APPENDIX M6

TSF LABORATORY TESTING OF TAILINGS

ANGAS PROCESSING FACILITY

MISCELLANEOUS PURPOSES LICENSE APPLICATION 2019/0826

TERRAMIN

ABN | 67 062 576 238
Unit 7 / 202-208 Glen Osmond Road | Fullarton SA 5063

REPORT

TERRAMIN AUSTRALIA LIMITED

Tailings Storage Facility
Angas Zinc Mine

Laboratory Testing of Tailings

March, 2010

105032R12

Document History and Status

Title:	Tailings Storage Facility, Angas Zinc Mine – Laboratory Testing of Tailings
Job Number/Extension	105032.04
Document Number:	105032R12
Last Printed:	10 March 2010
File Path:	J:\2005\105032 Angas Zinc Project\Documents\105032R12\105032R12.doc
Author:	Behrooz G Nejad
Reviewer:	Keith Seddon
Job Manager:	Behrooz G Nejad

Rev.	Status	Issued to	Issue Date	Signatures	
				Author	Reviewer
0	Final Issue	BAC	10/03/2010	BGN	KDS

This Revision distributed To:	Hard Copy	Electronic Copy
Angas Zinc Mine	1-3	☑
ATC Melbourne Office	4	On network

BEHROOZ G NEJAD
Author

Keith Seddon
Reviewer

IMPORTANT NOTICE

Please refer to our Conditions of Investigation and Report

ATC Williams Pty Ltd
222 Beach Road (P.O. Box 5286) Mordialloc Vic 3195
T +61 3 8587 0900 F +61 3 8587 0901
melb@atcwilliams.com.au
ATC Williams unites the companies of Australian Tailings Consultants and MPA Williams & Associates

CONDITIONS OF INVESTIGATION AND REPORT

Conditions of Report

1. This report has been prepared by us for the purposes stated herein. We do not accept responsibility for the consequences of extrapolation, extension or transference of the findings and recommendations of this report to different sites, cases or conditions.

2. This report is based in part on information which was provided to us by the client and/or others and which is not under our control. We do not warrant or guarantee the accuracy of this information.

3. We believe the conclusions and recommendations contained herein were reasonable and appropriate at the time of issue of the report. However, the user is cautioned that fundamental input assumptions upon which this report is based may change with time. It is the user's responsibility to ensure that input assumptions remain valid.

4. This report must be read in its entirety. This notice constitutes an integral part of the report, and must be reproduced with every copy.

5. This report is prepared solely for the use of the person or company to whom it is addressed. No responsibility or liability to any third party is accepted for any damages howsoever arising out of the use of this report by any third party.

6. Unless specifically agreed otherwise in the contract of engagement, ATC Williams retains Intellectual Property Rights over the contents of this report. The client is granted a licence to use the report for the purposes for which it was commissioned.

Geotechnical Investigation

7. Geotechnical site investigation necessarily involves the investigation of the subsurface conditions at a site at a few isolated locations, and the interpretation and extrapolation of those conditions to elsewhere on the site not so investigated. This procedure has been adopted at the site that is the subject of this report and due care and skill has been applied in carrying out and reporting on the work. Thus the findings, conclusions and comments contained in this report represent professional estimates and opinions and are not to be read as facts unless the context makes it clear to the contrary. In general, statements of fact are confined to statements as to what was done and/or what was observed. Other statements have been based on professional judgement.

8. The scope of the work has been planned in the absence of any fore-knowledge of the site other than that stated in the report. Unless otherwise stated we consider that the number of locations investigated and the depths to which they have been investigated are reasonable bearing in mind the scale and nature of the project, and the defined purpose for which the investigation was undertaken.

9. We do not accept any responsibility for any variance between the interpreted and extrapolated conditions and those that are revealed by any means subsequently. Specific warning is also given that many factors, either natural or artificial, may render ground conditions different from those which pertained at the time of the investigation. Should there be revealed during the construction or at any other time any apparent difference from subsurface conditions described or assessed in this report, it is strongly recommended that such differences be brought to our attention so that its significance may be assessed and appropriate advice given.

ATC Williams
GROUNDED IN DESIGN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

A programme of laboratory testing was undertaken on production samples of tailings from Angas Zinc (AZ) Tailings Storage Facility (TSF) at Strathalbyn, South Australia.

The original design for the storage was based on testing carried out on a pre-production sample of tailings [**Ref. 1**], obtained from the results of metallurgical test work. It was always recognised that the tailings characterisation testing would need to be repeated as soon as a sample of production tailings became available, to confirm the design values.

This report documents the recent tailings testing results and provides an assessment of the relevance of the results compared to the design values.

The work was carried out in accordance with ATC Williams proposal dated 18 November 2009 and AZ order no. 109668.

2 SAMPLES RECEIVED

The production tailings and decant water samples were received on 25 November 2009 sealed in 20 litre drums. There were 4 drums of the tailings slurry (ex-thickener) and 6 drums of the decant pond water. The samples were received in good condition with no evidence of leakage during transport.

3 SAMPLE PREPARATION

The tailings drums were opened and some liquor was set aside. The drums were then emptied into a large tub with the set aside liquor used to rinse out the drums. The sample was thoroughly mixed and sampled for initial solids content.

The decant water drums were set aside for the dilution of tailings when required for specific tests.

4 SCOPE OF WORK

The following tests were performed on the tailings sample:

- pH, TDS, initial solids content
- Atterberg limits (plasticity)
- Particle density (specific gravity)
- Particle size distribution (including hydrometer)
- Segregation threshold
- Shrinkage limit density
- Tray settlement tests
- Rheology
- Rowe Cell Consolidation

5 SOLIDS CONTENT

The average solids content of the sample on delivery to the laboratory was 62.3%. This is slightly lower than the average solids content of around 64% (ex-thickener) achieved over the 2009 calendar year. The pH and TDS of the tailings liquor were 6.94 and 18,274 mg/lit respectively.

The pH and TDS of the water from the decant pond were 3.02 and 18,875 mg/lit respectively.

6 ATTERBERG LIMITS

A sub-sample of "As Received" tailings was air dried and tested in accordance with AS 1289 3.1.2, 3.2.1 and 3.3.1.

The results of the tests were:-

Liquid Limit	21%
Plastic Limit	21%
Plasticity Index	0, Non Plastic

No atterberg limits could be measured for the pre-production tailings during the design stage as described in the previous ATC report on laboratory testing of tailings [**Ref. 1**].

7 PARTICLE DENSITY

The particle density of the solids was measured in accordance with AS 1289 3.5.1.

The particle density of the tailings sample was 3.21 t/m^3 as compared to 3.48 t/m^3 determined for the pre-production tailings [**Ref. 1**].

8 PARTICLE SIZE DISTRIBUTION

A sub-sample of tailings was prepared and tested in accordance with AS 1289 3.6.2 with the exception that washing was carried out on a 38 μm sieve instead of a 75 μm sieve. The analysis of the material finer than 38 μm was carried out in accordance with AS 1289 3.6.3 (hydrometer method).

The tailings grading curve is plotted in **Figure 1**. The grading curve for the pre-production tailings is also provided for comparison. As can be seen the actual production tailings is finer than the pre-production tailings.

NATA accredited test reports for the Atterberg limits, particle density, and particle size distribution tests are presented in **Appendix A**.

9 SEGREGATION THRESHOLD

This test is carried out to estimate the solids content at which separation of the coarser fraction, i.e. segregation, during static settling first occurs. The procedure used was to agitate a sample of slurry in a glass cylinder and allow it to settle. The solids content was varied by decanting or adding water as required and the test was repeated until some sign of segregation was noted.
Two sub-samples of equal volume were then taken using a small pipette; one from the bottom of the cylinder and the other from just below the surface. These samples were put into two test tubes and were diluted, agitated and decanted to separate the coarser particles. The volumes of coarser particles remaining were compared and the whole test was repeated until the volumes were judged to be equal. The slurry in the cylinder was then tested for solids content and this was the threshold value.

The segregation threshold of the tailings sample was 51% solids. This is significantly lower than the value of 68% measured for the pre-production tailings sample [**Ref. 1**]. This is believed to be the consequence of the finer grading and lower particle density of the production tailings.

As mentioned earlier in **Section 5**, an average solids content of around 64% has been achieved for the tailings over the 2009 calendar year and hence it has been non-segregating.

10 SHRINKAGE LIMIT DENSITY

This test was carried out to determine the maximum dry density that could result from the evaporation drying of the tailings on a beach. A slurry sample at 62.3% solids (as received) was poured into a 300 mm diameter pan to a depth of approximately 45 mm and allowed to settle. The decant was removed and the sample was slowly dried using heat lamps. Measurements of the weight loss and sample thickness were made as the drying proceeded. Only minor surface cracks were developed around the sample perimeter. A point was reached where the sample volume became constant while the moisture content continued to decrease. This is the shrinkage limit density condition. The sample was oven dried and the relationship between moisture content and dry density was calculated.

The shrinkage limit density of the tailings was 1.62 t/m^3 approximately 12% lower than the density of 1.85 t/m^3 measured for the pre-production tailings. This is presumed to be related to the increase in the fines content (ie silt and clay) of the samples as presented in **Figure 1**, and the lower particle density. The result is presented in **Figure 2**.

A re-test has been ordered to confirm the measured shrinkage limit density and the result will be provided later, if found to be different.

11 TRAY SETTLEMENT

A sub-sample of tailings was poured into large diameter pans and the settlement of the surface of the tailings with time was accurately recorded.

The settlement results are plotted in **Figure 3**. The data derived from the testing are summarised in **Table 1**.

TABLE 1 – TRAY SETTLEMENT RESULTS

Sample	Solids Content %		Sample Depth (mm)			$\frac{H_F}{H_O} \times 100$ %	Settled Dry Density t/m³	Bleed Water	
	Initial	Final	Initial Ho	Final HF	ΔH			% of Initial Water	m³/t Dry Solids
Pre-Production*	69.4	75.1	51.2	43.5	7.7	85	1.62	24.84	0.11
Tailings	62.5	67.6	60	52	8	86.7	1.27	20.23	0.122

* Provide for information only

As can be seen the initial settled density of tailings is around 22% lower than the density for the pre-production tailings.

12 RHEOLOGY

A total of four samples were prepared for rheology testing at a range of solids contents. The samples were prepared at 64%, 66%, 68% and 70% solids. Testing was performed by both the Couette flow method (bob in cup) and shear vane to give yield stress results.

A plot of the Plastic Viscosity vs. Solids Content data obtained from the Couette flow testing is presented in **Figure 4**.

Figure 5 presents the variations of Tangent Intercept Stress and Yield Stress vs. Solids Content data obtained from both the Couette flow (C.F.) and the Shear Vane (S.V.) methods.

A summary of the data is also presented in **Table 2**.

TABLE 2 – RHEOLOGY TESTING DATA SUMMARY

Test Method	Solids Content (%)	Yield Strength (Pa)	Tangent Intercept Stress (Pa)	Plastic Viscosity (mPa.S)
C.F.*	71.0	4	4.6	54
C.F. *	74.1	9	12.6	157
C.F. *	77.2	45	55	731
S.V. *	77.2	95	-	-
S.V. *	80.1	590	-	-
S.V. *	80.1 (Repeat)	411	-	-
S.V. *	81.7	2400	-	-
C.F.	64	9.4	15.8	80.9
C.F.	66	15.9	23.8	101.6
C.F.	68	25.1	36.8	121.7
C.F.	70	35	79.2	207.5
S.V.	64	14.1		
S.V.	66	23.1		
S.V.	68	39.5		
S.V.	70	73.3		

*Provided for information only - Results from pre-production tailings testing

As can be seen the viscosity of the actual production tailings for a given solids content is significantly higher than the viscosity of the pre-production tailings.

Values of shear stress at a strain rate of 100 s^{-1} (τ_{100}) for different solids content are presented in **Figure 6**.

The Herchel Bulkley model parameters were derived from the Rheogram curves and are presented in **Table 3**.

TABLE 3 – RHEOLOGY TESTING HERCHEL BULKLEY MODEL PARAMETERS

Solids Content (%)	Yield Strength - T0 (Pa)	Consistency index - K (Pa.S)	Flow Index - η (Pa.S)
71.0*	0.1	0.85	0.535
74.1*	0.8	2.1	0.560
77.2*	10	6.8	0.620
64	9.4	1.16	0.558
66	15.9	1.25	0.577
68	25.1	2.29	0.510
70	35	14.72	0.322

*Provided for information only - Results from pre-production tailings testing

13 ROWE CELL CONSOLIDATION

A consolidation test was conducted on a sub-sample of the tailings slurry using the Rowe Cell consolidation equipment. Consolidation was carried out in 10 stages with the effective vertical stress ranging from 1 to 640 kPa.

Figure 7 shows the changes in void ratio with effective vertical stress (consolidation pressure). The results for the pre-production tailings sample are also presented for comparison. As can be seen over the range of applied stresses, the slope of compression line is steeper for the production tailings. In other word, the actual production tailings are more compressible than the pre-production tailings.

A Compression Index, Cc, of 0.17 has been determined.

The changes in the coefficient of consolidation with effective vertical stress are presented in **Figure 8**.

Figure 9 presents the changes in permeability with void ratio for the tailings sample.

The saturated permeability ranges from $1x10^{-7}$ m/s at 640 kPa to around $6x10^{-7}$ m/s at 1 kPa. The permeability of the pre-production tailings sample was between $1x10^{-6}$ m/s at 120 kPa and $2x10^{-6}$ m/s at 20 kPa. The reduction in the measured permeability of the tailings might be related to the increased fines content in the actual sample compared to the pre-production tailings.

14 RESULTS SUMMARY AND COMPARISON

In summary the results presented here indicate that the production tailings have significantly higher silt/clay content (ie % finer than 75 μm) than the pre-production tailings. This has had a direct influence on the settled density of tailings as the silt/clay particles generally have lower densities. The high clay/silt content has also increased the tailings compressibility whilst reduced its saturated permeability.

The segregation threshold of the actual production tailings has been also effected by changes in the tailings particle size distribution. This will directly influence the operational requirement used for the tailings solids content at discharge (ie solids content > 70%). Now that the segregation threshold of actual production tailings is around 51%, the target solids content can be reduced.

The increased viscosity of production tailings has resulted in steeper tailings beach slopes (around 6%) than those adopted for the TSF design [**Ref. 2**], which is considered to be favourable. Nevertheless the high viscosity may significantly influence the performance of the tailings pumping and delivery system.

Reference to the Rowe Cell test results indicates that the full normal consolidation of tailings may not be achieved by the end of mine life particularly under the decant pond area. A consolidation analysis is required to confirm this. The results of consolidation modelling will be used in the closure design to assess the final settlement of the tailings surface.

The reduction in the estimated saturated permeability of tailings is believed to moderately reduce the flow rate into and out of the tailings stack.

The measured shrinkage limit density for the production tailings slurry is lower than the overall density of 1.74 t/m^3 determined (for the tailings deposit in the TSF) from the recent tailings beach survey [**Ref. 3**]. Therefore a retest has been ordered to check on the accuracy of the measured density.

The pH of the water samples from the decant pond confirms the high “potentially acid forming” (PAF) nature of the tailings that was identified during the design stage by column leach testing [**Ref. 2**].

15 CLOSURE

The readers’ attention is drawn to the conditions of investigation at the front of this report.

<u>ATC WILLIAMS PTY LTD</u>

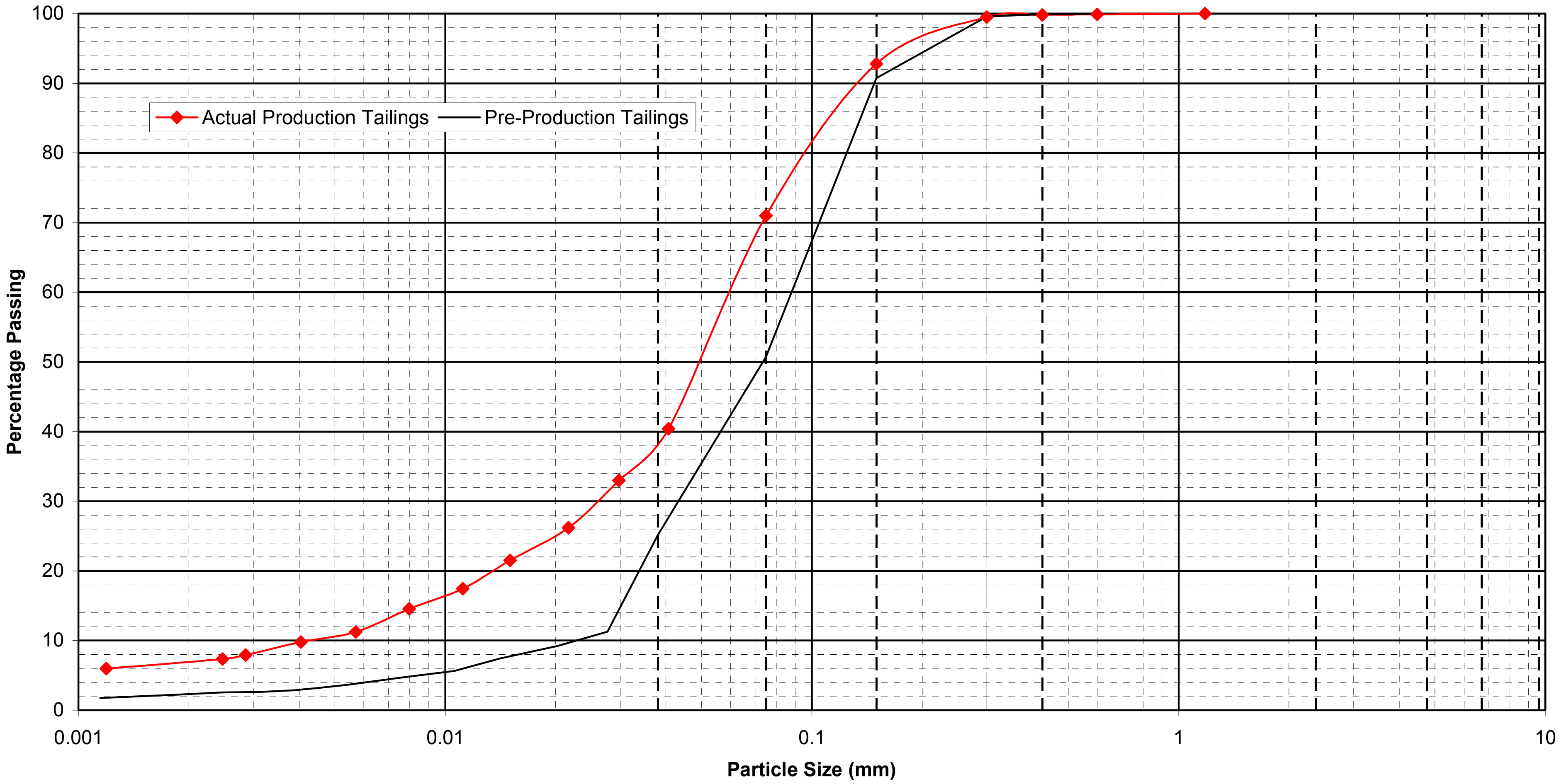
REFERENCES

[1] Australian Tailings Consultant, “Terramin Australia Limited, Report on Laboratory Testing of Tailings for the Angas Zinc Project”, Ref. 105032R01 (December 2005).

[2] Australian Tailings Consultants “Angas Zinc Mine, Tailings Storage Facility Design Report, Strathalbyn, South Australia”, Ref. 105032R06Rev.2, December 2006.

[3] ATC Williams “Terramin Australia Limited, Tailings Storage Facility, Angas Zinc Mine, Annual Surveillance Report 2010”, Ref. 105032R11, March 2010.

FIGURES



ATC Williams Pty Ltd
222 Beach Road
(P.O. Box 5286)
Mordialloc Vic 3195
AUSTRALIA
T +61 3 8587 0900
F +61 3 8587 0901
melb@atcwilliams.com.au
www.atcwilliams.com.au

TERRAMIN AUSTRALIA LIMITED

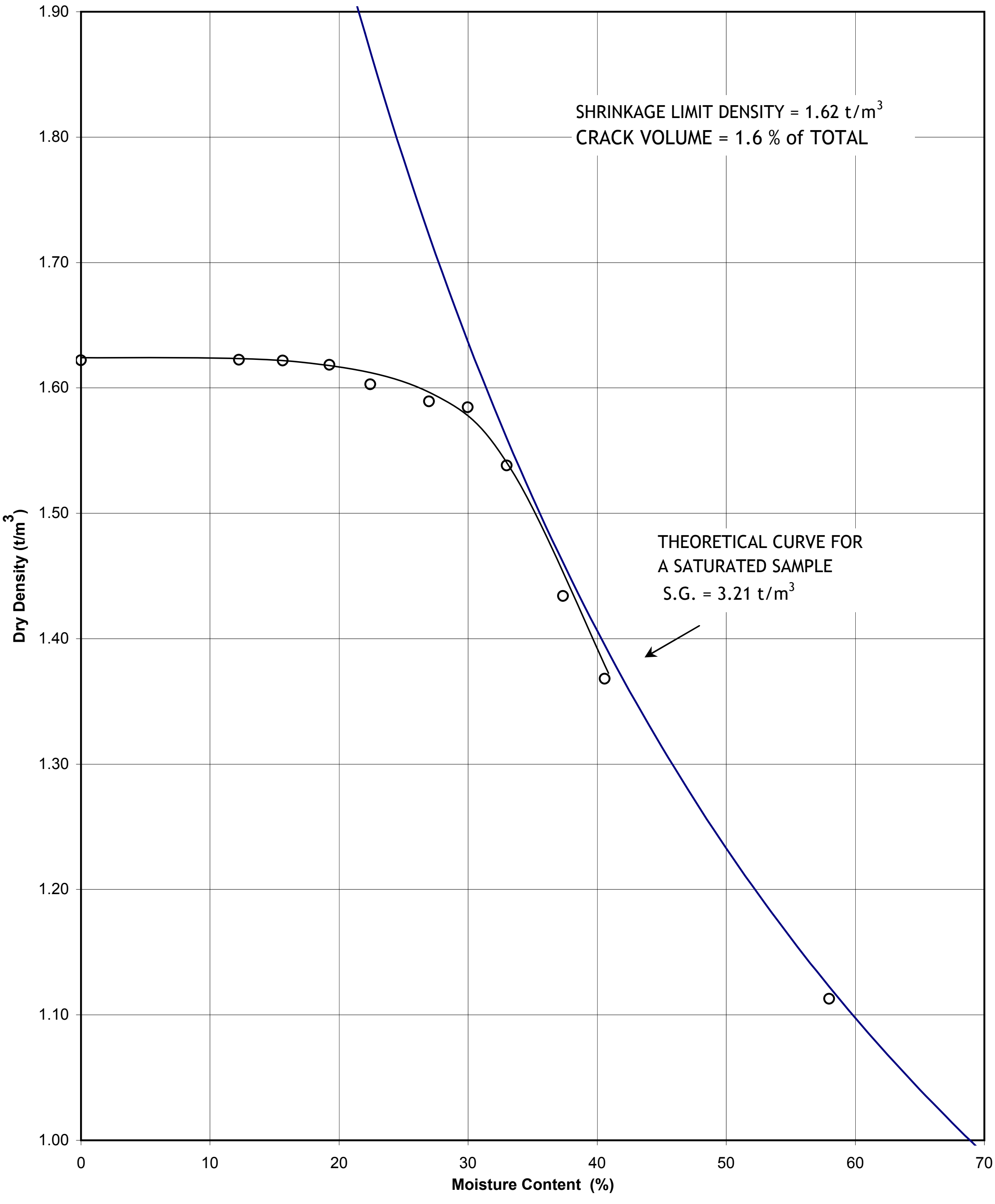
ANGAS ZINC MINE - TAILINGS STORAGE FACILITY

LABORATORY TESTING OF TAILINGS

Particle Size Distribution - "As Received" Tailings

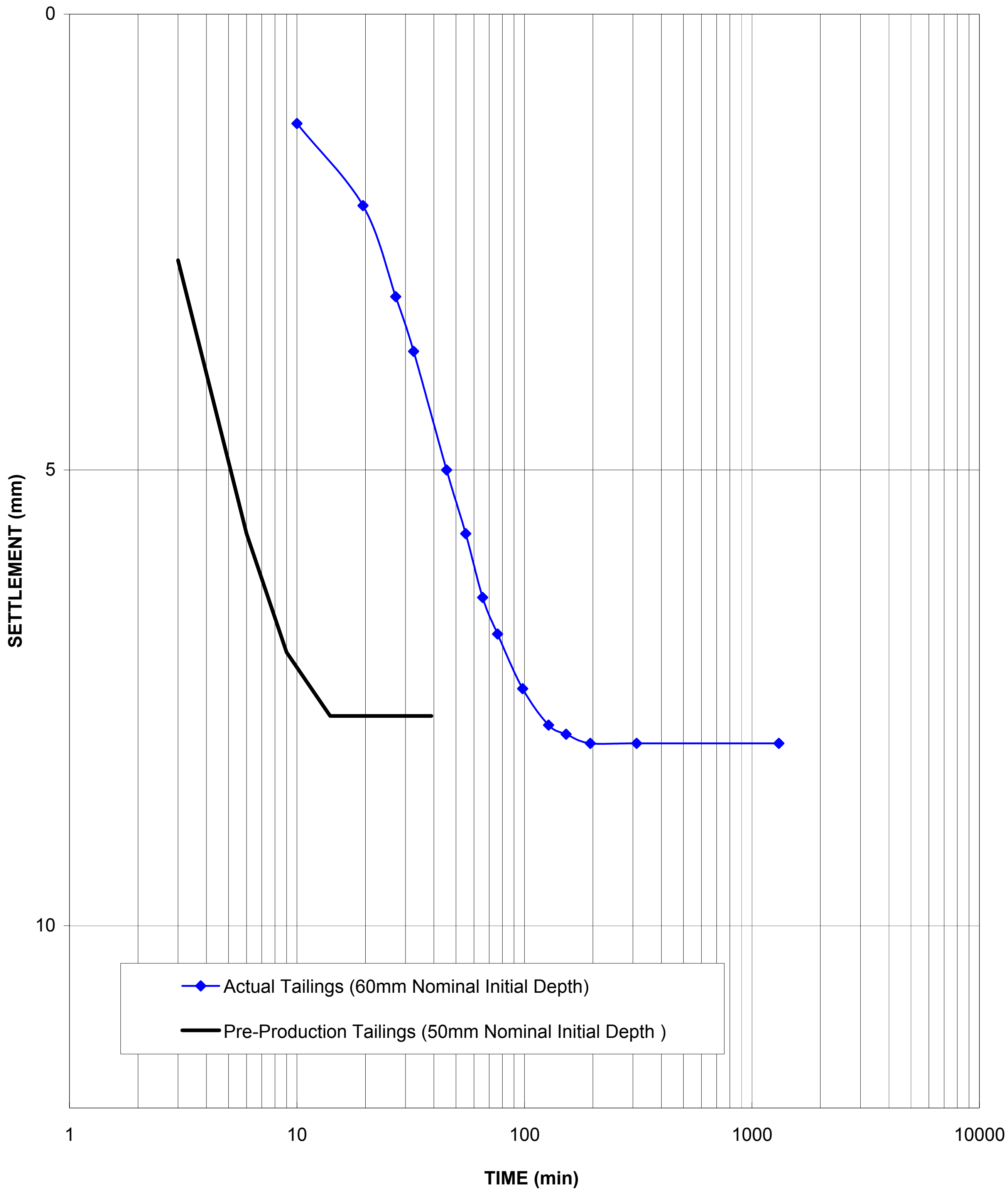
Date: 2/03/2010 **Job No:** 105032.04

FIGURE 1



TERRAMIN AUSTRALIA LIMITED ANGAS ZINC MINE -TAILINGS STORAGE FACILITY LABORATORY TESTING OF TAILINGS	SHRINKAGE LIMIT DENSITY DRY DENSITY Vs. MOISTURE CONTENT
ATC Williams GROUNDED IN DESIGN ATC Williams Pty Ltd 19 Beach Avenue Mordialloc Vic 3195 AUSTRALIA T +61 3 9590 9222 F +61 3 9590 9228 melb@atcwilliams.com.au www.atcwilliams.com.au	**Job No:** 105032.04 **Date:** 9/02/2010 **FIGURE 2**

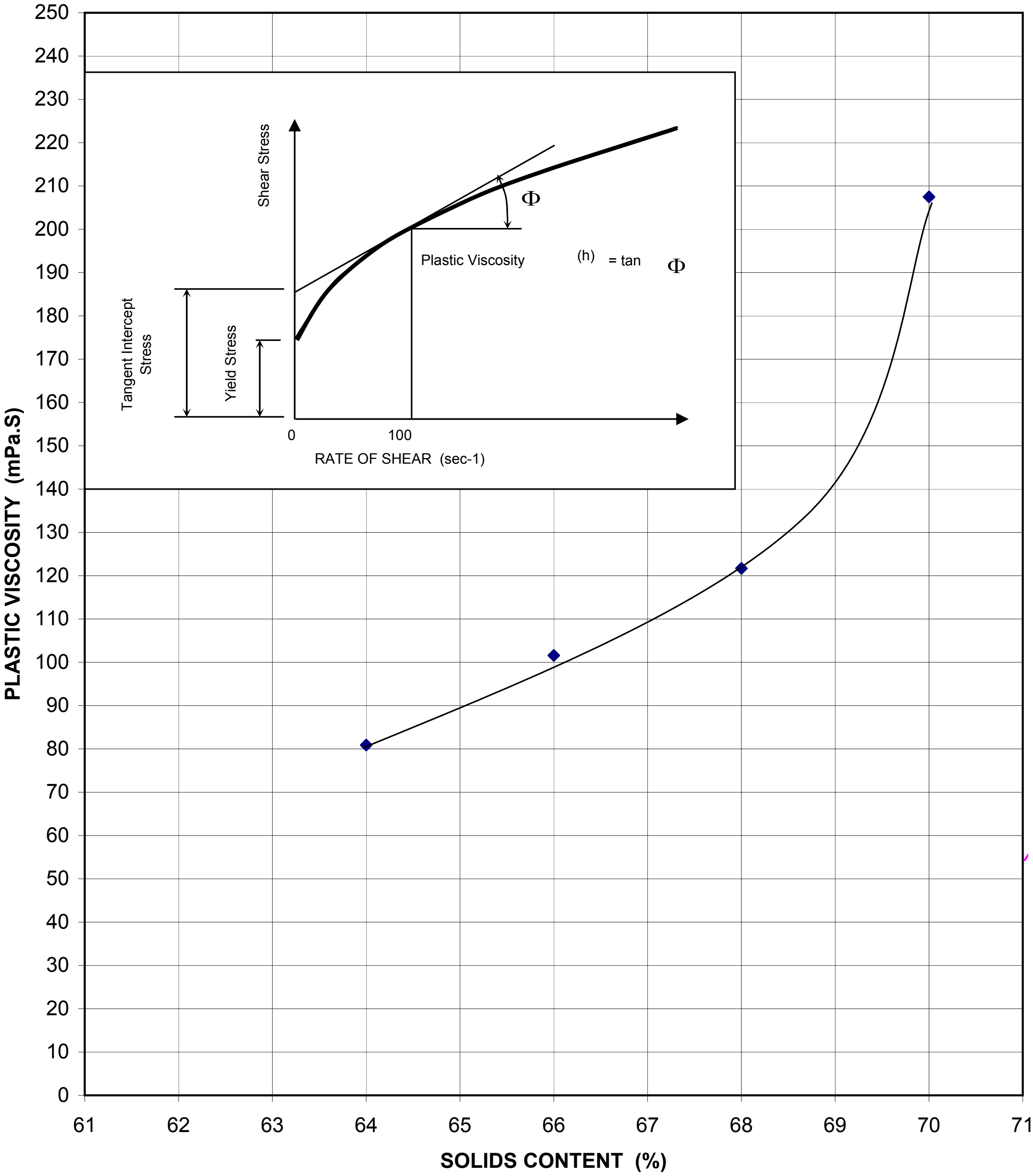
J:\2005\105032 Angas Zinc Project\04 Tailings Testing\Data & Calcs\BGN\Figure R12



TERRAMIN AUSTRALIA LIMITED ANGAS ZINC MINE -TAILINGS STORAGE FACILITY LABORATORY TESTING OF TAILINGS	INITIAL SETTLED DENSITY Settlement Vs. Time 62.5 % INITIAL SOLIDS
ATC Williams GROUNDED IN DESIGN ATC Williams Pty Ltd 19 Beach Avenue Mordialloc Vic 3195 AUSTRALIA T +61 3 9590 9222 F +61 3 9590 9228 melb@atcwilliams.com.au www.atcwilliams.com.au	**Job No:** 105032.04 **Date:** 20/01/2010 **FIGURE 3**

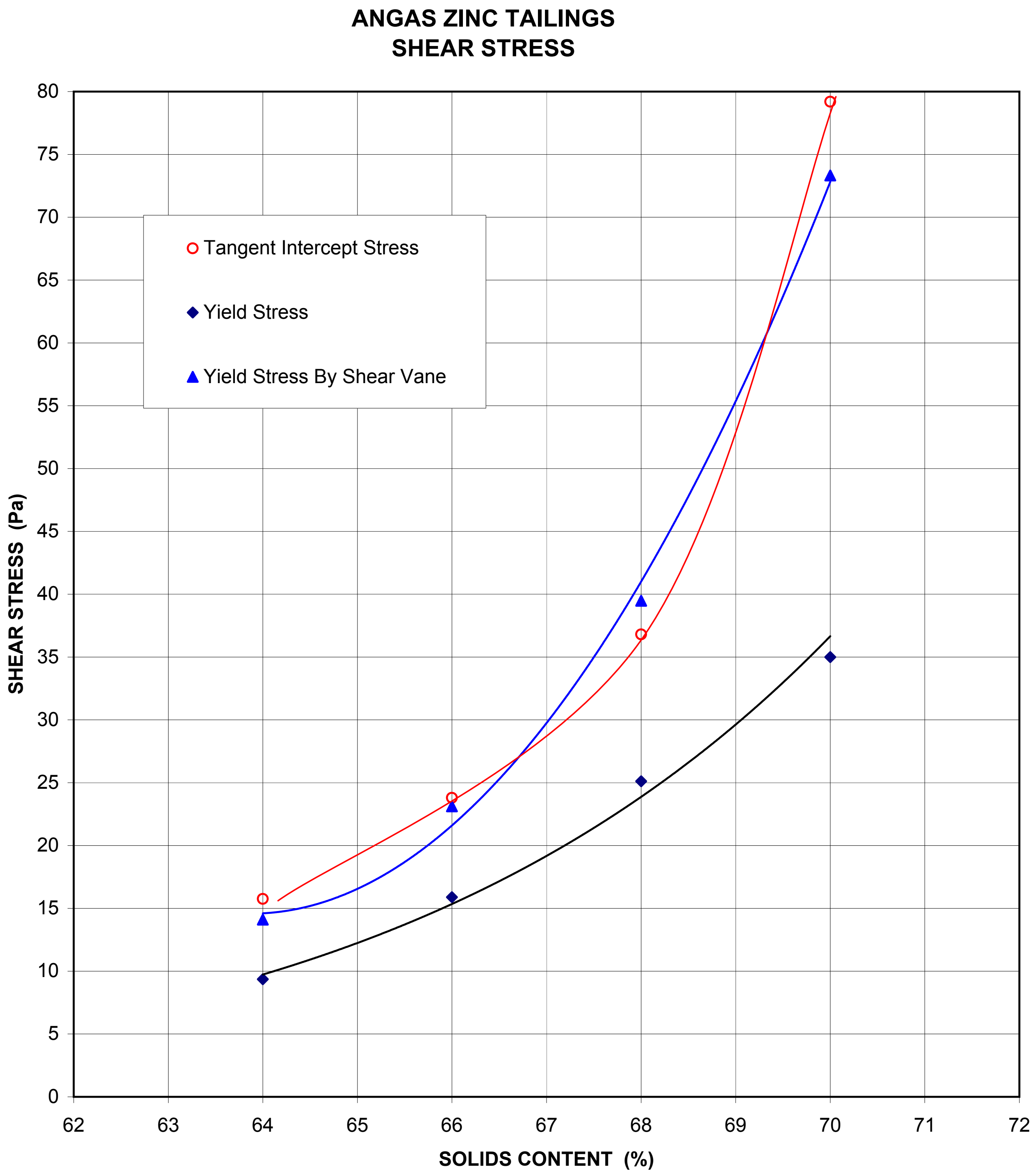
J:\2005\105032 Angas Zinc Project\04 Tailings Testing\Data & Calcs\BGN\Figure R12

ANGAS ZINC TAILINGS
PLASTIC VISCOSITY



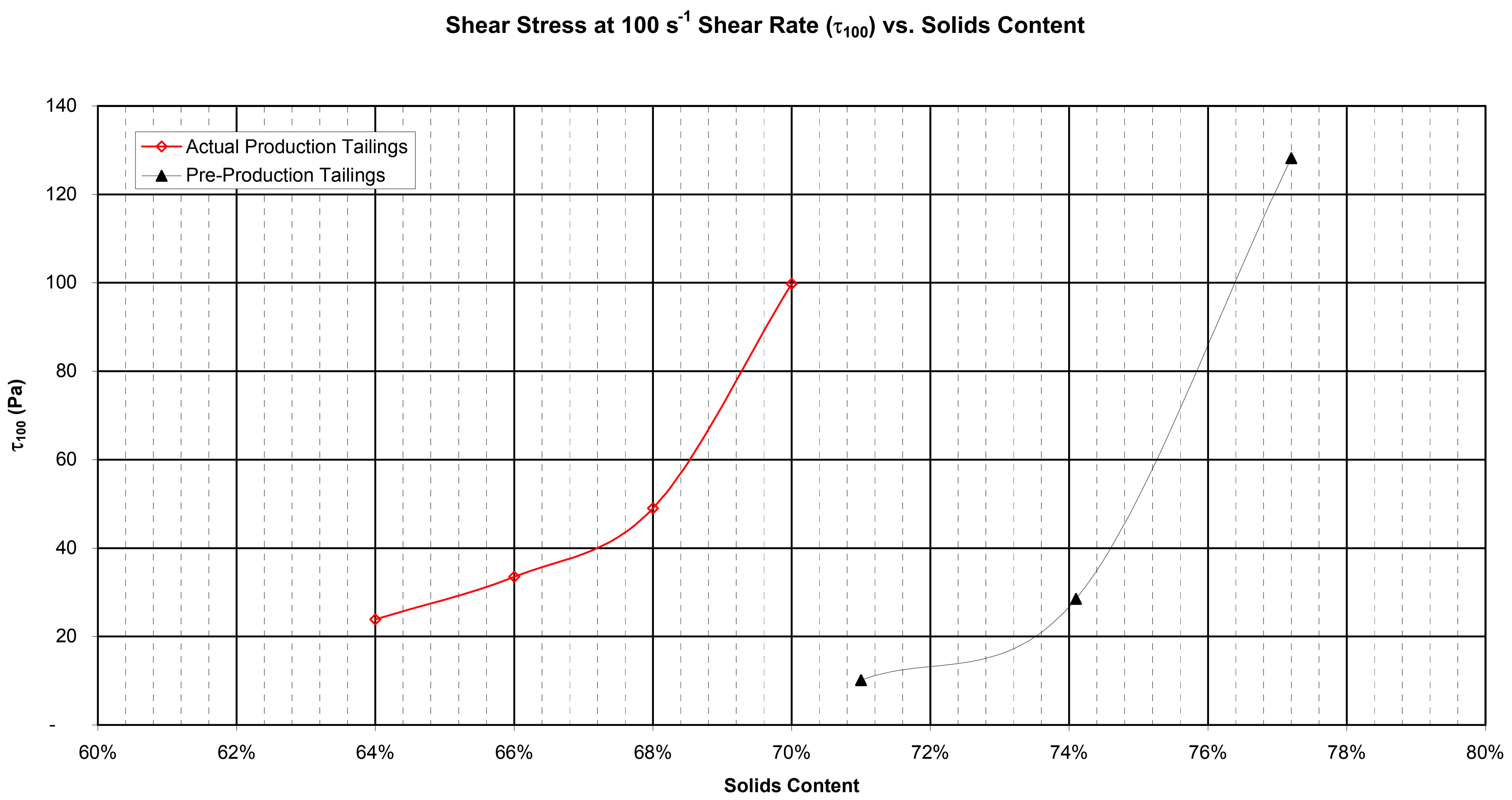
TERRAMIN AUSTRALIA LIMITED **ANGAS ZINC MINE -TAILINGS STORAGE FACILITY** **LABORATORY TESTING OF TAILINGS**	**RHEOLOGY** **Plastic Viscosity Vs.** **Solids Content**	
ATC Williams GROUNDED IN DESIGN	**Job No:**	105032.04
ATC Williams Pty Ltd 19 Beach Avenue Mordialloc Vic 3195 AUSTRALIA T +61 3 9590 9222 F +61 3 9590 9228 melb@atcwilliams.com.au www.atcwilliams.com.au	**Date:**	30/01/2010
	FIGURE 4	

J:\2005\105032 Angas Zinc Project\04 Tailings Testing\Data & Calcs\BGN\Figure R12



TERRAMIN AUSTRALIA LIMITED ANGAS ZINC MINE -TAILINGS STORAGE FACILITY LABORATORY TESTING OF TAILINGS	RHEOLOGY Yield Stress Vs. Solids Content
ATC Williams GROUNDED IN DESIGN ATC Williams Pty Ltd 19 Beach Avenue Mordialloc Vic 3195 AUSTRALIA T +61 3 9590 9222 F +61 3 9590 9228 melb@atcwilliams.com.au www.atcwilliams.com.au	**Job No:** 105032.04 **Date:** 30/01/2010 **FIGURE 5**

J:\2005\105032 Angas Zinc Project\04 Tailings Testing\Data & Calcs\BGN\Figure R12



ATC Williams Pty Ltd
19 Beach Avenue
(P.O. Box 5286)
Mordialloc Vic 3195
AUSTRALIA
T +61 3 9590 9222
F +61 3 9590 9228
melb@atcwilliams.com.au
www.atcwilliams.com.au

TERRAMIN AUSTRALIA LIMITED

ANGAS ZINC MINE - TAILINGS STORAGE FACILITY

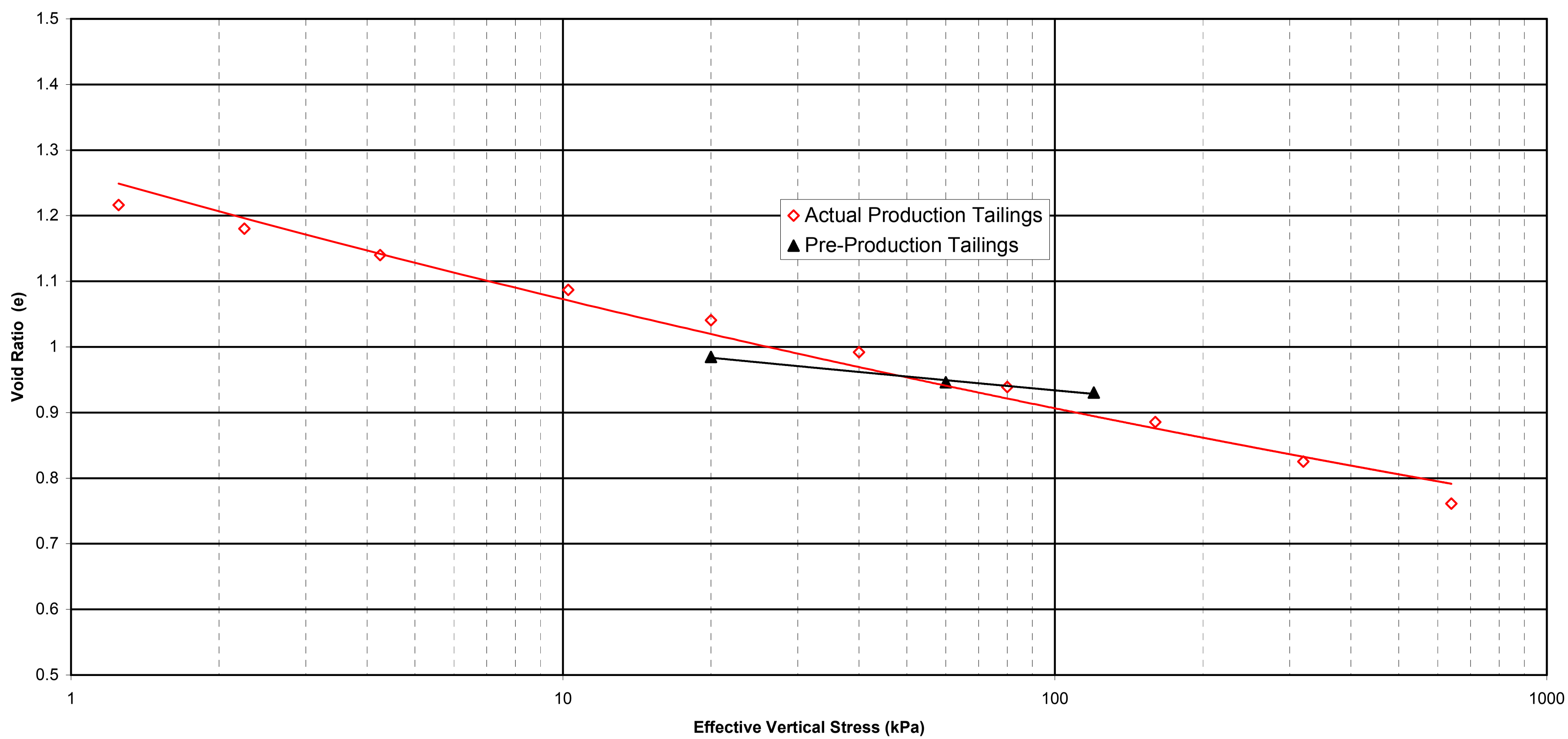
LABORATORY TESTING OF TAILINGS

Rheology - τ_{100} Vs. Solids Content

Date: 22/02/2010 **Job No:** 105032.04

FIGURE 6

J:\2005\105032 Angas Zinc Project\04 Tailings Testing\Data & Calcs\BGN\Figure R12.xls Fig 6



ATC Williams
GROUNDED IN DESIGN

ATC Williams Pty Ltd
19 Beach Avenue
(P.O. Box 5286)
Mordialloc Vic 3195
AUSTRALIA
T +61 3 9590 9222
F +61 3 9590 9228
melb@atcwilliams.com.au
www.atcwilliams.com.au

TERRAMIN AUSTRALIA LIMITED

ANGAS ZINC MINE - TAILINGS STORAGE FACILITY

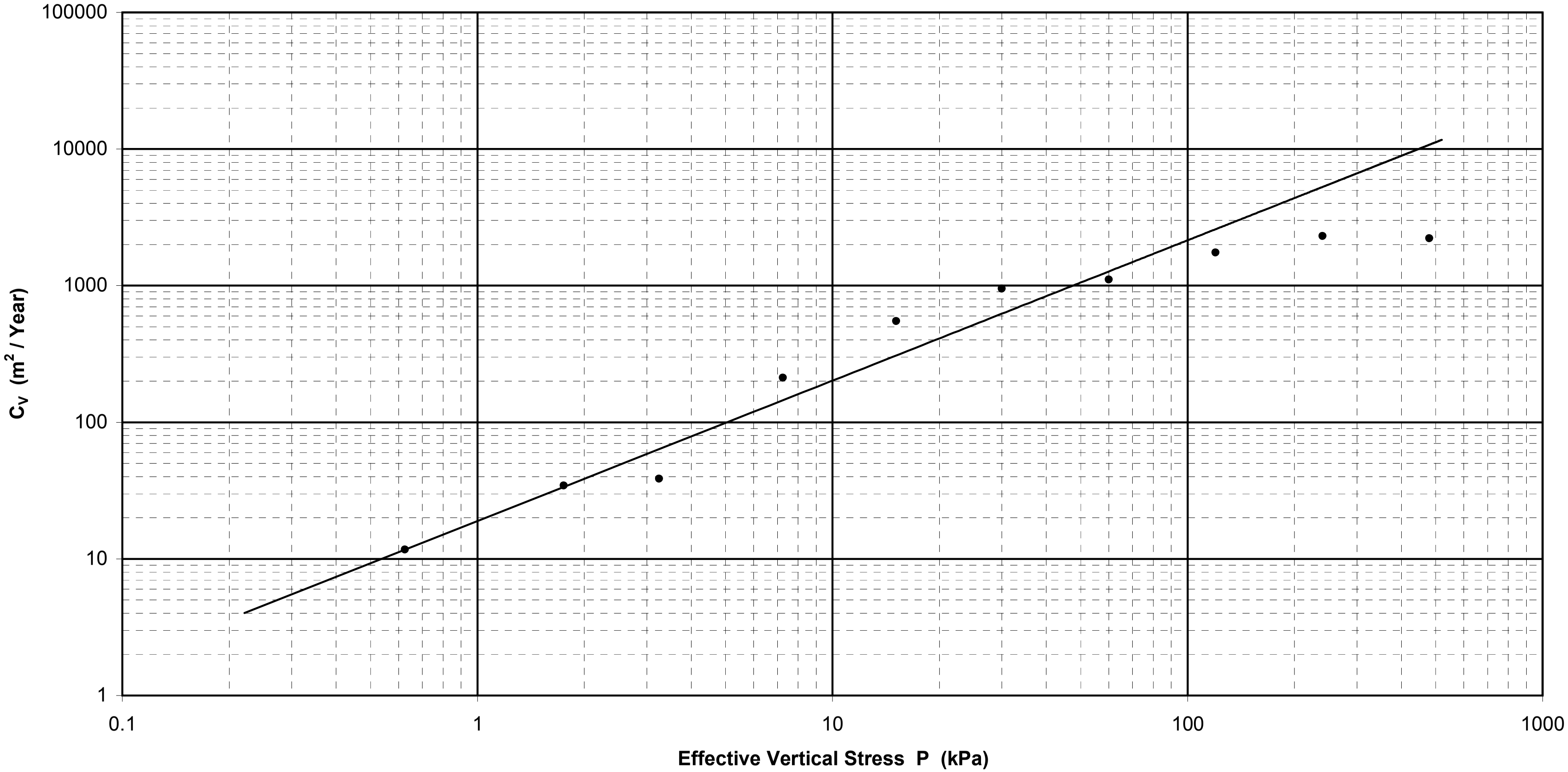
LABORATORY TESTING OF TAILINGS

Rowe Cell Consolidation - Void Ratio Vs. Effective Vertical Stress

Date:	22/02/2010	**Job No:**	105032.04	**FIGURE 7**

J:\2005\105032 Angas Zinc Project\04 Tailings Testing\Data & Calcs\BGN\Figure R12.xls Fig 7

Coefficient of Consolidation vs. Effective Vertical Stress (log Cv / log P)



ATC Williams Pty Ltd
19 Beach Avenue
(P.O. Box 5286)
Mordialloc Vic 3195
AUSTRALIA
T +61 3 9590 9222
F +61 3 9590 9228
melb@atcwilliams.com.au
www.atcwilliams.com.au

ATC Williams GROUNDED IN DESIGN

TERRAMIN AUSTRALIA LIMITED

ANGAS ZINC MINE - TAILINGS STORAGE FACILITY

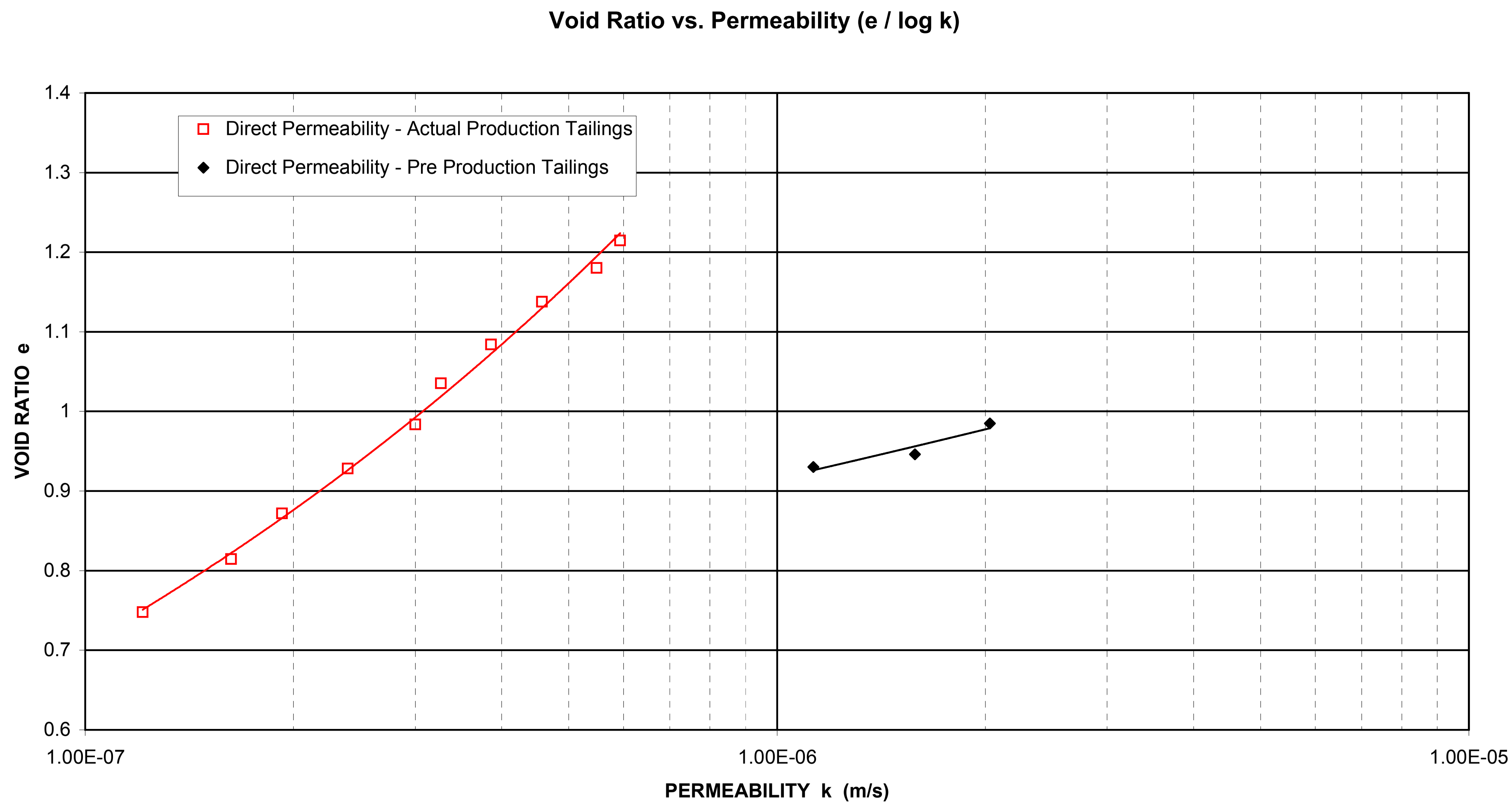
LABORATORY TESTING OF TAILINGS

Rowe Cell Consolidation - Coefficient of Consolidation Vs. Effective Vertical Stress

Date: 22/02/2010 **Job No:** 105032.04

FIGURE 8

J:\2005\105032 Angas Zinc Project\04 Tailings Testing\Data & Calcs\BGN\Figure R12.xls Fig 8



ATC Williams Pty Ltd
19 Beach Avenue
(P.O. Box 5286)
Mordialloc Vic 3195
AUSTRALIA
T +61 3 9590 9222
F +61 3 9590 9228
melb@atcwilliams.com.au
www.atcwilliams.com.au

TERRAMIN AUSTRALIA LIMITED

ANGAS ZINC MINE - TAILINGS STORAGE FACILITY

LABORATORY TESTING OF TAILINGS

Rowe Cell Consolidation - Void Ratio Vs. Permeability

Date: 22/02/2010 **Job No:** 105032.04

FIGURE 9

APPENDIX A

Particle Size Distribution Results

TEST IN ACCORDANCE WITH AS 1289

☑ Method 3.6.1 ☑ Method 3.6.3

☑ Oven Drying Method 2.1.1

ATC Williams GROUNDED IN DESIGN

Client: Terramin Australia Limited

Address: 28 Greenhill Road, Wayville SA 5034

Project: Angas Zinc - Tailings Testing

NATA Report No.:

Job No.: 105032.04

Register No.: 00110

Location: SA

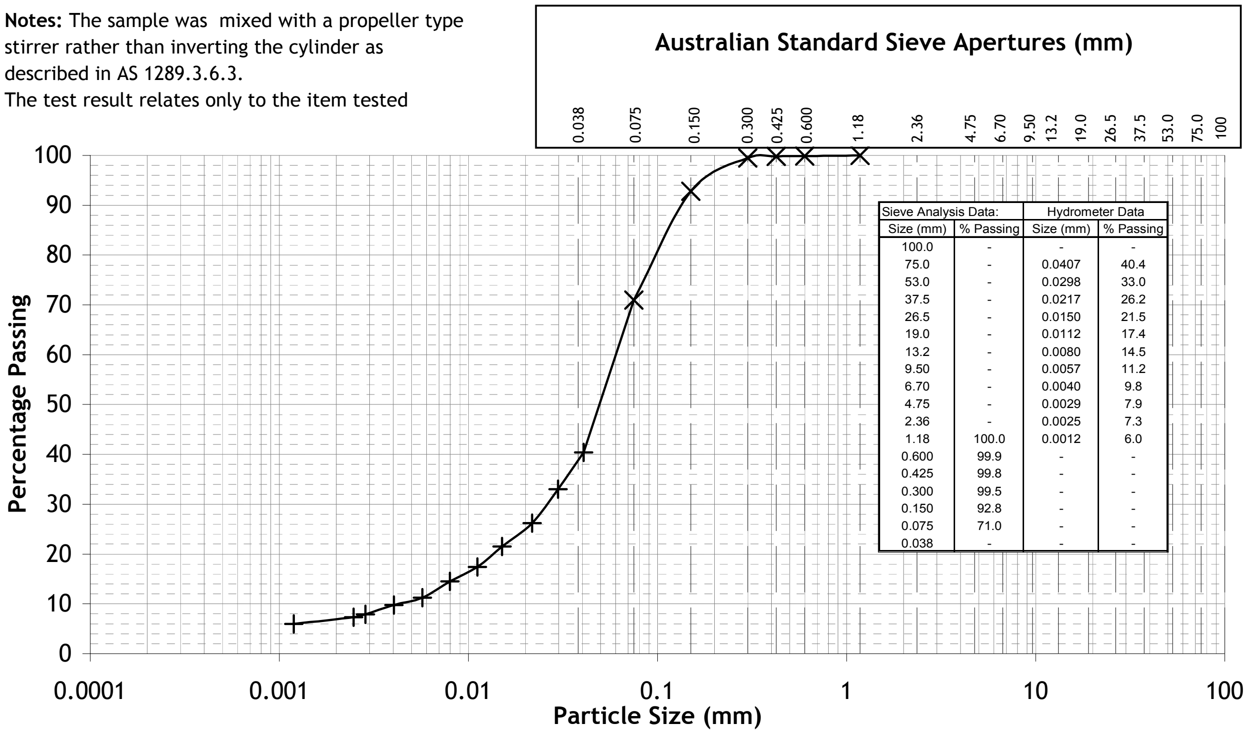
Sample Description: Tailings Sample	Borehole ☐ No:	Test Pit ☐ Depth:

Dispersion Method used: Mechanical Stirrer **Hydrometer Type Used:** ASTM 152H

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1

☑ Sample provided by the Client

Notes: The sample was mixed with a propeller type stirrer rather than inverting the cylinder as described in AS 1289.3.6.3.
The test result relates only to the item tested



Sieve Analysis Data:		Hydrometer Data	
Size (mm)	% Passing	Size (mm)	% Passing
100.0	-	-	-
75.0	-	0.0407	40.4
53.0	-	0.0298	33.0
37.5	-	0.0217	26.2
26.5	-	0.0150	21.5
19.0	-	0.0112	17.4
13.2	-	0.0080	14.5
9.50	-	0.0057	11.2
6.70	-	0.0040	9.8
4.75	-	0.0029	7.9
2.36	-	0.0025	7.3
1.18	100.0	0.0012	6.0
0.600	99.9	-	-
0.425	99.8	-	-
0.300	99.5	-	-
0.150	92.8	-	-
0.075	71.0	-	-
0.038	-	-	-

CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

0.002 0.006 0.02 0.06 0.2 0.6 2 6 20 60

NATA ACCREDITED LABORATORY NUMBER: 3372

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Approved Signatory: Date:

Name of Signatory: Insert name here

ATC Williams Pty Ltd

Laboratory

19 Beach Avenue, Mordialloc Vic 3915

T +61 3 9590 9222 F +61 3 9590 9228

melb@atcwilliams.com.au www.atcwilliams.com.au ABN 64 005 931 288

Classification (Atterberg Limits)

TEST IN ACCORDANCE WITH AS 1289

ATC Williams
GROUNDED IN DESIGN

Client: Terramin Australia Limited .... **NATA Report No.:** ....

Address: 28 Greenhill Road, Wayville, SA 5034 .... **Job No.:** 105032.04 ....

....

Project: Angas Zinc – Tailings Testing .... **Location:** SA ....

Register Number	Sample Description	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Sample Curled (CU) / Crumbled (CR)
00110	Tailings Sample	21	21	0	-	-

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1.
☒ Sample provided by the client

The test results relate only to the items tested.

Test Methods:

☐ Liquid Limit AS 1289.3.1.1 (Standard method)
☒ Liquid Limit AS 1289.3.1.2 (Subsidiary method)
☒ Plastic Limit AS 1289.3.2.1
☒ Plasticity Index AS 1289.3.3.1
☐ Linear Shrinkage AS 1289.3.4.1
☐ Moisture Content AS 1289.2.1.1

Sample Preparation:

☐ Natural Moisture ☒ Air Dried ☐ Oven Dried ☐ Unknown
☐ Wet Sieved ☒ Dry Sieved ☐ Unsieved

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA ACCREDITED LABORATORY NUMBER: 3372
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Approved Signatory .... Date 5th February 2010 ....

Name of Signatory *Insert name here.*

ATC Williams Pty Ltd
19 Beach Avenue, Mordialloc Vic 3915
T +61 3 9590 9222 F +61 3 9590 9228
melb@atcwilliams.com.au www.atcwilliams.com.au ABN 64 005 931 288
ATC Williams unites the companies of Australian Tailings Consultants and MPA Williams & Associates

Determination of the Soil Particle Density of a Soil

TEST IN ACCORDANCE WITH AS 1289.3.5.1

ATC Williams
GROUNDED IN DESIGN

Client: Terramin Australia Limited .... **NATA Report No.:** ....

Address: 28 Greenhill Road, Wayville, SA 5034 .... **Job No.:** 105032.04 ....

....

Project: Angas Zinc – Tailings Testing .... **Location:** SA ....

Register Number	Sample Description	Test Temperature (°C)	% of Sample >2.36 mm	Particle Density (g/cm^3)
00110	Tailings Sample	25	Nil	3.21 #

Notes:

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1

☒ Sample provided by the client

* = apparent average soil particle density – particle size less than 2.36 mm

X = apparent average soil particle density – particle size greater than 2.36 mm

= soil particle density of the total sample

The test results relate only to the items tested.

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA ACCREDITED LABORATORY NUMBER: 3372
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Approved Signatory .... Date ....

Name of Signatory *Insert name here* ....

ATC Williams Pty Ltd
19 Beach Avenue, Mordialloc Vic 3915
T +61 3 9590 9222 F +61 3 9590 9228
melb@atcwilliams.com.au www.atcwilliams.com.au ABN 64 005 931 288
ATC Williams unites the companies of Australian Tailings Consultants and MPA Williams & Associates

Moisture Content of a Soil

TEST IN ACCORDANCE WITH AS 1289.2.1.1

ATC Williams
GROUNDED IN DESIGN

Client: Terramin Australia Limited ....

NATA Report No.: ....

Address: 28 Greenhill Road, Wayville, SA 5034 ....

....

Job No.: 105032.04 ....

Project: Angas Zinc – Tailings Testing ....

Location: SA ....

Register Number	Description	Depth (m)	Moisture Content (%)
00110	Tailings Sample	NA	60.5

Notes:

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1.

☒ Sample provided by the client

The test results relate only to the items tested.

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA ACCREDITED LABORATORY NUMBER: 3372
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Approved Signatory .... Date ....

Name of Signatory *Insert name here* ....

ATC Williams Pty Ltd
19 Beach Avenue, Mordialloc Vic 3915
T +61 3 9590 9222 F +61 3 9590 9228
melb@atcwilliams.com.au www.atcwilliams.com.au ABN 64 005 931 288
ATC Williams unites the companies of Australian Tailings Consultants and MPA Williams & Associates