



**Boral Construction Materials  
Materials Technical Services**

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**NOTIFICATION OF N.A.T.A TEST REPORT REPLACEMENT**

CLIENT: P.F. FORMATION

FILE NO: 250/17

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand for 2017

REPORT NO. OF REPORT BEING REPLACED: 158527

NEW REPORT NO: 158892

REASON FOR REPLACEMENT: Transcription error with results

SIGNATURE:

A handwritten signature in black ink, appearing to be a stylized name.

DATE:

7.7.17


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**TEST REPORT**

CLIENT: P.F. FORMATION

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand for 2017

TEST PROCEDURE: i) AS1141 – Methods for Sampling and Testing Aggregates

ii) RMS - Materials Test Methods Vol. 1

iii) ASTM 7428-15, Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

FILE No: 250/17

REQUEST No: 72761

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7<sup>th</sup> November 2014

Sample Description:		Fine Washed Sand	
Location:		Maroota Quarry	
Laboratory Sample No:		191351	
Date Sampled:		27.4.17	
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	99
	1.18 mm	30-100	96
	600 micron	15-100	86
	425 micron	-	67
	300 micron	5-50	40
	150 micron	0-20	9
AS1141.12	Material finer than 75 micron (%)	0-5	2
AS1141.5	Particle Density (DRY) (t/m <sup>3</sup> )	Min 2.1	2.57
	Particle Density (SSD) (t/m <sup>3</sup> )		2.60
	Apparent Particle Density (t/m <sup>3</sup> )		2.64
	Water Absorption (%)	Max. 2.0	1.0
AS1141.4	Uncompacted Bulk Density (t/m <sup>3</sup> )		1.45
	Compacted Bulk Density (t/m <sup>3</sup> )	Min 1.2	1.58
AS1141.24	Sodium Sulphate Soundness		
	Total Weighted (% Loss)	Max. 6	1.5
	Fraction tested:		
	1.18mm+600 µm (%Loss)		2.0
	-600 µm +300µm (% Loss)		1.4
AS1141.33	Silt Content (%)		8
AS1141.34	Organic impurities other than sugar	Not darker than std.	Pass
	The colour assessment was made visually using coloured reference glass		
RMS T262	Moisture Content (%)		7.5

**Note: Replacement for Report No: 158527.**

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

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

Page 1 of 2



Approved Signatory

Kamal Ali

Date

7.7.17

Serial No.

158892

Accredited for compliance with ISO/IEC 17025

NATA Accredited Laboratory

Number: 547


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**TEST REPORT**

CLIENT: P.F. FORMATION

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand for 2017 FILE No: 250/17

TEST PROCEDURE: i) AS1141 – Methods for Sampling and Testing Aggregates REQUEST No: 72761

ii) RMS - Materials Test Methods Vol. 1

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: 7<sup>th</sup> November 2014

Sample Description:			Fine Washed Sand
Location:			Maroota Quarry
Laboratory Sample No:			191351
Date Sampled:			27.4.17
<b>Test Method:</b>	<b>Test:</b>	<b>Spec</b>	<b>Results:</b>
RMS T279	Method of Determining Voids Content and Flow Time % of Voids The Mean Flow Time (sec.)		46.4 23.5
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 = 19.5		9.3

**Note: Replacement for Report No: 158527.**

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: 250/17

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand for 2017

REQUEST No: 72761

TEST PROCEDURE: Texas Highway Department – Materials and Tests Division – TEX.402-A, Rev. Sept. 1966

Sample Description:		Fine Washed Sand
Location:		Maroota Quarry
Laboratory Sample No:		191351
Date Sampled:		27.4.17
<b>Test Method:</b>	<b>Test:</b>	<b>Results:</b>
TEX-402-A	Fineness Modulus of Fine Aggregate	2.01

Sample submitted by client.

  
Kamal Ali  
SECTION HEAD – AGGREGATES  
10<sup>th</sup> June 2017

J. Graham, QC File, File



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**Method for Determining Voids Content - Flow Time**  
**RMS T279, Oct. 2012**

CLIENT: P.F. FORMATION

FILE NO: 250/17

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand for 2017

LAB SAMPLE NO: 191351

REQUEST: 72761

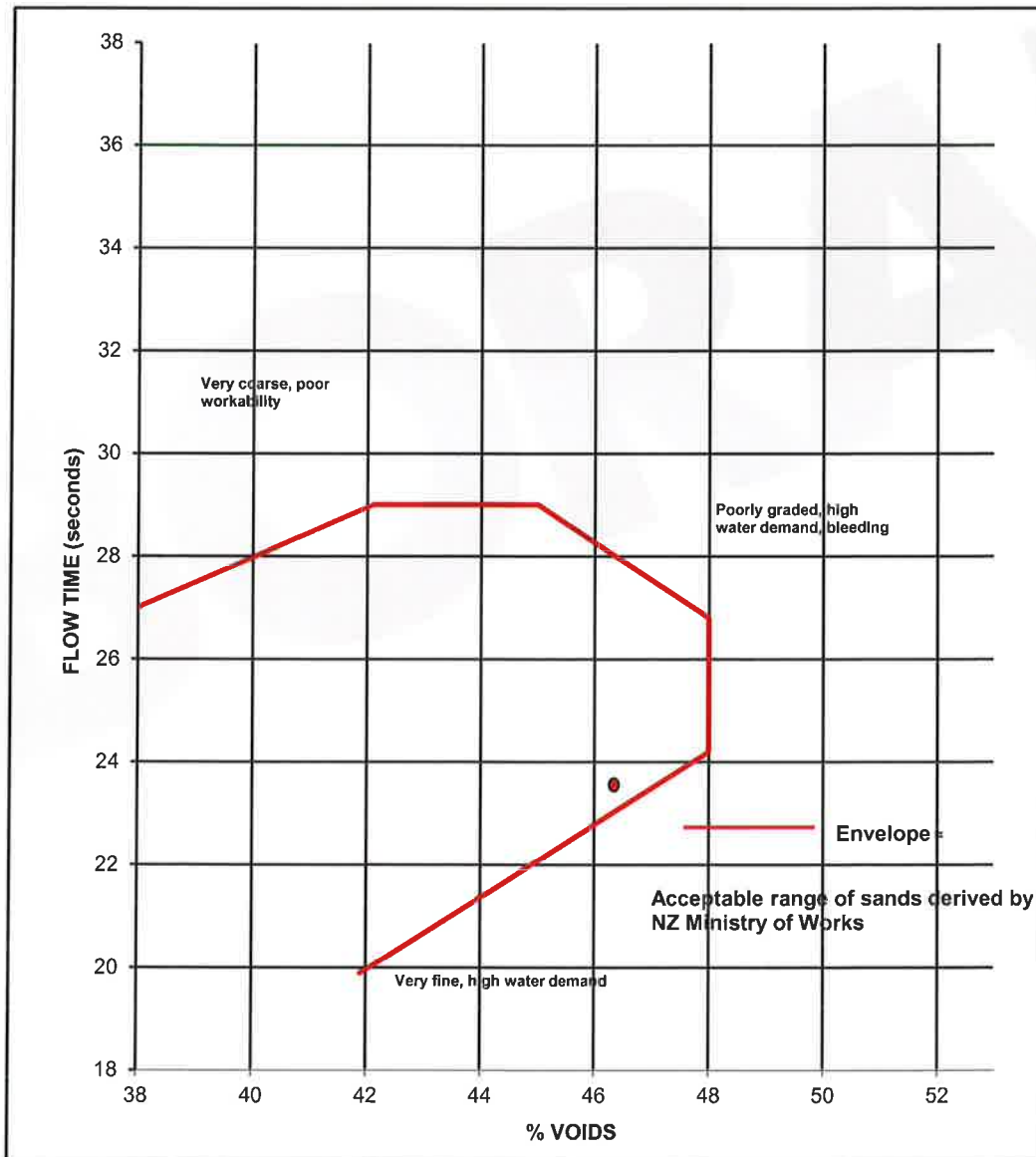
SPECIFICATION: AS2758.1- Concrete Agg. – Date: 7th Nov. 2014

LOCATION : Maroota Quarry

TEST METHOD: RMS – Materials Test Methods Vol.1

DATE SAMPLED: 27.4.17

SAMPLE DESCRIPTION: Fine Washed Sand



Material sampled by client.

Kamal Ali   
SECTION HEAD – AGGREGATES

5<sup>th</sup> June 2017

J. Graham, QC File, File



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**TEST REPORT**

CLIENT: P.F. FORMATION

FILE No: 250/17

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand for 2017

REQUEST No: 72761

TEST PROCEDURE: AASHTO T 304 – Uncompacted Void Content of Fine Aggregate (Method A)

Sample Identification	Field Sample Number	Laboratory Sample Number	Bulk Dry Specific Gravity (t/m <sup>3</sup> )	Uncompacted Voids Content (%)
Fine Washed Sand ex Maroota Quarry– 27/4/2017	1	191351	2.57	46.4

Material sampled by client

J. Graham, QC File, File



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COMPETENCE

Approved Signatory

Kamal Ali

Date 5.6.17

Serial No.

158528

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NATA Accredited Laboratory

Number: 547



Ref: 2017 191351 Fine Washed Sand Sand Equivalent RMS PI A.F.T.  
 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 - 2017  
 MATERIAL: Fine Washed Sand from Maroota Quarry

FILE No: 250/17  
 REQUEST No: 72761  
 DATE SAMPLED: 27.4.17  
 DATE TESTED: 4.5.17 to 16.5.17

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. 191351
<b>Sand Equivalent</b>	<b>80</b>
Temperature of test solution (°C)	22

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. 191351
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 31.5.17 Serial No. 158529

**Artemio Mendoza**



**Boral Construction Materials  
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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  
2017 to AS 2758.1 Specification

FILE No.: 250 / 17

REQUEST No.: 72761

**TEST PROCEDURE:**

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

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.:	191351
Date Sampled:	27.04.17
Sample Description:	Fine Washed Sand
Field No.:	1

**TEST RESULTS:**

Chloride as Cl <sup>-</sup> (%)	0.001
Sulfate as SO <sub>3</sub> (%)	0.04
Material Finer than 2 micron (µm) (%)	Not Applicable
Light Particles (%)	Nil
Sugar	Not Detected
Sulfur as S (%)	0.01
Methylene Blue Adsorption value (mg/g)	2
Methylene Blue Adsorption value for a Duplicate (mg/g)	2
Average Methylene Blue Adsorption value (mg/g)	2
Organic Matter (%)	0.1
pH (AS)	5.5
pH (RMS)	5.5
Soluble Salts (%)	< 0.3 (Free from Soluble Salts)

Sample submitted by the Client.

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

Approved Signatory

FRANK GRIMA

Date 30-5-17 Serial No. 158530



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**TEST REPORT**

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

FILE No: 250 / 17

PROJECT: Annual Full Test of Fine Washed Sand from Maroota for 2017.

REQUEST No: 72761

**TEST METHOD:**

AS 2350.2 Clause 5.5 - Loss on Ignition (Modified)

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

Laboratory Sample No.: 191351  
Date Sampled: 27.04.17  
Sample Description: Fine Washed Sand from Maroota  
Quarry,  
Field No.: 1

**TEST RESULTS:**

CO<sub>2</sub> by Loss on Ignition (%) 0.15  
Calcium Carbonate as CaCO<sub>3</sub> (%) 0.33  
Acid Insoluble Residue (%) 100

Sample submitted by the Client.

FRANK GRIMA  
Analytical Chemist  
30<sup>th</sup> May, 2017

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.: 250/17

PROJECT: Quality Control Annual Full Test of Fine Washed sand ex Maroota for 2017.

REQUEST No.:72761

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

Laboratory Sample No.: 191351  
Date Sampled: 27/04/17  
Date Received: 27/04/17  
Sample Description: Fine washed  
sand  
Field No.: 1

**TEST RESULTS**

Silicon as SiO<sub>2</sub> (%) 94.6

Sample submitted by the Client.

Nanthini Selvadurai

Analytical Chemist

16<sup>th</sup> May 2017.

J.Graham, Q.C.File, Mat.File, File.



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**TEST REPORT**

**Client:** P.F. FORMATION

**File No:** 250/17

**Address:** 1774 WISEMANS FERRY ROAD MAROOTA, NSW 2756

**Req No:** 72761

**Date Received:** April 2017

**Date Sampled:** 27/04/2017

**Project:** Quality Control Annual Full Test of Fine Washed Sand wx Maroota for 2017.

**Test Method:** Accelerated Mortar Bar Test for AAR Assessment - RMS T363

LAB SAMPLE N°	SAMPLE DESCRIPTION	LOCATION
191351	Fine Washwd Sand	Maroota Quarry
N/A	Boral GP / SL Cement	Berrima

**RESULTS:**

**Flow:** 6%

**W/C Ratio:** 0.48

Age (Days)	Expansion % (Average of 3 specimens)
3	0.006
7	0.017
<b>10</b>	<b>0.029</b>
14	0.048
17	0.059
<b>21</b>	<b>0.076</b>

**Aggregate Reactivity Classification:**

Mortar Bar Expansion (%) in 1M NaOH (80°C)		Classification
10 days	21 days	
< 0.10*	< 0.10*	Non Reactive
< 0.10*	≥ 0.10*	Slowly Reactive
≥ 0.10*	>> 0.10*	Reactive

\*0.15% for naturally occurring Fine Aggregates

**Notes:** N/A

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



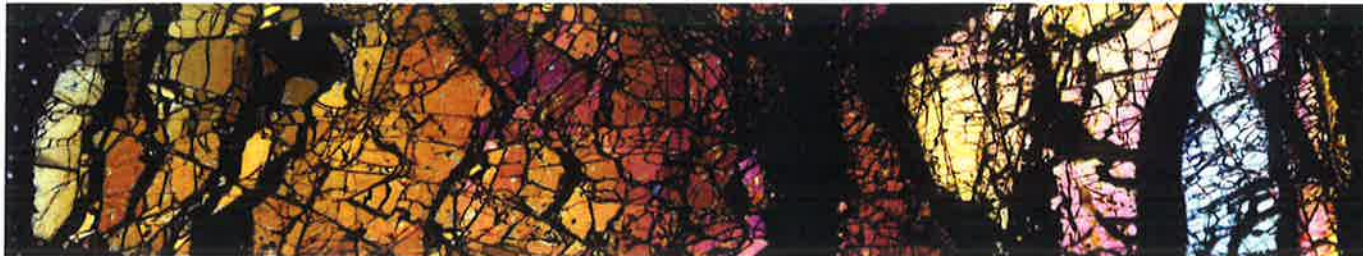
Approved Signatory Safwan Fawal

Date 2/06/2017 Serial No. 158531

NATA Accredited Laboratory

Accredited for compliance with ISO/IEC 17025

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 (191351) FROM MAROOTA QUARRY,

prepared for

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

Purchase Order: 5741301  
Invoice Number: 00007612  
Client Ref: George Calvar

Issued by

  
T. F. D. Spring B.Sc. MAppSc  
23 May 2017

MAY, 2017

Bo170508

Page 1 of 6

*The material contained within this report may not be quoted other than in full. Extracts may be used only with expressed prior written approval of Geochempet Services*

## GEOCHEMPET SERVICES, BRISBANE

**Sample Number:** 191351 **Date Sampled:** 27/04/2017

**Product Type:** Fine Washed Sand **Date Supplied:** 27/04/2017

**Sample Source:** Ex. Maroota Quarry **Date Recieved:** 08/05/2017

**Location:** P.F. Formation

**Work Requested** Petrographic analysis in relation to suitability for use as concrete; petrographic assessment of potential for alkali-silica reactivity

**Methods** Account taken of ASTM C295 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 quartzose 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 191351.

# GEOCHEMPET SERVICES, BRISBANE

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

Sieve Size	Wt % of sample
Coarse (>1.18mm)	12.2%
Medium (>0.3mm)	53.3%
Fine (>0.075mm)	33.7%
Silt (<0.075mm)	0.8%

The minor coarse fraction consists mainly of lithic fragments of variably ferruginized 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 was noted, suggesting the presence of minor silt and clay in the sample.

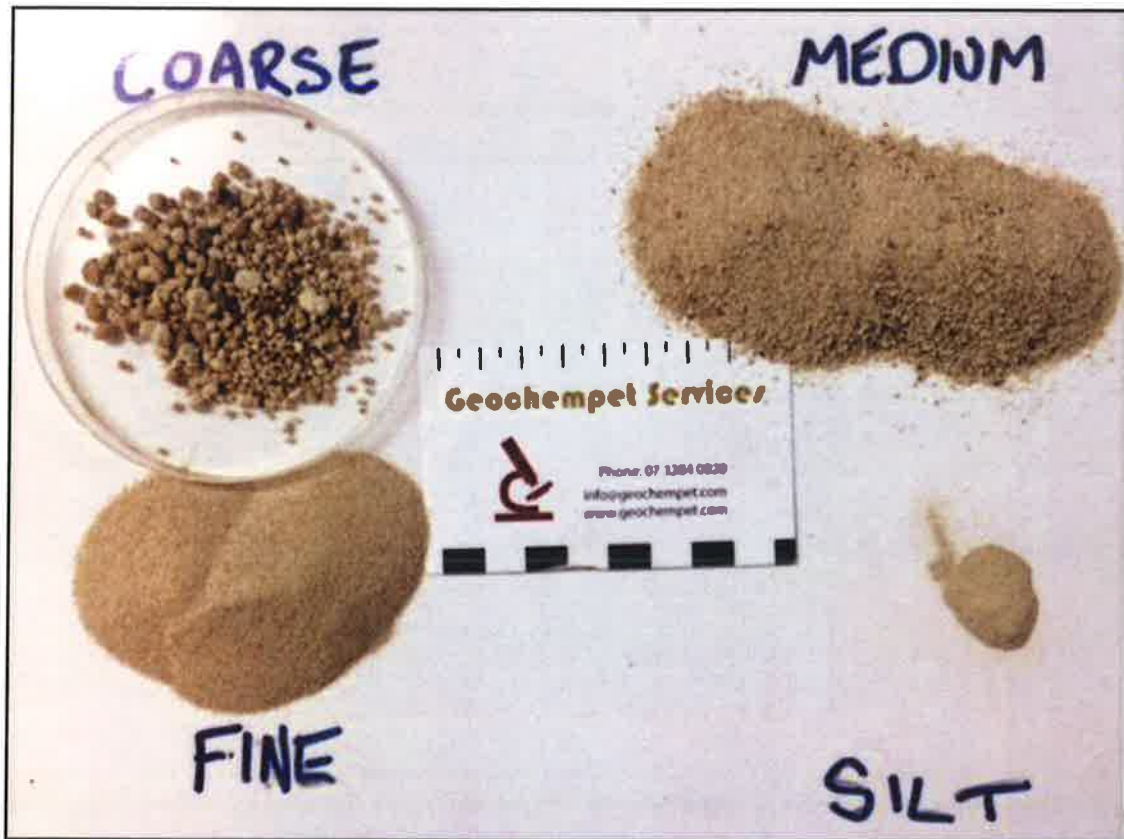
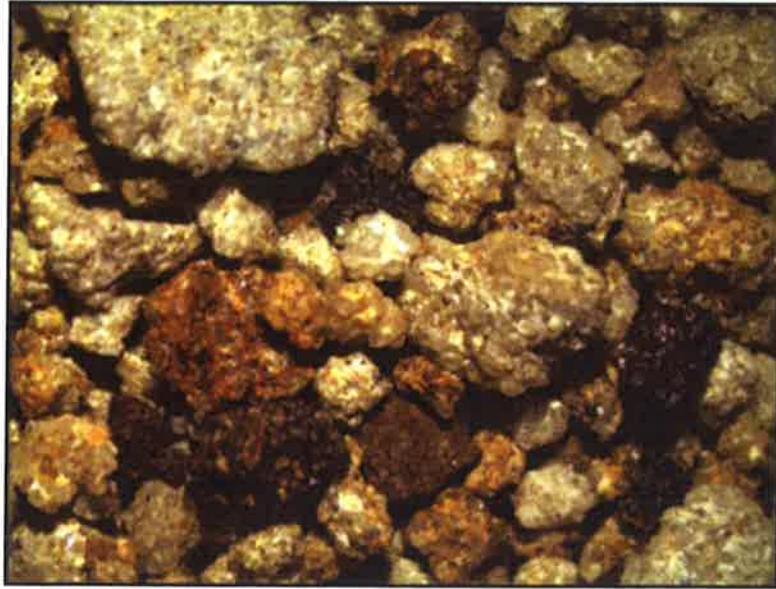


Figure 2: Digital image of sieve fractions as recorded above.

## GEOCHEMPET SERVICES, BRISBANE



**Figure 3:** Digital image of coarse sieve fraction as recorded above. Note the sandstone clasts.

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:

- 58% quartz as single, free, unstrained to mildly strained grains (48%) or as simple composite crystalline aggregates of quartz grains (10%)
- 13% quartz as moderately strained single or more commonly crystalline composite grains
- 2% quartzite (moderately strained)
- 2% 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)
- 19% lithic clasts of quartz sandstone (8% quartz, 1% feldspar and 1% acid volcanic clasts)
- 1% lithic clasts of iron stones
- <1% lithic clasts of intermediate volcanics
- <1% lithic clasts of meta-pelite/slate
- <1% ferruginous fragments
- 3% sericitized fragments
- <1% clay cemented quartz grains
- <1% clay coating on free quartz grains

The free silica content (or total quartz plus chert content) of the sand is 81% comprised of 71% free quartz grains or simple crystalline composite grains, and 10% quartz locked within lithic fragments of quartzite, clay cemented clasts and arenite and <1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

## GEOCHEMPET SERVICES, BRISBANE

In thin section, the sand is seen to consist very largely of quartz, comprising 48% quartz as single, free, unstrained to mildly strained grains, 10% quartz as simple composite crystalline aggregates of quartz grains, and 13% 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 limited (less than 1%). Other siliceous clasts include 2% quartzite.

Variable weathered sericitized and kaolinized feldspar grains amount to about 2%. 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 22% of the sample and consist of 2% acid volcanic/tuffaceous fragments (<1% finely crystalline quartz in groundmass), 19% quartz sandstone (consisting of quartz and subordinate feldspars suspended in a clay and ferruginous matrix), 1% ironstone and less than 1% of both intermediate volcanics and meta-pelite/slate.

Ferruginous fragments (probably after feldspars) amounts to about <1% of the sand sample. Sericitized clasts amounted to 3%.

Clay cemented quartz grains were also noted making up less than 1%.

### Comments and Interpretations

The supplied fine washed sand sample (labelled 191351) from the Maroota Quarry is considered to be fairly clean quartzose and lithic sand which may be described broadly for engineering purposes as medium to fine quartzose and lithic sand.

The **free silica content** (or **total quartz content** as defined in the Queensland Department of Main Roads Test Method **Q188**) of the sand is **about 81%** comprised of 71% free quartz grains or simple crystalline composite grains, and 10% quartz locked within lithic fragments of quartzite, clay cemented clasts 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 quartz grains which may contribute to water demand.

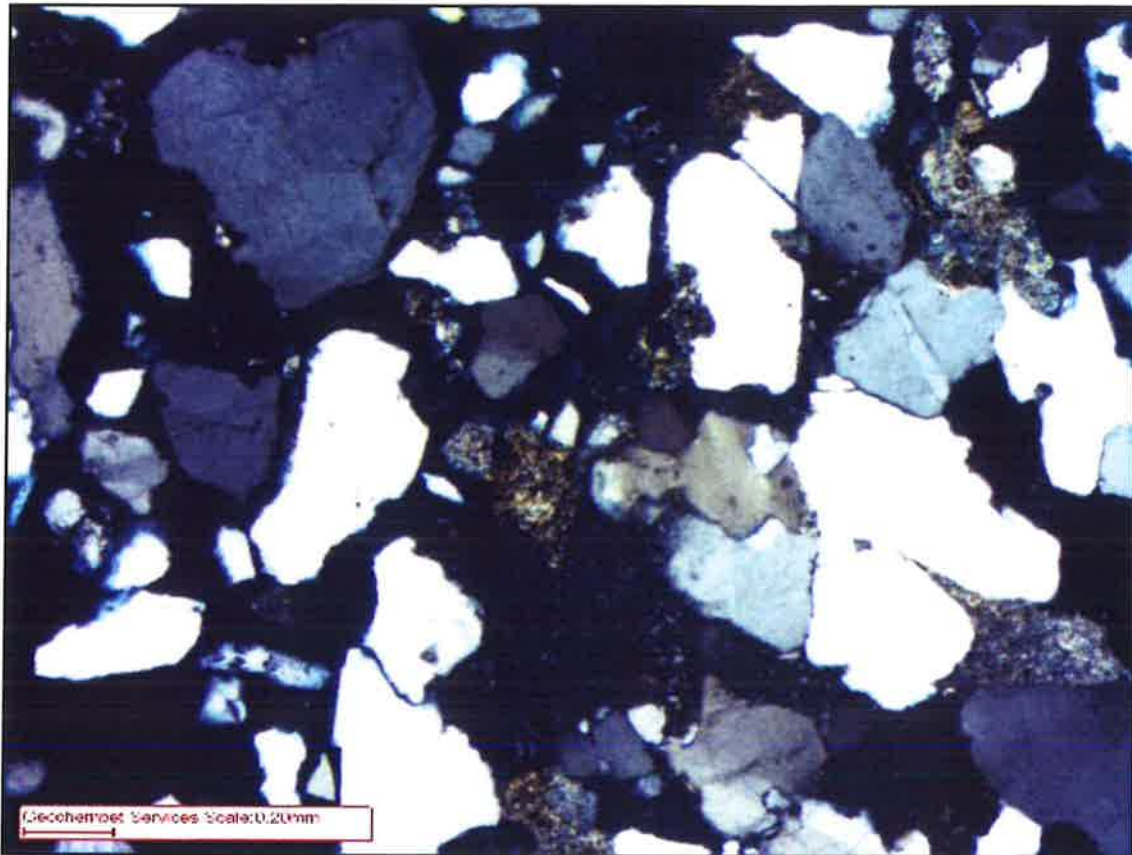
The sand as a whole is predicted to have **potential for mild or slow deleterious alkali-silica reactivity in concrete**. It carries about 15% of moderately stained quartz (as free grains or simple composite grains, and in quartzite), and <1% microcrystalline quartz in lithic clasts of acid volcanic/tuffaceous 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 81%.





**Figure 4:** Microscopic image of supplied sand sample 191351, 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. Note the sandstone clasts making up the majority of the right side of the image.