TP2A-R19

TP2A-R19

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-R20
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711420E 7652881N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry. **SHALE** Extremely weathered, cleaved/laminated, grey and red brown. Excavated As : GRAVEL: Very dense/dense, fine to coarse, grey, red brown, with sand and clay fines, dry			
			1.0						
			1.5			**SHALE** Highly weathered, grey and pale grey, cleaved / laminated and closely fractured, very low / low strength, dry.			
			2.0			Test pit TP2A-R20 terminated at 1.8m Bucket refusal - hard excavation			
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-R20

TP2A-R20

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-R21
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.10
JOB LOCATION Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**
EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711489E 7652899N
REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry. **SILTSTONE** Extremely weathered, thinly bedded, grey and red brown. Excavated As : GRAVEL: Very dense/dense, fine to coarse, grey, red brown, with cobbles, sand and silt fines, dry			
			1.0			**SILTSTONE** Highly weathered, grey and pale grey, thinly beddded 30 - 100 mm layers, closely fractured, low strength, dry. becoming medium strength			
			1.5 2.0 2.5 3.0 3.5 4.0 4.5			Test pit TP2A-R21 terminated at 1.2m Bucket refusal - hard excavation			

TP2A-R21

TP2A-R21

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-R22
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 12-9-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 710423E 7654330N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5 1.0 1.5			**COBBLES WITH SANDY GRAVEL** Medium dense, red brown and grey subrounded to angular cobbles of sandstone and siltstone, supported in a sandy gravel matrix comprising fine to coarse gravel and sand, dry. with boulders to 0.4 m dia.			
			2.0			**SHALE** Extremely weathered. Excavated as: Clayey GRAVEL: Dense, fine to coarse, tabular, red brown and grey, with sand, dry/moist			
			2.5			**SHALE** Highly weathered, red brown and grey, laminated and cleaved, with pockets of extremely weathered material (clayey gravel), very low strength. Test pit TP2A-R22 terminated at 2.5m Bucket refusal - hard excavation			
			3.0 3.5 4.0 4.5						

TP2A-R22

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-R23
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 12-9-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 710420E 7654339N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5 1.0 1.5 2.0			**COBBLES WITH SANDY GRAVEL MATRIX** Medium dense, red brown and grey subrounded to angular cobbles of sandstone and siltstone, supported in a sandy gravel matrix comprising fine to coarse gravel and sand, dry. with boulders to 0.5 m dia.			
			2.5			**SILTSTONE** Extremely / highly weathered, red brown and grey, laminated, very low/low strength.			
			3.0 3.5 4.0 4.5			Test pit TP2A-R23 terminated at 2.7m Bucket refusal - hard excavation			

TP2A-R23

TP2A-R23

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-R24
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 12-9-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 710424E 7654345N Creek channel

REMARKS Seepage at 2.6 m

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	Seepage 2.6 m		0.5 1.0 1.5 2.0 2.5			**COBBLES WITH SANDY GRAVEL MATRIX** Medium dense, red brown and grey subrounded to angular cobbles of sandstone and siltstone, supported in a sandy gravel matrix comprising fine to coarse gravel and sand, dry. with boulders to 0.5 m dia.			
	▶					**SANDSTONE** Highly weathered, green-grey with red oxide staining, medium texture, closely jointed, low/medium strength, wet.			
			3.0 3.5 4.0 4.5			Test pit TP2A-R24 terminated at 2.8m Bucket refusal - hard excavation			

TP2A-R24

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T20
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711427E 7652866N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry.			
					GP-GC	**SHALE** Extremely weathered. Excavated As : Very dense/dense, fine to coarse tabular GRAVEL, grey and red brown, dry			
						SHALE Highly weathered, grey, laminated, subvertical cleavage/bedding, very low to low strength. Test pit TP2A-T20 terminated at 0.6m Bucket refusal - hard excavation			

1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

MPAW/ATC/ATCW BOREHOLE / TEST PIT 114185.10.GPJ GINT AUSTRALIA.GDT 9-11-18

TP2A-T20

TP2A-T20

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T21
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711489E 7652899N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered				GP-GC	**TOPSOIL: GRAVEL**			
					GP-GC	Medium dense, fine to coarse gravel, red brown, with sand, clay and trace rootlets, dry.			
						SHALE Extremely weathered. Excavated As : Very dense/dense, fine to coarse tabular GRAVEL, grey and red brown, dry			
			0.5			**SHALE** Highly weathered, grey, laminated, subvertical cleavage/bedding, very low to low strength, dry. Test pit TP2A-T21 terminated at 0.6m Bucket refusal - hard excavation			
			1.0						
			1.5						
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T21

TP2A-T21

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T22
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711488E 7653083N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC SM	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry. **Silty SAND** Loose, fine and medium, yellow brown, trace roots and organics, dry (Alluvium) **COBBLES** Medium dense, rounded to subrounded of sandstone, ironstone and dolerite, grey, red and brown, with gravel, trace sand and silt, dry (Alluvium)			
			1.0 1.5		GP-GC	**SILTSTONE/SHALE** Extremely weathered. Excavated as: Very dense, fine to coarse, angular tabular GRAVEL, grey and red brown, with sand and clay fines, dry/moist. 1.0 - 1.3 m with clayey gravel pockets			
			2.0 2.5 3.0 3.5 4.0 4.5			Test pit TP2A-T22 terminated at 1.9m Bucket refusal - hard excavation			

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T23
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711433E 7653191N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5 1.0			**COBBLES & BOULDERS with Gravel** Medium dense, rounded to subrounded cobbles and boulders to 0.6 m diameter of sandstone, ironstone and dolerite, grey, red and brown, with gravel, trace sand and silt, dry (Alluvium).			
			1.5 2.0 2.5		GP	**SHALE** Extremely weathered. Excavated As : Very dense/dense, fine to coarse tabular GRAVEL, red brown, trace sand and silt, dry/moist. Bedding / cleavage 40 - 50 dip to north.			
			3.0 3.5 4.0 4.5			Test pit TP2A-T23 terminated at 2.5m Test pit terminated			

TP2A-T23

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T24
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711661E 7653016N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry. **GRAVEL** Loose, fine to coarse, tabular shale gravel, red brown with sand and clay fines, dry (Colluvium)			
			1.0		GP-GC	**SILTSTONE/SHALE** Extremely weathered. Excavated As : Very dense/dense, fine to coarse tabular GRAVEL, red brown, dry **SILTSTONE/SHALE** Highly weathered, grey, laminated, subvertical cleavage/bedding, very low to low strength.			
			1.5 2.0 2.5 3.0 3.5 4.0 4.5			Test pit TP2A-T24 terminated at 1m Bucket refusal - hard excavation			

TP2A-T24

TP2A-T24

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T25
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711853E 7653220N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GM GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, silt and rootlets, dry. **SHALE** Extremely weathered. Excavated As : Very dense/dense, fine to coarse tabular, grey, red brown, trace sand and silt, dry/moist. **SHALE** Highly weathered, grey / white, laminated / cleaved with 70 - 80 degree dip, with siltstone banding, very low to low strength, dry			
			1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5			Test pit TP2A-T25 terminated at 0.7m Bucket refusal - hard excavation			

TP2A-T25

TP2A-T25

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T26
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.10
JOB LOCATION Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**
EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711911E 7653268N
REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC GP-GC GP	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry. **GRAVEL** Loose, fine to coarse, tabular shale gravel, red brown with sand and clay fines, dry (Colluvium) **SHALE** Extremely weathered. Excavated As : Very dense/dense, fine to coarse tabular GRAVEL, grey, red brown, trace sand and silt, dry/moist.			
			1.0			**SHALE** Highly weathered, grey / white, laminated / cleaved with subvertical dip, subvertical cleavage/bedding, very low to low strength (dry).			
			1.5			Test pit TP2A-T26 terminated at 1.1m Bucket refusal - hard excavation			
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T26

TP2A-T26

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T27
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.10
JOB LOCATION Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**
EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711947E 7653298N
REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry. **COBBLES** Medium dense, rounded to subrounded of sandstone, ironstone and dolerite, grey, red and brown, with boulders to 0.6 m dia, gravel, trace sand and silt, dry/moist (Alluvium) **SILTSTONE/SHALE** Extremely / highly weathered, grey, laminated, subvertical cleavage/bedding, extremely low to low strength, dry.			
			1.0						
			1.5			Test pit TP2A-T27 terminated at 1.2m Bucket refusal - hard excavation			
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T27

TP2A-T27

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T28
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.10
JOB LOCATION Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**
EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712055E 7653428N
REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry. **SHALE/SILTSTONE** Extremely weathered. Excavated As : Very dense/dense, fine to coarse tabular GRAVEL, grey, red brown, with sand and clay fines, dry			
			1.0			**SHALE/SILTSTONE** Highly weathered, grey and white, thinly interbedded, subvertical dip, vertical cleavage/bedding, very low to low strength, dry			
			1.5						
			2.0						
			2.5			Test pit TP2A-T28 terminated at 2m Bucket refusal - hard excavation			
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T28

TP2A-T28

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T29
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.10
JOB LOCATION Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**
EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712089E 7653463N
REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC SM	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry. **Silty SAND** Loose, fine and medium, brown, trace roots, dry (Alluvium)			
			1.0 1.5 2.0 2.5		GP	**MIXTURE OF COBBLES/BOULDERS with Gravel** Medium dense/dense, rounded to subrounded of sandstone, ironstone and dolerite, grey, red and brown, clast supported with boulders to 0.5 m dia, with gravel, trace sand and silt, dry/moist (Alluvium)			
			3.0 3.5 4.0 4.5			Test pit TP2A-T29 terminated at 2.6m Bucket refusal - hard excavation			

TP2A-T29

TP2A-T29

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T30
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712114E 7653491N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5 1.0 1.5 2.0		SM GP-GM GP-GM	**TOPSOIL: SILTY SAND** Loose, fine and medium, brown, trace roots, dry. **GRAVEL** Medium dense, fine to coarse gravel of sandstone, ironstone, with cobbles, sand and silt, dry (Alluvium) **SANDSTONE** Extremely weathered, pale yellow and red brown extremely low strength. Recovered as Sandy GRAVEL with silt, dry.			
			2.5 3.0 3.5 4.0 4.5			Test pit TP2A-T30 terminated at 2.4m Bucket refusal - hard excavation			

TP2A-T30

TP2A-T30

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T31
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 6-9-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712134E 7653513N Creek channel

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5			**SANDY GRAVEL WITH COBBLES AND BOULDERS** Medium dense, red brown and grey, fine to coarse gravel and sand, with cobbles and boulders to 0.7 m diameter, dry.			
			1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5			**SHALE / SILTSTONE** Extremely / highly weathered, red brown and grey, laminated with minor siltstone layering, subvertical bedding dip, with pockets of clayey gravel to 0.8 m depth, dry. becoming highly weathered			
						Test pit TP2A-T31 terminated at 4.8m Bucket refusal - hard excavation			

TP2A-T31

TP2A-T31

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T32
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.10
JOB LOCATION Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**
EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712155E 7653548N
REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5 1.0 1.5 2.0		GP-GM GP-GM	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, silt trace rootlets, dry. **GRAVEL** Medium dense, fine to coarse gravel of sandstone, ironstone, with cobbles, sand and silt, dry (Alluvium)			
			2.5 3.0 3.5 4.0 4.5			Test pit TP2A-T32 terminated at 2.3m Bucket refusal - hard excavation			

TP2A-T32

TP2A-T32

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T33
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 1-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712276E 7653723N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered				GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry.			
					GP-GC	**GRAVEL** Loose, fine to coarse, red brown with sand and clay fines, dry (Colluvium)			
					GP-GC	**SHALE/SILTSTONE** Extremely weathered. Excavated As : Very dense/dense, fine to coarse, grey, red brown, with sand and clay fines, dry			
			0.5			**SHALE/SILTSTONE** Highly weathered, grey with iron staining, laminated / cleaved with interbedded siltstone layers, very low to low strength, dry			
						Test pit TP2A-T33 terminated at 0.6m Bucket refusal - hard excavation			
			1.0						
			1.5						
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T33

TP2A-T33

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T34
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.10
JOB LOCATION Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**
EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712006E 7653479N
REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.0		SM	**TOPSOIL: SILTY SAND**
					SM	Loose, fine to coarse, red brown, with roots, dry
						Silty SAND Loose, fine and medium, red brown, trace gravel, dry (Alluvium)
			0.5		GP-GM	**Sandy GRAVEL** Medium dense/ dense, fine to coarse, red brown, fine to coarse sand with cobbles and silt, dry (Alluvium)
			1.0		GP	**GRAVEL** Medium dense/ dense, fine to coarse, red and red brown, fine to coarse sand with cobbles trace silt, dry (Alluvium)
			1.5			
			2.0			
			2.5			**SHALE/SILTSTONE** Highly weathered, grey, thin interbedded shale and siltstone layers, extremely low / very low strength, dry (Alluvium)
			3.0			Test pit TP2A-T34 terminated at 2.9m Bucket refusal - hard excavation
			3.5			
			4.0			
			4.5			

TP2A-T34

TP2A-T34

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T35
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711928E 7653529N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	% Finer than 0.075mm	Additional Observations
	not encountered		0.5		SM	**TOPSOIL: SILTY SAND** Loose, fine to coarse, red brown, with roots, dry				
					SM	**Silty SAND** Loose, fine and medium, red brown, trace gravel, dry (Alluvium)	BK		11	
			1.0		GP-GM	**Sandy GRAVEL** Medium dense/ dense, fine to coarse, red brown, fine to coarse sand with cobbles and silt, dry (Alluvium)				
			1.5							
			2.0		GP	**GRAVEL** Medium dense/ dense, fine to coarse, red and red brown, fine to coarse sand with cobbles trace silt, dry (Alluvium)				
			2.5			**SHALE/SILTSTONE** Extremely to highly weathered, grey, thin interbedded shale and siltstone layers, extremely low / very low strength, dry				
			3.0			Test pit TP2A-T35 terminated at 2.8m Bucket refusal - hard excavation				
			3.5							
			4.0							
			4.5							

TP2A-T35

TP2A-T35

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T36
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 6-9-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711920E 7653570N Creek channel

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5 1.0 1.5 2.0			**COBBLES WITH SANDY GRAVEL** Medium dense, red brown and grey subrounded to angular cobbles of sandstone and siltstone, clast supported with a matrix of sandy gravel comprising fine to coarse gravel and sand, dry.			
			2.5 3.0 3.5			**SILTSTONE** Highly weathered, red brown and grey, laminated with minor shale layers, subvertical bedding dip, dry.			
			4.0 4.5			Test pit TP2A-T36 terminated at 3.5m Bucket refusal - hard excavation			

TP2A-T36

TP2A-T36

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T37
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 6-9-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711841E 7653640N Creek channel

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5			**COBBLES WITH SANDY GRAVEL** Medium dense, red brown and grey subrounded to angular cobbles of sandstone and siltstone, clast supported with a matrix of sandy gravel comprising fine to coarse gravel and sand, dry.			
			1.0			**SANDSTONE** Highly weathered, grey with minor red brown staining, fine and medium grained, massive, low / medium strength.			
			1.5						
			2.0			Test pit TP2A-T37 terminated at 1.9m Bucket refusal - hard excavation			
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T37

TP2A-T37

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T38
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.10
JOB LOCATION Pilbara, WA

DATE 3-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**
EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712326E 7652489N
REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GM GP-GM	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, silt and rootlets, dry. **GRAVEL** Loose, fine to coarse, red brown with sand and silt fines, dry. **SANDSTONE** Extremely weathered, thinly bedded, grey and red brown. Excavated as: GRAVEL: Very dense/dense, fine to coarse, grey, red brown, with cobbles, sand and silt fines, dry			
			1.0			**SANDSTONE** Highly weathered, fine and medium grained, massive/faintly laminated, grey and pale grey, low /medium strength, dry.			
			1.5 2.0 2.5 3.0 3.5 4.0 4.5			Test pit TP2A-T38 terminated at 1.2m Bucket refusal - hard excavation			

TP2A-T38

TP2A-T38

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T39
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 3-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712339E 7652533N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5			**COBBLES WITH GRAVEL** Medium dense / dense, rounded cobbles of sandstone, dolerite and ironstone, grey, red and brown, supported in a gravel and sand maxtrix, trace boulders to 0.4 m diameter, dry.			
			1.0			**SANDSTONE** Extremely weathered, thinly bedded, brown and red brown. Excavated As : GRAVEL: Very dense/dense, fine to coarse, grey, red brown, with cobbles, sand and clay fines, dry/moist.			
			1.5			**SANDSTONE** Extremely to highly weathered, medium and coarse grained, massive/faintly laminated, grey and pale grey, very low /low strength, dry. becoming low to medium strength			
			2.0			Test pit TP2A-T39 terminated at 1.7m Bucket refusal - hard excavation			
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T39

TP2A-T39

TP2A-T39

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T40
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 3-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712358E 7652559N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GM	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, silt and rootlets, dry. **COBBLES WITH GRAVEL** Medium dense / dense, rounded cobbles of sandstone, dolerite and ironstone, grey, red and brown, supported in a gravel and sand maxtrix, trace boulders to 0.4 m diameter, dry.			
			1.0			**SHALE** Extremely weathered, thinly bedded, brown and red brown. Excavated As: GRAVEL: Very dense/dense, fine to coarse, grey, red brown, with cobbles, sand and clay fines, dry/moist.			
			1.5			**SHALE** Extremely to highly weathered, medium and coarse grained, massive/faintly laminated, grey and pale grey, very low /low strength, dry.			
			2.0			Test pit TP2A-T40 terminated at 1.9m Bucket refusal - hard excavation			
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T40

TP2A-T40

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T41
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 3-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712371E 7652553N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GM	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, silt and rootlets, dry. **COBBLES WITH GRAVEL** Medium dense / dense, rounded cobbles of sandstone, dolerite and ironstone, grey, red and brown, supported in a gravel and sand maxtrix, trace boulders to 0.4 m diameter, dry.			
			1.0			**SHALE** Extremely weathered, thinly bedded, brown and red brown. Excavated As: GRAVEL: Very dense/dense, fine to coarse, tabular, grey, red brown, sand and clay fines, dry/moist.			
			1.5						
			2.0			**SHALE** Highly weathered, subvertical laminations and cleavage, grey, extremely low / low strength, dry.			
			2.5			Test pit TP2A-T41 terminated at 2.1m Bucket refusal - hard excavation			
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T41

TP2A-T41

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T42
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712139E 7653616N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0		GP-GC	**Sandy GRAVEL** Loose, fine to coarse, gravel, red brown, fine to coarse sand, with silt fines, dry (Colluvium)			
					GP-GC	**SHALE** Extremely weathered. Excavated As : Very dense/dense, fine to coarse GRAVEL, grey, red brown, with sand and clay fines, dry			
			0.5			**SHALE** Highly weathered, grey and white, thinly interbedded, subvertical dip, subvertical cleavage/bedding, very low / low strength, dry Test pit TP2A-T42 terminated at 0.5m Bucket refusal - hard excavation			
			1.0						
			1.5						
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T42

TP2A-T42

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T43
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712257E 7653705N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GC GP-GC GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry. **GRAVEL** Loose, fine to coarse, gravel, red brown, fine to coarse sand, with silt fines, dry (Colluvium) **SHALE/SILTSTONE** Extremely weathered. Excavated As: Very dense/dense, fine to coarse GRAVEL, grey, red brown, with sand and clay fines, dry **SHALE/SILTSTONE** Highly weathered, grey and red brown, thinly interbedded shale and siltstone layers (20 mm - 30 mm thickness), very low / low strength, dry Test pit TP2A-T43 terminated at 0.7m Bucket refusal - hard excavation			

1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

MPAW/ATC/ATCW BOREHOLE / TEST PIT 114185.10.GPJ GINT AUSTRALIA.GDT 9-11-18

TP2A-T43

TP2A-T43

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T44
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

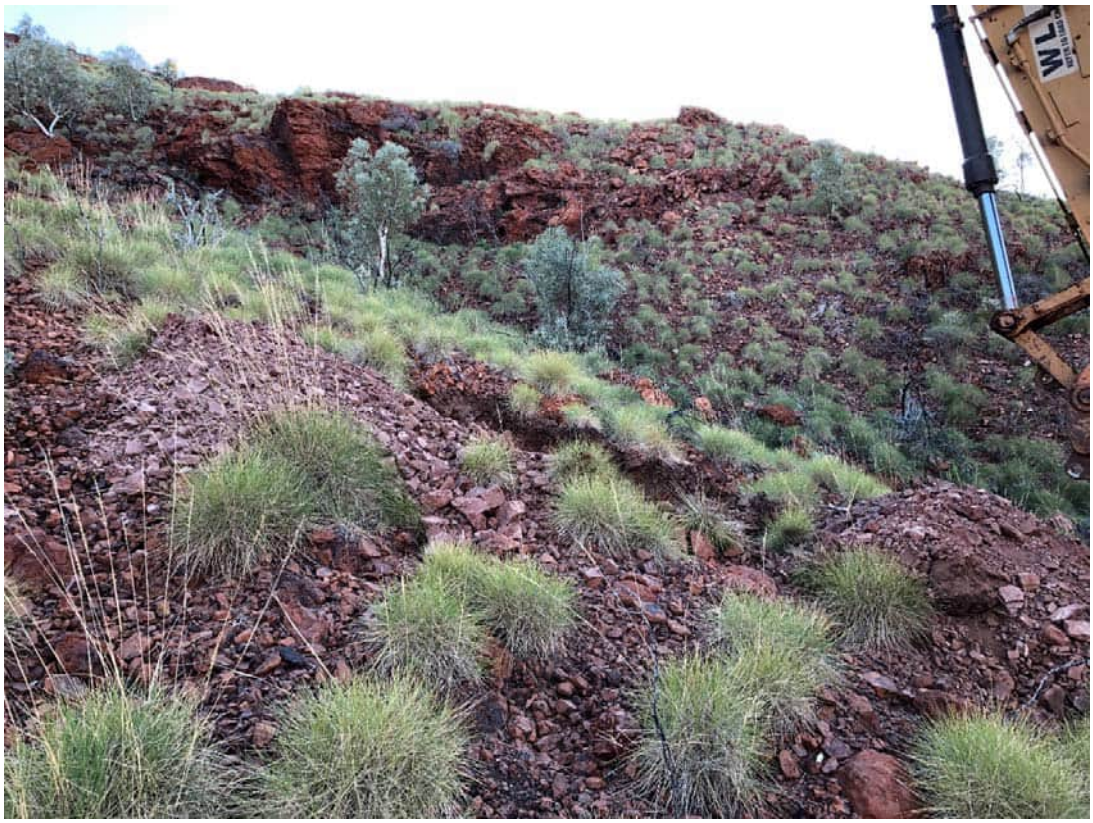
DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 712281E 7653742N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered				GP-GC	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry.			
					GP-GC	**SHALE/SILTSTONE** Extremely weathered. Excavated As : Very dense/dense, fine to coarse GRAVEL, grey, red brown, with sand and clay fines, dry			
			0.5			**SHALE/SILTSTONE** Highly weathered, grey brown, thinly interbedded shale and siltstone layers (20 mm - 30 mm thickness), very low / low strength, dry Test pit TP2A-T44 terminated at 0.5m Bucket refusal - hard excavation			
			1.0						
			1.5						
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T44



TP2A-T44

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T45
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711803E 7653234N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.5		GP-GM	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, silt and rootlets, dry. **SANDSTONE** Extremely weathered, pale grey with red oxide staining, close vertical jointing. Excavated as COBBLES with gravel and sand, dry			
						SANDSTONE Highly weathered, pale grey with red oxide staining, medium and coarse, close vertical jointing, low / medium strength, dry Test pit TP2A-T45 terminated at 0.5m Bucket refusal - hard excavation			

1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

MPAW/ATC/ATCW BOREHOLE / TEST PIT 114185.10.GPJ GINT AUSTRALIA.GDT 9-11-18

TP2A-T45

TP2A-T45

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T46
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711622E 7653071N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered				GP-GC	**TOPSOIL: GRAVEL**			
					GP-GC	Medium dense, fine to coarse gravel, red brown, with sand, clay and rootlets, dry.			
						SHALE/SILTSTONE Extremely weathered. Excavated As : Very dense/dense, fine to coarse GRAVEL, grey, red brown, with sand and clay fines, dry			
			0.5			**SHALE/SILTSTONE** Highly weathered, grey and red brown, interbedded shale and siltstone layers 20 - 40 mm thickness dipping 70 degrees into hillslope, very low / low strength, dry			
						Test pit TP2A-T46 terminated at 0.7m Bucket refusal - hard excavation			
			1.0						
			1.5						
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T46

TP2A-T46

ATC Williams

FIGURE
TEST PIT NUMBER TP2A-T47
SHEET 1 OF 1

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.10 **JOB LOCATION** Pilbara, WA

DATE 2-8-18 **LOGGED BY** CJ **CHECKED** JPL **R.L. SURFACE** **DATUM**

EQUIPMENT 20t Excavator, 1 m wide bucket **LOCATION** 711595E 7653038N

REMARKS Groundwater not encountered

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition	Sample Type	Sample condition	Additional Observations
	not encountered		0.0		GP-GM	**TOPSOIL: GRAVEL** Medium dense, fine to coarse gravel, red brown, with sand, silt, trace rootlets, dry.			
					GP-GM	**GRAVEL** Loose, fine to coarse, grey brown with sand and silt fines, dry (Colluvium)			
			0.5			**SANDSTONE** Extremely weathered, red brown and grey. Excavated As: COBBLES/BOULDERS: Dense, red brown and grey boulders to 0.4 m dia, with gravel and sand, dry.			
						SANDSTONE Highly weathered, green-grey, medium and coarse grained, closely jointed, medium strength, dry. (Very hard to excavate).			
			0.7			Test pit TP2A-T47 terminated at 0.7m Bucket refusal - hard excavation			
			1.0						
			1.5						
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						
			4.5						

TP2A-T47

Coarse Rejects Stockpile

Coarse Rejects Stockpile

ROM Pad

ROM Pad

ROM Pad

ROM Pad

TSF Stage 1

TSF Stage 1

TSF Stage 1

TSF Stage 1

Waste Dumps

Waste Dumps

Waste Dumps

Waste Dumps

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

FILL

GRAVEL (GP or GW)

SAND (SP or SW)

SILT (ML or MH)

CLAY (CL, CI or CH)

ORGANIC SOILS (OL or OH or Pt)

COBBLES or BOULDERS

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

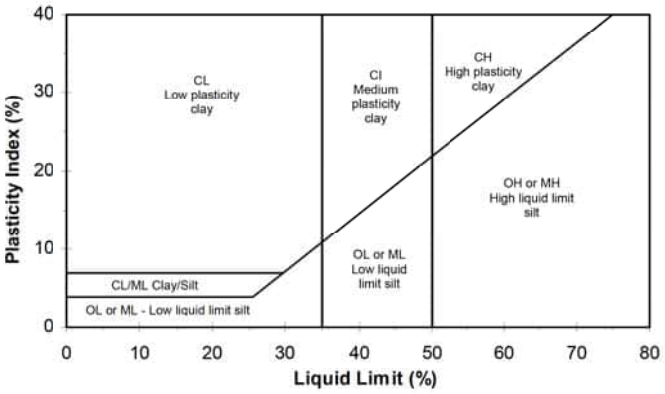
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726 – 1993, (Amdt1 – 1994 and Amdt2 – 1994), Appendix A. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Major Division	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	20 to 63 mm
	Medium	6.0 to 20 mm
	Fine	2.0 to 6.0 mm
SAND	Coarse	0.6 to 2.0 mm
	Medium	0.2 to 0.6 mm
	Fine	0.075 to 0.2 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

AS1726 - 1993

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays & Silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in the dry condition & may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sands and gravels tend to cohere.

CONSISTENCY AND DENSITY

AS1726 - 1993

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

SPT correlations are not stated in AS1726 – 1993, and may be subject to corrections for overburden pressure and equipment type.

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

AS*	Auger Screwing	RD	Rotary blade or drag bit	NQ	Diamond Core - 47 mm
AD*	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V-Bit	RAB	Rotary Air Blast	HQ	Diamond Core - 63 mm
*T	TC-Bit, e.g. ADT	RC	Reverse Circulation	HMLC	Diamond Core – 63mm
HA	Hand Auger	PT	Push Tube	BH	Tractor Mounted Backhoe
ADH	Hollow Auger	CT	Cable Tool Rig	EX	Tracked Hydraulic Excavator
DTC	Diatube Coring	JET	Jetting	EE	Existing Excavation
WB	Washbore or Bailer	NDD	Non-destructive digging	HAND	Excavated by Hand Methods

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance.** Rapid penetration possible with little effort from the equipment used.

M **Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.

H **High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

▽	Water level at date shown	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUNDWATER NOT ENCOUNTERED	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (s_v = peak value, s_r = residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure tests
DCP	Dynamic cone penetration test
CPT	Static cone penetration test
CPTu	Static cone penetration test with pore pressure (u) measurement

Ranking of Visually Observable Contamination and Odour (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$$

SCR = Solid Core Recovery (%)

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum \text{Axial lengths of core} > 100 \text{ mm}}{\text{Length of core run}} \times 100$$

REPORT OF TEST PIT: TP-01

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711528 m E 7652004 m N MGA94 56
SURFACE RL: 284.00 m DATUM: AHD
PIT DEPTH: 1.00 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 3/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	284.00	TP-01 0 0.5 BDS 0.00 m			CL-CI	Sandy CLAY low to medium plasticity, brown, sub-angular fine grained sand	D	VSt	
			0.5	*0.50* 283.50	TP-01 0.5-1.0 BDS 0.50 m			GP	GRAVEL coarse grained, sub-angular, grey, laminted	D	D - VD	
			1.0	283.00					TEST PIT DISCONTINUED @ 1.00 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-02

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711667 m E 7652466 m N MGA94 56
SURFACE RL: 268.00 m DATUM: AHD
PIT DEPTH: 0.50 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 3/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	268.00	TP-02 0.0-0.5 BDS 0.00 m			GP	GRAVEL fine grained, sub-rounded, red brown, with some fine grained sub-rounded sand, with some sub-angular cobbles	D	MD - VD	
			0.5	267.50					TEST PIT DISCONTINUED @ 0.50 m STABLE REFUSAL BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-03

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711535 m E 7652798 m N MGA94 56
SURFACE RL: 263.00 m DATUM: AHD
PIT DEPTH: 0.50 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 3/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	263.00	TP-03 0-0.3 BDS 0.00 m			GC	Clayey GRAVEL coarse grained, angular, red brown, 10 - 20% low plasticity clay, trace sand	D	L	
				0.30								
				262.70	TP-03 0.3-0.5 BDS 0.30 m			GP	GRAVEL fine grained, sub-angular, white and pale brown, with less than 10% medium to high PI clay, weakly cemented, medium strength		D	
			0.5	262.50					TEST PIT DISCONTINUED @ 0.50 m STABLE REFUSAL BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-04

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711310 m E 7653181 m N MGA94 56
SURFACE RL: 258.00 m DATUM: AHD
PIT DEPTH: 1.10 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 4/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	258.00								
				0.20	TP-04 0-0.5 0.00 m			GC	Clayey GRAVEL coarse grained, sub-angular to angular, grey brown, 20 - 30%, low to medium PI, red brown clay, with 10 - 20%, sub-angular, fine grained sand		MD	
				257.80				GC				
			0.5	0.50					increase in clay content	D		
				257.50	TP-04 0.5- 1.1 0.50 m			SC	Clayey SAND fine to coarse grained, pale red brown, 20 - 30%, low to medium PI clay, recovered as low strength cobble sized fragments, extremely to completely weathered sandstone		D - VD	
			1.0	256.90					TEST PIT DISCONTINUED @ 1.10 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-05

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711180 m E 7653775 m N MGA94 56
SURFACE RL: 253.00 m DATUM: AHD
PIT DEPTH: 1.50 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 4/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 252.90	TP-05 0.1-0.4 BDS 0.10 m				TOPSOIL, trace organics and root fibres		L	
				0.40 252.60				CL-CI	Sandy CLAY 40 - 50%, low to medium plasticity, red brown, with 10 - 15% sub-angular sand, with 10 - 30% gravel		MD	
			0.5		TP-05 0.4-1.5 BDS 0.50 m			SP	Clayey GRAVEL fine to medium grained, sub-angular, white - yellow, low PI clay, with some sand, extremely to completely weathered sandstone	D	D	
			1.0									
			1.5	251.50					TEST PIT DISCONTINUED @ 1.50 m STABLE REFUSAL BACKFILLED			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-06

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711096 m E 7653880 m N MGA94 56
SURFACE RL: 251.00 m DATUM: AHD
PIT DEPTH: 1.10 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 4/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 250.90 0.30 250.70	TP-06 0 - 0.3 BDS 0.00 m TP-06 -.3 - 1.1 BDS 0.30 m			GP GP	TOPSOIL, dense root fibres Silty GRAVEL coarse grained, sub-angular, grey brown, with 20 -30 % silt Gravelly COBBLES sub-angular to angular, pale yellow with grey brown, less than 5% non plastic silt	D	D	
			0.5 1.0									
			1.0	249.90					TEST PIT DISCONTINUED @ 1.10 m STABLE REFUSAL BACKFILLED			
			1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

GAP 8_07.2 LIB.GLB Log GAP NON-CORED WITH SKETCH 117645032 - TEST PITS.GPJ <<DrawingFile>> 08/02/2012 11:37 8.2.800

REPORT OF TEST PIT: TP-07

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710746 m E 7654313 m N MGA94 56
SURFACE RL: 247.00 m DATUM: AHD
PIT DEPTH: 2.00 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 4/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	247.00 0.20				CL	CLAY low to medium plasticity, red brown, with some root fibres and organics			
			0.5	246.80	TP-07 BDS 0.20 m			GW	GRAVEL with cobbles fine to coarse grained, angular, red brown, trace fine grained, sub-rounded sand, with less than 5 % low to medium PI clay	D	MD - D	
			1.0									
			1.5									
			2.0	245.00					TEST PIT DISCONTINUED @ 2.00 m STABLE REFUSAL BACKFILLED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-08

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710527 m E 7654466 m N MGA94 56
SURFACE RL: 248.00 m DATUM: AHD
PIT DEPTH: 1.80 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 4/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 247.90	TP-08 0.1 - 0.5 BDS 0.10 m			GP	TOPSOIL trace organics and rootlets			
			0.5	0.50 247.50	TP-08 0.5 - 1.0 BDS 0.50 m				Sandy Clayey GRAVEL coarse grained, sub-angular, red brown, with low PI clay, and fine grained, sub-rounded sand GRAVEL coarse grained, sub-rounded, red brown	D	MD	
			1.0	1.00 247.00	TP-08 1.0 -1.8 BDS 1.00 m			GP	with some cobbles, increasing cementation with depth		D	
			1.5									
			2.0	246.20					TEST PIT DISCONTINUED @ 1.80 m STABLE REFUSAL BACKFILLED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-09

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710340 m E 7654510 m N MGA94 56
SURFACE RL: 245.00 m DATUM: AHD
PIT DEPTH: 0.40 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 4/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 244.90				GC GM	Clayey GRAVEL (TOPSOIL) medium to coarse grained, sub-angular, pale brown, with 20 - 30% low PI clay	D	D	
			0.5	244.60					GRAVEL with cobbles medium to coarse grained, sub-angular, white and pale brown, trace silt, iron stained cobbles			
			1.0						TEST PIT DISCONTINUED @ 0.40 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-10

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710242 m E 7654631 m N MGA94 56
SURFACE RL: 245.00 m DATUM: AHD
PIT DEPTH: 0.90 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 4/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 244.90	TP-10 0.1-0.4 BDS 0.10 m			SC	TOPSOIL, trace fine roots Clayey SAND fine grained, sub-rounded, brown, 20 %, low PI clay, with some fine to coarse grained gravel	D	MD - D	
			0.5	0.40 244.60	TP-10 0.3-0.9 BDS 0.30 m			SP	SAND fine to coarse grained, sub-rounded, yellow brown, trace non plastic silt, moderately cemented			
			1.0	244.10					TEST PIT DISCONTINUED @ 0.90 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-11

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710236 m E 7654741 m N MGA94 56
SURFACE RL: 245.00 m DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 4/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	245.00	TP-11 0.2 - 1.2 BDS 0.20 m			GW	GRAVEL medium to coarse grained, sub-angular to angular, dark red, with some medium to coarse grained sand, trace low to medium PI clay	D	D - VD	
			0.5									
			1.0									
				243.80					TEST PIT DISCONTINUED @ 1.20 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-12

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 713005 m E 7652044 m N MGA94 56
SURFACE RL: 279.00 m DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 5/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.15					TOPSOIL, with trace rootlets	D		
				278.85	TP-12 0.15-0.4			GW	Sandy GRAVEL			
				0.40	BDS 0.15 m				fine to medium grained, sub-rounded to sub-angular, red			
			0.5	278.60	TP-12 0.4-1.2			GP	brown, with 30 - 40% medium to coarse, sub-angular sand, and 20% medium PI clay		MD	
					BDS 0.40 m				GRAVEL			
			1.0						fine to coarse grained, sub-angular, red brown becoming grey, moderatey cemented, recovered as cobble sized, extremely to completely weathered sandstone			
				277.80					TEST PIT DISCONTINUED @ 1.20 m			
			1.5						STABLE			
									REFUSAL			
			2.0						BACKFILLED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

GAP 8_07.2 LIB.GLB Log GAP NON-CORED WITH SKETCH 117645032 - TEST PITS.GPJ <<DrawingFile>> 08/02/2012 11:39 8.2.800

REPORT OF TEST PIT: TP-13

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 713213 m E 7651876 m N MGA94 56
SURFACE RL: 277.00 m DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 5/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.15 276.85	TP-13 0.15 - 1.2 BDS 0.15 m			CL-CI	TOPSOIL, Silty SAND, fine to medium grained, rounded sand brown grey with organics and rootlets Sandy CLAY low to medium plasticity, white grey, with 20% medium to coarse grained, sub-angular sand, recovered as cobbles and coarse gravels extremely to completely weathered rock	M	D - VD	
			1.0	275.80					TEST PIT DISCONTINUED @ 1.20 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-14

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 714155 m E 7651137 m N MGA94 56
SURFACE RL: 285.00 m DATUM: AHD
PIT DEPTH: 0.60 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 5/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	285.00	TP-14 0-0.3 BDS 0.00 m			SC	Clayey SAND fine to medium grained, sub-rounded, red brown, 20% low Pl clay, with 5 -10% sub-rounded to sub-angular gravel	D	L	
				0.30								
				284.70	TP-14 0.3-0.6 BDS 0.30 m			GP	GRAVEL fine to coarse grained, grey white, extremely to completely weathered sandstone		VD	
			0.5	284.40					TEST PIT DISCONTINUED @ 0.60 m STABLE REFUSAL BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-15

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 714789 m E 7650913 m N MGA94 56
SURFACE RL: 294.00 m DATUM: AHD
PIT DEPTH: 1.10 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 5/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 293.90 0.40 293.60	TP-15 0.1-0.4 BDS 0.10 m			GC GP	TOPSOIL, trace rootlets Clayey Sandy GRAVEL medium to coarse grained, sub-angular, 40%, red brown, with 30% fine to medium grained, sub-angular sand, and 10 -20% low to medium PI clay GRAVEL fine to coarse grained, sub-rounded to sub-angular, red brown with grey white, extremely to completely weathered sandstone	D	L - MD MD - VD	
			1.0	292.90					TEST PIT DISCONTINUED @ 1.10 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-16

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 714259 m E 7651096 m N MGA94 56
SURFACE RL: 288.00 m DATUM: AHD
PIT DEPTH: 0.60 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 5/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	288.00								
				0.20				SC	Clayey SAND medium to coarse grained, sub-angular, brown, with 10 -15% low PI clay, trace gravel	D	L	
				287.80				GP	GRAVEL fine to coarse grained, sub-angular, grey white, extremely to completely weathered sandstone		D - VD	
			0.5	287.40					TEST PIT DISCONTINUED @ 0.60 m STABLE REFUSAL BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-17

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711186 m E 7653054 m N MGA94 56
SURFACE RL: 259.00 m DATUM: AHD
PIT DEPTH: 0.40 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 5/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	259.00				GP	Gravelly COBBLES sub-angular, red brown, with coarse grained, sub-angular to sub-rounded gravel, trace sand	D	D - VD	
			0.5	258.60					TEST PIT DISCONTINUED @ 0.40 m STABLE REFUSAL BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-18

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711403 m E 7653859 m N MGA94 56
SURFACE RL: 251.00 m DATUM: AHD
PIT DEPTH: 2.10 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 6/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.15					TOPSOIL, Gravelly SAND, 70 - 80% fine to coarse grained sand, with some fine sub-rounded gravel (20 - 25%)			
				250.85	TP-18 0.15-1.3 BDS 0.15 m			GP	Sandy GRAVEL fine to coarse grained, sub-rounded, 40 - 50%, red brown, with 30 - 40% fine to coarse grained, rounded sand	D	MD	
			0.5									
			1.0									
				1.30								
				249.70				GP	with some boulders and cobbles		D - VD	
			1.5									
			2.0									
				248.90					TEST PIT DISCONTINUED @ 2.10 m STABLE REFUSAL BACKFILLED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-19

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711801 m E 7653937 m N MGA94 56
SURFACE RL: 254.00 m DATUM: AHD
PIT DEPTH: 1.30 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 6/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.15 253.85					TOPSOIL, Silty GRAVEL, with some root fibres			
			0.5	0.70 253.30				GW	GRAVEL fine to coarse grained, sub-rounded, 80 - 90%, grey brown, with some cobbles, and trace fine, sub-rounded sand	D	MD - VD	
			1.0					GW	less than 5% red, low to medium PI clay			
			1.5	252.70					TEST PIT DISCONTINUED @ 1.30 m STABLE REFUSAL BACKFILLED			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-20

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 711937 m E 7653909 m N MGA94 56
SURFACE RL: 261.00 m DATUM: AHD
PIT DEPTH: 1.40 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 6/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 260.90	TP-20 0.1-1.0 BDS 0.10 m			GC	TOPSOIL, trace root fibres Clayey GRAVEL fine to coarse grained, sub-angular, 80 - 90%, brown grey, with 5 -10% low PI clay	D	MD - D	
			0.5									
			1.0	1.00 260.00	TP-20 1.0-1.4 BDS 1.00 m			GC	Clayey GRAVEL fine to coarse grained, sub-angular, 60 -70%, red with yellow, green and grey, with 20% high PI, moderately cemented clay		D - VD	
			1.5	259.60					TEST PIT DISCONTINUED @ 1.40 m STABLE REFUSAL BACKFILLED			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-21

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 712055 m E 7653856 m N MGA94 56
SURFACE RL: 268.00 m DATUM: AHD
PIT DEPTH: 0.90 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 6/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 267.90	TP-21 0.1-0.6 BDS 0.10 m			GC	TOPSOIL, trace root fibres Clayey GRAVEL fine to coarse grained, angular, pale red brown, with 20 -30% medium to high PI clay	D	L - MD	
			0.5	0.60 267.40				GP	GRAVEL coarse grained, angular, grey red, trace high PI clay, with some cobbles, increasing cobbles with depth		D - VD	
			1.0	267.10					TEST PIT DISCONTINUED @ 0.90 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-22

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710943 m E 7653856 m N MGA94 56
SURFACE RL: 251.00 m DATUM: AHD
PIT DEPTH: 1.30 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 7/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.15					TOPSOIL, Sandy GRAVEL, medium grained, sub-angular, red brown gravel with fine to coarse grained, sub-angular to sub-rounded sand (40%)			
				250.85	TP-22 0.15-1.3 BDS 0.15 m			GP	GRAVEL medium to coarse grained, angular, pale grey brown, with 10% low to medium PI clay, and 10 - 15% sub-rounded, fine, well cemented sand. (sandstone)	D	D - VD	
			0.5									
			1.0									
				249.70					TEST PIT DISCONTINUED @ 1.30 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-23

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710774 m E 7653839 m N MGA94 56
SURFACE RL: 252.00 m DATUM: AHD
PIT DEPTH: 0.80 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 7/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 251.90	TP-23 0.1-0.6 BDS 0.10 m			GC	TOPSOIL, trace rootlets Clayey GRAVEL fine grained, pale red brown, with 20 - 30% low to medium PI clay	D	MD - D	
			0.5		TP-23 0.6-0.8 BDS 0.60 m						VSt - H	
			1.0	251.20					TEST PIT DISCONTINUED @ 0.80 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-24

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710739 m E 7654015 m N MGA94 56
SURFACE RL: 249.00 m DATUM: AHD
PIT DEPTH: 1.90 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 7/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.15					TOPSOIL, rootlets to 150 mm depth			
				248.85	TP-24 0.15-0.5 BDS 0.15 m			GC	Clayey GRAVEL fine to medium grained, sub-angular, red, with 30 - 40% low to medium PI clay		MD - D	
			0.5	0.50 248.50	TP-24 0.5-1.9 BDS 0.50 m			GC	Clayey GRAVEL fine to coarse grained, sub-rounded, pale red, with low PI clay	D	D - VD	
			1.0									
			1.5									
			2.0	247.10					TEST PIT DISCONTINUED @ 1.90 m STABLE REFUSAL BACKFILLED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-25

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710410 m E 7653998 m N MGA94 56
SURFACE RL: 247.00 m DATUM: AHD
PIT DEPTH: 2.20 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 7/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 246.90	TP-25 0.1-0.8 BDS 0.10 m			CL-CI	TOPSOIL, GRAVEL and trace rootlets Gravelly CLAY low to medium plasticity, pale red brown, with 30 -40% fine to coarse, sub-rounded gravel		St	
			0.5	0.80 246.20	TP-25 0.8 2.0 BDS 0.80 m 2 Bags			GC	Clayey GRAVEL fine to coarse grained, sub-rounded, red and pale brown, with low to medium PI clay, with some sand, trace cobbles	D	MD - D	
			1.0									
			1.5									
			2.0	2.00 245.00				GP	COBBLES	M	D - VD	
			2.5	244.80					TEST PIT DISCONTINUED @ 2.20 m STABLE REFUSAL BACKFILLED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-26

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710475 m E 7653987 m N MGA94 56
SURFACE RL: 247.00 m DATUM: AHD
PIT DEPTH: 1.50 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 7/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	247.00 0.20					TOPSOIL, dense rootlets			
			0.5	246.80 0.70	TP-26 0.2-0.7 BDS 0.20 m			GW	GRAVEL fine to coarse grained, sub-rounded to sub-angular, dark red, trace medium PI clay, trace cobbles		MD - D	
			1.0	246.30				GW	COBBLES with fine grained gravel	D	D - VD	
			1.5	245.50					TEST PIT DISCONTINUED @ 1.50 m STABLE REFUSAL BACKFILLED			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-27

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710512 m E 7654248 m N MGA94 56
SURFACE RL: 245.00 m DATUM: AHD
PIT DEPTH: 1.60 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 7/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.15					TOPSOIL			
				244.85				GW	GRAVEL with cobbles fine to coarse grained, sub-rounded, red brown, with 30 - 40% cobbles, with some medium PI clay		MD - D	
			0.5	0.90						D		
			1.0	244.10	TP-27 0.9-1.6 BDS 0.90 m			GW	GRAVEL fine to coarse grained, sub-angular to angular, pale brown and white grey, with some fine grained sand, moderately cemented		D - VD	
			1.5	243.40					TEST PIT DISCONTINUED @ 1.60 m STABLE REFUSAL BACKFILLED			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-28

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710484 m E 7654264 m N MGA94 56
SURFACE RL: 244.00 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 8/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.15					TOPSOIL, Sandy GRAVEL, fine to medium grained, sub-rounded to rounded, dark red	D		
				243.85	TP-28 0.15-0.8 BDS 0.15 m 2 Bags			GP	Sandy GRAVEL with cobbles fine grained, sub-rounded, red purple, with 30 - 40% cobbles, and medium to coarse grained, sub-rounded sand		MD	
			0.5	0.80								
				243.20	TP-28 0.8-2.5 BDS 0.80 m			GP	GRAVEL fine to medium grained, sub-angular, grey red, trace medium grained, sub angular sand, trace low PI clay, with some cobbles	M	MD - VD	
			1.0									
			1.5									
			2.0									
			2.5	241.50					TEST PIT DISCONTINUED @ 2.50 m STABLE REFUSAL BACKFILLED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-29

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710475 m E 7654318 m N MGA94 56
SURFACE RL: 244.00 m DATUM: AHD
PIT DEPTH: 1.90 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 8/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	244.00	TP-29 0-1.3 BDS 0.00 m			GW	Sandy GRAVEL fine to medium grained, sub-rounded, grey brown, with fine to coarse grained, sub-angular sand	D	MD	
			1.0	1.30						M		
		▽	1.5	242.70	TP-29 1.3-1.9 BDS 1.30 m			GW	Sandy Clayey GRAVEL fine to coarse grained, sub-rounded to sub-angular, pale yellow red brown, with 10 - 20% low to medium PI clay, and fine grained, rounded sand		MD - VD	pit left open for 1.5 hrs water ingress at 1.3 m depth with small pool at bottom of pit
			2.0	242.10					TEST PIT DISCONTINUED @ 1.90 m STABLE REFUSAL BACKFILLED			
			5.0									

Sketch & Other Observations

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-30

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710338 m E 7654346 m N MGA94 56
SURFACE RL: 243.00 m DATUM: AHD
PIT DEPTH: 0.90 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 8/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	243.00	TP-30 0.0-0.9 BDS 0.00 m			GW	Sandy GRAVEL fine to coarse grained, sub-rounded, pale brown grey, with medium to coarse grained, sub-rounded sand, trace silt, with 10% cobbles	D	MD - VD	
			1.0	242.10					TEST PIT DISCONTINUED @ 0.90 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-31

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710284 m E 7654341 m N MGA94 56
SURFACE RL: 243.00 m DATUM: AHD
PIT DEPTH: 1.40 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 8/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.15					TOPSOIL, dense rootlets			
				242.85	TP31 0.15-1.4 BDS 0.15 m			GW	Sandy GRAVEL with cobbles fine to coarse grained, sub-rounded, brown, with 30 - 40% cobbles, and fine to coarse grained, sub-rounded sand, refusal on boulders	D	MD - D	
			0.5									
			1.0									
			1.5	241.60					TEST PIT DISCONTINUED @ 1.40 m STABLE REFUSAL BACKFILLED			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-32

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710166 m E 7654444 m N MGA94 56
SURFACE RL: 242.00 m DATUM: AHD
PIT DEPTH: 4.00 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 13/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	242.00				GW	Sandy Silty GRAVEL (TOPSOIL) fine to coarse grained, sub-rounded to sub-angular, dark brown		MD	
				0.30								
			0.5	241.70				GP	GRAVEL medium to coarse grained, sub-rounded to sub-angular, grey brown, trace medium grained, sub-rounded sand, cobble sized	D	MD	
			1.0	1.20								
				240.80	TP-32 1.2-2.1 BDS 1.20 m			SC	Clayey GRAVEL fine to coarse grained, sub-angular, red brown, with 15 - 20% medium to high PI clay, with some fine to coarse grained, sub-angular sand, with some cobbles		MD	
		13/12/11	1.5									
			2.0	2.10								
				239.90	TP-32 2.1-3.1 BDS 2.10 m			GP	Sandy GRAVEL fine to coarse grained, sub-rounded to sub-angular, brown, with fine to coarse grained sand, trace high PI (less than 5%) clay, with some to 300 mm cobbles	M	D	
			2.5									
			3.0	3.10								
				238.90	TP-32 3.1-4.0 BDS 3.10 m			GP	GRAVEL fine to coarse grained, angular, yellow grey, trace low PI clay, trace sand, iron oxide staining		D	
			3.5									
			4.0	238.00					TEST PIT DISCONTINUED @ 4.00 m STABLE TARGET DEPTH BACKFILLED			
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-33

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710149 m E 7654434 m N MGA94 56
SURFACE RL: 241.00 m DATUM: AHD
PIT DEPTH: 2.10 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 13/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 240.90				SP GP	SAND fine to coarse grained, 60 - 70%, with some fine to coarse, sub-rounded gravel, Creek bed	D		
			0.5						GRAVEL fine to coarse grained, sub-rounded to sub-angular, with some occasional boulders to 1.2 m, interbedded with layers of sand and cobbles	M	L - MD	
		▽	1.5									
			2.0							W		
				238.90					TEST PIT DISCONTINUED @ 2.10 m UNSTABLE FLOODING BACKFILLED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-34

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710024 m E 7654594 m N MGA94 56
SURFACE RL: 243.00 m DATUM: AHD
PIT DEPTH: 1.30 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 13/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	243.00				GP	Sandy GRAVEL (TOPSOIL)			
				0.20					medium to coarse grained, sub-rounded to sub-angular, to cobble sized, brown, with fine to coarse, sub-angular sand, trace organics and roots			
				242.80	TP-34 0.2-0.8 BDS 0.20 m			CI	CLAY			
			0.5						medium plasticity, red brown, with some sand, with some fine grained gravel	D	VD	
				0.80								
				242.20	TP-34 0.8-1.3 BDS 0.80 m			GC	Clayey GRAVEL			
			1.0						fine to coarse grained, angular, red brown, with 30% clay, extremely weathered rock interbedded with clay, becoming rock with depth			
				241.70					TEST PIT DISCONTINUED @ 1.30 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-35

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710198 m E 7654540 m N MGA94 56
SURFACE RL: 242.00 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	242.00				SW	SAND (TOPSOIL) fine grained, sub-rounded, brown, trace organics and rootlets			
				0.30								
				241.70	TP-35 0.3-1.8 BDS 0.30 m			CI	Sandy CLAY medium plasticity, red, with fine grained, sub-rounded sand, with some gravel	D	MD	
			0.5									
			1.0									
			1.5									
				1.80								
			2.0	240.20	TP-35 1.8-2.5 BDS 1.80 m			GP	Sandy Clayey GRAVEL coarse grained, sub-rounded to sub-angular, with 20% medium PI clay, and 20% fine to medium grained sand, with cobbles to 0.2 m, increasing with depth	M	D	
			2.5	239.50					TEST PIT DISCONTINUED @ 2.50 m STABLE REFUSAL BACKFILLED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-36

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710284 m E 7654218 m N MGA94 56
SURFACE RL: 274.00 m DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	274.00					COBBLES fine to coarse, to 500 mm, sub-angular to angular, white with red, trace low PI, less than 10 % clay, with some coarse, angular gravel	D	D	
			1.2	272.80					TEST PIT DISCONTINUED @ 1.20 m STABLE REFUSAL BACKFILLED			
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-37

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 712216 m E 7653885 m N MGA94 56
SURFACE RL: 330.00 m DATUM: AHD
PIT DEPTH: 1.00 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	330.00				GP	GRAVEL fine to coarse grained, sub-angular to angular, more than 50%, brown to red brown, trace low PI clay, becoming rock at 1.0 m	D		
			1.0	329.00					TEST PIT DISCONTINUED @ 1.00 m STABLE REFUSAL BACKFILLED			
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-38

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710550 m E 7654524 m N MGA94 56
SURFACE RL: 250.00 m DATUM: AHD
PIT DEPTH: 2.40 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	250.00				GM	Gravelly SILT low liquid limit, red brown, with fine grained, sub-rounded to sub-angular gravel, occasional roots to 3 mm diameter		L	
				0.20 249.80				GC	Gravelly CLAY medium plasticity, red brown, with fine to medium grained, angular gravel, gravel content increasing with depth			
			0.5		TP-38 0.5-1.0 BDS 0.50 m 2 Bags					D		
			1.0								D	
			1.5		TP-38 1.5-2.0 BDS 1.50 m 2 Bags							
			2.0									
			2.5	247.60					TEST PIT DISCONTINUED @ 2.40 m STABLE REFUSAL BACKFILLED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-39

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710570 m E 7654598 m N MGA94 56
SURFACE RL: 260.00 m DATUM: AHD
PIT DEPTH: 0.50 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	260.00				GP	GRAVEL fine to coarse grained, to 150 mm, angular, brown becoming red brown, extremely weathered rock	D	D - VD	
			0.5	259.50					TEST PIT DISCONTINUED @ 0.50 m STABLE REFUSAL BACKFILLED			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F03e RL3

REPORT OF TEST PIT: TP-40

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 710805 m E 7654308 m N MGA94 56
SURFACE RL: 247.00 m DATUM: AHD
PIT DEPTH: 3.50 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	246.95				SM	Silty SAND fine grained, brown to red brown			
			0.5					SM	Silty SAND fine to medium grained, rounded, red brown, with 10 - 15% low PI silt, weakly cemented, friable			
			1.0	1.40								
			1.5	245.60 1.60				GP	Sandy GRAVEL medium to coarse grained, sub-rounded to sub-angular, red brown, with 10 - 20% fine to medium grained, rounded sand, with cobbles to 200 mm diameter	D	D	
				245.40 1.90				SM				
			2.0	245.10				GP	Silty SAND fine to medium grained, rounded, red brown, with 10 - 15% low PI silt			
				2.40								
			2.5	244.60				GW	Sandy GRAVEL fine to coarse grained, sub-rounded to sub-angular, red brown, with 10 - 20% fine to medium grained, rounded sand, with cobbles to 200 mm diameter			
			3.0						GRAVEL fine to coarse grained, angular, grey brown, trace clay or low PI fines			
			3.5	243.50					TEST PIT DISCONTINUED @ 3.50 m STABLE TARGET DEPTH BACKFILLED			
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-41

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 713412 m E 7652354 m N MGA94 56
SURFACE RL: 271.00 m DATUM: AHD
PIT DEPTH: 1.60 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 270.90				GP GP	Sandy GRAVEL fine to medium grained, pale brown, with fine to coarse grained sand			
			0.5						Sandy GRAVEL fine to coarse grained, sub-angular, grey to pale brown, with 20 - 30% fine to coarse grained sand, trace (less than 5%) low PI clay, with some 300 mm diameter cobbles, becoming coarse and cobble frequency increasing with depth	D		
			1.0									
			1.5	269.40					TEST PIT DISCONTINUED @ 1.60 m STABLE REFUSAL BACKFILLED			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

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GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-42

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 713296 m E 7652541 m N MGA94 56
SURFACE RL: 268.00 m DATUM: AHD
PIT DEPTH: 0.90 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	267.95				GP	GRAVEL fine to coarse grained, sub-angular, red brown		L	
				0.40				SM	Silty SAND fine to coarse grained, sub-rounded, red brown, with 40 - 60% low to medium PI fines silt	D	VSt	
			0.5	267.60				GP	GRAVEL coarse grained, rounded to sub-rounded, red brown, with some cobbles, trace sand		D	
			1.0	267.10					TEST PIT DISCONTINUED @ 0.90 m STABLE REFUSAL BACKFILLED			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-43

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 713229 m E 7652603 m N MGA94 56
SURFACE RL: 237.00 m DATUM: AHD
PIT DEPTH: 2.10 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	0.10 236.90				SM GP	Silty SAND fine to coarse grained, sub-rounded to sub-angular, brown, with 10% low PI fines silt		L	
			0.5						Sandy GRAVEL fine to coarse grained, to 120 mm, sub-rounded, brown, with fine to coarse grained, sub-rounded sand		D	
			1.0	1.10 235.90	TP-43 1.1-1.5 BDS 1.10 m 2 Bags			GC	Sandy Clayey GRAVEL fine grained, sub-rounded, brown, with low to medium PI clay, and fine to coarse grained, sub-rounded sand	D	D	
			1.5	1.50 235.50 1.80 235.20	TP-43 1.5-1.8 BDS 1.50 m 2 Bags			GC GP	Clayey GRAVEL coarse grained, to 100 mm, angular, grey white, with 30% low to medium PI clay, extremely weathered rock GRAVEL fine to coarse grained, angular, grey, trace (less than 10%) medium PI clay, with cobble size, extremely weathered rock		D D - VD	
			2.0	234.90					TEST PIT DISCONTINUED @ 2.10 m STABLE REFUSAL BACKFILLED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-44

Golder Associates

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 713340 m E 7652590 m N MGA94 56
SURFACE RL: 268.00 m DATUM: AHD
PIT DEPTH: 2.50 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	268.00				GM	Silty GRAVEL fine grained, sub-rounded, grey brown, with low PI silt, dense roots to 3 mm diameter			
				0.20								
				267.80				GP	Sandy GRAVEL fine to coarse grained, to 120 mm, sub-rounded, red, with 10 - 20% fine to coarse grained, rounded sand, to cobble sized.	D	D	
			0.5									
			1.0									
				1.50								
			1.5	266.50	TP-44 1.5-1.9 BDS 1.50 m 2 Bags			GC	Clayey GRAVEL fine to coarse grained, to 150 mm, sub-rounded, grey with red, with 20 - 30% medium PI clay, to cobble sized.			
				1.90								
			2.0	266.10				GP	GRAVEL fine to coarse grained, angular, grey with red	M	VD	
			2.5	265.50					TEST PIT DISCONTINUED @ 2.50 m STABLE REFUSAL BACKFILLED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Sketch & Other Observations

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F03e
RL3

REPORT OF TEST PIT: TP-45

CLIENT: FMG
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

COORDS: 713435 m E 7652618 m N MGA94 56
SURFACE RL: 268.00 m DATUM: AHD
PIT DEPTH: 1.70 m
BUCKET TYPE: 600 mm bucket

SHEET: 1 OF 1
MACHINE: Cat 307
CONTRACTOR: Cross Verwijmeren
LOGGED: BPC DATE: 14/12/11
CHECKED: DRA DATE: 7/2/12

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	267.95				GM GP	Silty GRAVEL fine grained, sub-rounded to sub-angular, grey brown, with 20% low PI silt Sandy GRAVEL fine to coarse grained, to 200 mm, rounded to sub-rounded, red brown, with 20% fine to coarse grained, sub-rounded sand, to cobble sized	D	D	
			1.5	266.30					TEST PIT DISCONTINUED @ 1.70 m STABLE REFUSAL BACKFILLED			
			5.0									

Sketch & Other Observations

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F03e
RL3

APPENDIX C

ROCK DESCRIPTION AND CLASSIFICATION | APPENDIX B1

TYPES

ORIGIN		FORMATION		EXAMPLES
Sedimentary	Clastic	Strengthening of sedimentary particles of older rocks		Conglomerate, sandstone, siltstone, shale
	Chemical	Precipitation from solution		Salt, gypsum, chert, some limestones
	Organic	Activity of organisms		Coal, some limestones
Pyroclastic		Ejected from volcanoes		Tuff, agglomerates, volcanic breccia
Metamorphic		Action of high temperatures and stresses on rock substances.		Slate, phyllite, schist, quartzite, gneiss
Igneous	Extrusive	Crystallisation of molten rock substance	Lava flows, fine grained or glassy, rapid cooling	Rhyolite, andesite, basalt
	Intrusive		Sills, dykes, medium grained or porphyritic	Porphyry, dolerite
			Deep seated masses, coarse grained, slow cooling	Granite, diorite, gabbro

MATERIAL WEATHERING

Classification			Properties Compared to Fresh Rock		
			Colour	Fabric	Strength
Residual Soil	RS		Completely changed	Completely lost	Exhibits soil properties; can be remoulded; may disintegrate in water
Extremely Weathered	EW		Completely changed	Evident	
Highly Weathered	HW	DW*	Staining or bleaching affects the whole of the rock substance; other signs of decomposition evident.	Preserved	Strength not related to original fresh rock
Moderately Weathered	MW		Staining/weathering extend throughout the whole of the rock substance to the extent that the original colour of the fresh rock is not recognisable.	Preserved	
Slightly Weathered	SW		Partial staining or discoloration, developed from discontinuity surfaces. The colour and texture of fresh rock are distinguishable.	Preserved	Little or no change
Fresh	FR		No sign of decomposition or staining visible to the naked eye		

*DW = Distinctly weathered

DEFECTS

Layering	Bedding	Discontinuities parallel to the stratification, e.g. thin clay or graphite layers in sandstone.
	Foliation, Cleavage	Elongated or tabular minerals arranged near parallel to one another, micro-fractures may be present.
Fractures, Fractured Zones	Joint	Little tensile strength across the joint; planar, curved or irregular, open or unfilled; surfaces smooth or slickensided.
	Sheared Zone	Close joints or fracturing at a slight angle to boundaries with slightly curved, smooth or rough, slickensided surfaces; lenticular shapes.
Weak seams or zones	Crushed	Disoriented angular fragments of host rock; clay through to gravel sizes or mixtures; boundaries commonly slickensided.
	Decomposed	Discoloured and weakened host rock; host rock structure apparent; gradational boundaries
	Infilled	Soil materials; no host rock structure; may be layered parallel to boundaries.

DEFECT SPACING

CLASSIFICATION	SPACING (mm)
Extremely wide	greater than 2000
Very wide	600 to 2000
Wide	200 to 600
Moderately wide	60 to 200
Close	20 to 60
Very close	6 to 20
Extremely close	less than 6
Note : Defect spacing is also quantified by the defect spacing column on the borelog.	

STRENGTH

CLASSIFICATION	Point Load Strength Index I_S (50) (MPa)
Extremely low	less than 0.03
Very low	0.03 to 0.1
Low	0.1 to 0.3
Medium	0.3 to 1
High	1 to 3
Very high	3 to 10
Extremely high	greater than 10
Note : Point load tests are shown on the logs. If they have not been carried out, no strength descriptors are used.	

ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-01
SHEET 1 OF 2

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 09/02/18 **COMPLETED** 09/02/18 **R.L. SURFACE** 251.136 **DATUM** m

LOCATION 0710610E 7654439N **INCLINATION** 90° **BEARING** ---

EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL

REMARKS Groundwater encountered at 6.6 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description	Well Details
		50	0	251			**SILTSTONE** Extremely weathered, grey with some pale yellow brown stains. Fine grained, with very low strength, with trace clay and sand	EW					
		100	0	250	1		becomes extremely to highly weathered, very low to low strength, grey with pale yellow and red brown staining, withclayey material at 1.4 m	EW/HW				Multiple clay parting and fractures, irregular, rough, stained, from 1.4 m to 6 m	
		66	0	249	2								
		66	0	248	3							Seam, with clayey sand/fine gravel grey infill, irregular, rough, stained, at 2.8 m	
		66	0	247	4		red brown and orange staining between 3.9 m and 4.1 m with minor staining after 4.1 m					Seam, with clayey sand/fine gravel grey infill, irregular, rough, stained, at 3.8 m Seam, with clayey sand/fine gravel grey infill, irregular, rough, stained, at 3.9 m Seam, with clayey sand/fine gravel grey infill, irregular, rough, stained, at 4.25 m Multiple fractures with voids, with clayey/silty sand infill, irregular, rough, stained, from 4.5 m to 6 m	
		60	0	246	5								
▼		50	0	245	6		grey with very minor to no staining after 6.0 m					Multiple fractures, irregular, rough, from 6 m to 7.5 m	
		60	0	244	7								
		40	0	243	8							Multiple fractures with clayey silty sand infill, grey, irregular, rough, from 7.5 m to 9 m	
			0		9							Multiple fractures, irregular, rough, from 9	

FIGURE
BOREHOLE NUMBER BH2A-01
SHEET 2 OF 2

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 09/02/18 **COMPLETED** 09/02/18 **R.L. SURFACE** 251.136 **DATUM** m

LOCATION 0710610E 7654439N **INCLINATION** 90° **BEARING** ---

EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL

REMARKS Groundwater encountered at 6.6 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description	Well Details
		66	0		10		**SILTSTONE** *(continued)*	EW/HW				m to 10.5 m	
				241			**SANDSTONE** Extremely to highly weathered, pale grey with red brown and orange staining, fine to coarse grained, very low to low strength. Infered bedding 60°					Multiple fractures, irregular, rough, with sand infill, from 10.5 m to 12 m	
		66	0	240	11								
					12							Multiple fractures, 65° irregular, rough with minor infill, and brown staining from 12 m to 12.7 m	
		95	0	239			becomes pale grey and brown with dark grey, orange and red brown staining at 12.6 m						
				238	13							Foliation/bedding structure 70° from 13.5 m	
		100	12	237	14		no staining below 13.8 m					Fractures and joints, 20 - 30°, irregular, very rough, stained, at 14.1 m	
					15		**SILTSTONE** Highly weathered, grey with minorr red and orange staining, low strength, massive	HW					
				236			BH2A-01 terminated at 15m						
					16								
				235									
					17								
				234									
					18								
				233									

BH2A-01 (0.0 to 7.5 m)

BH2A-01 (7.5 to 14.0 m)

BH2A-01 (14.0 to 15.0 m)

FIGURE
BOREHOLE NUMBER BH2A-01A
SHEET 1 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 02/09/18 **COMPLETED** **R.L. SURFACE** **DATUM**

LOCATION 0710576E 7654435N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
							SANDSTONE Highly weathered, grey with red clayey gravel filled fractures, fine and medium, massive, medium and high strength.	HW				0.20 - 0.30 m & 0.42 m - 0.47 m clayey filled fractures
		78	23		1		**SILTSTONE/SHALE** Highly weathered, pale brown and white, laminated with shale layering, low and medium strength					
							SANDSTONE Highly weathered, grey with brown staining, fine and medium, massive, medium and high strength.					
					2		**SILTSTONE/SHALE** Highly weathered, white and pale brown, laminated with shale layering, low and medium strength.					
		100	29				**SANDSTONE** Highly weathered, grey with brown stained fracture surfaces, fine and medium, massive, medium and high strength, no stains on fracture surfaces. 2.55 - 2.61 m laminated siltstone/shale layer. 2.80- 4.20 m moderatately weathered, high strength					2.55 - 2.61 m laminated siltstone layer, fractures on laminations, planar, tight, dip 65 °
					3			MW				
										A 2.05		Sample 3.20 - 3.62 m UCS 57.0 MPa . Modulus 49.4 GPa. Shear Failure
		100	78		4			HW				
												calcite filled bedding fracture 65°
					5							4.80 - 5.05 m fractures irregular, open.
		100	35				5.30 - 6.20 m coarse grained, dark grey with some dark grey clasts in sandstone matrix					
					6		moderately weathered below 5.8 m					from 5.90 m fractures/joints in sandstone, 25° to subhorizontal, irregular, clean with no infill evident.
		88	38		7							
					8							
		100	32		9							

ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-01A

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 02/09/18 **COMPLETED** **R.L. SURFACE** **DATUM**

LOCATION 0710576E 7654435N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100	32				**SANDSTONE** *(continued)*	HW				
		100	34		10							laminations evident
		100	51		11							
		100	25		12							
		100	0		13							
		100	18		14		thin pale grey siltstone band (15 mm) dip 65°					13.82 - 14.2 m fractured zone, rubble core pieces with some clay infill.
							14.51 m - 14.53 m highly weathered shale layer					14.51 m - 14.53 m highly weathered shale layer, 20 mm width, 70 ° dip
					15		14.70 - 15.75 m coarse grained, dark grey with some volcanic ash in sandstone matrix					
		100	21		16		from 15.75 m, mostly fine grained, with faint cross bedded fabric and red brown staining					
		100	52		17		17.17 m extremely weathered shale layer, 15 mm width from 17.25 m, coarse grained, congolmeratic sandstone, high strength					17.17 m extremely weathered shale layer, 15 mm width, alpha 30 °
					18		**SANDSTONE** Moderately to highly weathered, fine grained, grey with red staining, massive, medium and high strength	MW/HW				

ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-01A

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 02/09/18 **COMPLETED** **R.L. SURFACE** **DATUM**

LOCATION 0710576E 7654435N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100	52				**SANDSTONE** Moderately to highly weathered, fine grained, grey with red staining, massive, medium and high strength *(continued)*	MW/HW				from 18.5 m, joints in sandstone mostly irregular, rough, no infill
		100	60		19							
					20							
		100	57		21							
							SILTSTONE Moderately weathered, grey and red brown, faintly foliated / bedded, high strength	MW				21.65 m fracture on lamination 65 °
		100	36		22		22.23 m extemely weathered shale layer 50 mm thickness					22.23 shale band bedding alpha 25°
							SANDSTONE Moderately to highly weathered, fine grained, grey with red staining, faintly bedded / foliated, medium and high strength	MW/HW				
		100	85		23							23.7 - 23.8 m 65 ° red brown stained, joint bedding
					24							
		100	27		25		25.00 - 25.04 m shale band, low strength					
					26							from 25.65 m rubble core
							BH2A-01A terminated at 26m					
					27							

BH2A_01A - 0.0 - 2.84 m

BH2A_01A - 2.84 - 5.28 m

BH2A_01A - 5.28 - 7.49 m

BH2A_01A - 7.49 - 9.85 m

BH2A_01A - 9.85 - 11.96 m

BH2A_01A - 11.96 - 14.00 m

BH2A_01A - 14.00 - 16.36 m

BH2A_01A - 16.36 - 18.50 m

BH2A_01A - 18.50 - 20.69 m

BH2A_01A - 20.69 - 23.00 m

BH2A_01A - 23.00 - 25.35 m

BH2A_01A - 25.35 - 26.00 m

FIGURE
BOREHOLE NUMBER BH2A-02

SHEET 1 OF 1

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 09/02/18 **COMPLETED** 10/02/18 **R.L. SURFACE** 244.721 **DATUM** m

LOCATION 0710418E 7654321N **INCLINATION** 90° **BEARING** ---

EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL

REMARKS Groundwater encountered at 3.0 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		15	0	244	1		**SANDY GRAVEL** (CREEK DEPOSITS) Fine to coarse, brown, with thin layering of red brown and white clayey material (river bed with layering over sand, silt and clay)					
		10	0	243	2							
	▼			242	3		**CLAYEY GRAVEL** Fine to coarse, grey, brown and green grey (residual soil)			A 0.29		
		25	0	241	4							
				240	5							
		26	0	239	6		**SANDSTONE** Extremely weathered, grey, red brown and yellow brown, fine to coarse grained, very low strength	EW				Highly fractured, with yellow and pale brown clay infill, from 5.4 m to 6.0 m
				238	7		Drill hole terminated due to sand collapsing around the drill string causing reduced torque and jamming the barrel BH2A-02 terminated at 6m			A 3.3		
				237	8							
				236	9							

BH2A-02 (0.0 – 6.0 m)

FIGURE
BOREHOLE NUMBER BH2A-02A
SHEET 1 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 31/08/18 **COMPLETED**
R.L. SURFACE 242.2 **DATUM** m
LOCATION 0710463E 7654326N **INCLINATION** 90° **BEARING** ---
EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL
REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa	Defect Spacing mm	Defect Description
		55	0	242	1		**SANDSTONE/SILTSTONE** Extremely weathered. Recovered as: Medium and coarse, angular siltstone and sandstone gravel, dark grey, grey and red brown.	EW				
		100	0	241	2		**SILTSTONE** Highly weathered, grey and black with dark red brown laminations, low and medium strength	HW				1.35 - 2.05 m highly fractured core
		100	0	240			from 2.05 m with extremely weathered shale layers, very low and medium strength.					2.0 - 2.40 m 70° cleavage/bedding dip.
		100	0	239	3		**SHALE** Highly weathered with extemely weathered sections of hard clay, grey and green grey with brown staining, subvertical cleavage/laminations, very low and low strength	EW/HW				
		26	0	238	4		**SANDSTONE** Extemely / highly weathered, grey with brown and red brown mottling, medium and coarse grained, massive, low and medium strength.	EW/HW				4.0 - 4.60 m highly fractured core, some extremely weathered core with clayey sand pockets and calcite veining.
		97	42	237	5							
		100	69	236	6		**SANDSTONE** Moderately weathered, grey, fine and medium grained, high strength.	MW/HW				from 5.75 m fractures in sandstone mostly irregular, rough, open, clean or with minor clay infill.
		100	80	235	7							Sample 6.30 - 6.68 m UCS 60.7 MPa Shear failure.
		92	14	234	8		8.1 - 8.45 m siltstone layer, highly weathered, medium strength.					laminations/fabric 70°
					9							

Estimated Strength: EL VL L M H VH EH
Defect Spacing mm: 20 60 200 600 2000
$Is_{(50)}$ MPa: D- diametral A- axial

ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-02A
SHEET 2 OF 3

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 31/08/18 **COMPLETED**
R.L. SURFACE 242.2 **DATUM** m
LOCATION 0710463E 7654326N **INCLINATION** 90° **BEARING** ---
EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL
REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		92	14	233				MW/HW				
							SILTSTONE Highly weathered, laminated, grey, red brown and pale brown, with thin sandstone layers 10 - 50 mm thickness, medium and high strength					
		100	17	232	10							
					11							
				231			11.1 - 11.5 m shale bed dip 65°					
		100	45		12		from 11.95 m becoming moderately weathered, mostly dark grey, with grey sandstone laminations, high strength	MW				
				230								
		63	25		13		from 12.75 m becoming slightly weathered to moderately weathered, high and very high strength	SW/MW				
				229								
		100	29		14							
				228								from 14.4 m fractures on siltstone laminations mostly tight, clean. Joints undulating/planar clean.
		83	19		15			SW/MW				
				227								
							15.60 m becoming slightly weathered, dark grey / grey, laminated 65°	SW				15.6 m fabric shaley 65°
		100	34	226	16							
					17							
				225								
		100	52		18							
				224								

ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-02A
SHEET 3 OF 3

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

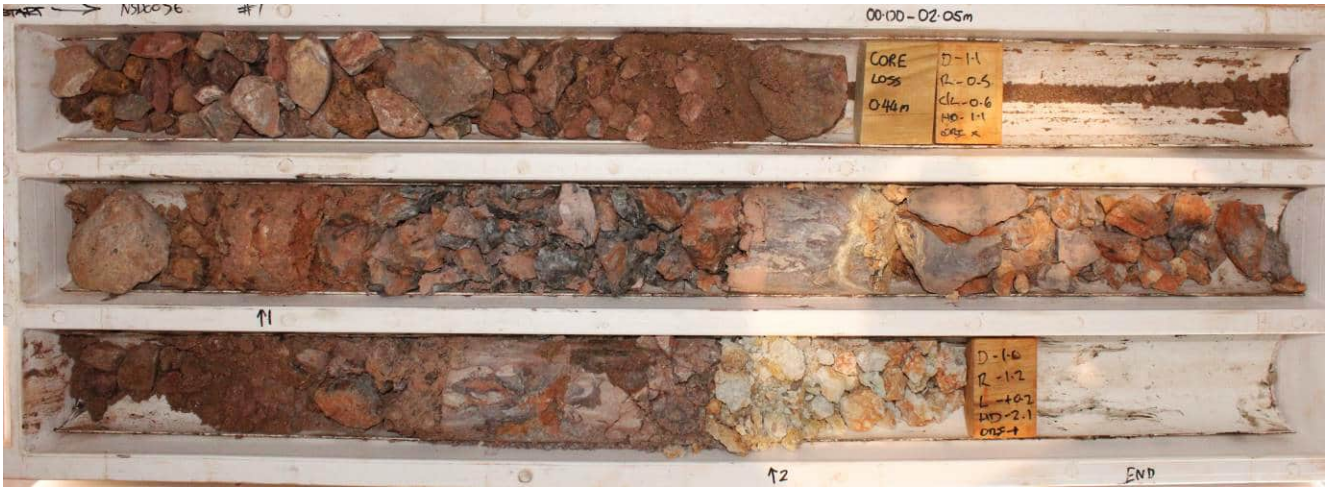
DATE STARTED 31/08/18 **COMPLETED** **R.L. SURFACE** 242.2 **DATUM** m

LOCATION 0710463E 7654326N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100	52				**SILTSTONE** *(continued)*	SW				18.26 - 18.5 m high fractured core
		100	49	223	19							
					20		20 m subvertical bedding					
		100	60	222								
					21							21.20 - 21.78 m subvertical joint undulating, smooth, clean
		100	31	221								
					22							
				220			**SANDSTONE (GREYWACKE)** Freshly weathered, dark grey, fine and medium grained, massive, high and very high strength.					
					23							
		96	42	219								
					24							
				218			24.1 - 24.63 m mineralized section, moderately weathered, grey and dark grey, high mica content, low and medium strength.	MW				
								SW				
					25		from 24.95 m medium and coarse grained, massive, very high strength					
		100	71	217								25.2 m bedding joints 60° clean
					26							
				216			BH2A-02A terminated at 26.1m					
					27							
				215								



BH2A_02A - 0.0 - 2.05 m

BH2A_02A - 2.05 - 4.21 m

BH2A_02A - 4.21 - 6.58 m

BH2A_02A - 6.58 - 8.89 m

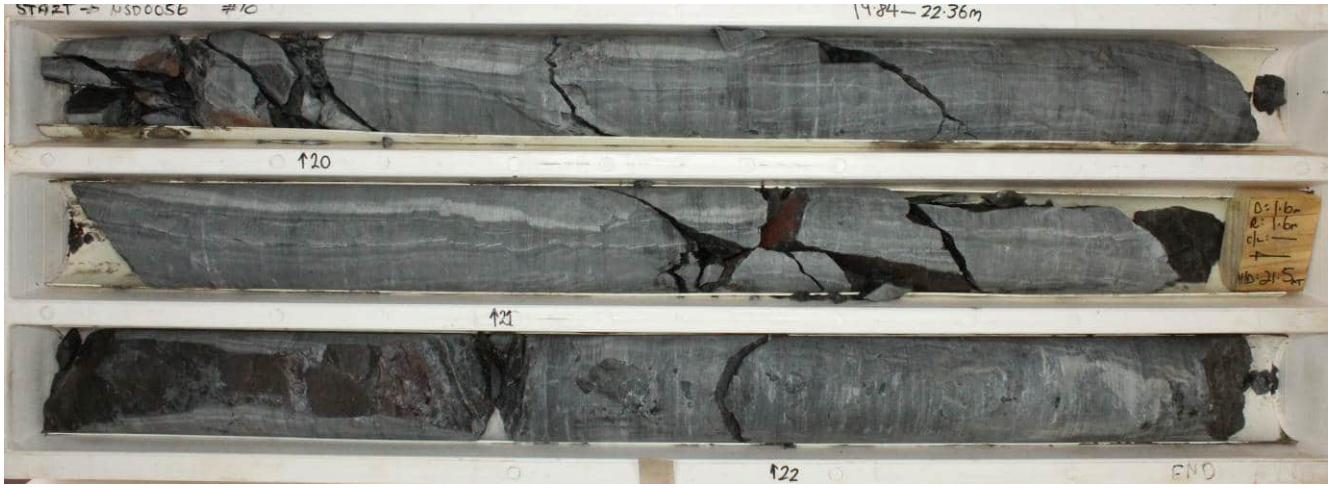
BH2A_02A - 8.89 - 11.10 m

BH2A_02A - 11.10 - 13.47 m

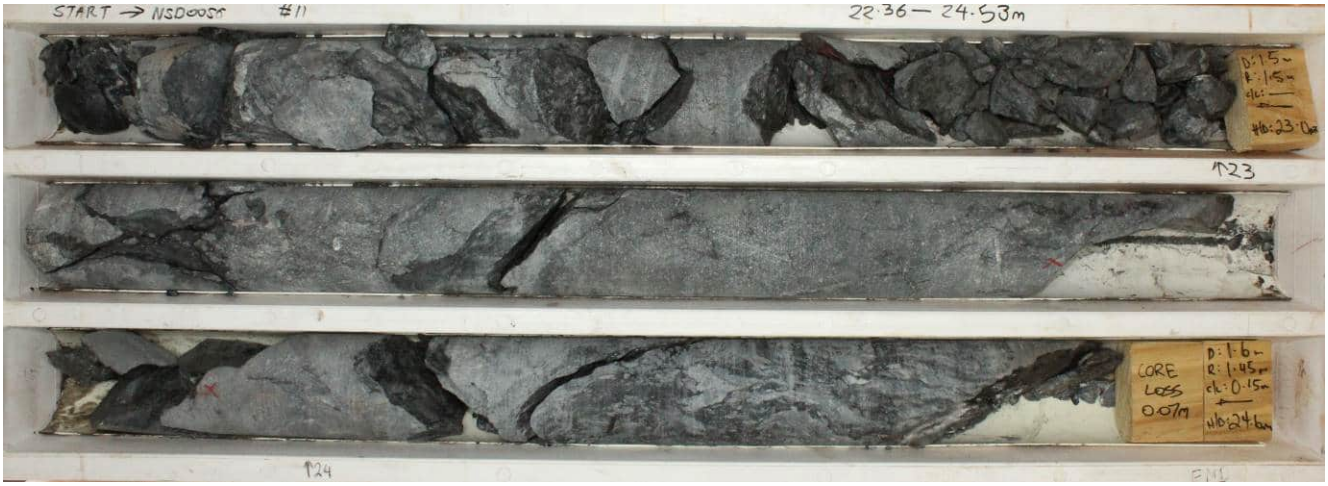
BH2A_02A - 13.47 - 15.49 m

BH2A_02A - 15.49 - 17.93 m

BH2A_02A - 17.93 - 19.84 m



BH2A_02A - 19.84 - 22.36 m



BH2A_02A - 22.36 - 24.53 m

BH2A_02A - 24.53 - 26.10 m

FIGURE
BOREHOLE NUMBER BH2A-03
SHEET 1 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 05/02/18 **COMPLETED** 08/02/18 **R.L. SURFACE** 256.064 **DATUM** m

LOCATION 0712082E 7653495N **INCLINATION** 90° **BEARING** ---

EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL

REMARKS Groundwater encountered at 4.0 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		0	0	256	0		**GRAVELLY SAND (CREEK SAND)** Fine and medium, redbrown, with trace silt and clay					
				255	1							
		33	0	254	2							
				253	3		**SANDSTONE** Highly weathered, pale yellow brown/brown with mottled yellow and orange staining, fine to coarse grained with embedded fine gravel, very low to low strength, massive	HW				Parting, undulating, very rough, stained, from 2.8 m to 4.5 m
▼		27	6.7	252	4							
		95	77	251	5		becomes highly to moderately weathered, low to medium strength at 4.5 m becomes pale yellow brown with pale red brown and pale grey at 5.1 m	HW/MW				Joints and partings, planar, very rough, subhorizontal to 10°, from 4.5 m to 7.5 m Crushed seam, irregular, very rough, stained, at 5.1 m Shear zone, 30 to 35°, planar, very rough, clean, at 5.2 m
		62	50	250	6		with fine and medium gravel embedded after 5.6 m					
		100	90	249	7							Seam, infilled with sand, very rough, stained, from 7.3 m to 7.4 m Sheared surface, 45 to 70°, planar, very rough, stained, at 7.4 m Parting, planar, very rough, 0°, clean, from 7.5 m to 9 m Sheared surface, 45 to 70°, planar, very rough, stained, at 7.65 m
		100	100	248	8		becomes moderately weathered with medium strength at 7.5 m with fine gravel after 7.7 m	MW				
				247	9							

FIGURE
BOREHOLE NUMBER BH2A-03
SHEET 2 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 05/02/18 **COMPLETED** 08/02/18 **R.L. SURFACE** 256.064 **DATUM** m

LOCATION 0712082E 7653495N **INCLINATION** 90° **BEARING** ---

EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL

REMARKS Groundwater encountered at 4.0 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
					10		**SANDSTONE** *(continued)*	MW				
		93	70	246			becomes highly weathered with low to medium strength at 10.2 m					Crushed seam, irregular, very rough, clean, from 10.2 m to 10.3 m Parting, planar, very rough, clean, from 10.3 m to 10.5 m
							with orange staining after 10.5 m	HW				Joints and partings, planar or undulating, very rough, stained, from 10.5 m to 12 m
					11							
		66	53	245								Sheared zone, curved, rough, clean, at 11.4 m
												Sheared zone, planar, rough, coated, at 11.7 m
				244	12							Sheared zone, curved, rough, clean, at 11.8 m Joints and partings, planar or undulating, very rough, clean, from 12 m to 13.5 m
							SANDSTONE Moderately to slightly weathered, medium to high strength, grey with minor pale yellow brown and red brown staining with trace embedded fine gravel at 12.15 m	MW/SW				Seam, infilled with yellow brown grey clay, planar, very rough, stained, from 12.1 m to 12.15 m Sheared surface, 45 to 80°, planar, rough, stained, at 12.55 m
		100	56	243	13							Sheared surface, 45 to 80°, planar, rough, stained, at 13.1 m Sheared surface, 45 to 80 °, planar, rough, stained, at 13.3 m Partings, planar, very rough, clean, from 13.5 m to 15 m Shear surface, 85 to 90 °, planar, rough, with yellow staining, from 13.5 m to 14.5 m
		100	26	242	14							
				241	15							Joints and partings, 0 °, planar, very rough, clean, from 15 m to 16.5 m
		100	70									
				240	16							Seam, infilled with yellow clay, rough, stained, at 15.9 m Shear surface, 70 °, planar, rough, stained, at 16.3 m
							becomes fresh, high to very high strength, with minor staining to no staining at 16.6 m	FR				Shear surface, 45 to 50 °, planar, very rough stained, at 16.6 m
		100	83	239	17							Partings, planar, very rough, clean, from 17 m to 18.5 m
		100	100	238	18							

ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-03

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 05/02/18 **COMPLETED** 08/02/18 **R.L. SURFACE** 256.064 **DATUM** m

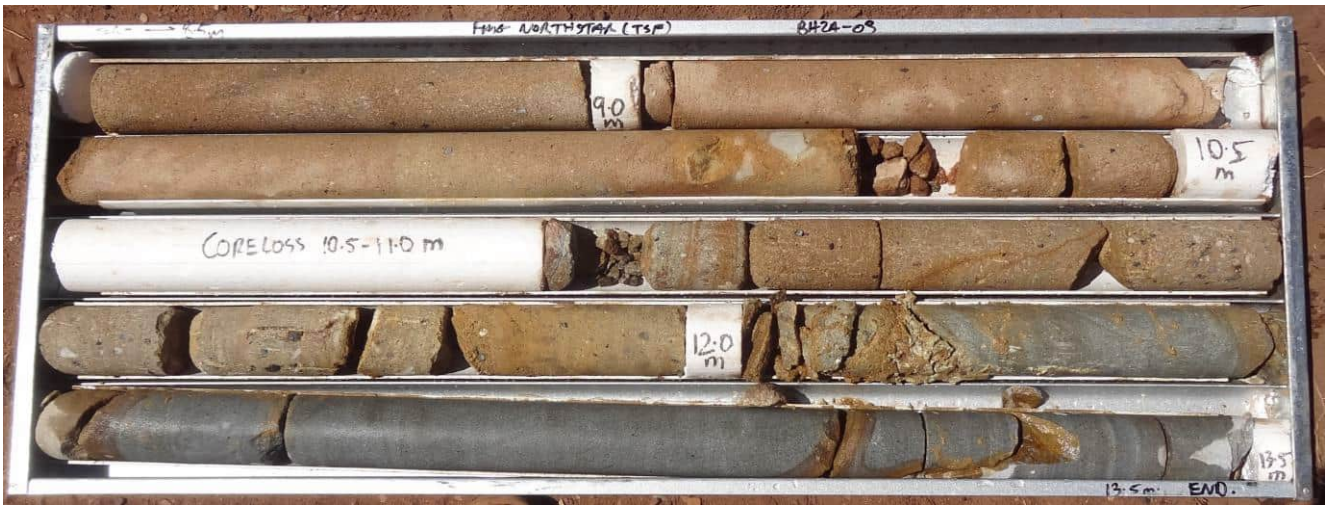
LOCATION 0712082E 7653495N **INCLINATION** 90° **BEARING** ---

EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL

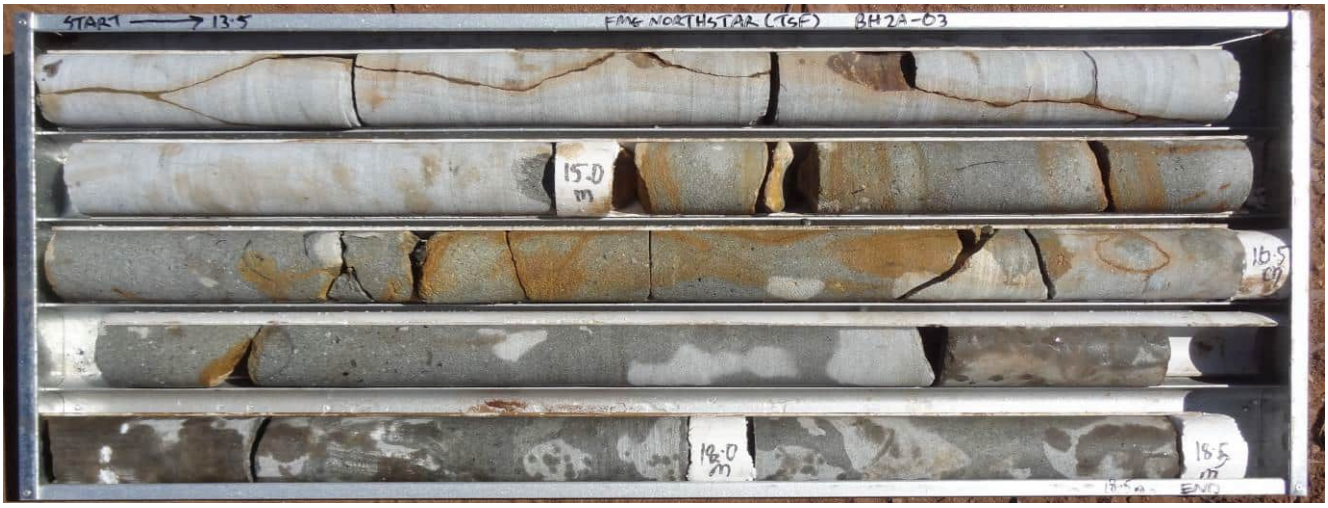
REMARKS Groundwater encountered at 4.0 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100	100				**SANDSTONE** *(continued)*	FR				
		100	100	237	19							
							BH2A-03 terminated at 19.5m					
				236	20							
				235	21							
				234	22							
				233	23							
				232	24							
				231	25							
				230	26							
				229	27							

BH2A-03 (0.0 – 8.5 m)



BH2A-03 (8.5 – 13.5 m)



BH2A-03 (13.5 – 18.5 m)

BH2A-03 (18.5 – 19.5 m)

FIGURE
BOREHOLE NUMBER BH2A-04
SHEET 1 OF 2

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 11/02/18 **COMPLETED** 12/02/18 **R.L. SURFACE** 257.392 **DATUM** m
LOCATION 0711921E 7653330N **INCLINATION** 90° **BEARING** ---
EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL
REMARKS Groundwater encountered at 6.4 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition; Rock: type, weathering, colour, fabric, estimated strength, structure and bedding)	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa (D- diametral A- axial)	Defect Spacing mm (20 60 200 600 2000)	Defect Description	Well Details
		50	0	257	1		**CLAYEY SAND** Fine to coarse, red brown, with silt and gravel						
				256			becomes grey at 1.4 m					fractured, with clayey sand/gravel infill, planar, slicken sided, smooth, coated, from 1.8 m to 3 m Joints, 80 - 90 °, planar, smooth, stained, from 2 m to 5 m	
		90	0		2		**SHALE** Extremely to highly weathered, pale grey with purple, orange and redbrown staining, fine grained, very low to low strength, foliated structure generally orientated at 80 to 87° to GL	EW/HW					
		100	0	255	3		becomes highly to moderately weathered, with low to medium strength at 3.0 m	HW/MW				Seam, calcite with gravel, irregular, rough, stained, from 2.7 m to 2.75 m Sheared surface, planar, 0 °, very rough, coating (white calcite), stained, from 3 m to 4.5 m	
		100	26	254	4							Crushed seam, irregular, undulating, rough, stained, at 3.6 m Crushed seam, irregular, undulating, rough, stained, at 3.7 m	
				253			with only purple staining and minor orange and yellow staining after 4.5 m					Crushed seam, irregular, undulating, rough, stained, at 4.2 m Sheared surface, 0 - 5 °, planar, smooth, clean, from 4.5 m to 6 m	
		100	33	252	5							Crushed seam, irregular, rough, stained, at 4.9 m	
					6		becomes moderately weathered, medium to high strength at 6.0 m	MW				Crushed seam, irregular, rough, stained, at 5.6 m Crushed seam, irregular, rough, stained, at 5.9 m	
▼		100	67	251	7							Sheared surface, 50 - 60 °, planar, rough, stained, at 7 m Sheared surface, planar, smooth/rough, clean, from 7.1 m to 7.5 m	
				250			with red brown and pale purple staining dipping at 80° to 87° after 7.4 m					Sheared surface, planar/undulating, rough, clean, from 7.5 m to 8.8 m	
		100	67	249	8		with just red brown staining at 80° to 87° after 8.0 m						
					9							Joints, 85 °, smooth, clean, planar, from 8.8 m to 9 m Highly fractured, with grey/red brown clay	
			7										

FIGURE
BOREHOLE NUMBER BH2A-04
SHEET 2 OF 2

ATC Williams

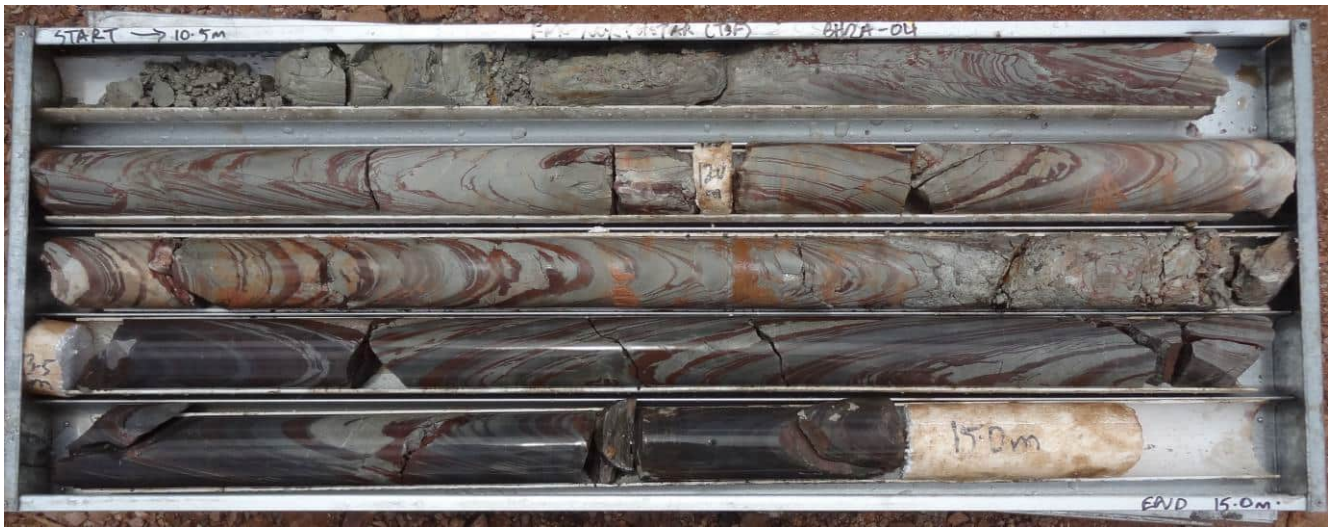
CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 11/02/18 **COMPLETED** 12/02/18 **R.L. SURFACE** 257.392 **DATUM** m
LOCATION 0711921E 7653330N **INCLINATION** 90° **BEARING** ---
EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL
REMARKS Groundwater encountered at 6.4 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition; Rock: type, weathering, colour, fabric, estimated strength, structure and bedding)	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description	Well Details
		67	7	248	10		becomes extremely weathered, with very low strength, with fine grey quartz gravel after 9.0 m **SHALE** *(continued)*	EW/HW				Infill, irregular, stepped, from 9 m to 11 m	
		100	53	247	11		becomes moderately weathered, low to medium strength at 11.0 m	MW				Sheared surface, planar, rough, clean, at 11.8 m	
		100	50	246	12							Sheared surface, irregular, rough, stained, at 12.1 m Sheared surface, irregular, rough, stained, at 12.6 m	
		100	70	245	13		becomes moderately to slightly weathered, medium to high strength, dark grey/grey with purple and red brown staining after 13.5 m	MW/SW				Seam, with cemented grey sand infill, 85 - 90 °, rough, stepped, from 13.2 m to 13.3 m Sheared surface, 30 - 36 °, planar/stepped, rough, clean, at 13.7 m Seam, 85 - 90 °, with grey cemented sand, planar, rough, clean, at 14 m	
				244	14							Sheared surface, 30 - 36 °, planar/stepped, rough, clean, at 14.7 m	
				243	15								
				242	16		BH2A-04 terminated at 15m						
				241	17								
				240	18								

BH2A-04 (0.0 – 5.5 m)

BH2A-04 (5.5 – 10.5 m)



BH2A-04 (10.5 – 15.0 m)

FIGURE
BOREHOLE NUMBER BH2A-05
SHEET 1 OF 2

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 03/02/18 **COMPLETED** 05/02/18 **R.L. SURFACE** 258.913 **DATUM** m

LOCATION 0711487E 7653040N **INCLINATION** 90° **BEARING** ---

EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL

REMARKS Groundwater encountered at 4.2 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description	Well Details
		33	0	258	1		**SANDY GRAVEL/CLAYEY GRAVEL** Fine to coarse, redbrown, with clay and silt						
		50	0	257	2								
		86	0	256	3		**SHALE** Extremely to highly weathered, pale grey with mottled redbrown and orange, fine grained, very low to low strength, foliated structure with general orientation 80° to 90° from GL	EW/HW				Crushed seam, irregular, rough, from 3 m to 3.3 m	
	▼	100	23	255	4							Infill cemented material, from 3.5 m to 3.6 m Crushed seam, irregular, rough, clean, from 3.6 m to 4.1 m Shear zone, planar, smooth, clean, from 4.1 m to 4.3 m Crushed seam, irregular, smooth, from 4.3 m to 4.9 m	
		100	65	254	5		becomes highly to moderately weathered, grey mottled with lower staining of pale redbrown and orange, with low to medium strength at 5 m	HW/MW				Joint and parting, 80 to 85 °, planar, smooth, stained, from 4.9 m to 5.9 m	
		100	26	253	6							Shear zone, irregular, smooth, clean, from 6 m to 6.9 m	
		100	0	252	7							Crushed seam, irregular, rough, clean, from 6.9 m to 7.5 m	
		100	0	251	8							Joint, 85 to 90 °, planar, clean, from 7.5 m to 8.6 m	
		100	100	250	9							Parting, stepped, smooth, clean, at 8.9 m Parting, stepped and irregular, smooth,	

FIGURE
BOREHOLE NUMBER BH2A-05
SHEET 2 OF 2

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 03/02/18 **COMPLETED** 05/02/18 **R.L. SURFACE** 258.913 **DATUM** m
LOCATION 0711487E 7653040N **INCLINATION** 90° **BEARING** ---
EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL
REMARKS Groundwater encountered at 4.2 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition; Rock: type, weathering, colour, fabric, estimated strength, structure and bedding)	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description	Well Details
		100	43	249	10		becomes moderately weathered, with medium strength at 9 m **SHALE** *(continued)*	MW				from 9 m to 10 m Crushed seam, irregular, slicken sided/smooth, from 10 m to 10.2 m Joint, planar, rough, from 10.3 m to 10.5 m Shear zone, planar, smooth, at 10.7 m	
		100	50	248	11							Crushed seam, planar, smooth, from 11 m to 11.2 m Parting, stepped, rough, clean, from 11.2 m to 11.7 m Joint, 85 to 90 °, planar, smooth, clean, from 11.7 m to 12 m	
		100	66	247	12							Joints and partings, planar or stepped, slicken sided or rough, from 12 m to 13.2 m	
		100	66	246	13							Crushed seam, irregular, smooth, clean, from 13.2 m to 13.4 m Seam, with white calcite, irregular, rough, at 13.7 m	
		100	66	245	14							Parting, stepped, rough, at 14.05 m Parting, stepped, rough, at 14.4 m Crushed seam, irregular, smooth, from 14.5 m to 14.75 m	
				244	15							Sheared surface, planar, rough, at 14.8 m	
				243	16		BH2A-05 terminated at 15m						
				242	17								
				241	18								

BH2A-05 (0.0 – 6.5 m)

BH2A-05 (6.5 – 11.2 m)

BH2A-05 (11.2 – 15.0m)

FIGURE
BOREHOLE NUMBER BH2A-06
SHEET 1 OF 2

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 10/02/18 **COMPLETED** 10/02/18 **R.L. SURFACE** 272.676 **DATUM** m
LOCATION 0711793E 7652094N **INCLINATION** 90° **BEARING** ---
EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL
REMARKS Groundwater encountered at 2.3 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		50	0	272	1		**SHALE** Extremely to highly weathered, pale grey with yellow, purple and orange staining, fine grained, very low to low strength, with a foliated structure generally oriented at 80° to 87° from the ground level	EW/HW				Highly fractured, with red brown clay and sand infill, from 0.0 m to 1.6 m
		100	0	271	2		becomes highly weathered at 1.6 m	HW				Seam, infilled with red brown clayey sand, irregular, very rough, at 1.7 m
	▼	100	56	270	3		becomes moderately weathered, with purple orange and redbrown minor staining after 2.5 m	MW				Sheared surface, stepped, rough, with white coating, at 2.7 m Sheared zone, stepped or irregular, 20 to 45 °, rough, stained, from 3.0 to 4.5 m
		100	63	269	4							
		90	11	268	5							Seam, infilled with grey clay, irregular, rough, at 4.6 m Seam, infilled fine to coarse grey and yellow brown clayey sand of high plasticity with fine gravel of host rock, irregular, rough, between 5.0 m and 5.4 m
		100	91	267	6		becomes moderately to slightly weathered at 5.5 m	MW/SW				Sheared surface, planar, 10 to 20 °, smooth, clean, at 5.95 m Sheared surface, planar, rough, clean, at 6.1 m Crushed seam, irregular, smooth, stained, from 6.4 m to 6.5 m
		100	75	266	7		becomes slightly weathered to fresh at 6.5 m	SW				Sheared surface, planar, smooth, clean, at 6.95 m Joints, planar, 70 to 85 °, irregular, stained, from 7 m to 7.5 m
		100	96	265	8							Sheared surface, 0 °, undulating, rough, stained, at 8.0 m
				264	9							Sheared surface, 0 °, undulating, rough, stained, at 8.0 m

ATC Williams

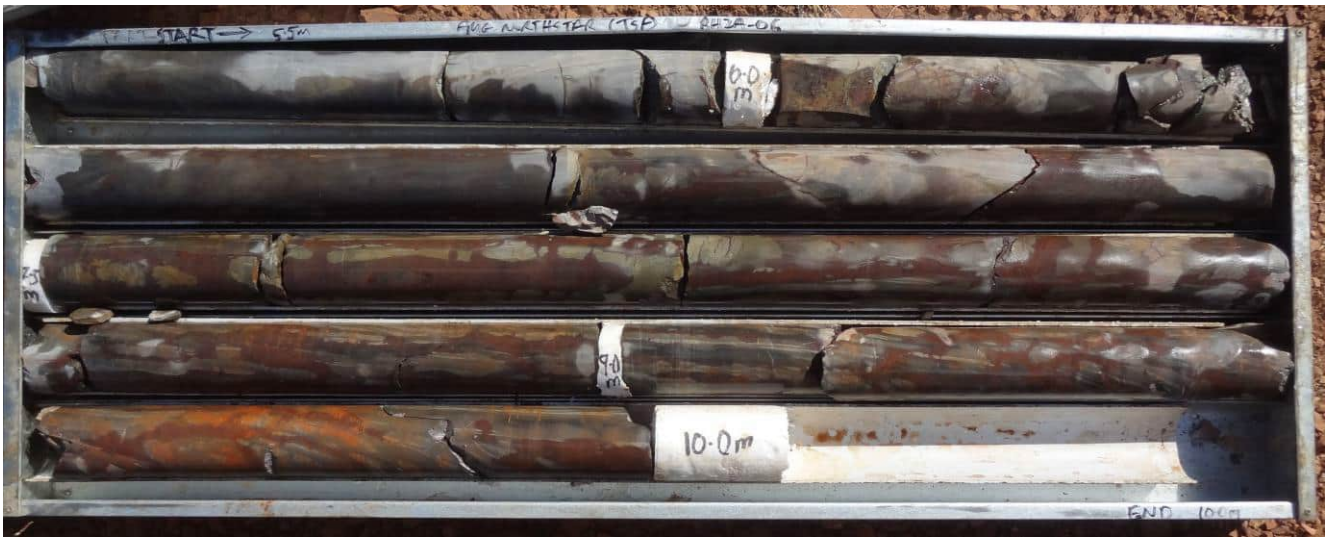
FIGURE
BOREHOLE NUMBER BH2A-06
SHEET 2 OF 2

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 10/02/18 **COMPLETED** 10/02/18 **R.L. SURFACE** 272.676 **DATUM** m
LOCATION 0711793E 7652094N **INCLINATION** 90° **BEARING** ---
EQUIPMENT HQ Diamond Core Rig **LOGGED BY** AP **CHECKED BY** JL
REMARKS Groundwater encountered at 2.3 m bgl

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100	100	263	10		**SHALE** *(continued)*	SW				Partings, irregular, rough, stained, at 9.15 m Sheared surface, irregular, smooth, stained, at 9.9 m
				262	11		BH2A-06 terminated at 10m					
				261	12							
				260	13							
				259	14							
				258	15							
				257	16							
				256	17							
				255	18							

BH2A-06 (0.0 – 5.5 m)



BH2A-06 (5.5 – 10.0m)

FIGURE
BOREHOLE NUMBER BH2A-07
SHEET 1 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 08/09/18 **COMPLETED** **R.L. SURFACE** 251.4 **DATUM** m

LOCATION 0710670E 7654621N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100	0	251			**SILTSTONE** Highly weathered to extremely weathered, grey, purple and red laminated with shale layers, low and medium strength.	HW/EW				
					1		becoming highly weathered grey and purple laminations, medium and high strength.	HW				clay filled joints in siltstone 1.02 m, 1.24m, 1.39m, 1.44m
		96	9	250						A 2.39		
					2							
		100	55	249			**SHALE** Slightly weathered, grey and purple laminations with siltstone layering, medium strength.	SW				2.7 m - 4.45 m subvertical fractures mostly tight and irregular with no infill. Bedding fractures mostly planar and tight.
				248	3							
					4							
		100	15	247			from 4.45 m moderately weathered, grey, sheared texture to shale, medium strength	MW/HW				
		100	20		5							
				246			**SILTSTONE** Moderately weathered, grey, laminated with shale partings, high strength	MW				
		100	58		6					A 1.91		Sample 6.00 - 6.50 m UCS 20.0 MPa. Modulus 6.81 GPa. Shear failure
				245								
					7							
		100	23	244			from 7.25 m sheared texture.					7.25 - 8.43 m fractures mostly irregular, rough in foliated shale
					8		**SHALE** Slightly and moderately weathered, grey and purple laminations with siltstone layering, low and medium strength.	SW/MW				7.82 - 8.43 m highly fracture core
		100	38	243			**SILTSTONE** Moderately to highly weathered, red grey and brown, laminated with shale layering, medium and high strength.	MW/HW				
					9							

FIGURE
BOREHOLE NUMBER BH2A-07
SHEET 2 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 08/09/18 **COMPLETED** **R.L. SURFACE** 251.4 **DATUM** m

LOCATION 0710670E 7654621N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm	Defect Description
		100	38	242			**SILTSTONE** Moderately to highly weathered, red grey and brown, laminated with shale layering, medium and high strength. *(continued)*	MW/HW				
		100	41	241	10		**SHALE** Slightly weathered with purple laminations, high / very high strength.	SW				@ 10.0 m foliation / bedding 75°
		100	77	240	11							
		100	87	239	12							
		100	7	238	13		**SHALE** Slightly weathered, grey, laminated with siltstone layering, medium strength.					12.70 - 15.0 m subvertical laminations 13.0 - 14.5 m shale fractures mostly subhorizontal, irregular, tight with no infill.
		100	13	237	14		from 14.5 m moderately to highly weathered, low and medium strength	MW/HW				
		100	21	236	15		**SILTSTONE** Moderately weathered, grey and purple with red oxide staining, laminated with shale partings, medium and high strength	MW				fractures in siltstone mostly subhorizontal, irregular, tight or open with no infill.
				235	16							
				234	17							
					18		17.90 - 18.25 m shale layer, moderately weathered, grey, low strength.					

FIGURE
BOREHOLE NUMBER BH2A-07
SHEET 3 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 08/09/18 **COMPLETED**
R.L. SURFACE 251.4 **DATUM** m
LOCATION 0710670E 7654621N **INCLINATION** 90° **BEARING** ---
EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL
REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm	Defect Description
		100	21	233	19		**SILTSTONE** *(continued)*	MW				
		100	47	232	20		20.0 - 21.05 m coarser grained, tending to sandstone					20.0 - 23.2 m siltstone fractures mostly subhorizontal, irregular, rough, tight with no infill.
		100	49	231	21		21.0 - 24.28 m shale/siltstone					20.85 m bedding 70°
		100	28	230	22							
		100	15	229	23							
		100	29	228	24							
				227	25		**SHALE** Slightly weathered, grey with purple laminations, medium strength.	SW				25.60 m lamination 80°
				226	26							
				225	27		BH2A-07 terminated at 26.1m					

Estimated Strength: EL VL L M H VH EH
Defect Spacing mm: 20 60 200 600 2000

MPAW/ATC CORED BOREHOLE 114185.14 BH LOGS 9-11.GPJ GINT AUSTRALIA.GDT 12/11/18

BH2A_07 - 0.0 - 2.50 m

BH2A_07 - 2.50 - 4.90 m

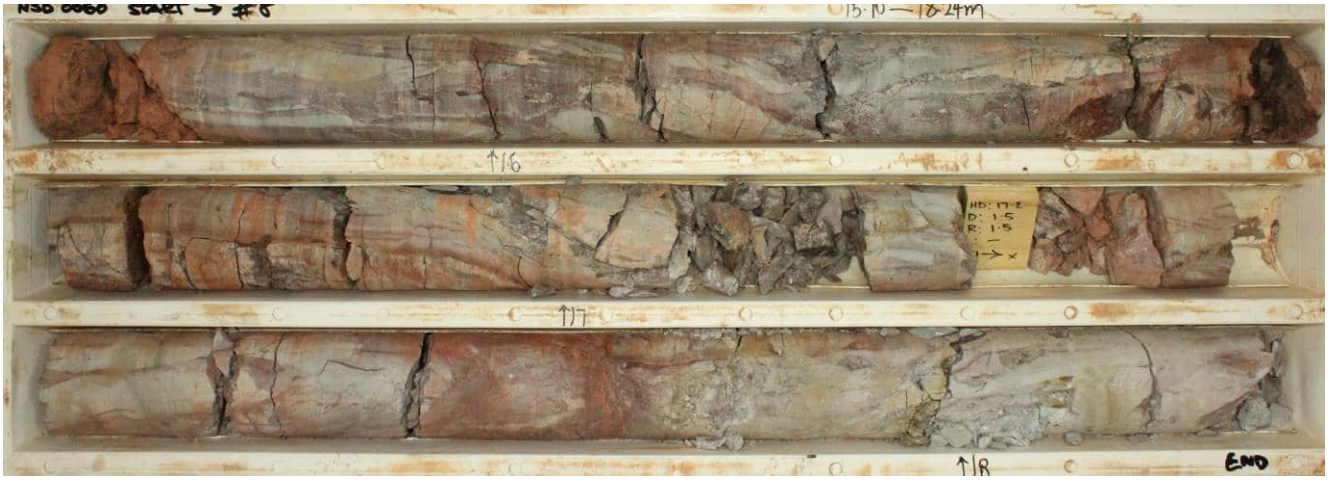
BH2A_07 - 4.90 - 7.00 m

BH2A_07 - 7.00 - 8.96 m

BH2A_07 - 8.96 - 11.29 m

BH2A_07 - 11.29 - 13.59 m

BH2A_07 - 13.59 - 15.70 m

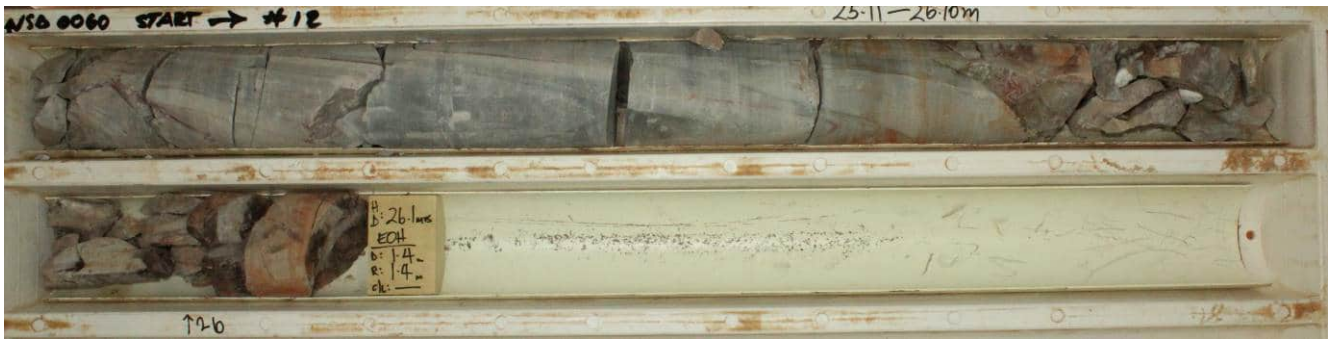


BH2A_07 - 15.70 - 18.24 m

BH2A_07 - 18.24 - 20.56 m

BH2A_07 - 20.56 - 22.91 m

BH2A_07 - 22.91 - 25.11 m



BH2A_07 - 25.11 - 26.10 m

FIGURE
BOREHOLE NUMBER BH2A-08
SHEET 1 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 06/09/18 **COMPLETED** **R.L. SURFACE** 253.6 **DATUM** m

LOCATION 0710628E 7654504N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		91	0	253			**CLAYEY GRAVEL (Possible drill pad fill)** Medium dense, fine to coarse, red brown becoming red brown and white					
							SANDSTONE Extremely weathered, grey and white. Recovered as medium and coarse gravel.	EW				
					1							
		27	0	252	2							core typically fracture at start and end of drill runs (drilling induced).
		23	0	251	3							
							SANDSTONE Extremely and highly weathered, grey and white with pale brown staining, medium grained, massive from 3.0 m, low and medium strength	HW/EW		A 0.65		Sample 3.0 - 3.38 m point load 0.65 MPa
		61	0	250	4							
		100	0	249			4.5 - 5.0 m extremely weathered with siltstone layering highly fractured (rubble core)	EW				4.5 - 5.0 m highly fractured (rubble core)
					5		from 5.0 m becoming highly weathered yellow brown and grey mottled, medium grained, low and medium strength	HW				
		100	8	248	6							5.8 m - 10.2 m fractures in sandstone mostly subhorizontal, irregular, open with some clay infill.
							6.40 - 6.78 m extremely weathered to highly weathered , white and pale grey, with silca cementation, low and medium strength	EW/HW				6.40 m - 6.78 m highly fractured, rubble core
		100	33	247	7		from 6.78 m, extremely to highly weathered, white and pale brown, low / medium strength	HW/EW				
				246								
		95	41	245	8							
					9							

MPAW/ATC CORED BOREHOLE 114185.14 BH LOGS 9-11.GPJ GINT AUSTRALIA.GDT 12/11/18

FIGURE
BOREHOLE NUMBER BH2A-08
SHEET 2 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 06/09/18 **COMPLETED**
R.L. SURFACE 253.6 **DATUM** m
LOCATION 0710628E 7654504N **INCLINATION** 90° **BEARING** ---
EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL
REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm	Defect Description
		95	41				**SANDSTONE** *(continued)*	HW/EW				
				244	10							
		100	19				**SHALE** Highly weathered, pale grey and pale brown, vertical bedding / cleavage, very low / low strength.	HW				
				243	11		**SANDSTONE** Highly weathered, pale grey with pale brown staining, medium grained, massive, medium / high strength	HW				
		87	7	242	12							
							SHALE Highly weathered, pale grey and pale brown, vertical bedding / cleavage, very low / low strength.	HW				
				241	13		**SANDSTONE** Moderately weathered, pale grey with pale brown staining, medium grained, massive, medium / high strength	HW/EW				12.75 m - 17.43 m joints in sandstone mostly subhorizontal, irregular, clean, either open or tight.
		93	48	240	14							
		79	67	239	15							
		100	50	238	16		from 15.90 m becoming highly weathered, dark grey brown					16.08 m & 16.40 m Bedding fractures mostly tight, planar 70°.
		100	35	237	17							
		73	7	236	18		**SHALE** Highly weathered, pale grey dark grey, vertical bedding / cleavage, very low / low strength.					Shale vertically laminated / cleaved. Bedding fractures tight, planar.

Estimated Strength: EL VL L M H VH EH
Defect Spacing mm: 20 60 200 600 2000

FIGURE
BOREHOLE NUMBER BH2A-08
SHEET 3 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 06/09/18 **COMPLETED** **R.L. SURFACE** 253.6 **DATUM** m

LOCATION 0710628E 7654504N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		73	7	235	19		**SHALE** Highly weathered, pale grey dark grey, vertical bedding / cleavage, very low / low strength. *(continued)*					
		100	0	234	20		becoming moderately weathered, low strength	MW				20.24 m & 20.55 m irregular subhorizontal joints
		100	0	233	21							21.0 - 22.45 m joints in sandstone mostly subhorizontal, irregular, open or tight, no infill.
				232			**SANDSTONE** Moderately weathered, grey with red brown staining on fractures, medium grained, faintly laminated, medium / high strength	MW				
		100	49	231	22							
					23		**SHALE** Slightly weathered/ freshly weathered, grey / dark grey, laminated with thin siltstone layering low and medium strength bedding 70 °	FR				22.5 m shale laminatinations 70°
		100	63	230	24		**SANDSTONE** Slightly weathered, grey / dark grey, medium grained, laminated with siltstone layers, high / very high strength.	SW				22.75 m -23.1 m highly fractured core
				229	25		becoming grey and faintly laminated					from 23.8 m, joints in sandstone mostly rough, open or closed with no infill.
		93	36	228	26		**SANDSTONE** Moderately weathered, grey / dark grey, coarse grained with volanic ash, medium / high strength.	MW				
							becoming fine and medium grained, highly weathered	HW				
				227	27		BH2A-08 terminated at 26.1m					

BH2A_08 - 0.0 - 3.21 m

BH2A_08 - 3.21 - 5.81 m

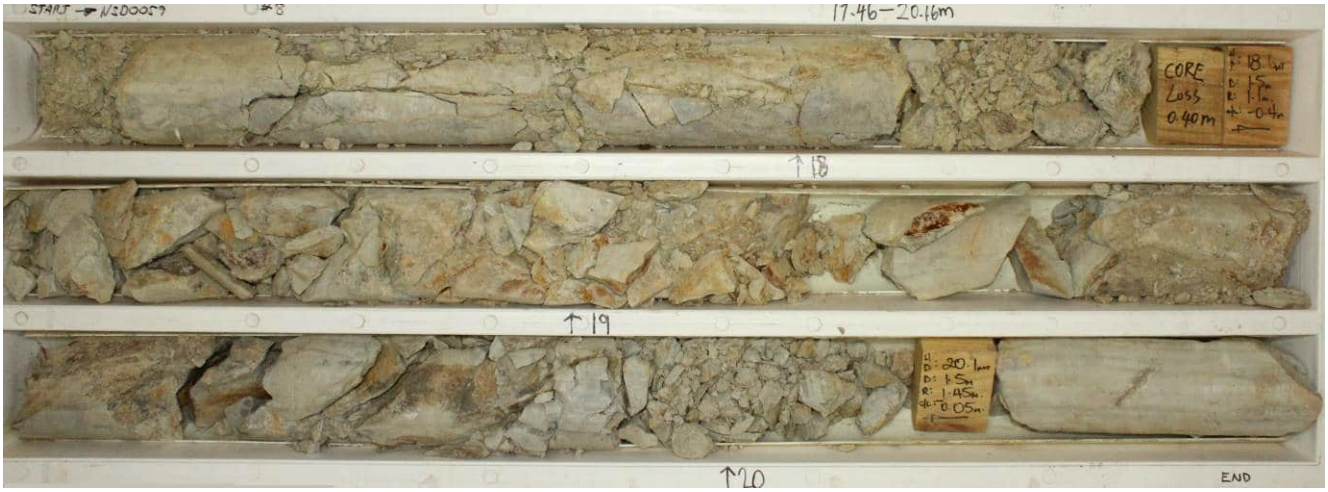
BH2A_08 - 5.81 - 8.04 m

BH2A_08 - 8.04 - 10.41 m

BH2A_08 - 10.41 - 12.51 m

BH2A_08 - 12.51 - 15.02 m

BH2A_08 - 15.02 - 17.46 m



BH2A_08 - 17.46 - 20.16 m

BH2A_08 - 20.16 - 22.41 m

BH2A_08 - 22.41 - 24.60 m

BH2A_08 - 24.60 - 26.10 m

FIGURE
BOREHOLE NUMBER BH2A-08(A)
SHEET 1 OF 2

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 07/09/18 **COMPLETED**
R.L. SURFACE 253.6 **DATUM** m
LOCATION 0710625E 7654503N **INCLINATION** 90° **BEARING** ---
EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL
REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
							GRAVEL (Possible drill pad fill) Medium dense, fine to coarse, red brown with clay					
		43	0	253	1		**SANDSTONE/SHALE** Sandstone extremely to highly weathered with clayey sand pockets, medium and coarse grained, light grey with brown staining, massive, low strength and medium strength with interbedded Shale: pale grey, laminated very low / low strength.	EW/HW				Note broken core typically present at start and of drill runs (drilling induced).
				252	2							Sandstone fractures predominatly, irregular, rough, either clay filled or clean.
		92	0	251	3		2.13 - 2.29 m highly weathered shale layer, very low strength					
		82	0	250	4							
				249	5							
		67	0	248	6		5.18 - 5.52 m highly weathered, grey shale layer, very low strength					
		83	15	247	7		6.0 m becoming highly weathered	HW				bedding 80° from 7.2 m, joints in shale mostly subhorizontal, irregular and rough. Bedding fractures mostly planar, smooth, tight.
		85	22	246	8		**SHALE/SILTSTONE** Shale: highly weathered / moderately weathered, pale grey with brown staining, laminated, low strength with interbedded Siltstone: highly weathered, laminated, medium strength	HW/MW				
		100	0	245	9							8.1 - 8.4 m sandy material in core tray (presumed fall-in / bottom slough)

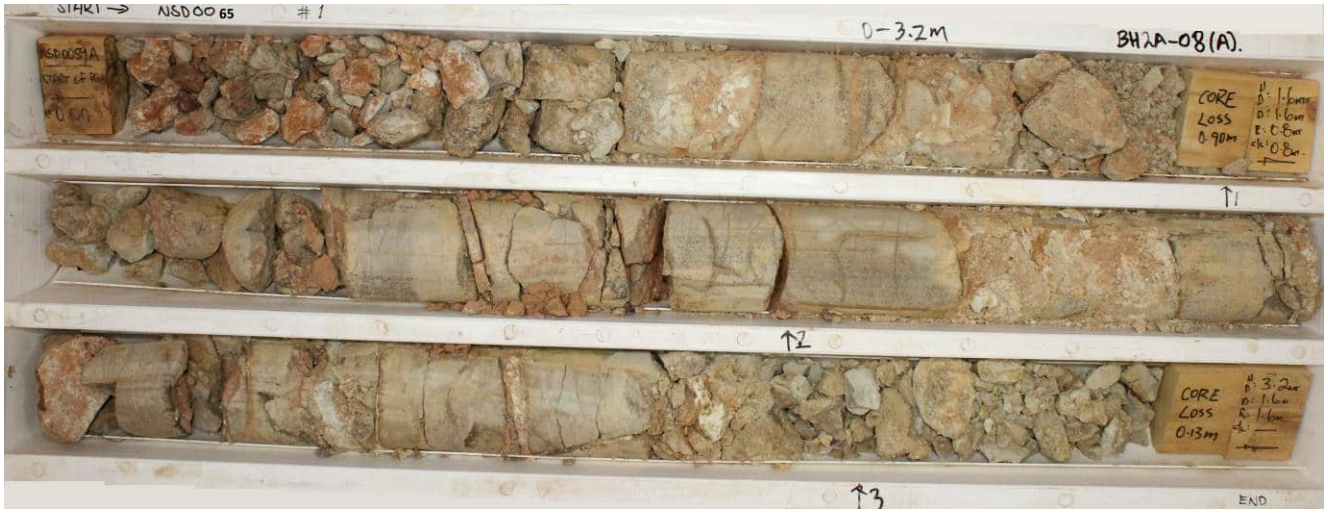
ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-08(A)
SHEET 2 OF 2

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 07/09/18 **COMPLETED**
R.L. SURFACE 253.6 **DATUM** m
LOCATION 0710625E 7654503N **INCLINATION** 90° **BEARING** ---
EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL
REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100	28	244	10		**SHALE/SILTSTONE** *(continued)*	HW/MW				9.95 - 10.95 m fractures mostly irregular and rough
				243			from 10.5 m predominantly highly weathered siltstone, medium strength					
		95	49		11		from 10.95 m mostly shale, white and pale grey very low / low strength					
				242								
		100	0		12							lamination 80°
				241								
							BH2A-08(A) terminated at 12.6m					
					13							
				240								
					14							
				239								
					15							
				238								
					16							
				237								
					17							
				236								
					18							



BH2A_08A - 0.00 - 3.20 m

BH2A_08A - 3.20 - 5.87 m

BH2A_08A - 5.87 - 8.10 m

BH2A_08A - 8.10 - 9.95 m

BH2A_08A - 9.95 - 11.95 m

BH2A_08A - 11.95 - 12.60 m

FIGURE
BOREHOLE NUMBER BH2A-09
SHEET 1 OF 3

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 28/08/18 **COMPLETED**
R.L. SURFACE 256.5 **DATUM** m
LOCATION 0710395E 7654280N **INCLINATION** 90° **BEARING** ---
EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL
REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
							CLAYEY GRAVEL (Possible drill pad fill) Medium dense, fine to coarse, red brown, with indurated core pieces.	EW/HW				
				256			**SANDSTONE/SILTSTONE** Sandstone, extremely / highly weathered, grey, white and red brown, medium and coarse grained interbedded with minor Siltstone/Shale layers; grey and dark grey, laminated, very low and low strength bedding 70°					
		41	0		1							Sandstone fractures typically irregular, rough, mostly open and clean with no infill. Laminations, wavy 5 - 15°. Core more fractured at start/end of drill runs (drilling induced fractures?).
				255								
					2					A 0.15		Sample 2.24 - 2.40 m point load 0.15 MPa
		58	0	254								
					3		3.1 - 3.35 m extremely weathered, clayey sand with sandstone lithorelicts.					
		40	0	253								
					4							
				252								
		90	0		5		from 4.70 m becoming highly weathered, grey and pale brown, medium and coarse grained sandstone, medium and high strength	HW				laminations subvertical and undulating
				251								
		100	41		6							5.70 - 9.20 m joints mostly irregular, rough, stained, open with no infill. Subvertical foliation
				250								
					7							
		100	20	249								
					8		8.10 - 8.75 m locally, extremely weathered, with red brown clayey sand pockets in fractures, low strength	EW				
		100	0	248								
					9			HW				

ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-09
SHEET 2 OF 3

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 28/08/18 **COMPLETED** **R.L. SURFACE** 256.5 **DATUM** m

LOCATION 0710395E 7654280N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
							SANDSTONE/SILTSTONE *(continued)*	HW				
		100	44	247	10							
				246								10.60 - 11.0 m irregular subvertical joints, clean or with minor infill.
		100	28	245	11							
					12		11.80 - 12.2 m locally extremely weathered with red brown clay infill in fractures	EW				
								HW				
		100	34	244	13							
				243								
					14		**SILTSTONE/SHALE** Highly weathered grey and red brown, laminated, medium strength.					
		100	23	242	15		**SANDSTONE** Highly and moderately weathered, grey, white and red brown, pale grey, medium and high strength, massive	HW/MW				
		100	22	241	16							
				240	17							
		100	29	239			17.1 - 17.23 m mineralized section, with clay infill in fractures	HW				
					18		**SANDSTONE (Greywacke)** Moderately weathered, grey with red brown oxide staining on fractures, faintly bedded, medium and high strength.	MW				

ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-09
SHEET 3 OF 3

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 28/08/18 **COMPLETED**
R.L. SURFACE 256.5 **DATUM** m
LOCATION 0710395E 7654280N **INCLINATION** 90° **BEARING** ---
EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL
REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100	29	238			**SANDSTONE (Greywacke)** *(continued)*	MW				
					19							
		100	66	237								19.6 m brown stained bedding joint, 65°
					20							
		100	30	236								
					21		20.78 - 21.13 m siltstone layer, grey, high strength					20.78 - 21.13 m siltstone fractures on laminations mostly undulating and tight, alpha 20 - 25°
		100	56	235								
					22		from 21.95 m slightly weathered, massive, high and very high strength	SW				Below 21.95 m joints mostly, rough with no infill, 10° - 30°
				234								
					23					A 4.94		Sample 23.00 - 23.35 m UCS 79.9 MPa. Shear failure
		100	69	233								
					24							
				232			21.43 m to 26.1 m moderately weathered, grey with red brown staining on fractures, high strength	MW				
					25							
		100	29				below 25.2 m, mineralized with irregular subvertical veining in core					from 25.25 m core fractures subvertical and on veining.
				231								
					26							
							BH2A-09 terminated at 26.1m					
				230								
					27							

BH2A_09 - 0.00 - 3.40 m

BH2A_09 - 3.40 - 6.57 m

BH2A_09 - 6.57 - 9.03 m

BH2A_09 - 9.03 - 11.12 m

BH2A_09 - 11.12 - 13.72 m

BH2A_09 - 13.72 - 15.78 m

BH2A_09 - 15.78 - 17.87 m

BH2A_09 - 17.87 - 20.20 m

BH2A_09 - 20.20 - 22.78 m

BH2A_09 - 22.78 - 24.80 m

BH2A_09 - 24.80 - 26.10 m

FIGURE
BOREHOLE NUMBER BH2A-10
SHEET 1 OF 2

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 12/09/18 **COMPLETED** **R.L. SURFACE** 245.8 **DATUM** m

LOCATION 0710659E 7654067N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm	Defect Description
		42		245	1		**COBBLES (COLLUVIUM/ ALLUVIUM)** Medium dense, grey and red brown, with red brown sand and gravel maxtrix (probable boulders in core profile).					Borehole not physically logged by ATCW. Log generated from core images and FMG logging data.
		100										
		80		244	2		from 1.95 m with clayey matrix between cobbles and boulders					
		100		243	3		**SHALE/SILTSTONE** Highly weathered, with extremely weathered sections of hard clay, grey with red ironstone layering, laminated, very low strength, bedding 65°	HW/EW				Shale fractures mostly irregular with rough or smooth surfaces. A few fractures with thin clay infill.
		100		242	4							
		100		241	5							4.90 m laminations 50° - 60°
		100		240	6							5.4 m Red brown extremely weathered infill 60°
		100		239	7		**SANDSTONE** Highly weathered with extremely weathered pockets of gravelly clay, brown and dark brown, medium and coarse grained, low and medium strength					
		100		238	8		7.3 - 7.5 m laminated, grey and purple shale layer					
		100		237	9		from 8.0 m mostly moderately weathered, grey with some brown staining, medium and high strength	MW				8.85 m bedding fracture, planar, smooth, minor silt clay infill. 65°

Estimated Strength: EL VL L M H VH EH

Defect Spacing mm: 20 60 200 600 2000

MPAW/ATC CORED BOREHOLE 114185.14 BH LOGS 9-11.GPJ GINT AUSTRALIA.GDT 12/11/18

ATC Williams

FIGURE
BOREHOLE NUMBER BH2A-10
SHEET 2 OF 2

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 12/09/18 **COMPLETED** **R.L. SURFACE** 245.8 **DATUM** m

LOCATION 0710659E 7654067N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

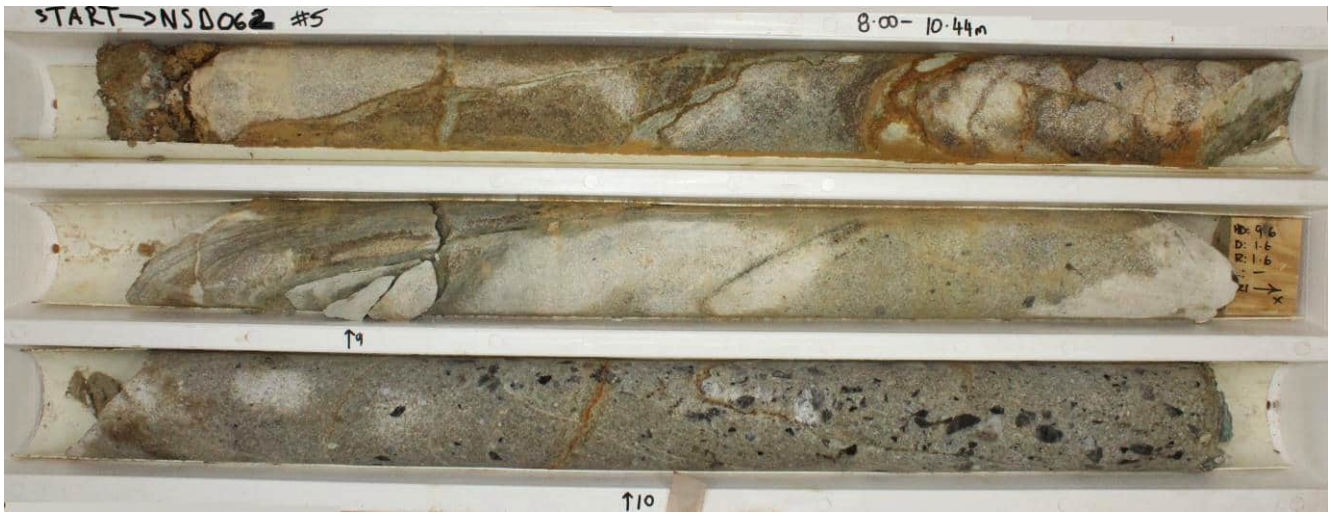
Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100		236	10		**SANDSTONE** *(continued)* from 9.15 m slightly weathered, grey, high strength	SW				
		100		235	11		9.8 m - 11.05 m with black volanic clasts supported in sandstone matrix					fractures in sandstone mostly irregular and undulating with rough surface, < 30°
		100		234	12		from 12.15 m, moderately weathered, medium and high strength	MW				undulating clay filled fractures 11.33 m, 13.40 m, 13.98 m and 14.97 m.
		100		233	13		from 12.70 m, slightly weathered, high strength	SW				
		100		232	14		from 13.45 m moderately weathered medium and high strength. Black volvanic clasts	MW				
		100		231	15							
				230	16		BH2A-10 terminated at 15.2m					
				229	17							
				228	18							

BH2A_10 - 0.00 - 2.33 m

BH2A_10 - 2.33 - 4.57 m

BH2A_10 - 4.57 - 6.63 m

BH2A_10 - 6.63 - 8.00 m



BH2A_10 - 8.00 - 10.44 m

BH2A_10 - 10.44 - 12.57 m

BH2A_10 - 12.57 - 14.84 m

BH2A_10 - 14.84 - 15.20 m

FIGURE
BOREHOLE NUMBER BH2A-11
SHEET 1 OF 1

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 13/09/18 **COMPLETED** **R.L. SURFACE** 249.4 **DATUM** m

LOCATION 0711176E 7654067N **INCLINATION** 90° **BEARING** ---

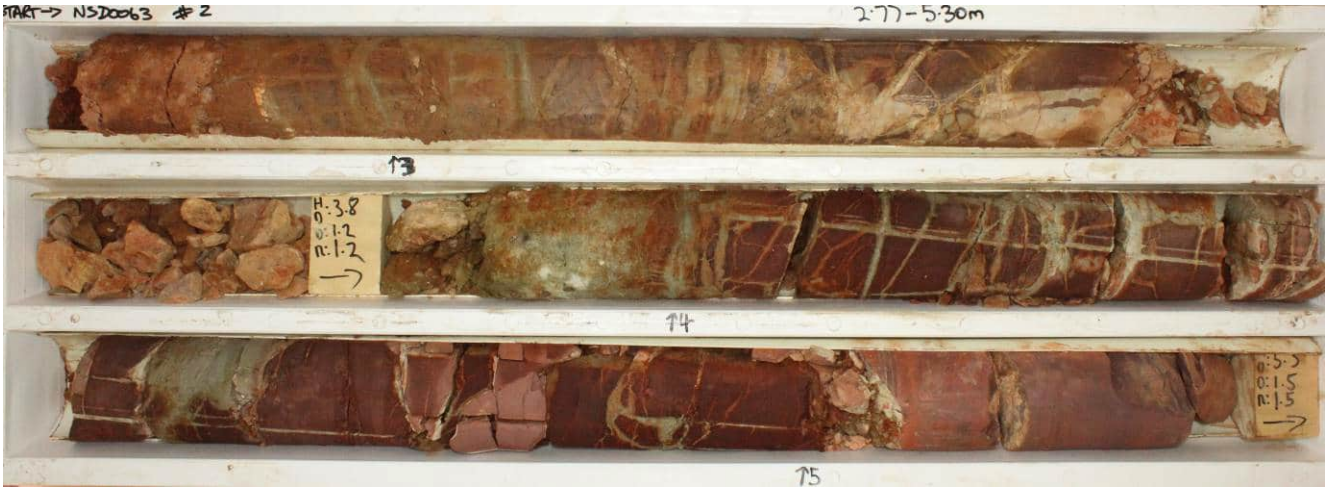
EQUIPMENT HQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		61		249	1		**COBBLES (COLLUVIUM/ ALLUVIUM)** Medium dense, grey and dark grey with red brown sand and gravel maxtrix (probable cobbles and boulders in core profile).					Borehole not physically logged by ATCW. Log generated from core images and FMG logging data.
		57		248	2							
		100		247	3		**SANDSTONE** Extremely weathered to CLAYEY SAND: weakly cemented, red brown and grey, with sandstone lithorelics.	EW				
		100		246	4		**SANDSTONE** Highly weathered, red brown with grey banding, low and medium strength.	HW				Sandstone fractures mostly, irregular or undulating with thin clayey sand infill. < 25°
		100		245	5		**SILTSTONE** Highly weathered to moderately weathered, red brown with some grey, medium and high strength	HW				Siltstone fractures mostly, irregular and rough. < 25°.
		77		244	6							minor clay fill in fractures at 5.06 m, 5.51 m and 7.12 m.
				243	7							
		92		242	8		subvertical fabric evident.					
		100		241	9		**SHALE** Slightly weathered, grey with subvertical dark red laminations, low and medium strength.	SW				

BH2A-11 terminated at 9m

BH2A_11 - 0.00 - 2.77 m



BH2A_11 - 2.77 - 5.30 m

BH2A_11 - 5.30 - 7.80 m

BH2A_11 - 7.80 - 9.00 m

FIGURE
BOREHOLE NUMBER BH2A-12
SHEET 1 OF 2

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd **JOB NAME** North Star Magnetite Project

JOB NUMBER 114185.14 **JOB LOCATION** Pilbara, WA

DATE STARTED 11/09/18 **COMPLETED** **R.L. SURFACE** 263.0 **DATUM** m

LOCATION 0711666E 7653021N **INCLINATION** 90° **BEARING** ---

EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL

REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm	Defect Description
		87	0	262	1		**COBBLES (Colluvium)** Sandstone cobbles with red brown clayey gravel matrix. (Possible drill pad fill to approx. 0.3 m depth)					
		100	0	261	2		**SILTSTONE** Highly weathered, grey / dark grey with red brown staining, subvertical laminations/bedding, medium and high strength	HW		A 2.3		1.1 - 4.86 m siltstone fractures mostly irregular, rough and tight. Surfaces stainined or with minor silt infill.
		93	0	260	3							
		100	8	259	4							
				258	5		**SHALE** Highly weathered, grey with red brown staining, vertical bedding cleavage, low strength.					4.86 - 5.45 m highly fractured shale layer
		93	37	257	6		**SILTSTONE** Highly weathered, dark grey, grey and purple, subvertical laminations/bedding, medium and high strength			A 1.56		5.6 - 5.80 m fractures in siltstone mostly subhorizontal, irregular, rough with no infill. Sample 5.70 - 6.06 m UCS 134.7 MPa. Shear Failure 5.9 m laminations 15-20°.
		100	67	256	7							7.45 m white vein, tight.
				255	8		**SHALE** Extremely / highly weathered, grey with red brown staining, vertical bedding cleavage, very low strength.	EW/HW				
		100	48	254	9		**SILTSTONE** Highly weathered, dark grey, grey and purple, subvertical laminations/bedding, medium and high strength.	HW				
							SILTSTONE	SW				

Estimated Strength: EL VL L M H VH EH

Defect Spacing mm: 20 60 200 600 2000

FIGURE
BOREHOLE NUMBER BH2A-12
SHEET 2 OF 2

ATC Williams

CLIENT Iron Bridge Operations Pty Ltd
JOB NAME North Star Magnetite Project
JOB NUMBER 114185.14
JOB LOCATION Pilbara, WA

DATE STARTED 11/09/18 **COMPLETED**
R.L. SURFACE 263.0 **DATUM** m
LOCATION 0711666E 7653021N **INCLINATION** 90° **BEARING** ---
EQUIPMENT PQ Diamond Core Rig **LOGGED BY** CJ **CHECKED BY** JL
REMARKS

Method	Water	TCR %	RQD %	RL (m)	Depth (m)	Graphic Log	Material Description: Soil: type, USCS symbol, strength, plasticity or particle size, colour, secondary components, moisture condition. Rock: type, weathering, colour, fabric, estimated strength, structure and bedding	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	Defect Spacing mm (20 60 200 600 2000)	Defect Description
		100	48				Slightly weathered, grey, grey with purple layering, sheared fabric in places very high and high strength. **SILTSTONE** *(continued)*	SW				
		100	76	253	10							
				252	11							11.35 m lamination 70°
		100	47	251	12		11.45 - 12.75 m moderately / slightly weathered	MW/SW				12.34 - 12.51 m irregular fractures, tight with 2 -4 mm silt / calcite infill.
		100	75	250	13		**SHALE** Freshly weathered within fine sandstone layers typically < 50 mm thickness, high / very high strength	FR				from 13.1 m, joints irregular or stepped, tight or open, no in fill.
				249	14							14 m - 15 m Subvertical foliated bedding
		100	39	248	15							from 14.25 m joint surfaces irregular, smooth, no infill. 65°
				247	16		BH2A-12 terminated at 15.7m					
				246	17							
				245	18							

BH2A_12 - 0.00 - 2.43 m

BH2A_12 - 2.43 - 4.84 m

BH2A_12 - 4.84 - 6.90 m

BH2A_12 - 6.90 - 8.95 m

BH2A_12 - 8.95 - 11.44 m

BH2A_12 - 11.44 - 13.59 m

BH2A_12 - 13.59 - 15.70 m

REPORT OF BOREHOLE: BH01

Golder Associates

CLIENT: Fortescue Metals Group Limited
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

POSITION:
COORDS: 710491.0 m E 7654795.0 m N MGA94 56
SURFACE RL: 266.00 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 142 mm HOLE DEPTH: 30.00 m

SHEET: 1 OF 1
DRILL RIG:
CONTRACTOR: McKAY
LOGGED: RF DATE: 11/12/11
CHECKED: GM DATE: 22/11/11

Drilling				Sampling		Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	AIRLIFT YIELD (L/s)	CONSTRUCTION
RC	11/12/11	0	266.00				SANDSTONE, fine grained, red brown colour, medium/high strength		Backfill
			3.00						Bentonite Seal (Wetted)
			263.00				Interbedded SANDSTONE, fine grained, red brown, high strength and SILTSTONE pale grey, medium strength		
		5							
		10							Gravel Pack
		15							Solid Casing 100mm
		20							Bentonite Seal (Wetted)
		25							Gravel Pack
			27.00						Slotted Casing 100mm
			239.00				Interbedded SANDSTONE, fine grained, pale grey, high strength and SILTSTONE pale gray, medium strength		
		30	30.00						
			236.00				END OF BOREHOLE @ 30.00 m		

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F05 RL3

GAP 8_07.2 LIB.GLB Log GAP WELL 117645032 - BOREHOLES NEW.GPJ <<DrawingFile>> 03/02/2012 17:57 8.2.856

REPORT OF BOREHOLE: BH02

Golder Associates

CLIENT: Fortescue Metals Group Limited
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

POSITION:
COORDS: 710144.0 m E 7654616.0 m N MGA94 56
SURFACE RL: 241.00 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 142 mm HOLE DEPTH: 30.00 m

SHEET: 1 OF 1
DRILL RIG:
CONTRACTOR: McKAY
LOGGED: RF DATE: 12/12/11
CHECKED: GM DATE: 22/11/11

Drilling				Sampling		Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	AIRLIFT YIELD (L/s)	CONSTRUCTION
RC	12/12/11	0	241.00				GP - Poorly graded Sandy GRAVEL. Medium size grained. Grey white and red brown colour, with some fine to coarse sand, traces of low plasticity fines.		Bentonite Seal (Wetted)
									Gravel Pack
									Bentonite Seal (Wetted)
		5							
			8.00 233.00				Interbedded SANDSTONE, medum to fine grained, yellow and grey colour, high strength and SILTSTONE pale grey colour, medium strength.		
		10	11.00 230.00				SILTSTONE. Red brown colour. Low/medium strength.		
			13.00 228.00				Interbedded SANDSTONE, fine grained, grey colour, high strength and SILTSTONE grey colour, medium strength		
		15							Solid casing 100mm
									Material collapsed
			18.00 223.00				Interbedded SANDSTONE, fine grained, red brown and yellow colour, high strength and SILTSTONE pale grey and red brown colour, medium strength		
		20							
		25							Slotted casing 100mm
		30	30.00 211.00				END OF BOREHOLE @ 30.00 m		

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F05 RL3

GAP 8_07.2 LIB.GLB Log GAP WELL 117645032 - BOREHOLES NEW.GPJ <<DrawingFile>> 03/02/2012 17:57 8.2.856

REPORT OF BOREHOLE: BH05 A

Golder Associates

CLIENT: Fortescue Metals Group Limited
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

POSITION:
COORDS: 710512.0 m E 7654257.0 m N MGA94 56
SURFACE RL: 245.00 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 142 mm HOLE DEPTH: 30.00 m

SHEET: 1 OF 1
DRILL RIG:
CONTRACTOR: McKAY
LOGGED: RF DATE: 12/12/11
CHECKED: GM DATE: 22/11/11

Drilling				Sampling		Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	AIRLIFT YIELD (L/s)	CONSTRUCTION
RC	12/12/11	0	245.00				GP - Poorly graded Sandy GRAVEL. Medium size grained. Grey white and red brown, with some fine to coarse sand, traces of low placity fines.		Backfill
			1.00 244.00				SILTSTONE pale grey colour, medium strength.		
		5							Bentonite Seal
			8.00 237.00				SANDSTONE, medium to fine grained, pale grey colour, high strength.		Gravel Pack
		10							
		15							Solid Casing 100mm
									Material collapsed
		20							
		25							Slotted casing 100mm
		30	30.00 215.00				END OF BOREHOLE @ 30.00 m		Material collapsed

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F05 RL3

GAP 8_07.2 LIB.GLB Log GAP WELL 117645032 - BOREHOLES NEW.GPJ <<DrawingFile>> 03/02/2012 17:57 8.2.856

REPORT OF BOREHOLE: BH05 B

Golder Associates

CLIENT: Fortescue Metals Group Limited
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

POSITION:
COORDS: 710512.0 m E 7654257.0 m N MGA94 56
SURFACE RL: 245.00 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 190 mm HOLE DEPTH: 8.20 m

SHEET: 1 OF 1
DRILL RIG:
CONTRACTOR: McKAY
LOGGED: RF DATE: 12/12/11
CHECKED: GM DATE: 22/11/11

Drilling				Sampling		Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	AIRLIFT YIELD (L/s)	CONSTRUCTION
RC	12/12/11	0	245.00				GP - Poorly graded Sandy GRAVEL. Medium size grained. Grey white and red brown, with some fine to coarse sand, traces of low placity fines.		Backfill
		1	1.00 244.00				SILTSTONE pale grey colour, medium strength.		Bentonite Seal (Wetted) Solid Casing 100mm
		2							
		3							
		4							Gravel Pack
		5							Slotted Casing 100mm
		6							
		7							Material Collapsed
		8	8.20 236.80				END OF BOREHOLE @ 8.20 m		
		9							

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F05 RL3

GAP 8_07.2 LIB.GLB Log GAP WELL 117645032 - BOREHOLES NEW.GPJ <<DrawingFile>> 03/02/2012 17:57 8.2.856

REPORT OF BOREHOLE: BH06 A

CLIENT: Fortescue Metals Group Limited
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

POSITION:
COORDS: 710279.0 m E 7654206.0 m N MGA94 56
SURFACE RL: 272.50 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 142 mm HOLE DEPTH: 72.00 m

SHEET: 1 OF 1
DRILL RIG:
CONTRACTOR: McKAY
LOGGED: RF DATE: 11/12/11
CHECKED: GM DATE: 22/11/11

Drilling				Sampling		Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	AIRLIFT YIELD (L/s)	CONSTRUCTION
RC	11/12/11	0	272.50				Interbedded SANDSTONE, fine grained, red brown, low strength and SILTSTONE pale grey, low strength		
			6.00 266.50				SANDSTONE, medium to fine grained, red brown and pale grey colour, low to medium strength.		Backfill
		10	14.00 258.50				SANDSTONE, medium grained, red brown and pale grey colour, medium strength.		Bentonite Seal (Wetted)
		20							Gravel Pack
		30	33.00 239.50				SANDSTONE, medium grained, pale grey colour, medium to high strength.		
		40							Solid Casing 100mm
		50							Material collapsed
		60							
		70	72.00 200.50				END OF BOREHOLE @ 72.00 m		Slotted Casing 100mm

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GAP gINT FN. F05 RL3

GAP 8_07.2 LIB.GLB Log GAP WELL 117645032 - BOREHOLES NEW.GPJ <<DrawingFile>> 03/02/2012 17:57 8.2.856

REPORT OF BOREHOLE: BH06 B

CLIENT: Fortescue Metals Group Limited
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

POSITION:
COORDS: 710279.0 m E 7654206.0 m N MGA94 56
SURFACE RL: 272.50 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 190 mm HOLE DEPTH: 6.50 m

SHEET: 1 OF 1
DRILL RIG:
CONTRACTOR: McKAY
LOGGED: RF DATE: 11/12/11
CHECKED: GM DATE: 22/11/11

Drilling				Sampling		Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	AIRLIFT YIELD (L/s)	CONSTRUCTION
RC		0	272.50				Interbedded SANDSTONE, fine grained, red brown, low strength and SILTSTONE pale grey, low strength		Solid Casing 100mm Backfill Bentonite Seal (Wetted) Slotted Casing 100mm Gravel Pack
		1							
		2							
		3							
		4							
		5							
		6	6.00 266.50				SANDSTONE, medium to fine grained, red brown and pale grey colour, low to medium strength.		
			6.50 266.00				END OF BOREHOLE @ 6.50 m		
		7							

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GAP gINT FN. F05
RL3

GAP 8_07.2 LIB.GLB Log GAP WELL 117645032 - BOREHOLES NEW.GPJ <<DrawingFile>> 03/02/2012 17:57 8.2.856

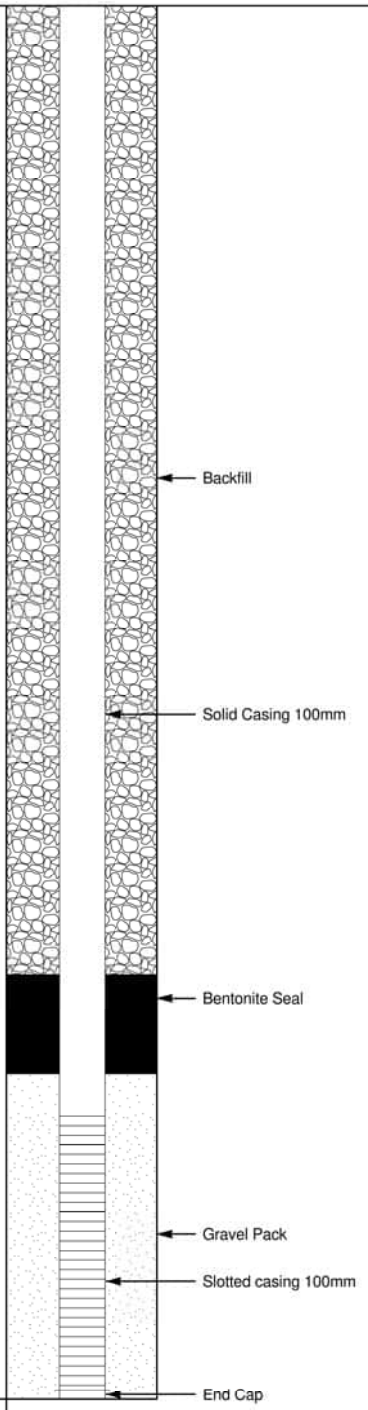
REPORT OF BOREHOLE: BH11 A

CLIENT: Fortescue Metals Group Limited
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

POSITION:
COORDS: 711571.0 m E 7651947.0 m N MGA94 56
SURFACE RL: 285.50 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 190 mm HOLE DEPTH: 29.50 m

SHEET: 1 OF 1
DRILL RIG:
CONTRACTOR: McKAY
LOGGED: RF DATE: 10/12/11
CHECKED: GM DATE: 22/11/11

Drilling				Sampling		Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	AIRLIFT YIELD (L/s)	CONSTRUCTION
RC	10/12/11 ▽	0	285.50				SILTSTONE, pale grey colour, medium strength		
			6.00 279.50				SILTSTONE, red brown colour, medium strength		
			8.00 277.50				SILTSTONE, pale grey colour, medium strength		
			12.00 273.50				SILTSTONE, red brown and pale grey colour, medium strength. Minor interbedded MUDSTONE		
			15.00 270.50				SILTSTONE, pale grey colour, medium strength		
			20.00 265.50				SILTSTONE, grey to black colour, medium to high strength. Groundwater Encountered @ 20 m.		
			29.50 256.00				END OF BOREHOLE @ 29.50 m		



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GAP gINT FN. F05 RL3

REPORT OF BOREHOLE: BH11 B

CLIENT: Fortescue Metals Group Limited
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

POSITION:
COORDS: 711571.0 m E 7651947.0 m N MGA94 56
SURFACE RL: 285.50 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 190 mm HOLE DEPTH: 8.50 m

SHEET: 1 OF 1
DRILL RIG:
CONTRACTOR: McKAY
LOGGED: RF DATE: 10/12/11
CHECKED: GM DATE: 22/11/11

Drilling				Sampling		Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	AIRLIFT YIELD (L/s)	CONSTRUCTION
RC		0	285.50				SILTSTONE, pale grey colour, medium strength		Bentonite Seal
		1							Solid Casing 100mm
		2							
		3							
		4							Gravel Pack
		5							
		6	6.00 279.50				SILTSTONE, red brown colour, medium strength		Slotted Casing 100mm
		7							
		8	8.00 277.50				SILTSTONE, pale grey colour, medium strength		
			8.50 277.00				END OF BOREHOLE @ 8.50 m		
		9							

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GAP gINT FN. F05 RL3

GAP 8_07.2 LIB.GLB Log GAP WELL 117645032 - BOREHOLES NEW.GPJ <<DrawingFile>> 03/02/2012 17:57 8.2.856

REPORT OF BOREHOLE: BH17

CLIENT: Fortescue Metals Group Limited
PROJECT: North Star Magnetite Project
LOCATION: Pilbara Region
JOB NO: 117645032

POSITION:
COORDS: 712308.0 m E 7654002.0 m N MGA94 56
SURFACE RL: 334.50 m DATUM: AHD
INCLINATION: -90°
HOLE DIA: 142 mm HOLE DEPTH: 102.00 m

SHEET: 1 OF 1
DRILL RIG:
CONTRACTOR: McKAY
LOGGED: RF DATE: 14/12/11
CHECKED: GM DATE: 22/11/11

Drilling				Sampling		Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	AIRLIFT YIELD (L/s)	CONSTRUCTION
RC		0	2.00 332.50				GP-GM - Residual soil. Silty GRAVEL poorly graded. Coarse subangular particle. Red brown colour. Trace of low plasticity silt. Dry and dense		Backfill
							CHERT. High to very high strength		
		10							Gravel Pack
		20							Bentonite Seal
		30							Gravel Pack
		40							Solid Casing 100mm
		50							
		60							
		70							Material collapsed
		80							
		90							
		100	102.00 232.50				END OF BOREHOLE @ 102.00 m		Slotted Casing 100mm

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

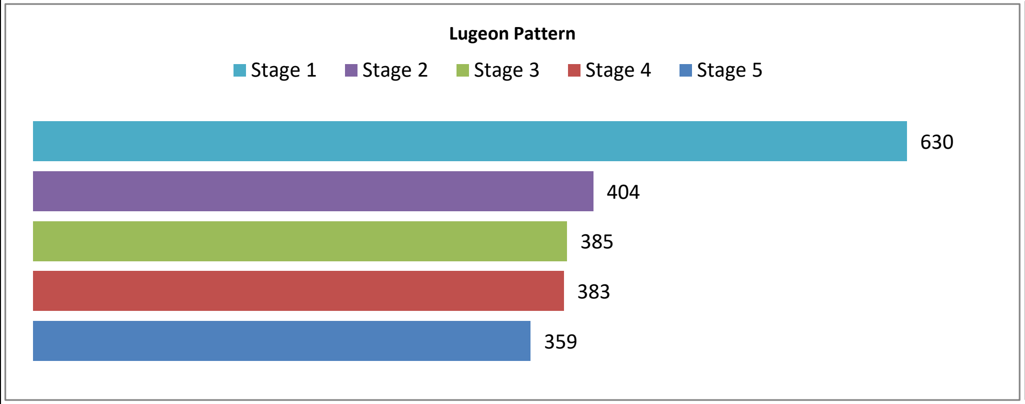
GAP gINT FN. F05
RL3

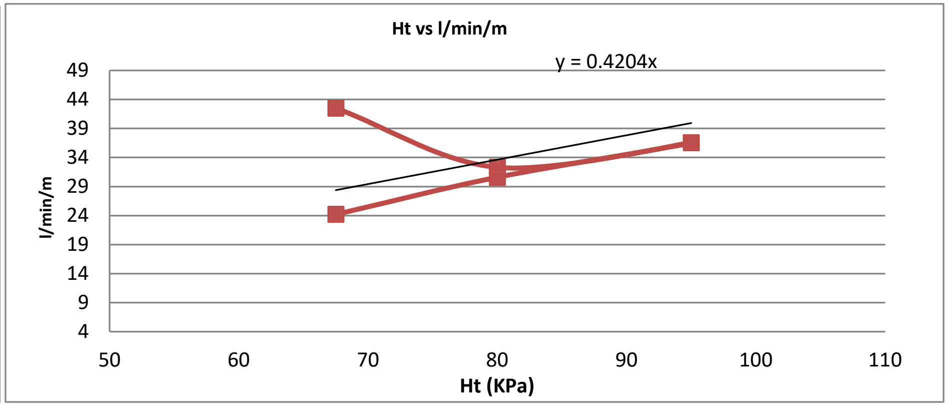
GAP 8_07.2 LIB.GLB Log GAP WELL 117645032 - BOREHOLES NEW.GPJ <<DrawingFile>> 03/02/2012 17:57 8.2.856

APPENDIX D

PACKER TEST RESULT				ATC Williams				Hole ID:	BH2A-01A
								Tested by	CJ
Ground water level BGL (m)			9.7						
Packer seal section (m)			3.0 - 4.0				6.0 - 7.0		
Gauge pressure height above G.L (m)			0.5						
Maximum test pressure (KPa)			50						
Test pressures (KPa)		**25%**	12.5		**50%**	25	**75%**	40	
Test Section (m)									
From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**
4	6	12.5	10	850	85	42.5	0	67.5	630
		25	10	646	64.6	32.3	0	80.0	404
		40	10	731	73.1	36.6	0	95.0	385
		25	10	612	61.2	30.6	0	80.0	383
		12.5	10	484	48.4	24.2	0	67.5	359

Stage 1
Stage 2
Stage 3
Stage 4
Stage 5





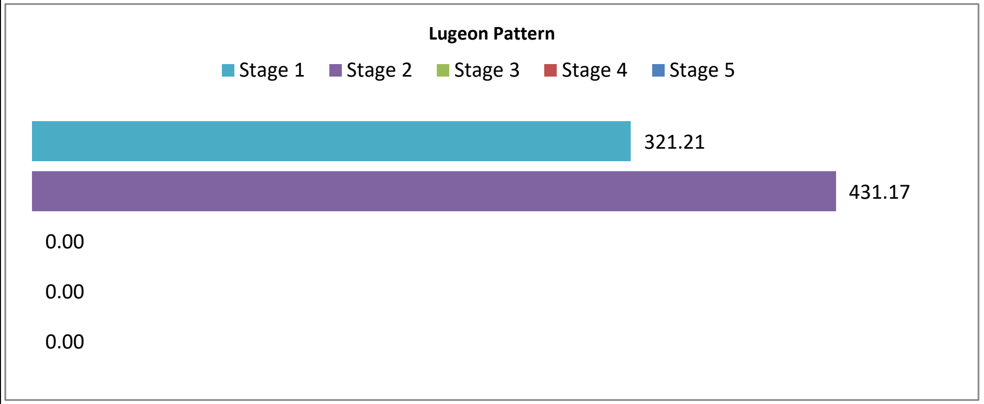
Method 1			**Method 2**		
Interpretation			Coefficient 1	0.4200	
Behaviour	Void Filling		Coefficient 2	0.0000	
Classification	Very High		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representitive lugeon value	**420**	
Condition of rock mass discontinuities	Open, closely spaced discontinuities, or voids				
Representative lugeon value	**359**				

PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-01A
		Tested by	CJ

Ground water level BGL (m)	9.7	
Packer seal section (m)	8.5 - 9.5 m	11.5 - 12.5 m
Gauge pressure height above G.L (m)	0.5	
Maximum test pressure (KPa)	120	

Test pressures (KPa)	**25%**	30	**50%**	60	**75%**	90

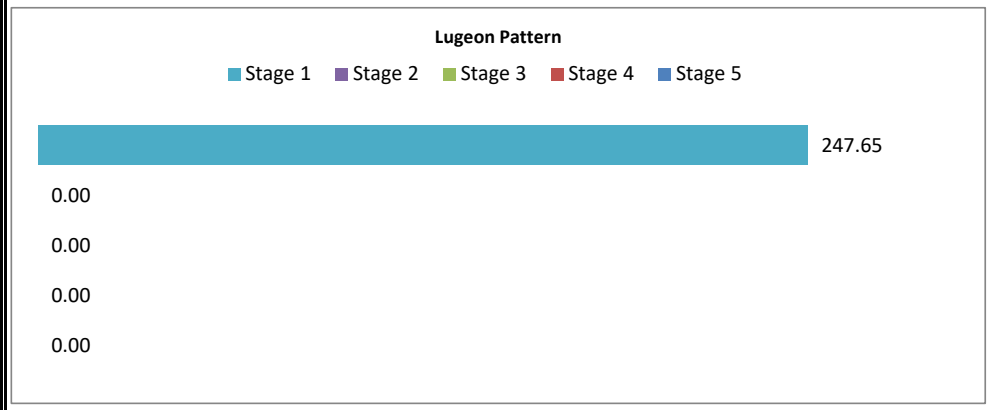
	Test Section (m)										
	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**
Stage 1	9.5	11.5	30	10	848	84.8	42.40	0	132.0	321.21
Stage 2			60	10	1397	139.7	69.85	0	162.0	431.17
Stage 3			90	10	0	0	0.00	0	192.0	0.00
Stage 4			60	10	0	0	0.00	0	162.0	0.00
Stage 5			30	10	0	0	0.00	0	132.0	0.00



Method 1			**Method 2**		
Interpretation			Coefficient 1		
Behaviour	-		Coefficient 2		
Classification	-		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representitive lugeon value	**0**	
Condition of rock mass discontinuities	Open, closely spaced discontinuities, or voids				
Representative lugeon value	**431**	Incomplete test. Insuffcient pump flow to achieve Stage 3 pressure of 90 kPa.			

PACKER TEST RESULT							Hole ID:	BH2A-01A
							Tested by	CJ
Ground water level BGL (m)		9.7						
Packer seal section (m)		11.0 - 12.0 m				15.0 - 16.0 m		
Gauge pressure height above G.L (m)		0.5						
Maximum test pressure (KPa)		150						
Test pressures (KPa)	25%	40		50%	75		75%	115
Test Section (m)								

	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Lugeon Value (L)
Stage 1	12	15	40	10	1055	105.5	35.17	0	142.0	247.65
Stage 2			75	10	0	0	0.00	0	177.0	0.00
Stage 3			115	10	0	0	0.00	0	217.0	0.00
Stage 4			75	10	0	0	0.00	0	177.0	0.00
Stage 5			40	10	0	0	0.00	0	142.0	0.00

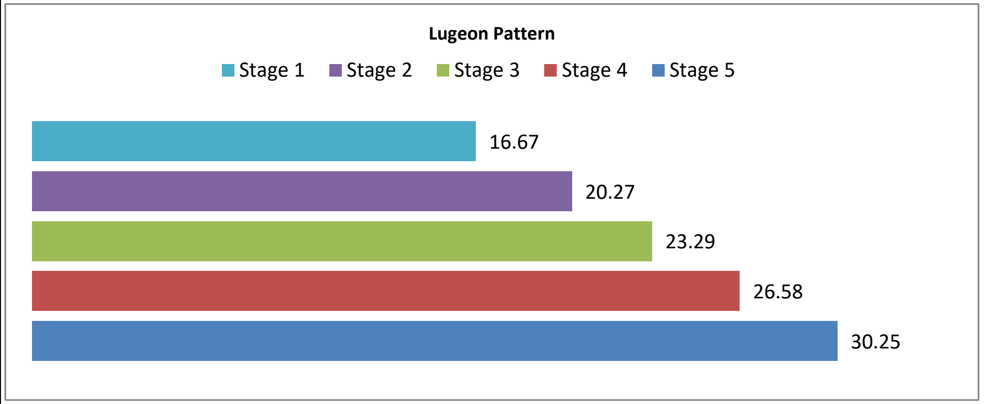


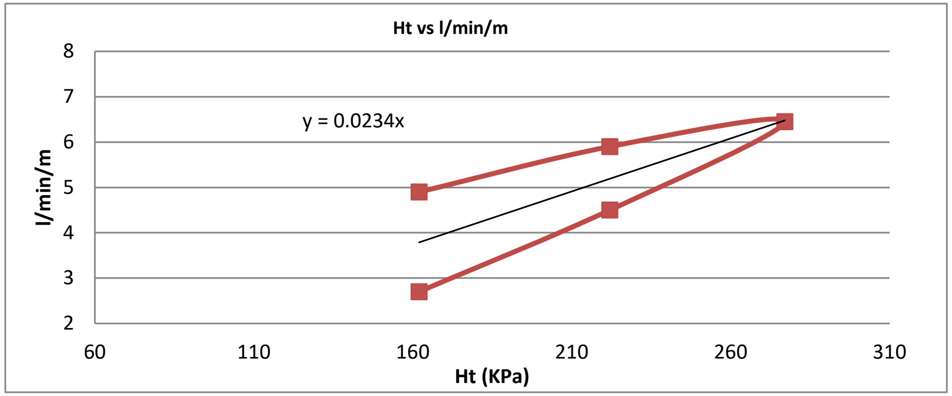
Method 1			Method 2		
Interpretation			Coefficient 1		
Behaviour	Void filling?		Coefficient 2		
Classification	Very High		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representitive luegon value	**0**	
Condition of rock mass discontinuities	Open, closely spaced discontinuities, or voids				
Representative lugeon value	**250**	Test aborted at end of Stage 1. Unable to reach 2nd Stage pressure due to v. high flow (insufficent pump capacity).			

PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-01A
		Tested by	CJ

Ground water level BGL (m)	9.7					
Packer seal section (m)	16.5 - 17.5 m			19.5 - 20.5 m		
Gauge pressure height above G.L (m)	0.5					
Maximum test pressure (KPa)	225					
Test pressures (KPa)	**25%**	60	**50%**	120	**75%**	175

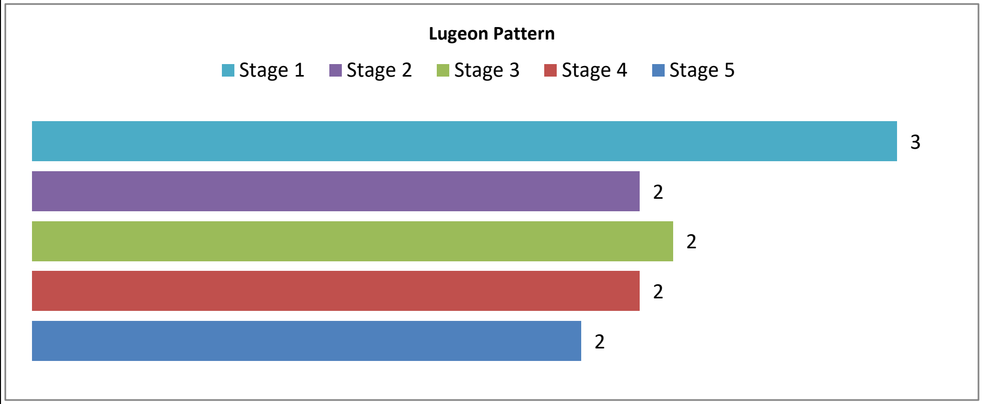
	Test Section (m)									
	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**
Stage 1	17.5	19.5	60	10	54	5.4	2.70	0	162.0	16.67
Stage 2			120	10	90	9	4.50	0	222.0	20.27
Stage 3			175	10	129	12.9	6.45	0	277.0	23.29
Stage 4			120	10	118	11.8	5.90	0	222.0	26.58
Stage 5			60	10	98	9.8	4.90	0	162.0	30.25

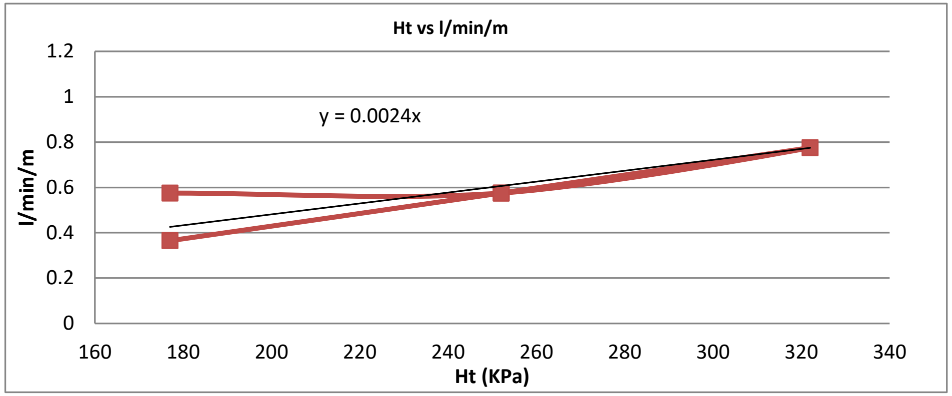




Method 1			**Method 2**	
Interpretation			Coefficient 1	0.0234
Behaviour	wash out		Coefficient 2	0.0000
Classification	Medium		Max pressure	1000
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**23**
Condition of rock mass discontinuities	Someopen			
Representative lugeon value	**30**			

PACKER TEST RESULT								Hole ID:	BH2A-01A	
								Tested by	CJ	
Ground water level BGL (m)			9.7							
Packer seal section (m)			22.0 - 23.0 m				25.0 - 26.0 m			
Gauge pressure height above G.L (m)			0.5							
Maximum test pressure (KPa)			300							
Test pressures (KPa)		**25%**	75		**50%**	150		**75%**	220	
Test Section (m)										
From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**	
23	25	75	10	11.5	1.15	0.6	0	177.0	3	Stage 1
		150	10	11.5	1.15	0.6	0	252.0	2	Stage 2
		220	10	15.5	1.55	0.8	0	322.0	2	Stage 3
		150	10	11.5	1.15	0.6	0	252.0	2	Stage 4
		75	10	7.3	0.73	0.4	0	177.0	2	Stage 5

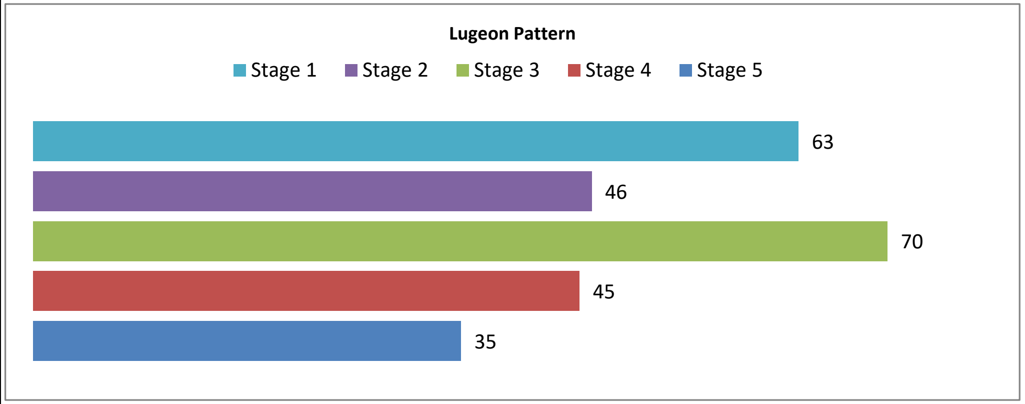


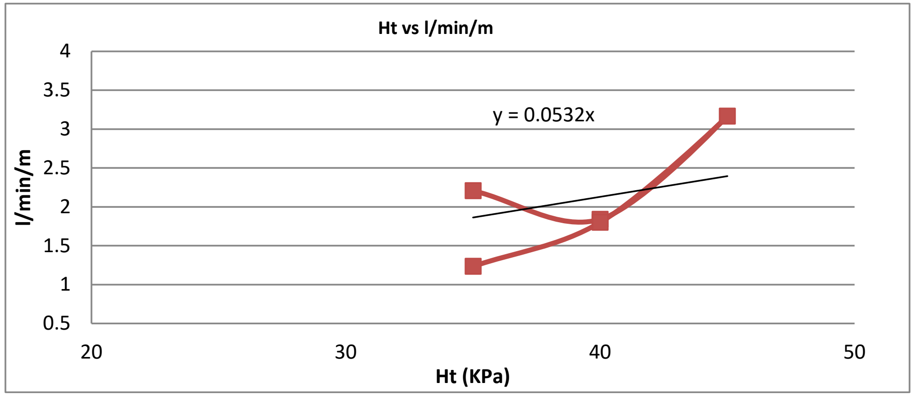


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0024	
Behaviour	Void Filling		Coefficient 2	0.0000	
Classification	Low		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representitive lugeon value	**2**	
Condition of rock mass discontinuities	Tight				
Representative lugeon value	**2**				

PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-02A
		Tested by	CJ

Ground water level BGL (m)		2								
Packer seal section (m)		3					6			
Gauge pressure height above G.L (m)		0.5								
Maximum test pressure (KPa)		35								
Test pressures (KPa)		**25%**	10		**50%**	15		**75%**		20
Test Section (m)										
From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Luegon Value (L)**	
3	6	10	10	66.2	6.62	2.2	0	35.0	63	Stage 1
		15	10	55.2	5.52	1.8	0	40.0	46	Stage 2
		20	10	95	9.5	3.2	0	45.0	70	Stage 3
		15	10	54	5.4	1.8	0	40.0	45	Stage 4
		10	10	37	3.7	1.2	0	35.0	35	Stage 5

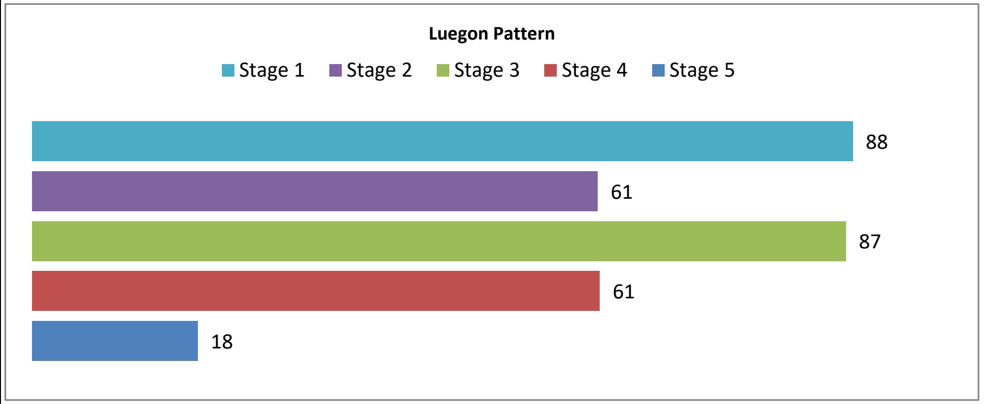


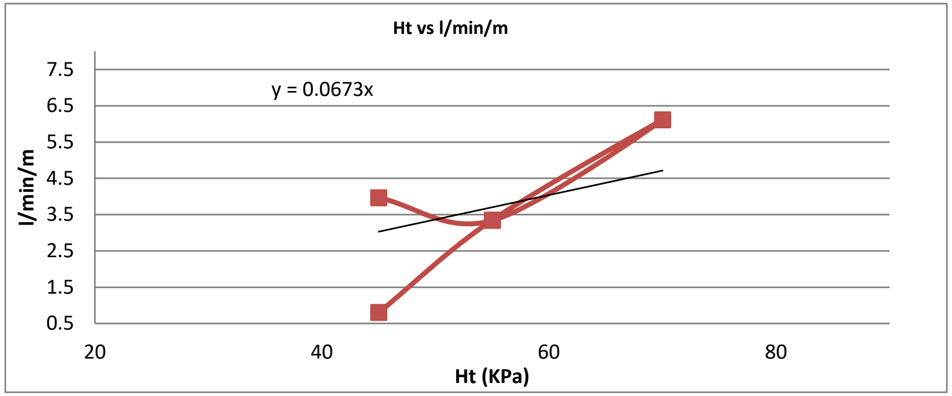


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0532	
Behaviour	Dilation/void filling		Coefficient 2	0.0000	
Classification	High		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**53**	
Condition of rock mass discontinuities	Many Open				
Representative lugeon value	**45**				

PACKER TEST RESULT				ATC Williams				Hole ID:	BH2A-02A
								Tested by	CJ
Ground water level BGL (m)			2						
Packer seal section (m)			6.5				10.5		
Gauge pressure height above G.L (m)			0.5						
Maximum test pressure (KPa)			60						
Test pressures (KPa)		**25%**	20		**50%**	30	**75%**	45	
Test Section (m)									
From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Luegon Value (L)**
6.5	10.5	20	10	158.5	15.85	4.0	0	45.0	88
		30	10	133.5	13.35	3.3	0	55.0	61
		45	10	244.5	24.45	6.1	0	70.0	87
		30	10	134	13.4	3.4	0	55.0	61
		20	10	32	3.2	0.8	0	45.0	18

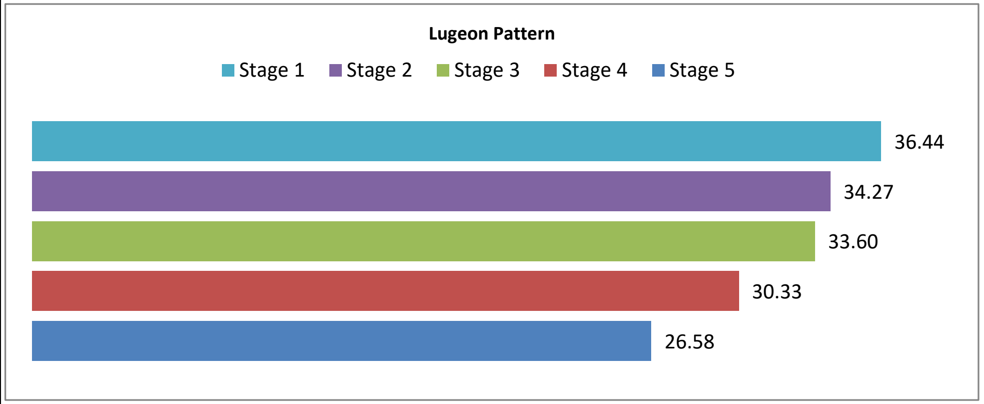
Stage 1
Stage 2
Stage 3
Stage 4
Stage 5

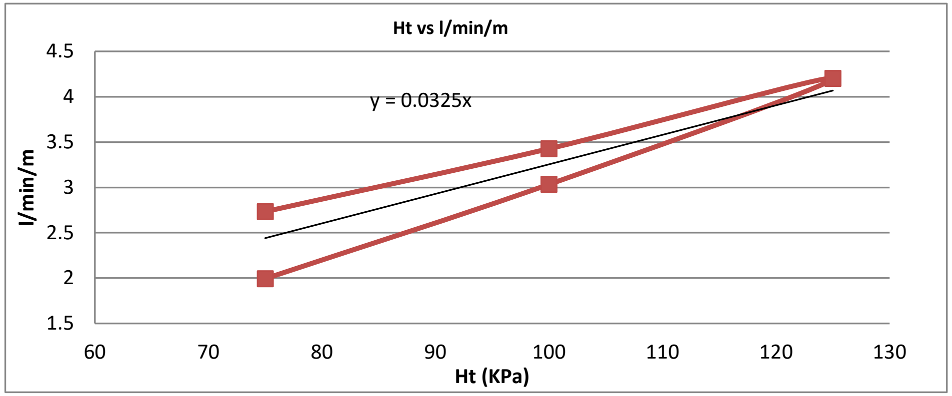




Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0673	
Behaviour	Dilation / Void Filling		Coefficient 2	0.0000	
Classification	Very High		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**67**	
Condition of rock mass discontinuities	Open closed space or voids				
Representative lugeon value	**61**				

PACKER TEST RESULT				ATC Williams				Hole ID:	BH2A-02A	
								Tested by	CJ	
Ground water level BGL (m)			2							
Packer seal section (m)			12				15			
Gauge pressure height above G.L (m)			0.5							
Maximum test pressure (KPa)			100							
Test pressures (KPa)		25%	50		50%	75		75%	100	
Test Section (m)										
From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Luegon Value (L)**	
Stage 1	12	15	50	10	82	8.2	2.73	0	75.0	36.44
Stage 2			75	10	102.8	10.28	3.43	0	100.0	34.27
Stage 3			100	10	126	12.6	4.20	0	125.0	33.60
Stage 4			75	10	91	9.1	3.03	0	100.0	30.33
Stage 5			50	10	59.8	5.98	1.99	0	75.0	26.58





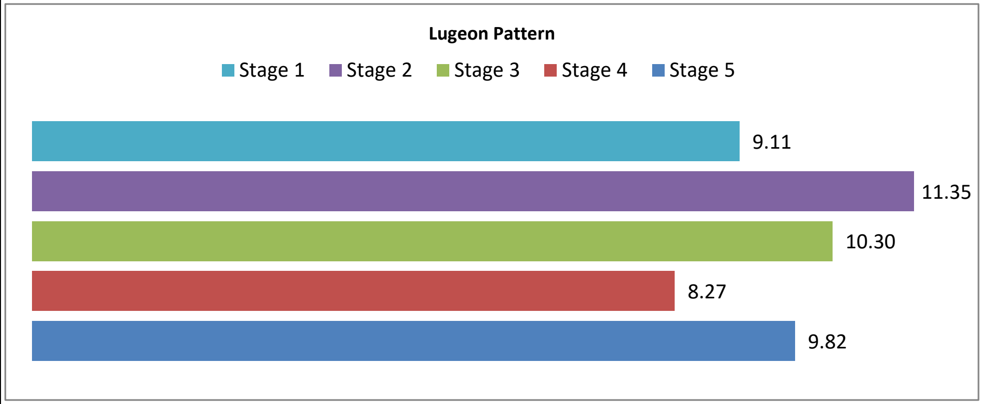
Method 1			Method 2		
Interpretation			Coefficient 1	0.0325	
Behaviour	Void Filling		Coefficient 2	-0.3843	
Classification	Low		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**32**	
Condition of rock mass discontinuities	Tight				
Representative lugeon value	**27**				

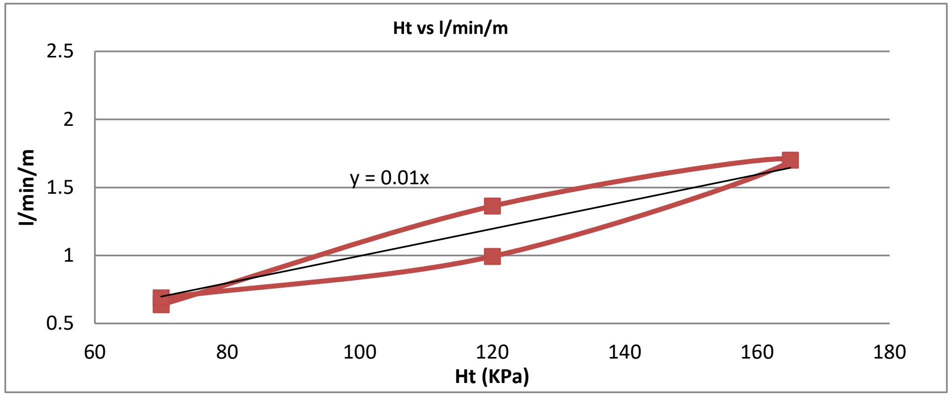
PACKER TEST RESULT		
	Hole ID:	BH2A-02A
	Tested by	CJ

Ground water level BGL (m)	2	
Packer seal section (m)	16.5	20.5
Gauge pressure height above G.L (m)	0.5	
Maximum test pressure (KPa)	140	

Test pressures (KPa)	**25%**	45	**50%**	95	**75%**	140

	Test Section (m)										
	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Luegon Value (L)**
Stage 1	16.5	20.5	45	10	25.5	2.55	0.64	0	70.0	9.11
Stage 2			95	10	54.5	5.45	1.36	0	120.0	11.35
Stage 3			140	10	68	6.8	1.70	0	165.0	10.30
Stage 4			95	10	39.7	3.97	0.99	0	120.0	8.27
Stage 5			45	10	27.5	2.75	0.69	0	70.0	9.82

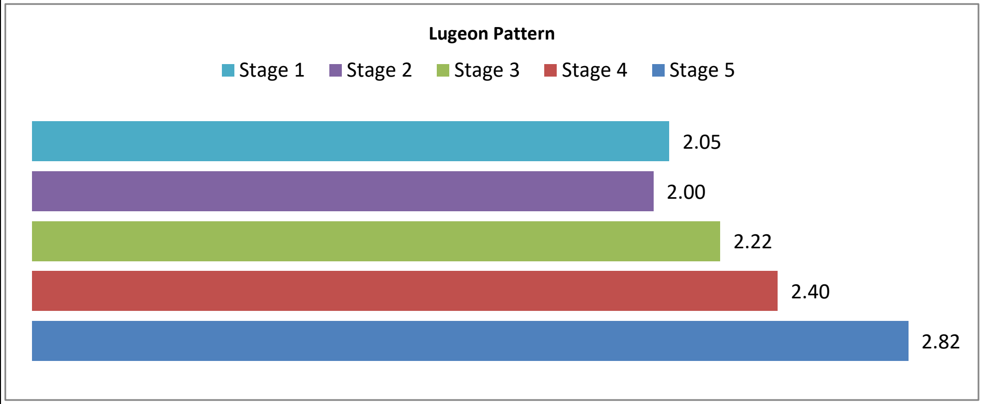


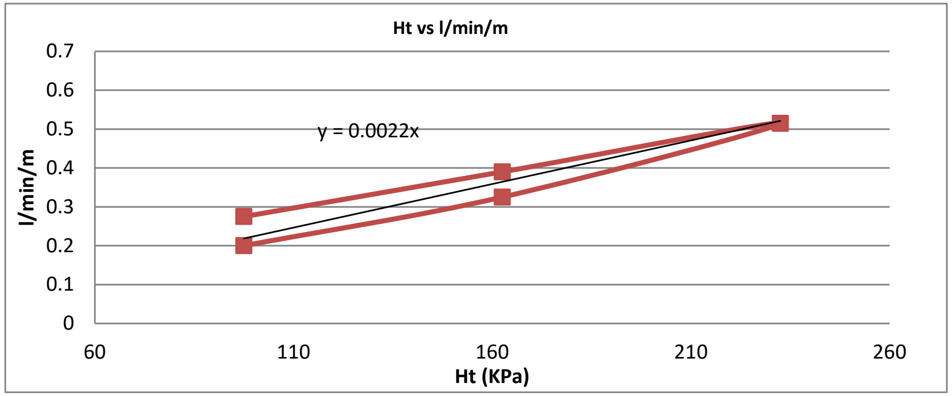


Method 1			**Method 2**	
Interpretation			Coefficient 1	0.0100
Behaviour	Laminar		Coefficient 2	0.0000
Classification	Moderate		Max pressure	1000
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**10**
Condition of rock mass discontinuities	Few partly open			
Representative lugeon value	**10**			

PACKER TEST RESULT							Hole ID:	BH2A-02A	
							Tested by	CJ	
Ground water level BGL (m)		2							
Packer seal section (m)		22.5				24.5			
Gauge pressure height above G.L (m)		0.75							
Maximum test pressure (KPa)		205							
Test pressures (KPa)	25%	70		50%	135		75%	205	
Test Section (m)									

	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Luegon Value (L)
Stage 1	22.5	24.5	70	10	4	0.4	0.20	0	97.5	2.05
Stage 2			135	10	6.5	0.65	0.33	0	162.5	2.00
Stage 3			205	10	10.3	1.03	0.51	0	232.5	2.22
Stage 4			135	10	7.8	0.78	0.39	0	162.5	2.40
Stage 5			70	10	5.5	0.55	0.28	0	97.5	2.82

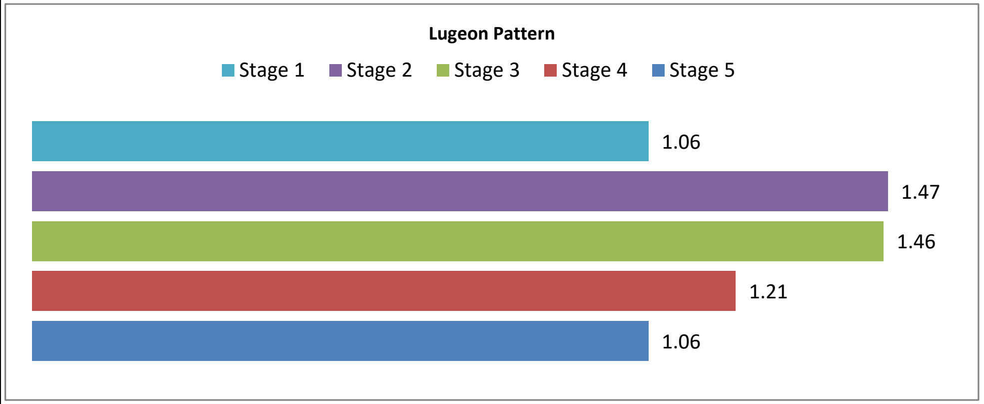


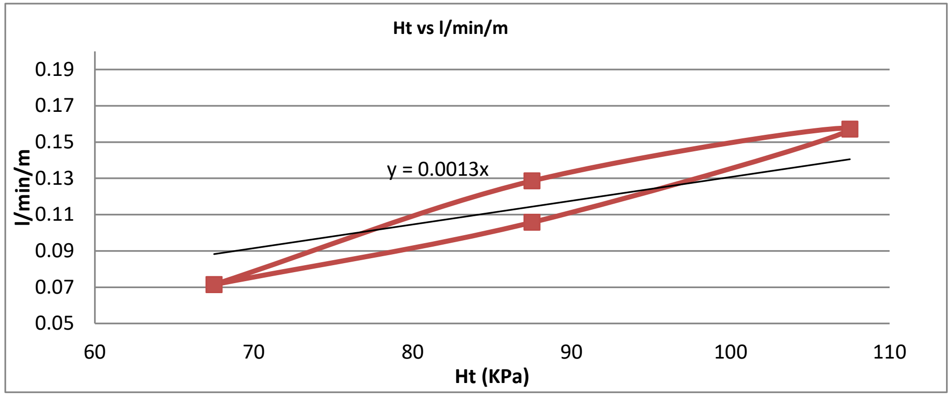


Method 1			Method 2		
Interpretation			Coefficient 1	0.0022	
Behaviour	wash out		Coefficient 2	0.0000	
Classification	Moderate		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**2**	
Condition of rock mass discontinuities	Few partly open				
Representative lugeon value	**2**				

PACKER TEST RESULT			ATC Williams				Hole ID:	BH2A-03	
							Tested by	AP	
Ground water level BGL (m)			4						
Packer seal section (m)			6			7			
Gauge pressure height above G.L (m)			0.75						
Maximum test pressure (KPa)			80						
Test pressures (KPa)		25%	20	50%	40	75%	60		
Test Section (m)									
From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Luegon Value (L)
7	10.5	20	10	2.5	0.25	0.07	0	67.5	1.06
		40	10	4.5	0.45	0.13	0	87.5	1.47
		60	10	5.5	0.55	0.16	0	107.5	1.46
		40	10	3.7	0.37	0.11	0	87.5	1.21
		20	10	2.5	0.25	0.07	0	67.5	1.06

Stage 1
Stage 2
Stage 3
Stage 4
Stage 5





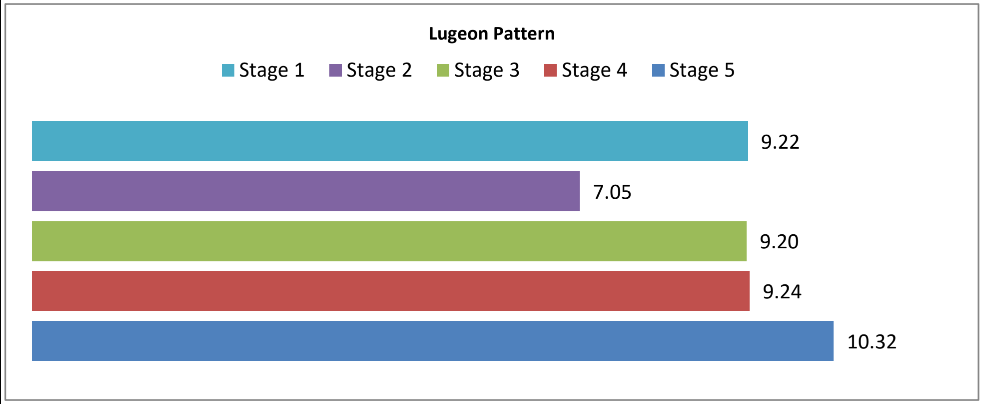
Method 1			Method 2		
Interpretation			Coefficient 1	0.0013	
Behaviour	Dilation		Coefficient 2	0.0000	
Classification	Low		Max pressure	1000	
Hydraulic Conductivity Range	1e-5 to 6e-5	cm/s	Representative lugeon value	**1**	
Condition of rock mass discontinuities	Tight				
Representative lugeon value	**1.06**				

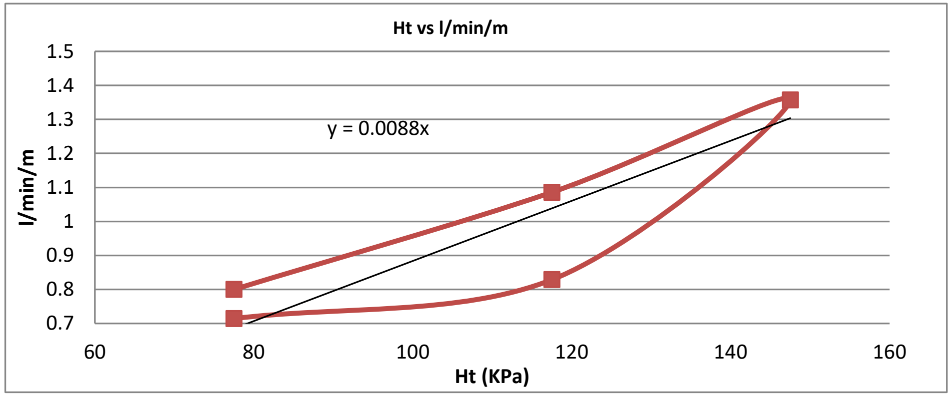
PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-03
		Tested by	AP

Ground water level BGL (m)	4				
Packer seal section (m)	10.5		11.5		
Gauge pressure height above G.L (m)	0.75				
Maximum test pressure (KPa)	130				
Test pressures (KPa)	**25%** 30	**50%**	70	**75%**	100

Test Section (m)

	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Luegon Value (L)
Stage 1	11.5	15	30	10	25	2.5	0.71	0	77.5	9.22
Stage 2			70	10	29	2.9	0.83	0	117.5	7.05
Stage 3			100	10	47.5	4.75	1.36	0	147.5	9.20
Stage 4			70	10	38	3.8	1.09	0	117.5	9.24
Stage 5			30	10	28	2.8	0.80	0	77.5	10.32

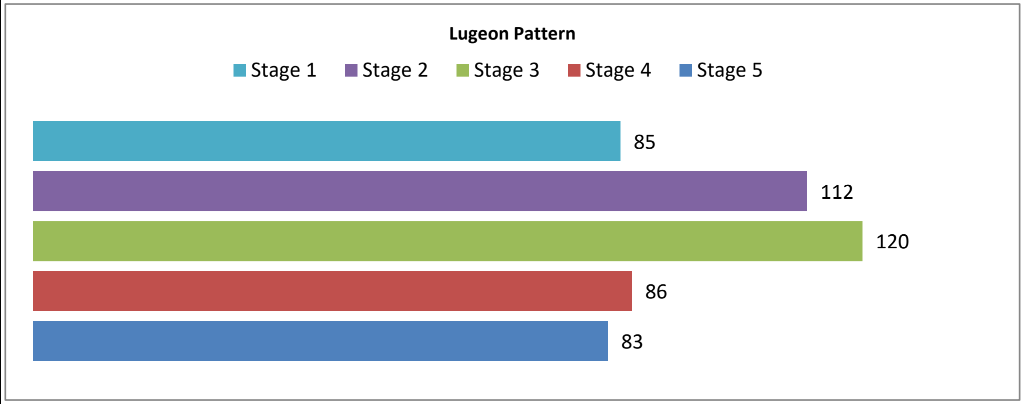


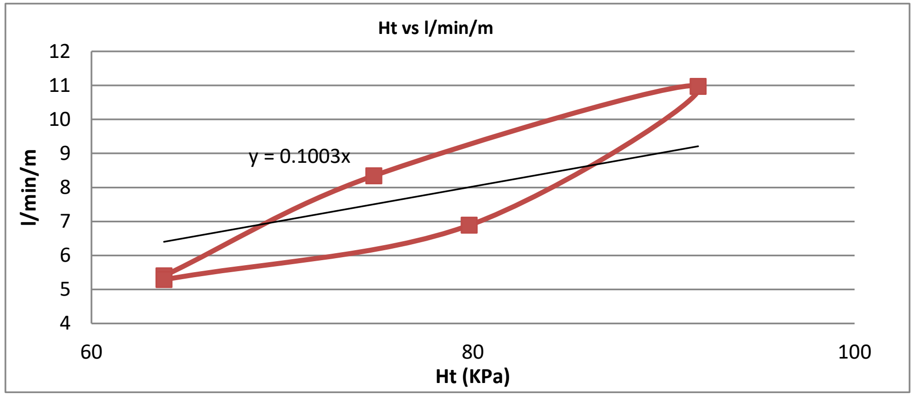


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0088	
Behaviour	Turbulent or wash out		Coefficient 2	0.0000	
Classification	Moderate		Max pressure	1000	
Hydraulic Conductivity Range	6e-5 to 2e-4	cm/s	Representative lugeon value	**9**	
Condition of rock mass discontinuities	Few partly open				
Representative lugeon value	**10.32**				

PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN			Hole ID:	BH2A-05
				Tested by	AP
Ground water level BGL (m)	4.23				
Packer seal section (m)	6			7	
Gauge pressure height above G.L (m)	0.75				
Maximum test pressure (KPa)	80				
Test pressures (KPa)	**25%** 20	**50%** 40		**75%** 60	

	Test Section (m)									
	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Luegon Value (L)**
Stage 1	7	10.5	20	10	189	18.9	5.4	6	63.8	85
Stage 2			40	10	292	29.2	8.3	15	74.8	112
Stage 3			60	10	384	38.4	11.0	18	91.8	120
Stage 4			40	10	241	24.1	6.9	10	79.8	86
Stage 5			20	10	185	18.5	5.3	6	63.8	83

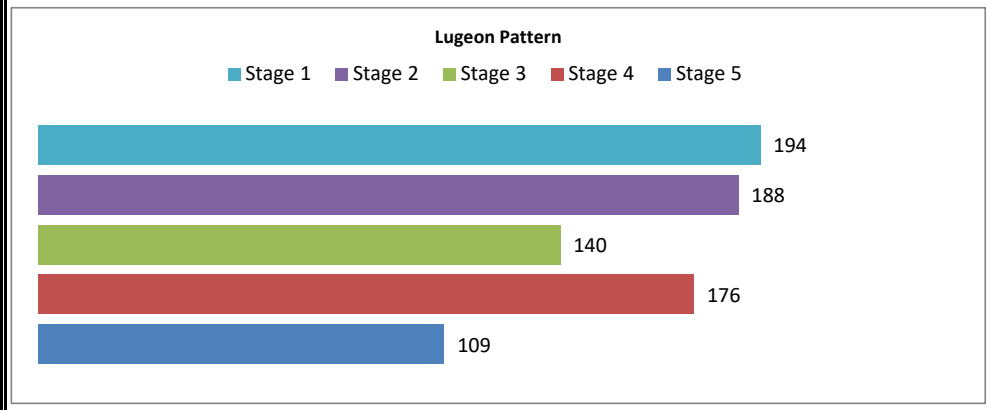


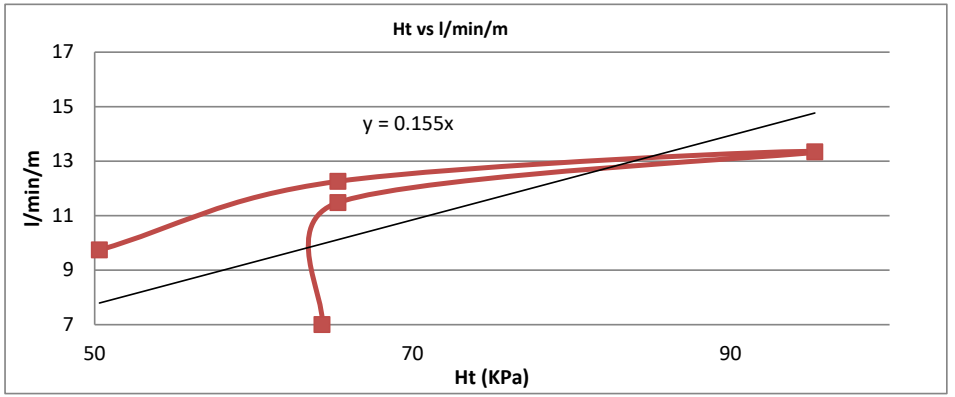


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.1003	
Behaviour	Dilation		Coefficient 2	0.0000	
Classification	High		Max pressure	1000	
Hydraulic Conductivity Range	6e-4 to 1e-3	cm/s	Representative lugeon value	**100**	
Condition of rock mass discontinuities	Many Open				
Representative luegon value	**83**				

PACKER TEST RESULT						Hole ID:	BH2A-05
						Tested by	AP
Ground water level BGL (m)		4.23					
Packer seal section (m)		9			10		
Gauge pressure height above G.L (m)		0.8					
Maximum test pressure (KPa)		120					
Test pressures (KPa)	25%	30	50%	60	75%	90	
Test Section (m)							

	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Luegon Value (L)
Stage 1	10	15	30	10	487	48.7	9.7	30	50.3	194
Stage 2			60	10	613	61.3	12.3	45	65.3	188
Stage 3			90	10	667	66.7	13.3	45	95.3	140
Stage 4			60	10	574	57.4	11.5	45	65.3	176
Stage 5			30	10	350	35	7.0	16	64.3	109



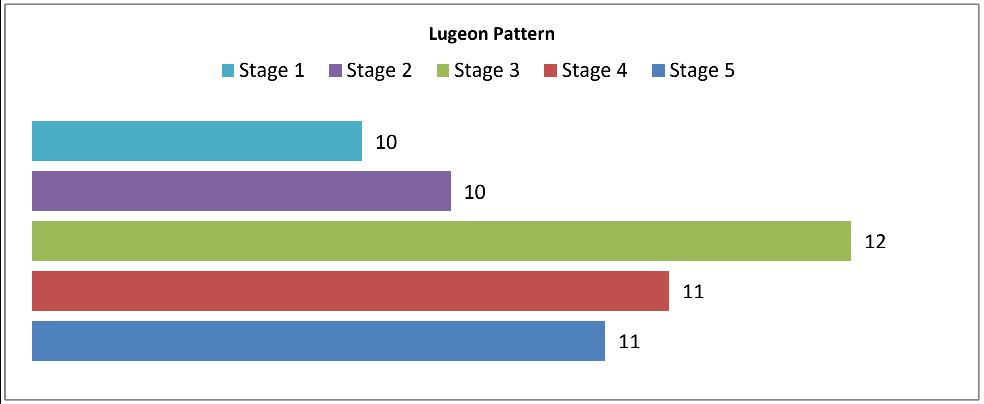


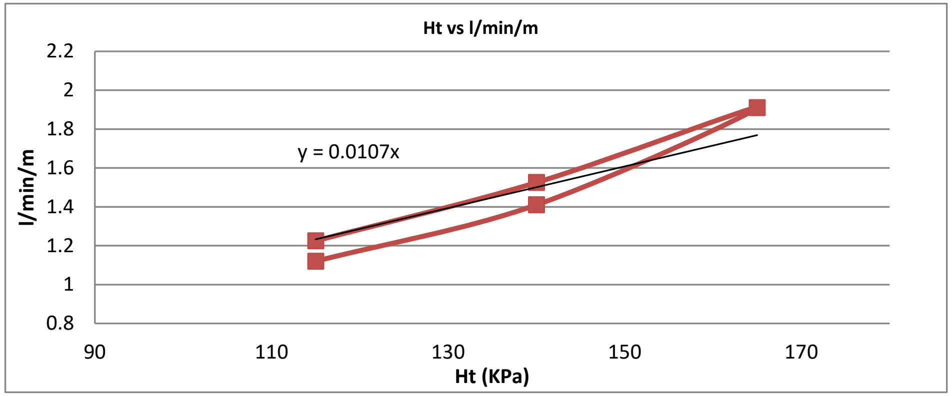
Method 1			Method 2		
Interpretation			Coefficient 1	0.1550	
Behaviour	Void Filling		Coefficient 2	0.0000	
Classification	Very High		Max pressure	1000	
Hydraulic Conductivity Range	> 1e-3	cm/s	Representative lugeon value	**155**	
Condition of rock mass discontinuities	Open closed space or voids				
Representative lugeon value	**109**				

STRADDLE PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-07
		Tested by	CJ

Ground water level BGL (m)	9				
Packer seal section (m)	7.5		9.5		
Gauge pressure height above G.L (m)	0.5				
Maximum test pressure (KPa)	100				
Test pressures (KPa) **25%**	25	**50%**	50	**75%**	75
Test Section (m)					

	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**
Stage 1	7.5	9.5	25	10	22.4	2.24	1.1	0	115.0	10
Stage 2			50	10	28.2	2.82	1.4	0	140.0	10
Stage 3			75	10	38.2	3.82	1.9	0	165.0	12
Stage 4			50	10	30.5	3.05	1.5	0	140.0	11
Stage 5			25	10	24.5	2.45	1.2	0	115.0	11



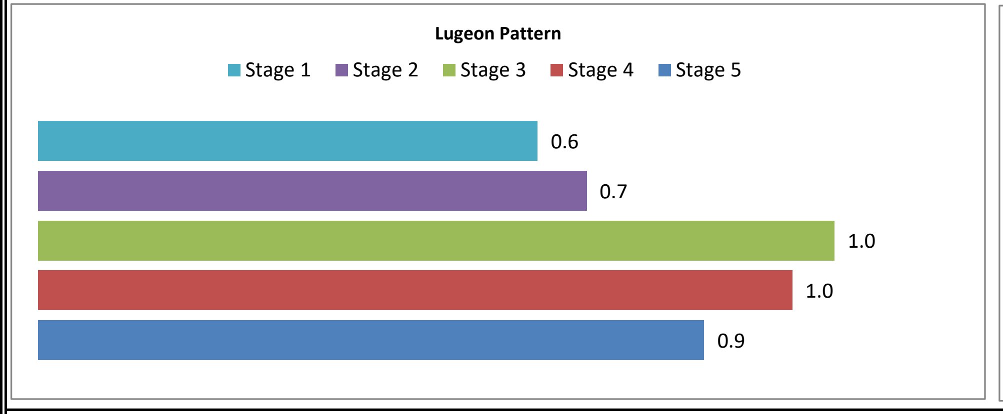


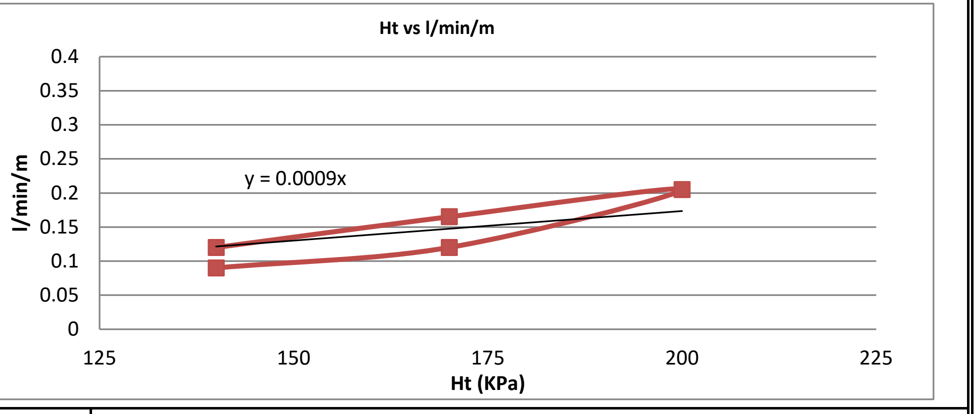
Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0107	
Behaviour	Dilation		Coefficient 2	0.0000	
Classification	Moderate		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**11**	
Condition of rock mass discontinuities	Few partly open				
Representative lugeon value	**12**				

STRADDLE PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-07
		Tested by	CJ

Ground water level BGL (m)		21.5							
Packer seal section (m)		10				12			
Gauge pressure height above G.L (m)		0							
Maximum test pressure (KPa)		120							
Test pressures (KPa)	**25%**	30		**50%**	60	**75%**	90		
Test Section (m)									

	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**
Stage 1	10	12	30	10	1.8	0.18	0.09	0	140.0	0.6
Stage 2			60	10	2.4	0.24	0.12	0	170.0	0.7
Stage 3			90	10	4.1	0.41	0.21	0	200.0	1.0
Stage 4			60	10	3.3	0.33	0.16	0	170.0	1.0
Stage 5			30	10	2.4	0.24	0.12	0	140.0	0.9

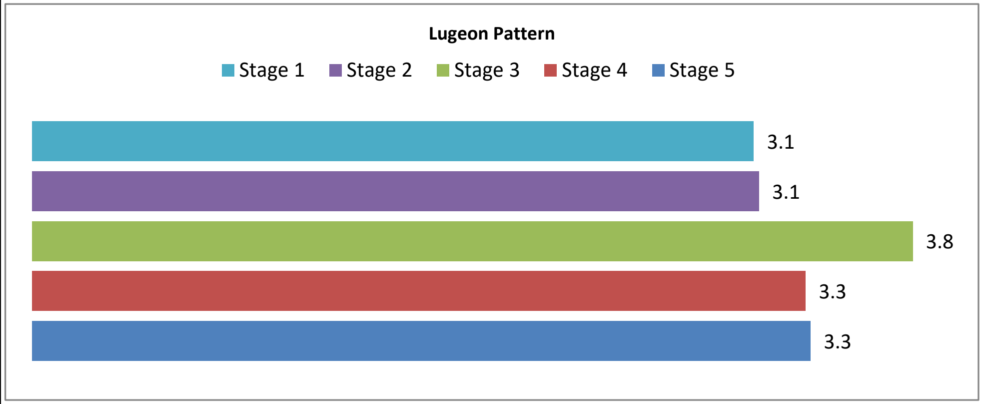


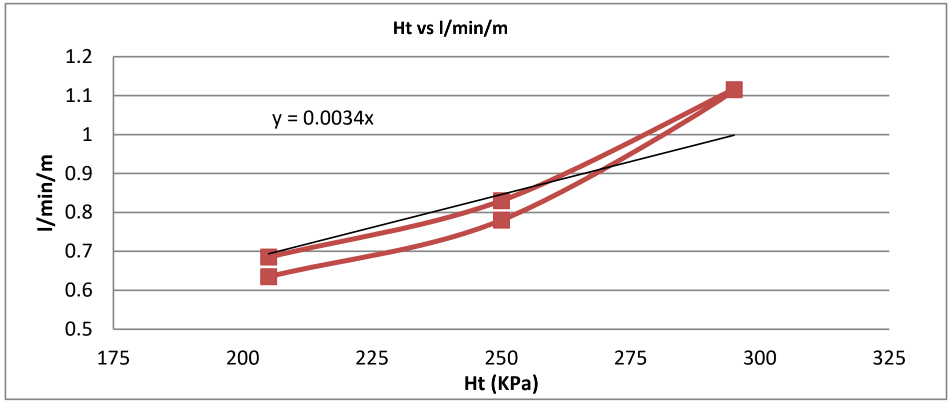


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0009	
Behaviour	Dilation		Coefficient 2	0.0000	
Classification	Very Low		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**1**	
Condition of rock mass discontinuities	Very Tight				
Representative lugeon value	**0.6**				

STRADDLE PACKER TEST RESULT			ATC Williams					Hole ID:	BH2A-07
								Tested by	CJ
Ground water level BGL (m)			21.5						
Packer seal section (m)			15				17		
Gauge pressure height above G.L (m)			0						
Maximum test pressure (KPa)			180						
Test pressures (KPa)		**25%**	45		**50%**	90		**75%**	135
Test Section (m)									
From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**

	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Lugeon Value (L)
Stage 1	15	17	45	10	12.7	1.27	0.63	0	205.0	3.1
Stage 2			90	10	15.6	1.56	0.78	0	250.0	3.1
Stage 3			135	10	22.3	2.23	1.12	0	295.0	3.8
Stage 4			90	10	16.6	1.66	0.83	0	250.0	3.3
Stage 5			45	10	13.7	1.37	0.69	0	205.0	3.3





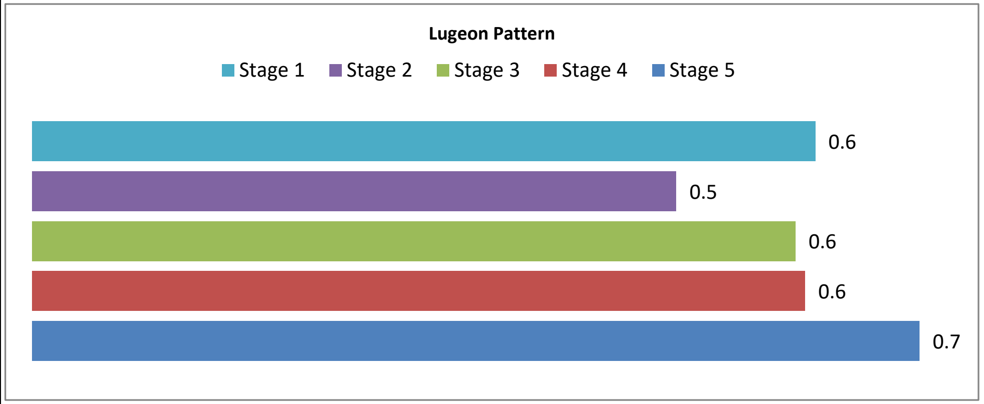
Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0034	
Behaviour	Laminar		Coefficient 2	0.0000	
Classification	Low		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**3**	
Condition of rock mass discontinuities	Tight				
Representative lugeon value	**3.3**				

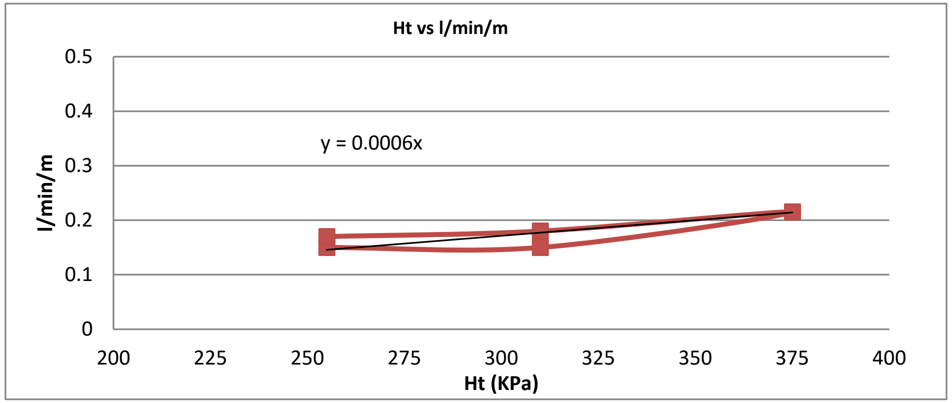
STRADDLE PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-07
		Tested by	CJ

Ground water level BGL (m)	21.5		
Packer seal section (m)	18.5	20.5	
Gauge pressure height above G.L (m)	0.5		
Maximum test pressure (KPa)	235		

Test pressures (KPa)	**25%**	55	**50%**	110	**75%**	175

	Test Section (m)									
	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**
Stage 1	18.5	20.5	55	10	3	0.3	0.15	0	255.0	0.6
Stage 2			110	10	3	0.3	0.15	0	310.0	0.5
Stage 3			175	10	4.3	0.43	0.22	0	375.0	0.6
Stage 4			110	10	3.6	0.36	0.18	0	310.0	0.6
Stage 5			55	10	3.4	0.34	0.17	0	255.0	0.7

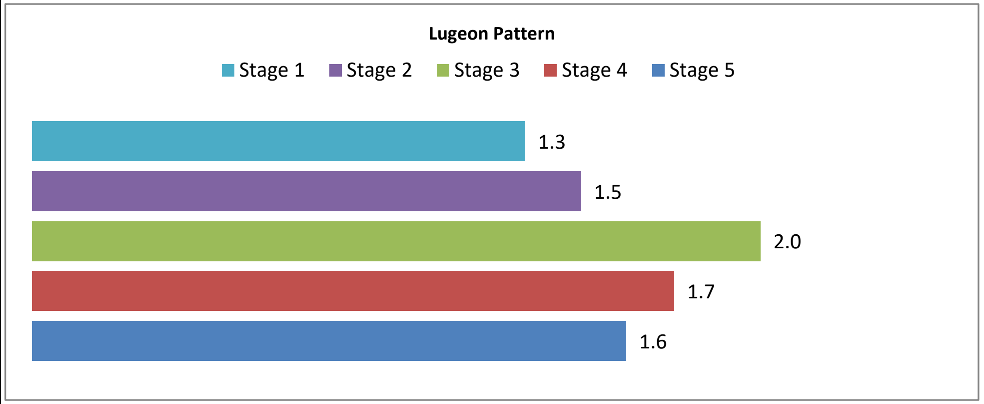


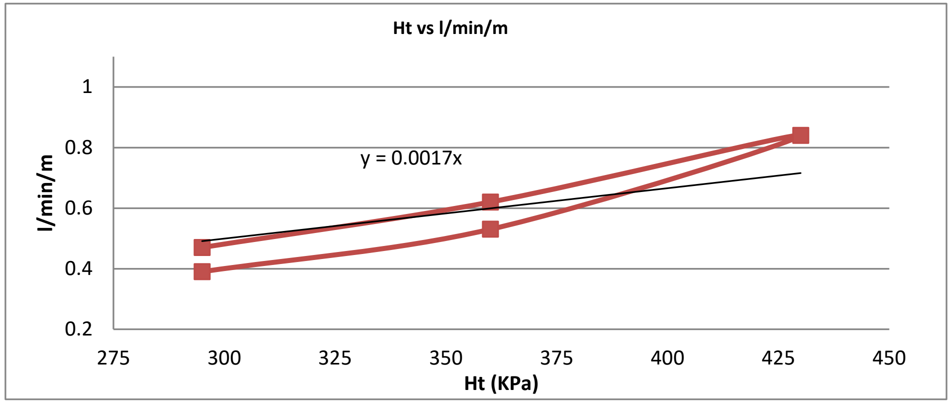


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0006	
Behaviour	Turbulant		Coefficient 2	0.0000	
Classification	Very Low		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**1**	
Condition of rock mass discontinuities	Very Tight				
Representative lugeon value	**0.5**				

STRADDLE PACKER TEST RESULT						ATC Williams		Hole ID:	BH2A-07	
								Tested by	CJ	
Ground water level BGL (m)			21.5							
Packer seal section (m)			21.5				23.5			
Gauge pressure height above G.L (m)			0.5							
Maximum test pressure (KPa)			280							
Test pressures (KPa)		25%	75		50%	140		75%	210	
Test Section (m)										
From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m		H_{loss} (KPa)	Ht (KPa)	Lugeon Value (L)
21.5	23.5	75	10	7.8	0.78	0.39		0	295.0	1.3
		140	10	10.6	1.06	0.53		0	360.0	1.5
		210	10	16.8	1.68	0.84		0	430.0	2.0
		140	10	12.4	1.24	0.62		0	360.0	1.7
		75	10	9.4	0.94	0.47		0	295.0	1.6

Stage 1
Stage 2
Stage 3
Stage 4
Stage 5

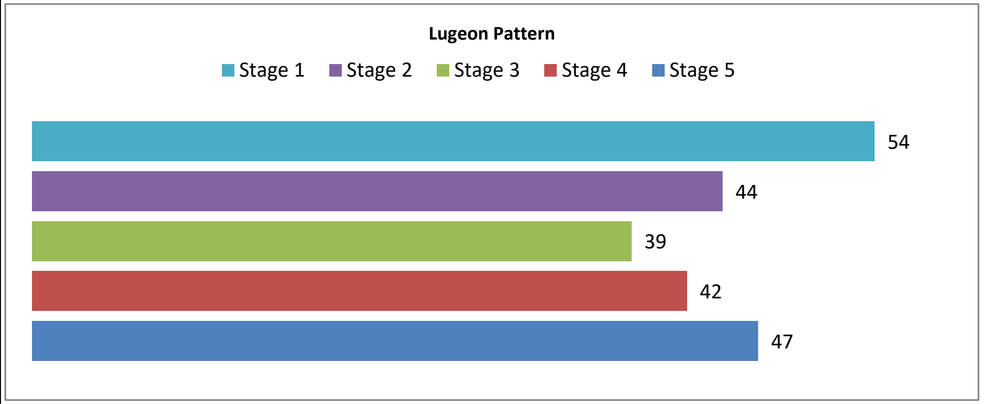


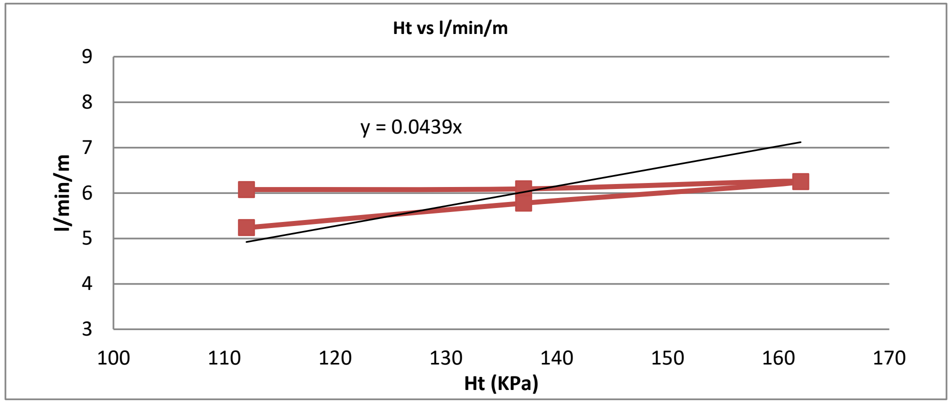


Method 1			Method 2		
Interpretation			Coefficient 1	0.0017	
Behaviour	Dilation		Coefficient 2	0.0000	
Classification	Low		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**2**	
Condition of rock mass discontinuities	Tight				
Representative lugeon value	**1.3**				

STRADDLE PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-08(A)
		Tested by	CJ

Ground water level BGL (m)		9								
Packer seal section (m)		7.2					9.2			
Gauge pressure height above G.L (m)		0.5								
Maximum test pressure (KPa)		95								
Test pressures (KPa)		**25%**	25		**50%**	50		**75%**	75	
Test Section (m)										
	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**
Stage 1	7.2	9.2	25	10	121.5	12.15	6.08	0	112.0	54
Stage 2			50	10	121.8	12.18	6.09	0	137.0	44
Stage 3			75	10	125	12.5	6.25	0	162.0	39
Stage 4			50	10	115.5	11.55	5.78	0	137.0	42
Stage 5			25	10	104.7	10.47	5.23	0	112.0	47

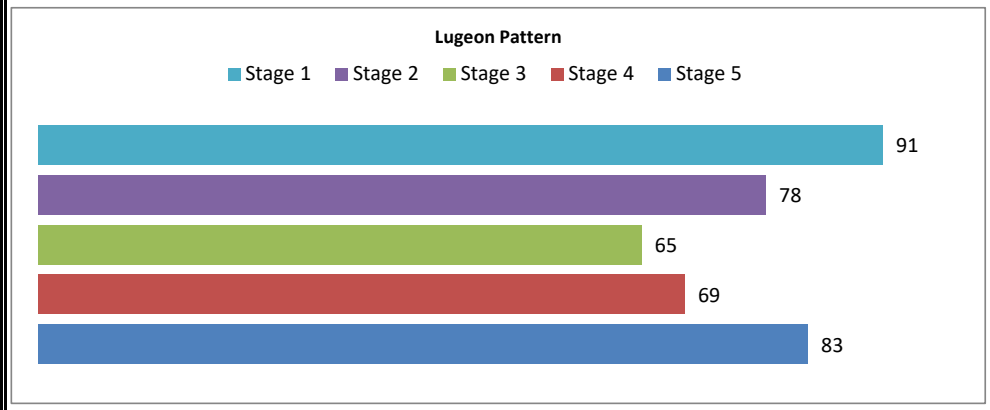


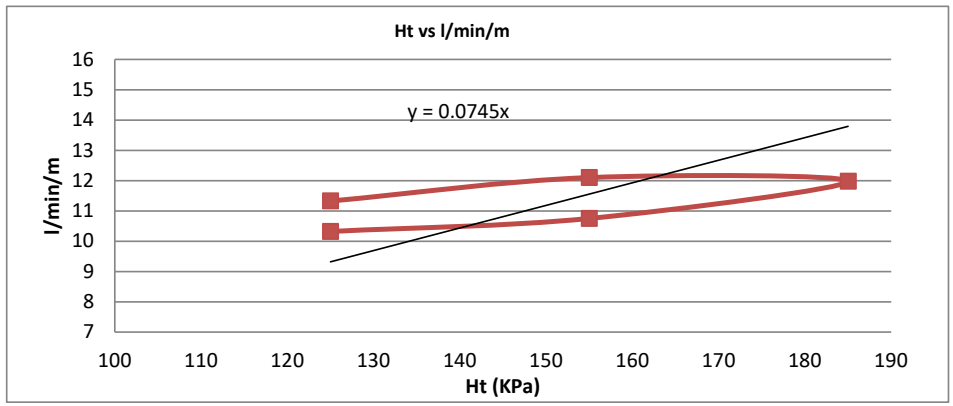


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0439	
Behaviour	Turbulant		Coefficient 2	0.0000	
Classification	Medium		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**44**	
Condition of rock mass discontinuities	Some open				
Representative lugeon value	**39**				

STRADDLE PACKER TEST RESULT									Hole ID:	BH2A-08(A)
									Tested by	CJ
Ground water level BGL (m)										
Packer seal section (m)										
Gauge pressure height above G.L (m)										
Maximum test pressure (KPa)										
Test pressures (KPa)		25%			50%			75%		
Test Section (m)										

	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Lugeon Value (L)
Stage 1	9	11	30	10	226.5	22.65	11.33	0	125.0	91
Stage 2			60	10	242	24.2	12.10	0	155.0	78
Stage 3			90	10	239.5	23.95	11.98	0	185.0	65
Stage 4			60	10	215	21.5	10.75	0	155.0	69
Stage 5			30	10	206.4	20.64	10.32	0	125.0	83

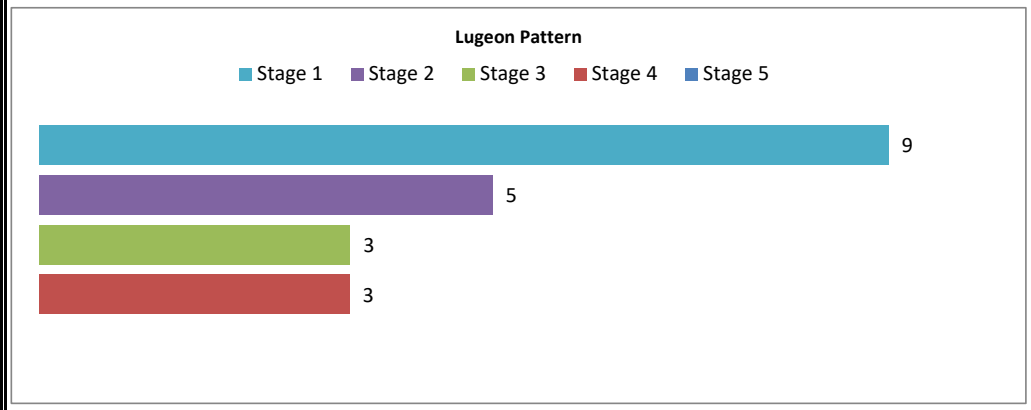




Method 1			Method 2		
Interpretation			Coefficient 1	0.0786	
Behaviour	Turbulant		Coefficient 2	0.0000	
Classification	High		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**79**	
Condition of rock mass discontinuities	Many open				
Representative lugeon value	**65**				

STRADDLE PACKER TEST RESULT									Hole ID:	BH2A-08
									Tested by	CJ
Ground water level BGL (m)				9						
Packer seal section (m)				13				15		
Gauge pressure height above G.L (m)				0.5						
Maximum test pressure (KPa)				170						
Test pressures (KPa)		25%	40		50%	85		75%	130	
Test Section (m)										

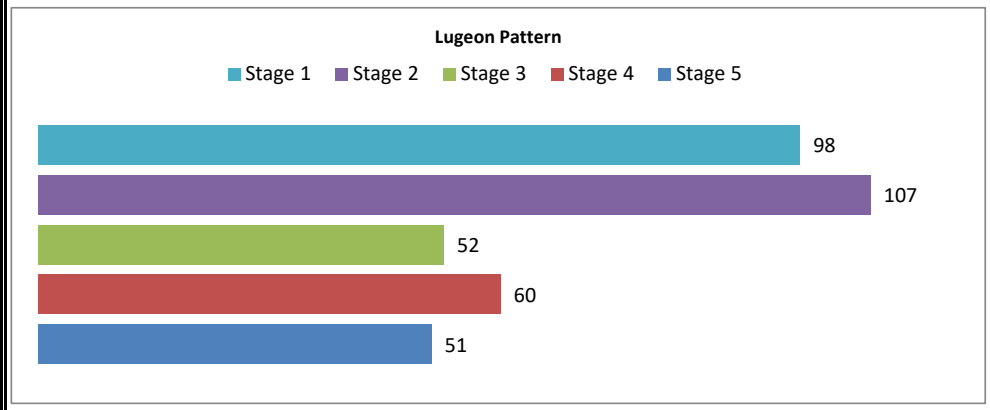
	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Lugeon Value (L)
Stage 1	13	15	40	10	23.6	2.36	1.2	0	135.0	9
Stage 2			85	10	16.8	1.68	0.8	0	180.0	5
Stage 3			130	10	14.4	1.44	0.7	0	225.0	3
Stage 4			85	10	11.5	1.15	0.6	0	180.0	3
Stage 5										



Method 1			Method 2		
Interpretation			Coefficient 1		
Behaviour	Laminar		Coefficient 2		
Classification	Low		Max pressure		
Hydraulic Conductivity Range		cm/s	Representative lugeon value		
Condition of rock mass discontinuities	Tight				
Representative lugeon value	**3**	Inflatable top packer fails start of stage 5.			

STRADDLE PACKER TEST RESULT									Hole ID:	BH2A-08
									Tested by	CJ
Ground water level BGL (m)										
Packer seal section (m)										
Gauge pressure height above G.L (m)										
Maximum test pressure (KPa)										
Test pressures (KPa)		25%			50%			75%		
Test Section (m)										

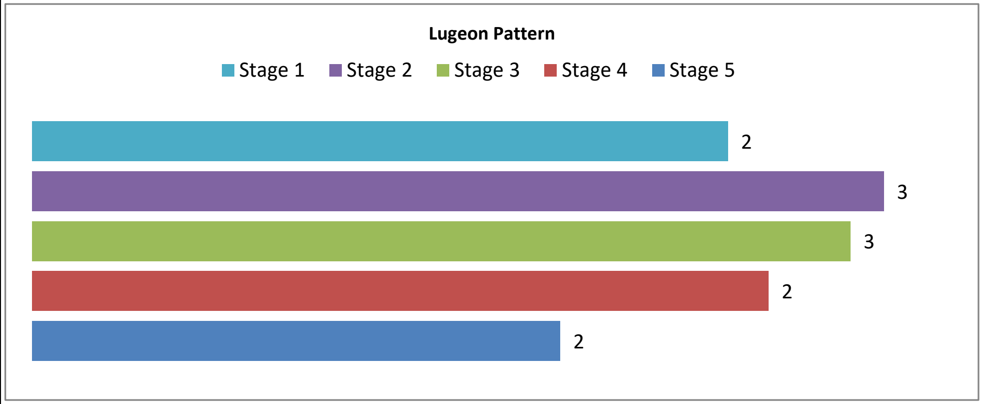
	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Lugeon Value (L)
Stage 1	12.5	15.5	60	10	456	45.6	15.20	0	155.0	98
Stage 2			120	10	691	69.1	23.03	0	215.0	107
Stage 3			180	10	431	43.1	14.37	0	275.0	52
Stage 4			120	10	384	38.4	12.80	0	215.0	60
Stage 5			60	10	235.5	23.55	7.85	0	155.0	51

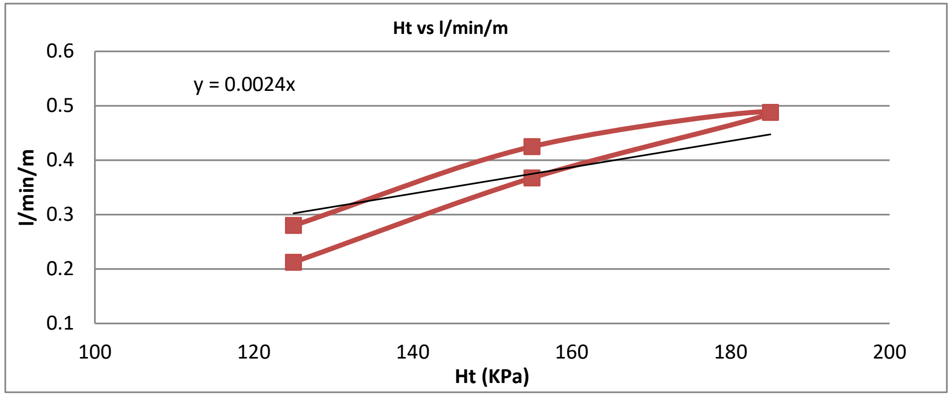


Method 1			Method 2		
Interpretation			Coefficient 1	NA	
Behaviour	Laminar		Coefficient 2	NA	
Classification	High		Max pressure	NA	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**NA**	
Condition of rock mass discontinuities	Many Open				
Representative lugeon value	**54**	Some leakage (bypass) around top packer Stage 1 & 2. Average of Stage 3, 4 & 5 adopted.			

STRADDLE PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-08
		Tested by	CJ

Ground water level BGL (m)		9								
Packer seal section (m)		22.5				23.5				
Gauge pressure height above G.L (m)		0.5								
Maximum test pressure (KPa)		120								
Test pressures (KPa)		**25%**	30		**50%**	60	**75%**	90		
Test Section (m)										
From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**	
22.5	23.5	30	10	2.8	0.28	0.3	0	125.0	2	Stage 1
		60	10	4.25	0.425	0.4	0	155.0	3	Stage 2
		90	10	4.875	0.4875	0.5	0	185.0	3	Stage 3
		60	10	3.675	0.3675	0.4	0	155.0	2	Stage 4
		30	10	2.125	0.2125	0.2	0	125.0	2	Stage 5

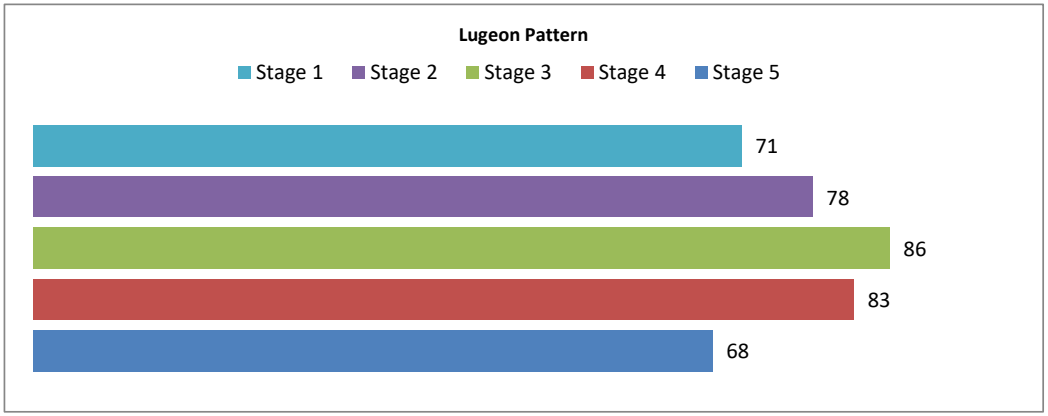


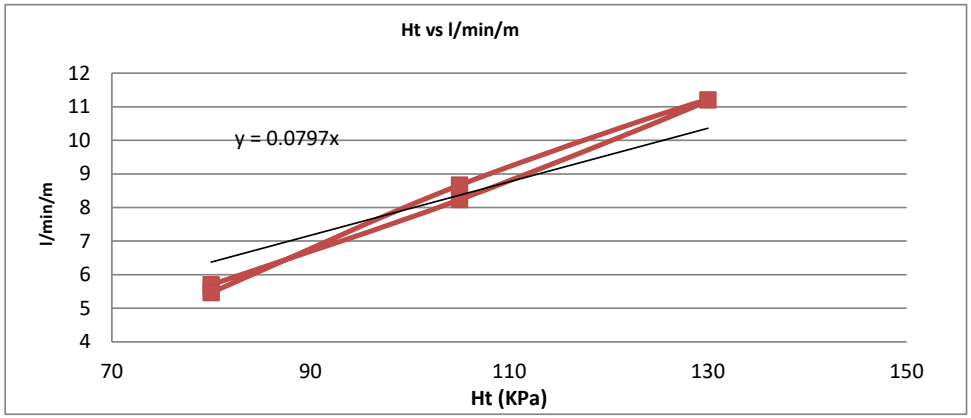


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0024	
Behaviour	Laminar		Coefficient 2	0.0000	
Classification	Low		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**2**	
Condition of rock mass discontinuities	Tight				
Representative lugeon value	**2**				

PACKER TEST RESULT										
								Hole ID:	BH2A-09	
								Tested by	CJ	
Ground water level BGL (m)			5							
Packer seal section (m)			7.5					10.5		
Gauge pressure height above G.L (m)			0.5							
Maximum test pressure (KPa)			100							
Test pressures (KPa)		25%	25			50%	50	75%	75	
Test Section (m)										

	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Lugeon Value (L)
Stage 1	7.5	10.5	25	10	171	17.1	5.7	0	80.0	71
Stage 2			50	10	247	24.7	8.2	0	105.0	78
Stage 3			75	10	336	33.6	11.2	0	130.0	86
Stage 4			50	10	260	26	8.7	0	105.0	83
Stage 5			25	10	164	16.4	5.5	0.002205	80.0	68



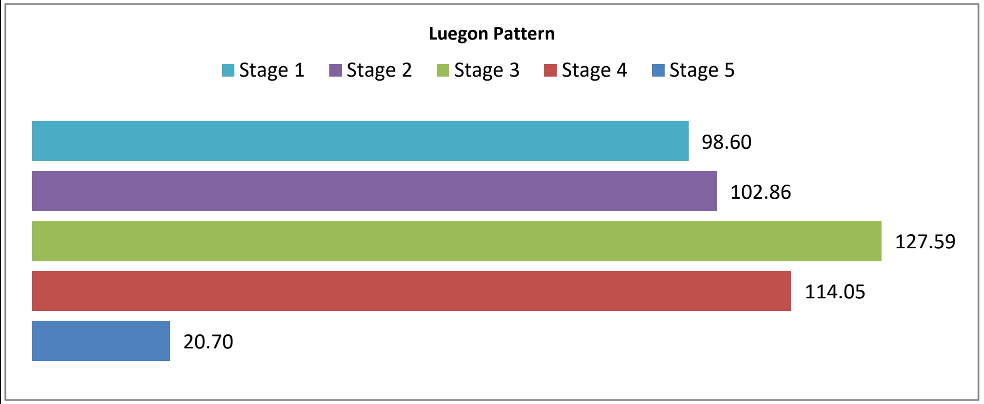


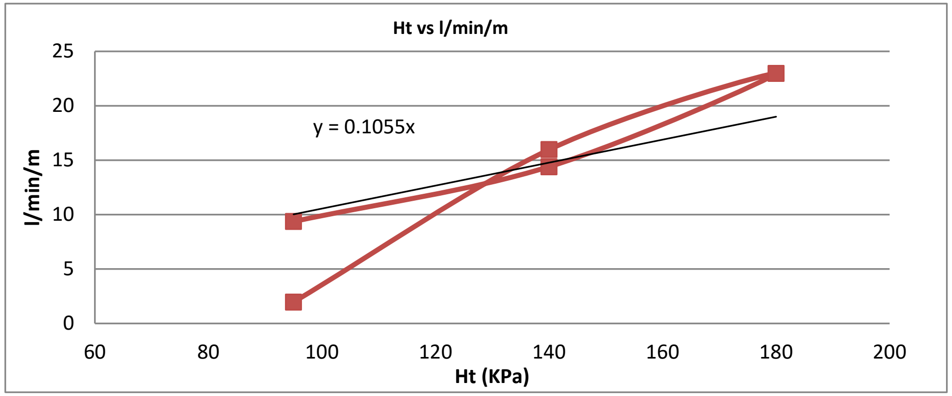
Method 1			Method 2		
Interpretation			Coefficient 1	0.0797	
Behaviour	Dilation		Coefficient 2	0.0000	
Classification	High		Max pressure	1000	
Hydraulic Conductivity Range	7E-06	m/s	Representative lugeon value	**80**	
Condition of rock mass discontinuities	Many Open				
Representative lugeon value	**83**				

PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-09
		Tested by	CJ

Ground water level BGL (m)	5		
Packer seal section (m)	11.5 - 12.5 m	15.5 - 16.5 m	
Gauge pressure height above G.L (m)	0.5		
Maximum test pressure (KPa)	170		
Test pressures (KPa)	**25%** 40	**50%** 85	**75%** 125

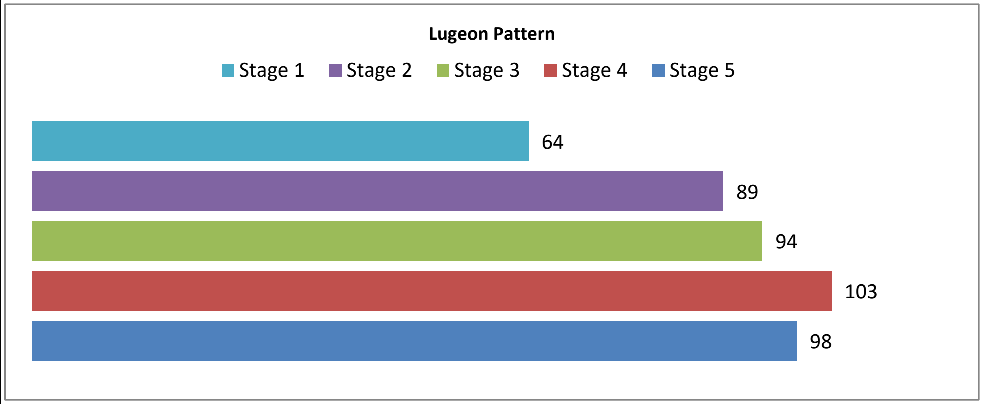
	Test Section (m)									
	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Luegon Value (L)**
Stage 1	12.5	15.5	40	10	281	28.1	9.37	0	95.0	98.60
Stage 2			85	10	432	43.2	14.40	0	140.0	102.86
Stage 3			125	10	689	68.9	22.97	0	180.0	127.59
Stage 4			85	10	479	47.9	15.97	0	140.0	114.05
Stage 5			40	10	59	5.9	1.97	0	95.0	20.70

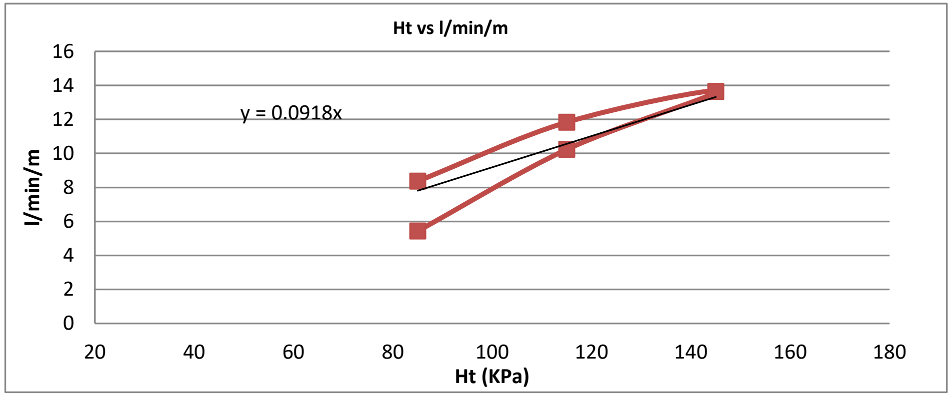




Method 1			**Method 2**		
Interpretation			Coefficient 1	0.1055	
Behaviour	Dilation		Coefficient 2	0.0000	
Classification	Low		Max pressure	1000	
Hydraulic Conductivity Range	1E-05	m/s	Representative lugeon value	**106**	
Condition of rock mass discontinuities	Many Open				
Representative lugeon value	**114**	Stage 5 water pressure pulsing during test. Pressure may have been <40 kPa .			

PACKER TEST RESULT										
								Hole ID:	BH2A-09	
								Tested by	CJ	
Ground water level BGL (m)			5							
Packer seal section (m)			12.5 - 13.5 m				16.5 - 17.5 m			
Gauge pressure height above G.L (m)			0.5							
Maximum test pressure (KPa)			120							
Test pressures (KPa)		**25%**	30		**50%**	60	**75%**	90		
Test Section (m)										
	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Luegon Value (L)**
Stage 1	13.5	16.5	30	10	163	16.3	5.4	0	85.0	64
Stage 2			60	10	307	30.7	10.2	0	115.0	89
Stage 3			90	10	409	40.9	13.6	0	145.0	94
Stage 4			60	10	355	35.5	11.8	0	115.0	103
Stage 5			30	10	251	25.1	8.4	0	85.0	98



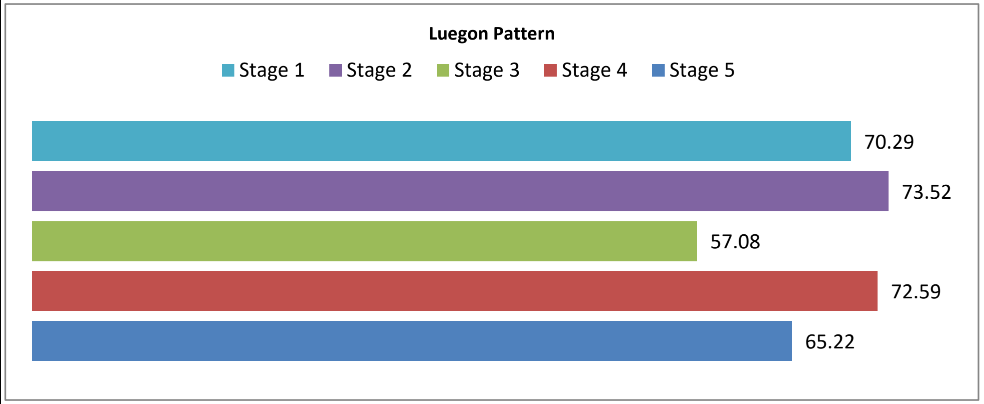


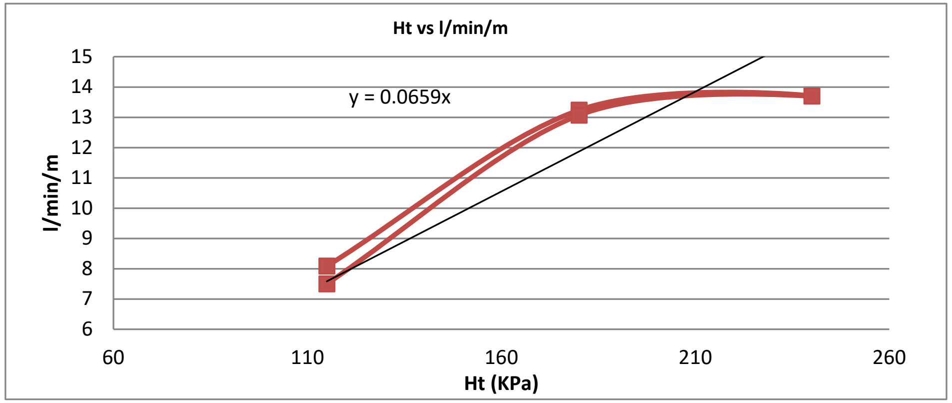
Method 1				**Method 2**		
Interpretation				Coefficient 1	0.0918	
Behaviour	Wash-out			Coefficient 2	0.0000	
Classification	Very High			Max pressure	1000	
Hydraulic Conductivity Range	1E-05	m/s		Representative lugeon value	**92**	
Condition of rock mass discontinuities	Open closed space or voids					
Representative lugeon value	**100**					

PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-09
		Tested by	CJ

Ground water level BGL (m)	5					
Packer seal section (m)	18.0 - 19.0 m			22.0 - 23.0 m		
Gauge pressure height above G.L (m)	0.5					
Maximum test pressure (KPa)	250					
Test pressures (KPa)	**25%**	60	**50%**	125	**75%**	185
Test Section (m)						

	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Luegon Value (L)**
Stage 1	19	22	60	10	242.5	24.25	8.08	0	115.0	70.29
Stage 2			125	10	397	39.7	13.23	0	180.0	73.52
Stage 3			185	10	411	41.1	13.70	0	240.0	57.08
Stage 4			125	10	392	39.2	13.07	0	180.0	72.59
Stage 5			60	10	225	22.5	7.50	0	115.0	65.22

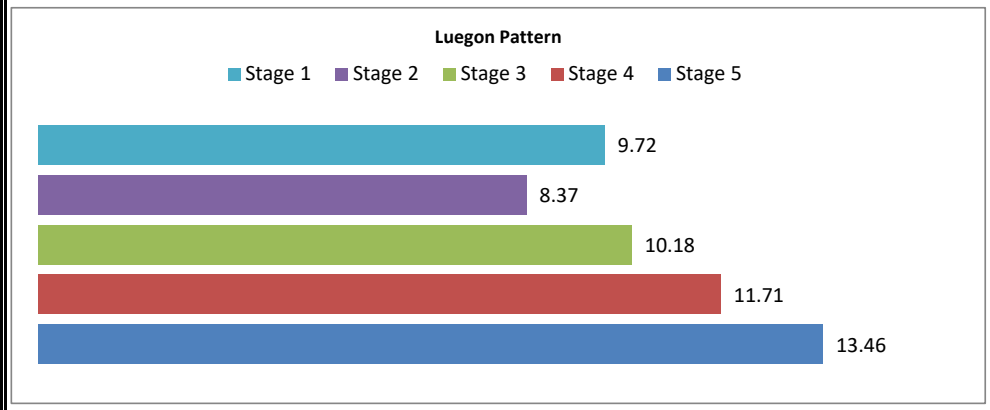


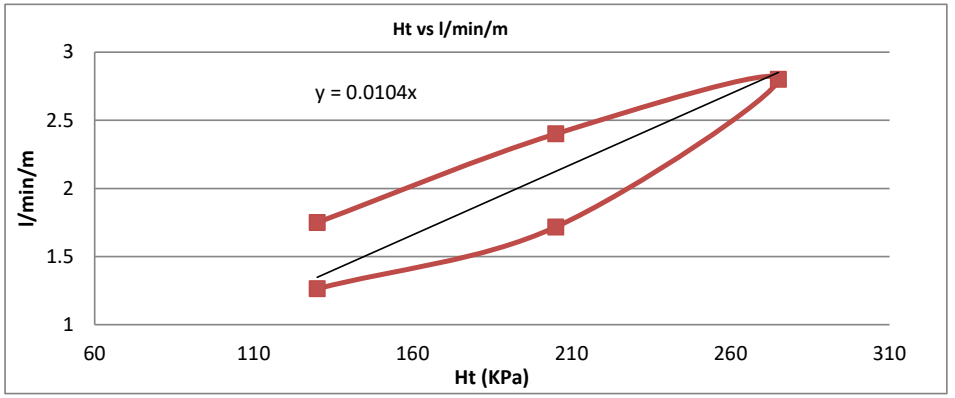


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0659	
Behaviour	Laminar		Coefficient 2	0.0000	
Classification	High		Max pressure	1000	
Hydraulic Conductivity Range	7E-06	m/s	Representative lugeon value	**66**	
Condition of rock mass discontinuities	Few partly open				
Representative lugeon value	**68**				

PACKER TEST RESULT							Hole ID:	BH2A-09
							Tested by	CJ
Ground water level BGL (m)		5						
Packer seal section (m)		21.0 - 22.0 m				25.0 - 26.0 m		
Gauge pressure height above G.L (m)		0.5						
Maximum test pressure (KPa)		300						
Test pressures (KPa)	25%	75		50%	150		75%	220
Test Section (m)								

	From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Luegon Value (L)
Stage 1	22	25	75	10	37.9	3.79	1.26	0	130.0	9.72
Stage 2			150	10	51.5	5.15	1.72	0	205.0	8.37
Stage 3			220	10	84	8.4	2.80	0	275.0	10.18
Stage 4			150	10	72	7.2	2.40	0	205.0	11.71
Stage 5			75	10	52.5	5.25	1.75	0	130.0	13.46

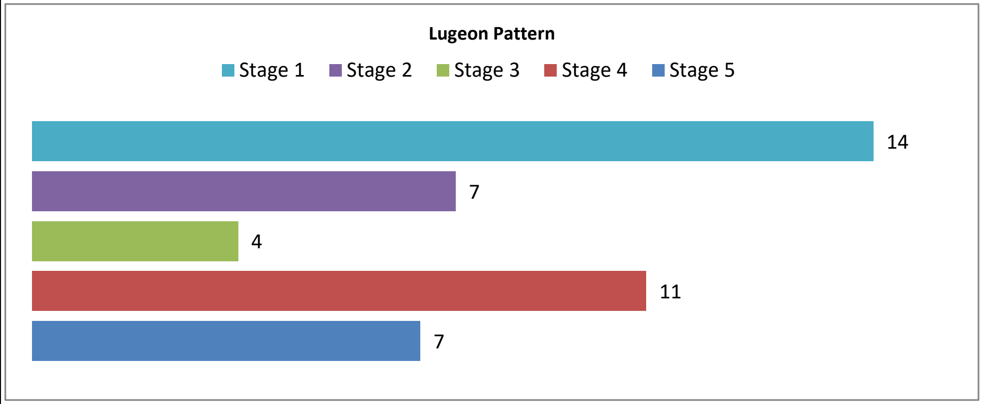


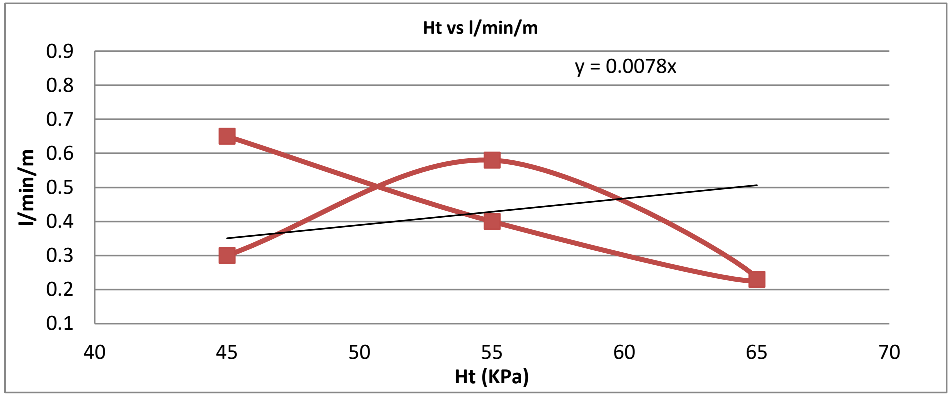


Method 1			Method 2		
Interpretation			Coefficient 1	0.0104	
Behaviour	wash out		Coefficient 2	0.0000	
Classification	Moderate		Max pressure	1000	
Hydraulic Conductivity Range	1E-06	m/s	Representative lugeon value	**10**	
Condition of rock mass discontinuities	Few partly open				
Representative lugeon value	**13**				

STRADDLE PACKER TEST RESULT	ATC Williams GROUNDED IN DESIGN	Hole ID:	BH2A-12
		Tested by	CJ

Ground water level BGL (m)			7							
Packer seal section (m)			3				4			
Gauge pressure height above G.L (m)			0							
Maximum test pressure (KPa)			40							
Test pressures (KPa)		**25%**	10		**50%**	20		**75%**	30	
Test Section (m)										
From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**	
3	4	10	10	6.5	0.65	0.7	0	45.0	14	Stage 1
		20	10	4	0.4	0.4	0	55.0	7	Stage 2
		30	10	2.3	0.23	0.2	0	65.0	4	Stage 3
		20	10	5.8	0.58	0.6	0	55.0	11	Stage 4
		10	10	3	0.3	0.3	0	45.0	7	Stage 5

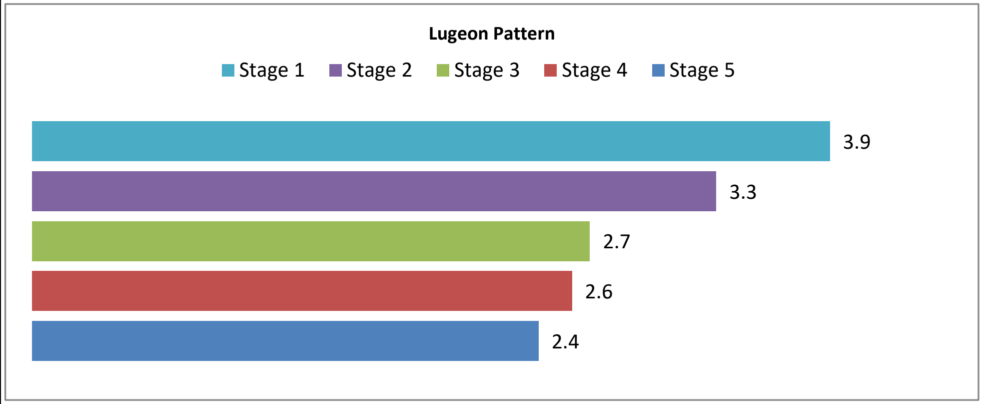


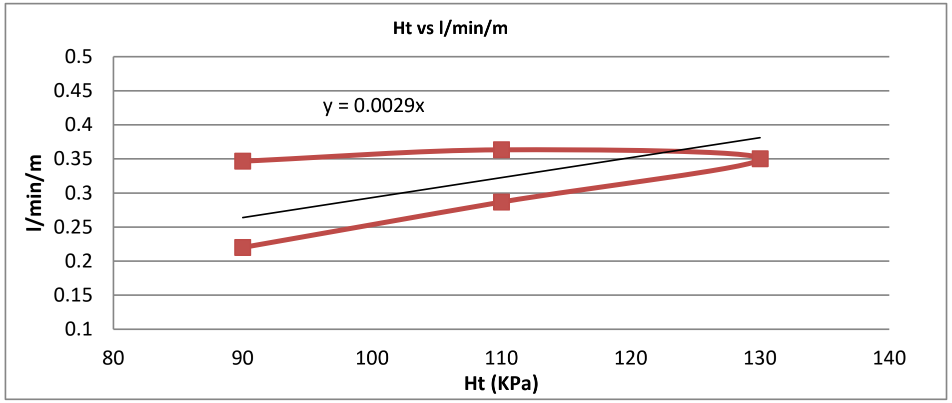


Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0078	
Behaviour	Turbulant/Laminar		Coefficient 2	0.0000	
Classification	Low		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**8**	
Condition of rock mass discontinuities	Tight				
Representative lugeon value	**8**				

Average lugeon value adopted. Gauage accurracy poor at low pressures (10 kPa). Operator probably had the pressure too high on stage 1...?

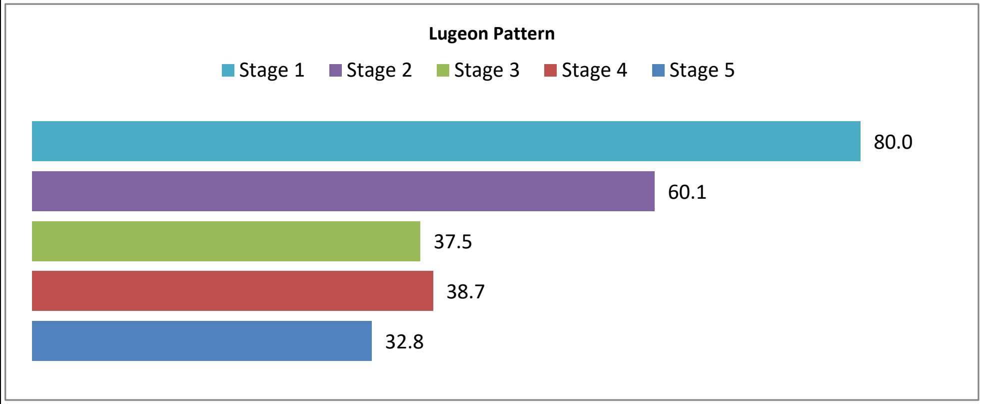
STRADDLE PACKER TEST RESULT										
									Hole ID:	BH2A-12
									Tested by	CJ
Ground water level BGL (m)			7							
Packer seal section (m)			6.3				9.3			
Gauge pressure height above G.L (m)			0							
Maximum test pressure (KPa)			80							
Test pressures (KPa)		25%	20		50%	40		75%	60	
Test Section (m)										
From	To	Pressure (KPa)	Time (mins)	Water volume loss (l)	Q(l/min)	l/min/m	H_{loss} (KPa)	Ht (KPa)	Lugeon Value (L)	
Stage 1 6.3	9.3	20	10	10.4	1.04	0.35	0	90.0	3.9	
Stage 2		40	10	10.9	1.09	0.36	0	110.0	3.3	
Stage 3		60	10	10.5	1.05	0.35	0	130.0	2.7	
Stage 4		40	10	8.6	0.86	0.29	0	110.0	2.6	
Stage 5		20	10	6.6	0.66	0.22	0	90.0	2.4	

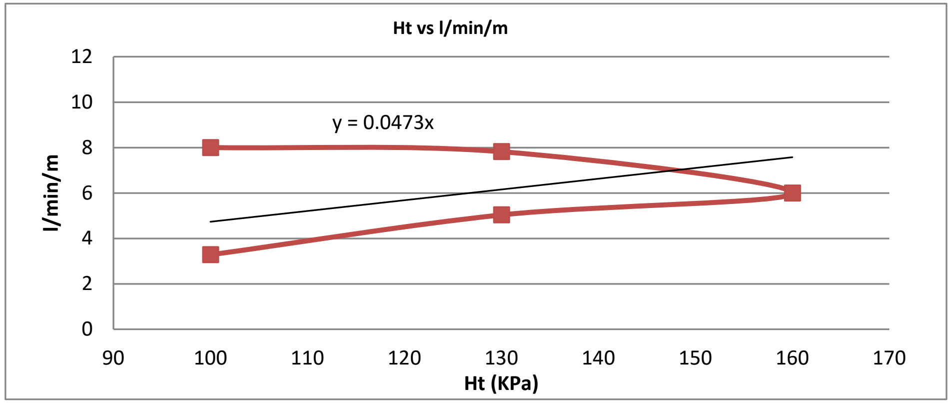




Method 1			Method 2		
Interpretation			Coefficient 1	0.0029	
Behaviour	Void Filling		Coefficient 2	0.0000	
Classification	Low		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**3**	
Condition of rock mass discontinuities	Tight				
Representative lugeon value	**2.4**				

STRADDLE PACKER TEST RESULT									Hole ID:	BH2A-12
									Tested by	CJ
Ground water level BGL (m)			7							
Packer seal section (m)			9.5				12.5			
Gauge pressure height above G.L (m)			0							
Maximum test pressure (KPa)			120							
Test pressures (KPa)		**25%**	30		**50%**	60		**75%**	90	
Test Section (m)										
	From	**To**	**Pressure (KPa)**	**Time (mins)**	**Water volume loss (l)**	**Q(l/min)**	**l/min/m**	**H_{loss} (KPa)**	**Ht (KPa)**	**Lugeon Value (L)**
Stage 1	9.5	12.5	30	10	240	24	8.00	0	100.0	80.0
Stage 2			60	10	234.5	23.45	7.82	0	130.0	60.1
Stage 3			90	10	180	18	6.00	0	160.0	37.5
Stage 4			60	10	151	15.1	5.03	0	130.0	38.7
Stage 5			30	10	98.4	9.84	3.28	0	100.0	32.8





Method 1			**Method 2**		
Interpretation			Coefficient 1	0.0473	
Behaviour	Void Filling		Coefficient 2	0.0000	
Classification	Medium		Max pressure	1000	
Hydraulic Conductivity Range		cm/s	Representative lugeon value	**47**	
Condition of rock mass discontinuities	Some open				
Representative lugeon value	**33**				

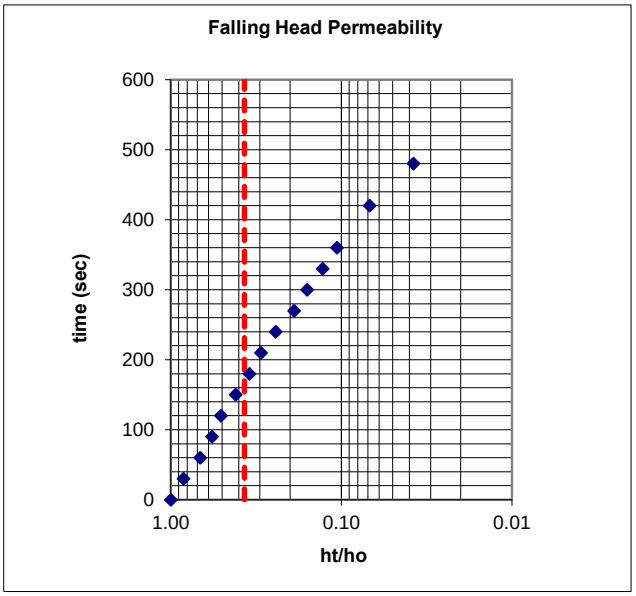
Borehole BH2A-01 **Date** 16-02-18

t (sec)	Depth (m)	ht/ho
0	0	1.000
30	1.05	0.841
60	2.17	0.671
90	2.82	0.573
120	3.25	0.508
150	3.85	0.417
180	4.32	0.345
210	4.65	0.295
240	5	0.242
270	5.35	0.189
300	5.55	0.159
330	5.75	0.129
360	5.9	0.106
420	6.15	0.068
480	6.35	0.038
900	6.57	0.005
1920	6.6	0.000

Datum (m)*	0
Standing Water Level (m)	6.6
Borehole diameter (m)	0.096
Casing diameter (m)	0.096
Test Section diameter (m)	0.096
Depth of borehole (m)	7.5
Depth of casing (m)	0
Test Zone Length	7.5
h0 = Head at test start (m)	6.6
Shape Factor Case (1 - 7)	4

*All measurements below datum

Stratum Description:
0.0m to 7.50: Siltstone EW-HW



A = cross section area 0.007238 m^2
F = Shape Factor 9.328695
Either **T = Basic time lag (ht/ho = 0.37)** 180 s
Or **t1 =** **t2 =**

K = **4.31E-06** m/s

NORTH STAR PROJECT - PERMEABILITY TESTING

Job No: 114185.10

ATC Williams

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perth@atcwilliams.com.au

Date: 16.02.18

Our Ref:

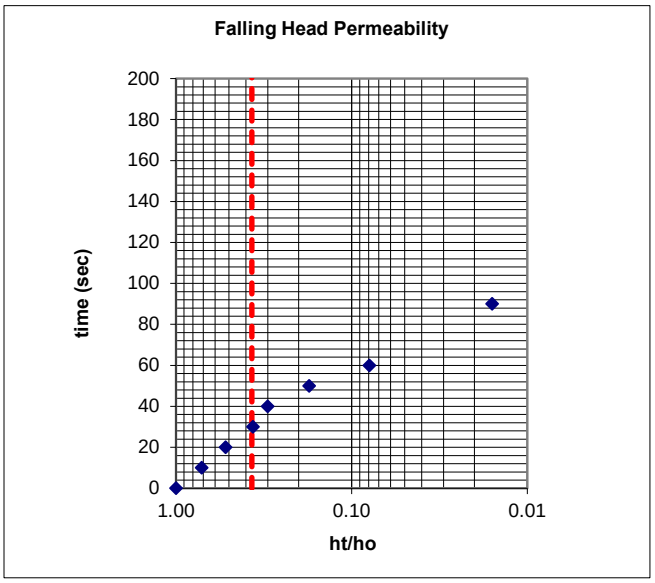
Borehole BH2A-02 **Date** 16-02-18

t (sec)	Depth (m)	ht/ho
0	0	1.000
10	0.9	0.714
20	1.5	0.524
30	2	0.365
40	2.2	0.302
50	2.6	0.175
60	2.9	0.079
90	3.1	0.016

Datum (m)*	0
Standing Water Level (m)	3.15
Borehole diameter (m)	0.096
Casing diameter (m)	0.05
Test Section diameter (m)	0.096
Depth of borehole (m)	6
Depth of casing (m)	0
Test Zone Length	6
h0 = Head at test start (m)	3.15
Shape Factor Case (1 - 7)	4

*All measurements below datum

Stratum Description:
0.0m - 5.4 m: Gravelly Sand (Alluvium)
5.4 - 6.0 m: Sandstone EW



A = cross section area 0.007238 m^2

F = Shape Factor 7.807821

Either **T = Basic time lag (ht/ho = 0.37)** 30 s

Or **t1 =** **t2 =**

K = **3.09E-05** m/s

NORTH STAR PROJECT - PERMEABILITY TESTING

Job No: 114185.10

ATC Williams

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1141 Hay St
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Date: 16.02.18

Our Ref:

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perth@atcwilliams.com.au

Job No: 114185.14

Date: 12/09/2018

BOREHOLE PERMEABILITY TEST - PORCHET METHOD

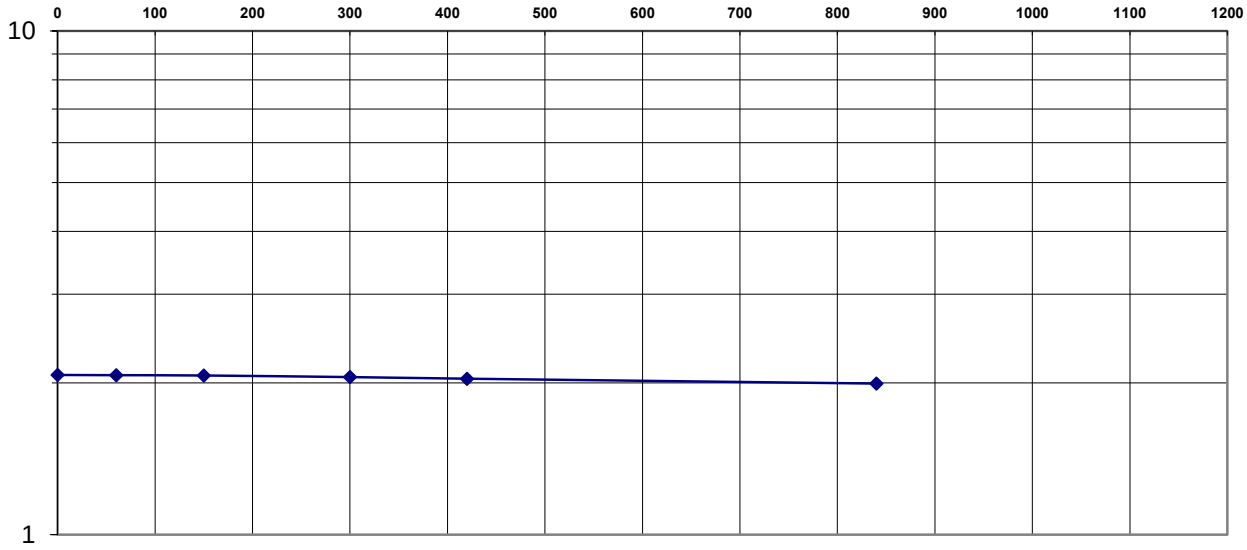
TESTED BY: CJ

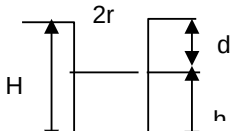
PROJECT: IRON BRIDGE OPERATIONS, NORTH STAR MAGNETITE

HOLE NO: BH2A-10 **Depth: (m)** 2.10 **Radius:(m)** 0.15 (TOP rock roller)

Water: (m) 3

Test One					Test One (Continued)				
t hr:min:sec	t sec	d m	h m	h + r/2 m	t hr:min:sec	t sec	d m	h m	h + r/2 m
0:00:00	0	0.1	2	2.075					
0:01:00	60	0.102	1.998	2.073					
0:02:30	150	0.105	1.995	2.07					
0:05:00	300	0.12	1.98	2.055					
0:07:00	420	0.135	1.965	2.04					
0:14:00	840	0.18	1.92	1.995					





$$K = \frac{1.15 \times r}{t_2 - t_1} \quad \text{Log}_{10} \left[\frac{h_{t1} + r/2}{h_{t2} + r/2} \right]$$

	t1	t2	Permeability
1	0	840	3.51E-06
	60	420	3.34E-06
2			

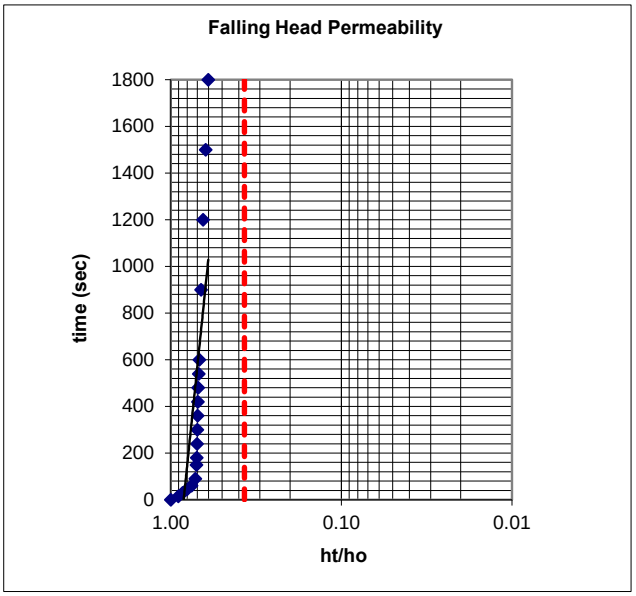
Borehole BH2A-10 **Date** 12-09-18

t (sec)	Depth (m)	ht/ho
0	0	1.000
15	0.4	0.902
30	0.6	0.854
45	0.8	0.805
60	1	0.756
90	1.15	0.720
150	1.2	0.707
180	1.21	0.705
240	1.22	0.702
300	1.23	0.700
360	1.25	0.695
420	1.26	0.693
480	1.27	0.690
540	1.29	0.685
600	1.31	0.680
900	1.38	0.663
1200	1.45	0.646
1500	1.54	0.624
1800	1.63	0.602

Datum (m)*	1.1
Standing Water Level (m)	4.1
Borehole diameter (m)	0.124
Casing diameter (m)	0.124
Test Section diameter (m)	0.124
Depth of borehole (m)	9.1
Depth of casing (m)	8.5
Test Zone Length	0.6
h0 = Head at test start (m)	4.1
Shape Factor Case (1 - 7)	4

*All measurements below datum

Stratum Description:	
0.0 - 2.45	Cobbles (Alluvial)
2.45 - 6.1	Shale/Siltstone HW/MW
6.1 - 9.1	Sandstone EW-MW



A = cross section area 0.012076 m^2

F = Shape Factor 1.653248

Either **T = Basic time lag (ht/ho = 0.37)** s

Or **t1 =** 150 **t2 =** 1500

K = **1.69E-05** m/s

NORTH STAR PROJECT - PERMEABILITY TESTING

Job No: 114185.14

ATC Williams

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Date: 13.09.2018

Our Ref:

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perth@atcwilliams.com.au

Job No: 114185.14

Date: 13/09/2018

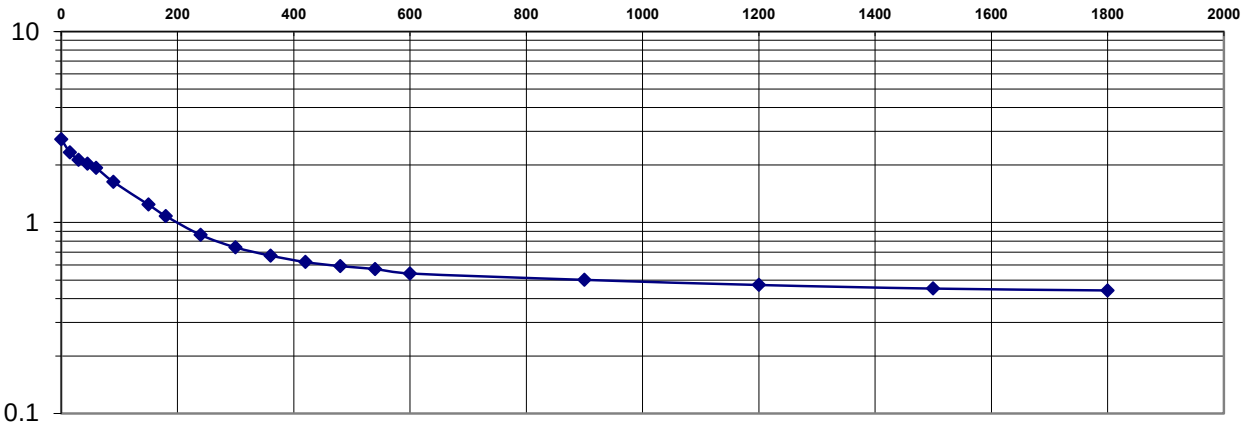
BOREHOLE PERMEABILITY TEST - PORCHET METHOD

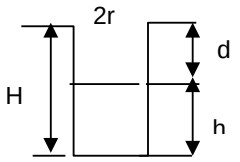
TESTED BY: CJ

PROJECT: IRON BRIDGE OPERATIONS, NORTH STAR MAGNETITE

HOLE NO: BH2A-11 **Depth: (m)** 2.30 **Radius:(m)** 0.062
Water: (m) 3

Test One					Test One (Continued)				
t hr:min:sec	t sec	d m	h m	h + r/2 m	t hr:min:sec	t sec	d m	h m	h + r/2 m
0:00:00	0	-0.4	2.7	2.731					
0:00:15	15	0	2.3	2.331					
0:00:30	30	0.2	2.1	2.131					
0:00:45	45	0.3	2	2.031					
0:01:00	60	0.4	1.9	1.931					
0:01:30	90	0.7	1.6	1.631					
0:02:30	150	1.09	1.21	1.241					
0:03:00	180	1.25	1.05	1.081					
0:04:00	240	1.47	0.83	0.861					
0:05:00	300	1.59	0.71	0.741					
0:06:00	360	1.66	0.64	0.671					
0:07:00	420	1.71	0.59	0.621					
0:08:00	480	1.74	0.56	0.591					
0:09:00	540	1.76	0.54	0.571					
0:10:00	600	1.79	0.51	0.541					
0:15:00	900	1.83	0.47	0.501					
0:20:00	1200	1.86	0.44	0.471					
0:25:00	1500	1.88	0.42	0.451					
0:30:00	1800	1.89	0.41	0.441					





$$K = \frac{1.15 \times r}{t_2 - t_1} \quad \text{Log}_{10} \left[\frac{h_{t1} + r/2}{h_{t2} + r/2} \right]$$

	t1	t2	Permeability
1	15	540	8.30E-05
	600	1800	5.27E-06
2			

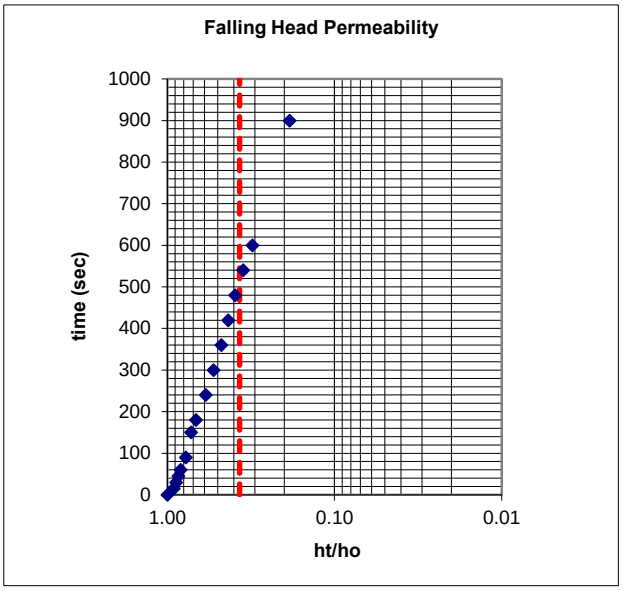
Borehole BH2A-11 **Date** 13-09-18

t (sec)	Depth (m)	ht/ho
0	1.4	1.000
15	1.7	0.917
30	1.8	0.889
45	1.9	0.861
60	2	0.833
90	2.2	0.778
150	2.4	0.722
180	2.57	0.675
240	2.87	0.592
300	3.09	0.531
360	3.28	0.478
420	3.44	0.433
480	3.58	0.394
540	3.73	0.353
600	3.88	0.311
900	4.33	0.186
1200	4.6	0.111
1500	4.88	0.033
1800	5.04	-0.011

Datum (m)*	1.1
Standing Water Level (m)	5
Borehole diameter (m)	0.124
Casing diameter (m)	0.124
Test Section diameter (m)	0.124
Depth of borehole (m)	10.1
Depth of casing (m)	9.6
Test Zone Length	0.7
h0 = Head at test start (m)	3.6
Shape Factor Case (1 - 7)	4

*All measurements below datum

Stratum Description:	
0.0 - 2.6	Cobbles (Alluvial)
2.6 - 3.3	Sandstone EW/HW
3.3 - 8.1	Siltstone HW/MW
8.1 - 9.0	Shale SW



A = cross section area 0.012076 m^2
F = Shape Factor 1.808706
Either **T = Basic time lag (ht/ho = 0.37)** 500 S
Or **t1 =** **t2 =**

K = **1.34E-05** m/s

NORTH STAR PROJECT - PERMEABILITY TESTING

Job No: 114185.14

ATC Williams

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perth@atcwilliams.com.au

Date: 13.09.2018

Our Ref:

APPENDIX E

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

MOISTURE CONTENT TEST REPORT

In accordance with AS 1289.2.1.1

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/9-27_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/9-27**
Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**see below**		
Sampling Method:	**Tested as Received**		

Soil Moisture Content - Oven Drying Method

Sample Number	Sample ID	Moisture Content (%)
LLS18/9	TSF - TP2A - 46 0.4m - 0.6m	**2.8**
LLS18/10	TSF - TP2A - 16 0.7m - 0.9m	**12.3**
LLS18/11	TSF - TP2A - 42 0.5m - 0.7m	**4.3**
LLS18/12	TSF - TP2A - 45 1.7m - 1.9m	**10.1**
LLS18/13	Coarse Rejects 1 - SP01	**0.5**
LLS18/14	Coarse Rejects 2 - SP02	**0.2**
LLS18/15	Coarse Rejects 3 - SP03	**0.3**
LLS18/16	ROM Pad - SP08	**0.8**
LLS18/17	TSF - TP2A - 06 1.0m - 1.2m	**1.9**
LLS18/18	Wastedump 1 - SP05	**1.7**
LLS18/19	Wastedump 2 - SP06	**2.1**

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

MOISTURE CONTENT TEST REPORT

In accordance with AS 1289.2.1.1

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/9-27_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/9-27**
Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**see below**		
Sampling Method:	**Tested as Received**		

Soil Moisture Content - Oven Drying Method

Sample Number	Sample ID	Moisture Content (%)
LLS18/20	Wastedump 3 - SP07	**0.9**
LLS18/21	TSF - TP2A - 04 0.2m - 0.4m	**2.6**
LLS18/22	TSF - TP2A - 24 0.5m - 0.7m	**5.0**
LLS18/23	TSF - TP2A - 54a 0.4m - 0.6m	**4.6**
LLS18/24	TSF - TP2A - 16 0.2m - 0.4m	**5.0**
LLS18/25	Tailings Stage 1 - SP04	**3.2**
LLS18/26	TSF - TP2A - 23 0.4m - 0.6m	**2.3**
LLS18/27	TSF - TP2A - 03 0.5m - 0.7m	**1.7**

Comments:

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Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

EMERSON CLASS TEST REPORT

In accordance with **AS 1289.3.8.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/235-237 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/235-237**
Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**see below**		
Sampling Method:	**Tested as Received**		

EMERSON CLASS NUMBER

Sample Number	Sample ID	Emerson Class Number
LLS18/235	TSF - TP2A-04 0.2-0.4m	**5**
LLS18/236	TSF - TP2A-54a 0.4-0.6m	**5**
LLS18/237	Tailings Stage 1 - SP04	**6**

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 06-February-2018

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UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

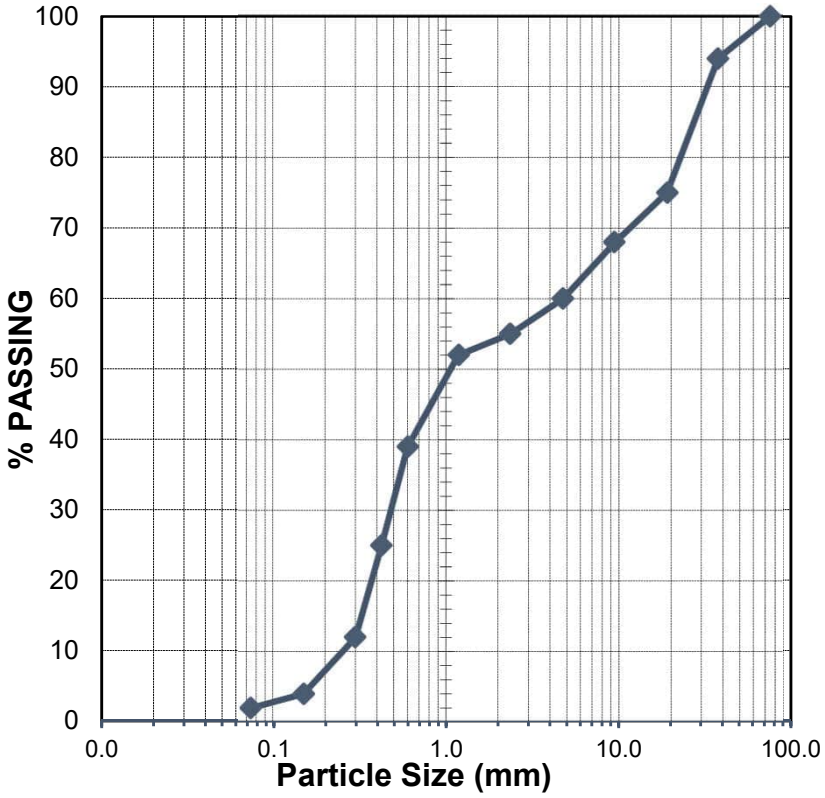
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/27_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/27**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A-03 0.5m - 0.7m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	100
37.5	94
19.0	75
9.5	68
4.75	60
2.36	55
1.18	52
0.600	39
0.425	25
0.300	12
0.150	4
0.075	2

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
				Shrinkage Specimen Details	
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Mould Length (mm)***	***Condition of Dried Specimen***
29	**Not Obtainable**	**NP**	**0.0**	**125** ☐ **250** ☑	**Cracked** ☐ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

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Accreditation No. 19872

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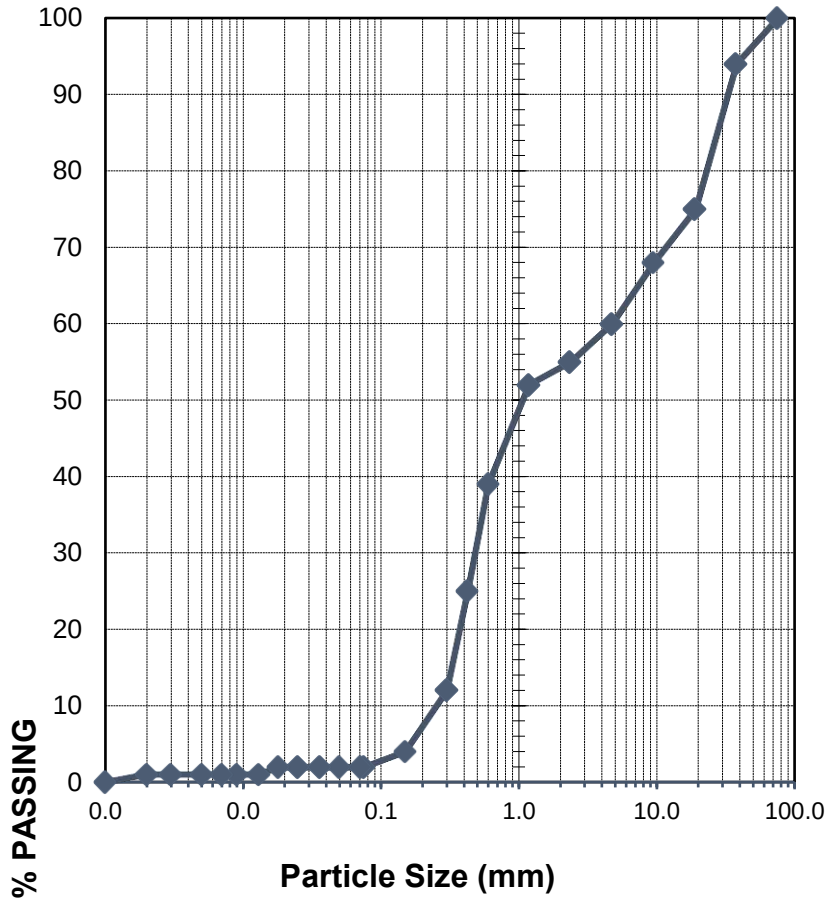
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1,3.6.3 & 3.5.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/238 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/238**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A-03 0.5-0.7m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING AND HYDROMETER



Sieve Size (mm)	Percent Passing Sieve (%)
AS 1289.3.6.1 / 1289.3.6.3	
75.0	100
37.5	94
19.0	75
9.5	68
4.75	60
2.36	55
1.18	52
0.600	39
0.425	25
0.300	12
0.150	4
0.075	2
0.071	2
0.050	2
0.036	2
0.025	2
0.018	2
0.013	1
0.009	1
0.007	1
0.005	1
0.003	1
0.002	1
0.001	0

Field Moisture Content (%) - AS 1289.2.1.1	Particle Density (gm/cm^3) - AS 1289.3.5.1 (-2.36mm)
-	2.73

Comments: *AS 1289.3.6.3 & 3.5.1 not covered under scope of accreditation.*

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

Approved Signatory

Name M. van Herk

Function Laboratory Manager

Issue Date 06-February-2018

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

TEST REPORT

DRY DENSITY & MOISTURE CONTENT RELATION OF SOIL

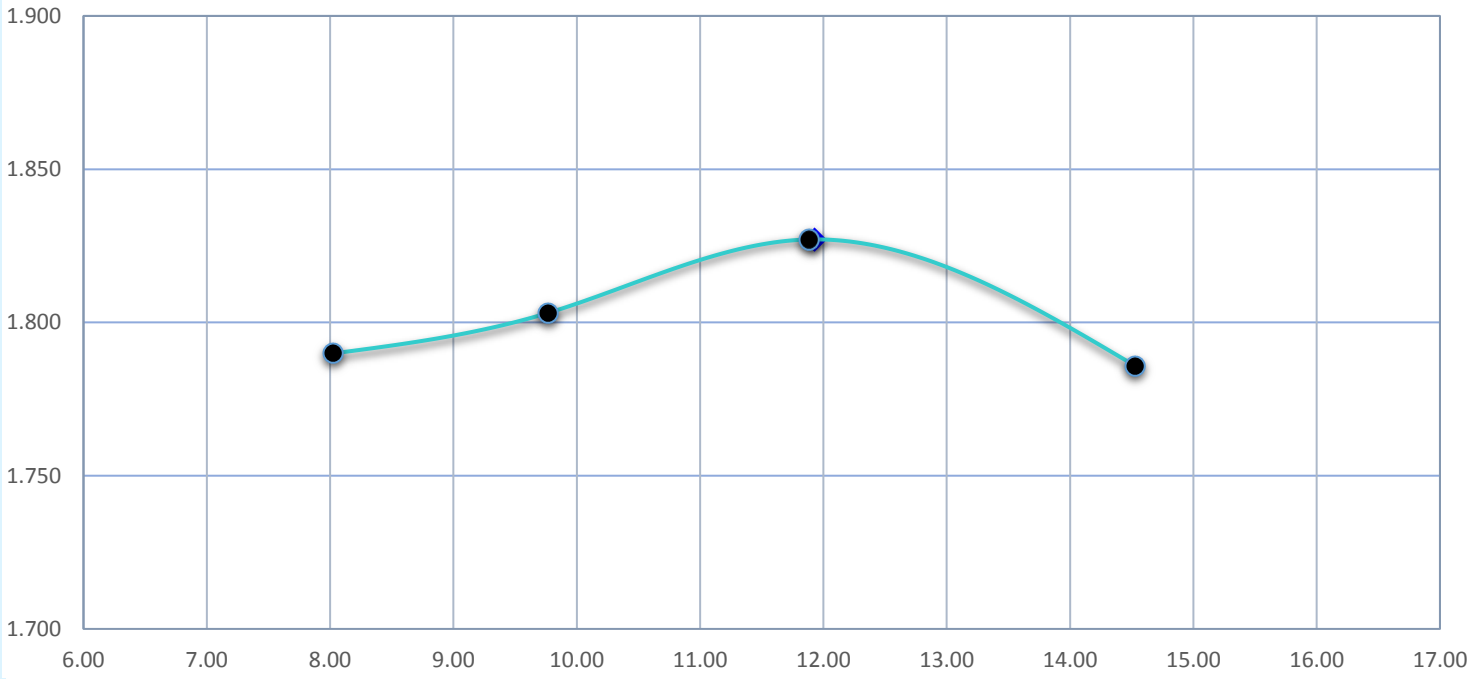
In accordance with **AS 1289.5.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/238 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/238 _1**
Sampling Location	**TSF and Stockpiles**	Date Received	**13/01/2018**
Sample Identification	**TSF - TP2A-03 0.5-0.7m**	Date Tested	**18/01/2018**
Sampling Method	**Sampled by client, tested as received**	Preparation Method	**AS 1289.1.1**
Liquid Limit Method	**Visual/tactile assessment by competent technician**	Sample Curing Time	**24 Hours**

	Oversize Material
Retained 19.0mm (%)	**17.5**

AS 1289.5.1.1, 2.1.1, 1.1	**Laboratory Moisture & Density Results**				
Moisture Content (%)	**8.0**	**9.8**	**11.9**	**14.5**	
Dry Density (t/m³)	**1.790**	**1.803**	**1.827**	**1.786**	

Plot: Dry Density vs. Moisture Content



Maximum Dry Density (t/m³)	**1.827**
Optimum Moisture Content (%)	**11.9**

Comments:

Approved Signatory:

Name: M. van Herk
Function: Laboratory Manager
Date: 20-January-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

FALLING HEAD PERMEABILITY - TEST REPORT

In accordance with **AS 1289.6.7.2, 5.2.1, 2.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/238 _1_FHPERM**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/238**
Sample / Location	**Pilbara**	Sampled By	**Client**
Description	**TSF - TP2A-03 0.5-0.7m**		
Sampling Method:	**Tested as Received**		

Falling Head Permeability

Laboratory Moisture Ratio (%)	101.5
Laboratory Density Ratio (%)	90.0
Compactive Effort	Standard
Surcharge (kPa)	3
% Retained on 19mm Sieve	0
Coefficient of Permeability (m/sec)	**3.1×10^{-4}**

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 07-February-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

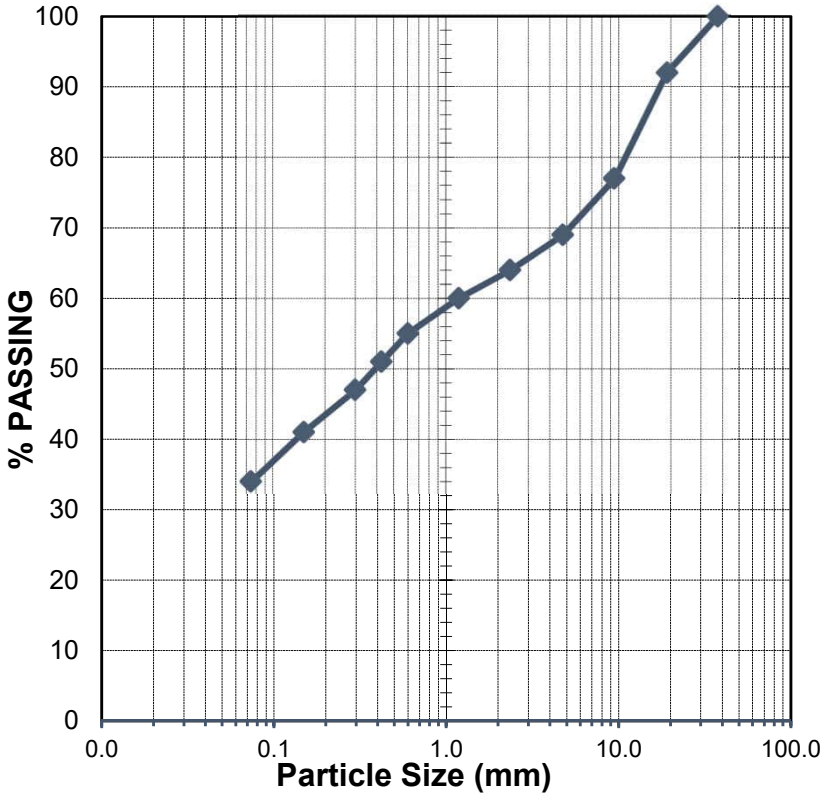
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/21_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/21**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 04 0.2m - 0.4m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	92
9.5	77
4.75	69
2.36	64
1.18	60
0.600	55
0.425	51
0.300	47
0.150	41
0.075	34

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
				Shrinkage Specimen Details	
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Mould Length (mm)***	***Condition of Dried Specimen***
28	**13**	**15**	**6.7**	**125** ☐ **250** ☑	**Cracked** ☐ **Curled** ☑

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

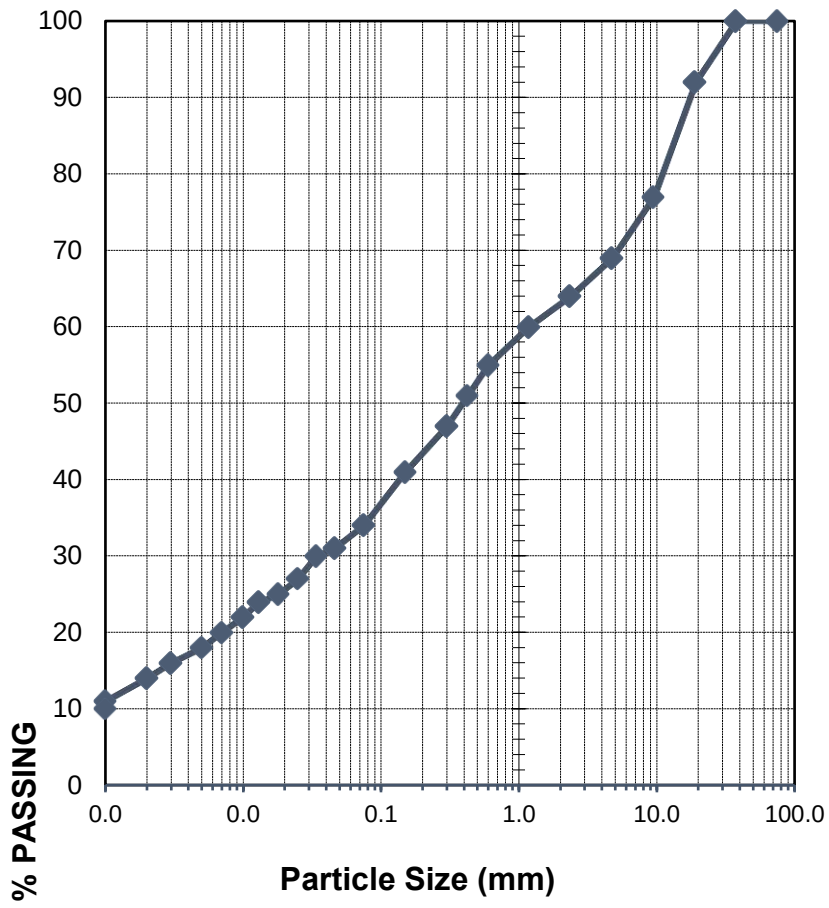
LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1,3.6.3 & 3.5.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/235 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/235**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 04 0.2-0.4m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING AND HYDROMETER



Sieve Size (mm)	Percent Passing Sieve (%)
AS 1289.3.6.1 / 1289.3.6.3	
75.0	100
37.5	100
19.0	92
9.5	77
4.75	69
2.36	64
1.18	60
0.600	55
0.425	51
0.300	47
0.150	41
0.075	34
0.046	31
0.034	30
0.025	27
0.018	25
0.013	24
0.01	22
0.007	20
0.005	18
0.003	16
0.002	14
0.001	11
0.001	10

Field Moisture Content (%) - AS 1289.2.1.1	Particle Density (gm/cm^3) - AS 1289.3.5.1 (-2.36mm)
-	2.81

Comments: *AS 1289.3.6.3 & 3.5.1 not covered under scope of accreditation.*

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

Approved Signatory

Name M. van Herk

Function Laboratory Manager

Issue Date 06-February-2018

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

TEST REPORT

DRY DENSITY & MOISTURE CONTENT RELATION OF SOIL

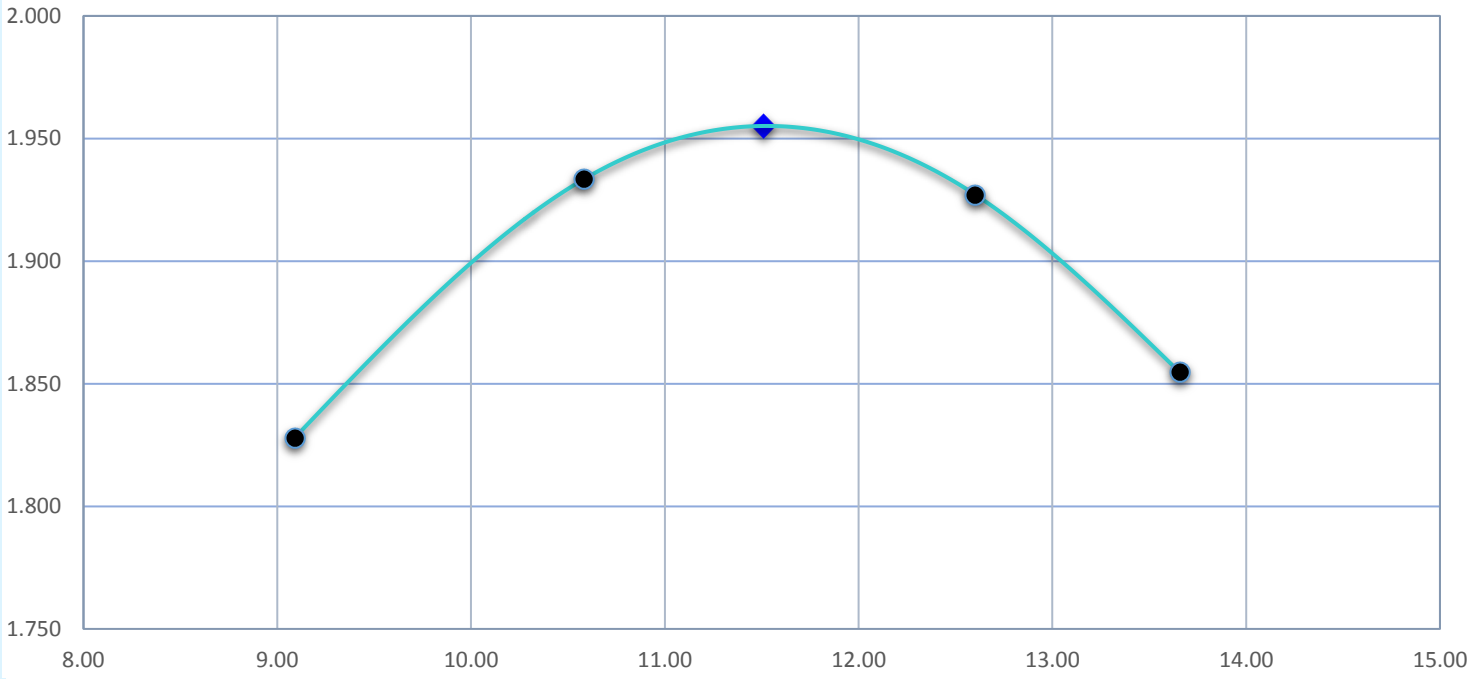
In accordance with **AS 1289.5.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/235 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/235 _1**
Sampling Location	**TSF and Stockpiles**	Date Received	**13/01/2018**
Sample Identification	**TSF - TP2A-04 0.2-0.4m**	Date Tested	**18/01/2018**
Sampling Method	**Sampled by client, tested as received**	Preparation Method	**AS 1289.1.1**
Liquid Limit Method	**Visual/tactile assessment by competent technician**	Sample Curing Time	**24 Hours**

	Oversize Material
Retained 19.0mm (%)	**10.0**

AS 1289.5.1.1, 2.1.1, 1.1	**Laboratory Moisture & Density Results**				
Moisture Content (%)	**9.1**	**10.6**	**12.6**	**13.7**	
Dry Density (t/m³)	**1.828**	**1.933**	**1.927**	**1.855**	

Plot: Dry Density vs. Moisture Content



Maximum Dry Density (t/m³)	**1.955**
Optimum Moisture Content (%)	**11.5**

Comments:

Approved Signatory:

Name: M. van Herk

Function: Laboratory Manager

Date: 20-January-2018

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FALLING HEAD PERMEABILITY - TEST REPORT

In accordance with **AS 1289.6.7.2, 5.2.1, 2.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/235 _1_FHPERM**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/235**
Sample / Location	**Pilbara**	Sampled By	**Client**
Description	**TSF - TP2A-04 0.2-0.4m**		
Sampling Method:	**Tested as Received**		

Falling Head Permeability

Laboratory Moisture Ratio (%)	98.5
Laboratory Density Ratio (%)	98.5
Compactive Effort	Standard
Surcharge (kPa)	3
% Retained on 19mm Sieve	0
Coefficient of Permeability (m/sec)	**$6.0 \times 10^{(-10)}$**

Comments:

NATA
WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

Approved Signatory

Name	M. van Herk
Function	Laboratory Manager
Issue Date	07-February-2018

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E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

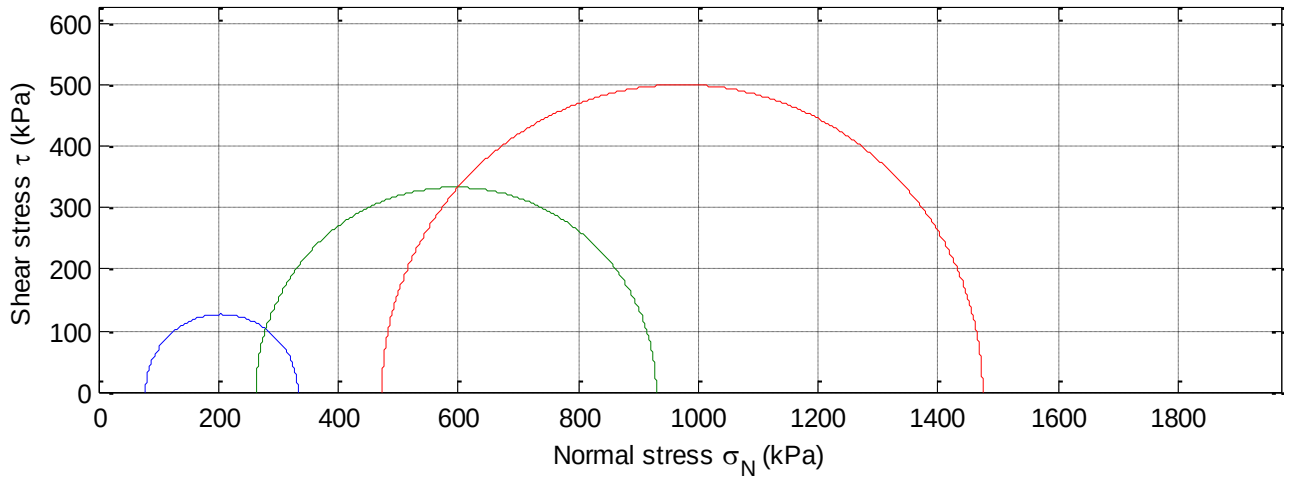
Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-04	Lab:	EPLab
Sample ID:	LLS18_255_LL1801_CU3		
Depth (m):	0.20 - 0.40	Room Temperature at Test:	~ 18°c

Tested by:	Phil	Initial Moisture (%):	11.58	Strain Rate (mm/min):	0.006
Height (mm):	138.16	Final Moisture (%):	8.21	Skempton's (B):	0.99
Diameter (mm):	59.81	Bulk Density (t/m³):	2.14	Geology:	-
L/D Ratio:	2.31	Dry Density (t/m³):	1.92		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	21.28	30.62	77.26
Angle of Shear Resistance Φ' (Degrees) :	31.92	29.25	26.57

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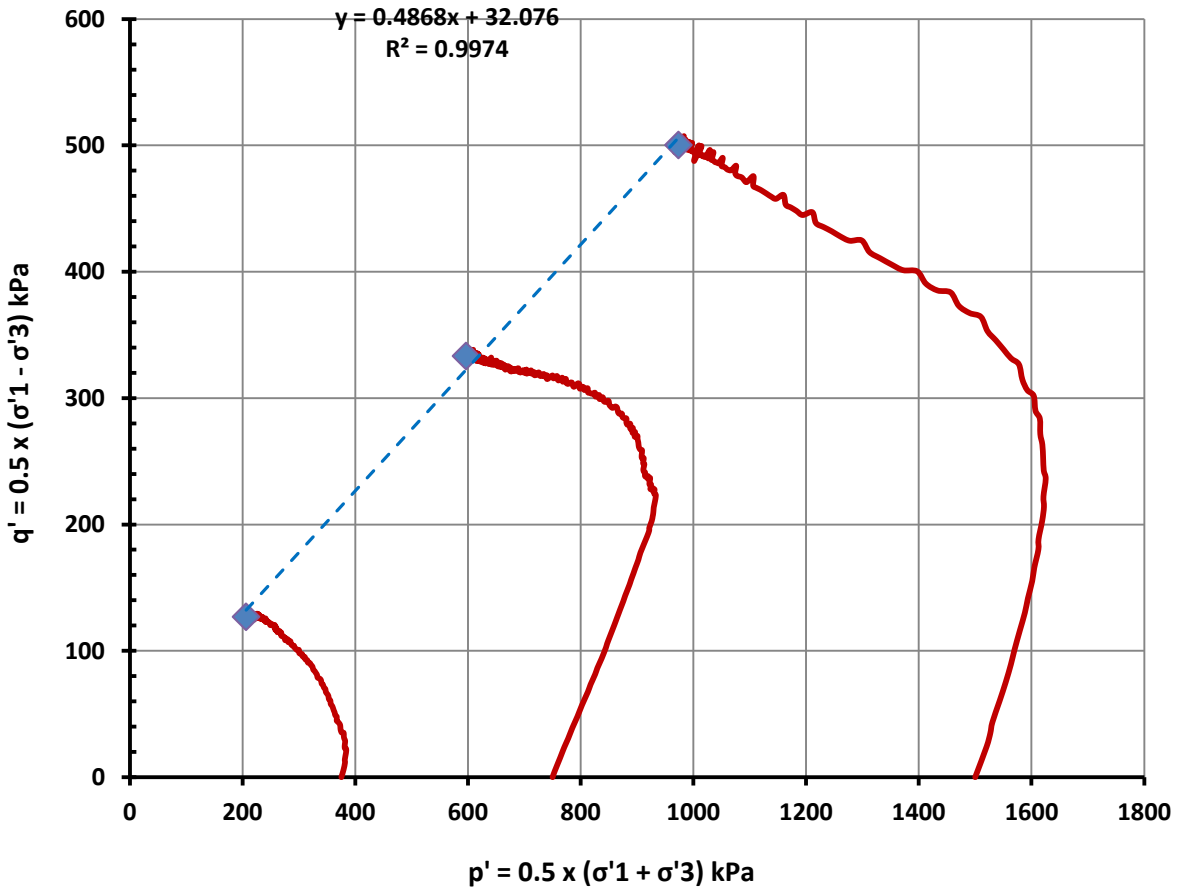
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-04	Lab:	EPLab
Sample ID:	LLS18_255_LL1801_CU3		
Depth (m):	0.20 - 0.40	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : 36.73

Angle of Shear Resistance Φ' (Deg) : 29.13

Integrity Precision Innovation

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Mob: 0422 814 231

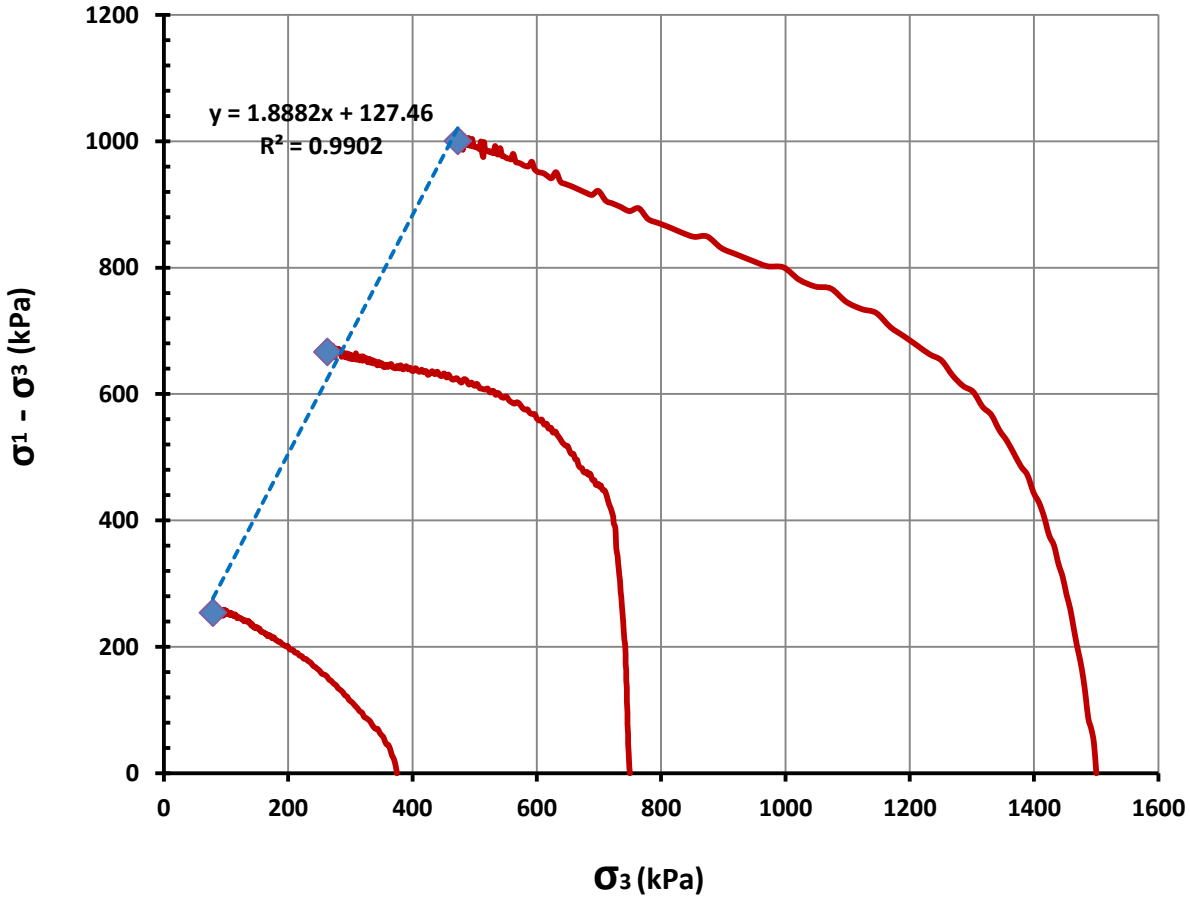
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-04	Lab:	EPLab
Sample ID:	LLS18_255_LL1801_CU3		
Depth (m):	0.20 - 0.40	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	**37.49**
Angle of Shear Resistance Φ' (Deg) :	**29.07**

Integrity Precision Innovation

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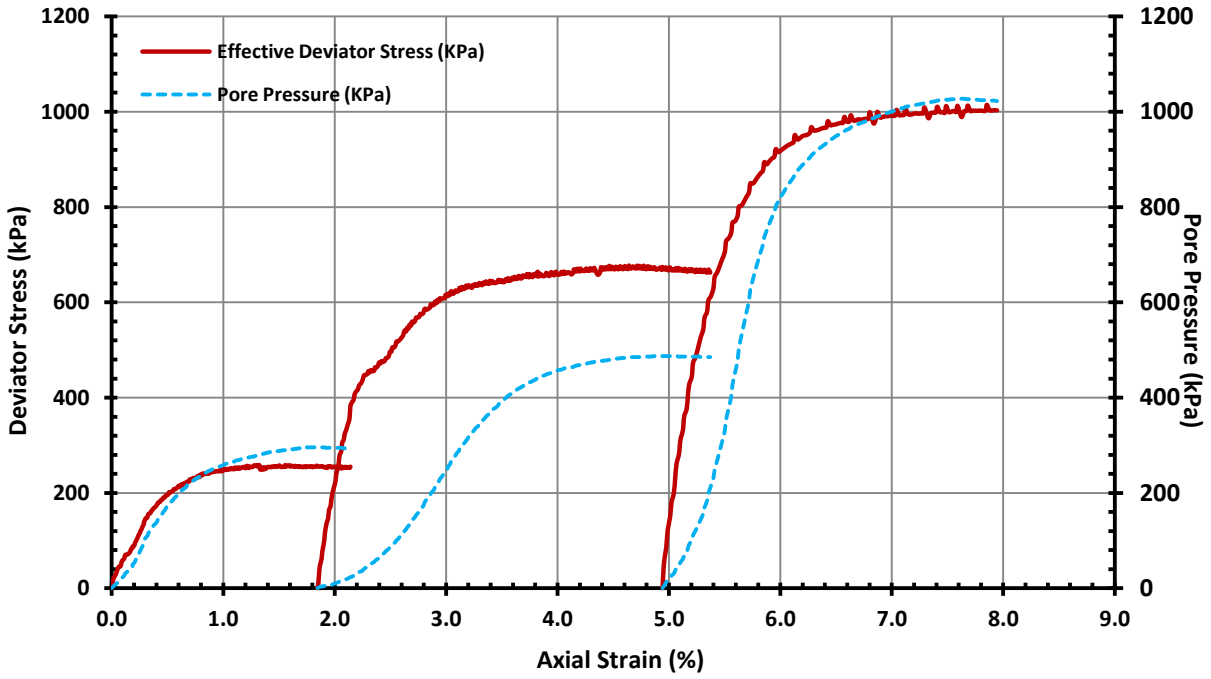
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-04	Lab:	EPLab
Sample ID:	LLS18_255_LL1801_CU3		
Depth (m):	0.20 - 0.40	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	375	0	296	333	79	4.21	254	1.91
2	750	0	487	930	263	3.53	667	5.08
3	1500	0	1027	1474	473	3.12	1001	7.65

Integrity Precision Innovation

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E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-04	Lab:	EPLab
Sample ID:	LLS18_255_LL1801_CU3		
Depth (m):	0.20 - 0.40	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID: TSF-TP2A-04 **Depth (m):** 0.20 - 0.40
Lab ID: LLS18_255_LL1801_CU3 **Date Tested:** 22/01/2018

Failure Mode: Bulging Failure

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

Integrity Precision Innovation

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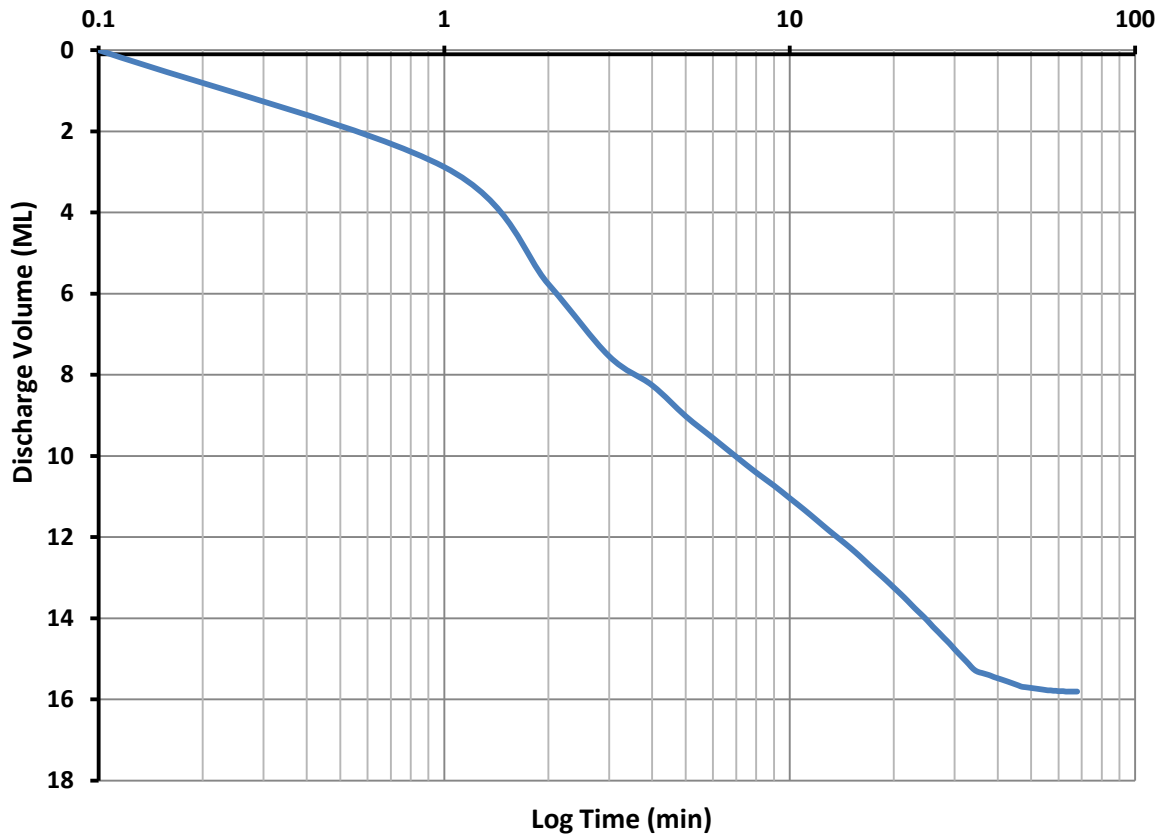
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-04	Lab:	EPLab
Sample ID:	LLS18_255_LL1801_CU3		
Depth (m):	0.20 - 0.40	Room Temperature at Test:	~ 18°C

Discharge Volume (ML) Vs Log Time (min)



Cv (cm²/s): 0.048 based on t_{90}

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CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

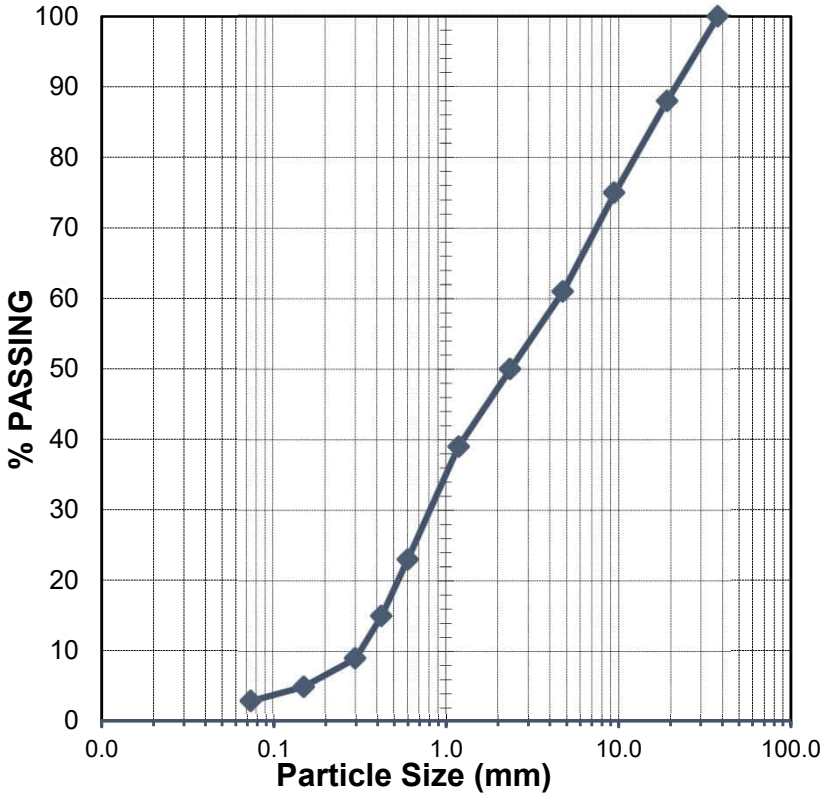
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/17_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/17**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 06 1.0m - 1.2m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	88
9.5	75
4.75	61
2.36	50
1.18	39
0.600	23
0.425	15
0.300	9
0.150	5
0.075	3

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
25	**Not Obtainable**	**NP**	**0.0**	**125** ☑ **250** ☐	**Cracked** ☐ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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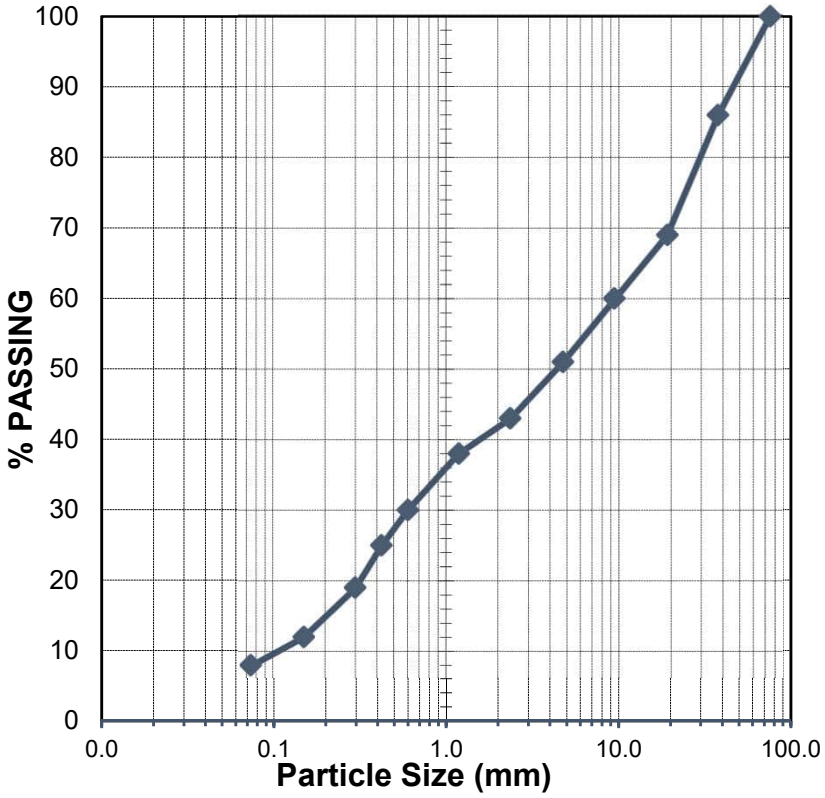
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/24_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/24**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 16 0.2m - 0.4m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	100
37.5	86
19.0	69
9.5	60
4.75	51
2.36	43
1.18	38
0.600	30
0.425	25
0.300	19
0.150	12
0.075	8

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
				Shrinkage Specimen Details	
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Mould Length (mm)***	***Condition of Dried Specimen***
25	**15**	**11**	**3.6**	**125** ☐ **250** ☑	**Cracked** ☑ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

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UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

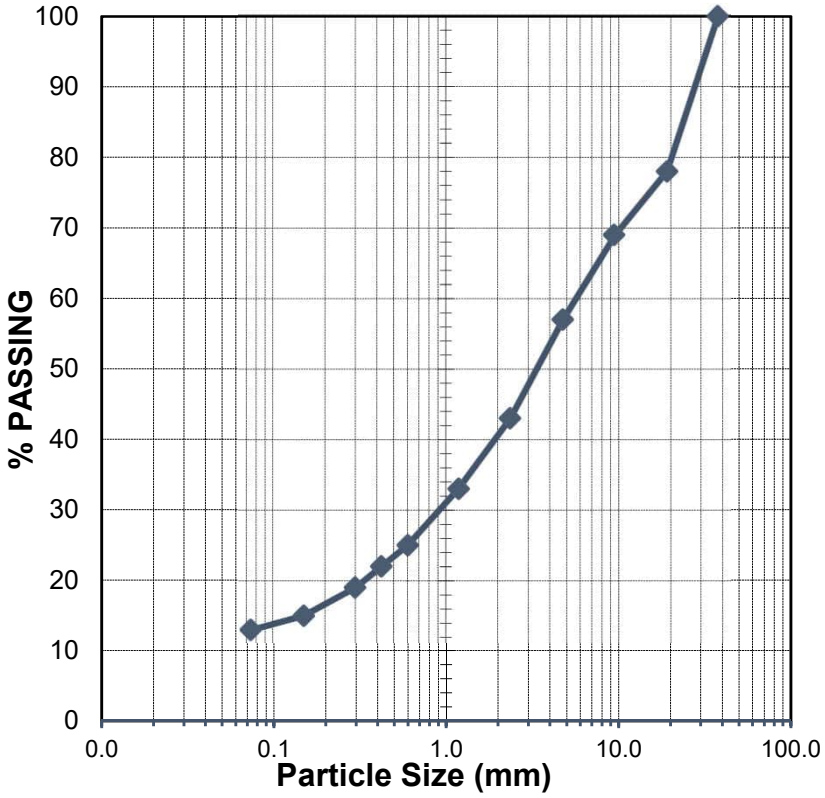
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/10_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/10**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 16 0.7m - 0.9m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	78
9.5	69
4.75	57
2.36	43
1.18	33
0.600	25
0.425	22
0.300	19
0.150	15
0.075	13

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
				Shrinkage Specimen Details	
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Mould Length (mm)***	***Condition of Dried Specimen***
52	**28**	**24**	**10.4**	**125** ☑ **250** ☐	**Cracked** ☐ **Curled** ☑

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing
Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

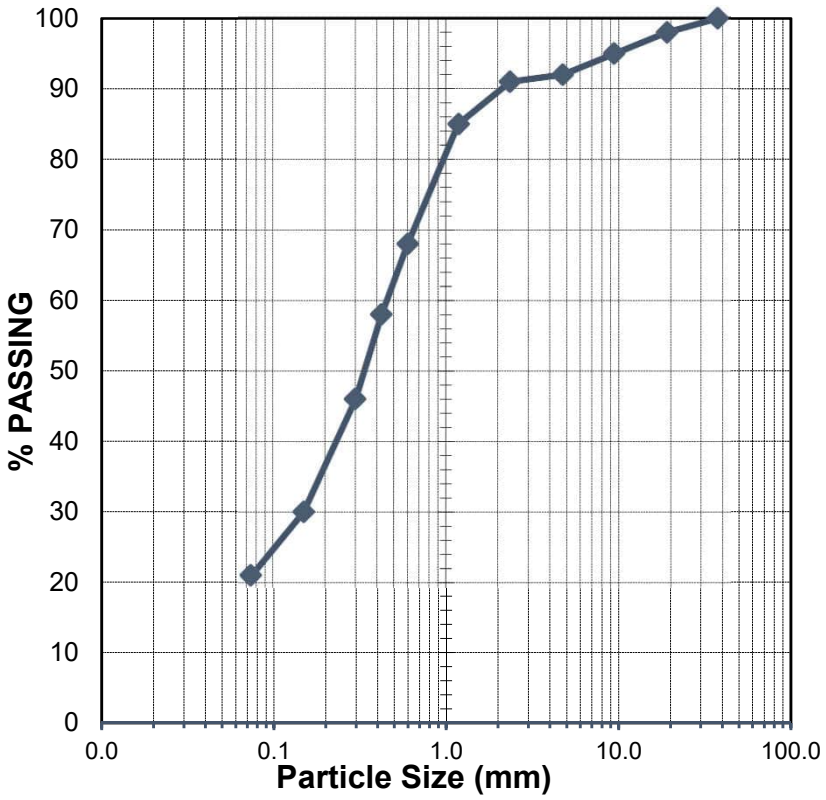
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/26_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/26**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A-23 0.4m - 0.6m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	98
9.5	95
4.75	92
2.36	91
1.18	85
0.600	68
0.425	58
0.300	46
0.150	30
0.075	21

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
				Shrinkage Specimen Details	
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Mould Length (mm)***	***Condition of Dried Specimen***
28	**22**	**7**	**2.0**	**125** ☐ **250** ☑	**Cracked** ☑ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

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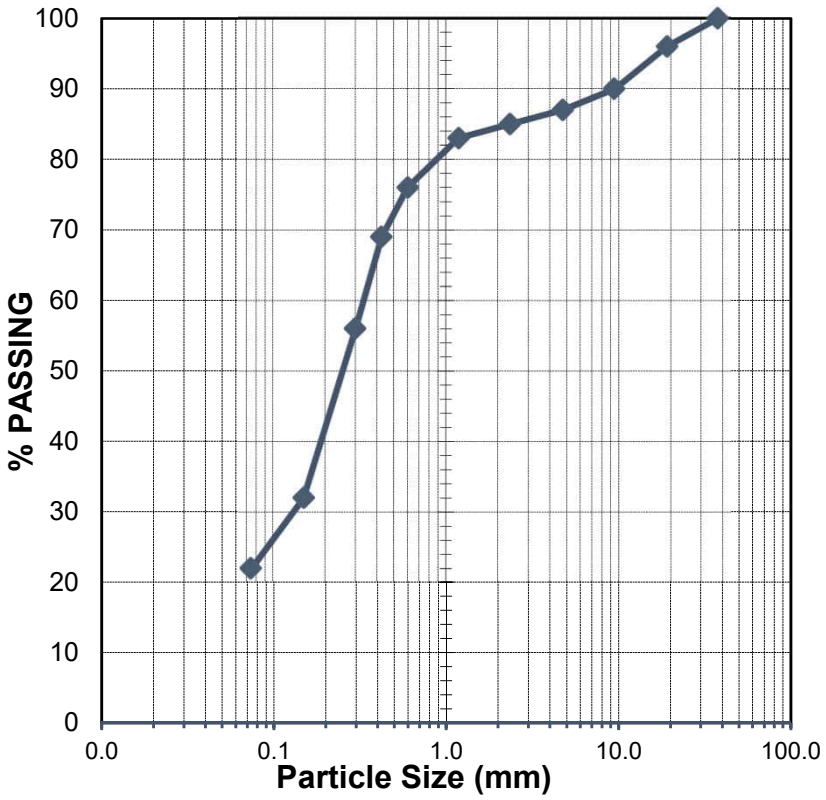
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/22_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/22**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 24 0.5m - 0.7m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	96
9.5	90
4.75	87
2.36	85
1.18	83
0.600	76
0.425	69
0.300	56
0.150	32
0.075	22

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
23	**14**	**9**	**1.2**	**125** ☐ **250** ☑	**Cracked** ☑ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

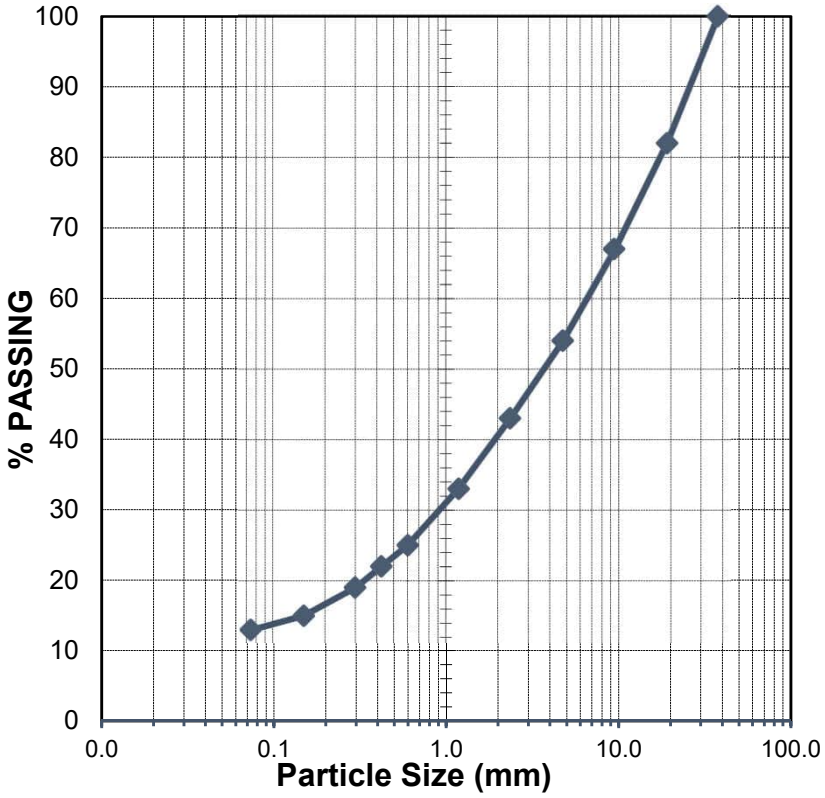
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/11_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/11**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 42 0.5m - 0.7m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	82
9.5	67
4.75	54
2.36	43
1.18	33
0.600	25
0.425	22
0.300	19
0.150	15
0.075	13

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
28	**13**	**15**	**6.4**	**125** ☑ **250** ☐	**Cracked** ☐ **Curled** ☑

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

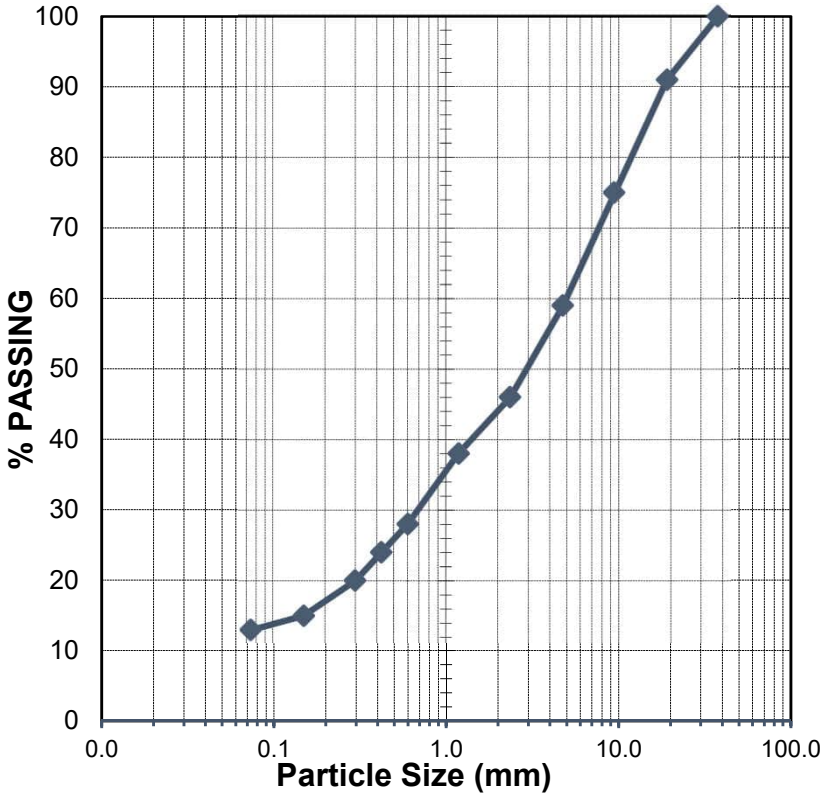
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/12_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/12**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 45 1.7m - 1.9m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	91
9.5	75
4.75	59
2.36	46
1.18	38
0.600	28
0.425	24
0.300	20
0.150	15
0.075	13

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
47	**21**	**27**	**12.0**	**125** ☑ **250** ☐	**Cracked** ☐ **Curled** ☑

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

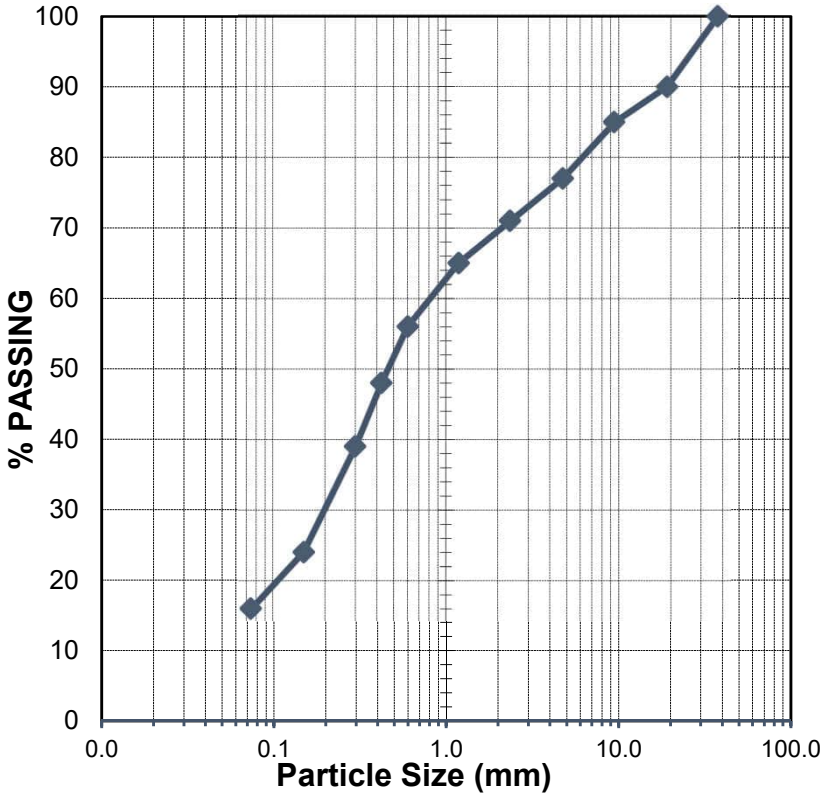
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/9_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/9**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 46 0.4m - 0.6m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	90
9.5	85
4.75	77
2.36	71
1.18	65
0.600	56
0.425	48
0.300	39
0.150	24
0.075	16

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
				Shrinkage Specimen Details	
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Mould Length (mm)***	***Condition of Dried Specimen***
22	**15**	**7**	**2.4**	**125** ☑ **250** ☐	**Cracked** ☑ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

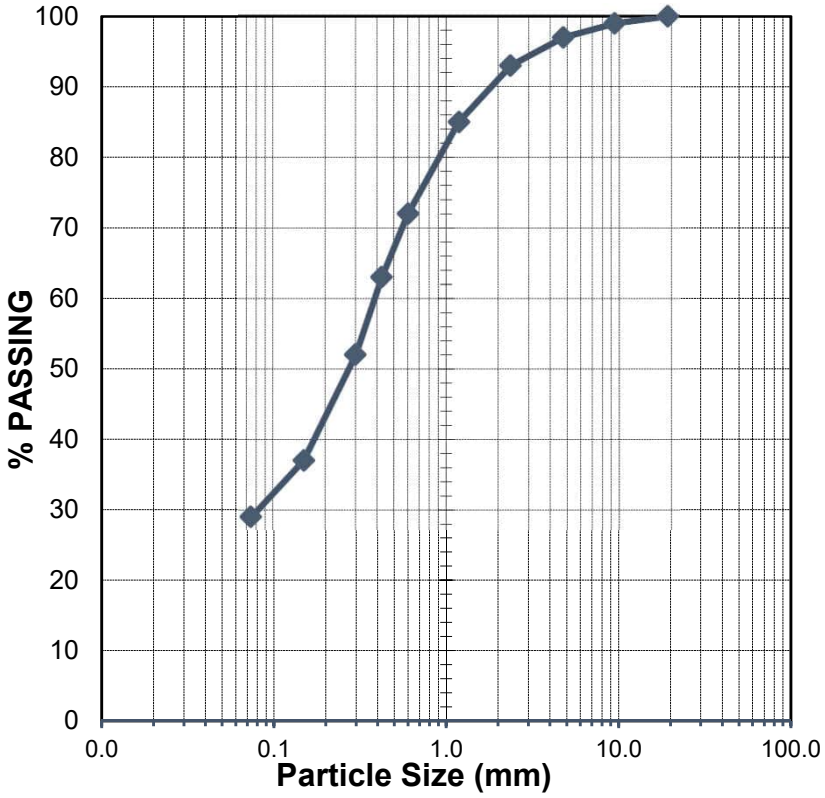
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/23_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/23**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 54a 0.4m - 0.6m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	
19.0	100
9.5	99
4.75	97
2.36	93
1.18	85
0.600	72
0.425	63
0.300	52
0.150	37
0.075	29

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
				Shrinkage Specimen Details	
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Mould Length (mm)***	***Condition of Dried Specimen***
25	**12**	**14**	**4.0**	**125** ☐ **250** ☑	**Cracked** ☑ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing
Accreditation No. 19872

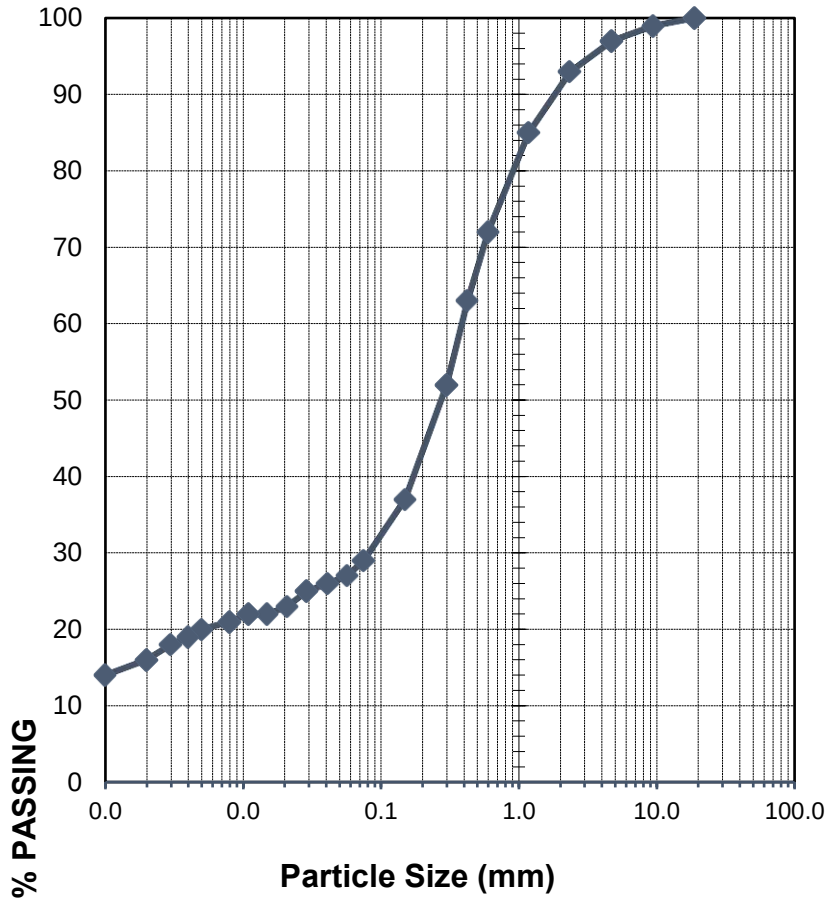
LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1,3.6.3 & 3.5.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/236 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/236**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**TSF - TP2A - 54a 0.4-0.6m**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING AND HYDROMETER



Sieve Size (mm)	Percent Passing Sieve (%)
AS 1289.3.6.1 / 1289.3.6.3	
75.0	
37.5	
19.0	100
9.5	99
4.75	97
2.36	93
1.18	85
0.600	72
0.425	63
0.300	52
0.150	37
0.075	29
0.057	27
0.041	26
0.029	25
0.021	23
0.015	22
0.011	22
0.008	21
0.005	20
0.004	19
0.003	18
0.002	16
0.001	14

Field Moisture Content (%) - AS 1289.2.1.1	Particle Density (gm/cm^3) - AS 1289.3.5.1 (-2.36mm)
-	2.68

Comments: *AS 1289.3.6.3 & 3.5.1 not covered under scope of accreditation.*

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

Approved Signatory

Name M. van Herk

Function Laboratory Manager

Issue Date 06-February-2018

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

TEST REPORT

DRY DENSITY & MOISTURE CONTENT RELATION OF SOIL

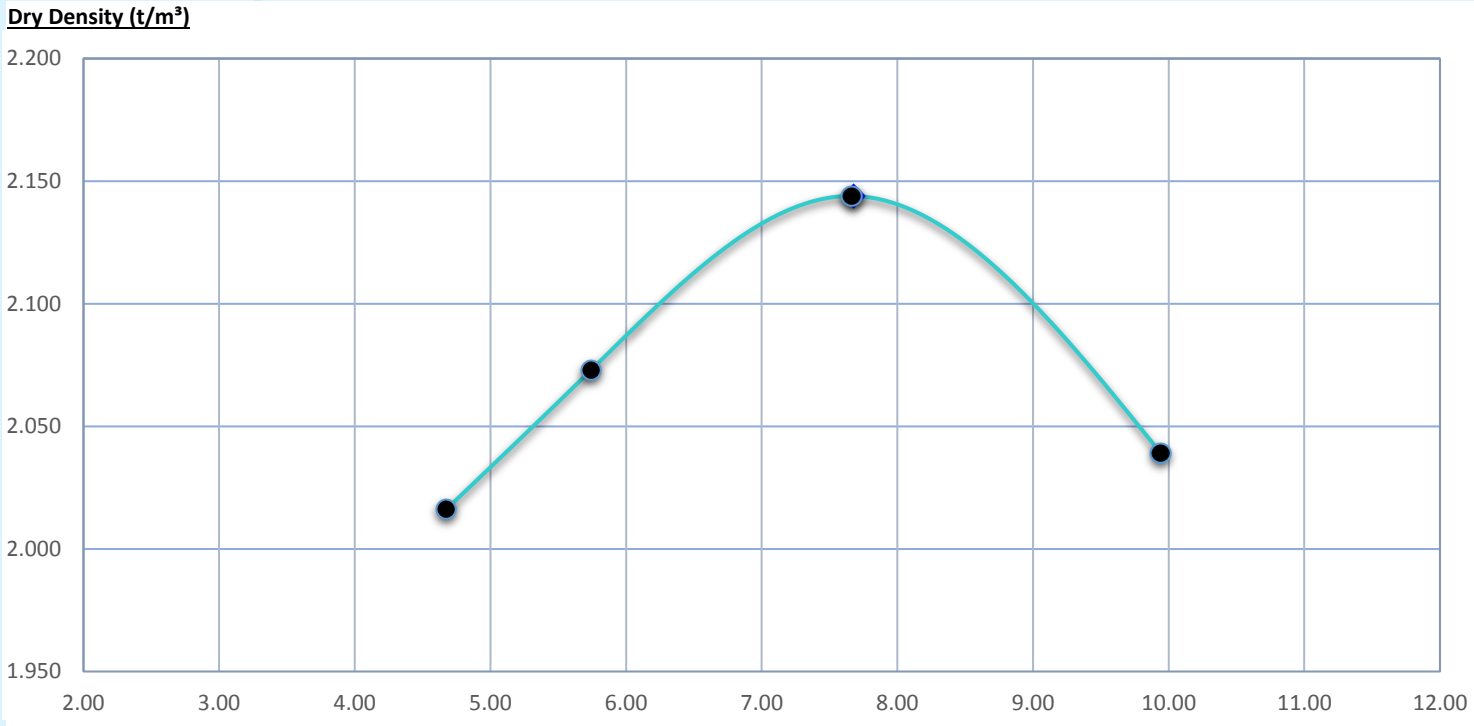
In accordance with **AS 1289.5.2.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/236 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/236**
Sampling Location	**TSF and Stockpiles**	Date Received	**13/01/2018**
Sample Identification	**TSF - TP2A-54A 0.4-0.6m**	Date Tested	**19/01/2018**
Sampling Method	**Sampled by client, tested as received**	Preparation Method	**AS 1289.1.1**
Liquid Limit Method	**Visual/tactile assessment by competent technician**	Sample Curing Time	**24 Hours**

Oversize Material	
Retained 19.0mm (%)	**5.3**

AS 1289.5.2.1, 2.1.1, 1.1	**Laboratory Moisture & Density Results**				
Moisture Content (%)	**4.7**	**5.7**	**7.7**	**9.9**	
Dry Density (t/m³)	**2.016**	**2.073**	**2.144**	**2.039**	

Plot: Dry Density vs. Moisture Content



Maximum Dry Density (t/m³)	**2.144**
Optimum Moisture Content (%)	**7.7**

Comments:

Approved Signatory:

Name: M. van Herk
Function: Laboratory Manager
Date: 20-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

TEST REPORT

DRY DENSITY & MOISTURE CONTENT RELATION OF SOIL

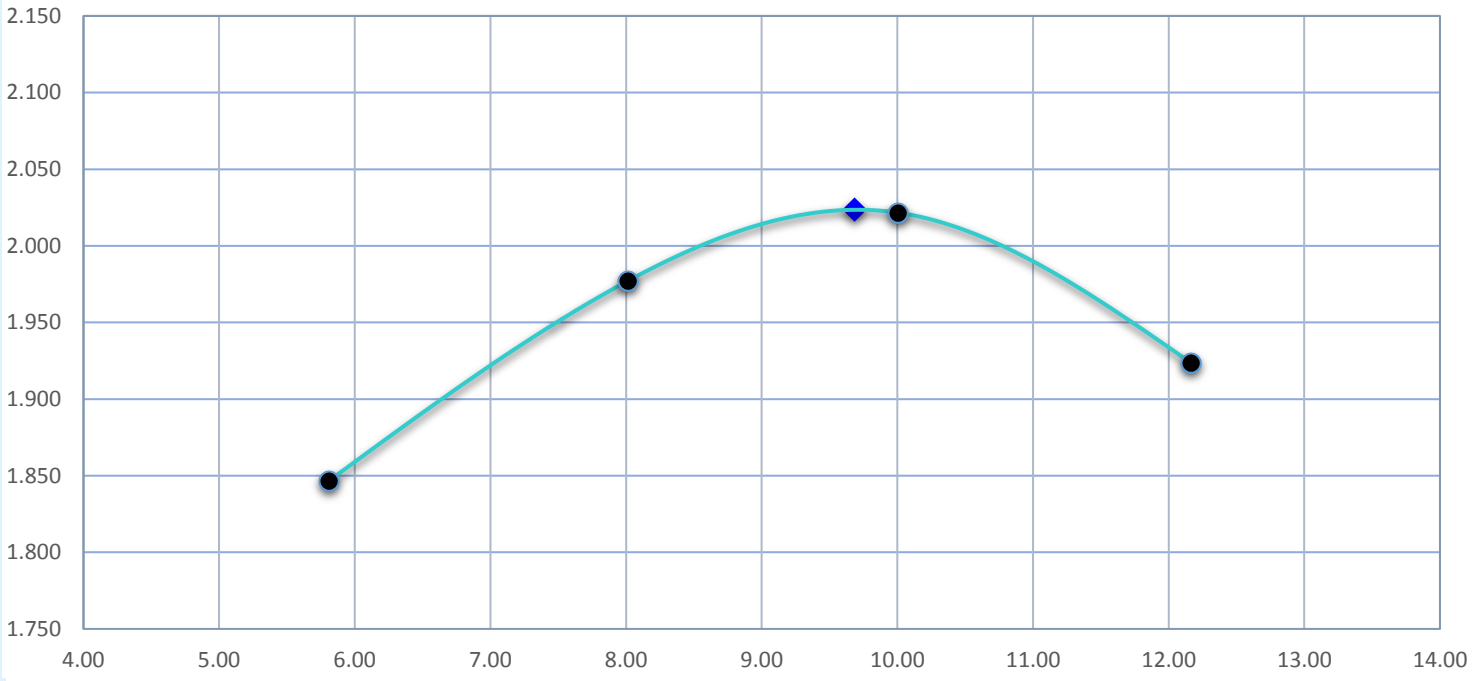
In accordance with **AS 1289.5.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/236 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/236 _1**
Sampling Location	**TSF and Stockpiles**	Date Received	**13/01/2018**
Sample Identification	**TSF - TP2A-54A 0.4-0.6m**	Date Tested	**18/01/2018**
Sampling Method	**Sampled by client, tested as received**	Preparation Method	**AS 1289.1.1**
Liquid Limit Method	**Visual/tactile assessment by competent technician**	Sample Curing Time	**24 Hours**

	Oversize Material
Retained 19.0mm (%)	**5.3**

AS 1289.5.1.1, 2.1.1, 1.1	**Laboratory Moisture & Density Results**				
Moisture Content (%)	**5.8**	**8.0**	**10.0**	**12.2**	
Dry Density (t/m³)	**1.847**	**1.977**	**2.022**	**1.924**	

Plot: Dry Density vs. Moisture Content



Maximum Dry Density (t/m³)	**2.023**
Optimum Moisture Content (%)	**9.7**

Comments:

Approved Signatory:

Name: M. van Herk
Function: Laboratory Manager
Date: 20-January-2018

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LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

FALLING HEAD PERMEABILITY - TEST REPORT

In accordance with **AS 1289.6.7.2, 5.2.1, 2.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/236 _1_FHPERM**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/236**
Sample / Location	**Pilbara**	Sampled By	**Client**
Description	**TSF - TP2A-54a 0.4-0.6m**		
Sampling Method:	**Tested as Received**		

Falling Head Permeability

Laboratory Moisture Ratio (%)	101.0
Laboratory Density Ratio (%)	98.0
Compactive Effort	Standard
Surcharge (kPa)	3
% Retained on 19mm Sieve	0
Coefficient of Permeability (m/sec)	**$1.0 \times 10^{(-9)}$**

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 07-February-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing
Accreditation No. 19872

Perth
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WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

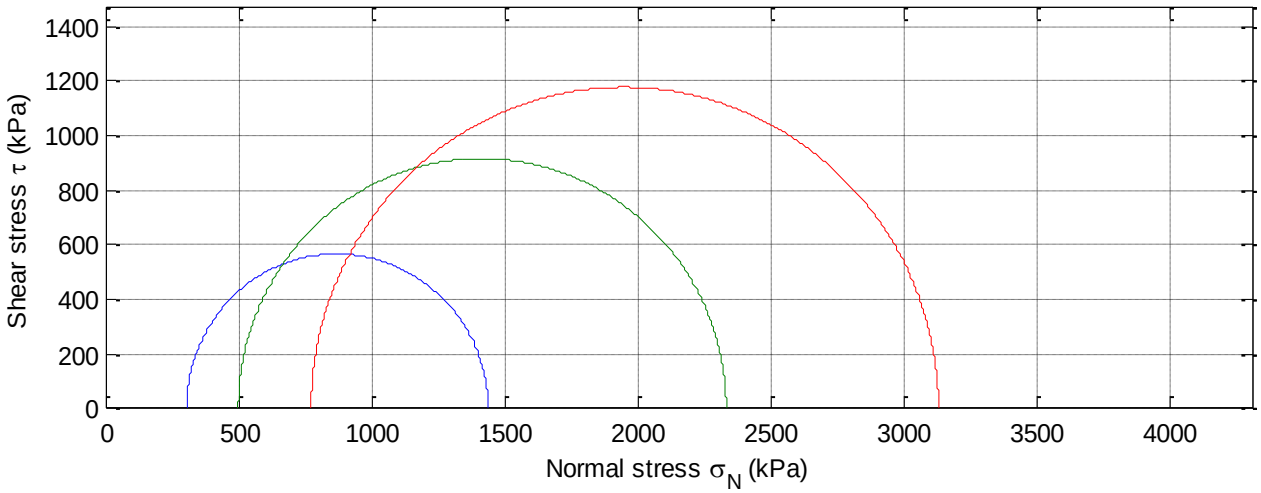
Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-54A	Lab:	EPLab
Sample ID:	LLS18_236_LL1801_CU3		
Depth (m):	0.40 - 0.60	Room Temperature at Test:	~ 18°c

Tested by:	Phil	Initial Moisture (%):	9.45	Strain Rate (mm/min):	0.006
Height (mm):	128.02	Final Moisture (%):	6.91	Skempton's (B):	0.99
Diameter (mm):	62.21	Bulk Density (t/m³):	2.17	Geology:	-
L/D Ratio:	2.06	Dry Density (t/m³):	1.98		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	7.57	88.37	258.14
Angle of Shear Resistance Φ' (Degrees) :	40.03	34.61	29.25

Integrity Precision Innovation

Perth
Unit 3, 34 Sphinx Way
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WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

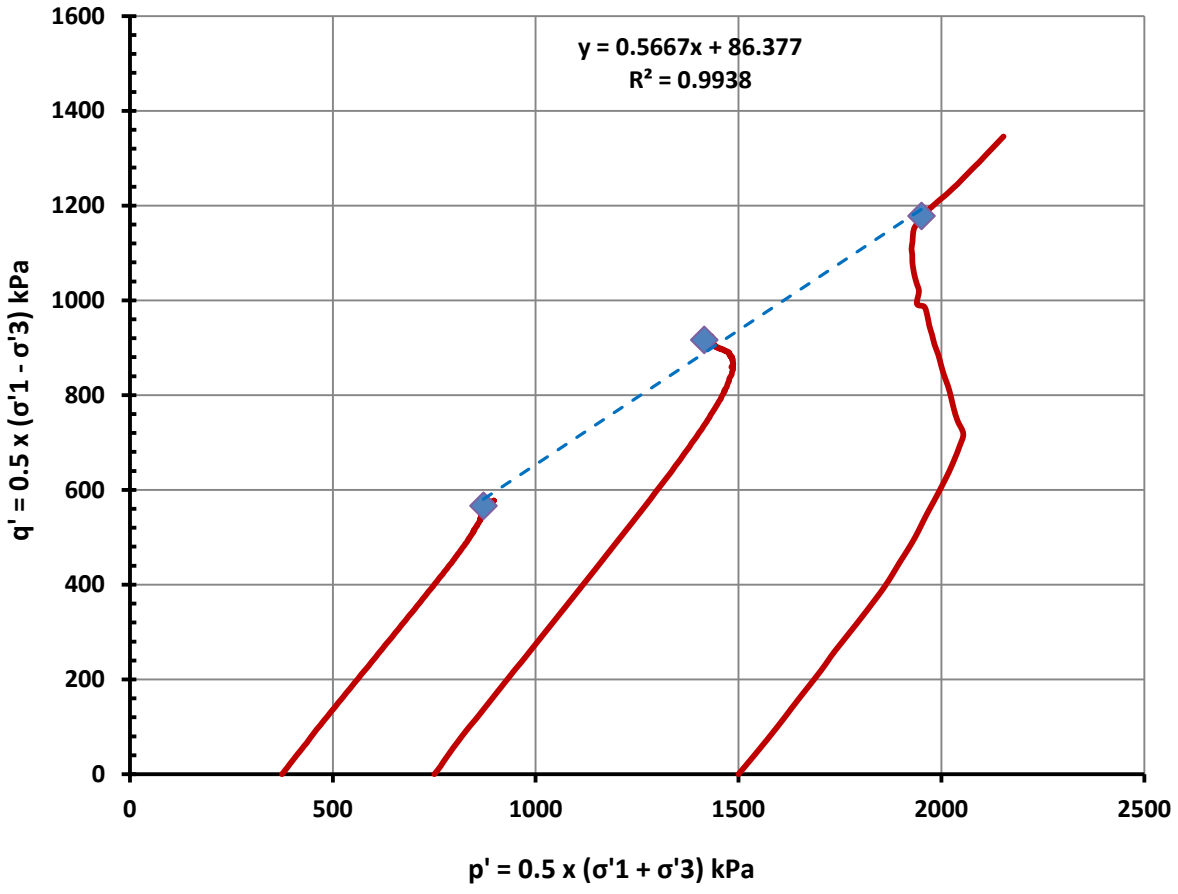
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-54A	Lab:	EPLab
Sample ID:	LLS18_236_LL1801_CU3		
Depth (m):	0.40 - 0.60	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	**104.84**
Angle of Shear Resistance Φ' (Deg) :	**34.52**

Integrity Precision Innovation

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

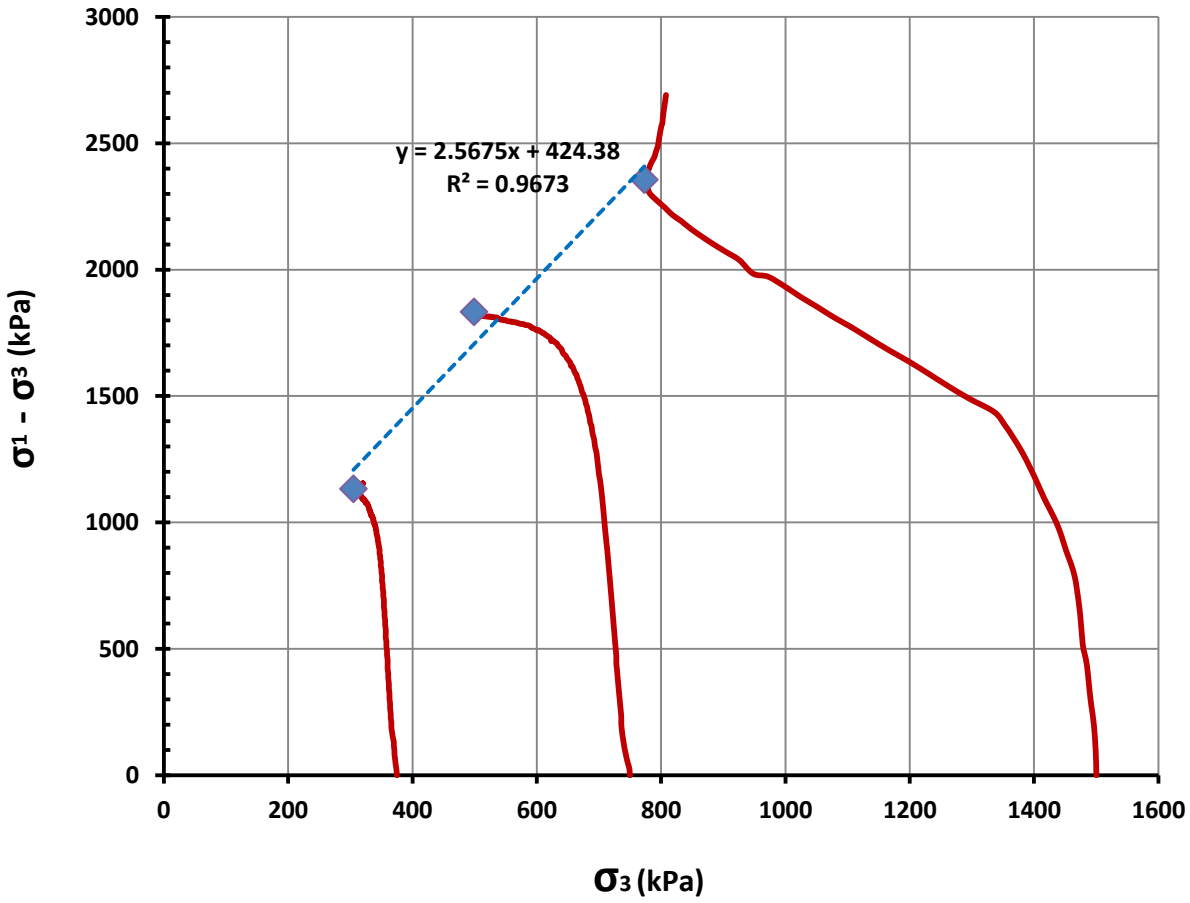
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-54A	Lab:	EPLab
Sample ID:	LLS18_236_LL1801_CU3		
Depth (m):	0.40 - 0.60	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : 112.30

Angle of Shear Resistance Φ' (Deg) : 34.22

Integrity Precision Innovation

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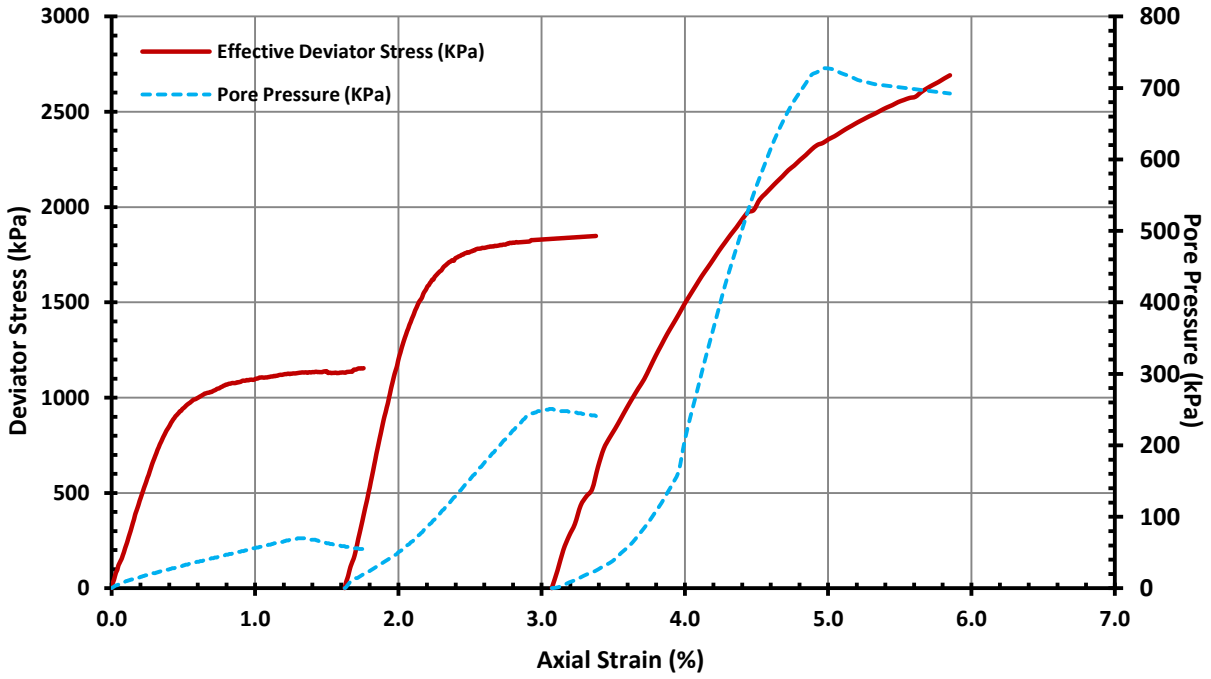
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-54A	Lab:	EPLab
Sample ID:	LLS18_236_LL1801_CU3		
Depth (m):	0.40 - 0.60	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'_0	U'_f	Principal Effective Stresses			$\sigma'_1 - \sigma'_3$	Strain (%)
				σ'_1	σ'_3	σ'_1 / σ'_3		
1	375	0	70	1438	305	4.71	1133	1.35
2	750	0	251	2332	499	4.67	1833	3.08
3	1500	0	727	3129	773	4.05	2356	5.00

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Mob: 0422 814 231

E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-54A	Lab:	EPLab
Sample ID:	LLS18_236_LL1801_CU3		
Depth (m):	0.40 - 0.60	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID: TSF-TP2A-54A **Depth (m):** 0.40 - 0.60
Lab ID: LLS18_236_LL1801_CU3 **Date Tested:** 22/01/2018

Failure Mode: Shear Failure to Vertical @ 35.2°

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

Integrity Precision Innovation

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Mob: 0422 814 231

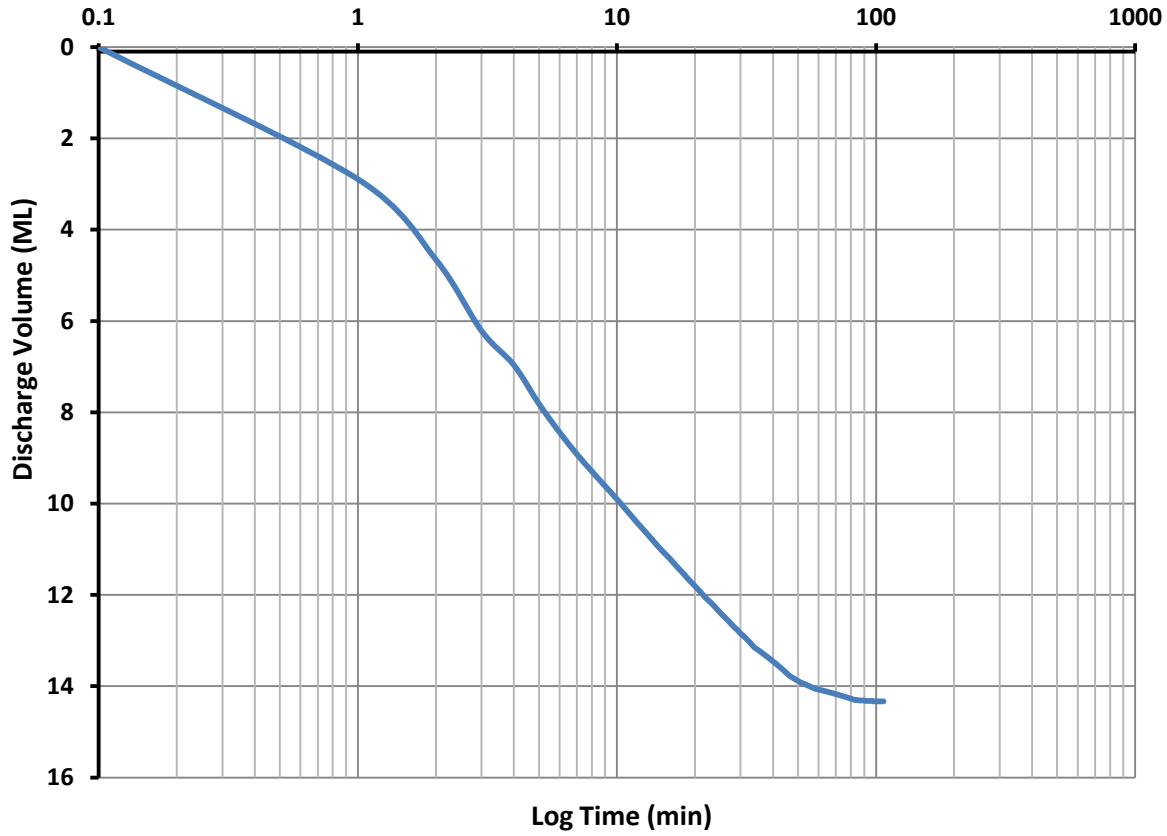
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	TSF-TP2A-54A	Lab:	EPLab
Sample ID:	LLS18_236_LL1801_CU3		
Depth (m):	0.40 - 0.60	Room Temperature at Test:	~ 18°C

Discharge Volume (ML) Vs Log Time (min)



Cv (cm²/s): 0.062 based on t_{90}

Integrity Precision Innovation

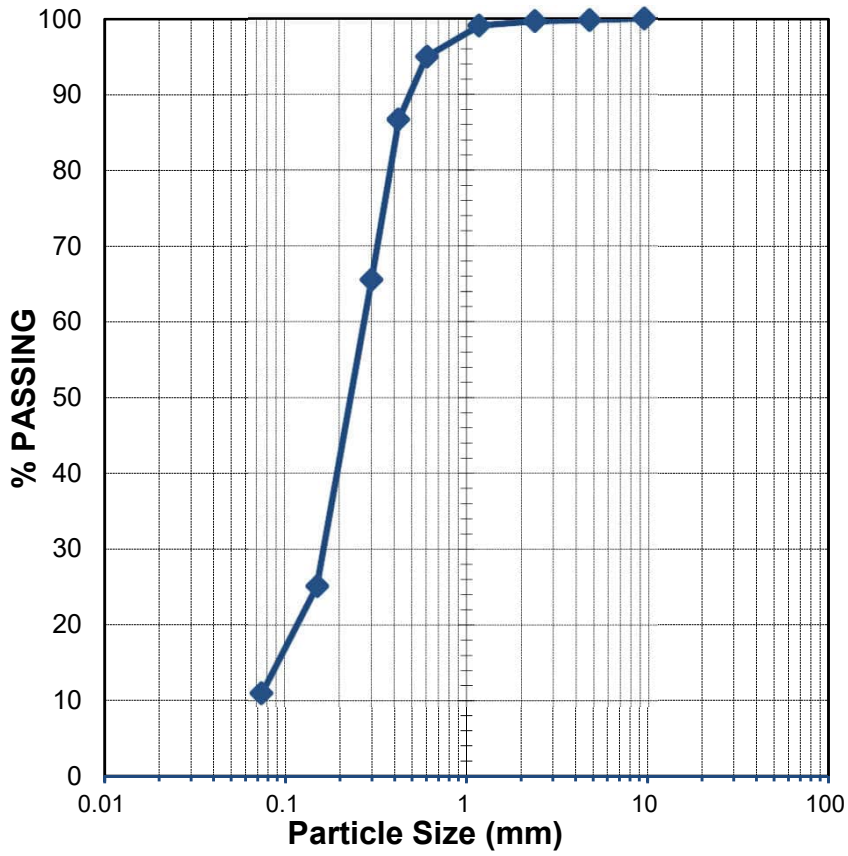
Liquid Labs WA
08 94723349
16B/81 Briggs Street
Carlisle, WA 6101

SOIL CLASSIFICATION TEST REPORT

Client	**ATC Williams**	Ticket No.	**S2193**
Client Address	**1141 Hay street, West Perth WA 6005**	Report No.	**LLS18/3915_1_PSD**
Project	**Northstar Geotechnical Investigation**	Sample No.	**LLS18/3915**
Sampling Location	**Northstar Mine Site**	Sampled By	**Client**
Sample Identification	**TP2A - T35 - 0.2-0.4m, Creek Sand**		
Sampling Method	**Sampled by Client, Tested as Received**	Preparation Method	**AS1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.00	
53.00	
37.50	
19.00	
9.50	100
4.75	100
2.36	100
1.180	99
0.600	95
0.425	87
0.300	66
0.150	25
0.075	11

Comments:

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

Approved Signatory

Name Ross Cook

Function Senior Technician

Issue Date 04-September-2018

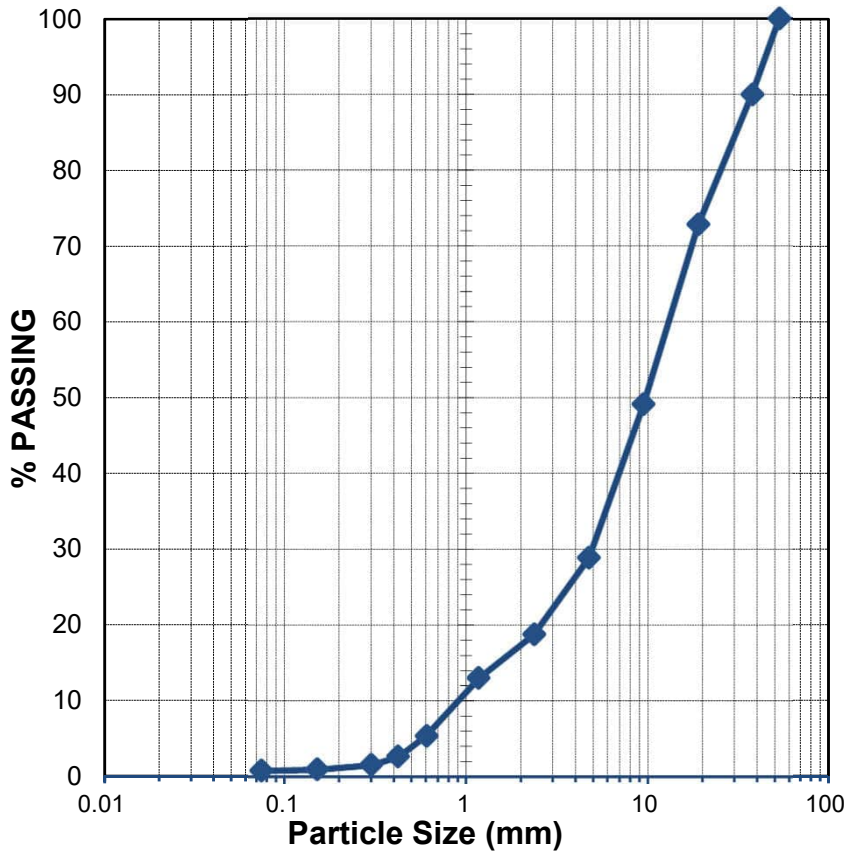
Liquid Labs WA
08 94723349
16B/81 Briggs Street
Carlisle, WA 6101

SOIL CLASSIFICATION TEST REPORT

Client	**ATC Williams**	Ticket No.	**S2193**
Client Address	**1141 Hay street, West Perth WA 6005**	Report No.	**LLS18/3914_1_PSD**
Project	**Northstar Geotechnical Investigation**	Sample No.	**LLS18/3914**
Sampling Location	**Northstar Mine Site**	Sampled By	**Client**
Sample Identification	**TP2A - R08 - 0.8-1.2m, Creek Gravel**		
Sampling Method	**Sampled by Client, Tested as Received**	Preparation Method	**AS1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.00	
53.00	100
37.50	90
19.00	73
9.50	49
4.75	29
2.36	19
1.180	13
0.600	5
0.425	3
0.300	2
0.150	1
0.075	1

Comments:

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

Approved Signatory

Name Ross Cook

Function Senior Technician

Issue Date 04-September-2018

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

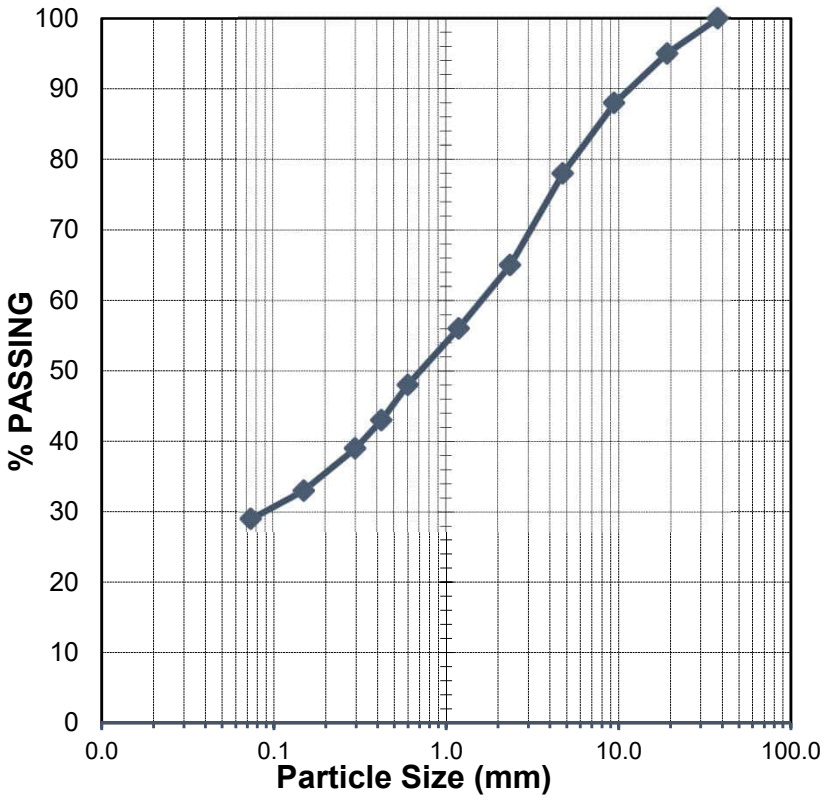
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/13_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/13**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**Coarse Rejects 1 - SP01**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	95
9.5	88
4.75	78
2.36	65
1.18	56
0.600	48
0.425	43
0.300	39
0.150	33
0.075	29

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
16	**11**	**6**	**3.6**	**125** ☐ **250** ☑	**Cracked** ☐ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing
Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

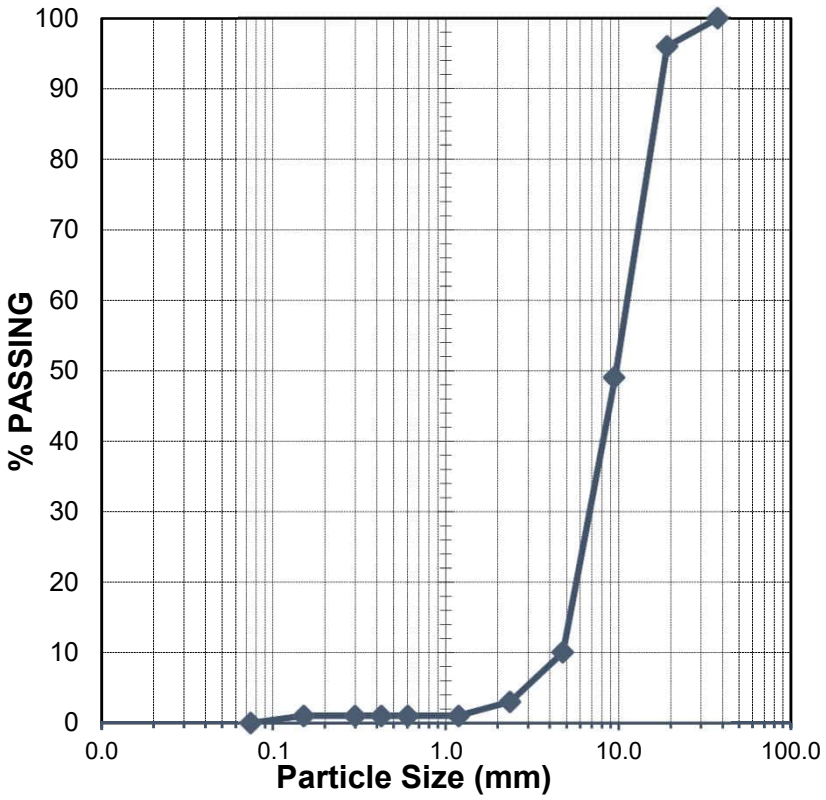
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/14_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/14**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**Coarse Rejects 2 - SP02**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	96
9.5	49
4.75	10
2.36	3
1.18	1
0.600	1
0.425	1
0.300	1
0.150	1
0.075	0

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
-	**-**	**-**	**-**	**125** ☐ **250** ☐	**Cracked** ☐ **Curled** ☐

Comments: *Insufficient sample to conduct Plastic Index*

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

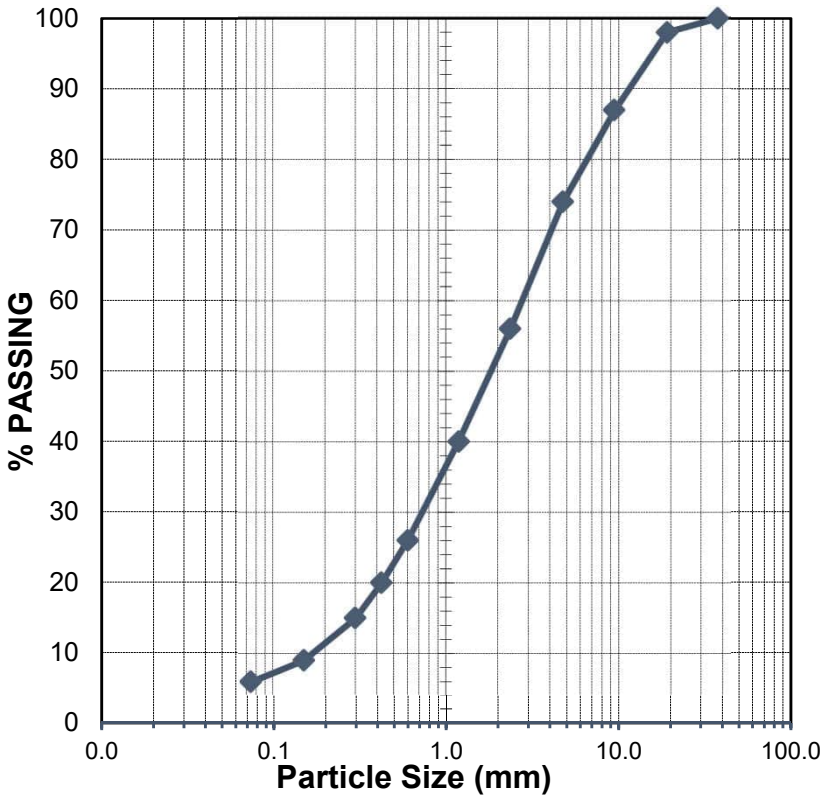
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/15_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/15**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**Coarse Rejects 3 - SP03**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	98
9.5	87
4.75	74
2.36	56
1.18	40
0.600	26
0.425	20
0.300	15
0.150	9
0.075	6

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
18	**Not Obtainable**	**NP**	**0.4**	**125** ☑ **250** ☐	**Cracked** ☐ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing
Accreditation No. 19872

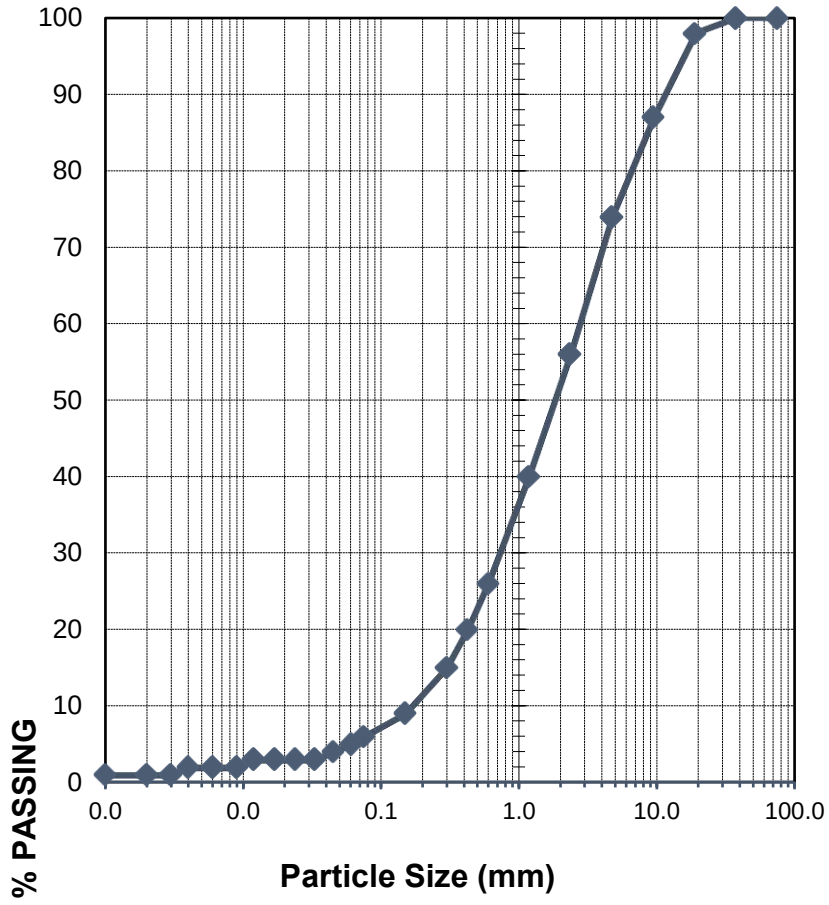
LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1,3.6.3 & 3.5.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/234 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/234**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**Coarse Rejects 3 - SP03**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING AND HYDROMETER



Sieve Size (mm)	Percent Passing Sieve (%)
AS 1289.3.6.1 / 1289.3.6.3	
75.0	100
37.5	100
19.0	98
9.5	87
4.75	74
2.36	56
1.18	40
0.600	26
0.425	20
0.300	15
0.150	9
0.075	6
0.061	5
0.045	4
0.033	3
0.024	3
0.017	3
0.012	3
0.009	2
0.006	2
0.004	2
0.003	1
0.002	1
0.001	1

Field Moisture Content (%) - AS 1289.2.1.1	Particle Density (gm/cm^3) - AS 1289.3.5.1 (-2.36mm)
-	2.71

Comments: *AS 1289.3.6.3 & 3.5.1 not covered under scope of accreditation.*

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

Approved Signatory

Name M. van Herk

Function Laboratory Manager

Issue Date 06-February-2018

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

TEST REPORT

DRY DENSITY & MOISTURE CONTENT RELATION OF SOIL

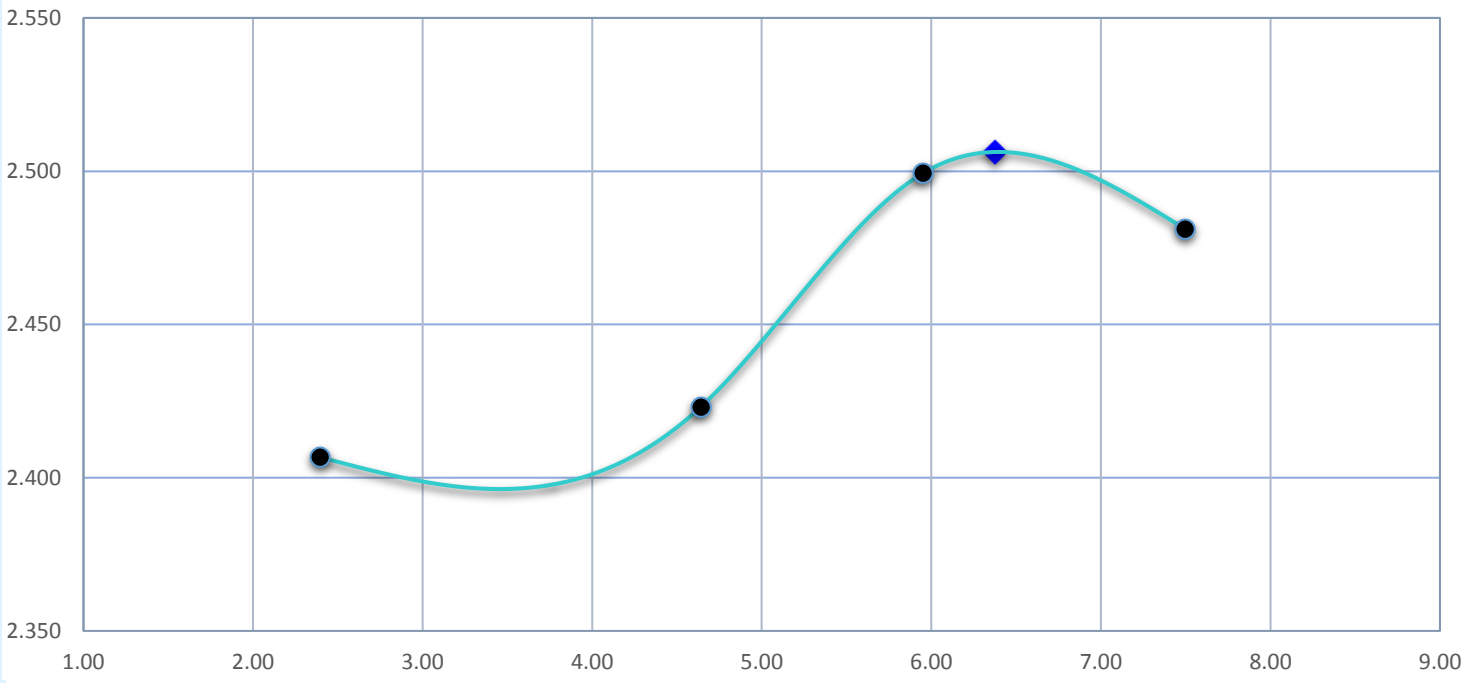
In accordance with **AS 1289.5.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/234 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/234 _1**
Sampling Location	**TSF and Stockpiles**	Date Received	**13/01/2018**
Sample Identification	**Coarse Rejects 3 - SP03**	Date Tested	**18/01/2018**
Sampling Method	**Sampled by client, tested as received**	Preparation Method	**AS 1289.1.1**
Liquid Limit Method	**Visual/tactile assessment by competent technician**	Sample Curing Time	**24 Hours**

	Oversize Material
Retained 19.0mm (%)	**2.3**

AS 1289.5.1.1, 2.1.1, 1.1	**Laboratory Moisture & Density Results**				
Moisture Content (%)	**2.4**	**4.6**	**6.0**	**7.5**	
Dry Density (t/m³)	**2.407**	**2.423**	**2.499**	**2.481**	

Plot: Dry Density vs. Moisture Content



Maximum Dry Density (t/m³)	**2.506**
Optimum Moisture Content (%)	**6.4**

Comments:

Approved Signatory:

Name: M. van Herk

Function: Laboratory Manager

Date: 20-January-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

FALLING HEAD PERMEABILITY - TEST REPORT

In accordance with **AS 1289.6.7.2, 5.2.1, 2.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/234 _1_FHPERM**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/234**
Sample / Location	**Pilbara**	Sampled By	**Client**
Description	**Coarse Rejects - SP03**		
Sampling Method:	**Tested as Received**		

Falling Head Permeability

Laboratory Moisture Ratio (%)	103.0
Laboratory Density Ratio (%)	90.0
Compactive Effort	Modified
Surcharge (kPa)	3
% Retained on 19mm Sieve	2
Coefficient of Permeability (m/sec)	**1.1×10^{-5}**

Comments:

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing
Accreditation No. 19872

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 07-February-2018

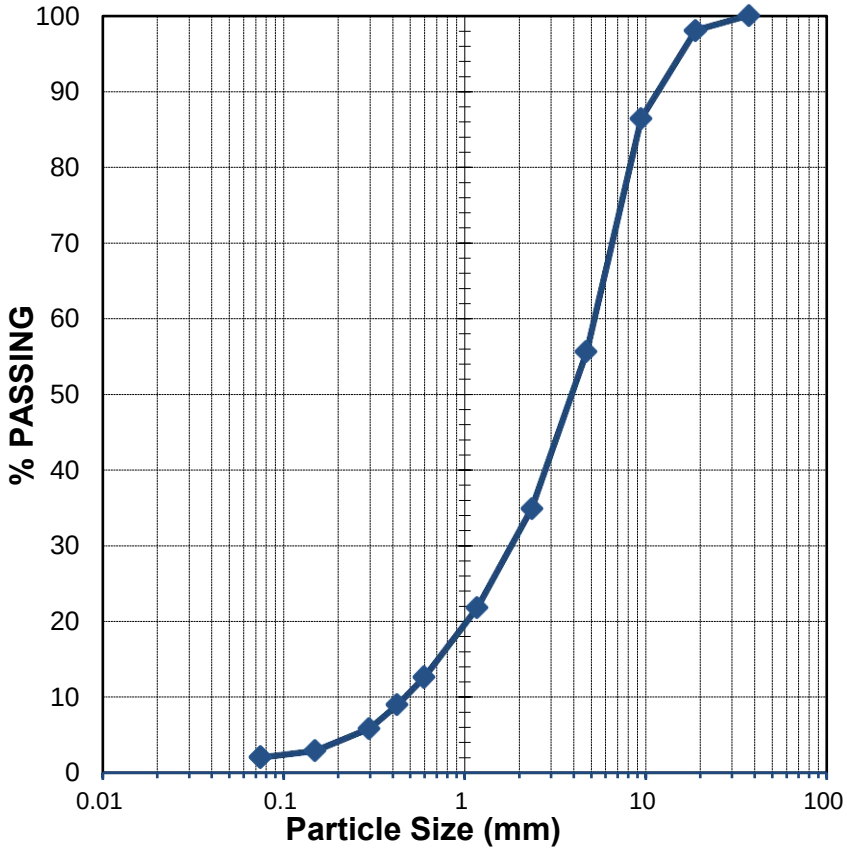
Liquid Labs WA
08 94723349
16B/81 Briggs Street
Carlisle, WA 6101

SOIL CLASSIFICATION TEST REPORT

Client	**ATC Williams**	Ticket No.	**S2293**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/4221_1_PSD**
Project	**Geotechnical Investigation - 115185.14**	Sample No.	**LLS18/4221**
Sampling Location	**Iron Bridge, North Star TSF**	Sampled By	**Client**
Sample Identification	**Sample A**		
Sampling Method	**Sampled by Client, Tested as Received**	Preparation Method	**AS1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.00	
53.00	
37.50	100
19.00	98
9.50	86
4.75	56
2.36	35
1.180	22
0.600	13
0.425	9
0.300	6
0.150	3
0.075	2

Comments:

Approved Signatory

Name	Brooke Elliott
Function	Quality Manager
Issue Date	06-October-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

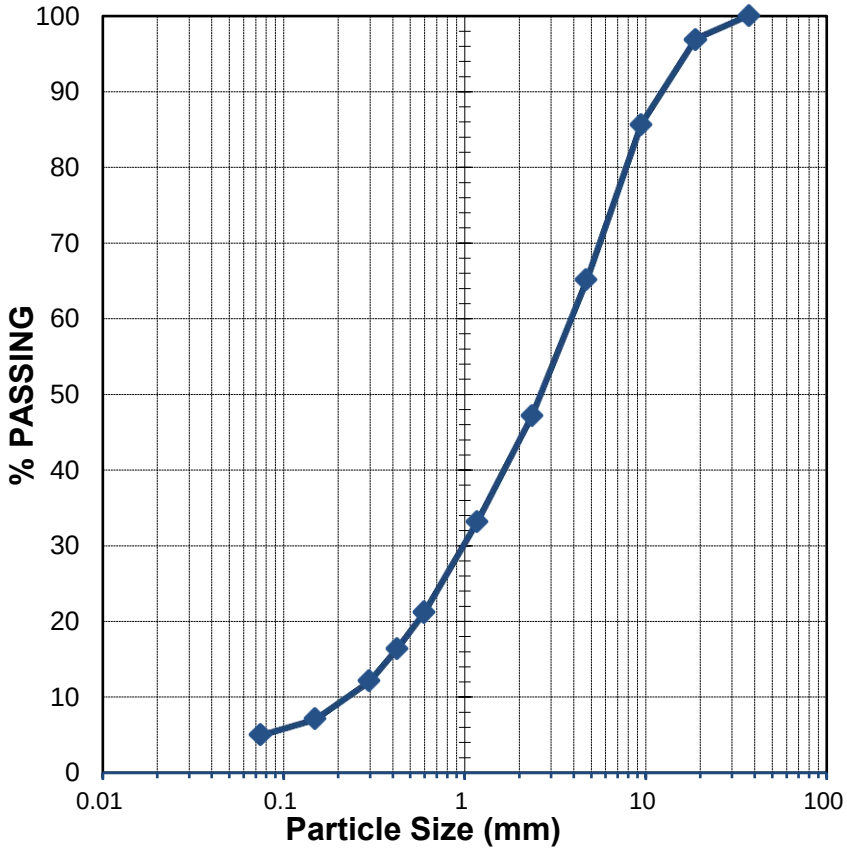
Liquid Labs WA
08 94723349
16B/81 Briggs Street
Carlisle, WA 6101

SOIL CLASSIFICATION TEST REPORT

Client	**ATC Williams**	Ticket No.	**S2293**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/4222_1_PSD**
Project	**Geotechnical Investigation - 115185.14**	Sample No.	**LLS18/4222**
Sampling Location	**Iron Bridge, North Star TSF**	Sampled By	**Client**
Sample Identification	**Sample B**		
Sampling Method	**Sampled by Client, Tested as Received**	Preparation Method	**AS1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.00	
53.00	
37.50	100
19.00	97
9.50	86
4.75	65
2.36	47
1.180	33
0.600	21
0.425	16
0.300	12
0.150	7
0.075	5

Comments:

Approved Signatory

Name	Brooke Elliott
Function	Quality Manager
Issue Date	06-October-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

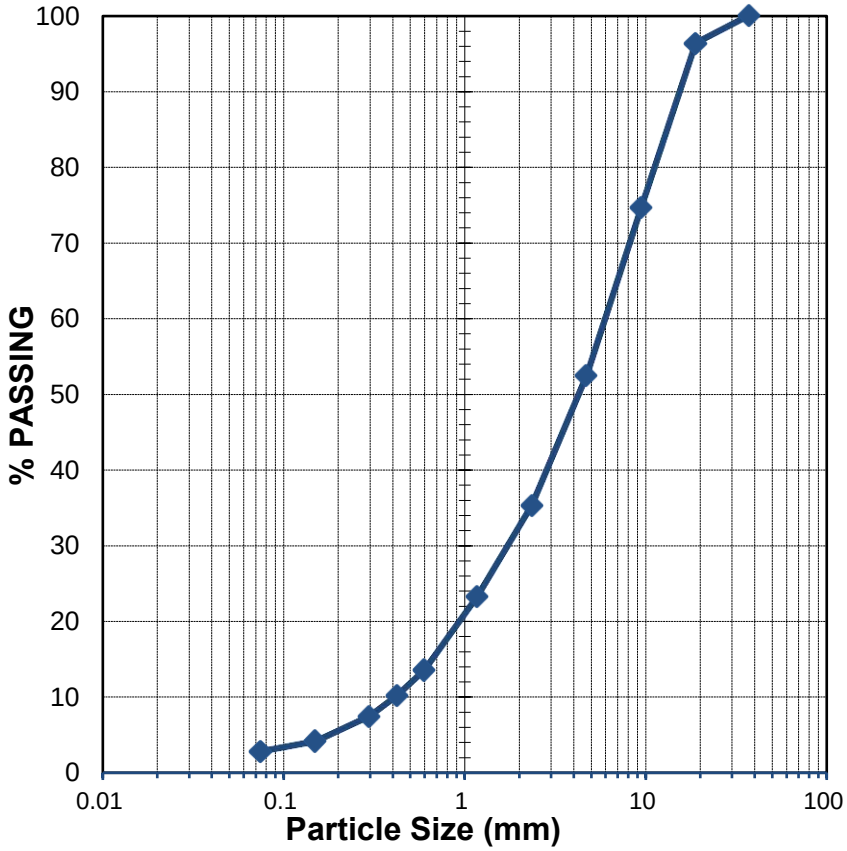
Liquid Labs WA
08 94723349
16B/81 Briggs Street
Carlisle, WA 6101

SOIL CLASSIFICATION TEST REPORT

Client	**ATC Williams**	Ticket No.	**S2293**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/4223_1_PSD**
Project	**Geotechnical Investigation - 115185.14**	Sample No.	**LLS18/4223**
Sampling Location	**Iron Bridge, North Star TSF**	Sampled By	**Client**
Sample Identification	**Sample C**		
Sampling Method	**Sampled by Client, Tested as Received**	Preparation Method	**AS1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.00	
53.00	
37.50	100
19.00	96
9.50	75
4.75	53
2.36	35
1.180	23
0.600	14
0.425	10
0.300	7
0.150	4
0.075	3

Comments:

Approved Signatory

Name	Brooke Elliott
Function	Quality Manager
Issue Date	06-October-2018

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Liquid Labs WA
08 94723349
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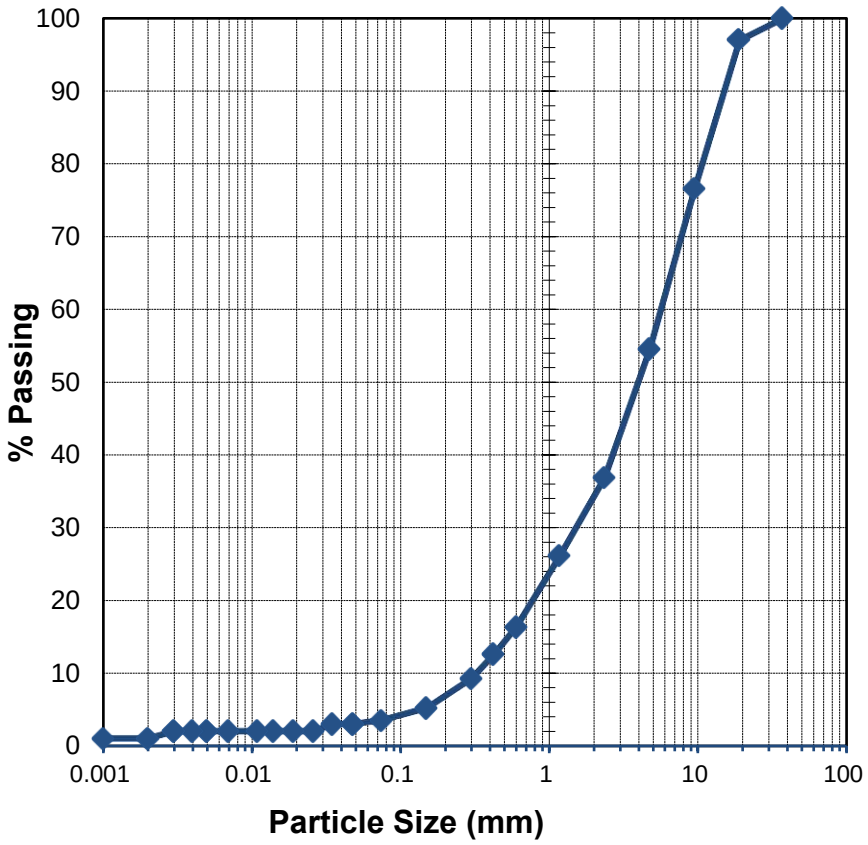
Carlisle, WA 6101

SOIL CLASSIFICATION TEST REPORT

AS 1289.2.1.1, 3.6.1,‡3.6.3, 3.1.1, 3.2.1, 3.3.1, 3.4.1 & ‡3.5.1

Client	**ATC Williams**	Ticket No.	**S2293**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/4224_1_PSDPIHYDRO**
Project	**Geotechnical Investigation - 115185.14**	Sample No.	**LLS18/4224**
Sample Location	**Iron Bridge, North Star TSF**	Sampled By	**Client**
Sample Identification	**Sample A+B+C**		
Sampling Method	**Sampled by Client, Tested as Received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING AND HYDROMETER



Sieve Size (mm)	Percent Passing Sieve (%)
AS 1289.3.6.1 /‡ 1289.3.6.3	
37.5	100
19.0	97
9.5	77
4.75	55
2.36	37
1.18	26
0.600	16
0.425	13
0.300	9
0.150	5
0.075	4
0.048	3
0.035	3
0.026	2
0.019	2
0.014	2
0.011	2
0.007	2
0.005	2
0.004	2
0.003	2
0.002	1
0.001	1

‡ Particle Density (gm/cm^3) - AS 1289.3.5.1

3.28

CONSISTENCY LIMITS - CONE PENETROMETER

AS1289.3.1.1	AS 1289.3.2.1	AS1289.3.3.2	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	**Mould Length (mm)**	***Condition of Dried Specimen***
Not Obtainable	**Non Plastic**	**Non Plastic**	**0.5**	**250**	**-**

Comments: ‡ NATA Accreditation does not cover the performance of this service

Approved Signatory

Name Matt van Herk

Function Laboratory Manager

Issue Date 08-October-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

‡ NATA Accreditation does not cover the performance of this service

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY

STANDARD DRY DENSITY & MOISTURE CONTENT RELATION OF SOIL TEST REPORT

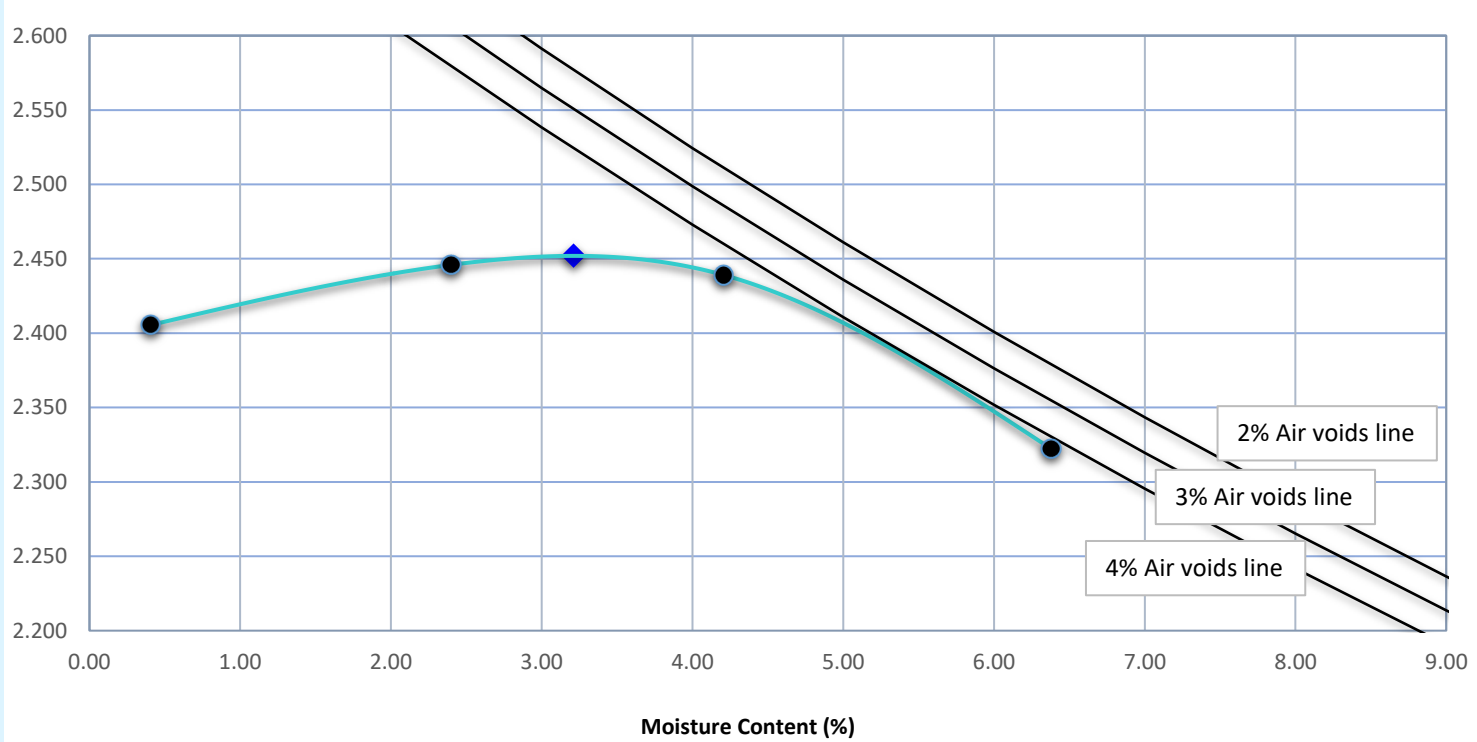
AS 1289.5.1.1

Client	**ATC Williams**	Ticket No.	**S2293**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/4224_1_SMDD**
Project	**Geotechnical Investigation - 115185.14**	Sample No.	**LLS18/4224**
Sampling Location	**Iron Bridge, North Star TSF**	Date Received	**25/09/2018**
Sample Identification	**Sample A+B+C**	Date Tested	**26/09/2018**
Sampling Method	**Sampled by Client, Tested as Received**	Preparation Method	**AS1289.1.1**
Liquid Limit Method	**Visual/tactile assessment by competent technician**	Sample Curing Time	**2.5 Hours**

Oversize Material	
Retained 19.0mm (%)	**0**
Retained 37.5mm (%)	**-**

AS 1289.5.1.1, 2.1.1, 1.1	**Laboratory Moisture & Density Results**				
Moisture Content (%)	**0.4**	**2.4**	**4.2**	**6.4**	
Dry Density (t/m³)	**2.41**	**2.45**	**2.44**	**2.32**	

Plot: Dry Density vs. Moisture Content



Standard Maximum Dry Density (t/m³)	**2.45**
Standard Optimum Moisture Content (%)	**3.0**

Comments:

The above air void lines are derived from a calculated apparent particle density of 2.872 t/m³

Approved Signatory:

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

Name: Brooke Elliott
Function: Quality Manager
Date: 08-October-2018

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY

Liquid Labs WA
08 94723349
16B/81 Briggs Street
Carlisle, WA 6101

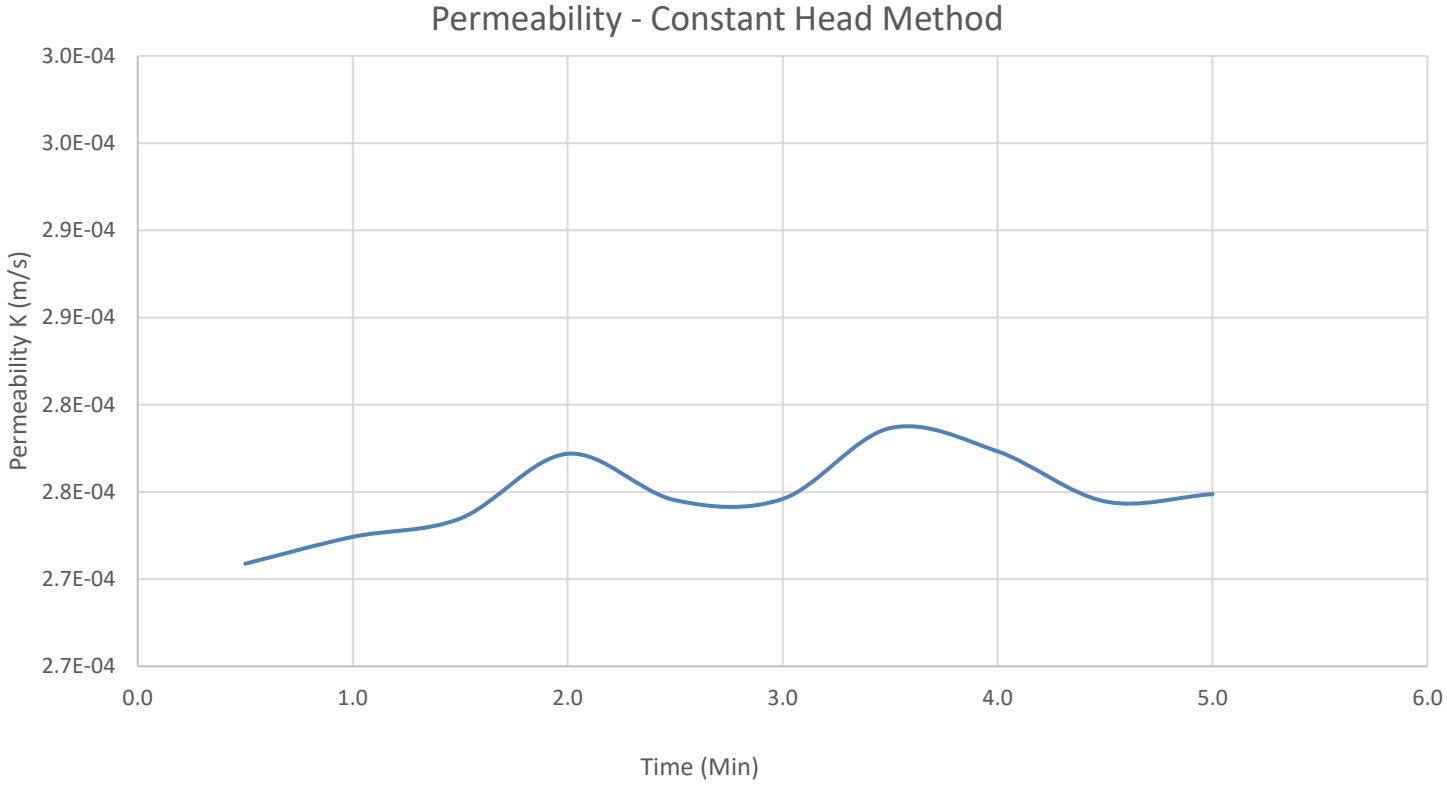
CONSTANT HEAD PERMEABILITY TEST REPORT

AS 1289.6.7.1, 2.1.1, 5.2.1

Client	**ATC Williams**	Ticket No.	**S2293**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/4224 _1_CHPERM**
Project	**Geotechnical Investigation - 115185.14**	Sample No.	**LLS18/4224**
Location	**Iron Bridge, North Star TSF**	Sampled By	**Client**
Sample Identification	**Sample A+B+C**		
Sampling Method:	**Sampled by Client, Tested as Received**	Date Tested	**1/10/2018**

Specimen conditions at test

Laboratory Density Ratio (%)	**220.9**	**Laboratory Moisture Ratio (%)**	**99.2**
Compactive Effort	**Modified**	**% Retained on 19mm Sieve**	**0.0**
Surcharge (kPa)	**3**	**Hydraulic Head (mm)**	**70**



Coefficient of Permeability K_{20} (m/s) **2.76E-04**

Comments:

Approved Signatory

Name Brooke Elliott
Function Quality Manager
Issue Date 08-October-2018

NATA
WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

≠ NATA Accreditation does not cover the performance of this service

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

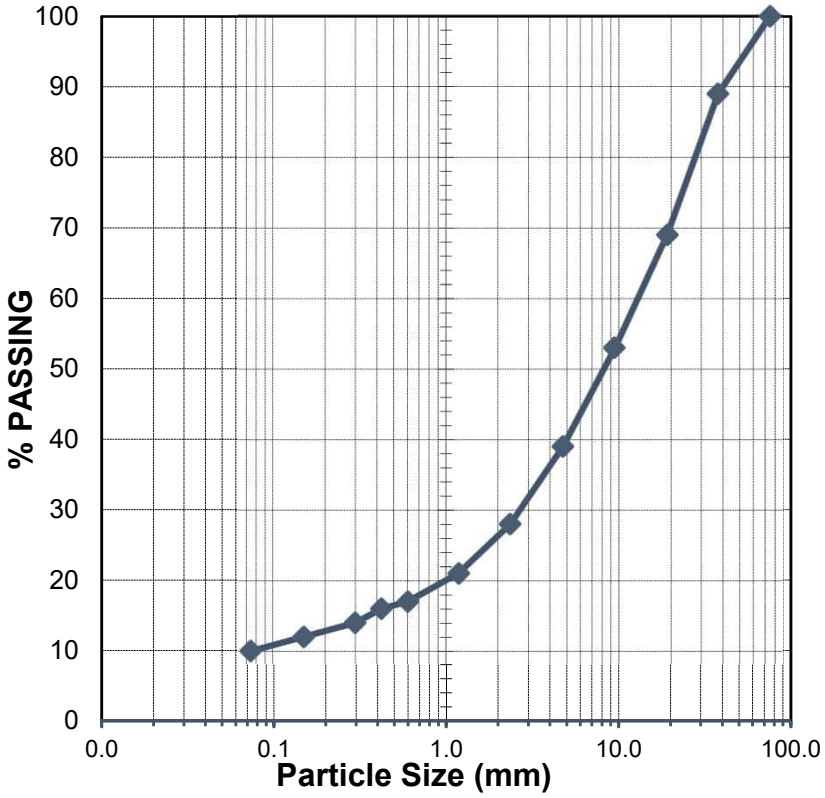
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/16_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/16**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**ROM Pad - SP08**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	100
37.5	89
19.0	69
9.5	53
4.75	39
2.36	28
1.18	21
0.600	17
0.425	16
0.300	14
0.150	12
0.075	10

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
-	**-**	**-**	**-**	**125** ☐ **250** ☐	**Cracked** ☐ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

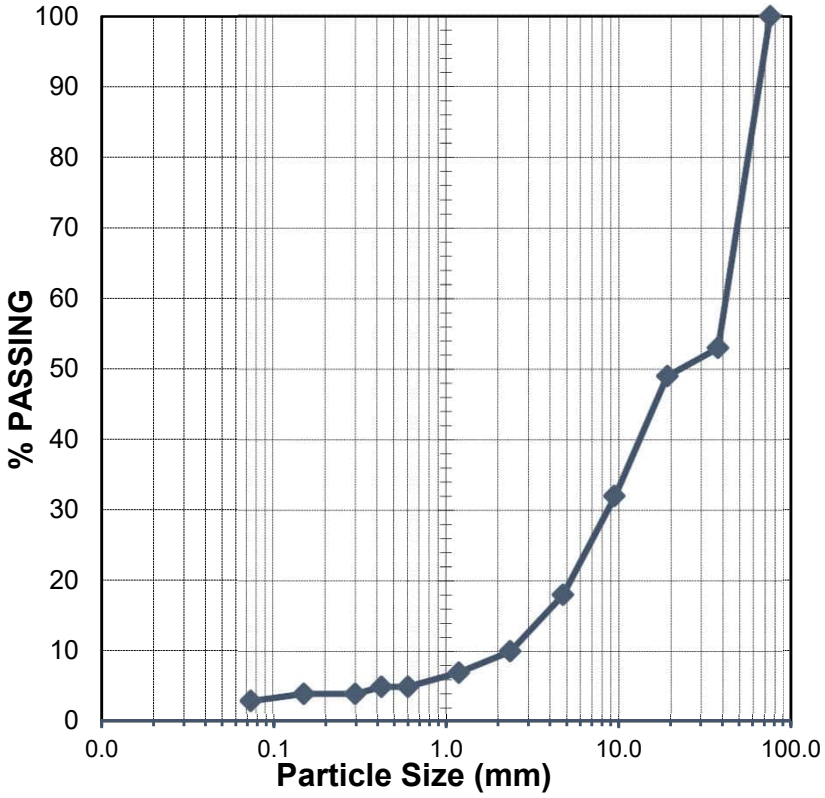
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/18_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/18**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**Wastedump 1 - SP05**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	100
37.5	53
19.0	49
9.5	32
4.75	18
2.36	10
1.18	7
0.600	5
0.425	5
0.300	4
0.150	4
0.075	3

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
				Shrinkage Specimen Details	
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Mould Length (mm)***	***Condition of Dried Specimen***
-	**-**	**-**	**-**	**125** ☐ **250** ☐	**Cracked** ☐ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

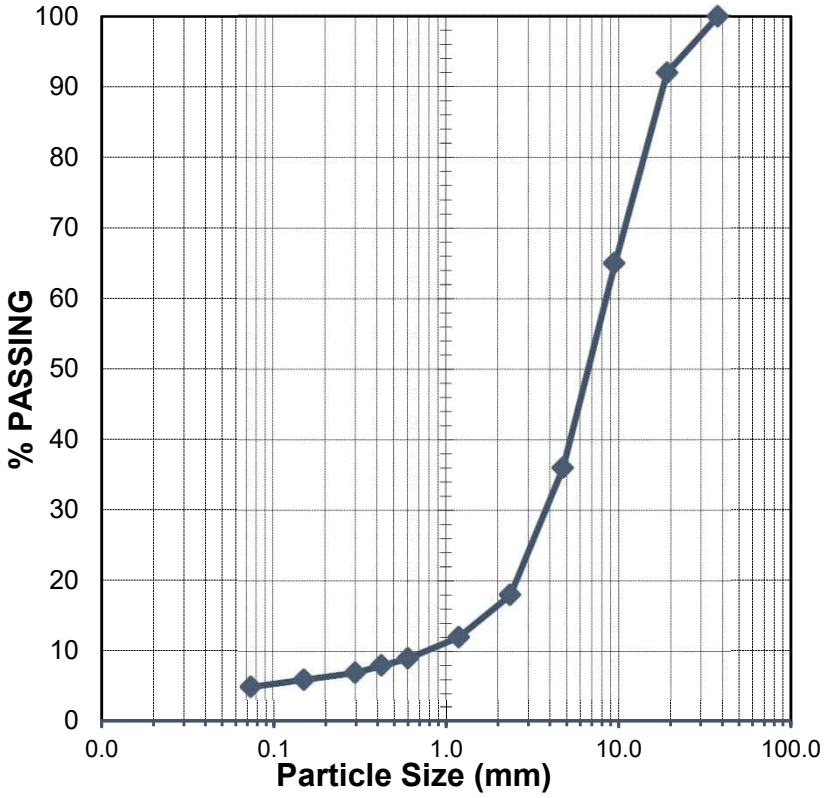
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/19_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/19**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**Wastedump 2 - SP06**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	92
9.5	65
4.75	36
2.36	18
1.18	12
0.600	9
0.425	8
0.300	7
0.150	6
0.075	5

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
-	**-**	**-**	**-**	**125** ☐ **250** ☐	**Cracked** ☐ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

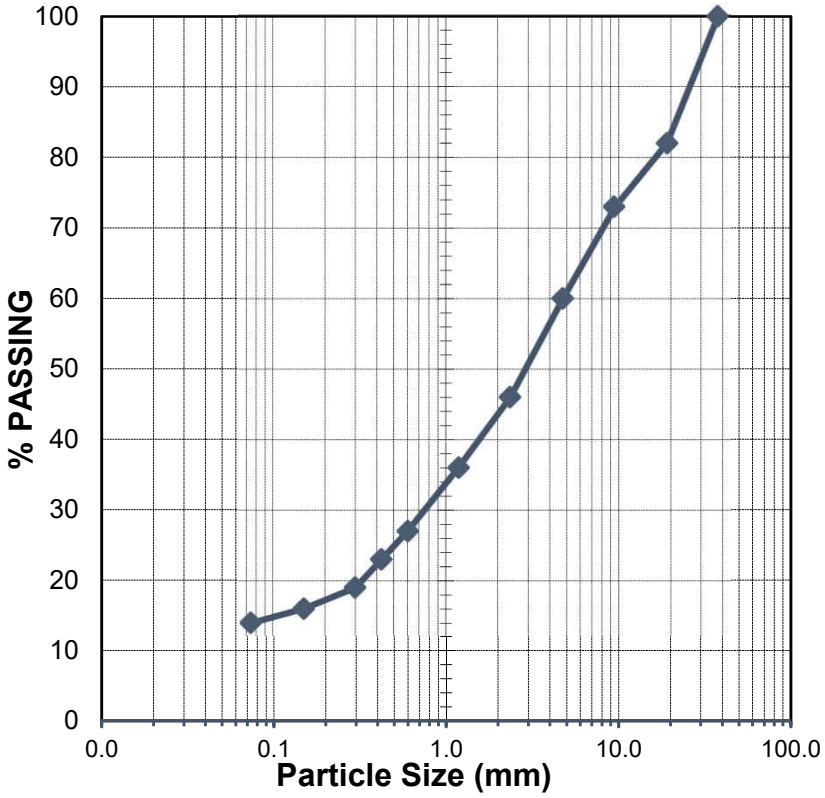
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/20_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/20**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**Wastedump 3 - SP07**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	100
19.0	82
9.5	73
4.75	60
2.36	46
1.18	36
0.600	27
0.425	23
0.300	19
0.150	16
0.075	14

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
-	**-**	**-**	**-**	**125** ☐ **250** ☐	**Cracked** ☐ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing
Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

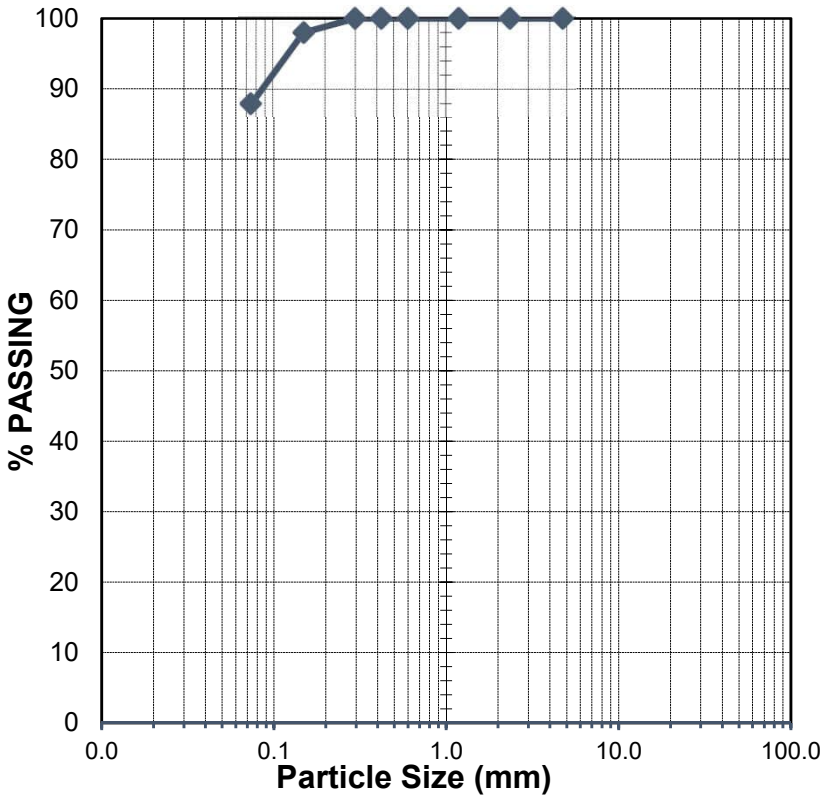
SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/25_1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/25**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**Tailings Satge 1 - SP04**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING

AS 1289.3.6.1



Sieve Size (mm)	Percent Passing Sieve (%)
75.0	
37.5	
19.0	
9.5	
4.75	100
2.36	100
1.18	100
0.600	100
0.425	100
0.300	100
0.150	98
0.075	88

CONSISTENCY LIMITS - CASAGRANDE

AS 1289.3.9.1	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1		
Liquid Limit (%)	**Plastic Limit (%)**	**Plasticity Index (%)**	**Linear Shrinkage (%)**	***Shrinkage Specimen Details***	
				Mould Length (mm)	***Condition of Dried Specimen***
18	**13**	**5**	**3.6**	**125** ☐ **250** ☑	**Cracked** ☐ **Curled** ☐

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 11-January-2018

NATA WORLD RECOGNISED ACCREDITATION

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Accreditation No. 19872

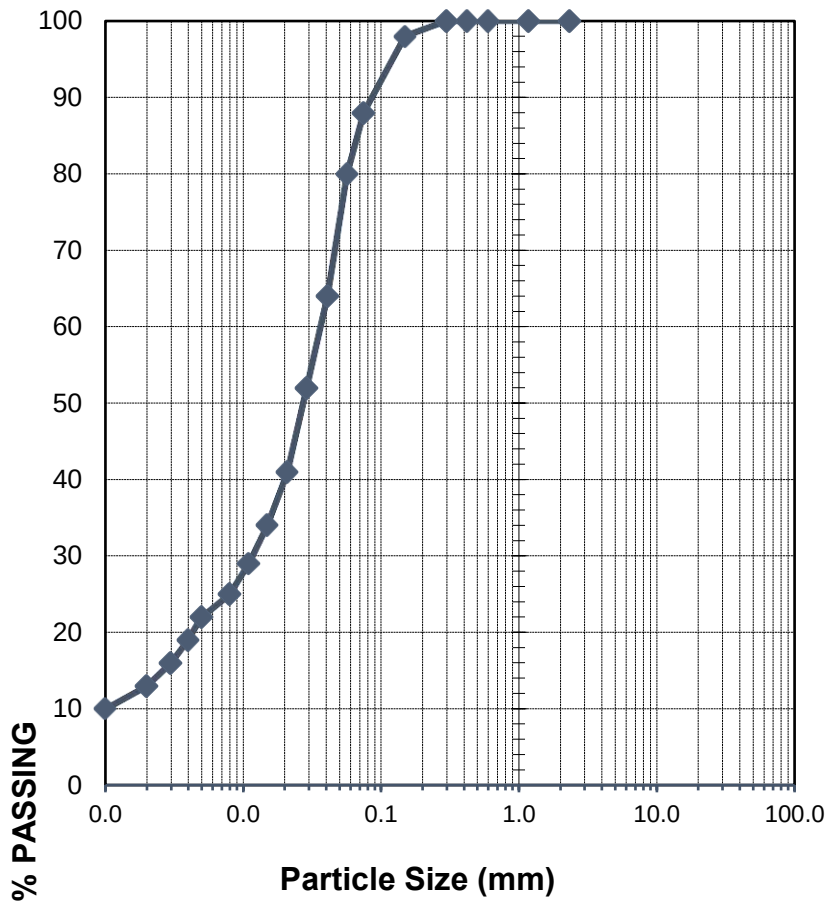
LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

SOIL CLASSIFICATION - TEST REPORT

In accordance with **AS 1289.2.1.1, 3.6.1,3.6.3 & 3.5.1**

Client	**ATC Williams**	Ticket No.	**S1226**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/237 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/237**
Sampling Location	**Pilbara**	Sampled By	**Client**
Sample Identification	**Tailings Stage 1 - SP04**		
Sampling Method	**Tested as received**	Preparation Method	**AS 1289.1.1**
Sample History	**Air Dried**	Wet or Dry Sieved	**Dry Sieved**

PARTICLE SIZE DISTRIBUTION - ANALYSIS BY SIEVING AND HYDROMETER



Sieve Size (mm)	Percent Passing Sieve (%)
AS 1289.3.6.1 / 1289.3.6.3	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	100
0.425	100
0.300	100
0.150	98
0.075	88
0.057	80
0.041	64
0.029	52
0.021	41
0.015	34
0.011	29
0.008	25
0.005	22
0.004	19
0.003	16
0.002	13
0.001	10

Field Moisture Content (%) - AS 1289.2.1.1	Particle Density (gm/cm^3) - AS 1289.3.5.1 (-2.36mm)
-	3.93

Comments: *AS 1289.3.6.3 & 3.5.1 not covered under scope of accreditation.*

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

Approved Signatory

Name M. van Herk

Function Laboratory Manager

Issue Date 06-February-2018

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

TEST REPORT

DRY DENSITY & MOISTURE CONTENT RELATION OF SOIL

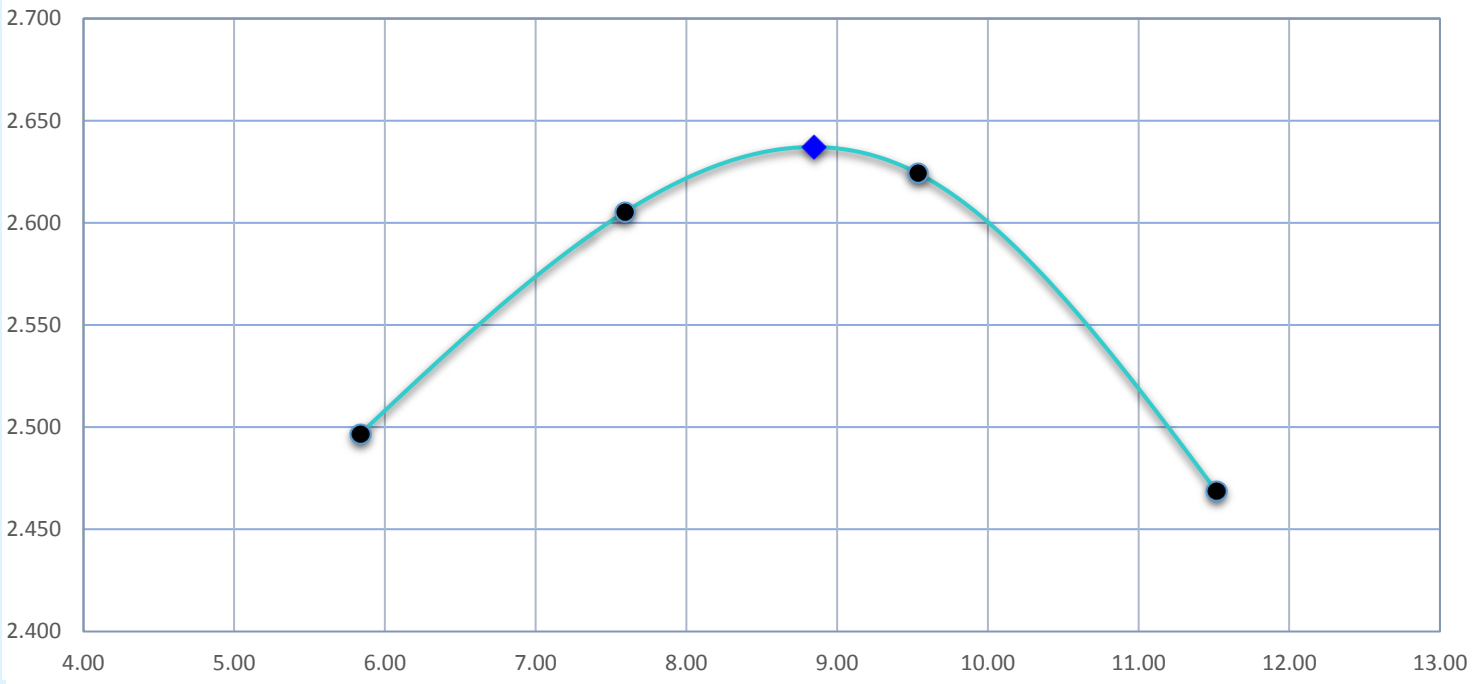
In accordance with **AS 1289.5.2.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/237 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/237**
Sampling Location	**TSF and Stockpiles**	Date Received	**13/01/2018**
Sample Identification	**Tailings Stage 1 - SP04**	Date Tested	**19/01/2018**
Sampling Method	**Sampled by client, tested as received**	Preparation Method	**AS 1289.1.1**
Liquid Limit Method	**Visual/tactile assessment by competent technician**	Sample Curing Time	**24 Hours**

Oversize Material	
Retained 19.0mm (%)	**0.0**

AS 1289.5.2.1, 2.1.1, 1.1	**Laboratory Moisture & Density Results**				
Moisture Content (%)	**5.8**	**7.6**	**9.5**	**11.5**	
Dry Density (t/m³)	**2.497**	**2.605**	**2.624**	**2.469**	

Plot: Dry Density vs. Moisture Content



Maximum Dry Density (t/m³)	**2.637**
Optimum Moisture Content (%)	**8.8**

Comments:

Approved Signatory:

Name: M. van Herk
Function: Laboratory Manager
Date: 20-January-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

TEST REPORT

DRY DENSITY & MOISTURE CONTENT RELATION OF SOIL

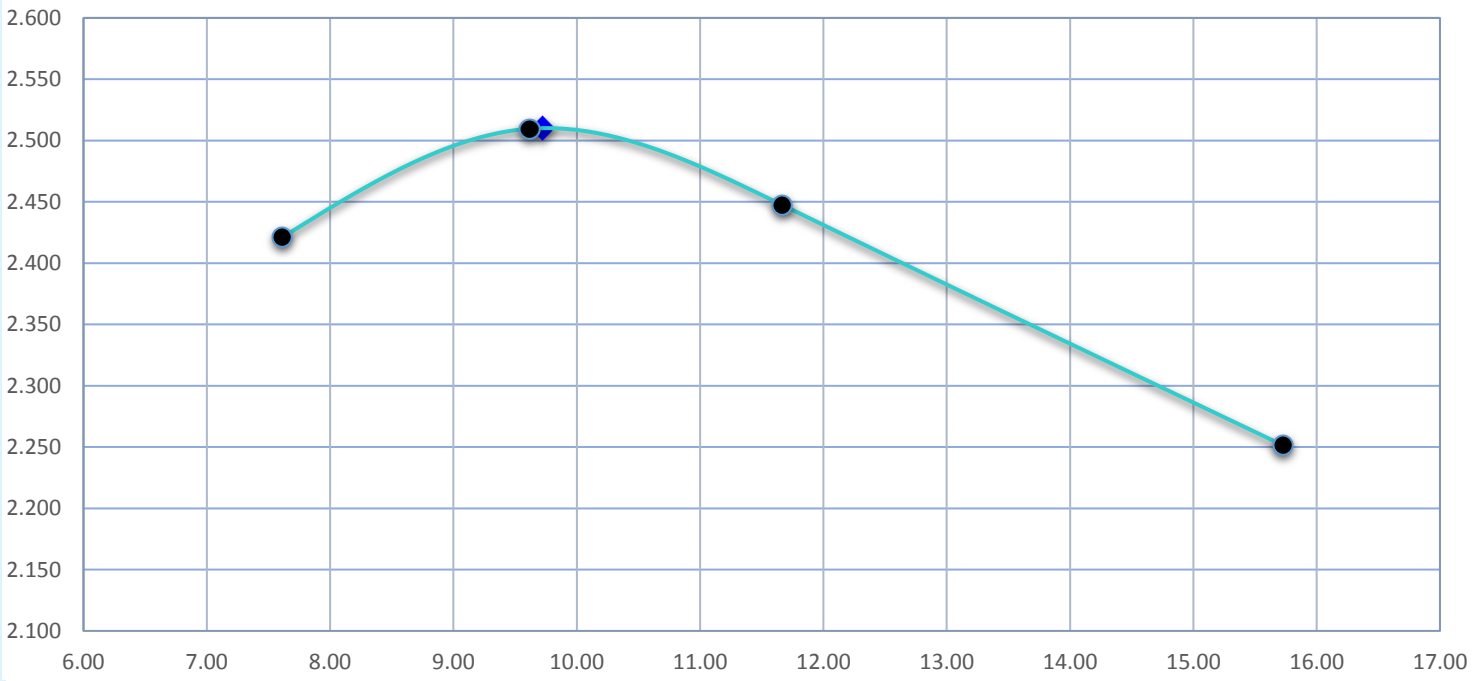
In accordance with **AS 1289.5.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/237 _1**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/237 _1**
Sampling Location	**TSF and Stockpiles**	Date Received	**13/01/2018**
Sample Identification	**Tailings Stage 1 - SP04**	Date Tested	**18/01/2018**
Sampling Method	**Sampled by client, tested as received**	Preparation Method	**AS 1289.1.1**
Liquid Limit Method	**Visual/tactile assessment by competent technician**	Sample Curing Time	**24 Hours**

	Oversize Material
Retained 19.0mm (%)	**0.0**

AS 1289.5.1.1, 2.1.1, 1.1	**Laboratory Moisture & Density Results**				
Moisture Content (%)	**7.6**	**9.6**	**11.7**	**15.7**	
Dry Density (t/m³)	**2.421**	**2.510**	**2.447**	**2.251**	

Plot: Dry Density vs. Moisture Content



Maximum Dry Density (t/m³)	**2.510**
Optimum Moisture Content (%)	**9.7**

Comments:

Approved Signatory:

Name: M. van Herk
Function: Laboratory Manager
Date: 20-January-2018

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 19872

LIQUIDLABSWA
CONSTRUCTION MATERIALS TESTING LABORATORY
UNIT 4, 96 BRIGG ST, WELSHPOOL, WA 6106 LIQUIDLABSWA.COM.AU

FALLING HEAD PERMEABILITY - TEST REPORT

In accordance with **AS 1289.6.7.2, 5.2.1, 2.1.1**

Client	**ATC Williams**	Ticket No.	**S1248**
Client Address	**1141 Hay Street, West Perth WA 6005**	Report No.	**LLS18/237 _1_FHPERM**
Project	**North Star Magnetite Project**	Sample No.	**LLS18/237**
Sample / Location	**Pilbara**	Sampled By	**Client**
Description	**Tailings Stage 1 - SP04**		
Sampling Method:	**Tested as Received**		

Falling Head Permeability

Laboratory Moisture Ratio (%)	101.0
Laboratory Density Ratio (%)	98.0
Compactive Effort	Standard
Surcharge (kPa)	3
% Retained on 19mm Sieve	0
Coefficient of Permeability (m/sec)	**4.0×10^{-8}**

Comments:

Approved Signatory

Name M. van Herk
Function Laboratory Manager
Issue Date 07-February-2018

NATA WORLD RECOGNISED ACCREDITATION

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Mob: 0422 814 231

E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

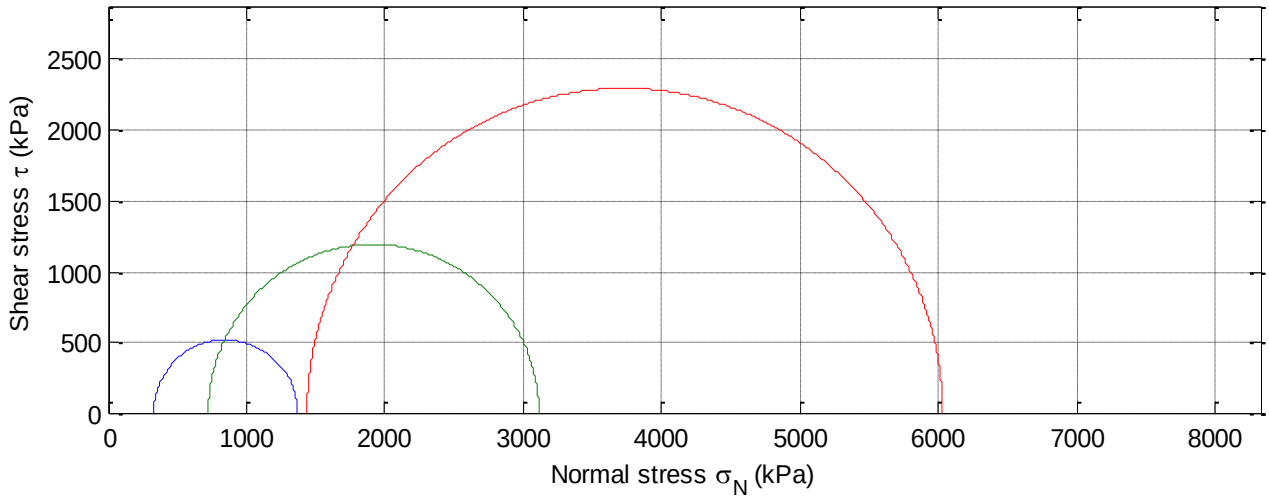
Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	Tailings Stage 1 - SP04	Lab:	EPLab
Sample ID:	LLS17_237_LL1801_CU3		
Depth (m):	-	Room Temperature at Test:	~ 18°c

Tested by:	Phil	Initial Moisture (%):	9.74	Strain Rate (mm/min):	0.006
Height (mm):	127.60	Final Moisture (%):	7.85	Skempton's (B):	0.99
Diameter (mm):	60.38	Bulk Density (t/m³):	2.68	Geology:	-
L/D Ratio:	2.11	Dry Density (t/m³):	2.44		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	2.64	6.48	39.65
Angle of Shear Resistance Φ' (Degrees) :	37.60	37.38	37.23

Integrity Precision Innovation

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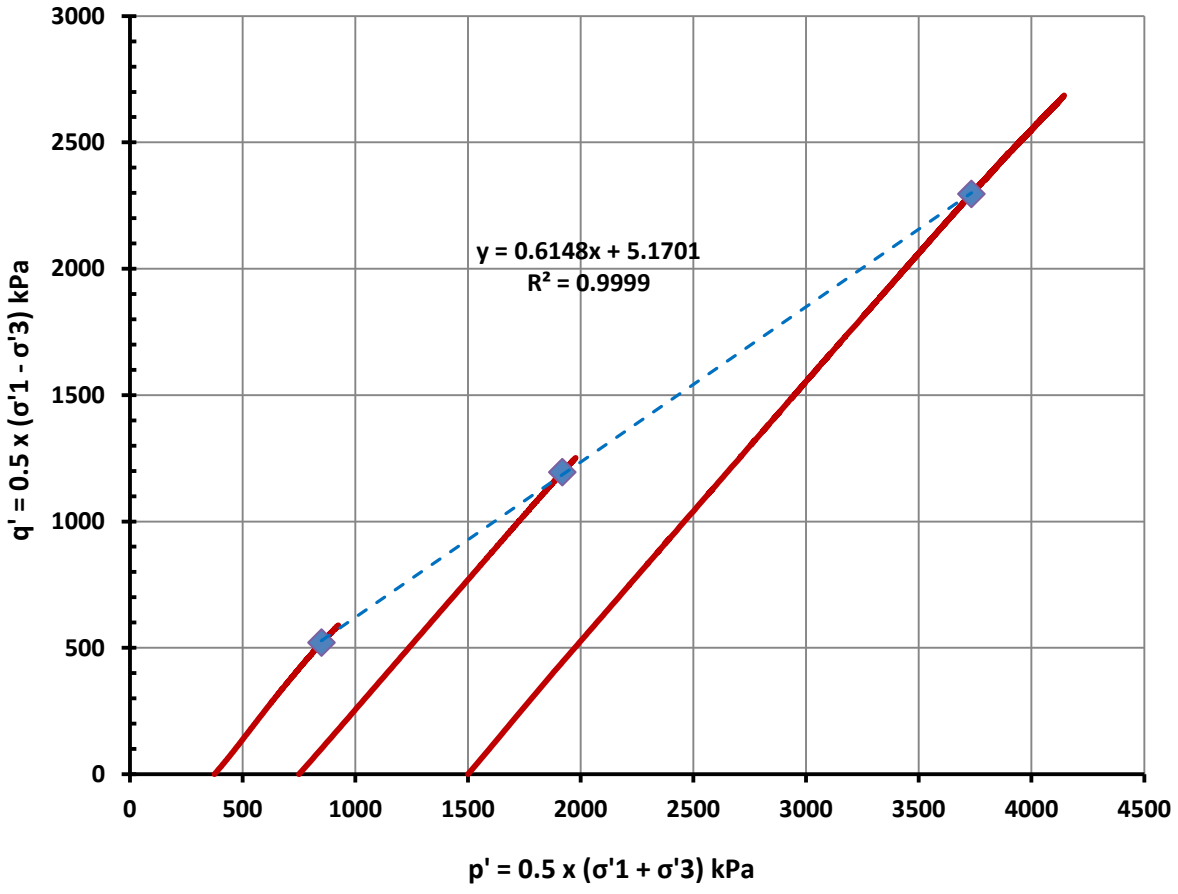
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	Tailings Stage 1 - SP04	Lab:	EPLab
Sample ID:	LLS17_237_LL1801_CU3		
Depth (m):	-	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : 6.56

Angle of Shear Resistance Φ' (Deg) : 37.94

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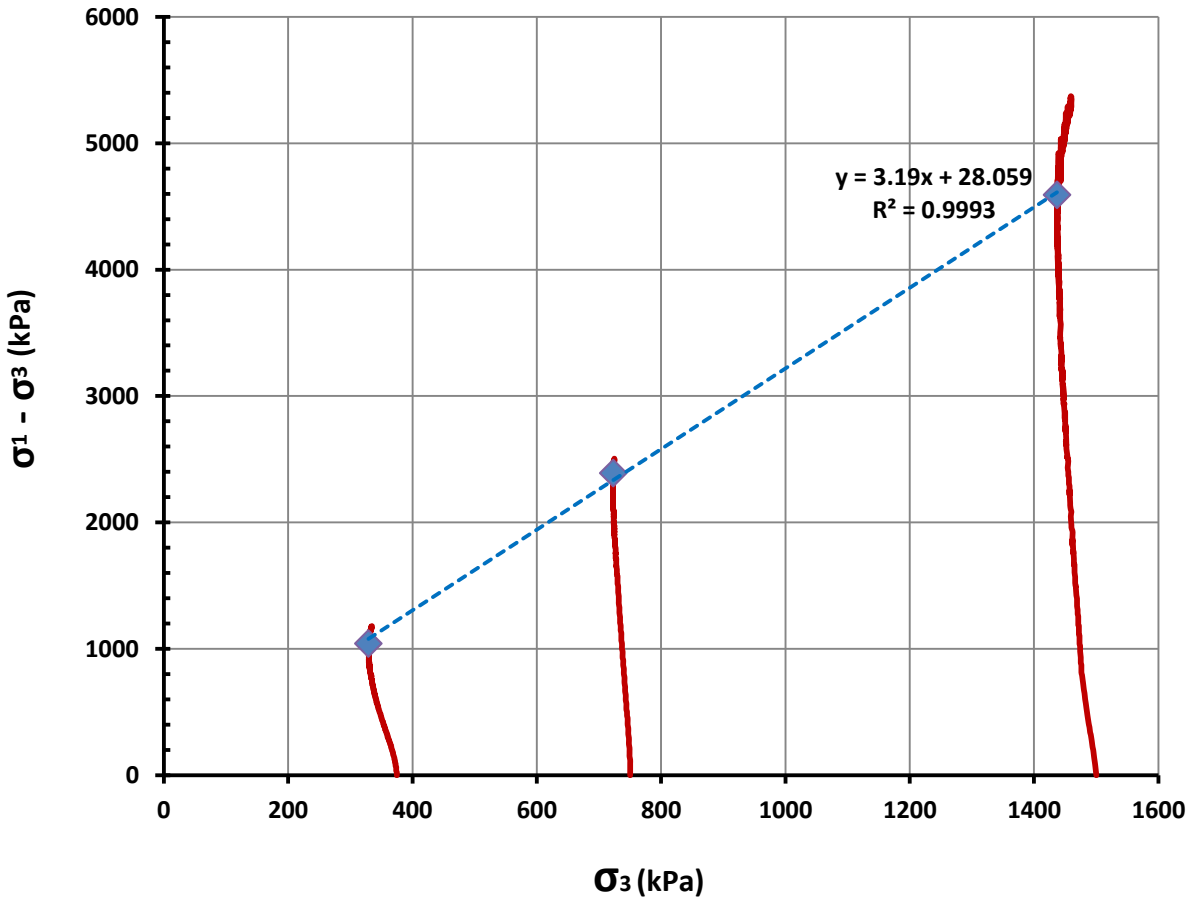
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	Tailings Stage 1 - SP04	Lab:	EPLab
Sample ID:	LLS17_237_LL1801_CU3		
Depth (m):	-	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	**6.85**
Angle of Shear Resistance Φ' (Deg) :	**37.93**

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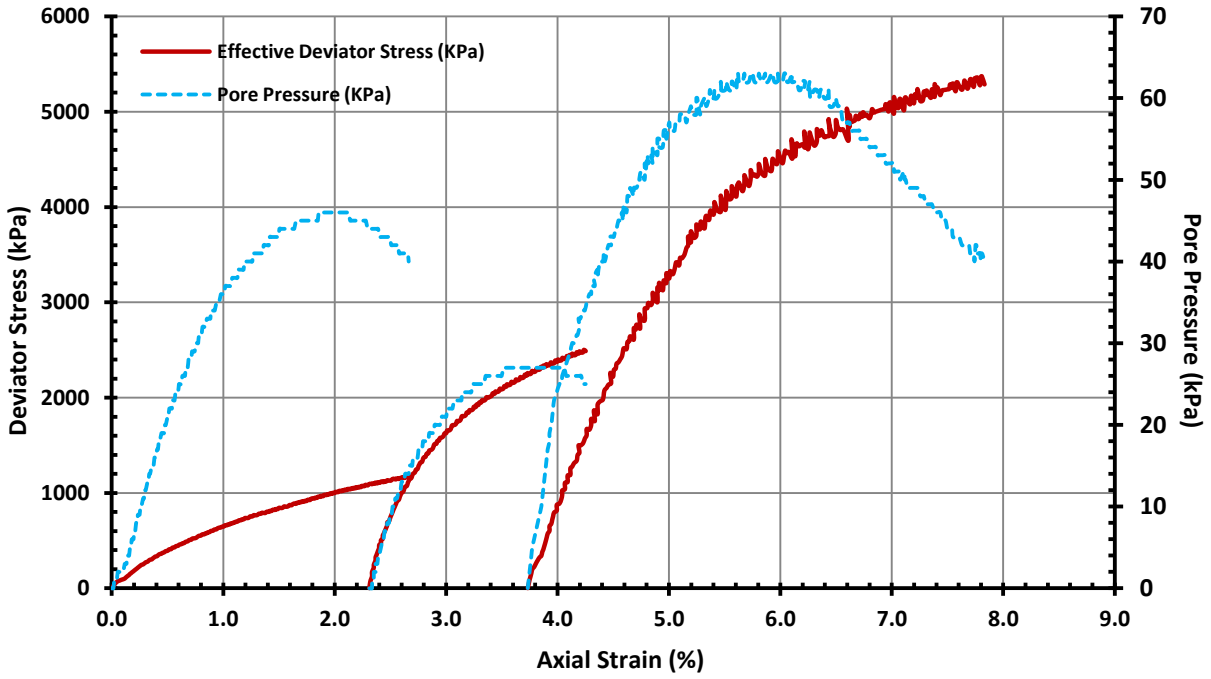
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	Tailings Stage 1 - SP04	Lab:	EPLab
Sample ID:	LLS17_237_LL1801_CU3		
Depth (m):	-	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	375	0	46	1371	329	4.17	1042	2.12
2	750	0	27	3113	723	4.31	2390	4.02
3	1500	0	63	6029	1437	4.20	4592	6.04

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MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	Tailings Stage 1 - SP04	Lab:	EPLab
Sample ID:	LLS17_237_LL1801_CU3		
Depth (m):	-	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID: Tailings Stage 1 - SP04 **Depth (m):** -

Lab ID: LLS17_237_LL1801_CU3 **Date Tested:** 22/01/2018

Failure Mode: Shear Failure Angle @ 38.1°

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

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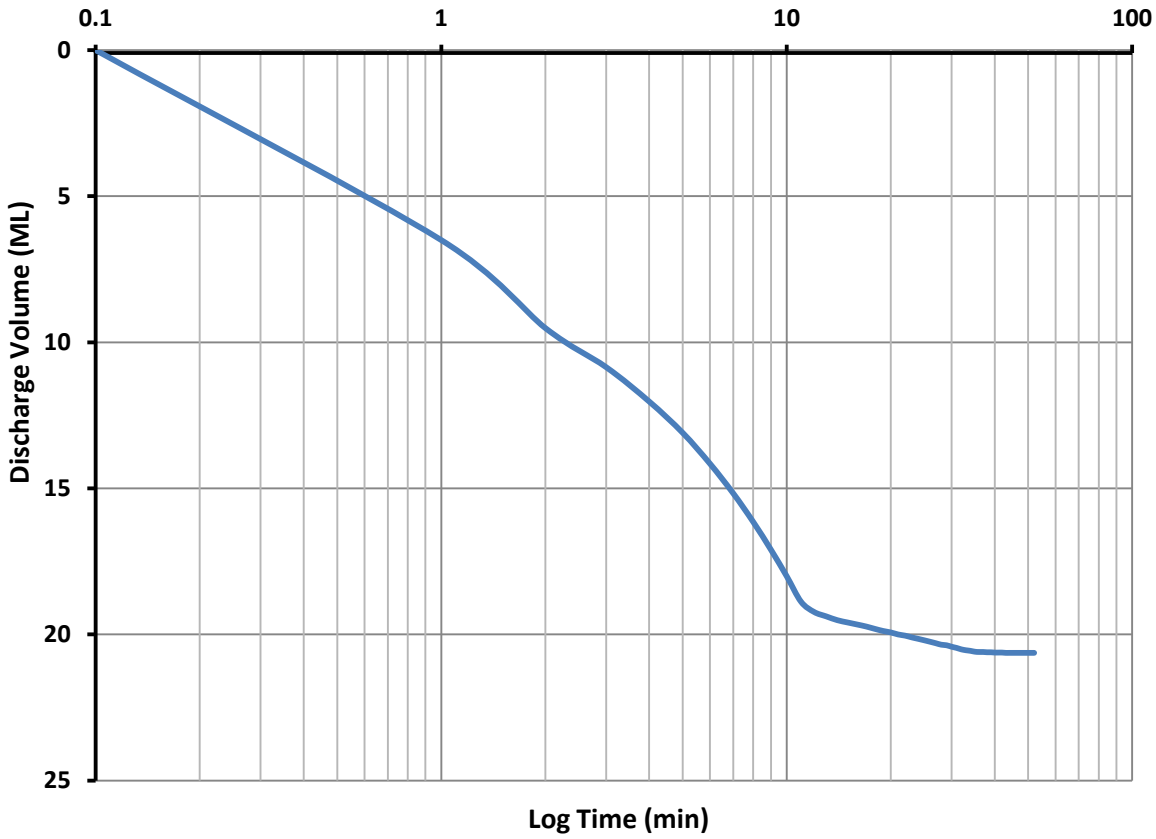
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Liquid Labs WA	Date Tested:	22/01/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Sample No:	Tailings Stage 1 - SP04	Lab:	EPLab
Sample ID:	LLS17_237_LL1801_CU3		
Depth (m):	-	Room Temperature at Test:	~ 18°C

Discharge Volume (ML) Vs Log Time (min)



Cv (cm²/s): 0.211 based on t_{90}

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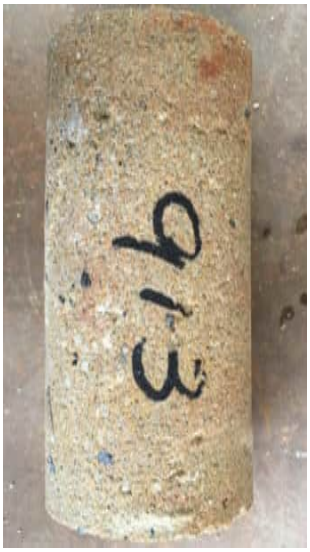
E-Precision Laboratory

UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client:	Liquid Labs Pty Ltd	Date Tested:	06/02/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Client ID:	BH2A-03	Lab:	EPLAB
Lab ID:	LLS18_913_UCS		
Depth (m):	4.70 - 4.90	Room Temperature at Test:	19°C
Tested by:	Phil	Sample Description:	-
Checked by:	Phil		
		* **Testing Temperature:**	N/A
Length/Diameter Ratio:	2.29	**Bulk Density (t/m³):**	2.47
Correction Applied:	N	**Moisture Content (%):**	1.55
Failure Mode:	Shear Failure		
Length (mm):	138.71	**Loading Rate (mm/min):**	0.05
Diameter (mm):	60.50		

Before Test



After Test

UCS (MPa)	8.17	**Bedding Angle (deg)**	N/A
Failure Angle (deg)	28.6		

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078

Accredited for compliance with ISO/IEC 17025

Authorised Signatory (Geotechnical Engineer):

NATA ACCREDITATION NO: 19078

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E-Precision Laboratory

UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client:	Liquid Labs Pty Ltd	Date Tested:	06/02/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Client ID:	BH2A-03	Lab:	EPLAB
Lab ID:	LLS18_915_UCS		
Depth (m):	11.10 - 11.25	Room Temperature at Test:	19°C
Tested by:	Phil	Sample Description:	-
Checked by:	Phil		
		* **Testing Temperature:**	N/A
Length/Diameter Ratio:	2.53	**Bulk Density (t/m³):**	2.50
Correction Applied:	N	**Moisture Content (%):**	2.17
Failure Mode:	Shear Failure		
Length (mm):	153.11	**Loading Rate (mm/min):**	0.05
Diameter (mm):	60.60		

Before Test

After Test

UCS (MPa)	10.44	**Bedding Angle (deg)**	N/A
Failure Angle (deg)	29.1		

Notes:
Stored and Tested the Sample as received
Samples supplied by the Client
NATA: 19078

Accredited for compliance with ISO/IEC 17025

Authorised Signatory (Geotechnical Engineer):

NATA ACCREDITATION NO: 19078

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E-Precision Laboratory

UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client:	Liquid Labs Pty Ltd	Date Tested:	06/02/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Client ID:	BH2A-04	Lab:	EPLAB
Lab ID:	LLS18_919_UCS		
Depth (m):	6.60 - 6.90	Room Temperature at Test:	19°C
Tested by:	Phil	Sample Description:	-
Checked by:	Phil		
		* **Testing Temperature:**	N/A
Length/Diameter Ratio:	2.03	**Bulk Density (t/m³):**	2.49
Correction Applied:	N	**Moisture Content (%):**	0.00
Failure Mode:	Shear Failure		
Length (mm):	124.28	**Loading Rate (mm/min):**	0.05
Diameter (mm):	61.20		

Before Test

After Test

UCS (MPa)	8.02	**Bedding Angle (deg)**	15.6
Failure Angle (deg)	15.6		

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078

Accredited for compliance with ISO/IEC 17025

Authorised Signatory (Geotechnical Engineer):

NATA ACCREDITATION NO: 19078

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E-Precision Laboratory

UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client:	Liquid Labs Pty Ltd	Date Tested:	06/02/2018
Project:	North Star Magnetite	EP Lab Job Number:	LLABS
Client ID:	BH2A-04	Lab:	EPLAB
Lab ID:	LLS18_921_UCS		
Depth (m):	13.70 - 13.90	Room Temperature at Test:	19°C
Tested by:	Phil	Sample Description:	-
Checked by:	Phil		
		* **Testing Temperature:**	N/A
Length/Diameter Ratio:	2.28	**Bulk Density (t/m³):**	2.60
Correction Applied:	N	**Moisture Content (%):**	0.00
Failure Mode:	Shear Failure		
Length (mm):	139.95	**Loading Rate (mm/min):**	0.05
Diameter (mm):	61.38		

Before Test

After Test

UCS (MPa)	27.81	**Bedding Angle (deg)**	17.6
Failure Angle (deg)	29.5		

Notes:
Stored and Tested the Sample as received
Samples supplied by the Client
NATA: 19078

Accredited for compliance with ISO/IEC 17025

Authorised Signatory (Geotechnical Engineer):

NATA ACCREDITATION NO: 19078

Integrity Precision Innovation

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E-PRECISION LABORATORY

POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client:	Liquid Labs Pty Ltd	Date Tested:	07/02/2018
Project:	North Star Magnetite Project	Date Reported:	07/02/2018
		EP Lab Job Number:	LLABS
Lab:	EPLab		
Tested by:	Phil		

Results

Lab ID:	PLT_LLS18_912	PLT_LLS18_914	PLT_LLS18_916	PLT_LLS18_918	PLT_LLS18_920
Client ID:	BH2A-01	BH2A-03	BH2A-03	BH2A-04	BH2A-04
Test Type:	AXIAL	AXIAL	AXIAL	AXIAL	AXIAL
Depth (m):	13.80 - 13.90	9.80 - 10.10	15.15 - 15.35	3.85 - 4.00	11.80 - 11.95
Lithology/Description:	-	-	-	-	-
Moisture Content (%):	0	0	0	0	0
Diameter (D) (mm):	60.96	60.81	60.82	61.08	61.11
Length (t) (mm):	25.38	27.21	25.72	26.91	25.78
L/D Ratio:	0.42	0.45	0.42	0.44	0.42
Mode of Failure:	Axial Split	Axial Split	Axial Split	Axial Split	Axial Split
Load at Failure (kN):	2.9	1.9	2.4	1.2	1.9
I_S (MPa)	**1.47**	**0.90**	**1.20**	**0.57**	**0.95**
$I_{S(50)}$ (MPa)	**1.40**	**0.87**	**1.14**	**0.55**	**0.90**

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

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E-Precision Laboratory

POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client:	Liquid Labs Pty Ltd	Date Tested:	07/02/2018
Project:	North Star Magnetite Project	Date Reported:	07/02/2018
		EP Lab Job Number:	LLABS

Lab: EPLab
Tested by: Phil

Results

Lab ID:	PLT_LLS18_922	PLT_LLS18_924			
Client ID:	BH2A-05	BH2A-05			
Test Type:	AXIAL	AXIAL			
Depth (m):	5.20 - 5.40	13.70 - 14.00			
Lithology/Description:	-	-			
Moisture Content (%):	0	0			
Diameter (D) (mm):	61.01	61.07			
Length (t) (mm):	25.81	25.36			
L/D Ratio:	0.42	0.42			
Mode of Failure:	Axial Split	Axial Split			
Load at Failure (kN):	0.61	1.1			
I_S (MPa)	**0.30**	**0.56**			
$I_{S\,(50)}$ (MPa)	**0.29**	**0.53**			

Notes:
Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

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E-Precision Laboratory

POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client:	Liquid Labs Pty Ltd	Date Tested:	07/02/2018
Project:	North Star Magnetite Project	Date Reported:	07/02/2018
		EP Lab Job Number:	LLABS
Lab:	EPLab		
Tested by:	Phil		

PHOTO POST TESTING

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

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Soil Rock Calibration

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Queens Park
WA 6107
Ph: +61 8 9258 8323

SLAKE DURABILITY INDEX TEST REPORT

Test Method: AS 1289 4.133.3.4

Client	Liquid Labs WA	**Report No.**	P 18030010-SD
Address	Unit 16b 81 Briggs Street CARLISLE WA 6101		
Project	Northstar Magnetite Project - Pilbara	**Test Date**	13/03/2018
		Report Date	15/03/2018

Sample No.	18030010	18030011
Client ID	BH2A-06	BH2A-06
Depth (m)	2.80-3.00	9.20-9.50
Slake Durability (2nd cycle) (%)	97.0	98.1
Slake Durability (1st cycle) (%)	97.8	98.5
Water Used	Tap	Tap
Appearance of fragments retained in the drum	Original Form	Original Form
Appearance of fragments passing through the drum	Fragments and Fines	Fragments and Fines

Sample No.		
Client ID		
Depth (m)		
Slake Durability (2nd cycle) (%)		
Slake Durability (1st cycle) (%)		
Water Used		
Appearance of fragments retained in the drum		
Appearance of fragments passing through the drum		

NOTES/REMARKS:

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Perth Laboratory

Authorised Signatory

C. Channon

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Laboratory No. 9926

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E-Precision Laboratory

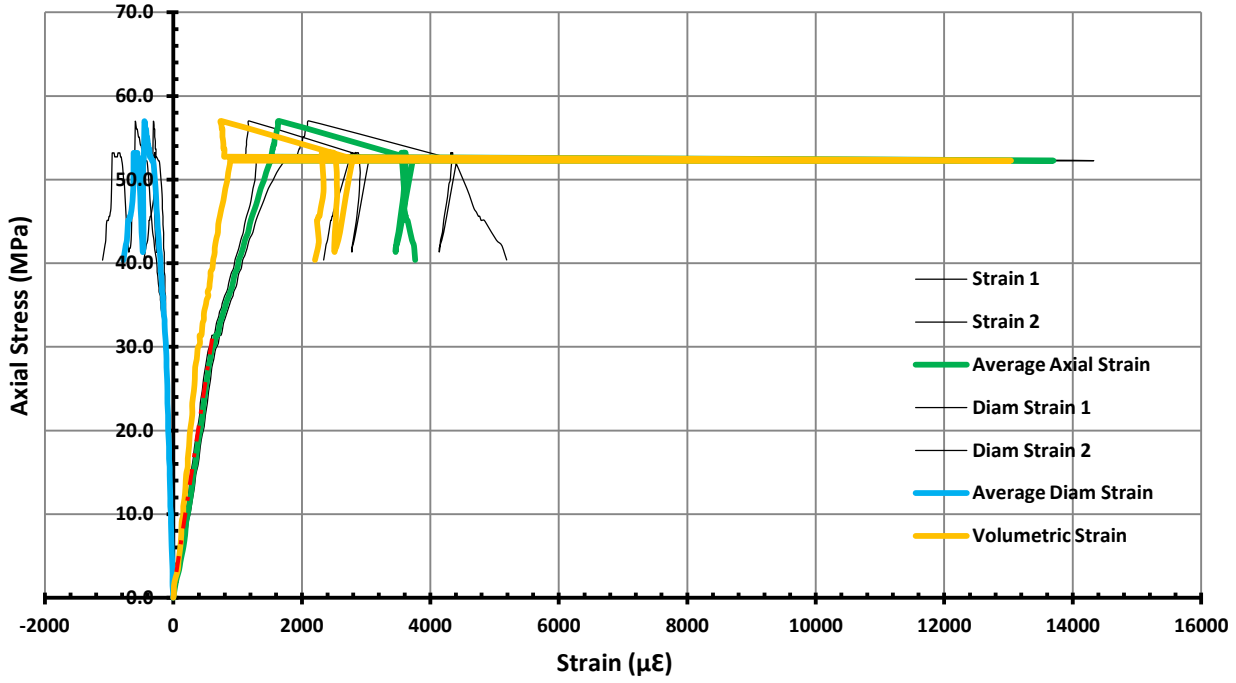
UCS & DEFORMATION TEST REPORT

Test Method: AS 4133.4.2.1 & ISRM Method

Client:	Liquid Labs WA	Date Tested:	31/09/2018
Project:	Iron Bridge North Star TSF	EP Lab Job Number:	LLAB
Sample No:	BH2A 01A	Lab:	EPLab
Sample ID:	BH2A_01A_1_LLAB16_UCSE		
Depth (m):	3.20 - 3.62	Room Temperature at Test:	18°C

Tested by:	Phil	**Geology:**	-
Checked by:	Phil		
Length (mm):	194.42	**Length/Diameter Ratio:**	2.38
Diameter (mm):	81.86	**Bulk Density (t/m³):**	2.07
Rate of Loading (mm/min):	0.025		

Axial Stress (MPa) Vs Strain Plot



Max UCS (MPa)				**57.00**	
Young's Modulus (GPa)				**Poisson's Ratio**	
Secant (0-50%)			**45.14**	**0.184**	
Tangent			**49.40**	**0.180**	
Bedding Angle (°)	**N/A**	**Failure Mode**	**Shear**	**Moisture Content (%)**	**0.86**
				Bulk Density (t/m³)	**2.07**

Integrity Precision Innovation

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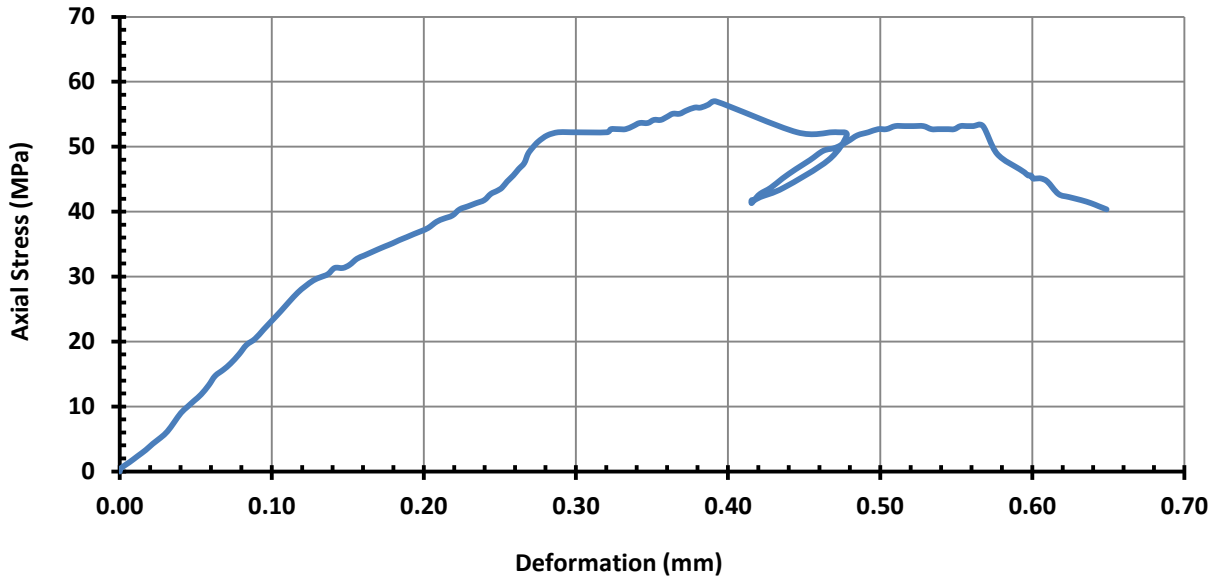
E-Precision Laboratory

UCS & DEFORMATION TEST REPORT

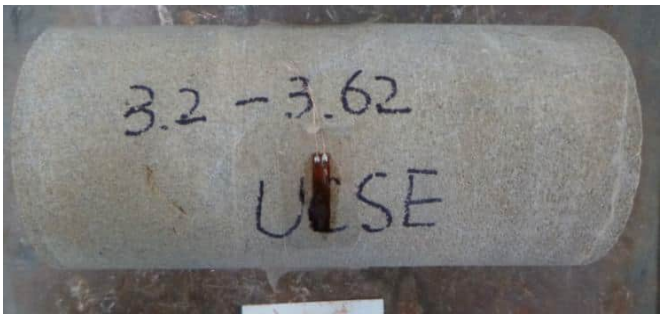
Test Method: AS 4133.4.2.1 & ISRM Method

Client:	Liquid Labs WA	Date Tested:	31/09/2018
Project:	Iron Bridge North Star TSF	EP Lab Job Number:	LLAB
Sample No:	BH2A 01A	Lab:	EPLab
Sample ID:	BH2A_01A_1_LLAB16_UCSE		
Depth (m):	3.20 - 3.62	Room Temperature at Test:	18°C

Axial Stress (MPa) Vs Axial Deformation (mm)



Pre-Test Photo



Post Test Photo

Failure Angle to Vertical: 25.7° Intact Rock

Comments:

Stored and tested the Sample as received, samples supplied by the Client

NATA: 19078 **Authorised Signature (Geotechnical Engineer):**

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E-Precision Laboratory

UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client:	Liquid Labs WA	Date Tested:	30/09/2018
Project:	Iron Bridge North Star TSF	EP Lab Job Number:	LLABS
Client ID:	BH2A 02A	Lab:	EPLAB
Lab ID:	BH2A_02A_1_UCS		
Depth (m):	6.30 - 6.68	Room Temperature at Test:	19°C
Tested by:	Phil	Sample Description:	-
Checked by:	Phil		
		* **Testing Temperature:**	N/A
Length/Diameter Ratio:	2.41	**Bulk Density (t/m³):**	2.60
Correction Applied:	N	**Moisture Content (%):**	0.00
Failure Mode:	Shear Failure		
Length (mm):	199.78	**Loading Rate (mm/min):**	0.05
Diameter (mm):	82.92		

Before Test

After Test

UCS (MPa)	60.74	**Bedding Angle (deg)**	N/A
Failure Angle (deg)	25.9		

Notes:
Stored and Tested the Sample as received
Samples supplied by the Client
NATA: 19078

Accredited for compliance with ISO/IEC 17025

Authorised Signatory (Geotechnical Engineer):

NATA ACCREDITATION NO: 19078

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E-Precision Laboratory

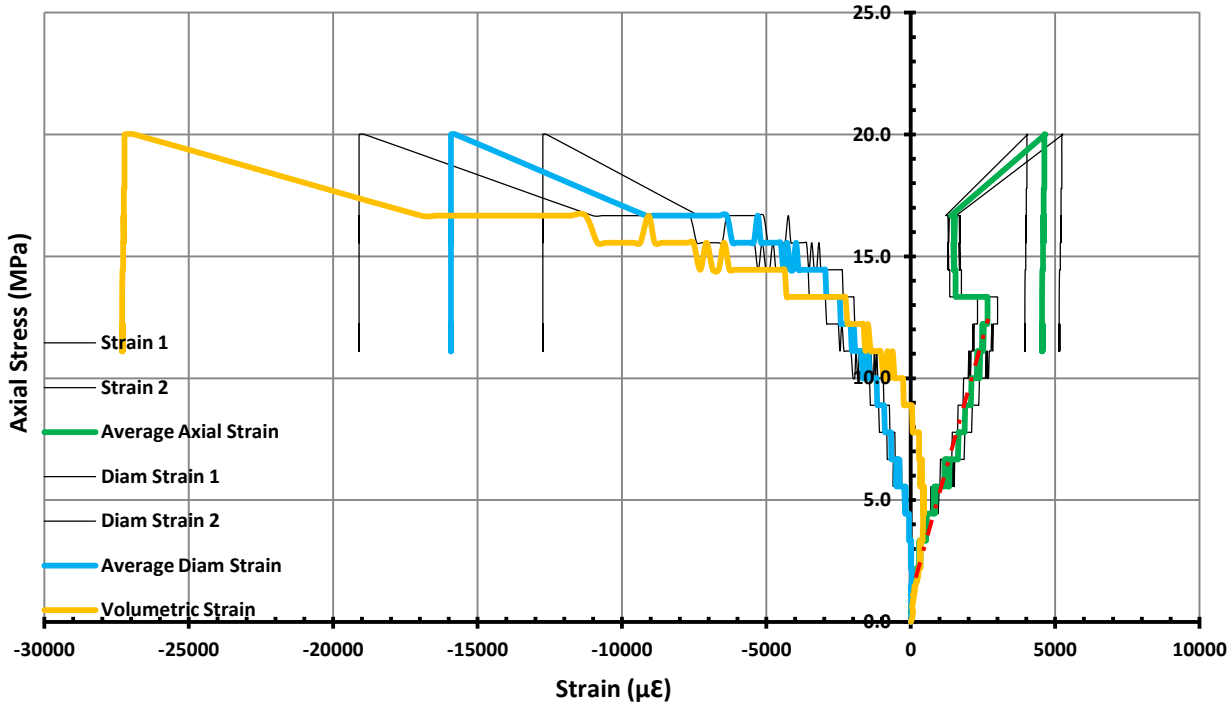
UCS & DEFORMATION TEST REPORT

Test Method: AS 4133.4.2.1 & ISRM Method

Client:	Liquid Labs WA	Date Tested:	31/09/2018
Project:	Iron Bridge North Star TSF	EP Lab Job Number:	LLAB
Sample No:	BH2A 07	Lab:	EPLab
Sample ID:	BH2A_07_1_LLAB16_UCSE		
Depth (m):	6.00 - 6.50	Room Temperature at Test:	18°C

Tested by:	Phil	**Geology:**	-
Checked by:	Phil		
Length (mm):	169.36	**Length/Diameter Ratio:**	2.04
Diameter (mm):	82.90	**Bulk Density (t/m³):**	2.47
Rate of Loading (mm/min):	0.025		

Axial Stress (MPa) Vs Strain Plot



Max UCS (MPa)				**20.01**	
Young's Modulus (GPa)				**Poisson's Ratio**	
Secant (0-50%)			**4.47**	**0.528**	
Tangent			**6.81**	**0.325**	
Bedding Angle (°)	**N/A**	**Failure Mode**	**Shear**	**Moisture Content (%)**	**0.00**
				Bulk Density (t/m³)	**2.47**

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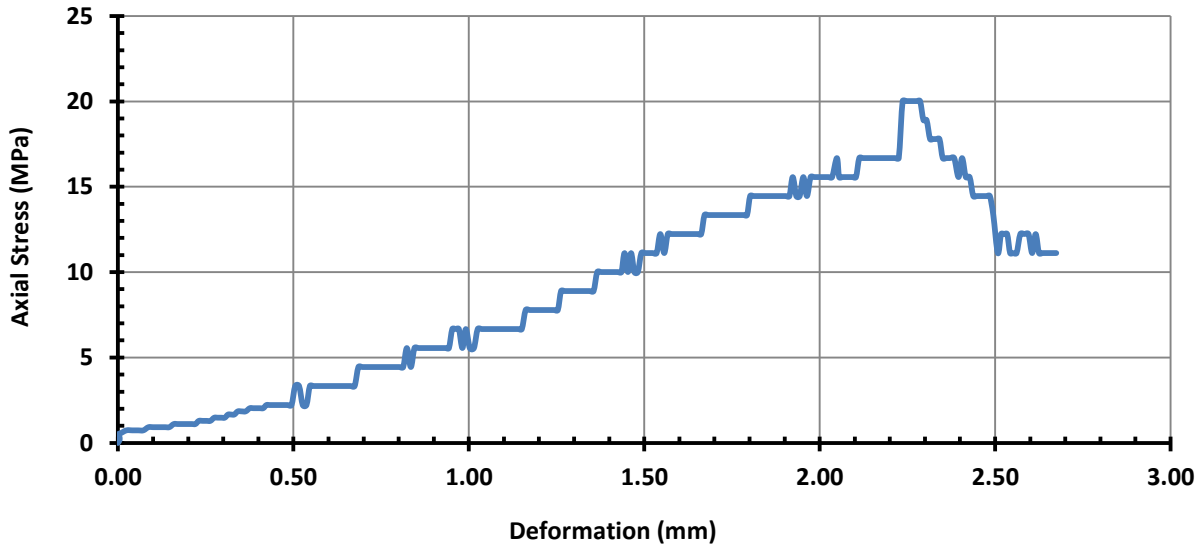
UCS & DEFORMATION TEST REPORT

Test Method: AS 4133.4.2.1 & ISRM Method

Client:	Liquid Labs WA	Date Tested:	31/09/2018
Project:	Iron Bridge North Star TSF	EP Lab Job Number:	LLAB
Sample No:	BH2A 07	Lab:	EPLab
Sample ID:	BH2A_07_1_LLAB16_UCSE		
Depth (m):	6.00 - 6.50	Room Temperature at Test:	18°C

Axial Stress (MPa) Vs Axial Deformation (mm)



Pre-Test Photo

Post Test Photo

Failure Angle to Vertical: **27.8° along structure**

Comments:

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NATA: 19078 **Authorised Signature (Geotechnical Engineer):**

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E-Precision Laboratory

UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client:	Liquid Labs WA	Date Tested:	30/09/2018
Project:	Iron Bridge North Star TSF	EP Lab Job Number:	LLABS
Client ID:	BH2A 09	Lab:	EPLAB
Lab ID:	BH2A_09_1_UCS		
Depth (m):	23.00 - 23.35	Room Temperature at Test:	19°C
Tested by:	Phil	Sample Description:	-
Checked by:	Phil		
		* **Testing Temperature:**	N/A
Length/Diameter Ratio:	2.41	**Bulk Density (t/m³):**	2.63
Correction Applied:	N	**Moisture Content (%):**	0.00
Failure Mode:	Shear Failure		
Length (mm):	197.13	**Loading Rate (mm/min):**	0.05
Diameter (mm):	81.82		

Before Test

After Test

UCS (MPa)	79.88	**Bedding Angle (deg)**	N/A
Failure Angle (deg)	22.9		

Notes:
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Samples supplied by the Client
NATA: 19078

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UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Test Method: AS4133 4.2.1

Client:	Liquid Labs WA	Date Tested:	30/09/2018
Project:	Iron Bridge North Star TSF	EP Lab Job Number:	LLABS
Client ID:	BH2A 12	Lab:	EPLAB
Lab ID:	BH2A_12_1_UCS		
Depth (m):	5.70 - 6.06	Room Temperature at Test:	19°C
Tested by:		Sample Description:	-
Checked by:	Phil		
		* **Testing Temperature:**	N/A
Length/Diameter Ratio:	2.22	**Bulk Density (t/m³):**	2.44
Correction Applied:	N	**Moisture Content (%):**	0.00
Failure Mode:	Shear Failure		
Length (mm):	36.11	**Loading Rate (mm/min):**	0.05
Diameter (mm):	16.27		

Before Test

After Test

UCS (MPa)	134.68	**Bedding Angle (deg)**	N/A
Failure Angle (deg)	28.5		

Notes: *Sample subcored*

Stored and Tested the Sample as received

Samples supplied by the Client

Accredited for compliance with ISO/IEC 17025

NATA: 19078

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E-PRECISION LABORATORY

POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client:	Liquid Labs Pty Ltd	Date Tested:	01/10/2018
Project:	Iron Bridge North Star TSF	Date Reported:	03/10/2018
		EP Lab Job Number:	LLABS

Lab: EPLab
Tested by: Phil

Results

Lab ID:	PLT_LLS18_IB_01	PLT_LLS18_IB_02	PLT_LLS18_IB_03	PLT_LLS18_IB_04	PLT_LLS18_IB_05
Client ID:	BH2A 01A	BH2A 02A	BH2A 02A	BH2A 07	BH2A 07
Test Type:	AXIAL	AXIAL	AXIAL	AXIAL	AXIAL
Depth (m):	3.20 - 3.62	3.30 - 3.45	6.30 - 6.68	1.46 - 1.63	6.00 - 6.50
Lithology/Description:	-	-	-	-	-
Moisture Content (%):	0.23	5.88	0	0	0
Diameter (D) (mm):	81.92	82.13	82.78	82.37	82.78
Length (t) (mm):	35.26	46.55	33.56	31.89	31.26
L/D Ratio:	0.43	0.57	0.41	0.39	0.38
Mode of Failure:	Axial Split	Axial Split	Axial Split	Axial Split	Axial Split
Load at Failure (kN):	6.9	1.2	10.9	7.5	5.9
I_s (MPa)	**1.88**	**0.25**	**3.08**	**2.24**	**1.79**
$I_{s(50)}$ (MPa)	**2.05**	**0.29**	**3.33**	**2.39**	**1.91**

Notes:
Stored and Tested the Sample as received

Samples supplied by the Client

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E-PRECISION LABORATORY

POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client:	Liquid Labs Pty Ltd	Date Tested:	01/10/2018
Project:	Iron Bridge North Star TSF	Date Reported:	03/10/2018
		EP Lab Job Number:	LLABS

Lab: EPLab
Tested by: Phil

Results

Lab ID:	PLT_LLS18_IB_06	PLT_LLS18_IB_07	PLT_LLS18_IB_08	PLT_LLS18_IB_09	PLT_LLS18_IB_10
Client ID:	BH2A 08	BH2A 09	BH2A 09	BH2A 12	BH2A 12
Test Type:	AXIAL	AXIAL	AXIAL	AXIAL	AXIAL
Depth (m):	3.00 - 3.38	2.24 - 2.40	23.00 - 23.35	1.50 - 1.68	5.70 - 6.06
Lithology/Description:	-	-	-	-	-
Moisture Content (%):	4.63	1.78	0	0	6.31
Diameter (D) (mm):	82.19	82.06	82.01	82.68	82.56
Length (t) (mm):	33.59	43.33	42.6	62.55	33.54
L/D Ratio:	0.41	0.53	0.52	0.76	0.41
Mode of Failure:	Axial Split	Axial Split	Axial Split	Axial Split	Axial Split
Load at Failure (kN):	2.1	0.6	19.3	12.2	5.1
I_S (MPa)	**0.60**	**0.13**	**4.34**	**1.85**	**1.45**
$I_{S(50)}$ (MPa)	**0.65**	**0.15**	**4.94**	**2.30**	**1.56**

Notes:
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Samples supplied by the Client

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POINT LOAD STRENGTH INDEX TEST REPORT

Test Method: AS4133.4.1

Client:	Liquid Labs Pty Ltd	Date Tested:	01/10/2018
Project:	Iron Bridge North Star TSF	Date Reported:	03/10/2018
		EP Lab Job Number:	LLABS
Lab:	EPLab		
Tested by:	Phil		

PHOTO POST TESTING

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

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