248000E

248500E

249000E

249500E

1453000N

1452500N

RL 35

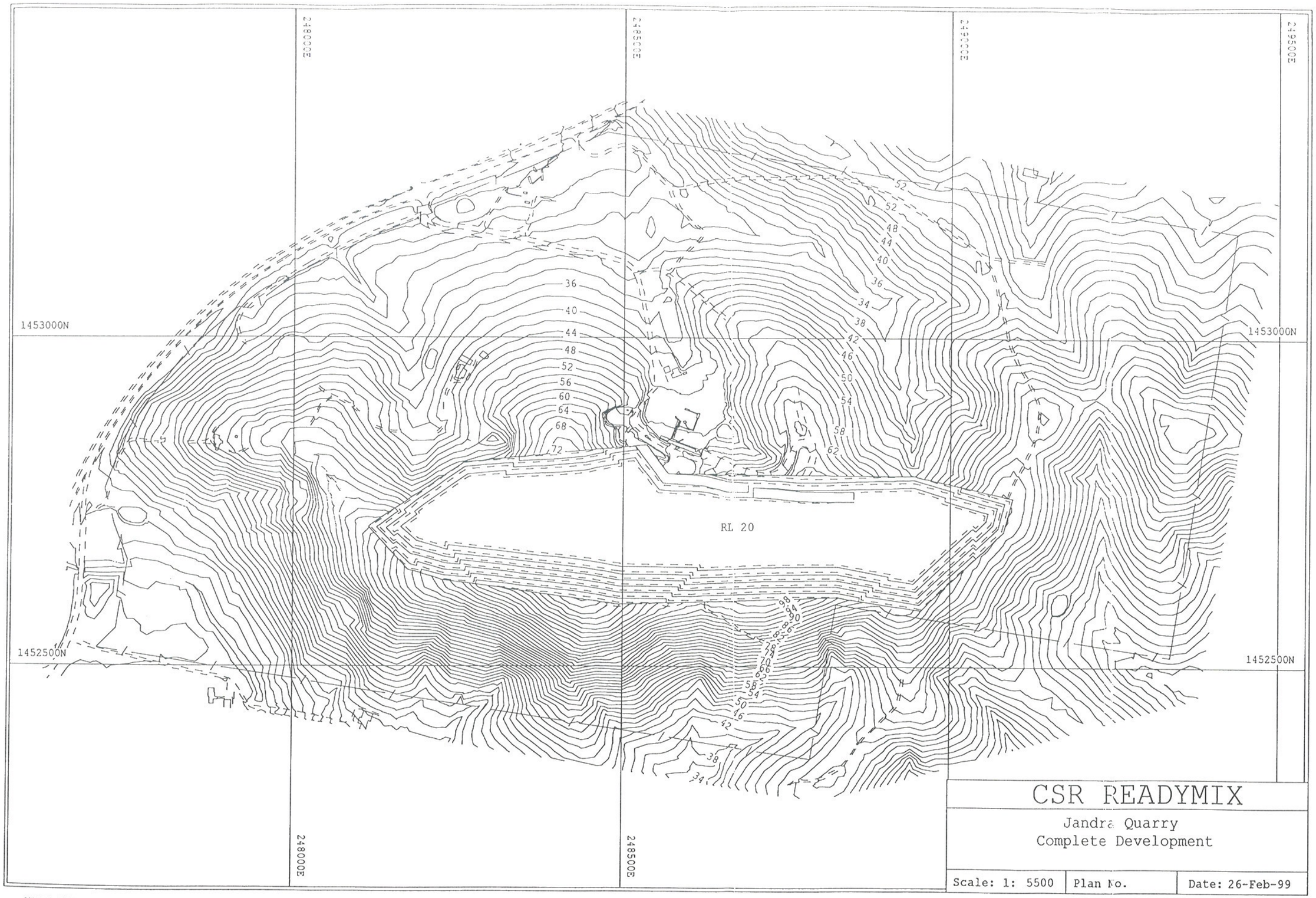
CSR READYMIX

Jandra Quarry
Stage 3 Development

Scale: 1: 5500	Plan No.	Date: 26-~~Feb 99~~

Jan-eisb.pf

SURPAC2000 - SURPAC Software International



CSR READYMIX

Jandra Quarry
Complete Development

Scale: 1: 5500	Plan No.	Date: 26-Feb-99

SURPAC2000 - SURPAC Software International

JANDRA QUARRY
EXTENSION

CSR™

F. LETTER OF INTENT FOR COEXISTENCE AGREEMENT

August 1999

Non-binding Letter of Intent

Proposed commercial terms in relation to our proposed Adjoining Owners Co-operation Agreement between Youth Care & Life Style Centre Incorporated as owners of Lot 10 DP 7900056 at 15194 Pacific Highway, Possum Brush (The Owner) and CSR as owners of Lots 14 &15 DP 7900056 Pacific Highway, Possum Brush (CSR).

SUBJECT TO AGREEMENT

1. The Owner will enter into a contractual agreement (rather than a lease) with CSR over the land described as Lot 10 DP 790056 at 15194 Pacific Highway Possum.

2. This agreement relates to the portion of the Owner's land described in Appendix 1 as buffer land or a "zone of exclusion".

3. The agreement term will be an initial 5 years with 4 x 5 year options for CSR to renew the agreement.

4. In year one of the agreement, CSR will pay The Owner $5,000 pa contractual fee payable by monthly instalments in advance.

5. Payments made in subsequent years of the initial term and any option to renew will be adjusted annually at the rate of CPI x previous year contractual fee to a maximum adjustment of 5%.

6. If cabins are constructed and used for accommodation in the "zone of exclusion" then CSR will pay an additional $800 contractual fee per cabin per annum. (This figure is based on quarry blasts coinciding with cabin occupancy on 10 occasions each year). Payment in subsequent years of the initial year of cabin occupancy will be adjusted annually at the rate of CPI x previous year contractual fee to a maximum adjustment of 5%.

7. The Owner and CSR agree to the following requirements applying to the "zone of exclusion" when CSR carries out the detonation of explosives (blasting)on the eastern extension to the existing approved area for quarry excavation on CSR's adjoining property:

   a) The Owner shall provide CSR with a copy of the proposed camp bookings at least one month in advance.

b) CSR will verbally notify The Owner not less than 7 days prior to intended blasting.

c) CSR will verbally notify The Owner of the proposed time of blasting on the day before the intended blasting.

d) CSR will verbally notify The Owner of the proposed time of blasting before 9:30am on the day of the intended blasting.

e) The Owner will comply with CSR's instructions regarding safety procedures to be followed during the blasting. Such procedures require The Owner to ensure that no persons enter the "zone of exclusion" during blasting and that all persons move to a designated safe area. The "designated safe area" is also detailed in Appendix 1.

f) CSR will endeavour to exercise flexibility with the time of blasting so that The Owner's activities within the buffer land are not unreasonably interrupted. However, should CSR not be able to exercise such flexibility for any particular blast (eg due to weather conditions or product availability), then the designated time of detonation will take precedent over The Owner's activities program.

8. On receipt of a written request from the Owner, CSR will assist the Owner in its endeavour to construct a dam on the Owner's land by paying for the hire of a bulldozer to the maximum value of $10,000. CSR will have no further obligation in relation to the construction of the dam on the Owner's land

9. Should The Owner decide to sell the land, the Owner will give CSR a "first right of refusal" to buy the land on the same terms offered to someone else. If CSR chooses not to buy the land then the Owner would be obliged (if CSR so elects) to have any purchaser sign an agreement with CSR on the same terms as this one as a condition of the sale of the property.

   The reason for these requested conditions is that without them CSR wouldn't have any rights if the Owner sells the land to someone else.

10. The agreement will be stamped by CSR at CSR's cost. CSR will pay The Owner's legal costs and expenses in relation to this agreement to a maximum of $5,000 on receipt of itemised accounts.

11. If CSR does not obtain development consent for its quarry extension on both the eastern and western sides of the existing approved area on CSR's adjoining property, CSR will be entitled to terminate the agreement with 14 days prior notice in writing and without penalty. The proposed quarry extensions are also detailed in Appendix1.

12. CSR will not be bound by the agreement unless CSR formally executes the agreement on receipt of final terms which are acceptable to CSR. The terms of the proposal agreement and any subsequent agreement are to remain confidential between the parties, subject to disclosure required by law, even in the event that The Owner does not proceed to formal execution.

13. Both parties are required to carry public liability insurance. Details to be determined and agreed.

Signed by: .....

Authorised Representative of Youth Care & Life Style Centre Inc.

Date: 29.9.99

Signed by: .....

Authorised Representative of CSR Limited

Date: 27.8.99

JANDRA QUARRY
EXTENSION

CSR™

G. JANDRA QUARRY BLAST DESIGN

ORICA QUARRY SERVICES

Technical Centre - Kurri Kurri

Orica Australia Pty Ltd
ACN 004 117 828
Technical Centre, George Booth Drive
PO Box 196, Kurri Kurri NSW 2327 Australia
Tel 02 4939 5200
Direct Tel 02 4939 5225 Fax 02 4939 3762

Facsimile

To	Ian Stenhouse	Facsimile	029 6852399
Company	CSR	Total Pages	1
From	Andrew Brodbeck	Date	7 April 1999
Subject	Jandra Quarry - EIS Information		

Ian

Following our phone conversation today, information regarding the above is detailed in the table below.

The data is based on an approximate blast size of 20,000 t (rock density 2.6 g/cc). These parameters would be a starting point and may be influenced by the local geology. They will require careful monitoring to achieve the optimum design.

Parameter	12 m Bench Height (Solid)	12 m Bench Height (Weathered)	15 m Bench Height
Blasthole Diameter (mm)	89	89	89
Burden (m)	3.2	3.6	3.3
Spacing (m)	3.7	4.1	3.8
Blasthole Depth (m)	13	13	16
Blasthole Angle (deg)	10	10	10
Stemming Length (m)	3	3	3
Number of Blastholes	54	44	41
Subdrill (m)	0.9	0.9	0.9
Explosive Density - Wet Blasthole (g/cc)	1.2	1.2	1.2
Explosive Density - Dry Blasthole (g/cc)	1.1	1.1	1.1
Explosive Charge per Blasthole - Wet (kg)	75	75	97

Could you pass this information to Murray Curtis and Mike Druce please. If you require further input please ring.

Regards

Andrew

JANDRA QUARRY
EXTENSION

CSR

H. CSR BLAST CONTROL STANDARDS

CSR CONSTRUCTION MATERIALS (COUNTRY NSW & VIC) - QUARRIES

DRILLING AND BLASTING PROCEDURES

FOR

JANDRA QUARRY

EDITION: 19-4-99
ISSUE NO.: 4

Distribution: Jandra Quarry
Taree Area Office
Orica Quarry Services
Gilbert Drilling and Blasting

CONTENTS

QUARRY:	JANDRA	PAGE NO.:	3 of 13
PROCEDURE NO.:	P 1	ISSUE NO.:	3
OPERATION:	**PLANNING & DESIGN**	ISSUE DATE:	18/8/97

PURPOSE: To ensure that all blasts are planned and designed to comply with development consent conditions and all safety and environmental requirements.

P1.1 The Quarry Manager will notify the blasting contractor three weeks in advance of when the next blast is required. The approximate quantity of rock required will also be advised.

P1.2 Prior to site inspection by blasting contractor the site is to be prepared for survey. All raw feed from the previous blast shall be loaded out from the face immediately in front of the blast area and benches shall be cleared of loose rocks and overburden.

P1.3 The blast is to be planned by the blasting contractor in conjunction with the Quarry Manager. The blasting contractor shall prepare a Blast Design consisting of a Drilling Plan and a Blast Initiation Plan (or Shot Plan).

P1.4 The planning will be conducted in accordance with the Quarry Development Plan.

P1.5 The planning will consider potential environmental and safety hazards including

- flyrock
- ground vibration
- blast overpressure
- noise
- dust
- quarry roads
- location of quarry plant, buildings
- location of neighbours
- warning siren
- authorised persons for all associated tasks
- monitoring requirements

QUARRY:	JANDRA	PAGE NO.:	4 of 13
PROCEDURE NO.:	P 1	ISSUE NO.:	3
OPERATION:	**PLANNING & DESIGN (cont'd)**	ISSUE DATE:	18/8/97

P1.6 The Blast Design must ensure that overpressure and ground vibration from the blast do not exceed the following limits at the point of measurement:

Overpressure Limit = 115dBL
Ground Vibration Limit = 5mm/sec

The overpressure and ground vibration caused by the blast will be measured at any point within one metre of any residential boundary or at any noise sensitive areas.

P1.7 The blasting contractor will provide an estimation of ground vibration and overpressure from the planned blast.

P1.8 At the completion of the design and prior to drilling, the blasting contractor and the Quarry Manager shall inspect the site and approve the compatibility of the design with the proposed blast site. The blasting contractor shall formally approve the design.

P1.9 Where any doubt exists that flyrock may occur, a protective cover shall be included in the design.

QUARRY:	JANDRA	PAGE NO.:	5 of 13
PROCEDURE NO.:	P 2	ISSUE NO.:	3
OPERATION:	**DRILLING**	ISSUE DATE:	18/8/97

PURPOSE: To ensure that all drilling is carried out safely and to design.

P2.1 The bench is to be cleared to enable access for the drill rig and explosives truck.

P2.2 The contractor shall mark out all holes to be drilled.

P2.3 The blasting contractor shall provide the driller with a Drilling Plan which will contain the following information:

- hole diameter
- depth of holes
- subgrade
- inclination of holes
- hole spacings
- hole burden

P2.4 The Driller shall measure the depth of each hole and confirm that it is the required depth before moving on. Where possible the front row of holes will be drilled first.

P2.5 The Driller shall advise the Quarry Manager when the front and side rows have been completed to ensure that the holes are surveyed before the drill rig leaves the site.

P2.6 All completed holes are to be sealed by plastic bags or the like to prevent accidental collapse or filling of the hole.

QUARRY:	JANDRA	PAGE NO.:	6 of 13
PROCEDURE NO.:	P 2	ISSUE NO.:	3
OPERATION:	**DRILLING (cont'd)**	ISSUE DATE:	18/8/97

P2.7 The Driller is required to keep a daily log and shall include:

- final depth of hole
- angle of hole
- hard bands of rock
- presence of water
- stability of holes

The driller shall highlight any exceptions to the drilling plan.

A copy of the driller's log is to be given to the Quarry Manager and shotfirer.

P2.8 The front row of holes and any side holes are to be checked for accuracy using survey equipment.

P2.9 The Driller is responsible for the maintenance, breakdown and efficiency of the drill rig. All problems to be reported to the Quarry Manager at the earliest stage.

QUARRY:	JANDRA	PAGE NO.:	7 of 13
PROCEDURE NO.:	P 3	ISSUE NO.:	4
OPERATION:	**BLASTING**	ISSUE DATE:	19/4/99

PURPOSE: To ensure safe and efficient blasting practices.

P3.1 At least 48 hours prior to the blast, written notification of the proposed blast is to be given to the following neighbours:

Lot 10, DP790056 (YC & LS Centre)
Lot 11, DP790056 (CSR Tenant)
Lot 4, DP790058 (Loveday)
Lot 5, DP790058 (Mowbray)

The Jandra Quarry "Blast Notice" form is to be used for this purpose. This form will include the warning siren information outlined in P3.10 and P3.11.

P3.2 All blasting is to be fired and supervised by a certified shot firer in accordance with Mines Inspection Act 1901.

P3.3 Before loading holes the driller's log shall be reviewed by the blasting contractor and any modifications are to be made accordingly.

P3.4 Prior to loading a shot a blast initiation pattern and loading chart shall be drawn up by the blasting contractor and authorised by the Quarry Manager.

P3.5 Prior to actual blasting, the shot area is to be cleared, by CSR, of all materials that may contaminate raw feed, including plastic, boxes and used drilling consumables.

P3.6 All holes are to be double primed where bench height is over 10 metres.
Stemming is to be a minimum 3.0 metres.
Burden is to be a minimum 2.5 metres on the front and side holes.
Any variation to these must be approved by the Quarry Manager.

P3.7 The stemming material is to be 10mm or 14mm aggregate.

QUARRY:	JANDRA	PAGE NO.:	8 of 13
PROCEDURE NO.:	P 3	ISSUE NO.:	4
OPERATION:	**BLASTING (cont'd)**	ISSUE DATE:	19/4/99

P3.8 Quarry excavation plant shall not work within 15m of any loaded shot.

P3.9 Prior to blasting the shotfirer shall demand the removal of all persons from the quarry blast area. All access routes to the quarry area are to be closed off. A second check of the blast area shall be made.

P3.10 Before all blasts the warning siren shall be sounded as follows:

- 3 short sounds three minutes before firing
- 2 short sounds one minute before firing
- 1 short sound ten seconds before firing

P3.11 After the blast and prior to normal operations recommencing the Shotfirer shall inspect the shot site to ensure complete initiation. The result of the inspection is to be given to the Quarry Manager. The Manager shall then instruct the "all clear " signal to be sounded.

"All clear"signal: one long sound of the warning siren.

P3.12 Any misfires are to be reported to the Dept. of Mineral Resources Inspector. The procedure for dealing with any misfire shall be determined by the blasting contractor and Quarry Manager in consultation with the Mines Inspector in accordance with the Mineral Resources Regulations.

P3.13 If rock from blasting is projected outside the boundaries of the quarry, the Manager or Supervisor must notify the Dept. of Mineral Resources Inspector as soon as possible but no later than 24 hours after blasting. The contact number is (067) 702 100 or (02) 9901 8470 if local inspector is unavailable.

QUARRY:	JANDRA	PAGE NO.:	9 of 13
PROCEDURE NO.:	P 3	ISSUE NO.:	4
OPERATION:	**BLASTING (cont'd)**	ISSUE DATE:	19/4/99

P3.14 Following any blasting a blast report shall be completed and signed off by the blasting contractor. The report shall include the results of any instructed blast monitoring referred to in Procedure P1.5

P3.15 Secondary blasting shall not be permitted.

CSR CONSTRUCTION MATERIALS (COUNTRY NSW & VIC) - QUARRIES

DRILLING AND BLASTING PROCEDURES

QUARRY:	JANDRA	PAGE NO.:	10 of 13
PROCEDURE NO.:	P 4	ISSUE NO.:	1
OPERATION:	**REVIEW**	ISSUE DATE:	11/4/97

PURPOSE: To ensure that the drill and blast procedures are reviewed for effectiveness

P4.1 All complaints are to be immediately investigated.

P4.2 All complaints and their outcomes are to be recorded.

P4.3 The Drilling and Blasting Procedures are to be reviewed within one week of the blast by the Quarry Manager in consultation with the driller and blasting contractor.

P4.4 Results of monitoring are to be provided to:

- Environmental Protection Authority
- Greater Taree City Council

P4.5 The Jandra Quarry "Drilling and Blasting Check List" is to be completed for every blast by the Quarry Manager in consultation with the driller and blasting contractor.

CSR CONSTRUCTION MATERIALS (COUNTRY NSW & VIC) - QUARRIES

JANDRA QUARRY

DRILLING AND BLASTING CHECK LIST

(Issue No. 2)

To be completed by Manager in consultation with driller and blasting contractor.

tick box

P1 PLANNING AND DESIGN:

1. Has blasting contractor been given required notice of proposed blast and quantity of rock ? ☐

2. Has raw feed and loose material been removed from the front and top of the proposed shot prior to site inspection by blasting contractor? ☐

3. Has access been provided for the drill rig and explosives truck? ☐

4. Has blast design considered all safety and environmental hazards as outlined in Procedure P1.5? ☐

5. Provided by blasting contractor: Estimated overpressure .....dBL

   Estimated ground vibration .....mm/sec

6. Is a protective cover required to control flyrock? Yes ☐ No ☐

7. Has design been checked for compatibility with the site? ☐

DRILLING AND BLASTING CHECK LIST (cont'd)

P2 DRILLING:

8. Has blast design and drilling plan been explained to the driller? ☐

9. Have all drill holes been sealed adequately ? ☐

10. Has drill log been completed with all required details? (see P2.6) ☐

11. Are there any exception to the drilling plan? Yes ☐ No ☐

    If yes, comment: .....

12. Has drill hole accuracy been checked? ☐

BLASTING:

13. Have neighbours been given minimum 48 hour notification of the proposed blast as per Procedure P3.1 ☐

14. Has driller's log been reviewed by the blasting contractor? ☐

15. Stemming material used: 10mm agg. ☐ 14mm agg. ☐

16. Burden, spacing and stemming depths OK ? ☐

17. Has all contamination been removed from the blast area ? ☐

Prior to blast:

18. Has required monitoring been set up ? ☐

19. Are climatic conditions suitable ? ☐
    comments: .....

DRILLING AND BLASTING CHECK LIST (cont'd)

20. Have all personnel been briefed regarding the blast ? ☐

21. Has traffic control been arranged ? ☐

22. Has all plant and equipment been screened or relocated away from the blast ? ☐

23. Has quarry blast area been cleared ? ☐

24. Are all personnel accounted for ? ☐

25. Have all warning sirens been sounded as per procedure P3.9 ☐

After the shot:

26. Did blast go off ? ☐

27. Has shot area been inspected by shotfirer? ☐

28. Has plant and equipment been checked for damage ? ☐

comments:.....

29. Has the "All Clear" signal been given? ☐

30. OK given for road and area to be reopened for normal operation ? ☐

31. Have there been any complaints about the blast? No ☐ Yes ☐
If yes, attach details.

Signed: .....
Quarry Manager

Date: .....

JANDRA QUARRY

EXTENSION

CSR™

I. SOIL TEST RESULTS

ERM Mitchell McCotter Quality System			
Referred to	NB	Ref. No.	38070
Date Received:	19.4.99		
Source:	Scone Soil Lab		
		Yes	No
Data suitability check required		☑	☐
Data is: Current		☑	☐
Applicable to project		☑	☐
Checked by: NB			
Attach explanation for "no" answers or data problems			
Signature: .....Date:			

SOIL TEST REPORT

Scone Research Service Centre

REPORT NO: SCO99/111R1

REPORT TO: Nicky Barkwill
ERM Mitchell McCotter
P.O. Box 487
TAREE, 2430

REPORT ON: Six soil samples
Job 38070 Jandra Quarry Ext.

PRELIMINARY RESULTS ISSUED: 6 April, 1999

REPORT STATUS: Final

DATE REPORTED: 8 April, 1999

METHODS: Information on test procedures can be obtained from Scone Research Service Centre

TESTING CARRIED OUT ON SAMPLE AS RECEIVED.

G. Holman
(Technical Officer)

Gundy Road Scone NSW 2337 P.O. Box 283 Scone NSW 2337 DX 4206
Telephone (02) 65451666 Facsimile (02)65452520

Report No.: SCO99/111R1
Client Reference: Nicky Barkwill
ERM Mitchell McCotter
P.O. Box 487
TAREE, 2430

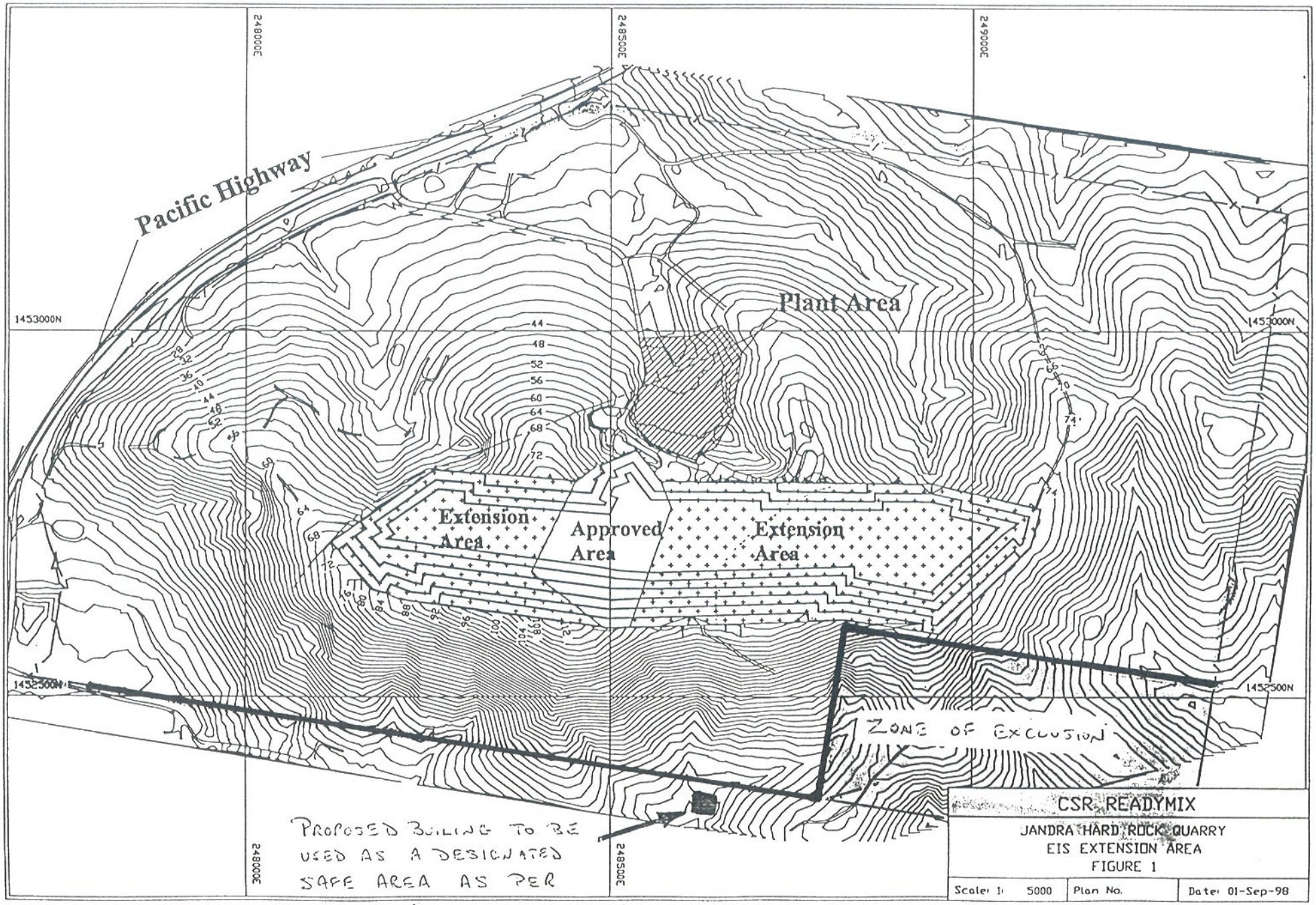
Lab. No.	Method	C1A/3	C2A/2	C6A/2	C8A/2	P9B/2	P8A/2	C5A/3 CEC & exch. cations (me/100g)					
	Sample Id.	EC (dS/m)	pH	OC (%)	P (mg/kg)	EAT	D (%)	CEC	Na	K	Ca	Mg	Al
1.	38070 Moist Forest H1	0.06	5.6	5.26	5	3(2)	29	12.7	0.4	0.4	4.2	4.0	1.9
2.	38070 Moist Forest H2	0.05	5.3	0.83	<1	5	15	16.2	0.5	0.2	1.0	3.7	8.8
3.	38070 DOF Site 1 H1	0.08	6.5	4.06	6	8/3(1)	34	17.7	0.3	0.5	10.3	4.4	nd
4.	38070 DOF Site 1 H2	0.06	6.5	2.31	4	3(1)	46	11.4	0.2	0.3	5.7	3.2	nd
5.	38070 DOF Site 2 H1	0.07	5.6	2.78	3	8/3(1)	40	9.1	0.2	0.5	3.7	2.7	0.2
6.	38070 DOF Site 2 H2	0.04	5.9	0.52	2	2(1)	67	8.3	0.2	0.4	1.3	3.8	0.7

nd = not detected

Lab. No.	Method	P7B/1 Particle Size Analysis (%)					P7C/1 Particle Size Analysis - Mechanical Dispersion (%)				
	Sample Id.	clay	silt	f.sand	c.sand	gravel	clay	silt	f.sand	c.sand	gravel
1.	38070 Moist Forest H1	26	36	16	11	11	24	31	18	16	11
2.	38070 Moist Forest H2	68	20	2	4	6	22	27	32	13	6
3.	38070 DOF Site 1 H1	16	19	17	24	24	10	22	19	25	24
4.	38070 DOF Site 1 H2	20	19	18	18	25	12	27	17	19	25
5.	38070 DOF Site 2 H1	16	18	28	25	13	6	24	30	27	13
6.	38070 DOF Site 2 H2	17	16	26	22	19	7	23	27	24	19

CW Colman.

END OF TEST REPORT


Pacific Highway
Plant Area
Extension Area
Approved Area
Extension Area
ZONE OF EXCLUSION
PROPOSED BUILING TO BE USED AS A DESIGNATED SAFE AREA AS PER
2480000E
2485000E
2490000E
1453000N
1452500N
CSR READYMIX
JANDRA HARD ROCK QUARRY
EIS EXTENSION AREA
FIGURE 1
Scale: 1: 5000
Plan No.
Date: 01-Sep-98

APPENDIX 1

JANDRA QUARRY
EXTENSION

CSR™

J. WATER BALANCE MODEL

JANDRA QUARRY - WATER BALANCE

DRY YEAR

Simple Water Balance

STAGE 1

Runoff Coeff's		Surf. Areas	
Quarry	0.35	0.09	km2
Stockpile Area	0.30	0.07	km2
Batching Area	0.30	0.02	km2
Haul Roads	0.45	1140.00	m

Assumed Storage

Volume 10.10 ML

Surface Area 5050.00 m2

Assumed Production

Annual 250000.00 tonnes

	WATER SOURCES				TOTAL		WATER DEMANDS								
	Rainfall Dry	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Haul Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													5.05		
J	112.20	3.61	2.26	0.81	6.68	2.05	0.31	0.36	0.01	0.64	179.80	3.37	8.35	0.00	0.00
F	58.20	1.87	1.17	0.42	3.46	1.69	0.31	0.36	0.01	0.52	148.40	2.90	8.91	0.00	0.00
M	133.90	4.31	2.69	0.96	7.97	1.55	0.31	0.36	0.01	0.48	136.40	2.72	10.10	4.06	0.00
A	68.30	2.20	1.37	0.49	4.06	1.16	0.31	0.36	0.01	0.36	102.00	2.21	10.10	1.85	0.00
M	46.00	1.48	0.92	0.33	2.74	0.74	0.31	0.36	0.01	0.23	65.10	1.66	10.10	1.08	0.00
J	53.60	1.73	1.08	0.39	3.19	0.62	0.31	0.36	0.01	0.19	54.00	1.49	10.10	1.70	0.00
J	18.10	0.58	0.36	0.13	1.08	0.71	0.31	0.36	0.01	0.22	62.00	1.61	9.56	0.00	0.00
A	8.10	0.26	0.16	0.06	0.48	0.99	0.31	0.36	0.01	0.31	86.80	1.98	8.06	0.00	0.00
S	37.90	1.22	0.76	0.27	2.26	1.30	0.31	0.36	0.01	0.40	114.00	2.39	7.93	0.00	0.00
O	24.90	0.80	0.50	0.18	1.48	1.66	0.31	0.36	0.01	0.52	145.70	2.86	6.55	0.00	0.00
N	6.80	0.22	0.14	0.05	0.40	1.81	0.31	0.36	0.01	0.56	159.00	3.06	3.89	0.00	0.00
D	183.40	5.91	3.69	1.32	10.91	2.19	0.31	0.36	0.01	0.68	192.20	3.56	10.10	1.14	0.00
J	112.20	3.61	2.26	0.81	6.68	2.05	0.31	0.36	0.01	0.64	179.80	3.37	10.10	3.30	0.00
F	58.20	1.87	1.17	0.42	3.46	1.69	0.31	0.36	0.01	0.52	148.40	2.90	10.10	0.56	0.00
M	133.90	4.31	2.69	0.96	7.97	1.55	0.31	0.36	0.01	0.48	136.40	2.72	10.10	5.24	0.00
A	68.30	2.20	1.37	0.49	4.06	1.16	0.31	0.36	0.01	0.36	102.00	2.21	10.10	1.85	0.00
M	46.00	1.48	0.92	0.33	2.74	0.74	0.31	0.36	0.01	0.23	65.10	1.66	10.10	1.08	0.00
J	53.60	1.73	1.08	0.39	3.19	0.62	0.31	0.36	0.01	0.19	54.00	1.49	10.10	1.70	0.00
J	18.10	0.58	0.36	0.13	1.08	0.71	0.31	0.36	0.01	0.22	62.00	1.61	9.56	0.00	0.00
A	8.10	0.26	0.16	0.06	0.48	0.99	0.31	0.36	0.01	0.31	86.80	1.98	8.06	0.00	0.00
S	37.90	1.22	0.76	0.27	2.26	1.30	0.31	0.36	0.01	0.40	114.00	2.39	7.93	0.00	0.00
O	24.90	0.80	0.50	0.18	1.48	1.66	0.31	0.36	0.01	0.52	145.70	2.86	6.55	0.00	0.00
N	6.80	0.22	0.14	0.05	0.40	1.81	0.31	0.36	0.01	0.56	159.00	3.06	3.89	0.00	0.00
D	183.40	5.91	3.69	1.32	10.91	2.19	0.31	0.36	0.01	0.68	192.20	3.56	10.10	1.14	0.00

JANDRA QUARRY - WATER BALANCE
AVERAGE YEAR

Simple Water Balance

STAGE 1

Runoff Coeff's		Surf. Areas		
Quarry	0.35	0.09	km2	**Assumed Storage**
Stockpile Area	0.30	0.07	km2	Volume 10.10 ML
Batching Area	0.30	0.02	km2	Surface Area 5050.00 m2
Haul Roads	0.45	1140.00	m	**Assumed Production**
				Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Average	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													5.05		
J	19.00	0.61	0.38	0.14	1.13	2.05	0.31	0.36	0.01	0.64	179.80	3.37	2.81	0.00	0.00
F	215.70	6.95	4.34	1.55	12.83	1.69	0.31	0.36	0.01	0.52	148.40	2.90	10.10	2.64	0.00
M	44.00	1.42	0.88	0.32	2.62	1.55	0.31	0.36	0.01	0.48	136.40	2.72	9.99	0.00	0.00
A	183.00	5.89	3.68	1.32	10.89	1.16	0.31	0.36	0.01	0.36	102.00	2.21	10.10	8.57	0.00
M	264.20	8.51	5.31	1.90	15.72	0.74	0.31	0.36	0.01	0.23	65.10	1.66	10.10	14.06	0.00
J	28.00	0.90	0.56	0.20	1.67	0.62	0.31	0.36	0.01	0.19	54.00	1.49	10.10	0.17	0.00
J	16.00	0.52	0.32	0.12	0.95	0.71	0.31	0.36	0.01	0.22	62.00	1.61	9.44	0.00	0.00
A	6.40	0.21	0.13	0.05	0.38	0.99	0.31	0.36	0.01	0.31	86.80	1.98	7.84	0.00	0.00
S	6.80	0.22	0.14	0.05	0.40	1.30	0.31	0.36	0.01	0.40	114.00	2.39	5.85	0.00	0.00
O	102.70	3.31	2.06	0.74	6.11	1.66	0.31	0.36	0.01	0.52	145.70	2.86	9.10	0.00	0.00
N	190.80	6.14	3.84	1.37	11.35	1.81	0.31	0.36	0.01	0.56	159.00	3.06	10.10	7.29	0.00
D	72.10	2.32	1.45	0.52	4.29	2.19	0.31	0.36	0.01	0.68	192.20	3.56	10.10	0.73	0.00
J	19.00	0.61	0.38	0.14	1.13	2.05	0.31	0.36	0.01	0.64	179.80	3.37	7.86	0.00	0.00
F	215.70	6.95	4.34	1.55	12.83	1.69	0.31	0.36	0.01	0.52	148.40	2.90	10.10	7.69	0.00
M	44.00	1.42	0.88	0.32	2.62	1.55	0.31	0.36	0.01	0.48	136.40	2.72	9.99	0.00	0.00
A	183.00	5.89	3.68	1.32	10.89	1.16	0.31	0.36	0.01	0.36	102.00	2.21	10.10	8.57	0.00
M	264.20	8.51	5.31	1.90	15.72	0.74	0.31	0.36	0.01	0.23	65.10	1.66	10.10	14.06	0.00
J	28.00	0.90	0.56	0.20	1.67	0.62	0.31	0.36	0.01	0.19	54.00	1.49	10.10	0.17	0.00
J	16.00	0.52	0.32	0.12	0.95	0.71	0.31	0.36	0.01	0.22	62.00	1.61	9.44	0.00	0.00
A	6.40	0.21	0.13	0.05	0.38	0.99	0.31	0.36	0.01	0.31	86.80	1.98	7.84	0.00	0.00
S	6.80	0.22	0.14	0.05	0.40	1.30	0.31	0.36	0.01	0.40	114.00	2.39	5.85	0.00	0.00
O	102.70	3.31	2.06	0.74	6.11	1.66	0.31	0.36	0.01	0.52	145.70	2.86	9.10	0.00	0.00
N	190.80	6.14	3.84	1.37	11.35	1.81	0.31	0.36	0.01	0.56	159.00	3.06	10.10	7.29	0.00
D	72.10	2.32	1.45	0.52	4.29	2.19	0.31	0.36	0.01	0.68	192.20	3.56	10.10	0.73	0.00

JANDRA QUARRY - WATER BALANCE
WET YEAR

Simple Water Balance

STAGE 1

Runoff Coeff's		Surf. Areas		
Quarry	0.35	0.09	km2	**Assumed Storage**
Stockpile Area	0.30	0.07	km2	Volume 10.10 ML
Batching Area	0.30	0.02	km2	Surface Area 5050.00 m2
Haul Roads	0.45	1140.00	m	**Assumed Production**
				Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul		WATER DEMANDS							
	Rainfall Wet	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													5.05		
J	245.20	7.90	4.93	1.77	14.59	2.05	0.31	0.36	0.01	0.64	179.80	3.37	10.10	6.17	0.00
F	51.10	1.65	1.03	0.37	3.04	1.69	0.31	0.36	0.01	0.52	148.40	2.90	10.10	0.14	0.00
M	104.80	3.37	2.11	0.75	6.24	1.55	0.31	0.36	0.01	0.48	136.40	2.72	10.10	3.51	0.00
A	448.50	14.44	9.01	3.23	26.69	1.16	0.31	0.36	0.01	0.36	102.00	2.21	10.10	24.48	0.00
M	295.20	9.51	5.93	2.13	17.56	0.74	0.31	0.36	0.01	0.23	65.10	1.66	10.10	15.91	0.00
J	8.90	0.29	0.18	0.06	0.53	0.62	0.31	0.36	0.01	0.19	54.00	1.49	9.14	0.00	0.00
J	112.40	3.62	2.26	0.81	6.69	0.71	0.31	0.36	0.01	0.22	62.00	1.61	10.10	4.11	0.00
A	47.60	1.53	0.96	0.34	2.83	0.99	0.31	0.36	0.01	0.31	86.80	1.98	10.10	0.85	0.00
S	23.30	0.75	0.47	0.17	1.39	1.30	0.31	0.36	0.01	0.40	114.00	2.39	9.10	0.00	0.00
O	79.60	2.56	1.60	0.57	4.74	1.66	0.31	0.36	0.01	0.52	145.70	2.86	10.10	0.87	0.00
N	26.80	0.86	0.54	0.19	1.59	1.81	0.31	0.36	0.01	0.56	159.00	3.06	8.63	0.00	0.00
D	249.00	8.02	5.00	1.79	14.82	2.19	0.31	0.36	0.01	0.68	192.20	3.56	10.10	9.79	0.00
J	245.20	7.90	4.93	1.77	14.59	2.05	0.31	0.36	0.01	0.64	179.80	3.37	10.10	11.22	0.00
F	51.10	1.65	1.03	0.37	3.04	1.69	0.31	0.36	0.01	0.52	148.40	2.90	10.10	0.14	0.00
M	104.80	3.37	2.11	0.75	6.24	1.55	0.31	0.36	0.01	0.48	136.40	2.72	10.10	3.51	0.00
A	448.50	14.44	9.01	3.23	26.69	1.16	0.31	0.36	0.01	0.36	102.00	2.21	10.10	24.48	0.00
M	295.20	9.51	5.93	2.13	17.56	0.74	0.31	0.36	0.01	0.23	65.10	1.66	10.10	15.91	0.00
J	8.90	0.29	0.18	0.06	0.53	0.62	0.31	0.36	0.01	0.19	54.00	1.49	9.14	0.00	0.00
J	112.40	3.62	2.26	0.81	6.69	0.71	0.31	0.36	0.01	0.22	62.00	1.61	10.10	4.11	0.00
A	47.60	1.53	0.96	0.34	2.83	0.99	0.31	0.36	0.01	0.31	86.80	1.98	10.10	0.85	0.00
S	23.30	0.75	0.47	0.17	1.39	1.30	0.31	0.36	0.01	0.40	114.00	2.39	9.10	0.00	0.00
O	79.60	2.56	1.60	0.57	4.74	1.66	0.31	0.36	0.01	0.52	145.70	2.86	10.10	0.87	0.00
N	26.80	0.86	0.54	0.19	1.59	1.81	0.31	0.36	0.01	0.56	159.00	3.06	8.63	0.00	0.00
D	249.00	8.02	5.00	1.79	14.82	2.19	0.31	0.36	0.01	0.68	192.20	3.56	10.10	9.79	0.00

JANDRA QUARRY - WATER BALANCE
DRY YEAR

Simple Water Balance

STAGE 2

Runoff Coeff's		Surf. Areas	
Quarry	0.35	0.130	km2
Stockpile Area	0.30	0.067	km2
Batching Area	0.20	0.024	km2
Haul Roads	0.45	1440.00	m

Assumed Storage
Volume 12.20 ML
Surface Area 6100.00 m2

Assumed Production
Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Dry	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													6.10		
J	112.20	5.11	2.26	0.54	7.90	2.59	0.31	0.36	0.01	0.77	179.80	4.04	9.95	0.00	0.00
F	58.20	2.65	1.17	0.28	4.10	2.14	0.31	0.36	0.01	0.63	148.40	3.46	10.59	0.00	0.00
M	133.90	6.09	2.69	0.64	9.43	1.96	0.31	0.36	0.01	0.58	136.40	3.23	12.20	4.59	0.00
A	68.30	3.11	1.37	0.33	4.81	1.47	0.31	0.36	0.01	0.44	102.00	2.59	12.20	2.22	0.00
M	46.00	2.09	0.92	0.22	3.24	0.94	0.31	0.36	0.01	0.28	65.10	1.90	12.20	1.34	0.00
J	53.60	2.44	1.08	0.26	3.77	0.78	0.31	0.36	0.01	0.23	54.00	1.70	12.20	2.08	0.00
J	18.10	0.82	0.36	0.09	1.27	0.89	0.31	0.36	0.01	0.26	62.00	1.84	11.63	0.00	0.00
A	8.10	0.37	0.16	0.04	0.57	1.25	0.31	0.36	0.01	0.37	86.80	2.31	9.89	0.00	0.00
S	37.90	1.72	0.76	0.18	2.67	1.64	0.31	0.36	0.01	0.49	114.00	2.82	9.74	0.00	0.00
O	24.90	1.13	0.50	0.12	1.75	2.10	0.31	0.36	0.01	0.62	145.70	3.41	8.09	0.00	0.00
N	6.80	0.31	0.14	0.03	0.48	2.29	0.31	0.36	0.01	0.68	159.00	3.66	4.91	0.00	0.00
D	183.40	8.34	3.69	0.88	12.91	2.77	0.31	0.36	0.01	0.82	192.20	4.28	12.20	1.35	0.00
J	112.20	5.11	2.26	0.54	7.90	2.59	0.31	0.36	0.01	0.77	179.80	4.04	12.20	3.85	0.00
F	58.20	2.65	1.17	0.28	4.10	2.14	0.31	0.36	0.01	0.63	148.40	3.46	12.20	0.64	0.00
M	133.90	6.09	2.69	0.64	9.43	1.96	0.31	0.36	0.01	0.58	136.40	3.23	12.20	6.19	0.00
A	68.30	3.11	1.37	0.33	4.81	1.47	0.31	0.36	0.01	0.44	102.00	2.59	12.20	2.22	0.00
M	46.00	2.09	0.92	0.22	3.24	0.94	0.31	0.36	0.01	0.28	65.10	1.90	12.20	1.34	0.00
J	53.60	2.44	1.08	0.26	3.77	0.78	0.31	0.36	0.01	0.23	54.00	1.70	12.20	2.08	0.00
J	18.10	0.82	0.36	0.09	1.27	0.89	0.31	0.36	0.01	0.26	62.00	1.84	11.63	0.00	0.00
A	8.10	0.37	0.16	0.04	0.57	1.25	0.31	0.36	0.01	0.37	86.80	2.31	9.89	0.00	0.00
S	37.90	1.72	0.76	0.18	2.67	1.64	0.31	0.36	0.01	0.49	114.00	2.82	9.74	0.00	0.00
O	24.90	1.13	0.50	0.12	1.75	2.10	0.31	0.36	0.01	0.62	145.70	3.41	8.09	0.00	0.00
N	6.80	0.31	0.14	0.03	0.48	2.29	0.31	0.36	0.01	0.68	159.00	3.66	4.91	0.00	0.00
D	183.40	8.34	3.69	0.88	12.91	2.77	0.31	0.36	0.01	0.82	192.20	4.28	12.20	1.35	0.00

JANDRA QUARRY - WATER BALANCE
AVERAGE YEAR

Simple Water Balance

STAGE 2

Runoff Coeff's		Surf. Areas	
Quarry	0.35	0.130 km2	Assumed Storage
Stockpile Area	0.30	0.067 km2	Volume 12.20 ML
Batching Area	0.20	0.024 km2	Surface Area 6100.00 m2
Haul Roads	0.45	1440.00 m	Assumed Production
			Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Average	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													6.10		
J	19.00	0.86	0.38	0.09	1.34	2.59	0.31	0.36	0.01	0.77	179.80	4.04	3.39	0.00	0.00
F	215.70	9.81	4.34	1.04	15.19	2.14	0.31	0.36	0.01	0.63	148.40	3.46	12.20	2.92	0.00
M	44.00	2.00	0.88	0.21	3.10	1.96	0.31	0.36	0.01	0.58	136.40	3.23	12.06	0.00	0.00
A	183.00	8.33	3.68	0.88	12.88	1.47	0.31	0.36	0.01	0.44	102.00	2.59	12.20	10.16	0.00
M	264.20	12.02	5.31	1.27	18.60	0.94	0.31	0.36	0.01	0.28	65.10	1.90	12.20	16.70	0.00
J	28.00	1.27	0.56	0.13	1.97	0.78	0.31	0.36	0.01	0.23	54.00	1.70	12.20	0.28	0.00
J	16.00	0.73	0.32	0.08	1.13	0.89	0.31	0.36	0.01	0.26	62.00	1.84	11.48	0.00	0.00
A	6.40	0.29	0.13	0.03	0.45	1.25	0.31	0.36	0.01	0.37	86.80	2.31	9.62	0.00	0.00
S	6.80	0.31	0.14	0.03	0.48	1.64	0.31	0.36	0.01	0.49	114.00	2.82	7.29	0.00	0.00
O	102.70	4.67	2.06	0.49	7.23	2.10	0.31	0.36	0.01	0.62	145.70	3.41	11.11	0.00	0.00
N	190.80	8.68	3.84	0.92	13.43	2.29	0.31	0.36	0.01	0.68	159.00	3.66	12.20	8.69	0.00
D	72.10	3.28	1.45	0.35	5.08	2.77	0.31	0.36	0.01	0.82	192.20	4.28	12.20	0.80	0.00
J	19.00	0.86	0.38	0.09	1.34	2.59	0.31	0.36	0.01	0.77	179.80	4.04	9.49	0.00	0.00
F	215.70	9.81	4.34	1.04	15.19	2.14	0.31	0.36	0.01	0.63	148.40	3.46	12.20	9.02	0.00
M	44.00	2.00	0.88	0.21	3.10	1.96	0.31	0.36	0.01	0.58	136.40	3.23	12.06	0.00	0.00
A	183.00	8.33	3.68	0.88	12.88	1.47	0.31	0.36	0.01	0.44	102.00	2.59	12.20	10.16	0.00
M	264.20	12.02	5.31	1.27	18.60	0.94	0.31	0.36	0.01	0.28	65.10	1.90	12.20	16.70	0.00
J	28.00	1.27	0.56	0.13	1.97	0.78	0.31	0.36	0.01	0.23	54.00	1.70	12.20	0.28	0.00
J	16.00	0.73	0.32	0.08	1.13	0.89	0.31	0.36	0.01	0.26	62.00	1.84	11.48	0.00	0.00
A	6.40	0.29	0.13	0.03	0.45	1.25	0.31	0.36	0.01	0.37	86.80	2.31	9.62	0.00	0.00
S	6.80	0.31	0.14	0.03	0.48	1.64	0.31	0.36	0.01	0.49	114.00	2.82	7.29	0.00	0.00
O	102.70	4.67	2.06	0.49	7.23	2.10	0.31	0.36	0.01	0.62	145.70	3.41	11.11	0.00	0.00
N	190.80	8.68	3.84	0.92	13.43	2.29	0.31	0.36	0.01	0.68	159.00	3.66	12.20	8.69	0.00
D	72.10	3.28	1.45	0.35	5.08	2.77	0.31	0.36	0.01	0.82	192.20	4.28	12.20	0.80	0.00

JANDRA QUARRY - WATER BALANCE
WET YEAR

Simple Water Balance

STAGE 2

Runoff Coeff's		**Surf. Areas**	
Quarry	0.35	0.130 km2	**Assumed Storage**
Stockpile Area	0.30	0.067 km2	Volume 12.20 ML
Batching Area	0.20	0.024 km2	Surface Area 6100.00 m2
Haul Roads	0.45	1440.00 m	**Assumed Production**
			Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Wet	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													6.10		
J	245.20	11.16	4.93	1.18	17.26	2.59	0.31	0.36	0.01	0.77	179.80	4.04	12.20	7.12	0.00
F	51.10	2.33	1.03	0.25	3.60	2.14	0.31	0.36	0.01	0.63	148.40	3.46	12.20	0.14	0.00
M	104.80	4.77	2.11	0.50	7.38	1.96	0.31	0.36	0.01	0.58	136.40	3.23	12.20	4.14	0.00
A	448.50	20.41	9.01	2.15	31.57	1.47	0.31	0.36	0.01	0.44	102.00	2.59	12.20	28.98	0.00
M	295.20	13.43	5.93	1.42	20.78	0.94	0.31	0.36	0.01	0.28	65.10	1.90	12.20	18.88	0.00
J	8.90	0.40	0.18	0.04	0.63	0.78	0.31	0.36	0.01	0.23	54.00	1.70	11.13	0.00	0.00
J	112.40	5.11	2.26	0.54	7.91	0.89	0.31	0.36	0.01	0.26	62.00	1.84	12.20	5.00	0.00
A	47.60	2.17	0.96	0.23	3.35	1.25	0.31	0.36	0.01	0.37	86.80	2.31	12.20	1.04	0.00
S	23.30	1.06	0.47	0.11	1.64	1.64	0.31	0.36	0.01	0.49	114.00	2.82	11.02	0.00	0.00
O	79.60	3.62	1.60	0.38	5.60	2.10	0.31	0.36	0.01	0.62	145.70	3.41	12.20	1.02	0.00
N	26.80	1.22	0.54	0.13	1.89	2.29	0.31	0.36	0.01	0.68	159.00	3.66	10.43	0.00	0.00
D	249.00	11.33	5.00	1.20	17.53	2.77	0.31	0.36	0.01	0.82	192.20	4.28	12.20	11.49	0.00
J	245.20	11.16	4.93	1.18	17.26	2.59	0.31	0.36	0.01	0.77	179.80	4.04	12.20	13.22	0.00
F	51.10	2.33	1.03	0.25	3.60	2.14	0.31	0.36	0.01	0.63	148.40	3.46	12.20	0.14	0.00
M	104.80	4.77	2.11	0.50	7.38	1.96	0.31	0.36	0.01	0.58	136.40	3.23	12.20	4.14	0.00
A	448.50	20.41	9.01	2.15	31.57	1.47	0.31	0.36	0.01	0.44	102.00	2.59	12.20	28.98	0.00
M	295.20	13.43	5.93	1.42	20.78	0.94	0.31	0.36	0.01	0.28	65.10	1.90	12.20	18.88	0.00
J	8.90	0.40	0.18	0.04	0.63	0.78	0.31	0.36	0.01	0.23	54.00	1.70	11.13	0.00	0.00
J	112.40	5.11	2.26	0.54	7.91	0.89	0.31	0.36	0.01	0.26	62.00	1.84	12.20	5.00	0.00
A	47.60	2.17	0.96	0.23	3.35	1.25	0.31	0.36	0.01	0.37	86.80	2.31	12.20	1.04	0.00
S	23.30	1.06	0.47	0.11	1.64	1.64	0.31	0.36	0.01	0.49	114.00	2.82	11.02	0.00	0.00
O	79.60	3.62	1.60	0.38	5.60	2.10	0.31	0.36	0.01	0.62	145.70	3.41	12.20	1.02	0.00
N	26.80	1.22	0.54	0.13	1.89	2.29	0.31	0.36	0.01	0.68	159.00	3.66	10.43	0.00	0.00
D	249.00	11.33	5.00	1.20	17.53	2.77	0.31	0.36	0.01	0.82	192.20	4.28	12.20	11.49	0.00

JANDRA QUARRY - WATER BALANCE
DRY YEAR

Simple Water Balance

STAGE 3

Runoff Coeff's		Surf. Areas	
Quarry	0.35	0.171	km2
Stockpile Area	0.30	0.067	km2
Batching Area	0.20	0.024	km2
Haul Roads	0.45	1740.00	m

Assumed Storage
Volume 14.50 ML
Surface Area 7250.00 m2

Assumed Production
Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Dry	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													7.25		
J	112.20	6.72	2.26	0.54	9.51	3.13	0.31	0.36	0.01	0.91	179.80	4.73	12.03	0.00	0.00
F	58.20	3.48	1.17	0.28	4.93	2.58	0.31	0.36	0.01	0.75	148.40	4.02	12.94	0.00	0.00
M	133.90	8.01	2.69	0.64	11.35	2.37	0.31	0.36	0.01	0.69	136.40	3.75	14.50	6.04	0.00
A	68.30	4.09	1.37	0.33	5.79	1.77	0.31	0.36	0.01	0.52	102.00	2.98	14.50	2.81	0.00
M	46.00	2.75	0.92	0.22	3.90	1.13	0.31	0.36	0.01	0.33	65.10	2.15	14.50	1.75	0.00
J	53.60	3.21	1.08	0.26	4.54	0.94	0.31	0.36	0.01	0.27	54.00	1.90	14.50	2.64	0.00
J	18.10	1.08	0.36	0.09	1.53	1.08	0.31	0.36	0.01	0.31	62.00	2.08	13.95	0.00	0.00
A	8.10	0.48	0.16	0.04	0.69	1.51	0.31	0.36	0.01	0.44	86.80	2.64	12.00	0.00	0.00
S	37.90	2.27	0.76	0.18	3.21	1.98	0.31	0.36	0.01	0.58	114.00	3.25	11.96	0.00	0.00
O	24.90	1.49	0.50	0.12	2.11	2.54	0.31	0.36	0.01	0.74	145.70	3.96	10.11	0.00	0.00
N	6.80	0.41	0.14	0.03	0.58	2.77	0.31	0.36	0.01	0.81	159.00	4.26	6.43	0.00	0.00
D	183.40	10.98	3.69	0.88	15.54	3.34	0.31	0.36	0.01	0.98	192.20	5.01	14.50	2.47	0.00
J	112.20	6.72	2.26	0.54	9.51	3.13	0.31	0.36	0.01	0.91	179.80	4.73	14.50	4.78	0.00
F	58.20	3.48	1.17	0.28	4.93	2.58	0.31	0.36	0.01	0.75	148.40	4.02	14.50	0.91	0.00
M	133.90	8.01	2.69	0.64	11.35	2.37	0.31	0.36	0.01	0.69	136.40	3.75	14.50	7.60	0.00
A	68.30	4.09	1.37	0.33	5.79	1.77	0.31	0.36	0.01	0.52	102.00	2.98	14.50	2.81	0.00
M	46.00	2.75	0.92	0.22	3.90	1.13	0.31	0.36	0.01	0.33	65.10	2.15	14.50	1.75	0.00
J	53.60	3.21	1.08	0.26	4.54	0.94	0.31	0.36	0.01	0.27	54.00	1.90	14.50	2.64	0.00
J	18.10	1.08	0.36	0.09	1.53	1.08	0.31	0.36	0.01	0.31	62.00	2.08	13.95	0.00	0.00
A	8.10	0.48	0.16	0.04	0.69	1.51	0.31	0.36	0.01	0.44	86.80	2.64	12.00	0.00	0.00
S	37.90	2.27	0.76	0.18	3.21	1.98	0.31	0.36	0.01	0.58	114.00	3.25	11.96	0.00	0.00
O	24.90	1.49	0.50	0.12	2.11	2.54	0.31	0.36	0.01	0.74	145.70	3.96	10.11	0.00	0.00
N	6.80	0.41	0.14	0.03	0.58	2.77	0.31	0.36	0.01	0.81	159.00	4.26	6.43	0.00	0.00
D	183.40	10.98	3.69	0.88	15.54	3.34	0.31	0.36	0.01	0.98	192.20	5.01	14.50	2.47	0.00

JANDRA QUARRY - WATER BALANCE
AVERAGE YEAR

Simple Water Balance

STAGE 3

Runoff Coeff's		Surf. Areas	
Quarry	0.35	0.171	km2
Stockpile Area	0.30	0.067	km2
Batching Area	0.20	0.024	km2
Haul Roads	0.45	1740.00	m

Assumed Storage
Volume 14.50 ML
Surface Area 7250.00 m2

Assumed Production
Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Average	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													7.25		
J	19.00	1.14	0.38	0.09	1.61	3.13	0.31	0.36	0.01	0.91	179.80	4.73	4.13	0.00	0.00
F	215.70	12.91	4.34	1.04	18.28	2.58	0.31	0.36	0.01	0.75	148.40	4.02	14.50	3.89	0.00
M	44.00	2.63	0.88	0.21	3.73	2.37	0.31	0.36	0.01	0.69	136.40	3.75	14.48	0.00	0.00
A	183.00	10.95	3.68	0.88	15.51	1.77	0.31	0.36	0.01	0.52	102.00	2.98	14.50	12.51	0.00
M	264.20	15.81	5.31	1.27	22.39	1.13	0.31	0.36	0.01	0.33	65.10	2.15	14.50	20.24	0.00
J	28.00	1.68	0.56	0.13	2.37	0.94	0.31	0.36	0.01	0.27	54.00	1.90	14.50	0.47	0.00
J	16.00	0.96	0.32	0.08	1.36	1.08	0.31	0.36	0.01	0.31	62.00	2.08	13.78	0.00	0.00
A	6.40	0.38	0.13	0.03	0.54	1.51	0.31	0.36	0.01	0.44	86.80	2.64	11.68	0.00	0.00
S	6.80	0.41	0.14	0.03	0.58	1.98	0.31	0.36	0.01	0.58	114.00	3.25	9.01	0.00	0.00
O	102.70	6.15	2.06	0.49	8.70	2.54	0.31	0.36	0.01	0.74	145.70	3.96	13.75	0.00	0.00
N	190.80	11.42	3.84	0.92	16.17	2.77	0.31	0.36	0.01	0.81	159.00	4.26	14.50	11.16	0.00
D	72.10	4.32	1.45	0.35	6.11	3.34	0.31	0.36	0.01	0.98	192.20	5.01	14.50	1.10	0.00
J	19.00	1.14	0.38	0.09	1.61	3.13	0.31	0.36	0.01	0.91	179.80	4.73	11.38	0.00	0.00
F	215.70	12.91	4.34	1.04	18.28	2.58	0.31	0.36	0.01	0.75	148.40	4.02	14.50	11.14	0.00
M	44.00	2.63	0.88	0.21	3.73	2.37	0.31	0.36	0.01	0.69	136.40	3.75	14.48	0.00	0.00
A	183.00	10.95	3.68	0.88	15.51	1.77	0.31	0.36	0.01	0.52	102.00	2.98	14.50	12.51	0.00
M	264.20	15.81	5.31	1.27	22.39	1.13	0.31	0.36	0.01	0.33	65.10	2.15	14.50	20.24	0.00
J	28.00	1.68	0.56	0.13	2.37	0.94	0.31	0.36	0.01	0.27	54.00	1.90	14.50	0.47	0.00
J	16.00	0.96	0.32	0.08	1.36	1.08	0.31	0.36	0.01	0.31	62.00	2.08	13.78	0.00	0.00
A	6.40	0.38	0.13	0.03	0.54	1.51	0.31	0.36	0.01	0.44	86.80	2.64	11.68	0.00	0.00
S	6.80	0.41	0.14	0.03	0.58	1.98	0.31	0.36	0.01	0.58	114.00	3.25	9.01	0.00	0.00
O	102.70	6.15	2.06	0.49	8.70	2.54	0.31	0.36	0.01	0.74	145.70	3.96	13.75	0.00	0.00
N	190.80	11.42	3.84	0.92	16.17	2.77	0.31	0.36	0.01	0.81	159.00	4.26	14.50	11.16	0.00
D	72.10	4.32	1.45	0.35	6.11	3.34	0.31	0.36	0.01	0.98	192.20	5.01	14.50	1.10	0.00

JANDRA QUARRY - WATER BALANCE
WET YEAR

Simple Water Balance

STAGE 3

Runoff Coeff's		Surf. Areas	
Quarry	0.35	0.171	km2
Stockpile Area	0.30	0.067	km2
Batching Area	0.20	0.024	km2
Haul Roads	0.45	1740.00	m

Assumed Storage
Volume 14.50 ML
Surface Area 7250.00 m2

Assumed Production
Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Wet	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													7.25		
J	245.20	14.68	4.93	1.18	20.78	3.13	0.31	0.36	0.01	0.91	179.80	4.73	14.50	8.80	0.00
F	51.10	3.06	1.03	0.25	4.33	2.58	0.31	0.36	0.01	0.75	148.40	4.02	14.50	0.31	0.00
M	104.80	6.27	2.11	0.50	8.88	2.37	0.31	0.36	0.01	0.69	136.40	3.75	14.50	5.13	0.00
A	448.50	26.84	9.01	2.15	38.01	1.77	0.31	0.36	0.01	0.52	102.00	2.98	14.50	35.03	0.00
M	295.20	17.67	5.93	1.42	25.02	1.13	0.31	0.36	0.01	0.33	65.10	2.15	14.50	22.87	0.00
J	8.90	0.53	0.18	0.04	0.75	0.94	0.31	0.36	0.01	0.27	54.00	1.90	13.35	0.00	0.00
J	112.40	6.73	2.26	0.54	9.53	1.08	0.31	0.36	0.01	0.31	62.00	2.08	14.50	6.30	0.00
A	47.60	2.85	0.96	0.23	4.03	1.51	0.31	0.36	0.01	0.44	86.80	2.64	14.50	1.40	0.00
S	23.30	1.39	0.47	0.11	1.97	1.98	0.31	0.36	0.01	0.58	114.00	3.25	13.23	0.00	0.00
O	79.60	4.76	1.60	0.38	6.75	2.54	0.31	0.36	0.01	0.74	145.70	3.96	14.50	1.51	0.00
N	26.80	1.60	0.54	0.13	2.27	2.77	0.31	0.36	0.01	0.81	159.00	4.26	12.51	0.00	0.00
D	249.00	14.90	5.00	1.20	21.10	3.34	0.31	0.36	0.01	0.98	192.20	5.01	14.50	14.11	0.00
J	245.20	14.68	4.93	1.18	20.78	3.13	0.31	0.36	0.01	0.91	179.80	4.73	14.50	16.05	0.00
F	51.10	3.06	1.03	0.25	4.33	2.58	0.31	0.36	0.01	0.75	148.40	4.02	14.50	0.31	0.00
M	104.80	6.27	2.11	0.50	8.88	2.37	0.31	0.36	0.01	0.69	136.40	3.75	14.50	5.13	0.00
A	448.50	26.84	9.01	2.15	38.01	1.77	0.31	0.36	0.01	0.52	102.00	2.98	14.50	35.03	0.00
M	295.20	17.67	5.93	1.42	25.02	1.13	0.31	0.36	0.01	0.33	65.10	2.15	14.50	22.87	0.00
J	8.90	0.53	0.18	0.04	0.75	0.94	0.31	0.36	0.01	0.27	54.00	1.90	13.35	0.00	0.00
J	112.40	6.73	2.26	0.54	9.53	1.08	0.31	0.36	0.01	0.31	62.00	2.08	14.50	6.30	0.00
A	47.60	2.85	0.96	0.23	4.03	1.51	0.31	0.36	0.01	0.44	86.80	2.64	14.50	1.40	0.00
S	23.30	1.39	0.47	0.11	1.97	1.98	0.31	0.36	0.01	0.58	114.00	3.25	13.23	0.00	0.00
O	79.60	4.76	1.60	0.38	6.75	2.54	0.31	0.36	0.01	0.74	145.70	3.96	14.50	1.51	0.00
N	26.80	1.60	0.54	0.13	2.27	2.77	0.31	0.36	0.01	0.81	159.00	4.26	12.51	0.00	0.00
D	249.00	14.90	5.00	1.20	21.10	3.34	0.31	0.36	0.01	0.98	192.20	5.01	14.50	14.11	0.00

JANDRA QUARRY - WATER BALANCE
DRY YEAR

Simple Water Balance

STAGE 4

Runoff Coeff's		Surf. Areas	
Quarry	0.35	0.176 km2	
Stockpile Area	0.30	0.067 km2	
Batching Area	0.20	0.024 km2	
Haul Roads	0.45	1740.00 m	

Assumed Storage
Volume 14.80 ML
Surface Area 7400.00 m2

Assumed Production
Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Dry	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													7.40		
J	112.20	6.91	2.26	0.54	9.71	3.13	0.31	0.36	0.01	0.93	179.80	4.75	12.36	0.00	0.00
F	58.20	3.59	1.17	0.28	5.03	2.58	0.31	0.36	0.01	0.77	148.40	4.04	13.35	0.00	0.00
M	133.90	8.25	2.69	0.64	11.58	2.37	0.31	0.36	0.01	0.71	136.40	3.77	14.80	6.37	0.00
A	68.30	4.21	1.37	0.33	5.91	1.77	0.31	0.36	0.01	0.53	102.00	2.99	14.80	2.92	0.00
M	46.00	2.83	0.92	0.22	3.98	1.13	0.31	0.36	0.01	0.34	65.10	2.16	14.80	1.82	0.00
J	53.60	3.30	1.08	0.26	4.64	0.94	0.31	0.36	0.01	0.28	54.00	1.91	14.80	2.73	0.00
J	18.10	1.11	0.36	0.09	1.57	1.08	0.31	0.36	0.01	0.32	62.00	2.09	14.28	0.00	0.00
A	8.10	0.50	0.16	0.04	0.70	1.51	0.31	0.36	0.01	0.45	86.80	2.65	12.33	0.00	0.00
S	37.90	2.33	0.76	0.18	3.28	1.98	0.31	0.36	0.01	0.59	114.00	3.26	12.35	0.00	0.00
O	24.90	1.53	0.50	0.12	2.15	2.54	0.31	0.36	0.01	0.75	145.70	3.98	10.53	0.00	0.00
N	6.80	0.42	0.14	0.03	0.59	2.77	0.31	0.36	0.01	0.82	159.00	4.28	6.84	0.00	0.00
D	183.40	11.30	3.69	0.88	15.86	3.34	0.31	0.36	0.01	1.00	192.20	5.03	14.80	2.87	0.00
J	112.20	6.91	2.26	0.54	9.71	3.13	0.31	0.36	0.01	0.93	179.80	4.75	14.80	4.96	0.00
F	58.20	3.59	1.17	0.28	5.03	2.58	0.31	0.36	0.01	0.77	148.40	4.04	14.80	1.00	0.00
M	133.90	8.25	2.69	0.64	11.58	2.37	0.31	0.36	0.01	0.71	136.40	3.77	14.80	7.82	0.00
A	68.30	4.21	1.37	0.33	5.91	1.77	0.31	0.36	0.01	0.53	102.00	2.99	14.80	2.92	0.00
M	46.00	2.83	0.92	0.22	3.98	1.13	0.31	0.36	0.01	0.34	65.10	2.16	14.80	1.82	0.00
J	53.60	3.30	1.08	0.26	4.64	0.94	0.31	0.36	0.01	0.28	54.00	1.91	14.80	2.73	0.00
J	18.10	1.11	0.36	0.09	1.57	1.08	0.31	0.36	0.01	0.32	62.00	2.09	14.28	0.00	0.00
A	8.10	0.50	0.16	0.04	0.70	1.51	0.31	0.36	0.01	0.45	86.80	2.65	12.33	0.00	0.00
S	37.90	2.33	0.76	0.18	3.28	1.98	0.31	0.36	0.01	0.59	114.00	3.26	12.35	0.00	0.00
O	24.90	1.53	0.50	0.12	2.15	2.54	0.31	0.36	0.01	0.75	145.70	3.98	10.53	0.00	0.00
N	6.80	0.42	0.14	0.03	0.59	2.77	0.31	0.36	0.01	0.82	159.00	4.28	6.84	0.00	0.00
D	183.40	11.30	3.69	0.88	15.86	3.34	0.31	0.36	0.01	1.00	192.20	5.03	14.80	2.87	0.00

JANDRA QUARRY - WATER BALANCE
AVERAGE YEAR

Simple Water Balance

STAGE 4

Runoff Coeff's		Surf. Areas	
Quarry	0.35	0.176 km2	
Stockpile Area	0.30	0.067 km2	
Batching Area	0.20	0.024 km2	
Haul Roads	0.45	1740.00 m	

Assumed Storage
Volume 14.80 ML
Surface Area 7400.00 m2

Assumed Production
Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Average	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													7.40		
J	19.00	1.17	0.38	0.09	1.64	3.13	0.31	0.36	0.01	0.93	179.80	4.75	4.30	0.00	0.00
F	215.70	13.29	4.34	1.04	18.66	2.58	0.31	0.36	0.01	0.77	148.40	4.04	14.80	4.12	0.00
M	44.00	2.71	0.88	0.21	3.81	2.37	0.31	0.36	0.01	0.71	136.40	3.77	14.80	0.04	0.00
A	183.00	11.27	3.68	0.88	15.83	1.77	0.31	0.36	0.01	0.53	102.00	2.99	14.80	12.84	0.00
M	264.20	16.27	5.31	1.27	22.85	1.13	0.31	0.36	0.01	0.34	65.10	2.16	14.80	20.70	0.00
J	28.00	1.72	0.56	0.13	2.42	0.94	0.31	0.36	0.01	0.28	54.00	1.91	14.80	0.52	0.00
J	16.00	0.99	0.32	0.08	1.38	1.08	0.31	0.36	0.01	0.32	62.00	2.09	14.10	0.00	0.00
A	6.40	0.39	0.13	0.03	0.55	1.51	0.31	0.36	0.01	0.45	86.80	2.65	12.00	0.00	0.00
S	6.80	0.42	0.14	0.03	0.59	1.98	0.31	0.36	0.01	0.59	114.00	3.26	9.33	0.00	0.00
O	102.70	6.33	2.06	0.49	8.88	2.54	0.31	0.36	0.01	0.75	145.70	3.98	14.24	0.00	0.00
N	190.80	11.75	3.84	0.92	16.50	2.77	0.31	0.36	0.01	0.82	159.00	4.28	14.80	11.66	0.00
D	72.10	4.44	1.45	0.35	6.24	3.34	0.31	0.36	0.01	1.00	192.20	5.03	14.80	1.21	0.00
J	19.00	1.17	0.38	0.09	1.64	3.13	0.31	0.36	0.01	0.93	179.80	4.75	11.70	0.00	0.00
F	215.70	13.29	4.34	1.04	18.66	2.58	0.31	0.36	0.01	0.77	148.40	4.04	14.80	11.52	0.00
M	44.00	2.71	0.88	0.21	3.81	2.37	0.31	0.36	0.01	0.71	136.40	3.77	14.80	0.04	0.00
A	183.00	11.27	3.68	0.88	15.83	1.77	0.31	0.36	0.01	0.53	102.00	2.99	14.80	12.84	0.00
M	264.20	16.27	5.31	1.27	22.85	1.13	0.31	0.36	0.01	0.34	65.10	2.16	14.80	20.70	0.00
J	28.00	1.72	0.56	0.13	2.42	0.94	0.31	0.36	0.01	0.28	54.00	1.91	14.80	0.52	0.00
J	16.00	0.99	0.32	0.08	1.38	1.08	0.31	0.36	0.01	0.32	62.00	2.09	14.10	0.00	0.00
A	6.40	0.39	0.13	0.03	0.55	1.51	0.31	0.36	0.01	0.45	86.80	2.65	12.00	0.00	0.00
S	6.80	0.42	0.14	0.03	0.59	1.98	0.31	0.36	0.01	0.59	114.00	3.26	9.33	0.00	0.00
O	102.70	6.33	2.06	0.49	8.88	2.54	0.31	0.36	0.01	0.75	145.70	3.98	14.24	0.00	0.00
N	190.80	11.75	3.84	0.92	16.50	2.77	0.31	0.36	0.01	0.82	159.00	4.28	14.80	11.66	0.00
D	72.10	4.44	1.45	0.35	6.24	3.34	0.31	0.36	0.01	1.00	192.20	5.03	14.80	1.21	0.00

JANDRA QUARRY - WATER BALANCE
WET YEAR

Simple Water Balance

STAGE 4

Runoff Coeff's		**Surf. Areas**	
Quarry	0.35	0.176 km2	**Assumed Storage**
Stockpile Area	0.30	0.067 km2	Volume 14.80 ML
Batching Area	0.20	0.024 km2	Surface Area 7400.00 m2
Haul Roads	0.45	1740.00 m	**Assumed Production**
			Annual 250000.00 tonnes

	WATER SOURCES				TOTAL	Haul	WATER DEMANDS								
	Rainfall Wet	Quarry	Stockpile Area	Batching Area	RUNOFF AVAIL (ML)	Roads Dust Supp	Plant Dust Supp	Road Base	Truck Wash Demand	Dam Evapo. Loss	Pan Evap (mm)	TOTAL MONTHLY DEMAND	Storage	discharge	deficit
													7.40		
J	245.20	15.10	4.93	1.18	21.21	3.13	0.31	0.36	0.01	0.93	179.80	4.75	14.80	9.06	0.00
F	51.10	3.15	1.03	0.25	4.42	2.58	0.31	0.36	0.01	0.77	148.40	4.04	14.80	0.38	0.00
M	104.80	6.46	2.11	0.50	9.07	2.37	0.31	0.36	0.01	0.71	136.40	3.77	14.80	5.30	0.00
A	448.50	27.63	9.01	2.15	38.80	1.77	0.31	0.36	0.01	0.53	102.00	2.99	14.80	35.81	0.00
M	295.20	18.18	5.93	1.42	25.53	1.13	0.31	0.36	0.01	0.34	65.10	2.16	14.80	23.38	0.00
J	8.90	0.55	0.18	0.04	0.77	0.94	0.31	0.36	0.01	0.28	54.00	1.91	13.66	0.00	0.00
J	112.40	6.92	2.26	0.54	9.72	1.08	0.31	0.36	0.01	0.32	62.00	2.09	14.80	6.50	0.00
A	47.60	2.93	0.96	0.23	4.12	1.51	0.31	0.36	0.01	0.45	86.80	2.65	14.80	1.47	0.00
S	23.30	1.44	0.47	0.11	2.02	1.98	0.31	0.36	0.01	0.59	114.00	3.26	13.55	0.00	0.00
O	79.60	4.90	1.60	0.38	6.89	2.54	0.31	0.36	0.01	0.75	145.70	3.98	14.80	1.66	0.00
N	26.80	1.65	0.54	0.13	2.32	2.77	0.31	0.36	0.01	0.82	159.00	4.28	12.84	0.00	0.00
D	249.00	15.34	5.00	1.20	21.54	3.34	0.31	0.36	0.01	1.00	192.20	5.03	14.80	14.55	0.00
J	245.20	15.10	4.93	1.18	21.21	3.13	0.31	0.36	0.01	0.93	179.80	4.75	14.80	16.46	0.00
F	51.10	3.15	1.03	0.25	4.42	2.58	0.31	0.36	0.01	0.77	148.40	4.04	14.80	0.38	0.00
M	104.80	6.46	2.11	0.50	9.07	2.37	0.31	0.36	0.01	0.71	136.40	3.77	14.80	5.30	0.00
A	448.50	27.63	9.01	2.15	38.80	1.77	0.31	0.36	0.01	0.53	102.00	2.99	14.80	35.81	0.00
M	295.20	18.18	5.93	1.42	25.53	1.13	0.31	0.36	0.01	0.34	65.10	2.16	14.80	23.38	0.00
J	8.90	0.55	0.18	0.04	0.77	0.94	0.31	0.36	0.01	0.28	54.00	1.91	13.66	0.00	0.00
J	112.40	6.92	2.26	0.54	9.72	1.08	0.31	0.36	0.01	0.32	62.00	2.09	14.80	6.50	0.00
A	47.60	2.93	0.96	0.23	4.12	1.51	0.31	0.36	0.01	0.45	86.80	2.65	14.80	1.47	0.00
S	23.30	1.44	0.47	0.11	2.02	1.98	0.31	0.36	0.01	0.59	114.00	3.26	13.55	0.00	0.00
O	79.60	4.90	1.60	0.38	6.89	2.54	0.31	0.36	0.01	0.75	145.70	3.98	14.80	1.66	0.00
N	26.80	1.65	0.54	0.13	2.32	2.77	0.31	0.36	0.01	0.82	159.00	4.28	12.84	0.00	0.00
D	249.00	15.34	5.00	1.20	21.54	3.34	0.31	0.36	0.01	1.00	192.20	5.03	14.80	14.55	0.00

JANDRA QUARRY
EXTENSION

CSR™

K. AIR QUALITY ASSESSMENT

JANDRA QUARRY EXTENSION

Air Quality Assessment

For:
CSR CONSTRUCTION MATERIALS

October 1999
38070AIRRP2

Report No. 38070AIRRP2

This report was prepared in accordance with the scope of services set out in the contract between ERM Mitchell McCotter Pty Ltd ACN 002 773 248 (ERMMM) and CSR Construction Materials. To the best of our knowledge, the proposal presented herein accurately reflects the CSR's intentions when the report was printed. However, the application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document. In preparing the report, ERMMM used data, surveys, analyses, designs, plans and other information provided by the individuals and organisations referenced herein. While checks were undertaken to ensure that such materials were the correct and current versions of the materials provided, except as otherwise stated, ERMMM did not independently verify the accuracy or completeness of these information sources.

Approved by:	*Tony McNamara*
Position:	Project Director
Signed:	
Date:	

ERM Mitchell McCotter Quality System

Prepared by:	*Murray Curtis*
Position:	Project Manager
Signed:	
Date:	14/10/99

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Chapter 1

INTRODUCTION

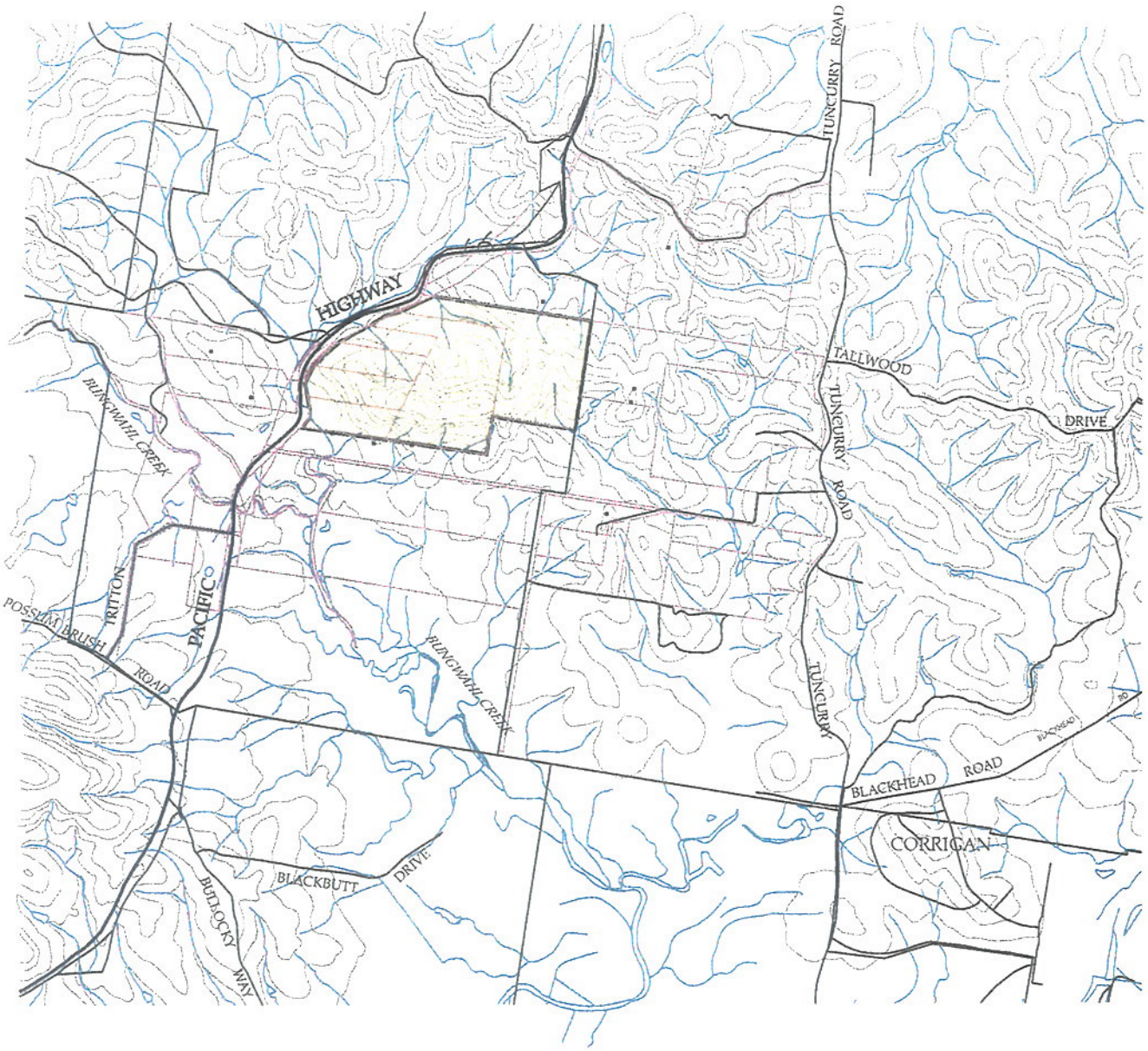
1.1 AN OVERVIEW

CSR Construction Materials (CSR) owns and operates a quarry situated on 118 ha of freehold land located adjacent to the Pacific Highway approximately 18 km south of Taree (see *Figure 1.1*). Current approvals allow for an extraction rate of 150,000 tonnes per annum (tpa), place some stringent controls on operating hours and blasting, and give reserves of around 560,000 tonnes. This equates to about four year's life. The present operation crushes and screens the material and provides a pre-coating facility for sealing aggregates.

CSR is seeking to gain approval to:

- expand operating hours from 6.00 am to 6.00 pm Monday to Friday and 6.00 am to 3.00 pm Saturdays. Ancillary operations such as refuelling, servicing and maintaining plant will be undertaken between 6.00 am and 9.00 pm Monday to Saturday;
- expand the existing site facilities area;
- lift approved production levels from 150,000 tpa to an average 250,000 tpa;
- significantly expand reserves to allow planning for the companies future. This includes extraction down to Relative Level (RL) 20 and will provide 16 million tonnes of fresh rock;
- remove the restrictions on blasting to enable the adoption of normal commercial blasting practices;
- locate on site, from time to time on an as needs basis, a mobile pugmill and/or a mobile asphalt plant; and
- construct a new weighbridge and office complex west of the current weighbridge.

Quarry practices will remain essentially the same, including the continuation of current dust mitigation procedures. The quarry processing plant will not be changed, the extra capacity required will be accommodated by the extension of the operating hours.



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SOURCE: CMA 1:25,000 TOPO NABIAC SHEET

CSR PROPERTY BOUNDARY

RESIDENCES

CADASTRAL BOUNDARIES

N

0 800m

ERM MITCHELL McCOTTER

Figure 1.1 SITE LOCALITY

1.2 QUARRY DEVELOPMENT

The main haul roads to the upper benches have been established on the eastern side of the existing quarry. To avoid disruption to the main haul roads it is proposed to initially quarry to the west.

Existing benches have been developed at 12 m heights and it is proposed to continue with 12 m separation down to RL 50. From this level it is proposed to develop two 15 m high benches. The quarry plan includes:

- terminal bench width of half the face height;
- final face angle of 75°;
- haul roads 15 m wide and at 1:10 grade;
- rock density of 2.65 t/m^3;
- topsoil 1 m thick; and
- weathered rock 10 m thick.

Four stages of development have been proposed as described below.

1.2.1 Stage 1.

This stage involves expanding the quarry to the west.

Where possible, the first action will be to develop an excavated slot along the southern rim of the quarry through the topsoil and weathered rock, leaving the final south face at a stable angle suitable for plant growth, and replanting. When the active quarry face extends south to meet this revegetated slot, much of the final visual impact will be mitigated. Where the development of the slot is not possible due to the location of the existing southern quarry face, revegetation will be commenced as soon as possible following completion of the final southern face. At the same time a sump will be put down into the floor of the quarry to trap all the water from disturbed areas. This will be enlarged from time to time.

Benches will be developed at RL 50, 62, 74, 84 and 96. It has been calculated that this development will generate 61,900 m^3 of overburden, 619,300 m^3 (1.64 million tonnes) of weathered rock and 1,685,800 m^3 (4.47 million tonnes) of fresh rock. It is expected that most of the weathered rock will be processed and sold as road base type product.

As terminal faces are developed on the southern and western limits overburden and topsoil will be placed on the benches and rehabilitated. This method has been used successfully at the Ferntree Gully Quarry (Melbourne) by CSR.

The prior rehabilitation of the top 10 m of overburden and the weathered rock along the southern slot and the ridge on the northern rim of the quarry, will assist to significantly reduce any further visual impact when the site is viewed from the north.

1.2.2 Stage 2

This stage involves the easterly development of the RL 50, 62, 74, 86 and 98 faces half way to the proposed eastern limit of the quarry and developing a new floor at RL 35 in the latter part.

Again, a preliminary slot will be cut along the southern rim, to enable rehabilitation of the top bench in weathered rock before it is exposed to view from the north. Terminal faces on the southern rim, not needed for access or the haul road, will be rehabilitated.

This stage will yield some 442,000 m^3 of overburden, 489,100 m^3 of weathered rock (1.29 million tonnes) and 1,640,800 m^3 of fresh rock (4.35 million tonnes).

Visual impact of this stage be diminished by prior rehabilitation of the weathered rock face.

Early in Stage 2 the existing haul roads will need to be relocated, and it is proposed that access from the RL 50 bench to the higher benches will be via a ramp developed along the northern and eastern faces. The higher sections of this ramp will be live and will have to be relocated from time to time.

All runoff from the disturbed area will be gathered either on the RL 35 level, or in a sump below RL 35. After settling, all water will be pumped out into the existing water management system.

Towards the end of this stage operations will come within 20 m of the south-east corner of the CSR property. A formal legal agreement between CSR and the owners of the adjoining property (YALA) restricting activities on the adjoining land during blasting is currently being negotiated.

1.2.3 Stage 3

This stage is the continued development east of the RL 35, 50, 62, 74 and 98 benches to their most eastern limit. At no stage will the eastern ridge be breached. Towards the end of this stage a drop cut to a new floor level at RL 20 will be developed.

Again the weathered rock profile along the southern rim will be rehabilitated, and after development all visible terminal faces will be rehabilitated.

During this stage the operation will extract 34,500 m^3 of overburden, 300,700 m^3 of weathered rock (751,700 tonnes) and 1,371,600 m^3 of fresh rock (3.6 million tonnes).

Completion of this stage will represent the end of any disturbance of the site, the quarry having practically reached its final rim position.

1.2.4 Stage 4

In this stage effort is concentrated on removing the bottom RL 20 bench, and some peripheral clean up. It will release 4,500 m^3 of overburden, 45,000 m^3 of weathered rock (112,700 tonnes) and 1,537,600 m^3 of fresh rock (4.1 million tonnes).

Other than maintenance of existing rehabilitation there will be little additional areas requiring rehabilitation.

At the end of this stage the floor will be approximately 750 metres long and 100 metres wide. This stage has the potential to yield in excess of 2.5 million tonnes of fresh rock. Approval for extraction of this additional resource is not part of this application.

Chapter 2

AIR QUALITY CRITERIA

2.1 AIR QUALITY CRITERIA

The effects of dust on health and amenity were assessed by comparing dust deposition rates and dust concentrations with recognised air quality criteria. These criteria were established from research in both New South Wales, Victoria and overseas. To include the full range of potential impacts, reference was made to criteria for long-term (annual average) and short-term (24 hour) periods, and to different particle sizes. The following sections detail appropriate criteria.

2.2 NATIONAL ENVIRONMENT PROTECTION MEASURE (NEPM)

Ambient air quality throughout Australia is the subject of *The National Environment Protection Council (Ambient Air Quality) Measure 1998* (NEPM). This is a Commonwealth initiative to achieve nominated standards of air quality within ten years. All states and territories have adopted the ten-year air quality goals for pollutants specified in Schedule 2 of NEPM.

In adopting the NEPM air quality goals, the State Government undertakes to conduct measurements of air quality at performance monitoring stations located in regions where greater than 25,000 people may be affected. Monitoring station locations are selected to represent exposure of a large proportion of the population rather than exposure of individual people. It is also important to note that the NEPM criteria are not to be compared solely to the emissions from one source, they are meant as regional air quality goals. NEPM criteria are therefore not considered in this assessment.

2.3 DUST DEPOSITION

Dust deposition criteria developed by the NSW Environment Protection Authority (NSW EPA) are given in *Table 2.1*. These set maximum increases above existing levels. For example, in residential areas with existing annual average deposition of between zero and two $g/m^2/month$, an increase of up to two $g/m^2/month$ would be permitted.

Table 2.1 ASSESSMENT CRITERIA FOR DUST DEPOSITION

Existing Deposition (g/m^2/month)	Maximum Acceptable Increase (g/m^2/month annual average)	
	Residential Suburban Land Use	Rural, Semi-Rural Urban, Commercial & Industrial Land Uses
2	2	2
3	1	2
4	0	1

Based on these criteria the permissible increase at properties around the quarry will be as shown in *Table 2.2*.

Table 2.2 GUIDELINES FOR INCREASES IN DUST DEPOSITION

Site	Annual Average Deposition for 1996 - 1997[1] (g/m^2/month)	Permissible increase in deposition (g/m^2/month)
1	1.90	2.0
2	1.76	2.0
3	2.62	2.0

Note: 1. Details provided in Section 3.6.

2.4 DUST CONCENTRATION

Concentration criteria for long-term annual averages and short-term 24 hour periods were considered. Two size ranges were also addressed: total solid particulate matter (TSP) or particles less than 50 microns (one millionth of a metre) and particles smaller than 10 microns (PM_{10}).

PM_{10} particle concentrations are of interest because they can reach the lower parts of the respiratory system and may have health as well as amenity impacts. Most PM_{10} particles are caused by combustion from motor vehicles, bushfires and industrial processes. Some PM_{10} particles are generated by evaporation of sea spray and from vegetation. Most quarrying dust consists of coarser particles which have amenity rather than health effects.

The assessment criteria are as follows.

2.4.1 *Short-term Criteria*

Based on United States Environmental Protection Agency (USEPA) standards, the NSW EPA adopts a 24 hour concentration criterion of 150 $\mu g/m^3$ for PM_{10} which should not be exceeded more than once per year.

2.4.2 *Long-term Criteria*

The National Health and Medical Research Council of Australia (NHMRC) recommends a maximum annual concentration of 90 $\mu g/m^3$ total suspended particulate in a residential environment, which is compared to in the absence of a more suitable standard. For particles smaller than 10 microns, the NSW EPA adopts the USEPA PM_{10} standard of 50 $\mu g/m^3$ annual average.

Chapter 3

DUST DISPERSION MODELLING

3.1 INTRODUCTION

The ISC dispersion model was chosen to predict dust deposition rates and airborne concentrations of respirable (PM_{10}) and inhalable (TSP) dust resulting from dust emissions. Calculated dust deposition rates were compared against available monitored data in the locality to validate the model's result. No measured values were available for TSP and PM_{10} concentrations in the locality.

3.2 ISC MODEL

The Industrial Source Complex (ISC) dispersion model is a gaussian plume dispersion model used to evaluate the air quality impact of emissions from industrial source complexes. It has been approved by most regulatory authorities nationally and internationally. The ISC model consists of two programs for short and long term analyses. The short-term model uses sequential hourly meteorological data to estimate deposition or concentration patterns from one hour to one year. The long-term model uses statistical wind data summaries to estimate seasonal and annual concentration and deposition patterns. For the purpose of this investigation only the short-term model has been used. It has been used to account for the short-term variability of the emissions from the quarry.

3.3 SELECTION OF MODEL OPTIONS

For modelling atmospheric dispersion of emissions from the quarry, the following options were selected:

- Unless otherwise stated, regulatory and/or default options were used as based on previous studies.
- Ground level concentrations are predicted at 14 discrete receptors corresponding to locations of sensitivity. A Cartesian receptor grid was also used with local grid coordinates and a resolution of 200 meters.

- As a conservative assumption, only dry deposition was considered. The effects of wet deposition would reduce the total dust impact of the quarry. Additionally an appropriate scavenging coefficient (for wet deposition) could not be determined with any confidence.

- Plume mass depletion was not included for deposition calculations.

The ISC plume dispersion model was used to determine the 24 hour and annual average ground level concentration of PM_{10} and the annual average ground level concentration of TSP. Monthly averages for dust deposition were also predicted.

3.4 METHODOLOGY

CSR proposes to extend their quarry operations at Jandra from 150,000 tonnes per annum to an average 250,000 tonnes per annum. Dust emissions from each quarrying activity were estimated and used in a short-term dust dispersion model. The model calculated average 24 hour concentrations for PM_{10} and TSP around the quarry based on emission rates and meteorological data.

There has been a wide and significant body of data that has been collected to demonstrate the accuracy of the ISC modelling process. For this assessment, 12 months of dust deposition monitoring data recorded at the quarry site boundary were available to verify modelling assumptions. This was performed to confirm that all assumptions in the model under current conditions are valid. The dust deposition monitoring results verified the assumptions of the model for the current stage.

Based on the verified model, levels of dust deposition and dust concentrations were predicted. Air quality impacts due to proposed quarry operations were determined by comparing the predicted levels with relevant criteria.

3.4.1 Existing Environment

Dispersion modelling requires good quality weather data, including wind speed, wind direction and atmospheric stability. This is incorporated into the model as a frequency distribution of wind speed and wind direction by stability class.

The ISC model requires specific meteorological (MET) data. Hourly information for a complete year is required for wind direction, winds speed, temperature, stability class, rural and urban mixing heights to complete calculations.

The Bureau of Meteorology installed an automatic weather station at the Taree airport. The information is a compilation of meteorological data at 9.00 am to 3.00 pm. The data includes rainfall, wind speed and wind frequency for the area. The information is insufficient for complete modelling of dust emission from the quarry and instead a compilation of statistical data, "Metsamp" was used. This meteorological file is used to calculate a worst case scenario and as such only the highest concentration value can be considered, as opposed to the NSW EPA regulations which allow for one exceedence of the short-term value.

Appendix A details the windrose summaries for wind speed and direction for the Taree region for each of the seasons. The roses are similar for each season and, wind direction and speed vary slightly with more than 50% of wind prevailing from the east in the mornings and from the north-west in the afternoon.

Calm conditions (less than 3 m/s) are experienced for approximately 30% of the mornings and the afternoon breeze creating less stable conditions later in the day.

Daily average temperatures from 28°C in the summer, 21°C in the autumn, 18°C in the winter and 23°C in the spring.

The number of rain days per year average 130 with approximately 1,184 mm of rain falling during an average year.

3.4.2 *Wind Data*

Wind speed influences the dust emitted from disturbed areas. Wind erosion of such areas mainly occurs at velocities of more than 5.4 metres per second, which were recorded approximately 15 per cent of the time in the Jandra area. For the meteorological file used, wind direction is allocated in 30 degree increments for the full 360 degrees. Wind speed ranged from 0.5 m/s to 20 m/s for all of the wind directions calculated.

3.4.3 *Stability Class*

Stability class is used to determine the rate at which a dust plume disperses by turbulent mixing. Each stability class is associated with a dispersion curve, which is used by the dispersion model to calculate plume dimensions and dust concentrations downwind of the source.

Stability classes are categorised from 1 to 6 or, A to F. Stability Class 1 applies under sunny conditions with light winds when dispersion of the plume is most rapid. Stability Class 4 applies under windy and/or overcast conditions when dispersion is moderately rapid, and stability Class 6 occurs at night when winds are light and the

sky is clear. Classes 2, 3 and 5 are intermediate conditions between those described above.

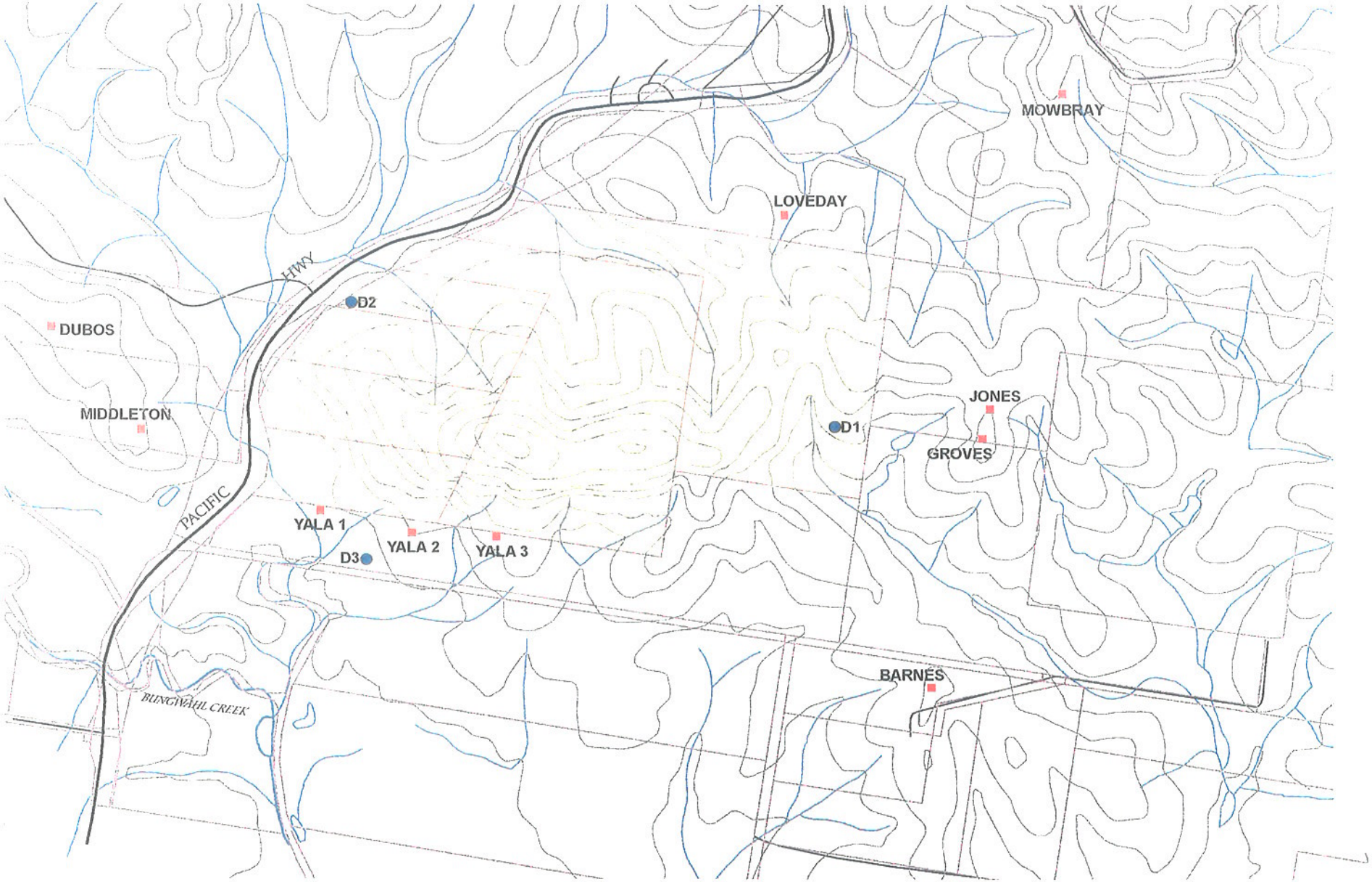
The meteorological data used covered all 6 stability classes.

3.4.4 Mixing Heights

Mixing Height refers to the height that fine dust particles will be ultimately mixed in the atmosphere. In this instance where most of the sources are non-buoyant ground level emissions, the predictions from the ISC model are not particularly sensitive to the mixing heights. Theoretical mixing height values have been used to cover both urban and rural mixing heights ranging from 1,000 to 2,250 metres.

3.5 DUST DEPOSITION MONITORING RESULTS

CSR has a network of dust gauges located around the quarry as shown on *Figure 3.1*. *Table 3.1* shows monthly dust deposition monitored at specific sites around the quarry.



57106/38070/g2.iml.CDR

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Figure 3.1 DUST MONITORING LOCATIONS

Table 3.1 DUST MONITORING RESULTS

Site	Date	Dust Deposition [1]
1	02/01/96	2.37
2		2.55
3		2.54
1	02/11/96	0.116
2		0.445
3		0.189
1	02/12/96	5.53
2		4.44
3		4.62
1	30/01/97	3.62
2		2.38
3		2.31
1	04/03/97	1.74
2		13.38 *
3		2.40
1	01/04/97	1.39
2		1.81
3		3.45
1	29/04/97	1.15
2		1.69
3		2.46
1	02/06/97	1.56
2		1.73
3		4.04
1	30/07/97	2.06
2		1.09
3		3.68
1	02/08/97	0.67
2		0.74
3		2.11
1	02/09/97	0.69
2		0.74
3		1.06

Note *1 g/m²/month - grams per square metre per month (1996 to 1997).*

** Suspect result.*

To predict dust dry deposition concentrations, the ISC model requires additional information in the MET data file. In addition to hourly data for a complete year on wind direction, speed, temperature, stability class, rural and urban mixing height, three other factors are required. These are friction velocity, Monin-obhikov length and surface roughness. It is difficult to accurately input statistical data for these variables. To obtain dry dust deposition predictions these variables have been input from an existing MET file.

The deposition values predicted from the current quarrying operations can be compared against the measured results, *Table 3.2.*

Table 3.2 COMPARISON OF DUST MONITORING SITES MEASUREMENTS VERSUS PREDICTED CONCENTRATIONS

Dust Monitoring Site	Measured Range (g/m^2/month)	Average (g/m^2/month)	Predicted Concentration (g/m^2/month)
1	0.116 - 5.53	1.90	0.94
2	0.445 - 4.44 (13.38) *	1.76	2.47
3	0.189 - 4.62	2.62	0.65

Note: * *Suspect result, averages calculated excluding 13.38 value.*

The predicted concentrations fall within the measured range of monitored dust levels. Drilling and blasting have not been included as sources in the modelling of dust deposition due to their episodic impacts. However even without these episodic impacts the predicted concentrations correlate to an acceptable level.

Chapter 4

DUST EMISSIONS

4.1 INTRODUCTION

Quarry operations generate dust from many sources. Initially sediment controls are implemented and then the area is cleared of vegetation. Next drilling and blasting takes place. This involves the drilling of a series of holes in a grid format to a depth dependant on the planned quarry face, in this instance either 13 or 16 m. Explosives are then placed down the holes. The holes are then capped with stemming, which at the time of the blast, results in the soil being ruptured and up-lifted minimising the dust emission significantly.

Drilling and in particular blasting has the greatest potential for dust emissions. A number of mitigation measures such as capping, not blasting during adverse wind speed and wind direction need to be considered during each blasting episode. Although the potential dust emissions from blasting are significant, appropriate measures can significantly reduce the impact. In addition drilling and blasting is an episodic emission which occurs approximately monthly at the quarry. The object of blasting is to open seams which are suitable for front-end loaders and excavators to access. As a dust control measure the shot rock is well watered down prior to loading and CSR guidelines for blasting are followed. The shot rock is loaded into dump trucks and transported to the processing plant.

The material is transported by dump truck to the crushing and screening plant where it is crushed and sorted according to size. After crushing and screening the product is stockpiled using front-end loaders, or dependant on the market, goes to the pre-coating or asphalt batching plants.

Dust sources include dust from construction of access roads, land clearing, drilling, blasting, loading and unloading, transport, crushing and screening, wind erosion from stockpiles and dumps. Each operation can produce dust in varying amounts projecting it into the air at different heights and falling at different distances from the source. For example truck movement generates small amounts of dust at low levels while uncontrolled blasting can project dust high into the atmosphere and dust particle size can vary depending on the blast size.

4.2 DUST EMISSIONS RATES

The amount of dust generated has been calculated by applying emission factors for the various processes. Emission factors have been obtained from published data by the former State Pollution Control Commission of New South Wales (SPCC), now the NSW EPA.

Emission factors for activities not listed in the SPCC report were taken from United States Environment Protection Agency (USEPA) studies. A list of individual quarrying activities, emission factors and data sources used in assessments are presented in *Table 4.1*.

Table 4.1 EMISSION RATES

Activity	Emission Rate	Reference
Overburden removal		
Excavator/Shovel	0.025 kg/t	SPCC et al (1988)
Dozer	5.1 kg/hr	USEPA (1988)
Drilling	0.6 kg/hole	SPCC (1983)
Blasting	550-4,334 kg/blast	SPCC (1983) modified
Quarrying		
Excavator/FEL	0.025 kg/t	SPCC et al (1988)
Dozers/Rubber tyred Dozers	3.1 kg/hr	USEPA (1988)
Rehabilitation		
Dumping	0.012 kg/t	SPCC et al(1988)
Dozer	5.1 kg/hr	USEPA (1988)
Haulage		
Overburden	2 kg/vkt	SPCC et al(1988)
Extraction	2 kg/vkt	SPCC et al(1988)
Wind Erosion		
Extraction	0.4 kg/ha/hr	SPCC (1983)
Overburden	0.4 kg/ha/hr	SPCC (1983)
Pre-Strip	0.4 kg/ha/hr	SPCC (1983)

Notes:

kg	*kilogram*	*vkt*	*vehicle kilometre travelled*
hr	*hour*	*km*	*kilometre*
ha	*hectares*	*t*	*tonne*
m3	*cubic metre*	*FEL*	*Front End Loaders*

4.3 DUST PARTICLE SIZE

PM_{10} emissions were estimated by adding the fine particles (FP) and a percentage of the inhalable particles (IP) fraction based on distributions provided by the USEPA.

A list of individual quarrying activities and the associated particle size distribution are presented in *Table 4.2*.

Table 4.2 PARTICLE SIZE DISTRIBUTION

Plant/Activity	FP (%)	IP (%)	CP (%)	Reference
Excavator/Shovel/FEL	7.0	50.0	43.0	Dames & Moore (1986)
Dozer/Rubber tyred	19.6	54.0	26.4	USEPA (1981)
Dumping	4.0	44.0	52.0	Dames & Moore (1986)
Conveyor	4.0	44.0	52.0	Dames & Moore (1986)
Dozer	19.6	54.0	26.4	USEPA (1981)
Haulage	6.0	53.0	41.0	Dames & Moore (1986)
Overburden - Wind Erosion	3.5	67.0	29.5	Dames & Moore (1986)

Notes:

FP *fine particles (0 to 2.5 microns)*

IP *Inhalable particles (2.5 to 15.0 microns)*

CP *Coarse particles (15 to 30.0 microns)*

Emissions were entered into the model as open pit and area sources. These sources were located at worst case locations as well as being representative of current quarrying operations. Consideration was also given to sources located on the pit floor and at elevations below the normal ground level.

Activities in the quarry that generate dust include:

- wind erosion;
- stockpile wind erosion;
- drilling;
- blasting;
- excavator during truck loading;
- haulage;

- dumping;
- crushing and screening;
- exhaust from vehicles;
- conveyor transfer points; and
- product stockpiling and loading with front-end loaders.

4.4 DUST EMISSION ESTIMATES

4.4.1 Wind Erosion

The annual average dust emission for exposed areas is 0.4 kg/ha/hr (SPCC 1983). Application of this annual average for all wind-speeds would overestimate emissions depending on the number of days when wind-speed was less than 5m/s. Examination of the wind roses concluded that in fact only 15% of wind speeds were above 5.4m/s.

Good quarry practice ensures that once exposed faces are no longer needed they are to be rehabilitated as quickly as possible, therefore the area within the quarry which has been cleared and exposed, but not rehabilitated, will be kept to a minimum.

Currently the maximum output of the quarry is 150,000 tonnes per annum. Based upon the maximum area exposed of 1.5 ha (Wilkinson-Murray 1986) for production of 50,000 tonnes per annum it has been calculated that the required face exposed to achieve the current output would be 4.5 ha. For the proposed increase in output to 250,000 tonnes per annum (Stages 1 - 4) the exposed face has been calculated at 7.5 ha.

The emissions for wind erosion have been modelled as an open-pit source. Based on this information we estimate that the current facility emissions for wind erosion is 15,768 kg/yr and emissions for each of the proposed Stages 1-4 are 26,280 kg/yr.

4.4.2 Stockpile Wind Erosion

The emission factor for stockpile erosion is the same as that for wind erosion (0.4 kg/ha/hr (SPCC 1983). It has been estimated that the current operations maximum required stockpile area is 0.648 ha (approximately 30m by 70m by 3m high). For Stages 1-4 this value has been calculated to be 1.08 ha (a ratio of 150,000:250,000 calculated from output (tpa)). It is proposed that the stockpiles will be sprayed with