


**Boral Construction Materials
Materials Technical Services**

 Unit 4, 3-5 Gibbon Road
 Baulkham Hills NSW 2153 Australia
 PO Box 400, Winston Hills NSW 2153

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TEST REPORT

CLIENT: P.F. Formation

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2018

 TEST METHOD: i) AS1141 – Methods for Sampling and Testing Aggregates FILE NO: 250/18
 ii) RMS – Materials Test Methods Vol. 1 REQUEST NO: 80231
 iii) ASTM D7428, Standard Test Method for Resistance of Fine Aggregate to Degradation by
 Abrasion in the Micro-Deval Apparatus.

 SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

Sample Description:		Coarse Sand	
Location:		Maroota Quarry	
Date Sampled:		10.9.18	
Laboratory Sample No:		210014	
Test Method:	Test:	Spec:	Results:
AS1141.11.1*	% Passing A.S. Sieve		
	9.5mm	100*1	
	6.7mm	-	
	4.75mm	90-100	100
	2.36mm	60-100	91
	1.18mm	30-100	76
	600 micron	15-100	57
	425 micron	-	44
	300 micron	5- 50	27
	150 micron	0- 20	6
AS1141.12	Material finer than 75 micron (%)	0- 5	2
AS1141.4	Uncompacted Bulk Density t/m ³		1.59
	Compacted Bulk Density t/m ³	Min. 1.2	1.70
RMS T262	Moisture Content (%)	4- 8	4.1
AS1141.5	Particle Density (Dry) t/m ³	Min. 2.1	2.60
	Particle Density (SSD) t/m ³		2.61
	Apparent Particle Density t/m ³		2.63
	Water Absorption (%)	Max. 2.0	0.3
AS1141.24	Sodium Sulphate Soundness (Total Weighted % Loss)	Max. 6	0.6
	Fraction tested :		
	-4.75mm+2.36mm (% Loss)		1.4
	-2.36mm+1.18mm (% Loss)		0.7
	-1.18mm+600 µm (% Loss)		0.8
	-600 µm +300 µm (% Loss)		0.3

*Sample washed over 75 micron sieve as per AS1141.11.1 Clause 5.6.

*1 As per Fine Aggregate – Recommended Gradings (Table B2), AS2758.1

Page 1 of 2



Approved Signatory

Kamal Ali

Date

18.10.18

Serial No.

17 2 9 5 0

Accredited for compliance with ISO/IEC 17025

NATA Accredited Laboratory

Number: 547


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Page 2 of 2

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SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

Sample Description:			Coarse Sand
Location:			Maroota Quarry
Date Sampled:			10.9.18
Laboratory Sample No:			210014
Test Method:	Test:	Spec:	Results:
AS1141.33	Silt Content (%)		4
AS1141.34	Organic impurities other than sugar The colour assessment was made visually using coloured reference glass	Not darker than std.	Pass
RMS T279	Method of Determining Voids Content % Voids The Mean Flow Time (Sec.)		41.5 21.7
ASTM D7428	Micro-Deval Abrasion Test % Loss The % loss of the control aggregate tested closest to the time at which the sample was tested = 19.1		5.4
AS1141.25.3*	Degradation Factor Fine Aggregate The wash water after using permitted 500ml was:		99 Clear

*At the end of 20 min. reading the height (H) of the upper surface of the flocculate column was not possible. Reading was performed after 40 min.

Sample submitted by client

J. Graham, QC File, File



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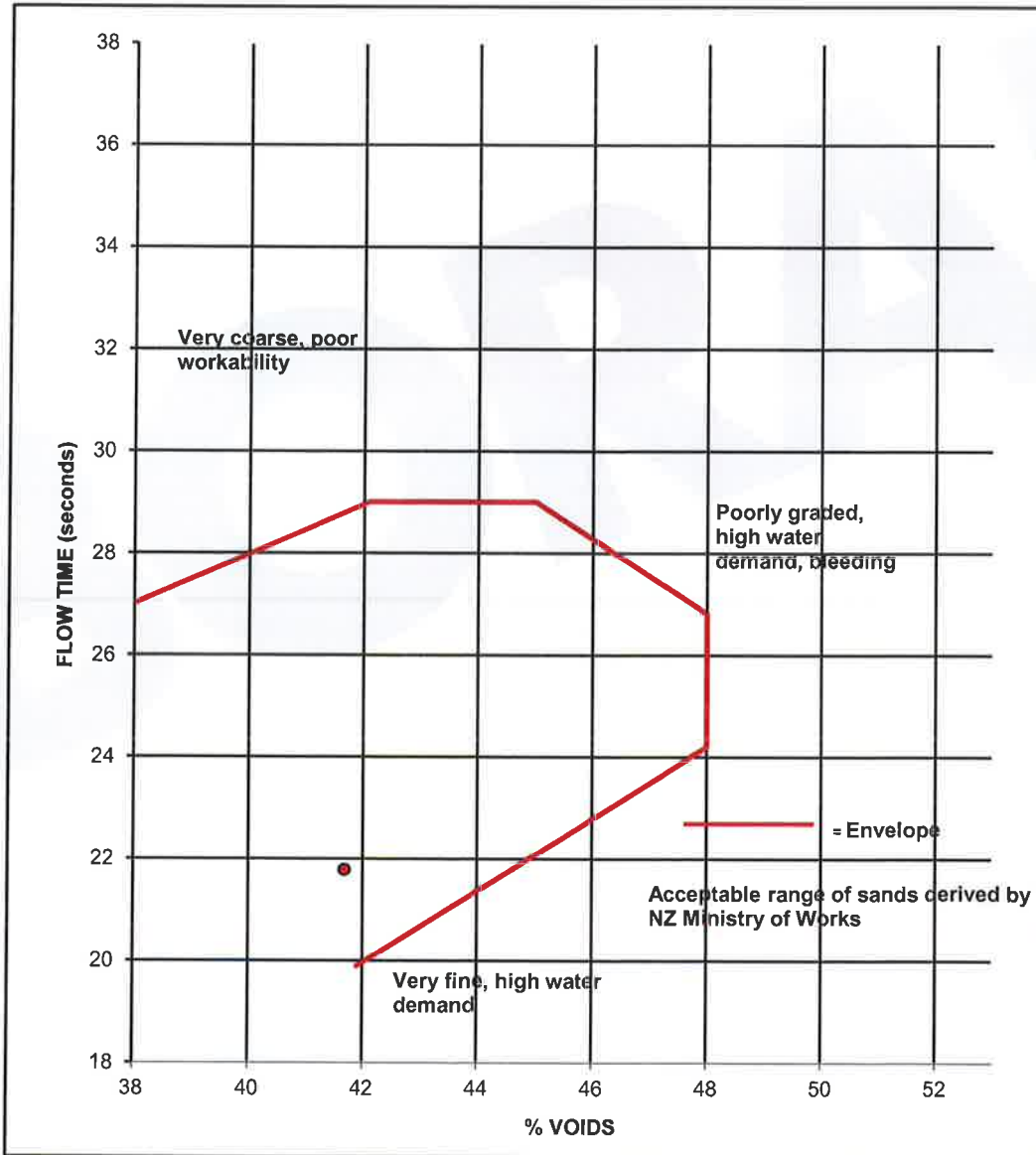
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Method for Determining Voids Content - Flow Time
RMS T279

CLIENT: P.F. Formation
PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2018
LAB SAMPLE NO: 210014
SAMPLE LOCATION: Maroota Quarry
TEST METHOD: RMS – Materials Test Methods Vol. 1
SAMPLE DESCRIPTION: Coarse Sand

FILE NO: 250/18
REQUEST: 80231
DATE SAMPLED: 10.9.18



Sample submitted by client
J. Graham, QC File, File


Kamal Ali
SECTION HEAD - AGGREGATES
15th October 2018



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TEST REPORT

CLIENT: P.F. Formation

FILE NO: 250/18

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2018

REQUEST NO: 80231

TEST PROCEDURE: TEST PROCEDURE: Texas Highway Department – Materials and Tests Division –
TEX.402-A, Rev. Sept. 1999

Sample Description:		Coarse Sand
Location:		Maroota Quarry
Date Sampled:		10.9.18
Laboratory Sample No:		210014
Test Method:	Test:	Results:
TEX-402-A	Fineness Modulus of Fine Aggregate	2.43

Sample submitted by client.


Kamal Ali
Section Head – Aggregates

15th October 2018

J. Graham, QC File, File



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TEST REPORT

CLIENT: P. F. FORMATION
PROJECT: Quality Control - Annual Full Test - 2018
MATERIAL: Coarse Sand from Maroota Quarry

FILE No: 250/18
REQUEST No: 80231
DATE SAMPLED: 10.9.18
DATE TESTED: 14.9.18 to 19.9.18

Test Method AS1289.3.7.1	Results
Determination of the Sand Equivalent of a soil using a power-operated shaker	Field Sample No. 1 Laboratory Sample No. 210014
Sand Equivalent	85
Temperature of test solution (°C)	23

Test Methods RMS T108 and T109	Results
Determination of the Liquid Limit (refers to AS1289.3.1.1), Plastic Limit (refers to AS1289.2.1), and Plasticity Index of Road Materials.	Field Sample No. 1 Laboratory Sample No. 210014
Test: RMS T108 - Liquid Limit (%) RMS T109 - Plastic Limit (%) and Plasticity Index (%)	N/A* N/A** NP
Sample history Preparation method Method used for moisture content determination	OD DS N/App
<p>N/A* - Test is not applicable due to continual slippage in bowl. Liquid Limit could not be obtained. NP - Non-plastic. N/A** - Unable to roll, plastic limit could not be obtained. N/App. - Not Applicable. Sample history:- NS = Natural state, AD = Air dried, OD = Oven dried at 50°C, UN = Unknown, AR = As received Preparation method:- WS = Wet sieved, DS = Dry sieved, AR = As received</p>	

Note: Sample provided by client.

JOSHUA GRAHAM, Q. C. FILE, FILE.



Approved Signatory _____
Date 20.9.18 Serial No. 172951

Artemio Mendoza



Page 1 of 1

Report Template – Rev. (2) April, 2017 – Authorised by M.A.

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FILE No.: 250 / 18

TEST REPORT

CLIENT: P.F. Formation

1774 Wisemans Ferry Road Maroota NSW 2756

PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2018 to
AS 2758.1 Specification

REQUEST No.: 80231

TEST PROCEDURE:

AS 1012.20 – Determination of Chloride and Sulfate in Hardened Concrete and Concrete Aggregates

AS 1141.13 – Material Finer than 2 micron

AS 1141.31 – Determination of Light Particles

AS 1141.35 – Detection of Sugar

AS 1141.36 – Sulfur in Metallurgical Slag, Crushed Rock or Other Pavement Materials

RMS T659 – Methylene Blue Adsorption value of Road Construction Material

AS 1289.4.1.1 – Organic Matter content

AS 1289.4.3.1 – Determination of the pH value of a Soil

RMS T123 – Determination of the pH value of a Soil

RMS T264 – Soluble Salts in Sand

Laboratory Sample No.:

210014

Date Sampled:

10.09.18

Sample Description:

Coarse Sand

Field No.:

1

TEST RESULTS:Sulfate as SO₃ (%)

0.03

Material Finer than 2 micron (µm) (%)

Not Applicable

Light Particles (%)

Nil

Sugar

Not Detected

Sulfur as S (%)

0.02

Methylene Blue Adsorption value (mg/g)

1

Methylene Blue Adsorption value for a Duplicate (mg/g)

1

Average Methylene Blue Adsorption value (mg/g)

1

Organic Matter (%)

0.1

pH (AS)

6.8

pH (RMS)

6.8

Soluble Salts (%)

< 0.3 (Free from Soluble Salts)

Sample submitted by the Client.

Joshua Graham, Q.C. File, Mat. File, File.

Frank Grima

Approved Signatory

Date 19-10-18

Serial No.

172952





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TEST REPORT

CLIENT: P.F.FORMATION
1774 Wisemans Ferry Road,
Maroota, NSW 2756

FILE No: 250 / 18

PROJECT: Quality Control Annual Full test of Coarse Sand ex. Maroota for
2018.

REQUEST No: 80231

TEST PROCEDURE:

AS 1012.20.1 – Determination of Chloride and Sulfate in Hardened Concrete and Aggregates – Nitric Acid
Extraction Method

AS1012.20.2 – Determination of Water-Soluble Chloride in Hardened Concrete and Concrete Aggregates

Laboratory Sample No.: 210014
Date Sampled: 10.09.18
Date Received: 12.09.18
Sample Description: Coarse Sand
Maroota Quarry

Field No.: 1

TEST RESULTS:

Chloride as Cl⁻ (Acid) (%) 0.003
Chloride as Cl⁻ (Water) (%) * 0.001

Sample submitted by the Client.

Joshua Graham, Mat .File; File.

Approved Signatory  Otilia Costache

Date 18.10.2018 Serial No. 172953





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TEST REPORT

CLIENT: P.F. Formation
1774 Wisemans Ferry Road Maroota NSW 2756

FILE No: 250 / 18

PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2018 to
AS 2758.1 Specification

REQUEST No: 80231

TEST METHOD:

AS 2350.2 Clause 5.5 - Loss on Ignition (Modified)

Tex- 612 - J - Acid Insoluble Residue For Fine Aggregate

Laboratory Sample No.: 210014
Date Sampled: 10.9.18
Sample Description: Coarse Sand
Field No.: 1

TEST RESULTS:

CO₂ by Loss on Ignition (%) < 0.1
Calcium Carbonate as CaCO₃ (%) 0.1
Acid Insoluble Residue (%) 98

Sample submitted by the Client.

S. Krishnamoorthy
Analytical Chemist
3rd October 2018

Joshua Graham, Q.C.File, Mat.File, File.



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TEST REPORT

CLIENT: P.F.FORMATION
1774 Wisemans Ferry Road, Maroota, NSW 2756.

FILE No.: 250/18

PROJECT: Quality Control Annual Full Test of Coarse sand ex Maroota for 2018.

REQUEST No.: 80231

TEST PROCEDURE: Boral Chemical Method 2 – Determination of metal oxides by Lithium Meta Borate Fusion and analysed using ICP

Laboratory Sample No.: 210014
Date Sampled: 10/09/18
Date Received: 12/09/18
Sample Description: Coarse sand

Field No.: 1

TEST RESULTS

Silicon as SiO₂ (%) 98.3

Sample submitted by the Client.

A handwritten signature in black ink, appearing to read "NQS".

Nanthini S
Analytical Chemist
19th October 2018.
J.Graham, Q.C.File, Mat.File, File.



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Test Report

Client:	P. F. FORMATION	File No:	250/18
Address:	1774 Wisemans Ferry Road Maroota, NSW 2756	Req. No:	80231
Date Received:	September 2018	Date Sampled:	10/09/2018
Project:	Quality Control Annual Full Test of Coarse Sand ex Maroota for 2018.		
Test Method:	Accelerated Mortar Bar Test for AAR Assessment - RMS T363		

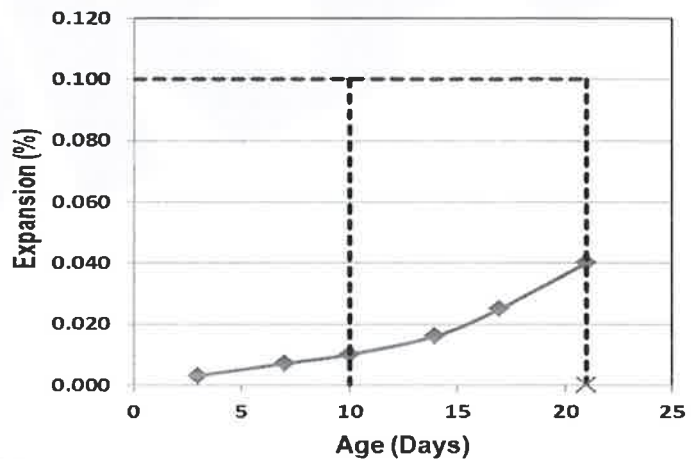
Lab Sample No	Sample Description	Location
210014	Coarse Sand	Marrota Quarry
N/A	Boral GP / SL Cement	Berrima

Results:

Flow (%): 12

W/C Ratio: 0.40

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.003
7	0.007
10	0.010
14	0.016
17	0.025
21	0.040



Mortar Bar Expansion (E) % Duration of Specimens In 1mol/L NaOH at 80°C		RMS T363 Aggregate Reactivity Classification
10 Days	21 Days	
< 0.1*	< 0.1*	Non-Reactive
< 0.1*	≥ 0.1*	Slowly Reactive
≥ 0.1*	>> 0.1*	Reactive

* 0.15% for naturally occurring fine aggregates

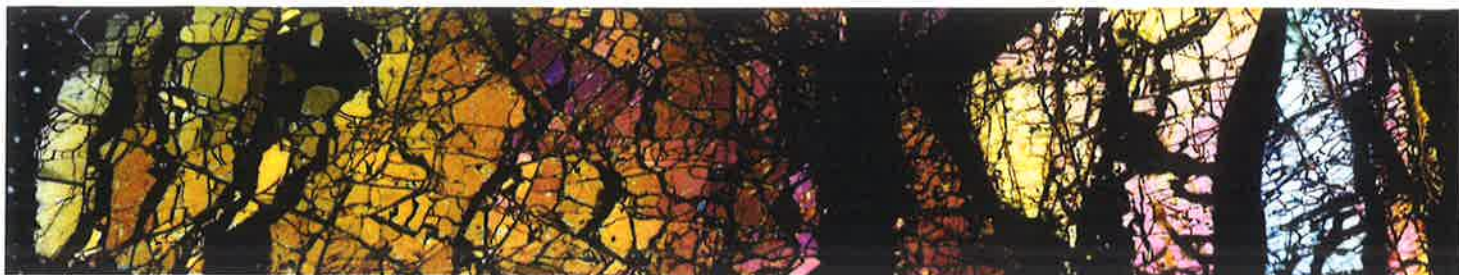
Notes: N/A

Joshua Graham, Q. C. File, Mat. File, File



Approved Signatory Safwan Fawal

Date 19/10/2018 Serial No. 172954



Geochempet Services

ABN 980 6945 3445

PETROLOGICAL and GEOCHEMICAL CONSULTANTS

Principals: K.E. Spring B.Sc. (Hons), MAppSc and H.M. Spring B.Sc.



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PETROGRAPHIC REPORT ON A COARSE SAND SAMPLE (210014) FROM MAROOTA QUARRY

prepared for

**BORAL RESOURCES (NSW) PTY LTD
MATERIALS TECHNICAL SERVICES**

Purchase Order: 5968140

Invoice Number: 00008398

Client Ref: Kamal Ali

Issued by


A. Nik BAppSc MEngSc
9 October 2018

October, 2018

Bo181013

Page 1 of 6

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GEOCHEMPET SERVICES, BRISBANE

Sample Number: 210014 **Date Sampled:** 10/09/2018

Product Type: Coarse Sand **Date Supplied:** 12/09/2018

Sample Source: Ex. Maroota Quarry **Date Received:** 26/09/2018

Location: P. F. Formation

Work Requested Petrographic analysis in relation to suitability for use as concrete sand

Methods Account taken of ASTM C 295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete*, the AS2758.1 – 2014 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)*, the AS1141 Standard Guide for the *Method for sampling and testing aggregates*, of the content of the 2015 joint publication of the Cement and Concrete Association of Australia and Standards Australia, (HB 79-2015) entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*

Identification Quartz sand

Description

The sample consisted of about 0.3 kg of free flowing, reddish orange, clean sand, composed of water-worn, sub-rounded and sub-angular quartz grains and minor lithic fragments.



Figure 1: Digital image of sub-sample from supplied sample 210014

GEOCHEMPET SERVICES, BRISBANE

In a crude, dry sieving test of small subsample these results were tabulated:

Sieve Size	Wt % of sample
Coarse (>1.18mm)	26.3%
Medium (>0.3mm)	50.1%
Fine (>0.075mm)	22.7%
Silt (<0.075mm)	0.9%

The coarse fraction consists of quartz grains and minor lithic fragments of variably ferruginized sandstone clasts which are difficult to break by hand. There are no apparent deleterious grain coatings; benign secondary iron oxide occurs as minor grain coatings and within surficial indents.

When a subsample was swirled in water, a very pale turbidity was noted, which cleared rapidly suggesting minor silt and clay within the sample.

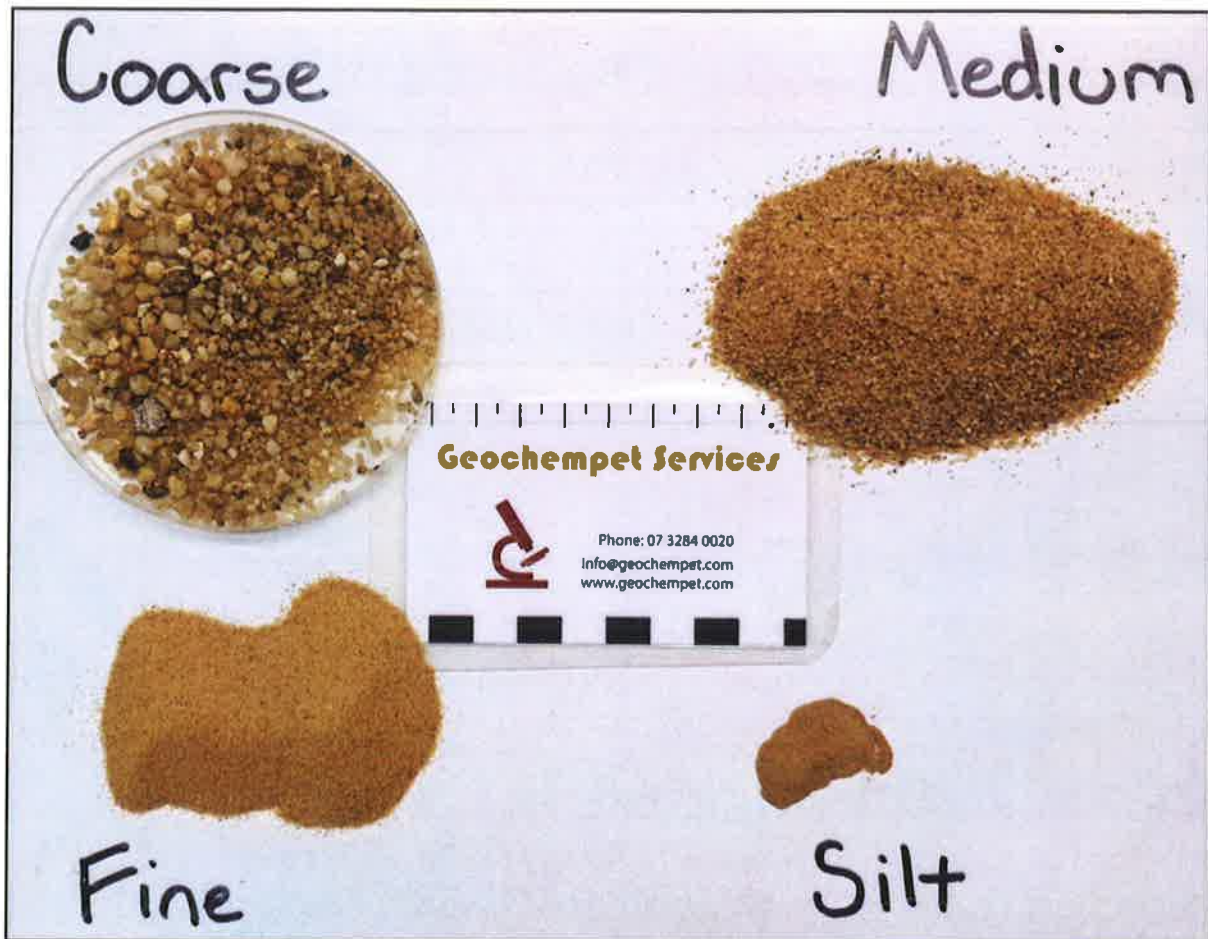


Figure 2: Digital image of sieve fractions as recorded above.

GEOCHEMPET SERVICES, BRISBANE



Figure 3: Digital image of coarse sieve fraction as recorded above. Note the secondary iron oxide in indents.

A thin section was prepared for microscopic examination in transmitted polarized light. A count of 100 widely spaced points falling within sectioned clasts gave the following composition:

- 69% quartz as single, free, unstrained to mildly strained grains (60%) or as simple composite crystalline aggregates of quartz grains (9%)
- 16% quartz as moderately strained single or more commonly crystalline composite grains
- 7% quartzite (5% moderately strained)
- 1% feldspar grains (orthoclase)
- <1% heavy mineral grains (including epidote, zircon, haematite/goethite, hornblende and opaque oxide)
- <1% free mica flakes
- 1% lithic clasts of acid volcanics (<1% microcrystalline quartz)
- 1% lithic clasts of quartz sandstone (1% quartz)
- 1% lithic clasts of intermediate volcanics
- 3% ferruginous fragments (1% quartz)
- <1% sericitized fragments
- 1% secondary iron coating on free quartz grains

GEOCHEMPET SERVICES, BRISBANE

The free silica content (or total quartz plus chert content) of the sand is 94% comprised of 85% free quartz grains or simple crystalline composite grains, and 9% quartz locked within lithic fragments of quartzite, quartz sandstone and ferruginous fragments and <1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

In thin section, the sand is seen to consist very largely of quartz, comprising 60% quartz as single, free, unstrained to mildly strained grains, 9% quartz as simple composite crystalline aggregates of quartz grains, and 16% quartz as moderately strained single or crystalline composite grains. The grains carry minor iron trapped in surface indents, but the amount is very small (apparently 1%). Siliceous fragments of quartzite amounts to about 7%.

Variable weathered sericitized and kaolinized feldspar grains amount to about 1%. Small heavy mineral grains are conspicuous and amount to less than 1%, comprising epidote, zircon, haematite/goethite, hornblende and opaque oxide.

Lithic clasts amount to 3% of the sample and consist of 1% acid volcanic/tuffaceous fragments (<1% finely crystalline quartz in groundmass), 1% quartz sandstone (consisting of quartz and subordinate feldspars suspended in a ferruginous matrix) and 1% intermediate volcanics.

Ferruginous fragments amount to about 3% with sericitized clasts amounted to less than 1%.

Comments and Interpretations

The supplied coarse sand sample (labelled 210014) from the Maroota Quarry is considered to be fairly clean quartz sand which may be described broadly for engineering purposes as fairly evenly graded.

The **free silica content** of the sand is **about 94%**, comprised of 85% free quartz grains or simple crystalline composite grains, and 9% quartz locked within lithic fragments of quartzite, quartz sandstone and ferruginous fragments and <1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

Being composed largely of sub-rounded and sub-angular grains of quartz, the sand is interpreted to be **physically suitable for use as concrete sand**.

The sand as a whole is predicted to have **potential for mild or slow deleterious alkali-silica reactivity in concrete**. It carries about 21% of moderately stained quartz (as free grains or simple composite grains, and in quartzite), and <1% microcrystalline quartz in lithic clasts of acid volcanic/tuffaceous rock.

Guidance can be obtained from the 2015 joint publication of the *Cement and Concrete Association of Australia* and *Standards Australia*, entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*.

Free Silica Content

The free silica content is about 94%.

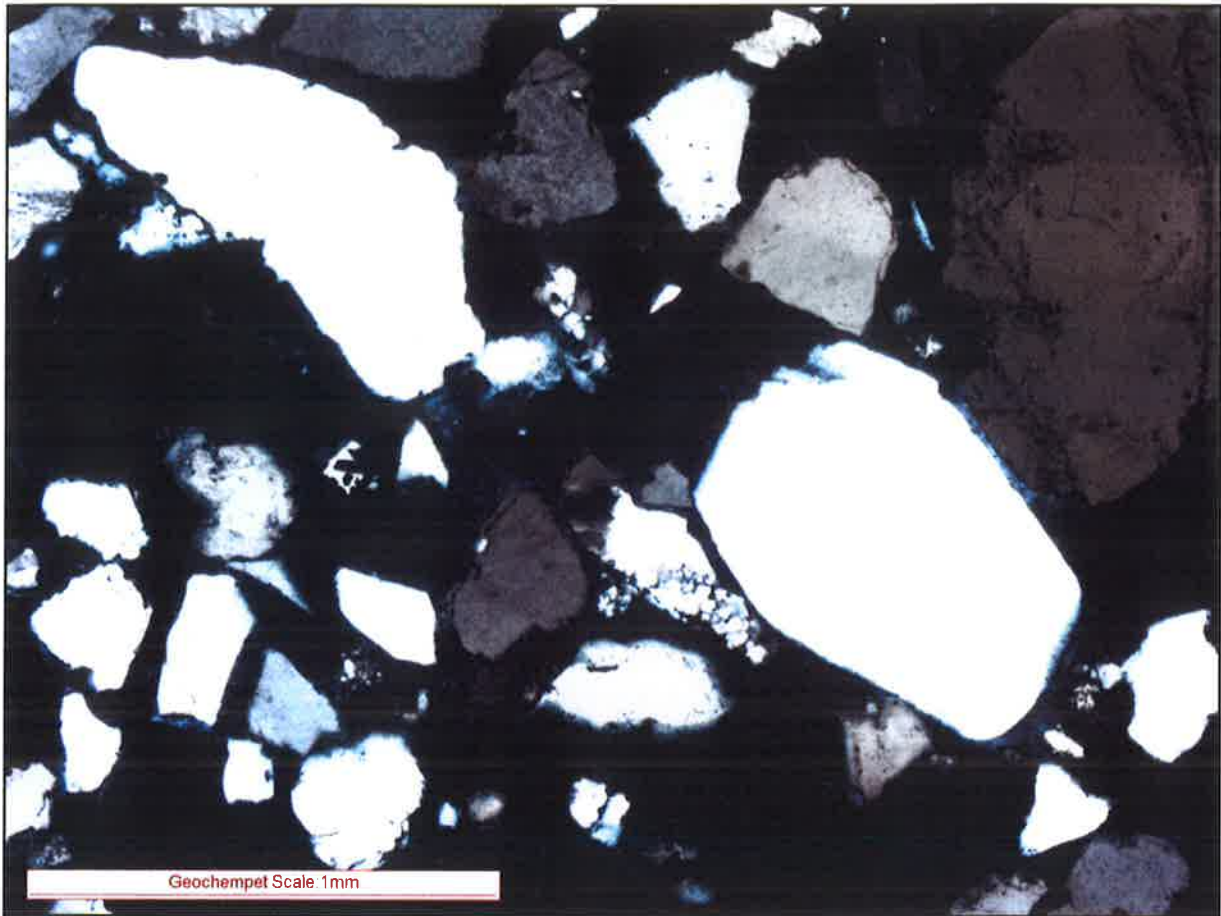


Figure 4: Micrograph of supplied sand sample 210014, taken at low magnification under transmitted cross polarised light. Image shows a typical view of the sample, dominated by sub-angular to sub-rounded quartz showing a range of straining extinctions, along with minor lithic clasts of quartzite.