Boral Construction Materials
Materials Technical Services

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TEST REPORT

CLIENT: P.F. FORMATION
PROJECT: Quality Control – Annual Full Test of Fine Washed Sand ex Maroota for 2023
TEST PROCEDURE: i) AS1141 – Methods for Sampling and Testing Aggregates FILE No: 250/23
ii) TfNSW - Materials Test Methods Vol. 1 REQUEST No: 105569
iii) ASTM 7428, Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus DATE TESTED: 12.5.23 to 26.6.23
SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

Sample Description:			Fine Washed Sand
Location:			Maroota Quarry
Date Sampled:			24.4.23
Date Received:			5.5.23
Laboratory Sample No:			283169
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	97
	1.18 mm	30-100	93
	600 micron	15-100	81
	425 micron	-	58
	300 micron	5-50	28
	150 micron	0-20	5
AS1141.12	Material finer than 75 micron (%)	0-5	1
AS1141.4	Uncompacted Bulk Density (t/m³)		1.46
	Compacted Bulk Density (t/m³)	Min 1.2	1.56
T262	Moisture Content (%)		3.7
AS1141.5	Particle Density (DRY) (t/m³)	Min 2.1	2.61
	Particle Density (SSD) (t/m³)		2.62
	Apparent Particle Density (t/m³)		2.65
	Water Absorption (%)	Max. 2.0	0.7
AS1141.24	Sodium Sulphate Soundness		
	Total Weighted (% Loss)	Max. 6	1.2
	Fraction tested:		
	-1.18mm+600 µm (%Loss)		4.3
	-600 µm +300µm (% Loss)		0.5
AS1141.33	Silt Content (%)		6
AS1141.34	Organic impurities other than sugar	Not darker than	Lighter than Std
	The colour assessment was made	std.	
	visually using coloured reference glass		

*Sample washed over 75 micron sieve as per AS1141.11.1 Clause 6.6.
** As per Coarse Aggregate – Recommended Gradings (Table B2), AS2758.1

Approved Signatory Kamal Ali

Date 30.6.23 Serial No. AGG105569.KA.1

Report Template - Revision 2 Jan 2020 - Authorised by K. Ali

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

Sample Description:			Fine Washed Sand
Location:			Maroota Quarry
Date Sampled:			24.4.23
Date Received:			5.5.23
Laboratory Sample No:			283169
Test Method:	**Test:**	**Spec**	**Results:**
AS1141.25.3	Degradation Factor – Fine Aggregate The wash water after using permitted 500ml was:		41 Clear
T279	Method of Determining Voids Content and Flow Time % of Voids The Mean Flow Time (sec.)		46.2 22.7
ASTM D7428	Micro-Deval Abrasion Test % Loss The % loss of the control agg. tested closest to the time at which the sample was tested = 19.5		5.1

Sample Submitted by Client.

J. Graham, QC File, File

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TEST REPORT

FILE No: 250/23

CLIENT: P.F. FORMATION

REQUEST NO: 105569

PROJECT: Quality Control– Annual Full Test of Fine Washed Sand ex Maroota for 2023. DATE TESTED: 29.6.23

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:		24.4.23
Date Received:		5.5.23
Laboratory Sample No:		283169
Test Method:	**Test:**	**Results:**
TEX-402-A	Fineness Modulus of Fine Aggregate	1.96

Sample submitted by client.

Kamal Ali
SECTION HEAD – AGGREGATES
30th June 2023

J. Graham, QC File, File

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TEST REPORT

CLIENT: P.F. FORMATION FILE No: 250/23

PROJECT: Quality Control – Annual Full Test of Fine Washed Sand ex Maroota for 2023 REQUEST No: 105569

TEST PROCEDURE: AASHTO T 304 – Uncompacted Void Content of Fine Agg. (Method A) DATE TESTED: 29.6.23

Sample Identification	Field Sample Number	Laboratory Sample Number	Bulk Dry Specific Gravity (t/m³)	Uncompacted Voids Content (%)
Fine Washed Sand ex Maroota Quarry Sampled- 24.4.23 Received- 5.5.23	1	283169	2.61	45.7

Material sampled by client

J. Graham, QC File, File

Kamal Ali

Approved Signatory _____

Date 30.6.23 Serial No. AGG105569.KA.2

NATA Accredited Laboratory
Number: 547

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TEST REPORT

CLIENT:	P. F. FORMATION	FILE No:	250/23
PROJECT:	Quality Control - Annual Full Test for 2023	REQUEST No:	105569
MATERIAL:	Fine Washed Sand from Maroota Quarry	DATE RECEIVED:	05.05.23
		DATE SAMPLED:	24.04.23
		DATE TESTED:	05.05.23-25.05.23

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.** 283169
Sand Equivalent	**83**
Temperature of test solution (°C)	**21**

AS1289 - Soil Classification Tests	Results
Determination of the Liquid Limit, Plastic Limit and Plasticity Index	**Field Sample No.** 1 **Laboratory Sample No.** 283169
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**

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

Note: Sample provided by client.

JOSHUA GRAHAM, Q. C. FILE, FILE.

Approved Signatory Aroon Singh. Aroon Singh

Date 25. 05. 23. Serial No. SOIL105569.AS.1

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 ex. Maroota for 2023 to ITP PF Fine Sand-10AFQ01-Maroota,19/09/2017 and AS2758.1,7thNov.2014 Specification.

FILE No.: 250 / 23
REQUEST No.: 105569

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 Aggregates and Hardened Concrete
AS 1141.31 – Determination of Light Particles
AS 1141.35 – Detection of Sugar
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
Tex- 612 - J - Acid Insoluble Residue for Fine Aggregate
AS 2350.2 Clause 5.5 - Loss on Ignition (Modified)

Laboratory Sample No.:	283169
Date Sampled:	24.04.23
Date Received:	05.05.23
Date Tested:	From15.05.23 to 23.05.23
Sample Description:	Fine Washed Sand
Field No.:	1

TEST RESULTS:

Chloride as Cl^- (Acid-Soluble) (%)	0.009
Chloride as Cl^- (Water-Soluble) (%)	0.004
Sulfate as SO_3 (%)	0.09
Light Particles (%)	0
Sugar	Not Detected
Organic Matter (%)	0.1
pH (AS) pH (RMS)	8.1 8.0
*Acid Insoluble Residue (%)	98
*Calcium Carbonate as $CaCO_3$ (%)	0.8

Note: *The Test method not covered by the laboratory's current scope of accreditation.
Sample was provided by the Client.
Joshua Graham, Q.C.File, Mat.File, File.

Approved Signatory _____ Otilia Costache

Date 23.05.2023 Serial No. CHEM105569.OC.1

NATA Accredited Laboratory
Number: 547

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TEST REPORT

CLIENT:	P.F. Formation 1774 Wisemans Ferry Road Maroota NSW 2756	FILE No.: 250 / 23
PROJECT:	Quality Control Annual Full Test of Fine Washed Sand ex. Maroota for 2023	REQUEST No.: 105569
SPECIFICATION:	AS 2758.1 - Part 1 - Concrete Aggregate - 7th November 2014	

TEST PROCEDURE:
AS 1141.12 – Material Finer than 75 micron *
AS 1141.13 – Material Finer than 2 micron
AS 1141.36 – Sulfur in Metallurgical Slag, Crushed Rock or other Pavement Materials
RMS T264 – Soluble Salts in Sand
International Slurry Surfacing Association No.145 Methylene Blue Adsorption Value
RMS T659 – Methylene Blue Adsorption Value of Road Construction Material

Laboratory Sample Number:	283169
Date Sampled:	24.4.23
Date Received:	5.5.23
Date Tested:	From 12.5.23 to 23.5.23
Sample Description:	Fine Washed Sand
Field No.:	1

TEST RESULTS:

Material Finer than 75 micron (µm) (%) *	1
Material Finer than 2 micron (µm) (%)	Not Applicable
Sulfur (%)	0.02
Soluble Salts (%)	Free from Soluble Salts
Methylene Blue Value (mg/g) (ISSA) #	2.5
Methylene Blue Value (mg/g) (RMS)	2
Methylene Blue Value for a Duplicate (mg/g)	2
Average Methylene Blue Value (mg/g)	2
DFI = MBV x Material Finer than 75µm (mg/g x %) +	2

Sample was provided by the Client.
The Test method is not in the current scope of NATA Accreditation for the Boral MTS Laboratory.
+ This index calculation is not part of TfNSW T659 or AS1141.12 and therefore not in the current scope of NATA Accreditation for the Boral MTS Laboratory.

* The authorised signatory for AS 1141.12 is K.Ali.

Joshua Graham, Mat.File, File.

Approved Signatory K.Ali S.Krishnamoorthy

Date 25.5.23. Serial No. CHEM105569.SK.1

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TEST REPORT

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

FILE No: 250/23

PROJECT: Quality Control Annual Full Test of Fine Washed Sand ex Maroota for 2023.

REQUEST No: 105569

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

Laboratory Sample No.:	283169
Date Sampled:	24/04/2023
Date Received :	05/05/2023
Date Tested :	23/05/2023
Sample Description:	Fine Washed Sand

TEST RESULTS

Silicon as SiO_2 (%)	95.5

Note:

- Sample was provided by the Client
- Test results relate only to the sample tested
- This report shall not be reproduced except in full without the approval of the Boral MTS Laboratory.

Nanthini Selvadurai
Analytical Chemist
23rd May 2023.
J.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: 05/05/2023
Project: Quality Control Annual Full Test of Fine Washed Sand ex Maroota for 2023
Test Method: Accelerated Mortar Bar Test for AAR Assessment - RMS T363

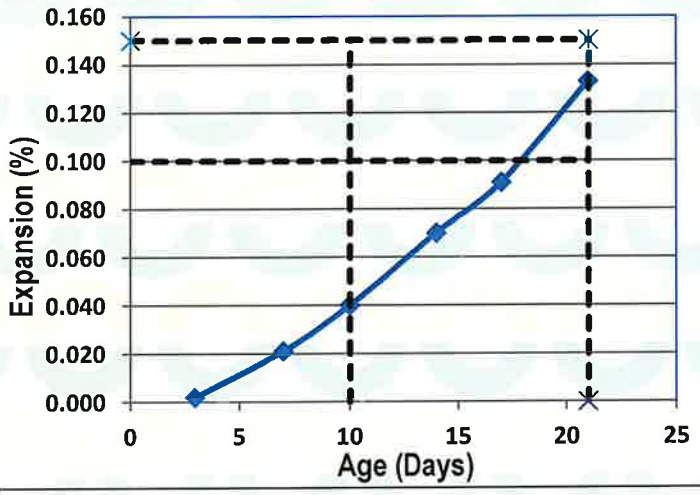
File No: 250/23
Req. No: 105569
Date Sampled: 24/04/2023

Lab Sample No	Sample Description	Location
283169	Fine Washed Sand	Maroota Quarry
N/A	Boral GP/SL Cement	Berrima

Results:

Flow (%): 10 **W/C Ratio:** 0.42 **Mixing Date:** 30/05/2023

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.002
7	0.021
10	0.040
14	0.070
17	0.091
21	0.133



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

Note:

- Sample supplied by the client.

Joshua Graham, QC File, Mat. File, File

Approved Signatory: Julius Alvaro

Date 27/06/2023 Serial No. CEM105569.JA.1

NATA Accredited Laboratory
Number: 547

GEOCHEMPET SERVICES

ABN 25 065 630 506
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PETROGRAPHIC REPORT ON A SAND SAMPLE (283169) FROM MAROOTA QUARRY

prepared for

BORAL RESOURCES (NSW) PTY LTD MATERIALS TECHNICAL SERVICES

Purchase Order:	6693023
Invoice Number:	G202307517
Client Ref:	Kamal Ali Justin Dowse

Issued by

K. H. Lynn
BSc. (Hons)
11 July 2023

Reviewed by

A.G. Christy
MA PhD FMinSoc
11 July 2023

GEOCHEMPET SERVICES, BRISBANE

Sample ID:	283169	**Date Sampled:**	24/04/2023
Geochempet ID:	G23050108	**Date Received**:	22/05/2023
Sample Location:	Maroota Quarry	**Sample Type**:	Fine Washed Sand
Client:	P.F.Formation	**Project:**	QC AFT

Work Requested: Petrographic analysis in relation to use as concrete sand and as a fine component in asphalt; petrographic assessment of potential for alkali-silica reactivity.

Methods Adapted from 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 pale greyish-orange, clean, medium to fine sand. Clasts are mainly subrounded to subangular, with visible lithic clasts of varying composition.

Figure 1: Photograph of sub-sample of the supplied sand.

Size Fractions

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

Sieve Size	Wt % of sample
Coarse (>1.18 mm)	7.5%
Medium (>0.3 mm)	64.6%
Fine (>0.075 mm)	26.1%
Silt (<0.075 mm)	1.8%

The coarse fraction consists mostly of lithic fragments of sandstone and subordinate fragments of quartzite and quartz grains. The sandstone fragments can be broken by hand, but not completely broken down into individual mineral constituents, indicating that some suturing of grain boundaries has occurred. There are no apparent deleterious grain coatings; traces of benign secondary iron oxide occur within cracks and surficial indents.

When a subsample was swirled in a beaker of water, it generated a very light but persistent, pale greyish orange turbidity, with minor argillized scum, and some traces of plant fragments at the surface, indicating only very minor silts and clays within the sample.

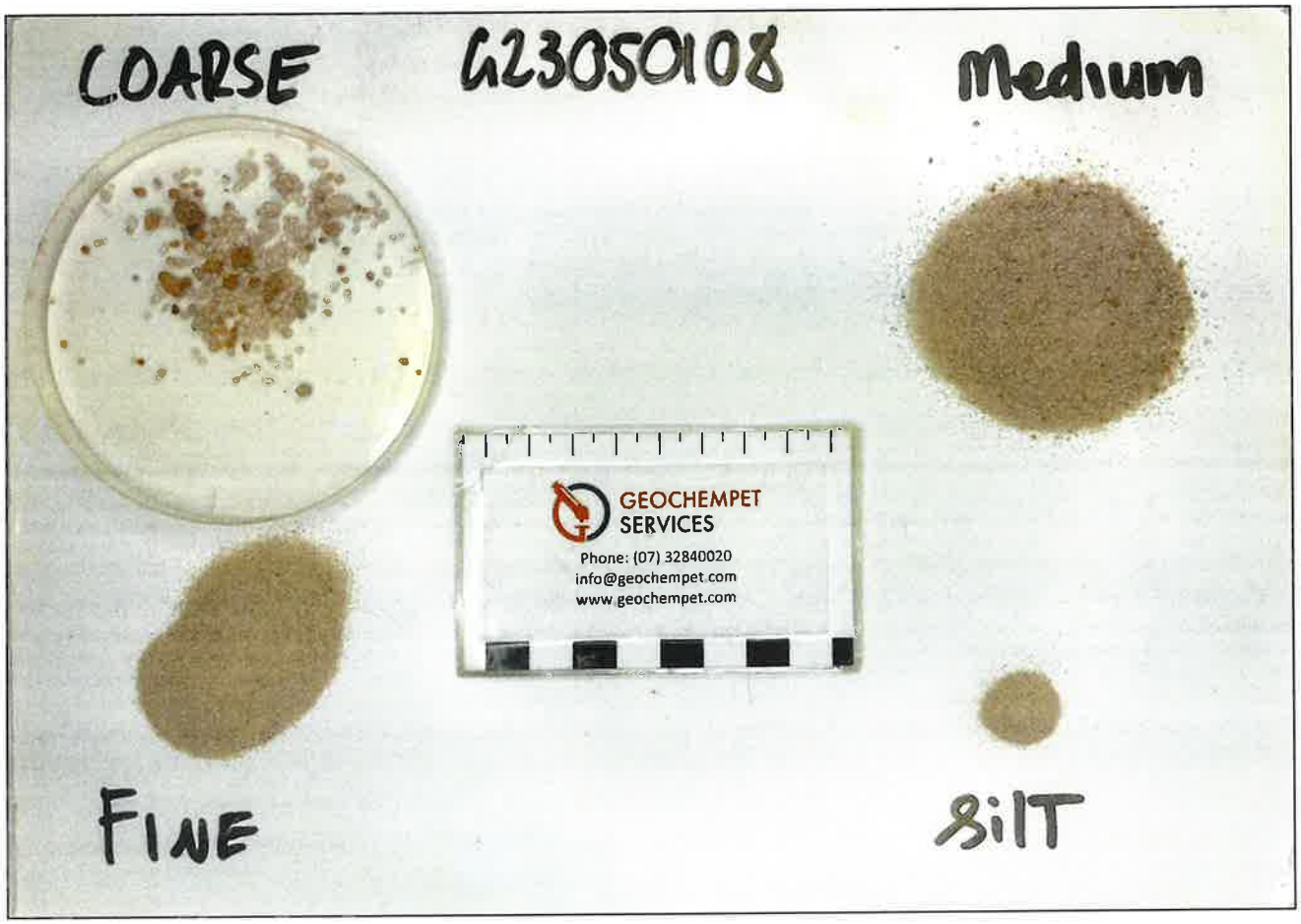

Figure 2: Image of the sieved sand.

Figure 3: Magnified image of the coarse fraction, consisting of lithic sandstone fragments and minor quartzite and quartz grains.

Mineralogy

A thin section was prepared from a randomly selected subsample of the supplied sand to permit detailed, microscopic examination in transmitted, polarised light. An approximate composition of the sand, expressed in volume percent of clast types and based on a systematic count of 100 points falling within sectioned fragments, is:

59%	quartz as unstrained to mildly-strained simple (55%) or composite free grains (4%)
25%	quartz as moderately-strained simple or more commonly composite free grains
3%	quartzite (moderately strained)
1%	vein quartz (highly strained)
1%	feldspar (K-feldspar and minor plagioclase)
1%	free mica (muscovite)
<1%	other free mineral grains (including feldspar, zircon, rutile, and opaque oxide)
5%	lithic clasts of sandstone (4% quartz (1% moderately strained))
2%	lithic clasts of granite (1% quartz, 1% K-feldspar and <1% other minerals)
1%	lithic clasts of tuffaceous/volcanic felsic rock (<1% microcrystalline quartz)
<1%	lithic clasts of intermediate volcanic rock
1%	sericitised fragments
1%	argillized fragments
trace	secondary iron coatings

Thin Section Description

A simultaneous determination of free silica content (or total quartz content as defined in the Queensland Main Roads Test Method Q188) indicated about 93%, comprising about 84% free grains of quartz, 9% quartz locked within lithic clasts of quartzite, vein quartz, and sandstone, and <1% finely microcrystalline quartz locked within lithic clasts of felsic/tuffaceous volcanic rock.

In thin section, the sand is seen to consist mostly of quartz, comprising 55% quartz as single, free, unstrained to mildly-strained grains, 4% quartz as simple composite crystalline aggregates of quartz grains, and 25% quartz as moderately-strained single or crystalline composite grains. Other siliceous fragments include 3% moderately-strained quartzite, and 1% highly-strained vein quartz. Other mineral grains include <1% zircon, rutile, and opaque oxide.

Felspars were in slightly weathered condition, dusted by fine clays and amounted to about 1% of mostly K-feldspar and minor plagioclase. Free flakes of muscovite were observed in the sand which ranged up to 0.5 mm in size, amounting to about 1% of the sample.

Other lithic clasts amount to 8% of the sample and consist of 5% sandstone (4% quartz), 2% granite (1% quartz), 1% felsic volcanic/tuffaceous fragments (<1% finely microcrystalline quartz) and <1% intermediate volcanics.

Sericitised and argillized clasts made up approximately 2% of the sample which were most likely derived from the weathering of feldspars.

Some very minor earthy secondary iron oxide clay is observed in indents, cracks, and interstitial spaces in lithic clasts. Traces of plant material are also present.

Comments and Interpretations

The supplied fine sand sample (labelled 283169) from the Maroota Quarry is considered to be fairly clean quartz 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 93%**, comprising about 84% free grains of quartz, 9% quartz locked within lithic clasts of quartzite, vein quartz, granite and sandstone, and <1% finely microcrystalline quartz locked within lithic clasts of felsic/tuffaceous volcanic rock.

Being composed largely of subrounded and subangular 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 lithic clasts of quartzite), 1% highly-strained vein quartz fragments, and <1% microcrystalline quartz in lithic clasts of felsic volcanic/tuffaceous rock.

Therefore, the sand is interpreted to be **physically suitable for use in concrete**, provided that appropriate precautions are taken in mix and engineering design to take account of its perceived potential for mild or slow deleterious alkali-silica reactivity.

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 93%.

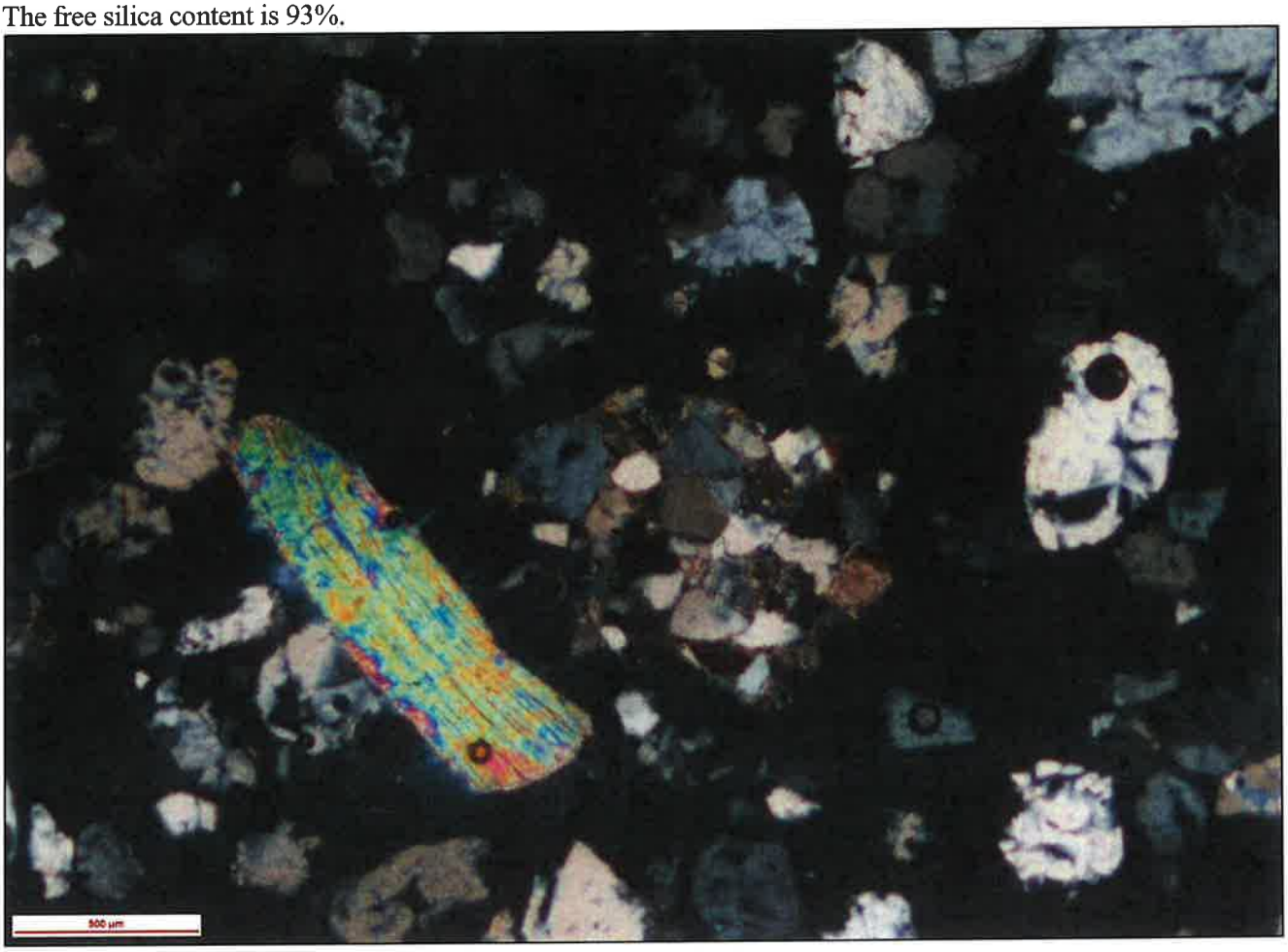

Figure 4: Image taken at a low magnification with transmitted, cross-polarised light, which shows a view of the mineral assemblage of supplied sand, dominated by free quartz grains and minor sandstone. Note the free muscovite flake to the left.

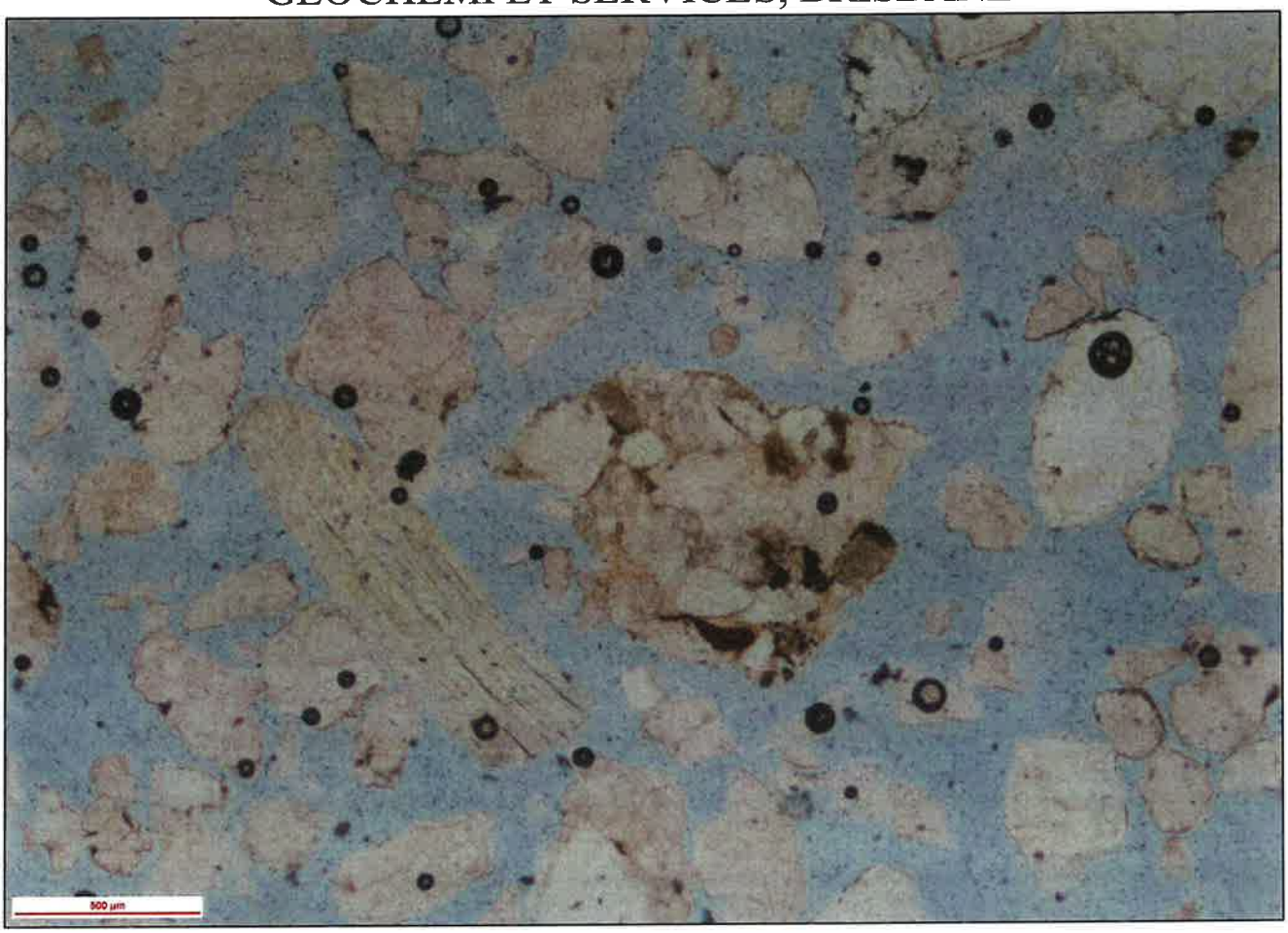

Figure 5: Plane-polarised light view of the same field of view as Figure 4.