

**Boral Construction Materials
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TEST REPORT

CLIENT: P.F. FORMATION

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand ex Maroota for 2020

TEST PROCEDURE: i) AS1141 – Methods for Sampling and Testing Aggregates FILE No: 250/20

ii) RMS - Materials Test Methods Vol. 1 REQUEST No: 89386

iii) ASTM 7428-15, Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion
in the Micro-Deval Apparatus DATE TESTED: 9.5.20 to 29.5.20SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

Sample Description:		Fine Washed Sand	
Location:		Maroota Quarry	
Date Sampled:		13.4.20	
Date Received:		15.5.20	
Laboratory Sample No:		239739	
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	87
	425 micron	-	71
	300 micron	5-50	32
	150 micron	0-20	5
AS1141.12	Material finer than 75 micron (%)	0-5	1
AS1141.4	Uncompacted Bulk Density (t/m ³)		1.39
	Compacted Bulk Density (t/m ³)	Min 1.2	1.52
RMS T262	Moisture Content (%)		6.7
AS1141.5	Particle Density (DRY) (t/m ³)	Min 2.1	2.59
	Particle Density (SSD) (t/m ³)		2.60
	Apparent Particle Density (t/m ³)		2.63
	Water Absorption (%)	Max. 2.0	0.6
AS1141.24	Sodium Sulphate Soundness		
	Total Weighted (% Loss)	Max. 6	1.3
	Fraction tested:		
	1.18mm+600 µm (%Loss)		6.2
	-600 µm +300µm (% Loss)		0.7
AS1141.33	Silt Content (%)		4
AS1141.34	Organic impurities other than sugar	Not darker than	Lighter than Std
	The colour assessment was made visually using coloured reference glass	std.	

Note: Replacement for Report No: AGG89386.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



Approved Signatory  Kamal Ali
Date 9.7.20 Serial No. AGG89386.KA.1.R1

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Number: 547

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TEST REPORT

FILE No: 250/20

CLIENT: P.F. FORMATION

REQUEST NO: 89386

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand ex Maroota for 2020

DATE TESTED: 2.6.20

TEST PROCEDURE: Texas Highway Department – Materials and Tests Division – TEX.402-A, Rev. Sept. 2014

Sample Description:		Fine Washed Sand
Location:		Maroota Quarry
Date Sampled:		13.4.20
Date Received:		15.5.20
Laboratory Sample No:		239739
Test Method:	Test:	Results:
TEX-402-A	Fineness Modulus of Fine Aggregate	1.84

Sample submitted by client.

Kamal Ali 
SECTION HEAD – AGGREGATES
10th June 2020

J. Graham, QC File, File



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TEST REPORT

CLIENT: P.F. FORMATION

FILE No: 250/20

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand ex Maroota for 2020

REQUEST No: 89386

TEST PROCEDURE: AASHTO T 304 – Uncompacted Void Content of Fine Agg. (Method A) DATE TESTED: 2.6.20

Sample Identification	Field Sample Number	Laboratory Sample Number	Bulk Dry Specific Gravity (t/m ³)	Uncompacted Voids Content (%)
Fine Washed Sand ex Maroota Quarry Sampled- 13.4.20 Received- 15.5.20	1	239739	2.59	47.3

Material sampled by client

J. Graham, QC File, File

Kamal Ali



Approved Signatory

Date 10.6.20

Serial No. AGG89386.KA.2

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Method for Determining Voids Content - Flow Time

RMS T279

CLIENT: P.F. FORMATION

FILE NO: 250/20

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand ex Maroota for 2020

LAB SAMPLE NO: 239739

REQUEST: 89386

SPECIFICATION: AS2758.1- Concrete Agg. – Date: 7th Nov. 2014

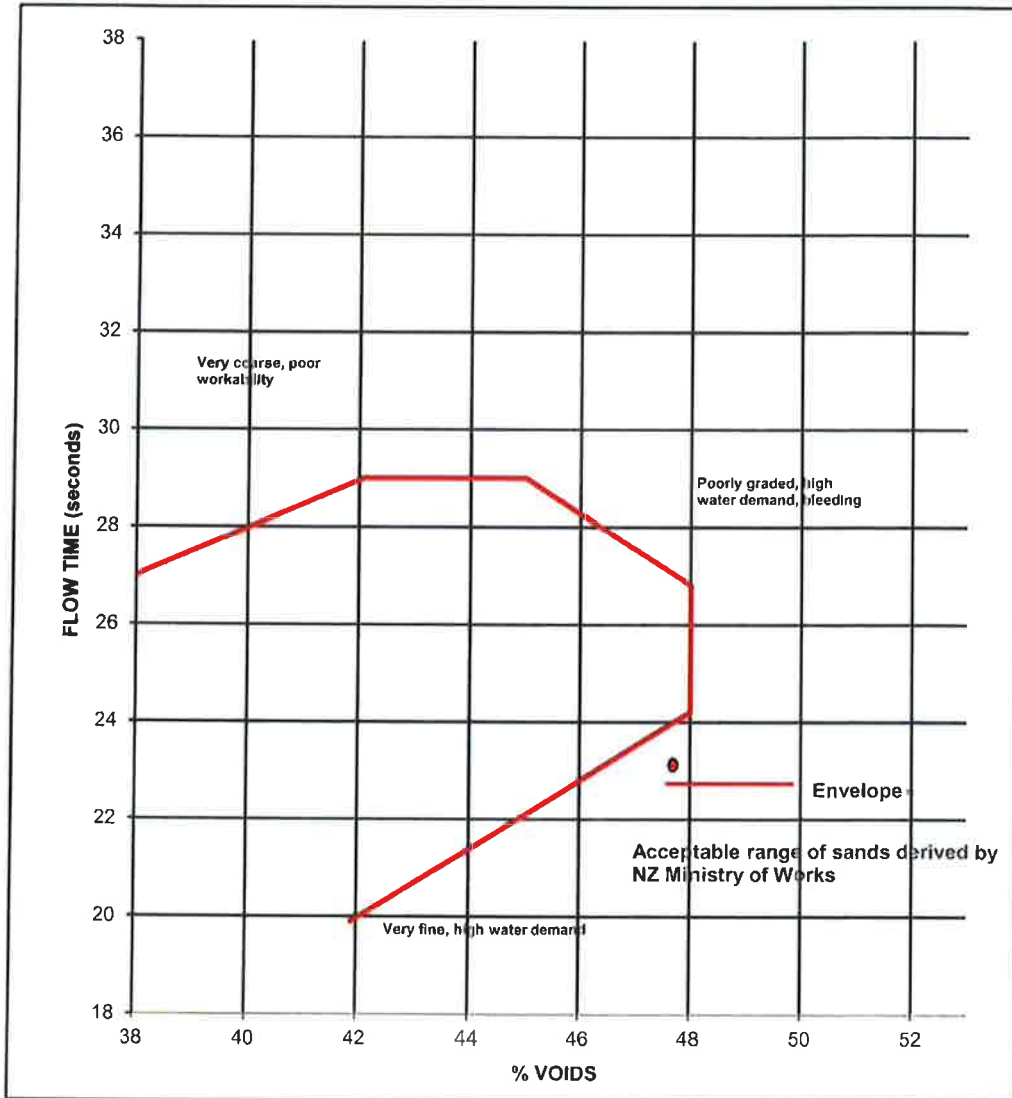
LOCATION : Maroota Quarry

TEST METHOD: RMS – Materials Test Methods Vol.1


DATE SAMPLED: 13.4.20

SAMPLE DESCRIPTION: Fine Washed Sand

DATE TESTED: 25.5.20



Material sampled by client.

Kamal Ali 
SECTION HEAD – AGGREGATES
10th June 2020
J. Graham, QC File, File



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TEST REPORT

CLIENT: P. F. FORMATION
 PROJECT: Quality Control - Annual Full Test - 2020
 MATERIAL: Fine Washed Sand from Maroota Quarry

FILE No: 250/20
 REQUEST No: 89386
 DATE RECEIVED: 15.5.20
 DATE SAMPLED: 13.4.20
 DATE TESTED: 15.5.20 to 22.5.20

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. 239739
Sand Equivalent	80
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. 239739
AS1289.3.1.1 - Liquid Limit (%) AS1289.3.2.1 - Plastic Limit (%) AS1289.3.3.1 - Plasticity Index (%)	N/A* N/A** NP
Sample history Preparation method Method used for moisture content determination	OD WS 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  Artemio Mendoza
 Date 22.5.20 Serial No. SOJL89386.AM.1

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TEST REPORT

CLIENT: P.F. Formation
1774 Wisemans Ferry Road Maroota NSW 2756
PROJECT: Quality Control Annual Full Test of Fine Washed Sand ex. Maroota for 2020.

FILE No: 250 / 20

REQUEST No: 89386

TEST PROCEDURE:

- AS 1141.12 – Percent Passing 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 – 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.:	239739
Date Sampled:	13.04.20
Date Received:	15.05.20
Date Tested:	21 st May to the 9 th June 2020
Sample Description:	Fine Washed Sand
Field No.:	1

TEST RESULTS:

Percent Passing 75micron (µm) (%)	1
Material Finer than 2 micron (µm) (%)	Not Applicable
Light Particles (%)	0
Sugar	Not Detected
Sulfur as S (%)	< 0.02
Methylene Blue Adsorption value (mg/g)	3
Methylene Blue Adsorption value for a Duplicate (mg/g)	3
Average Methylene Blue Adsorption value (mg/g)	3
Organic Matter (%)	0.1
pH (AS)	9.9
pH (RMS)	9.8
Soluble Salts (%)	< 0.3 (Free from Soluble Salts)

Sample submitted by the Client.

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



Approved Signatory

KAMAL ALI
FRANK GRIMA

Date 11-6-2020 Serial No. CHEM89386.FG.1

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TEST REPORT

CLIENT: P.F. FORMATION
1774 Wisemans Ferry Road Maroota, N.S.W. 2756

FILE No: 250 / 20

PROJECT: Quality Control Annual Full Test of Fine Washed Sand from
Maroota for 2020.

REQUEST No: 89386

TEST PROCEDURE:

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

AS 1012.20.2 – Water Soluble Chloride in Hardened Concrete and Aggregates

Laboratory Sample No.:	239739
Date Sampled:	13.04.20
Date Received:	15.05.20
Date Tested:	3.06.20 to 9.06.20
Sample Description:	Fine Washed Sand

Field No.: 1

TEST RESULTS:

Chloride as Cl ⁻ (%)	0.002
Sulfate as SO ₃ (%)	0.03
Water Soluble Chloride as Cl ⁻ (%)	0.002

Sample submitted by the Client.

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



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Approved Signatory Frank Grima

FRANK GRIMA

Date 11-6-2020 Serial No. CHEM89386.F.G.2

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TEST REPORT

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

FILE No: 250 / 20

PROJECT: Quality Control Annual Full Test of Fine Washed Sand ex. Maroota for
2020 to AS 2758.1 Specification.

REQUEST No: 89386

TEST METHOD:

AS 2350.2 Clause 5.5 - Loss on Ignition (Modified)

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

International Slurry Surfacing Association No. 145 – Methylene blue Adsorption Value

Laboratory Sample No.:	239739
Date Sampled:	13.04.20
Sample Description:	Fine Washed Sand
Field No.:	1

TEST RESULTS:

CO ₂ by Loss on Ignition (%)	0.1
Calcium Carbonate as CaCO ₃ (%)	0.1
Acid Insoluble Residue (%)	96
Methylene Blue Adsorbed (mg/g)	2.5

Sample submitted by the Client.

Note: Test results in this test report relate only to the samples tested.

Otilia Costache

28.05.2020

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



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TEST REPORT

CLIENT: P.F. FORMATION

FILE No: 250/20

PROJECT: Quality Control Annual Full Test of Fine Washed Sand ex Maroota for 2020. REQUEST No: 89386

TEST PROCEDURE: Boral In House Method 7 – Based on AS2350.2 using XRF.

Laboratory Sample No.: 239739
Date Sampled: 13/04/20
Date Received: 15/05/20
Date Tested: 26/05/20
Sample Description: Fine Washed
Sand
Field No.: 1

TEST RESULTS

Silicon as SiO₂ (%) 95.2

Note:

- Sample submitted by the Client.
- Test results relate only to the sample tested
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A handwritten signature in black ink, appearing to read "Nanthini Selvadurai".

Nanthini Selvadurai

Analytical Chemist

09th June 2020.

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



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Test Report

Client: P.F. FORMATION
Address: 1774 Wisemans Ferry Road Maroota, NSW 2756
Date Received: April 2020
Project: Quality Control Annual Full Test of Fine Washed Sand ex Maroota for 2020.
Test Method: Accelerated Mortar Bar Test for AAR Assessment - RMS T363

File No: 250/20
Req. No: 89386
Date Sampled: 13/04/2020

Lab Sample No	Sample Description	Location
239739	Fine Washed Sand	Maroota Quarry
N/A	Boral GP / SL Cement	Berrima

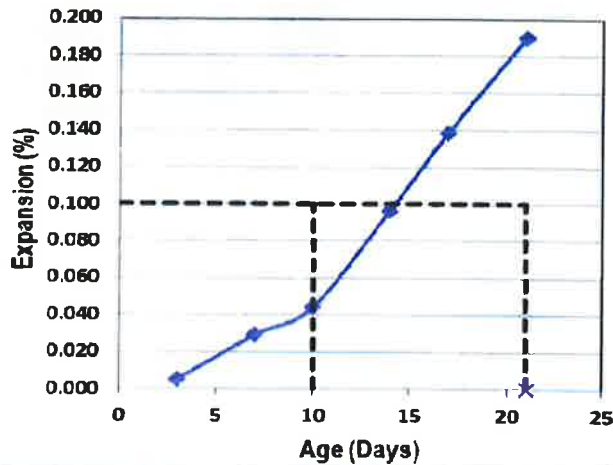
Results:

Flow (%): 10

W/C Ratio: 0.46

Date Mixed: 26/05/2020

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.005
7	0.029
10	0.044
14	0.096
17	0.138
21	0.190



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 22/06/2020 Serial No. CEM89386.SF.1

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ABN 25 065 630 506

PETROGRAPHIC, GEOLOGICAL & GEOCHEMICAL CONSULTANTS

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PETROGRAPHIC REPORT ON A FINE WASHED SAND SAMPLE (239739) FROM MAROOTA QUARRY

prepared for

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

Purchase Order: 6226213
Invoice Number: G2006519
Client Ref: Kamal Ali

Issued by


H.M. Spring BSc
12 June 2020

June, 2020

Bo200604

Page 1 of 6

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GEOCHEMPET SERVICES, BRISBANE

Sample Number: 239739 **Date Sampled:** 13/4/20
Product Type: Fine Washed Sand **Date Supplied:** 15/05/20
Sample Source: Maroota Quarry **Date Received:** 25/05/20
Client: 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 quartz and lithic 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 239739

GEOCHEMPET SERVICES, BRISBANE

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

Sieve Size	Wt % of sample
Coarse (>1.18mm)	7.1%
Medium (>0.3mm)	75.2%
Fine (>0.075mm)	17.5%
Silt (<0.075mm)	0.2%

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.

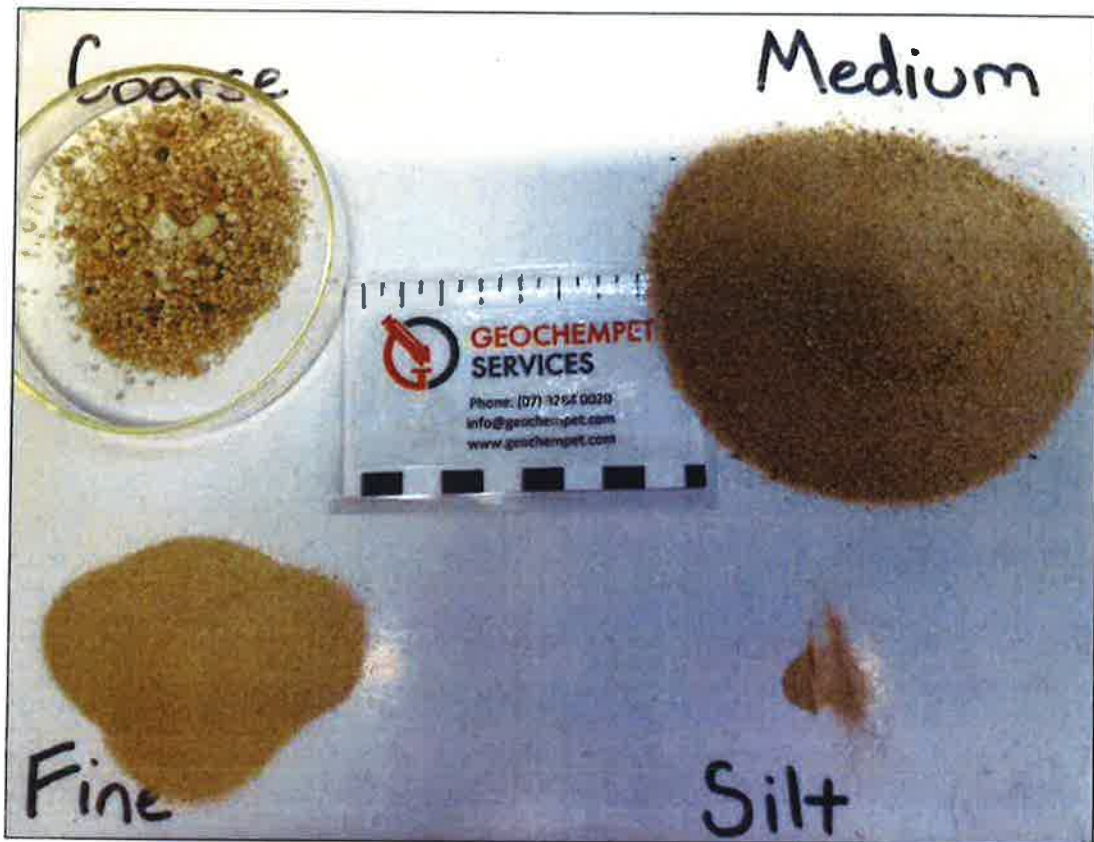


Figure 2: Digital image of sieve fractions as recorded above, note the sandstone fragments in the coarse fraction.

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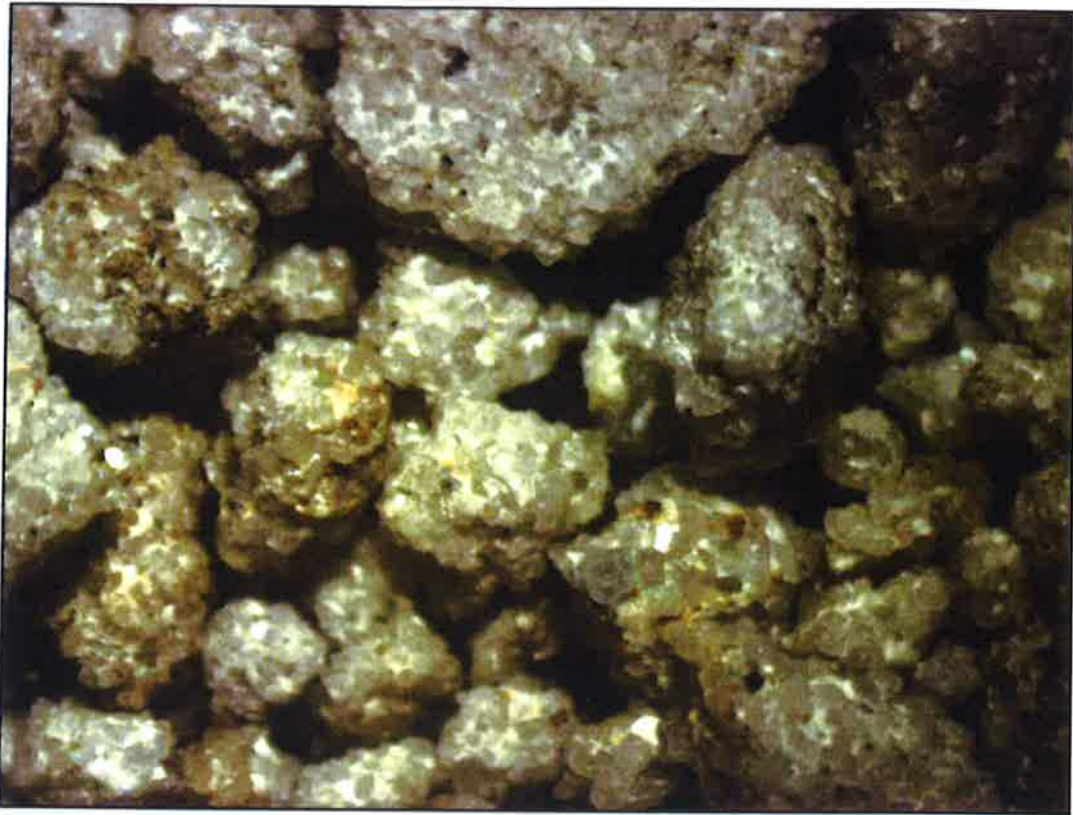


Figure 3: Digital image of coarse sieve fraction as recorded above, note the clay trapped in surface dents.

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:

- 56% quartz as single, free, unstrained to mildly strained grains (45%) or as simple composite crystalline aggregates of quartz grains (11%)
- 21% quartz as moderately strained single or more commonly crystalline composite grains
- 2% quartzite (2% moderately strained)
- <1% feldspar grains (orthoclase)
- <1% heavy mineral grains (including epidote, zircon, haematite/goethite, hornblende and opaque oxide)
- 2% free grains of epidote
- 1% free mica flakes
- <1% lithic clasts of acid volcanics (<1% microcrystalline quartz)
- 17% lithic clasts of quartz sandstone (12% quartz; 5% 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

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The free silica content (or total quartz plus chert content) of the sand is 91% comprised of 77% free quartz grains or simple crystalline composite grains, and 14% quartz locked within lithic fragments of quartzite, and arenite and < 1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

In thin section, the sand is seen to consist very largely of quartz, comprising 45% quartz as single, free, unstrained to mildly strained grains, 11% 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 less than 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 less than 1%, comprising zircon, haematite/goethite, hornblende and opaque oxide. Free grains of 2% epidote and 1% free mica

Lithic clasts amount for quartz sandstone (consisting of quartz and subordinate feldspars suspended in a clay matrix) amount to 17%, <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 239739) from the Maroota Quarry is considered to be fairly clean quartz sand which may be described broadly for engineering purposes as medium quartz and lithic sand.

The **free silica content (or total quartz content)** of the sand is **about 91%** comprised of 77% free quartz grains or simple crystalline composite grains, and 14% 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.**

The sand as a whole is predicted to have **potential for mild or slow deleterious alkali-silica reactivity in concrete.** It carries about 28% 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 91%.

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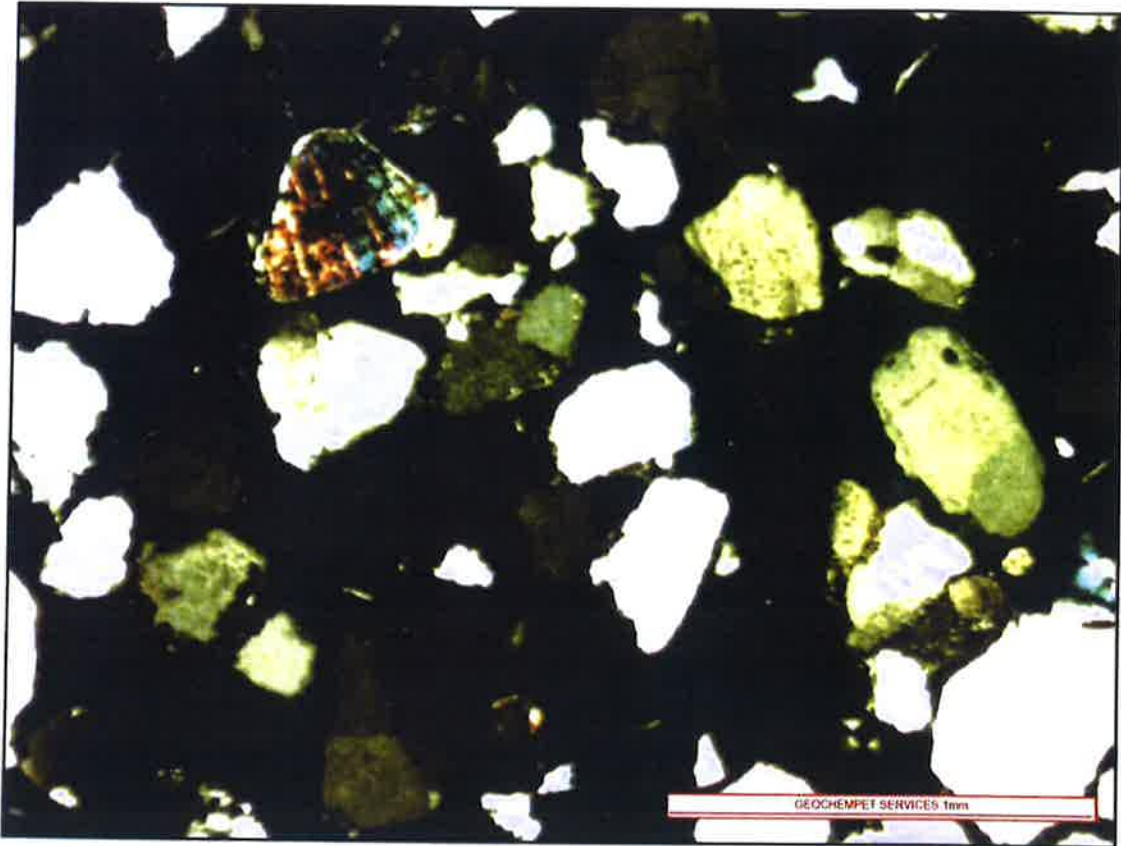


Figure 4: Microscopic image of supplied sand sample, taken at low magnification under transmitted cross polarised light. Image shows a typical view of the sample, dominated by sub-rounded quartz showing a range of extinctions, along with arenite fragments. Note the large epidote fragment in the upper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