
**Boral Construction Materials
Materials Technical Services**

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 Baulkham Hills NSW 2153 Australia
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TEST REPORT

CLIENT: P.F. FORMATION

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand ex Maroota for 2019

TEST PROCEDURE: i) AS1141 – Methods for Sampling and Testing Aggregates FILE No: 250/19

ii) RMS - Materials Test Methods Vol. 1 REQUEST No: 83721

 iii) ASTM 7428-15, 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:		Fine Washed Sand	
Location:		Maroota Quarry	
Laboratory Sample No:		219144	
Date Sampled:		11.4.19	
Test Method:	Test:	Spec	Results:
*AS1141.11.1	% Passing A.S. Sieve		
	9.5mm	100**	
	6.7 mm	-	
	4.75 mm	90-100	100
	2.36 mm	60-100	98
	1.18 mm	30-100	94
	600 micron	15-100	81
	425 micron	-	58
	300 micron	5-50	34
	150 micron	0-20	8
AS1141.12	Material finer than 75 micron (%)	0-5	2
AS1141.5	Particle Density (DRY) (t/m ³)	Min 2.1	2.62
	Particle Density (SSD) (t/m ³)		2.63
	Apparent Particle Density (t/m ³)		2.65
	Water Absorption (%)	Max. 2.0	0.4
AS1141.4	Uncompacted Bulk Density (t/m ³)		1.43
	Compacted Bulk Density (t/m ³)	Min 1.2	1.56
AS1141.24	Sodium Sulphate Soundness		
	Total Weighted (% Loss)	Max. 6	1.0
	Fraction tested:		
	1.18mm+600 µm (%Loss)		2.2
	-600 µm +300µm (% Loss)		0.7
AS1141.33	Silt Content (%)		8
AS1141.34	Organic impurities other than sugar The colour assessment was made visually using coloured reference glass	Not darker than std.	Lighter than Std
RMS T262	Moisture Content (%)		5.2

Note: Replacement for Report No: AGG83721.KA.1

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

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

Note: Test results relate only to the samples tested

Page 1 of 2

Kamal Ali

Approved Signatory:

Date 15.11.19

Serial No. AGG83721.KA.1.R1


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 COMPETENCE

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Page 2 of 2

TEST REPORT

CLIENT: P.F. FORMATION

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand ex Maroota for 2019

TEST PROCEDURE: i) AS1141 – Methods for Sampling and Testing Aggregates FILE No: 250/19

ii) RMS - Materials Test Methods Vol. 1

REQUEST No: 83721

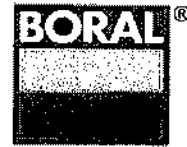
iii) ASTM 7428-15, Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion
in the Micro-Deval ApparatusSPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

Sample Description:			Fine Washed Sand
Location:			Maroota Quarry
Laboratory Sample No:			219144
Date Sampled:			11.4.19
Test Method:	Test:	Spec	Results:
AS1141.25.3	Degradation Factor – Fine Aggregate The wash water after using permitted 500ml was:		35 Clear
RMS T279	Method of Determining Voids Content and Flow Time % of Voids The Mean Flow Time (sec.)		46.5 22.3
ASTM D7428*1	Micro-Deval Abrasion Test % Loss The % loss of the control agg. tested closest to the time at which the sample was tested = 19.3		8.5

Sample Submitted by Client.

*1 Sample tested without preparing standard grading as per ASTM D7428 Clause 8 Note 2

J. Graham, QC File, File



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TEST REPORT

CLIENT: P.F. FORMATION

FILE No: 250/19

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand ex Maroota for 2019


REQUEST No: 83721

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

Sample Description:		Fine Washed Sand
Location:		Maroota Quarry
Laboratory Sample No:		219144
Date Sampled:		11.4.19
Test Method:	Test:	Results:
TEX-402-A	Fineness Modulus of Fine Aggregate	1.85

This report replaces our laboratory report issued on 6th June 2019

Sample submitted by client.

Kamal Ali 
SECTION HEAD – AGGREGATES
15th Nov. 2019

J. Graham, QC File, File



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Method for Determining Voids Content - Flow Time

RMS T279

CLIENT: P.F. FORMATION

FILE NO: 250/198

PROJECT: Quality Control - Annual Full Test of Fine Washed Sand ex Marootafor 2019

LAB SAMPLE NO: 219144

REQUEST: 83721

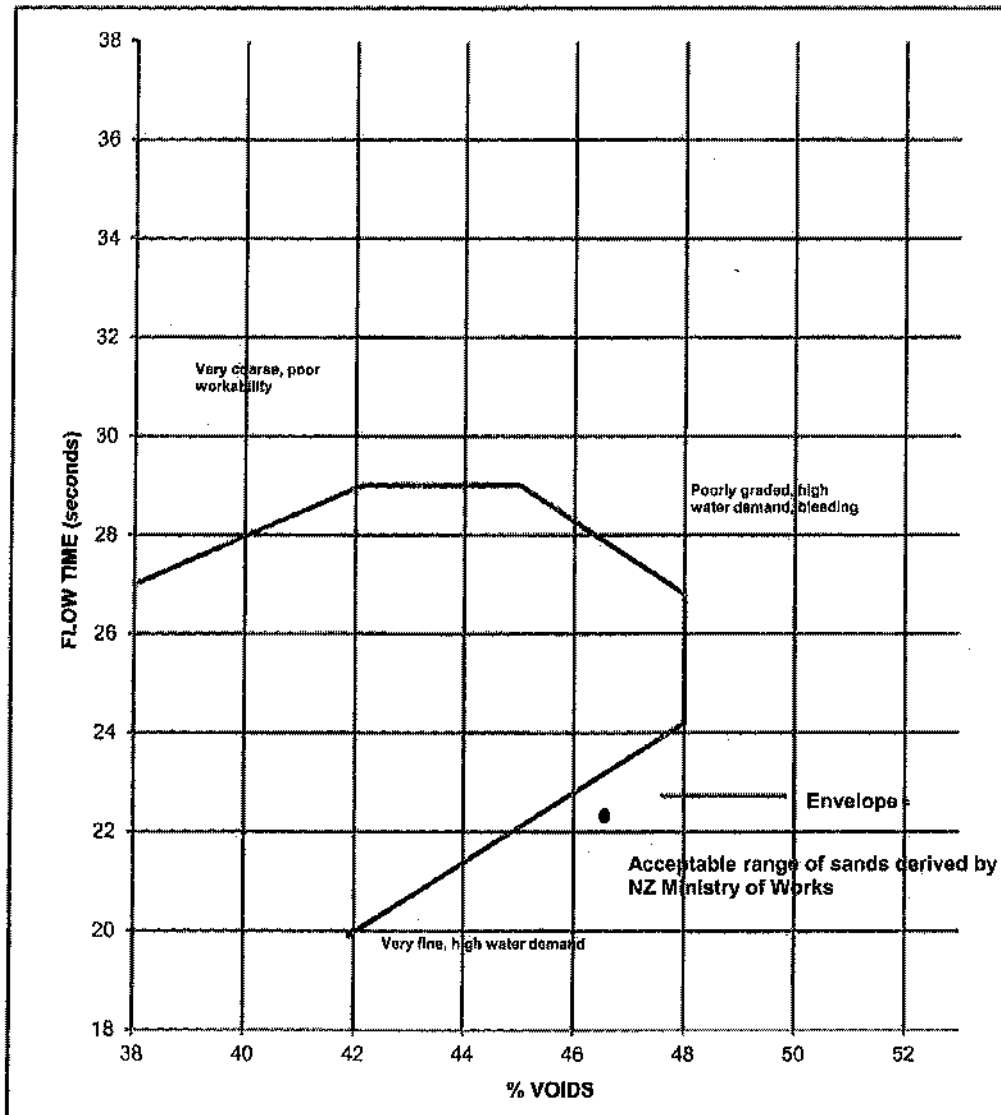
SPECIFICATION: ITP P.F. Fine Sand -10AFQ01- Quarry: Maroota - Date: 19/09/2017

TEST METHOD: RMS - Materials Test Methods Vol.1


LOCATION : Maroota Quarry

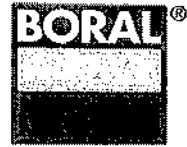
SAMPLE DESCRIPTION: Fine Washed Sand

DATE SAMPLED: 11.4.19



Material sampled by client.

Kamal Ali 
SECTION HEAD - AGGREGATES
6th June 2019
J. Graham, QC File, File



Ref: 2019 219144 Fine Washed Sand Maroota Sand Equivalent AS PI - AFT

Page 1 of 1

Report Template Rev 0 Jan 09 Authorised by A. Mendoza

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TEST REPORT

CLIENT: P. F. FORMATION
PROJECT: Quality Control - Annual Full Test - 2019
MATERIAL: Fine Washed Sand from Maroota Quarry

FILE No: 250/19
REQUEST No: 83721
DATE RECEIVED: 12.4.19
DATE SAMPLED: 11.4.19
DATE TESTED: 23.4.19 to 24.4.19

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. 219144
Sand Equivalent	70
Temperature of test solution (°C)	22

AS1289 - Soil Classification Tests	Results
Determination of the Liquid Limit, Plastic Limit and Plasticity Index	Field Sample No. 1 Laboratory Sample No. 219144
AS1289.3.1.1 - Liquid Limit (%)	N/A*
AS1289.3.2.1 - Plastic Limit (%)	N/A**
AS1289.3.3.1 - Plasticity Index (%)	NP
Sample history	OD
Preparation method	WS
Method used for moisture content determination	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 22.5.19 Serial No. 181147

Artemio Mendoza

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TEST REPORT

CLIENT: P.F. FORMATION FILE No: 250 / 19
1774 Wisemans Ferry Road Maroota, N.S.W. 2756
PROJECT: Quality Control Annual Full Test of Fine Washed Sand from REQUEST No: 83721
Maroota for 2019.
SPECIFICATION: ITP PF Fine Sand Document – 10AFQ01 for Maroota Quarry – 19.09.2017.

TEST PROCEDURE:

- AS 1141.12 – Material Finer than 75 micron
- AS 1141.13 – Material Finer than 2 micron
- AS 1141.31 – Determination of Light Particles
- AS 1141.35 – Detection of Sugar
- AS 1141.36 – Sulphur in Metallurgical Slag, Crushed Rock or Other Pavement Materials
- AS 1012.20.1 – Determination of Chloride and Sulfate in Hardened Concrete and Aggregates – Nitric Acid Extraction Method
- Tex – 812 – J – Acid Insoluble Residue for Fine Aggregate
- International Slurry Surfacing Association No.145 – Methylene Blue Adsorption Value

Laboratory Sample No.: 203604
Date Sampled: 11.04.18
Sample Description: Fine Washed Sand
Field No.: 1

TEST RESULTS:

		ALLOWABLE LIMITS
Material Finer than 75 micron (µm) (%)	2	0 - 4%
Material Finer than 2 micron (µm) (%)	Not Applicable	Max. 1%
Light Particles (%)	0	Max. 1%
Sugar	Not Detected	Negative
Sulphur as S (%)	0.02	Max. 0.02%
Chloride as Cl ⁻ (%)	0.009	Max. 0.05%
Sulfate as SO ₄ (%)	0.03	Max. 0.2%
Methylene Blue Adsorption value (mg/g)	5.5	
MBV x -75 Micron Calculation +	11	100
Acid Insoluble Residue (%)	100	Min. 60%

Sample submitted by the Client.

+ Note: DFI = (MBV mg/g) X (Material finer than 75µm %)

DFI Calculation is not part of ISSA No: 145 or AS1141.12 and not covered by our laboratory's current scope of accreditation.

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



Approved Signatory _____

KAMAL ALI
FRANK GRIMA

Date 18-6-19 Serial No. 181148

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TEST REPORT

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

FILE No: 250 / 19

PROJECT: Quality Control Annual Full test of Fine Washed Sand ex. Maroota for 2019. REQUEST No: 83721

Specification: ITP PF Fine Sand - 10AFQ01.Quarry:Maroota.Date:19/09/2017

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.: 219144
Date Sampled: 11.04.19
Date Received: 12.04.19
Sample Description: Fine Washed Sand
Maroota Quarry

Field No.: 1

TEST RESULTS:

Chloride as Cl⁻ (Acid) (%) 0.009
Chloride as Cl⁻ (Water) (%) 0.009

.Sample submitted by the Client.
Joshua Graham, Mat .File, File.

Otilia Costache

Approved Signatory 
Date 17-06-2019 Serial No. 181149



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Test Report

Client: P. F. FORMATION **File No:** 250/19
Address: 1774 Wisemans Ferry Road Maroota, NSW 2756 **Req. No:** 83721
Date Received: April 2019 **Date Sampled:** 11/04/2019
Project: Quality Control Annual Full Test of Fine Washed Sand ex Maroota for 2019.
Test Method: Accelerated Mortar Bar Test for AAR Assessment - RMS T363

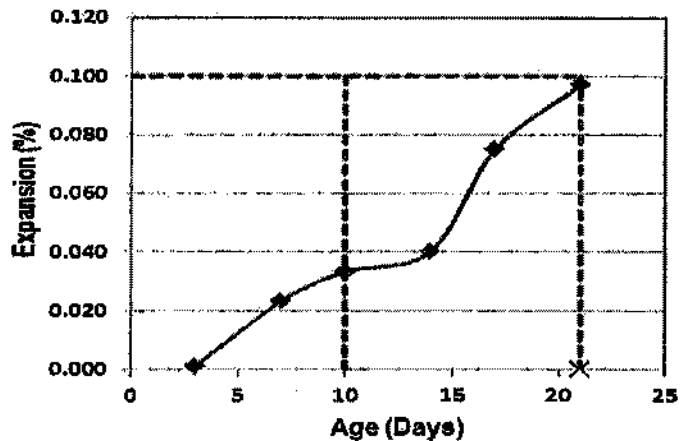
Lab Sample No	Sample Description	Location
219144	Fine Washed Sand	Maroota Quarry
N/A	Boral GP / SL Cement	Berrima

Results:

Flow (%): 8

W/C Ratio: 0.47

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.001
7	0.023
10	0.033
14	0.040
17	0.075
21	0.097



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: Sample submitted by the Client.

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



Approved Signatory Safwan Fawal
 Date 6/06/2019 Serial No. 181150

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Number: 547

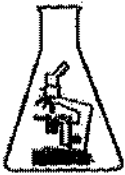


Geochempet Services

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 FINE WASHED SAND SAMPLE (219144) FROM MAROOTA QUARRY

prepared for

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

Purchase Order: 6061496
Invoice Number: 00008733
Client Ref: Kamal Ali

Issued by

H.M. Spring BSc
20 May 2019

MAY, 2019

Bo190513

Page 1 of 6

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Sample Number: 219144 **Date Sampled:** 11/04/19
Product Type: Fine Washed Sand **Date Supplied:** 12/04/19
Sample Source: Maroota Quarry **Date Received:** 01/05/19
Location: P.F. Formation
Work Requested Petrographic analysis in relation to suitability for use as concrete sand and as a fine component in asphalt

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 Medium to fine quartz sand

Description

The sample consisted of about 0.5 kg of very light yellowish-grey, clean sand, composed of water-worn, sub-rounded and sub-angular quartz grains and minor lithic fragments.

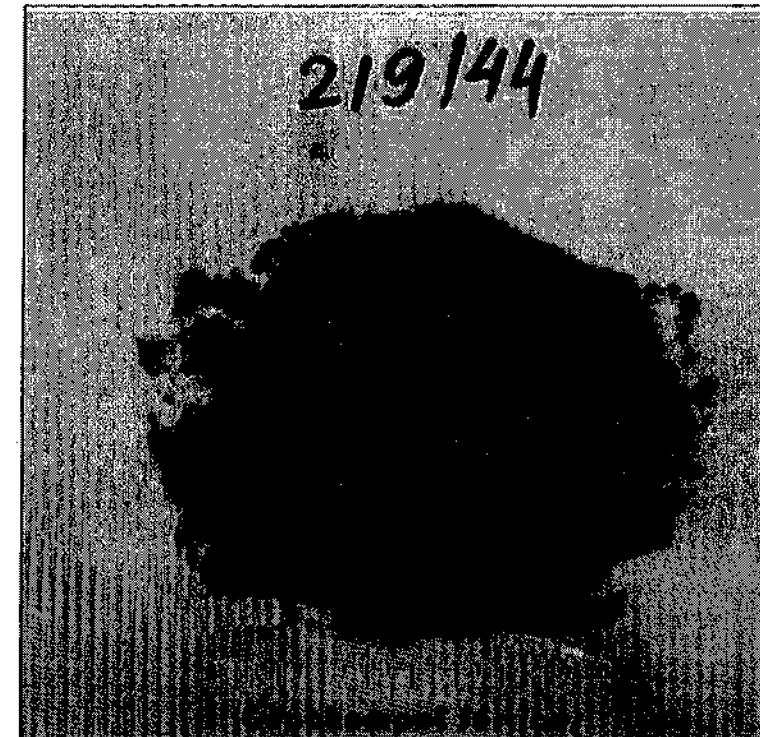


Figure 1: Digital image of sub-sample from supplied sample 19144

MAY, 2019

Bo190513

Page 2 of 6

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GEOCHEMPET SERVICES, BRISBANE

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

Sieve Size	Wt % of sample
Coarse (>1.18mm)	6.0%
Medium (>0.3mm)	68.2%
Fine (>0.075mm)	25.3%
Silt (<0.075mm)	0.5%

The coarse fraction consists of quartz grains and minor lithic fragments of quartzite and sandstone clasts which are difficult to break by hand. There are no apparent deleterious grain coatings.

When a subsample was swirled in water, a very light grey persistent turbidity with minor argillized scum was noted, suggesting the presence of minor silt and clay in the sample.

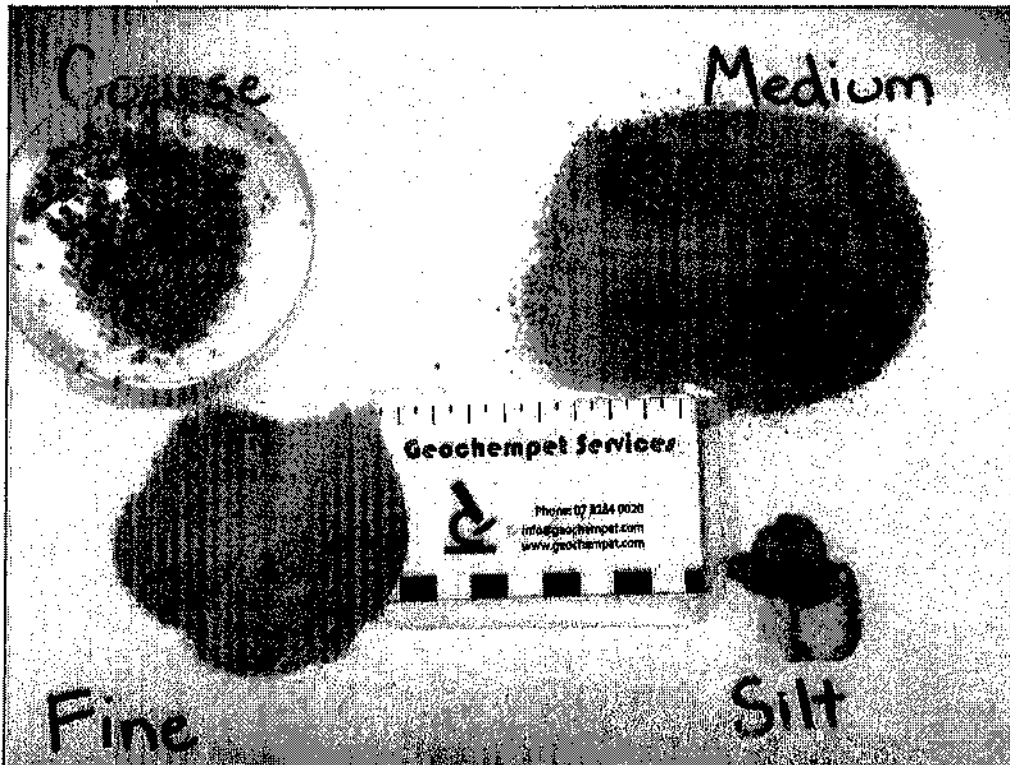


Figure 2: Digital image of sieve fractions as recorded above.

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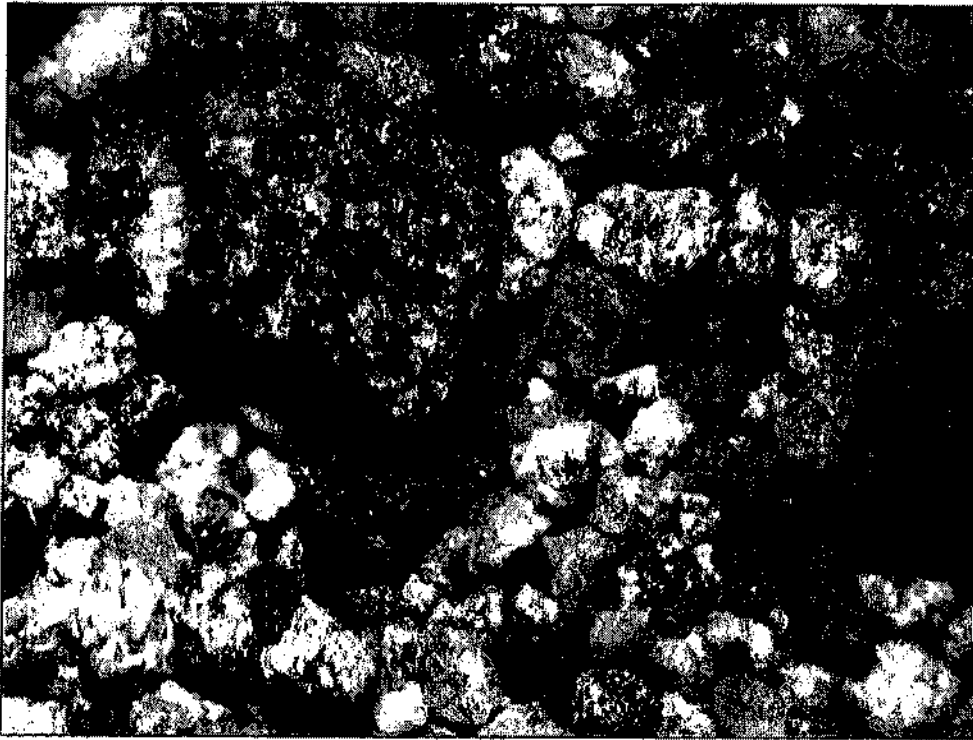


Figure 3: Digital image of coarse sieve fraction as recorded above.

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:

- 62% quartz as single, free, unstrained to mildly strained grains (48%) or as simple composite crystalline aggregates of quartz grains (14%)
- 21% quartz as moderately strained single or more commonly crystalline composite grains
- 2% quartzite (52% moderately strained)
- <1% feldspar grains (orthoclase)
- 1% heavy mineral grains (including epidote, zircon, haematite/goethite, hornblende and opaque oxide)
- <1% free mica flakes
- 2% lithic clasts of acid volcanics (<1% microcrystalline quartz)
- 11% lithic clasts of quartz sandstone (9% quartz; 2% moderately strained)
- <1% lithic clasts of intermediate volcanics
- <1% lithic clasts of meta-pelite/slate
- <1% ferruginous fragments
- <1% sericitized fragments
- 1% clay coating on free quartz grains

The free silica content (or total quartz plus chert content) of the sand is 94% comprised of 83% free quartz grains or simple crystalline composite grains, and 11% quartz locked within lithic fragments of quartzite, and arenite and < 1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

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In thin section, the sand is seen to consist very largely of quartz, comprising 48% quartz as single, free, unstrained to mildly strained grains, 14% quartz as simple composite crystalline aggregates of quartz grains, and 21% quartz as moderately strained single or crystalline composite grains. The grains are confirmed to carry some clay trapped in surface indents, but the amount is small (apparently 1%). Other siliceous fragments include 2% quartzite.

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

Lithic clasts amount to 13% of the sample and consist of 2% acid volcanic/tuffaceous fragments (<1% finely crystalline quartz in groundmass), 11% quartz sandstone (consisting of quartz and subordinate feldspars suspended in a clay matrix), <1% intermediate volcanics and a further <1% meta-pelite/slate.

Ferruginous fragments (probably after feldspars) amounts to about <1% of the sand sample. Sericitized clasts amounted to <1% along with a trace of plant rootlets.

Comments and Interpretations

The supplied fine washed sand sample (labelled 219114) from the Maroota Quarry is considered to be fairly clean quartz sand which may be described broadly for engineering purposes as medium to fine quartz sand.

The **free silica content** (or **total quartz content**) of the sand is **about 94%** comprised of 83% free quartz grains or simple crystalline composite grains, and 11% quartz locked within lithic fragments of quartzite, and arenite 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**. It does carry some hard to remove clay coatings and clay-cemented arenite grains which may contribute to water demand.

The sand as a whole is predicted to have **potential for mild or slow deleterious alkali-silica reactivity in concrete**. It carries about 25% 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*.

In short, sand equivalent to the supplied sample is predicted to be **suitable for use as a fine component in asphalt**.

Free Silica Content

The free silica content is about 94%.

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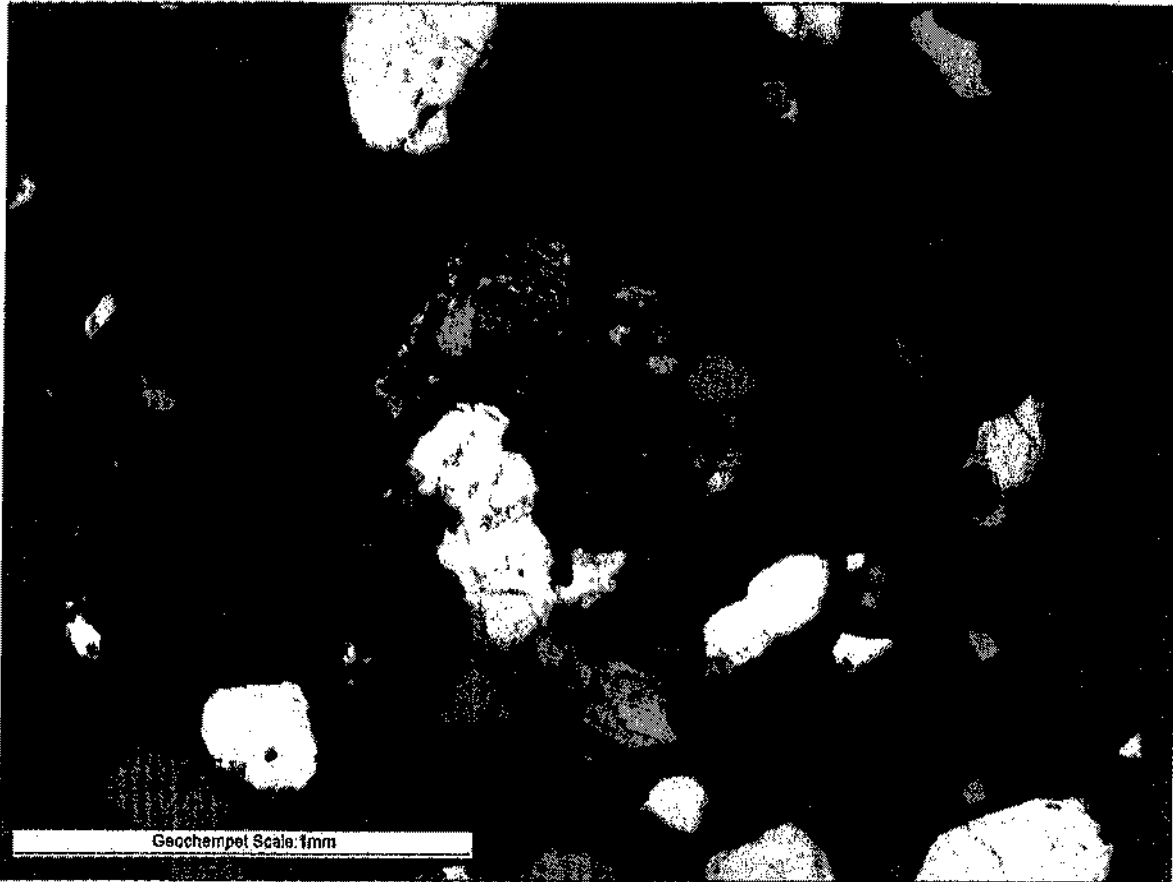


Figure 4: Microscopic image of supplied sand sample, taken at low magnification under transmitted cross polarised light. Image shows a typical view of the sample, dominated by sub-rounded quartz showing a range of extinctions, along with arenite fragments.