following the traffic assessment, the following actions were undertaken to improve the existing road network:

- Auxiliary turn lanes on Stakehill Road.
- · Speed limit reduction to 70 km/hr along Stakehill Road and Baldivis Road to improve road
- Installation of curve warning signs with advisory speed limit of 60 km/hr along neighbouring roads
- Prune overgrown vegetation along neighbouring roads.
- Construction of bus stop pull in lanes.

In addition, a Transport Management Plan was prepared and implemented for the Stage 1 Project.

Transport of fill sand produced by the Expansion Project will utilise the same existing transport route as the Stage 1 Project. Traffic generated will also be at the same or lower volume and composition as the Stage 1 Project. No change to the current transport route or increases in traffic are anticipated as a result of the Expansion Project.



## 3.1 Overview

HAUS is seeking to implement the Expansion Project to continue to supply fill sand for the Perth Metropolitan Area and South West until approval can be sought for Stage 2 of the proposal.

The key components of the Expansion Project comprise:

- Extraction of up to 500,000 t of sand within a Limit of Extraction area of 7.2 ha. The Limit of
  Extraction area will extend 100 m into the existing 250m buffer located along Stakehill Road. A
  buffer of approximately 150 m will remain in place adjacent to Stakehill Road. The sand would be
  quarried by front end loader, and loaded for transportation off site. No screening or washing of
  sand is proposed for the Expansion Project as all sand quarried will be utilised for fill.
- Transport of sand to customers within the Perth Metropolitan Area and South West along existing Stage 1 transport routes at the same or lower levels of existing Stage 1 vehicle volume and composition.
- Abstraction of up to 150,000 kL per annum of groundwater for dust suppression in accordance with the existing Licence To Take Water [(GWL 162863(2)].
- Use of all other existing Stage 1 infrastructure comprising access road, weighbridge, power supply, communications, maintenance workshop, administration office, ablutions, crib room, fuelling facility, wheel wash facility and waste collection area.

A site layout for the Expansion Project is shown in Figure 3.

Quarrying of the Expansion Project resource is expected to commence upon receipt of environmental approval and will enable HAUS to continue the current rate of throughput for another year with the resource life expected to extend for a maximum of three years depending on market demand. The Stage 1 Project is currently in operation and HAUS intends to lodge approvals for Stage 2 of the Baldivis Sand Quarry Project located within Mining Lease MLA 70/1241 within this time subject to stakeholder consultation with the DMP for relocation of the explosive reserve prior to 2016.

A detailed description of the key components of the Expansion Project is provided in the following sections.

## 3.2 Area of Disturbance

Table 3-1 shows a breakdown of area of disturbance of the existing Stage 1 Project and proposed Expansion Project components within Mining Lease M70/1046. The total area of land disturbance for the Expansion Project is anticipated to be 7.2 ha. The excavation area for the Expansion Project is approximately 100 m in width and 800 m in length.

Clearance of rehabilitated vegetation will be required for the Expansion area. The area was rehabilitated in 2008 following clearance, by Department of Agriculture, of the European Borer infested pine forest. As less than 10 ha of vegetation will be cleared, clearing will be addressed through the 10 ha clearing allowance per tenement, per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

Table 3-1 below shows the estimated areas of existing and proposed disturbance areas.



Project Component	Area (ha)
Existing Infrastructure	
Laydown Area	0.4
Weighbridge and Wheel Wash Facility	0.08
Road Access	2.5
Workshop and Waste Collection	0.03
Refuelling Area	0.02
HAUS Compound including Crib Room	0.3
Administration Office	0.05
Stage 1 Extraction Area including Sedimentation Ponds	27.2
Total Existing Disturbed Area	30.58
Proposed Expansion Project	
Quarry Extraction Area	7.2
Total Lease Disturbance	37.78
Total Lease Undisturbed area	11.11
Total Lease Area	48.89

#### Table 3-1 Estimated Areas of Disturbance as part of the Expansion Project

## 3.3 Sand Extraction

### 3.3.1 Site Preparation

Site preparation activities will be conducted prior to, and concurrently with, activities as quarrying occurs across the Project Area. Areas to be disturbed will be outlined by survey and delineated in the field with survey pegs and flagging tape before ground disturbance commences.

The topsoil (nominally 15 cm of the soil profile) will be stripped and stockpiled behind the excavation face. The topsoil stockpiles will be no more than 2 m high to maintain biological integrity and will form perimeter bunds around the extraction area. The cleared vegetation will be stockpiled on the topsoil for stabilisation.

A 150 m existing revegetated area will be left in place between the Project and Stakehill Road. This will act as a screening buffer between the Project and receptors to the north of the Project Area.



### 3.3.2 Design and Method of Operation

Quarrying will be undertaken progressively from the southern boundary to the northern boundary of the expansion quarry area progressing in strips from south to north across the site (Figure 8). As the site is intersected by the access road, excavation will take place either side of the access road in an east and west face.

Sand will be initially excavated using a front-end loader and no overburden will be produced as the sand resource occurs immediately below the topsoil. Extraction will be to a maximum depth of 2 m AHD (20 m bgl) across the site resulting in a maximum pit face height of up to 20 m depending on topography. A pit face of at least 5 m will be maintained for noise attenuation.

Working face angles for the Expansion Project will be in the range of 40 to 50 degrees from horizontal based on quarrying operations conducted to date for the Stage 1 Project. Benching will be undertaken, where required, if the depth of extraction is greater than twice the height of the front-end loader (i.e. a face height of approximately 8 m) to ensure a safe and stable working environment. The berm width for an 8 m pit face will be at least 3 m wide.

A distance of at least of 2 m between the pit floor level and the groundwater level will be maintained. As such, no dewatering will be required as quarrying will be undertaken above the groundwater table.

Once the sand is extracted, it will either be directly loaded onto trucks for sale at the weighbridge for transport to customers' offsite. As the excavated sand will be used as fill material no washing or screening will be required on site.

The anticipated mine equipment on site is as follows:

- One water cart.
- One generator (300 kilo volt-ampere (kVA)) which is currently located at the screening and washing plant but also used to supply power to the groundwater production bore.
- Two front end loaders.
- An average of three, but up to a maximum of six load and haul vehicles.

#### 3.3.3 Production Schedule

Quarry operations are anticipated to commence in January 2014, upon receipt of all environmental approvals, and extend for approximately three years. The total volume of sand resource extracted from the quarry area over the life of the Expansion Project is expected to be up to 500,000 t.

The normal operating hours for the quarry are six days a week from 7am to 6pm, each Monday to Friday, and 7am to 12pm, each Saturday. Occasionally, quarry operations extend to 6pm on Saturdays in special circumstances. The Expansion Project will operate in accordance with these existing operating hours.

### 3.3.4 Rehabilitation

During operations, HAUS will undertake progressive quarrying and rehabilitation. Following quarrying of each area, HAUS will rehabilitate land in accordance with LandCorp's requirements comprising:

• The excavation is restored and reinstated in accordance with the rehabilitation program outlined in the Closure Plan approved by LandCorp.



- Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
- The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan. The approved floor level varies from 0 to 20 m bgl as indicated on the floor plan agreed between HAUS and LandCorp.
- All rubbish, debris, improvements or alterations effected by Holcim associated with the excavation works are completely removed from the land.
- All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.

The area has been designated as urban deferred land under local planning policy. The site also has strategic importance for the State as it is listed as an Outer Region Major Sand Resource within the Statement of Planning Policy No. 2.4 – Basic Raw Materials (WAPC, 2000).

Quarry closure and rehabilitation is discussed in greater detail in Section 6.

## 3.4 Support Facilities

### 3.4.1 Existing Infrastructure

The Expansion Project will utilise existing infrastructure for the Stage 1 Project, which is described in the following sections.

#### 3.4.1.1 Access

Access is via the existing access road to the Explosives Reserve and an existing building to the north east of the site. Both facilities are located within Reserve 38575 held by DMP.

The access road is a sealed road with a roundabout constructed in consultation with DMP. HAUS and DMP share access of the access road and all HAUS vehicle traffic complies with the existing Transport Management Plan for the Stage 1 Project.

The existing building has been leased from DMP and is used as a site office, lunch room and for ablutions.

#### 3.4.1.2 Maintenance Area, Equipment Storage Area and Fuelling Facility

A maintenance area, equipment storage area for the storage of heavy equipment and fuelling facility is located within a fenced compound in the north of the Stage 1 site, part of which is within land leased from DMP (Figure 3).

The maintenance area contains one bay with a containment apron; wash down bay with drive-in sump and an oil/hydrocarbon separator.

Oils are stored in the Stage 1 maintenance area for equipment maintenance and are segregated and bunded in accordance with Australian Standard (AS) 1940 and DMP and DER requirements.

Diesel is stored in the maintenance area in a self-bunded 20,000l capacity storage tank. The fuel storage and refilling facility is bunded in accordance with AS 1940 and DMP and DER requirements, with appropriate surface water drainage and collection. A dangerous goods licence is held for the storage of diesel onsite.

No other dangerous goods or hazardous substances will be used for the Expansion Project.

#### 3.4.1.3 Waste Collection Facilities

Operations for the Expansion Area will utilise existing facilities in the Stage 1 area. The waste compound is a collection and storage point for domestic, industrial and hydrocarbon waste prior to disposal offsite and is located within the fenced compound in the north east of the Stage 1 site. Different wastes produced during the Expansion Project will be stored and disposed as follows in accordance with the existing Stage 1 Waste Management Plan, which will be revised to incorporate the Expansion Project. The following is included in the Waste Management Plan:

- Domestic waste will be segregated, removed and disposed of at an offsite landfill as part of the local collections by the City of Rockingham.
- Industrial waste such as tyres will be recycled or reused, where possible, or alternatively segregated, removed and disposed of at an offsite landfill by a licensed contractor.
- Hydrocarbon wastes such as accidental oil spills will be mopped up with absorbent material and segregated for removal and disposal offsite by a licensed contractor. An oil/water separator in the maintenance area is regularly cleaned and the waste removed and disposed offsite by a licensed contractor.

Wheel washing will be undertaken at the existing Stage 1 wheel wash facility using a closed-circuit water recycling system.

#### 3.4.1.4 Communication Lines

Communications run from the existing communication network at Baldivis Road along the access road to the fenced compound and weighbridge. The existing building leased from DMP and used as a site office, lunch room and ablutions has existing communications.

### 3.5 Power

A 300 kVA diesel generator is located at the screening and washing plant. The generator contains its own fuel tanks and is self bunded in accordance with AS 1940 and DMP and DER requirements. Power is reticulated around the Stage 1 Project using aerial transmission lines. Step down transformers have been installed to achieve the desired final voltage.

Power lines run from the existing Synergy network at Baldivis Road along the access road to the fenced compound and weighbridge. The existing buildings onsite leased from DMP are connected to the Perth Metropolitan Area grid operated by Synergy.



## 3.6 Transport

### 3.6.1 Transport Route

Sand quarried onsite will be transported by semi-trailers, semi-trailers plus trailers and road trains from the Project to customers throughout the Perth Metropolitan Region and South West. Vehicle movements for the Expansion Project will be at the same or lower levels of existing Stage 1 vehicle volume and composition (Appendix G).

The current transport route is that the majority of vehicles exit the quarry via Stakehill Road and then continue onto Baldivis Road. From Baldivis Road, approximately 80% of the traffic utilises Kwinana Freeway and 20% utilise Karnup Road East. Vehicles approach the quarry utilising a similar distribution route. Local deliveries enter and exit the quarry along Stakehill Road, using Mandurah Road. The designated transport route for Project is presented in Figure 7.

To improve traffic operations and safety along Stakehill Road, HAUS has provided auxiliary turn lanes with truck warning signs and side road warning signs on Stakehill Road for both approaches to allow for the separation of turning traffic from the straight-through traffic.

In addition, HAUS has an existing Transport Management Plan for the Stage 1 Project in place to ensure the safe operation of vehicles in and surrounding the site (updated plan is shown in Appendix H). Traffic management options given within the Transport Management Plan, and implemented on site, include:

#### Site Traffic Management

- 1. Limiting operation hours for vehicle movements
- 2. Site speed limits
- 3. Wheel-washing
- 4. Covering loads
- 5. Site weighbridge
- 6. Hazard management meetings.

#### **Off-site Traffic Management**

- 1. Heavy vehicles will use designated transport routes
- 2. Heavy vehicles will comply with Main Roads WA regulations
- 3. Upgrade intersection of Stakehill Road and site entrance (completed).

This Transport Management Plan will be updated to include the Expansion Project.

## 3.7 Water Supply

Any potable water required for use in the site office area will be purchased as bottled water.

Up to 150,000 kL per annum of groundwater will be abstracted for dust suppression for the Expansion Project in accordance with the existing Groundwater Well Licence GWL162863(2). An annual groundwater monitoring report (Golder, 2012) has been produced which states that groundwater monitoring demonstrates that the production bore is being operated within abstraction limits and with no significant environmental impacts.



## 3.8 Compliances with Legislation and Other Approvals

Other approvals required under tenement conditions or other relevant legislation are described in the following sections.

### 3.8.1 Tenement Conditions

The tenement conditions of Mining Lease M70/1046 have been reviewed in respect to the Expansion Proposal and are presented in Appendix A.

### 3.8.2 Environmental Protection Act 1986

The site is currently a revegetated area. Clearing of revegetation will be addressed through the 10 ha clearing allowance per tenement per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

### 3.8.3 Mines Safety and Inspection Act 1994

A Project Management Plan has been approved by the DMP for the Stage 1 of the Project.

### 3.8.4 Dangerous Goods Safety Act 2004

A dangerous goods licence is required for the storage of diesel fuel onsite. HAUS has an existing dangerous goods licence obtained prior to the commencement of Stage 1 quarrying operations.

### 3.8.5 Rights in Water and Irrigation Act 1914

A Licence To Take Water (GWL 162863(2)) is held by HAUS for the abstraction of groundwater. This is discussed in Section 3.7 Water Supply.

### 3.8.6 Mines Safety Branch, Department of Mines and Petroleum

HAUS will use the existing access road and building held by the DMP within Explosives Reserve 38575.

HAUS consulted with the DMP during the Stage 1 Project and as a result developed onsite traffic management procedures (Transport Management Plan), including widening of the access road and installing a roundabout, prior to the commencement of quarrying operations for the shared use of the access road. HAUS has consulted with the DMP for the Expansion Project and will operate the Expansion Project in accordance with the existing traffic management procedures. The existing Transport Management Plan will be updated to include the Expansion Project.

HAUS currently leases the existing building and surrounding land at the north east of the site from DMP. The existing building has been converted for use as a site office, lunch room and ablutions.

A separation distance of 100 m is currently maintained between the active quarry area and Explosives Reserve during operation of the Stage 1 Project. This will be maintained during the Expansion Project. HAUS will extend the existing boundary fence to include the Expansion Project prior to the commencement of operations.



### 3.8.7 LandCorp Agreement

HAUS and LandCorp have an established agreement framework by which the site will be transferred to LandCorp following the completion of quarry operations. It is understood that LandCorp will use the land for residential development. HAUS has consulted with LandCorp regarding the operation and post-quarrying handover for the Expansion Project, as required by this agreement. It is understood that LandCorp's requirements for the post-quarrying handover comprise:

- The excavation is restored and reinstated in accordance with the rehabilitation program outlined in the Closure Plan approved by LandCorp.
- Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
- The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan. The approved floor level varies from 0 to 20 m bgl as indicated on the floor plan agreed between HAUS and LandCorp.
- All rubbish, debris, improvements or alterations effected by Holcim associated with the excavation works are completely removed from the land.
- All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.

A copy of this Mining Proposal has been submitted to LandCorp.



## 4.1 Land Clearing

Clearing of 7.2 ha of revegetation in the existing buffer area will be required for quarry development. Clearing of vegetation will be addressed through the 10 ha clearing allowance per tenement per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

## 4.2 Water

### 4.2.1 Surface Water

Potential impacts relating to surface hydrology include potential impacts on the stream flow and water quality of the Serpentine River and floodplain and nearby wetlands of conservation significance. URS has undertaken a desktop assessment of potential impacts to surface hydrology, which is presented below.

Predicted surface water flows during operation of the Expansion Project are presented in Table 4.1.

Catchment	Area Average Annua Rainfall		Average Annual Surface Runoff	Peak Flow Rate for Average Recurrence Interval (years)		
	(km²) (mm)	1		10	100	
			(m <sup>3</sup> )	(	(m³/s)	
Predicted Pre-Mining Surface Runoff						
North East Local Catchment Trimmed	2.35	756.7	266,736	0.67	1.44	3.07
Expansion Project Catchment	0.078	756.7	8,853	0.06	0.14	0.30
Predicted Surface Runoff During Expansion Project Operation						
North East Local Catchment Trimmed	2.27	756.7	257,656	0.64	1.39	2.97
Expansion Project Catchment	0.078	756.7	0	0	0	0

### Table 4-1 Predicted Runoff During Operation

The surface water catchments and direction of surface water flows for the Expansion Project Area are presented in Figure 4. They differ from the previous assessment for the Stage 1 Project, by the separation of the local catchment by the Forrest Highway, stopping any flows from the site to the Serpentine River.

During quarrying operations, rainfall and surface water collected in the active quarry area will infiltrate the sandy soils of the Expansion Project Area. No discharge of surface water from the active quarry area is anticipated. A 2 m layer of sand will be maintained above the groundwater table during quarrying, in accordance with the agreement between HAUS and LandCorp for the operation and relinquishment of the site, and this layer has sufficient storage capacity to contain a 1 in 100 year 72 hour rainfall event (URS, 2007).



Quarrying operations will have minimal impact on stream flow of the North East Local Catchment (a 3.4% reduction) due to the high infiltration capacity of the sandy soils of the Expansion Project Area and small area of total disturbance (7.2 ha). Therefore, no stream flow impacts to the nearby wetlands of conservation significance are anticipated due to the high infiltration rate of the sandy soils and the presence of the Forrest Highway preventing any flow reaching these wetlands.

No surface water quality impacts to the nearby wetlands of conservation significance due to increased sedimentation during operations are likely to occur as all rainfall and surface runoff will be collected in the active quarry area. The active quarry area will act as a detention pond collecting rainfall and surface runoff and releasing it to the local groundwater system through infiltration.

Surface water contamination may occur through spills or leaks of hydrocarbons. HAUS will ensure that the management measures described in the Stage 1 Hydrocarbon Management Plan in Section 4.7 are updated to include the Expansion Project and implemented during operations to minimise these potential impacts.

### 4.2.2 Groundwater

HAUS will require water for dust suppression during operation of the Expansion Project and will utilise the existing groundwater production bore for supply. HAUS currently has a Licence To Take Water [GWL162863(2)] to abstract up to 150,000 kL per annum of groundwater for the washing of extracted sand and for dust suppression purposes.

No impacts to groundwater quantity will occur as a result of the Expansion Project as all groundwater abstraction will be in accordance with the existing Licence To Take Water. The volume of groundwater abstracted will also be well below the existing allocation as only dust suppression use will be required as washing of sand will no longer be undertaken.

No dewatering will be required as quarrying will be undertaken above the groundwater table and a distance of at least 2 m between the pit floor level and the groundwater level will be maintained during operations.

HAUS has an existing Groundwater Operating Strategy for the Stage 1 Project, which includes a groundwater monitoring programme. This will be implemented during the Expansion Project operations. The Groundwater Operating Strategy is a component of the EMP for the Project.

## 4.3 Flora and Vegetation

Revegetation occurring within the existing screening buffer will be required to be cleared for the quarrying operations (7.2 ha). This will be addressed through the 10 ha clearing allowance per tenement per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

As the area was previously cleared and the seed list for the revegetation was known, no Declared Rare Flora listed under the *Wildlife Conservation Act* 1950, Threatened Flora or Threatened Ecological Communities listed under the EPBC Act or Priority Flora species or Threatened Ecological Communities listed by DPAW are expected to occur within the Expansion Project Area and be impacted by the Expansion Project.



A number of remnant vegetation areas are located surrounding the Project site (outside the tenement area) as described in Section 2.8. No Declared Rare Flora listed under the *Wildlife Conservation Act* 1950, Threatened Flora or Threatened Ecological Communities listed under the EPBC Act were found within the remnant vegetation areas. Two Priority Flora species (*Dillwynia dillwynioides* (Priority 3) and *Schoenuscapillifolius* (Priority 2)) were recorded within the remnant vegetation areas (Appendix D).

These remnant vegetation areas will not be directly disturbed by the Expansion Project as they are located outside the Expansion Project Area (and outside of the tenement), however there is potential for the remnant vegetation areas to be indirectly impacted through the introduction of weeds and dieback, fire and dust.

To minimise indirect impacts to remnant vegetation areas surrounding the Expansion Project Area, HAUS will update the existing Stage 1 Weed and Dust Management Plans to include the Project Area and implement the same during operation of the Expansion Project.

### 4.3.1 Weeds and Dieback

Activities associated with the Expansion Project have the potential to cause the introduction of weed species and dieback not already present in the Project site and surrounding remnant vegetation areas. As described in Section 2.8, 38 weed species were recorded within the remnant vegetation areas surrounding the Expansion Project Area.

To reduce the potential for introduction of weeds and dieback to the Expansion Project site and the spread of these to the remnant vegetation areas, HAUS has an existing Weed Management Plan for the Stage 1 Project as a component of the EMP for the Project. This will be updated to include the Expansion Project and will continue to be implemented during operations. The Weed Management Plan includes:

- Vehicle hygiene measures requiring trucks entering and leaving the site to pass through the wheel wash facility to remove any soil and weed material from their wheels.
- In consultation with the DMP Explosives Reserve, maintaining firebreaks surrounding the site to act as a buffer for fire protection, spread of weeds and dieback and fugitive dust generated by the Project.
- Weed control measures, such as spraying of herbicides, in the event weeds occur.

### 4.4 Fauna

As described in Section 2.9, the Project Area contains no rare or significant habitat types and is unlikely to support conservation significant fauna or invertebrate species. Species of high conservation significance known from the local area are not expected to depend on or regularly utilise the proposed Expansion Project Area. A small number of locally significant bird species may reside within the proposed disturbance footprint, but these species also occur in adjacent remnants. As such, no direct impacts to any conservation significant fauna are anticipated as a result of the Expansion Project.

The Expansion Project is expected to have negligible impacts on local groundwater and as such is not expected to impact any stygofauna that may be present.



To minimise indirect impacts to fauna surrounding the Project site, HAUS has an existing Fauna Management Plan as a component of the EMP for the Stage 1 Project. This will be updated and implemented for the Expansion Project.

The Fauna Management Plan includes:

- Avoiding direct contact with fauna where possible.
- Training personnel in fauna recognition and recovery procedures in the event fauna are found onsite during operation of the Project.

In addition, to minimise indirect impacts to fauna, HAUS will update the Weed, Noise and Waste Management Plans to include the Expansion Project and implement these updated plans during operations.

## 4.5 Topsoil and Soil Profiles

Prior to ground disturbance, the topsoil (nominally the top 15 cm of the soil profile) will be stripped and stockpiled delineated from the quarry area to create a bund of no more than 2 m high to maintain biological integrity. Stockpiles will be located sufficiently distant from quarrying operations so that they will not be disturbed prior to being used in rehabilitation.

The topsoil will be stripped in a dry state to preserve soil structure and in relatively still conditions, if possible. The topsoil within the bund will be stabilised initially with a polymer application and seeded with native vegetation species indigenous to the area to reduce erosion and to discourage weeds.

## 4.6 Domestic and Industrial Waste Products

During Stage 1 operations, HAUS employs the principles of reduce, reuse, recycle to minimise waste produced. Different wastes produced during the Stage 1 Project are stored and disposed as follows:

- Domestic waste is segregated, removed and disposed at an offsite landfill as part of the local collections by the City of Rockingham.
- Industrial waste such as tyres are recycled or reused, where possible, or alternatively segregated, removed and disposed at an offsite landfill by a licensed contractor.
- Hydrocarbon wastes such as accidental oil spills are mopped up with absorbent material and segregated for removal and disposal offsite by a licensed contractor. An oil/water separator in the maintenance area is regularly cleaned and the waste removed and disposed offsite by a licensed contractor.

The waste compound is a collection and storage point for domestic, industrial and hydrocarbon waste prior to disposal offsite and is located within the fenced compound in the north east of the Stage 1 Project site. Wheel washing is undertaken using a closed-circuit water recycling system.

These management measures are included within the Stage 1 Waste Management Plan, which will be updated to include the Expansion Project and implemented during operations. The Waste Management Plan is a component of the EMP for the Project.



## 4.7 Hydrocarbon Management

There is the potential for incorrect storage of hydrocarbons to result in the contamination of soil, surface water and groundwater and to pose a safety risk to personnel onsite.

HAUS have implemented a Hydrocarbon Management Plan to minimise the risk of contamination of soil, surface water and groundwater and harm to personnel onsite. This plan includes the following management actions:

- Purchase, storage and transport of fuel will comply with Poisons Act 1964, Poisons Regulations 1965, Mines Safety and Inspection Act 1994, Mines Safety and Inspection Regulations 1995, *Dangerous Goods Safety Act 2004,* Dangerous Goods (Storage) Regulations 2007 and Dangerous Goods (Road Transport) Amendment Regulations 1988.
- Bunding of fuel and oil storage areas in accordance with AS 1940 and DMP and DER requirements.
- Implementation of fuelling procedures.
- Operation of an oil/water separator in the maintenance area.
- Hydrocarbon spills are cleaned up and contaminated soil disposed offsite at a licensed landfill, in the event that hydrocarbon spills occur.

The Hydrocarbon Management Plan is a component of the EMP for the Project and will be update to include the Expansion Project (included in Appendix H).

### 4.8 Dangerous Goods and Hazardous Substances

No dangerous goods or hazardous substances, other than hydrocarbons, will be used on the Project site. Hydrocarbon management has been addressed in Section 4.7.

## 4.9 Atmospheric Pollution and Noise

#### 4.9.1 Air Quality

The Expansion Project will temporarily increase the quantity of emissions of oxides of nitrogen, carbon monoxide, carbon dioxide and small quantities of particulate matter and sulphur dioxide from front end loaders and trucks during quarrying, screening and washing of sand. These emissions are not expected to have a significant effect on the air quality of the area.

### 4.9.2 Fugitive Dust

Fugitive dust may be generated as a result of the Project due to:

- Site preparation activities such as topsoil stripping.
- Sand extraction.
- Movement of vehicles.
- Wind erosion of exposed surfaces.



Katestone undertook an air quality assessment of the potential impact of particulates (dust) from the proposed Expansion Project (Appendix B). The air quality assessment involved dust modelling to predict particulate emissions from the proposed sand quarry operations to areas surrounding the site.

Outputs from the air quality model have been compared to Ambient Air Quality National Environmental Protection Measure (NEPM) guidelines and the 24-hour average total suspended particles (TSP) guideline in the Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999 (EPP Atmospheric Wastes). NEPM provides a set of ambient air standards, including PM<sub>10</sub> and PM<sub>2.5</sub>, which are designed to protect human health. These standards are widely used to assess potential health impacts from pollutants.

The  $PM_{10}$  and  $PM_{2.5}$  standards are a maximum concentration of 50  $\mu$ g/m<sup>3</sup> (micrograms per cubic metre) over a 24 hour period for particle matter less than 10 and 2.5 micrometres, respectively.

Whilst the  $PM_{2.5}$  standard has not been adopted by the WA EPA and the Baldivis Quarry is not in the Kwinana area, both the TSP guideline and  $PM_{2.5}$  standard have also been used in this assessment.

Air dispersion modelling was carried out using the AUSPLUME Version 6.0 dispersion model (Victorian EPA). In order to accurately predict air quality impacts from the site operations the model needs to be set with site conditions. Input data to the model included:

- Topography.
- Estimation of dust emissions resulting from HAUS activities i.e. use of front-end loaders and heavy vehicles.
- Atmospheric conditions.

As wind is a key factor in determining air quality impacts, a key input is atmospheric conditions. A site specific atmospheric model has been developed utilising site based information and the Commonwealth Scientific Industrial Research Organisation (CSIRO) the Air Pollution Model (TAPM). Key considerations in the TAPM model are:

- Wind speed and direction: annual, diurnal and seasonal distributions for wind.
- Mixing height: the height above ground within which particulates or other pollutants can mix with ambient air.
- Stability class: Measure of the stability of the atmosphere.

The dust modelling was undertaken for atmospheric conditions experienced during each season of the year. Predicted particulate concentrations generated by the model were then assessed in respect to the Ambient Air Quality National Environmental Protection Measure (NEPM 2003) for  $PM_{10}$  (particulates of less than 10 µg/m<sup>3</sup> in size).

Ambient air back levels have also been ascertained from the site from monitoring. Ambient air quality has been cumulatively taken into account with the predicted air quality impacts from the Expansion Project Operations.

The air quality assessment has shown that under any season during the year, following watering of roads, there will be no exceedance of the NEPM  $PM_{2.5}$ ,  $PM_{10}$  or Atmospheric Wastes EPP TSP at any residences during operation of the sand quarry (Figures 9, 10 and 11).



HAUS has implemented dust management measures described in the Dust Management Plan and HAUS' Safety, Health and Environment (SHE) Guideline 3.22 Dust Other Than Silica and SHE Guideline 4.9 for the Project for the Stage 1 Project. The Dust Management Plan will be revised to incorporate the Expansion Project.

HAUS has also undertaken a dust monitoring programme to meet Australian Standard (AS) 3580.9.8-2001 Method for Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter for the Stage 1 Project. The dust monitoring programme features weather forecasting with an alarm system with alert SMS to the Quarry Manager for response including additional watering, stabilisation measures and stop work actions. As described in Section 2.6.3, this dust monitoring programme has been effective as very few exceedances attributable to HAUS have occurred during the operation of the Stage 1 quarry. The dust monitoring programme will be continued during operations for the Expansion Project.

Given that the predicted dust concentrations from the sand quarry at residences are below the NEPM  $PM_{2.5}$ ,  $PM_{10}$  standard or Atmospheric Wastes EPP TSP and the implementation of the Dust Management Plan, no unacceptable impacts from dust are anticipated as a result of the Expansion Project.

#### 4.9.3 Noise

Noise generated during sand extraction and transport of sand from the proposed Expansion Project has the potential to impact nearby sensitive receptors.

A noise impact assessment was undertaken by URS during October 2013 and is included in Appendix C. The following information has been undertaken from this report unless otherwise specified.

A noise survey was undertaken as part of the Noise Impact Assessment in order to ascertain the existing noise environment at sensitive receptors and to measure the current noise generated from site activities. As existing plant, equipment and vehicles used for the Stage 1 Project will be utilised for the Expansion Project, with the exception of the screening and washing plant as fill sand will be produced for the Expansion Project, measured existing site noise levels will give an indication of potential noise levels at receptors during operation of the Expansion Project.

The noise assessment involved noise modelling (Sound Plan) to predict the propagation of noise from the Expansion Project to areas surrounding the site. The noise modelling was undertaken for the worst case scenario of atmospheric conditions and also for "neutral" or calm conditions. Predicted noise level contours generated by the model were then assessed in respect to the Environmental Protection (Noise) Regulations 1997.

Environmental noise is governed by the Environmental Protection (Noise) Regulations 1997. These regulations stipulate the maximum allowable external noise levels to be generated during operations. The noise regulations permit the sand quarry to operate from 7.00am through to 6.00pm Monday to Saturday. The prescribed noise limit for residential land (the surrounding land use of the Expansion Project) is  $L_{A10}$  45dB (A). To take account of the screening plant for the site, which has an influencing factor (tonality), this limit was revised down to 40 dB(A). However, as the screening plant will not be in operation for the Expansion Project this no longer has an effect. Therefore the assigned noise level during operation of the sand quarry, under the regulations for this period for residential land use, is  $L_{A10}$  45 dB(A).



The noise assessment has shown that without any noise control measures, HAUS may exceed the allowable noise level by up to 1dB(A) at sensitive receptor R0 (Figure12 and 13). Predicted noise levels at each sensitive receptor are given in Table 4-2.

Receptor	Scenario 1: Morning dB(A)	Scenario 2: Afternoon dB(A)
R0	46	35
R1	44	35
R2	44	43
R3	41	42
R4	38	41
R5	31	38
R6	32	42
R7	29	40
R8	29	40
R9	22	35
R10	22	35
R11	20	34

 Table 4-2
 Predicted Noise Levels at Receptors

An exceedance of 1 dB(A) is considered marginal and is not likely to cause any noise impacts. It should be noted that baseline noise monitoring has indicated that the ambient noise levels (from road traffic) are in excess of 10dB(A) above the assigned noise level. Baseline monitoring indicated  $L_{A10}$  noise levels of 53 dB(A) at receptor R0 and 64 dB(A) at R4. Further this to this, the shutdown of the existing screening plant will decrease the amount of noise generated by site operations. It is considered that that noise generated from the Expansion Project will not be audible at receptors.

Impacts will be managed through the noise management measures described in the existing Noise Management Plan and HAUS' SHE Guideline 3.17 Noise for the Stage 1 Project. This EMP has been updated to take account of the Expansion Project (included in Appendix H). Management measures included the following:

- Noise generated by plant, trucks and other heavy machinery will be minimised and managed by:
- Prohibiting the use of engine brakes.
- Setting speed limits onsite
- Regularly maintaining internal haul roads to ensure a good running surface.
- Actively maintaining plant and machinery to ensure that all worn parts are replaced and that correct greasing, lubrication and replacement of acoustic covers takes place to reduce noise emissions.
- Silencers and noise attenuation will be utilised as required.
- Reduction in the amount of vehicles in operation.



- Noise awareness training.
- Complaints register.
- Site operations will be regularly monitored to ensure that excavation configurations, to minimise noise emissions, are being adhered to.
- Regular noise monitoring and inspections will be undertaken and will be reviewed by the Site Manager to evaluate the effectiveness of noise control measures.
- Noise monitoring will be undertaken at the Expansion Project site boundary during key works (e.g. commencement of operations, during the first month of operations).

Taking into account the current noise environment and management measures described in the EMP (Appendix H), it is considered that no noise impacts will arise from the Expansion Project Expansion.

## 4.10 Fire Management

Uncontrolled bush fires have the potential to pose a risk to people, property, livestock and native wildlife, and may adversely affect biodiversity.

HAUS will minimise the risk of fire by updating the Stage 1 Project Fire Management Plan to include the Expansion Project and implement during operations. The Fire Management Plan considers both reducing the risk of fire occurring as a result of the Project and fire preparedness should a fire occur. This includes:

- Ensuring machinery and vehicles are equipped with fire extinguishers and personnel are briefed on the risks of machinery inadvertently setting grass alight.
- Clearing and maintaining firebreaks around all buildings.
- Ensuring personnel are trained and adequately equipped for fire fighting.
- Utilising the water cart for fire fighting purposes when appropriate.
- Liaison with the DMP Explosives Reserve to ensure communication of fire protection measures in place.

The Fire Management Plan is a component of the EMP for the Project (Appendix H).

### 4.11 Environmental Management Plan

HAUS has a Safety, Health and Environment Management System (SHE MS), developed in alignment with the fundamental management principles as set out in the following Australian and International Standards:

- AS/New Zealand Standards (NZS) 4801: Occupational Health and Management Systems Specification with Guidance for Use.
- AS/NZS 4804: Occupational Health and Management Systems General Guidelines on Principles, Systems and Supporting Techniques.
- AS/NZS 4360: Risk Management.
- ISO 14001: Environmental Management Systems Specification with Guidance for Use.



 AS/NZS ISO 14004: Environmental Management Systems – General Guidelines on Principles, Systems and Supporting Techniques.

The SHE MS is designed to provide a practical and industry specific management system. It is used to support sites across HAUS to implement, maintain and continually improve an effective SHE management program. A copy of HAUS' SHE Policy, Guiding Principles and Management Directives are presented in Appendix I.

An EMP has been prepared for the Stage 1 Project and this will be updated to include the Expansion Project (Appendix H). The updated EMP will be implemented during operations and will form part of the SHE Plan for the site. The EMP includes the following plans:

- Groundwater Operating Strategy.
- Weed Management Plan.
- Fauna Management Plan.
- Pest Management Plan.
- Waste Management Plan.
- Hydrocarbon Management Plan.
- Sedimentation Management Plan.
- Fire Management Plan.
- Dust Management Plan.
- Noise Management Plan.
- Aboriginal Heritage.
- Transport Management Plan.

#### **Commitment 1**

HAUS will update the existing Baldivis Sand Quarry Stage 1 Project Environmental Management Plan to include the Expansion Project and implement during operations.



## 5.1 Heritage

### 5.1.1 European Heritage

No European heritage sites were identified within the Project based on the findings of review of the Australia Heritage Database, National Trust, State Register and Local Government's Municipal Inventory. The State Register and Local Government's Municipal Inventory identified four places of importance in the Baldivis area, although these are located between approximately 2km and 10 km to the north of the Project Expansion site (DoE, 2013).

No European heritage sites will be impacted as a result of the Expansion Project.

### 5.1.2 Aboriginal Heritage

No Aboriginal sites of significance have been identified to date within the Expansion Project Area based on the findings of the Aboriginal heritage assessment. The Expansion Project site has been heavily disturbed in the past due to the planting of the pine plantation, although there is potential for unidentified buried archaeological sites to occur.

The Expansion Project has the potential to impact these unidentified buried archaeological sites during sand extraction.

HAUS have prepared and implemented an Aboriginal Heritage Management Plan as part of the Stage 1, which will be updated and forms part of the EMP for the Expansion Project.

The Aboriginal Heritage Management Plan includes the following management measures:

- Briefing of personnel for the potential for unidentified buried archaeological material to occur and HAUS obligations under the *Aboriginal Heritage Act* 1972 as part of site inductions.
- Response procedures in the event that unidentified buried material is found during sand extraction. This includes stop work and report to the Supervisor and Quarry Manager and then seek advice from DIA regarding the identification and management of the material.

HAUS is cognisant of their responsibilities under the *Aboriginal Heritage Act* 1972 and, if any buried material is identified as having Aboriginal heritage significance, will seek Section 18 clearance prior to the operations recommencing. No unidentified buried archaeological sites have been found on the Stage 1 Site to date.

## 5.2 Land Use and Community

The environmental assessment process in WA is a public process and the Proponent is expected to consult with the public and government agencies to ensure that updated information about local issues and concerns is used in the environmental and social impact assessment of the Project.

A summary of the consultation undertaken, key issues raised and the Proponent's response for the Expansion Project is summarised in Table 5-1.



Stakeholder	Issue of Concern	Proponent's Response	
DMP (Environment Branch)	A Mining Proposal will require to be submitted to DMP for assessment under the <i>Mining Act</i> 1978.	This Mining Proposal has been prepared for submission to DMP under the <i>Mining Act</i> 1978.	
	The Expansion Project will also require referral to the EPA. DMP recommend direct referral to EPA instead of under the Memorandum of Understanding	An EPA Referral Form with the Mining Proposal as supporting information has been submitted to the EPA under the <i>Environmental Protection Act</i> 1986.	
	between EPA and DMP as they believe it will be a faster process. A Closure Plan prepared in	The existing Quarry Closure Plan for the Stage 1 Project has been updated to include the Expansion Project. Refer to	
	accordance with the EPA and DMP Mine Closure Guidelines is not required for the Expansion Project.	Section 6. A Clearing Permit under the Environmental Protection (Clearing of	
	A Clearing Permit under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 will be required for any clearing of	Native Vegetation) Regulations 2004 is not required as HAUS proposes to clear 7.2 ha under the 10 ha limit per tenement per financial year as an exemption.	
	native vegetation. No flora and vegetation survey is required for the Expansion Project Area as it is rehabilitation and a list of species planted is known. The existing flora and vegetation survey for the surrounding remnant vegetation areas (Appendix D) is still valid to describe surrounding vegetation. Dust and noise impacts to receptors will need to be assessed.	Flora and vegetation has been described for the Expansion Project Area and surrounding remnant vegetation areas using the rehabilitation species list and existing flora and vegetation survey (Appendix D). Refer to Section 2.8. Dust and noise modelling and assessment of impacts to receptors has been undertaken for the Expansion Project. Refer to Sections 2.6.3 and 2.7.	
DMP (Mines Safety Branch)	No issues of concern as the Expansion Project will not change mine safety issues or safety to the surrounding community. The existing Stage 1 Project Management Plan is valid for the Expansion Project.	HAUS will continue to implement the existing Stage 1 Project Management Plan for the Expansion Project.	
DMP (Dangerous Goods Branch)	No issues of concern as the Expansion Project will not affect the operation of the Explosives Reserve. The existing management procedures in place are valid or the Expansion Project.	HAUS will continue to implement the existing management procedures and Transport Management Plan for the Expansion Project. Refer to Section 2.10.6.	

#### Table 5-1 Summary of Consultation



Stakeholder	Issue of Concern	Proponent's Response	
DER (Industry Regulation)	An amendment to the existing Licence is required to include the Expansion Project due to the update of management plans. This is to take	An Licence Amendment Application to amend Licence has been submitted to DER under the <i>Environmental Protection</i> <i>Act</i> 1986.	
	account of the fact that screening plant is no longer required.	Dust and noise modelling and assessment of impacts to receptors have	
	Dust and noise impacts to receptors will need to be assessed.	been undertaken for the Expansion Project. Refer to Sections 2.6.3 and 2.7.	
	The existing dust and noise management plans for the Stage 1 Project will need to be updated to include the Expansion Project.	The Stage 1 dust and noise management plans have been updated to include the Expansion Project. Refer to Appendix H.	
OEPA (Mining and Industrial Branch)	Referral to the EPA under Section 38 of the <i>Environmental Protection Act</i> 1986 is required for the Expansion Project.	An EPA Referral Form and the Mining Proposal attached as supporting information has been submitted to the EPA under Section 38 of the <i>Environmental Protection Act</i> 1986. Dust and noise modelling and assessment of impacts to receptors has been undertaken for the Expansion Project. Refer to Section 2.6.3 and 2.7.	
	Dust and noise impacts to receptors will need to be assessed. HAUS may consult with the Air Quality and Noise Branches of DER regarding the acceptability of the dust and noise		
DAA	No issues of concern. The existing Aboriginal heritage assessment for the Stage 1 and 2 Project Areas (Appendix F) is valid for the Expansion Project.	Impacts to Aboriginal heritage have been assessed using the existing Aboriginal heritage assessment for the Stage 1 and 2 Project Areas. Refer to Section 2.10.3.	
LandCorp	Consultation with LandCorp has been undertaken during development of the agreement between HAUS and LandCorp for the development (quarrying and handover) of the Stage 1 and 2 Project Areas.	HAUS has an agreement with LandCorp pertaining to the development (quarrying and handover) of the Stage 1 and 2 Project Areas. Refer to Section 6.	
City of Rockingham	Dust impacts to receptors will need to be assessed.	Dust and noise modelling and assessment of impacts to receptors has	
	Satisfied with environmental assessment process that HAUS is undertaking for the Expansion Project.	been undertaken for the Expansion Project. Refer to Sections 2.6.3 and 2.7.	



Stakeholder	Issue of Concern	Proponent's Response
Neighbouring	Overall, no issues of concern with	No increase in truck movements are
Residents	current Stage 1 Project operation and	proposed as part of the Expansion
(Stakehill	proposed Expansion Project. One	Project. The number of truck movements
Road, Firbank	resident queried whether there would	will be at or below existing approved
Close and	be any increase to truck movements	Stage 1 limits. Refer to Section 2.10.6.
Ukrich Place)	as a result of the Expansion Project.	

To continue to engage with stakeholders and the community during the operation of the Expansion Project, HAUS will continue to implement a Complaints Register and respond to any stakeholder or community issues as they arise.

#### Commitment 2

Holcim will continue to implement a Complaints Register during operation of the Baldivis Sand Quarry Stage 1 Expansion Project and respond to any stakeholder or community issues as they arise.

## 5.3 Social Environment

#### 5.3.1 Conservation Areas

A number of Bush Forever sites, environmentally sensitive areas and wetlands of conservation significance occur within the vicinity of the Project Area as described in Sections 2.4 and 2.10.5 (as shown on Figure 4).

None of the Bush Forever sites nor environmentally sensitive areas are located within or adjacent to the Expansion Area so will not be impacted by the Project.

There will be no direct impact on wetlands of conservation significance nor environmentally sensitive areas as none occur within the Expansion Project site. However, potential exists for these wetlands to be impacted indirectly from groundwater abstraction and changes to surface water flow.

Groundwater monitoring has been undertaken on the Stage 1 Project site as part of Licence To Take Water [GWL162863(2)] (Golders 2012). The groundwater monitoring has found that the quality of groundwater had not changed significantly over time and that there is no evident impact on wetlands of conservation significance from a change in groundwater levels arising from abstraction of groundwater at the site. Groundwater abstraction for dust suppression use for the Expansion Project will be significantly less than for the Stage 1 Project as no washing of sand will be undertaken. As a result, any impacts to groundwater levels will be significantly less than for the Stage 1 Project.

Any groundwater abstraction for the Expansion Project will be undertaken in accordance with Licence To Take Water [GWL162863(2)].

As discussed in 4.2.1Surface Water, it is unlikely that any surface flow from the site would reach the Serpentine River and Floodplain. No surface water quality impacts to the nearby wetlands of conservation significance are likely to occur.



#### 5.3.2 Traffic

As discussed in Section 2.10.6, the existing transport route for the Stage 1 Project is that the majority of vehicles exit the Project site via Stakehill Road and then continue onto Baldivis Road towards the Kwinana Freeway. At the freeway, 80% of vehicles turn onto the freeway and 20% continue onto Karnup Road east.

Transcore Pty Ltd undertook a traffic impact assessment of traffic arising from the Stage 1 Project in May 2007. The traffic impact assessment undertaken comprised:

- Review of existing local road network and traffic composition and volume along these roads.
- Assessment of HAUS' traffic from transport of sand during operations on the existing local road network and traffic.

In addition, in response to traffic issues raised by the community, the traffic impact assessment also independently reviewed:

- Road safety along Stakehill Road and Baldivis Road.
- School bus routes and safety.
- Cumulative impacts of Southern Gateway Alliance's traffic arising from operations for the Perth to Bunbury Highway.

The findings of the traffic assessment were that the volume of the traffic generated by the Stage 1 Project was low and would not have a significant impact on the capacity of the existing intersections.

Following the traffic assessment, the following actions were undertaken to improve the existing road network:

- Auxiliary turn lanes on Stakehill Road.
- Speed limit reduction to 70 km/hr along Stakehill Road and Baldivis Road to improve road.
- Installation of curve warning signs with advisory speed limit of 60 km/hr along neighbouring roads.
- Prune overgrown vegetation along neighbouring roads.
- Bus stop pull in bays.

In addition, a Transport Management Plan was prepared and implemented for the Stage 1 Project.

In order to manage traffic related impacts HAUS prepared a Transport Management Plan as a component of the EMP for the Stage 1 Project. This will be updated and implemented for the Expansion Project.

As part of the Transport Management Plan (Appendix H), the following has been undertaken:

- Installation of turning lanes to allow trucks to enter and exit the main road safely, without causing interruptions to other vehicles.
- Signage at the entrance to the proposed sand quarry operations and along Stakehill Road and Baldivis Roads.
- Setting and enforcement of speed limits onsite.
- Enforcement of operating hours.



- Covering of trucks prior to leaving site.
- Discouraging engine breaking.

In addition, the following has also been implemented by third parties the following:

- Main Roads WA and the City of Rockingham have placed signage along Stakehill Road and Baldivis Roads as per the traffic impact assessment recommendations.
- Bus stop areas created to allow school buses to pull off the road and allow children to enter and exit school buses more safely.
- Key residents along the transport route asked to record traffic issues in a diary format for feedback to HAUS.

Transport of fill sand produced by the Expansion Project will utilise the same existing transport route as the Stage 1 Project. Traffic generated will also be at the same or lower volume and composition as the Stage 1 Project. No change to the current transport route or increases in traffic and as a result no further transport impacts are anticipated as a result of the Expansion Project.

### 5.3.3 Visual Amenity

To minimise potential impacts to visual amenity as a result of the Project, a screening bund has been constructed along Stakehill Road. The bund has been planted with native species. While the Expansion Project will remove part of the screening area, 150m of the screening area will remain in place which is considered sufficient for visual amenity. HAUS will ensure that the screening bund is re-established at a height of up to 2 m within the remaining buffer area of 150 m.

### 5.3.4 Workforce Induction and Training

HAUS will utilise the existing workforce for the Stage 1 Project to undertaken the Expansion Project. All employees and contractors have completed an induction programme that covers the relevant environmental, occupational health and safety aspects of the operations. Any new employees will undertake the same inductions.



# **Quarry Closure**

## 6.1 Closure Objectives

The following section outlines the decommissioning and rehabilitation that will be undertaken following cessation of quarry operations for relinquishment of Mining Lease M70/1046 to the State and transfer of the site to LandCorp for residential development.

## 6.2 Post Mining Land Use

It is understood that LandCorp will use the land for residential development. HAUS and LandCorp have an established agreement framework by which the Stage 1 site will be transferred to LandCorp following the completion of quarry operations. This aggreement includes the Expansion Project Area which is the subject of the future LandCorp residential development. The site is also zoned Urban Deferred under the City of Rockingham's Town Planning Scheme.

Acknowledging the final end land use of the site as residential, HAUS will establish a safe and stable landform consistent with LandCorp's requirements until the site is developed.

It is understood that LandCorp's requirements for the condition of the Expansion Area at transfer of ownership are:

- Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
- The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan (final floor map). The approved floor level varies from 0 to 20 m bgl as indicated on the floor plan agreed between HAUS and LandCorp.
- All rubbish, debris, improvements or alterations effected by HAUS associated with the excavation works are completely removed from the land.
- All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.

## 6.3 Rehabilitation and Closure Criteria

Decommissioning and rehabilitation procedures to be undertaken for the Project are described in the following sections.

### 6.3.1 Minimising Erosion

HAUS will reduce the potential for erosion by:

- Restricting clearing and disturbance to the minimum required for safe and efficient operations.
- Undertaking rehabilitation progressively.

### 6.3.2 Topsoil Management

Topsoil stockpiles will be located behind the moving face and away from active quarrying operations, typically in site bunding. Soils will be stripped in a dry state to preserve soil structure and in relatively still conditions, if possible. Where required, the stockpiles will be covered with polymer agents and seeded with local native vegetation species to reduce erosion and to discourage weeds.

The dimensions of the topsoil stockpiles will not exceed 2 m in height.



#### **6 Quarry Closure**

This is to prevent topsoil becoming anaerobic and deteriorating in soil structure, organic matter, nutrients, seed resource and populations of beneficial soil micro-organisms. Stockpiles will be located sufficiently distant from quarrying operations so that they will not be disturbed prior to being used in rehabilitation.

### 6.3.3 Landform Design

Rehabilitation earthworks will be undertaken to develop a stable landform that is compatible with LandCorp's requirements, the surrounding area and future residential land use. The central elements of LandCorp's landform design requirements are as described in Section 6.2.

### 6.3.4 Revegetation

Topsoil will be respread and ripped during the rehabilitation process to ensure cohesion between the topsoil, the subsoil and the disturbed land surface. Ripping will also provide niches where organic matter and seed can collect and facilitates the infiltration of surface water.

The topsoil will be stabilised with a polymer agent and seeded with sterile oats (or similar) to prevent the spread of non-native species into adjacent areas. These areas will be monitored and seeded, if required.

### 6.3.5 Decommissioning of Infrastructure and Facilities

All infrastructure, including the maintenance area, weighbridge, wheel wash facility, waste compound, but excluding the site office, ablutions, lunch room facilities to be included in existing facilities leased from DMP, will be removed at the end of Stage 1 quarrying operations and the Expansion Project and these areas will be rehabilitated as described above.

### 6.3.6 Monitoring and Maintenance

Rehabilitated areas will be monitored to ensure the success of the rehabilitation programme (in accordance with LandCorp timeframes). Monitoring will be carried out on a regular basis to assess:

- The physical stability of the landform of rehabilitated areas.
- The characteristics of the vegetation in rehabilitated areas.
- Water drainage from the site.
- Any public safety aspects.

Monitoring the rehabilitated areas will ensure that any areas requiring remedial work are identified. Maintenance procedures will be carried out where necessary and may include:

- Replanting areas that may not have regenerated.
- Repairing any erosion problems.
- Weed control.



# **Summary of Commitments**

The Project will be conducted in a manner that will ensure that the environmental and social impacts of the Project are minimised, and in accordance with the company's requirements for the management of safety, health and the environment. Copies of the company's SHE Policy, Guidelines and Management Directives are included as Appendix I. In addition to this, HAUS has made a number of commitments with respect to minimising the environmental and social impacts of the proposed Project. These are summarised in Table 7-1.

Environmental Aspect	Management Commitment Implementation	Timeline	
Environmental Management Plan	Commitment 1 - HAUS will update the existing Baldivis Sand Quarry Stage 1 Project Environmental Management Plan to include the Expansion Project and will implement during operations.	Prepared prior commencement operations.	to of
Social	Commitment 2 - Holcim will continue to implement a Complaints Register during operation of the Baldivis Sand Quarry Stage 1 Expansion Project and respond to any stakeholder or community issues as they arise.	Undertaken dur operations.	ing
Quarry Closure	Commitment 3 – HAUS will update the existing Baldivis Sand Quarry Stage 1 Quarry Closure Plan to include the Expansion Project and will implement during operations.	Prepared prior commencement operations.	to of

#### Table 7-1 Summary of Commitments



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# **Figures**





### SITE LOCATION



hind

PTY LTD

Figure: 1 Rev. A

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#### HOLCIM (AUSTRALIA) PTY LTD

BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

### LOCALITY MAP AND MINING TENURE



Figure:



HOLCIM (AUSTRALIA) PTY LTD

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File No: 42908418-ES-003.mxd Approved: MJ Drawn: RNM Date: 31/10/2013

### SITE LAYOUT



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BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

Date: 5/11/2013

### SURFACE WATER CATCHMENTS





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Approved: MJ

Date: 29/10/2013 Rev. A This drawing is subject to COPYRIGHT. T:\Jobs\42908418\DATA\FIGURES\42908418-ES-006\_RB.mxd



HOLCIM (AUSTRALIA) PTY LTD

BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

### **VEGETATION MAP**









Figure:









<b>Location:</b>	<b>Averaging period:</b>	<b>Date</b>
Baldivis, WA	1 year	AUS
<b>Type:</b>	<b>Objective</b> :	Prep
Contour map	90 μg/m³	Ada

Source: Katestone Environmental Pty Ltd (2013) Whilst every care is taken by URS to ensure the accuracy of the digital data, URS makes no representation or waranties about its accuracy, reliability, completeness, suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for any expenses, sases, damages (including indirect or consequential damage) and costs which may be incurred as a result of data being inaccurate in any way for any reason. Electronic files are provided for information only. The data in these files is not controlled or subject to automatic updates for users outside of URS.

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BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

#### EXTRACTS FROM KATESTONE **AIR QUALITY IMPACT ASSESSMENT**







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BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

#### EXTRACTS FROM KATESTONE **AIR QUALITY IMPACT ASSESSMENT**







Location: Baldivis, WA	<b>Averaging period</b> : 1 year	D A
Туре:	Objective:	P
Contour map	2 g/m²/month	A

Source: Katestone Environmental Pty Ltd(2013) Whilst every care is taken by URS to ensure the accuracy of the digital data, URS makes no representation or waranties about its accuracy, reliability, completeness, suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for any expenses, sases, damages (including indirect or consequential damage) and costs which may be incurred as a result of data being inaccurate in any way for any reason. Electronic files are provided for information only. The data in these files is not controlled or subject to automatic updates for users outside of URS.

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BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

#### EXTRACTS FROM KATESTONE **AIR QUALITY IMPACT ASSESSMENT**





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BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

EXTRACTS FROM URS NOISE QUALITY IMPACT ASSESSMENT 6AM TO MIDDAY





HOLCIM (AUSTRALIA) PTY LTD

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NOISE QUALITY IMPACT ASSESSMENT **MIDDAY TO 6PM** 

> Figure: Rev. A



# Appendix A Mining Lease and Conditions



A





# MINING TENEMENT SUMMARY REPORT

# MINING LEASE 70/1046

Status: Live

### TENEMENT SUMMARY

Area: 48.91500 HA

Mark Out : 05/07/1999 11:05:00

Received : 09/07/1999 12:15:00

Term Granted : 21 Years

Death Reason : Death Date : Commence : 15/11/2006 Expiry : 14/11/2027

### **CURRENT HOLDER DETAILS**

### Name and Address

HOLCIM (AUSTRALIA) PTY LTD C/- TENEMENT ADMINISTRATION SERVICES PTY LTD, LEVEL 2, 326 HAY STREET, EAST PERTH, WA, 6004

### DESCRIPTION

Locality:	Peel Estate: O/P 2761
Datum:	Datum situated on surveyed north west corner of Crown
	Reserve 37090
Boundary:	LAND APPLIED FOR IS IDENTICAL TO PEEL ESTATE:
	PTS 859 TO 861 INCLUSIVE, AND 862 TO 869
	INCLUSIVE AS SHOWN ON OP 2761

Area :	Туре	Dealing No	Start Date	Area
	Surveyed		02/05/2008	48.91500 HA
	Granted		15/11/2006	50.23100 HA
	Applied For		05/07/1999	325.00000 HA

# ShireShire NoStartEndAreaROCKINGHAM CITY749005/07/199948.91500 HA

### **RENT STATUS**

Due For Year End 14/11/2013: PAID IN FULL Due For Year End 14/11/2014: \$0.00

### **EXPENDITURE STATUS**

Expended Year End 14/11/2012: Current Year Commitment : EXPENDED IN FULL \$10,000.00

# Conditions - M70/1046 as at 28/02/2012

### Endorsements

Cond No	Version	Text	Start	End
		<ul> <li>The lessee's attention is drawn to :</li> <li>the provisions of the Aboriginal Heritage Act 1972 and any Degulations thereunder.</li> </ul>		
1	1	<ul> <li>Water and Rivers Commission Act 1995 and any Regulations thereunder; and</li> <li>Identification of environmental sensitive wetlands listed within the RAMSAR Convention 1971, Australian Nature Conservation Agency's Directory of important wetlands, the National Estates Register and the Environmental Protection Policies 1999.</li> </ul>	15/11/2006	
		This mining lease authorises the mining of the land for all minerals as defined in Section 8 of the Mining Act 1978 with the exception of:		
2	1	<ul> <li>Uranium ore;</li> <li>Iron ore, unless specifically authorised under Section 111 of the Act;</li> <li>Bauxite</li> </ul>	15/11/2006	
3	1	The lessee's attention is drawn to the Environmental Protection Act 1986 and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, which provides for the protection of all native vegetation from damage unless prior permission is obtained.	15/11/2006	
4	1	The grant of this lease is confined to the land designated " Stage 1 " on the plan shown at folio 101 of Department of Industry and Resources file 484/2005 vol 3 and described as follows:GDA 94 ZONE 50 6415152.902N 388140.765E, 6415772.709N 388141.308E, 6415788.852N 388188.503E, 6415930.351N 388441.365E, 6416042.638N 388642.023E, 6416146.628N 388827.854E, 6416155.473N 388843.660E, 6415829.133N 388903.074E, 6415393.826N 388900.374E, 6415393.813N 388730.336E, 6415381.427N 388660.621E, 6415243.902N 388381.555E, 6415152.902N 388140.765E.	15/11/2006	
5	1	The lessee's attention is drawn to the existence of an agreement dated 31 October 2006 between Western Australian Land Authority (LandCorp), CSR Limited and Rinker Australia Pty Ltd and Deed of Variation dated 31 October 2006 between LandCorp and Rinker Australia Pty Ltd in relation to land at Karnup the subject of Mining Lease 70/1046 and application for Mining Lease 70/1241 and filed at pages 373 to 395 of Department of Industry and Resources File No. 484/2005 Volume 4.	15/11/2006	
6	1	The Lessee's attention is drawn to the Minister's requirement that the holder of this Lease lodge security in the form of an Unconditional Performance Bond for due compliance with environmental conditions in the sum of:		

• \$53,000

Cond No	Version	Text	Start	End
1	1	Survey.	15/11/2006	
2	1	All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion.	15/11/2006	
3	1	All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Industry and Resources (DoIR). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DoIR.	15/11/2006	
4	1	All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program.	15/11/2006	
5	1	Unless the written approval of the Environmental Officer, DoIR is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations.	15/11/2006	
6	1	The lessee submitting a plan of proposed operations and measures to safeguard the environment to the Director, Environment, DoIR for his assessment and written approval prior to commencing any developmental or productive mining or construction activity.	15/11/2006	
7	1	Mining on any road, road verge or road reserve being confined to below a depth of 15 metres from the natural surface.	15/11/2006	
8	1	Written notification, where practicable, of the time frame, type and extent of proposed ground disturbing activities being forwarded to the Department of Environment Kwinana/Peel, the Explosives Reserve Manager and the Principal Explosives Officer Safety, DOCEP seven days prior to commencement of those activities.	15/11/2006	
9	1	Any significant waterway (flowing or not), wetland or its fringing vegetation that may exist on site not being disturbed or removed without prior written approval from the Department of Environment.	15/11/2006	
10	1	The rights of ingress to and egress from the Lease being at all reasonable times preserved to officers of the Department of Environment for inspection and investigation purposes.	15/11/2006	
11	1	The storage and disposal of hydrocarbons, chemicals and potentially hazardous substances being in accordance with the Department of Environment's Guidelines and Water Quality Protection Notes .	15/11/2006	
12	1	Measures such as effective sediment traps and stormwater retention facilities being implemented to preserve the natural values of receiving catchments and those of adjacent areas of native vegetation.	15/11/2006	
13	1	Groundwater quality monitoring bores being installed, maintained and utilised for water quality monitoring on and near the mine-site and downstream where aquifers are present.	15/11/2006	
14	1	Petroleum hydrocarbon and other chemical storage areas being appropriately contained using bunded retention compounds incorporating stormwater disposal and the removal of sediments.	15/11/2006	
15	1	Unless permission is first obtained from the Department of Environment	15/11/2006	

ground breaking activities are prohibited within the floodway and within a lateral distance of:

- 50 metres from a perennial waterway; and 30 metres from a seasonal waterway. •
- •

16	1	Developmental activities are prohibited within floodplains unless the prior written approval is obtained from the Department of Environment.	15/11/2006
17	1	All Mining Act tenement activities prohibited within 200 metres of RAMSAR or ANCA listed wetlands unless written permission of Department of Conservation and Land Management, in consultation with the Department of Environment, is first obtained.	15/11/2006
18	1	All Mining Act tenement activities prohibited within 200 metres of "Conservation" and "Resource Enhancement" Category wetlands unless written permission of the Department of Environment is first obtained.	15/11/2006
19	1	Abstraction of groundwater from within 500 metres of a wetland is prohibited unless authorised by the Department of Environment.	15/11/2006
	1	Consent to Mine on Explosives and Forestry Purposes Reserve 37090 Granted Subject to :	15/11/2006
20	1	The General Manager, Forestry Products Commission's consent being obtained before accessing the the area for mining purposes prior to harvesting. The General Manager may give or refuse access at his discretion and the lessee may be asked to meet reasonable costs should early harvesting be required.	15/11/2006
21	1	All drill holes to be either capped below ground level or suitably and clearly marked.	15/11/2006
22	1	The prior consent of the Explosives Reserve Manager being obtained before entering the reserve and all employees to participate in a Reserve induction course should this be required by the Reserve Manager.	15/11/2006
23	1	Safety distances around the Reserve boundary being observed after discussion with the Explosives Reserve Manager and no fires to be lit without prior permission from the Reserve Manager.	15/11/2006
	1	Consent to Mine on Storage and Manufacture of Explosives and Security Sensitive Ammonium Nitrate Containing Substance Reserve 38575 Granted Subject to :	15/11/2006
24	1	Prior to any mining being commenced on Storage and Manufacture of Explosives and Security Sensitive Ammonium Nitrate Containing Substance Reserve 38575 the written approval of the Principal Explosives Officer, Resources Safety DOCEP is required.	15/11/2006
		The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the document titled:	
25	1	<ul> <li>"Baldivis Sand Quarry Stage 1 - Sand Extraction Project Mining Proposal - MP 5772" dated 1 August 2007;</li> <li>"Mining Plan Baldivis Sand Quarry Stage 1 - MP 5772" dated August 2007</li> </ul>	16/04/2008
		and both rotained on Department of Industry and Depayments File Ma	

and both retained on Department of Industry and Resources File No. E0024/200802

		Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail.	
26	1	All topsoil being removed ahead of all mining operations from sites such as pit areas, ore stockpile areas and new access roads and being stockpiled for later respreading or immediately respreading.	16/04/2008
27	1	At the completion of operations, all buildings and structures being removed from site or demolished and buried to the satisfaction of the Director, Environment Division, DoIR.	16/04/2008
28	1	All rubbish and scrap is to be progressively disposed of in a suitable manner.	16/04/2008
29	1	At the completion of operations, or progressively where possible, all access roads and other disturbed areas being covered with topsoil, deep ripped and revegetated with local native grasses, shrubs and trees to the satisfaction of the Director, Environment Division, DoIR.	16/04/2008
30	1	Any alteration or expansion of operations within the lease boundaries beyond that outlined in the above document(s) not commencing until a plan of operations and a programme to safeguard the environment are submitted to the Director, Environment, DoIR for his assessment and until his written approval to proceed has been obtained.	16/04/2008
		The lessee submitting to the Director, Environment Division, DoIR, a brief annual report outlining the project operations, minesite environmental management and rehabilitation work undertaken in the previous 12 months and the proposed operations, environmental	
31	1	management plans and rehabilitation programmes for the next 12 months. This report to be submitted each year in:	16/04/2008

• March.

# Appendix B Air Quality Impact Assessment

B

URS Project No. 42908418/01/0

# Air Quality Impact Assessment - Baldivis Quarry, Stage 1 Expansion

Prepared for

URS

# October 2013

# Final

# Prepared by Katestone Environmental Pty Ltd

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# Glossary

Term	Definition
µg/m³	micrograms per cubic metre
km	kilometres
m	metres
μm	micrometres
m/s	metres per second
m²	square metres
g	grams
PM	Particulate matter (fine dust)
$PM_{2.5}$ and $PM_{10}$	Particulate matter with diameter less than 2.5 or 10 micrometres, respectively
TSP	Total suspended particles
t	tonnes
tpa	tonnes per annum

## 1. Introduction

Katestone Environmental Pty Ltd (Katestone) was commissioned by URS Corporation Pty Limited (URS) on behalf of Holcim (Australia) Pty Ltd (Holcim) to undertake an air quality assessment of the proposed Stage 1 expansion of the Baldivis Quarry, operated by Holcim, located approximately fifty kilometres to the south of Perth and 14 kilometres south-southeast of Rockingham, Western Australia.

The Baldivis Quarry site comprises two mining leases, M70/1046 (referred to as Stage 1) approximately 50 ha in size, and the pending M70/1241 (referred to as Stage 2) approximately 275 ha in size. Holcim has been operating Stage 1 of the quarry since 2008. The availability of resources within Stage 1 has been depleted and Holcim proposes to expand the area quarried within Stage 1 to provide an additional 3 years of quarry life (hereafter referred to as the Expansion Project). Holcim proposes to seek approval separately for Stage 2 of the quarry within this time.

This assessment examines the air quality impacts of the Expansion Project on the local atmospheric environment through the following:

- Description of the existing air environment in the region
- Estimation of air pollutant emissions likely to be released from the quarry expansion
- Quantification of meteorological parameters, land-uses and terrain features in the Baldivis region that may impact the dispersion of air pollutants released from the quarry
- Prediction of ambient ground-level air pollutant concentrations by dispersion modelling of the quarry expansion
- Assessment of predicted impacts by comparison with air quality objectives used in Western Australia
- Detail proposed mitigation techniques, if appropriate

# 2. Project Infrastructure and Processes

Stage 1 of the Baldivis Quarry has been operational since February 2008. The existing approved Stage 1 extraction resource is depleted and Holcim proposes to expand the extraction area, within the granted mining lease M70/1046, to the north of the existing extraction area (the Expansion Project). A map of the Baldivis Quarry is shown in Figure 1. The Expansion Project area is shown in light blue.

The area of the Expansion Project is approximately 100 m in width with a total area of 7.85 ha. A separation buffer distance of 150 m between quarry activities and Stakehill Road will remain.

On average, material will be extracted at a rate of 2,500 tonnes per day, peaking at up to 3,000 tonnes per day. Active quarrying of sand will generally be undertaken in 2 ha parcels depending on market requirements. Previously quarried areas may be used for access and will be left as exposed areas until they are rehabilitated.

The Expansion Project and remaining resource will provide an additional 3 years of life to Baldivis Quarry. The existing infrastructure and facilities (site road and offices) will remain in use for the Expansion Project with the exception that the screening and washing plant will not be operating as fill sand will be loaded directly into haul tracks and sent to market. There will be occasions where fill sand will be stockpiled, but only for a number of days.

The Expansion Project will operate as per the normal approved operating hours of the existing Baldivis Quarry. The quarry operates six days a week from 7 am to 6 pm, Monday to Friday and 7 am to 12 pm, each Saturday. Occasionally, operations may extend to 6 pm on Saturday.

The following operations are proposed for the Expansion Project:

- Fill sand will be extracted at up to the peak rate of 3,000 tonnes per day
- Quarrying will generally be undertaken progressively in 2 ha parcels
- A front end loader will be used to extract the sand
- There is no overburden on site so only topsoil will need to be removed before quarrying begins
- Sand will be loaded directly onto trucks and processed for sale at the weighbridge
- During certain times, extracted fill sand may be stockpiled for a few days prior to the transportation of material offsite
- A separation distance of 100 m will be maintained between the active quarry area and the Explosives Reserve
- Sand will be transported from site using semi-trailers. The number of vehicle movements for the Expansion Project is less than the previously approved vehicle movements. Approximately 60 heavy vehicle movements per day will occur to and from site.

Dust will be the primary air pollutant emitted from the Baldivis Quarry as the primary focus of the quarry operation is the extraction and transportation of fill sand.

# 3. Considerations for Assessing Air Quality

### 3.1 Description of Dust

The risk to air quality associated with a sand quarry is caused by the release of dust from the day to day activities including; sand extraction, sand handling, sand stockpiling and haulage of sand (the estimated emissions of dust from the Expansion Project are described in detail in Section 4).

The potential effect of dust on the environment, on human health and on amenity depends on:

- the size of dust particles
- the concentration of dust in the atmosphere
- the rate of particle deposition

Dust with an aerodynamic diameter greater than 10 micrometres ( $\mu$ m) tends to be associated with amenity impacts, while dust less than 10  $\mu$ m in diameter is associated with health impacts. For this reason, dust is sub-divided into a number of metrics based on particle size. These metrics are total suspended particulates (TSP), PM<sub>10</sub>, PM<sub>2.5</sub> and dust deposition rate.

- TSP refers to the total of all particles suspended in the air. TSP was first used as a human health metric, but research has a poor correlation between the concentration of TSP and health effects. TSP is now used as a metric of the potential for dust to affect amenity.
- $PM_{10}$  is a subset of TSP (US EPA, 2010) and refers to particles suspended in the air with an aerodynamic diameter less than 10  $\mu$ m.
- PM<sub>2.5</sub> is a subset of TSP and PM<sub>10</sub> and refers to particles suspended in the air with an aerodynamic diameter less than 2.5 μm. PM<sub>2.5</sub> is also called fine particulate matter (US EPA, 2010).
- Dust deposition rate is the mass of particulate matter that collects on an area over a one month period. Dust deposition rate is used as a metric of the potential for dust to affect amenity.

These dust metrics will be assessed in this air quality assessment of the Baldivis Quarry Expansion Project.

### 3.2 Legislation

The WA Department of Environment Regulation (DER), formally the WA Department of Environment and Conservation (DEC), is yet to finalise a state specific environmental protection policy for ambient air quality.

In 2000, the WA DER articulated an interim approach to adopting ambient air quality guideline values. This interim approach is to adopt the NEPM standards for ambient air quality. For air pollutants not covered by the Air NEPM or Air Toxics NEPM, DER adopts the World Health Organisation's Guidelines for Air Quality or air quality guidelines from other jurisdictions where appropriate.

The National Environmental Protection Council defines national ambient air quality standards and goals in consultation with, and agreement from, all state governments. These were first published in 1997 in the *National Environment Protection (Ambient Air Quality) Measure (Air NEPM)*, and updated in 2003, followed by the *National Environment Protection (Air Toxics) Measure 2004 (Air Toxics NEPM)*.

A summary of the air quality criteria adopted for this assessment is presented in Table 1. In the Western Australian *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* a 24-hour average TSP guideline is reported. A 24-hour average standard of 90  $\mu$ g/m<sup>3</sup> (up to a limit of 150  $\mu$ g/m<sup>3</sup>) applies for an isolated residential dwelling in the Kwinana area. Whilst the Baldivis Quarry is not in the Kwinana area, this guideline has been adopted in this assessment to understand short-term (24-hour average) impacts of TSP emitted from quarry activities.

Pollutant	Averaging Period	Air Quality Criteria	Units	Source	
PM <sub>10</sub>	24-hour	50 <sup>a</sup>	µg/m³	Air NEPM	
	24-hour	25	µg/m³	Air NEPM	
PIVI <sub>2.5</sub>	Annual	8	µg/m³	(advisory)	
TSP	24-hour	90	µg/m³	Kwinana (Atmospheric Wastes)	
	Annual	90	µg/m³	NSW DECC	
Dust deposition rate	Annual	2 <sup>b</sup> 4 <sup>c</sup>	g/m <sup>2</sup> /month	NSW DECC	
Note: <sup>a</sup> Five exceedances per year allowed <sup>b</sup> Maximum increase in deposited dust level <sup>c</sup> Maximum total deposited dust level					

### Table 1 Air quality criteria for particulate concentrations and dust deposition rate

# 4. Emissions of Air Pollutants

There is a potential for certain site activities to generate air pollutant emissions. The type and magnitude of air pollutants emitted from the quarry will vary depending upon the rate and intensity of each activity and the application of emission control measures. Dust is the primary air pollutant emitted from the Baldivis Quarry.

Activities occurring at the site that may give rise to emissions of dust are:

- Removal of topsoil
- Stockpiling of topsoil
- Extraction of sand from the pit using front-end loaders
- Transfer of sand (including loading of trucks or transfer to stockpile)
- Temporary stockpile of sand ready for sale
- Exposure of disturbed areas
- Wheel generated dust from truck haulage movements

Dust emission rates have been calculated for the Expansion Project using emission factors and detailed information on quarry activities. The quarry characteristics, such as peak extraction rates, location of active extraction area, temporary stockpiles and haul roads were based on information supplied by URS on behalf of Holcim.

Dust emission rates from the Expansion Project operations have been calculated using dust emission factors published by the United States Environmental Protection Agency (USEPA) (USEPA 1998, USEPA, 2006a; USEPA, 2006b, USEPA 2011). The use US EPA dust emission factors represent is common practice when site specific dust emission rates are not available. For the many dust-producing activities, the dust emission rate is dependent upon the wind speed, with little or no dust emissions occurring for some activities below a threshold wind speed.

The dust emission rates for the Expansion Project have been calculated using the peak extraction rate to correspond to the maximum potential impact of the quarry over 24-hour periods and over a one year period. The dust emissions from activities on-site, such as sand transfers and haulage, have been modelled consistent with the proposed hours of operation. Dust emissions from wind erosion have been modelled on an hourly varying basis using a threshold for wind speed below which emissions are zero and above which emissions vary depending on wind speed.

The emissions have been calculated based on a peak extraction rate of 3,000 tonnes per day. Other factors that determine the dust emission rate are the moisture content of the fill sand, fill sand particle size distribution and the mitigation measures that may be employed. These key factors have been accounted for in estimating the dust emissions for the proposed Expansion Project. Details of the methodology and the emission factor equations used for estimating dust emissions are included in Appendix A.

For the purpose of this assessment dust mitigation from the use of a water truck has been included within the modelling approach. This has been incorporated into the modelling via a quantitative dust emissions reduction of 75% compared to no mitigation. The 75% reduction is based on the fact that water is readily available on-site to be used as a dust suppressant. This dust suppression technique has been by Holcim on the existing Stage 1 operations at Baldivis Quarry. The assessment has also assumed the revegetation of exposed areas over time with a 90% reduction in emissions once revegetated. For security purposes the Baldivis Quarry has 2 m high vegetated bunding around the perimeter of the quarry. The vegetated bunding will help to reduce the amount of dust generated from quarry activities

from leaving the site . However, this reduction cannot be quantified in the dispersion model used in this assessment.

A summary of the emissions for the Expansion Project are shown in Table 2. The total emissions for the year modelled are shown given that several sources have been modelled as hourly varying. Further details of the estimate of dust emissions from these sources is provided in Appendix A.

Table 2	Estimated	total	TSP,	PM10,	PM <sub>2.5</sub>	emissions	for	the	Expansion	Project
	operations	5								

Δοτίντευ	Total En	Total Emission Rate (kg/year)				
Activity	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>			
Top soil removal by graders	9,444	2,951	293			
Truck movements on paved haul roads	3,593	690	167			
Truck movements on unpaved haul roads	16,926	4,778	478			
Front end loader picking up sand						
Front end loader dropping sand into trucks		17,600 <sup>1</sup>	2,643 <sup>1</sup>			
Wind erosion – temporary sand stockpiles						
Wind erosion – pit	25 472 <sup>1</sup>					
Wind erosion – topsoil stockpiles	33,472					
Wind erosion – exposed areas (old disturbance)						
Wind erosion – disturbed areas (new disturbance)						
Wind erosion – rehabilitated areas						
Total	65,435	26,018	3,581			
Table note:						
' modelled as an hourly varying source						

# 5. Existing Environment

### 5.1 Description of Study Area

The Baldivis Quarry is located approximately 50 kilometres to the south of Perth and 14 kilometres south-southeast of Rockingham, Western Australia. The site is bordered by the Kwinana Freeway, approximately one km to the east, and Stakehill Road to the north.

The area of Baldivis is typically rural with areas of residential land-use. The Expansion Project area has historically been used as a pine plantation; however, it has been cleared due to the presence of the European House Borer and revegetated. In recent years, the amount of residential development in the local area has increased.

### 5.2 Location of Sensitive Receptors

There are several sensitive receptors located within the study area (Figure 1). The existing residences and the distance from the existing operations (Stage 1) to these residences are presented in Table 3.

Holcim has been operational at the Baldivis Quarry since 2008. To date, Holcim has not received any complaints from these residences in relation to dust.

Receptor	Eastings <sup>1</sup> (metres)	Northings <sup>1</sup> (metres)	Distance from Expansion Project Operations (m)	Direction			
R1	388373	6416115	360	Ν			
R2	388242	6415926	240	NW			
R3	388126	6415936	270	NW			
R4	388039	6415865	240	NW			
R5	387773	6415942	510	NW			
R6	387785	6415727	380	NW			
R7	387680	6415794	530	NW			
R8	387638	6415730	550	NW			
R9	387169	6415387	1,010	E			
R10	387179	6415210	1,020	E			
R11	387183	6414886	1,130	SW			
R12	388485	6416056	270	Ν			
<sup>1</sup> Datum: GDA94 UTM Zone 50 South							

### Table 3 Location of sensitive receptors

### 5.3 On-site monitoring

### 5.3.1 Meteorology

Meteorological monitoring has been conducted near the Administration Building on the Baldivis Quarry site since 2008 (known as ADMIN). The ADMIN meteorological monitoring station uses a 10 metre tower and records wind speed and wind direction over a 5-minute averaging period. The 5-minute average observations obtained from this monitoring station have been used to generate a meteorological file suitable for use in the dispersion modelling assessment. A detailed summary of the meteorology used in the Expansion Project air quality assessment, which includes the ADMIN meteorological data, is provided in Section 7. Appendix B details the methodology for the selection of the meteorology used in the Expansion Project air quality assessment .

### 5.3.2 PM<sub>10</sub>

Monitoring of  $PM_{10}$  using a Tapered Element Oscillating Microbalance (TEOM) has been conducted at two locations, known as the Administration Building and the Tuart Ridge Winery on Stakehill Road.

The Administration Building TEOM (ADMIN) is located approximately 300 m northeast from the boundary of the current pit operations and within 30 m of the maintenance area for the quarry vehicles. The second TEOM is located at the Tuart Ridge Winery (TRW) on Stakehill Road which, is approximately 300 m to the west-northwest of the Administration Building TEOM.

Table 4 presents a summary of 24-hour average ground-level concentrations of  $PM_{10}$  recorded at both monitors.

		ADN	/IN		TRW				
Year	Maximum	95 <sup>th</sup> Percentile	70 <sup>th</sup> Percentile	Average	Maximum	95 <sup>th</sup> Percentile	70 <sup>th</sup> Percentile	Average	
2008 <sup>1</sup>	75.5	23.3	15.9	14.3	87.1	27.9	19.7	17.2	
2009	75.4	33.3	20.6	19.1	68.1	31.3	20.9	18.7	
2010	120.7	38.7	21.5	19.3	115.3	33.4	19.5	17.8	
2011	70.1	27.8	18.4	16.1	58.7	24.2	15.7	13.7	
2012	83.9	32.1	18.9	17.3	75.4	30.6	18.3	16.9	
2013 <sup>2</sup>	87.5	29.5	17.5	16.0	36.8	27.4	16.4	14.6	
Table note:       1         1       Data obtained for the period 20 March 2008 to 31 December 2008									

# Table 4 Summary of 24-hour average concentrations of $PM_{10}$ monitoring data ( $\mu g/m^3$ )

<sup>2</sup> Data obtained for the period 1 January 2013 to 31 August 2013

Analysis of the data indicates that there have been several exceedances of the Air NEPM 24-hour average  $PM_{10}$  standard of 50 µg/m<sup>3</sup> since operation of the monitors. There have also been some exceedances of the Holcim Baldivis Quarry Licence Condition, which states that 24-hour average  $PM_{10}$  concentrations to be below 50 µg/m at the TRW monitor. A summary of all the 24-hour average  $PM_{10}$  concentrations above  $50\mu$ g/m<sup>3</sup>, at either the ADMIN or TRW monitors, is provided in Table 5. Some of the levels recorded above  $50\mu$ g/m<sup>3</sup> can be attributed to regional dust events in the Perth area. There are several instances where the observed 24-hour average  $PM_{10}$  concentration at the ADMIN monitor is above 50 µg/m<sup>3</sup> but below 50 µg/m<sup>3</sup> at the TRW monitor. These elevated levels are most likely due to localised dust sources. To the immediate south of the ADMIN monitor is the

Holcim workshop maintenance area that is unpaved. Elevated levels of  $PM_{10}$  may be attributed to activities at this location.

24-hour average PM <sub>10</sub> concentrations (μg/m <sup>3</sup> ) greater than 50 μg/m <sup>3</sup>		Predominant wind direction during	Is there an exceedance of the Baldivis Quarry	Did operations at Baldivis Quarry contribute to the	
Date	ADMIN	TRW	at ADMIN site)	Licence (above 50 µg/m³ at TRW)	exceedance of PM <sub>10</sub> at TRW
16/4/2008	71.2	80.8	SW	Yes	Unlikely. Bush fire event occurred in Perth metropolitan area.
14/9/2008	50.8	31.8	W and WSW	No	No exceedance at TRW
12/1/2009	55.0	27.0	SW	No	No exceedance at TRW
13/2/2009	59.8	22.7	SE	No	No exceedance at TRW
11/11/2009	51.1	50.5	SW	Yes	Unlikely. Wind direction not from quarry to TRW.
15/12/2009	50.2	47.5	S & SSE	No	No exceedance at TRW
16/12/2009	75.4	68.2	SSE	Yes	Probable. Proximity of a staff BBQ to monitor may have caused exceedance
23/12/2009	63.8	38.1	SW	No	No exceedance at TRW
30/01/2010	105.6	57.0	SW	Yes	Unlikely. Wind direction not from quarry to TRW.
2/02/2010	97.9	44.0	S, SW & SSW	No	No exceedance at TRW
28/04/2010	77.0	84.8	ENE & SW	Yes	Unlikely. Bush fire event occurred in Perth metropolitan area.
29/04/2010	104.2	99.3	W & SW	Yes	Unlikely. Bush fire event occurred in Perth metropolitan area.
06/05/2010	118.6	111.2	S	Yes	Wind direction is from quarry to TRW but bush fire events were noted
1/12/2010	55.9	ND	S	ND	No exceedance at TRW
2/12/2010	56.7	ND	S	ND	No exceedance at TRW
9/5/2011	54.2	32.0	S	No	No exceedance at TRW
26/11/2011	70.1	58.7	S	Yes	Yes. Winds from quarry to TRW
3/1/2012	73.3	60.9	E	Yes	Unlikely. Wind direction not from quarry to TRW.
29/1/2012	43.8	68.8	ESE & SE	Yes	Possible. Wind direction is from quarry to TRW
14/2/2012	83.9	75.4	SW	Yes	Wind direction is from quarry to TRW but bush fire events were noted
16/2/2012	70.3	60.6	SSW	Yes	Wind direction is from quarry to TRW but bush fire events were noted
31/8/2013	16.4	65.1	NE &W	Yes	Controlled burn near TRW
17/1/2013	81.4	34.0	SSW	No	No exceedance at TRW
17/2/2013	87.5	ND	S	ND	No exceedance at TRW

Table 5 Summary of 24-hour average PM<sub>10</sub> above 50 µg/m<sup>3</sup>
## 6. Air Dispersion Modelling Methodology

#### 6.1 Overview

Air dispersion modelling was carried out using the Ausplume Version 6.0 dispersion model (Victorian EPA). The dispersion modelling was conducted over a one year period using a meteorological data file generated by TAPM, a prognostic mesoscale model, and 5-minute on-site observations of wind speed and wind direction at the ADMIN station. Alternative meteorological data files were considered for the Expansion Project. Details of the meteorological data file selection process is provided in Appendix B.

Details of the TAPM and Ausplume configuration are supplied in the following sections.

#### 6.2 Development of Site Specific Meteorology for Dispersion Modelling

The CSIRO model TAPM (Version 4.0.5) was used in this assessment to generate a meteorological model of the region. This is a prognostic model that uses detailed data on terrain, synoptic meteorology, land use and soil moisture to calculate wind flows and other meteorological variables.

TAPM was developed by the CSIRO and has been validated by the CSIRO and Katestone for various sources and regions (see <u>www.dar.csiro.au/TAPM/</u> for more details on the model and validation results from the CSIRO).

Recorded wind data (speed and direction) from the quarry administration block for the model year of 2012 was assimilated into TAPM.

TAPM was setup as follows:

- 30 x 30 grid point domain with an outer grid of 30 km and nesting grids of 10 km, 3 km and 1 km
- 25 vertical levels
- Australian Geosciences 9 second Digital Elevation Model (DEM) terrain data
- The TAPM defaults for soil type and sea surface temperature
- Default options selected for advanced meteorological inputs
- The synoptic data used in the simulation is for the year 2012
- Measured wind speed and wind direction data from the on-site monitoring site (ADMIN) for 2012 was assimilated into the model

The site-specific meteorological file extracted from TAPM at the study site has been used as input into the AUSPLUME dispersion modelling.

The modelled meteorology used for this assessment is analysed in Section 7 and a full description of the methodology to select the most appropriate meteorology is provided in Appendix B.

#### 6.3 AUSPLUME configuration

AUSPLUME is a Gaussian plume dispersion model and is an industry-accepted model. The dispersion modelling was conducted over a one year period using the metrological file described above. Modelling the dust emissions from the quarry over a one year period encompasses all weather conditions likely to be experienced at the site.

Key features of AUSPLUME used to simulate dispersion:

- Gridded receptor area of 21 by 26 grid points at 100 m spacing
- Discrete receptors were modelled explicitly
- 366 days (1 January 2012 to 31 December 2012)
- AUSPLUME meteorological file generated using TAPM and on-site observations
- Flat terrain information
- Horizontal dispersion curves for sources < 100m high calculated using the Pasquill Gifford option
- The Irwin rural exponent scheme for wind profiles
- Surface roughness of 0.4 m to account for surrounding land use (rolling rural land use)
- Default temperature gradients
- Deposition and dry depletion calculated
- Particle size distributions modelled for all sources as reported in Table 6. A particle density of 1.78 g/cm<sup>3</sup> was used for all dust sources assuming that it is all sand.
- All other options were set as default.

#### Table 6 Typical size distribution for emitted dust (USEPA, 2006a)

Size fraction <sup>A</sup>	Particle size (µm)	Mass percent
TSP	21.1	Coloulated from ratio of
PM <sub>10</sub>	6.1	
PM <sub>2.5</sub>	1.0	emission rates

Table note: A Particle density and mass fraction for each size fraction (TSP, PM10 and PM2.5) is required in the modelling so that dry depletion can be calculated for TSP and PM10. For example, larger particles of TSP will settle on the ground closer to the source, whilst smaller particles will travel further before settling out of the plume on to the ground. The inclusion of each size fraction ensures that this is accounted for within the model.

The source characteristics used as input in Ausplume are summarised in Table 7 and shown in Figure 1.

#### Table 7 **Expansion Project dust sources - model inputs**

Activity	Model Source ID	Source Height	Initial Vertical Spread
Top soil removal by graders	ACTIV	4	1
Truck movements on paved haul roads	PH	5	1.25
Truck movements on unpaved haul roads	UPH	5	1.25
Front end loader picking up sand	ACTIV	4	1
Front end loader dropping sand into trucks	ACTIV	4	1
Wind erosion – temporary sand stockpiles	SPILE	4	1
Wind erosion – pit	ACTIV	4	1
Wind erosion – topsoil stockpiles	ACTIV	4	1
Wind erosion – exposed areas (old disturbance)	EXPOS	1	0.25
Wind erosion – disturbed areas (new disturbance)	DIST	1	0.25
Wind erosion – rehabilitated areas	EXPOS	1	0.25

An example AUSPLUME configuration file is provided in Appendix C.

#### 6.4 **Background Concentrations Used for the Cumulative Assessment**

The background concentrations used in this assessment are presented in Table 8.

The background concentrations for PM<sub>10</sub> have been taken from the data obtained at TRW. TSP and PM<sub>2.5</sub> are not measured on-site or at the closest DER monitoring site in Rockingham. In the absence of monitoring data for TSP and PM<sub>2.5</sub>, a ratio has been applied. The assessment has assumed that TSP is approximately 50% of  $PM_{10}$  and  $PM_{2.5}$  is approximately 20% of PM<sub>10</sub>.

Dust deposition has been assessed in isolation against the appropriate criteria.

Pollutant	Averaging Period	Concentration (µg/m <sup>3</sup> )				
TOD	24-hour	41.8 <sup>1</sup>				
13F	Annual	37.4 <sup>1</sup>				
	24-hour	20.9 <sup>2</sup>				
PINI <sub>10</sub>	Annual	18.7 <sup>3</sup>				
DM	24-hour	4.2 <sup>4</sup>				
PIVI <sub>2.5</sub>	Annual	3.74				
Dust deposition Assessed in isolation						
Table note:						
$^{1}$ Assessment has assumed that TSP is approximately 50% of PM <sub>10</sub>						
<sup>2</sup> The highest 70 <sup>th</sup> percentile 24-hour concentration measured at TRW						

Table 8 Background concentrations used in the assessment

<sup>3</sup> The highest annual average concentration measured at TRW
 <sup>4</sup> Assessment has assumed that PM<sub>2.5</sub> is approximately 20% of PM<sub>10</sub>

## 7. Analysis of Dispersion Meteorology

The meteorological dataset for the assessment has been generated using TAPM and the assimilation of on-site meteorological data. The meteorological data selection methodology is presented in Appendix B. This section describes the meteorology used in the Ausplume dispersion model.

#### 7.1 Wind Speed and Direction

The annual, diurnal and seasonal distributions of winds at the Project site for 2012 are presented as wind roses in Figure 2, Figure 3 and Figure 4, respectively.

The annual wind distribution (Figure 2) shows that the highest proportion of winds come from the northeast to east. Few winds occur from between the north and west-northwest. Winds from the south to west tend to be stronger.

The diurnal wind roses (Figure 3) show typically light winds in the early morning (midnight to 6am) from the northeast to east, which strengthen during the hours of 6am to midday. In the afternoon (midday to 6pm) the wind direction changes to predominantly a southwest to west-southwest and these winds tend to be strong. At night (6pm to midnight), the wind direction is generally from the south to southwest.

The seasonal wind roses (Figure 4) show that the wind direction has a strong seasonal dependence. During winter, the predominant wind direction is from the northeast. In spring, there are winds in all directions with a dominance of strong winds from the southwest to west. In summer these stronger winds occur between east and southwest. Winds during summer are predominantly from the south-eastern quadrant. During autumn there is a greater proportion of winds from the northeast to east.

#### 7.2 Mixing Height

The mixing height refers to the height above ground within which particulates or other pollutants released at or near ground can mix with ambient air. During stable atmospheric conditions (F class stability), the mixing height is often quite low and particulate dispersion is limited to within this layer. During the day, solar radiation heats the air at the ground level and causes the mixing height to rise. The air above the mixing height during the day is generally cooler. The growth of the mixing height is dependent on how well the air can mix with the cooler upper level air and therefore depends on meteorological factors such as the intensity of solar radiation and wind speed. During strong wind speed conditions the air will be well mixed, resulting in a high mixing height.

Mixing height information at the Project site is presented in Figure 5. The data shows that the mixing height increases from its overnight minimum at around 6am, reaching a peak at approximately 2pm. The mixing height then decreases from around 3pm to a minimum height during the night time.

#### 7.3 Stability Class

Stability classification is a measure of the stability of the atmosphere and can be determined from wind measurements and other atmospheric observations. The stability classes range from A class, which represents very unstable atmospheric conditions that may typically occur on a sunny day, to F class stability, which represents very stable atmospheric conditions that typically occur during light wind conditions at night. Unstable conditions (Classes A to C) are characterised by strong solar heating of the ground that induces turbulent mixing in the

atmosphere close to the ground. This turbulent mixing is the main driver of dispersion during unstable conditions. Dispersion processes for Class D conditions are dominated by mechanical turbulence generated as the wind passes over irregularities in the local surface. During the night, the atmospheric conditions are generally stable (often Classes E and F).

A summary of the predicted frequency of each stability class at the Baldivis Quarry site is presented in Table 9. Class D representing neutral stability occurs for approximately 46% of the time, indicating that mechanical turbulence is the main contributor to instability in this region.

Table 9	Predicted frequency of occurrence (%) of atmospheric stability at the
	project site under the Pasquil-Gifford stability classification scheme

Pasquill-Gifford Stability Class Classification		Frequency (%) <sup>1</sup>			
A	Extremely unstable	1			
В	Unstable	9			
С	Slightly unstable	16			
D	Neutral	46			
E	Slightly stable	11			
F	Stable	17			
Note: <sup>1</sup> Stability class extracted from TAPM at the project site					

### 8. Results of Air Quality Impact Assessment

This section presents the results of dispersion modelling for peak operations of the expanded Baldivis Quarry.

The ground-level concentrations of TSP,  $PM_{10}$  and  $PM_{2.5}$  as well as dust deposition rates predicted for the quarry operating at peak capacity are presented in Table 10 for the Expansion Project in isolation. Table 11 shows the ground-level concentrations of TSP,  $PM_{10}$  and  $PM_{2.5}$  including background concentrations. The dust deposition rate is presented in isolation only.

Figure 6 and Figure 7 show contour plots of predicted maximum 24-hour average and annual average ground-level concentrations of TSP, including a background. Figure 8 shows a contour plot of predicted maximum 24-hour ground-level concentrations of  $PM_{10}$  including a background. Figure 9 and Figure 10 show contour plots of predicted maximum 24-hour and annual average ground-level concentrations of  $PM_{2.5}$  including a background. Figure 11 shows a contour plot of predicted annual average dust deposition rate assessed in isolation.

The air quality assessment for the Expansion Project shows that:

- Predicted dust levels comply with all relevant criteria at all receptors assessed for the Expansion Project in isolation. This includes the application of water as a dust suppression measure.
- Predicted dust levels comply with all relevant criteria at all receptors assessed for the Expansion Project and including background concentrations. This includes the application of water as a dust suppression measures.

•

	Concentration (µg/m <sup>3</sup> )					Deposition	
Receptor	TSP		PI	PM <sub>10</sub>		PM <sub>2.5</sub>	
U	Maximum 24- Hour Average	Annual Average	Maximum 24-Hour Average	6 <sup>th</sup> Highest 24-Hour Average	Maximum 24-Hour Average	Annual Average	Annual Average
R1	19.0	1.9	10.1	7.1	2.2	0.2	0.35
R2	32.9	4.1	16.2	13.6	5.5	0.4	0.73
R3	35.8	3.0	20.2	11.4	7.5	0.3	0.52
R4	33.6	3.3	19.9	12.5	6.8	0.3	0.60
R5	13.4	1.3	8.1	6.0	3.3	0.2	0.23
R6	22.9	2.4	14.2	11.2	5.3	0.3	0.48
R7	15.9	1.5	9.6	7.7	3.8	0.2	0.29
R8	13.8	1.5	8.9	7.1	3.5	0.2	0.29
R9	8.9	0.7	5.5	2.8	1.1	0.1	0.10
R10	7.9	0.7	4.9	3.5	1.2	0.1	0.09
R11	6.7	0.7	4.5	3.1	1.9	0.1	0.07
R12 <sup>1</sup>	26.5	3.0	12.5	n/a	2.9	0.3	0.60
Criteria	90	90	-	50	25	8	2

Table 10 Predicted ground-level concentrations of TSP, PM<sub>10</sub> and PM<sub>2.5</sub> and the dust deposition rate at sensitive receptor locations due to peak operations of the Expansion Project in isolation

<sup>1</sup> Receptor 12 was identified after modelling was completed. Results are only indicative and are based on the contour plots. No contour plot of 6th highest 24-hour average PM<sub>10</sub> was produced so only the maximum 24-hour average is presented for Receptor 12.

# Table 11Predicted ground-level concentrations of TSP, PM10 and PM2.5 at sensitive<br/>receptor locations due to peak operations of the Expansion Project<br/>including background concentrations

	Concentration (µg/m³)						
Receptor ID	TSP		Р	PM <sub>10</sub>		PM <sub>2.5</sub>	
	Maximum 24-Hour Average	Annual Average	Maximum 24-Hour Average	6 <sup>th</sup> Highest 24-Hour Average	Maximum 24- Hour Average	Annual Average	
R1	60.8	39.3	31.0	28.0	6.4	3.9	
R2	74.7	41.5	37.1	34.5	9.7	4.1	
R3	77.6	40.4	41.1	32.3	11.7	4.0	
R4	75.4	40.7	40.8	33.4	11.0	4.0	
R5	55.2	38.7	29.0	26.9	7.5	3.9	
R6	64.7	39.8	35.1	32.1	9.5	4.0	
R7	57.7	38.9	30.5	28.6	8.0	3.9	
R8	55.6	38.9	29.8	28.0	7.7	3.9	
R9	50.7	38.1	26.4	23.7	5.3	3.8	
R10	49.7	38.1	25.8	24.4	5.4	3.8	
R11	48.5	38.1	25.4	24.0	6.1	3.8	
R12 <sup>1</sup>	68.3	40.4	33.4	n/a	7.1	4.0	
Background	41.8	37.4	20.9	20.9	4.2	3.7	
Criteria	90	90	-	50	25	8	

Table note:

<sup>1</sup> Receptor 12 was identified after modelling was completed. Results are only indicative and are based on the contour plots. No contour plot of 6th highest 24-hour average  $PM_{10}$  was produced so only the maximum 24-hour average is presented for Receptor 12.

### 9. Mitigation Measures

Holcim has implemented a Dust Management Plan for the Stage 1 operations. These measures will be extended to cover the activities within the Expansion Project.

The dust management measures are detailed in Table 12.

Management Measure	Action
Maintenance of water sprays on crushing and screening equipment to ensure that they are operating effectively	All Holcim equipment will be regularly maintained to ensure safe and efficient operation.
Procedures for the determination of the frequency of the operation of water sprays throughout the process line	Determining the frequency of operation of the water sprays will consider multiple factors such as current weather conditions (winds, temperature, rainfall etc) and moisture content of the screened material.
Procedures for the watering material stockpiles and access roads, including frequency and duration of watering	A water cart will be available for the watering of material stockpiles, access roads and other open areas and used as necessary to ensure adequate saturation of the surface area of the material stockpiles and access roads to reduce dust emissions.
Procedures for the watering and/or covering of trucks	Holcim has a company fleet load covering policy ensuring all company vehicles have loads covered by tarpaulin before exiting sites. The cover is applied as soon as a safe load distribution has been confirmed ensuring minimum exposure to wind and in turn minimising the risk of dust emissions
Procedures for the timing of operations according to wind conditions	Forecast weather and conditions to identify when strong winds are likely to occur so that more frequent watering of open areas can be undertaken during these periods. The strongest winds during the year are typically easterly and south westerly winds during summer. In the case of unusually strong wind conditions operations would temporarily cease until a more favourable wind condition enabled operations to recommence.
Procedures for the use of truck wheel wash	Truck wheel wash points are employed upon exit of the site.
General housekeeping practices to be employed for the purpose of minimising fugitive dust emission.	Stockpiles will be constructed in such a manner as to allow water truck access to ensure adequate saturation to reduce dust emissions. Stockpiles will not be sited against boundary areas to reduce the possibility of dust emissions. Design of traffic flow plans will incorporate reduction strategies.

Table 12 Management measures for dust

### 10. Conclusions

An air quality assessment was undertaken to assess the potential dust impacts for a proposed expansion of Baldivis Quarry with a peak extraction rate of up to 3,000 tonnes per day.

Dispersion modelling has been undertaken to assess the potential impact of the Baldivis Quarry Expansion Project on the ground-level concentrations of TSP,  $PM_{10}$  and  $PM_{2.5}$  as well as the dust deposition rate at the surrounding residences. A cumulative assessment that included the background concentrations for TSP,  $PM_{10}$  and  $PM_{2.5}$  has been conducted. Dust deposition has been assessed in isolation.

The air quality assessment for the Expansion Project shows that:

- Predicted dust levels comply with all relevant criteria at all receptors assessed for the Expansion Project in isolation. This includes the application of water as a dust suppression measure.
- Predicted dust levels comply with all relevant criteria at all receptors assessed for the Expansion Project and including background concentrations. This includes the application of water as a dust suppression measure.

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Katestone Environmental Pty Ltd URS D1010981-3 Baldivis Quarry – Expansion Project















# Appendix A

Expansion Project Activity Data and Dust Emissions Estimation Information

## Contents

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#### A1 Emissions methodology

Dust emission rates for activities related to the operation of the Baldivis Quarry were based on emission factors and methods published by the US EPA (USEPA 2006a, USEPA 2006b, USEPA 2006c, USEPA 1998, USEPA 2011). Section 4 Table 2 of the Air Quality Impact Assessment - Baldivis Quarry, Stage 1 Expansion details the estimated dust emissions from the quarry operations.

The following sections describe how these emission rates from each activity were calculated, and presents the activity data used in those calculations.

#### A1.1 Hourly varying emissions

The Baldivis Quarry will operate for a maximum of 11 hours per day, between 7am and 6pm. AUSPLUME has been set up to reflect this for the relevant sources, with no emissions from quarry operations modelled overnight (e.g. truck movements and material handling). Wind erosion sources have been modelled as occurring 24 hours per day (e.g. stockpiles and exposed areas)

A number of sources of emissions at the quarry site are dependent on wind speed, which varies considerably throughout the day and night. For dust impacts, worst-case meteorological conditions are generally moderate to strong winds. Activities that have emission rates dependent on wind speed will have higher emission rates during strong winds and during these strong winds, dust particles are more likely to be lifted by the wind and carried further off-site than during light winds. Light winds, however, will result in the worst dispersion conditions if dust is generated independent of wind speed, for example wheel generated dust. Under these conditions the low winds will inhibit the dispersion of the source resulting in elevated concentrations.

To account for the variation in winds, a time series of hourly average wind speeds generated by TAPM (including the assimilation of on-site measurements) at the quarry site was used in the calculations of emissions from wind erosion and front end loader operations.

The main material to be excavated at the site is sand. Wind tunnel studies indicate that a 4.7 m/s wind speed is required for sand particles with a diameter of 174  $\mu$ m to become airborne (Parrett, 1992). For particles with diameters greater than 174  $\mu$ m, a wind speed greater than 4.7 m/s would be required for dust lift-off. This has been used as a threshold in the wind-dependent emission calculations, so that emissions only occur during hours when the average wind speed is greater than 4.7 m/s.

#### A2 Activity data and emissions calculations

#### A2.1 Topsoil removal by graders

The emission factors for topsoil removal by grading were calculated from the AP42 documents, Chapter 11.9 "Western Surface Coal Mining" (October 1998).

Material	Units	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>
Topsoil	kg/VKT	0.0034 (S) <sup>2.5</sup>	0.6 x 0.0056 (S) <sup>2.0</sup>	TSP x 0.031

Where S = mean vehicle speed (km/hr).

For the modelling assessment, a mean vehicle speed of 10 km/hr has been adopted. AUSPLUME has been set up to model emissions due to topsoil removal during the maximum quarry hours of operation, 7am to 6pm.

#### A2.2 Paved haul roads

The emission factors for wheel generated dust due to haulage along the paved section of road up to the site boundary were calculated from the AP-42 documents in chapter 13.2.1 titled "Paved Roads" dated December 2011.

The equation included in the assessment is as follows:

$$E = k (sL)^{0.91} \times (W)^{1.02}$$

Where sL = road surface silt loading (g/m<sup>2</sup>)

W = mean vehicle weight (tons) and the following constants were assumed.

Constant	TSP (assumed from PM <sub>30</sub> )	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>
k (g/VKT)	3.23	0.62	0.15

The following activity data were used to calculate emissions due to haulage of product material on the section of paved road. AUSPLUME was set up to model the dispersion of haulage emissions generated between 7am and 6pm.

A control factor of 75% was applied to account for watering of haul roads.

Parameter	Units	Value	Source
	2		US EPA AP-42 documents, Chapter
Silt loading of haul road	g/m²	8.2	13.2.1-3 "Paved roads" (US EPA,
	_		2006a). Average value for quarrying
Truck weight (empty)	tonnes	25	Provided by URS on behalf of Holcim
Truck payload	tonnes	50	Provided by URS on behalf of Holcim
Truck weight (average)	tons	55.1	Calculated
Length of paved haul	km	0.25	Site layout provided by URS on behalf
road	KIII	0.25	of Holcim
Trips per day	Trips/day	60	calculated

#### A2.3 Unpaved haul roads

The emission factors for wheel generated dust due to haulage along unpaved roads were calculated from the AP42 documents in Chapter 13.2.2 titled "Unpaved roads" dated November 2006.

The equation included in the assessment is as follows:

$$E = k \left( s/12 \right)^a \left( W/3 \right)^b$$

Where s = surface material silt content (%)

W = mean vehicle weight (tons) and the following constants were assumed.

Constant	TSP (assumed from PM <sub>30</sub> )	PM <sub>10</sub>	PM <sub>2.5</sub>
k (lb/VMT)	4.9	1.5	0.15
а	0.7	0.9	0.9
b	0.45	0.45	0.45

The following activity data were used to estimate emissions from haulage activity on unpaved roads onsite. AUSPLUME was set up to model the dispersion of haulage emissions generated during the maximum quarry operational hours of 7am to 6pm.

Parameter	Units	Value	Source
Surface material silt content	%	8	Average value for haul road for stone quarrying and processing (USEPA, 2006c)
Truck weight (empty)	tonnes	25	Provided by LIPS on behalf of Heleim
Truck payload	tonnes	50	Frovided by OKS of benall of Floicin
Truck weight (average)	tons	55.1	Calculated
Unpaved haul road	km	0.4	Site layouts provided by URS on behalf of
length (one way)	NIII	0.4	Holcim
Trips per day	Trips/day	60	Calculated

A control factor of 75% was applied to account for watering of haul roads.

### A2.4 Front end loader

The emission rates due to front end loaders picking up material, and dumping material into trucks were calculated using the following equation for transfer points from the AP42 documents, Chapter 13.2 "Aggregate Handling and Storage Piles" (November 2006b):

$$E = k0.0016 \left(\frac{U}{2.2}\right)^{1.3} \left(\frac{M}{2}\right)^{-1.4} kg / t$$

k =	0.74 for particles less than 30 µm
-----	------------------------------------

k = 0.35 for particles less than 10  $\mu$ m

k = 0.053 for particles less than 10  $\mu$ m

U = mean wind speed in m/s

M = material moisture content

AUSPLUME was set up to model emissions from front end loader transfers during the maximum quarry hours of operation of 7am to 6pm. Emissions during quarry operations were calculated for every hour using the hourly average wind speed generated by the meteorological model TAPM with on-site data assimilated.

A moisture content of 2.1% was used.

Parameter	Units	Value	Source
Moisture content of sand	%	2.1	Average value for various limestone products, stone quarrying and processing (US EPA, 2006a).
Front end loader overburden extraction/dumping rate	tonnes/day	3,000	Provided by URS on behalf of Holcim

## A2.5 Wind erosion from product stockpiles, extraction area, and topsoil stockpiles

The emissions due to wind erosion of the product stockpiles, active extraction area and topsoil stockpiles were calculated from the AP42 documents, chapter 11.9 "Western Surface Coal Mining" (October 1998). Scaling factors for the  $PM_{10}$  and  $PM_{2.5}$  emission factors were taken from the AP42 documents, chapter 13.2 "Industrial Wind Erosion" (November 2006).

Material	Units	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>
Active	ka/(bootaro)(bour)	10 v	TSP x 0.5 (USEPA,	PM <sub>10</sub> x 0.075
stockpiles	kg/(nectare)(nour)	$1.0 \times u$	2006b).	(USEPA, 2006b).

Where u = hourly average wind speed (from time series generated by TAPM).

Emissions were calculated during hours when the hourly average wind speed was above 4.7 m/s. The activity data in the following section were then applied to calculate a wind erosion emission rate for each hour of the year.

Parameter	Units	Surface area	Source
Active extraction area	ha	2.0	Mining progresses in 2ha strips
Product stockpile	ha	1.2	Estimated by Katestone from GIS files provided by URS on behalf of Holcim
Topsoil stockpile	ha	0.5	Assumed 2m high, 6m wide, 750m long

A control factor of 75% was applied to account for watering.

#### A2.6 Wind erosion from exposed, disturbed and rehabilitated areas

The emission factors from wind erosion for the exposed, inactive areas of Baldivis Quarry were calculated from the AP42 documents, chapter 11.9 "Western Surface Coal Mining" (October 1998) and adapted to include the effect of hourly varying wind speed. The following equations were used:

Material	Units	TSP	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>
Inactive exposed areas	Mg/(hectare)(year)	$0.85  imes rac{u}{u_{ave}}$	TSP x 0.5 (USEPA, 2006b).	TSP x 0.075 (USEPA, 2006b).

Where u = hourly average wind speed, and  $u_{ave} =$  the average wind speed for all hours where wind speed is greater than 4.7 m/s, both from the time series generated by TAPM.

The following activity data has been used to estimate wind erosion from the exposed, inactive extraction areas at the quarry.

Parameter	Units	Value	Source
Exposed areas (old disturbance area)	ha	15.2	
Exposed areas (new disturbance area)	ha	5.8	Estimated by Katestone from GIS files provided by URS on behalf of Holcim
Rehabilitated exposed areas	ha	2.0	

A control factor of 90% was applied to rehabilitated areas.

#### A3 References

Parrett, F.W., 1992, Dust emission – a review, Applied Environmetrics Balwyn.

USEPA, 2006a, Aggregate Handling and Storage Piles, AP-42 Chapter 13.2.4, USEPA Office of Air Quality Planning and Standards.

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USEPA, 2006b, Industrial Wind Erosion, AP-42 Chapter 13.2.4, USEPA Office of Air Quality Planning and Standards.

USEPA, 2006c, Unpaved Roads, AP-42 Chapter 13.3.2, USEPA Office of Air Quality Planning and Standards.

USEPA, 1998, Western Surface Coal Mining, AP-42 Chapter 11.9, USEPA Office of Air Quality Planning and Standards.

# Appendix B

Expansion Project Meteorological Data Selection Methodology

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#### B1 Overview

A key component of the air quality assessment for the Baldivis Sand Quarry Expansion Project is the selection of meteorological data that is both representative of the site and suitable for use in a dispersion model.

Three methods for developing a meteorological file suitable for use in the assessment were considered:

- 1. Use a WA DER approved meteorological data file from the WA DER Hope Valley station
- 2. Create a meteorological data file using measurements from the Baldivis Quarry site meteorological monitoring station
- 3. Create a meteorological data file using TAPM (a prognostic meteorological model) combined with data from the on-site monitoring station

The following sections describe each option and which option was selected for use in the Expansion Project air quality assessment.

#### B2 Baldivis Quarry meteorological monitoring station data

Meteorological monitoring has been conducted near the Administration Building on the Baldivis Quarry site since March 2008. The station is known as "ADMIN". The ADMIN station uses a 10 metre tower and records wind speed, wind direction, sigma theta, temperature and pressure over a 5-minute averaging period.

The annual data capture rate and statistics for the 5-minute average records of wind speed and wind direction at the ADMIN station are presented in Table B1. The data capture rate at the ADMIN station is very good with all full years (2009 -2012) recording at least a 96% data capture rate.

ADMIN Station	Data Capture Rate (%)	Mean Wind speed (m/s)	Mean Wind direction (°)				
All years	98.3	2.9	162				
2008 <sup>1</sup>	97.9	2.7	161				
2009	99.6	3.1	176				
2010	97.9	2.9	158				
2011	96.4	2.9	157				
2012	98.4	2.9	158				
2013 <sup>2</sup>	98.5	2.6	163				
Table notes: <sup>1</sup> Monitoring began in March 2008 <sup>2</sup> Monitoring data only available up to August 2013							

Table B1	Summary	v statists for the	Baldivis Quarry	monitorina	station

Frequency distributions of wind speed and wind direction for the full years (2009 - 2012) and all the data, are shown in Figure B1 and Figure B2 respectively. The figures show there is little variation between years.

As a minimum, a meteorological data file suitable for use in Ausplume requires hourly records of temperature, wind speed, wind direction, stability class and mixing height. As there is insufficient information to calculate all parameters required for Ausplume, the TAPM

prognostic model with data assimilation of wind speed and wind direction from the ADMIN station was used to develop an Ausplume meteorological file for the site.

#### B3 TAPM and ADMIN Station Meteorological File

Katestone has used ADMIN station measurements of wind speed and wind direction in conjunction with the TAPM model for 2012 to produce a site representative meteorological dataset suitable for use in Ausplume. As described previously, there was no significant variation between the full years of ADMIN station data (2009 - 2012) and therefore, the newest complete year has been used (2012).

The TAPM configuration is described in Section 6.2 of the Expansion Project air quality assessment report.

A statistical summary of wind speed from the 2012 TAPM model with and without the assimilation of the 2012 ADMIN meteorological data is provided in Table B3.

Parameter	Units	2012 TAPM	2012 TAPM and ADMIN (assimilated)
Average wind speed	m/s	3.41	2.89
% winds <= 1 m/s	%	5%	17%
% winds < 2 m/s	%	26%	36%
% winds > 4.7 m/s	%	23%	16%
% winds > 5.4 m/s	%	14%	9%

 Table B2
 Comparison of meteorological data files

Figure B3 and Figure B4 show a comparison of frequency of wind speed and direction, respectively, from the 2012 TAPM with and without assimilation of the 2012 ADMIN meteorological data.

### B4 WA DER Hope Valley meteorological file

In WA, it is standard practice in air quality assessments to use a WA DER approved meteorological file ready for use in Ausplume.

The WA DER Hope Valley dataset has been derived from measurements at a location which is the same distance inland (approximately 6 km) but a further 20 km north of the Baldivis Quarry site. The WA DER approved meteorological data file has been derived from the year 1996 and has not been updated. This data has been reviewed by Katestone in comparison to the on-site measurements obtained at the Baldivis Quarry ADMIN station to determine if the Hope Valley data file is representative and suitable for use in the Expansion Project air quality assessment.

### B5 Comparison of meteorological files

Wind flows in a project area are important for understanding the capacity of the air to disperse air pollutants. For dust impacts from the Expansion Project, worst-case meteorological conditions are generally moderate to strong winds. Activities that have emission rates dependent on wind speed will have higher emission rates during strong winds and during these strong winds, dust particles are more likely to be lifted by the wind and carried further off-site than during light winds.

Light winds, however, will result in the worst dispersion conditions if dust is generated independent of wind speed, for example wheel generated dust. Under these conditions the low winds will inhibit the dispersion of the source resulting in elevated concentrations.

A statistical summary of wind speed from the 2012 TAPM and ADMIN meteorological data file compared to the WA DER Hope Valley meteorological data file is provided in Table B3.

Parameter	Units	2012 TAPM and ADMIN	WA DER Hope Valley
Average wind speed	m/s	2.89	4.20
% winds <= 1 m/s	%	17%	1%
% winds < 2 m/s	%	36%	8%
% winds > 4.7 m/s	%	16%	36%
% winds > 5.4 m/s	%	9%	27%

Table B3 Comparison of meteorological data files

Figure B5 and Figure B6 show a comparison of frequency of wind speed and direction, respectively, from the 2012 TAPM and ADMIN meteorological data file and the WA DER Hope Valley meteorological data file.

The data clearly shows that the WA DER Hope Valley dataset predicts a lower frequency of light winds (<2 m/s) and predicts a higher frequency of stronger winds (>4 m/s) compared to the 2012 TAPM and ADMIN meteorological data file. The 2012 TAPM and ADMIN meteorological file has more light winds than the WA DER Hope Valley meteorological file, leading to potentially poorer dispersion conditions. However, the WA DER Hope Valley file has stronger winds leading to more dust being generated from the quarry.

#### B6 Selection of meteorological file for Ausplume

To understand which factor is more important on sensitive receptor impacts in the vicinity of the Baldivis Quarry, and to select which meteorological file to use in the Expansion Project air quality assessment, both meteorological files have been used in Ausplume. The Ausplume dispersion model configuration is provided in Section 6.3 of the main report.

The 24-hour average  $PM_{10}$  concentrations, selected to show a worst case short term impact, at the nearest sensitive receptors using the 2012 TAPM and ADMIN meteorological file and the WA DER Hope Valley meteorological file are presented in Table B4.

The results show that the 2012 TAPM and ADMIN meteorological file results in higher predicted concentrations of 24-hour average  $PM_{10}$  at all sensitive receptors. Based on these findings, the Expansion Project air quality assessment has been conducted using the 2012 TAPM and ADMIN metrological file.

	2012 TAPM a	nd ADMIN file	WA DER Hope Valley file		
Receptor	Maximum 24- Hour Average	6 <sup>th</sup> Highest 24- Hour Average	Maximum 24- Hour Average	6 <sup>th</sup> Highest 24- Hour Average	
R1	10.1	7.1	6.8	5.2	
R2	16.2	13.6	14.3	8.6	
R3	20.2	11.4	6.5	5.7	
R4	19.9	12.5	14.3	6.7	
R5	8.1	6.0	8.0	3.8	
R6	14.2	11.2	10.4	7.3	
R7	9.6	7.7	7.0	5.0	
R8	8.9	7.1	6.2	4.9	
R9	5.5	2.8	2.4	1.6	
R10	4.9	3.5	2.6	1.5	
R11	4.5	3.1	2.2	1.3	
Criteria	-	50	-	50	

## Table B4 Comparison of 24-hour average PM<sub>10</sub> concentrations (µg/m<sup>3</sup>) using two different meteorological data files












# Appendix C Expansion Project Ausplume Configuration

Baldivis Quarry Expansion Project - PM10 concentration (w Depletion)

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+06
Constant background concentration	0.00E+00
Terrain effects	None
Plume depletion due to dry removal	mechanisms included.
Smooth stability class changes?	No
Other stability class adjustments ("un	ban modes") None
Ignore building wake effects?	No
Decay coefficient (unless overridden	by met. file) 0.000
Anemometer height	10 m
Roughness height at the wind vane s	site 0.300 m
Use the convective PDF algorithm?	No
DISPERSION CURVES	
Horizontal dispersion curves for sour	rces <100m high Pasquill-Gifford
Vertical dispersion curves for source	es <100m high Pasquill-Gifford
Horizontal dispersion curves for sour	rces >100m high Briggs Rural
Vertical dispersion curves for source	es >100m high Briggs Rural
Enhance horizontal plume spreads for	or buoyancy? Yes
Enhance vertical plume spreads for	r buovancy? Yes
Adjust horizontal P-G formulae for ro	oughness height? Yes
Adjust vertical P-G formulae for rou	ighness height? Yes
Roughness height	0.400m
Adjustment for wind directional shea	r None
PLUME RISE OPTIONS	3
Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	PRIME method.
Entrainment coeff. for neutral & stab	le lapse rates 0.60.0.60
Partial penetration of elevated invers	sions? No
Disregard temp, gradients in the hou	Irly met. file? No
g	,,
and in the absence of boundary-lave	er potential temperature gradients
given by the hourly met. file, a value	from the following table
(in K/m) is used:	
· /	
Wind Speed Stability Cla	SS
Category A B C D	EF

1	0.000 0.000 0.000 0.000 0.020 0.035	
2	0.000 0.000 0.000 0.000 0.020 0.035	
3	0.000 0.000 0.000 0.000 0.020 0.035	
4	0.000 0.000 0.000 0.000 0.020 0.035	
5	0.000 0.000 0.000 0.000 0.020 0.035	
6	0.000 0.000 0.000 0.000 0.020 0.035	

### WIND SPEED CATEGORIES Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

AVERAGING TIMES 1 hour

Baldivis Quarry Expansion Project - PM10 concentration (w Depletion)

### SOURCE GROUPS

Group No. Members

- 1 ACTIV1 ACTIV2
- 2 SPILE1
- 3 PH1 PH2 PH3 PH4 UPH5 UPH6 UPH7 UPH8
- 4 EXPOS1 EXPOS2
- 5 DIST1 DIST2 DIST3 DIST4
- 6 ACTIV1 ACTIV2 SPILE1 PH1 PH2 PH3 PH4 UPH5 UPH6 UPH7 UPH8 EXPOS1 EXPOS2 DIST1

DIST2 DIST3 DIST4

1

Baldivis Quarry Expansion Project - PM10 concentration (w Depletion)

SOURCE CHARACTERISTICS

### INTEGRATED POLYGON AREA SOURCE: ACTIV1

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388260 6415564 0m 4 1m 4m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388260 6415564 2 388168 6415521 3 388126 6415612 4 388218 6415655 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.8600 6.1 1.78 0.1400 1.0 1.78

### INTEGRATED POLYGON AREA SOURCE: ACTIV2

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388260 6415564 0m 4 1m 4m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388260 6415564 2 388218 6415655 3 388308 6415696 4 388349 6415605 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.8600 6.1 1.78 0.1400 1.0 1.78

INTEGRATED POLYGON AREA SOURCE: SPILE1

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388478 6415509 0m 4 1m 4m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388478 6415509 2 388570 6415550 3 388624 6415431 4 388534 6415390 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with

this emission factor.

Particle	Particle	Particle	
Mass	Size	Density	
fraction	(micron)	(g/cm3)	
0.8500	6.1	1.78	
0.1500	1.0	1.78	

INTEGRATED POLYGON AREA SOURCE: PH1

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388466 6415894 0m 4 1m 5m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388466 6415894 2 388475 6415899 3 388493 6415857 4 388484 6415853 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.9000	6.1	1.78
0.1000	1.0	1.78

INTEGRATED POLYGON AREA SOURCE: PH2

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388475 6415899 0m 4 1m 5m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388475 6415899 2 388466 6415894 3 388448 6415936 4 388457 6415940 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)	
	· · ·	,	
0.9000	6.1	1.78	
0.1000	1.0	1.78	

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### INTEGRATED POLYGON AREA SOURCE: PH3

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388484 6415853 0m 4 1m 5m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388484 6415853 2 388493 6415857 3 388529 6415774 4 388520 6415770 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.9000	6.1	1.78	
0.1000	1.0	1.78	

### INTEGRATED POLYGON AREA SOURCE: PH4

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388520 6415770 0m 4 1m 5m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388520 6415770 2 388529 6415774 3 388567 6415686 4 388554 6415691 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.9000	6.1	1.78	
0.1000	1.0	1.78	

### INTEGRATED POLYGON AREA SOURCE: UPH5

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388554 6415691 0m 4 1m 5m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388554 6415691 2 388567 6415686 3 388477 6415644 4 388473 6415653 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.9000	6.1	1.78
0.1000	1.0	1.78

### INTEGRATED POLYGON AREA SOURCE: UPH6

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388473 6415653 0m 4 1m 5m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388473 6415653 2 388477 6415644 3 388391 6415603 4 388387 6415613 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.9000 6.1 1.78 0.1000 1.0 1.78

#### INTEGRATED POLYGON AREA SOURCE: UPH7

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388387 6415613 0m 4 1m 5m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388387 6415613 2 388391 6415603 3 388306 6415563 4 388301 6415572 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.9000	6.1	1.78
0.1000	1.0	1.78

#### INTEGRATED POLYGON AREA SOURCE: UPH8

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388301 6415572 0m 4 1m 5m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388301 6415572 2 388306 6415563 3 388220 6415523 4 388216 6415532 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.9000	6.1	1.78	
0.1000	1.0	1.78	

INTEGRATED POLYGON AREA SOURCE: EXPOS1

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388573 6415703 0m 4 0m 1m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388573 6415703 2 388883 6415883 3 388898 6415406 4 388720 6415398 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.8500	6.1	1.78	
0.1500	1.0	1.78	

### INTEGRATED POLYGON AREA SOURCE: EXPOS2

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height

388557 6415669 0m 4 0m 1m

Integrated Polygon Area Source Vertice Locations (in metres)

No. X Y No. X Y 1 388557 6415669 2 388647 6415405 3 388334 6415238 4 388181 6415497 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle	Particle	Particle
Mass	Size	Density
fraction	(micron)	(g/cm3)

0.8500	6.1	1.78
0.1500	1.0	1.78

#### INTEGRATED POLYGON AREA SOURCE: DIST1

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388741 6415816 0m 4 0m 1m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388741 6415816 2 388577 6415722 3 388548 6415803 4 388703 6415899 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.8500	6.1	1.78	
0.1500	1.0	1.78	

INTEGRATED POLYGON AREA SOURCE: DIST2

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388445 6415655 0m 4 0m 1m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388445 6415655 2 388402 6415740 3 388501 6415793 4 388531 6415695 (Constant) emission rate = 1.00E+00 grams/second per square metre Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)	
0.8500	6.1	1.78	
0.1500	1.0	1.78	

### INTEGRATED POLYGON AREA SOURCE: DIST3

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388445 6415655 0m 4 0m 1m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388445 6415655 2 388347 6415609 3 388312 6415691 4 388402 6415740 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Particle Particle Mass Size Density fraction (micron) (g/cm3)

0.8500	6.1	1.78
0.1500	1.0	1.78

### INTEGRATED POLYGON AREA SOURCE: DIST4

X0(m) Y0(m) Ground El No. Vertices Ver. spread Height 388741 6415816 0m 4 0m 1m

Integrated Polygon Area Source Vertice Locations (in metres) No. X Y No. X Y 1 388741 6415816 2 388703 6415899 3 388856 6415995 4 388872 6415891 (Constant) emission rate = 1.00E+00 grams/second per square metre

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)	
0.8500	6.1	1.78	
0.1500	1.0	1.78	

1

Baldivis Quarry Expansion Project - PM10 concentration (w Depletion)

**RECEPTOR LOCATIONS** 

**DISCRETE RECEPTOR LOCATIONS (in metres)** 

No	. X	Y	ELE	EVN	HE	IGHT	-	No	э.	Х	Y	/	EL	EVI	Νŀ	HEI	GHI	Γ
1	388373	641	6115	(	0.0	0.0		9	387	169	641	53	87	C	0.0	0	.0	
2	388242	641	5926	(	0.0	0.0		10	387	7179	64	15	210	(	0.0	C	0.0	
3	388126	641	5936	(	0.0	0.0		11	387	7183	64	148	386	(	0.0	C	0.0	
4	388039	641	5865	(	0.0	0.0		12	387	7163	64	14:	327		0.0	C	0.0	
5	387773	641	5942	(	0.0	0.0		13	387	7157	64	14(	030		0.0	C	0.0	
6	387785	641	5727	<b>(</b>	0.0	0.0		14	387	7324	64	13	761	(	0.0	C	0.0	
7	387680	641	5794	(	0.0	0.0		15	387	799	64	13	303		0.0	C	0.0	
8	387638	641	5730	(	0.0	0.0		16	388	3512	64	13	322	(	0.0	C	0.0	

METEOROLOGICAL DATA : Ausplume met from TAPM with obs reconstructed by AT f

-----

HOURLY VARIABLE EMISSION FACTOR INFORMATION

\_\_\_\_\_

The input emission rates specfied above will be multiplied by hourly varying factors entered via the input file:

N:\URS KE1010981 Baldivis Quarry\Work\Modelling directory\PM10\Emissions.pm10 For each stack source, hourly values within this file will be added to each declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is: Hourly varying PM10 emissions for Baldivis Quarry

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

-----

Prefix ACTIV allocated: ACTIV1 ACTIV2 Prefix SPILE allocated: SPILE1 Prefix PH allocated: PH1 PH2 PH3 PH4 Prefix UPH allocated: UPH5 UPH6 UPH7 UPH8 Prefix EXPOS allocated: EXPOS1 EXPOS2 Prefix DIST allocated: DIST1 DIST2 DIST3 DIST4

# Appendix C Operational Noise Impact Assessment

# URS

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URS Project No. 42908418/01/0



# Report

Baldivis Sand Quarry Operational Noise Impact Assessment

28 OCTOBER 2013

Prepared for Holcim (Australia) Pty Ltd

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42908418



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Appendix A Noise Modelling Contours



# **Abbreviations**

Abbreviation	Description
dB	decibels
dB(A)	decibels, A-weighted
EPA	Environmental Protection Authority
Hz	Hertz
L <sub>A10,t</sub>	statistical noise level exceeded 10% of the time period t, representing the typical upper noise level
L <sub>A90,t</sub>	statistical level exceeded 90% of the time period t, representing the background noise level
L <sub>Aeq,t</sub>	time averaged A-weighted sound pressure level, over time period t
WA	Western Australia
WHO	World Health Organization
GPS	Global Positioning System
SWL	Sound Power Level
SPL	Sound Pressure Level
NMP	Noise Management Plan
HS	Herring Storrer
IF	Influencing Factor
Mt	Mega tonnes
ha	Hectares



## Introduction

URS was engaged by Holcim to undertake an operational noise impact assessment of the proposed expansion of the Baldivis Sand Quarry Stage 1 Project (the expansion project).

Activities at the sand quarry have not raised noise issues thus far; however, the expansion proposed has the potential to elevate noise levels, since the separation distance between the closest noise sensitive receptors and the work area will be reduced.

The expansion project will consist of extraction of up to 500 Mt of sand within an area of 7.85 ha. The sand will be quarried and loaded to haul trucks by front end loaders. The haul trucks will transport sand off-site and the volume of vehicles is not planned to vary from the original Stage 1 proposal.

A factor to consider as otherwise positive for the site is the cease in operations of a screening and washing plant, which may reduce noise levels from site and eliminate tonality in the overall noise emissions from the site.

This assessment forms a technical appendix to the main environmental impact review for the proposed expansion of Stage 1 for the Baldivis Sand Quarry. It includes an assessment and supporting data in relation to the potential noise impacts resulting from the proposed expansion of the quarry.

The assessment of the potential noise and vibration impacts on surrounding noise sensitive receptor locations has been carried out in accordance with the relevant WA Noise Regulations and Guidelines.



# Scope of Assessment

## 2.1 Objective of Assessment

The objective of this assessment is to identify any potential for noise impacts from the proposed expansion of Stage 1 of Holcim's Baldivis Sand Quarry. The proposed activities have been flagged as having the potential to increase noise given the reduction in setback distance between the identified sensitive receptors and the new operating areas of the sand quarry.

The assessment included reviewing the quarry's noise management plan (NMP) to identify any potential revision of the adopted noise criteria and undertaking noise prediction to objectively estimate noise levels at noise sensitive locations.

# 2.2 Methodology

This noise assessment has involved the following steps:

- · Identify the study area applicable to the assessment;
- Review of the NMP, applicable criteria and general requirements;
- Understand the existing acoustic environment of the study area;
- Identify noise sensitive receptors;
- Review of the assigned noise levels;
- · Predict operational noise and comparison with the nominated noise criteria; and
- Recommend measures to achieve satisfactory performance.

# **Project Description**

The sand quarry tenement is located in Baldivis, approximately 49 km south of Perth, Western Australia. The expansion project is located within the Holcim tenement M70/1046 surrounded by Stakehill Road along the northern boundary, a number of residential and commercial premises to the northwest, west and south, and undeveloped land and the Kwinana Freeway to the east. There is an existing explosives reserve towards the south of Stage 1 of the MLA (see **Figure 3-1**).

The tenement is adjacent to a number of residential premises towards the north and west of the site and noise from activities within the site has potential to be audible or disturb surrounding residences, in particular those located across Stakehill Road to the north of the site.

An expansion of the Stage 1 is proposed to reduce the "Buffer Zone" existing between Stakehill Road and the limit of the sand quarry. The expansion proposed would establish quarrying operations located 100 metres closer to Stakehill Road, and therefore the limit line for extraction would be set at approximately 150 m away from Stakehill Road (i.e. new buffer zone would be 150 m).

### 3.2 Noise Sensitive Receptors

Noise sensitive receptors have been identified by considering the location of the proposed site relative to the surrounding environment. The NMP includes a number of 'other' sensitive receptors which have also been included.

Figure 3-1 shows the location of these 12 sensitive receptors in relation to the site and the features of the site.



# **3 Project Description**



### Figure 3-1 Site and Noise Sensitive Receptors



### 4.1 Noise Management Plan – Performance Standards

The NMP prescribed noise limits and operational hours are based on a noise impact assessment undertaken by Herring Storrer (HS) (Report Ref. 7204-4-06225).

The noise limits indicated in the NMP define the maximum allowable external noise levels to be generated during quarrying operations. The normal operating hours for quarrying are 7am to 6pm, Monday to Friday and between 7am and 1pm on Saturdays.

The noise limit for residential land, and the assessment criteria for quarrying operations is  $L_{A10}$  45 dB corrected down by 5 dB(A) due to tonality, which results in the assigned noise level of  $L_{A10}$  40 dB.

### 4.2 Environmental Protection (Noise) Regulations 1997

The basis for the noise assessment undertaken by HS was the Environmental Protection (Noise) Regulations 1997 (Noise Regulations 1997). These regulations take into consideration the sensitivity of the land and are based on an initial framework of ideal noise levels for a number of identified settings such as residential, commercial and industrial receptors.

The assigned noise level identified for each type of sensitive receptor and for the various times of the day, are corrected by an influencing factor (IF) which is determined by the character of the noise source. During the impact assessment undertaken by HS, a -5 dB(A) correction were added to the IF for alleged tonality. The tonality has been acknowledged in the NMP and accepted in the adopted noise limit.

The Stage 1 expansion proposal includes the shut-down of a screening wash plant within the site, which is the dominant and tonal noise source. Other noise sources have not been identified as tonal during a site visit after undertaking noise measurements.

Tonality is not thoroughly developed within the Noise Regulations 1997; however, it is commonly identified when a sound frequency band has a significant difference with its two adjacent frequency bands, and the central band is clearly elevated in comparison with the two adjacent.

Based on the observations and noise monitoring presented in **Section** 5, it is not believed that the 5 dB(A) correction for tonality would be applicable for the expansion of the Stage 1 of the quarry (i.e. after omission of the screening wash plant).

The Noise Regulations 1997 reference other noise character features, for example impulsive noise. For the purposes of this assessment, no such features apply and there is no need to apply an IF.

### 4.3 Noise Criterion

The nominated noise criterion for quarrying operations between 7am and 6pm weekdays is  $L_{A10}\ 45$  dB(A).



Δ

# **Noise Measurements**

### 5.1 Methodology

Noise measurements have been conducted by short-term attended monitoring within the site to gather source levels. Off-site measurements have also been undertaken at selected noise sensitive receptors. The measurements were undertaken between 9am and 3pm approximately on Wednesday 2 October 2013.

All the noise measurements were undertaken in general accordance with AS 1055:1997 "Acoustics – Description and Measurement of Environmental Noise", consistent with WA's Noise Regulations 1997.

The equipment detailed in **Table 5-1** was used. These instruments comply with AS IEC 61672.1 – 2004 "Electroacoustics – Sound level meters – Specifications" and AS IEC 60942-2004: "Electroacoustics – Sound Calibrators" as appropriate, and have a recent calibration certificate traceable to a NATA certified laboratory.

#### Table 5-1 Equipment used for noise survey

Monitoring	Item	Make	Model	Туре	Serial Number
Short-term attended	Sound level meter	Bruel & Kjaer	2250	Type 1	3002096
	Calibrator	Bruel & Kjaer	4231	Class 1	3005155

### 5.2 Monitoring Locations

Noise monitoring was undertaken at several locations on-site whilst the equipment and visiting trucks were in operation and off-site focusing on the nearest noise sensitive receptors.

The noise monitoring locations are shown in Figure 5-1 and Figure 5-2.



### **5 Noise Measurements**

# Figure 5-1 On-Site Noise Monitoring Locations



Figure 5-2 Off-Site Noise Monitoring Locations




#### **5 Noise Measurements**

# 5.3 Source Levels

On site noise monitoring was undertaken in the near-field to quantify existing noise generating plant likely to be utilised during the project expansion.

The most prominent and dominating noise sources were found to be the screening plant and the front end loaders; however, the screening plant will cease operations during the project expansion and this source was not included in the noise modelling, as described in **Section** 6.

**Table 5-2** summarises the noise source measurements. These measurements were analysed to calculate source sound power levels and used in the noise modelling.

Source	Time (min)	Distance (m)	L <sub>Aeq</sub> dB(A)	L <sub>Amax</sub> dB(A)	L <sub>A10</sub> dB(A)	L <sub>A90</sub> dB(A)
Screening	15	3	90	91	90	89
plant	15	2	92	93	92	91
	10	1	96	97	96	96
	5	10	81	82	81	81
	5	~ 50	66	73	68	64
Water	10	1	87	88	87	87
pump	5	2	80	81	81	80
	5	2	82	83	82	82
	5	2	86	88	87	86
Front end loader	9	15	72	87	74	68
(loading trucks)	4	10	74	84	75	72
Front end loader (driving by)	30 seconds.	10	76	80	79	73

#### Table 5-2 On-site Measurements

# 5.4 Existing Noise Environment

The environment around the identified noise sensitive receptors is characterised by road traffic noise being the dominant source along Stakehill Road. This road carries a constant flow of light and heavy vehicles. During the site visit, it was observed that the road traffic noise dominates the background and ambient noise levels during the entire period of the off-site walk, between 12pm and 3pm.

Trucks entering and leaving the site were audible from the monitoring locations; however, the volume of vehicles on Stakehill Road is very high in comparison to the observed number of quarry vehicles.



#### **5 Noise Measurements**

#### Table 5-3 Off-site Measurements

Location	Time (min)	L <sub>Aeq</sub> dB(A)	L <sub>Amax</sub> dB(A)	L <sub>A10</sub> dB(A)	L <sub>A90</sub> dB(A)	Observations
R0	15	49	66	53	39	No industrial noise audible, road traffic noise dominant
R4	15	60	79	64	41	No industrial noise audible, road traffic noise dominant. There is no line of sight between this point and the site. Noise from site was not audible at any time, including during lulls in traffic



# Noise Modelling

# 6.1 Introduction

Noise modelling software has been used to predict operational noise levels at sensitive receptors. The noise model was constructed to enable the prediction of noise levels from the various operational activities. This was achieved by combining the contribution from each noise source. The noise model takes into account:

- sound power levels of each source;
- receptor locations;
- · meteorological effects and attenuation due to distance; and
- ground and atmospheric absorption.

**Table 6-1** lists the key model parameters that have been chosen to provide a conservative representation of actual conditions.

#### Table 6-1 Model settings

Parameter	Setting / Source	
Software	SoundPLAN V7.2	
Algorithm	CONCAWE	
Order of reflections	2	
Search radius	5 km	
Ground absorption	Water - 0 (reflective)	
	All other areas - 0.6 (60% soft ground)	
Receiver height	1.5 m	
Noise contour grid	1.5 m height, 10 m resolution	

The meteorological conditions used in the noise modelling were obtained from the air quality impact assessment undertaken for this project. In accordance with Section 5.2.3 of Guidance for the Assessment of Environmental Factors, Environmental Noise Draft No. 8, site specific meteorological data may be used in noise modelling in place of the "default meteorological conditions". The air quality report established the following parameters relevant to the assessment period (Daytime, between 0700 and 1900 hrs.):



#### **6 Noise Modelling**

#### Table 6-2 Model meteorological parameters

Parameter	"Scenario 1" Morning: 6am-midday	"Scenario 2" Afternoon: Midday-6pm
Wind Speed	3 m/s	4 m/s
Wind Direction	NE	WSW
Pasquill Stability	D	С
Temperature	20 °C	20 ℃
Relative Humidity	50 %	50 %

In order to present a worst case assessment, the meteorological conditions most favourable for sound propagation have been used alongside more conservative factors.

Temperature and relative humidity are consistent with the "default meteorological conditions" as recommended by Section 5.2.3 of the Guide for the Assessment of Environmental Factors.

# 6.2 Equipment and Modelling Scenarios

**Table 6-3** summarises the operational noise sources linked to the activities likely to represent the most conservative scenarios in terms of noise emissions from the proposed operations.

Source	Qty	Sound Power Levels dB(A)
Front end loaders	2	108 <sup>1</sup>
Quarry Haul truck (on site)	1	98 <sup>2</sup>
Generator	1	98 <sup>2</sup>
Water pump	1	97 <sup>1</sup>
Water truck	1	105 <sup>2</sup>

#### Table 6-3Noise Sources

<sup>1</sup>Noise data source: URS measurements, 2013

<sup>2</sup> Noise data source: Noise Management Plan, Herring Storrer/URS, 2008

From the site visit, it was observed that quarry trucks would arrive to site and leave in a period of approximately 15 minutes. During a typical working day, the volume and flow of trucks arriving and leaving the site would be steady from 7am until approximately 3pm. Similarly with the two front end loaders, they would split the time between loading trucks near the quarry edge or resetting the quarry face for the next truck load-in and driving around the site.

The sound power levels for the front end loaders determined from site measurements were calculated from  $L_{Amax}$  measurements conducted in proximity of the front end loader during movement. The front end loaders generate more noise during movement than during loading. Moreover, the mobile plant use broadband noise alarms during reversing and there was no tonal component observed in the overall noise levels.

The calculation of L<sub>A10</sub> noise levels, based on site observations, included the following assumptions:

- One front end loader would be loading a truck near the quarry face;
- One front end loader would be driving around the site;



#### **6 Noise Modelling**

- One truck would be driving around the site continuously;
- The water truck would be running continuously;
- The water pump would be running continuously; and
- The generator would be running continuously and relocated near the weighting bridge.

The water truck was not in operation during the site visit; however, site personnel informed that the water truck may be used for up to two hours during a typical day. Thus, the model considered the water truck to be continuous for the calculation purposes.

The topography used for the most conservative scenario considered the final quarry face, assuming that the quarry would progress towards the north, with a front end loader loading trucks and working along the northern end of the quarry, while the second front end loader drives around the site carrying sand.

After considering all the above mentioned operational conditions, the scenarios modelled included those two sets of meteorological parameters from Table 6-4.

. These conditions would represent the worst case scenarios during the day: Scenario 1 and Scenario 2.

# 6.3 Modelling Predictions

The noise level predictions of this section represent the worst case scenario for the proposed daytime operations. The results of the two scenarios modelled, specified in the previous section, are summarised in **Table 6-4**.

Descriter	Scenario 1: Morning	Scenario 2: Afternoon
Receptor	dB(A)	dB(A)
R0	46	35
R1	44	35
R2	44	43
R3	41	42
R4	38	41
R5	31	38
R6	32	42
R7	29	40
R8	29	40
R9	22	35
R10	22	35
R11	20	34

#### Table 6-4Noise Sources

Noise contour plots for each modelling scenario showing the maximum predicted operational noise levels are included in **Appendix A**.



# **Assessment and Recommendations**

The noise predictions indicate compliance of the nominated  $L_{A10}$  noise criterion of 45 dB(A) at all sensitive receptors, except for R0 where predicted noise levels exceeded the noise criterion by 1 dB(A) on Scenario 1, during the "Morning" period. This marginal exceedance is not likely to generate any noise impacts at the sensitive receptors since pre-existing ambient and background noise levels are 4 dB(A) over the noise criterion, due to road traffic along Stakehill Road and to a lesser extent due to the Perth to Bunbury Freeway.

The shut-down of the existing screening plant will reduce the pre-identified characteristic of tonality for the site. From measurements obtained during the site visit, no evidence of tonality from the noise sources considered for this noise assessment was observed. Thus, the nominated noise criterion of 45 dB(A) would not be required to be corrected for tonality, as it was the case in the previous noise impact assessment where tonal emissions from the site was conservatively assumed.

At receptor points, attended measurements confirmed that noise from the site is not audible and the dominant noise source is road traffic on the local road network.

It is noted that Scenario 2 noise levels were in general higher for receptors located west of the site and Scenario 1 produced higher noise levels at the nearest receptors located immediately north of the site, on Stakehill Road.

The controls recommended to mitigate the noise generated on-site due to the proposed operations are the implementation of best practices and management measures to avoid excessive noise during vehicles movements, including the use of front end loaders and visiting trucks. Regular maintenance of the mobile and fixed plant is recommended to maintain engines and mechanical parts in good working order. Ongoing training and instruction of equipment use and maintenance are recommended to assist with noise reduction.



# Conclusion

URS was engaged to undertake a noise impact assessment of the expansion of the Baldivis Sand Quarry Stage 1 Project. Holcim proposes the reduction of the setback distance between the site boundary along Stakehill Road and the final line of extraction towards the north of the site reducing the distance between the identified noise sensitive receptors and the quarrying area. The original buffer zone of 250 m between Stakehill Road and the extraction limit line will be reduced by 100 m and the new proposed buffer zone will be 150 m.

The screening washing plant, which is the loudest existing noise source identified during a site visit, will not be operational during the proposed stage 1 expansion. This will reduce the noise profile of the site.

A site visit and noise measurements were undertaken during Wednesday 2 October 2013 between 9 am and 3pm. Noise measurements of operating plant and ambient and background measurements at noise sensitive receptors were conducted. The measurements around the sensitive receptors showed ambient readings higher than the previous assessment's noise limit of 40 dB(A); road traffic is the dominant source of local noise and not the quarry operations. Other than the screening/washing plant, which will no longer operate during the expansion project, there is no tonal noise sources which would attract a +5 dB(A) feature correction. Moreover, tonal noise emissions produced by the screening/washing plant were not proved from the site measurements, overall cumulative noise emissions from the site were not perceived as tonal during the site visit and noise from the quarry (or tonal components) was not audible at sensitive receptors.

Therefore, based on recent observations and noise measurements, the +5 dB(A) correction which is within the current noise management plan is not recommended for the further stages of the project. The project's noise criterion is therefore 45 dB(A).

Noise modelling was carried out and worst case scenarios defined by conservative meteorological parameters assumed. The predictions revealed compliance with the nominated noise criterion of 45 dB(A) at the sensitive receptors, except at receptor R0 where a marginal exceedance of 1 dB(A) was predicted during the morning worst case scenario meteorological conditions.

Best practice engineering noise control measures are already implemented and with the continued implementation of operational best work practices as well as management procedures, the project's 45 dB(A) criterion will be met. Further stages of the project will require detailed assessment and updated plant noise data.



URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Holcim.

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Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.



# Appendix A Noise Modelling Contours



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# Appendix D Flora and Vegetation Survey



# FLORA AND VEGETATION of

# **BALDIVIS EXPLOSIVES RESERVE**

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November 2006

#### STATEMENT OF LIMITATIONS

#### Scope of Services

This report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Eleanor Bennett ("the Author"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

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In preparing the report, the Author has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, the Author has not verified the accuracy of completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. The Author will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to the Author.

#### **Environmental Conclusions**

In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

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The report has been prepared for the benefit of the Client and no other party. The Author assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of the Author or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

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# INDEX

# SUMMARY

Bennett Environmental Consulting Pty Ltd undertook a botanical survey of the Baldivis Explosives Reserve on 15<sup>th</sup> September 2006. Most of the area consists of pine plantations, which are currently being harvested. It is intended to develop the site eventually for housing.

The site occurs in the Serpentine Vegetation Complex of which 9% of the original pre-European area is listed as remaining vegetated within the Perth Metropolitan area of the Swan Coastal Plain. This is below the 30% target level required to maintain the biodiversity of that vegetation complex.

The natural, remnant vegetation at the site occurs as small areas of remnant bushland mainly as small wetlands and higher ground along a bridle trail. Each of these areas is small in size, well below the 20ha recommended as the Urban Bushland Strategy's lowest preferred area limit.

Two priority flora were recorded during the survey. The Priority 2 Flora *Schoenus capillifolius* was recorded from the two wetlands with standing water, quadrats BD03 and BD07 and *Dillwynia dillwynioides* from another wetland BD01.

It is recommended that the areas of remnant vegetation at the site be retained with the proposed housing development as conservation/recreation areas. These areas should be enhanced with weed removal and perimeter planting, especially around the wetlands.

Although the Serpentine Vegetation Complex remaining is below the recommended level for conservation the vegetation at the site surveyed is not of sufficient size to be of significance. A commitment has been made to conserve all the wetland and bridle trail areas, which is most of the bushland at the site. It is also recommended that the area of *Eucalyptus gomphocephala* be conserved, as it is possibly the most eastern extent of that taxon within the Stakehill/Rockingham area.

# **1. INTRODUCTION**

#### 1.1 Background

Bennett Environmental Consulting Pty Ltd was contracted by Strategen to undertake a flora and vegetation survey of the Baldivis Explosives Reserve. Most of the area consists of pine plantation with small areas of remnant bushland. The Baldivis Explosives Reserve is not a Bush Forever Site but Bush Forever Site 376, Baldivis Road Bushland occurs to the north of the area.

#### **1.2** Scope of Works

The requirements for this project were to:

- i. Record the vegetation units and associated species.
- ii. Search for significant plant species.
- iii. Record the presence of any Threatened Ecological Community.

# 2. BACKGROUND INFORMATION

#### 2.1 Geology and Soils

Baldivis is on the Swan Coastal Plain, a low lying plain covered mainly by woodlands of *Banksia* speciesor Tuart (*Eucalyptus gomphocephala*) on the sandy soils, and Paperbarks (*Melaleuca* species) in swampy areas (Mitchell *et al*, 2002). The Coastal Plain is up to 30km wide, and composed of Quaternary continental sediments. Rainfall ranges from 600-1000mm annually and the climate is Mediterranean.

The eastern boundary is marked by scarps. The alluvial terrain along the eastern fringe of the plain comprises material of different ages. The older layers are characterized by duplex soils (Churchward and Macarthur, 1990). The survey site occurs in the Serpentine River System, which was formed on older alluvium but in conditions of ponding, which is reflected in the fine texture and poor internal drainage of the soils.

#### 2.2 Vegetation

An Australia-wide mapping exercise by Thackway and Cresswell (1995) resulted in the production of the Interim Biogeographic Regionalisation for Australia (IBRA). This system divides Australia into bioregions on the basis of their dominant landscape-scale attributes. IBRA was developed as a framework primarily to identify deficiencies in the Australian network of protected areas and to set priorities for further enhancing the reserve system. Baldivis occurs in the Swan Coastal Plain Bioregion 2 (abbreviated SCP2).

Beard (1981) mapped the original natural vegetation of the area he nominated as the Swan Area at a 1:1 000 000 scale. The proposed development occurs within the South-west Botanical Province in the Drummond Subdistrict and the Spearwood System. The principal component of the Spearwood System is *Eucalyptus* species Woodland with numerous lakes in chains parallel to the coast.

Heddle *et al.* (1980) described the vegetation complexes of the Darling System at a scale of 1: 250 000. There was found to be a distinct pattern of plant distribution linked to landforms, soils and climate. The most obvious trend was associated with increasing aridity from west to east on the Darling Plateau. The vegetation changes observed were a decrease in height and percentage cover of the tallest stratum and a distinct change in floristics. The vegetation complex identified for the site is the Serpentine River Complex of the Pinjarra Plain. The vegetation for this complex is described as Closed Scrub of *Melaleuca* species and Fringing Woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* along streams. The uplands support Woodlands of *Corymbia calophylla, Eucalyptus marginata* and *Banksia* species.

#### 2.3 Extent of Vegetation

It is estimated that 9% of the pre-European area of this vegetation unit remains as remnant vegetation on the Swan Coastal Plain portion of Metropolitan Perth (Western Australian Planning Commission, 2000). The aim is to retain 4% of the original area in conservation. Western Australian the objective of the EPA (2002) and Commonwealth of Australia (2001) is to retain 30% or more of each of the pre-clearing extent of each ecological community if the biodiversity is to be protected.

#### 2.4 Threatened Ecological Communities

The Threatened Ecological Communities listed by CALM as occurring on the Pinjarra Plain are:

- Floristic Community Type 1b Southern *Corymbia calophylla* Woodlands on heavy soils
- Floristic Community Type 3a *Corymbia calophylla Kingia australis* Woodlands on heavy soil
- Floristic Community Type 3b *Corymbia calophylla Eucalyptus marginata* Woodlands on sandy clay soil, and
- Floristic Community Type 3c *Corymbia calophylla Xanthorrhoea preissii* Woodlands and Shrublands.

Floristic Community Types (FCT) 3a and 3c are listed by the Department of Environment and Conservation as Critically Endangered and under the Environment Protection and Biodiversity Conservation Act 1999 (Environment Australia, 2006) as Endangered. FCT's 1b and 3c are listed by the Department of Environment and Conservation as Vulnerable, but are not listed under the Environment Protection and Biodiversity Conservation Act 1999.

#### 2.5 Significant Flora

No specific search was undertaken of the Department of Conservation and Environment Rare Flora Database as an extensive listing of Declared Rare, Priority and other Significant Flora are provided in Bush Forever (Western Australian Planning Commission, 2000).

Code	Code Declared Rare and Priority Flora Categories
R	DRF (Declared Rare Flora) - Extant Taxa. Taxa, which have been adequately
	searched for and are deemed to be in the wild either rare, in danger of extinction, or
	otherwise in need of special protection.
Х	DRF (Declared Rare Flora) -Presumed Extinct Taxa. Taxa which have not been
	collected, or otherwise verified, over the past 50 years despite thorough searching,
	or of which all known wild populations have been destroyed more recently.
1	Priority One -Poorly Known Taxa. Taxa, which are known from one or a few
	(generally <5) populations, which are under threat.
2	Priority Two -Poorly Known Taxa. Taxa which are known from one or a few
	(generally <5) populations, at least some of which are not believed to be under
	immediate threat.
3	Priority Three -Poorly Known Taxa. Taxa, which are known from several
	populations, at least some of which are not believed to be under immediate threat.
4	Priority Four -Rare Taxa. Taxa which are considered to have been adequately
	surveyed and which whilst being rare, are not currently threatened by any
	identifiable factors.

Table 1. Code and description of Rare and Priority Flora

Table 1 presents the definitions of Declared Rare and the four Priority Flora ratings under the Wildlife Conservation Act (1950) as extracted from Department of Conservation and Land Management (2006). Table 2 presents the definitions of the threatened species under the Environmental Protection and Biodiversity Conservation Act, 1999 (Environment Australia, 2006).

Code	Code Declared Rare and Priority Flora Categories			
Ex	Extinct			
	Taxa which at a particular time if, at that time, there is no reasonable doubt that the			
	last member of this species has died.			
ExW	Extinct in the Wild			
	Taxa which is known only to survive in cultivation, in captivity or as a naturalised			
	population well outside its past range; or it has not been recorded in its known			
	and/or expected habitat, at appropriate seasons, anywhere in its past range, despite			
	exhaustive surveys over a time frame appropriate to its life cycle and form.			
CE	Critically Endangered			
	Taxa which at any particular time if, at that time, it is facing an extremely high risk			
	of extinction in the wild in the immediate future, as determined in accordance with			
	the prescribed criteria.			
E	Endangered			
	Taxa, which is not critically endangered, and it is facing a very high risk of			
	extinction in the wild in the immediate or near future, as determined in accordance			
	with the prescribed criteria.			
V	Vulnerable			
	Taxa which is not critically endangered or endangered and is facing a high risk of			
	extinction in the wild in the medium-term future, as determined in accordance with			
	the prescribed criteria.			
CD	Conservation Dependent			
	Taxa which at a particular time if, at that time, the species is the focus of a specific			
	conservation program, the cessation of which would result in the species becoming			
	vulnerable, endangered or critically endangered within a period of 5 years.			

 
 Table 2. Categories of Threatened Flora Species (Environmental Protection and Biodiversity Conservation Act, 1999)

# Table 3. List of conservation flora recorded for the Pinjarra Plain (Western Australian Planning Commission, 2000)

CODE	TAXON	CODE	TAXON
R	Andersonia gracilis	2	Schoenus capillifolius
	Caladenia huegelii		Stylidium aceratum
	Calytrix breviseta subsp. breviseta		Trichocline sp. Treeton
	Centrolepis caespitosa	3	Angianthus micropodioides
	Diuris drummondii		Aotus cordifolia
	Diuris purdiei		Baeckea tenuifolia
	Drakaea elastica		Cyathochaeta teretifolia
	Eleocharis keigheryi		Dillwynia dillwynioides
	Grevillea curviloba subsp. curviloba		Haemodorum loratum
	Hydatella dioica		Myriocephalus appendiculatus
	Lepidosperma rostratum		Myriophyllum echinatum
	Tetraria australiensis		Rhodanthe pyrethrum
	Verticordia plumosa subsp. pleiobotrya		Schoenus benthamii
1	Acacia lasiocarpa var. bracteolata		Stylidium longitubum
	Eryngium subdecumbens		Stylidium mimeticum
	Grevillea evanescens	4	Anthotium junciforme
	Haloragis tenuifolia		Aponogeton hexatepalus
	Hydrocotyle striata		Drosera occidentalis subsp. occidentalis
	Schoenus pennisetis		Grevillea thelemanniana
	Tripterococcus paniculatus		Hydrocotyle lemnoides
2	Acacia benthamii		Thysanotus glaucus
	Amperea protensa		Verticordia lindleyi subsp. lindleyi
	Byblis lindleyana		Villarsia submersa
	Comesperma rhadinocarpum		
	Eryngium pinnatifidum subsp. palustre		
	Haloragis aculeolata		
	Phyllangium palustre		

Of the total number of significant flora recorded for the area, four (*Caladenia, Diuris* and *Drakaea* species) are orchids; twenty-one are annuals or ephemerals, five are sedges and the remainder are perennials or shrubs.

#### 3. METHODS

Field work was undertaken on  $15^{th}$  September 2006. Quadrats or relevees were recorded. The 10m x 10m quadrats were temporary and established in NESW orientation using a compass to ensure accuracy. This method meets the requirement that the survey will be undertaken in accordance with Appendix 2 of the Guidance Statement No. 51 (EPA 2004a). At the NW corner a photograph was taken and a handheld GPS was used to record the coordinates in WGS84. Relevees were recorded where the bushland was too narrow to place a quadrat. The co-ordinates were recorded and the species within a 5m radius recorded. All species within the 10m x 10m quadrat and 5m radius of the relevees, plus dominant opportunistic species outside of theses areas were recorded.

The vegetation, flora and weed surveys were conducted concurrently. For each quadrat, the following was recorded in the field:

- GPS reading (WGS84, equivalent to Geocentric Datum of Australia 1994 (GDA94)) at NW corner.
- Digital photograph taken at the NW corner.
- Soil type.
- Presence, size and type of any outcropping rocks.
- Topography eg. Ridge, upper slope, middle slope, lower slope, drainage line, minor creek, major creek, wetland.
- Aspect where this is applicable.
- Percentage litter cover divided into bark, leaves, twigs and logs.
- Vegetation condition using the scale (Keighery, 1994).
- Presence of any Declared Rare or Priority Flora or other significant flora.
- Additional information including dieback, age since fire, predators, erosion, weeds, grazing, tracks etc.
- All species were listed together with their percentage cover within the quadrat and average height.

Prior to commencing the field work the aerial photograph was viewed to identify the locations of remnant vegetation within the study area as most of the area was a pine plantation. All species unknown in the field were collected, pressed and identified later using appropriate keys and by comparison with collections housed at the Western Australian Herbarium. A collection of each Rare or Priority Flora was made and forms will be completed and sent to the Rare Flora section of the Department of Conservation and Land Management. The pressed and dried specimens will be sent to the Western Australian Herbarium for inclusion in their collection.

All tracks at the site were driven and transects were walked through all the remnant bushland.

#### 4. **RESULTS**

Most of the study area was planted with pines, which at the time of the survey were being logged. Scattered native taxa, including occasional *Eucalyptus marginata* and *Xylomelum occidentale* and annual taxa were scattered through these cultivated areas. The remnant bushland consisted of wetlands and strips of vegetation along a bridle trail, along some perimeter fences and scattered areas within the ordnance area.

#### 4.1 Vegetation Units

The vegetation units recorded during the survey were described using the vegetation layers as given in Table 4.

LIFE FORM / HEIGHT	CANOPY COVER			
CLASS	DENSE 70 % - 100%	MID DENSE 30% - 70%	SPARSE 10% - 30%	VERY SPARSE 2% - 10%
Trees $> 30 \text{ m}$	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30 m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15 m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees $< 5 \text{ m}$	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs $> 2 \text{ m}$	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs $1.5 - 2 \text{ m}$	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 - 1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1 m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 - 0.5 m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass $> 0.5$ m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5 m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous species	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges $> 0.5 \text{ m}$	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges $< 0.5 \text{ m}$	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

 Table 4. Vegetation Classification (from Muir 1977)

#### 4.1.1 Lower Ground

There were five distinct small wetlands at the site (See Appendix C, Map 1) all of which are included n the Keysbrook suite (Semeniuk, 1997). Two of the wetlands had water in them at the time of the survey (quadrats BD03 and BD07) the others were all dry.

Dense Low Forest A of *Melaleuca rhaphiophylla* over Tall Sedges of *Lepidosperma tetraquetrum* fringing the standing water with Open Herbs dominated by *Triglochin linearis* in the water. The soil was a sandy clay.

This was the vegetation unit at quadrats BD03 and BD07. At quadrat BD07, many of the *Melaleuca rhaphiophylla* trees were covered in *Cassytha racemosa*.

A degraded form of this unit was:

Low Woodland A of *Eucalyptus rudis* subsp. *rudis*, *Melaleuca rhaphiophylla* and *Banksia littoralis* over Thicket of *Kunzea glabrescens* over Low Sedges dominated by *Lepidosperma drummondii* in sandy clay.

This was the dominant vegetation at BD01, the dry sites, although at two (BD01b and BD01c) the dense cover of *Lepidosperma drummondii* was missing.

Two other small remnants of lower vegetation included:

Open Low Woodland A over Open Scrub of *Kunzea glabrescens* over Low Heath C of *Hypocalymma angustifolium* over Very Open Low Sedges dominated by *Dasypogon* bromeliifolius in grey sand.

This vegetation occurs as a narrow strip along the firebreak on the eastern side but continued into the adjoining property (BD02).

Low Woodland A of *Eucalyptus rudis* subsp. *rudis* and *Melaleuca preissiana* over Thicket of *Kunzea glabrescens* and *Jacksonia furcellata* over Open Low Sedges dominated by *Hypolaena exsulca* in grey sand.

This was a very small remnant and occurred on the eastern end of the bridle trail. (BD04)

#### 4.1.2 Higher Ground

Low Woodland A of Banksia attenuata, Banksia menziesii and Allocasuarina fraseriana, occasionally with Banksia ilicifolia over Low Heath C and Low Heath D of mixed taxa or Low Sedges in grey sand.

This was the vegetation associated with the bridle trails and the remnant vegetation on the western boundary (BD05, BD06, BD09).

Woodland of *Eucalyptus gomphocephala* over Low Woodland A of *Banksia grandis, Banksia attenuata, Banksia menziesii* and *Allocasuarina fraseriana* over Tall Grass of weed taxa in grey sand.

This vegetation unit occurred as a small area on a slight rise at the site (BD08).

#### 4.2 Floristic Community Type

The vegetation of the higher ground is inferred to be either Floristic Community Type (FCT) 21a or FCT 28 (Gibson *et al.*, 1994), neither of which are listed as Threatened Ecological Communities (Department of Environment and Conservation, 2006). The vegetation of the lower ground is inferred to be FCT 14, which also is not listed as a Threatened Ecological Community by DEC.

#### 4.3 PATN Analysis

The data obtained during the survey was run through the statistical package PATN (Blatant, 2002). Two sets of data were run for each quadrat. The data recorded for the quadrat and then again but including all the opportunistic taxa. The results of the analyses are provided in Appendix D. There is some ambiguity in the results as to whether the quadrats inferred to be FCT21a (BD5, BD6, BD8 and BD9) are in fact representative of that Floristic Community Type. The dampland units are not FCT14 as inferred but vary considerably between FCT5, FCT6, FCT11, FCT12, FCT15, FCT17 and FCT21c. The remnant vegetation at the site is very scattered and each is very small in area which is possibly attributing to the difficulty in assigning a definite FCT to each quadrat.

Although the results are not definite none of the Floristic Community Types that they could be are listed as Threatened Ecological Communities.

#### 4.4 Vegetation Condition

The vegetation condition recorded for each of the quadrats is included in Appendix B and mapped in Appendix E.

Rating	Description	Explanation
1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds
		are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to
		vegetation structure covers repeated fire, aggressive weeds, dieback, logging,
		grazing.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple
		disturbance. Retains basic vegetation structure or ability to regenerate it.
		Disturbance to vegetation structure covers frequent fires, aggressive weeds at
		high density, partial clearing, dieback and grazing.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for
		regeneration but not to a state approaching good condition without intensive
		management. Disturbance to vegetation structure includes frequent fires,
		presence of very aggressive weeds, partial clearing, dieback and grazing.

Table 5 Explanation of Vegetation Condition Rating (Keighery, 1994)

Table 6 provides a summary of the vegetation condition recorded using the rating provided in Table 5. Some degraded areas had a good tree canopy but the understorey was completely or nearly completely replaced by weeds.

Rating	Description	Quadrat Reference
2-3	Very good to excellent	BD03
3	Very good	BD01, BD04, BD05
3-4	Good to very good	BD02, BD07
4	Good	BD01b, BD06
4-5	Good to degraded	BD01c, BD08
6	Completely degraded	Pine plantation and logged area

Table 6. Vegetation Condition recorded during the survey

#### 4.5 Wetland Classification

None of the wetlands are listed as EPP wetlands (Environmental Protection Authority, 2004b). In the same publication a wetland meets the environmental quality criteria if

- The wetland is recognised internationally, nationally or regionally as provided in regulation 5 of the regulations;
- The wetland has one of the significant natural attributes referred to in regulation 6 of the regulations; or
- The wetland has at least 2 of the environmental values listed in regulation 7 of the regulations.

If the wetland is listed in The Darling System – System 6 (Environmental Protection Authority, 1993) it is considered to be regionally significant (Regulation 5). *None of the wetlands at the site are listed in this publication.* 

If the wetland has one or more of the listed significant natural attributes (Regulation 6) it is considered a significant wetland. These attributes are summarized below:

- a) supports flora being declared to be protected flora for the purposes of the Wildlife Conservation Act 1950 – not applicable as no Declared Rare Flora recorded but two priority flora were recorded. Schoenus capillifolius from BD03 and BD07 and Dillwynia dillwynioides from BD01;
- b) supports fauna specified in a notice in operation under section 14(2)(ba) of the Wildlife Conservation Act 1950 as fauna likely to become extinct, or is rare, or otherwise in need of special protection – not applicable;
- c) supports vegetation in good, very good, excellent of pristine condition B.J. Keighery (1994) Wetlands BD03 and BD07 are the only ones at the site which have vegetation in good or better;
- d) supports an ecological community listed as 'threatened' in Category 1, 2, 3, or 4, as described by V.J. English and J. Blyth (1997) *not applicable*;
- e) is a wetland that is part of a natural wetland group of which fewer than 30% of wetlands of that type in that group are represented in the conservation estate on the Swan Coastal Plain, according to the wetland type and geomorphic classification system in Hill, A.L., Semeniuk, C.A., Semeniuk V and Del Marco, A. (1996) not applicable;

f) it is a significant habitat or refuge for native or migratory fauna – not applicable.

None of the listed criteria in Regulation 7 are applicable to the site.

Three wetlands surveyed as BD01, BD03 and BD07 have significant natural attributes and should be retained in conservation. Weed control could improve the vegetation condition of these wetlands. It is recommended that a buffer be retained where there is natural vegetation surrounding the wetland or rehabilitated where the natural vegetation has been removed. Wetland BD03 still has some surrounding natural vegetation but BD07 is surrounded by weeds (See Appendix B).

#### 4.6 Flora

A total of 174 taxa, 127 genera and 56 vascular plant families were recorded during the survey. The dominant families were:

Papilionaceae with 12 genera and 15 taxa of which 3 were weeds; Cyperaceae with 7 genera and 13 taxa all of which are endemic; Asteraceae with 10 genera and 11 taxa of which 8 are weeds; Myrtaceae with 6 genera and 12 taxa all of which are endemic; Anthericaceae with 6 genera and 9 taxa all of which are endemic; and Proteaceae with 5 genera and 9 taxa all of which are endemic.

These 6 families represent 10.9% of the total number of vascular plant families, 36.2% of the total number of genera and 39.7% of the total number of taxa recorded during the survey.

#### 4.7 Significant Flora

Two Priority Flora were recorded during the survey from wetlands. They are the Priority 3 Flora *Dillwynia dillwynioides* from quadrat BD01 (but not BD01b or BD01c) and Priority 2 Flora *Schoenus capillifolius* recorded from quadrats BD03 and BD07. The collections of *Schoenus capillifolius* were not in flower or bud but it is inferred to be that taxon but there is a possibility that it could be the Priority 4 Flora *Schoenus natans*.

#### 4.8 Introduced Species

A total of 38 weeds were recorded from the remnant bushland. All except for one, have been identified as weeds by the Department of Environment and Conservation (Western Australian Herbarium 2006). *\*Cotula coronopifolia* as yet has not been determined as a weed by the Department of Conservation and Land Management (1999). The rating allocated to each weed by CALM is based on three criteria:

**Invasiveness** – ability to invade natural bushland in good to excellent condition or ability to invade waterways.

**Distribution** – wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world.

**Environmental impacts** – Ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community.

Ratings indicate the following.

**High** indicates this weed is prioritised for control and/or research ie prioritizing funding to it.

**Moderate** indicates control or research effort should be directed to it if funds are available, however it should be monitored (possibly a reasonably high level of monitoring).

**Mild** indicates monitoring of the weed and control where appropriate. **Low** indicates that this species would require a low level of monitoring.

SCIENTIFIC NAME	COMMON NAME	CALM RATING	INVASIVENESS	IMPACTS
*Ehrharta calycina	Perennial veldt grass	High	√	√
*Euphorbia terracina	Geraldton carnation weed	High	✓	~
*Lagurus ovatus	Hares tail grass	High	√	√
*Lupinus cosentinii	Sandplain lupin	High	√	√
*Moraea flaccida	One leaf Cape tulip	High	√	$\checkmark$
*Romulea rosea	Guildford grass	High	√	$\checkmark$
*Typha orientalis	Bullrush	High	✓	√
*Watsonia meriana cv bulbillifera	Bulbil watsonia	High	✓	√
*Zantedeschia aethiopica	Arum lily	High	√	√
*Aira caryophyllea	Silvery hair grass	Moderate	√	

 Table 7. Weeds recorded during the survey classified according to CALM (1999)

SCIENTIFIC NAME	COMMON NAME	CALM RATING	INVASIVENESS	IMPACTS
*Anagallis arvensis	Pimpernel	Moderate	1	
*Arctotheca calendula	Cape weed	Moderate	√	
*Briza maxima	Blowfly grass	Moderate	√	
*Callitriche stagnalis	Common starwort	Moderate	√	
*Carpobrotus edulis	Hottentot fig	Moderate	✓	
*Ehrharta longiflora	Annual veldt grass	Moderate	✓	
*Heliophila pusilla		Moderate	✓	
*Hypochaeris glabra	Flat weed	Moderate	✓	
*Lolium rigidum	Annual rye grass	Moderate	✓	
*Olea europaea	Olive	Moderate	✓	
*Orobanche minor	Lesser broomrape	Moderate	✓	
*Pinus pinaster	Pinaster pine	Moderate	✓	
*Solanum nigrum	Nightshade	Moderate	✓	
*Sonchus asper	Prickly sowthistle	Moderate	✓	
*Sonchus oleraceus	Common sowthistle	Moderate	√	
*Ursinia anthemoides	Ursinia	Moderate	√	
*Vulpia bromoides	Squirrels tail fescue	Moderate	√	
*Vulpia myuros		Moderate	✓	
*Osteospermum clandestinum	Stinking roger	Mild		
*Phytolacca octandra	Ink weed	Mild		
*Trachvandra divaricata	Onion weed	Mild		
*Acacia iteaphylla	Flinders Range wattle	Low		
*Acetosella vulgaris	Sorrel	Low		
*Conyza bonariensis	Flaxleaf fleabane	Low		
*Erodium botrys	Corkscrews	Low		
*Lotus suaveolens	Lotus	Low		
*Lupinus luteus	Yellow lupin	Low		
*Mentha x piperita	Eau de Cologne mint	Low		
*Cotula coronopifolia	Water buttons	Not listed		

All weeds with the CALM rating of High should be targeted for removal. Grass weeds can be readily removed with a grass specific herbicide. The other weeds rated as high require specific techniques for their removal. There were not many plants of Arum lily or Geraldton Carnation weed recorded so these could be removed successfully by hand pulling. Brown and Brooks (2002) provide the information on weed removal for the above taxa. Where weeds occur in or adjacent to standing water care will need to be taken in the selection of the herbicide due to the impact that could occur on animals living in that environment.

## 5. ECOLOGICAL IMPORTANCE OF THE SITE

The environmental potential of the site can be assessed using the Environmental Protection Authority (EPA) Guidance Statement 10 (Environmental Protection Authority, 2003).

- The site is in the vegetation complex, Serpentine River of which 9% remains as bushland in the Perth Metropolitan Area. This is below the 10% requirement for bushland retention in Metropolitan Perth but above the 4% it is intended to retain of Serpentine River complex (Western Australian Planning Commission, 2000).
- The remnant vegetation of the higher ground is inferred to be Floristic Community Type 21a or 28, neither of which are listed as Threatened Ecological Communities.
- The remnant vegetation of the lower ground is inferred to be Floristic Community Type 14, which is not listed as a Threatened Ecological Community.

- The site is proposed for housing subdivision but it is intended to retain the bridle trail and all wetlands in conservation.
- There were no Declared Rare or Priority Flora recorded from the site.
- A total of 55 vascular plant families, 124 genera and 164 taxa were recorded from the site.
- The vegetation condition varied considerably from excellent to degraded.
- The tree canopy typically was still intact with only a few dead Banksia trees recorded. These deaths did not appear to be associated with dieback but rather from excessive burns or the prolonged hot summers and dry winters that Perth has recently experienced.
- The remnant vegetation at the site covers an area less than 20ha, Urban Bushland Strategy's lowest preferred area limit (EPA, 2004b).
- The site consists of several small linear areas of remnant bushland each with 2 very long sides and 2 short sides. Elongate remnants are stated by the EPA (2003b) to have value as connecting links, but the more extended the remnants are, the greater their susceptibility to weed invasion and disturbance.
- There is potential linkage with adjoining vegetation, especially via the bridle trails with Bush Forever Site 376. Bush Forever Site 376 links with bushland to the west and is included in Greenway 67 and 84 (Tingay, Alan & Associates, 1998).

## 6. **DISCUSSION**

Very little natural remnant vegetation remains at the Baldivis Explosives Reserve. Most of the Reserve is a pine plantation, which is currently being logged. A few native plants remain scattered through the standing pine plantation and in the parts, which have already been logged.

The area included some wetlands, which were in good or better condition, and these should be retained. The area surrounding each wetland should be rehabilitated to ensure their ongoing conservation, where they occur in reasonably close proximity the area between should be rehabilitated to establish a corridor and to reduce the encroachment of weeds. The site also includes bridle trail with patches of remnant bushland, but this vegetation is higher on the landscape. Weeds in these areas should be controlled to increase the conservation value of the bushland and to prevent re-infestation by weeds.

A total of 174 taxa were recorded from the site of which 38 were weeds. Two Priority Flora were recorded during the survey. Plants of *Schoenus capillifolius* were recorded from BD03 and BD07, the two wetlands with standing water, and plants of *Dillwynia dillwynioides* from wetland BD01. Using the wetland classification (Environmental Protection Authority, 2004) these three wetlands are considered as having significant natural attributes.

Six vegetation units were described for the site. Four vegetation units were in the lower ground, two of which were narrow strips along a firebreak or beside the higher vegetation. The other two were remnant wetlands at the site. The two higher ground vegetation units included a *Banksia* dominated and *Eucalyptus gomphocephala* dominated canopy. The *Eucalyptus gomphocephala* vegetation unit is close to the eastern extent of that taxon (Department of Conservation and Land Management, 2003) within the Stakehill/Rockingham area.

## 7. ACKNOWLEDGEMENTS

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# **APPENDIX A**

# Species listed in Taxonomic Order under Vascular Plant Families

ABBREVIATION	EXPLANATION
subsp.	Subspecies
CV.	Cultivar
*	weeds
sp.	species, used where only a sterile collection was made

#### VASCULAR PLANT FAMILY Taxon

Zamiaceae	
	Macrozamia riedlei
Pinaceae	
	*Pinus pinaster
Typhaceae	
	*Typha orientalis
Juncaginaceae	
_	Triglochin linearis
Poaceae	
	*Aira caryophyllea
	*Briza maxima
	*Ehrharta calycina
	*Ehrharta longiflora
	*Lagurus ovatus
	*Lolium rigidum
	*Vulpia bromoides
~	*Vulpia myuros
Cyperaceae	
	Baumea articulata
	Baumea juncea
	Bolboschoenus caldwellii
	Isolepis congrua
	Lepidosperma drummondii
	Lepidosperma squamatum
	Mesomelaena pseudostygia
	Schoenus brevisetis
	Schoenus capilliformis
	Schoenus clandestinus
	Schoenus rigens
	Schoenus subfasciculatus
	Tetraria octandra
Araceae	* <b>7</b> 1 1 1 1 1
T	*Zantedeschia aethiopica
Lemnaceae	T 1.
D	Lemna disperma
Restionaceae	
	Desmocladus flexuosus
	Hypolaena exsulca
	Lepyroaia glauca
	Lyginia barbata
Juncacaaa	Lyginia imberbis
Juncaceae	hunaus nallidus
Dasynogonacoa	Juncus patitaus
Dasypogonacea	Canthocarnus proissii
	Dasynogon bromelijfeling
	Lomandra caespitosa
	Lomandra harmanhradita
	Ботипити петтиртойши

Lomandra preissii
Dasypogonacea	e (cont.)
	Lomandra sericea
	Lomandra suaveolens
Xanthorrhoeace	eae
	Xanthorrhoea brunonis
	Xanthorrhoea preissii
Phormiaceae	
	Dianella revoluta
Anthericaceae	
	Caesia micrantha
	Chamaescilla corymbosa
	Corynotheca micrantha
	Dichopogon preissii
	Sowerbaea laxiflora
	Thysanotus arenarius
	Thysanotus patersonii
	Thysanotus sparteus
	Thysanotus thyrsoideus
Asphodelaceae	
	*Trachyandra divaricata
Colchicaceae	
	Burchardia congesta
Haemodoraceae	9
	Anigozanthos humilis
	Conostylis aculeata
	Haemodorum spicatum
	Phlebocarya ciliata
Iridaceae	
	*Moraea flaccida
	Patersonia occidentalis
	*Romulea rosea
	*Watsonia meriana cv. bulbillifera
Orchidaceae	
	Caladenia flava
	Caladenia latifolia
	Eriochilus dilatatus
	Lyperanthus serratus
	Pterostylis nana
	Pterostylis recurva
	Pyrorchis nigricans
Casuarinaceae	
	Allocasuarina fraseriana
Proteaceae	
	Adenanthos cygnorum
	Banksia attenuata
	Banksia grandis
	Banksia ilicifolia
	Banksia littoralis

Proteaceae (con	t.)
× ×	, Banksia menziesii
	Petrophile linearis
	Stirlingia latifolia
	Xylomelum occidentale
Loranthaceae	
	Nuytsia floribunda
Polygonaceae	
	*Acetosella vulgaris
Chenopodiaceae	e
	Chenopodium sp.
Amaranthaceae	
	Alternanthera nodiflora
	Ptilotus polystachyus
Phytolaccaceae	
	*Phytolacca octandra
Aizoaceae	
	*Carpobrotus edulis
Molluginaceae	
	Macarthuria australis
Portulacaceae	
	Calandrinia granulifera
	Portulaca oleracea
Lauraceae	
	Cassytha racemosa
Brassicaceae	
	*Heliophila pusilla
Droseraceae	
	Drosera erythrorhiza
	Drosera macrantha
	Drosera stolonifera
Crassulaceae	
	Crassula colorata
Mimosaceae	
	Acacia cochlearis
	*Acacia iteaphylla
	Acacia pulchella
	Acacia saligna
	Acacia stenoptera
Papilionaceae	
	Bossiaea eriocarpa
	Daviesia divaricata
	Daviesia triflora
	Dillwynia dillwynioides
	Gompholobium tomentosum
	Hardenbergia comptoniana
	Hovea trisperma

# Papilionaceae (cont.)

	Isotropis cuneifolia
	Jacksonia furcellata
	Jacksonia sternbergiana
	Kennedia prostrata
	*Lotus suaveolens
	*Lupinus cosentinii
	*Lupinus luteus
	Pultenaea ochreata
Geraniaceae	
	*Erodium botrys
	Geranium retrorsum
Rutaceae	
	Philotheca spicata
Euphorbiaceae	
	*Euphorbia terracina
Callitrichaceae	-
	*Callitriche stagnalis
Dilleniaceae	
	Hibbertia hypericoides
	Hibbertia racemosa
	Hibbertia stellaris
	Hibbertia subvaginata
Violaceae	
	Hybanthus calycinus
Thymelaeaceae	
	Pimelea rosea
Myrtaceae	
	Astartea scoparia
	Calytrix flavescens
	Eucalyptus gomphocephala
	Eucalyptus marginata subsp. marginata
	Eucalyptus rudis subsp. rudis
	Hypocalymma angustifolium
	Kunzea glabrescens
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca teretifolia
	Melaleuca thymoides
	Melaleuca viminea
Haloragaceae	
	Glischrocaryon aureum

# Apiaceae

	Centella asiatica
	Eryngium pinnatifidum
	Trachymene coerulea
	Trachymene pilosa
	Xanthosia huegelii
Epacridaceae	
	Brachyloma preissii
	Conostephium pendulum
	Leucopogon propinquus
	Styphelia tenuiflora
Primulaceae	
	*Anagallis arvensis
Oleaceae	
	*Olea europaea
Menyanthaceae	
	Villarsia albiflora
Lamiaceae	
	Hemiandra pungens
	*Mentha x piperita
Solanaceae	
	*Solanum nigrum
Orobanchaceae	
D	*Orobanche minor
Rudiaceae	
	Opercularia apiciflora
Cooderiesee	Opercularia vaginata
Goodemaceae	
	Dampiera linaleyana
	Dampiera linearis
	Lechendullia biloba
Stylidiaceae	Scuevola canescens
Styndiactae	Stylidium brunonianum
	Stylidium piliforum
Asteraceae	Stytutium putjerum
1 ister accue	*Arctotheca calendula
	*Convza honariensis
	*Cotula coronopifolia
	*Hvnochaeris glahra
	Lagenonhora huegelii
	*Osteospermum clandestinum
	Podolepis gracilis
	Ouinetia urvillei
	*Sonchus asper
	*Sonchus oleraceus
	*Ursinia anthemoides

# APPENDIX B Quadrat Data

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### QUADRAT BD01

Datum: 389441E; 6415370N Soil: Black peaty sandy clay Litter: Leaves 5%; Branches 20%; Logs 2% Topography: Swamp

**Vegetation Description:** Low Woodland A of *Eucalyptus rudis* subsp. *rudis*, *Melaleuca rhaphiophylla* and *Banksia littoralis* over Tall Sedges of *Lepidosperma longitudinale* **Vegetation Condition:** 3

**Other Notes:** Area very dry. Lot of open ground without any vegetation. Some surrounding *Eucalyptus rudis* subsp. *rudis* exceed 10m, in height. Only a small section of the whole wetland was in vegetation condition 3, most was condition 4.



### **Relevee BD01b**

Open Low Woodland A of *Melaleuca rhaphiophylla* and *Banksia littoralis* over Very Open Low Grass or Very Open Herbs of weeds. There were a few scattered *Lepidosperma longitudinale*. **Vegetation Condition**: 4

### **Relevee BD01c**

Low Forest A of *Melaleuca rhaphiophylla* over Scrub of *Kunzea glabrescens* over Very Open Low Sedges and Very Open Low grass and Very Open Herbs **Vegetation Condition:** 4-5





Relevee BD01b

Relevee BD01c

TAXON	HEIGHT (cm)	% COVER
*Aira caryophyllea	5	10
Astartea scoparia	175	5
Banksia littoralis	800	10
Dillwynia dillwynioides	150	10
Dampiera lindleyana	50	5
*Briza maxima	10	30
Dianella revoluta	60	2
*Ehrharta calycina	30	<1
Eucalyptus rudis subsp. rudis	600	3
Hibbertia stellaris	50	2
*Hypochaeris glabra	5	5
Juncus pallidus	110	1
Kunzea glabrescens	800	10
Lepidosperma longitudinale	50	50
Lepyrodia glauca	95	2
*Lotus suaveolens	10	<1
Melaleuca rhaphiophylla	800	10
Melaleuca teretifolia	220	3
Quinetia urvillei	5	<1
Trachymene coerulea	5	<1
Villarsia albiflora	70	3
*Vulpia myuros	10	20
Baumea juncea	opportunistic	
Chamaescilla corymbosa	opportunistic	
*Conyza bonariensis	opportunistic	
Dasypogon bromeliifolius	opportunistic	
Desmocladus flexuosus	opportunistic	
*Ehrharta longiflora	opportunistic	
*Heliophila pusilla	opportunistic	
Hypolaena exsulca	opportunistic	
Jacksonia sternbergiana	opportunistic	
Opercularia apiciflora	opportunistic	
Patersonia occidentalis	opportunistic	
*Pinus pinaster	opportunistic	
Pterostylis nana	opportunistic	

Pultenaea ochreata	opportunistic	
Schoenus rigens	opportunistic	
*Sonchus oleraceus	opportunistic	
Stylidium brunonianum	opportunistic	
Trachymene pilosa	opportunistic	
*Ursinia anthemoides	opportunistic	
*Zantedeschia aethiopica	opportunistic	

# **Relevee BD02**

Datum: 389771E; 6415212N Soil: Grey sand

Litter: Leaves 5%; Branches 5%

Topography: Flat

Vegetation Description: Open Low Woodland A over Open Scrub of Kunzea glabrescens over Low Heath C of Hypocalymma angustifolium over Very Open Low Sedges dominated by Dasypogon bromeliifolius in grey sand **Vegetation Condition: 3-4** 

Other Notes: Narrow strip of remnant bushland along firebreak



TAXON	HEIGHT (cm)	% COVER
Dasypogon bromeliifolius	10	10
Drosera stolonifera	15	<1
*Ehrharta longiflora	50	15
Hypocalymma angustifolium	100	60
*Hypochaeris glabra	5	10
Kunzea glabrescens	400	5
Patersonia occidentalis	40	1
*Ursinia anthemoides	30	< 1
*Aira caryophyllea	opportunistic	
*Arctotheca calendula	opportunistic	
Astartea scoparia	opportunistic	
*Briza maxima	opportunistic	
Crassula colorata	opportunistic	

Dichopogon preissii	opportunistic	
*Ehrharta calycina	opportunistic	
Eucalyptus rudis subsp. rudis	opportunistic	
Jacksonia sternbergiana	opportunistic	
Lomandra caespitosa	opportunistic	
Lyginia imberbis	opportunistic	
Nuytsia floribunda	opportunistic	
*Pinus pinaster	opportunistic	
Pultenaea ochreata	opportunistic	
Thysanotus patersonii	opportunistic	

Datum: 389374E; 6414895N Soil: Black peat, sandy clay

Litter: Leaves 5%; Branches 15%; Logs 5%

Topography: Swamp

**Vegetation Description:** Dense Low Forest of *Melaleuca rhaphiophylla* over Tall Sedges of *Lepidosperma tetraquetrum* fringing the standing water with Open Herbs dominated by *Triglochin linearis* in the water

Vegetation Condition: 2-3

**Other Notes:** Standing water in the centre of the wetland had trees of *Melaleuca rhaphiophylla* and sedges. The wetland was fringed by *Melaleuca rhaphiophylla* and beyond that was a fringe of *Eucalyptus rudis* subsp. *rudis*. There were a few *\*Typha orientalis* surrounded by a weedy area. Weed control would improve this wetland considerably



TAXON	HEIGHT (cm)	% COVER
Baumea articulata	175	40
Chenopodium sp.	5	3
*Briza maxima	30	2
*Callitriche stagnalis	3	2
*Cotula coronopifolia	30	2
Lemna disperma	1	2
*Lotus suaveolens	5	<1
Melaleuca rhaphiophylla	800	70
Portulaca oleracea	5	<1
Schoenus capillifolius	5	40
*Sonchus oleraceus	15	<1
Triglochin linearis	30	10
Villarsia albiflora	20	<1
*Acetosella vulgaris	opportunistic	

Bolboschoenus caldwellii	opportunistic	
Caladenia latifolia	opportunistic	
Centella asiatica	opportunistic	
*Conyza bonariensis	opportunistic	
*Ehrharta calycina	opportunistic	
*Ehrharta longiflora	opportunistic	
Eucalyptus rudis subsp. rudis	opportunistic	
Geranium retrorsum	opportunistic	
*Hypochaeris glabra	opportunistic	
Isolepis congrua	opportunistic	
Juncus pallidus	opportunistic	
Lepidosperma longitudinale	opportunistic	
*Moraea flaccida	opportunistic	
*Orobanche minor	opportunistic	
*Phytolacca octandra	opportunistic	
Pterostylis nana	opportunistic	
Schoenus subfascicularis	opportunistic	
*Solanum nigrum	opportunistic	
*Sonchus asper	opportunistic	
Thysanotus manglesii	opportunistic	
*Typha orientalis	opportunistic	
*Ursinia anthemoides	opportunistic	
*Vulpia bromoides	opportunistic	

### **Relevee BD04**

**Datum:** 389106E; 6413942N **Soil:** Grey sand

Litter: leaves 20%; branches 30% Topography: Lower slope

**Vegetation Description:** Low Woodland A of *Eucalyptus rudis* subsp. *rudis* and *Melaleuca preissiana* over Thicket of *Kunzea glabrescens* and *Jacksonia furcellata* over Open Low Sedges dominated by *Hypolaena exsulca* 

Vegetation Condition: 3

**Other Notes:** Narrow strip. Extends about 20m from the eastern edge of the bridle trail vegetated boundary



TAXON	HEIGHT (cm)	% COVER
Acacia pulchella	70	1
Astartea scoparia	100	1
*Briza maxima	30	5
Caladenia flava	30	<1
*Ehrharta calycina	70	3
Eucalyptus rudis subsp. rudis	800	15
Hibbertia subvaginata	35	1
*Hypochaeris glabra	5	10
Hypolaena exsulca	40	30
Jacksonia furcellata	250	3
Kunzea glabrescens	750	40
*Lagurus ovatus	30	1
Lyginia barbata	70	3
Melaleuca preissiana	400	10
Patersonia occidentalis	50	1

G 1 .	70	1
Schoenus rigens	/0	1
*Ursinia anthemoides	15	5
Adenanthos cygnorum	opportunistic	
*Arctotheca calendula	opportunistic	
Banksia grandis	opportunistic	
Banksia ilicifolia	opportunistic	
Brachyloma preissii	opportunistic	
*Carpobrotus edulis	opportunistic	
Crassula colorata	opportunistic	
Drosera stolonifera	opportunistic	
*Euphorbia terracina	opportunistic	
Gompholobium tomentosum	opportunistic	
Kennedia prostrata	opportunistic	
Phlebocarya ciliata	opportunistic	
Stylidium brunonianum	opportunistic	
Trachymene pilosa	opportunistic	
*Zantedeschia aethiopica	opportunistic	

Datum: 389116E; 6414412N Soil: Grey sand Litter: Leaves 40%; Branches 3% Topography: Middle slope Vegetation Description: Low Forest A of *Banksia attenuata, Banksia menziesii* and *Allocasuarina* fraseriana over Dwarf Scrub D of Calytrix flavescens over Open Low Sedges of Desmocladus flexuosus Vegetation Condition: 3 Other Notes: Narrow strip – bridle trail



## **Relevee BD05b**

As above but the area had been burnt within the last 12 months



Area included several *Kunzea* glabrescens shrubs in excess of 2m tall

TAXON	HEIGHT (cm) % COVER			
Acacia pulchella	50	1		
Allocasuarina fraseriana	800	5		
Banksia attenuata	750	5		
Banksia ilicifolia	700	10		
Banksia menziesii	700	25		
Brachyloma preissii	70	5		
*Briza maxima	30	2		
Burchardia congesta	50	<1		
Caladenia flava	30	<1		
Calytrix flavescens	30	30		
Conostylis aculeata	30	1		
Dasypogon bromeliifolius	60	10		
Desmocladus flexuosus	30	30		
Drosera erythrorhiza	1	<1		
Drosera stolonifera	15	1		
*Ehrharta calycina	70	2		
Eriochilus dilatatus	5	<1		
Hemiandra pungens	5	3		
Hibbertia hypericoides	50	<1		
Hovea trisperma	40	<1		
*Hypochaeris glabra	5	3		
Hypolaena exsulca	50	5		
Lagenophora huegelii	20	<1		
Lomandra hermaphrodita	20	<1		
Lomandra suaveolens	50	1		
Lyginia barbata	70	1		
Lyperanthus serratus	5	1		
Macarthuria australis	50	3		
Petrophile linearis	35	1		
Philotheca spicata	50	2		
Pyrorchis nigricans	1	<1		
Sowerbaea laxiflora	70	1		
Stylidium brunonianum	15	<1		
Thysanotus patersonii	Twiner	<1		
Thysanotus thyrsoideus	30	1		
Trachymene pilosa	5	<1		
*Anagallis arvensis	opportunistic			
Calandrinia granulifera	opportunistic			
Chamaescilla corymbosa	opportunistic			
Corynotheca micrantha	opportunistic			
Dampiera linearis	opportunistic			
Daviesia divaricata	opportunistic			
Dianella revoluta	opportunistic			
Eucalyptus marginata subsp. marginata	opportunistic			
*Euphorbia terracina	opportunistic			
Gompholobium tomentosum	opportunistic			
*Heliophila pusilla	opportunistic			

Hibbertia racemosa	opportunistic	
Hybanthus calycinus	opportunistic	
Isotropis cuneifolia	opportunistic	
Kennedia prostrata	opportunistic	
Kunzea glabrescens	opportunistic	
Lechenaultia biloba	opportunistic	
Lepidosperma squamatum	opportunistic	
Macrozamia riedlei	opportunistic	
Melaleuca thymoides	opportunistic	
Mesomelaena pseudostygia	opportunistic	
Opercularia vaginata	opportunistic	
Pimelea rosea	opportunistic	
*Pinus pinaster	opportunistic	
Podolepis gracilis	opportunistic	
Ptilotus polystachyus	opportunistic	
Schoenus clandestinus	opportunistic	
Stirlingia latifolia	opportunistic	
Styphelia tenuiflora	opportunistic	
*Trachyandra divaricata	opportunistic	
Xanthorrhoea brunonis	opportunistic	
Xanthorrhoea preissii	opportunistic	
Xanthosia huegelii	opportunistic	
Xylomelum occidentale	opportunistic	
*Zantedeschia aethiopica	opportunistic	

Datum: 387288E; 6413989N

Soil: Grey sand

Litter: Leaves 60%; Branches 15%

Topography: Lower slope, facing SE

**Vegetation Description:** Low Forest A of *Banksia attenuata* and *Allocasuarina fraseriana* over Scrub of *Kunzea glabrescens* over Open Tall Grass of \**Ehrharta calycina* over Open Low Grass of \**Briza maxima* over Open Low Sedges of *Desmocladus flexuosus* **Vegetation Condition:** 4

Other Notes: Trail bike track through the area. Very open understorey



TAXON	HEIGHT (cm)	<b>% COVER</b> 40	
Banksia attenuata	1000		
Conostylis aculeata	50	1	
Dasypogon bromeliifolius	70	5	
*Ehrharta calycina	60	15	
Kunzea glabrescens	500	15	
Mesomelaena pseudostygia	70	5	
Scaevola canescens	30	1	
Sowerbaea laxiflora	70	1	
Thysanotus arenarius	Twiner	<1	
Acacia cochlearis	opportunistic		
*Acacia iteaphylla	opportunistic		
Acacia pulchella	opportunistic		
Allocasuarina fraseriana	opportunistic		
Banksia menziesii	opportunistic		
*Briza maxima	opportunistic		
Burchardia congesta	opportunistic		

Caesia micrantha	opportunistic	
Caladenia flava	opportunistic	
Chamaescilla corymbosa	opportunistic	
Desmocladus flexuosus	opportunistic	
Dianella revoluta	opportunistic	
Drosera erythrorhiza	opportunistic	
Drosera stolonifera	opportunistic	
Eucalyptus gomphocephala	opportunistic	
Eucalyptus marginata subsp. marginata	opportunistic	
*Euphorbia terracina	opportunistic	
Gompholobium tomentosum	opportunistic	
Hardenbergia comptoniana	opportunistic	
Hibbertia hypericoides	opportunistic	
Hovea trisperma	opportunistic	
Hybanthus calycinus	opportunistic	
*Hypochaeris glabra	opportunistic	
Isotropis cuneifolia	opportunistic	
Lepidosperma squamatum	opportunistic	
Lyginia barbata	opportunistic	
Macrozamia riedlei	opportunistic	
*Olea europaea	opportunistic	
Philotheca spicata	opportunistic	
Phlebocarya ciliata	opportunistic	
Pimelea rosea	opportunistic	
*Pinus pinaster	opportunistic	
Pterostylis recurva	opportunistic	
*Romulea rosea	opportunistic	
Thysanotus sparteus	opportunistic	
*Ursinia anthemoides	opportunistic	
Xanthorrhoea brunonis	opportunistic	

Datum: 389166E; 6415271
Soil: Grey sandy clay
Litter: Leaves 5%; Branches 15%; Logs 15%
Topography: Wetland
Vegetation Description: Low Forest A of *Melaleuca rhaphiophylla* over grass/sedge 45%
Vegetation Condition: 3-4
Other Notes: Water in puddles throughout the wetland. More *Lepidosperma longitudinale* on the edge of the wetland outside of the *Melaleuca rhaphiophylla* area. Extensive cover of \**Ehrharta*



TAXON	HEIGHT (cm)	% COVER
Alternanthera nodiflora	20	5
*Callitriche stagnalis	5	<1
Cassytha racemosa	Twiner	40
*Ehrharta longiflora	20	10
Schoenus capillifolius	5	45
Juncus pallidus	70	1
Lepidosperma longitudinale	60	5
*Lotus suaveolens	5	<1
Melaleuca rhaphiophylla	800	70
*Mentha x piperita	25	1
Pterostylis nana	10	<1
*Solanum nigrum	30	<1
*Sonchus asper	30	<1
Triglochin linearis	30	<1
Villarsia albiflora	40	1

Acacia saligna	opportunistic	
*Arctotheca calendula	opportunistic	
Conostylis aculeata	opportunistic	
*Ehrharta calycina	opportunistic	
*Erodium botrys	opportunistic	
Eucalyptus rudis subsp. rudis	opportunistic	
*Heliophila pusilla	opportunistic	
Jacksonia furcellata	opportunistic	
*Lolium rigidum	opportunistic	
*Lupinus cosentinii	opportunistic	
*Lupinus luteus	opportunistic	
Melaleuca viminea	opportunistic	
Pimelea rosea	opportunistic	
*Ursinia anthemoides	opportunistic	

**Datum:** 388821E; 6414829N

Soil: Grey sand

Litter: Leaves 30%; Branches 3%

Topography: Upper slope

**Vegetation Description:** Woodland of *Eucalyptus gomphocephala* over Low Woodland A of *Banksia grandis, Banksia attenuata, Banksia menziesii* and *Allocasuarina fraseriana* over Tall Grass of weed taxa

## **Vegetation Condition:** 4-5

**Other Notes:** *Eucalyptus gomphocephala* trees up to 14-16m tall. This area is worthy of conservation although there is a high weed cover. This vegetation unit continues down to middle and lower slopes.



TAXON	HEIGHT (cm)	% COVER
Allocasuarina fraseriana	800	5
Banksia attenuata	700	5
Banksia grandis	700	5
Banksia menziesii	700	2
*Briza maxima	20	5
Burchardia congesta	90	<1
Chamaescilla corymbosa	10	<1
Conostylis aculeata	30	1
Corynotheca micrantha	30	<1
Drosera erythrorhiza	1	<1
*Ehrharta calycina	90	70

Eucalyptus gomphocephala	1400	20
Hardenbergia comptoniana	Twiner	<1
*Lolium rigidum	15	<1
Mesomelaena pseudostygia	70	20
*Romulea rosea	15	1
Sowerbaea laxiflora	70	1
Acacia pulchella	opportunistic	
Acanthocarpus preissii	opportunistic	
Adenanthos cygnorum	opportunistic	
Desmocladus flexuosus	opportunistic	
Dichopogon preissii	opportunistic	
Eucalyptus marginata subsp. marginata	opportunistic	
*Heliophila pusilla	opportunistic	
Jacksonia furcellata	opportunistic	
*Lagurus ovatus	opportunistic	
Leucopogon propinquus	opportunistic	
*Lupinus luteus	opportunistic	
Macrozamia riedlei	opportunistic	
Patersonia occidentalis	opportunistic	
Philotheca spicata	opportunistic	
Tetraria octandra	opportunistic	
*Watsonia meriana cv. bulbillifera	opportunistic	

Datum: 389057E; 6414845N

Soil: Grey sand

Litter: Leaves 60%; Branches 10%; Logs 5%

Topography: Lower slope

**Vegetation Description:** Low Woodland A of *Banksia attenuata, Banksia menziesii* and *Eucalyptus marginata* subsp. *marginata* over Dwarf Scrub C dominated by *Hibbertia hypericoides* over Open Tall Grass of \**Ehrharta calycina* and Open Low Grass of \**Briza maxima* **Vegetation Condition:** 3

Other Notes: Occurred at the bridle trail below the Tuarts



TAXON	HEIGHT (cm)	% COVER
Acacia pulchella	110	3
Banksia attenuata	850	15
Banksia menziesii	850	5
Brachyloma preissii	60	1
*Briza maxima	40	20
Burchardia congesta	60	1
Caesia micrantha	50	1
Caladenia flava	30	<1
Conostephium pendulum	10	<1
Dampiera linearis	10	1
Desmocladus flexuosus	25	5
Dichopogon preissii	70	5
Drosera macrantha	Twiner	<1
Drosera stolonifera	20	2
*Ehrharta calycina	60	20
Eucalyptus marginata subsp. marginata	800	10

Hardenbergia comptoniana	Twiner	3
Hibbertia hypericoides	60	15
Hovea trisperma	20	<1
Hybanthus calycinus	15	<1
*Hypochaeris glabra	5	3
Isotropis cuneifolia	15	<1
Lagenophora huegelii	25	<1
Lepidosperma squamatum	70	5
Lomandra preissii	50	<1
Lomandra sericea	30	<1
Mesomelaena pseudostygia	70	5
Philotheca spicata	50	1
Phlebocarya ciliata	40	2
Pterostylis nana	10	1
*Sonchus oleraceus	15	1
Sowerbaea laxiflora	50	2
Tetraria octandra	60	5
Xanthosia huegelii	5	<1
Acacia cochlearis	opportunistic	
Acacia stenoptera	opportunistic	
Anigozanthos humilis	opportunistic	
Bossiaea eriocarpa	opportunistic	
Daviesia divaricata	opportunistic	
Daviesia triflora	opportunistic	
Eryngium pinnatifidum	opportunistic	
Eucalyptus gomphocephala	opportunistic	
Glischrocaryon aureum	opportunistic	
Haemodorum spicatum	opportunistic	
Macarthuria australis	opportunistic	
Macrozamia riedlei	opportunistic	
Opercularia vaginata	opportunistic	
*Osteospermum clandestinum	opportunistic	
Petrophile linearis	opportunistic	
Pimelea rosea	opportunistic	
Podolepis gracilis	opportunistic	
Ptilotus polystachyus	opportunistic	
Pyrorchis nigricans	opportunistic	
*Romulea rosea	opportunistic	
Scaevola canescens	opportunistic	
Schoenus clandestinus	opportunistic	
Stylidium brunonianum	opportunistic	
Stylidium piliferum	opportunistic	
*Ursinia anthemoides	opportunistic	
Xanthorrhoea brunonis	opportunistic	

# **APPENDIX C**

# Maps

- Location of quadrats and relevees
   Vegetation units
   Vegetation condition



Map 1. Location of quadrats and relevees



Map 2. Vegetation Units

Dense Low Forest of *Melaleuca rhaphiophylla* over Tall Sedges of *Lepidosperma tetraquetrum* fringing the standing water with Open Herbs dominated by *Triglochin linearis* in the water.

Low Woodland A of *Eucalyptus rudis* subsp. *rudis, Melaleuca rhaphiophylla* and *Banksia littoralis* over Thicket of *Kunzea glabrescens* over Low Sedges dominated by *Lepidosperma drummondii* in sandy clay.

Open Low Woodland A over Open Scrub of *Kunzea glabrescens* over Low Heath C of *Hypocalymma angustifolium* over Very Open Low Sedges dominated by *Dasypogon bromeliifolius* in grey sand.

Low Woodland A of *Eucalyptus rudis* subsp. *rudis* and *Melaleuca preissiana* over Thicket of *Kunzea glabrescens* and *Jacksonia furcellata* over Open Low Sedges dominated by *Hypolaena exsulca* in grey sand.

Low Woodland A of Banksia attenuata, Banksia menziesii and Allocasuarina fraseriana, occasionally with Banksia ilicifolia over Low Heath C and Low Heath D of mixed taxa or Low Sedges in grey sand.

Woodland of *Eucalyptus gomphocephala* over Low Woodland A of *Banksia grandis, Banksia attenuata, Banksia menziesii* and *Allocasuarina fraseriana* over Tall Grass of weed taxa in grey sand.

Remainder of the area is pine plantation



Map 3. Vegetation condition

Rating	Description
2-3	Very good to excellent
3	Very good
3-4	Good to very good
4	Good
4-5	Good to degraded
6	Completely degraded

# APPENDIX D PATN Analysis

Undertaken by E.Griffin

# **1.0 INTRODUCTION**

## 1.1 Purpose of this report

The current report is intended to help clarify the assignment of Floristic Community type (FCT) designation to vegetation community (site) data. FCTs were defined by Gibson et al (1994) based on site data collected from vegetation on the Swan Coastal Plain. In particular, the potential that a Threatened Ecological Community (English and Blyth 1997) is represented by the data collected needs to be clarified.

## **1.2 Location of Baldivis Sites**

The sites were ???.

### 1.3 Brief background to floristic analysis of vegetation on the Swan Coastal Plain

Floristic analysis (ie., analysis of variation in vegetation based on the species present, rather than description of structural variation and dominance) as a significant component of the understanding of the variation present in the native vegetation of the Swan Coastal Plain dates to Gibson *et al* (1994 – all references to the SCP survey in the current report refer to this publication), the first publication to document the floristics of the vegetation of a large part of the Swan Coastal Plain. While the SCP survey is based on a very significant amount of work, it must be viewed as a "first pass" survey, limited, in the context of the great variety of vegetation present in the very large area surveyed, by the relatively limited number (509) of sites (quadrats) it is based on. To a limited degree, this limitation has subsequently been addressed in an "update" to the work of the SCP survey (which describes additional units). However, there is no detailed publication of the results of this update available and the additional data used are not readily available in an appropriate form (ie., one that would enable ready comparison of new data to the overall data set).

The units described by the SCP survey are a series of "floristic community types", a "unit" whose rank is defined by the use within a study. The SCP survey surveyed a very large survey area and defined a relatively small number of floristic community types. Consequently, the floristic community types they have described are of a very high order (see Trudgen 1999, volume 1, for further discussion of this point). This is an extremely important point to fully grasp in interpreting the analysis presented by the SCP survey and in understanding the meaning of analysis of other data sets when they are compared to the floristic community types.

The important effects of the limited size data set used by the SCP survey and of the relatively small number of floristic community types defined by them, can be summarised by the following points:

- the definition of all but two of the Threatened Ecological Communities for vegetation on the Swan Coastal Plain (English and Blyth 1997) has been based on the floristic community types of the SCP survey. It therefore follows, that with two exceptions, only vegetation units from one study that are different at a very high order of floristics are treated as rare by Government. No account is taken of other important differences, such as differences in structure and dominance;
- 2. for the definition of floristic community types to be robust, a sufficient sized database is needed to give adequate precision in their definition. About half of the floristics community types (or sub types) of the SCP survey are based on less than 10 sites. It is likely that with a larger data set there would be significant alteration in the classification of those floristic community types from the SCP survey based on small numbers of sites.
- 3. as noted above, many (if not most) of the floristic community types defined by the SCP survey are very broad. They contain very significant variation in floristics, structure and dominance. Some (or in more highly cleared parts of the Swan Coastal Plain much) of this variation may be rare by any reasonable definition, but it is currently "buried" within larger groups;
- 4. there is likely to be significant variation not sampled by the SCP survey. This includes some variation at a high level of floristic difference (see Trudgen 1999, volume 1, for an example of this) and undoubtedly quite significant (large!) amounts of variation at "medium" and "low" levels.

5. the document, and its use by Government, has focussed attention in the environmental impact assessment process on the high level of units described, deflecting attention from the layers of variation beneath these units that also have significant conservation value.

From these points it is obvious that there is a need for a major "upgrade" to the floristic analysis of the vegetation of the Swan Coastal Plain to provide a more detailed floristic classification that considers not only more of the variation present, but explicitly recognises more of the variation present in formally described units.

Obviously, such a reworking would have some effect on what vegetation is considered rare on the Swan Coastal Plain. It needs to be stressed that it would be very unlikely to find that any of the vegetation currently considered to be rare on the basis of the SCP survey's classification was not rare. On the other hand, it is likely that such a review would very probably consider to be rare some vegetation which is not currently considered rare.

### 1.4 Data provided

It is very important in comparing different sets of floristic data that they are comparable in the application of names, in the intensity of the survey (ie., the effort of searching resulting in similar proportion of the flora at sites being recorded) and in the size of the site recorded. If the data from different data sets is not comparable in these ways, it reduces the clarity of the results of the analyses carried out. If the discrepancy in the comparability of the data sets is large, the results may become meaningless.

It was noted that the sites were recorded in summer and the likely under representation of some species because of that. Some differences in representation is shown in Appendix 2 for comparison.

### 2.0 METHODS

### 2.1 Data Preparation

The data from the Baldivis sites were provided in a spreadsheet. These were incorporated into a standard MS Access based database designed for this type of data. One virtue of the database is that the species recorded at each site are stored against standard codes (numbers, those used by the Western Australian Herbarium) for each species. This facilitates ready comparison of data from different surveys stored in the same system.

After the data were incorporated into the database, a process of reconciliation of flora species names with those used in the SCP survey was undertaken. This step was necessary at least because of changes in nomenclature over the last ten years and the potential of survey specific variations in the application of names. The reconciliation involved:

- reducing some infra-specific names to the relevant species name, and
- combining some taxa where confusion is known to have occurred in field observations and identifications.

The reconciliation process was relatively straightforward as most of the names had already been standardised. Most reconciliation was to conform with the methods that the SCP survey used to manage confusing taxa plus some nomenclatural changes.

### 2.2 Comparability of datasets

It was concluded that the quadrat datasets were probably reasonably compatible in nomenclature. The richness of sites are moderate in some quadrats given most were dampland related (see extract of dendrogram in results.) The number of species from families often overlooked (eg Orchidaceae) is lower than that of quadrats in SCP dataset for similar vegetation (Appendix 2).

#### 2.3 Comparisons made

The data therefore from the 11 quadrats plus the 509 sites from the SCP survey of the southern part of the Swan Coastal Plain (south of Gingin) were combined. This enabled various analyses to be performed.

The main purpose was intended to assign the individual sites to the Floristic Community Types (FCTs) defined in the SCP survey. These data are provided in Baldivis.mdb.)

#### 2.4 Analyses carried out

The approach was the use of numerical classification techniques (PATN) based on the similarity of the floristic composition of the Baldivis quadrats to sites in the SCP survey data set.

### 2.4.1 PATN

Several modules of the numerical classification package PATN (Belbin 1987) were used for the analyses. The parameter values were the same as used by the SCP survey to ensure consistency of analysis with that study.

The PATN modules used were ASO (calculation of similarity matrix), FUSE (classification based on the results of ASO), DEND (representation of classification) and NNB (determination of sites most similar to each site – nearest neighbours). The results of the analyses were imported into a database (Baldivis.mdb) so that site characteristics and previous classifications (eg., Floristic Community Types derived in earlier classifications) could be associated and various analyses based on these data could be performed.

The assignment of floristic community types to the Baldivis quadrats was made by summarising the results of two different methods:

- the classification, and
- the ten nearest neighbours.

Experience demonstrates that the results of these are likely to vary, but that from nearest neighbours is likely to make more sense for it is not directly influenced by group membership. On the other hand the nearest neighbour analysis often is ambiquous as it provides several options.

To the classification dendrogram of the combined dataset, the FCT assigned by the SCP survey was associated with the SCP survey sites. The apparent FCTs were assigned to the Baldivis quadrats by interpreting the position of these sites in the dendrogram (particularly by the way they joined to the SCP sites).

The 10 sites in the combined data set that were most similar to each of Baldivis quadrats were obtained from the nearest neighbour method (NNB). By associating those nearest neighbours from the SCP survey, the most likely FCTs from this method for each of the Baldivis quadrats were determined.

It is common for there to appear tob inconsistencies in the affinitie indicated by these methods. Classification can be strongly influenced by the membership of groups which can "draw" a site "away" from another that it appears similar to. An attempt was then made to reconcile these different assignments of a Floristic Community Type. The relevant portion of the site by species matrix was examined to seek clarity in some cases.

### **3.0 LIMITATIONS**

It has been found in earlier projects that the addition of new sites to the SCP survey data set to produce a combined classification disrupts the original classification. The more data added, the higher the level of the disruption. This is particularly the case with wetland sites, partly because there are relatively few of these in the SCP data set and these communities are often very distinctive. This problem can make it difficult to assign Floristic Community Types to new sites using this method.

Secondly, it is common for new data to group to their cohorts. In some cases this has proven to result from common deficiencies in the data, ie. whole groups of species missing. This absence tends to draw them together. The more sites in the added batch, the tighter they draw together.

The analyses are conducted without personal knowledge of the sites.

# 4.0 RESULTS

# 4.1 Determination of floristic community type by classification

site	FCT	NO	data
			dend E Bennett Baldivis with SCP Nov 2006 all species
			0.2050 0.3656 0.5261 0.6867 0.8472 1.0078
BD05		72	
BD06		46	
BD09		61	I_I
BD08		33	I
C71-2	21a	68	
C71-3	21a	56	
DRAIN-1	21a	59	
CAPEL-7	21a	48	I
CLIF-1	21a	65	
GUTHR-5	21a	64	
KEME-2	21a	76	II
REDL-1	21a	67	
CRAMPT-1	21a	53	
CRAMPT-2	21a	63	
GUTHR-3	21a	62	
MANEA-2	21a	63	
HARRY-5	21a	52	
WELL-2	21a	71	
PAGA-4	21a	53	
PAGA-7	21a	68	
TAM-1	21a	45	
WELL-1	21a	48	
FL-4	21a	52	
KOOLJ-2	21a	53	
KOOLJ-3	21a	50	
KOOLJ-4	21a	68	
card10	6	29	
TWIN-1	6	19	
TWIN-2	6	27	
TWIN-3	6	43	
TWIN-4	6	23	
BD01		42	
BD02		23	
BD04		32	
card11	6	24	
card4	6	26	
BD03		35	
BD07		29	

Figure 1	1a. F	Relevant	portions (	of Dendro	ogram, all	species
<b>—</b> • • •						

|--|

site	FCT	NO	data						
			dend E Bennett Baldivis with SCP Nov 2006 inside only						
			0.2050	0.3656	0.5261	0.6867	0.8472	1.0078	
			1						
BD09		61							
DEPOT-1	28	44							
YAN-3	28	48			II				
NEER-3	28	45		_					
NEER-4	28	49							
BD05		72							
hymus04	21c	26			I				
DEJONG-c	21c	41							
FL-5	21c	41							
FL-6	21c	38		I					
hymus03	21c	30			II	I			
BD02		23							
card11	6	24				I			
card4	6	26			I	I	_		
card10	6	29					l		
ELLEN-7	6	23					I		
PEARCE-1	6	23			<u> </u>		I		
TWIN-1	6	19							
TWIN-2	6	27							
TWIN-3	6	43			I	I			
TWIN-4	6	23				<u> </u>	11		
BD06		46							
BD08		33			I				
PLINE-6	22	13					I		
AUSTB-3	11	27							
TWIN-11	11	23				I			
BULL-12	11	25				I			
hymus01	11	21							
hymus02	11	24				_			
MODO-3	11	16				II			
BD01		42							
BD04		32				I			
C71-1	11	51							
HARRY-6	11	25					I		
CARAB-3	11	30							
rowe01	11	15				_			
low10b	11	24				I	I		
BAMBUN-2	15	16							
CARAB-1	15	15							
TWIN-10	15	10							
TWIN-5	15	19				I			
BD03		35							
BD07		29			I				
hymus05	11	30							
nymus06	11	32		0.0055	I				
			0.2050	0.3656	0.5261	U.686/	0.8472	T.00.18	
								I	
### 4.2 Determination of floristic community type using Nearest Neighbour method

S	s1	f1	v1	s2	f2	v2	s3	f3	v3	s4	f4	v4	s5	f5	v5
BD01	BD02		0.548	BD03		0.611	BD04		0.657	MHENRY-2	30c	0.666	BD07		0.671
BD02	BD01		0.548	BD04		0.555	card11	6	0.659	card4	6	0.673	TWIN-8	21c	0.692
BD03	BD07		0.541	BD01		0.611	TWIN-3	6	0.736	hymus05	11	0.746	NAVB-4	24	0.75
BD04	BD02		0.555	MODO-2	21c	0.575	PLINE-7	21c	0.650	BD01		0.657	AUSTB-4	5	0.661
BD05	BD06		0.435	BD09		0.465	AUSTRA	21a	0.495	WELL-2	21a	0.507	REDL-1	21a	0.521
BD06	BD09		0.434	BD05		0.435	BD08		0.519	SHENT-1	28	0.565	KING-2	28	0.567
BD07	BD03		0.541	BD01		0.671	PAGA-2	13	0.756	TWIN-4	6	0.764	PAGA-5	17	0.8
BD08	BD06		0.519	FL-5	21c	0.621	BD09		0.634	BD05		0.653	WELL-1	21a	0.654
BD09	BD06		0.434	BD05		0.465	PAGA-4	21a	0.522	CRAMPT-1	21a	0.557	REDL-1	21a	0.559

Table 1a. Results of Nearest Neighbour analysis, all species

#### Table 1a (cont)

S	s6	f6	v6	s7	f7	v7	s8	f8	v8	s9	f9	v9	s10	f10	v10
BD01	HARRY-3	5	0.687	low08	5	0.692	low07	21c	0.7	TWIN-11	11	0.709	MILT-1	5	0.710
BD02	WHITE-2	4	0.7	TWIN-1	6	0.714	low06b	21c	0.714	FL-5	21c	0.718	low07	21c	0.718
BD03	TWIN-4	6	0.75	BD02		0.75	TWIN-5	15	0.769	NEER-1	24	0.772	CARAB-3	11	0.777
BD04	BD05		0.666	FL-5	21c	0.666	low06b	21c	0.666	low12a	21	0.670	low12b	21a	0.675
BD05	CRAMPT-	21a	0.522	YAN-3	28	0.529	WELL-1	21a	0.529	low13b	23	0.532	BANK-2	23a	0.545
BD06	CRAMPT-	21a	0.575	low04	21a	0.587	WELL-1	21a	0.595	PAGA-4	21	0.596	CRAMPT-	21a	0.596
BD07	hymus06	11	0.8	BD08		0.803	BD02		0.803	McLART	13	0.804	PAGA-8	25	0.804
BD08	FL-6	21c	0.662	YAN-6	28	0.662	TAM-1	21a	0.666	NINE-1	21	0.671	WELL-2	21a	0.673
BD09	NEER-3	28	0.561	PAGA-7	21a	0.562	WELL-2	21a	0.572	NEER-4	28	0.578	GUTHR-5	21a	0.580

s - the site being compared

s1 to s10 – the 1<sup>st</sup> to  $10^{th}$  most similar sites f1 to f10 – the FCT of the similar sites (only for SCP sites)

v1 to v10 – the dissimilarity value between the site and the similar sites (values above 0.6 tend to indicate low similarity)

Table 1b.	<b>Results</b>	of Nearest	Neighbour	analysis,	inside o	uadrats onl	v
							-/

e	e1	f1	v1	e2	f2	v2	63	f3	v3	e4	fA	v4	e5	f5	v5
3	31		V 1	32	14	V Z	35	15			17		- 35	15	•5
BD01	BD04		0.666	CAPEL-	12	0.704	BD07		0.705	low09b	5	0.709	TWIN-11	11	0.720
BD02	BD04		0.666	rowe01	11	0.739	card11	6	0.75	BD06		0.764	card4	6	0.764
BD03	BD07		0.6	TWIN-10	15	0.714	PAGA-5	17	0.739	BD01		0.741	hymus05	11	0.756
BD04	MODO-2	21c	0.607	BD01		0.666	BD02		0.666	FL-6	21c	0.703	HARRY-	5	0.707
BD05	BANK-2	23a	0.505	hymus04	21c	0.516	RIVD-2	21a	0.529	FL-5	21c	0.532	NINE-2	21a	0.533
BD06	BD08		0.615	TRIG-4	28	0.714	BD02		0.764	KING-2	28	0.766	BD05		0.777
BD07	BD03		0.6	BD01		0.705	TWIN-5	15	0.757	ELLIS-1	17	0.769	PAGA-5	17	0.769
BD08	BD06		0.615	card11	6	0.658	BD05		0.660	WELL-1	21a	0.661	WOODV-	28	0.672
BD09	DEPOT-1	28	0.538	BD05		0.542	CRAMPT	21a	0.563	SHENT-1	28	0.575	low13a	21a	0.582

#### Table 1b (cont)

s	s6	f6	v6	s7	f7	v7	s8	f8	v8	s9	f9	v9	s10	f10	v10
BD01	hymus02	11	0.727	low08	5	0.728	FL-10	12	0.729	HARRY-	5	0.733	RIVD-1	12	0.733
BD02	GUTHR-4	5	0.772	TWIN-1	6	0.777	TWIN-8	21c	0.8	card7	21	0.8	TWIN-4	6	0.806
BD03	TWIN-11	11	0.764	hymus02	11	0.771	RUAB-3	13	0.793	TWIN-5	15	0.8	hymus01	11	0.812
BD04	HARRY-6	11	0.707	PLINE-7	21c	0.708	low06b	21c	0.714	low07	21c	0.719	MODO-6	4	0.727
BD05	BD09		0.542	hymus03	21c	0.545	AUSTRA-1	21a	0.545	low12a	21	0.547	low13b	23a	0.549
BD06	WELL-2	21a	0.8	FL-5	21c	0.8	KING-1	28	0.810	BD09		0.814	NEER-3	28	0.814
BD07	hymus05	11	0.772	PAGA-2	13	0.777	cool 01	17	0.777	McLART	13	0.777	hymus06	11	0.782
BD08	WOODV-2	28	0.682	TRIG-4	28	0.684	BD09		0.686	NEER-	24	0.704	YAN-6	28	0.704
BD09	REDL-1	21a	0.584	PAGA-4	21a	0.586	RIVD-2	21a	0.590	GUTHR-	21	0.591	NINE-1	21a	0.594

	Dendr	ogram	Nearest	Neighbour	Conclusion
	All	Inside	All	Inside	
BD01	6	11	?30c/5	12/5	
BD02	6	6	6	11/6	
BD03	6	11	6/11	?15/17/11	
BD04	6	11	21c	21c	
BD05	21a	21c	21a	23a/21c/21a	
BD06	21a	6/22	28/21a	28	
BD07	6	11	?13/6	?15/17	
BD08	21a	6/22	21c/21a	6/21	
BD09	21a	28	21c/28	28/21	

### **4.3 Combining the results** Table 2 Summary of FCT assignment

The analyses are quite consistent. There is slight ambiguity for some sites as to whether they are 21a.

#### 5.0 REFERENCES

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FCOD	Species_LUP.name	Species_LUP_1.name					
031	Aira caryophyllea	Aira praecox					
031	Austrostipa sp.						
031	Avena barbata	Avena barbata/fatua					
032	Tricostularia neesii var. neesii	Tricostularia neesii					
039	Lyginia imberbis	Lyginia barbata					
039	Meeboldina scariosa	Leptocarpus scariosus					
054D	Xanthorrhoea brunonis subsp. brunonis	Xanthorrhoea brunonis					
054J	Burchardia congesta	Burchardia umbellata/congesta					
055	Anigozanthos manglesii subsp. manglesii	Anigozanthos manglesii					
055	Conostylis aculeata subsp. aculeata	Conostylis aculeata					
066	Disa bracteata	Monadenia bracteata					
090	Adenanthos cygnorum subsp. cygnorum	Adenanthos cygnorum					
090	Dryandra lindleyana var. lindleyana	Dryandra nivea					
143	Drosera nitidula subsp. nitidula	Drosera nitidula					
163	Acacia pulchella var. pulchella	Acacia pulchella					
165	Daviesia incrassata subsp. incrassata	Daviesia incrassata					
165	Gastrolobium capitatum	Nemcia capitata					
273	Astartea affinis	Astartea aff. fascicularis					
273	Kunzea glabrescens	Kunzea aff. micrantha (BJK & NG 040)					
273	Pericalymma ellipticum var. ellipticum	Pericalymma ellipticum					
273	Verticordia densiflora var. densiflora	Verticordia densiflora					
313	Hemiandra pungens	Hemiandra pungens/linearis					
316	Gratiola pubescens	Gratiola peruviana					
343	Stylidium brunonianum subsp. brunonianum	Stylidium brunonianum					
343	Stylidium junceum subsp. junceum	Stylidium junceum					
343	Stylidium repens var. repens	Stylidium repens					
345	Millotia sp.						

APPENDIX 1 Names combined for reconcilliation

Appendix 2 Comparison of average species per family per site for relevant FCTs.

(Familie	s appare	ently	low ir	i Balo	livis s	sites t	<u>pold)</u>					
FCODE	OAK	4	6	11	12	13	14	21a	21c	22	23a	23b
002												
003		0.06		0.15								
004												
011C				0.08		0.11		0.05				
011D												
013												
016A	0.09			0.15				0.64	0.25		0.21	0.05
017												
018	0.09											
025						0.22						
026				0.15	0.40	0.78						
031	1 36	2 13	3 33	3.62	1 40	1 11	0.50	2.92	2 75	0 45	3 95	1 24
032	0.64	1 94	1 78	2.62	2 00	1 78	1 00	1.54	1.88	1 27	2 21	2 19
035	0.01	0.06		0.38				0.10	0.06			
036		0.00		0.00		0 1 1		0.10	0.00			
000	1 73	2.06	1 56	0.69	1 60	1 33		2 13	2 4 4	1 64	2 32	2.81
0.00	1.75	0.60	1.00	0.03	0.80	0.11		0.15	0.31	0.00	0.63	0.10
0400		0.03	1.00	0.77	0.00	0.11		0.15	0.51	0.03	0.05	0.19
047								0 03	0 12			
050								0.03	0.13			
050	0.40	0.12	0 22	0.24	0.60	0 22		0.24			0.05	
054P	0.18	0.13	0.33	0.31	0.00	0.33		0.21			0.05	
U04B	4.00	4 75	0.50	0 4 5				2.07	2.05	1 00	2 4 4	2.00
054D	0.64	0.75	0.22	0.15			0.50	0.46	0.56	0.55	0.58	0.43
054E	4 45	0.06	0.22	0.08	0.40	0.00	0.50	0.13	0.06	4.00	4.00	4 50
054F	1.45	1.94	0.78	1.23	0.40	0.22		3.67	2.50	1.30	4.26	1.52
054G												
	0.18	0.63	0.33	0.08		0.33	0.50	0.82	0.63	0.09	0.89	0.86
054L												
055	1.27	0.94	0.33	0.08		0.11		2.28	1.44	1.09	2.42	2.43
056A		0.06										
060	0.64	0.69	1.33	0.92		0.22		0.74	1.00	0.91	1.68	1.38
066	0.09	1.38	1.22	1.00	0.60	0.11	3.00	3.05	2.44	1.18	2.42	1.05
070	0.09							0.33	0.19	0.18	0.47	0.05
088												
090	1.55	1.31	0.89	0.23		0.89	1.50	3.44	3.50	4.82	4.42	5.05
092		0.31						0.05			0.05	0.05
095												
097	0.09	0.13	0.11					0.05	0.19		0.21	0.19
103				0.15				0.03	0.06			
105												
106				0.08				0.03				
108												
110		0.38	0.11	0.08	0.80	0.11		0.46	0.38	0.09	0.74	0.19
1104		0.00	0.11	0.00	0.20	0.11		0.40	0.00	0.00	0 11	0.05
111					0.20			0 03	0.13		0.11	0.05
113		0.12	0.11	0.22				0.03		0.00	0.11	
110		0.13	0.11	0.23				0.30		0.09		
119		0.50		0.24	0.00	0.07		0.00		0.40	0.00	0.40
131		0.56		0.31	0.80	0.67		0.26		0.18	0.26	0.43
136												

(Families apparently low in Baldivis sites bold)

FCODE	OAK	4	6	11	12	13	14	21a	21c	22	23a	23b
138			0.11					0.13				
143	0.18	1.44	2.00	0.15	0.60	0.33		2.33	1.56	1.18	2.16	2.05
149		0.13	0.33	0.23	0.60	0.11		0.10	0.19	0.09	0.32	0.05
152			0.11					0.28				
163	1.09	0.69	0.56	0.54	0.20	0.11	1.00	1.05	0.50	0.36	1.05	0.81
164	0.09											
165	2.91	1.94	0.78	1.38	2.40	0.78	2.50	4.33	2.00	2.09	4.00	3.76
167			0.11								0.16	0.05
168				0.23								
173												
175	0.82	0.88			0.20			0.59	0.31	0.36	0.89	1.67
182		0.06						0.23	0.06			0.05
183		0.06			0.20	0.11		0.21	0.13	0.27	0.05	0.14
185	0.09	0.06		0.15				0.38	0.38	0.18	0.42	0.33
202		0.13						0.10		0.09	0.05	0.05
207												
215												0.05
223												
226	0.36	0.31	0.11	0.15				1.97	1.19	0.73	2.21	2.62
236												
243								0.05			0.05	
263		0.13						0.08				0.24
273	3.09	4.44	3.11	3.23	3.60	3.22	4.00	2.97	3.31	3.55	4.74	5.62
275					0.60							
276								0.08	0.13	0.45	0.53	0.33
281	0.09	1.31	0.22	0.69	0.20	0.44	0.50	2.33	1.31	0.64	1.68	1.14
288	0.18	0.50	0.22	0.23				2.00	1.00	1.91	2.53	4.71
293			0.33	0.08			0.50	0.23				
302		0.13			0.40			0.08	0.13	0.27	0.37	0.62
303			0.11	0.08	0.20							
303A				0.31	0.60	0.33						
304												
307												
307A												
313	0.09			0.08		0.11		0.26	0.06		0.16	0.14
315				0.08		0.11		0.05			0.05	
316	0.09		0.56	0.23	1.20	0.33					0.05	
320								0.03				
323			0.22			0.11						
326												
329												
331				0.31		0.11		0.23			0.16	
339				0.08				0.13	0.06		0.47	0.38
340	0.09			0.54	0.80	0.22		0.33			0.11	0.05
341	0.45	1.00	0.11	0.38	0.60	0.33		0.56	0.31	0.64	1.00	0.86
343	0.82	3.13	0.44	0.92	1.00	0.22		1.77	1.94	3.27	3.68	4.10
345	0.82	1.88	2.67	2.62	3.00	1.00	1.00	4.03	2.56	0.55	4.47	1.29

### Appendix E Vertebrate Fauna Report

URS

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### **EXECUTIVE SUMMARY**

The operators of the Baldivis Sand Quarry [Holcim (Australia) Pty Ltd (Holcim)] have proposed to extract sand from a previously rehabilitated area. Holcim propose to clear a 100m wide section supporting five year old revegetation; in total, an area of about 7.85 ha is proposed to be cleared (disturbance area). Of this, approximately 6.26 ha contains revegetation, while 1.59 ha is already cleared.

Bamford Consulting Ecologists (BCE) was commissioned by URS, acting on behalf of Holcim to conduct a fauna assessment of the proposed disturbance area to contribute to a Mining Proposal for the project. The aims of this assessment were primarily to determine if the site contains habitat for any significant fauna, and/or has any important ecological function for local biodiversity. The site inspection was conducted on 29<sup>th</sup> August 2013.

Three major Vegetation and Substrate Associations were found within the project area.

- 1. Acacia pulchella dense shrubland with scattered shrubs;
- 2. Revegetated fringe of Marri (*Corymbia calophylla*), Tuart (*Eucalyptus gomphocephala*), Calothamnus (*Calothamnus* sp.) and additional shrubs including *Acacia pulchella*; and
- 3. Cleared / Disturbed land native vegetation was observed to be restricted mostly to the western half of the proposed disturbance footprint. Most of the eastern half had been previously cleared or disturbed.

The desktop survey identified nearly 300 vertebrate species potentially occurring in the general region of Baldivis (within a radius of about 10km), but this was reviewed on the basis of available habitat. A total of 22 native fauna species was recorded within the project area during the site inspection. These comprised of 20 bird and two mammal species.

The project area contains no rare or significant habitat types and is likely to support few conservation significant fauna species. Species of high conservation significance known from the local area are not expected to depend on or regularly utilise the proposed disturbance area. A small number of locally significant bird species may reside within the proposed disturbance footprint, but these species also occur in adjacent remnants. The project area provides minimal buffering to adjacent vegetation and is part of a loose network of remnants in the immediate region. This network supports local fauna and the proposed development will retain a strip of revegetation along the northern boundary of the quarry site and thus most of this function should persist.

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### **1. INTRODUCTION**

### 1.1 Background

The operators of the Baldivis Sand Quarry (Holcim) have proposed to extract sand from a previously rehabilitated area. Holcim propose to clear a 100m wide section supporting five year old revegetation. In total, an area of about 7.85ha is proposed to be cleared. Of this, approximately 6.26 ha contains revegetation, while 1.59 ha is already cleared.

Bamford Consulting Ecologists (BCE) was commissioned by URS, acting on behalf of Holcim, to conduct a fauna environmental impact assessment (EIA) of the proposed disturbance area to support the Mining Proposal for the project. A fauna assessment is required to identify the fauna values of a site so that impacts from the proposed works can be assessed and, where possible, minimised.

### 1.2 Approach to Fauna Investigations

The objectives of fauna studies in the EIA process are broadly to determine the fauna values of a site and the likely impacts of a proposed development. This provides government agencies with the information needed to assess the significance of impacts under state and government legislation. Investigations required for EIA can vary enormously, ranging from a desktop review with little or no fieldwork, to comprehensive and long term field sampling. Appendices 1- 4 outlines the BCE general approach to fauna investigations for EIA, and Table 1 (below) uses criteria from the Environmental Protection Authority's (EPA) Guidance Statement 56 to provide a framework for determining the appropriate level of investigation for the quarry expansion proposal.

Based upon the review in the table below, the site is small and may be of low value for fauna (because it has been recently rehabilitated), but the context and function of the site are uncertain. The regional fauna assemblage is already well known. Therefore, the approach to the fauna investigation for the quarry expansion proposal is:

- Desktop review with an emphasis on species of conservation significance. The desktop review includes a review of all available data, including databases (e.g. those managed by the Department of Parks and Wildlife (DPAW, formerly Department of Environment and Conservation), Department of Sustainability, Environment, Water Population and Communities (SEWPaC), Birdlife Australia and private records held by BCE), in order to generate a list of fauna species likely to be present in an area;
- Site inspection to identify the fauna habitats of the site and adjacent areas; and
- Reporting. This report discusses the importance of the site in terms of its role in supporting fauna in the region (e.g. provision of habitat, ecological function), and the presence of significant species.

Criterion for guidance to assess level of investigation	Application of criteria to the Holcim quarry expansion proposal
Size and scale of the proposed development.	Proposed development is small (about 7.85ha).
Context: position relative to conservation estate and/or intact natural environments.	Surrounding areas are cleared or harvested pine plantations, with some small fragments of remnant native vegetation
Context: rarity of environments.	The vegetation of the site is five year old revegetation so of lower value for fauna compared with natural vegetation in the region.
Context: extent of clearing and other forms of habitat degradation in region.	Region is extensively cleared and variably developed.
Availability of existing information on fauna assemblage.	Vertebrate fauna assemblage very well documented from previous studies in region. List of significant species readily determined from the desktop review.
Ecological functions and processes (e.g. fire, linkage, patterns of distribution, hydrology, species interactions).	Examination of context required to determine if project area has a connectivity function. Aerial photographs suggest it may have a "stepping stone" role and native vegetation in region consist of scattered fragments
Numbers and types if significant species.	Few significant species likely to be present due to nature of vegetation (young rehabilitation); can be reviewed from desktop study.
Complexity of the environment.	Environment does not appear to be highly complex (but desktop review and a site inspection can inform on this).
Potential for rehabilitation or similar that require monitoring.	Not known to what extent the site can be rehabilitated following sand extraction. Not known if current rehabilitation is being monitored.
Potential for cumulative impacts.	There are existing impacts in the region and even though the site is small and rehabilitated, development will add to cumulative impacts in the region.

### Table 1. Review of criteria for determining appropriate level of investigation.

### **2 PROJECT DESCRIPTION**

### 2.1 Project Location

The Baldivis Sand Quarry (the project) is situated on Stakehill Road, Baldivis. The project is bounded by mining lease M70/1046 (see Figure 1). The area was formerly covered in pine plantation but has since been cleared.

The project area lies within the Swan Coastal Plain (SWA2) subregion of the Swan Coastal Plain Bioregion (Interim Biogeographical Regionalisation for Australia classification system, EA 2000; McKenzie *et al.* 2003, see Figure 2). The Swan Coastal Plain Bioregion falls within the Bioregion Group 1 classification of EPA (2004). Group 1 comprises the "bioregions of the South-West Botanical Province that are extensively cleared for agriculture."

### 2.2 Vegetation

As part of mine expansion plans, Holcim proposes to clear a strip of the previous revegetated land to the north of the current mining area. A 100m strip of revegetation is proposed to be cleared (see Figure 1). This is referred to as the "project area" or "site" throughout the report.

Revegetation of Mining Lease M70/1046 was conducted in 2008 (J. Moro, pers. comm.). Several native species were planted and included:

- 1. Agonis flexuosa;
- 2. Tuart (*Eucalyptus gomphocephala*);
- 3. Calothamnus rupestris.

Some natural revegetation of the area has also occurred.



Figure 1. Location of the project. The proposed clearing area lies on the northern edge of the existing quarry.

### **3. METHODS**

### 3.1 Approach

This fauna assessment and report preparation were carried out with reference to guidance and position statements published by the WA Environmental Protection Authority (EPA) on fauna surveys and environmental protection, and Commonwealth biodiversity legislation (e.g. EPA 2002; EPA 2004). The level of fauna assessment required by the EPA is determined by the size and location of the proposed disturbance and the sensitivity of the surrounding environment in which the disturbance is planned.

Due to the scale and nature of the proposal, a Level 1 survey was deemed suitable (for this assessment) to satisfy the EPA guidelines, given the small area of proposed disturbance and the large extent of sampling in the region. For this assessment, a Level 1 survey involved a desktop study and reconnaissance survey (site inspection). The EPA describes a Level 1 survey as:

"Background research or 'desktop' study with the purpose to gather background information on the target area (usually at the locality scale). This involves a search of all sources for literature, data and map-based information (EPA, 2004)."

The purpose of a Reconnaissance Survey is to verify the accuracy of the background study; to further delineate and characterise the fauna and faunal assemblages present in the target area; and to identify potential impacts.

This involves:

"a target area visit by suitably qualified personnel to undertake selective, low intensity sampling of the fauna and faunal assemblages, and to provide habitat descriptions and habitat maps of the project area" (EPA, 2004).

### 3.2 Personnel

The site inspection was conducted on 29<sup>th</sup> August 2013 by: Jeff Turpin: B.Sc. (Zoology)

This fauna assessment document was prepared by Mr Jeff Turpin and Dr Mike Bamford (B.Sc. Hons. Ph.D.).

### 3.3 Nomenclature and Taxonomy

As per the recommendations of EPA (2004), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's *Checklist of the Vertebrates of Western Australia*. The authorities used for each vertebrate group are: amphibians and reptiles (Aplin and Smith 2001), birds (Christidis and Boles 1994; Johnstone 2001), and mammals (How *et al.* 2001).

### 3.4 Sources of Information for Desktop Assessment

Information for this fauna assessment was drawn primarily from the DPAW NatureMap (2013), the Birds Australia Atlas Database, DPAW Threatened Fauna Database and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) Protected Matters Search Tool. All databases were interrogated in June 2013 (see below). This information was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns were:

- frogs (Tyler et al. 2000),
- reptiles (Storr et al. 1983, 1990, 1999 and 2002),
- birds (Blakers et al. 1984; Johnstone and Storr 1998; Johnstone and Storr, 2003; Storr, 1984), and
- mammals (Churchill 1998; Strahan 1995; Menkhorst and Knight 2001).

Information was also available from historical surveys undertaken by BCE in the region. The type of records help on data base and the area searched are shown below Table 2).

Database	Type of records held on database	Area searched			
NatureMap	Records of specimens held in the WA Museum. DPAW records, Information and records on Threatened and Priority species in Western Australia. Includes historical data.	Baldivis Sand Quarry -plus 10km buffer			
Birds Australia Atlas Database	Records of bird observations in Australia, 1998-2011.	Species list for the 1 degree grid cell containing Baldivis Sand Quarry			
EPBC Protected Matters Search Tool	Records on matters protected under the EPBC Act, including threatened species and conservation estate.	Baldivis Sand Quarry -plus 10km buffer			
BCE	Fauna Assessment and Opportunistic Records	Karnup Pine Plantation			

Table 2. Database searches conducted for the fauna assessment.

### 3.5 Previous Fauna Surveys

BCE has conducted several fauna assessments in the local area. This includes native vegetation remnants within the Pine Plantation previously adjacent to the project area (BCE, 2006). Species of conservation significance recorded from the area included Carnaby's Black-Cockatoo, Quenda (Southern Brown Bandicoot) and several locally significant bird species.

### 3.6 Site Inspection

During the site inspection, the project area was traversed on foot. Fauna habitats encountered were recorded as well as opportunistic fauna observations.

The aim of the site inspection was to develop an understanding of the fauna habitats occurring at the site, and to search for evidence of conservation significant species. Habitats present within the project area were assessed as to the likelihood of supporting species of conservation significance known to occur in the region. All fauna species observed during surveying were recorded.

The site inspection consisted of:

- searching for evidence of significant species such as diggings and burrows, roost hollows, tracks, scats, shelters etc.;
- bird census;
- opportunistic observations; and
- habitat assessment.

### 3.6.1 Searching for Significant Species

Significant species identified in the desktop assessment that may occur in the project area include several that can be found by searching for evidence of their activities. These include the Quenda or Southern Brown Bandicoot (tracks and diggings), Carnaby's Black-Cockatoo (feeding sign), Forest Red-tailed Black-Cockatoo (feeding sign), Baudin's Black-Cockatoo (feeding sign), South-West Carpet Python (shed skin, tracks, scats), bat species (roosting hollows) and mygalomorph spiders (burrows, shelters). Searching for evidence of significant fauna was therefore undertaken by traversing through habitat considered suitable for such species.

### 3.6.2 Bird Surveys

Bird censusing was conducted opportunistically while traversing the site. All fauna habitats were visited and thus sampled opportunistically for birds. Opportunistic bird observations were recorded at all times during surveying.

### 3.6.4 Opportunistic Surveys

At all times, observations of fauna were noted when they contributed to the accumulation of information on the fauna of the site. These included such casual observations as birds or reptiles seen while travelling through the site.

### 3.6.5 Habitat Assessment

Each habitat visited was assessed as to the suitability of supporting threatened fauna.

### 3.7 Limitations

The EPA Guidance Statement 56 (EPA 2004) outlines a number of limitations that may arise during surveying. These survey limitations are addressed below:

Table 3. Fauna survey limitations.

Limitation	Comment	
Level of survey.	Level 1 (desktop study and reconnaissance survey). Survey intensity was deemed adequate due to the size of project and large number of fauna surveys previously conducted in the region	
Competency/experience of the consultant(s) carrying out the survey.	The authors have had extensive experience in conducting desktop reviews and site inspections.	
Scope. (What faunal groups were sampled and were some sampling methods not able to be employed because of constraints?)	Low level sampling was conducted for reptiles, birds amphibians and mammals.	
Proportion of fauna identified, recorded and/or collected.	No species collected, all fauna observed identified.	
ources of information e.g. previously railable information (whether historic or cent) as distinct from new data.Sources include previous reports on the fauna local area (BCE database); databases (BA, DP WAM, EPBC);		
The proportion of the task achieved and further work which might be needed.	Site Inspection completed.	
Timing/weather/season/cycle.	Site Inspection conducted August 2013.	
Disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey.	No disturbances affected the survey.	
Intensity. (In retrospect, was the intensity adequate?)	Survey intensity was low (desktop study and site inspection), however was adequate to satisfy EPA guidelines.	
Completeness (e.g. was relevant area fully surveyed).	Desktop study covered project area and adjacent habitats. Site inspection covered all areas of the project.	
Resources (e.g. degree of expertise available in animal identification to taxon level).	All species identified to taxon level.	
Remoteness and/or access problems.	No.	
Availability of contextual (e.g. biogeographic) information on the region.	Extensive regional (e.g. Swan Coastal Plain) information was available and was consulted.	

### 4. RESULTS

Native vegetation is restricted mostly to the western half of the proposed disturbance footprint. Most of the eastern half had been previously cleared or disturbed. The revegetated areas occur in the western half of the footprint.

### 4.1 Fauna Habitats / Vegetation and Substrate Associations

The revegetated area was dominated by areas of dense Acacia pulchella shrubland, with scattered to isolated shrubs including Adenanthos cygnorum, Acacia saligna, Jacksonia sp., and Hakea spp. This shrubland is likely to be the result of natural regeneration subsequent to the clearing of pine (evidenced by the presence of many low tree stumps). Additionally, a planted fringe of Marri (Corymbia calophylla), Tuart (Eucalyptus gomphocephala), Calothamnus (Calothamnus sp.) and additional shrubs occurred. Understorey species included introduced grasses and the native Conostylis sp., Kennedia prostrata and Carpobrotus sp. Three major Vegetation Substrate Associations (VSAs) were found within the project area.

- 1. Acacia pulchella dense shrubland with scattered shrubs;
- 2. Revegetated fringe of Marri (*Corymbia calophylla*), Tuart (*Eucalyptus gomphocephala*), Calothamnus (*Calothamnus* sp.) and additional shrubs including *Acacia pulchella*; and
- 3. Cleared / Disturbed land.

The following plates (Plates 1 - 4) depict the vegetation of the project area.



**Plate 1.** *Acacia pulchella* shrubland with scattered *Adenanthos cygnorum* and fringing Marri (*Corymbia calophylla*).



Plate 2. Acacia pulchella shrubland with scattered replanted eucalypts.



Plate 3. Acacia pulchella shrubland with scattered replanted eucalypts.



Plate 4. Acacia pulchella shrubland with scattered replanted eucalypts.

Native vegetation occurring close by but outside the mining lease 70/1046 included Banksia / Sheoak Woodland, Melaleuca Forest fringing drainage depressions and Tuart (*Eucalyptus gomphocephala*) Woodland.

### 4.2 Vertebrate Fauna

The desktop survey identified nearly 300 vertebrate species potentially occurring in the general region of Baldivis (this includes seabirds), but this was reviewed on the basis of available habitat to include 9 frog, 40 reptile, 94 bird and 16 mammal species that could occur in the project area. This would include vagrants but importantly identifies the species of conservation significance that may be present. Conservation significant fauna species occurring or likely to occur in the project area are discussed below.

A total of 22 native fauna species was recorded within the project area during the site inspection. This comprised 20 bird and two mammal species. Species recorded during the field survey were:

1.	Australian Ringneck	Barnardius zonarius
2.	Splendid Fairy-wren	Malurus splendens
3.	White-browed Scrubwren	Sericornis frontalis
4.	Western Gerygone	Gerygone fusca
5.	Weebill	Smicrornis brevirostris
6.	White-fronted Chat	Epthianura albifrons
7.	New Holland Honeyeater	Phylidonyris novaehollandiae
8.	White-cheeked Honeyeater	Phylidonyris nigra
9.	Singing Honeyeater	Lichenostomus virescens
10.	Brown Honeyeater	Lichmera indistincta
11.	Red Wattlebird	Anthochaera carunculata
12.	Western Wattlebird	Anthochaera lunulata
13.	Golden Whistler	Pachycephala pectoralis
14.	Willie Wagtail	Rhipidura leucophrys
15.	Australian Magpie	Gymnorhina tibicen
16.	Australian Raven	Corvus coronoides
17.	Australasian Pipit	Anthus novaeseelandiae
18.	Silvereye	Zosterops lateralis
19.	Welcome Swallow	Hirundo neoxena
20.	Tree Martin	Hirundo nigricans
21.	Western Grey Kangaroo	Macropus fuliginosus
22.	Feral Cat	Felis catus

While two Western Grey Kangaroos were observed within the area, numerous tracks of the Feral Cat were also recorded. Significantly, there was no evidence of the Southern Brown Bandicoot (Quenda) utilising the project area.

An additional seven species were recorded in native vegetation located close to the site:

1.	Grey Fantail	Rhipidura fuliginosa
2.	Grey Shrike-thrush	Colluricincla harmonica
3.	Inland Thornbill	Acanthiza apicalis

- 4. Carnaby's Black-Cockatoo Calyptorhynchus latirostris
- 5. Crested Pigeon
- Common Bronzewing
   Red-capped Parrot

Calyptorhynchus latirostri Ocyphaps lophotes Phaps chalcoptera Purpureicephalus spurius

### 4.3 Conservation Significant Fauna

Bamford Consulting (2006) identified several species of conservation significance likely to occur in vegetation remnants in the local area. These were the Carnaby's Black-Cockatoo, Quenda and several conservation significant bird species. Conservation significant fauna recorded from the local area with the potential to occur within the project area are discussed below.

## Calyptorhynchus latirostrisCarnaby's Black- Cockatoo (EPBCEndangered and Schedule 1, WA Wildlife Conservation Act 1950)

Listed as Endangered under the EPBC Act and Schedule 1 (Endangered) under the WA *Wildlife Conservation Act 1950*, Carnaby's Black-Cockatoo occurs in the south-west of Western Australia, approximately south-west of a line between the Murchison River (near Kalbarri) and Cape Arid National Park (east of Esperance). It has been recorded in the area and was observed in adjacent intact vegetation.

Carnaby's Black-Cockatoo has declined due to loss of breeding habitat in the wheatbelt and of non-breeding habitat along the west coast, partly due to urban expansion. While small areas of foraging habitat around the metropolitan area support only small numbers of birds for short periods of time, the progressive loss of such small areas is an ongoing concern for this species.

Carnaby's Black-Cockatoo is known to feed on seeding *Banksia* and *Eucalyptus* as well as proteaceous heaths (Johnstone and Storr 1998). It will feed on scattered Proteaceae and has been observed extracting grubs from *Jacksonia* sp. (M. Bamford). Loss of feeding habitat is identified as an important contributing factor to the decline of Carnaby's Black-Cockatoo in Garnett and Crowley (2000). Further loss of significant regional feeding habitat may constitute a trigger as a controlled action under the EPBC Act and may require assessment by the SEWPaC. Some areas of feeding habitat (proteaceous heaths) occur including around the fringes of the wetlands, however no breeding habitat (Eucalypt trees) occurs in the project area.

The project area contains no mature trees and therefore no tree hollows large enough to support this species. The project area is dominated by *Acacia pulchella* shrubland with a few scattered proteaceae species. As a result, the foraging potential for Carnaby's Cockatoo is low.

# Calyptorhynchus baudiniiBaudin'sBlack-Cockatoo(EPBCVulnerable and Schedule 1, WA Wildlife Conservation Act 1950)

Listed as Vulnerable under the EPBC Act and as Schedule 1 (Endangered) under the WA *Wildlife Conservation Act 1950*, Baudin's Black-Cockatoo occurs in the deep south-west of Western Australia, approximately south-west of a line between Morangup (near Bullsbrook, north of Perth) and Waychinicup National Park (east of Albany). Birds generally breed in the Karri, Marri and Wandoo forests in the

southern parts of the species' range and move north to the Darling Range and Swan Coastal Plain during autumn and winter (non-breeding period). Clearing for agriculture and logging has removed nesting and feeding trees for this species (particularly *Corymbia calophylla*). The species has been recorded in the region but appears to be a vagrant onto the Swan Coastal Plain in the Baldivis area.

The project area contains no mature trees and therefore no tree hollows large enough to support this species. The project area is dominated by *Acacia pulchella* shrubland with a few scattered young Marri trees. As a result, the foraging potential for Baudin's Black-Cockatoo is minimal.

# Calyptorhynchus banksii nasoForest Red-tailed Black-Cockatoo (EPBCVulnerable and Schedule 1 under the WA Wildlife Conservation Act 1950)

Listed as Vulnerable under the EPBC Act and Schedule 1 (Vulnerable) under the WA *Wildlife Conservation Act 1950*, this species is of concern because clearing and forestry have reduced the available breeding and feeding habitat. The Forest Red-tailed Black-Cockatoo occurs in the south-west of Western Australia, approximately south-west of a line between Gingin and the Green Range (near Wellstead, east of Albany). The range of this subspecies is closely tied to the distribution of Marri (*Corymbia calophylla*); the favoured nesting and food tree. The species occurs occasionally on the Swan Coastal Plain, where it is associated with Marri or Pine Plantations (J. Turpin, pers. obs.). Due to the lack of Marri trees within the proposed project area, the Forest Red-tailed Black-Cockatoo is unlikely to breed or forage in the project area. Therefore, the potential for Red-tailed Black Cockatoo to occur is low.

# Isoodon obesulus fusciventer Southern Brown Bandicoot/ Quenda, (Priority 5)

The Quenda is listed as Priority 5 by DPAW and has declined on the Swan Coastal Plain. It occurs in the south-west of Western Australia north to Yanchep and Gingin, south to Albany and east to Esperance. This species previously occurred north to Moore River but like many mammals in the region has undergone a large range reduction (Maxwell *et al.* 1996). On the Swan Coastal Plain, it is patchily distributed as a result of land clearance, habitat degradation and feral predators, and often occurs in small and fragmented populations (DEC, 2008). It is commonly associated with dense, low vegetation.

BCE (2006) recorded this species from the adjacent Karnup Pine Plantation in 2006. However, since this time, the local area has seen significant land clearance. When present, diggings and tracks of the Quenda are typically prominent, particularly in sandy areas. There was no evidence of the Quenda in the project area.

### **Declining Birds on the Swan Coastal Plain**

A number of bird species have been identified by the WA Department of Environmental Protection (DEP, 2000) as having declined in the Perth area due to impacts associated with urban development. A few of these are birds of prey, but the majority are small birds that rely on woodlands and shrublands where they are either residents (eg. fairy-wrens and thornbills) or seasonal visitors (honeyeaters). The fairy-wrens and thornbills are particularly sensitive to habitat loss and fragmentation, whereas the honeyeaters have a greater ability to access suitable habitat even when it is fragmented by urban development. The majority of the species listed by the DEP (2000) are also noted as having declined Australia-wide by more than 20% in the New Atlas of Australian Birds (Barrett *et al.* 2003). The declining bird species listed by DEP (2000) are recognised as conservation significant by BCE (CS3, see Appendix 1). Those likely to occur in the project area are listed in Table 4.

**Table 4.** Twenty-eight CS3 Bird species are expected in the local area. These species are listed as declining in the Perth region by DEP (2000). Six species were recorded in the project area.

Common Name	Species Name	<b>Expected Status in</b>
		Project Area
Square-tailed Kite	Lophoictinia isura	Vagrant
Whistling Kite	Haliastur sphenurus	Visitor
Brown Goshawk	Accipiter fasciatus	Visitor
Collared Sparrowhawk	Accipiter cirrhocephalus	Visitor
Wedge-tailed Eagle	Aquila audax	Visitor
Little Eagle	Hieraaetus morphnoides	Visitor
Brown Falcon	Falco berigora	Visitor
Painted Button-quail	Turnix varia	Vagrant
Common Bronzewing	Phaps chalcoptera	Visitor
Brush Bronzewing	Phaps elegans	Vagrant
Splendid Fairy-wren	Malurus splendens	Resident (Recorded)
Southern Emu-wren	Stipiturus malachurus	Vagrant
White-browed Scrub-wren	Sericornis frontalis	Resident (Recorded)
Inland Thornbill	Acanthiza apicalis	Resident
Western Thornbill	Acanthiza inornata	Visitor
Yellow-rumped Thornbill	Acanthiza chrysorrhoa	Resident
Western Wattlebird	Anthochaera lunulata	Resident (Recorded)
White-cheeked Honeyeater	Phylidonyris nigra	Resident (Recorded)
Western Spinebill	Acanthorhynchus superciliosus	Visitor
New Holland Honeyeater	Phylidonyris novaehollandiae	Resident (Recorded)
Tawny-crowned Honeyeater	Phylidonyris melanops	Visitor
Scarlet Robin	Petroica multicolour	Visitor
Hooded Robin	Melanodryas cucullata	Vagrant
White-breasted Robin	Eopsaltria griseogularis	Vagrant
Golden Whistler	Pachycephala pectoralis	Resident (Recorded)
Grey Shrike-thrush	Colluricincla harmonica	Resident
Black-faced Woodswallow	Artamus cinereus	Resident
Dusky Woodswallow	Artamus cyanopterus	Vagrant

Six of these CS3 species were recorded from the project area: Splendid Fairy-wren, White-browed Scrub-wren, White-cheeked Honeyeater, Western Wattlebird, New Holland Honeyeater and Golden Whistler. The Splendid Fairy-wren, White-browed Scrub-wren, Thornbills and the robins are all sedentary species that have poor powers of dispersal and thus rely upon continuity of habitat to persist. As a result, the proposed project area may support some small but locally significant populations of these species. Other species, such as the Golden Whistler and honeyeaters, are likely to forage within both the project area and adjacent areas of native vegetation.

### 4.4 Significant Invertebrates

Invertebrates in general are beyond the scope of assessment for EIA because there are so many species and their taxonomy is so poorly understood, but it is possible to focus on a small range of taxa that are either of listed conservation significance, or that are short-range endemics. Harvey (2002) notes that the majority of invertebrate species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Schizomida (schizomids: spider-like arachnids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish).

Significant species are discussed below (see Appendix 1 for conservation status codes):

### Conservation Significance Level 1

• Leioproctus douglasiellus (Native Bee). Schedule 1 under the WA Wildlife Act 1950. This species is known only from a few records on the Swan Coastal Plain including from Pearce, Forrestdale Lake Nature Reserve and Brixton Street Wetlands. It has been collected from flowers of Goodenia filiformis and Anthotium junciforme. Due to a lack of associated food plants, it is not expected to occur within the project area.

Conservation Significance Level 2

- Symenon grantiosa, Castniidae (Graceful Sunmoth) Priority 4 listed by DPAW. The Graceful Sun-Moth Synemon gratiosa (Castniidae) is noted as occurring in few locations from Yanchep south to Mandurah and to be threatened by land clearing. This species inhabits Lomandra maritima on coastal dunes and Lomandra hermaphrodita within Banksia Woodland and Heath. The Graceful Sunmoth has been recorded patchily on the Swam Coastal Plain from several areas of remnant vegetation. Due to a lack of associated food plants, it is not expected to occur within the project area.
- *Austrosaga spinifer* (Cricket) Priority 3 listed by DPAW. Recorded from heathlands between Perth and Cervantes, but the nature of these heathlands is not known. Unlikely to occur.
- *Hyaleus globuliferus* (Native Bee) Priority 3 listed by DPAW. Forages on the flowers of Woollybush *Adenanthos cygnorum* and some other species. Some Woollybush is present but this is a very widespread plant that responds positively to disturbance. Unlikely to occur.
- Leioproctus contrarius (Native Bee) Priority 3 listed by DPAW. Apparently dependent upon flowers of Goodeniaceae and known from Banksia woodlands. Recent surveys have shown that it is more widespread that previously thought.

This species has been recorded at Forrestdale and Murdoch however there are no records near the project area. Unlikely to occur.

- *Leioproctus bilobatus* (Native Bee) Priority 2 listed by DPAW. This species is known only from a few records on the Swan Coastal Plain, however there are no records near the project area. Unlikely to occur.
- *Throscodectes xiphos* (Cricket) Priority 1 listed by DPAW. Associated with Banksia Woodland which is absent from the proposed project area. Unlikely to occur.

### **5. DISCUSSION**

Due to widespread vegetation clearing in the region, few areas of intact native vegetation remain. As a result, intact native vegetation in the Baldivis area is of local importance and naturally regenerated areas may provide some value to local fauna.

Within the proposed disturbance footprint, native vegetation (intact or regenerated) is restricted mostly to the western half. Most of the eastern half had been previously cleared or disturbed.

### 5.1 Habitat Types

Habitats of conservation significance tend to be those that are both rare across the landscape and that are important for significant species and/or for biodiversity. Due to the extensive clearing in the region, all remaining native vegetation is likely to be of value to fauna and support isolated and fragmented faunal populations. However, as the project area is regenerating from recent clearing its value to fauna is largely habitat supplementation – providing foraging habitat to those species able to move through the area and persist in larger adjacent bush remnants. The project area thus may provide some foraging value to mobile species such as whistlers and honeyeaters.

### 5.2 Significant Species

While several species of conservation significance are known from the local area, few are expected to occur or depend on the project area. The site provides no breeding habitat value to Black-Cockatoo species and only very limited foraging value to Carnaby's Black-Cockatoo – as the site is dominated by *Acacia pulchella* shrubland. While appearing to contain habitat suitable to support the Quenda (low, dense shrubland), no evidence of this species was recorded. The project area does support a small population of locally significant Splendid Fairy-wrens and White-browed Scrubwrens. Impacts to species of conservation significance associated with the proposal are considered to be minimal.

### 5.3 Ecological Function

The vegetation of the project area is dominated by *Acacia pulchella* shrubland, with scattered trees (Marri and Tuart) and larger shrubs (*Acacia* species, *Calothamnus* species, *Adenanthos*) planted or naturally regenerated in the last five years. The project area is mostly surrounded by cleared and disturbed land. Some small areas of native vegetation occur to the north and west and a narrow strip of intact vegetation extends along Holcim's eastern boundary perimeter. As a result, the project area may provide some level of linkage to other adjacent bush remnants, particularly to bird species that are able to cross areas of cleared or disturbed habitat. It also provides linkage to adjacent habitat to the west, allowing Western Grey Kangaroos to move through the area. Significantly, conservation significant fauna species such as the Black-Cockatoos and Quenda are not expected to depend on the project area as a stepping stone to other areas of adjacent habitat. The project area as part of a larger foraging range or as a stepping stone to access adjacent habitats. The proposed development area

affects only part of the strip of revegetation that lies between the quarry and the road to the north, and thus any linkage function is likely to persist.

There are no conservation reserves or large areas of intact native vegetation adjacent to the proposed project area and, therefore, the project area does not contribute to or provide a buffer to any such areas. The site is surrounded by Miscellaneous Reserve R 37090 (a harvested pine plantation) which does contain some small native vegetation remnants.

### 5.4 Conclusions

The project area contains no rare or significant habitat types and is likely to support few conservation significant fauna species. Species of high conservation significance known from the local area are not expected to depend on or regularly utilise the proposed disturbance area. A small number of locally significant bird species may reside within the proposed disturbance footprint, but these species also occur in adjacent remnants. The project area is part of a loose network of remnant vegetation in the immediate region but the proposed development will retain a strip of revegetation.

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### Appendices

### Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

### Assemblage characteristics

<u>Uniqueness</u>. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

<u>Completeness</u>. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

<u>Richness</u>. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

### Vegetation/substrate associations (VSAs)

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver *et al.* 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even

small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

### Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

### Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and the Western Australian *Wildlife Conservation Act* 1950 (Wildlife Conservation Act). In addition, the Western Australian Department of Wildlife and Parks (DPAW) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in

### Appendix 3.

<u>Conservation Significance (CS) 1</u>: Species listed under State or Commonwealth Acts. Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The Wildlife Conservation Act uses a series of Schedules to classify status, but also recognizes the IUCN categories and ranks species within the Schedules using the categories of Mace and Stuart (1994).

### *Conservation Significance (CS) 2*: Species listed as Priority by the DEC but not listed under State or Commonwealth Acts.

In Western Australia, the DPAW has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the Wildlife Conservation Act but for which the DPAW feels there is cause for concern. Some Priority species are also assigned to the Conservation Dependent category of the IUCN.

### Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DPAW, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (DEP 2000).

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey 2002).

### Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

### Ecological processes upon which the fauna depend

These are the processes that affect and maintain fauna populations in an area and as such are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a project may be affected by processes such as fire regime, landscape patterns (such as fragmentation and/or linkage), the presence of feral species and hydrology. Impacts may be significant if processes are altered such that fauna populations are adversely affected, resulting in declines and even localised loss of species. Threatening processes as outlined below are effectively the ecological processes that can be altered to result in impacts upon fauna.

### Appendix 2. Explanation of threatening processes.

Potential impacts of proposed developments upon fauna values can be related to threatening processes. This is recognised in the literature and under the EPBC Act, in which threatening processes are listed (see Appendix 4). Processes that may impact fauna values are discussed below. Rather than being independent of one another, processes are complex and often interrelated. They are the mechanisms by which fauna can be affected by development. Impacts may be significant if large numbers of species or large proportions of populations are affected.

### Loss of habitat affecting population survival

Clearing for a development can lead to habitat loss for a species with a consequent decline in population size. This may be significant if the smaller population has reduced viability. Conservation significant species or species that already occur at low densities may be particularly sensitive to habitat loss affecting population survival.

### Loss of habitat leading to population fragmentation

Loss of habitat can affect population movements by limiting movement of individuals throughout the landscape as a result of fragmentation. Obstructions associated with the development, such as roads, pipes and drainage channels, may also affect movement of small, terrestrial species. Fragmented populations may not be sustainable and may be sensitive to effects such as reduced gene flow.

### Degradation of habitat due to weed invasion leading to population decline

Weed invasion can occur as a result of development and if this alters habitat quality, can lead to effects similar to habitat loss.

### **Increased mortality**

Increased mortality can occur during project operations; for example from roadkill, animals striking infrastructure and entrapment in trenches. Roadkill as a cause of population decline has been documented for several medium-sized mammals in eastern Australia (Dufty 1989; Jones 2000). Increased mortality due to roadkill is often more prevalent in habitats that have been fragmented (Scheick and Jones 1999; Clevenger and Waltho 2000; Jackson and Griffin 2000).

Increased mortality of common species during development is unavoidable and may not be significant for a population. However, the cumulative impacts of increased mortality of conservation significant species or species that already occur at low densities may have a significant impact on the population.

### Species interactions, including predation and competition

Changes in species interactions often occur with development. Introduced species, including the feral Cat, Red Fox and Rabbit may have adverse impacts upon native species and development can alter their abundance. In particular, some mammal species are very sensitive to introduced predators and the decline of many mammals in Australia has been linked to predation by the Red Fox, and to a lesser extent the feral Cat (Burbidge and McKenzie 1989). Introduced grazing species, such as the Rabbit, Goat, Camel and domestic livestock, can also degrade habitats and deplete vegetation that may be a food source for other species.
Changes in the abundance of some native species at the expense of others, due to the provision of fresh watering points, can also be a concern. Harrington (2002) found the presence of artificial fresh waterpoints in the semi-arid mallee rangelands to influence the abundance and distribution of certain bird species. Common, water-dependent birds were found to out-compete some less common, water-independent species. Over-abundant native herbivores, such as kangaroos, can also adversely affect less abundant native species through competition and displacement.

#### Hydroecology

Interruptions of hydroecological processes can have major effects because they underpin primary production in ecosystems and there are specific, generally rare habitats that are hydrology-dependent. Fauna may be impacted by potential changes to groundwater level and chemistry and altered flow regime. These changes may alter vegetation across large areas and may lead to habitat degradation or loss. Impacts upon fauna can be widespread and major.

Changes to flow regime across the landscape may alter vegetation and may lead to habitat degradation or loss, affecting fauna. For example, Mulga has a shallow root system and relies on surface sheet flow during flood events. If surface sheet flow is impeded, Mulga can die (Kofoed 1998), which may impact on a range of fauna associated with this vegetation type.

#### Fire

The role of fire in the Australian environment and its importance to vertebrate fauna has been widely acknowledged (Gill *et al.* 1981; Fox 1982; Letnic *et al.* 2004; Bamford and Roberts 2003). It is also one of the factors that has contributed to the decline and local extinction of some mammal and bird species (Burbidge and McKenzie 1998). Fire is a natural feature of the environment but frequent, extensive fires may adversely impact some fauna, particularly mammals and short-range endemic species. Changes in fire regime, whether to more frequent or less frequent fires, may be significant to some fauna. Impacts of severe fire may be devastating to species already occurring at low densities or to species requiring long unburnt habitats to survive. In terms of conservation management, it is not fire *per se* but the fire regime that is important, with evidence that infrequent, extensive and intense fires adversely affect biodiversity, whereas frequent fires that cover small areas and are variable in both season and intensity can enhance biodiversity. Fire management may be considered the responsibility of managers of large tracts of land.

#### Dust, light, noise and vibration

Impacts of dust, light, noise and vibration upon fauna are difficult to predict. Some studies have demonstrated the impact of artificial night lighting on fauna, with lighting affecting fauna behaviour more than noise (Rich and Longcore 2006). Effects can include impacts on predator-prey interactions, changes to mating and nesting behaviour, and increased competition and predation within and between invertebrates, frogs, birds and mammals.

The death of very large numbers of insects has been observed around some remote mine sites and attracts other fauna, notably native and introduced predators (M.Bamford pers. obs). The abundance of some insects can decline due to mortality around lights, although this has previously been recorded in fragmented landscapes where populations are already under stress (Rich and Longcore 2006). Artificial night lighting may also lead to disorientation of migratory birds. Aquatic habitats and open habitats such as grasslands and dunes may be vulnerable to light spill.

#### Appendix 3. Categories used in the assessment of conservation status.

IUCN categories (based on review by Mace and Stuart 1994) as used for the *Environment Protection* and *Biodiversity Conservation Act 1999* and the Western Australian *Wildlife Conservation Act 1950*.

Extinct	Taxa not definitely located in the wild during the past 50 years.				
Extinct in the Wild	Taxa known to survive only in captivity.				
Critically	Taxa facing an extremely high risk of extinction in the wild in the immediate				
Endangered	future.				
Endangered	Taxa facing a very high risk of extinction in the wild in the near future.				
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term future.				
Near Threatened	Taxa that risk becoming Vulnerable in the wild.				
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.				
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.				
Least Concern.	Taxa that are not Threatened.				

Schedules used in the WA Wildlife Conservation Act 1950

Schedule 1	Rare and Likely to become Extinct.
Schedule 2	Extinct.
Schedule 3	Migratory species listed under international treaties.
Schedule 4	Other Specially Protected Fauna

WA Department of Environment and Conservation Priority species (species not listed under the WA *Wildlife Conservation Act 1950*, but for which there is some concern).

Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4.	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

## Appendix 4. Ecological and threatening processes identified under legislation and in the literature.

Ecological processes are processes that maintain ecosystems and biodiversity. They are important for the assessment of impacts of development proposals, because ecological processes make ecosystems sensitive to change. The issue of ecological processes, impacts and conservation of biodiversity has an extensive literature. Following are examples of the sorts of ecological processes that need to be considered.

## **Ecological processes relevant to the conservation of biodiversity in Australia** (Soule *et al.* 2004):

- Critical species interactions (highly interactive species);
- Long distance biological movement;
- Disturbance at local and regional scales;
- Global climate change;
- Hydroecology;
- Coastal zone fluxes;
- Spatially-dependent evolutionary processes (range expansion and gene flow); and
- Geographic and temporal variation of plant productivity across Australia.

## Threatening processes [Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)]

Under the EPBC Act, a key threatening process is an ecological interaction that threatens or may threaten the survival, abundance or evolutionary development of a threatened species or ecological community. There are currently 19 key threatening processes listed by the federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC 2011):

- Competition and land degradation by feral/unmanaged Goats (Capra hircus);
- Competition and land degradation by feral Rabbits (Oryctolagus cuniculus);
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*);
- Incidental catch (bycatch) of Sea Turtles during coastal otter-trawling operations within Australian waters north of 28 degrees South;
- Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations;
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis;
- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris;
- Invasion of northern Australia by Gamba Grass and other introduced grasses;
- Land clearance;
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants;
- Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean;
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases;
- Predation by exotic rats on Australian offshore islands of less than 1000 km2 (100 000 ha);
- Predation by feral Cats (*Felis catus*);
- Predation by the European Red Fox (*Vulpes vulpes*);

- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs (Sus scrofa);
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species;
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*); and
- The reduction in the biodiversity of Australian native fauna and flora due to the imported Red Fire Ant, *Solenopsis invicta*.

**General processes that threaten biodiversity across Australia** (The National Land and Water Resources Audit):

- Vegetation clearing;
- Increasing fragmentation, loss of remnants and lack of recruitment;
- Firewood collection;
- Grazing pressure;
- Feral animals;
- Exotic weeds;
- Changed fire regimes;
- Pathogens;
- Changed hydrology—dryland salinity and salt water intrusion;
- Changed hydrology— such as altered flow regimes affecting riparian vegetation; and
- Pollution.

In addition to the above processes, SEWPaC has produced Significant Impact Guidelines that provide criteria for the assessment of the significance of impacts. These criteria provide a framework for the assessment of significant impacts. The criteria are listed below.

- Will the proposed action lead to a long-term decrease in the size of a population?
- Will the proposed action will reduce the area of occupancy of the species?
- Will the proposed action fragment an existing population?
- Will the proposed action adversely affect habitat critical to the survival of a species?
- Will the proposed action will disrupt the breeding cycle of a population?
- Will the proposed action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?
- Will the proposed action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
- Will the proposed action introduce disease that may cause the species to decline?
- Will the proposed action will interfere with the recovery of the species?

## Appendix F Aboriginal Heritage Assessment Summary



F

## Ethnosciences ABN: 47 065 099 228 Aboriginal Heritage

Summary of a Report of an Aboriginal Heritage Desktop Survey and Ethnographic Survey of Proposed Readymix Sand Quarry M70/1046 and MLA70/1241, and Archaeological Reconnaissance in relation to Stage 1 (M70/1046), Baldivis, Western Australia

Prepared for URS on behalf of Rinker Australia Pty Limited

By Edward McDonald, PhD and Bryn Coldrick, M.A.

July 2007



## **Aboriginal Heritage**

#### Disclaimer

The results, conclusions and recommendations contained within this report are based on information available at the time of its preparation. Whilst every effort has been made to ensure that all relevant data has been collated, the authors can take no responsibility for omissions and/or inconsistencies that may result from information becoming available subsequent to the report's completion.

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## Ethnosciences

## ABN: 47 065 099 228 Aboriginal Heritage

#### **Summary & Recommendations**

Ethnosciences was commissioned by URS on behalf of Rinker Australia Pty Limited (trading as Readymix) to undertake a desktop survey of a proposed sand quarry (M70/1046 and MLA70/1241), and an archaeological reconnaissance of Stage 1 (M70/1046) at Baldivis, Western Australia. Subsequently, Ethnosciences was requested to undertake ethnographic consultation in relation to the proposed development.

The desktop study involved a review of the Register of Aboriginal Sites held by the Department of Indigenous Affairs (DIA) and of published and unpublished literature, including reports of previous heritage surveys in the area. The purpose of the desktop study was to identify any known and potential Aboriginal heritage values within the proposed development area (PDA) that might be impacted by the proposed works.

A search of the Register of Aboriginal Sites found that the eastern portion of the PDA falls inside the boundary of the Serpentine River ceremonial and mythological site (Site ID 3582) as depicted on the public DIA mapping system. However, further investigation has confirmed that this is due to the fact that the Serpentine River site file is Closed Access and as a result, the spatial boundary of the site is denoted by two kilometre boxes on public mapping. Contact was made with DIA to ascertain the actual boundary of the site and the Department has advised that the site is the river itself and that neither the proposed Stage 1 project (M70/1046) nor the wider study area (MLA70/1241) actually intersect with Site 3582 (Serpentine River).

No additional sites were identified inside the study area during the search of the Register. However, far as can be ascertained, no specific Aboriginal heritage assessments had previously been undertaken of the study area. A number of surveys had taken place in the surrounding area, including a survey of the Kwinana Freeway

## Ethnosciences

## ABN: 47 065 099 228 Aboriginal Heritage

extension which identified an artefact scatter approximately 600m to the east of the study area (Site ID 3561 Karnup).

Though located in the Spearwood Sands, with its low number of archaeological sites, the existence of previously recorded archaeological sites in the surrounding area suggested that unrecorded sites may be present inside the PDA. This potential was somewhat lessened, though not completely eliminated, by the previous disturbance to the land, including the establishment of the pine plantation and explosives reserve. Previous research in similarly disturbed contexts has led to the discovery of archaeological sites.

Consequently, an archaeological reconnaissance of the PDA was undertaken in April 2007 to ascertain the potential of the area to contain archaeological material. No archaeological sites or archaeological material was observed during the inspection. Surface visibility was limited and the area was highly disturbed by forestry activities. A vehicular reconnaissance of a portion of the Stage 2 area (MLA70/1241) was also conducted confirming similar conditions.

On the basis of the reconnaissance, it is concluded that given the nature of surface visibility and ongoing ground disturbance, an archaeological survey would be unlikely to lead to the discovery of archaeological material. It is also the case, given the nature of the disturbance to the land, that archaeological monitoring would not be effective in the current situation. However, it would be appropriate to brief operational crews in respect of Aboriginal heritage in the event that cultural material is unearthed during sand quarrying operations. Aboriginal Heritage Management Procedures should also be established to deal with the possible discovery of Aboriginal cultural material. The proponent's obligations under the *Aboriginal Heritage Act (1972)* are outlined in Appendix 1.

Because there was also a potential that previously unrecorded ethnographic sites may be located within the Stage 1 and Stage 2 study areas, a preliminary consultation

### Ethnosciences

## ABN: 47 065 099 228 Aboriginal Heritage

and project notification process was implemented. Three Nyungar families who are known to claim association with the study area were contacted and an ethnographic survey of the PDA was conducted. No ethnographic sites were reported by the Aboriginal consultants, though they did request monitoring of the area. However, as pointed out above, it is concluded that archaeological monitoring is unlikely to be effective in the current situation.

#### Recommendations

- It is recommended that Aboriginal Heritage Management Procedures be prepared for the proposed sand quarry.
- It is further recommended that operational crews are briefed in respect of Aboriginal heritage in the event that cultural material is unearthed during sand quarrying operations.
- It is also recommended that should any Aboriginal sites be identified within the PDA, Ministerial consent under Section 18 of the *Aboriginal Heritage Act* (1972) to use the land on which the site is located should be obtained.

## Appendix G Traffic Impact Assessment

URS

#### URS Project No. 42908418/01/0

G

## Proposed Readymix Sand Quarry Stakehill Road, Baldivis

**Traffic Impact Statement** 

Prepared for: **Rinker Australia Pty Ltd**  Prepared by: **TRANSCORE PTY LTD** 3 Kimberley Street, West Leederville WA 6007 PO Box 42, Subiaco WA 6904 Telephone (08) 9382 4199 Facsimile (08) 9382 4177

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#### **APPENDIX A – SCHOOL BUS ROUTE**

#### **APPENDIX B – READYMIX TRUCK ROUTES**

APPENDIX C –STAKEHILL ROAD/PRIMARY ACCESS ROAD: PROPOSED INTERSECTION TREATMENT

## 1. INTRODUCTION & BACKGROUND

This Traffic Impact Statement has been prepared by Transcore on behalf of Rinker Australia Pty Ltd with regard to the proposed development of a sand quarry in Baldivis at Mining Lease M70/1046.

Prior to the Traffic Impact Statement prepared by Transcore, an independent traffic assessment was conducted by TARSC Pty Ltd and the reported key findings were:

- Additional traffic volume would not be significant;
- No current excessive delays or queues;
- Minor road modifications would be required at the intersection of the subject site access road and Baldivis Road.

A comprehensive stakeholder consultation exercise and social impact assessment was conducted by Coakes Consulting on behalf of the proponent. The consultation was carried out with a number of community groups and agencies including Rockingham City Council, the South West Group and local primary schools. Issues that arose from the consultation included traffic matters, namely:

- Sight distances
- Traffic queues at Stakehill Road near Old Mandurah Road during peak periods
- Crash incidents
- School bus stops and children crossing movements

As a result of the traffic issues raised by the community, the TARSC traffic assessment was reviewed and this Traffic Impact Statement additionally assesses the following list of issues:

- Cumulative impacts of Southern Gateway Alliance's operations with Readymix's proposed traffic movements;
- School bus routes/safety issues; and,
- Road safety along Stakehill Road and Baldivis Road.

The Traffic Impact Statement report will also independently assess the proposed access road/Stakehill Road intersection arrangement.

This report will feed into the Environmental Impact Assessment of the project by URS Australia Pty Ltd on behalf of the proponent.

## 2. EXISTING SITUATION

The subject site, which is currently part of the Peel Pine Plantation, is bordered by Stakehill Road to the north. There is a sealed single undivided access road serving the subject site which intersects with Stakehill Road approximately 400 metres west of Stakehill Road/Baldivis Road intersection and approximately 1.2 kilometres from the Stakehill Road/Harvey Road intersection. Refer **Figure 1** below. This road runs through the subject site and is the primary access road to the existing Department of Consumer and Employer Protection (DOCEP) explosives reserve site located south of the subject site. There are currently 3 access crossovers along Stakehill Road to the internal road/track network leading to the subject site. **Figure 2** shows the existing intersection of Stakehill Road and the primary access road. **Figures 3** and **4** show Stakehill Road east and west of its intersection with the primary access road respectively.



#### Figure 1: Aerial Photo of Subject Site

Figure 2: View of Stakehill Road/Primary Access Road intersection – Looking North



Figure 3: View of Stakehill Road from its Intersection with the Primary Access Road intersection – Looking West



Figure 4: View of Stakehill Road from its Intersection with the Primary Access Road intersection – Looking East



Stakehill Road in the vicinity of the subject site is a single undivided carriageway with a posted speed limit of 80km/hr. Based on the Western Australian Planning Commission (WAPC) Liveable Neighbourhoods guidelines (October 2004), this road functions as an Integrator Arterial B road. The Stakehill Road/Primary Access Road intersection is a priority-controlled unchannelised T-intersection with priority assigned to Stakehill Road.

According to traffic counts data sourced from Main Roads WA, this road east of Mandurah Road carried a weekday average of 6,120 vehicles per day in October 2004 with 2,898 trips eastbound (47%) and 3,222 trips westbound (53%).

As discussed later in Section 3 of this Report, the subject site would be operational during the weekdays and on Saturday mornings. Reviewing the Main Roads WA traffic counts data for weekdays and Saturday mornings, the peak hour traffic volumes on Stakehill Road were highest on the Saturday morning 10:15a.m. and 11:15a.m. (548 trips) and on the Friday evening between 4:30p.m. and 5:30p.m. (702 trips). It is assumed that as Stakehill Road is a truck route in a semi rural area with 15% of the traffic comprised of heavy vehicles.

**Figures 3** and **4** indicate that Stakehill Road is a straight road on approach to its intersection with Primary Access Road. Although there is some minor undulation along Stakehill Road east of the intersection, this undulation does not have a significant impact on sight lines and distances. It is estimated that sight distances of minimum 350m between a motorist on the Primary Access Road and approaching vehicles along Stakehill Road can be achieved. The available sight distances exceed the minimum Entering Sight Distances, Approach Sight Distances and Safe Intersection Sight Distances recommended by the

AUSTROADS Guide to Traffic Engineering Practice – Part 5: Intersections at Grade (2005) and the AUSTROADS Rural Road Design – A Guide to the Geometric Design of Rural Roads (2003) for a speed limit of 80km/h.

There are currently no dedicated footpaths along either side of Stakehill Road. However, there is a school bus stop located approximately two metres from the southern edge of Stakehill Road and immediately east of the Stakehill Road/Primary Access Road intersection as shown in **Figure 4**. The City of Rockingham has advised that this stop is decommissioned. According to information sourced from the Public Transport Authority, there are four existing school bus routes (non Transperth orange bus services) that traverse Baldivis Road/Stakehill Road, as follows:

- One route that traverses between the bus terminus on Paganoni Road and Tranby College via Stakehill Road;
- One route that traverses between the bus terminus on Gossage Road and Tranby College via Baldivis Road;
- One route that traverses between the bus depot on Eighty Road and Baldivis Primary School, and
- One route that traverses between the bus terminus on Paganoni Road and Baldivis Primary School.

Each bus route entails only one service in the morning and one service in the afternoon. There are three school bus stops along Stakehill Road/Baldivis Road. The nearest bus stop to the subject site is located on Baldivis Road, near its intersection with Churcher Road (1.2km north of the Primary Access Road/Stakehill Road intersection) and only serves the route between the bus terminus on Paganoni Road and Tranby College via Stakehill Road. Refer to **Appendix A**.

According to information provided by the proponent, the existing explosive reserve site south of the subject site generates low volumes (less than 20 vehicles per day) of traffic mainly comprising of light vehicles and an occasional explosives-carrying truck.

The traffic volumes recorded near Stakehill Road/Mandurah Road intersection would be lower in the vicinity of the subject site as traffic are distributed to the land uses located between Mandurah Road and the Primary Access Road. To allow for a robust assessment and allow for traffic growth since the 2004 traffic counts, it shall be assumed that the recorded traffic volumes along Stakehill Road near Mandurah Road are representative of the traffic volumes near the Primary Access Road. In addition, it shall also be conservatively assumed that there are at present 10 vehicles entering and 10 vehicles exiting the Primary Access Road during each peak period, and are directionally split with a 50/50 ratio to the east and west of the intersection.

**Figure 5** below depicts the estimated existing traffic volumes travelling through the Stakehill Road/Primary Access Road intersection. The directional split proportion is based on the recorded trend of 47% east, 53% west.

## Figure 5: Estimated Existing Weekday Morning (Evening) Peak Hour Volumes at Stakehill Road/Primary Access Road intersection



Available crash statistics along Stakehill Road and Baldivis Road have been sourced from Main Roads WA. These statistics were compiled from January 2001 to December 2005 and are depicted in **Figure 6** below. Also shown are the recorded daily volumes along Stakehill Road near its intersection with Old Mandurah Road, and Baldivis Road near its intersection with Sixty-Eight Road.



Figure 6: Crash Statistics along Stakehill Road and Baldivis Road (2001 - 2005)

The details of these crashes are summarised in Table 2 below.

Location	Nature	Severity	
Stakehill Road/Jarvis Road	1 head-on collision	1 medical casualty	
Stakehill Road/Fletcher Road	1 head-on collision	No casualty	
Stakehill Road/Eighty Road	1 right-angled collision	No casualty	
Stakehill Road/Baldivis Road	3 head-on collisions	2 medical casualties	
	2 right-angled collisions		
	2 collisions with large objects		
Baldivis Road/Churcher Road	1 head-on collision	1 medical casualty.	
Baldivis Road/Karnup Road	1 rear-end collision	1 medical casualty	
Baldivis Road/Sixty Eight Road	1 collision with a large object	1 medical casualty.	
Baldivis Road/Serpentine Road	2 rear-end collisions	No casualty	
	1 collision with a large object		

#### Table 2: Crash Statistics along Stakehill Road and Baldivis Road (2001 – 2005)

It is evident from the information above that the majority of the reported crashes along Stakehill and Baldivis Roads involved head-on collisions. It is also indicated by Main Roads WA data that out of the 16 accidents recorded in this locality, 15 of these occurred on level ground. Twelve of these 16 accidents occurred during dry weather conditions and more than half (10) of these 16 crashes occurred during the daytime.

However, 13 of these 16 crashes have been reported to occur while the motorists were negotiating curved sections of the above-mentioned roads. According to the information provided by City of Rockingham, the section of Stakehill Road/Baldivis Road with 7 recorded crashes has been the subject of road improvements as part of a Blackspot Funding Programme. Main Roads WA identified the S-Bend at the intersection of Baldivis Road/Stakehill Road as an accident prone area, and in early 2002, carried out roadworks to improve road safety under the National Blackspot Program. These works entailed realignment of the bend by changing the curve from a near ninety-degree bend to a smoothened bend, the replacement of existing turn signs by curve warning signs and increasing the advisory speed limit from 25km/h to 60km/h. Crash statistics reveal that from the start of 2001 to May 2002, there were 5 recorded crashes on this bend, all of which involved vehicles originating from the west and destined to the north. However, after the upgrading, between May 2002 to December 2005, the number of crashes has been reduced to 2 crashes.

## 3. **PROPOSED SITUATION**

It is proposed that the subject site be developed into a sand quarry, with access to be taken from the existing Primary Access Road. It is envisaged that the proposed quarry site would commence operations in December 2007 and operate for approximately 8 years. The normal operating times will be from 7:00a.m. to 6:00p.m. on weekdays and from 7:00a.m. to 12:00p.m. on Saturdays.

Based on information sourced from the proponent, the Readymix quarry operations would generate approximately 300 heavy vehicle trips per weekday, of which 80% would be semi-trailers, 15% semi-trailers plus trailers and 5% road trains. It is assumed that on Saturdays, the volume of vehicles would be 150 trips. Due to regulations, only semi-trailers would be permitted to travel east along Stakehill Road towards Baldivis Road and Kwinana Freeway. Semi-trailers with trailers and road trains would only be permitted to travel west towards Ennis Road/Mandurah Road. Refer to **Appendix B** for the truck routes. In addition, there would be an additional 100 standard (light) vehicles per day entering/exiting the site. The standard (light) vehicles and semi-trailers would enter and exit the site with a directional split ratio of 50/50. The other vehicles would only travel to and from the west. **Table 3** provides the resulting trips that would be generated by the Readymix Quarry, and the direction of distribution.

		INBOUND		OUTBOUND	
	Daily Volume	From	From	То	То
		East	West	East	West
Standard (light) vehicles	100	25	25	25	25
Semi-Trailers	240	60	60	60	60
Semi-Trailers plus Trailers	45	-	22	-	23
Road trains	15	-	7	-	8
Total	400	85	114	85	115

Table 3: Forecasted Trips To/From Readymix Quarry

It has been assumed that 10% of the daily traffic generated by the Readymix Quarry would occur during the road network peak period (including Saturday morning peak period). **Figure 7** below depicts the morning and evening peak hour trips entering/exiting the subject site. To ensure a robust assessment, it has been conservatively assumed that the highest recorded peak volumes including the peak Saturday morning period reflect the typical weekday peak period volumes.

**Figure 8** shows the projected traffic volumes (existing plus site-generated trips) through the existing Stakehill Road/Primary Access Road intersection.

Figure 7: Projected Readymix Quarry-Generated Weekday Morning (Evening) Peak Hour Volumes at Stakehill Road/Primary Access Road intersection



Figure 8: Projected Morning (Evening) Peak Hour Volumes at Stakehill Road/Primary Access Road intersection



### 4. TRAFFIC ASSESSMENT

#### 4.1 Intersection Capacity Analysis

In order to establish the traffic operations of the intersection of Stakehill Road/Primary Access Road, a capacity analysis using SIDRA computer package was undertaken. This package is a commonly used intersection-modelling tool by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These items are defined as following:

- Degree of Saturation: is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for varied traffic flow up to one for saturated flow or capacity.
- Level of Service: is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of services, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- Average Delay: is the average of all travel time delays for vehicles through the intersection.
- **95% Queue**: is the queue length below which 95% of all observed queue lengths fall.

The result of the existing SIDRA analysis for the intersection is detailed in **Table 3** below. The levels of service for the intersection are A during both peak periods, which is the highest level of service achievable. The results show that the maximum traffic queues on Stakehill Road would be on the western leg of the intersection (right turns from Stakehill Road) and would be less than 16 metres (which is equivalent to three standard (light) vehicles or one semi-trailer) with an average delay of less than three seconds. This is based on the assumption that straight-through eastbound traffic would not bypass any vehicles queueing to turn right into the Primary Access Road. The average delay for traffic turning left from Stakehill Road eastern leg into the Primary Access Road is less than 15 seconds. The delays are due to the slower negotiation speeds by left-turning traffic at a basic T-intersection. The average delay on the Primary Access Road is less than 16 seconds, with a queue of three metres (equivalent to less than one standard vehicle).

Based on the results of the SIDRA analysis, the intersection with the additional traffic generated from the Readymix Quarry operations would operate at good levels of service and with ample spare capacity. Nonetheless, as discussed below in Section 4.2, in order to improve traffic operations and safety, it is recommended that, if feasible, auxiliary turn lanes be provided on Stakehill Road on both approaches to the Primary Access Road to allow for the separation of turning traffic from the straight-through traffic. These treatments would provide

more intersection capacity and would reduce the queues and delays along Stakehill Road.

MORNING PEAK HOUR					
Approach	Movement	Degree of	Level of	Average	95 % Queue
	Type	Saturation	Service	Delay (sec)	(m)
Primary Access Road South Approach	L R	0.080 0.080	B B	14.6 14.6	2 2
Stakehill Road	L	0.184	B	14.5	0
East Approach	T	0.184	A	0.0	0
Stakehill Road	T	0.176	A	2.3	11
West Approach	R	0.176	A	2.3	11
ALL VEHICLES		0.184	A	2.1	11
		<b>EVENING PEA</b>	K HOUR	-	-
Approach	Movement	Degree of	Level of	Average	95 % Queue
	Type	Saturation	Service	Delay (sec)	(m)
Primary Access Road South Approach	L R	0.096 0.095	C C	15.8 15.8	3 3
Stakehill Road	L	0.233	B	14.5	0
East Approach	T	0.233	A	0.0	0
Stakehill Road	T	0.221	A	2.8	16
West Approach	R	0.221	A	2.8	16
ALL VEHICLES		0.233	Α	2.1	16

## Table 3: SIDRA Output – Forecast Stakehill Road/Primary Access Road Capacity Analysis During the Morning and Evening Peak Hour

T – through lane,– R - right turn lane, - L – left turn lane

#### 4.2 Proposed Intersection Treatment

Based on the forecasted traffic volumes through the Stakehill Road/Primary Access Road intersection as shown in **Figure 7**, the AUSTROADS Guide to Traffic Engineering Practice – Part 5: Intersections at Grade (2005) recommends that an <u>Au</u>xiliary lane <u>Right</u> turn treatment (AUR), whereby the road pavement of Stakehill Road eastbound carriageway is widened to allow for a heavy vehicle (19.0m long) to deviate from its through path and pass on the left of a single unit heavy vehicle. However, the same document also states that if a longer storage length is required, a <u>Channelised Right</u> turn (CHR) should be used whereby painted medians on both sides of the intersection is required. As road trains are

expected to turn right into the Primary Access Road from Stakehill Road, the right turn treatment recommended is a <u>Channelised Right turn</u>.

An <u>Au</u>xiliary Left turn treatment (AUL) is also recommended whereby an auxiliary lane is provided for the declaration, turning and storage, where necessary, of left turning traffic clear of the through traffic lane. The same document also recommends a left-turn storage length of 75m (including taper) for a 70km/hr road (Assuming the speed limit in this vicinity is reduced to 70 km/h – see section 4.5.2). As the largest vehicles turning left into the Primary Access Road would be a semi-trailer, the 75m left turn slip lane would be adequate. Refer to **Appendix C** for the proposed conceptual intersection layout. If feasible, the length of the proposed AUR would need to be increased from that shown on the concept plan in **Appendix C** to allow for the larger heavy vehicles. A detailed design to ensure feasibility and that turning paths for the largest vehicle turning into and out of the intersection to the west (road trains) and to the east (semi-trailers) can be accommodated would need to be undertaken upon approval of the conceptual intersection layout.

#### 4.3 Cumulative Impact of Southern Gateway Alliance Traffic

The Southern Gateway Alliance (SGA) prepared the *New Perth Bunbury Highway* – *Baldivis Extraction Management Plan* report in April 2007. According to this report, SGA proposes to establish two quarry sites on Reserve No. 37 090 for the supply of fill sand and limestone for the New Perth Bunbury Highway (NPBH) and will operate these sites for the duration of the NPBH project from 2007 to mid 2009. SGA also proposes to liaise with Readymix regarding the site management issues such as transport routes, site access, fencing and on-going site management during the period of SGA's extraction operations.

SGA proposes to extract from one site at a time, with extraction of the site closer to Readymix's extraction site to be carried out in 2007. Thereafter, extraction from the other site further south would be conducted between 2008 and 2009. The hours of operation would be between 7:00a.m. and 7:00p.m. Monday to Saturday inclusive.

The SGA report has identified that the sight distance at the intersection of Karnup Road/Baldivis Road is inadequate and SGA is currently in the process of obtaining necessary clearing approvals to improve the sight distance. In an independent road safety review, Transcore has also noted safety issues at this intersection. The safety review is discussed further in Section 4.5 below.

According to the report, there would be 200 heavy vehicles trips per day generated by SGA's extraction site in Stage 1. The traffic volume generated by SGA's Stage 2 extraction site would also be 200 heavy vehicle trips per day. These heavy vehicles would be comprised of semi-trailers. To reduce the impact on the surrounding local road network, SGA will create a direct connection to the Kwinana Freeway extension. This connection is expected to be constructed and open for use by the heavy vehicles as part of SGA's Stage 2 extraction

activity, and heavy vehicles would be directed to use this connection instead of Stakehill Road. Until this connection is available, SGA's generated traffic would use the existing access road crossover denoted as "A" in **Figure 1** of this report. SGA has selected this access crossover based on the available sight distance at this location. SGA will also upgrade this intersection to accommodate heavy vehicle movements and adequate signage would also be provided. SGA is committed to review the safety of the intersection and implement changes as required ensuring road safety is not compromised.

Based on SGA and Readymix extraction timeframes, the additional traffic volumes on Stakehill Road are expected to be as follows:

- February 2007 December 2007: SGA generated traffic of 200 heavy vehicles per day
- January 2008 December 2014: Readymix generated traffic of 300 heavy vehicles per day

Accordingly and based on the current timeframes, there would be no cumulation of heavy vehicle traffic from SGA's site and Readymix's site.

In the event that the connection to the Kwinana Freeway is not ready by early 2008, SGA's Stage 2 generated traffic would continue to use crossover "A" on Stakehill Road in the interim. There would then be a cumulation of heavy vehicle traffic from both SGA's Stage 2 site and Readymix's site. In this scenario, all 200 semi-trailer trips from the SGA site would use Stakehill Road to head north along Baldivis Road. Assuming that 10% of these trips occur during each peak morning and evening period, and that the inbound-outbound trips are split 50/50. Therefore, there would be 10 additional trips heading east along Stakehill Road past the Stakehill Road/Primary Access Road intersection towards Baldivis Road, and another 10 additional trips heading west along Stakehill Road past the Stakehill Road/Primary Access Road intersection towards the pit access road crossover "A". The SIDRA analysis was conducted again with the addition of these trips to the projected peak period trips at the Stakehill Road/Primary Access Road intersection. The results are summarised in **Table 4**.

Table 4: SIDRA Output – Forecast Stakehill Road/Primary Access Road Capacity Analysis During the Morning and Evening Peak Hour with SGA Heavy Vehicle Traffic

MORNING PEAK HOUR					
Approach	Movement	Degree of	Level of	Average	95 % Queue
	Type	Saturation	Service	Delay (sec)	(m)
Primary Access Road South Approach	L R	0.082 0.082	B B	14.8 14.8	2 2
Stakehill Road	L	0.189	B	14.5	0
East Approach	T	0.189	A	0.0	0
Stakehill Road	T	0.182	A	2.4	12
West Approach	R	0.182	A	2.4	12
ALL VEHICLES		0.189	А	2.1	12
		EVENING PEA	K HOUR		
Approach	Movement	Degree of	Level of	Average	95 % Queue
	Type	Saturation	Service	Delay (sec)	(m)
Primary Access Road South Approach	L R	0.098 0.098	C C	16.0 16.0	3 3
Stakehill Road	L	0.237	B	14.5	0
East Approach	T	0.238	A	0.0	0
Stakehill Road	T	0.228 0.228	A	2.9	17
West Approach	R		A	2.9	17
ALL VEHICLES		0.238	A	2.2	17

T – through lane, – R - right turn lane, - L – left turn lane

The SIDRA results show that even in the worst case scenario where all 200 heavy vehicles would use Stakehill Road to head north towards Baldivis Road, the Stakehill Road/Primary Access Road would still perform with good levels of service. In particular, the Stakehill Road eastern and western approaches would continue to perform at the same levels of service when compared to **Table 3**.

Therefore, the cumulative impact of the SGA traffic would be negligible on the intersection performance of the Stakehill Road/Primary Access Road intersection. Furthermore, in comparison with the existing eastbound daily traffic volumes of 2,898 vehicles per day, and Stakehill Road's capacity to carry up to 15,000 vehicles per day as an Integrator Arterial B road, the worst case scenario increase of 500 more vehicle trips (200 from SGA and 300 from Readymix) can still be accommodated for with no significant impact on the existing capacity and traffic flow along Stakehill Road, Baldivis Road and the intersections along these roads.

Stakehill Road and Baldivis Road lead to higher order roads which have higher capacities to accommodate the traffic from SGA and Readymix.

#### 4.4 School Bus Movements and Bus Stops

The school bus routes and designated bus stops shown in **Appendix A** was sourced from the Public Transport Authority. The routes between the termini/depots and Tranby College/Baldivis Primary School via Stakehill Road/Baldivis Road are the same for both the inbound and outbound school bus trips, with only one service running in the morning and one service in the evening for each route. According to the Public Transport Authority, the existing school bus service provision for this neighbourhood is currently under review, with outcomes of the review available in June 2007.

Notwithstanding the outcomes of the review, it is recommended that where practical and feasible, the designated school bus stops should be upgraded by providing a bus stop area, in the form of a gravel hardstand and in accordance with Public Transport Authority guidelines for rural contract school bus services, along the road verge so that buses are able to pull off the road and into the designated area without obstructing traffic flow along Stakehill Road and Baldivis Road. A visible bus stop pole should also be installed at the head of the bus stop area so that motorists are aware of the location of these bus stops.

It was observed that there are bus stop poles located along Stakehill Road and Baldivis Road, which are no longer required as these bus stops have been decommissioned. It is therefore recommended that the Public Transport Authority remove all unnecessary bus stop poles should be removed to avoid unnecessary confusion by motorists, school buses and school children.

#### 4.5 Road Safety

#### 4.5.1 Signage, Line Marking and Roadside Landscaping

Transcore has undertaken a site investigation of Stakehill Road and Baldivis Road between Mandurah Road and Safety Bay Road to identify potential areas for improvement/upgrades to the existing signage, line marking and roadside landscaping so as to alleviate road safety concerns by the local community. This section reports the findings, commencing from the western end of Stakehill Road to the northern end of Baldivis Road.

One of the observations was that the visibility of the Stakehill Road/Eighty Road intersection is obstructed by the roadside vegetation/verge plantation. It is recommended that the vegetation be pruned regularly to help improve sight visibility of the intersection.

It was also noted that there is a bend along Stakehill Road east of its intersection with Ukich Place. It is recommended that the bend be supplemented with a set of curve warning signs and advisory speed limit of 60km/hr in both directions.

On the approach to the Stakehill Road/Primary Access Road intersection, it is recommended that in addition to the proposed intersection upgrade treatment as discussed in Section 4.2 of this Report, a set of advanced Side Road Junction signs be installed on both the eastern and western approaches to the intersection so that motorists may be aware of potential turning traffic at this intersection. It is also recommended that Truck warning signs be installed on both approaches to this intersection so that motorists can expect heavy vehicle turning traffic along this section of Stakehill Road.

There is a bend along Stakehill Road east of Firbank Close as shown in **Figure 9**. Although there is a curve sign on the approach to the bend, there is no advisory speed limit sign. It is recommended that an advisory speed limit sign of 60km/hr be installed below the existing curve sign. In addition, this sign should be relocated east of the Stakehill Road/Primary Access Road intersection so that vehicles turning right from the Primary Access Road can also be forewarned of the bend.

Figure 9: View of Stakehill Road east of Stakehill Road/Firbank Close intersection – Looking East



As reported in Section 2 of this report, the crash statistics indicated that 80% of the reported crashes occurred while the motorists were negotiating curved sections of Stakehill and Baldivis roads, and half of these types of crashes occurred at the interface of Stakehill Road and Baldivis Road between 2001 and 2005. The horizontal alignment on the approach to the Stakehill Road/Baldivis Road intersection undergoes a series of bends/curves. A motorist approaching the intersection from the north would need to negotiate an S-Bend at the Baldivis Road/Karnup Road intersection, followed by a curve to the left south of the Baldivis Road/Churcher Road intersection. There is a curve warning sign with a 60km/hr advisory speed limit on the southbound carriageway in advance of the S-Bend, however, there is no corresponding curve warning sign on the northbound approach. Similarly, although there is a curve warning sign with 60km/hr advisory speed limit sign on the northbound carriageway of Baldivis Road on the approach to the bend south of Baldivis Road/Churcher Road intersection, there is no corresponding warning sign on the southbound approach.

It is recommended that the missing curve sign with the 60km/hr advisory speed limit sign is installed along Baldivis Road on the southbound approach to the bend south of Baldivis Road/Churcher Road intersection.

It is also recommended that the existing curve sign on the southbound carriageway approach to the S-Bend at the Baldivis Road/Karnup Road intersection be replaced with an S-Bend warning sign. In addition, the corresponding S-Bend and 60km/hr advisory speed limit sign should be installed on the northbound carriageway on the approach to this S-Bend.

There is an existing tree located opposite the T-intersection of Baldivis Road and Serpentine Road. The proximity of this tree to the road carriageway represent a hazard. Refer **Figure 10**. It is recommended that consideration should be given to the removal or relocation of this tree. Although there are 3 recorded crashes at this intersection, according to the advice provided by City of Rockingham and because of the extension of the Freeway and Karnup Road connection to the Freeway, the traffic volumes using Serpentine Road is anticipated to drop significantly and therefore no improvement measures are recommended at this intersection.



#### Figure 10: Baldivis Road looking North at its Intersection with Serpentine Road

#### 4.5.2 Speed Limit

In order to improve traffic safety and to bring the speed environment in line with the physical environment and traffic growth/urbanisation of the area, it is recommended that speed limit along Stakehill Road/Baldivis Road be reduced to 70km/h between Lugg Road and Mandurah Road.

#### 4.5.3 <u>Road Maintenance</u>

With regards to the maintenance of Stakehill Road and Baldivis Road, Readymix proposes to set up an alliance with the City of Rockingham, as the responsible authority, to monitor these roads' standard and quality. Accordingly, any damage of the road as a result of Readymix heavy vehicles would be addressed through the City of Rockingham.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

This Traffic Impact Statement found that the subject site would generate approximately 58 vehicle trips (inbound and outbound) along Stakehill Road, and 26 vehicle trips (inbound and outbound) during the peak morning and evening road network period.

The existing T-intersection of Stakehill Road/Primary Access Road has ample capacity to accommodate the increase in traffic due to the subject site. However, it was recommended that based on the AUSTROADS guidelines, an auxiliary right turn and left turn lane be provided on Stakehill Road at each approach to its intersection with the Primary Access Road. This would allow minimal disruption of traffic flows along Stakehill Road and reduce conflict potential between turning vehicles and straight-through vehicles.

Based on SGA's and Readymix's extraction timeframes, it is unlikely that Stakehill Road would carry both SGA's and Readymix's heavy vehicle traffic at the same time. However, Transcore has reviewed the potential cumulative impact of the SGA traffic in the worst case scenario when all 200 trips generated by the SGA site would use Stakehill Road instead of the direct connection to the Kwinana Freeway extension over the same duration when Readymix's extraction activity is underway. In comparison with the existing traffic volumes and the road capacity, the increase in vehicles trips can still be accommodated for with no significant impact on the existing capacity and traffic flow along Stakehill Road, Baldivis Road and the intersections along these roads in the vicinity of these sites. Stakehill Road and Baldivis Road lead to higher order roads which have higher capacities to accommodate the traffic from SGA and Readymix.

In addition, Transcore also conducted a review of the existing road safety issues along Stakehill Road and Baldivis Roads and provided a series of recommendations. These are summarised below in **Table 5** and addresses several of the traffic concerns raised by the local community.

Readymix, in alliance with the City of Rockingham, proposes to monitor the Stakehill Road and Baldivis Road standard and quality, and would address any damage caused by the Readymix trucks through the City of Rockingham.

# Table 5: Summary of Stakehill Road an Baldivis Road Safety Review & Recommendations

Issue	Recommendation	Consequence	
No designated bus stop area.	Provide a bus stop area of 18m x 2.5m within road verge in the form of gravel hardstand where practical.	Reduce obstruction of traffic flow on Stakehill and Baldivis Roads.	
Existing bus stop poles are old and not very visible.	Install visible bus stop poles.	Increase motorist and commuter awareness of bus stop location.	
Several decommissioned bus stops along Stakehill Road and Baldivis Road verges.	Remove redundant existing bus stop poles.	Reduce motorist and commuter confusion.	
Obstructed visibility of Stakehill Road/Eighty Road intersection.	Prune overgrown vegetation.	Improve sight visibility to/from the intersection.	
Horizontal bend along Stakehill Road east of Ukich Place.	Install curve warning signs with advisory speed limit of 60km/hr.	Increase motorist awareness Reduce potential for rear-end, head-on and out-of-control collisions.	
Increased heavy traffic movement at Stakehill Road/Primary Access Road intersection.	Install Truck warning signs. Install Side Road Junction warning signs. Provide right turn and left turn auxiliary lanes, if feasible.	Reduce interruptions of traffic flow along Stakehill Road. Reduce potential for vehicular conflict between through traffic and turning traffic.	
Horizontal bend along Stakehill Road east of Firbank Close with missing advisory speed limit sign.	Install an advisory speed limit sign of 60km/hr below the existing curve sign.	Increase motorist awareness Reduce potential for rear-end, head-on and out-of-control collisions.	
Horizontal bend along Baldivis Road near Churcher Road with missing curve and advisory speed limit sign on southbound approach.	Install curve sign with the advisory speed limit sign of 60km/hr along Baldivis Road on the southbound approach to the bend south of Baldivis Road / Churcher Road intersection.	Increase motorist awareness Reduce potential for rear-end, head-on and out-of-control collisions.	
S-Bend at the Baldivis Road / Karnup Road intersection.	Replace existing curve sign on the southbound carriageway approach to the S-Bend at the Baldivis Road / Karnup Road intersection with an S-Bend warning sign. An S-Bend and advisory speed limit sign of 60km/hr should be installed on the northbound carriageway on the approach to this S-Bend.	Increase motorist awareness Reduce potential for rear-end, head-on and out-of-control collisions.	
Tree located opposite Baldivis Road / Serpentine Road T- intersection.	Existing tree be removed or relocated.	Reduce potential collision with tree.	
80km/hr speed limit along Stakehill Road and Baldivis Road	Reduce to 70km/hr between Lugg Road and Mandurah Road.	Reduce speed-related collisions. Provide safer turning opportunities.	

#### **APPENDIX A – SCHOOL BUS ROUTES**






### **APPENDIX B – READYMIX TRUCK ROUTES**



### APPENDIX C -PRIMARY ACCESS ROAD/STAKEHILL ROAD: PROPOSED INTERSECTION TREATMENT



## Appendix H Environmental Management Plan





# **Environmental Management Plan**

Baldivis Sand Quarry

Stage 1 and Expansion Project - Environmental Management Plan

NOVEMBER 2013

Prepared for Holcim (Australia) Pty Ltd

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- Appendix N BSQ Groundwater Operating Strategy



### 1.1 Element

This Environmental Management Plan (EMP) has been compiled from a series of Management Plans for the Baldivis Sand Quarry; including the Stage 1 Project and Project Expansion. The purpose of the EMP is to provide measures proposed by Holcim (Australia) Pty Limited (HAUS), formerly known as CEMEX and Readymix, to prevent or mitigate potential impacts to the environment during construction and operation of the Stage 1 Project and Expansion Project. The Management Plans were developed based upon the significant issues identified during the environmental risk assessment process undertaken for the Stage 1 Project and Expansion Project.

At this time, the relevant Management Plans incorporated into this EMP comprise:

- Fauna Management.
- Fire Management.
- Hydrocarbon Management.
- Pest Management.
- Waste Management.
- Weed Management.
- Dust Management.
- Noise Management.
- Aboriginal Heritage Management.
- Transport Management.
- Groundwater Operating Strategy.

The individual Management Plans and the EMP as a whole is a live document that will be regularly reviewed, and revised in liaison with the relevant regulatory bodies and stakeholders. The Management Plans (with the exception of the Groundwater Operating Strategy) have also been created as standalone documents to fit within HAUS Safety Health and Environment (SHE) System.

### 1.2 **Project Description**

The Baldivis Sand Quarry is being undertaken on M70/1046, which is located approximately 50 km south of Perth, and 14 km south southeast of Rockingham, Western Australia (Figure 1).

The key components of the approved Stage 1 Project comprise:

- Quarrying, screening and washing of approximately 7 Mt of sand within an extraction area of 30 ha
  over a life of eight years to produce concrete, fill and brick layers' sand. The sand is quarried by
  front end loader and, if required, screened and washed at the mobile screening and washing plant.
  Washing water is deposited to a series of sedimentation ponds for settling of fines. Clay fines
  deposited are a by-product and are regularly removed and incorporated into sand products for sale.
- Abstraction of groundwater for washing of sand and dust suppression. Up to 150,000 kL are abstracted per annum.
- Transport of sand offsite. Up to 300 heavy vehicle movements occur each weekday and up to 150 heavy vehicle movements occur each Saturday for the transport of sand.
- Supporting infrastructure and facilities including a site office, lunch room and ablutions, a maintenance and equipment storage area, fuelling facility, weighbridge, power supply, wheel wash facility, power and communication lines and waste collection area.



An Explosives Reserve (Reserve 38575, Figure 2) administered by the Department of Consumer and Employment Protection (DoCEP) is located to the south of the Stage 1 Project Site. HAUS will maintain a separation distance of 100 metres from the Explosives Reserve until the Reserve is decommissioned.

Previously, the site was a Crown Reserve (Reserve 37090, Figure 2) set aside for forestry purposes and was administered by the Department of Environment and Conservation (DEC). A pine plantation that was present on the site was cleared by the Forest Products Commission (FPC) due to the presence of the European House Borer. Native title is not applicable to the site area.

The Stage 1 Project site is zoned Urban Deferred under the City of Rockingham's Town Planning Scheme. It is planned that, following the completion of quarry operations, the site will be transferred to LandCorp for residential development.

HAUS proposes to expand the existing Stage 1 of the Baldivis Sand Quarry (the expansion is hereafter referred to as the "Expansion Project") to continue to supply fill sand for the Perth Metropolitan Area and South West until approval can be sought for Stage 2 of the proposal.

The key components of the Expansion Project comprise:

- Extraction of up to 500,000 tonnes (t) of sand within a Limit of Extraction area of 7.21 ha. The Limit
  of Extraction area will extend 100 m into the existing 250 m buffer located along Stakehill Road. A
  buffer of approximately 150 m will remain in place adjacent to Stakehill Road. The sand would be
  quarried by front end loader, and loaded for transportation off site. No screening or washing of
  sand is proposed for the Expansion Project as all sand quarried will be utilised for fill.
- Transport of sand to customers within the Perth Metropolitan Area and South West along existing Stage 1 transport routes at the same or lower levels of existing Stage 1 vehicle volume and composition.
- Abstraction of up to 150,000 kL per annum of groundwater for dust suppression in accordance with the existing Licence To Take Water [GWL 162863(2)].
- Use of all other existing Stage 1 infrastructure comprising access road, weighbridge, power supply, communications, maintenance workshop, administration office, ablutions, crib room, fuelling facility, wheel wash facility and waste collection area.

Quarrying of the Expansion Project resource is expected to commence upon receipt of environmental approval and will enable HAUS to continue the current rate of throughput for another year with the resource life expected to extend for two to three years depending on market demand. HAUS intends to lodge approvals for Stage 2 of the Baldivis Sand Quarry Project located within Mining Lease M70/1241 within this time.

A site layout for the Expansion Project is shown in Figure 3.

### 1.2.1 Support Facilities

#### 1.2.1.1 Access

The entire Stage 1 Project site is fenced with signage to meet DMP requirements to prevent unauthorised access to the site.



Access is via the existing access road to the Explosives Reserve and an existing building to the north east of the site. Both facilities are located within Reserve 38575 held by DMP. The access road is a sealed road with a roundabout constructed in consultation with DMP.

A weighbridge is located at the entrance to the quarry area for the processing of sands for sale prior to transport offsite to customers. Prior to entering the weighbridge, trucks are required to pass through a wheel wash facility to minimise the spread of weeds to and from the site.

The existing building has been leased from DMP and is used as a site office, lunch room and for ablutions.

A small car park (8 bays) for workforce and visitor parking is located adjacent to the existing building onsite which is leased from DMP.

### 1.2.1.2 Maintenance Area, Equipment Storage Area and Fuelling Facility

A maintenance area, equipment storage area for the storage of heavy equipment and fuelling facility is located within a fenced compound in the north of the Stage 1 site, part of which is within land leased from DMP.

The maintenance area contains one bay with a containment apron; wash down bay with drive-in sump and an oil/hydrocarbon separator.

Oils are stored in the Stage 1 maintenance area for equipment maintenance and are segregated and bunded in accordance with Australian Standard (AS) 1940 and DMP and DER requirements.

Diesel is stored in the maintenance area in a self-bunded 20,000L capacity storage tank. The fuel storage and refilling facility is bunded in accordance with AS 1940 and DMP and DER requirements, with appropriate surface water drainage and collection. A dangerous goods licence is held for the storage of diesel onsite.

### 1.2.1.3 Waste Collection Facilities

The waste compound is a collection and storage point for domestic, industrial and hydrocarbon waste prior to disposal offsite and is located within the fenced compound in the north east of the Stage 1 site.

Wheel washing is undertaken using a closed-circuit water recycling system.

### 1.2.1.4 Communication Lines

Communications run from the existing communication network at Baldivis Road along the access road to the fenced compound and weighbridge. The existing building leased from DMP and used as a site office, lunch room and ablutions has existing communications.

#### 1.2.1.5 Power

A 300 kVA diesel generator is located at the screening and washing plant. The generator contains its own fuel tanks and is self bunded in accordance with AS 1940 and DMP and DER requirements. Power is reticulated around the Stage 1 Project using aerial transmission lines. Step down transformers have been installed to achieve the desired final voltage.



Power lines run from the existing Synergy network at Baldivis Road along the access road to the fenced compound and weighbridge. The existing buildings onsite leased from DMP are connected to the Perth Metropolitan Area grid operated by Synergy.

### 1.2.2 Area of Disturbance

The total area of land disturbance for the Stage 1 Project was 36.3 ha, which comprised 32.8 ha of new disturbance and 3.5 ha of existing disturbance (DMP's existing access road and building).

No clearing of native vegetation occurred within the Stage 1 Project Area as the site has been cleared by FPC prior to commencement of operations.

The total area of land disturbance for the Expansion Project is anticipated to be 7.21 ha.

Clearance of rehabilitated vegetation will be required for the Expansion Project. The area was rehabilitated in 2008 following clearance, by FPC, of the European Borer infested pine forest. As less than 10 ha of vegetation will be cleared, clearing will be addressed through the 10 ha clearing allowance per tenement, per financial year, as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

### 1.2.3 Operational Activities

The normal operating hours for the quarry are six days a week from 7am to 6pm, each Monday to Friday, and 7am to 1pm, each Saturday. Occasionally, quarry operations may extend to 6pm on Saturdays in special circumstances.

Prior to commencement of quarrying for the Stage 1 Project, a buffer of 250 m was delineated from the quarry area to the northern boundary of M70/1046 adjacent to Stakehill Road. A bund was constructed to provide a visual screen from quarry operations along Stakehill Road.

A 150 m existing revegetated area will be left in place between quarry operations and Stakehill Road for the Expansion Project. This will act as a screening buffer between the Expansion Project and sensitive receptors to the north of the Project Area.

### 1.2.3.1 Quarrying and Processing

Quarrying will be undertaken progressively from the southern to northern boundary of the quarry area, using a front end loader. It is not expected that overburden will be produced throughout operations as the sand resource occurs immediately below the topsoil. A distance of at least of 2 m between the pit floor level and the groundwater level will be maintained. No dewatering will be required as quarrying will be undertaken above the groundwater table.

Sand extracted is either directly loaded onto trucks and processed for sale at the weighbridge for transport to customers offsite (Stage 1 and Expansion Project) or is loaded in the mobile screening and washing plant for washing and or screening prior to sale (only the Stage 1 Project required use of a screening and washing plant for screening and washing of sand prior to sale). Organic debris that is required to be removed from screened sand is stockpiled within the screening bund area for use in rehabilitation. If required to meet specifications for use in concrete, sand may be further treated by washing.

Water generated from the sand washing process (only required during Stage 1 of the Project) is disposed to a series of sedimentation ponds for settling of the fines. The sand washing water



comprises approximately 10% fines and 90% water by volume. No additional contaminants are expected to be present within the washing sand water. Excess water in the sedimentation ponds is recycled as much as practicable to the mobile washing plant for reuse.

The ponds are shallow, unlined ponds, approximately 30 m wide by 103 m in length and up to 3.5 m in depth. Each pond has a capacity of up to 9,270 m3. The design of ponds has incorporated a 0.5 m freeboard to allow the system to accommodate a 1 in 100 year, 72 hour rainfall event (200 mm). A 10 m exclusion zone is located around each pond for safety as the sands will subside to their natural angle of repose over time.

### 1.2.3.2 Transportation of Sand

Sand quarried onsite is transported by semi-trailers, semi-trailers plus trailers and road trains from the BSQ to customers throughout the Perth Metropolitan Region and South West.

The Stage 1 Project initially commenced with traffic travelling both west along Stakehill Road towards Ennis Avenue/Mandurah Road and east along Stakehill Road towards Baldivis Road and the Kwinana Freeway from the site. To improve traffic operations and safety along Stakehill Road, turn lanes have been constructed to provide greater intersection capacity and reduce queues and delays along Stakehill Road.

The current transport route for the Stage 1 Project since the opening of the Forrest Highway (Perth to Bunbury Highway) is that the majority of vehicles exit the quarry via Stakehill Road and then continue onto Baldivis Road. From Baldivis Road, approximately 80% of the traffic utilises Kwinana Freeway and 20% utilise Karnup Road East. Vehicles approach the quarry utilising a similar distribution route. Local deliveries enter and exit the quarry along Stakehill Road, using Mandurah Road. The Expansion Project will utilise the same transport route.

During operations, up to 300 heavy vehicle movements occur each weekday to and from the site. Of these vehicle movements, approximately 80% are semi-trailers, approximately 15% are semi-trailers plus trailers and 5% are road trains. On Saturdays, up to 150 heavy vehicle trips of a similar vehicle composition occur. In addition, 100 standard vehicle movements occur each working day during operations.

### 1.2.4 Rehabilitation

HAUS and LandCorp have an established agreement framework by which the site will be transferred to LandCorp following the completion of quarry operations. It is understood that LandCorp will use the land for residential development.

HAUS has consulted with LandCorp regarding the operation and post-quarrying handover for the Expansion Project, as required by this agreement. It is understood that LandCorp's requirements for the post-quarrying handover comprise:

- The excavation is restored and reinstated in accordance with the rehabilitation program outlined in the Closure Plan approved by LandCorp.
- Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
- The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan [Final Pit Floor Levels agreed with Landcorp (2012)].



- All rubbish, debris, improvements or alterations effected by Holcim associated with the excavation works are completely removed from the land.
- All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.

### 1.3 Regulatory History

The following documents were issued to give environmental approval for the Stage 1 Project:

A lease for the Stage 1 Project (M70/1046) was issued by Department of Mines and Petroleum (DMP) to CSR Ltd (now HAUS) on 14<sup>th</sup> November 2006 under the *Mining Act* 1978. The lease was then transferred to Rinker Australia Pty Ltd on 19<sup>th</sup> December 2006, and is now held under the name of Holcim (Australia) Pty Limited.

Environmental approval and Operating Licence was given with a Licence for Prescribed Premises (L8176/2007/1) granted by the Department of Environment and Conservation [now known as Department of Environmental Regulation (DER)] on 28<sup>th</sup> February 2008 under Part V of the *Environmental Protection Act* 1986. This licence included operation of the mobile screening and washing plant.

A Licence to Take Water (GWL162863(1)) was granted by the Department of Water (DoW) on the 27<sup>th</sup> December 2007 for groundwater abstraction for dust suppression and processing purposes, under the *Rights in Water and Irrigation Act* 1914.

A Mining Proposal has been submitted to DMP under the *Mining Act* 1978 and a Licence Amendment Application has been submitted to DER under the *Environmental Protection Act* 1986 to seek environmental approval for the Expansion Project.



## **Management Plans**

The following Management Plans have been incorporated into this EMP and are attached in the section 'Guidelines':

- BSQ Guideline 1.1: Fauna Management.
- BSQ Guideline 1.2: Fire Management.
- BSQ Guideline 1.3: Hydrocarbon Management.
- BSQ Guideline 1.4: Pest Management.
- BSQ Guideline 1.5: Sedimentation Pond Management.
- BSQP Guideline 1.6: Waste Management.
- BSQ Guideline 1.7: Weed Management.
- BSQ Guideline 1.8: Dust Management.
- BSQ Guideline 1.9: Noise Management.
- BSQ Guideline 1.10: Aboriginal Heritage Management.
- BSQ Guideline 1.11: Transport Management.
- BSQ Groundwater Operating Strategy.

These Management Plans predominantly cover the key impacts associated with construction and operational activities of the Stage 1 Project and Expansion Project.

The Dust and Noise Management Plans and the Aboriginal Heritage Plan were prepared by HAUS, and other consultants, and updated by URS. The Transport Management Plan was prepared by Transcore Pty Ltd, and updated by URS. The other Management Plans were prepared by URS for HAUS.



## **Monitoring Requirements**

The monitoring required to be undertaken throughout the Stage 1 Project is described within each Management Plan (Appendices A **Error! Reference source not found**.to L) and is summarised below (Table 3-1). Checklists have also been prepared to assist HAUS with scheduling their Daily, Monthly and Annual monitoring and auditing tasks. The checklists are included in Appendix M.

#### Table 3-1 Monitoring Requirements for BSQ

Monitoring requirement	Frequency	Relevant Guideline or Document
<ul> <li>Inspection of Sedimentation Ponds for:</li> <li>Trapped or dead fauna/pests.</li> <li>Damage to fencing and/or signage.</li> <li>Minimum 0.5 m freeboard.</li> </ul>	Daily	BSQ Guideline 1.1 BSQ Guideline 1.4 BSQ Guideline 1.5 BSQ Guideline 1.6
Inspection and service of fire safety equipment to comply with regulatory requirements	Various (monthly to annually)	BSQ Guideline 1.2
Inspection of oil/water separator and removal of waste if required	Daily	BSQ Guideline 1.3
Hydrocarbon spills to be recorded	On event	BSQ Guideline 1.3
Record Controlled Waste Tracking forms required for offsite disposal of hydrocarbon waste	On event	BSQ Guideline 1.3
<ul> <li>Inspection of site for cleanliness including:</li> <li>Eating areas;</li> <li>Waste storage areas; and</li> <li>Food preparation areas.</li> </ul>	Daily	BSQ Guideline 1.4 BSQ Guideline 1.6
Record all feral animal sightings	On event	BSQ Guideline 1.4
Record pest control events	On event	BSQ Guideline 1.4
Inspection of sediment control measures	Daily	BSQ Guideline 1.5
Inspection of waste disposal practice to ensure correct disposal of wastes	Monthly	BSQ Guideline 1.6
Monitor spread and occurrence of weeds by photographing control areas and completing Weed Declaration Forms when appropriate	Monthly and on event	BSQ Guideline 1.7
Monitoring for dust emissions at two monitoring stations	Continuous	BSQ Guideline 1.8
<ul> <li>Monitoring noise emissions:</li> <li>Periodically; and</li> <li>During construction of noise barrier for the Stage 1 Project at commencement of operations for the Expansion Project.</li> </ul>	Bi-annually On event	BSQ Guideline 1.9
Inspection of equipment as per SHE Guideline 3.2 Fixed Plant and Mobile Equipment requirements to ensure noise control equipment is fitted correctly	Various	BSQ Guideline 1.10 SHE Guideline 3.2 (not included in this document)



### **3 Monitoring Requirements**

Monitoring requirement	Frequency	Relevant Guideline or Document
Monitoring groundwater abstraction rate from production bore PB01:		BSQ Groundwater Operating Strategy
Once every 6 hours	First 48 hours	
Once every 24 hours	First month	
Once every 2 weeks	Month 2 and 3	
For 2 years	Monthly	
Monitoring groundwater levels in designated monitoring bores (18 in total)	Monthly	BSQ Groundwater Operating Strategy
Monitoring groundwater chemistry from production bore PB01	Annually	BSQ Groundwater Operating Strategy



This EMP will be reviewed on an annual basis or more frequently if required, to address the following:

- Achievement of performance criteria outlined in the individual Management Plans is summarised below.
- Any changes in Project design or operation that require modifications to the environmental management procedures outlined in this EMP or SHE Procedures. Including preparing and compiling additional Managements Plans that may be required for further Project stages.
- Any issues identified as a result of internal and external audits, and HAUS management review of the audit outcomes, in relation to the suitability, adequacy and effectiveness of this EMP in meeting the agreed objectives.
- Corrective or preventative actions developed in response to environmental incidents and nonconformances.

The revised EMP will be submitted to the relevant stakeholders for information.

The revision number for the EMP will be recorded on the document's signature page.

### 4.1 Performance Criteria

The performance criteria against which this EMP will be reviewed and audited is summarised in Table 4-1. The details of the performance criteria are given in each Management Plan (Appendices A to L Some of the performance criteria are also required to be assessed and reported on under the BSQ provisions of the following environmental approvals which are described in Section 1.3:

- Mining lease M70/1046 under the Mining Act 1978.
- Licence for Prescribed Premises (L8176/2007/2) under Part V of the *Environmental Protection Act* 1986.
- Licence to Take Water (GWL162863(2)) under the Rights in Water and Irrigation Act 1914.

Table 4-1	Performance	Criteria	Summary
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Criteria No	Criteria specification	Measurable Parameter	Requirement
	SHE Guideline 1.1:	Fauna Management	
1	Maintain native vegetation areas outside of the Stage 1 Project area.	No native vegetation removed from outside the project area.	
2	Daily inspections of sedimentation ponds are carried out.	Daily checklist record.	
3	Noise levels comply with Environmental Protection (Noise) Regulations (1997).	Noise monitoring shows noise levels below the $L_{A10}$ 40 dB(A) criteria for the Stage 1 Project. Noise monitoring shows noise levels below the $L_{A10}$ 45 dB(A) criteria for the Expansion Project.	



Criteria No	Criteria specification	Measurable Parameter	Requirement		
4	Information about conservation- significant fauna to be displayed in a prominent site location.	Signage displayed.			
	SHE Guideline 1.2	: Fire Management			
5	Unauthorised Hot works prohibited onsite.	Hot works permit required and obtained for any hot works carried out.			
6	Unauthorised or accidental fires prohibited onsite.	No accidental or unauthorised fires.			
7	Fire safety equipment and fire safety training must comply at all times with legislative requirements and Australian Standards (AS), where they exist.	Fire safety equipment and training records kept to show compliance with legislation and AS.			
	SHE Guideline 1.3: Hyd	drocarbon Management			
8	Hydrocarbon use, storage and disposal must be carried out in a manner so that no environmental damage is caused.	No spillage of hydrocarbons beyond containment areas, and no subsequent discharge of hydrocarbon to the soil, surface water or groundwater. Spills that do occur in the containment area are to be recorded as a non conformance.			
9	No un-recorded disposal of hydrocarbon waste.	Record of Controlled Waste Tracking Forms are to be kept.			
	SHE Guideline 1.4	: Pest Management			
10	The European House Borer (EHB) is eradicated during stump removal procedure and risk of persistence or spread is nil.	All stumps removed during operations are burnt or chipped in accordance with EHB removal procedure.			
11	The presence of feral animals on site is minimal, and no populations of feral species established on or near to the BSQ site.	Record of feral/pest animal sightings and pest control activities.			
	SHE Guideline 1.5: Sedimentation Pond Management				



Criteria No	Criteria specification	Measurable Parameter	Requirement
12	Maintaining existing surface water quality during operations and following closure of BSQ	No discharge of runoff or rainfall to offsite surface water resulting in degradation of water quality	
13	Sedimentation ponds to be cleaned out regularly so that accumulated sediment reduces the capacity of the ponds no greater that 30%, to maintain 0.5 m freeboard	Daily inspection of Sedimentation Ponds and removal of sediment if required	
	SHE Guideline 1.5:	Waste Management	
12	All wastes to be disposed of correctly and inspections are to be recorded.	Monthly inspection of waste disposal practice with no greater than 20% of inspections missed.	
	SHE Guideline 1.6:	Weed Management	
13	Prevent the spread or increase in diversity of weed species.	Monthly photographs taken of weed control areas and outcomes assessed. Monthly audit of vehicle washdown procedures undertaken Weed Declaration Forms filled out to record spread of weeds or occurrence of new species.	
	SHE Guideline 1.7	: Dust Management	r
14	Prevention of the degradation of air quality surrounding BSQ through the emission of dust particles from the quarry.	Record of incidents and follow-up actions including incidents reported to the local DER office. Monitoring of dust emissions to ensure Level 1 to 3 triggers are responded to.	Licence for Prescribed Premises (L8176/2007/2)



Criteria No	Criteria specification	Measurable Parameter	Requirement
	SHE Guideline 1.8:	Noise Management	
15	Prevention of the surrounding environment from noise emissions.	Bi-annual monitoring of noise emissions carried out to ensure emissions are below the $L_{A10}$ 40 dB(A) criteria for the Stage 1 Project. Bi-annual monitoring of noise emissions carried out to ensure emissions carried out to ensure emissions are below the $L_{A10}$ 45 dB(A) criteria for the Expansion Project. Record of incidents and follow-up actions including incidents reported to the local DER office.	
	BSQ Groundwater	Operating Strategy	
16	<ul> <li>Maintenance of groundwater level surrounding abstraction area of production bore PB01 indicated by monitoring:</li> <li>a) BQ03, BQ08-09, BQ11, BQ13-15.</li> <li>b) BP01-02, BP04, BP06-07, BP10.</li> </ul>	Appropriate actions undertaken if >0.5 m decline in groundwater level compared to April 2007 levels in bores (a). Appropriate actions undertaken if >0.25 m decline in groundwater level compared to April 2007 levels in bores (b).	Licence To Take Water GWL162863(2).

### 4.2 Auditing

HAUS will establish and maintain a programme and procedures for periodic audits of this EMP. Maintenance and implementation of the audit programme will be the responsibility of HAUS' Site Management with the assistance of the Planning and Environment Team.

Environmental audits can occur in many forms, but have a common objective: to assess the environmental performance of a facility in order to identify risks and potential liabilities. The format of the audit will depend on the issue or area being reviewed but could include the following phases:

- Development of the audit protocol.
- Completion of a questionnaire by site personnel prior to a site visit by the auditor.
- Site visit, comprising interviews, site inspections and/or direct measurement.
- Review of relevant documentation and records, including achievement of performance criteria (Section 4.1).



• Preparation and submission of the audit report.

This EMP will be audited on an annual basis and the outcomes and information on the results of the audits will be provided to HAUS management for review, and included within the Annual Environmental Report (AER) in February each year.

In addition to formal audits by internal or external auditors, internal area or facility inspections will be conducted to assess the effectiveness of day-to-day environmental management. This will allow opportunities for improvements in environmental performance to be identified and acted upon as soon as possible. The inspections will occur on a weekly, monthly, annually or less frequent basis, depending on the area or facility being reviewed. The schedule of inspections is recorded on the Daily, Monthly and Annual Checklist documents (Appendix A). The monthly checklist includes items to be checked every 6 months.



## Reporting

### 5.1 Internal Reporting

Environmental records are evidence of the ongoing environmental performance of the BSQ and demonstrate conformance with legal and other requirements. Details of required records are included in each Management Plan (Appendices Error! Reference source not found. to Error! Reference source not found.). Additional environmental records to be maintained by HAUS and/or its contractors may include:

- A register of legal and other regulatory requirements including licences and permits.
- A register of environmental aspects and impacts.
- Incident reports.
- Training records.
- Inspection, calibration and maintenance records.
- Monitoring data.
- A register of non-conformances.
- Complaints and responses to these.
- Internal and external audits and reviews.

### 5.2 External Reporting

#### 5.2.1 DMP Requirements

As part of the conditions of Mining Lease M70/1046 under the *Mining Act* 1978 set by the DMP, HAUS is required to submit an Annual Environmental Report (AER) in March each year. The objectives of the AER are defined by DMP to report, for the period from 1 January to 31 December of the previous calendar year. The required form and guidance for preparation of the AER are given on the DMP website at:

http://www.dmp.wa.gov.au/7105 10298.aspx

### 5.2.2 DER Requirements

As a part of the conditions of the Category 12 Licence for Prescribed Premises (L8176/2007/2) under Part V of the *Environmental Protection Act* 1986 set by DER, HAUS is required to submit an Annual Environmental Report (AER) in February each year. The objectives of the AER are defined by DER to report, for the period from 1 January to 31 December of the previous calendar year, information including:

- Any complaints or environmental incidents and action taken by HAUS;
- A summary table of any exceedance reported under condition 1 of the licence;
- The characteristics; volume and effects of discharges to the environment;
- The characteristics of the receiving environment within the vicinity of the of the premises;
- An assessment against licence limits and other appropriate standards or guidelines; and
- The actual production over the duration of the licence.

#### **5 Reporting**

### 5.2.3 DoW Requirements

As a part of the conditions of the Licence to Take Water [GWL162863(2)] under the *Rights in Water and Irrigation Act* 1914 set by the DoW, HAUS is required to submit data covering the period of a water year which is defined as the period between 27 December and 26 December. Under the conditions of the Licence, which also refer to administrative requirements given in the BSQ Groundwater Operating Strategy (Appendix N) HAUS is required to:

Record the volume of water drawn from PB01 monthly and forward the information to the Waters and Rivers Commission by 27 March, 27 June, 27 September and 27 December for the first two years of operations.

Submit annual monitoring reports to DoW Kwinana Regional Office quarterly for the first year of operations and within two months of the completion of the water year for the second year of operations. The report submitted at the end of two years of operation will include a review of abstraction and aquifer response to enable revision of licence monitoring conditions.

Submit data in agreement with DoW reporting guidelines including:

- Presentation in tabular and graphic format.
- Presentation a continuous data for preceding years and the current year.
- Comparison of historical data for the year just ended and the licence-condition data.
- An explanation of the cause of any unusual or undesirable results, and a description of any subsequent actions undertaken.
- Comment on the effectiveness and accuracy of the monitoring program.



## Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Holcim Australia Pty.

Except as required by law, no third party may use or rely on, this Report unless otherwise agreed by URS in writing. Where such agreement is provided, URS will provide a letter of reliance to the agreed third party in the form required by URS.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.

It is prepared in accordance with the scope of work and for the purpose outlined in the contract dated 15 July 2013.

Where this Report indicates that information has been provided to URS by third parties, URS has made no independent verification of this information except as expressly stated in the Report. URS assumes no liability for any inaccuracies in or omissions to that information.

This Report was prepared between October and November 2013 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This Report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose. This Report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

To the extent permitted by law, URS expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this Report. URS does not admit that any action, liability or claim may exist or be available to any third party.

Except as specifically stated in this section, URS does not authorise the use of this Report by any third party.

It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements and proposed use of the site.

Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.



## Figures





### SITE LOCATION



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PTY LTD

Figure: 1 Rev. A

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#### HOLCIM (AUSTRALIA) PTY LTD

BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

### LOCALITY MAP AND MINING TENURE



Figure:



HOLCIM (AUSTRALIA) PTY LTD

URS

BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

### SITE LAYOUT



Appendix A Aboriginal Heritage Management Plan



A



ABORIGINAL HERITAGE MANAGEMENT

## BSQ Guideline 1.10 Aboriginal Heritage Management

## **Objectives**

To protect any Aboriginal Heritage sites that may be encountered during the operation of the Baldivis Sand Quarry (BSQ) including the Stage 1 and Expansion Projects.

## Background

Aboriginal heritage surveys were undertaken by Ethnosciences across M70/1046 and MLA70/1241 in 2007. No Aboriginal sites of significance have been identified to date within the site, based on the findings of this Aboriginal Heritage assessment.

The Stage 1 and Expansion site has been heavily disturbed in the past due to the planting of the pine plantation, although there is potential for unidentified buried archaeological sites during sand extraction. No archaeological sites have been found on the Stage 1 site to date.

- This plan will form part of the Environmental Management Plan for the Stage 1 and Expansion Project.
- Aboriginal Heritage sites encountered will be protected during the operation of the Stage 1 and Expansion Project.

### Scope

This procedure applies to all activities and all personnel, contractors and visitors at BSQ at all times.

### **Related Documents**

The following documents relate to Aboriginal Heritage Management at BSQ and should be consulted where applicable. This list is not exhaustive. Other Safety, Health and Environment (SHE) Guideline Documents and legislative requirements may also apply

- SHE Guideline 4.2: Hazard Identification;
  - 4.2A Aspects and Impacts Register for Aggregate Sites;
  - 4.2.2: Operating Practices;
    - 4.2.2A (2): Environmental Standards for Sand and Gravel Quarries; and
- Aboriginal Heritage Act 1972 (WA).

### **Approvals**

• Permission to disturb any identified aboriginal sites must be obtained by Ministerial consent under Section 18 of the *Aboriginal Heritage Act* 1972 (WA).

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ABORIGINAL HERITAGE MANAGEMENT

### Management Strategy

### General

The following management practices will be adopted in order to meet the objectives of the Aboriginal Heritage Management Plan:

- All staff and contractors will be informed of the potential for unidentified buried archaeological material on the site.
- All staff and contractors will be informed of their obligations under the *Aboriginal Heritage Act* 1972 (WA) in relation to the identification and protection of Aboriginal sites.
- Should unidentified buried material be located within the Stage 1 and Expansion Project sites, work will cease in the vicinity of the site until such time as appropriate management of the material has been discussed and endorsed by the Department of Aboriginal Affairs (DAA). No unidentified buried material has been found to date within the Stage 1 Project site.
- Should any Aboriginal sites be identified within the Stage 1 and Expansion Project site, Ministerial consent under Section 18 of the *Aboriginal Heritage Act* 1972 to use the land on which the site is located, will be sought.
- Should human/possible human skeletal material be uncovered during works, HAUS will immediately cease work in the vicinity of the material and inform the WA Police Department and the DAA. HAUS will be guided in its course of action after this by the WA Police and DAA.

## Definitions

#### Site: A site is defined by the Aboriginal Heritage Act 1972 as:

- (a) any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present;
- (b) any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;
- (c) any place which, in the opinion of the Committee, is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the State; and
- (d) any place where objects to which this Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed.

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ABORIGINAL HERITAGE MANAGEMENT

# Accountabilities Role Accountability Site Manager • Ensure that all personnel who report to you are aware of and conform to this procedure. • Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect). • Ensure the site conditions of contract include aboriginal heritage management requirements. All Persons • Conform to this procedure at all times.

## **Document Management**

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0	12 May 2008	Final	G Manning (CEMEX)	J Becher (URS)	G Manning (CEMEX)
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## References

Ethnosciences, Report of an Aboriginal Heritage Desktop survey and ethnographic Survey of Proposed Readymix sand Quarry M70/1046 and MLA70/1241, and Archaeological Reconnaissance in relation to Stage 1 (M70/1046), Baldivis, Western Australia, July 2007.

URS. Mining Proposal. Baldivis Sand Quarry Stage 1 Project Expansion. Baldivis, Western Australia, November 2013.

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Appendix B Dust Management Plan



B



DUST MANAGEMENT

# BSQ Guideline 1.8 Dust Management

## **Objectives**

To minimise the impact of mining activities and protect the amenity of residents surrounding the Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046) including both the Stage 1 and Expansion Projects; by ensuring dust levels meet the requirements of the Ambient Air Quality National Environmental Protection Measure (NEPM) for  $PM_{10}$  (particulates of less than 10 microns in size).

## Background

It is expected that mining activities at BSQ will generate a small amount of dust. In particular, dust will be generated by the process of screening and crushing sand and by machinery as sand is quarried and transported around the site.

Under the conditions of the Operating Licence, dust emissions from the Stage 1 Project and Expansion Project must meet criteria outlined in the NEPM for  $PM_{10}$ . The  $PM_{10}$  standard is a maximum concentration of 50 µg/m<sup>3</sup> (micrograms per metre cubed) over a 24 hour period.

Air quality assessments were undertaken by Sinclair Knight Mertz (SKM) and URS to assess the potential impact of airborne particulates (dust) generated by the Stage 1 Project and Expansion Project, respectively. This procedure is developed from the Baldivis Sand Quarry Stage 1 – Draft Dust Management Plan developed by SKM.

The SKM and URS assessments involved dust modelling (using AUSPLUME) to predict particulate emissions expected form the proposed sand quarry operations. The modelling was undertaken to predict dust generation for atmospheric conditions experienced during each season of the year. The predicted concentrations generated by the model were then assessed in respect to the Ambient Air Quality NEPM for PM<sub>10</sub>. The model predicted that there would be no exceedance of the NEPM criteria for either the Stage 1 Project or Expansion Project. However; HAUS is aware that there is the potential for the NEPM to be exceeded during worst case background and operating conditions.

To safeguard against the potential for the  $PM_{10}$  criteria to be exceeded, it was decided that HAUS would implement dust management measures to minimise the potential for dust generation during operation of the quarry.

## Scope

This procedure applies to all outdoor activities and all personnel, contractors and visitors at BSQ at all times.

## **Related Documents**

The following documents relate to dust management at BSQ and should be consulted where applicable. This list is not exhaustive. Other SHE Guideline Documents and legislative requirements may also apply.

- BSQ Guideline 1.6: Waste Management;
- SHE Guideline 3.1: Risk Management;

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- SHE Guideline 3.22: Dust other than Silica (Nuisance Dust):
- SHE Guideline 4.1: Permits, Licences and Approvals;
  - 4.1A: Guide to Environmental Planning Permits & Approvals for Holcim Operations.  $\cap$
  - 4.1E: Environmental Compliance Planner Aggregates. 0
- SHE Guideline 4.2: Hazard Identification;
  - 4.2A: Aspects and Impacts Register for Aggregates Sites.
- BSQ Quarry Closure Plan;
- Environmental Protection Act 1986 (WA); and •
- Australian Standard (AS) 3580.9.8-2001 Method for Sampling and Analysis of Ambient Air.

## **Planning and Approvals**

#### Planning

- The crushing and screening plants will be fitted with safety guarding but transfer points will not be fitted with any enclosing or sealing structures as they are not considered practical due to the mobile nature of the plant.
- The strongest winds during the year are typically easterly and south westerly winds during summer. If forecast weather conditions indicate strong winds are likely to occur, more frequent watering can be undertaken.
- Design of traffic flow plans will consider dust reduction strategies.
- Quarrying and rehabilitation will limit the size of active working open areas to less than 10 hectares.
- A 150 m buffer will be maintained between Stakehill Road and the excavation area to ensure dust emissions do not leave the site.

## Approvals

HAUS has a company fleet load covering policy requiring all trucks used to transport sand materials to have loads covered by tarpaulin before exiting the site. The covers are to be applied as soon as a safe load distribution has been determined ensuring minimum exposure to wind and dust generating conditions.

## Management Strategy

#### General

- Water sprays on crushing and screening equipment will be maintained through regular inspections to ensure safe and efficient operation.
- The frequency of water spraying operations throughout the process line will consider multiple factors such as current weather conditions (winds, temperature, rainfall etc) and moisture content of the screened material.
- A water cart will be used to water material stockpiles, access roads and other open areas and used as necessary to ensure adequate saturation of the surface area of the material stockpiles and access roads to reduce dust emissions. Revision Status Date Reviewed Page

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#### **BSQ Guideline 1.8**

#### DUST MANAGEMENT

- Raise the awareness of the workforce about the dust management plan. All employees will undergo site specific awareness training during inductions. The dust component of the training will include:
  - Knowledge of operational procedures that have the potential to generate dust.
  - Dust management measures that may be implemented around the site.
  - Knowledge on the effect of wind and weather conditions of possible dust generation and suppression.
  - Issues relating to the management of dust emitted from the site and staff responsibilities (community concern and monitoring).
- A Complaints Register will be established for the site to record the date, nature, and resolution action of any complaints. Complaints will be directed to the site supervisor for resolution. If the complaint is verified as being due to a site source, remedial action will be undertaken within 48 hours.

#### **Minimisation and Control**

Stockpiles will be managed to minimise the potential for dust generation. Minimisation measures include:

- Construction stockpiles in a manner to allow water trucks to access the stockpiles to ensure adequate saturation to reduce dust emissions; and
- Positioning of stockpiles away from site boundary areas to reduce possible dust emissions.

## **Monitoring and Performance Indicators**

#### Monitoring

HAUS has commenced a dust monitoring programme to meet Australian Standard (AS) 3580.9.8-2001 Method for Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter –  $PM_{10}$  Continuous Direct Mass Method using a Tapered Element Oscillating Microbalance Analyser to monitor baseline dust concentrations at the site prior to the operation of the sand quarry.

Dust monitoring will be continued during operations as required to monitor dust concentrations generated by the Stage 1 Project and Expansion Project.

Continuous ambient air monitoring for  $PM_{10}$  particulate matter is installed at two sites, nearby to the quarry operations (**Appendix A**).

One monitoring site is located near the Site Administration office. The Stage 1 Project and Expansion Project quarry emissions will be continuously monitored (24 hours per day, 365 days per year) at this site under South-westerly to South-easterly winds. This was the North-east  $PM_{10}$  monitoring location during the baseline study and identified as receptor 16 during the modelling study undertaken by SKM.

The second monitoring site is be located at the Tuart Ridge Winery, located on Stakehill Road, directly north of the Stage 1 Project and Expansion Project operations (Figure 1). This was identified as receptors 6 and 17 during the modelling study undertaken by SKM. This location will monitor quarry emissions continuously (24 hours per day, 365 days per year) under Southerly to Easterly winds.

The data logging equipment at the Tuart Ridge Winery is configured so that it is capable of initiating SMS mobile telephone alarms to the Site Manager whenever the following monitoring conditions arise. A three tiered approach will continue to be undertaken:

- Whenever the 15 minute averaged PM<sub>10</sub> particulate concentration has exceeded 100 ug/m3 (and is in the correct wind direction sector) (Level 1 Alert);
- Whenever the daily averaged PM<sub>10</sub> particulate concentration, to that moment of the day, has exceeded 40 ug/m3 (Level 2 Alert); and

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#### DUST MANAGEMENT

• Whenever the daily averaged PM<sub>10</sub> particulate concentration, to that moment of the day, has exceeded 45 ug/m3 (Level 3 Alert).

In the event that any of these  $PM_{10}$  monitoring conditions is triggered, appropriate dust suppression initiatives will be put in place by the Site Manager to minimise further high dust impact as described below:

- Level 1 Alert: The Site Manager will assess the site in respect to the prevalent winds, location and cause of dust emissions and increase dust management measures implemented to reduce dust emissions. This may include increasing the frequency of watering of open areas, including stockpiles and access roads;
- Level 2 Alert: The Site Manager will assess the site in respect to the prevalent winds, location and cause of dust emissions and increase dust management measures implemented to reduce dust emissions. This may include increasing the frequency of watering of open areas, including stockpiles and access roads. At this stage, the Site Manager is alerted that dust emissions have the potential to exceed the NEPM PM<sub>10</sub> standard and to be prepared to implement further dust management measures as described in the third tier below; and
- Level 3 Alert: The Site Manager, in the case of unusually strong wind conditions operations, would temporarily cease operations and water trucks would be activated over material stockpiles, access roads and other open areas until a more favourable wind condition enabled operations to recommence.

#### **Performance Indicators**

- Significant incidents will be reported to the Kwinana Peel Region (Booragoon Office) of the Department of Environment Regulation
- Records of complaints, response and follow-up actions will be forwarded to the Kwinana Peel Region (Booragoon Office) of the Department of Environment Regulation within 24 hours of receipt of the complaint
- The site supervisor will maintain contact with any complainant until the source of the incident is verified and resolved as far as is practicable



## Accountabilities

Role	Accountability
Site Manager	<ul> <li>Ensure that all personnel who report to you are aware of and conform to this procedure.</li> </ul>
	<ul> <li>Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect).</li> </ul>
	Ensure the site conditions of contract include dust management requirements.
	Ensure vehicle spraying mechanisms are maintained.
	<ul> <li>Ensure site complaints register is maintained and that appropriate actions is taken within 48 hrs if required.</li> </ul>
	<ul> <li>Ensure significant incidents are reported to the Kwinana Peel Region (Booragoon Office) of the Department of Environment and Regulation.</li> </ul>
	<ul> <li>Review and, if necessary, update this plan every two years or earlier if monitoring indicates that changes to dust management are required.</li> </ul>
All Persons	Conform to this procedure at all times.
	<ul> <li>Ensure any incidents (dust emissions or spray mechanism malfunction) are reported to the site manager.</li> </ul>

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0	5 May 2008	Final	T Hassell (URS)	J Becher (URS)	G Manning (CEMEX)
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## Attachments

Appendix A Sensitive Receptor and Dust Monitoring Station Locations



**BSQ Guideline 1.8** 

DUST MANAGEMENT

# Appendix A – Sensitive Receptor and Dust Monitoring Station Locations

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Appendix C Fauna Management Plan



С

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# BSQ Guideline 1.1 Fauna Management

## Objective

To minimise the impacts to native fauna at the Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046) and in nearby remnant vegetation areas surrounding the BSQ.

## Background

Native fauna could potentially be impacted by the indirect disturbance of remnant areas of vegetation surrounding the Stage 1 Project and Expansion Project site. Therefore, the protection of native fauna is dependent on the protection of remnant native vegetation and conservation areas surrounding the site. Potential impacts to fauna could include: noise disturbance, project activities, and attraction to water sources such as the sedimentation ponds.

It is not expected that native fauna will be present on the Stage 1 Project and Expansion Project site at the commencement of operations at BSQ. Following harvesting of the pine plantation at the Stage 1 site all remaining tree stumps and residual litter were removed and disposed of (via burning or chipping) within the site's operational area leaving little vegetation. The Expansion Project will require clearing of 7.85 ha of revegetation planted in the screening buffer. The remnant vegetation areas surrounding the Stage 1 and Expansion Project site will not be directly disturbed by operations at BSQ. Due to the small fragmented and degraded nature of the remnant vegetation, it likely that native fauna will only be present in small populations.

The most significant fauna habitats located in the vicinity of the Stage 1 Project Area include five "Bush Forever" sites, three of which contain Conservation Category wetlands. In addition, a further two small wetlands of Conservation Category significance, and several other swamps, floodplains and wetlands protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy* (1992) exist within 2km of the Stage 1 and Expansion Project Areas.

The conservation areas are listed in detail **Appendix A**. None of the wetlands identified are listed under the *Ramsar Convention on Wetlands* (1971) or the Australian Directory of Important Wetlands.

A vertebrate fauna assessment for the larger Stage 2 Project area (which includes Stage 1 area), was undertaken by Bamford Consulting Ecologists in September 2006. A further updated fauna assessment was undertaken in 2013 by Bamford Consulting Ecologists to include the Expansion Project Area. The assessments comprised a review of the Department of Parks and Wildlife (DPAW) threatened fauna database, WA Museum's FaunaBase database and available literature to determine those fauna species of conservation significance that are likely to occur in the area. The revegetation of the Expansion Project Area was classed as of low value to native species. Most of the remnant vegetation and wetland areas surrounding the Stage 1 and Expansion Project Area were classed as low value, with one of the wetland areas and a stand of Tuart trees (*Eucalyptus gomphocephala*) and strips of *Banksia* sp. woodland classed as having high value to native species.

The updated 2013 survey identified 11 fauna species of conservation significance which may occur within the vicinity of the Expansion Project Area. A list of the species identified in the fauna assessment as likely to occur in the vicinity of the Project Area is provided in **Appendix B**. The eleven species of conservation significance comprise one mammal, three bird and seven invertebrate species:

- Isoodon obesulus Quenda or Southern Brown Bandicoot (Priority 5 listed by DPAW);
- Calyptorhynchus banksii Forest Red-tailed Black-Cockatoo (Schedule 1, Vulnerable under the Wildlife Conservation Act 1950);

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- Calyptorhynchus latirostris Carnaby's Black-Cockatoo (Endangered under the EPBC Act and Schedule 1, Endangered under the Wildlife Conservation Act 1950):
- Calyptorhynchus baudinii Baudin's Black-Cockatoo (Vulnerable under the EPBC Act and Schedule 1, Endangered under the Wildlife Conservation Act 1950);
- Leioproctus douglasiellus Native Bee (Schedule 1, Endangered under the Wildlife Conservation Act 1950);
- Symenon grantiosa Graceful Sun-Moth (Priority 4 listed by DPAW);
- Austrosaga spinifer Cricket (Priority 3 listed by DPAW);
- *Hyaleus globuliferus* Native Bee (Priority 3 listed by DPAW);
- Leioproctus contrarius Native Bee (Priority 3 listed by DPAW);
- Leioproctus bilobatus Native Bee (Priority 2 listed by DPAW); and
- Throscodectes xiphos Cricket (Priority 1 listed by DPAW).

These species all have a low potential to occur within the Expansion Project Area based on available habitat and are described in further detail in **Appendix C**. Further information on the vertebrate species identified in the fauna survey conducted at BSQ (from the tables provided in **Appendix B**) can be found at the Department of Parks and Wildlife (DPAW) NatureMap website:

• http://naturemap.dec.wa.gov.au/default.aspx

## Scope

This procedure applies to all outdoor activities and all personnel, contractors and visitors at BSQ.

## **Related Documents**

The following documents relate to fauna management at BSQ and should be consulted where applicable. This list is not exhaustive. Other SHE Guideline Documents and legislative requirements may also apply.

- BSQ Guideline 1.4: Pest Management;
- BSQ Guideline 1.6: Waste Management;
- BSQ Guideline 1.7: Weed Management;
- BSQ Guideline 1.9: Noise Management;
- SHE Guideline 2.4: Contractor Management;
- SHE Guideline 3.1: Risk Management;
- SHE Guideline 3.20: Hazardous Substances Handling and Storage;
- SHE Guideline 4.1: Permits, Licences and Approvals;
  - 4.1A: Guide to Environmental Planning Permits & Approvals for Holcim Operations.
  - 4.1E: Environmental Compliance Planner Aggregates.
- SHE Guideline 4.2: Hazard Identification;
- SHE Guideline 4.2A: Aspects and Impacts Register for Aggregate Sites;
- BSQ Rehabilitation Plan;

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- Environmental Protection Act 1986;
- Environmental Protection (Clearing of Native Vegetation) Regulations 2004;
- Agriculture and Related Resources Protection Act 1976;
- Conservation and Land Management Act 1984;
- Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act);
- Environmental Protection (Swan Coastal Plain Lakes) Policy 1992; and
- Wildlife Conservation Act 1950.

## **Planning and Approvals**

#### Planning

- Native Vegetation must be protected from damage under Item 3 of the conditions for mining lease M70/1046 unless prior permission is obtained from the Department of Mines and Petroleum (DMP).
- Vegetated areas to be disturbed or accessed will, prior to entry or disturbance, be assessed with respect to the likelihood of disturbing or impacting native fauna. Removal of vegetation must be carried out in accordance with the Environmental Protection (Clearing of Native Vegetation) Regulation 2004 that allows 10 ha of clearing per financial year. Consultation with the BSQ Site Manager and the Safety, Health and Environmental (SHE) Co-ordinator (Perth Region) may be required.
- Pest and weed management procedures, prior to being carried out, will be assessed with respect to the likelihood of impacting native fauna through the use of hazardous substances. Consultation with the BSQ Site Manager and the Safety, Health and Environmental (SHE) Co-ordinator (Perth Region) may be required.

## Approvals

- No activity is to be undertaken that may disturb any native vegetation without prior consent of the Site Manager.
- No activity is to be undertaken that may disturb the wetland areas near the site.
- If required, obtain required permits from DMP for disturbance of Native Vegetation on site.
- Obtain required permits from the City of Rockingham prior to any burning on site.
- Chemicals brought onto site must be approved by the Site Manager and stored appropriately. New chemicals need to be added to the site's Hazardous Substances Register, labelled and a risk assessment undertaken as required in SHE Guideline 3.20: *Hazardous Substances Handling and Storage*.

## **Management Strategy**

#### General

• Adhere to Weed, Waste, Noise and Pest Environmental Management Plans in a manner which minimises direct and indirect impacts to native fauna.

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#### **BSQEP** Guideline 1.1

#### FAUNA MANAGEMENT

- Appropriate speed limits will be set, signposted and adhered to on all roads to avoid road-kills and the subsequent attraction of fauna. Speed is limited to a maximum of **30 km/hr** on site.
- Raise the awareness of the workforce about the conservation of fauna (particularly rare, threatened or vulnerable fauna) and their habitats and avoid direct contact with fauna where possible. All employees and contractors will undergo site specific environmental awareness training during inductions. The fauna component of this training will include:
  - Native fauna of the BSQ area.
  - Issues related to fauna management and staff responsibilities (recognition and recovery or species described in **Appendix C**).
  - The adverse impact of feral animals to the local ecosystem and the responsibility of staff in controlling feral animals.
  - How staff report sightings of animals, including reference material for positively identifying animals.
- If injured fauna are encountered, the DPAW's Wild Care 24 hour hotline [(08) 9474 9055] will be contacted.
- Information will be displayed on site to assist in identifying conservation-significant fauna previously identified on site (See Appendix C). Any sightings will be recorded by the site manager. Details to be recorded include, but are not limited to:
  - Species (if known).
  - Sex (if known).
  - Location (GPS coordinates if possible).
  - Weather conditions.
  - Vegetation type.
  - o Reliability of identification.
  - Date and time of sighting.
  - Name of observer.
- In the unlikely event that native vegetation is to be disturbed, the extent of the proposed disturbance of native vegetation will be clearly marked by flagging tape. This delineates the area to be cleared while still allowing fauna to relocate. Disturbances may also take place in stages to allow for local migration of fauna into adjacent areas.

## **Protection and Control**

- The Site Manager will be responsible for ensuring weed and pest control measures involving the use of hazardous chemicals or substances are carried out in a manner that will not impact native fauna or remnant vegetation.
- Minimise the potential risk of increasing feral animal abundance and diversity by ensuring all work areas are maintained and kept tidy under the Waste Management EMP. No pets or animals are to be brought onto site.
- All chemicals brought to site will be required to undergo assessment in regards to its potential to impact native fauna. The assessment process comprises:
  - Determining whether the relevant chemical is already registered on the Hazardous Substance Register (SHE Guideline 3.20A) for use at BSQ. If the chemical is already registered on the Hazardous Substance Register, the chemical can be brought on site and used under the conditions of the Material Safety Data Sheet (MSDS) and relevant JSA's associated with the chemical use tasks(s). If the chemical is not on the Hazardous Substance Register a risk assessment must be undertaken as required in SHE Guideline 3.20: Hazardous Substances – Handling and Storage.



 An assessment of the new chemical by the Site Manager and the SHE Coordinator (Perth Region). If approved, the chemical will be added to the Hazardous Substance Register and a copy of the MSDS associated with the chemical shall be submitted to the Site Manager, be retained on site and be accessible by all personnel and contractors.

## **Monitoring and Performance Indicators**

#### Monitoring

- Undertake daily inspection of sedimentation ponds for trapped or dead fauna and remove these if they occur. If deaths occur, investigate the installation of prevention measures, such as fencing or self rescue mats to protect fauna.
- Information about Conservation-significant fauna to be displayed on site.

#### **Performance Indicators**

- No native vegetation is to be removed from the nominated remnant vegetation areas outside of the Stage 1 and Expansion Project Area.
- Ensure Noise complies with Environmental Protection (Noise) Regulations (1997).
- Regular (daily) inspections of sedimentation pond carried out.
- Information about conservation-significant fauna to be displayed in a prominent site location.

## **Definitions**

**Conservation Category wetlands**: Are wetlands classified by the Western Australian Department of Environment and Conservation as having high ecological value

- http://portal.environment.wa.gov.au/portal/
- **Bush Forever sites**: Are protection areas identified under *Metropolitan Region Scheme amendment No.* 1082/33 Bush Forever and Related Lands and Bushland Policy for the Perth Metropolitan Region Statement of Planning policy 2.8 (draft SPP). The areas are identified as regionally significant bushland to be retained and protected forever.
  - http://www.wapc.wa.gov.au/Publications/99.aspx
- **Priority listed species**: The Western Australian Department of Conservation and Land Management have recognised species not listed under the *WA Wildlife Conservation Act* (1950), but for which there is some concern as Priority species.
  - Priority 1. Taxa with few, poorly known populations on threatened lands.
  - Priority 3. Taxa with several, poorly known populations, some on conservation lands.

International Union for the Conservation of Nature and Natural Resources (IUCN) categories used for the EPBC Act and the WA Wildlife Conservation Act assessments of conservation status:

- Vulnerable: Taxa facing a high risk of extinction in the wild in the medium-term future.
- Endangered: Taxa facing a very high risk of extinction in the wild in the near future.



# Accountabilities

Role	Accountability
Site Manager	• Ensure that all personnel who report to you are aware of and conform to this procedure.
	<ul> <li>Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect).</li> </ul>
	Ensure the site conditions of contract include fauna management requirements.
	• Ensure sightings of fauna are recorded (where required).
	<ul> <li>Process and approve vegetation disturbance and burning permits.</li> </ul>
	<ul> <li>Ensure Weed, Waste, Noise and Pest Management Procedures are carried out in a manner that will not negatively impact fauna or remnant vegetation.</li> </ul>
	• Review and, if necessary, update this plan every two years or earlier.
All Persons	Conform to this procedure at all times.
	Report the sighting of any suspected declared animals to the Site Manager.
	Obtain a permit prior to undertaking disturbance to vegetation.

## **Document Management**

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#### Attachments

Appendix A	Conservation Areas Identified in the Vicinity of Baldivis Sand Quarry.
Appendix B	Fauna Identified in the Vicinity of the Baldivis Sand Quarry.
Appendix C	Species of Conservation Significance Found in the Vicinity of Baldivis Sand Quarry.



# Appendix A – Conservation Areas Identified in the Vicinity of Baldivis Sand Quarry

The following is reproduced from Baldivis Sand Quarry Expansion Project – Sand Extraction Project M70/1046 (URS, 2013). The mining proposal identified Conservation Areas in the vicinity of the Project Area including: five Bush Forever sites, three small conservation category wetlands, and 8 wetlands protected under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992. None of the wetlands are listed under the Ramsar Convention in Wetlands 1971 or the Australian Directory of Important Wetlands.

There are five Bush Forever sites in the vicinity of the Expansion Project Area, three of which contain Conservation Category wetlands (Ministry for Planning (now Western Australia Planning Commission), 2000). These are:

- Bush Forever Site No. 277, located approximately 1 km east of the Project Area, this site comprises part of the Serpentine River and floodplain, which is a Conservation Category wetland.
- Bush Forever Site No. 376, located north east of the Project Area, on the other side of Stakehill Road (Beenyup Swamp).
- Bush Forever Site No. 75, located approximately 700 m north west of the Project Area. This site is Churcher Swamp and is a Conservation Category wetland.
- Bush Forever Site No. 275, located approximately 1.5 km north west of the Project Area. This site is Stakehill Swamp and is a Conservation Category wetland.
- Bush Forever Site No. 278, located over 1 km west of the Project Area.

Some of the above wetlands are also listed under the Environmental Protection Policy Swan Coastal Plain 1992 within 2 km of the Project Area. These comprise:

- Beenyup Swamp located approximately 380 m to the north east.
- Four small wetlands to the south east.
- Churcher Swamp located approximately 800 m to the north west.
- Serpentine Floodplain located approximately 1 km to the east.

#### References

URS (2013). *Baldivis Sand Quarry Stage 1 Expansion Project – Mining Proposal*. Consultants Report prepared for HAUS by URS Australia Pty Ltd, November 2013.

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BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

#### SURFACE WATER CATCHMENTS

Figure:



# Appendix B – Fauna Identified in the Vicinity of Baldivis Sand Quarry

The following is reproduced from Bamford Consulting Ecologists Report (2013). The table below has been reformatted for presentation purposes.

A site inspection was carried out in August 2013, across an area which included the Expansion Project Area, and notes were made on environmental and fauna habitat and fauna observations were also made. The conservation status of the fauna species is assessed under the *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), and the *Western Australian Wildlife Conservation Act* (1950. The Department of Parks and Wildlife (DPAW) has a supplementary list of Priority Fauna which are not listed as threatened under the *Wildlife Conservation Act* 1950, but for which the DPAW feels there is cause for concern.

Three levels of conservation significance were recognised in the report:

- Conservation Significance 1 (CS1) Species listed under State or Commonwealth Acts.
- Conservation Significance 2 (CS2) Species not listed under State or Commonwealth Acts but listed in publications on threatened fauna or as Priority species by DEC.
- Conservation Significance 3 (CS3) Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution, or unique genetic characteristics. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be CS3.

Species (Common name)	Species (Scientific name)	Status
Forest Red-tailed Black-Cockatoo	Calyptorhynchus banksii	CS1
Carnaby's Black-Cockatoo	Calyptorhynchus latirostris	CS1
Baudin's Black-Cockatoo	Calyptorhynchus baudinii	CS1
Square-tailed Kite	Lophoictinia isura	CS3
Whistling Kite	Haliastur sphenurus	CS3
Brown Goshawk	Accipiter fasciatus	CS3
Collared Sparrowhawk	Accipiter cirrhocephalus	CS3
Wedge-tailed Eagle	Aquila audax	CS3
Little Eagle	Hieraaetus morphnoides	CS3
Brown Falcon	Falco berigora	CS3
Painted Button-quail	Turnix varia	CS3
Common Bronzewing	Phaps chalcoptera	CS3
Brush Bronzewing	Phaps elegans	CS3
Splendid Fairy-wren	Malurus splendens	CS3
Southern Emu-wren	Stipiturus malachurus	CS3
White-browed Scrub-wren	Sericornis frontalis	CS3
Inland Thornbill	Acanthiza apicalis	CS3
Western Thornbill	Acanthiza inornata	CS3
Yellow-rumped Thornbill	Acanthiza chrysorrhoa	CS3
Western Wattlebird	Anthochaera lunulata	CS3
White-cheeked Honeyeater	Phylidonyris nigra	CS3
Western Spinebill	Acanthorhynchus superciliosus	CS3
New Holland Honeyeater	Phylidonyris novaehollandiae	CS3
Tawny-crowned Honeyeater	Phylidonyris melanops	CS3
Scarlet Robin	Petroica multicolour	CS3
Hooded Robin	Melanodryas cucullata	CS3
White-breasted Robin	Eopsaltria griseogularis	CS3
Golden Whistler	Pachycephala pectoralis	CS3
Grey Shrike-thrush	Colluricincla harmonica	CS3

Title

SHE Guideline 1.1 Fauna Management

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Date Reviewed

Sponsor

L Honan



#### **BSQEP Guideline 1.1**

#### FAUNA MANAGEMENT

Species (Common name)	Species (Scientific name)	Status
Black-faced Woodswallow	Artamus cinereus	CS3
Dusky Woodswallow	Artamus cyanopterus	CS3
MAMMALS		
Quenda, Southern Brown Bandicoot	lsodon obesulus	CS2
INVERTEBRATES		
Native Bee	Leioproctus douglasiellus	CS1
Graceful Sun-Moth	Symenon grantiosa	CS2
Cricket	Austrosaga spinifer	CS2
Native Bee	Hyaleus globuliferus	CS2
Native Bee	Leioproctus contrarius	CS2
Native Bee	Leioproctus bilobatus	CS2
Cricket	Throscodectes xiphos	CS2

#### References

Bamford Consulting Ecologists (2013). *Baldivis Sand Quarry - Assessment of Value of a Rehabilitation Area for Significant Fauna*. Consultants Report prepared for URSby Bamford Consulting Ecologists, September 2013.



# Appendix C – Species of Conservation Significance Found in the Vicinity of Baldivis Sand Quarry

Source	Photograph	Description	Conservation Status
Quenda or So	ı uthern Brown Bandicoot ( <i>Isodon obe</i>	esulus)	Otatus
Threatened Species network fact sheet <sup>1</sup>		The southern brown bandicoot is a medium sized marsupial with a long tapered snout, small ears and eyes, a large rump and short tail. Individuals can weigh between 400 and 1600 grams. Its body is mostly covered with coarse brown fur, with a softer creamy-white underbelly. Its forelegs, which are shorter than its hind legs, have curved claws used for digging for food.	Priority 5 listed by DPAW
Species Profile and Threats Database, Australian Government Department of Environment <sup>2</sup>	A Contraction of the second se	Baudin's Black-Cockatoo is a large cockatoo that measures 50–57 cm in length, with a wingspan of approximately 110 cm. It is mostly dull black in colour, with pale whitish margins on the feathers, large, rounded patches (white to yellowish-white in the female and dusky-white to brownish- white in the male) on the ear coverts, and rectangular white panels in the tail. It is usually seen in groups of three (comprising the adult pair and a single dependent young) or in small parties, but will occasionally gather in large flocks of up to 300 birds during the non- breeding season, usually at sites where food is abundant. During the breeding season, adults nest in solitary pairs.	Vulnerable under the EPBC Act and Schedule 1, Endangered under the <i>Wildlife</i> <i>Conservation</i> <i>Act</i> 1950
Forest Red-tai	iled Black-Cockatoo (Calyptorhynchu	is banksii)	
Threatened Species network fact sheet <sup>3</sup>		The red-tailed black-cockatoo is a large bird, up to 55–60 centimetres in length. An adult male is glossy black with bright red panels in its tail. The female and juvenile differ by the yellow spots found on their heads, yellow bars on the chest and yellow-orange tail panels. The red- tailed black-cockatoo may be seen alone during the breeding season, or in flocks containing up to 100 or more birds during autumn and winter.	Schedule 1, Vulnerable under the <i>Wildlife</i> <i>Conservation</i> <i>Act</i> 1950



#### **BSQEP Guideline 1.1**

#### FAUNA MANAGEMENT

Endangered

Schedule 1,

Vulnerable

under the

Wildlife Conservation

Act 1950

Act and

under the EPBC



Threatened Species network fact sheet<sup>4</sup>



This large black cockatoo (also known as the Short-billed Black-Cockatoo) has white tail panels, white cheek patches and a short bill. It lives only in southwest Australia where large-scale clearing for farming has fragmented much of its habitat, particularly mature eucalypts such as salmon gum and wandoo that have suitable hollows for nesting.

\* Invertebrates have not been included in this table as expert identification is required to confirm their presence.

#### References

SpeciesBank. Department of the Environment, Water, Heritage and the Arts website. Accessed February 2008. <u>http://www.environment.gov.au/biodiversity/abrs/online-resources/species-bank/index.html</u>

Fact Sheets and species databases:

<sup>1</sup> http://www.environment.gov.au/biodiversity/threatened/publications/pubs/tsd07-s-brown-bandicoot.pdf

<sup>2</sup> http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon\_id=769

<sup>3</sup> <u>http://www.environment.gov.au/biodiversity/threatened/publications/pubs/tsd07-r-tailed-b-cockatoo.pdf</u>

<sup>4</sup> <u>http://www.environment.gov.au/biodiversity/threatened/publications/pubs/black-cockatoo.pdf</u>

Images:

• http://upload.wikimedia.org/wikipedia/commons/thumb/e/ea/Calyptorhynchus\_latirostris\_Carnaby \_gnangarra.jpg/720px-Calyptorhynchus\_latirostris\_Carnaby\_gnangarra.jpg

Appendix D Fire Management Plan



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FIRE MANAGEMENT

# BSQ Guideline 1.2 Fire Management

## **Objective**

To minimise the threat, spread and impacts of fire at the Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046) including both the Stage 1 and Expansion Projects.

## Background

The BSQ is located in a former pine plantation. The plantation was largely cleared in 2007 due to the presence of the European House Borer (EHB). As part of the EHB eradication program, the remaining tree stumps from the clearing operation were burnt or chipped. The Expansion Project Area was rehabilitated as a screening buffer following clearance in 2007.

The Baldivis Explosives Reserve (BER), controlled by the Department of Mines and Petroleum (DMP), is currently operational and located within the Stage 2 project area. A 100 metre buffer is in place around the explosives reserve. All activities within 100 metres of the BER are authorised by DMP.

There will be no burning of vegetation or other materials required as a normal part of quarrying operations.

During general quarrying operations fires will only be lit during fire control and emergency response training exercises. Such training will be conducted in an open cleared area. Only small fires will be lit for the purposes of training on equipment to use and techniques to extinguish fires.

The DMP operate a reticulated fire system around the explosives compound area. The water bore at BSQ may be accessed by the DMP for the purposes of fire-fighting. Fire protection within the administration building, weighbridge and mobile equipment will be by use of hand held extinguishers. All mobile equipment and generating sets will be equipped with fire extinguishers.

The objective of this Management Plan is to ensure that fire control practices are implemented on site to minimise the risk of fire from site operations.

## Scope

This procedure applies to all activities and all personnel, contractors and visitors at BSQ at all times.

## **Related Documents**

The *Bush Fires Act* 1954 requires owners of premises to maintain firebreaks or low fuel areas around buildings and infrastructure. HAUS will undertake seasonal maintenance of firebreaks around plant infrastructure at BSQ in line with legislative requirements.

In addition to the Bush Fires Act (1954), the following documents relate to fire management at BSQ and should be consulted where applicable. This list is not exhaustive. Other SHE Guideline Documents and legislative requirements may also apply.

- SHE Guideline 3.4: Permit to Work;
- SHE Guideline 2.4: Contractor Management;

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#### FIRE MANAGEMENT

- SHE Guideline 3.1: Risk Management;
- SHE Guideline 3.2: Fixed Plant and Mobile Equipment;
- SHE Guideline 3.20: Hazardous Substances Handling and Storage;
- SHE Guideline 4.1: Permits, Licences and Approvals;
  - 4.1A: Guide to Environmental Planning Permits & Approvals for Holcim Operations.
  - 4.1E: Environmental Compliance Planner Aggregates.
- SHE Guideline 4.2: Hazard Identification;
  - 4.2A Aspects and Impacts Register for Aggregates Sites.
- SHE Standard 1.8: Emergency Response;
  - o Attachment 1.8C Potential Emergency Checklist.
  - Attachment 1.8E Emergency Drill / Evacuation Checklist.
- AS 1851-2005 Maintenance of Fire Protection Systems and Equipment.

## **Planning and Approvals**

#### Planning

- All activities, particularly those activities where there is potential for generating open flames or sparks, will need to undergo a risk assessment procedure (e.g. Job Hazard Analysis) to assess the fire risks associated with the activity. A Permit to Work will be required for any such activities.
- The risk assessment procedure will also include procedures or strategies for fire emergency.
- As part of the planning process for burning or hot-work activities, the expected weather conditions
  must be considered. In general, controlled burning or fire training activities must not be planned for
  summer months or during windy conditions.

#### Approvals

- Obtain consent of the Site Manager prior to undertaking any burning, including fire training exercises.
- The *Hot Work* section of the *Permit to Work* form must be completed and approved before undertaking any activity likely to generate an open flame, sparks or high ignition temperatures.
- A Fire Permit must be sought and received from the City of Rockingham before undertaking any controlled burning activities.
- Notify the Baldivis Explosives Reserve Manager of any intention to undertake burning on site. The contact number for the BER Manager is (08) 9524 3105.
- Notify the City of Rockingham of proposed burning activities.
- Notify the Volunteer Bush Fire Brigade of proposed burning activities (phone: 08 9528 7895).
- Chemicals brought onto site must be approved by the Site Manager. New chemicals need to be added to the site's Hazardous Substances Register, labelled and a risk assessment undertaken as required in SHE Guideline 3.20: *Hazardous Substances Handling and Storage*.



**BSQ Guideline 1.2** 

FIRE MANAGEMENT

## Management Strategy

A range of systems and practices will be in use at BSQ that will serve to manage the issue of fire control at the site. These are outlined below:

#### **Site Induction**

The site induction informs all personnel on site about fire awareness, the requirement to obtain a Hot Work Permit before undertaking welding, cutting or grinding activities; emergency contact numbers, procedures in case of a fire and fire control training that is periodically undertaken.

#### **Permit to Work – Hot Work**

All welding, cutting and grinding activities that are undertaken on site require the completion and authorisation of the relevant Hot Work section of the Permit to Work form (Appendix A). The permit will specify fire control practices to ensure no fires are started from conducting these activities.

#### **Fire Permit**

All planned burning activities that are undertaken on site require the completion and authorisation of a Fire Permit from the City of Rockingham. The permit will specify burning procedures and fire control practices to ensure fires are contained whilst undertaking these activities.

#### Communications

Contacts for Emergency Response are:

Baldivis Volunteer Bush Fire Brigade •

Peter Skilton: 9528 7895

Fire Service: 000 •

All vehicles are fitted with two-way radios that can also be used in an emergency situation.

#### Training

Periodic fire control training is undertaken for all personnel on site on the proper use of fire extinguishers, evacuation of buildings in case of fire and emergency muster points.

#### **Mobile Equipment Inspection Checklist**

All mobile equipment will be inspected before commencing work on site to ensure they are fitted with appropriate safety equipment that includes a fire extinguisher. Inspections will be carried out to ensure compliance with SHE Guideline 3.2 Fixed Plan and Mobile Equipment. Different vehicles have different checklist requirements. A list of the applicable checklists attached to SHE Guideline 3.2 is given in Appendix B.

#### **Use of Petrol Vehicles**

The use of Petrol Vehicles will be limited in areas of dry grass (such as areas rehabilitated with grasses). Consideration must be given to the potential fire hazards caused by using petrol vehicles in such areas. and whenever it is considered there may be such a potential risk, petrol vehicles should remain on formed limestone roads.

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#### FIRE MANAGEMENT

#### **Emergency Response Procedure**

The site will maintain an Emergency Response Procedure to be used in the event of serious accidents, incidents and fires.

## **Monitoring and Performance Indicators**

#### Monitoring

- Fire safety equipment will be inspected and serviced in line with regulatory requirements. The frequency of inspections is different for various fire safety equipment.
- See AS 1851-2005 Maintenance of Fire Protection Systems and Equipment for further detail on inspection and recording requirements.

#### **Performance Indicators**

- No unauthorised hot works on site;
- No unauthorised or accidental fires;
- No breaches of fire safety equipment compliance. Fire safety equipment and fire safety training must comply at all times with legislative requirements and Australian Standards, where they exist.

Role	Accountability
Site Manager	<ul> <li>Ensure that all personnel who report to you are aware of and conform to this procedure.</li> <li>Ensure the site conditions of contract include fire management and preparedness requirements.</li> <li>Process and approve Permit to Work and forms.</li> <li>Ensure appropriate Fire Permits are sought, approved and complied with for any required burning activities.</li> <li>Maintain fully-functioning and compliant fire safety equipment.</li> <li>Maintain a register of fire safety equipment inspections and fire training.</li> <li>Undertake fire drills and emergency response drills.</li> <li>Review and, if necessary, update this plan every two years or earlier if operational activities indicate that changes to fire management are required.</li> </ul>
All Persons	<ul> <li>Conform to this procedure at all times.</li> <li>Obtain a permit to work for all activities on site (and complete the Hot Work section of the permit if hot work activities are expected).</li> <li>Ensure vehicles brought on site have appropriate fire safety equipment, such as fire extinguisher.</li> </ul>

## Accountabilities



#### **BSQ Guideline 1.2**

FIRE MANAGEMENT

## **Document Management**

Rev No.	Date	Revision Description	Ву	Check	Approved
0	5 May 2013	Final	I Swane (URS)	J Becher (URS) T Hassell (URS)	G Manning (CEMEX)
0	6 November 2013	Final	M Jones (URS)	J Moro (URS)	L Honan (HAUS)

#### Attachments

Appendix A	Permit to Work
Appendix B	Vehicle Inspection Checklist References



**BSQ Guideline 1.2** 

FIRE MANAGEMENT

# **Appendix A – Permit to Work**

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Attachment 3.4A

## No XXXXXX

Permit to work (PTW)		
Date permit issued: Task/Work Supervisor/Contractor:		
Site: Location of task/work:		
Period of permit (days): Date(s): from/ to/	To:	
Task/work to be performed:		
Authorised Holcim person issuing permit (print name):		
Person(s) authorised to work (print name):		
Permit to work details		
Permit issuer to complete all sections that are appropriate to the job/task. Cross out sections that are n	ot relevant	
Task assessment (this section must be completed for all tasks)	Yes	No
Is a safe work method statement (SWMS), safe work procedure (SWP), job safety assessment (JSA) or risk assessment		
(If yes, this must be completed and approved and attached to the permit before issuing the permit)		
Will other people in the area need to be notified?		
Does the area need to be barricaded and sign posted (eg "caution people working") to restrict unauthorised access?		
Will any plant or equipment need to be locked out?		
Are provisions for safe access and egress required?		
Is any special PPE required?		
(If yes, list the PPE required)		
(If yes, list equipment/controls)		
Hot work	Yes	No
Is hot work (welding, cutting, grinding & heating) outside designated hot work areas required as part of the job? (If ves. complete the Hot Work checklist – SH Attachment 3.4F)		
Working at heights	Yes	No
Is work required to be completed at a height equal to or greater than 2 metres (including work near unprotected edges, unguarded openings, work on roofs where a risk of fall or falling objects exists)? (If yes, complete the working at beingths checklist – SH Attachment 3 4G)		
Excavation & trenching	Yes	No
Is excavation and/or trenching work required to be completed as part of the work?		
Risk of drowning	Yes	No
Is there a risk of drowning whilst completing the maintenance task? (If yes, complete the prevention of drowning checklist – SH Attachment 3.4I)		
Live access (non-electrical)	Yes	No
Is a person required to work near or on live or moving equipment (for example conveyor belt tracking, etc)? (If ves. complete the live access (non-electrical) checklist – SH Attachment 3.4J)		
Live access (electrical)	Yes	No
Is live electrical access required to switchboards, electrical cabinets or other electrical components? If yes, only an electrician can be given access to live circuits. A <u>risk assessment must</u> be completed.		
Critical Lifts	Yes	No
Are any dual lifts requiring 2 or more mobile cranes or mobile and large bridge gantry (LBG) combination OR any Humes multicast rotations (eg. Humeguard or Wingwalls) required?		
Confined space entry	Yes	No
Is entry into a Confined Space required?	·	
If yes, a confined space entry permit must be completed. Refer to SH Guideline 3.13 for further details Agitator barrel de-dagging	Yes	No
Is entry into an agitator barrel required for de-dagging?		
If yes, a de-dagging entry permit must be completed. Refer to SH Guideline 3.15 for further details	Vac	No
ASDESTOS WORK Is the work likely to disturb asbestos materials?	res	NO
If yes, a specialist contractor must be used. Refer to SH Guideline 3.23 for further details		
Authorised person issuing permit (sign):		
Person(s) authorised to work (sign):		

I have read all requirements detailed in the attached permit documentation and understand the hazards associated with the task. I understand that all controls detailed in the PTW documentation and attached checklists/risk assessments must be in place for the duration of the task.

SH Standard Guideline 3.4

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#### Attachment 3.4A

# High risk task observation

Authorised person to complete task observation.

High risk task observation I have reviewed this high risk task and all permit and risk assessment conditions are being followed, or are being addressed. Authorised person name: ..... Signature: .....

Date: ...../..../...../

Time: ..... am/pm

#### **Job/task completion** Permit receiver to complete all sections. N/A Completion of job/task Yes No Have all guards been put back on all plant / equipment? Have all safety locks and danger tags been removed and plant / equipment returned to service? Have all work areas been checked and cleared of debris and scrap? Has all safety equipment, barricades & signs been removed and stored? Have all fire extinguishers been returned to their storage location and any used extinguishers reported? Have all tools and equipment been cleaned and returned to storage? Has all plant / equipment been checked to ensure it is ready to return to service? No Final check of area – hot work only Yes Has the work area and surroundings been checked 30 minutes after completion of work and found to be safe? Other comments

ve been removed from the work a	area a	r

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Declaration of job/task completion I certify that the work is complete and that all people, materials and tools have nd the area has been returned to a clean and safe condition.

Work	supervisor/contractor:
Date:	

Signature: .....

Time: ..... am/pm

Permit returned	
I have personally checked that the clearances certified above are corre	ct and that this permit is now cancelled. I have notified the
Operations Manager and/or the SIT of any hazards that need to be add	lressed
Authorised person	
Closing permit:	Signature:
	-
Date:///	Time: am/pm

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FIRE MANAGEMENT

## **Appendix B – Vehicle Inspection Checklist References**

All references given are included as Attachments to SHE Guideline 3.2 Fixed Plant and Mobile Equipment.

Attachment 3.2G	Mobile Crane Safety Hardware
Attachment 3.2H	Forklift Safety Hardware
Attachment 3.2I	Agitator Safety Hardware
Attachment 3.2J	Travers Safety Hardware
Attachment 3.2K	Gantry Safety Hardware
Attachment 3.2L	Drill Rig
Attachment 3.2M	Quarry Dozer
Attachment 3.2N	Quarry Excavator-Face Shovel
Attachment 3.2O	Quarry Front End Loader
Attachment 3.2P	Quarry Grader
Attachment 3.2Q	Quarry Off Highway Dump Truck
Attachment 3.2R	Quarry Off Highway Water Truck
Attachment 3.2S	Quarry On Highway Bin Truck
Attachment 3.2T	Quarry On Highway Water Truck
Attachment 3.2U	Quarry Scraper
Attachment 3.2V	Quarry Skid Steer

# Appendix E Hydrocarbon Management Plan

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HYDROCARBON MANAGEMENT

# BSQ Guideline 1.3 Hydrocarbon Management

## **Objectives**

To ensure minimal release of hydrocarbons to the environment, either as a result of storage or handling incidents at the Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046) including the Stage 1 and Expansion Projects.

## Background

Waste hydrocarbons may be derived from mobile equipment and maintenance activities. Sources may include: waste oils, hoses, filters and used rags. All hydrocarbon wastes will be collected at or near their source, contained and disposed off-site at an appropriate hydrocarbon disposal facility. Inappropriate disposal or failure to contain hydrocarbon spills can result in contamination of soils, surface water and groundwater and pose a safety risk to personnel onsite.

A maintenance, equipment storage and fuelling area is located within a fenced compound in the north east of the BSQ site. The area contains one bay with a containment apron, wash down bay with a drivein sump and an oil/hydrocarbon separator. Oils and fuels will be stored in the compound for equipment maintenance. Diesel will be stored onsite in two self-bunded 25,000L capacity storage tanks.

The Department of Mines and Petroleum (DMP), and Department of Environment Regulation (DER) require all petroleum hydrocarbons to appropriately contained using bunded retention compounds in accordance with Australian Standard (AS) 1940 – *The storage and handling of flammable and combustible liquids*.

Further information for the management of hydrocarbon discharge in stormwater can be found in the *Stormwater Management Manual for Western Australia* available through the Department of Water website at:

• http://portal.water.wa.gov.au/portal/page/portal/WaterManagement/Stormwater/StormwaterMgtManual

## Scope

This procedure applies to all outdoor activities and all personnel, contractors and visitors at BSQ.

## **Related Documents**

The following documents relate to hydrocarbon management at BSQ and should be consulted where applicable. This list is not exhaustive. Other SHE Guideline Documents and legislative requirements may also apply.

- BSQ Guideline 1.5: Waste Management;
- SHE Guideline 3.1: Risk Management;
- SHE Guideline 3.20: Hazardous Substances Handling and Storage;
- SHE Guideline 3.21: Dangerous Goods;

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#### HYDROCARBON MANAGEMENT

- SHE Guideline 4.1: Permits, Licences and Approvals;
  - o 4.1A: Guide to Environmental Planning Permits & Approvals for Holcim Operations
  - o 4.1E: Environmental Compliance Planner Aggregates
- SHE Guideline 4.2: Hazard Identification;
  - 4.2A: Aspects and Impacts Register for Aggregates Sites
- Agriculture and Related Resources Protection Act 1976;
- Western Australian Environmental Protection Act 1986;
- Poisons Act 1964;
- Poisons Regulations 1965;
- Mines Safety and Inspection Act 1994;
- Mines Safety and Inspection Regulations 1995;
- Dangerous Goods Safety Act 2004;
- Dangerous Goods Safety Regulations 2007; and
- AS 1940 The storage and handling of flammable and combustible liquids.

## **Planning and Approvals**

#### Planning

- An oil/water separator will be installed in the maintenance area to catch all potential spills from the maintenance and re-fuelling of equipment and vehicles.
- A waste compound will be installed at the site and will function as a collection and storage point for domestic, industrial and hydrocarbon waste prior to disposal offsite. (See Waste Disposal Plan for details)
- Spill kits will be stored in the maintenance area, site office and with all operating equipment to contain any potential spills.
- Oil and fuel storage areas will be segregated and bunded in accordance with AS 1940 and DMP and DER requirements.
- All mobile equipment will be fuelled in the maintenance compound.
- Remote fuelling procedures will be adopted for fuelling of any immobile equipment on site.

#### **Approvals**

• Obtain consent of the Site Manager or authorised representative prior to disposal or oil and maintenance fuel wastes.



HYDROCARBON MANAGEMENT

## Management Strategy

#### General

- All hydrocarbons stored onsite, will be stored in segregated, bunded areas according to Australian Standard (AS) 1940 and DMP and DER requirements.
- During operations at BSQ, the principles of reduce, reuse and recycle will be employed to minimise the amount of waste produced.
- All hydrocarbon wastes including waste oils, absorbent material and materials contaminated with hydrocarbons will be collected and stored in the fenced waste compound in the north east of the project site, prior to being disposed offsite by a licensed contractor.
- All hydrocarbon substance storage containers and areas will be clearly identified with appropriate signage and labelling.
- The purchase, storage and transport of fuel will be carried out in accordance with:
  - Poisons Act 1964; 0
  - Poisons Regulations 1965; 0
  - Mines Safety and Inspection Act 1994;
  - Mines Safety and Inspection Regulations 1995; and 0
  - Dangerous Goods Safety Act 2004. 0
- Dangerous Goods Safety Regulations 2007; Raise the awareness of the workforce about the hydrocarbon management plan. All employees will undergo site specific awareness training during inductions. The hydrocarbon component of the training will include:
  - Hydrocarbon purchase, storage and use at BSQ. 0
  - Issues relating to the management of hydrocarbons on the site and staff responsibilities 0 (correct fuelling, storage and disposal).
  - The adverse impact of hydrocarbon spills to soils, surface water, groundwater and safety risk 0 to personnel onsite.
  - The measures to prevent hydrocarbon spills and procedures for clean-up of hydrocarbon 0 spills
  - How staff report hydrocarbon spills. 0

#### Hydrocarbon Waste Minimisation and Control

- Equipment and vehicle maintenance will only take place in the designated maintenance compound so that any spills and runoff can be collected in the sump.
- Accidental oil spills will be mopped up with absorbent material (using spill kits) and waste will be segregated for removal and disposal offsite by a licensed contractor (see Waste Management Plan). All spills are to be reported to the site manager and SHE Coordinator (Perth Region) for Incident Investigation.
- The oil/water separator in the maintenance area will be checked regularly and the waste removed and disposed offsite by a licensed contractor.
- All hazardous substances brought to site will be required to undergo assessment. The assessment process comprises:
  - Determining whether the relevant chemical is already registered on the Hazardous 0 Substance Register (SHE Guideline 3.20A) for use at BSQ. If the chemical is already registered on the Hazardous Substance Register, the chemical can be brought on site and used under the conditions of the Material Safety Data Sheet (MSDS) and relevant JSA's associated with the chemical use tasks(s). If the chemical is not on the Hazardous


#### HYDROCARBON MANAGEMENT

Substance Register a risk assessment must be undertaken as required in SHE Guideline 3.20: *Hazardous Substances – Handling and Storage*.

 An assessment of the new chemical by the Site Manager and the SHE Coordinator (Perth Region). If approved, the chemical will be added to the Hazardous Substance Register and a copy of the MSDS associated with the chemical shall be submitted to the Site Manager, be retained on site and be accessible by all personnel and contractors.

## **Remote Fuelling**

- Remote fuelling will be conducted by a fuel truck or light vehicle with a fuel trailer. Remote fuelling will only be carried out for immobile equipment on site such as; generator sets, bore pump and screening plant.
- Spill kits will be stored in the fuel truck or fuel trailer used on site for remote fuelling and be employed in the event of a spill during remote fuelling.
- In the event of a spill while remote fuelling, any affected sand material which cannot be immediately treated, will be excavated and transported to a hardstand area for storage prior to disposal in a licensed facility.

# **Monitoring and Performance Indicators**

#### Monitoring

- Undertake daily inspection of the oil/water separator and ensure all hydrocarbon waste is removed and collected for offsite disposal.
- Spills that occur are recorded as a non conformance.
- Retain all Controlled Waste Tracking Forms from offsite disposal of hydrocarbon waste.

## **Performance Indicators**

- Hydrocarbon use, storage and disposal must be carried out in a manner so that no environmental damage is caused.
- No spillage of hydrocarbons in areas beyond containment areas in the maintenance compound, and no subsequent discharge of hydrocarbon to the soil, surface water or groundwater. Spills that do occur in the containment area are to be recorded as a non conformance.
- Copies of Controlled Waste Tracking Forms are to be kept as evidence of appropriate disposal.



HYDROCARBON MANAGEMENT

# Definitions

- **Containment apron:** A hydrocarbon spill containment device consisting of a fluid-impervious receptical with side and end flaps. A drain valve is present to direct all spills to a designated area.
- **Oil/water separator:** A device used to collect and remove hydrocarbon pollutants from stormwater and/or runoff. It consists of a trap from which sediment and hydrocarbon can be removed.
- **Sump (drive-in):** A below ground collection container for vehicle wash-down water. All runoff collected will be directed through the oil/water separator from which hydrocarbons are removed and water is recycled.



# Accountabilities

Role	Accountability
Site Manager	Ensure that all personnel who report to you are aware of and conform to this procedure.
	<ul> <li>Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect).</li> </ul>
	<ul> <li>Ensure the site conditions of contract include hydrocarbon management requirements.</li> </ul>
	<ul> <li>Ensure all spills are contained and clean-up appropriately and recorded.</li> </ul>
	<ul> <li>Ensure hydrocarbons are used, stored and disposed of correctly and in accordance with AS 1940. Ensure offsite disposal is carried out by a licensed contractor.</li> </ul>
	<ul> <li>Ensure the oil/water separator is inspected daily and any sediment of hydrocarbon collected is removed and disposed of.</li> </ul>
	<ul> <li>Review and, if necessary, update this plan every two years or earlier if hydrocarbon monitoring indicates that changes to hydrocarbon management are required.</li> </ul>
	<ul> <li>Record and file copies of Controlled Waste Tracking Forms from offsite disposal of hydrocarbon waste.</li> </ul>
All Persons	Conform to this procedure at all times.
	<ul> <li>Ensure hydrocarbons are stored and disposed of correctly and the correct fuelling procedures are carried out.</li> </ul>
	Report any non-conformances or spills to the site manager.

# **Document Management**

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0	5 May 2008	Final	T Hassell (URS)	J Becher (URS) I Swane (URS)	G Manning (CEMEX)
0	6 November 2013	Final	M Jones (URS)	J Moro (URS)	L Honan (HAUS)

## References

Department of Water (2004). Stormwater Management Manual for Western Australia. Available online:

http://portal.water.wa.gov.au/portal/page/portal/WaterManagement/Stormwater/StormwaterMgtManual. Accessed February 2008.

Department of Environment and Conservation (DEC) Controlled Waste Tracking System. Available online:

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http://portal.environment.wa.gov.au/pls/portal/url/page/land/controlled waste/publications/guidelines

Appendix F Noise Management Plan



F



NOISE MANAGEMENT

# BSQ Guideline 6.9 Noise Management

# **Objectives**

To minimise the impact of mining activities and protect the amenity of residents surrounding the Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046) including the Stage 1 Project and Expansion Project; by ensuring noise levels meet the requirements of the Environment Protection (Noise) Regulations 1997.

# Background

It is expected that mining activities at BSQ will generate some noise associated with operation of processing equipment and machinery and the movement of vehicles around the site. The normal operating hours for the sand quarry will be from 7.00 am through to 6.00 pm Monday to Friday and a half day on Saturday.

Under the conditions of the Operating Licence, noise emissions at BSQ are to meet the criteria in the Environmental Protection (Noise) Regulations 1997. The regulations stipulate the maximum allowable external noise levels to be generated during quarrying operations. The assigned noise level during operation of the sand quarry, under the regulations for this period for residential land use, is  $L_{A10}$  45 dB(A). Due to the tonal or potentially intrusive characteristics of the noise generated for the Stage 1 Project attributed to the use of the screening and washing plant, the allowable level is 5 dB(A) less than the assigned level and hence  $L_{A10}$  40 dB(A). For the Expansion Project, the assigned noise level during operation of the sand quarry is  $L_{A10}$  45 dB(A) as only fill sand will be quarried and no screening or washing of sand is proposed.

Environmental noise assessments were undertaken by Herring Storer Acoustics and URS to assess the potential impact of noise generated by operations of the Stage 1 Project and Expansion Project, respectively. The assessment was adapted by Herring Storer Acoustics into the Baldivis Sand Quarry Stage 1 – Draft Noise Management Plan which was appended to the Mining Proposal. This procedure is developed by URS. An environmental noise assessment was undertaken by Herring Storer Acoustics to assess the potential impact of noise generated by operations of the Stage 1 Project.

The assessments undertaken by Herring Storer Acoustics and URS involved noise modelling (using SoundPlan V7.2) to predict noise levels from the proposed sand quarry operations to areas surrounding the site. The computer model considered ground topography, sound power levels equipment and machinery used on the site, and atmospheric conditions. The noise modelling was undertaken for the worst case scenario of atmospheric conditions. Predicted noise levels generated by the model were then assessed in respect to the Environmental Protection (Noise) Regulations 1997.

The noise assessment for the Stage 1 Project has shown that during operations, whilst a noise bund is in place during quarrying (a 5 m working pit face with equipment positioned within 20 m of the pit face) that noise levels predicted during worst case conditions are expected to range between 23 and 35 dB(A) at sensitive receptors to the north and west of the site. Predicted noise levels during worst case conditions without a noise barrier in place are expected to range between 33 and 45 dB(A) at sensitive receptors to the north and west of the site. The predicted noise generation in calm and worst case conditions, with and without noise control is shown in **Appendix A**.

Based on the noise assessment, it is possible that during the construction of the noise barrier (a 5 m working pit face with equipment positioned within 20 m of the pit face), noise may be generated at levels which exceed the criteria for quarrying activities. It is expected that this activity will be undertaken over the period of one day. All other proposed activities and noise levels generated are anticipated to be below criteria.

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The noise assessment for the Expansion Project has shown that during operations the noise predictions indicate compliance of the nominated  $L_{A10}$  noise criterion of 45 dB(A) at all sensitive receptors, except for sensitive receptor R0 where predicted noise levels exceeded the noise criterion by 1 dB(A) on Scenario 1, during the "Morning" period. This marginal exceedance is not likely to generate any noise impacts at the sensitive receptor since pre-existing ambient and background noise levels are 4 dB(A) over the noise criterion, due to road traffic along Stakehill Road and to a lesser extent due to the Kwinana Freeway. The predicted noise generation is shown in **Appendix B**.

The controls recommended to mitigate the noise generated on-site due to the proposed operations are the implementation of best practices and management measures to avoid excessive noise during vehicles movements, including the use of front end loaders and visiting trucks, as outlined in this noise management guideline.

# Scope

This procedure applies to all outdoor activities and all personnel, contractors and visitors at BSQ at all times.

# **Related Documents**

The following documents relate to noise management at BSQ and should be consulted where applicable. This list is not exhaustive. Other BSQ Guideline Documents and legislative requirements may also apply.

- BSQ Guideline 1.11: Transport Management;
- SHE Guideline 3.1: Risk Management;
- SHE Guideline 3.17: Noise;
- SHE Guideline 4.1: Permits, Licences and Approvals;
  - 4.1A: Guide to Environmental Planning Permits & Approvals for Holcim Operations.
  - 4.1E: Environmental Compliance Planner Aggregates.
- SHE Guideline 4.2: Hazard Identification;
  - 4.2A: Aspects and Impacts Register for Aggregates Sites.
  - 4.12: Noise Emissions.
- Environmental Protection Act 1986 (WA); and
- Environmental Protection (Noise) Regulations 1997.

# **Planning and Approvals**

#### Planning

- Noise management will be undertaken in accordance with the HAUS Safety, Health and Environment Management System, BSQ Guideline 3.17, Noise.
- Excavation will be undertaken progressively, from the south to the north of the site in east/west strips. A pit face of 5m for the Stage 1 Project will ensure a noise barrier between machinery and residences to minimise noise impact. Screening and loading operations will also be positioned behind similar barriers ensure minimal noise impact to residents.

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#### NOISE MANAGEMENT

- Site speed limits will be set at 30kmph to minimise noise caused by excessive acceleration or deceleration of vehicles as the move around site and while entering or exiting the site. Engine braking will not be permitted for trucks approaching the site.
- Under normal circumstances, equipment operation will be restricted to 7am to 6pm Monday to Friday and a half day on Saturday.

### **Approvals**

- In the event quarry operations significantly change as quarrying progresses, or if noise monitoring indicates that noise generated by operation may exceed the L<sub>A10</sub> 40 dB(A) criteria level for the Stage 1 Project or L<sub>A10</sub> 45 dB(A) criteria level for the Expansion Project, approval of works must be given by the Site Manager, and operations must be carried out in accordance with an appropriate noise management procedure.
- HAUS maintains a company fleet and will prohibit all trucks used to transport sand materials from using engine brakes while approaching the BSQ site from Stakehill Road.

## **Management Strategy**

#### General

- Noise generated by plant, trucks and other heavy machinery will be minimised and managed by:
  - Prohibiting the use of engine brakes;
  - Setting speed limits onsite;
  - Regularly maintaining internal haul roads to ensure a good running surface;
  - Fitting broadband reversing alarms to replace tonal bleeping alarms, where applicable, to all mobile plant and vehicles operating on site (i.e. front end loaders, water trucks and light vehiceles);
  - Actively maintaining plant and machinery to ensure that all worn parts are replaced and that correct greasing, lubrication and replacement of acoustic covers takes place to reduce noise emissions; and
  - Silencers and noise attenuation will be utilised as required.
- During operations, if noise levels are shown to be greater than L<sub>A10</sub> 40dBA for the Stage 1 Project or L<sub>A10</sub> 45dBA for the Expansion Project during noise monitoring, noise levels will be reduced by decreasing the number of equipment/vehicles in operation. Hand held noise measurements will continue to be undertaken at the northern boundary or at sensitive receptor R4 for the Stage 1 Project (Appendix A) or sensitive receptor R0 for the Expansion Project to measure the noise levels generated until noise levels generated are within criteria for quarrying activities.
- Raise the awareness of the workforce about the noise management plan. All employees will undergo site specific awareness training during inductions. The noise component of the training will include:
  - Training in the correct operation of equipment that has the potential to generate noise.
  - Awareness training in the operation of trucks and other vehicles to minimise noise emissions (including awareness of the site speed limits).
  - $\circ$   $\;$  The use of hearing protection provided to staff as required.
  - $\circ$  Noise management measures that may be implemented around the site.
  - Issues relating to the management of noise emitted from the site and staff responsibilities (community concern and monitoring).

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#### NOISE MANAGEMENT

• A Complaints Register will be established for the site to record the date, nature, and resolution action of any complaints. Complaints will be directed to the site supervisor for resolution. If the complaint is verified as being due to a site source, remedial action will be undertaken within 48 hours.

## **Minimisation and Control**

In addition to the above, during the construction of the noise barrier for the Stage 1 Project (a 5 m working pit face with equipment positioned within 20 m of the pit face) and during initiation of the Project Expansion, when it is possible that noise levels may exceed criteria for quarrying activities ( $L_{A10}$  40 dB(A) during Stage 1 and 45 dB(A) during the Project Expansion), the following additional management practices will be undertaken:

- Sensitive receptors likely to be affected by noise levels to be notified by the Site Manager at least 48 hours in advance of activities.
- Noise levels will be monitored by means of attended noise measurements, using a sound level meter (at regular intervals during a full day), and unattended noise measurements, using a noise data logger (continuously for at least seven days), at the northern boundary or at sensitive receptor D (Appendix A) prior to and during the day of construction. Similarly for the first week during initiation of the Project Expansion, attended and unattended noise monitoring will be conducted at the southern boundary of sensitive receptor R0 (Appendix B).
- In the event that complaints are received, the following actions will be undertaken:
  - The Site Manager will respond to the complaint, explain the activities being undertaken and complete a comprehensive log of the event, including date and times, the equipment and vehicles that were operating at the time referred to by the complainant;
  - If noise levels are shown to be greater than L<sub>A10</sub> 40 dB(A) during Stage 1 and 45 dB(A) during the Project Expansion and complaints are received, the noise levels will be reduced by decreasing the number of equipment/vehicles in operation. Hand held noise measurements will continue to be undertaken at the northern boundary or at sensitive receptor D (Stage 1, Appendix A) or receptor R0 (Project Expansion, Appendix B) to measure the noise levels generated until noise levels are within criteria for quarrying activities.

# **Monitoring and Performance Indicators**

## Monitoring

- Site operations will be regularly monitored to ensure that excavation configurations, to minimise noise emissions, are being adhered to.
- Equipment maintenance and inspection schedules shall be implemented to ensure that all equipment is operating in accordance with the manufacturer's instructions and within regulatory requirements. This will include ensuring that all noise control equipment is correctly fitted and operating at design performance.
- In addition to the noise monitoring during construction of the noise bund for Stage 1 and during initiation of the Project Expansion, quarterly noise monitoring comprised by one-day attended and one-week unattended noise measurements and inspections will be undertaken and will be reviewed by the Site Manager to evaluate the effectiveness of noise control measures. An Environmental Noise Survey Report will be prepared by an acoustics specialist to record the results of the noise monitoring. An example of an Environmental Noise Survey Report is given as Attachment 4.2.5 of SHE Guideline 4.2 - Hazard Identification.
- Noise monitoring will include:
  - During the construction of the working face for the Stage 1 Project and at commencement of operations for the Expansion Project, operator attended noise monitoring using a hand held

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sound level meter will be undertaken for a full working day at the northern boundary or at sensitive receptor D for the Stage 1 Project and sensitive receptor R0 for the Expansion Project (**Appendix A and B**) prior to and during the day of construction to measure the noise levels generated during construction of the noise barrier (a 5 m working pit face with equipment positioned within 20 m of the pit face).

During the first month of operations for the Stage 1 Project and the Expansion Project, a continuous unattended noise logger will log noise levels and audio over a week to measure the noise levels generated at the northern boundary or at sensitive receptor D for the Stage 1 Project and sensitive receptor R0 for the Expansion Project (Appendix A and B). This monitoring would be repeated in the event quarry operations significantly change or quarterly as quarrying progresses.

#### **Performance Indicators**

- Significant incidents will be reported to the Kwinana Peel Office (Booragoon Office) of the Department of Environmental Regulation.
- Records of complaints, response and follow-up actions will be forwarded to the Kwinana Peel Office (Booragoon Office) of the Department of Environmental Regulation within 24 hours of receipt of the complaint.
- The site supervisor will maintain contact with any complainant until the source of the incident is verified and resolved as far as is practicable.

## Definitions

L<sub>A10</sub> noise level (dB(A)): A noise level measured in decibels (dBA) that is exceeded for 10% of each sampling period during noise monitoring.



# Accountabilities

Role	Accountability
Site Manager	<ul> <li>Ensure that all personnel who report to you are aware of and conform to this procedure.</li> </ul>
	<ul> <li>Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect).</li> </ul>
	Ensure the site conditions of contract include noise management requirements.
	<ul> <li>Ensure plant and machinery is regularly inspected and maintained to ensure they are operating correctly and noise control equipment is fitted properly.</li> </ul>
	<ul> <li>Ensure site complaints register is maintained and that appropriate actions is taken within 48 hrs if required.</li> </ul>
	<ul> <li>Ensure noise monitoring is carried out during construction of the noise barrier and whenever required.</li> </ul>
	<ul> <li>Review and, if necessary, update this plan every two years or earlier if monitoring indicates that changes to dust management are required.</li> </ul>
All Persons	Conform to this procedure at all times.
	Ensure hearing protection is worn when required.
	<ul> <li>Ensure plant, machinery and vehicles are operated correctly to minimize noise emissions.</li> </ul>
	• Ensure any incidents (noise complaints) are reported to the site manager.

# **Document Management**

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0	5 May 2008	Final	T Hassell (URS)	J Becher (URS)	G Manning (CEMEX)
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	2013				

## Attachments

Appendix APredicted Noise Levels in the Vicinity of Baldivis Sand Quarry during the Stage 1 ProjectAppendix BPredicted Noise Levels in the Vicinity of Baldivis Sand Quarry during the Expansion<br/>Project



NOISE MANAGEMENT

# Appendix A – Predicted Noise Levels in the Vicinity of Baldivis Sand Quarry During the Stage 1 Project





	Readymix Proposed Sand Quarry - Baldivis         5m Bund Close to Source South East Winds - Noise Contour Plot	0 600 800 m Reference 06225-01
Whilst every care is taken by URS to ensure the a losses, damages (including indirect or consequent	accuracy of the digital data, URS makes no representation or warranties about its accuracy, reliability, completeness, suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for any expenses, ntial damage) and costs which may be incurred as a result of data being inaccurate in any way for any reason. Electronic files are provided for information only. The data in these files is not controlled or subject to automatic updates for users outside of URS.	
HOLCIM (AUSTRALIA) PTY LTD	BSQ GUIDELINE: DUST MANAGEMENT	STAGE 1 NOISE MAP
URS	File No:         42908418-ES-D002.xlsx         Drawn:         RNM         Approved:         MJ         Date:         05/11/2013         Rev:         Approved:         Approved:         MJ         Date:         05/11/2013         Approved:         Approved:         Approved:         MJ         Date:         05/11/2013         Approved:         Approved: <t< td=""><td>Appendix A1</td></t<>	Appendix A1



NOISE MANAGEMENT

# Appendix B – Predicted Noise Levels in the Vicinity of Baldivis Sand Quarry During the Expansion Project



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**EXTRACTS FROM URS** NOISE QUALITY IMPACT ASSESSMENT **MIDDAY TO 6PM** 









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BSQ GUIDELINE: DUST MANAGEMENT

EXTRACTS FROM URS NOISE QUALITY IMPACT ASSESSMENT 6AM TO MIDDAY





Appendix G Pest Management Plan



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URS No. 42908418//A



# BSQ Guideline 1.4 Pest Management

# Objective

To ensure no new populations of pest animals are established and existing populations are eradicated and/or managed at the Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046) including the Stage 1 and Expansion Projects.

# Background

Feral animals can have a major impact on native animals by predation, competition for food and by damaging ecosystems. Fauna assessments of wetland and remnant bushland close to the site (Bamford Consulting Ecologists Reports, 2006 and 2013) did not record the presence of any notable pest species. Historically, the Stage 1 Project Area was a pine plantation that was cleared and the stumps burnt for the eradication of the European House Borer (EBC). Management actions relating to the EBC have been removed from this plan as this pest has been eradicated from the site.

Feral animals may be attracted to the area surrounding the Stage 1 and Expansion Project Areas due to site activities, such as the presence of easily accessible putrescible waste and food and water sources (*e.g.* dripping pipes and sedimentation ponds).

Common pest/feral animals in the Swan Coastal Plain region include:

• Fox; Red Fox – *Vulpes vulpes* 

Feral pig - Sus scrofa

Declared pest animal (A5)

Declared pest animal (A5)

• European Rabbit - Oryctolagus cuniculus

Declared pest animal (A4, A5, A6)

Other species, such as feral cats (*Felus catus*), rats and mice are marked as exempt from declaration, however if they occur in feral state, advice on control and management may be obtained from the Agriculture Protection Board.

Further information on declared pest species found at BSQ (from the list of species above) can be found online at the DAF website:

• <u>http://www.agric.wa.gov.au/content/pw/vp/kw/vertebrate\_policy.htm</u>

# Scope

•

This procedure applies to all outdoor activities and all personnel, contractors and visitors at BSQ.

# **Related Documents**

The following documents relate to pest management at BSQ and should be consulted where applicable. This list is not exhaustive. Other SHE Guideline Documents and legislative requirements may also apply.

• BSQ Guideline 1.2: Fire Management;

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- BSQ Guideline 1.6: Waste Management;
- SHE Guideline 3.1: Risk Management
- SHE Guideline 3.20: Hazardous Substances Handling and Storage;
- SHE Guideline 4.1: Permits, Licences and Approvals;
  - 4.1A: Guide to Environmental Planning Permits & Approvals for Holcim Operations.
  - 4.1E: Environmental Compliance Planner Aggregates.
- SHE Guideline 4.2: Hazard Identification;
  - 4.2A: Aspects and Impacts Register for Aggregates Sites.
- BSQ Quarry Closure Plan;
- Agriculture and Related Resources Protection Act 1976; and
- Agriculture and Related Resources Protection (European House Borer) Regulations 2006.

# **Planning and Approvals**

## Planning

- Waste management practices will be put in place to ensure putrescible waste is isolated and not accessible to animals.
- Pest management control measures, prior to being carried out, will be assessed with respect to the likelihood of impacting native flora and/or fauna through the use of hazardous substances. Consultation with the BSQ Site Manager and the Safety, Health and Environmental (SHE) Coordinator (Perth Region) may be required.

## Approvals

• Chemicals brought onto site must be approved by the Site Manager. New chemicals need to be added to the site's Hazardous Substances Register, labelled and a risk assessment undertaken as required in SHE Guideline 3.20: *Hazardous Substances – Handling and Storage*.

# **Management Strategy**

## General

- Adhere to Waste and Fire Management Plans in a manner which prevents the establishment of feral animal populations, and minimises the impact to native flora and fauna.
- Sightings of pest or feral animals are to be reported to the Site Manager. The Site Manager will ensure appropriate control, baiting and/or eradication procedures are implemented, if required, to minimise the introduction or spread of pest species.
- The presence of permanent or semi-permanent food sources, such as putrescible waste, can attract bird and other fauna species including feral animals. These food sources include bins, outside dining areas or food storage areas. These areas may require isolation so that animals can not access the food sources. Methods of isolation may include:

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- Perimeter fencing and roofing of waste storage areas;
- Use of lockable or limited access rubbish bins; and
- Use of self-closing doors to access of food preparation, consumption and storage areas.
- Tanks, leaking pipes, drums and sedimentation ponds are to be maintained so as to minimise attraction for feral animals, and if leaks or bursts are detected, they are to be repaired as soon as practicable.

## **Eradication and Control**

- Minimise the potential risk of increasing feral animal abundance and diversity by ensuring all work areas are maintained and kept tidy under the Waste Management EMP. No pets or animals are to be brought onto site.
- The Site Manager will be responsible for selecting and utilising competent pest eradication experts to undertake the pest control activities (if the use of external experts is deemed necessary). The pest eradication method(s) will be selected in consultation between the Site Manager and SHE Coordinator (Perth Region). The selected method(s) must:
  - o Fully consider the health and safety of personnel, contractors and visitors;
  - Not contaminate soil, surface waters and groundwater; and
  - Minimise impacts to native (non-weed) flora and fauna.

For additional information on pest control, refer to the Department of Agriculture and Food (DAF) Farmnote publications available on the DAF website. Some of the relevant publications include:

- Feral Pig Farmnote 110/2000 (reviewed 2005)
- Options for fox control Farmnote 91/2001
- Options for rabbit control Farmnote 89/2001 (reviewed 2005)
- Rat and Mouse control in and around buildings Farmnote 114/2000 (reviewed 2005)
- Pest management and vegetation management contractors shall be required to produce, to the Site Manager, appropriate Job Safety Analysis (JSA) documentation for the eradication tasks to be performed. The use of chemicals and specialist heavy equipment at BSQ will be subject to approval (refer below).
- All chemicals brought to site will be required to undergo assessment. The assessment process comprises:
  - Determining whether the relevant chemical is already registered on the Hazardous Substance Register (SHE Guideline 3.20A) for use at BSQ. If the chemical is already registered on the Hazardous Substance Register, the chemical can be brought on site and used under the conditions of the Material Safety Data Sheet (MSDS) and relevant JSA's associated with the chemical use tasks(s). If the chemical is not on the Hazardous Substance Register a risk assessment must be undertaken as required in SHE Guideline 3.20: Hazardous Substances – Handling and Storage.
  - An assessment of the new chemical by the Site Manager and the SHE Coordinator (Perth Region). If approved, the chemical will be added to the Hazardous Substance Register and a copy of the MSDS associated with the chemical shall be submitted to the Site Manager, be retained on site and be accessible by all personnel and contractors.



# **Monitoring and Performance Indicators**

### Monitoring

- Undertake daily inspection of outdoor eating areas and other food preparation and storage areas to ensure cleanliness and hygiene is maintained and the site is kept tidy under the Waste Management EMP.
- Undertake daily inspection of sedimentation ponds for trapped or dead fauna and remove these if they occur. Any incidents involving pest species must be reported to the Site Manager.
- Record all feral animal sightings and implement eradication or deterrent measures if required.
- When pest eradication is carried out, record the method of eradication ensuring details such as area treated, tools or machinery used and chemical and concentration are included.

#### **Performance Indicators**

• The presence of feral animals on site is minimal, and no populations of feral species established on or near to the BSQ site.

# Definitions

- **Declared Animal:** An animal that has been "Declared" under the *Agriculture and Related Resources Protection Act 1976.* They are animals which represent a threat to agriculture and the environment or may cause social impacts in the community. The State has implemented control measures including the prevention of entry of mew pest species, removing small populations of existing species, minimising the impact of widespread species and raising awareness of the problems of and solutions for the pest species. A list of the Declared animals in Western Australia can be found online at the Department of Agriculture and Food website:
  - <u>http://www.agric.wa.gov.au/content/pw/vp/kw/vertebrate\_policy.htm</u>
  - A1 Entry prohibited
  - A2 Subject to eradication in the wild.
  - A3 Keeping prohibited.
  - A4 Entry subject to Department of Agriculture permits and/or conditions.
  - A5 Numbers will be reduced/controlled.
  - A6 Keeping subject to Department of Agriculture permits and/or conditions.

Sponsor

L Honan

A7 A management programme for each species outlines the area and conditions under which controls may be applied. Programmes are for the whole of the State or as indicated for each species.



# Accountabilities

Role	Accountability
Site Manager	• Ensure that all personnel who report to you are aware of and conform to this procedure.
	<ul> <li>Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect).</li> </ul>
	Ensure the site conditions of contract include pest management requirements.
	<ul> <li>Process and record all pest/feral animal sightings and determine is species sighted is a Declared species.</li> </ul>
	<ul> <li>Process and approve pest control measure procedures including stump removal, and ensure competent pest eradication experts are selected and utilised to undertake the pest control activities where appropriate.</li> </ul>
	Ensure any leaking or burst pipes or tanks are repaired as soon as practicable.
	Ensure contract scope of works detail pest management requirements.
	<ul> <li>Manage pest monitoring and eradication programmes on site.</li> </ul>
	<ul> <li>Review and, if necessary, update this plan every two years or earlier if pest monitoring indicates that changes to pest management are required.</li> </ul>
All Persons	Conform to this procedure at all times.
	<ul> <li>Report the sighting of any suspected declared animals to the Environmental Professional or Site Manager.</li> </ul>
	<ul> <li>Ensure site is kept tidy and rubbish free at all times and any leaking or burst pipes or tanks are reported to the Site Manager.</li> </ul>
	Obtain a permit to burn prior to undertaking disturbance to vegetation.

# **Document Management**

Rev No.	Date	<b>Revision Description</b>	Ву	Check	Approved
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0	6 November 2013	Final	J O'Halloran (URS)	J Moro (URS)	L Honan (HAUS)

Appendix H Quarry Closure Plan



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# Quarry Closure Plan Baldivis Sand Quarry Project

NOVEMBER 2013

Prepared for Holcim (Australia) Pty Ltd

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42908418



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# Introduction

The purpose of this document is to provide Holcim (Australia) Pty Ltd with a Quarry Closure Plan, specific for the Baldivis Sand Quarry (BSQ) including the Stage 1 Project and the Expansion Project. The Quarry Closure Plan will be a living document, open to development and review over the life of the BSQ.

# **1.1 Project Overview**

The Baldivis Sand Quarry is being undertaken on M70/1046, which is located approximately 50 km south of Perth, and 14 km south southeast of Rockingham, Western Australia (Figure 1).

The key components of the approved Stage 1 Project comprise:

- Quarrying, screening and washing of approximately 7 Mt of sand within an extraction area of 30 ha over a life of eight years to produce concrete, fill and brick layers' sand. The sand is quarried by front end loader and, if required, screened and washed at the mobile screening and washing plant. Washing water is deposited to a series of sedimentation ponds for settling of fines. Clay fines deposited are a by-product and are regularly removed and incorporated into sand products for sale.
- Abstraction of groundwater for washing of sand and dust suppression. Up to 150,000 kL are abstracted per annum.
- Transport of sand offsite. Up to 300 heavy vehicle movements occur each weekday and up to 150 heavy vehicle movements occur each Saturday for the transport of sand.
- Supporting infrastructure and facilities including a site office, lunch room and ablutions, a maintenance and equipment storage area, fuelling facility, weighbridge, power supply, wheel wash facility, power and communication lines and waste collection area.

An Explosives Reserve (Reserve 38575, Figure 2) administered by the Department of Consumer and Employment Protection (DoCEP) is located to the south of the Stage 1 Project Site. HAUS will maintain a separation distance of 100 metres from the Explosives Reserve until the Reserve is decommissioned.

Previously, the site was a Crown Reserve (Reserve 37090, Figure 2) set aside for forestry purposes and was administered by the Department of Environment and Conservation (DEC). A pine plantation that was present on the site was cleared by the Forest Products Commission (FPC) due to the presence of the European House Borer. Native title is not applicable to the site area.

The Stage 1 Project site is zoned Urban Deferred under the City of Rockingham's Town Planning Scheme. It is planned that, following the completion of quarry operations, the site will be transferred to LandCorp for residential development.

HAUS proposes to expand the existing Stage 1 of the Baldivis Sand Quarry (the expansion is hereafter referred to as the "Expansion Project") to continue to supply fill sand for the Perth Metropolitan Area and South West until approval can be sought for Stage 2 of the proposal.

The key components of the Expansion Project comprise:

• Extraction of up to 500,000 tonnes (t) of sand within a Limit of Extraction area of 7.21 ha. The Limit of Extraction area will extend 100 m into the existing 250 m buffer located along Stakehill Road. A buffer of approximately 150 m will remain in place adjacent to Stakehill Road. The sand would be quarried by front end loader, and loaded for transportation off site. No screening or washing of sand is proposed for the Expansion Project as all sand quarried will be utilised for fill.



#### **1** Introduction

- Transport of sand to customers within the Perth Metropolitan Area and South West along existing Stage 1 transport routes at the same or lower levels of existing Stage 1 vehicle volume and composition.
- Abstraction of up to 150,000 kL per annum of groundwater for dust suppression in accordance with the existing Licence To Take Water [GWL 162863(2)].
- Use of all other existing Stage 1 infrastructure comprising access road, weighbridge, power supply, communications, maintenance workshop, administration office, ablutions, crib room, fuelling facility, wheel wash facility and waste collection area.

Quarrying of the Expansion Project resource is expected to commence upon receipt of environmental approval and will enable HAUS to continue the current rate of throughput for another year with the resource life expected to extend for two to three years depending on market demand. HAUS intends to lodge approvals for Stage 2 of the Baldivis Sand Quarry Project located within Mining Lease M70/1241 within this time.

A site layout for the Expansion Project is shown in Figure 3.

# 1.2 Support Facilities

#### 1.2.1.1 Access

The entire Stage 1 Project site is fenced with signage to meet DMP requirements to prevent unauthorised access to the site.

Access is via the existing access road to the Explosives Reserve and an existing building to the north east of the site. Both facilities are located within Reserve 38575 held by DMP. The access road is a sealed road with a roundabout constructed in consultation with DMP.

A weighbridge is located at the entrance to the quarry area for the processing of sands for sale prior to transport offsite to customers. Prior to entering the weighbridge, trucks are required to pass through a wheel wash facility to minimise the spread of weeds to and from the site.

The existing building has been leased from DMP and is used as a site office, lunch room and for ablutions.

A small car park (8 bays) for workforce and visitor parking is located adjacent to the existing building onsite which is leased from DMP.

#### 1.2.1.2 Maintenance Area, Equipment Storage Area and Fuelling Facility

A maintenance area, equipment storage area for the storage of heavy equipment and fuelling facility is located within a fenced compound in the north of the Stage 1 site, part of which is within land leased from DMP (Figure 3).

The maintenance area contains one bay with a containment apron; wash down bay with drive-in sump and an oil/hydrocarbon separator.

Oils are stored in the Stage 1 maintenance area for equipment maintenance and are segregated and bunded in accordance with Australian Standard (AS) 1940 and DMP and DER requirements.

Diesel is stored in the maintenance area in a self-bunded 20,000L capacity storage tank. The fuel storage and refilling facility is bunded in accordance with AS 1940 and DMP and DER requirements,



#### **1 Introduction**

with appropriate surface water drainage and collection. A dangerous goods licence is held for the storage of diesel onsite.

#### 1.2.1.3 Waste Collection Facilities

The waste compound is a collection and storage point for domestic, industrial and hydrocarbon waste prior to disposal offsite and is located within the fenced compound in the north east of the Stage 1 site.

Wheel washing is undertaken using a closed-circuit water recycling system.

#### 1.2.1.4 Communication Lines

Communications run from the existing communication network at Baldivis Road along the access road to the fenced compound and weighbridge. The existing building leased from DMP and used as a site office, lunch room and ablutions has existing communications.

#### 1.2.1.5 Power

A 300 kVA diesel generator is located adjacent to the crib room. The generator contains its own fuel tanks and is self bunded in accordance with AS 1940 and DMP and DER requirements. Power is reticulated around the Stage 1 Project using aerial transmission lines. Step down transformers have been installed to achieve the desired final voltage.

Power lines run from the existing Synergy network at Baldivis Road along the access road to the fenced compound and weighbridge. The existing buildings onsite leased from DMP are connected to the Perth Metropolitan Area grid operated by Synergy.



# **Regulatory History**

The following documents were issued to give environmental approval for the Stage 1 Project:

A lease for the Stage 1 Project (M70/1046) was issued by Department of Mines and Petroleum (DMP) to CSR Ltd (now HAUS) on 14th November 2006 under the *Mining Act* 1978. The lease was then transferred to Rinker Australia Pty Ltd on 19th December 2006, and is now held under the name of Holcim (Australia) Pty Ltd.

Environmental approval and Operating Licence was given with a Licence for Prescribed Premises (L8176/2007/1) granted by the Department of Environment and Conservation [now known as the Department of Environmental Regulation (DER)] on 28th February 2008 under Part V of the *Environmental Protection Act* 1986. This licence included operation of the mobile screening and washing plant.

A Licence to Take Water (GWL162863(1)) was granted by the Department of Water (DoW) on the 27th December 2007 for groundwater abstraction for dust suppression and processing purposes, under the Rights in Water and Irrigation Act 1914.

A Mining Proposal has been submitted to DMP under the *Mining Act* 1978 and a Licence Amendment Application has been submitted to DER under the *Environmental Protection Act* 1986 to seek environmental approval for the Expansion Project.



# **Quarry Closure**

The following section outlines the decommissioning and rehabilitation that will be undertaken following cessation of quarry operations for relinquishment of Mining Lease M70/1046 to the State and transfer of the site to LandCorp for residential development. The plan will be continue to be developed over the life of the Stage 1 Project and will be consistent with Landcorp's requirements.

The total area of land disturbance for Stage 1 of the Project is anticipated to be 36.3 ha, which comprises 32.8 ha of proposed disturbance and 3.5 ha of existing disturbance (use of DMP's existing access road and building).

The total area of land disturbance for the Expansion Project is anticipated to be 7.21 ha.

# 3.1 Rehabilitation Plan

HAUS and LandCorp have an established agreement framework by which the site will be transferred to LandCorp following the completion of quarry operations. It is understood that LandCorp will use the land for residential development.

HAUS has consulted with LandCorp regarding the operation and post-quarrying handover for the Expansion Project, as required by this agreement. It is understood that LandCorp's requirements for the post-quarrying handover comprise:

- The excavation is restored and reinstated in accordance with the rehabilitation program outlined in the Closure Plan approved by LandCorp.
- Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
- The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan [Final Pit Floor Levels agreed with Landcorp (2012)].
- All rubbish, debris, improvements or alterations effected by Holcim associated with the excavation works are completely removed from the land.
- All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.

## 3.1.1 Erosion

Removal of vegetation and disturbance to the site can potentially increase surface runoff and increase the instance of erosion. It has been reported that there could be some potential impacts on downstream water quality due to erosion, particularly from exposed areas where topsoil has been removed for quarrying, before they are rehabilitated.

Rehabilitation should be carried out as soon as possible to avoid excessive soil erosion.

HAUS will reduce the potential for erosion by:

- Restricting clearing and disturbance to the minimum required for safe and efficient operations.
- Minimising disturbance to natural drainage patterns where possible.
- Undertaking rehabilitation progressively.

It is assumed that the surface runoff characteristics will be similar to that of the cleared vacant land prior to quarrying. Monitoring of rehabilitated areas will determine whether erosion has successfully been managed and identify any issues for remediation.


#### **3 Quarry Closure**

### 3.1.2 Topsoil Management

Topsoil is an integral part of rehabilitation as it contains organic matter and seed bank which assists in establishing vegetation when respread on disturbed areas. Topsoil at the site will be stripped and stockpiled separately, prior to commencing quarrying. The soils will be stripped in a dry state to preserve soil structure and stripping will be undertaken in relatively still weather conditions, where possible.

Stockpiles will be located sufficiently distant from quarrying operations so that they will not be disturbed prior to being used in rehabilitation.

- Topsoils be stripped and stockpiled separately from sand stockpiles.
- Topsoils should be stripped to a depth of approximately 1 to 2 cm. In some areas, topsoil depth may differ due to the topography of the site.
- Where practicable, soil will be stripped and returned directly to a rehabilitation area.
- Soil stripping should be avoided during wet conditions.
- The dimensions of the topsoil stockpiles will not exceed 2 m in height. This is to prevent topsoil becoming anaerobic and deteriorating in soil structure, organic matter, nutrients, seed resource and populations of beneficial soil micro-organisms.
- Where necessary the stockpiles will be covered with polymer agents and/or seeded with sterile oats species to reduce erosion and discourage weeds.

### 3.1.3 Topsoil Replacement

It is preferable not to stockpile topsoil for long periods of time as this can degrade the soil. HAUS will be quarrying the site and then rehabilitating areas progressively. This will ensure that topsoil is respread relatively soon after stripping. This will assist to preserve the structure of the soil and increase the likelihood of revegetation success.

- Topsoil will be respread and ripped to a depth of approximately 40 cm during the rehabilitation process to ensure cohesion between the topsoil, the subsoil and the disturbed land surface.
- To increase soil stability tree debris and rock should be respread with the soil, particularly if the materials are to be placed on slopes.

There is the potential that the vegetation cover will not be a major contributor to batter slope erosion resistance. The placement of coarse fragments of tree mulch over topsoil may considerably improve both erosion resistance and vegetation establishment.

#### 3.1.4 Landform Design

Rehabilitation earthworks will be undertaken to develop a stable landform that is compatible with LandCorp's requirements, the surrounding area and future residential land use.

The central elements of LandCorp's landform design requirements for the BSQ are as described in Section 3.1.

- HAUS will profile the rehabilitated Project Area to be compatible with the subsequent urban development by Landcorp.
- HAUS will continue to consult with Landcorp to determine any detailed requirements for final landform design. These requirements will be integrated into this document.



#### **3 Quarry Closure**

An early planning of the coarse layout of the future residential development, once prepared by Landcorp, will provide a guideline on how the land in future stages of the quarry development the land should be contoured to roughly coincide with future urban drainage master plan (Golder 2006).

### 3.1.5 Revegetation

Following completion of quarrying, HAUS will profile the landform (to Landcorp's specifications) and respread the area with the stockpiled topsoil, as discussed in Section 3.1.3. Fragmental material, such as rocks and vegetation debris will be included in the respread.

Ripping may be used if required in areas of harder material to provides niches where organic matter and seed can collect and facilitates the infiltration of surface water.

The topsoil will be stabilised with a polymer agent and seeded with sterile oats (hydromulched) to prevent the spread of non-native species into adjacent areas. Revegetated areas will be monitored and seeded, if required (discussed in Section 4).

### 3.1.6 Decommissioning of Infrastructure and Facilities

At the end of quarrying operations, all infrastructure, constructed by HAUS, including the maintenance area, weighbridge, wheel wash facility, waste compound, but excluding the site office, ablutions, lunch room included in existing facilities leased from DMP, will be removed at the end of quarrying operations and these areas will be rehabilitated as described above. The groundwater production bore will also be capped.



## Monitoring and Maintenance

HAUS will undertake progressive rehabilitation of the Project Site. Rehabilitated areas will be monitored to ensure the success of the rehabilitation programme. Monitoring will be carried out on a regular basis to assess:

- The physical stability of the landform of rehabilitated areas;
- The characteristics of the vegetation in rehabilitated areas;
- Evidence of colonisation by new weed species;
- Signs of erosion in disturbed areas;
- Water drainage from the site; and
- Any public safety aspects.

Monitoring the rehabilitated areas will ensure that any areas requiring remedial work are identified. Procedures for the monitoring of rehabilitation sites can be updated once rehabilitation works commence.

Maintenance procedures will be carried out where necessary and may include:

- · Replanting areas that may not have regenerated;
- Repairing any erosion problems;
- Weed control; and
- Fire management.

Following transfer of the Project site to LandCorp, HAUS will seek relinquishment of rehabilitation bonds from DMP and be removed of any further monitoring and or maintenance obligations.



# **Completion Criteria**

## 5.1 Completion Criteria

Completion criteria are an agreed set of environmental indicators which, upon being met, would demonstrate successful rehabilitation. Completion criteria are specific to the operation being closed and reflect the unique set of environmental, social and economic circumstances of the site.

Guidelines published by ANZMEC (2000) for completion criteria state they should be:

- 1. Specific enough to reflect unique set of environmental, social and economic circumstances.
- 2. Flexible enough to adapt to changing circumstances without compromising objectives.
- 3. Include environmental indicators suitable for demonstrating that rehabilitation trends are heading in the right direction.
- 4. Undergo periodic review resulting in modification if required due to changed circumstances or improved knowledge.
- 5. Based on targeted research which results in more informed decisions.

In the case of the BSQ, agreement has been established between HAUS and Landcorp by which the site will be transferred to LandCorp so the site can be developed for residential land use.

Acknowledging the likely final end land use of the site as residential, HAUS will rehabilitate the site to establish a safe and stable landform, consistent with LandCorp's requirements until the site is developed.

Rehabilitation Theme	Completion Criteria
Safety	All rubbish, debris, improvements or alterations effected by HAUS associated with the excavation works are completely removed from the land.
	Access to site is to be restricted, appropriate to final land use.
Stability of Landforms and Surfaces	All constructed landforms and disturbed areas are to be stable and resistant to erosion, or at least comparable to naturally-occurring erosion in the area.
	Drainage should be consistent with Landcorp's requirements for future land use.
Landform Reconstruction	Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
	The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan [Final Pit Floor Levels agreed with Landcorp (2012)].
Soil	All sediment ponds will be removed from the site.
	Any bunded topsoil will be respread on site and seeded in sterile grasses.
	The soil remaining at site should be safe, free of contamination and compatible with the final land use and landowner agreements.
Water Resources	The minimum buffer distance between the excavation level and the Average Annual Median Groundwater Level (AAMGL) will be at least 2 m.

#### Table 5-1 Landcorp Completion Criteria



### **5 Completion Criteria**

Rehabilitation Theme	Completion Criteria
Revegetation/Stabilisation	All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.

## 5.2 Performance Indicators

The success of the Quarry Closure Plan will be determined through a range of performance indicators associated with the monitoring programme as discussed in Section 3.

It is understood that LandCorp's requirements for the post-quarrying handover comprise:

- The excavation is restored and reinstated in accordance with the rehabilitation program outlined in the Closure Plan approved by LandCorp.
- Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
- The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan [Final Pit Floor Levels agreed with Landcorp (2012)].
- All rubbish, debris, improvements or alterations effected by Holcim associated with the excavation works are completely removed from the land.
- All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.



## References

Golder Associates 2006 preliminary hydrological characterisation: Baldivis explosives reserve crown reserve 38575 and 37090, Karnup. Unpublished report for Landcorp

EPA (2006) Guidance Statement for the Assessment of Environmental Factors; Rehabilitating Terrestrial Ecosystems

Australian and New Zealand Minerals and Energy Council (ANZMEC). 2000. Strategic Framework for Mine Closure. (http://www.dist.gov.au).



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# Figures





### SITE LOCATION



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Figure: 1 Rev. A

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#### HOLCIM (AUSTRALIA) PTY LTD

BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

### LOCALITY MAP AND MINING TENURE



Figure:



HOLCIM (AUSTRALIA) PTY LTD

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BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

### SITE LAYOUT







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Appendix I Sedimentation Pond Management Plan





# BSQ Guideline 1.5 Sedimentation Pond Management

## **Objectives**

To minimise the impact of mining activities at the Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046) including the Stage 1 Project and Expansion Project; on surface water and groundwater quality.

## Background

Sand washing occurred during the operation of Stage 1 of Baldivis Sand Quarry. Sand washing will not be undertaken during the operation of Expansion Project as fill sand will be quarried. This plan does not apply to the Expansion Project.

Sand washing water will be produced from the washing of sand to produce concrete sand. It is expected that the washing waster will consist of approximately 10% fines (<75  $\mu$ m) and 90% water by volume. The water produced from this process will be deposited into a series of up to 5 sedimentation ponds. The ponds will be constructed as shallow, unlined ponds with capacity of up to approximately 9,270 m<sup>3</sup>. The ponds will operate in series so that as one pond fills, water from the washing plant will be redirected into the next pond. Sediment in each pond will be left to dry out before being removed and stockpiled for reincorporation into sale products. As no chemicals or additives are used in the washing process, no contaminants will be present in either the sediment or the waste water. Waste water will be transferred, *via* pipeline, to be re-used in the operation of the mobile washing plant.

In the event of over-topping of the sediment ponds during heavy rainfall events, it is possible that runoff may impact the surface water quality of the nearby wetlands, Serpentine River and floodplain. Hence the ponds have been designed with a 0.5 m freeboard and the capacity to accommodate a 1 in 100 year, 72 hour rainfall event to minimise the possibility of over-topping.

The ponds also present a potential water source for native fauna, and pest species. If the ponds are found to attract animals, fencing or self-rescue mats may need to be installed to prevent adverse impacts to native fauna, or attraction of pest species.

During operations, it is expected that sediment removed from the ponds will be reincorporated into general fill products. No sediment will remain on-site following closure of the BSQ.

## Scope

This procedure applies to all activities and all personnel, contractors and visitors at BSQ at all times.

## **Related Documents**

The following documents relate to sedimentation pond management at BSQ and should be consulted where applicable. This list is not exhaustive. Other SHE Guideline Documents and legislative requirements may also apply.

- BSQ Guideline 1.1: Fauna Management;
- BSQ Guideline 1.4: Pest Management;
- BSQ Guideline 1.6: Waste Management;

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- SHE Guideline 3.1: Risk Management;
- SHE Guideline 3.20: Hazardous Substances Handling and Storage;
- SHE Guideline 4.1: Permits, Licences and Approvals;
  - 4.1A: Guide to Environmental Planning Permits & Approvals for Holcim Operations
  - o 4.1E: Environmental Compliance Planner Aggregates
- SHE Guideline 4.2: Hazard Identification;
  - 4.2A: Aspects and Impacts Register for Aggregates Sites
- BSQ Quarry Closure Plan;
- Agriculture and Related Resources Protection Act 1976;
- *Mining Act* 1978;
- Western Australian Environmental Protection Act 1986;
- Environmental Protection (Unauthorised Discharge) Regulations 2004 (WA), and
- Waterways Conservation Act 1976.

## **Planning and Approvals**

### Planning

• The sedimentation ponds are to be designed to accommodate a 1 in 100 year, 72 hour rainfall event (200 mm), while maintaining 0.5 m freeboard to minimise the possibility of over-topping.

### **Approvals**

- Discharge of sediment into the environment is controlled by the operating licence (Category 12) issued under the *Environmental Protection Act* 1986.
- Discharge of sediment into the environment is prohibited by Environmental Protection (Unauthorised Discharge) Regulations 2004 (WA)
- Environmental approval under the *Mining Act* 1978 was granted through approval of the Mining Proposal for M70/1046.

## **Management Strategy**

#### General

- Excess water from the sedimentation ponds will be re-used as much as possible, and recycled to the mobile washing plant. It will be inspected daily and, if required, pumped via pipeline to the mobile washing plant at regular intervals to maintain freeboard in the ponds and prevent over-topping.
- Ensure sediment from the dried out sedimentation ponds is removed regularly.
- Maintain fencing and signage around sedimentation ponds to restrict access.
- Raise the awareness of the workforce about the sedimentation management plan. All employees will
  undergo site specific awareness training during inductions. The sedimentation component of the
  training will include:

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- Erosion and sediment migration areas at BSQ.
- Issues relating to the management of sedimentation ponds and erosion on the site and staff responsibilities (monitoring and correct sediment placement).
- The adverse impact of erosion and sediment runoff or over-topping of ponds to the surface water.
- Reporting procedure for incidents (erosion or pond over-topping).

### **Sediment Minimisation and Control**

- Drainage systems, erosion and sediment controls will be installed where necessary to prevent the migration of sediment via wind or water. Controls may include:
  - Sediment traps and basins;
  - Geotextile silt fences; and
  - o Diversion drains.
- Water from sand washing activities will be recycled through the sedimentation ponds to reduce total water demand. Water from the sedimentation ponds will be recycled and transferred to the mobile washing plant via a pipeline.
- Drainage is to be diverted so that the active quarry area or "Quarry Catchment" will act as a detention pond collecting rainfall and surface runoff and releasing it to the local groundwater system through infiltration.
- If the sedimentation pond overtops, washing activities are to be stopped immediately. The overflow is to be contained and if necessary diverted, using sediment banks or sand bags, into the open void of the quarry. Washing activities will resume when 0.5 m freeboard is attained in the ponds.

## **Monitoring and Performance Indicators**

#### Monitoring

- Undertake daily inspection of sedimentation ponds to ensure 0.5 m freeboard is maintained to prevent overtopping of ponds. Records of the inspections are to maintained on the site's daily check sheet. Ensure diversion of water into adjoining ponds is carried out if ponds become full.
- Undertake daily inspection of sedimentation ponds for trapped or dead fauna and remove these if they occur.
- Conduct regular inspections of sediment control measures.
- Conduct regular inspections of pond fencing and signage to ensure these are intact.

### **Performance Indicators**

- Maintaining existing surface water quality during operations and following closure of BSQ.
- Sedimentation ponds to be cleaned out regularly so that accumulated sediment reduces the capacity of the ponds no greater that 30%, to maintain 0.5 m freeboard.
- No discharge of water from sedimentation ponds.



## **Definitions**

**1 in 100 year 72 hour rainfall event:** The size of a rainfall event (in mm) that would have a 1% chance of being equalled or exceeded within a 72 hour rainfall event. This parameter is used to determine flood protection requirements for constructed water-bodies to protect against damage or loss of life downstream if the structure was to fail. For BSQ the size of a 1 in 100 year 72 hour rainfall event is **200 mm**. The rainfall intensity for an event this size is equivalent to **2.78 mm/hr**.

**Freeboard:** The vertical distance between a specified water surface height and the crest of the wall containing the water.

## Accountabilities

Role	Accountability
Site Manager	<ul> <li>Ensure that all personnel who report to you are aware of and conform to this procedure.</li> </ul>
	<ul> <li>Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect).</li> </ul>
	<ul> <li>Ensure the site conditions of contract include sedimentation pond management requirements.</li> </ul>
	<ul> <li>Ensure daily inspections of the sedimentation ponds are recorded in the site check-sheet.</li> </ul>
	<ul> <li>Review and, if necessary, update this plan every two years or earlier if monitoring indicates that changes to sedimentation pond management are required.</li> </ul>
All Persons	Conform to this procedure at all times.
	<ul> <li>Ensure any incidents (over-topping or presence of dead fauna) are reported to the site manager.</li> </ul>

## **Document Management**

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0	5 May 2008	Final	T Hassell (URS)	J Becher (URS) I Swane (URS)	G Manning (CEMEX)
0	6 November 2013	Final	J O'Halloran (URS)	J Moro (URS)	L Honan (HAUS)

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Appendix J Transport Management Plan



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TRANSPORT MANAGEMENT

# SHE Guideline 1.11 Transport Management

## **Objectives**

The objective of this Transport Management Plan (TMP) is to ensure the safe operation of vehicles in and surrounding the Baldivis Sand Quarry (BSQ) including the Stage 1 Project and the Expansion Project.

## Background

A Traffic Impact Statement was prepared by TARSC Pty Ltd in 2006. This transport assessment was based on traffic travelling both west along Stakehill Road towards Ennis Avenue/Mandurah Road and east along Stakehill Road towards Baldivis Road and the Kwinana Freeway from the site. During operations, it is estimated that up to 300 heavy vehicle movements would occur each weekday and up to 150 heavy vehicle movements would occur on Saturday. In addition, it is estimated that 100 standard vehicles per day would also enter and or exit the site each working day during operations.

The reported key findings of TARSC were:

- Additional traffic volume would not be significant;
- No current excessive delays or queues; and
- Minor road modifications would be required at the intersection of the quarry entrance access road and Stakehill Road.

A Stakeholder consultation exercise was conducted by Coakes Consulting in 2007. The consultation was carried out with a number of residents, community groups and agencies including Rockingham City Council, the South West Group and local primary schools. Issues that arose from the consultation included traffic matters, namely:

- Sight distances;
- Traffic queues at Stakehill Road near Old Mandurah Road during peak periods;
- Crash incidents; and
- School bus stops and children crossing movements.

Transcore conducted a further traffic impact assessment in 2007 including the following list of issues:

- Cumulative impacts of Southern Gateway Alliance's operations with the traffic movements from the Baldivis sand quarry;
- School bus routes/safety issues; and,
- Road safety along Stakehill Road and Baldivis Road.

The Transcore impact statement supported the TARSC findings and additional recommendations are summarised in **Table 1**.



#### **BSQ Guideline 1.11**

#### TRANSPORT MANAGEMENT

#### Table 1 – Additional Recommendations from Transcore Impact Statement

Issue	Recommendation	Consequence
No designated bus stop area.	Provide a bus stop area of 18m x 2.5m within road verge in the form of gravel hardstand where practical.	Reduce obstruction of traffic flow on Stakehill and Baldivis Roads.
Existing bus stop poles are old and not very visible.	Install visible bus stop poles.	Increase motorist and commuter awareness of bus stop location.
Several decommissioned bus stops along Stakehill Road and Baldivis Road verges.	Remove redundant existing bus stop poles.	Reduce motorist and commuter confusion.
Obstructed visibility of Stakehill Road/Eighty Road intersection.	Prune overgrown vegetation.	Improve sight visibility to/from the intersection.
Horizontal bend along Stakehill Road east of Ukich Place	Install curve warning signs with advisory speed limit of 60km/hr.	Increase motorist awareness Reduce potential for rear-end, head-on and out-of-control collisions.
Increased heavy traffic movement at Stakehill Road/Primary Access Road intersection.	Install Truck warning signs. Install Side Road Junction warning signs. Provide right turn and left turn auxiliary lanes, if feasible.	Reduce interruptions of traffic flow along Stakehill Road. Reduce potential for vehicular conflict between through traffic and turning traffic.
Horizontal bend along Stakehill Road east of Firbank Close with missing advisory speed limit sign.	Install an advisory speed limit sign of 60km/hr below the existing curve sign.	Increase motorist awareness Reduce potential for rear-end, head-on and out-of-control collisions.
Horizontal bend along Baldivis Road near Churcher Road with missing curve and advisory speed limit sign on southbound approach.	Install curve sign with the advisory speed limit sign of 60km/hr along Baldivis Road on the southbound approach to the bend south of Baldivis Road / Churcher Road intersection.	Increase motorist awareness Reduce potential for rear-end, head-on and out-of-control collisions.
S-Bend at the Baldivis Road / Karnup Road intersection.	Replace existing curve sign on the southbound carriageway approach to the S-Bend at the Baldivis Road / Karnup Road intersection with an S-Bend warning sign. An S-Bend and advisory speed limit sign of 60km/hr should be installed on the northbound carriageway on the approach to this S-Bend.	Increase motorist awareness Reduce potential for rear-end, head-on and out-of-control collisions.
Tree located opposite Baldivis Road / Serpentine Road T- intersection.	Existing tree be removed or relocated.	Reduce potential collision with tree.
80km/hr speed limit along Stakehill Road and Baldivis Road	Reduce to 70km/hr between Lugg Road and Mandurah Road.	Reduce speed-related collisions. Provide safer turning

The current transport route for the Stage 1 Project since the opening of the Forrest Highway (Perth to Bunbury Highway) is that the majority of vehicles exit the quarry via Stakehill Road and then continue onto Baldivis Road. From Baldivis Road, approximately 80% of the traffic utilises Kwinana Freeway and 20% utilise Karnup Road East. Vehicles approach the quarry utilising a similar distribution route. Local deliveries enter and exit the quarry along Stakehill Road, using Mandurah Road. The Expansion Project will utilise the same transport route.



**BSQ Guideline 1.11** 

TRANSPORT MANAGEMENT

Vehicle movements for the Expansion Project will be at the same or lower levels of existing Stage 1 vehicle volume and composition.

## Scope

This procedure applies to all activities and all personnel, contractors and visitors at BSQ at all times.

## **Related Documents**

The following documents relate to transport management at BSQ and should be consulted where applicable. This list is not exhaustive. Other SHE Guideline Documents and legislative requirements may also apply.

- SHE Guideline 3.14 Traffic Management.
- SHE Guideline 3.16 Road Trucks and Transport.
- SHE Guideline 2.4: Contractor Management.
- SHE Guideline 3.1: Risk Management.
- Road Traffic (Vehicle Standards) Regulations 2002.
- Road Traffic (Vehicle Standards) Rules 2002.
- Trade Measurement Act 2006.

## **Management Strategy**

### General

The following management practices will be adopted in order to meet the objectives of the plan:

- All staff and contractors will be informed of the requirements of this plan.
- Clear signage will be established and maintained on site to assist in safe operation of vehicles

#### **Site Traffic Management**

- No heavy vehicles will be permitted to enter or exit the site outside of the operational hours of 7am to 6pm Monday to Saturday.
- All vehicles will operate within the site speed limit of 30 km/h.
- All vehicles will exit the quarry over the wheel-wash to reduce the possibility of dust and sediment being carried onto the public roads.
- All loaded heavy vehicles exiting the quarry will be required to cover their loads with tarpaulins before exiting site.
- The site weighbridge will be regularly maintained, registered and calibrated in accordance with requirements of the *Trade Measurement Act* 2006.
- Hazards associated with traffic will be regularly reviewed in site safety meetings.

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#### TRANSPORT MANAGEMENT

### **Off-Site Traffic Management**

- Heavy vehicles travelling to and from the site will use the designated transport routes (Appendix A).
- Heavy vehicles will comply with Main Roads WA regulations which require:
  - Only semi-trailers are permitted to travel east along Stakehill Road towards Baldivis Road and the Kwinana Freeway (Transcore Pty Ltd, 2007).
  - All heavy vehicles may travel on the west-bound route along Stakehill Road to Ennis Ave.
- HAUS has obtained approval to upgrade the intersection of Stakehill Road and the BSQ entrance road in accordance with the recommendations of the TARSC (2006) and Transcore (2007) reports.

HAUS has worked with the City of Rockingham and Main Roads WA to implement the recommendations of the Transcore study relating to signage, visibility and bus stops.

## Definitions

### **Heavy Vehicle Classification**

All vehicles with a gross vehicle mass greater than 4.5 tonnes are classified as heavy vehicles. Heavy vehicles operated in a combination less than 19 metres in length, 2.5 metres width, 4.3 metres height and 42.5 tonnes gross mass are considered "as of right" vehicles and have unrestricted access to the road network. Heavy vehicles exceeding these mass or dimension limits are required to operate under a Notice or Permit issued by Main Roads WA.



## Accountabilities

Role	Accountability
Site Manager	• Ensure that all personnel who report to you are aware of and conform to this procedure.
	<ul> <li>Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect).</li> </ul>
	<ul> <li>Ensure the site conditions of contract include transport management requirements.</li> </ul>
	<ul> <li>Ensure recommendations made in the Transcore (2007) report are pursued with the City of Rockingham and Main Roads (WA)</li> </ul>
All Persons	Conform to this procedure at all times.

## **Document Management**

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0	1 May 2008	Final	G Ma (CEN	anning MEX)	J Becher (URS)	G Manning (CEMEX) (
0	6 November 2013	Final	J (URS	O'Halloran S)	J Moro (URS)	L Honan (HAUS)

## References

TARSC Pty Ltd, Baldivis Sand Quarry Readymix Traffic Study, December 2006

Transcore, Proposed Readymix sand Quarry Stakehill Road, Baldivis, Traffic Impact Statement, 2007

Main Roads WA, Heavy Vehicle Operations: http://www.mainroads.wa.gov.au/NR/mrwa/run/start.asp

### Attachments

Appendix A Designated Transport Route.



**BSQ Guideline 1.11** 

TRANSPORT MANAGEMENT

## **Appendix A – Designated Transport Route**



Appendix K Waste Management Plan



K



# BSQ Guideline 1.6 **Waste Management**

## **Objectives**

To minimise the amount of solid or liquid waste generated by mining activities at the Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046) including the Stage 1 Project and Expansion Project; and ensure that waste generated is disposed of in an environmentally acceptable manner in accordance with regulatory requirements.

## Background

Waste is defined herein as a substance (liquid or solid) that is discarded, emitted or deposited in the environment that has the potential to negatively impact upon the environment. At BSQ, wastes that may be generated will fall into three categories:

- Domestic waste: including putrescible waste, non-recyclable packaging, food containers and bottles, plastic recyclables, paper and cardboard, non-hazardous liquids, glass, domestic waste water and sewage;
- Industrial waste: including waste water from sand processing activities, tyres, chemicals, scrap metal, building rubble and waste from site and vehicle maintenance; and
- Hydrocarbon waste: fuel waste as described in the Hydrocarbon Management Plan.

Liquid wastes have the potential to impact flora and fauna by affecting the quality of available water through surface or ground flows, direct fauna deaths through drowning, and soil contamination.

The site will contain a waste compound which will function as a collection and storage point for domestic, industrial and hydrocarbon waste prior to disposal offsite. Waste materials that are accepted by the City of Rockingham Millar Rd Landfill are listed in **Appendix A**.

The Western Australian disposal requirements for the different types of Quarry and Maintenance wastes expected to be generated at BSQ are summarised in **Table 1** and **Table 2**.

#### **Domestic Wastewater**

Sewage and wastewater is generated as a result of flushing toilets and washing and carrying out ablutions at the site office. The BSQ site office is located in a building leased from the Department of Mines and Petroleum. This building was converted for use as a site office, lunchroom and ablutions. Septic tank facilities already exist within the existing DMP building. The capacity of the tanks is sufficient for current requirements. An additional septic system was installed to service the weighbridge and crib room.

#### Wastewater from Wheel Washing

Waste water will be generated during the sand-washing process. Waste water will comprise approximately 10% fines (<75  $\mu m$ ) and 90% water by volume. No additives are used in the washing process therefore no contaminants are expected to be present in the sand washing wastewater. The disposal of sand washing wastewater and the operation of the sedimentation ponds and water recycling pipelines has the potential to impact the surface water quality of the nearby wetlands and the Serpentine River and floodplain.



#### **BSQ Guideline 1.6**

#### WASTE MANAGEMENT

Waste water from the wheel washing facility will be collected in a closed-circuit system and treated (using a filter and oil/water separator) before being re-used for wheel washing. Any collected waste is to be disposed according to the Hydrocarbon Management Plan.

#### **Surface Water Run-off**

It is expected that on-ground runoff will be minimal as infiltration rates are high. However, surface water runoff generated at the site after significant wet weather periods has the potential to impact the surface water quality of the nearby wetlands and the Serpentine River and floodplain by carrying contaminants and sediment offsite. Stormwater runoff from paved areas and car parks will be collected in the active quarry area where it will be released to the local groundwater system through infiltration.

#### Acid Sulphate Soils and Acid Mine Drainage

According to mapping completed by the Western Australian Planning Commission (2008), the Stage 1 and Expansion Project Areas are located within areas designated as no known risk of acid sulphate soils occurring within 3 m of the natural soil surface (or deeper). No waste rock or tailings will be generated as a result of the Stage 1 or Expansion Projects and, as the sand resource has no potential for acid generation, management of water on-site for potential Acid Mine Drainage (AMD) impacts is not required during Stage 1 or Expansion Project activities. No sediment will remain onsite following closure of the quarry as sediment will be progressively removed from sedimentation ponds and incorporated into saleable products.

Further information on waste management in Western Australia can be found online at the Department of Environment Regulation (DER) website:

http://www.der.wa.gov.au/your-environment/waste

## Scope

This procedure applies to all activities and all personnel, contractors and visitors at BSQ at all times.

### **Related Documents**

The following documents relate to waste management at BSQ and should be consulted where applicable. This list is not exhaustive. Other SHE Guideline Documents and legislative requirements may also apply.

- BSQ Guideline 1.3: Hydrocarbon Management;
- BSQ Guideline 1.5: Sedimentation Management;
- SHE Guideline 3.01: Risk Management;
- SHE Guideline 3.20: Hazardous Substances;
- SHE Guideline 4.1: Permits, Licences and Approvals;
  - 4.1A: Guide to Environmental Planning Permits & Approvals for Holcim Operations
  - 4.1E: Environmental Compliance Planner Aggregates
- SHE Guideline 4.2: Hazard Identification;
  - 4.2A: Aspects and Impacts Register for Aggregates Sites
- BSQ Quarry Closure Plan;

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- Agriculture and Related Resources Protection Act 1976;
- Western Australian Environmental Protection Act 1986;
- Environmental Protection (Liquid Waste) Regulations 1996;
- Dangerous Goods Safety Act 2004;
- Waterways Conservation Act 1976.

## **Planning and Approvals**

#### Planning

- A waste compound will be installed at the site and will function as a collection and storage point for domestic, industrial and hydrocarbon waste prior to disposal offsite.
- Rubbish bins (protected against pests) will be placed in appropriate areas around the site to collect domestic waste.
- All wastes generated onsite will, prior to being disposed of offsite, be assessed to determine if they are hazardous or if permits are required for disposal.
- Waste disposal bins (including bins for recyclables) will be clearly marked and colour-coded to indicate their contents.

#### **Approvals**

- Obtain permits from the City of Rockingham prior to installing any additional septic systems on site.
- Obtain consent of the Site Manager or authorised representative prior to disposal of hazardous wastes. Disposal of hazardous wastes must be in accordance with site licence conditions. HAUS Guidelines are attached to this document.
- Controlled Waste Tracking Forms (CWTF) may be required for disposal of waste off-site. See Tables 1 and 2 for detail.

## **Management Strategy**

#### General

- During operations at BSQ, the principles of reduce, reuse and recycle will be employed to minimise the amount of waste produced.
- Raise the awareness of the workforce about the waste management plan. All employees will undergo site specific awareness training during inductions. The waste component of the training will include:
  - Knowledge of the different types of waste generated at BSQ (domestic, industrial and hydrocarbon) and how each type is stored and disposed of.
  - Issues relating to the management of waste on the site and staff responsibilities (segregation and correct storage and disposal).
  - The adverse impact of significant contamination of waste streams to waste disposal practices.
  - The importance of maintaining hygiene to prevent the occurrence and persistence of feral species.

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- How staff report non-conformances or significant contamination of waste streams.
- All waste generated will be collected and stored in the fenced waste compound in the north east of the project site. Waste types stored in the compound will include domestic, industrial and hydrocarbon wastes.
- Wastes produced during the Stage 1 and Expansion Projects will be stored and disposed of as follows (specific details are included in Tables 1 and 2):
  - Domestic waste will be segregated, removed and disposed at an offsite landfill as a part of the local collections by the City of Rockingham;
  - Industrial waste such as tyres will be recycled or reused where possible, or alternatively segregated, removed and disposed at an offsite landfill by a licensed contractor; and
  - Hydrocarbon waste will be managed as outlined in the Hydrocarbon Management Plan and as per site licence conditions.
- Any hazardous waste disposed, will be recorded on the Hazardous Waste Disposal Register (SHE Guideline 3.20, Attachment 3.20F)
- Ensure the capacity of the septic tank system and any additional systems installed on site are adequate to accommodate all site sewage.
- Excess water from the sedimentation ponds will be re-used as much as possible, and recycled to the mobile washing plant. It will be pumped via pipeline to the mobile washing plant.
- Wheel washing will be undertaken using a closed-circuit water recycling system to avoid water waste.
- An oil/water separator will be installed in the wheel washing system, inspected daily and maintained as required.

#### **Waste Minimisation and Control**

- Water from sand washing activities will be recycled through the sedimentation ponds to reduce total water demand. Water from the sedimentation ponds will be recycled and transferred to the mobile washing plant via a pipeline.
- The active quarry area or "Quarry Catchment" will act as a detention pond collecting rainfall and surface runoff and releasing it to the local groundwater system through infiltration.
- Minimise the potential risk of increasing feral animal abundance and diversity by ensuring all work areas are maintained and kept tidy. All waste generated is to be placed in bins which will be emptied into the waste storage compound prior to being disposed of offsite.
- All hazardous substances will be stored and disposed of in the correct manner as outlined in the Material Safety Data Sheet (MSDS) relevant to that substance.

## **Monitoring and Performance Indicators**

#### Monitoring

- Undertake daily inspection of sedimentation ponds to ensure 0.5 m freeboard is maintained to prevent overtopping of ponds. Records of inspections are to be maintained daily on the site check sheet.
- Eating areas and other food preparation and storage areas to be inspected regularly to ensure cleanliness and hygiene is maintained and the site is kept tidy.

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Undertake waste inspections in conjunction with monthly safety inspections to ensure waste materials
are being segregated and disposed of correctly and that significant contamination of waste streams
does not occur.

### **Performance Indicators**

- Waste inspections will be conducted. No greater than 20% of waste inspections will be missed.
- All wastes are disposed of correctly.
- All site inspections are accurately recorded.

## Definitions

- Ablutions: Washing or cleansing of the body and using liquid to clean or perform activities relating to personal hygiene. *e.g.* washing hands.
- **Putrescible Waste:** Organic waste that biologically decomposes quickly enough to cause odours and attract flies.
- **Recyclables:** Waste materials which can be re-processed to make new products. Recyclable packaging and containers that are accepted at the Millar Road Landfill facility in Baldivis, City of Rockingham are listed in **Appendix A**.
- Significant Contamination of recycling waste streams: The placement of waste materials in inappropriate waste streams. The level of contamination deemed significant will need to be determined by operational staff during the initial phases of operation, depending on what is practicable.



#### **BSQ Guideline 1.6**

#### WASTE MANAGEMENT

#### Table 1: Quarry Wastes - WA

Туре	Classification	Disposal Requirement	Comment
Overburden	Inert	Wastes to be disposed of in approved landfill for the type of waste.	
		Alternative disposal options that beneficially use the waste may be acceptable but must be assessed on a case by case basis to ensure acceptable environmental controls are available for short term pollution and/or long term contamination risk.	
Slimes	Controlled	Licensed transporter (driver and vehicle) to be used if transporting more than 200Kg or 200L.	
		Controlled waste to be disposed of at an approved disposal site.	
		Controlled Waste Tracking Forms (CWTF) to be completed	
Acidic/ Alkaline Water	Controlled	Licensed transporter (driver and vehicle) to be used if transporting more than 200Kg or 200L.	
		Controlled waste to be disposed of at an approved disposal site.	
		Controlled Waste Tracking Forms (CWTF) to be completed	
Slurry/ Sediment	Controlled	Licensed transporter (driver and vehicle) to be used if transporting more than 200Kg or 200L.	
		Controlled waste to be disposed of at an approved disposal site.	
		Controlled Waste Tracking Forms (CWTF) to be completed.	
		Alternative disposal options that beneficially use the waste may be acceptable but must be assessed on a case by case basis to ensure acceptable environmental controls are available for short term pollution and/or long term contamination risk.	


#### WASTE MANAGEMENT

#### Table 2: Maintenance Related Waste - WA

Туре	Classification	Disposal Requirement	Comment
Oils	Controlled	Licensed transporter (driver and vehicle) to be used if transporting more than 200 kg or 200 L.	
		Controlled waste to be disposed of at an approved disposal site.	
		Controlled Waste Tracking Forms (CWTF) to be completed.	
Oily rags/ kitty litter	Putrescible	Wastes to be disposed of in approved landfill for the type of waste.	
Chemicals	Hazardous	Wastes to be disposed of in designated landfills by Licensed transporter under Tracking form.	
Flammables	Hazardous	Wastes to be disposed of in designated landfills by Licensed transporter under Tracking form.	
Acids	Hazardous	Wastes to be disposed of in designated landfills by Licensed transporter under Tracking form.	
Tyres	Controlled	Licensed transporter (driver and vehicle) to be used if transporting more than 200 kg or 200 L.	
		Controlled waste to be disposed of at an approved disposal site.	
		Controlled Waste Tracking Forms (CWTF) to be completed	
Packaging	Inert	Wastes to be disposed of in approved landfill for the type of waste.	
Oxide Bags	Putrescible	Wastes to be disposed of in approved landfill for the type of waste.	
Drums	Controlled	Licensed transporter (driver and vehicle) to be used if transporting more than 200 kg or 200 L.	
		Controlled waste to be disposed of at an approved disposal site.	
		Controlled Waste Tracking Forms (CWTF) to be completed	
General refuse	Putrescible	Wastes to be disposed of in approved landfill for the type of waste.	
Batteries	Controlled	Licensed transporter (driver and vehicle) to be used if transporting more than 200 kg or 200 L.	
		Controlled waste to be disposed of at an approved disposal site.	
		Controlled Waste Tracking Forms (CWTF) to be completed	
Oil Filters	Putrescible	Wastes to be disposed of in approved landfill for the type of waste.	



#### WASTE MANAGEMENT

#### Table 2 (continued)

Туре	Classification	Disposal Requirement	Comment
Coolant	Controlled	Licensed transporter (driver and vehicle) to be used if transporting more than 200 kg or 200 L.	
		Controlled waste to be disposed of at an approved disposal site.	
		Controlled Waste Tracking Forms (CWTF) to be completed	
Yard clean-up (dirt/ dusts)	Inert	Wastes to be disposed of in approved landfill for the type of waste.	
		Alternative disposal options that beneficially use the waste may be acceptable but must be assessed on a case by case basis to ensure acceptable environmental controls are available for short term pollution and/or long term contamination risk.	
Septic Tank Sludge	Controlled	Licensed transporter (driver and vehicle). Controlled waste to be disposed of at an approved disposal site.	



# Accountabilities

Role	Accountability
Site Manager	<ul> <li>Ensure that all personnel who report to you are aware of and conform to this procedure.</li> </ul>
	<ul> <li>Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect).</li> </ul>
	<ul> <li>Ensure the site conditions of contract include waste management requirements.</li> </ul>
	<ul> <li>Set KPIs based on volumes and masses of waste disposed of during first year of operation and maintain monitoring during operation, ensuring continual improvement.</li> </ul>
	<ul> <li>Ensure waste inspections are scheduled and carried out.</li> </ul>
	Ensure hazardous materials are stored and disposed of correctly.
	<ul> <li>Carry out regular daily inspections of the site to ensure site is kept generally tidy.</li> </ul>
	<ul> <li>Review and, if necessary, update this plan every two years or earlier if waste monitoring indicates that changes to waste management are required.</li> </ul>
All Persons	Conform to this procedure at all times.
	<ul> <li>Ensure site is kept tidy and rubbish free at all times and that waste material is segregated, stored and disposed of correctly.</li> </ul>
	<ul> <li>Report any non-conformances or suspected significant contamination of the waste streams to the site manager.</li> </ul>

# **Document Management**

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0	5 May 2008	Final	T Hassell (URS)	J Becher (URS) I Swane (URS)	G Manning (HAUS)
0	6	Final	J O'Halloran	J Moro (URS)	L Honan (HAUS)
	November		(URS)		
	2013				

#### References

Western Australian Planning Commission (2008). South Metropolitan Region Scheme acid sulfate soils. Maps available online <u>http://www.wapc.wa.gov.au</u>. Accessed February 2008.

### Attachments

Appendix A Wastes That Are Accepted at the City of Rockingham, Millar Rd Landfill Facility.



#### WASTE MANAGEMENT

# Appendix A – Wastes That Are Accepted at the City of Rockingham, Millar Rd Landfill Facility.

#### **Recyclable packaging and containers:**

- Glass bottles and jars
- Newspapers
- Envelopes (windowless)
- Egg cartons
- Steel paint cans (empty)
- Juice cartons
- Plastics marked with:

- Aluminium cans
- Magazines
- Telephone books
- Cardboard
- Steel aerosol cans (empty)
- Aluminium foilOffice paper
- Pizza boxes (clean)
- Steel food cans
- Milk cartons



#### Large Recyclable Materials:

- Whitegoods
- Concrete

# Scrap metalRoof tiles

- **Organic material and Green Waste:** 
  - Grass clippings
  - Garden prunings
  - Flowers
  - Untreated timber

#### Hazardous Wastes:

- Gas bottles
- Tyres
- Household chemicals
- Fire extinguishers

- Small branches
- Weeds
- Paper and cardboard
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- Vehicle batteries
- Household paints
- Household thinners
- Smoke alarms

- Sump oil
- Household cleaners
- Diesel fuel
- Paint

- Bricks
- Terracotta pipes
- Twigs
- Leaves
- Small timber offcuts
- •

# Appendix L Weed Management Plan



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WEED MANAGEMENT

# SHE Guideline 1.7 Weed Management

# **Objective**

To minimise the introduction, propagation and distribution of environmental weed species at the Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046) including the Stage 1 and Expansion Project.

# Background

Weed species invade native ecosystems and can adversely affect the survival of indigenous flora and fauna. Although weeds are usually exotic species, some weed species are also indigenous.

Environmental weeds can compete with indigenous plants for resources such as nutrients, moisture and light. They can prevent natural regeneration, reduce wildlife habitat, alter water flows, increase soil erosion, introduce poisons into the soil or poison animals, change fire behaviour and may introduce foreign genes into local plant populations. As a consequence, environmental weeds can have a large effect on the health and survival of indigenous plants and animals.

In a flora survey undertaken in 2006 by Bennett Environmental Consulting, 38 weed species were recorded within the remnant vegetation surrounding the site, and are listed in **Appendix A**. All species, except for one, have been identified as weeds by the Department of Environment and Conservation (Western Australian Herbarium 2006). These weeds could potentially spread to the BSQ or introduced weed species could spread from the BSQ to these remnant vegetation areas.

Further information on environmental weed species found at BSQ (from the list of weeds provided in Appendix A) can be found online at the Department of Agriculture and Food (DAF) website:

• http://agspsrv95.agric.wa.gov.au/dps/version02/01\_plantsearch.asp.

### Scope

This procedure applies to all outdoor activities and all personnel, contractors and visitors at BSQ.

### **Related Documents**

The following documents relate to weed management at BSQ and should be consulted where applicable. This list is not exhaustive. Other SHE Guideline Documents and legislative requirements may also apply.

- SHE Guideline 4.1: Permits, Licences and Approvals;
  - o 4.1A: Guide to Environmental Planning Permits & Approvals for Holcim Operations
  - o 4.1E: Environmental Compliance Planner Aggregates
- SHE Guideline 4.2: Hazard Identification;
  - 4.2A: Aspects and Impacts Register for Aggregates Sites
- BSQ Quarry Closure Plan;
- Agriculture and Related Resources Protection Act 1976.

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WEED MANAGEMENT

# Planning and Approvals

#### Planning

- Vegetated areas to be disturbed or accessed will, prior to entry or disturbance, be assessed with respect to the likelihood of encountering or distributing weeds. Consultation with the BSQ Site Manager and the Safety, Health and Environmental (SHE) Coordinator (Perth Region) may be required.
- The potential requirement for equipment washdown facilities will be undertaken at the planning stage of all jobs where the potential to encounter or distribute weeds exists. Consultation with the BSQ Site Manager may be required.

### Approvals

- Soil, mulch, grain, hay or similar bulk material likely to be contaminated with weed seed shall be required to have a Weed Hygiene Declaration prior to being imported onto site. A blank copy of the Weed Hygiene Declaration form (Qld DNRW, 2006) is provided in **Appendix A**.
- Earthmoving, soil disturbance and vegetation disturbance equipment (*e.g.* dozers, graders, drill rigs, wood-chippers) and contractor vehicles shall be inspected and approved for entry to site in accordance with SHE Guideline 3.2 Fixed Plant and Mobile Equipment. Such inspection and approval will consider the likelihood of the equipment/vehicles carrying weed seeds. If the equipment is likely to be contaminated with weed seed a Weed Hygiene Declaration form must be completed and submitted to the Site Manager before each piece of earthmoving, soil disturbance and vegetation disturbance equipment will be permitted on site.
- Obtain a permit to excavate, clear vegetation, remove topsoil and burn prior to undertaking disturbance to vegetation or soil.
- Chemicals brought onto site must be approved by the Site Manager.

# **Management Strategy**

#### General

- All earthmoving, soil disturbance and vegetation disturbance equipment (*e.g.* dozers, graders, drillrigs, wood-chippers) brought to site shall be thoroughly washed down prior to arriving at site to ensure all soil and plant matter has been removed. If the equipment is likely to be contaminated with weed seed a Weed Hygiene Declaration form (**Appendix A**) must be completed and presented to the Site Manager.
- For contractor equipment, weed wash down shall be a requirement of the site conditions of the contract. It shall be the responsibility of the contract owner to ensure thorough wash down occurs and that records of equipment inspection and site approval are maintained.
- Earthmoving equipment shall be inspected and approved for entry to site in accordance with SHE Guideline 3.2 Fixed Plant and Mobile Equipment.
- Soil, mulch, grain, hay or similar bulk material likely to be contaminated with weed seed shall be required to have a Weed Hygiene Declaration prior to being imported onto site.
- All personnel and contractors shall report (to the Site Manager) sightings of environmental and/or declared weeds (refer to **Appendix A**) or plants that appear out of place as an environmental incident. The Site Manager will determine whether or not the plant is a declared plant or environmental weed and take appropriate action, conforming to legislation where necessary.

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#### WEED MANAGEMENT

• Populations of new weeds shall be mapped and monitored by the Site Manager (or their appointed representative) to ensure they are not spreading.

### **Eradication and Control**

 The Site Manager will be responsible for selecting and utilising competent vegetation management experts to undertake the weed eradication programme (if the use of external experts is deemed necessary). Such a programme may include, for example, the following methods as appropriate for the particular weed species:

Methods not involving chemicals

- Manual removal
   Seed removal
- Lopping
   Overlay
- Ringbarking Overplanting
- o Scarifying

Chemical methods

- Cut stump
- Folia application (spray or wick wipe)
- Stem injection (drill & fill)
- Bark stripping & stem painting
- Bark frilling or chipping
- The weed eradication method(s) will be selected in consultation between the Site Manager, SHE Coordinator (Perth Region) and the vegetation management consultant/contractor. The selected method(s) must:
  - o fully consider the health and safety of personnel, contractors and visitors;
  - o not contaminate soil, surface waters and groundwater;
  - o minimise impacts to native (non-weed) plants.

For additional information on plant control, refer to the Department of Agriculture and Food publication: *Declared Plant Control Handbook*, sixth edition, 2002. The handbook can be downloaded from: *http://www.agric.wa.gov.au/content/pw/weed/decp/decplants\_handbook.pdf*.

- Vegetation management contractors shall be required to produce, to the Site Manager, appropriate Job Safety Analysis (JSA) documentation for the eradication tasks to be performed. The use of chemicals and hazardous power tools (*e.g.* chainsaws) at BSQ will be subject to approval (refer below).
- All chemicals brought to site will be required to undergo assessment. The assessment process comprises:
  - Determining whether the relevant chemical is already registered on the Hazardous Substance Register (SHE Guideline 3.20A) for use at BSQ. If the chemical is already registered on the Hazardous Substance Register, the chemical can be brought on site and used under the conditions of the Material Safety Data Sheet (MSDS) and relevant JSA's associated with the chemical use tasks(s). If the chemical is not on the Hazardous Substance Register, a New Chemical Request Form must be completed.
  - An assessment of the new chemical by the Site Manager and the SHE Coordinator (Perth Region). If approved, the chemical will be added to the Hazardous Substance Register and a copy of the MSDS associated with the chemical shall be submitted to the Site Manager, be retained on site and be accessible by all personnel and contractors.



#### WEED MANAGEMENT

- All hazardous power tools (*e.g.* chainsaws) brought to site will be required to undergo assessment for "fit for purpose" and safety, and operators will be required to produce documentation showing competency to operate the equipment.
- Weed eradication programmes will be undertaken at a time (vegetation growth stage, climate season, weather) when the weed eradication method will be most effective. The timing will typically be decided in consultation between the Site Manager and the vegetation management consultant/contractor.

## **Monitoring and Performance Indicators**

- Vehicles washdown procedures will be periodically audited to ensure that vehicles entering and/or leaving the site are free of weeds.
- Designated weed control areas will be photographed on a quarterly or when necessary to ensure the spread of weeds is detected and recorded.
- Weed Declaration forms will be collected by the Site Manager and compared to the list on Appendix
   A to determine if weed diversity is increasing or decreasing, and to detect any new species that may
   be present.

## Definitions

- **Declared Plant:** A Declared Plant is a weed that has been "Declared" under the *Agriculture and Related Resources Protection Act 1976.* They are pest plants targeted for control under state legislation and are species that have, or could have, serious economic, environmental or social impacts. A list of Declared Plants in Western Australia can be found online at the Department of Agriculture and Food website:
  - http://www.agric.wa.gov.au/content/PW/WEED/DECP/DECLAREDPLANTS\_INDEX.HTM
- **Environmental Weed:** A plant that invades and thrives in environments in which it does not naturally occur. An environmental weed, by its very nature, interferes with the natural processes of the environment. Environmental weeds include all Declared Plants and non-declared nuisance plants.

#### Weed Eradication Methods:

- *Manual Removal*: The plant is removed by hand-pulling or grubbing. Usually undertaken during the wettest time of the year when the soil is moist (soft).
- Lopping: Weeds are removed with an axe, scythe, chainsaw, brushcutter, saw or similar cutting implement. Not recommended for species with underground tubers or bulbs.
- *Ringbarking*: The bark is peeled away or cut through and the sapwood (outer, often lighter-coloured wood) is cut, around the entire girth of the plant, preventing nutrient and water flow in the stem.
- *Scarifying*: The top few centimetres of soil are removed using a suitable tool such as a fire hoe. The aim is to remove soil-stored seed.
- *Seed Removal*: Seed can be collected by hand from undesirable species. The aim is to exhaust the seed supply. Tall seed heads can be removed mechanically using a whipper-snipper, slasher, etc.
- *Overlay*: Old carpet, carpet underlay, a thick layer of newspapers, steamed eucalypt mulch or black plastic is used to prevent sunlight reaching the weed-infested soil. Alternatively, the ground is watered and covered with clear plastic, which is pegged down. The plastic acts as a glasshouse germinating all seed in the soil. After time the water supply is exhausted and the plants die.

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*Overplanting*: Dense stands of native shrubs and trees are established to shade-out weeds.

- *Cut stump*: The weed plant is lopped and the exposed surface of the stump painted with a herbicide. The application of herbicide should occur within 15 seconds to ensure the absorption of the chemical through the plant system.
- Stem Injection (drill & fill): A hole is drilled at a downward slope into the trunk of the plant. The hole is filled with (usually undiluted) herbicide and plugged. Injection under pressure is sometimes most effective, particularly for plants containing high levels of sap, such as exotic coral trees.
- *Bark Frilling (or chipping)*: The bark and sap-wood are 'frilled' (also called chipping) using a small axe and the cups produced are immediately filled with undiluted herbicide.
- Folia Application: The leaf surface is sprayed (or wiped with a wick dipped in) an appropriate herbicide.
- *Bark stripping and stem painting*: The bark surface is peeled away and the exposed wood is treated with an appropriate herbicide.

Role	Accountability
Site Manager	<ul> <li>Ensure that all personnel who report to you are aware of and conform to this procedure.</li> </ul>
	<ul> <li>Ensure the process for awarding and varying contract requires environmental approval (where the contract has an environmental aspect).</li> </ul>
	<ul> <li>Ensure the site conditions of contract include weed and pest management requirements.</li> </ul>
	• Ensure weed wash down is being undertaken (where necessary) on earthmoving and other heavy vehicle equipment moving onto and off site.
	Process and approve Weed Hygiene Declaration forms.
	• Process and approve excavation, clearing, topsoil removal and burning permits.
	Maintain a topsoil inventory for the site.
	<ul> <li>Develop and maintain maps identifying the location of significant weed areas on site.</li> </ul>
	<ul> <li>Ensure significant weed areas are demarcated and, where practical, eradicated or otherwise quarantined from other flora.</li> </ul>
	• Ensure contract scope of works detail weed and pest management requirements.
	<ul> <li>Manage weed and pest eradication programmes on site.</li> </ul>
	Review and, if necessary, update this plan every two years.
All Persons	Conform to this procedure at all times.
	• Report the sighting of any suspected declared plants and declared animals to the Site Manager.
	<ul> <li>Obtain a permit to excavate, clear, remove topsoil and burn prior to undertaking disturbance to vegetation or soil.</li> </ul>
	<ul> <li>Ensure earthmoving and ground disturbance equipment is washed down to remove plant matter and soil prior to site entry. A Weed Hygiene Declaration form must be completed and presented to the Site Manager.</li> </ul>

## Accountabilities



WEED MANAGEMENT

## **Document Management**

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0	5 May 2008	Final	l Sw	ane (URS)	J Becher (URS)	G Manning (CEMEX)
0	6 November 2013	Final	J (UR:	O'Halloran S)	J Moro (URS)	Honan (HAUS)

### Attachments

Appendix A	Weeds Identified at Baldivis Sand Quarry.
Attachment	Weed Hygiene Declaration Form.



#### WEED MANAGEMENT

# Appendix A – Weeds Identified at Baldivis Sand Quarry

The following is reproduced from Bennett Environmental Consulting (2006). The common name for Vulpia myuros (Rats tail fescue) was not included in the Bennett Environmental Consulting (2006) report and has been sourced from http://plantnet.rbgsyd.nsw.gov.au.

A total of 38 weeds were recorded from the remnant bushland surrounding the site. All except for one have been identified as weeds by the Department of Environment and Conservation (Western Australian Herbarium 2006). \*Cotula coronopifolia as yet has not been determined as a weed by the Department of Conservation and Land Management (CALM) (1999).

The rating allocated to each weed by CALM is based on three criteria:

- **Invasiveness** ability to invade natural bushland in good to excellent condition or ability to invade waterways.
- **Distribution** wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world.
- Environmental impacts Ability to change the structure, composition and function of . ecosystems. In particular an ability to form a monoculture in a vegetation community.

Ratings indicate the following.

- High indicates this weed is prioritised for control and/or research *i.e.* prioritizing funding to it. •
- **Moderate** indicates control or research effort should be directed to it if funds are available, however it should be monitored (possibly a reasonably high level of monitoring).
- Mild indicates monitoring of the weed and control where appropriate.
- Low indicates that this species would require a low level of monitoring.

Scientific Name	Common Name	CALM Rating	Invasiveness	Impacts
Ehrharta calycina	Perennial veldt grass	High	~	~
Euphorbia terracina	Geraldton carnation weed	High	✓	✓
Lagurus ovatus	Hares tail grass	High	✓	✓
Lupinus cosentinii	Sandplain lupin	High	✓	✓
Moraea flaccida	One leaf Cape tulip	High	~	✓
Romulea rosea	Guildford grass	High	~	~
Typha orientalis	Bullrush	High	~	~
Watsonia meriana cv bulbillifera	Bulbil watsonia	High	✓	✓
Zantedeschia aethiopica	Arum lily	High	~	✓
Aira caryophyllea	Silvery hair grass	Moderate	~	
Anagallis arvensis	Pimpernel	Moderate	~	
Arctotheca calendula	Cape weed	Moderate	✓	
Briza maxima	Blowfly grass	Moderate	✓	
Callitriche stagnalis	Common starwort	Moderate	✓	
Carpobrotus edulis	Hottentot fig	Moderate	✓	
Ehrharta longiflora	Annual veldt grass	Moderate	✓	
Heliophila pusilla		Moderate	✓	
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#### Weeds recorded during the survey classified according to CALM (1999):

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#### WEED MANAGEMENT

Scientific Name	Common Name	CALM Rating	Invasiveness	Impacts
Hypochaeris glabra	Flat weed	Moderate	✓	
Lolium rigidum	Annual rye grass	Moderate	✓	
Olea europaea	Olive	Moderate	✓	
Orobanche minor	Lesser broomrape	Moderate	✓	
Pinus pinaster	Pinaster pine	Moderate	✓	
Solanum nigrum	Nightshade	Moderate	✓	
Sonchus asper	Prickly sowthistle	Moderate	✓	
Sonchus oleraceus	Common sowthistle	Moderate	✓	
Ursinia anthemoides	Ursinia	Moderate	✓	
Vulpia bromoides	Squirrels tail fescue	Moderate	✓	
Vulpia myuros	Rats tail fescue	Moderate	✓	
Osteospermum clandestinum	Stinking roger	Mild		
Phytolacca octandra	Ink weed	Mild		
Trachyandra divaricata	Onion weed	Mild		
Acacia iteaphylla	Flinders Range wattle	Low		
Acetosella vulgaris	Sorrel	Low		
Conyza bonariensis	Flaxleaf fleabane	Low		
Erodium botrys	Corkscrews	Low		
Lotus suaveolens	Lotus	Low		
Lupinus luteus	Yellow lupin	Low		
Mentha x piperita	Eau de Cologne mint	Low		
Cotula coronopifolia	Water buttons	Not Listed		

All weeds with the CALM rating of **High** should be targeted for removal.

Grass weeds can be readily removed with a grass specific herbicide. The other weeds rated as high require specific techniques for their removal. There were not many plants of Arum lily or Geraldton Carnation weed recorded so these could be removed successfully by hand pulling. Brown and Brooks (2002) provide the information on weed removal for the above taxa.

Where weeds occur in or adjacent to standing water care will need to be taken in the selection of the herbicide due to the impact that could occur on animals living in that environment.

#### References

- Bennett Environmental Consulting (2006). *Flora and Vegetation of Baldivis Explosives Reserve*. Consultants Report prepared for Strategen by Bennett Environmental Consulting Pty Ltd, November 2006.
- Brown, K. and Brooks, K. (2002). Bushland Weeds *A Practical Guide to Their Management*. Environmental Weed Action Network.
- Department of Conservation and Land Management (1999). *Environmental Weed Strategy for Western Australia*.
- Western Australian Herbarium (2006). Max. Department of Conservation and Land Management

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WEED MANAGEMENT

# **Attachment – Weed Hygiene Declaration Form**

# Weed Declaration Form

		This declaration is valid for se	upplying items	specified belo	w from (insert	dates);		
			to					
1. Item being	delivered (pleas	se tick the relevant box and provi	de a brief descr	ption)				
Sand/gravel	Soil	Mulch		Other				
Amount		Des	scription					
(Eg.	weight, size of lo	ad, number of items)	(	Eg. hay, soil)				
Provide detai	ils of weeds:					Yes	No	Maybe
3. If you is no reprodu Nil 🗌 W Steps Taken	a answered 'ye active material /ashing/Cleanin	s' or 'maybe' in question 2, (please tick the relevant boxe g □ Quarantine Period □	then what ac s and specify Chemical Tre	tions have be steps taken) eatment  Ce	en taken to re	otr	or ens	ure that t
4. 4. To	the best of my No	<b>y knowledge the 'thing' des</b> e on provided on this form is true	cribed above: e and correct:	still contains	s a weed liste	d in 2 a	bove	
Name:								

Name.	
Company:	
Telephone:	
Signature:	
Date:	

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# Appendix M Monitoring Checklists





MONITORING REQUIREMENTS CHECKLISTS

# BSQ Guideline 1.0 Monitoring Requirements Checklists

# **Objective**

To provide staff at Baldivis Sand Quarry (BSQ) (Mining Lease M70/1046), including the Stage 1 and Expansion Projects, with a summary of the requirements for onsite monitoring associated with BSQ Guidelines 1.1 to 1.11.

# **Checklists**

The attached checklists include:

- Attachment A SHE Guideline 1.0.1 Daily checklist;
- Attachment B SHE Guideline 1.0.2 Monthly checklist; and
- Attachment C SHE Guideline 1.0.3 Annual checklist.

Each checklist, one completed is required to be checked and signed by the Site Manager and retained for record and review in accordance with the BSQ Environmental Management Plan.

# **Related Documents**

- BSQ Stage 1 Environmental & Social Management Plan
- BSQ Guideline 1.1: Fauna Management;
- BSQ Guideline 1.2: Fire Management;
- BSQ Guideline 1.3: Hydrocarbon Management;
- BSQ Guideline 1.4: Pest Management;
- BSQ Guideline 1.5: Sedimentation Pond Management; BSQ Guideline 1.6: Waste Management;
- BSQ Guideline 1.7: Weed Management;
- BSQ Guideline 1.8: Dust Management;
- BSQ Guideline 1.9: Noise Management;
- BSQ Guideline 1.10: Aboriginal Heritage Plan;
- BSQ Guideline 1.11: Transport Management; and
- BSQ Groundwater Operating Strategy.



#### MONITORING REQUIREMENTS CHECKLISTS

### Accountabilities

Role	Accountability				
Site Manager	<ul> <li>Ensure that monitoring requirements are carried out in accordance with the Management Plans and the BSQ Stage 1 Environmental Management Plan.</li> </ul>				
	<ul> <li>Ensure checklists are reviewed, signed and retained for record keeping and auditing.</li> </ul>				
	<ul> <li>Review and, if necessary, update the checklists every two years or earlier if associated Management Plans are updated.</li> </ul>				

# **Document Management**

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0	5 May 2008	Final	T Hassell (URS)	J Becher (URS)	G Manning (CEMEX)
0	1 November 2013	Final	M Jones (URS)	J Moro (URS)	L Honan (HAUS)

#### Attachments

Attachment A	BSQ Guideline 1.0.1 Daily Checklist.
Attachment B	BSQ Guideline 1.0.2 Monthly Checklist.
Attachment C	BSQ Guideline 1.0.3 Annual Checklist.



MONITORING REQUIREMENTS CHECKLISTS

# Attachment A – BSQ Guideline 1.0.1 Daily Checklist



#### DAILY CHECKLIST

Maintena	nce Compound				
	Check oil/water separator				
ves / no	Was any hydrocarbon or sediment re	moved from the separator?			
,					
Waste Co	ompound				
	Check compound is generally clean a	ind tidy.			
	Check compound for damage or wea	r.			
yes / no	Is any maintenance required?	Detail:			
-					
Sediment	ation Ponds				
	Check pond for trapped or dead fauna	а.			
	Check that there is minimum 0.5m fre	eboard in all ponds.			
	Check fencing and signage for damage	ge or wear.			
yes / no	Is any maintenance required?	Detail:			
	N:				
General	Site Area				
	Check eating, rubbish storage and for	od preparation areas to ensure hygiene and cleanliness			
	Check sediment control measures (if	applicable).			
yes / no	Is any maintenance or sediment	Detail:			
	removal required?				

e Manager Signature:	Date:



# **Related Documents**

The following documents outline the specific monitoring requirements at BSQ and should be consulted for further information where applicable.

- BSQ Guideline 1.1: Fauna Management.
- BSQ Guideline 1.2: Fire Management.
- BSQ Guideline 1.3: Hydrocarbon Management.
- BSQ Guideline 1.4: Pest Management.
- BSQ Guideline 1.5 Sedimentation Pond Management.
- BSQ Guideline 1.5: Waste Management.
- BSQ Guideline 1.6: Weed Management.
- BSQ Guideline 1.7: Dust Management.
- BSQ Guideline 1.8: Noise Management.
- BSQ Guideline 1.9: Aboriginal Heritage Plan.
- BSQ Guideline 1.10: Transport Management.
- BSQ Groundwater Operating Strategy.



MONITORING REQUIREMENTS CHECKLISTS

# Attachment B – BSQ Guideline 1.0.2 Monthly Checklist



#### MONTHLY CHECKLIST

weed Col					
	Photograph weed control areas.				
	Audit vehicle washdown procedures to ensure vehicles entering and/or leaving the site are weed and/or seed free.				
yes / no	Are all vehicles inspected free of weeds and/or seeds?	Detail:			
Maintena	nce Compound				
	Check that spill kits are complete and	suitable for use.			
Waste Co	mpound				
	Check for correct segregation of recyc	clables, hydrocarbon and haza	rdous wastes.		
yes / no	Is there any significant	Detail:			
	contamination of waste streams?				
	Inspect bunding and hazardous waste	e containment for damage or w	ear.		
yes / no	Is there any significant	Detail:			
-	contamination of waste streams?				
Groundwa	ater Monitoring				
	Monitor are record groundwater levels	in monitoring bores (18 in tota	al)		
	Monitor and record groundwater abstr	action rate (PB01)			
Noise Co	ntrol (every 6 months)				
	Monitor noise emissions over 24 hour	s for 1 week. Record results in	Environmental Noise		
	Survey Report.				
Fire Prote	ection Equipment Maintenance (mon	thly)			
	Check condition of smoke alarms and	batteries.			
pass/fail	Activate smoke alarm. Does the alarm	ו work?			
Fire Prote	ection Equipment Maintenance (every	y 6 months)			
	Inspect and test all portable and fixed	fire extinguishers.			
General C	Comments				
Site Mana	ager Signature:		Date:		



MONTHLY CHECKLIST

# **Related Documents**

The following documents outline the specific monitoring requirements at BSQ and should be consulted for further information where applicable.

- BSQ Guideline 1.1: Fauna Management;
- BSQ Guideline 1.2: Fire Management;
- BSQ Guideline 1.3: Hydrocarbon Management;
- BSQ Guideline 1.4: Pest Management; BSQ Guideline 1.5: Sedimentation Pond Management;
- BSQ Guideline 1.6: Waste Management;
- BSQ Guideline 1.7: Weed Management;
- BSQ Guideline 1.8: Dust Management;
- BSQ Guideline 1.9: Noise Management;
- BSQ Guideline 1.10: Aboriginal Heritage Plan;
- BSQ Guideline 1.11: Transport Management; and
- BSQ Groundwater Operating Strategy.



MONITORING REQUIREMENTS CHECKLISTS

# Attachment C – BSQ Guideline 1.0.3 Annual Checklist



ANNUAL CHECKLIST

Weed Co	Weed Control						
	Conduct weed survey of weed control areas						
Fire Prote	ection Equipment Maintenance						
	Smoke alarm batteries have been changed						
	Check fire hoses and sprinklers for leaks and to ensure they operate correctly						
	Fire drills and emergency response drills carried out						
	Fire control training has been carried out						
Transpor	t and Traffic Management						
	Schedule inspection of weighbridge facility						
Groundw	ater Monitoring						
	Groundwater sample collected from PB01 and sent to laboratory for analysis						
Audit Sch	edule						
	Audit of Fauna Management procedure undertaken						
	Audit of Fire Management procedure undertaken						
	Audit of Hydrocarbon Management procedure undertaken						
	Audit of Pest Management procedure undertaken						
	Audit of Waste Management procedure undertaken						
	Audit of Weed Management procedure undertaken						
Conserval							

General Comments					
Site Manager Signature:				Date:	
Title	Sponsor	Date Issued	Revision Status	Date Reviewed	Page
SHE Guideline 1.0.3 Annual Checklist	L Honan	1 November	0	Bate Honowed	1 of 2
		2013			

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ANNUAL CHECKLIST

# **Related Documents**

The following documents outline the specific monitoring requirements at BSQ and should be consulted for further information where applicable.

- BSQ Guideline 1.1: Fauna Management;
- BSQ Guideline 1.2: Fire Management;
- BSQ Guideline 1.3: Hydrocarbon Management;
- BSQ Guideline 1.4: Pest Management;
- BSQ Guideline 1.5: Sedimentation Pond Management; BSQ Guideline 1.5: Waste Management;
- BSQ Guideline 1.6: Weed Management;
- BSQ Guideline 1.7: Dust Management;
- BSQ Guideline 1.8: Noise Management;
- BSQ Guideline 1.9: Aboriginal Heritage Plan;
- BSQ Guideline 1.10: Transport Management; and
- BSQ Groundwater Operating Strategy.

Appendix N BSQ Groundwater Operating Strategy



Ν



# Report

Operation Strategy for the Renewal and Amendment of GWL162863 - Baldivis Sand Quarry

14 APRIL 2010

Prepared for Holcim (Australia) Pty Ltd

18 Brodie Drive Bentley Western Australia 6102

42906357



Project Manager:

Chris Wetzelhuetter Senior Hydrogeologist **URS Australia Pty Ltd** 

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Author:

Chris Wetzelhuetter Senior Hydrogeologist

Date: Reference: Status: **14 April 2010** 42906357/WO260/C Final

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# **Executive Summary**

Holcim (Australia) Pty Ltd (formerly Rinker Australia Pty Ltd) is currently operating a sand quarry on Mining Lease M70/1046 at Stakehill Road, Baldivis, Western Australia. Groundwater is abstracted at the site from a pumping bore (PB1) (Figure 1, Table 1) which was drilled and constructed under URS supervision in August 2005. Pumping of PB1 began on 2/04/2008 and has occurred on an intermittent basis ever since. Groundwater is abstracted from Production Bore PB1 and stored in a pond onsite. The water is used for the purpose of dust suppression and sand processing.

The abstraction schedule for PB1 is approximately 12 hours on at 15 l/sec and 12 hours of from Monday to Friday, if the demand is high. During raining periods the demand is declining and water is abstracted only for several hours per day at 15 L/sec to top up the storage.

At PB1 and six (6) monitoring bores waterlevels are recorded on a quarterly basis. Details of the monitoring bore are demonstrated in Table 1.

Bore	Purpose	Easting (MGA94, Zone 50)	Northing (MGA94, Zone 50)	mAHD (toc)	Date constructed	Depth of Bore (m)	Screened interval
PB1	Production	388141.0	6415227.9	23.25	20/04/2007	36.2	23.20- 35.20m
BP08	Monitoring	388481.8	6414512.4	26.33	21/03/2007	30.0	25.27- 28.27m
PQ11	Monitoring	387583.5	6414512.0	6.97	21/03/2007	9.0	2.50- 8.50m
PB13	Monitoring	387350.8	6415064.1	12.41	21/03/2007	16.5	12.66- 15.66m
PQ14	Monitoring	387359.4	6415670.6	9.15	23/03/2007	12.0	5.00- 11.00m
BQ15	Monitoring	388050.4	6415714.1	15.32	23/03/2007	18	9.60- 15.60m
BP03	Monitoring	389105.6	6415400.2	5.85	19/03/2007	11.5	8.25- 11.25m

#### **Table 1: Bore summarising details**

The water requirements at the site have been covered for the past two years under GWL162863, which allows for an annual abstraction rate of 240,000 kL per year. This licence expired on 27 December 2008 and URS and Holcim have recently submitted a new 5C licence to amend and renew the existing licence. The estimated abstraction requirement at the site has fallen to 150,000 kL, and we hereby provide this document to outline the details of a new operating strategy to coincide with this reduction.



# **Operating Rules and Monitoring Schedule**

### 1.1 Abstraction

- Groundwater will be abstracted from production bore PB1 at a maximum annual rate of 150,000 kL/yr.
- The abstraction schedule for PB1 is approximately 12 hours on at 15 l/sec and 12 hours of from Monday to Friday, if the demand is high. During low demand periods abstracted will occur only for several hours per day at 15 L/sec to top up the storage.

## 1.2 Monitoring

The monitoring requirements are outlined below and in Table 2.

#### Production Bore

- Monthly abstraction measurements. These measurements will take place at the beginning of each month.
- Water Level measurement quaternary, scheduled together with monitoring bore level measurements.

#### Monitoring Bores

- Water level measurements of BP08, BQ11, BP13, BQ14, BQ15, BP03 every 3 month (quaternary).
- Trigger levels for BP08, BQ11, BP13, BQ14, BQ15, and BP03 are outlined in Table 3. The baseline for the trigger levels are the groundwater level recorded in April 2007.
- Contingency plan (Table 4): A trigger level is breached if a 0.5 metre decline in groundwater level from that recorded in April 2007 occurs. The actions that will be taken if the trigger is breached are:
  - Reduction of PB 1 abstraction rate by 50 per cent. Immediately reporting of this occurrence to the DoW Kwinana Regional Office. Discuss with the DoW a revised abstraction schedule.
  - Monitor BP10, BP07, BP01, BP02, BP04, BP06 and compare to groundwater level from that recorded in April 2007. Discuss with the DoW a revised abstraction schedule if a 0.25 metre decline in groundwater level from that recorded in April 2007.
  - Monitor BQ09 and compare to groundwater level from that recorded in April 2007. Report and Discuss with the DoW a revised abstraction schedule if a 0.5 metre decline in groundwater level from that recorded in April 2007.

#### Water Quality

- A groundwater sample will be collected from Production PB1 (when PB1 is operating) annually at the beginning of July and submitted to a laboratory for a standard cation-anion analysis. The analyses parameters are listed in Table 5. If error in the ion balance from the analysis is less than 10 per cent, sampling will be repeated.
- Groundwater sampling point will be the pipe outlet at the storage pond. The pump should run at least 30min before sampling takes place.



# 1 Operating Rules and Monitoring Schedule

Bore	Purpose	Water level Measurement	Meter use reading	GW Sampling
PB 1	Production	1 <sup>st</sup> Jan, 1 <sup>st</sup> April, 1 <sup>st</sup> July, 1 <sup>st</sup> Sep, 1 <sup>st</sup> Dec	Monthly (1 <sup>st</sup> Jan to Dec)	1 <sup>st</sup> July
BP08	Monitoring	1 <sup>st</sup> Jan, 1 <sup>st</sup> April, 1 <sup>st</sup> July, 1 <sup>st</sup> Sep, 1 <sup>st</sup> Dec		
BQ11	Monitoring	1 <sup>st</sup> Jan, 1 <sup>st</sup> April, 1 <sup>st</sup> July, 1 <sup>st</sup> Sep, 1 <sup>st</sup> Dec		
BP13	Monitoring	1 <sup>st</sup> Jan, 1 <sup>st</sup> April, 1 <sup>st</sup> July, 1 <sup>st</sup> Sep, 1 <sup>st</sup> Dec		
BQ14	Monitoring	1 <sup>st</sup> Jan, 1 <sup>st</sup> April, 1 <sup>st</sup> July, 1 <sup>st</sup> Sep, 1 <sup>st</sup> Dec		
BQ15	Monitoring	1 <sup>st</sup> Jan, 1 <sup>st</sup> April, 1 <sup>st</sup> July, 1 <sup>st</sup> Sep, 1 <sup>st</sup> Dec		
BP03	Monitoring	1 <sup>st</sup> Jan, 1 <sup>st</sup> April, 1 <sup>st</sup> July, 1 <sup>st</sup> Sep, 1 <sup>st</sup> Dec		

Table 2: Schedule for Monitoring
## 1 Operating Rules and Monitoring Schedule

Monitoring Bores	Baseline 30/04/07 m AHD	Trigger m AHD	Trigger m bTOC
BP 03	1.20	0.70	5.15
BP 08	0.99	0.49	25.84
BQ 11	0.90	0.40	6.57
BP 13	0.84	0.34	12.07
BQ 14	0.86	0.36	8.79
BQ 15	0.95	0.45	14.87
Additional Bores	if a trigger is breached		
BP 01	1.06	0.81	5.02
BQ 02	1.15	0.90	2.12
BP 04	1.28	1.03	4.00
BQ 05	0.58	0.08	2.51
BP 06	1.09	0.84	4.25
BP 07	1.06	0.81	22.58
BQ 09	1.04	0.54	8.31
BP 10	0.81	0.56	5.38
BP 12	0.95	0.45	20.13

Figure 3: Trigger Values for Monitoring Bores

Trigger	Applicable Bores	Action (if the trigger is breached)
A 0.5 metre decline in groundwater level from that recorded in April 2007.	BP03, BP08, BQ11, BP13, BQ14, BQ15	Reduce PB 1 abstraction rate by 50 per cent. Immediately report this occurrence to the DoW Kwinana Regional Office. Discuss with the DoW a revised abstraction schedule and monitor BP01, BQ02, BP04, BQ05, BP06 BP07, BQ09, BP10 and BP12 compare to groundwater level from that recorded in April 2007. Discuss with the DoW a revised abstraction schedule if a 0.25 metre decline in groundwater level from that
		recorded in April 2007.

Table 4: Trigger and contingency plan



## 1 Operating Rules and Monitoring Schedule

Analyte	Units
рН	pH unit
Total Dissolved Solids @ 180°C	mg/L
Electrical Conductivity @ 25°C	µS/cm
Calcium	mg/L
Potassium	mg/L
Sodium	mg/L
Chloride	mg/L
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L
Hydroxide Alkalinity as CaCO <sub>3</sub>	mg/L
Total Alkalinity as CaCO <sub>3</sub>	mg/L
Nitrate as N	mg/L
Nitrite + Nitrate as N	mg/L
Nitrite as N	mg/L
Sulphate as SO <sub>4</sub> <sup>2-</sup>	mg/L
Sulphur as S	mg/L
Iron	mg/L
Magnesium	mg/L
Manganese	mg/L

Table 3: List of analytes for annual groundwater sampling

### **1** Operating Rules and Monitoring Schedule

## 1.3 Reporting

Reporting requirements for the GWL will be:

- a Monthly Metering Report, an Annual Groundwater Summary and a Triennial Groundwater Review:
- A monthly metering report will be submitted not later than 14 days after the end of the water year. It will include the monthly meter readings and monthly water consumption. As a template the DoW Meter water use card should be used.
- A groundwater monitoring summary will be submitted annually.
- The strategy will be reviewed every three years (triennially). A groundwater monitoring review will be submitted triennially.

Reports will be submitted to the DoW Kwinana Regional Office in hardcopy format and will be submitted within two months of the conclusion of a water year. The scheduled delivery date will be 28 February.



# **Administrative Requirements**

The following administrative requirements are proposed:

1. The person responsible for implementing the operating strategy will be Gemma Blick (Holcim). Her contact details are:

Gemma Blick : Phone 089212 2000

Holcim (Australia) Pty Ltd

18 Brodie Hall Drive

Bentley Western Australia 6102

- 2. The water year is defined as 31 December to 31 December.
- 3. A monthly metering report will be submitted not later than 14 days after the end of the water year.
- 4. A groundwater monitoring summary will be submitted annually.
- 5. The strategy will be reviewed every three years (triennially). A groundwater monitoring review will be submitted triennially.
- 6. Reports will be submitted to the DoW Kwinana Regional Office in hardcopy format and will be submitted within two months of the conclusion of a water year. The scheduled delivery date will be 28 February.
- 7. Monitoring reports will be consistent with previous groundwater monitoring reports that have been produced in line with DoW reporting guidelines. Data will be presented in both tabular and graphic formats, as continuous (historical) data for the preceding years and the current year. The historical data will be compared to a discrete data set for the year just ended; and the licence-condition data. Should the monitoring reveal any unusual or undesirable results, the report will include an explanation of the cause and a description of the action to manage the groundwater resource. Comments will be made on the effectiveness and accuracy of the monitoring program.



# Summary

## 3.1 Summary of commitments

- Groundwater will be abstracted from production bore PB1 at a maximum annual rate of 150,000 kL/yr.
- The water year is defined as 31 December to 31 December
- A monthly metering report will be submitted not later than 14 days after the end of the water year.
- A groundwater monitoring summary will be submitted annually.
- The strategy will be reviewed every three years (triennially). A groundwater monitoring review will be submitted triennially.
- Reports will be submitted to the DoW Kwinana Regional Office in hardcopy format and will be submitted within two months of the conclusion of a water year. The scheduled delivery date will be 28 February.
- A groundwater sample will be collected from Production PB1 (when PB1 is operating) annually
- Water level measurements of production bore and monitoring bores every 3 month (quaternary)
- Trigger levels for BP08, BQ11, BP13, BQ14, BQ15, and BP03 are defined. The baseline for the trigger levels are the groundwater level recorded in April 2007.
- It trigger levels are breached, a contingency plan is established

We trust that this operating strategy adequately addresses your requirements, and we look forward to further progressing the project by confirming the groundwater licensing conditions. We would appreciate the project be treated with priority, as Holcim would like to continue their operations with confidence towards their water entitlements.

## 3.2 Responsibilities

The person responsible for implementing the operating strategy will be Deborah Cahill (Holcim). Her contact details are:

Deborah Cahill

Holcim (Australia) Pty Ltd

18 Brodie Hall Drive

Bentley Western Australia 6102

Name	Responsibility	Date	Signature
Gemma Blick	Key person t implementing Operating Strategy	or Date 14/4/2010	nall
Site personnel To nominate	Monthly me reading	er	



## 3 Summary

# 3.3 Approval by DoW

## Limitations

## 4.1 Geotechnical & Hydro Geological Report

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Holcim (Australia) Pty Ltd and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared in December 2009 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The borehole logs indicate the inferred ground conditions only at the specific locations tested. The precision with which conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of conditions as constrained by the project budget limitations. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report and our experience. Future advances in regard to the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact on our conclusions and recommendations regarding their potential presence on this site.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, URS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.



# Appendix A Figures



A









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# Appendix I SHE Policy



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Strength. Performance. Passion.



SHE Guideline 1.1

# Policy, Principles & Directives

Issue Date: August 2010

# **1.1 Policy, Principles & Directives**

The purpose of this standard and guideline is to state the Company's overall objectives for Safety and Health and demonstrate a commitment to improving Safety and Health performance.

To achieve this objective the Safety & Health and Environment policies, principles and management directives will be communicated to all employees and contractors at inductions, training sessions, toolbox meetings, Safety Improvement Team (SIT) meetings or site/cell communication sessions. These documents will also be displayed in prominent areas throughout the businesses.

Achieving this objective will assist in reducing incidents and meet Holcim's target of zeroHarm.

### Safety Health & Environment (SHE) Audit Requirements

- 1.1.1 The National Safety & Health Policy, Environmental Policy, Principles & Directives will be communicated to employees and contractors at inductions, training sessions, toolbox meetings, Safety Improvement Team (SIT) meetings or site/cell communication sessions.
- 1.1.2 The National Safety & Health Policy, Environmental Policy, Principles & Directives shall be displayed in prominent areas throughout the site/cell, for example on notice boards in offices and amenities blocks.
- 1.1.3 The National Safety & Health Policy and Environmental Policy shall be developed through consultation with employees at toolbox meetings, Safety Improvement Team (SIT) meetings or site/cell communication sessions as required.
- 1.1.4 Site/cell specific policies (where applicable) must be reviewed in consultation with the SIT every two (2) years or whenever there are significant changes, for example, to process or plant and be displayed as described above.

**Note:** During the development and review of this standard and guideline, consideration and reference was made to any applicable state/territory legislation and advisory material. This information can be viewed under the Legislation link within the SHE Intranet site.

## **COMMUNICATION OF SHE POLICY**

### Safety Health & Environment (SHE) Audit Requirements

1.1.1 The National Safety & Health and Environment Policies, Principles & Directives will be communicated to employees and contractors at inductions, training sessions, toolbox meetings, Safety Improvement Team (SIT) meetings or site/cell communication sessions.



• The Safety & Health and Environment Policies demonstrate the company's commitment to safety, health and environment.

Refer: Attachment 1.1AH/C Holcim Australia Safety & Health Policy

Refer: Attachment 1.1A/HB Broadway & Frame Safety & Health Policy

Refer: Attachment 1.1A/HE Excel Safety & Health Policy

Refer: Attachment 1.1AH/H Humes Safety & Health Policy

Refer: Attachment 1.1AE/C Holcim Australia Environment Policy

Refer: Attachment 1.1AE/B Broadway & Frame Environment Policy

Refer: Attachment 1.1AE/E Excel Environment Policy

Refer: Attachment 1.1AE/H Humes Environment Policy

• The Principles provide the direction on how safety, health and environment should be managed within the company.

Refer: Attachment 1.1B/B&F Broadway & Frame Guiding Principles

Refer: Attachment 1.1B/E Excel Guiding Principles

Refer: Attachment 1.1B/H Humes Guiding Principles

Refer: <u>Attachment 1.1B/C Holcim Guiding Principles</u>

• The Management Directives represent the specific SHE actions expected of all management personnel.

Refer: Attachment 1.1C/B&F Broadway & Frame Management Directives

Refer: Attachment 1.1C/E Excel Management Directives

Refer: Attachment 1.1C/H Humes Management Directives

Refer: Attachment 1.1C/C Holcim Management Directives

- Managers and supervisors at all levels shall ensure the Policy, Principles and Directives are communicated through any training or awareness session, induction etc.
- Encourage discussion on these documents at the sessions so people gain a clear understanding of them.

# DISPLAY SHE POLICY

## Safety Health & Environment (SHE) Audit Requirements

1.1.2 The National SHE Policy, Principles and Directives shall be displayed in prominent areas throughout the site/cell, for example on notice boards in offices and amenities blocks.

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Safety and Health Policy	Safety, Health and Environment Guiding Principles	Safety, Health and Environment Management Directive
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- Ensure outdated SHE Policy, Principles & Directives are removed from displays, noticeboards and files
- Display the SHE Policy, Principles & Directives in places where they are easily seen and read.

The Policy, Principles and Directives will be posted on the Holcim Australia SHE Intranet site so as to enable access for sites to download and print the most recent version

The Policy, Principles and Directives will be posted on the Holcim Australia web site so as to enable customers and other interested parties access to this information

# **REVIEW OF SHE POLICIES**

## Safety Health & Environment (SHE) Audit Requirements

1.1.3 The National SHE Policy shall be developed through consultation with employees at toolbox meetings, Safety Improvement Team (SIT) meetings or site/cell communication sessions as required.



When reviewing the Safety & Health Policy and Environment Policy ensure the needs of all employees, contractors, labour hire employees and visitors are represented and served by policy provisions and SHE system elements.

The process for consultation shall consist of the following

- National Safety and Health Manager will send an email to all Cell Managers and Senior Key Personnel asking them to extend an invitation to sites/cells to consult in the review of the SHE Policies
- Managers and supervisors at all levels shall encourage employees to participate in the development of the SHE Policies on an annual basis or as required
- Where there have been changes to the process, plant, environment etc, these may have an impact on the policies
- Encourage discussion around these areas so people gain a clear understanding of them
- Records of these discussions must be kept and include topics covered, attendees and the date
- Responses shall be forwarded to the SHE MS Co-ordinator via email, internal mail or phone for collation
- The Safety and Health Manager will review or forward the responses with the Senior Operational Safety Team.

# **REVIEW OF SITE SPECIFIC SHE POLICIES**

### Safety Health & Environment (SHE) Audit Requirements

1.1.4 Site/cell specific policies (where applicable) must be reviewed in consultation with the SIT every two (2) years or whenever there are significant changes, for example, to process or plant and be displayed as described above.



- All cells and sites must adopt the SHE Policies, Principles & Directives. However, there may be limited situations where additional cell or site specific policies are required
- These situations may arise within States and Territories due to specific legislation or other requirements
- Ensure site specific policies are reviewed with the SIT at least every two (2) years or where there have been changes to the situation, process, plant, environment that may have an impact on the policies
- Ensure specific policies are similarly displayed and communicated so people quickly identify the documents and understand their intent.

# Appendix J Quarry Closure Plan



J



# Quarry Closure Plan Baldivis Sand Quarry Project

NOVEMBER 2013

Prepared for Holcim (Australia) Pty Ltd

18 Brodie Hall Drive Bentley WA 6102

42908418



Project Manager:

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Date: Reference: Status: November 2013 42908418/01/0 FINAL

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## Introduction

The purpose of this document is to provide Holcim (Australia) Pty Ltd with a Quarry Closure Plan, specific for the Baldivis Sand Quarry (BSQ) including the Stage 1 Project and the Expansion Project. The Quarry Closure Plan will be a living document, open to development and review over the life of the BSQ.

## **1.1 Project Overview**

The Baldivis Sand Quarry is being undertaken on M70/1046, which is located approximately 50 km south of Perth, and 14 km south southeast of Rockingham, Western Australia (Figure 1).

The key components of the approved Stage 1 Project comprise:

- Quarrying, screening and washing of approximately 7 Mt of sand within an extraction area of 30 ha over a life of eight years to produce concrete, fill and brick layers' sand. The sand is quarried by front end loader and, if required, screened and washed at the mobile screening and washing plant. Washing water is deposited to a series of sedimentation ponds for settling of fines. Clay fines deposited are a by-product and are regularly removed and incorporated into sand products for sale.
- Abstraction of groundwater for washing of sand and dust suppression. Up to 150,000 kL are abstracted per annum.
- Transport of sand offsite. Up to 300 heavy vehicle movements occur each weekday and up to 150 heavy vehicle movements occur each Saturday for the transport of sand.
- Supporting infrastructure and facilities including a site office, lunch room and ablutions, a maintenance and equipment storage area, fuelling facility, weighbridge, power supply, wheel wash facility, power and communication lines and waste collection area.

An Explosives Reserve (Reserve 38575, Figure 2) administered by the Department of Consumer and Employment Protection (DoCEP) is located to the south of the Stage 1 Project Site. HAUS will maintain a separation distance of 100 metres from the Explosives Reserve until the Reserve is decommissioned.

Previously, the site was a Crown Reserve (Reserve 37090, Figure 2) set aside for forestry purposes and was administered by the Department of Environment and Conservation (DEC). A pine plantation that was present on the site was cleared by the Forest Products Commission (FPC) due to the presence of the European House Borer. Native title is not applicable to the site area.

The Stage 1 Project site is zoned Urban Deferred under the City of Rockingham's Town Planning Scheme. It is planned that, following the completion of quarry operations, the site will be transferred to LandCorp for residential development.

HAUS proposes to expand the existing Stage 1 of the Baldivis Sand Quarry (the expansion is hereafter referred to as the "Expansion Project") to continue to supply fill sand for the Perth Metropolitan Area and South West until approval can be sought for Stage 2 of the proposal.

The key components of the Expansion Project comprise:

• Extraction of up to 500,000 tonnes (t) of sand within a Limit of Extraction area of 7.21 ha. The Limit of Extraction area will extend 100 m into the existing 250 m buffer located along Stakehill Road. A buffer of approximately 150 m will remain in place adjacent to Stakehill Road. The sand would be quarried by front end loader, and loaded for transportation off site. No screening or washing of sand is proposed for the Expansion Project as all sand quarried will be utilised for fill.



### **1** Introduction

- Transport of sand to customers within the Perth Metropolitan Area and South West along existing Stage 1 transport routes at the same or lower levels of existing Stage 1 vehicle volume and composition.
- Abstraction of up to 150,000 kL per annum of groundwater for dust suppression in accordance with the existing Licence To Take Water [GWL 162863(2)].
- Use of all other existing Stage 1 infrastructure comprising access road, weighbridge, power supply, communications, maintenance workshop, administration office, ablutions, crib room, fuelling facility, wheel wash facility and waste collection area.

Quarrying of the Expansion Project resource is expected to commence upon receipt of environmental approval and will enable HAUS to continue the current rate of throughput for another year with the resource life expected to extend for two to three years depending on market demand. HAUS intends to lodge approvals for Stage 2 of the Baldivis Sand Quarry Project located within Mining Lease M70/1241 within this time.

A site layout for the Expansion Project is shown in Figure 3.

## 1.2 Support Facilities

### 1.2.1.1 Access

The entire Stage 1 Project site is fenced with signage to meet DMP requirements to prevent unauthorised access to the site.

Access is via the existing access road to the Explosives Reserve and an existing building to the north east of the site. Both facilities are located within Reserve 38575 held by DMP. The access road is a sealed road with a roundabout constructed in consultation with DMP.

A weighbridge is located at the entrance to the quarry area for the processing of sands for sale prior to transport offsite to customers. Prior to entering the weighbridge, trucks are required to pass through a wheel wash facility to minimise the spread of weeds to and from the site.

The existing building has been leased from DMP and is used as a site office, lunch room and for ablutions.

A small car park (8 bays) for workforce and visitor parking is located adjacent to the existing building onsite which is leased from DMP.

### 1.2.1.2 Maintenance Area, Equipment Storage Area and Fuelling Facility

A maintenance area, equipment storage area for the storage of heavy equipment and fuelling facility is located within a fenced compound in the north of the Stage 1 site, part of which is within land leased from DMP (Figure 3).

The maintenance area contains one bay with a containment apron; wash down bay with drive-in sump and an oil/hydrocarbon separator.

Oils are stored in the Stage 1 maintenance area for equipment maintenance and are segregated and bunded in accordance with Australian Standard (AS) 1940 and DMP and DER requirements.

Diesel is stored in the maintenance area in a self-bunded 20,000L capacity storage tank. The fuel storage and refilling facility is bunded in accordance with AS 1940 and DMP and DER requirements,



### **1 Introduction**

with appropriate surface water drainage and collection. A dangerous goods licence is held for the storage of diesel onsite.

### 1.2.1.3 Waste Collection Facilities

The waste compound is a collection and storage point for domestic, industrial and hydrocarbon waste prior to disposal offsite and is located within the fenced compound in the north east of the Stage 1 site.

Wheel washing is undertaken using a closed-circuit water recycling system.

### 1.2.1.4 Communication Lines

Communications run from the existing communication network at Baldivis Road along the access road to the fenced compound and weighbridge. The existing building leased from DMP and used as a site office, lunch room and ablutions has existing communications.

#### 1.2.1.5 Power

A 300 kVA diesel generator is located adjacent to the crib room. The generator contains its own fuel tanks and is self bunded in accordance with AS 1940 and DMP and DER requirements. Power is reticulated around the Stage 1 Project using aerial transmission lines. Step down transformers have been installed to achieve the desired final voltage.

Power lines run from the existing Synergy network at Baldivis Road along the access road to the fenced compound and weighbridge. The existing buildings onsite leased from DMP are connected to the Perth Metropolitan Area grid operated by Synergy.



# **Regulatory History**

The following documents were issued to give environmental approval for the Stage 1 Project:

A lease for the Stage 1 Project (M70/1046) was issued by Department of Mines and Petroleum (DMP) to CSR Ltd (now HAUS) on 14th November 2006 under the *Mining Act* 1978. The lease was then transferred to Rinker Australia Pty Ltd on 19th December 2006, and is now held under the name of Holcim (Australia) Pty Ltd.

Environmental approval and Operating Licence was given with a Licence for Prescribed Premises (L8176/2007/1) granted by the Department of Environment and Conservation [now known as the Department of Environmental Regulation (DER)] on 28th February 2008 under Part V of the *Environmental Protection Act* 1986. This licence included operation of the mobile screening and washing plant.

A Licence to Take Water (GWL162863(1)) was granted by the Department of Water (DoW) on the 27th December 2007 for groundwater abstraction for dust suppression and processing purposes, under the Rights in Water and Irrigation Act 1914.

A Mining Proposal has been submitted to DMP under the *Mining Act* 1978 and a Licence Amendment Application has been submitted to DER under the *Environmental Protection Act* 1986 to seek environmental approval for the Expansion Project.



# **Quarry Closure**

The following section outlines the decommissioning and rehabilitation that will be undertaken following cessation of quarry operations for relinquishment of Mining Lease M70/1046 to the State and transfer of the site to LandCorp for residential development. The plan will be continue to be developed over the life of the Stage 1 Project and will be consistent with Landcorp's requirements.

The total area of land disturbance for Stage 1 of the Project is anticipated to be 36.3 ha, which comprises 32.8 ha of proposed disturbance and 3.5 ha of existing disturbance (use of DMP's existing access road and building).

The total area of land disturbance for the Expansion Project is anticipated to be 7.21 ha.

## 3.1 Rehabilitation Plan

HAUS and LandCorp have an established agreement framework by which the site will be transferred to LandCorp following the completion of quarry operations. It is understood that LandCorp will use the land for residential development.

HAUS has consulted with LandCorp regarding the operation and post-quarrying handover for the Expansion Project, as required by this agreement. It is understood that LandCorp's requirements for the post-quarrying handover comprise:

- The excavation is restored and reinstated in accordance with the rehabilitation program outlined in the Closure Plan approved by LandCorp.
- Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
- The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan [Final Pit Floor Levels agreed with Landcorp (2012)].
- All rubbish, debris, improvements or alterations effected by Holcim associated with the excavation works are completely removed from the land.
- All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.

## 3.1.1 Erosion

Removal of vegetation and disturbance to the site can potentially increase surface runoff and increase the instance of erosion. It has been reported that there could be some potential impacts on downstream water quality due to erosion, particularly from exposed areas where topsoil has been removed for quarrying, before they are rehabilitated.

Rehabilitation should be carried out as soon as possible to avoid excessive soil erosion.

HAUS will reduce the potential for erosion by:

- Restricting clearing and disturbance to the minimum required for safe and efficient operations.
- Minimising disturbance to natural drainage patterns where possible.
- Undertaking rehabilitation progressively.

It is assumed that the surface runoff characteristics will be similar to that of the cleared vacant land prior to quarrying. Monitoring of rehabilitated areas will determine whether erosion has successfully been managed and identify any issues for remediation.



### **3 Quarry Closure**

### 3.1.2 Topsoil Management

Topsoil is an integral part of rehabilitation as it contains organic matter and seed bank which assists in establishing vegetation when respread on disturbed areas. Topsoil at the site will be stripped and stockpiled separately, prior to commencing quarrying. The soils will be stripped in a dry state to preserve soil structure and stripping will be undertaken in relatively still weather conditions, where possible.

Stockpiles will be located sufficiently distant from quarrying operations so that they will not be disturbed prior to being used in rehabilitation.

- Topsoils be stripped and stockpiled separately from sand stockpiles.
- Topsoils should be stripped to a depth of approximately 1 to 2 cm. In some areas, topsoil depth may differ due to the topography of the site.
- Where practicable, soil will be stripped and returned directly to a rehabilitation area.
- Soil stripping should be avoided during wet conditions.
- The dimensions of the topsoil stockpiles will not exceed 2 m in height. This is to prevent topsoil becoming anaerobic and deteriorating in soil structure, organic matter, nutrients, seed resource and populations of beneficial soil micro-organisms.
- Where necessary the stockpiles will be covered with polymer agents and/or seeded with sterile oats species to reduce erosion and discourage weeds.

### 3.1.3 Topsoil Replacement

It is preferable not to stockpile topsoil for long periods of time as this can degrade the soil. HAUS will be quarrying the site and then rehabilitating areas progressively. This will ensure that topsoil is respread relatively soon after stripping. This will assist to preserve the structure of the soil and increase the likelihood of revegetation success.

- Topsoil will be respread and ripped to a depth of approximately 40 cm during the rehabilitation process to ensure cohesion between the topsoil, the subsoil and the disturbed land surface.
- To increase soil stability tree debris and rock should be respread with the soil, particularly if the materials are to be placed on slopes.

There is the potential that the vegetation cover will not be a major contributor to batter slope erosion resistance. The placement of coarse fragments of tree mulch over topsoil may considerably improve both erosion resistance and vegetation establishment.

### 3.1.4 Landform Design

Rehabilitation earthworks will be undertaken to develop a stable landform that is compatible with LandCorp's requirements, the surrounding area and future residential land use.

The central elements of LandCorp's landform design requirements for the BSQ are as described in Section 3.1.

- HAUS will profile the rehabilitated Project Area to be compatible with the subsequent urban development by Landcorp.
- HAUS will continue to consult with Landcorp to determine any detailed requirements for final landform design. These requirements will be integrated into this document.


#### **3 Quarry Closure**

An early planning of the coarse layout of the future residential development, once prepared by Landcorp, will provide a guideline on how the land in future stages of the quarry development the land should be contoured to roughly coincide with future urban drainage master plan (Golder 2006).

## 3.1.5 Revegetation

Following completion of quarrying, HAUS will profile the landform (to Landcorp's specifications) and respread the area with the stockpiled topsoil, as discussed in Section 3.1.3. Fragmental material, such as rocks and vegetation debris will be included in the respread.

Ripping may be used if required in areas of harder material to provides niches where organic matter and seed can collect and facilitates the infiltration of surface water.

The topsoil will be stabilised with a polymer agent and seeded with sterile oats (hydromulched) to prevent the spread of non-native species into adjacent areas. Revegetated areas will be monitored and seeded, if required (discussed in Section 4).

## 3.1.6 Decommissioning of Infrastructure and Facilities

At the end of quarrying operations, all infrastructure, constructed by HAUS, including the maintenance area, weighbridge, wheel wash facility, waste compound, but excluding the site office, ablutions, lunch room included in existing facilities leased from DMP, will be removed at the end of quarrying operations and these areas will be rehabilitated as described above. The groundwater production bore will also be capped.



## Monitoring and Maintenance

HAUS will undertake progressive rehabilitation of the Project Site. Rehabilitated areas will be monitored to ensure the success of the rehabilitation programme. Monitoring will be carried out on a regular basis to assess:

- The physical stability of the landform of rehabilitated areas;
- The characteristics of the vegetation in rehabilitated areas;
- Evidence of colonisation by new weed species;
- Signs of erosion in disturbed areas;
- Water drainage from the site; and
- Any public safety aspects.

Monitoring the rehabilitated areas will ensure that any areas requiring remedial work are identified. Procedures for the monitoring of rehabilitation sites can be updated once rehabilitation works commence.

Maintenance procedures will be carried out where necessary and may include:

- · Replanting areas that may not have regenerated;
- Repairing any erosion problems;
- Weed control; and
- Fire management.

Following transfer of the Project site to LandCorp, HAUS will seek relinquishment of rehabilitation bonds from DMP and be removed of any further monitoring and or maintenance obligations.



# **Completion Criteria**

## 5.1 Completion Criteria

Completion criteria are an agreed set of environmental indicators which, upon being met, would demonstrate successful rehabilitation. Completion criteria are specific to the operation being closed and reflect the unique set of environmental, social and economic circumstances of the site.

Guidelines published by ANZMEC (2000) for completion criteria state they should be:

- 1. Specific enough to reflect unique set of environmental, social and economic circumstances.
- 2. Flexible enough to adapt to changing circumstances without compromising objectives.
- 3. Include environmental indicators suitable for demonstrating that rehabilitation trends are heading in the right direction.
- 4. Undergo periodic review resulting in modification if required due to changed circumstances or improved knowledge.
- 5. Based on targeted research which results in more informed decisions.

In the case of the BSQ, agreement has been established between HAUS and Landcorp by which the site will be transferred to LandCorp so the site can be developed for residential land use.

Acknowledging the likely final end land use of the site as residential, HAUS will rehabilitate the site to establish a safe and stable landform, consistent with LandCorp's requirements until the site is developed.

Rehabilitation Theme	Completion Criteria
Safety	All rubbish, debris, improvements or alterations effected by HAUS associated with the excavation works are completely removed from the land.
	Access to site is to be restricted, appropriate to final land use.
Stability of Landforms and Surfaces	All constructed landforms and disturbed areas are to be stable and resistant to erosion, or at least comparable to naturally-occurring erosion in the area.
	Drainage should be consistent with Landcorp's requirements for future land use.
Landform Reconstruction	Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
	The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan [Final Pit Floor Levels agreed with Landcorp (2012)].
Soil	All sediment ponds will be removed from the site.
	Any bunded topsoil will be respread on site and seeded in sterile grasses.
	The soil remaining at site should be safe, free of contamination and compatible with the final land use and landowner agreements.
Water Resources	The minimum buffer distance between the excavation level and the Average Annual Median Groundwater Level (AAMGL) will be at least 2 m.

#### Table 5-1 Landcorp Completion Criteria



### **5 Completion Criteria**

Rehabilitation Theme	Completion Criteria
Revegetation/Stabilisation	All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.

## 5.2 Performance Indicators

The success of the Quarry Closure Plan will be determined through a range of performance indicators associated with the monitoring programme as discussed in Section 3.

It is understood that LandCorp's requirements for the post-quarrying handover comprise:

- The excavation is restored and reinstated in accordance with the rehabilitation program outlined in the Closure Plan approved by LandCorp.
- Any final excavation face is left safe with all loose material removed and the side sloped to a batter of not more than 1 m in 3 m.
- The approved floor level of the excavation area is graded to an even surface in accordance with the Closure Plan [Final Pit Floor Levels agreed with Landcorp (2012)].
- All rubbish, debris, improvements or alterations effected by Holcim associated with the excavation works are completely removed from the land.
- All disturbed areas are hydro mulched or otherwise agreed as soon as practicable after topsoil has been placed and graded to the satisfaction of LandCorp.



# References

Golder Associates 2006 preliminary hydrological characterisation: Baldivis explosives reserve crown reserve 38575 and 37090, Karnup. Unpublished report for Landcorp

EPA (2006) Guidance Statement for the Assessment of Environmental Factors; Rehabilitating Terrestrial Ecosystems

Australian and New Zealand Minerals and Energy Council (ANZMEC). 2000. Strategic Framework for Mine Closure. (http://www.dist.gov.au).



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Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.



# Figures





### SITE LOCATION



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PTY LTD

Figure: 1 Rev. A

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#### HOLCIM (AUSTRALIA) PTY LTD

BALDIVIS SAND QUARRY STAGE 1 EXPANSION PROJECT

## LOCALITY MAP AND MINING TENURE



Figure:



HOLCIM (AUSTRALIA) PTY LTD

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## SITE LAYOUT







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