TEST PIT: TP18

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park
Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow
Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock
Date: 08/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0 – 0.7					SM	Sandy SILT/Silty SAND: fine to medium grained, red/brown, trace gravel, trace roots	D	D - VD			
E	H		0.7 – 1.5						SANDSTONE/LIMESTONE (80%): fine to coarse grained, sub-angular to sub-rounded, red/brown, with Sandy SILT, low plasticity, red/brown,, fine to medium grained, sub-angular to sub-rounded sand	D				
			1.5						Hole terminated at 1.50 m Refusal on solid rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP19

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow		Backhoe	**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	H		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, red/brown, trace / with Gravel (calcarenite), trace roots	D	VD			
									Hole terminated at 0.20 m Refusal on hard rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP20

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH RL*	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, with fines, trace roots	D				
	F		0.5					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, weakly to moderately cemented, with fines		D - VD			
	F-H				B(TP20-1)			GM	Silty Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white calcarenite with red/brown soils, fine to medium grained, sub-angular to sub-rounded sand (20%), trace fines			TP20-1		
	H		1.0						CALCARENITE: fine to carse grained, sub-angular to sub-rounded, white with red/brown soil matrix					1.20 : Distinctly weathered to slightly weathered with depth, medium strength
			1.5						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP21

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock

Date:	09/03/2022
Logged:	PF
Checked Date:	13/04/2022
Checked By:	TM

Excavation: METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	Sampling: SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	Field Material Description: SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E			0.0					SP	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, trace fine roots and organics			TP21/0.00		
								SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, trace Gravel		D - VD	TP21/0.50		
			0.5		B(TP21-1)				Becomes dark brown					
			1.0					SM	Mix of Silty SAND (50%) as described above and CALCARENITE (50%), fine to coarse grained, sub-angular to sub-rounded, white with red/brown staining, distinctly weathered to slightly weathered, medium strength			TP21-1 TP21/1.00 TP21/1.50		1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5											
			2.0						Hole terminated at 1.70 m Refusal on hard rock Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP22

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow			**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, trace roots, trace rootlets, trace organics	D	VD	TP22/0.00		
	F-H		0.5 – 1.0						Weathered CALCARENITE (Distinctly weathered) (80-90%), fine to coarse grained, sub-angular to sub-rounded, white, with Silty SAND matrix (10-20%), as described above	D		TP22/0.50 TP22/1.00		1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5 – 3.0						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP23

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park
Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow
Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock
Date: 09/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace roots and shell fragments	D	VD	TP23/0.00		
	E-F		0.5					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown			TP23/0.50		
	H		1.0						CALCARENITE: fine to coarse grained, sub-angular to sub-rounded, pale red/brown and white, distinctly weathered to slightly weathered with depth, with red/brown staining, medium strength (dull and ring sound with hammer, approximately 20% of soil matrix described as Silty SAND			TP23/1.00		1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP24

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel	D	VD		
E	F-H		0.5						CALCARENITE: fine to coarse grained, sub-angular to sub-rounded, white with red/brown staining, Distinctly weathered to slightly weathered at depth, medium strength, Silty SAND (10-20%) matrix as described above	D			0.90 : Destinctly weathered to slightly weathered with depth, medium strength
			1.0						Hole terminated at 0.90 m Refusal on hard rock Groundwater not encountered				
			1.5										
			2.0										
			2.5										
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP25

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow			**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, trace gravel	D	VD			
	F-H		0.5 – 1.0					SP	CALCARENITE (60-80%), fine to coarse grained, sub-angular to sub-rounded, white, with pale red/brown staining, Distinctly to slightly weathered with depth (staining in rock observed), medium strength (slight ring hard to break), Silty SAND (20-40%) soil matrix as described above					1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5 – 3.0						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP26

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel 15%), trace roots, organics and rootlets	D				
	F		0.5		B(TP26-1)			SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, with gravel		D	TP26-1		
	H		1.0						Weathered CALCARENITE: fine to coarse grained, sub-angular to sub-rounded, white, Distinctly weathered (60-80%), with Silty SAND soil matrix as described above					1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

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Galt GEOTECHNICS

TEST PIT: TP27

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	H		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, red/brown, trace roots	D	D			
									Hole terminated at 0.10 m Refusal on solid rock Groundwater not encountered		L - MD			
			0.5											
			1.0											
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

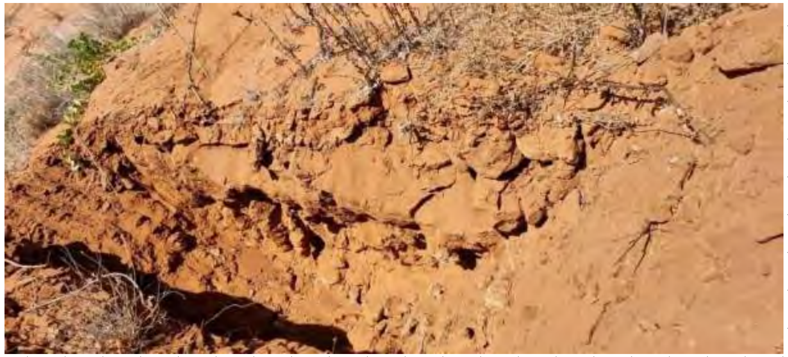
TEST PIT: TP28

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, trace roots	D	VD	TP28/0.00		
	E-F		0.5					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown			TP28/0.50		
	H		1.0						CALCARENITE (60-80%), fine to coarse grained, sub-angular to sub-rounded, white with red/brown staining, Distinctly to slightly weathered with depth, medium depth, Silty SAND (20-40%), matrix as described above			TP28/1.00		
			1.5						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered			TP28/1.50		
			2.0											
			2.5											
			3.0											

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP29

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 09/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown	D	VD	TP29/0.00		
			0.5						Becomes more silty			TP29/0.50		
	F-H		1.0									TP29/1.00		
			1.5						CALCARENITE: fine to medium grained, sub-angular to sub-rounded, white with red/brown staining, Distinctly weathered, medium strength, Silty SAND (20%), soil matrix as described above			TP29/1.50		
									Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP30

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F		**Date:**	09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	Backhoe		**Logged:**	PF
Project: Onslow Industrial Park		**Operator:**	Colin	**Checked Date:**	13/04/2022
		Bucket:	600 mm wide rock	**Checked By:**	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, with fines, trace roots	D	VD	TP30/0.00	
	E-F		0.5		B(TP30-1)			SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown			TP30/0.50	
			1.0									TP30-1 TP30/1.00	
			1.5									TP30/1.50	
			2.0									TP30/2.00	
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered			TP30/2.50	
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP31

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	SAMPLE OR FIELD TEST	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0			SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, red brown, with fines , trace gravel, trace roots	D	VL - MD	TP31/0.00	
	E-F		0.5			SP	Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, fine to coarse grained, sub-angular to sub-rounded gravel (30%), trace fines, weakly to moderately cemented soils observed as gravel size		D - VD	TP31/0.50	
	F-H	Groundwater 1.45 m	1.0			GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white calcarenite Gravel with brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace fines		D - VD	TP31/1.00, TP31/1.50	
	H		2.0	B(TP31-1)		GP	GRAVEL with Sand: fine to medium grained, sub-angular to sub-rounded, brown, fine to medium grained, sub-angular to sub-rounded sand, with fines		MD, D - VD	TP31/2.00, TP31-1, TP31/2.50	
			2.5				Hole terminated at 2.50 m Target depth Groundwater encountered at 1.45 m				
			3.0								

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP32

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, red/brown, trace roots	D	D - VD	TP32/0.00		
			0.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, red/brown, trace fine roots			TP32/0.50		
	E-F		1.0 – 2.5					GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white Gravel (calcarenite) and red/brown sands, fine to medium grained, sub-angular to sub-rounded sand, with fines			TP32/1.00 TP32/1.50		
			2.5 – 3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP33

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow		**Logged:** PF
Project: Onslow Industrial Park		**Operator:** Colin	**Checked Date:** 13/04/2022
		Bucket: 600 mm wide rock	**Checked By:** TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty SAND with Gravel: fine to medium grained, sub-angular to sub-rounded, pale brown, fine to medium grained, sub-angular to sub-rounded gravel	D	VD			
	F-H		0.5					GP	Sandy GRAVEL with fines: fine to coarse grained, sub-angular to sub-rounded, white Gravel with pale brown sands, fine to medium grained, sub-angular to sub-rounded sand, with fines					
			1.0						Hole terminated at 0.90 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP34

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, with fines	D	VD			
E	F-H		0.5 – 1.0					GP	Sandy Gravel with fines: fine to coarse grained, sub-angular to sub-rounded, white calcarenite Gravel and red/brown soils, fine to medium grained, sub-angular to sub-rounded sand	D				1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5 – 3.0						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP35

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow		Backhoe	**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	H		0.0					GP	Sandy Gravel with fines: fine to coarse grained, sub-angular to sub-rounded, white Gravel calcarenite with red/brown soils, fine to medium grained, sub-angular to sub-rounded sand	D	VD			
									Hole terminated at 0.15 m Refusal on hard rock Groundwater not encountered					
			0.5											
			1.0											
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP36

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	Gravelly SAND with fines: fine to medium grained, sub-angular to sub-rounded, red/brown, fine to medium grained, sub-angular to sub-rounded gravel, with fines	D	VD			
	F-H		0.5 – 1.4		B(TP36-1) (0.5–1.0)			SM	Silty SAND: fine to coarse grained, sub-angular to sub-rounded, with white calcarenite gravel and red/brown soil matrix, trace cobbles, trace boulders	D		TP36-1		
			1.5						Hole terminated at 1.40 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP37

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow		**Logged:** PF
Project: Onslow Industrial Park		**Operator:** Colin	**Checked Date:** 13/04/2022
		Bucket: 600 mm wide rock	**Checked By:** TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown soil with blue metal and calcarenite Gravel, with fines, trace gravel	D	VD			
	F-H		0.5					SP	Gravelly SAND with fines: fine to medium grained, sub-angular to sub-rounded, red/brown, fine to coarse grained, sub-angular to sub-rounded gravel					
			1.0						CALCARENITE: fine to coarse grained, sub-angular to sub-rounded, white with red/brown staining, Distinctly to slightly weathered with depth					
	H		1.5						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP38

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND with Silt: fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel		MD - VD			
	F-H		0.5		B(TP38-1)			GM	Silty Sandy Gravel with fines: fine to coarse grained, sub-angular to sub-rounded, white calcarenite Gravel and red/brown soils, fine to medium grained sand, sub-angular to sub-rounded sand					
			1.0						Becomes more silty, dark brown			TP38-1		
			1.5											
			2.0						Hole terminated at 1.70 m Refusal on hard rock Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP39

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe		**Date:**	10/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow			**Logged:**	PF
Project: Onslow Industrial Park		**Operator:**	Colin	**Checked Date:**	13/04/2022
		Bucket:	600 mm wide rock	**Checked By:**	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale red/brown, trace gravel , trace roots	D	VD			
								SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, pale red/brown, low plasticity fines					
	F-H		0.5 – 1.0						CALCARENITE (60-90%) increasing with depth: fine to coarse grained, sub-angular to sub-rounded, white, with pale red/brown soil matrix described as SAND with fines (above) 10-40% reducing with depth					
			1.5 – 3.0						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP40

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park
Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow
Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock
Date: 10/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale red/brown, trace gravel, trace cobbles, trace roots	D	MD - VD	TP40/0.00		
	F		0.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, pale red/brown, trace gravel, trace cobbles			TP40/0.50		
	E		1.0 – 2.5		B(TP40-1)			SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, with fines, trace gravel			TP40/1.00, TP40/1.50, TP40/2.00, TP40-1 TP40/2.50		
			3.0						Hole terminated at 2.80 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

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TEST PIT: TP41

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow			**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale red/brown, with fines, trace gravel, trace roots	D	VD			
	F		0.5					GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white Gravel with pale brown soils, fine to medium grained, sub-angular to sub-rounded sand, with fines					
	F-H		1.0 / 1.5					SP	Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, pale red brown soils with white rocks (40-60%), fine to coarse grained, sub-angular to sub-rounded calcarenite gravel, trace cobbles, trace fines	D - M				
			2.0 / 2.5 / 3.0						Hole terminated at 1.60 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP42

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 10/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E (0.0–0.5), E (0.5–2.5)		0.0–1.5					SP	SAND: fine to medium grained, sub-angular to sub-rounded pale red brown, with low plasticity fines (5-12%), trace Gravel (5-10%), cementation moderate at 5% Soil becomes brown with depth as it becomes moist Small calcarenite gravel fragments observed in SAND	D	VD			
			1.5–2.5						Fines content increasing	D - M				
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP43

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, pale red/brown, fine to coarse grained, sub-angular to sub-rounded gravel	D	VD			
	F-H		0.5					GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white calcarenite Gravel with pale red/brown sands, fine to medium grained, sub-angular to sub-rounded sand, trace fines, trace cobbles		D			
			1.0						Increasing fines content		MD			
			1.5						Hole terminated at 1.40 m Refusal on hard rock Groundwater not encountered		D			
			2.0								D			
			2.5								L - MD			
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01 GLB Log GH_EXCAVATION J2201059.GPJ <<DrawingFile>> 14/04/2022 07:46 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

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TEST PIT: TP44

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock
Date:	10/03/2022	**Logged:**	PF	**Checked Date:**	13/04/2022
Checked By:	TM				

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					GP	Sandy GRAVEL with fines: fine to coarse grained, angular to sub-rounded, white calcarenite with pale red/brown soils, fine to medium grained sub-angular to sub-rounded sand	D	VD	TP44/0.00		
	F-H		0.5		B(TP44-1)			SP	Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, pale red/brown, fine to coarse grained, sub-angular to sub-rounded gravel (30-40%), with fines, trace cobbles			TP44/0.50 TP44-1 TP44/1.00		
	H		1.0						Becomes more blocky/larger rock fragments (cobbles) CALCARENITE (70-90%); fine to coarse grained, sub-angular to sub-rounded, white with pale red/brown sandy matrix, fine to medium grained, sub-angular to sub-rounded sand, trace fines, calcarenite Distinctly to slightly weathered, medium strength			TP44/1.50		
			1.5						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP45

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F-H		0.0 – 1.0						CALCARENITE (70-90%); fine to coarse grained, sub-angular to sub-rounded, white with pale red/brown soil described as SAND with fines, fine to medium grained, sub-angular to sub-rounded, Becomes blocky with depth (more cobbles) Distinctly to slightly weathered with depth, medium strength	D	VD			
			1.0						Hole terminated at 1.00 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP46

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock
Date:	10/03/2022	**Logged:**	PF	**Checked Date:**	13/04/2022
Checked By:	TM				

Excavation: METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	Sampling: SAMPLE OR FIELD TEST	RECOVERED	Field Material Description: GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0 – 0.5						CALCARENITE (50-60%) and SAND (40-50%): Sandy Gravelly COBBLES; white with pale red/brown staining and soils, fine to coarse grained, sub-angular to sub-rounded gravel, fine to medium grained, sub-angular to sub-rounded sand, trace fines, weakly to moderately cemented soils	D	VD	TP46/0.00		
E	F-E		0.5 – 2.5		B(TP46-1) (1.5 – 2.0)			GP	Sandy GRAVEL: fine to coarse grained, angular to sub-rounded, white with pale red/brown straining soil, fine to medium grained, sub-angular to sub-rounded sand, with fines, trace cobbles	D (to 1.5); D - M (1.5 – 2.5)		TP46/0.50, TP46/1.00, TP46/1.50, TP46-1 TP46/2.00, TP46/2.50		
			2.5 – 3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP47

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 10/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow		**Logged:** PF
Project: Onslow Industrial Park		**Operator:** Colin	**Checked Date:** 13/04/2022
		Bucket: 600 mm wide rock	**Checked By:** TM

Excavation: METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	Sampling: SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale red/brown, trace roots	D	VD			
			0.5 – 2.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded pale red/brown	D (to ~1.5); D - M				
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

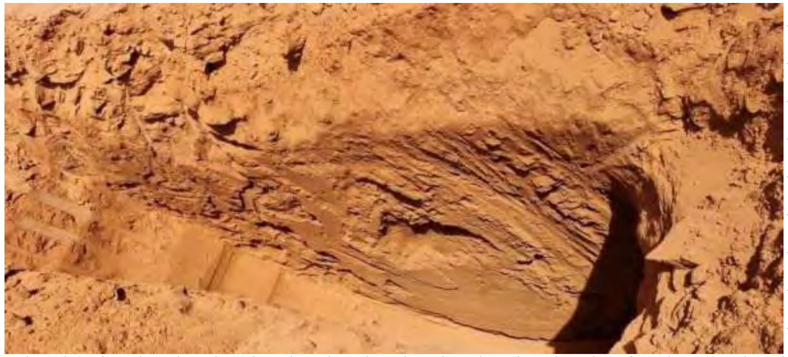
TEST PIT: TP48

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	Gravelly SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, sub-angular to sub-rounded gravel (30%), trace roots	D	D to VD	TP48/0.00		
E	F		0.5					SP	Gravelly SAND with fines: fine to medium grained, sub-angular to sub-rounded pale brown, fine to coarse grained, sub-angular to sub-rounded gravel	D		TP48/0.50		
E	F-H		1.0					GP	Silty Sandy Gravel: fine to medium grained, sub-angular to sub-rounded, dark brown, fine to medium grained, sub-angular to sub-rounded sand Weakly to moderately cemented soils observed	D		TP48/1.00		
			1.5						Hole terminated at 1.40 m Refusal on solid rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP49

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0 – 2.5					GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white Gravel and cobbles with pale red/brown staining and soil, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles, trace boulders Lesser fines with depth Weakly to moderately cemented soils observed	D (0.0–1.0) D - M (1.0–2.5)	VD			
			2.5 – 3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP50

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow			**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded brown, trace gravel, trace roots	D				
E	F-H		0.5						Weathered CALCARENITE (60-80%): fine to coarse grained, sub-angular to sub-rounded, white, Distinctly weathered to slightly weathered, medium strength, with fine to medium grained, sub-angular to sub-rounded, brown sand (10-40%), trace fines	D	VD			
			1.0						Hole terminated at 0.80 m Refusal on solid rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP51

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow		Backhoe	**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F-H		0.0					SP	Gravelly SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale brown sands with white calcarenite gravel, fine to medium grained, angular to sub-angular gravel, trace roots	D	VD			
			0.5						CALCARENITE (70-80%) mix with SAND with fines (20-30%), Sandy Cobbly GRAVEL: fine to coarse grained, angular to sub-angular, white Gravel and cobbles with pale brown staining and soils, fine to medium grained, sub-angular to sub-rounded sand					
			1.0						Hole terminated at 0.40 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP52

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	Gravelly SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, sub-angular to sub-rounded gravel, trace roots	D	D - VD	TP52/0.00		
			0.5		B(TP52-1)			SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded pale brown, trace gravel					
	F-H		1.0					GM	Silty Sandy Gravel: fine to medium grained, sub-angular to sub-rounded, dark brown, fine to medium grained, sub-angular to sub-rounded sand Weakly to moderately cemented soils observed			TP52-1 TP52/0.50 TP52/1.00		
			1.5						Hole terminated at 1.40 m Refusal on solid rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP53

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, brown,trace roots	D	D - VD			
	F-H		0.5					GM	Silty Sandy GRAVEL: fine to medium grained, sub-angular to sub-rounded, brown, fine to medium grained, sub-angular to sub-rounded sand					
	H								CALCARENITE (60-80%) with Sand with fines soil (20-40%), fine to coarse grained, sub-angular to sub-rounded, white calcarenite with brown staining, fine to medium grained, sub-angular to sub-rounded sand, low plasticity silt (5-10%), Distinctly weathered to slightly weathered, medium strength					
			1.0						Hole terminated at 0.90 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP54

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 1.1		B(TP54-1)			GM	FILL: Silty Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white calcarenite gravel with pale brown staining soils, fine to medium grained, sub-angular to sub-rounded sand	D	VD	TP54/0.00 TP54-1 TP54/0.50 TP54/1.00		
	F		1.1 – 1.3					GM	Silty Sandy Gravel: hit the level ground soil observed as above					
	H		1.3 – 1.5						CALCARENITE: fine to coarse grained,sub-angular to sub-rounded, white calcarenite with pale brown staining and soil, fine to medium grained, sub-angular to sub-rounded, pale brown sand with fines, low plasticity silt					
									Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP55

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock
Date:	10/03/2022	**Logged:**	PF	**Checked Date:**	13/04/2022
Checked By:	TM				

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 1.5						Mixture of CALCARENITE (30-50%) and Silty SAND: fine to medium grained, sub-angular to sub-rounded, brown, CALCARENITE observed as Gravel, cobbles and boulders, fine to medium grained, sub-angular to sub-rounded, pale brown/white and orange staining, Distinctly to moderately weathered, medium strength	D	VD			
			1.5 – 3.0						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP56

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 1.80		B(TP56-1) (0.5–1.0)			SM	FILL: Silty SAND, fine to coarse grained, sub-angular to sub-rounded, brown with white calcarenite gravel, fine to medium grained, sub-angular to sub-rounded gravel, trace shell fragments, trace cobbles	D	VD	TP56-1		
									Hole terminated at 1.80 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP57

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 1.1						FILL: Sandy GRAVEL with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown and white calcarenite Gravel and pale brown soils, fine to medium grained, sub-angular to sub-rounded sand weakly to moderately cemented soils observed	D	VD			
			1.1 – 2.0						Thin layer of blue metal gravel, trace black geofabric					
			2.0						Hole terminated at 2.00 m Refusal on hard rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

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TEST PIT: TP58

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.0						Mixture of of CALCARENITE ROCKS (10-20%) and soil described as: Sandy GRAVEL with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown/white calcarenite and blue metal Gravel with brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles	D	VL - L			
			2.0						Hole terminated at 2.00 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP59

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 11/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.0		B(TP59-1) (0.5–1.0)			SM	FILL: Silty SAND, fine to coarse grained, sub-angular to sub-rounded, pale brown, with white calcarenite rocks, with fine to medium grained, sub-angular to sub-rounded gravel, trace cobbles, trace organics	D	D - VD (0.1–0.3); VL - MD (0.5–1.0)	TP59-1		
			2.0 – 2.5					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, red/brown					
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP60

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park
Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow
Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock
Date: 11/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0–2.5		B(TP60-1) (0.5–1.0)				FILL: Mixture of about 30% CALCARENITE COBBLES / BOULDERS and about 70% SILTY GRAVELLY SAND, fine to coarse grained, sub-angular to sub-rounded, pale brown, with white calcarenite and grey blue metal gravel, fine to medium grained, sub-angular to sub-rounded gravel	D	VL - L; L - MD	TP60-1		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP61

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation: METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	Sampling: SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0–2.0		B(TP61-1) (0.5–1.0)			GM	FILL: Sandy GRAVEL with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown/white calcarenite of blue metal gravel and pale brown to brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace organics, trace roots	D	VD	TP61-1		
									Organics (shrubs, fluff) observed					
									Thin layer of blue metal gravel					
									A root observed					
			2.0						Hole terminated at 2.00 m Target depth Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

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Galt GEOTECHNICS

TEST PIT: TP62

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/0202
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.5					GM	FILL: Sandy Gravel with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown/white calcarenite and blue metal Gravel with pale brown sand/soils, fine to medium grained, sub-angular to sub-rounded sand, trace roots, plastic, etc fill, trace cobbles, trace boulders	D	VD / L - MD			
			2.5 – 3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

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Galt GEOTECHNICS

TEST PIT: TP63

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description								
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.0						FILL: Mixture of CALCARENITE/ cobbles and boulders (60-70%) and Soil (30-40%) described as: SANDY GRAVEL, sub-angular to sub-rounded, pale brown/white calcarenite rocks with pale red/brown staining and soils, fine to coarse grained, sub-angular to sub-rounded gravel, with fines, trace roots, plastic etc fill, trace organics	D	VD			
			2.0 – 2.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, brown					
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP64

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, brown, trace gravel, rootlets, roots and organics	D	VD	TP64/0.00		
	F		0.5					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace gravel	D - M		TP64/0.50		
	F-H		1.0		B(TP64-1)			GC	Clayey Sandy Gravel: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite rocks and brown soils, fine to medium grained, sub-angular to sub-rounded sand, low plasticity clay, trace cobbles			TP64-1 TP64/1.00		
			1.5						Hole terminated at 1.10 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP65

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 11/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Clayey/Silty SAND, fine to medium rained, sub-angular to sub-rounded, pale brown, trace gravel, trace roots	D				
			0.5					SP	SAND with fines: fine to medium grained, sub-angular to sub -rounded, brown		D - VD			
	F-H		1.0					GP	Sandy GRAVEL with fines: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and brown soil, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles	D - M				
	H		1.5						Mix of CALCARENITE ROCK (60%) and Soil (40%): Fine to medium grained, sub-angular to sub-rounded, pale brown-white calcarenite, Distinctly weathered, medium strength, soil described as above					
			2.0						Hole terminated at 1.80 m Refusal on hard rock Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP66

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	Backhoe		**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0				SP	FILL: SAND, fine to medium grained, sub-angular to sub-rounded, pale brown, trace fines, trace organics	D			
	E						SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, pale brown		MD to VD		
	F		0.5 – 1.0				GC	Clayey Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and pale brown soils and staining, fine to medium grained, sub-angular to sub-rounded sand				
								Organics (shrubs, fluff) observed				
	F-H		1.5					Mixture of CALCARENITE ROCKS and Soils observed as Sandy Gravel: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel (cobbles and boulders), pale brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace fines				
								Thin layer of blue metal gravel				
			2.0					A root observed				
			2.5 – 3.0					Hole terminated at 2.00 m Target depth Groundwater not encountered				

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP67

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, pale brown, trace fines, roots	D	VD	TP67/0.00		
	E		0.5					SP	SAND: fine to medium grained, sub-angular to sub-rounded, pale brown, with fines			TP67/0.50		
			1.0		B(TP67-1)					D	L - MD	TP67/1.00		
			1.5									TP67-1 TP67/1.50		
			2.0							D - M		TP67/2.00		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered			TP67/2.50		
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP68

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	Gravelly SAND, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, sub-angular to sub-rounded gravel, trace fines, trace cobbles and roots	D	VD			
			0.5					SP	SAND: fine to medium grained, pale brown, trace Gravel (10-15%), trace fines Gravel content decreases					
			1.0						Trace calcarenite cobbles and boulders observed with depth Weakly to moderately cemented sand in deeper areas					
			1.5							D - M				
			2.0						Hole terminated at 2.00 m Target depth Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP69

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow			**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, brown, moderately to well cemented sands	D	MD - VD			
	F-H		0.5 – 1.0					GP	Sandy Gravel with fines: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite rocks and brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles and boulders with depth					
			1.5 – 3.0						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations


Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP70

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 11/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SC	Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace gravel, roots	D		TP70/0.00		
	F		0.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, brown, weakly to moderately cemented soils observed		D to VD	TP70/0.50		
			1.0									TP70/1.00		
	H		1.5						Mixture of CALCARENITE ROCKS (Gravel, cobbles 50%) and Clayey SAND (50%); fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and brown soils, fine to medium grained, sub-angular to sub-rounded sand			TP70/1.50		
			2.0						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP71

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 11/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

Excavation: METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	Sampling: SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace roots	D	VD			
			0.5		B(TP71-1)			SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace Gravel	D - M		TP71-1		
	F-H		1.0 – 2.0						Mix of CALCARENITE ROCKS (50-60%) and Soils (40-50%) described as: Clayey Sandy Gravel: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite rocks and brown soils, fine to medium grained, sub-angular to sub-rounded sand (20-30%), low plasticity clay (15-20%), trace cobbles (15%)		D; MD - D			
			2.5 – 3.0						Hole terminated at 2.10 m Refusal on hard rock Groundwater not encountered		D - VD			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP72

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 11/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND, fine to medium grained, sub-angular to sub-rounded, brown, trace fines, trace roots	D	D to VD	TP72/0.00		
	E-F H		0.5 – 1.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, brown			TP72/0.50 TP72/1.00 TP72/1.50		
			2.0					GP	Sandy GRAVEL with fines: fine to medium grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and brown soils, fine to medium grained, sub-angular to sub-rounded sand			TP72/2.00		
			2.5 – 3.0						Hole terminated at 2.00 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP73

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park
Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow
Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock
Date: 11/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SC	Clayey SAND, fine to medium grained, sub-angular to sub-rounded, low plasticity clay, trace roots	D	D to VD			
E	E							SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, brown, low plasticity clay, trace Gravel	D	D to VD			
E	F-H		0.5					GC	Clayey Sandy Gravel: fine to medium grained, sub-angular to sub-rounded pale brown to white Gravel and brown soil, fine grained, sub-angular to sub-rounded sand, low plasticity clay, trace cobbles, becoming more rocky with depth (Calcarenite)	D				
			1.5						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP74

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock
Date:	11/03/2022	**Logged:**	PF	**Checked Date:**	13/04/2022
Checked By:	TM				

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SC	Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace roots	D	L - MD			
	E-F		0.5					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown low plasticity clay, trace Gravel		D			
	F		1.0					GC	Clayey Sandy GRAVEL: fine to medium grained, sub-angular to sub-rounded, pale brown-white Gravel and brown soils, fine to medium grained, sub-angular to sub-rounded sand, low plasticity clay					
	H								Mixture of CALCARENITE ROCKS (40-50%) and Soils described as: Sandy GRAVEL with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite rocks and brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles	D - M				
			1.5						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP75

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 11/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Clayey/Silty SAND, fine to medium grained, sub-angular to sub-rounded, brown, trace gravel and roots	D	D - VD			
	F		0.5					SM	Clayey/Silty SAND: fine grained, sub-angular to sub-rounded, brown, trace gravel					
	F-H		1.0						Mixture of CALCARENITE ROCKS (60-70%) and Soil (30-40%) described as: Clayey Sandy Gravel, fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and brown soil, fine to medium grained, sub-angular to sub-rounded sand					
			1.5						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP76

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, brown, trace Gravel, roots, rootlets and organics	D	VD	TP76/0.00		
E	E-F		0.5		B(TP76-1)			SM	Silty SAND: fine grained, sub-angular to sub-rounded, brown, trace Gravel	D		TP76-1 TP76/0.50		
E	F		1.0		B(TP76-2)			GM	Silty Sandy Gravel: fine to medium grained, sub-angular to sub-rounded, pale brown-white Gravel with brown staining and soils, fine grained, sub-angular to sub-rounded sand	D		TP76-2 TP76/1.00		
E	H		1.5						Mix of CALCARENITE ROCKS (50%) and soils as described above - Clayey Sandy Gravel	D		TP76/1.50		
			2.0, 2.5, 3.0						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Appendix D: Constant Head Infiltration Test Results

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:		

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP16 / PERC01

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
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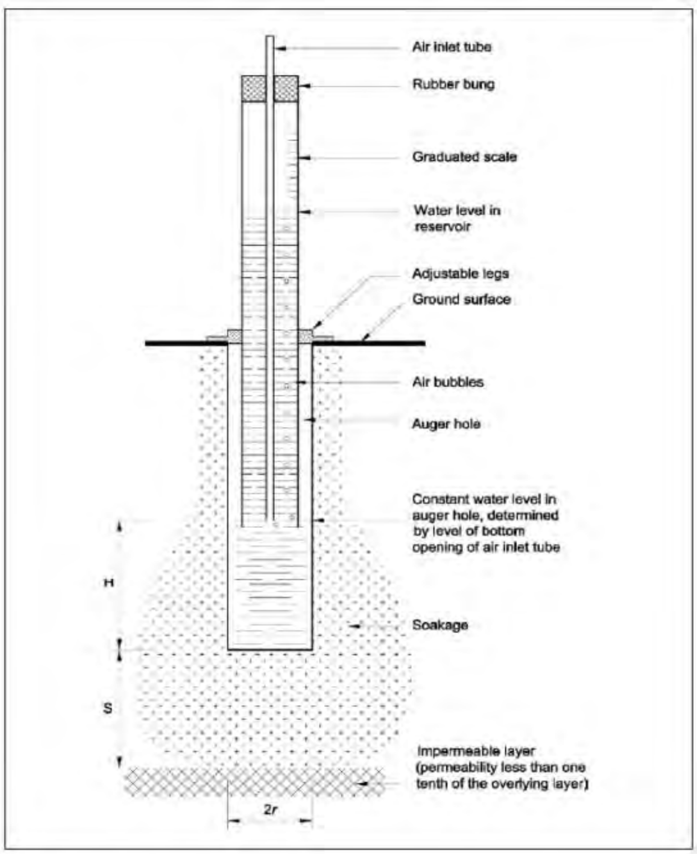
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	40	cm
H	Head of water above base	21	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
5.00	78.7	-78.70	-15.74
15.00	74	4.70	0.47
17.50	71.7	2.30	0.92
19.50	69.4	2.30	1.15
38.25	52	17.40	0.93
40.17	50.8	1.20	0.63
57.00	33.8	17.00	1.01
59.50	31.5	2.30	0.92
81.50	10	21.50	0.98
87.25	4.3	5.70	0.99
AVERAGE - LAST 5 READINGS			0.90

Calculation

Steady State Flow	0.90	cm/min
Flow from reservoir (Q)	6.40	cm^3/min
K_{sat}	0.006	cm/min
K_{sat}	1.026E-06	m/s
K_{sat}	**0.09**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP21/PERC02

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

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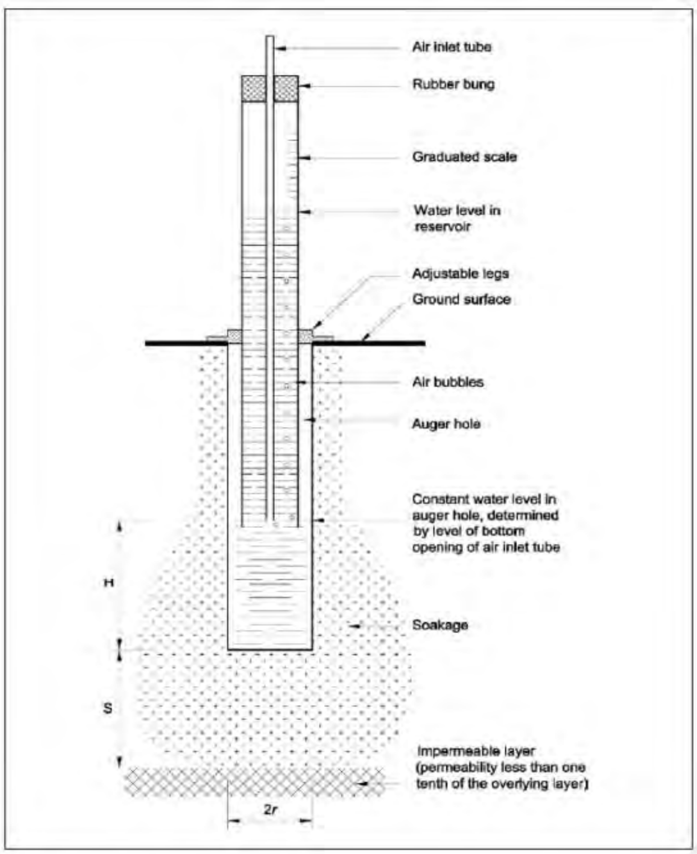
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	55	cm
H	Head of water above base	21	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
25.00	78.5	-78.50	-3.14
32.00	72.2	6.30	0.90
53.50	54.2	18.00	0.84
55.00	52	2.20	1.47
64.75	43.5	8.50	0.87
71.00	37	6.50	1.04
75.25	33	4.00	0.94
87.00	22	11.00	0.94
93.75	16	6.00	0.89
95.75	13.3	2.70	1.35
98.50	10.5	2.80	1.02
101.42	7.8	2.70	0.93
105.67	3.4	4.40	1.04
AVERAGE - LAST 5 READINGS			1.04

Calculation

Steady State Flow	1.04	cm/min
Flow from reservoir (Q)	7.38	cm^3/min
K_{sat}	0.007	cm/min
K_{sat}	1.183E-06	m/s
K_{sat}	**0.10**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP29/PERC03

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

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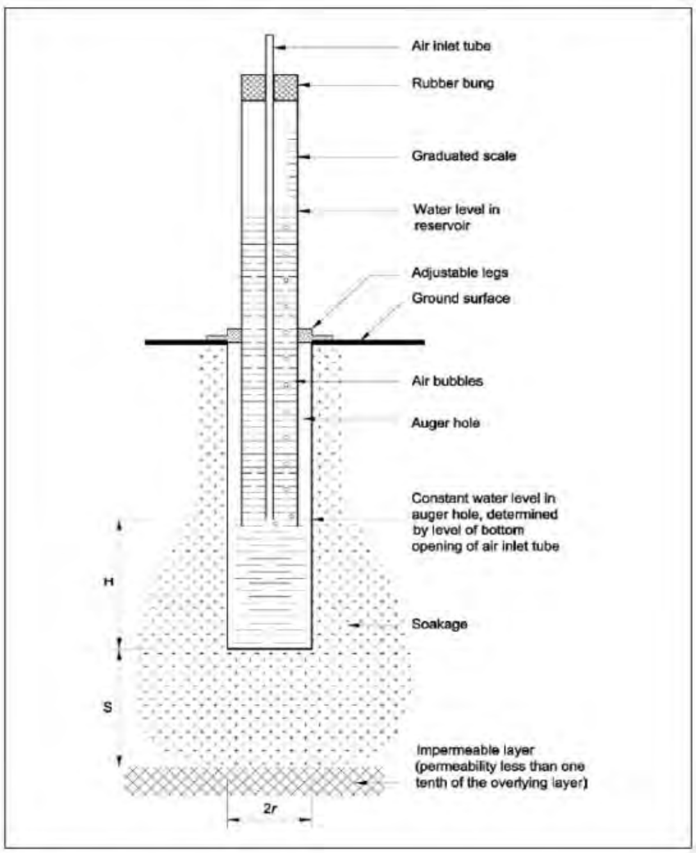
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	35	cm
H	Head of water above base	25	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	77		
2.75	72.8	4.20	1.53
3.50	71.5	1.30	1.73
4.00	70.5	1.00	2.00
5.42	68	2.50	1.76
6.00	67	1.00	1.71
6.83	65.5	1.50	1.80
7.42	64.5	1.00	1.71
8.00	63.5	1.00	1.71
25.33	34	29.50	1.70
25.75	33	1.00	2.40
35.83	16.5	16.50	1.64
37.25	14	2.50	1.76
AVERAGE - LAST 5 READINGS			1.84

Calculation

Steady State Flow	1.84	cm/min
Flow from reservoir (Q)	13.03	cm^3/min
K_{sat}	0.010	cm/min
K_{sat}	1.638E-06	m/s
K_{sat}	**0.14**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP31/PERC04

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

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	Comment field
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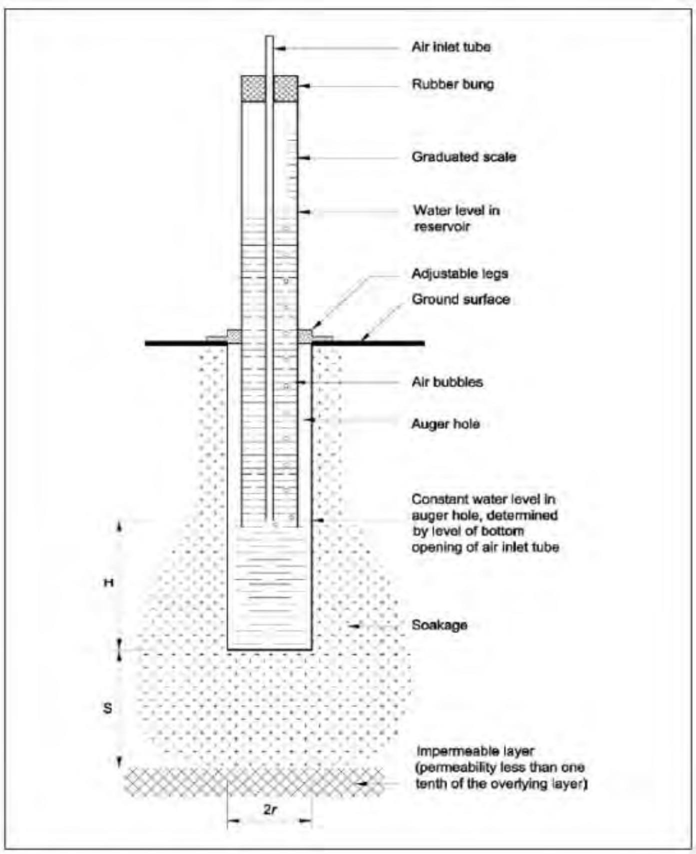
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	40	cm
H	Head of water above base	21	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
36.83	77.4	-77.40	-2.10
38.00	70	7.40	6.34
39.00	63.8	6.20	6.20
40.08	58	5.80	5.35
42.08	47	11.00	5.50
43.50	39.5	7.50	5.29
45.20	30	9.50	5.59
46.25	24.5	5.50	5.24
47.50	17	7.50	6.00
48.75	10	7.00	5.60
49.62	5	5.00	5.77
AVERAGE - LAST 5 READINGS			5.64

Calculation

Steady State Flow	5.64	cm/min
Flow from reservoir (Q)	39.87	cm^3/min
K_{sat}	0.038	cm/min
K_{sat}	6.391E-06	m/s
K_{sat}	**0.55**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP38/PERC05

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
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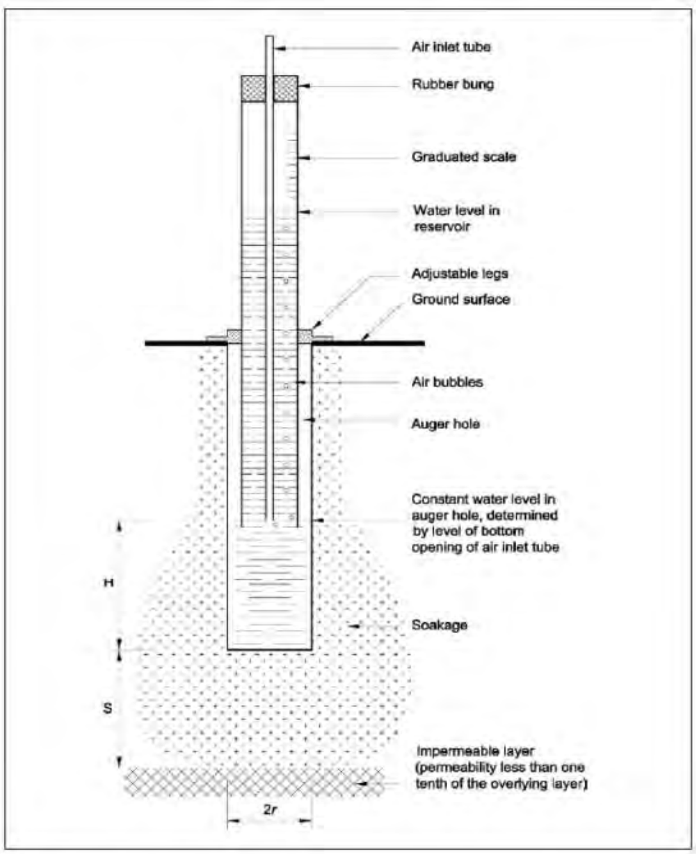
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	55	cm
H	Head of water above base	20	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	73.5		
11.83	52	21.50	1.82
20.25	40.5	11.50	1.37
27.83	29.1	11.40	1.50
36.75	16	13.10	1.47
43.25	6.5	9.50	1.46
43.75	5	1.50	3.00
44.5	3.5	1.50	2.00
45.5	2	1.50	1.50
AVERAGE - LAST 5 READINGS			1.89

Calculation

Steady State Flow	1.89	cm/min
Flow from reservoir (Q)	13.33	cm^3/min
K_{sat}	0.014	cm/min
K_{sat}	2.286E-06	m/s
K_{sat}	**0.20**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP42/PERC06

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

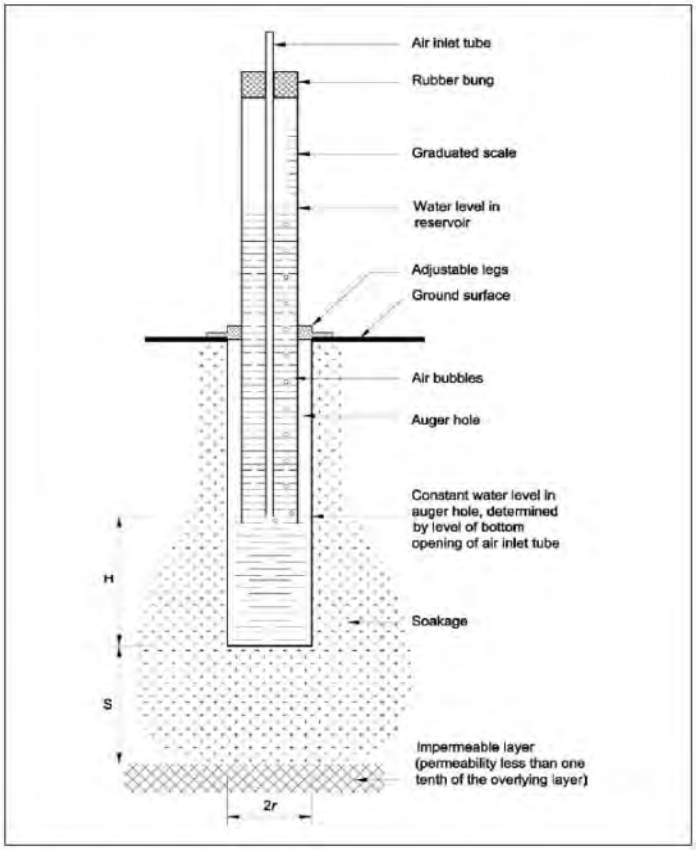
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	53	cm
H	Head of water above base	20	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	75.8		
0.50	70.5	5.30	10.60
0.83	65	5.50	16.50
1.42	55.8	9.20	15.77
1.83	48.8	7.00	16.80
2.17	42	6.80	20.40
2.75	33.5	8.50	14.57
3.17	25.5	8.00	19.20
3.75	16	9.50	16.29
4.00	10.5	5.50	22.00
4.42	3.5	7.00	16.80
4.58	1	2.50	15.00
AVERAGE - LAST 5 READINGS			17.86

Calculation

Steady State Flow	17.86	cm/min
Flow from reservoir (Q)	126.25	cm^3/min
K_{sat}	0.130	cm/min
K_{sat}	2.164E-05	m/s
K_{sat}	**1.87**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:		

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP48/PERC07

$$K = \frac{4.4Q\left[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}\right]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

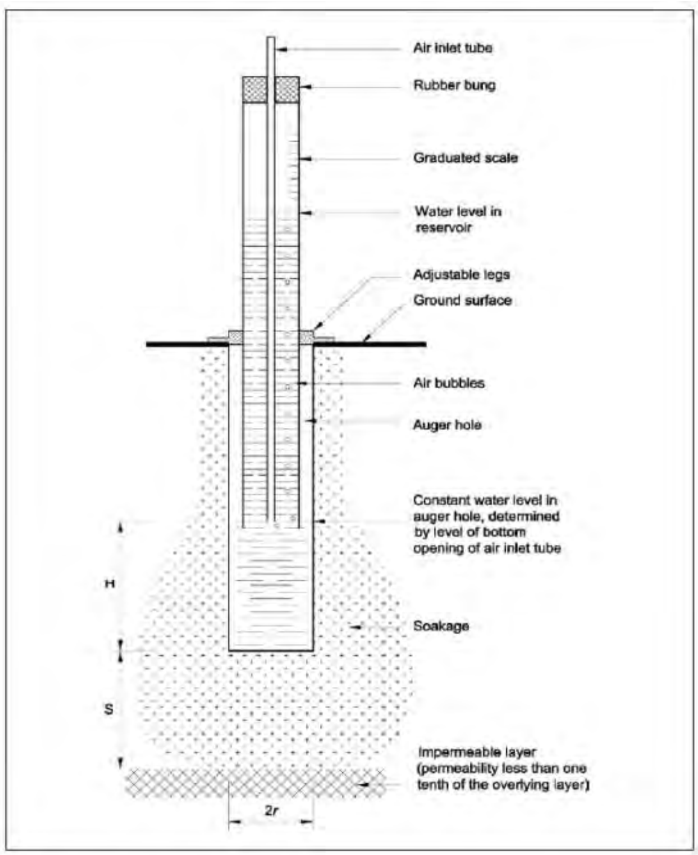
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	60	cm
H	Head of water above base	25	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	80.5		
0.33	78.5	2.00	6.00
3.10	60	18.50	6.69
4.47	51.3	8.70	6.37
5.25	46	5.30	6.77
5.60	43.5	2.50	7.14
6.58	35.5	8.00	8.14
8.00	24	11.50	8.12
8.92	15	9.00	9.82
9.50	10	5.00	8.57
AVERAGE - LAST 5 READINGS			8.36

Calculation

Steady State Flow	8.36	cm/min
Flow from reservoir (Q)	59.08	cm^3/min
K_{sat}	0.045	cm/min
K_{sat}	7.425E-06	m/s
K_{sat}	**0.64**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP52/PERC08

$$K = \frac{4.4Q\left[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}\right]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

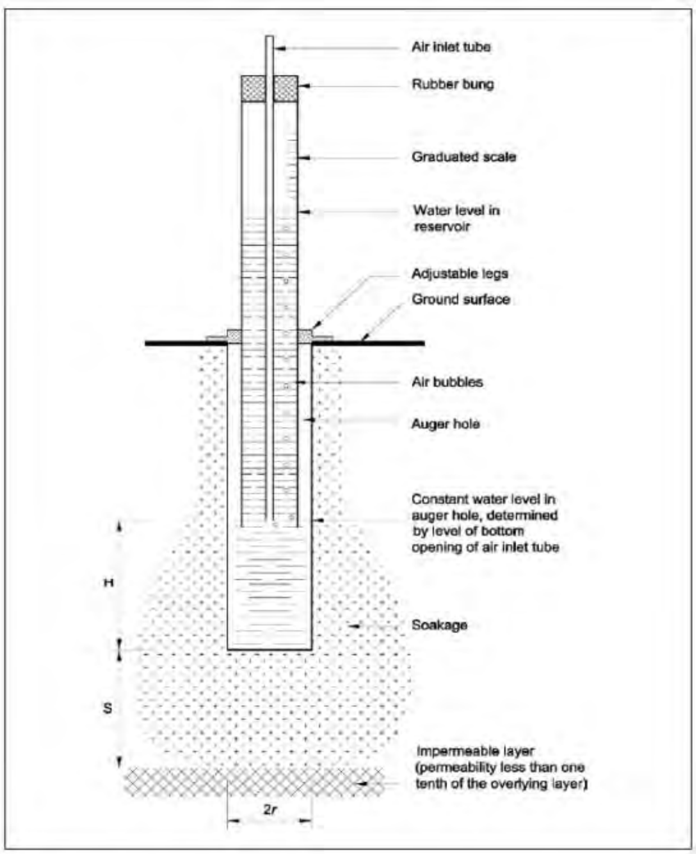
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	55	cm
H	Head of water above base	20	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	79		
1.5	76.5	2.50	1.67
6.5	63.5	13.00	2.60
8.75	57	6.50	2.89
15	41	16.00	2.56
20.25	28	13.00	2.48
20.5	26.7	1.30	5.20
25.5	14	12.70	2.54
26	13	1.00	2.00
27.5	9.5	3.50	2.33
28.5	7	2.50	2.50
29.5	4.5	2.50	2.50
31	1	3.50	2.33
AVERAGE - LAST 5 READINGS			2.33

Calculation

Steady State Flow	2.33	cm/min
Flow from reservoir (Q)	16.50	cm^3/min
K_{sat}	0.017	cm/min
K_{sat}	2.828E-06	m/s
K_{sat}	**0.24**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:		

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP65/PERC09

$$K = \frac{4.4Q\left[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}\right]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

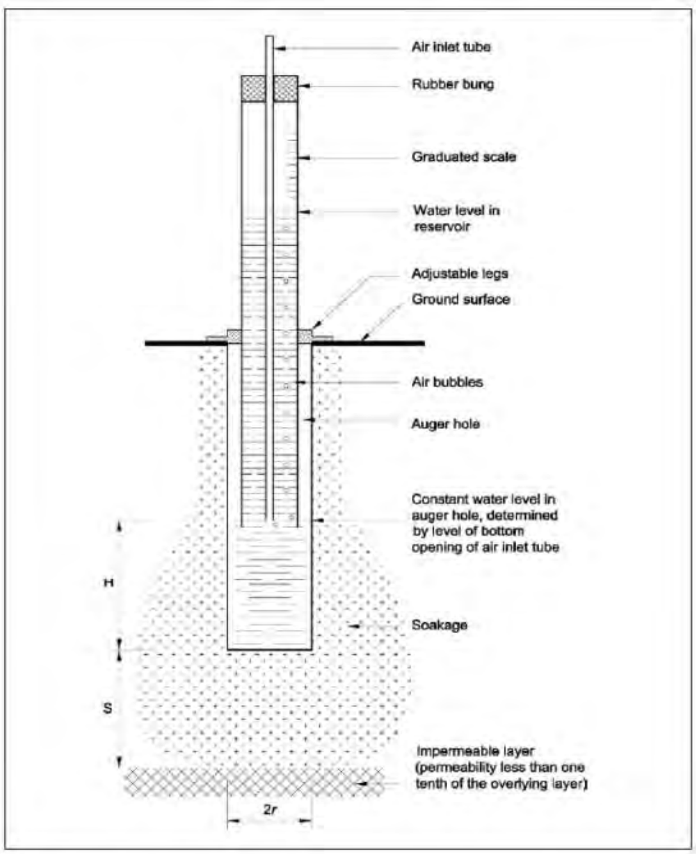
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	55	cm
H	Head of water above base	25	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
0.50	78.4	-78.40	-156.80
30.33	77.3	1.10	0.04
43.00	75	2.30	0.18
54.00	72.2	2.80	0.25
71.50	68.5	3.70	0.21
82.83	66	2.50	0.22
96.50	63.2	2.80	0.20
109.67	60.5	2.70	0.21
134.00	55	5.50	0.23
AVERAGE - LAST 5 READINGS			0.21

Calculation

Steady State Flow	0.21	cm/min
Flow from reservoir (Q)	1.51	cm^3/min
K_{sat}	0.001	cm/min
K_{sat}	1.898E-07	m/s
K_{sat}	**0.02**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP73/PERC10

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

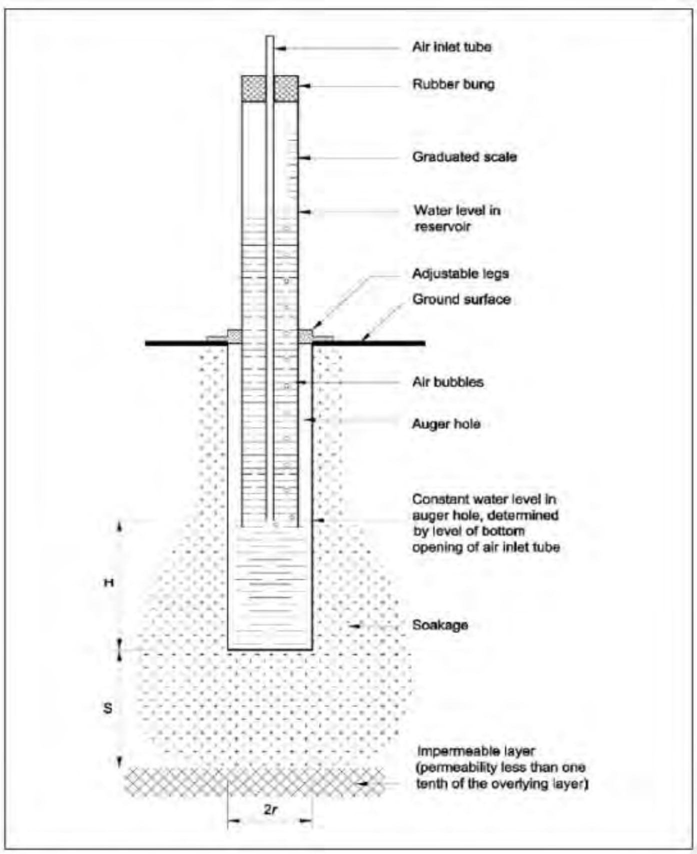
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	58	cm
H	Head of water above base	23	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	80		
7.75	78.8	1.20	0.15
16.33	78.5	0.30	0.03
32.50	77.3	1.20	0.07
40.25	74.5	2.80	0.36
52.50	69	5.50	0.45
78.00	56.7	12.30	0.48
101.00	43.3	13.40	0.58
121.92	29.8	13.50	0.65
127.00	25.7	4.10	0.81
145.67	10	15.70	0.84
150.25	5.7	4.30	0.94
AVERAGE - LAST 5 READINGS			0.76

Calculation

Steady State Flow	0.76	cm/min
Flow from reservoir (Q)	5.39	cm^3/min
K_{sat}	0.005	cm/min
K_{sat}	7.620E-07	m/s
K_{sat}	**0.07**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP76/PERC11

$$K = \frac{4.4Q\left[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}\right]}{2\,\pi H^2}$$

Paramete	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	64	cm
H	Head of water above base	24	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	0	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Spreadsheet Legend

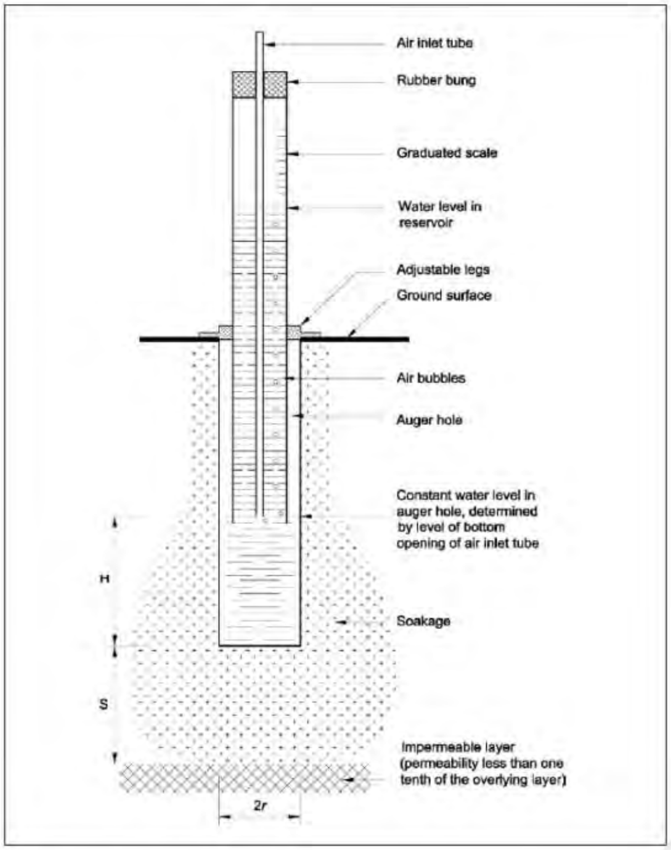
	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
48.50	78.7	-78.70	-1.62
178.00	77.7	1.00	0.01
230.00	76	1.70	0.03
254.33	74.5	1.50	0.06
280.00	74.3	0.20	0.01
320.50	73	1.30	0.03
354.00	71.4	1.60	0.05
400.67	69	2.40	0.05
AVERAGE - LAST 5 READINGS			0.04

Calculation

Steady State Flow	0.04	cm/min
Flow from reservoir (Q)	0.28	cm^3/min
K_{sat}	0.000	cm/min
K_{sat}	########	m/s
K_{sat}	**0.00**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Appendix E: Falling Head Infiltration Test Results

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

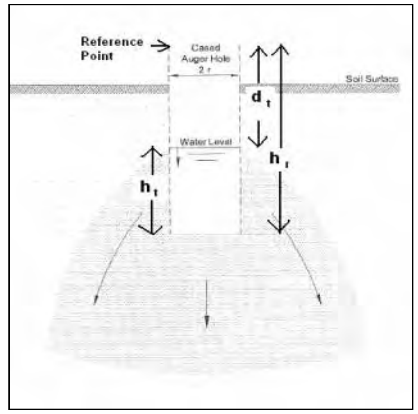
Galt Geotechnics

Spreadsheet author:	ORW
Date	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP15/IT01
Test Depth:	0.62 m

$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

Required input	
Calculated field	
Comment field	
Field not used	
Fixed field	

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.03	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

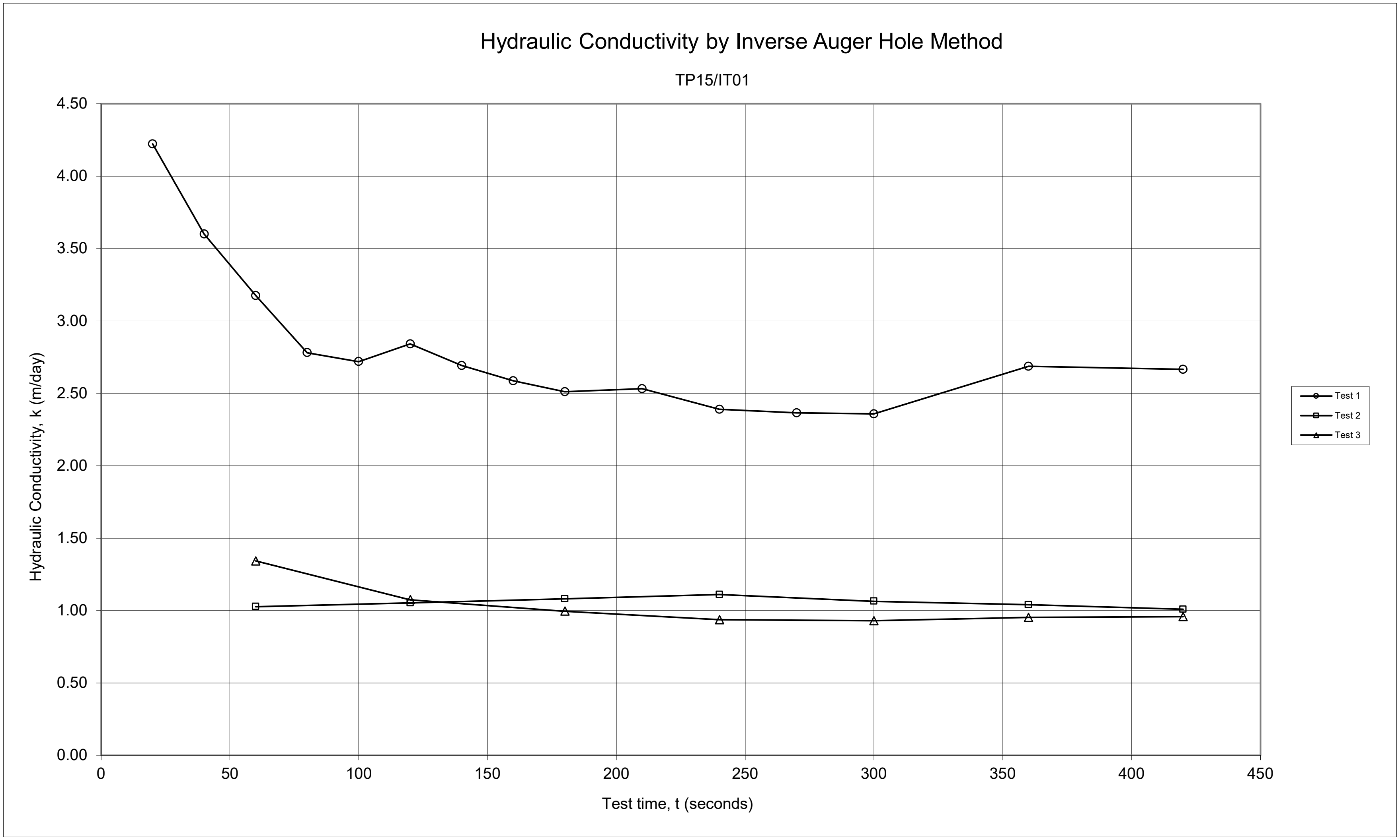
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.95	0.08		
20	0.956	0.074	4.9E-05	4.2
40	0.96	0.07	4.2E-05	3.6
60	0.963	0.067	3.7E-05	3.2
80	0.965	0.065	3.2E-05	2.8
100	0.968	0.062	3.1E-05	2.7
120	0.972	0.058	3.3E-05	2.8
140	0.974	0.056	3.1E-05	2.7
160	0.976	0.054	3.0E-05	2.6
180	0.978	0.052	2.9E-05	2.5
210	0.982	0.048	2.9E-05	2.5
240	0.984	0.046	2.8E-05	2.4
270	0.987	0.043	2.7E-05	2.4
300	0.99	0.04	2.7E-05	2.4
360	1	0.03	3.1E-05	2.7
420	1.005	0.025	3.1E-05	2.7
		AVERAGE	3.3E-05	2.8

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.83	0.2		
60	0.84	0.19	1.2E-05	1.0
120	0.85	0.18	1.2E-05	1.1
180	0.86	0.17	1.3E-05	1.1
240	0.87	0.16	1.3E-05	1.1
300	0.877	0.153	1.2E-05	1.1
360	0.884	0.146	1.2E-05	1.0
420	0.89	0.14	1.2E-05	1.0
		AVERAGE	1.2E-05	1.1

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.813	0.217		
60	0.827	0.203	1.6E-05	1.3
120	0.835	0.195	1.2E-05	1.1
180	0.843	0.187	1.2E-05	1.0
240	0.85	0.18	1.1E-05	0.9
300	0.858	0.172	1.1E-05	0.9
360	0.867	0.163	1.1E-05	1.0
420	0.875	0.155	1.1E-05	1.0
		AVERAGE	1.2E-05	1.0



\\galtgeo.local\OsbornePark\Data\Jobs\2022\J2201059 - SoA SI Onslow Industrial Park\08 Analysis\Permeability Inverse Auger Hole Method - Rev2

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

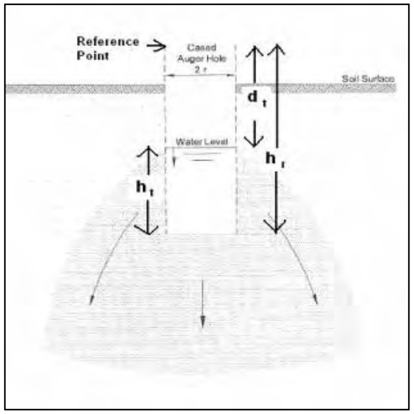
Galt Geotechnics

Spreadsheet author:	ORW	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP74/IT02
Test Depth:	0.58 m

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

Legend	
Required input	
Calculated field	
Comment field	
Field not used	
Fixed field	

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.015	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

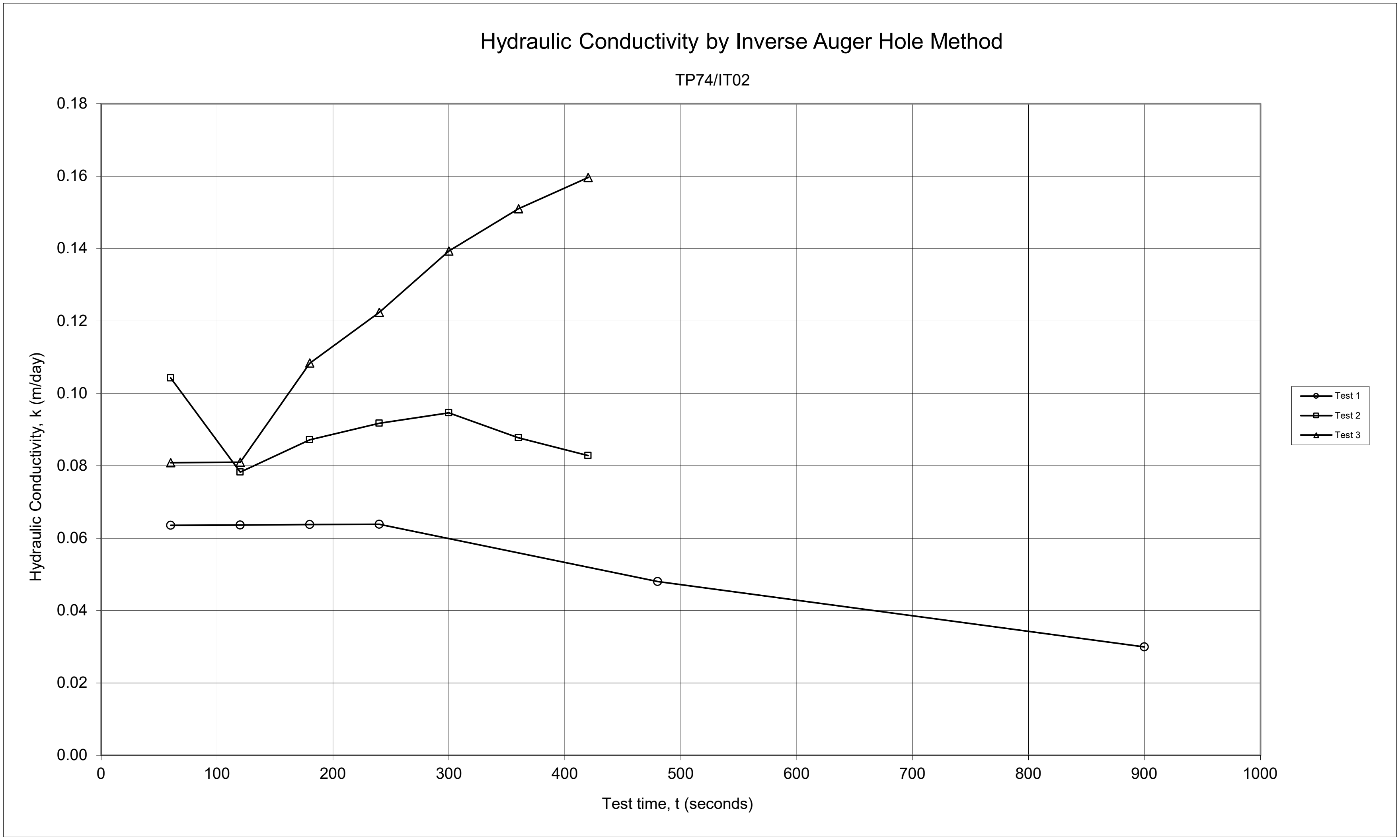
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.69	0.325		
60	0.691	0.324	7.4E-07	0.1
120	0.692	0.323	7.4E-07	0.1
180	0.693	0.322	7.4E-07	0.1
240	0.694	0.321	7.4E-07	0.1
480	0.696	0.319	5.6E-07	0.0
900	0.697	0.318	3.5E-07	0.0
		AVERAGE	6.4E-07	0.1

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.615	0.4		
60	0.617	0.398	1.2E-06	0.1
120	0.618	0.397	9.1E-07	0.1
180	0.62	0.395	1.0E-06	0.1
240	0.622	0.393	1.1E-06	0.1
300	0.624	0.391	1.1E-06	0.1
360	0.625	0.39	1.0E-06	0.1
420	0.626	0.389	9.6E-07	0.1
		AVERAGE	1.0E-06	0.1

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.495	0.52		
60	0.497	0.518	9.4E-07	0.1
120	0.499	0.516	9.4E-07	0.1
180	0.503	0.512	1.3E-06	0.1
240	0.507	0.508	1.4E-06	0.1
300	0.512	0.503	1.6E-06	0.1
360	0.517	0.498	1.7E-06	0.2
420	0.522	0.493	1.8E-06	0.2
		AVERAGE	1.4E-06	0.1


Hydraulic Conductivity by Inverse Auger Hole Method
TP74/IT02
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Hydraulic Conductivity, k (m/day)
0
100
200
300
400
500
600
700
800
900
1000
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

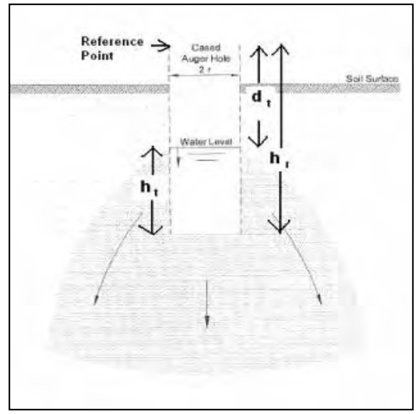
Galt Geotechnics

Spreadsheet author:	ORW
Date	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP20/IT03
Test Depth:	0.73 m

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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(orange)	Comment field
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Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.045	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.913	0.132		
20	0.915	0.13	1.0E-05	0.9
40	0.916	0.129	7.7E-06	0.7
60	0.917	0.128	6.9E-06	0.6
80	0.918	0.127	6.5E-06	0.6
100	0.919	0.126	6.2E-06	0.5
120	0.92	0.125	6.1E-06	0.5
140	0.921	0.124	6.0E-06	0.5
160	0.922	0.123	5.9E-06	0.5
180	0.923	0.122	5.9E-06	0.5
210	0.925	0.12	6.1E-06	0.5
240	0.927	0.118	6.2E-06	0.5
270	0.929	0.116	6.4E-06	0.6
300	0.932	0.113	6.9E-06	0.6
360	0.933	0.112	6.1E-06	0.5
720	0.937	0.108	3.7E-06	0.3
		AVERAGE	6.5E-06	0.6

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.852	0.193		
60	0.857	0.188	6.1E-06	0.5
120	0.859	0.186	4.3E-06	0.4
180	0.863	0.182	4.5E-06	0.4
240	0.865	0.18	4.0E-06	0.3
300	0.866	0.179	3.5E-06	0.3
360	0.867	0.178	3.1E-06	0.3
420	0.87	0.175	3.2E-06	0.3
		AVERAGE	4.1E-06	0.4

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.782	0.263		
60	0.785	0.26	2.7E-06	0.2
120	0.787	0.258	2.3E-06	0.2
180	0.789	0.256	2.1E-06	0.2
240	0.792	0.253	2.3E-06	0.2
300	0.795	0.25	2.4E-06	0.2
360	0.797	0.248	2.3E-06	0.2
420	0.802	0.243	2.7E-06	0.2
		AVERAGE	2.4E-06	0.2

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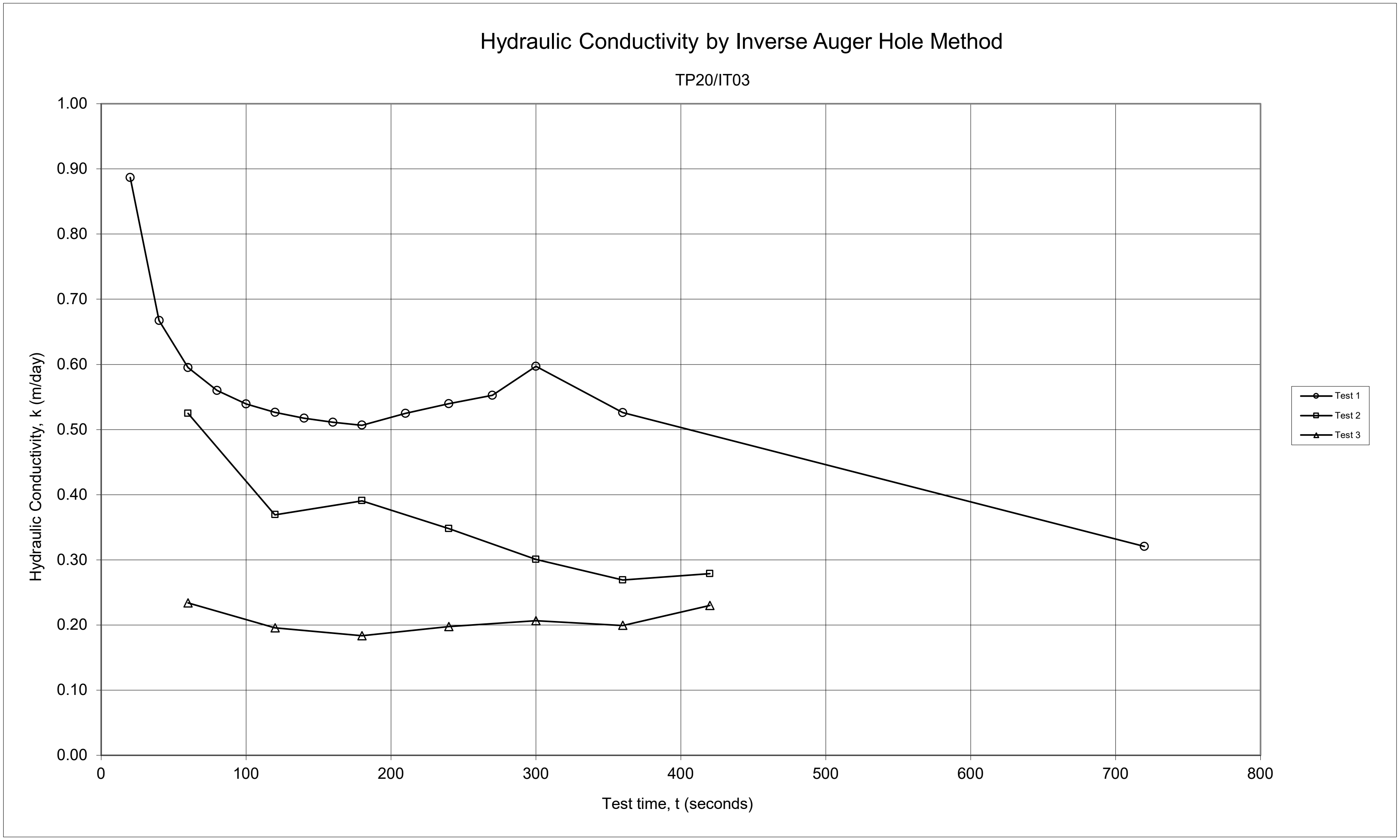

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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

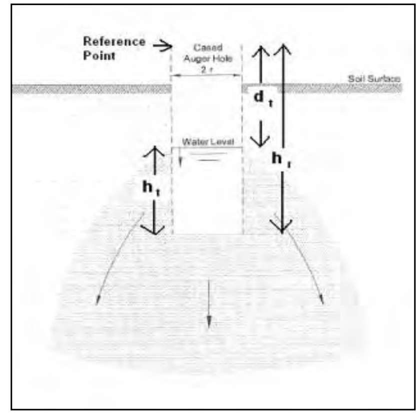
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP26/IT04
Test Depth:	0.67 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

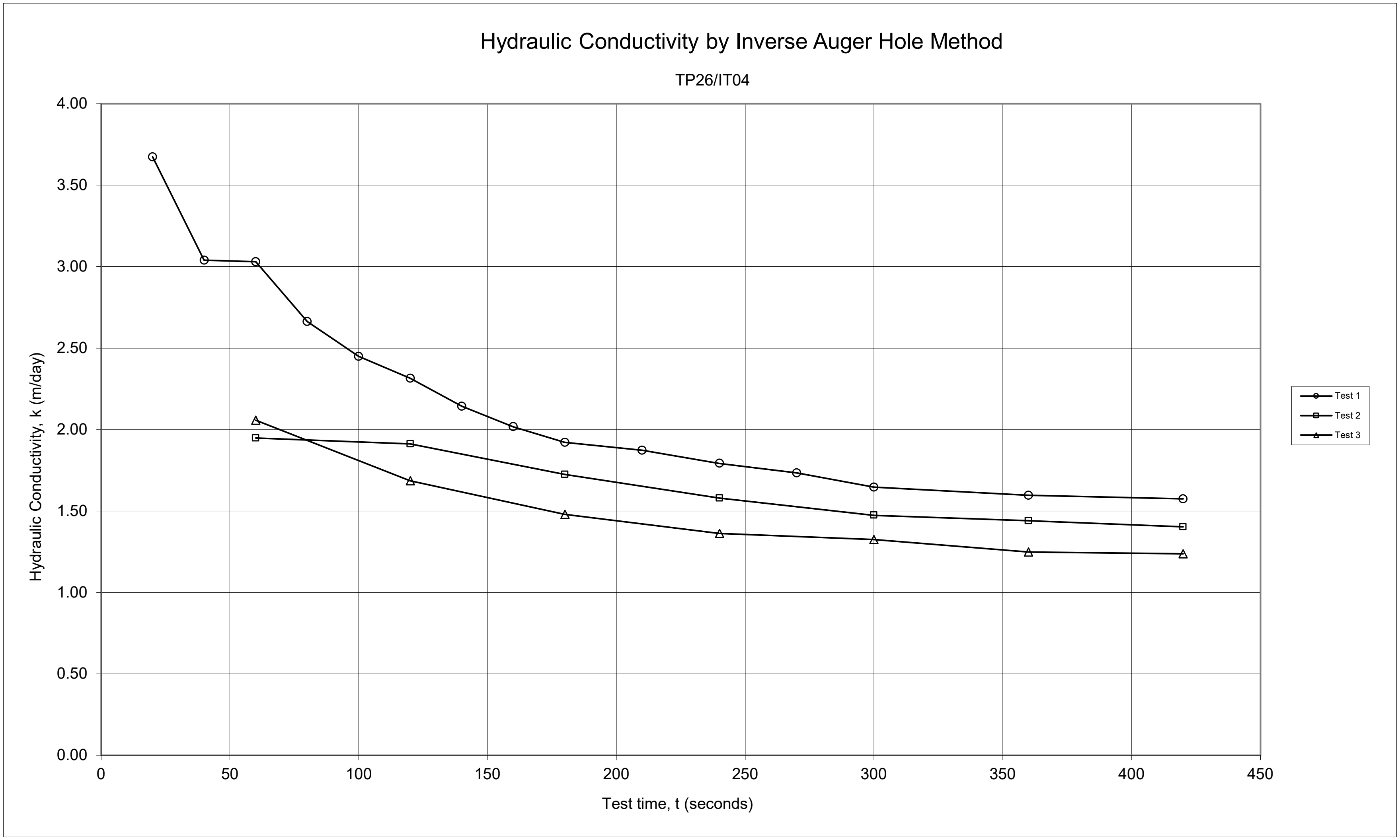
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.87	0.13		
20	0.878	0.122	4.3E-05	3.7
40	0.883	0.117	3.5E-05	3.0
60	0.889	0.111	3.5E-05	3.0
80	0.892	0.108	3.1E-05	2.7
100	0.895	0.105	2.8E-05	2.4
120	0.898	0.102	2.7E-05	2.3
140	0.9	0.1	2.5E-05	2.1
160	0.902	0.098	2.3E-05	2.0
180	0.904	0.096	2.2E-05	1.9
210	0.908	0.092	2.2E-05	1.9
240	0.911	0.089	2.1E-05	1.8
270	0.914	0.086	2.0E-05	1.7
300	0.916	0.084	1.9E-05	1.6
360	0.922	0.078	1.8E-05	1.6
420	0.928	0.072	1.8E-05	1.6
		AVERAGE	2.6E-05	2.2

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.818	0.182		
60	0.835	0.165	2.3E-05	1.9
120	0.85	0.15	2.2E-05	1.9
180	0.86	0.14	2.0E-05	1.7
240	0.868	0.132	1.8E-05	1.6
300	0.875	0.125	1.7E-05	1.5
360	0.883	0.117	1.7E-05	1.4
420	0.89	0.11	1.6E-05	1.4
		AVERAGE	1.9E-05	1.6

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.773	0.227		
60	0.795	0.205	2.4E-05	2.1
120	0.808	0.192	2.0E-05	1.7
180	0.818	0.182	1.7E-05	1.5
240	0.827	0.173	1.6E-05	1.4
300	0.837	0.163	1.5E-05	1.3
360	0.844	0.156	1.4E-05	1.2
420	0.853	0.147	1.4E-05	1.2
		AVERAGE	1.7E-05	1.5



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

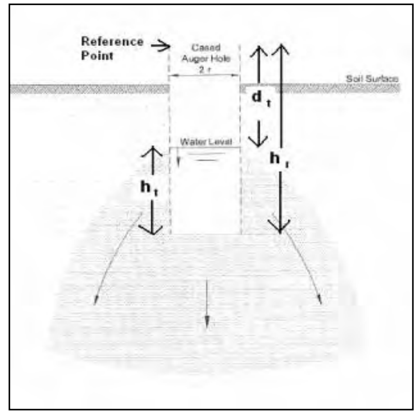
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP42 / IT05
Test Depth:	0.58 m

Spreadsheet author: ORW 17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	0.98	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

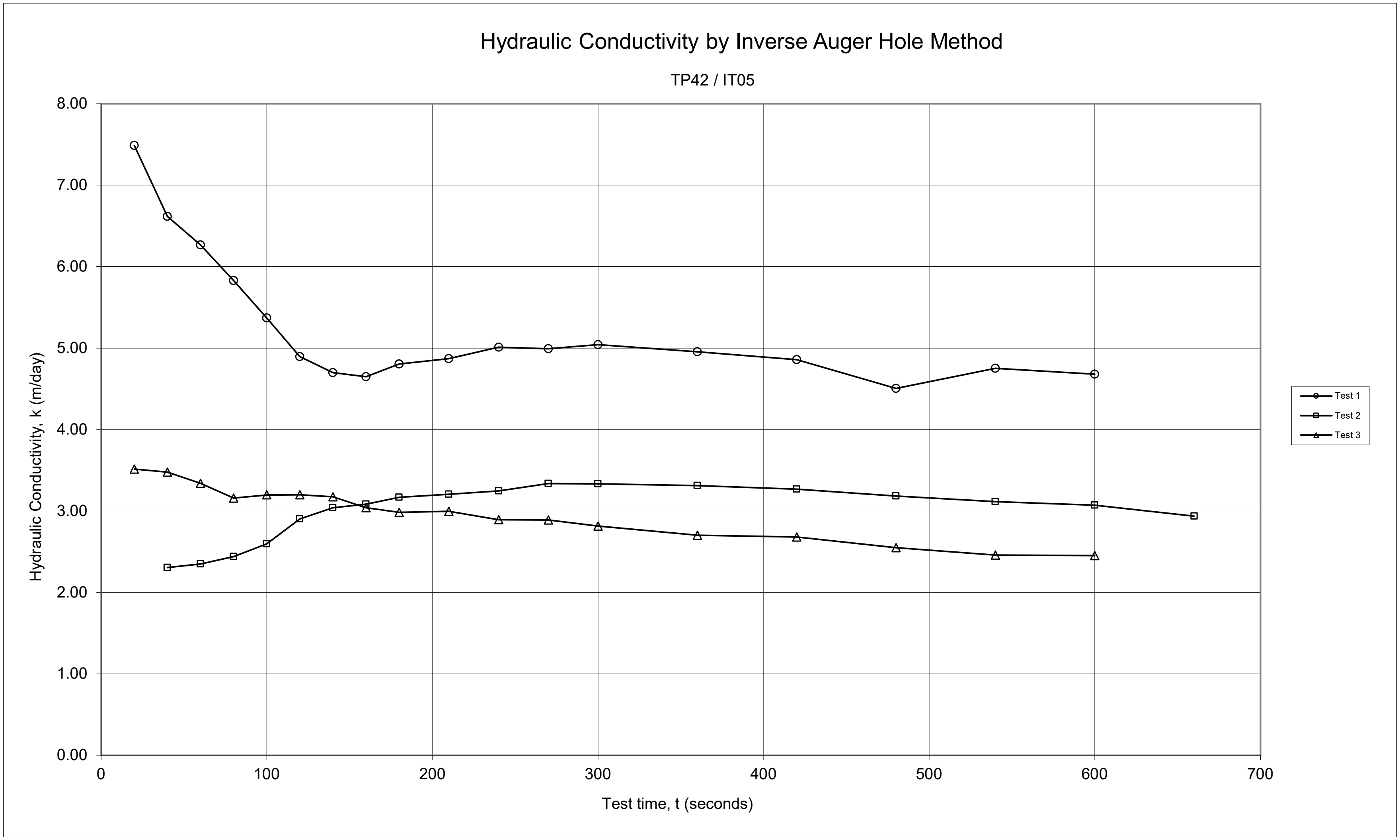
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.4	0.58		
20	0.465	0.515	8.7E-05	7.5
40	0.51	0.47	7.7E-05	6.6
60	0.55	0.43	7.3E-05	6.3
80	0.58	0.4	6.7E-05	5.8
100	0.602	0.378	6.2E-05	5.4
120	0.617	0.363	5.7E-05	4.9
140	0.637	0.343	5.4E-05	4.7
160	0.66	0.32	5.4E-05	4.6
180	0.69	0.29	5.6E-05	4.8
210	0.725	0.255	5.6E-05	4.9
240	0.76	0.22	5.8E-05	5.0
270	0.785	0.195	5.8E-05	5.0
300	0.81	0.17	5.8E-05	5.0
360	0.845	0.135	5.7E-05	5.0
420	0.872	0.108	5.6E-05	4.9
480	0.883	0.097	5.2E-05	4.5
540	0.913	0.067	5.5E-05	4.8
600	0.927	0.053	5.4E-05	4.7
		AVERAGE	6.1E-05	5.2

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.588	0.392		
40	0.616	0.364	2.7E-05	2.3
60	0.63	0.35	2.7E-05	2.3
80	0.645	0.335	2.8E-05	2.4
100	0.662	0.318	3.0E-05	2.6
120	0.684	0.296	3.4E-05	2.9
140	0.702	0.278	3.5E-05	3.0
160	0.717	0.263	3.6E-05	3.1
180	0.733	0.247	3.7E-05	3.2
210	0.753	0.227	3.7E-05	3.2
240	0.772	0.208	3.8E-05	3.2
270	0.792	0.188	3.9E-05	3.3
300	0.807	0.173	3.9E-05	3.3
360	0.833	0.147	3.8E-05	3.3
420	0.854	0.126	3.8E-05	3.3
480	0.87	0.11	3.7E-05	3.2
540	0.884	0.096	3.6E-05	3.1
600	0.897	0.083	3.6E-05	3.1
660	0.904	0.076	3.4E-05	2.9
		AVERAGE	3.5E-05	3.0

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.73	0.25		
20	0.744	0.236	4.1E-05	3.5
40	0.757	0.223	4.0E-05	3.5
60	0.768	0.212	3.9E-05	3.3
80	0.777	0.203	3.7E-05	3.2
100	0.788	0.192	3.7E-05	3.2
120	0.798	0.182	3.7E-05	3.2
140	0.807	0.173	3.7E-05	3.2
160	0.813	0.167	3.5E-05	3.0
180	0.82	0.16	3.5E-05	3.0
210	0.832	0.148	3.5E-05	3.0
240	0.84	0.14	3.3E-05	2.9
270	0.85	0.13	3.3E-05	2.9
300	0.857	0.123	3.3E-05	2.8
360	0.87	0.11	3.1E-05	2.7
420	0.884	0.096	3.1E-05	2.7
480	0.892	0.088	2.9E-05	2.5
540	0.9	0.08	2.8E-05	2.5
600	0.91	0.07	2.8E-05	2.5
		AVERAGE	3.4E-05	3.0



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

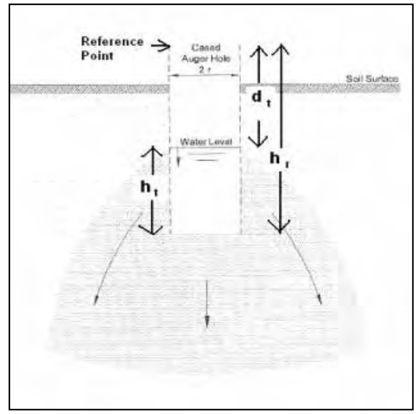
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP30/IT06
Test Depth:	0.65 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



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Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.08	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.948	0.132		
20	0.96	0.12	6.4E-05	5.5
40	0.97	0.11	6.1E-05	5.2
60	0.98	0.1	6.1E-05	5.3
80	0.99	0.09	6.3E-05	5.4
100	1	0.08	6.5E-05	5.7
120	1.005	0.075	6.1E-05	5.3
140	1.013	0.067	6.2E-05	5.4
160	1.02	0.06	6.3E-05	5.4
180	1.025	0.055	6.2E-05	5.3
210	1.032	0.048	6.0E-05	5.2
240	1.044	0.036	6.6E-05	5.7
270	1.05	0.03	6.6E-05	5.7
300	1.057	0.023	6.8E-05	5.8
360	1.067	0.013	6.9E-05	6.0
720	1.075	0.005	4.2E-05	3.6
		AVERAGE	6.2E-05	5.4

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.926	0.154		
20	0.932	0.148	2.7E-05	2.3
40	0.937	0.143	2.5E-05	2.2
60	0.943	0.137	2.6E-05	2.3
80	0.948	0.132	2.6E-05	2.3
100	0.95	0.13	2.3E-05	2.0
120	0.955	0.125	2.4E-05	2.0
140	0.96	0.12	2.4E-05	2.1
160	0.963	0.117	2.3E-05	2.0
180	0.968	0.112	2.4E-05	2.1
210	0.974	0.106	2.4E-05	2.1
240	0.98	0.1	2.4E-05	2.1
270	0.988	0.092	2.5E-05	2.2
300	0.995	0.085	2.6E-05	2.3
360	1.003	0.077	2.5E-05	2.2
720	1.015	0.065	1.6E-05	1.3
		AVERAGE	2.4E-05	2.1

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.855	0.225		
20	0.86	0.22	1.6E-05	1.4
40	0.862	0.218	1.1E-05	1.0
60	0.866	0.214	1.2E-05	1.0
80	0.869	0.211	1.1E-05	1.0
100	0.871	0.209	1.0E-05	0.9
120	0.873	0.207	9.7E-06	0.8
140	0.875	0.205	9.3E-06	0.8
160	0.878	0.202	9.4E-06	0.8
180	0.88	0.2	9.2E-06	0.8
210	0.885	0.195	9.5E-06	0.8
300	0.895	0.185	9.1E-06	0.8
360	0.903	0.177	9.3E-06	0.8
420	0.91	0.17	9.3E-06	0.8
		AVERAGE	1.0E-05	0.9

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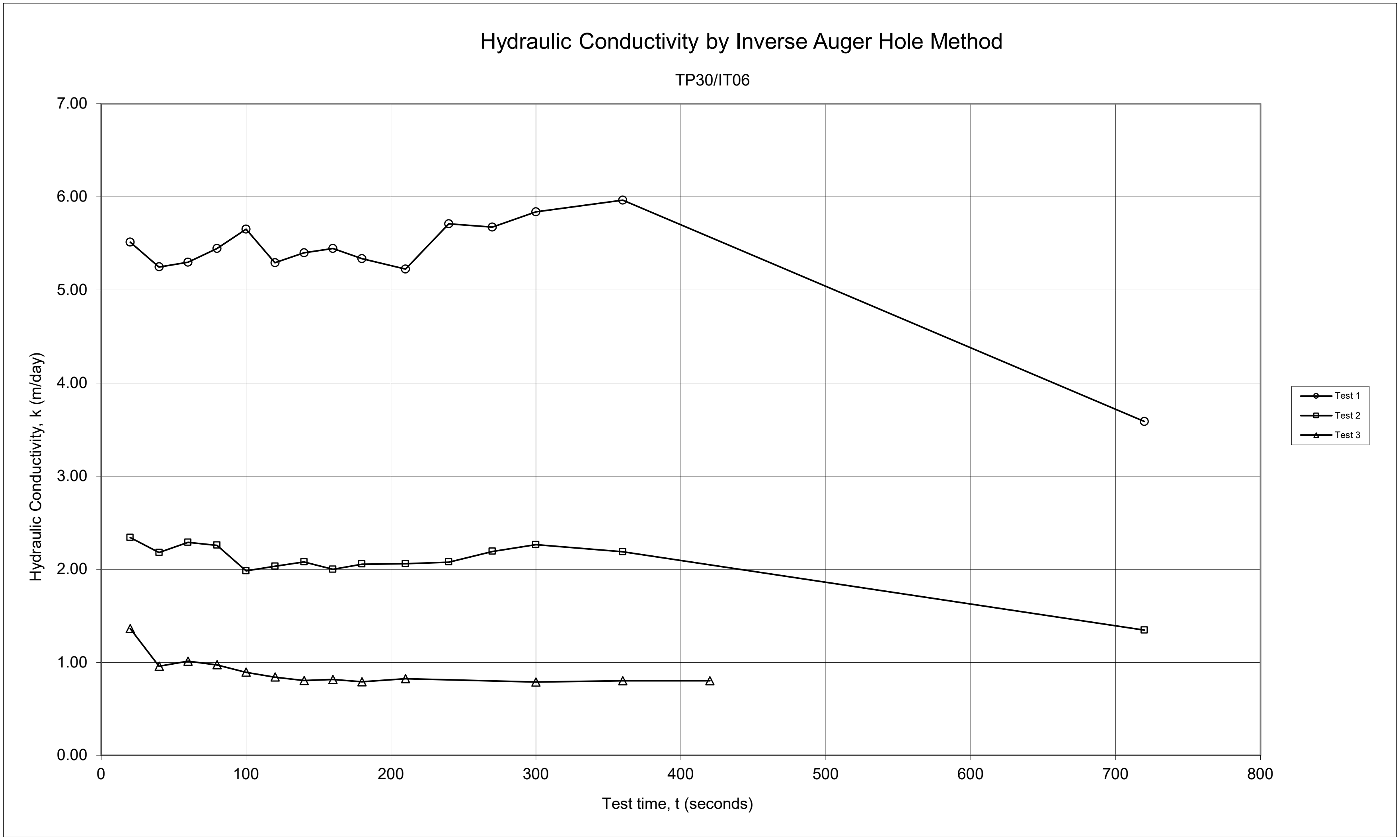

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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

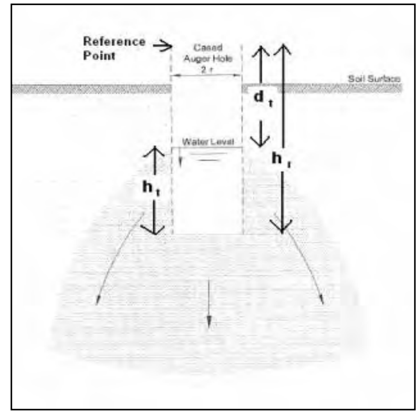
Galt Geotechnics

Spreadsheet author:	ORW	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP41/IT07
Test Depth:	0.62 m

$$K = 1.15r\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

(blue)	Required input
(green)	Calculated field
(orange)	Comment field
(crossed)	Field not used
(yellow)	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.05	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.847	0.203		
40	0.849	0.201	3.5E-06	0.3
60	0.851	0.199	4.6E-06	0.4
80	0.853	0.197	5.2E-06	0.5
100	0.855	0.195	5.6E-06	0.5
120	0.857	0.193	5.9E-06	0.5
140	0.858	0.192	5.5E-06	0.5
160	0.859	0.191	5.3E-06	0.5
180	0.86	0.19	5.1E-06	0.4
210	0.863	0.187	5.4E-06	0.5
240	0.865	0.185	5.4E-06	0.5
270	0.867	0.183	5.3E-06	0.5
300	0.868	0.182	5.1E-06	0.4
360	0.872	0.178	5.1E-06	0.4
420	0.875	0.175	4.9E-06	0.4
		AVERAGE	5.1E-06	0.4

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.824	0.226		
60	0.832	0.218	8.4E-06	0.7
120	0.837	0.213	6.9E-06	0.6
180	0.841	0.209	6.1E-06	0.5
240	0.846	0.204	6.0E-06	0.5
300	0.848	0.202	5.2E-06	0.5
360	0.852	0.198	5.1E-06	0.4
420	0.857	0.193	5.3E-06	0.5
		AVERAGE	6.2E-06	0.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.816	0.234		
60	0.821	0.229	5.1E-06	0.4
120	0.826	0.224	5.1E-06	0.4
180	0.83	0.22	4.8E-06	0.4
240	0.835	0.215	5.0E-06	0.4
300	0.838	0.212	4.6E-06	0.4
360	0.842	0.208	4.6E-06	0.4
420	0.845	0.205	4.4E-06	0.4
		AVERAGE	4.8E-06	0.4

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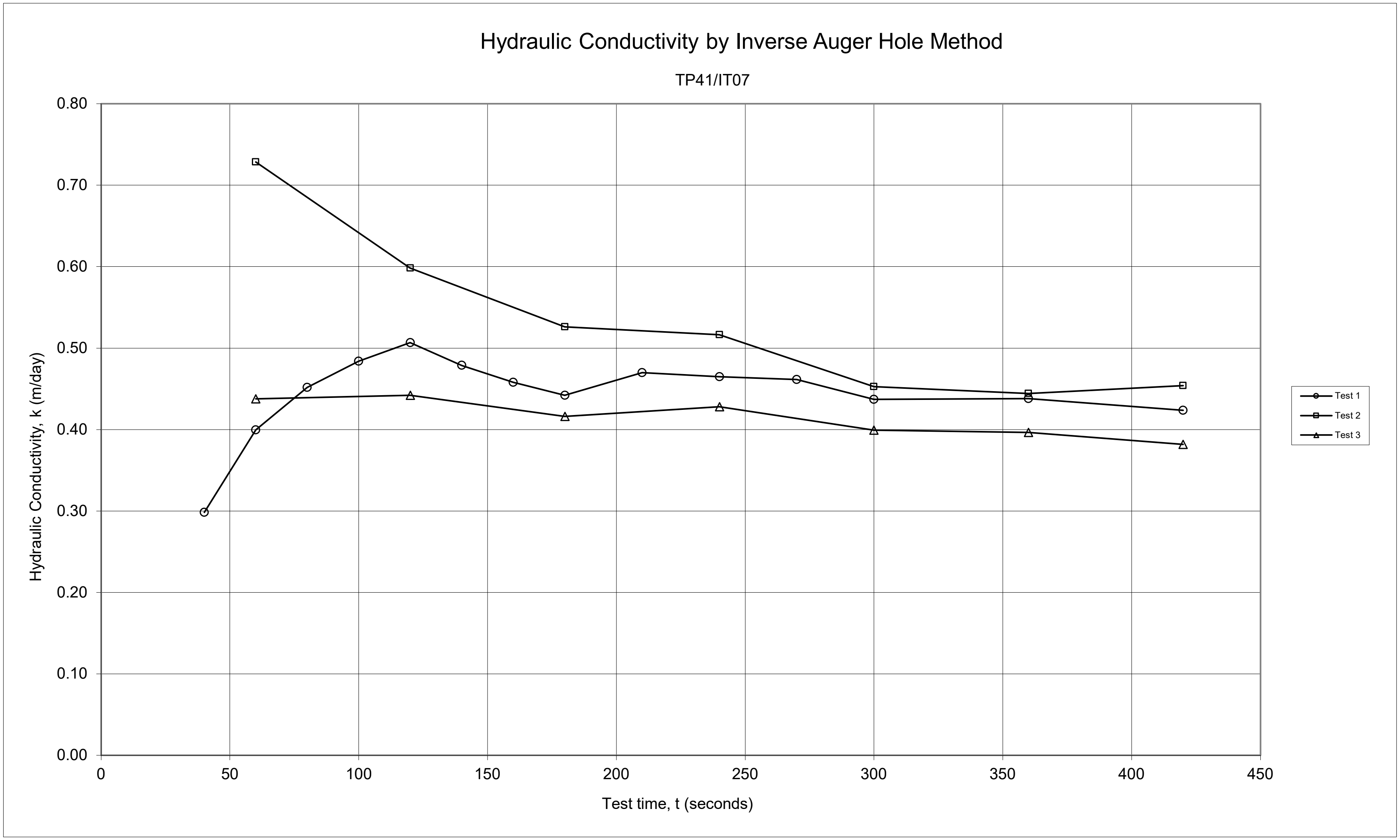

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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

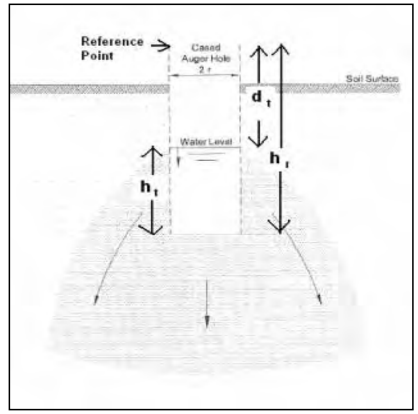
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP46/IT08
Test Depth:	0.47 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.055	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

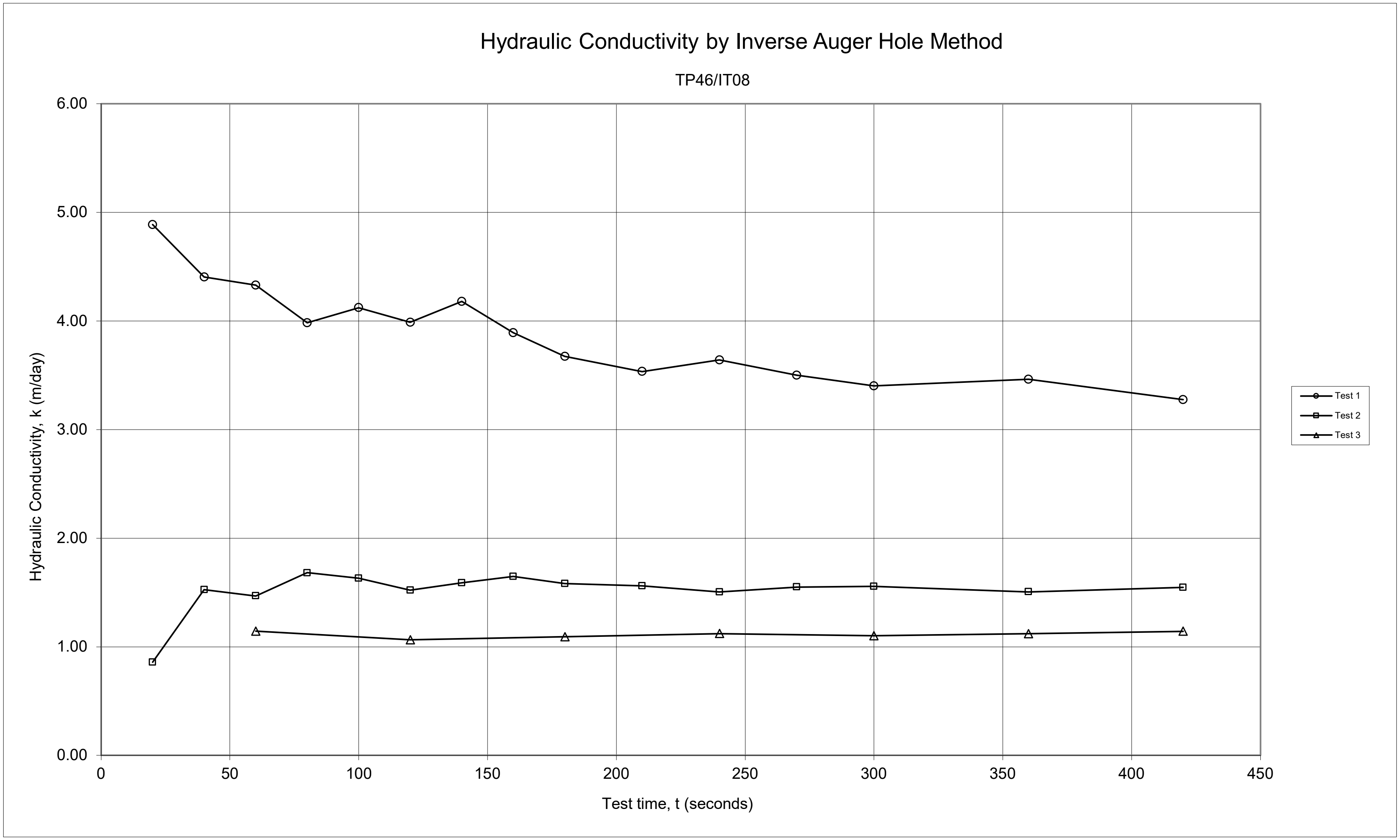
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.96	0.095		
20	0.968	0.087	5.7E-05	4.9
40	0.974	0.081	5.1E-05	4.4
60	0.98	0.075	5.0E-05	4.3
80	0.984	0.071	4.6E-05	4.0
100	0.99	0.065	4.8E-05	4.1
120	0.994	0.061	4.6E-05	4.0
140	1	0.055	4.8E-05	4.2
160	1.002	0.053	4.5E-05	3.9
180	1.004	0.051	4.3E-05	3.7
210	1.008	0.047	4.1E-05	3.5
240	1.014	0.041	4.2E-05	3.6
270	1.017	0.038	4.1E-05	3.5
300	1.02	0.035	3.9E-05	3.4
360	1.028	0.027	4.0E-05	3.5
420	1.032	0.023	3.8E-05	3.3
		AVERAGE	4.5E-05	3.9

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.918	0.137		
20	0.92	0.135	9.9E-06	0.9
40	0.925	0.13	1.8E-05	1.5
60	0.928	0.127	1.7E-05	1.5
80	0.933	0.122	1.9E-05	1.7
100	0.936	0.119	1.9E-05	1.6
120	0.938	0.117	1.8E-05	1.5
140	0.942	0.113	1.8E-05	1.6
160	0.946	0.109	1.9E-05	1.6
180	0.948	0.107	1.8E-05	1.6
210	0.952	0.103	1.8E-05	1.6
240	0.955	0.1	1.7E-05	1.5
270	0.96	0.095	1.8E-05	1.6
300	0.964	0.091	1.8E-05	1.6
360	0.97	0.085	1.7E-05	1.5
420	0.978	0.077	1.8E-05	1.5
		AVERAGE	1.8E-05	1.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.857	0.198		
60	0.868	0.187	1.3E-05	1.1
120	0.877	0.178	1.2E-05	1.1
180	0.887	0.168	1.3E-05	1.1
240	0.897	0.158	1.3E-05	1.1
300	0.905	0.15	1.3E-05	1.1
360	0.914	0.141	1.3E-05	1.1
420	0.923	0.132	1.3E-05	1.1
		AVERAGE	1.3E-05	1.1



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

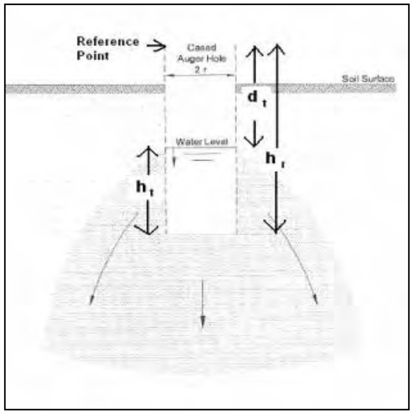
Galt Geotechnics

Spreadsheet author:	ORW
	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP50/IT09
Test Depth:	0.74 m

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

Required input	
Calculated field	
Comment field	
Field not used	
Fixed field	

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.862	0.138		
20	0.88	0.12	9.4E-05	8.1
40	0.89	0.11	7.6E-05	6.5
60	0.902	0.098	7.6E-05	6.5
80	0.912	0.088	7.4E-05	6.4
100	0.922	0.078	7.5E-05	6.4
120	0.928	0.072	7.0E-05	6.1
140	0.937	0.063	7.2E-05	6.2
160	0.944	0.056	7.2E-05	6.2
180	0.95	0.05	7.1E-05	6.2
210	0.96	0.04	7.3E-05	6.3
240	0.968	0.032	7.4E-05	6.4
270	0.973	0.027	7.2E-05	6.2
300	0.978	0.022	7.1E-05	6.1
360	0.985	0.015	6.8E-05	5.9
420	0.993	0.007	6.9E-05	6.0
		AVERAGE	7.4E-05	6.4

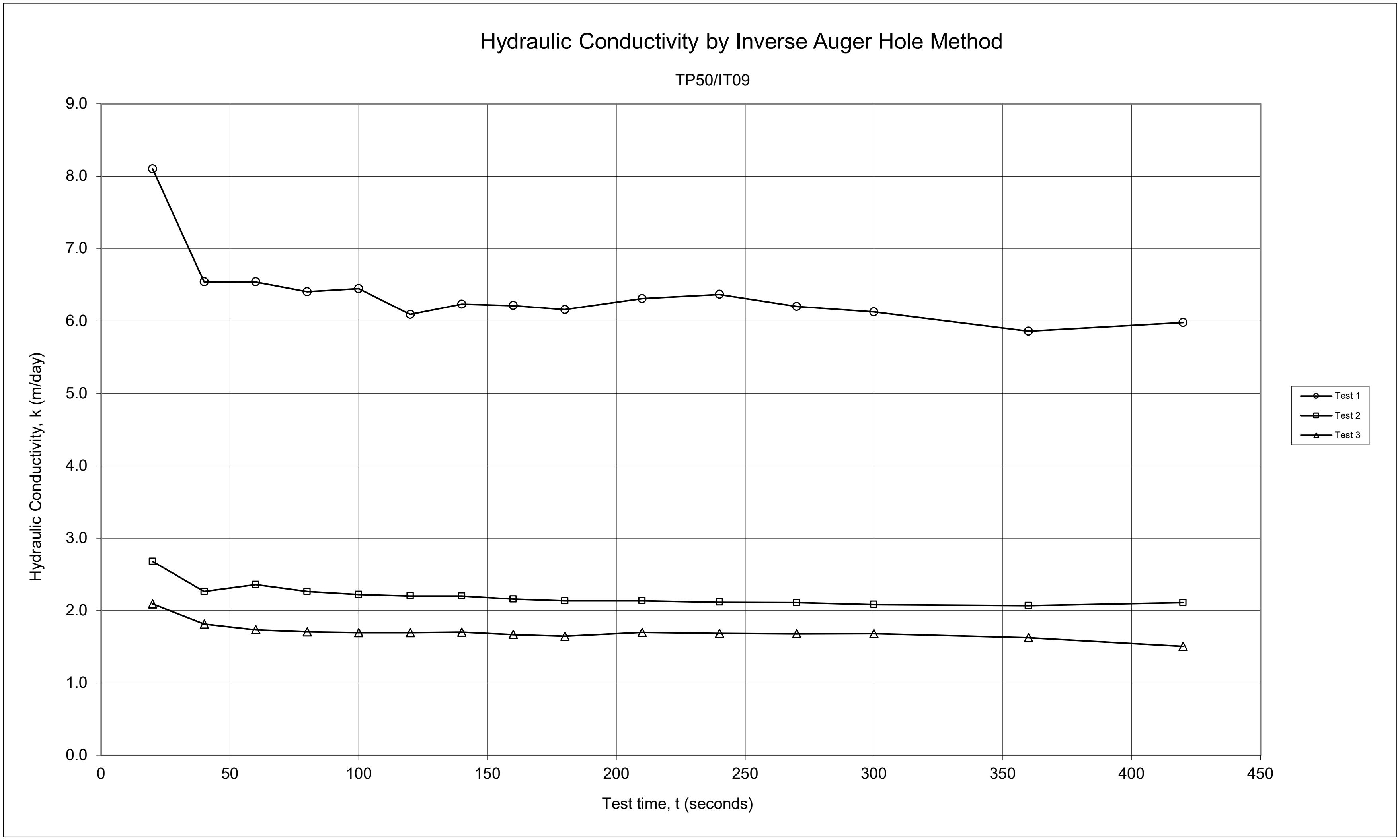
Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.793	0.207		
20	0.802	0.198	3.1E-05	2.7
40	0.808	0.192	2.6E-05	2.3
60	0.816	0.184	2.7E-05	2.4
80	0.822	0.178	2.6E-05	2.3
100	0.828	0.172	2.6E-05	2.2
120	0.834	0.166	2.5E-05	2.2
140	0.84	0.16	2.5E-05	2.2
160	0.845	0.155	2.5E-05	2.2
180	0.85	0.15	2.5E-05	2.1
210	0.858	0.142	2.5E-05	2.1
240	0.865	0.135	2.4E-05	2.1
270	0.872	0.128	2.4E-05	2.1
300	0.878	0.122	2.4E-05	2.1
360	0.89	0.11	2.4E-05	2.1
420	0.903	0.097	2.4E-05	2.1
		AVERAGE	2.6E-05	2.2

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.795	0.205		
20	0.802	0.198	2.4E-05	2.1
40	0.807	0.193	2.1E-05	1.8
60	0.812	0.188	2.0E-05	1.7
80	0.817	0.183	2.0E-05	1.7
100	0.822	0.178	2.0E-05	1.7
120	0.827	0.173	2.0E-05	1.7
140	0.832	0.168	2.0E-05	1.7
160	0.836	0.164	1.9E-05	1.7
180	0.84	0.16	1.9E-05	1.6
210	0.848	0.152	2.0E-05	1.7
240	0.854	0.146	1.9E-05	1.7
270	0.86	0.14	1.9E-05	1.7
300	0.866	0.134	1.9E-05	1.7
360	0.875	0.125	1.9E-05	1.6
420	0.88	0.12	1.7E-05	1.5
		AVERAGE	2.0E-05	1.7

Attachment 15.1A - Proposed Development - Onslow Industrial Park



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

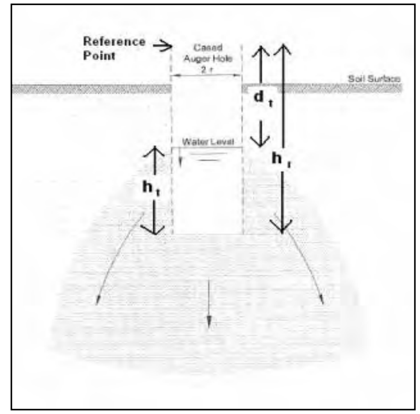
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP67/IT10
Test Depth:	0.71 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	0.96	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

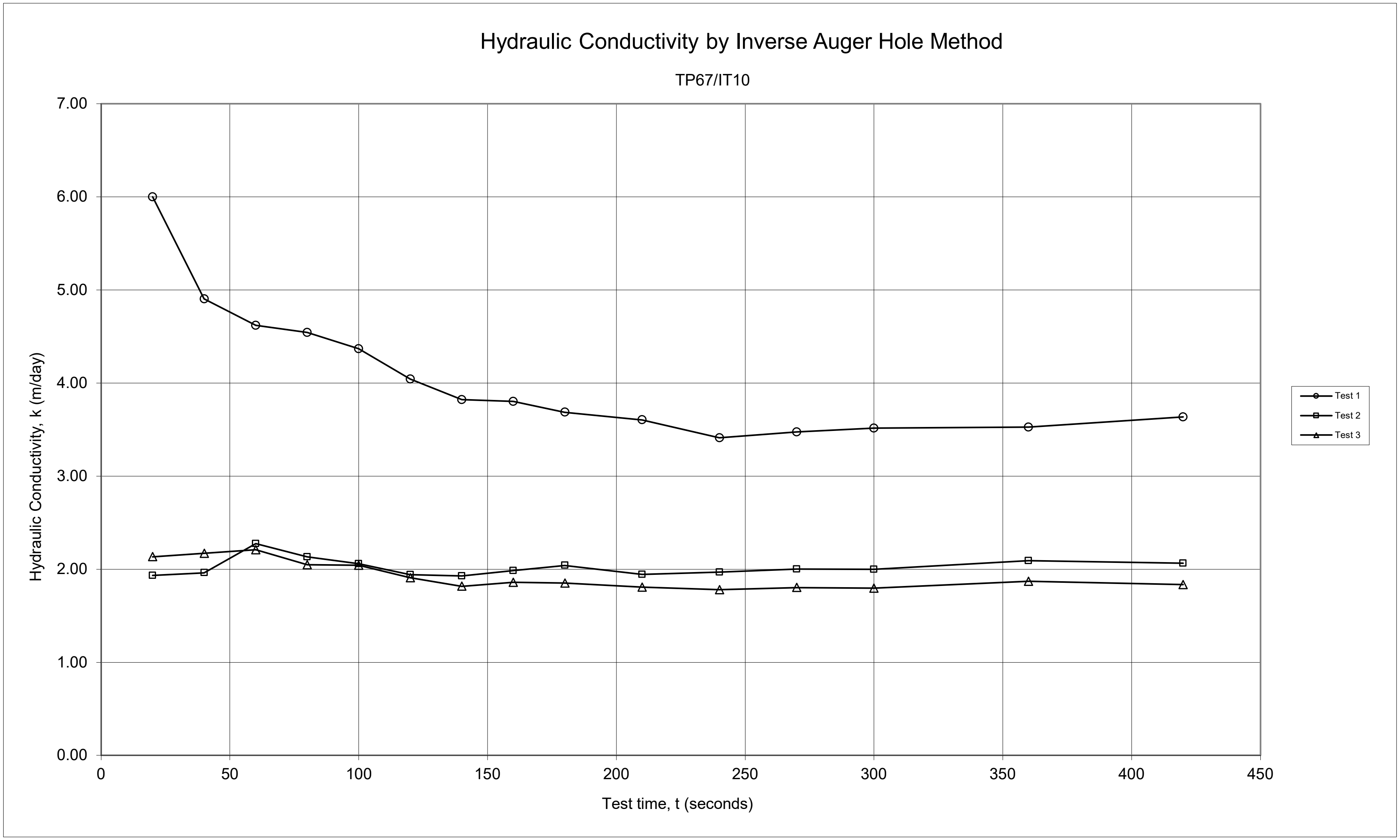
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.783	0.177		
20	0.8	0.16	6.9E-05	6.0
40	0.81	0.15	5.7E-05	4.9
60	0.82	0.14	5.3E-05	4.6
80	0.83	0.13	5.3E-05	4.5
100	0.838	0.122	5.1E-05	4.4
120	0.843	0.117	4.7E-05	4.0
140	0.848	0.112	4.4E-05	3.8
160	0.855	0.105	4.4E-05	3.8
180	0.86	0.1	4.3E-05	3.7
210	0.868	0.092	4.2E-05	3.6
240	0.873	0.087	3.9E-05	3.4
270	0.882	0.078	4.0E-05	3.5
300	0.89	0.07	4.1E-05	3.5
360	0.903	0.057	4.1E-05	3.5
420	0.916	0.044	4.2E-05	3.6
		AVERAGE	4.7E-05	4.1

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.805	0.155		
20	0.81	0.15	2.2E-05	1.9
40	0.815	0.145	2.3E-05	2.0
60	0.822	0.138	2.6E-05	2.3
80	0.826	0.134	2.5E-05	2.1
100	0.83	0.13	2.4E-05	2.1
120	0.833	0.127	2.2E-05	1.9
140	0.837	0.123	2.2E-05	1.9
160	0.842	0.118	2.3E-05	2.0
180	0.847	0.113	2.4E-05	2.0
210	0.851	0.109	2.3E-05	1.9
240	0.857	0.103	2.3E-05	2.0
270	0.863	0.097	2.3E-05	2.0
300	0.868	0.092	2.3E-05	2.0
360	0.88	0.08	2.4E-05	2.1
420	0.888	0.072	2.4E-05	2.1
		AVERAGE	2.3E-05	2.0

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.79	0.17		
20	0.796	0.164	2.5E-05	2.1
40	0.802	0.158	2.5E-05	2.2
60	0.808	0.152	2.6E-05	2.2
80	0.812	0.148	2.4E-05	2.0
100	0.817	0.143	2.4E-05	2.0
120	0.82	0.14	2.2E-05	1.9
140	0.823	0.137	2.1E-05	1.8
160	0.828	0.132	2.2E-05	1.9
180	0.832	0.128	2.1E-05	1.9
210	0.837	0.123	2.1E-05	1.8
240	0.842	0.118	2.1E-05	1.8
270	0.848	0.112	2.1E-05	1.8
300	0.853	0.107	2.1E-05	1.8
360	0.865	0.095	2.2E-05	1.9
420	0.873	0.087	2.1E-05	1.8
		AVERAGE	2.2E-05	1.9



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

Galt Geotechnics

Spreadsheet author:	ORW	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP31/IT11
Test Depth:	0.50 m

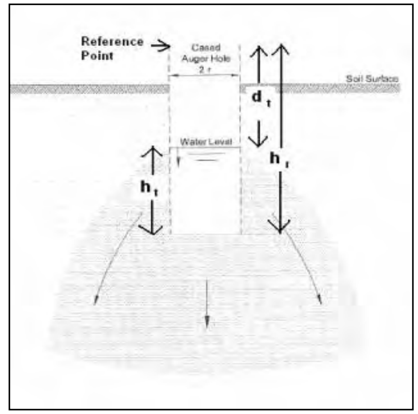
$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114

Spreadsheet Legend

- Required input
- Calculated field
- Comment field
- Field not used
- Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m



Test 1

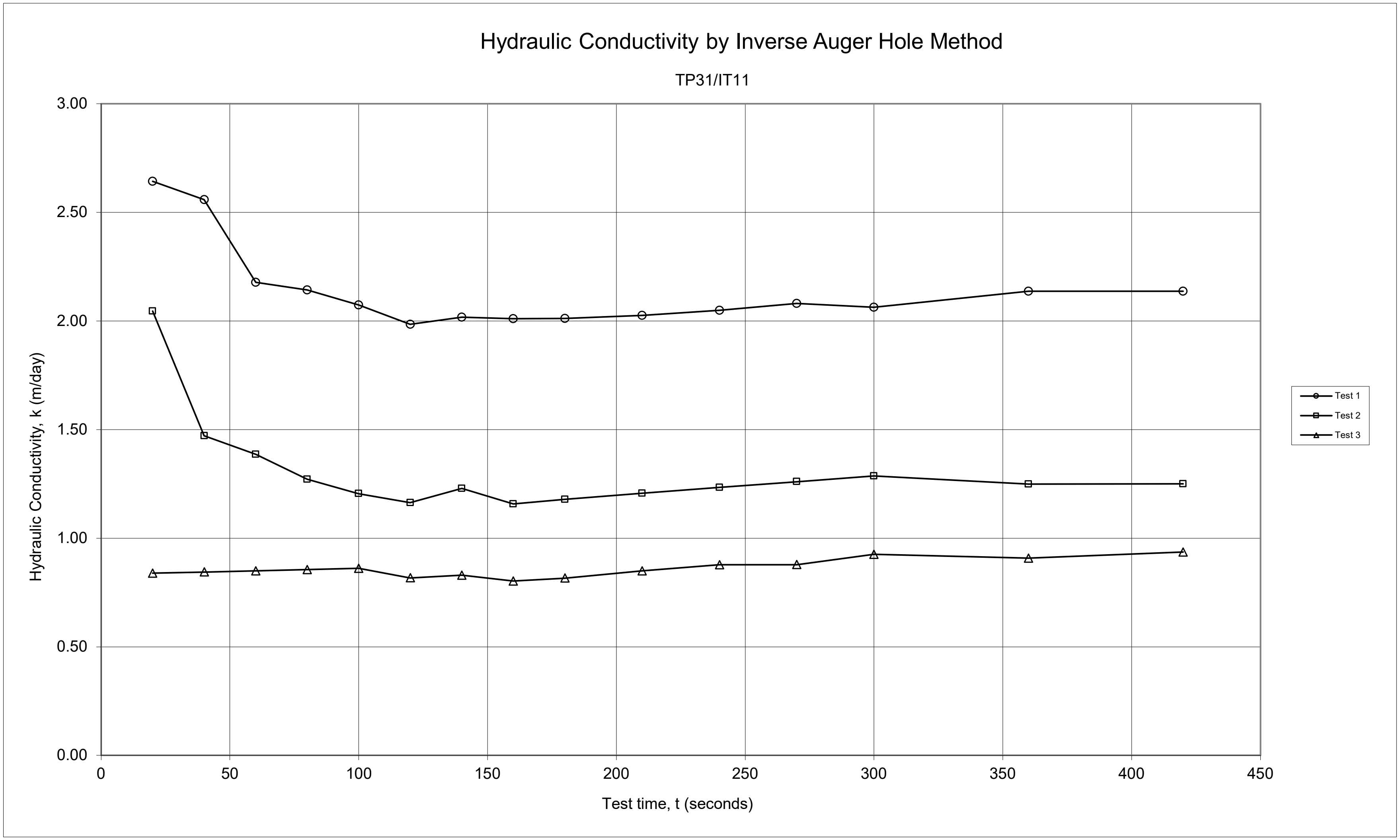
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.765	0.235		
20	0.775	0.225	3.1E-05	2.6
40	0.784	0.216	3.0E-05	2.6
60	0.789	0.211	2.5E-05	2.2
80	0.796	0.204	2.5E-05	2.1
100	0.802	0.198	2.4E-05	2.1
120	0.807	0.193	2.3E-05	2.0
140	0.814	0.186	2.3E-05	2.0
160	0.82	0.18	2.3E-05	2.0
180	0.826	0.174	2.3E-05	2.0
210	0.835	0.165	2.3E-05	2.0
240	0.844	0.156	2.4E-05	2.0
270	0.853	0.147	2.4E-05	2.1
300	0.86	0.14	2.4E-05	2.1
360	0.877	0.123	2.5E-05	2.1
420	0.89	0.11	2.5E-05	2.1
		AVERAGE	2.5E-05	2.1

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.79	0.21		
20	0.797	0.203	2.4E-05	2.0
40	0.8	0.2	1.7E-05	1.5
60	0.804	0.196	1.6E-05	1.4
80	0.807	0.193	1.5E-05	1.3
100	0.81	0.19	1.4E-05	1.2
120	0.813	0.187	1.3E-05	1.2
140	0.818	0.182	1.4E-05	1.2
160	0.82	0.18	1.3E-05	1.2
180	0.824	0.176	1.4E-05	1.2
210	0.83	0.17	1.4E-05	1.2
240	0.836	0.164	1.4E-05	1.2
270	0.842	0.158	1.5E-05	1.3
300	0.848	0.152	1.5E-05	1.3
360	0.856	0.144	1.4E-05	1.2
420	0.865	0.135	1.4E-05	1.2
		AVERAGE	1.5E-05	1.3

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.782	0.218		
20	0.785	0.215	9.7E-06	0.8
40	0.788	0.212	9.8E-06	0.8
60	0.791	0.209	9.8E-06	0.8
80	0.794	0.206	9.9E-06	0.9
100	0.797	0.203	1.0E-05	0.9
120	0.799	0.201	9.5E-06	0.8
140	0.802	0.198	9.6E-06	0.8
160	0.804	0.196	9.3E-06	0.8
180	0.807	0.193	9.4E-06	0.8
210	0.812	0.188	9.8E-06	0.8
240	0.817	0.183	1.0E-05	0.9
270	0.821	0.179	1.0E-05	0.9
300	0.827	0.173	1.1E-05	0.9
360	0.834	0.166	1.1E-05	0.9
420	0.843	0.157	1.1E-05	0.9
		AVERAGE	9.9E-06	0.9



Hydraulic Conductivity by Inverse Auger Hole Method
TP31/IT11
Hydraulic Conductivity, k (m/day)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
50
100
150
200
250
300
350
400
450
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

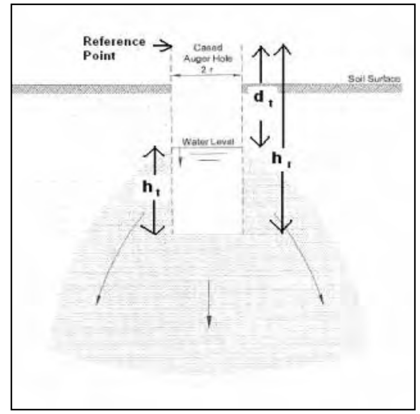
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP71 / IT12
Test Depth:	0.43 m

Spreadsheet author: ORW 17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.03	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

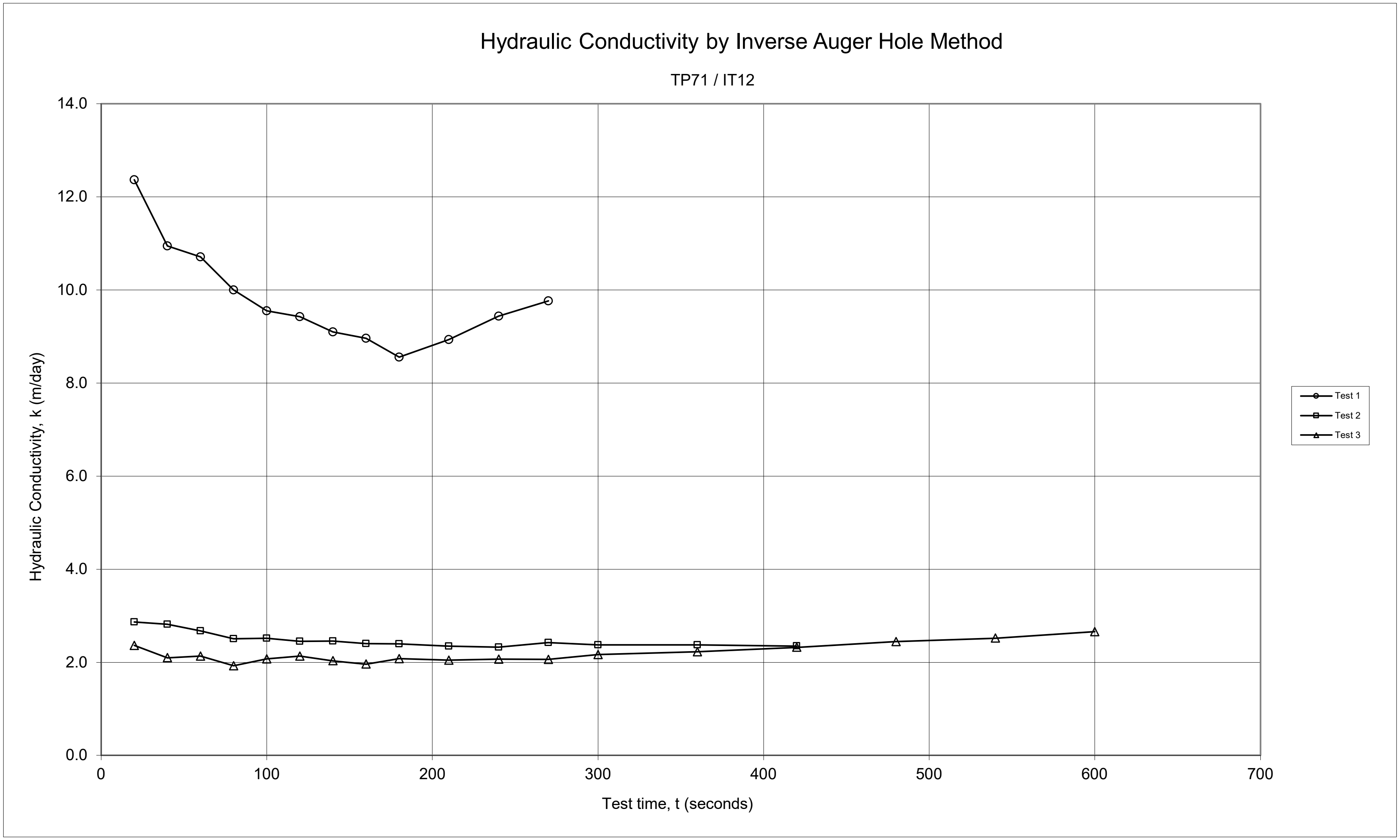
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.93	0.1		
20	0.95	0.08	1.4E-04	12.4
40	0.963	0.067	1.3E-04	10.9
60	0.975	0.055	1.2E-04	10.7
80	0.983	0.047	1.2E-04	10.0
100	0.99	0.04	1.1E-04	9.5
120	0.997	0.033	1.1E-04	9.4
140	1.002	0.028	1.1E-04	9.1
160	1.007	0.023	1.0E-04	9.0
180	1.01	0.02	9.9E-05	8.6
210	1.018	0.012	1.0E-04	8.9
240	1.025	0.005	1.1E-04	9.4
270	1.03	0	1.1E-04	9.8
		AVERAGE	1.1E-04	9.8

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.745	0.285		
20	0.758	0.272	3.3E-05	2.9
40	0.77	0.26	3.3E-05	2.8
60	0.78	0.25	3.1E-05	2.7
80	0.788	0.242	2.9E-05	2.5
100	0.798	0.232	2.9E-05	2.5
120	0.806	0.224	2.8E-05	2.5
140	0.815	0.215	2.8E-05	2.5
160	0.822	0.208	2.8E-05	2.4
180	0.83	0.2	2.8E-05	2.4
210	0.84	0.19	2.7E-05	2.3
240	0.85	0.18	2.7E-05	2.3
270	0.864	0.166	2.8E-05	2.4
300	0.872	0.158	2.7E-05	2.4
360	0.89	0.14	2.7E-05	2.4
420	0.905	0.125	2.7E-05	2.3
		AVERAGE	2.9E-05	2.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.822	0.208		
20	0.83	0.2	2.7E-05	2.4
40	0.836	0.194	2.4E-05	2.1
60	0.843	0.187	2.5E-05	2.1
80	0.847	0.183	2.2E-05	1.9
100	0.855	0.175	2.4E-05	2.1
120	0.862	0.168	2.5E-05	2.1
140	0.866	0.164	2.4E-05	2.0
160	0.87	0.16	2.3E-05	2.0
180	0.878	0.152	2.4E-05	2.1
210	0.885	0.145	2.4E-05	2.0
240	0.893	0.137	2.4E-05	2.1
270	0.9	0.13	2.4E-05	2.1
300	0.91	0.12	2.5E-05	2.2
360	0.925	0.105	2.6E-05	2.2
420	0.94	0.09	2.7E-05	2.3
480	0.955	0.075	2.8E-05	2.4
540	0.967	0.063	2.9E-05	2.5
600	0.98	0.05	3.1E-05	2.7
		AVERAGE	2.5E-05	2.2


Hydraulic Conductivity by Inverse Auger Hole Method
TP71 / IT12
Hydraulic Conductivity, k (m/day)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
100
200
300
400
500
600
700
Test time, t (seconds)
Test 1
Test 2
Test 3

Appendix F: DCP Test Results

DYNAMIC CONE PENETROMETER RECORD SHEET

AS 1298.6.3.2

Client: Shire of Ashburton **Job No:** J2201059
Project: Proposed Onlsow Industrial Park **Date:** 2/05/2022
Location: Lot 201 Onslow Road, Onslow **Engineer:** P. Fuentes

Test No:	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08
Location:	Dredge Stockpile	Dredge Stockpile	Dredge Stockpile	Dredge Stockpile	Dredge Stockpile	Dredge Stockpile	Dredge Stockpile	Dredge Stockpile
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET	SET	SET	SET	SET
100-200	10+	10+	10+	10	8	10	10	10+
200-300		10+		10+	8	10+	10+	
300-400					7			
400-500					10+			
500-600								
600-700								
700-800								
800-900								
900-1000								

Test No:	TP09	TP10	TP11	TP12	TP13	TP14	TP15	TP16
Location:	Dredge Stockpile	Dredge Stockpile	Dredge Stockpile	Dredge Stockpile	SITE	SITE	SITE	SITE
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET	SET	SET	SET	SET
100-200	8	3	10	6	2	5	14	9
200-300	10	2	10+	10+	2	4	9	9
300-400	10	2			1	2	4	11
400-500	10+	2			7	6	3	10
500-600		1			10+	8	3	11
600-700		1				10+	10+	14
700-800		0						11
800-900		4						13
900-1000		3						11

Test No:	TP17	TP18	TP19	TP20	TP21	TP22	TP23	TP24
Location:	SITE	SITE	SITE	SITE	SITE	SITE	SITE	SITE
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET	SET	SET	SET	SET
100-200	16	5	10+	6	4	10+	10+	10+
200-300	10	6		5	10			
300-400	15	10+		5	10			
400-500	10			5	10+			
500-600	8			10+				
600-700	8							
700-800	11							
800-900	12							
900-1000	8							

Dynamic Cone Penetrometer tests done in accordance with AS 1289.6.3.2

R: Refusal HB: Hammer-bounce

DYNAMIC CONE PENETROMETER RECORD SHEET

AS 1298.6.3.2

Client:	Shire of Ashburton	**Job No:**	J2201059
Project:	Proposed Onlsow Industrial Park	**Date:**	2/05/2022
Location:	Lot 201 Onslow Road, Onslow	**Engineer:**	P. Fuentes

Test No:	TP25	TP26	TP27	TP28	TP29	TP30	TP31	TP32
Location:	SITE	SITE	SITE	SITE	SITE	SITE	SITE	SITE
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET	SET	SET	SET	SET
100-200	10+	3	4	10+	10+	10+	2	5
200-300		4	10				1	10+
300-400		6	7				3	
400-500		5	6				6	
500-600		8	4				10+	
600-700		7	7					
700-800		10+	7					
800-900			3					
900-1000			2					

Test No:	TP33	TP34	TP35	TP36	TP37	TP38	TP39	TP40
Location:	SITE	SITE	SITE	SITE	SITE	SITE	SITE	SITE
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET	SET	SET	SET	SET
100-200	10+	10+	10+	10+	10+	10+	10+	3
200-300								10
300-400								10+
400-500								
500-600								
600-700								
700-800								
800-900								
900-1000								

Test No:	TP41	TP42	TP43	TP44	TP45	TP46	TP47	TP48
Location:	SITE	SITE	SITE	SITE	SITE	SITE	SITE	SITE
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET	SET	SET	SET	SET
100-200	10	10+	10+	10+	10+	10+	10+	10+
200-300	10+							
300-400								
400-500								
500-600								
600-700								
700-800								
800-900								
900-1000								

Dynamic Cone Penetrometer tests done in accordance with AS 1289.6.3.2

R: Refusal HB: Hammer-bounce

DYNAMIC CONE PENETROMETER RECORD SHEET

AS 1298.6.3.2

Client:	Shire of Ashburton	**Job No:**	J2201059
Project:	Proposed Onlsow Industrial Park	**Date:**	2/05/2022
Location:	Lot 201 Onslow Road, Onslow	**Engineer:**	P. Fuentes

Test No:	TP49	TP50	TP51	TP52	TP53	TP54	TP55	TP56
Location:	SITE	SITE	SITE	SITE	SITE	Stockpile	Stockpile	Stockpile
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET	SET	SET	SET	SET
100-200	10+	9	10+	5	9	10+	10+	10+
200-300		10		10+	8			
300-400		10			9			
400-500		10			10+			
500-600		10+						
600-700								
700-800								
800-900								
900-1000								

Test No:	TP57	TP58	TP59	TP60	TP61	TP62	TP63	TP64
Location:	Stockpile	Stockpile	Stockpile	Stockpile	Stockpile	Stockpile	Stockpile	SITE
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET	SET	SET	SET	SET
100-200	10+	1	6	1	10+	10+	10+	10+
200-300		1	4	1				
300-400		1	3	2				
400-500		2	1	3				
500-600		1	1	1				
600-700		1	1	1				
700-800		1	1	2				
800-900		1	2	2				
900-1000		1	10+	2				

Test No:	TP65	TP66	TP67	TP68	TP69	TP70	TP71	TP72
Location:	SITE	SITE	SITE	SITE	SITE	SITE	SITE	SITE
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET	SET	SET	SET	SET
100-200	6	12	10+	5	10+	6	10+	10+
200-300	8	6		3		7		
300-400	8	3		4		7		
400-500	10	3		10		7		
500-600	10+	5		10		10		
600-700		7		10+		10+		
700-800		10						
800-900		8						
900-1000		8						

Dynamic Cone Penetrometer tests done in accordance with AS 1289.6.3.2

R: Refusal HB: Hammer-bounce

DYNAMIC CONE PENETROMETER RECORD SHEET

AS 1298.6.3.2

Client:	Shire of Ashburton	**Job No:**	J2201059
Project:	Proposed Onlsow Industrial Park	**Date:**	2/05/2022
Location:	Lot 201 Onslow Road, Onslow	**Engineer:**	P. Fuentes

Test No:	TP73	TP74	TP75	TP76				
Location:	SITE	SITE	SITE	SITE				
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100	SET	SET	SET	SET				
100-200	6	2	6	10				
200-300	10	2	10+	10+				
300-400	10+	3						
400-500		4						
500-600		4						
600-700		9						
700-800		7						
800-900		5						
900-1000		5						

Test No:								
Location:								
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100								
100-200								
200-300								
300-400								
400-500								
500-600								
600-700								
700-800								
800-900								
900-1000								

Test No:								
Location:								
Depth (mm)	**Number of Penetrometer Blows per 100 mm Interval**							
0-100								
100-200								
200-300								
300-400								
400-500								
500-600								
600-700								
700-800								
800-900								
900-1000								

Dynamic Cone Penetrometer tests done in accordance with AS 1289.6.3.2

R: Refusal HB: Hammer-bounce

Attachment 15.1A - Proposed Development - Onslow Industrial Park

DYNAMIC CONE PENETROMETER FIELD TEST DATA

(AS 1289.6.3.2)

Client: Shire of Ashburton
Job No: J2201059
Project: Proposed Onlsow Industrial Park
Date: 2/05/2022
Location: Lot 201 Onslow Road, Onslow
Engineer: P. Fuentes

Test No:	TP14	TP21	TP30	TP31	TP42	TP46	TP67	TP71	TP72
Location:	SITE	SITE	SITE	SITE	SITE	SITE	SITE	SITE	SITE
Depth (mm)	**No of Penetrometer Blows per 100 mm Depth Interval**								
0-100									
100-200			Pre-Dig		Pre-Dig				
200-300				Pre-Dig		Pre-Dig	Pre-Dig	Pre-Dig	Pre-Dig
300-400			SET		SET				
400-500	Pre-Dig		10+		10				
500-600		Pre-Dig	10+		5				SET
600-700			7	SET	6	SET	SET	SET	6
700-800			6	6	5	10	4	5	6
800-900			4	10	3	10	4	10	5
900-1000			5	10	3	8	3	8	5
1000-1100	SET		5	10	3	7	2	4	8
1100-1200	2	SET	6	7	4	6	2	4	10
1200-1300	2	R	10	5	4	10	2	3	10+
1300-1400	4		10	76	4	3	3	7	10+
1400-1500	4		9	4	4	1	2	10	10
1500-1600	5		8	4	4	3	2	10	8
1600-1700	8		8	4	3	2	2	5	10
1700-1800	10HB		9	4	4	3	2	5	6HB
1800-1900			10+	4	4	5	2	3	
1900-2000			9	3	3	5	2	8	
2000-2100			6	3	3	6	3	3	
2100-2200			10+	4	3	6	3	3	
2200-2300				8	3	4	4	6	
2300-2400				10+	3	5	4	6	
2400-2500					3	5	3	10	
2500-2600					2	4			
2600-2700					3	10+			
2700-2800					2				
2800-2900					2				
2900-3000					2				

Dynamic Cone Penetrometer tests done in accordance with AS 1289.6.3.2
HB: Hammer bounce (refusal)
0 = Penetration due to hammer weight only
R: Refusal

Appendix G: List of Test Locations

J2201059 - Shire of Ashburton / SI / Onslow Industrial Park

Test locations - MGA94 Zone 50

Name	MGA_E (m)	MGA_N (m)
TP01	305255	7603921
TP02	305413	7603921
TP03	305255	7603762
TP04	305413	7603762
TP05	305097	7603604
TP06	305255	7603604
TP07	305097	7603446
TP08	305255	7603446
TP09	304943	7603287
TP10	305097	7603287
TP11	305083	7603129
TP12	304907	7603127
TP13	304863	7603248
TP14	304901	7603344
TP15/IT01	304812	7603365
TP16/PERC01	304777	7603474
TP17	304670	7603437
TP18	304703	7603344
TP19/SP	304764	7603248
TP20/IT03	304764	7603149
TP21/PERC02	304665	7603248
TP22	304604	7603344
TP23	304566	7603248
TP24	304656	7603156
TP25	304566	7603149
TP26/IT04	304466	7603248
TP27	304367	7603248
TP28	304466	7603149
TP29/PERC03	304367	7603149
TP30/IT06	304268	7603149
TP31/PERC04/IT11	304169	7603050
TP32	304268	7603050
TP33/PERC06	304367	7603050
TP34	304466	7603050
TP35/PERC05	304566	7603050
TP36	304566	7602950
TP37	304466	7602950
TP38/PERC05	304367	7602950

Name	MGA_E (m)	MGA_N (m)
TP39	304268	7602950
TP40	304169	7602950
TP41/IT07	304057	7602938
TP42/IT05	304169	7602851
TP43	304268	7602851
TP44	304367	7602851
TP45	304314	7602790
TP46/IT08	304245	7602746
TP47	304169	7602752
TP48/PERC07	304136	7602667
TP49	304283	7602680
TP50/IT09	304361	7602687
TP51/SP	304466	7602653
TP52/PERC08	304566	7602653
TP53	304466	7602554
TP54	304318	7602585
TP55	304314	7602599
TP56	304294	7602601
TP57	304281	7602581
TP58	304297	7602577
TP59	304308	7602547
TP60	304293	7602544
TP61	304280	7602546
TP62	304280	7602525
TP63	304298	7602514
TP64	304466	7602454
TP65/PERC09	304367	7602454
TP66	304268	7602454
TP67/IT10	304124	7602576
TP68	304191	7602410
TP69/IT11	304249	7602355
TP70	304367	7602355
TP71/IT12	304258	7602260
TP72/SP	304367	7602256
TP73/PERC10	304268	7602157
TP74/IT02	304367	7602157
TP75	304329	7602113
TP76/PERC11	304268	7602057

Appendix H: Laboratory Test Results

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with Gravel and Shells**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4724_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4724
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (2-2.5)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Clayey Silt**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with Gravel and Shells**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4726_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4726
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP08 (1.5-2)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with Limestone and shells**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4729_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4729
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP10 (1.5-2)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand**
Water Used:	**Distilled**

EMERSON CLASS NUMBER **4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4732_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4732
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0-0.4)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with Gravel and Shells**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with Shells and trace Gravel**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory: Coneill

Name: Cody O'Neill
Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP13 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with Limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4735_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4735
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP17 (0-0.5)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Clayey Silt**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with Limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4739_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4739
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP30 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with trace Limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4741_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4741
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP36 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

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TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4744_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4744
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP44 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with Gravel**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory: [signature]

Name: Cody O'Neill

Date: 31/March/2022

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TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4746_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4746
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP52 (0.3-0.7)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with trace of Limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

Accreditation No. 20599
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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Clayey Silt**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

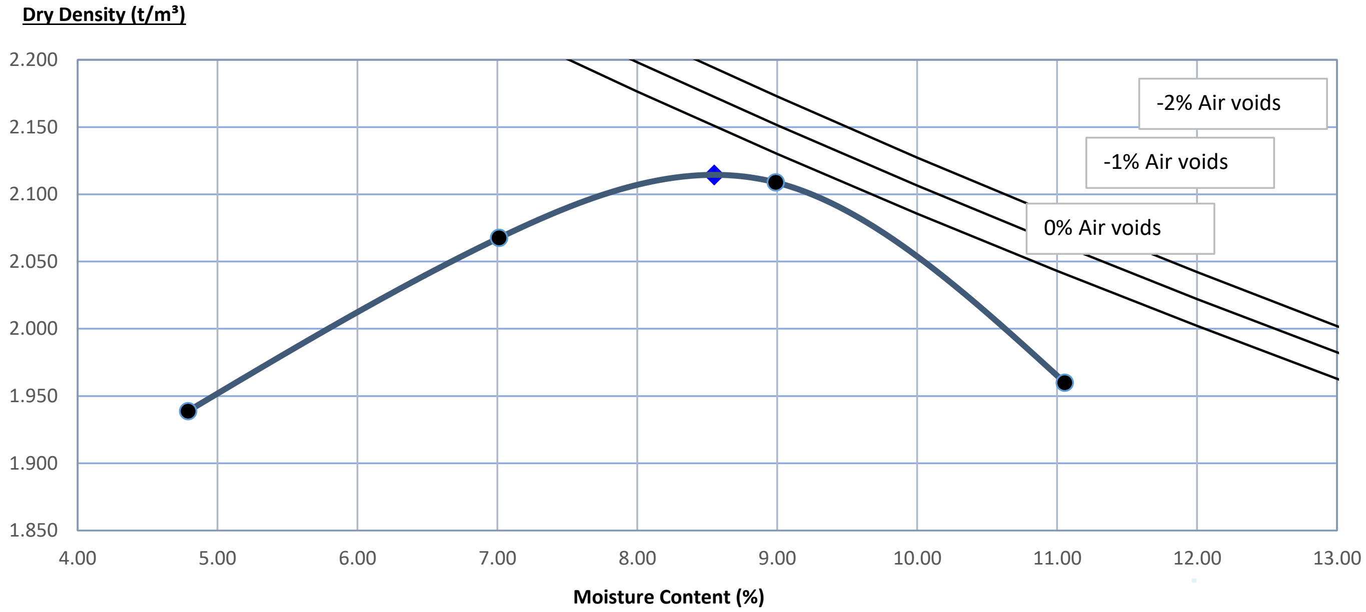
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**4.8**	**7.0**	**9.0**	**11.1**	
Dry Density (t/m³)	**1.939**	**2.068**	**2.109**	**1.960**	



Modified Maximum Dry Density (t/m³) **2.11**

Optimum Moisture Content (%) **8.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.635 t/m³***

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4751_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4751
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP61 (0.5-1)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

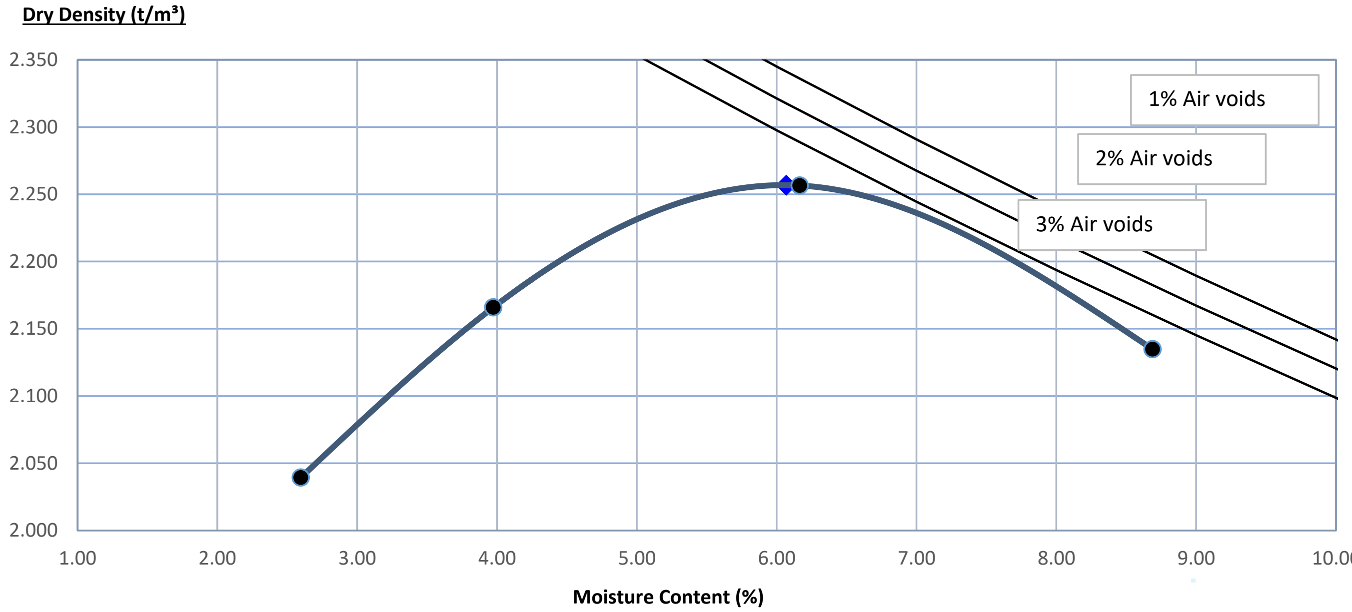
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **5** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**2.6**	**4.0**	**6.2**	**8.7**	
Dry Density (t/m³)	**2.039**	**2.166**	**2.257**	**2.135**	



Modified Maximum Dry Density (t/m³) **2.26**

Optimum Moisture Content (%) **6.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.761 t/m³*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4749_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4749
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP59 (0.5-1)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

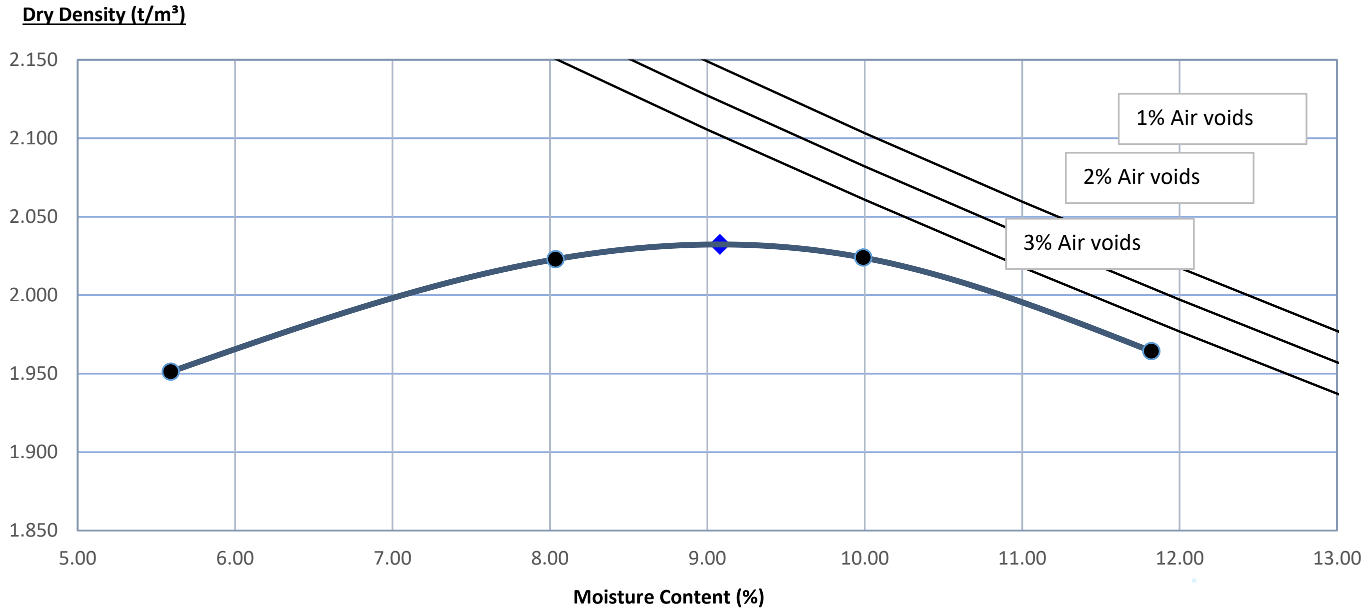
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **2** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**5.6**	**8.0**	**10.0**	**11.8**	
Dry Density (t/m^3)	**1.951**	**2.023**	**2.024**	**1.964**	



Modified Maximum Dry Density (t/m^3) **2.03**

Optimum Moisture Content (%) **9.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.698 t/m^3*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4743_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4743
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP40 (2-2.5)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

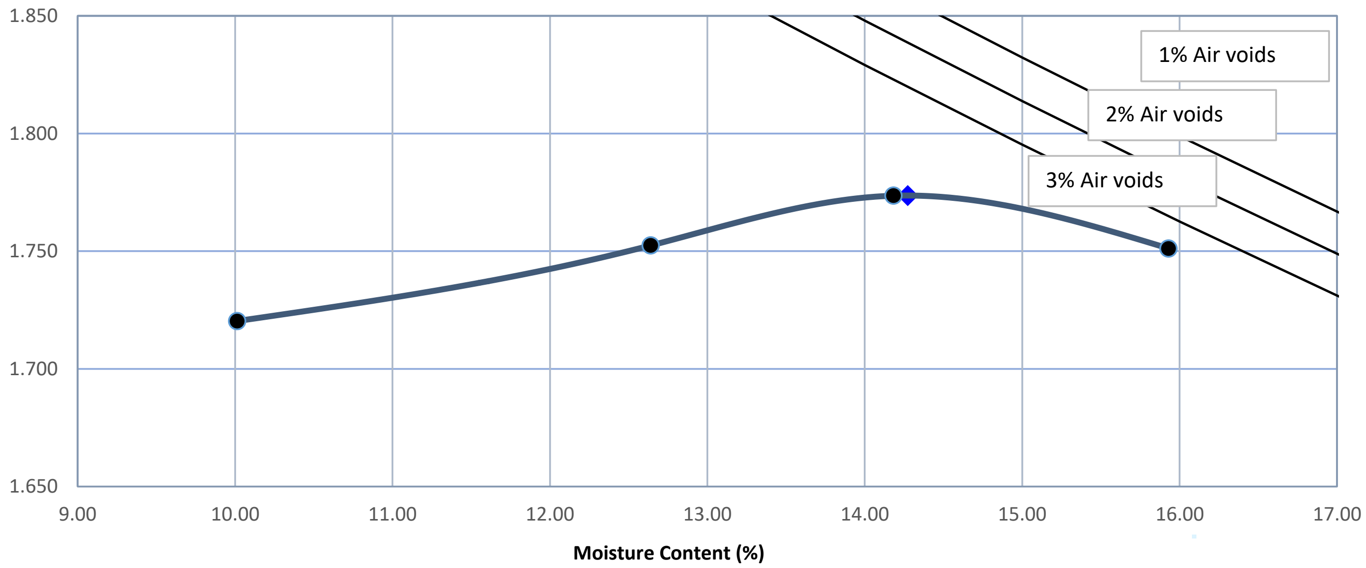
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**10.0**	**12.6**	**14.2**	**15.9**	
Dry Density (t/m³)	**1.720**	**1.752**	**1.774**	**1.751**	



Modified Maximum Dry Density (t/m³) **1.77**

Optimum Moisture Content (%) **14.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.562 t/m³*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	28/03/2022

TEST RESULTS - Modified Maximum Dry Density

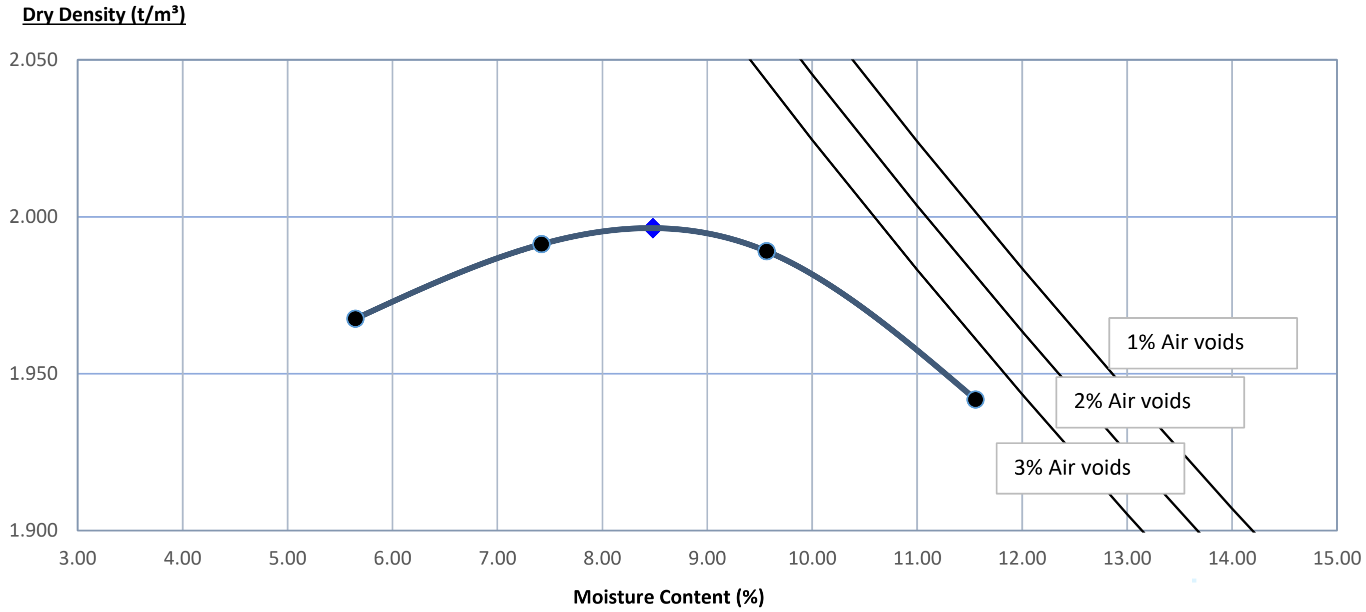
Sampling Method: Sampled by Client, Tested as Received

Sample Curing Time: 2 HRS

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 2 **Material + 37.5mm (%)** -

Moisture Content (%)	5.6	7.4	9.6	11.6	
Dry Density (t/m³)	1.967	1.991	1.989	1.942	



Modified Maximum Dry Density (t/m³) **2.00**

Optimum Moisture Content (%) **8.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.638 t/m³*

Approved Signatory:

Name: Cody O'Neill

Date: 29/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

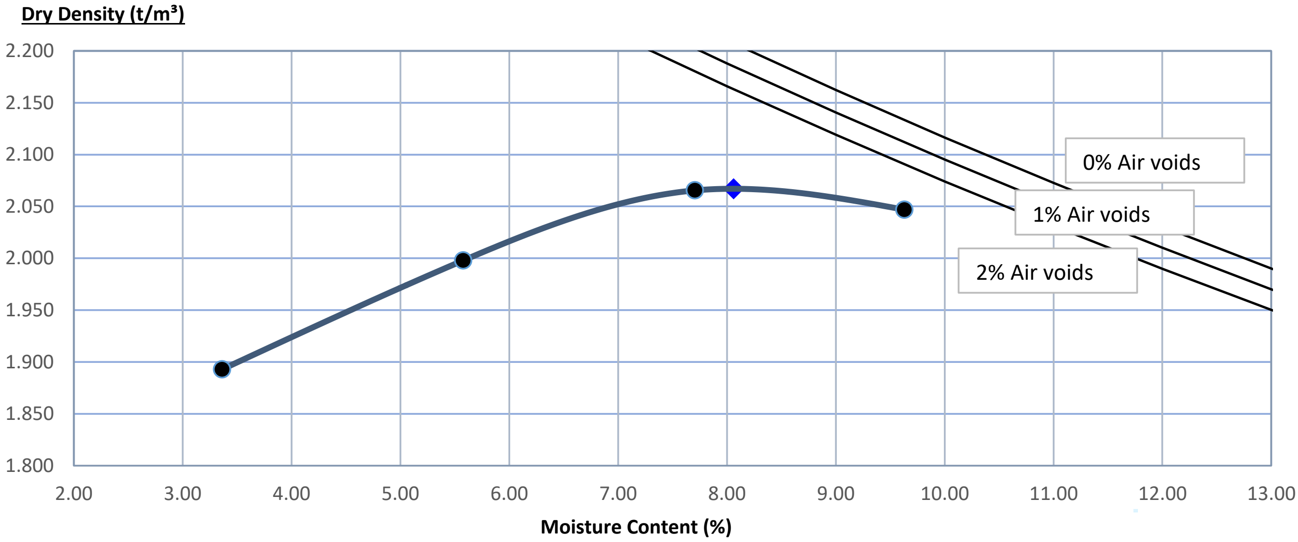
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 Hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**3.4**	**5.6**	**7.7**	**9.6**	
Dry Density (t/m³)	**1.893**	**1.998**	**2.065**	**2.047**	



Modified Maximum Dry Density (t/m³) **2.07**

Optimum Moisture Content (%) **8.0**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.685 t/m³***

Approved Signatory: Jwaldron

Name: Jason Waldron

Date: 01-April-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP13 (0.5-1)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

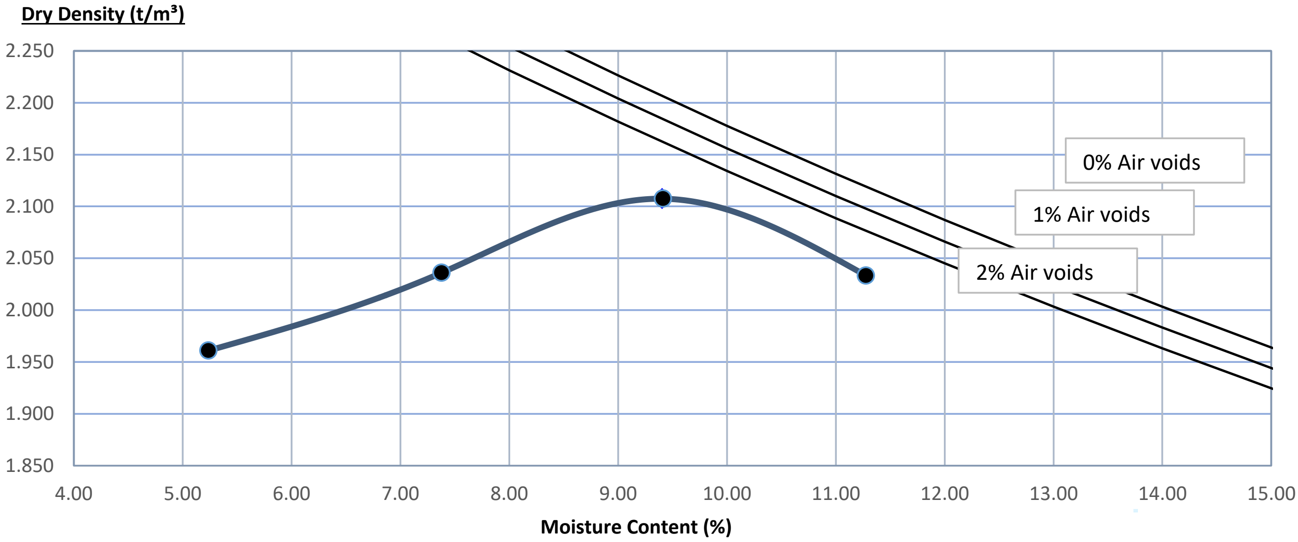
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 Hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **1** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**5.2**	**7.4**	**9.4**	**11.3**	
Dry Density (t/m³)	**1.961**	**2.036**	**2.107**	**2.033**	



Modified Maximum Dry Density (t/m³) **2.11**

Optimum Moisture Content (%) **9.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.784 t/m³***

Approved Signatory: JWaldron

Name: Jason Waldron

Date: 01-April-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

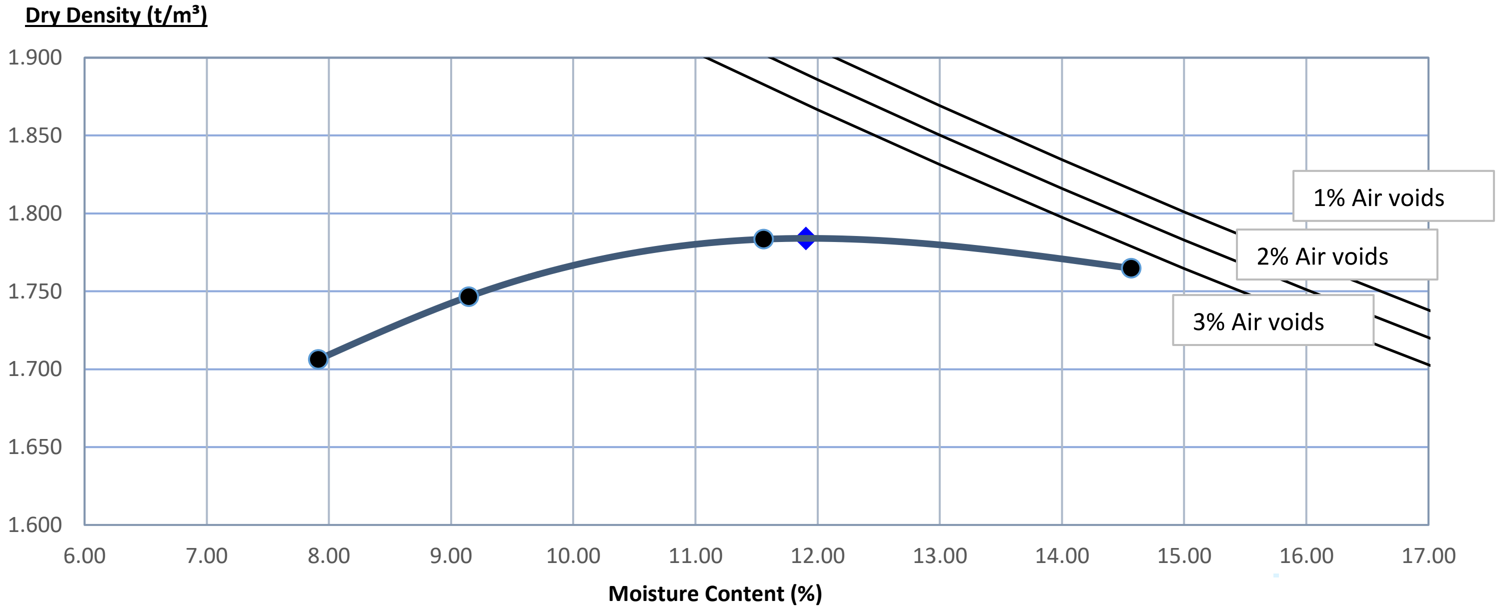
Sampling Method: Sampled by Client, Tested as Received

Sample Curing Time: 2 hrs

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 1 **Material + 37.5mm (%)** -

Moisture Content (%)	14.6	7.9	9.1	11.6	
Dry Density (t/m^3)	1.765	1.706	1.747	1.783	



Modified Maximum Dry Density (t/m^3) **1.78**

Optimum Moisture Content (%) **12.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.502 t/m^3*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4732_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4732
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0-0.4)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

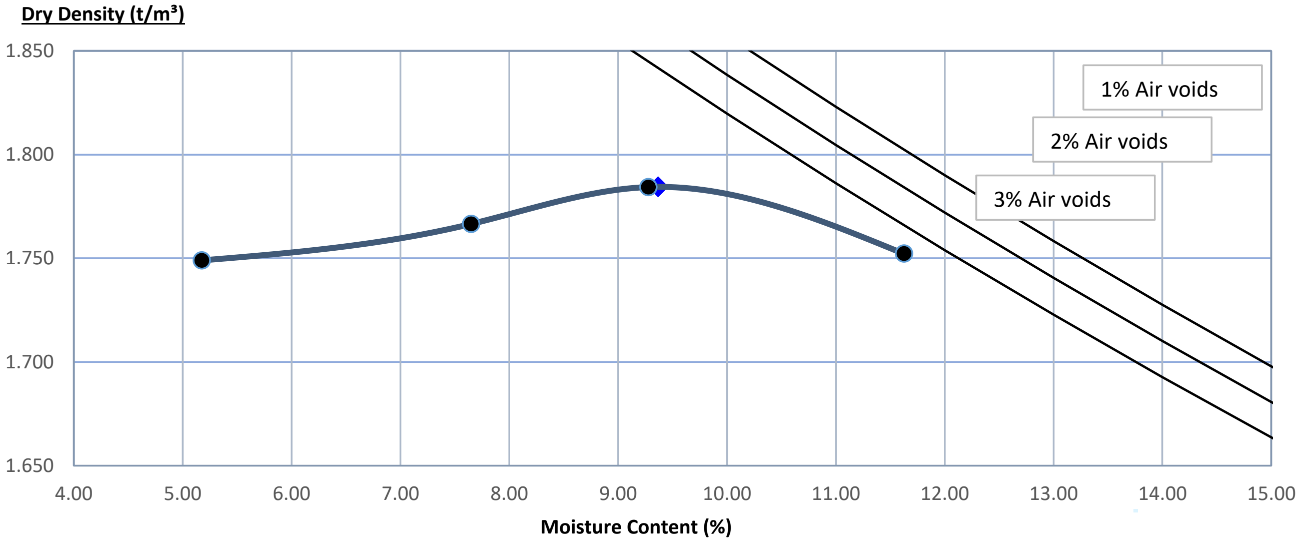
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **1** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**11.6**	**5.2**	**7.7**	**9.3**	
Dry Density (t/m³)	**1.752**	**1.749**	**1.767**	**1.784**	



Modified Maximum Dry Density (t/m³) **1.78**

Optimum Moisture Content (%) **9.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.309 t/m³*

Approved Signatory: Jwaldron

Name: Jason Waldron

Date: 01-April-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4731_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4731
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP11 (1.3-2)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

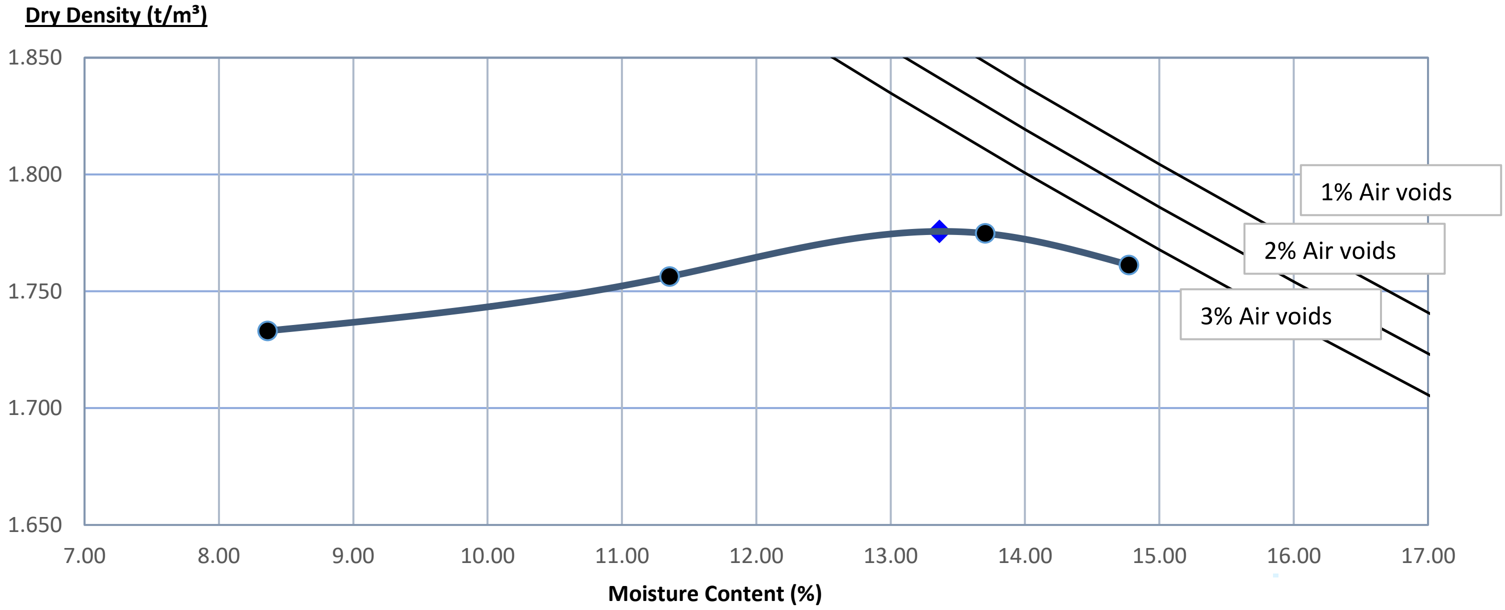
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **2** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**8.4**	**11.4**	**13.7**	**14.8**	
Dry Density (t/m³)	**1.733**	**1.756**	**1.775**	**1.761**	



Modified Maximum Dry Density (t/m³) **1.78**

Optimum Moisture Content (%) **13.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.508 t/m³***

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4727_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4727
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP09 (1-1.5)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

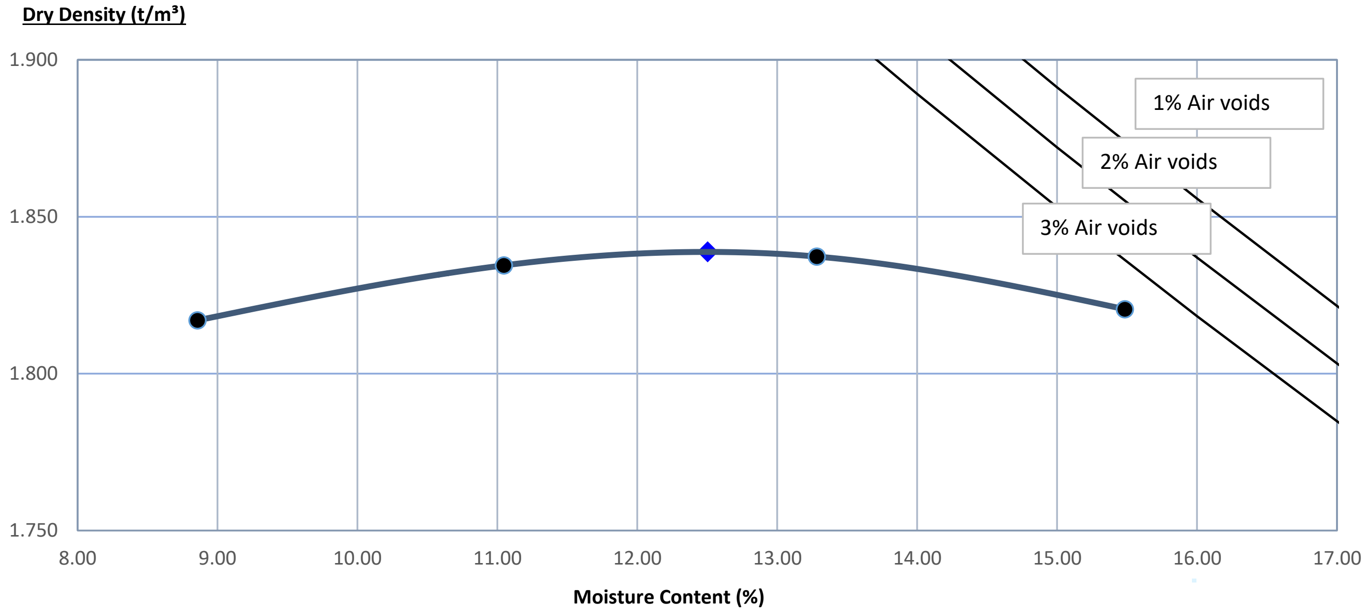
Sampling Method: Sampled by Client, Tested as Received

Sample Curing Time: 2 HRS

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 1 **Material + 37.5mm (%)** -

Moisture Content (%)	8.9	11.0	13.3	15.5	
Dry Density (t/m^3)	1.817	1.834	1.837	1.821	



Modified Maximum Dry Density (t/m^3) **1.84**

Optimum Moisture Content (%) **12.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.678 t/m^3*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4726_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4726
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP08 (1.5-2)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

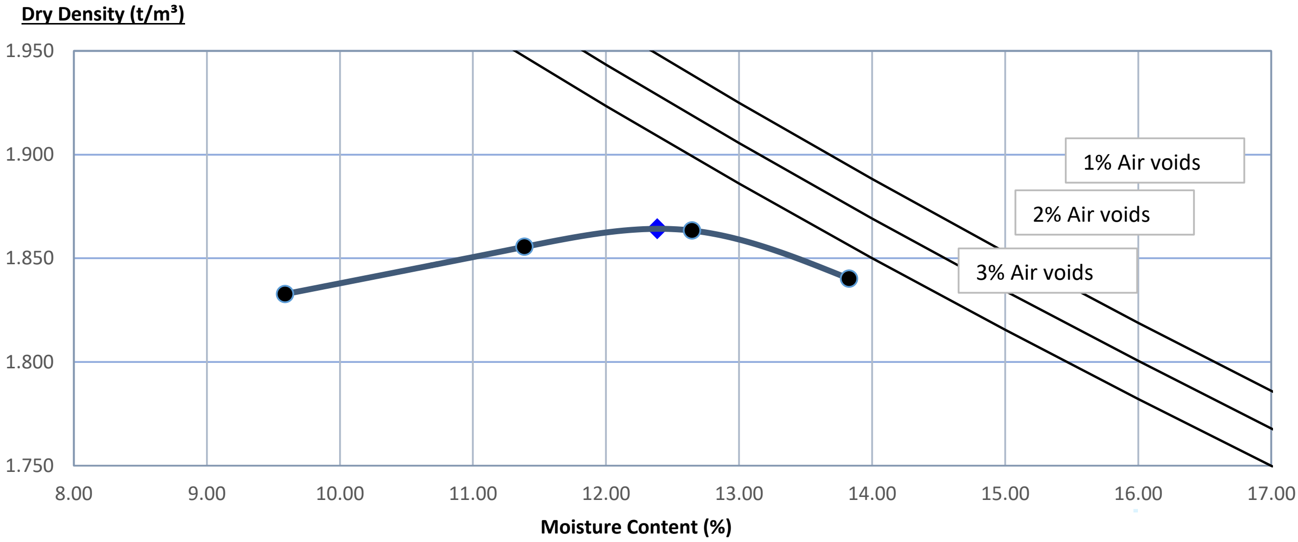
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 Hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **3** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**9.6**	**11.4**	**12.6**	**13.8**	
Dry Density (t/m³)	**1.833**	**1.855**	**1.863**	**1.840**	



Modified Maximum Dry Density (t/m³) **1.86**

Optimum Moisture Content (%) **12.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.602 t/m³***

Approved Signatory: Jwaldron

Name: Jason Waldron

Date: 01-April-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

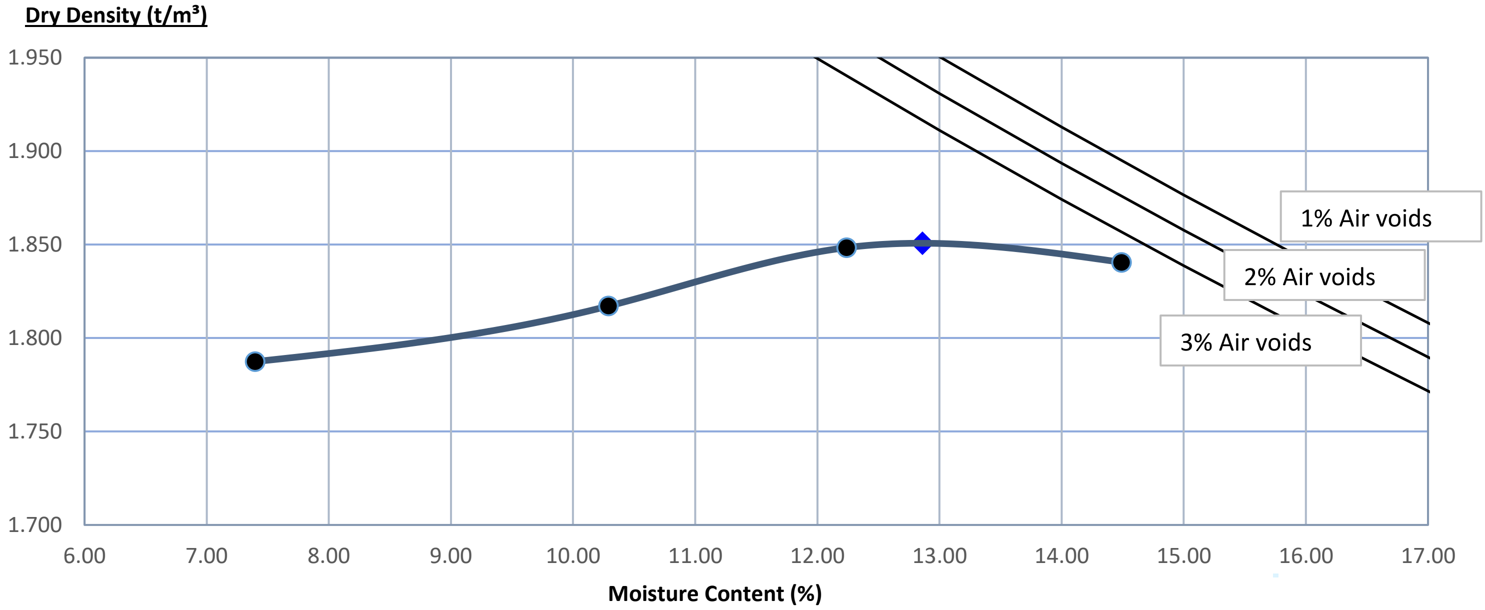
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **1** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**7.4**	**10.3**	**12.2**	**14.5**	
Dry Density (t/m^3)	**1.787**	**1.817**	**1.848**	**1.841**	



Modified Maximum Dry Density (t/m^3) **1.85**

Optimum Moisture Content (%) **13.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.649 t/m³*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4723_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4723
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (0-0.5)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

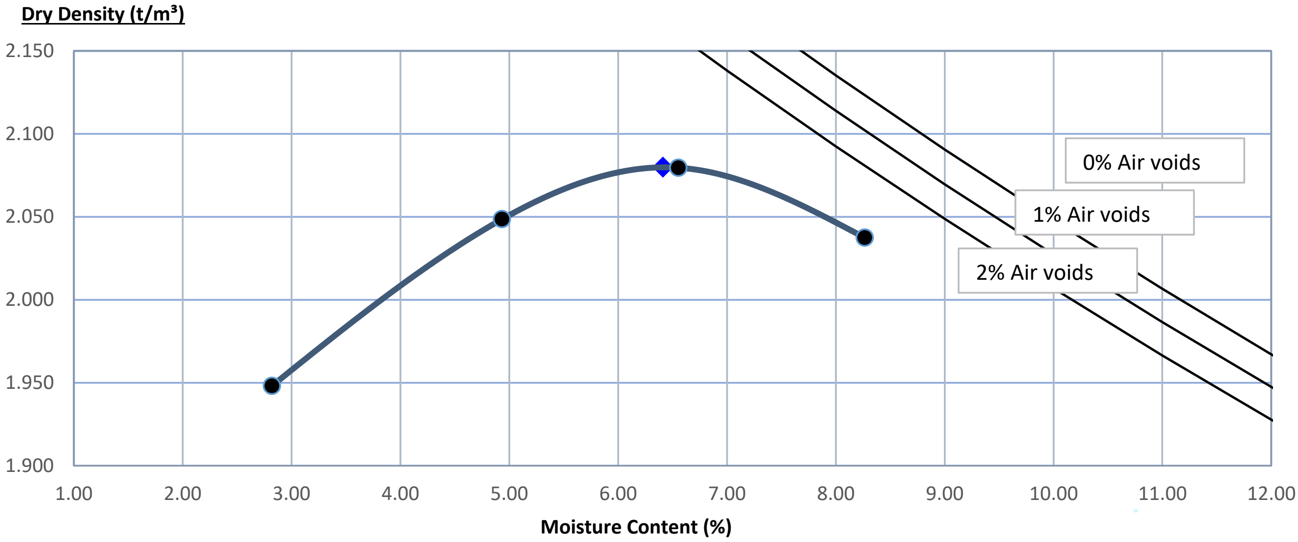
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 Hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **16** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**2.8**	**4.9**	**6.6**	**8.3**	
Dry Density (t/m^3)	**1.948**	**2.049**	**2.080**	**2.037**	



Modified Maximum Dry Density (t/m^3) **2.08**

Optimum Moisture Content (%) **6.5**

Comments:	***The above air void lines are derived from a calculated apparent particle density of 2.575 t/m^3***

Approved Signatory: JWaldron

Name: Jason Waldron

Date: 01-April-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

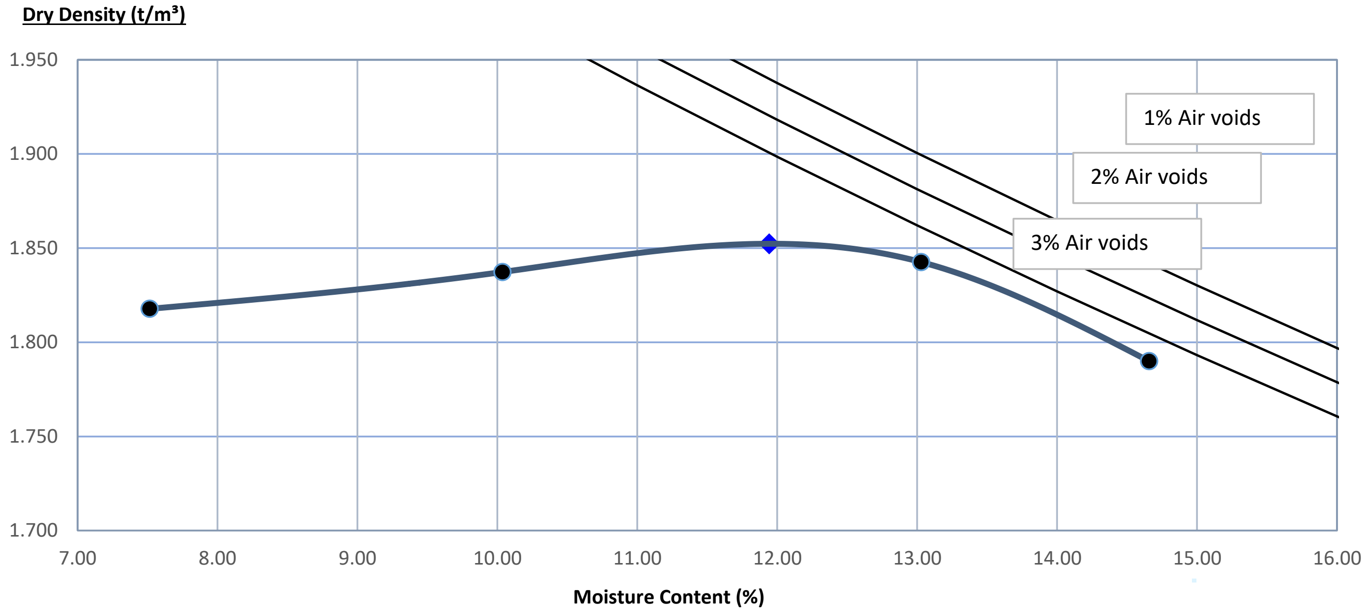
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **1** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**7.5**	**10.0**	**13.0**	**14.7**	
Dry Density (t/m³)	**1.818**	**1.837**	**1.843**	**1.790**	



Modified Maximum Dry Density (t/m³) **1.85**

Optimum Moisture Content (%) **12.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.558 t/m³*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4721_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4721
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (0-0.5)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

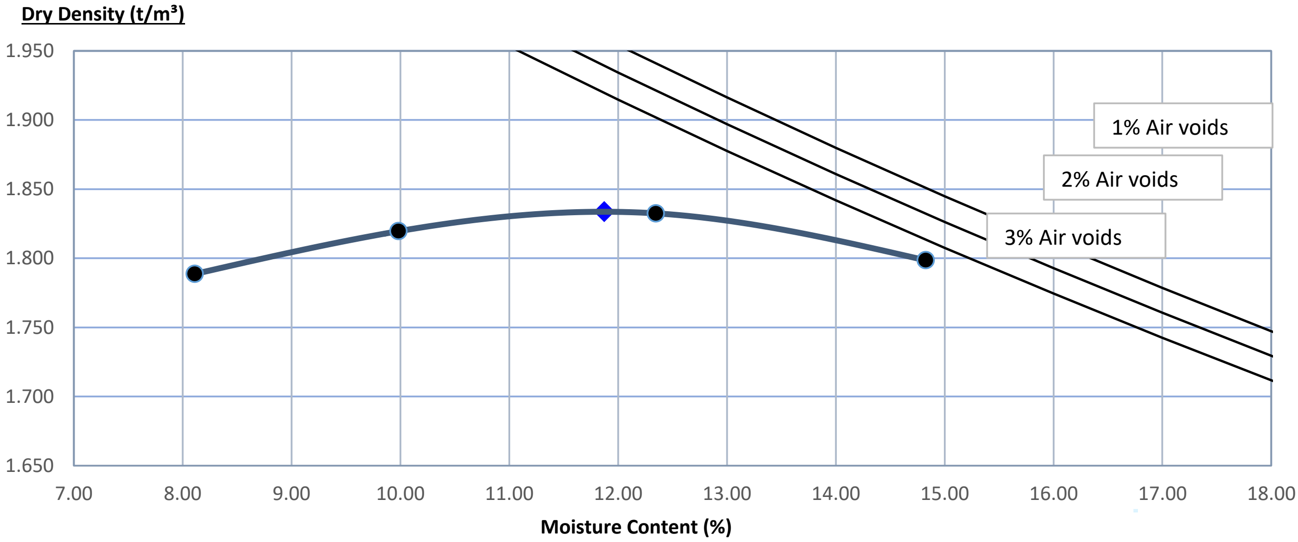
Sampling Method: Sampled by Client, Tested as Received

Sample Curing Time: 2 Hrs

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 1 **Material + 37.5mm (%)** -

Moisture Content (%)	8.1	10.0	12.3	14.8	
Dry Density (t/m³)	1.789	1.820	1.832	1.799	



Modified Maximum Dry Density (t/m³) **1.83**

Optimum Moisture Content (%) **12.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.586 t/m³*

Approved Signatory: [signature]

Name: Jason Waldron

Date: 01-April-2022

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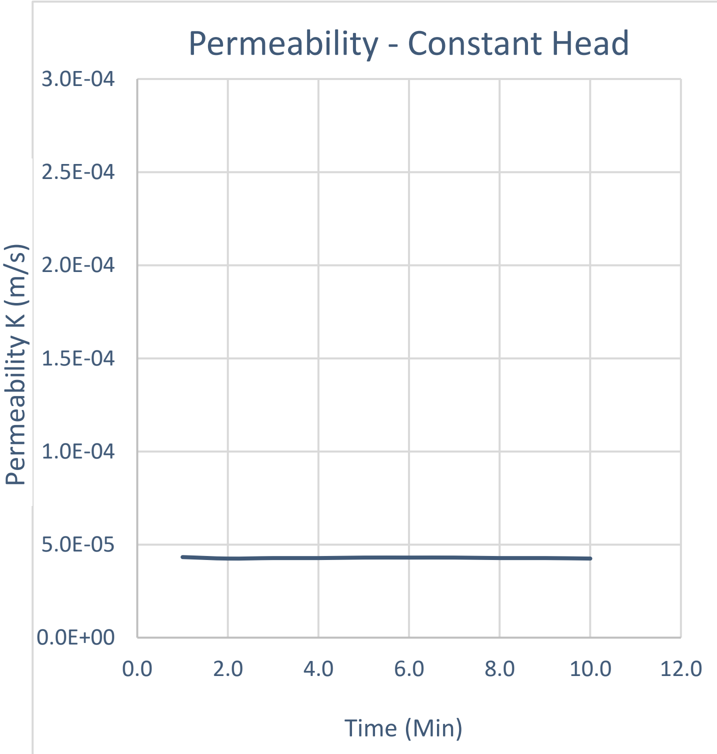
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4751_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4751
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP61 (0.5-1)m	*Date Tested:*	30/3 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	5
Maximum Dry Density (t/m3)	2.257
Optimum Moisture (%)	6.1
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.3
Laboratory Moisture Ratio (%)	95.0
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 4.28E-05

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

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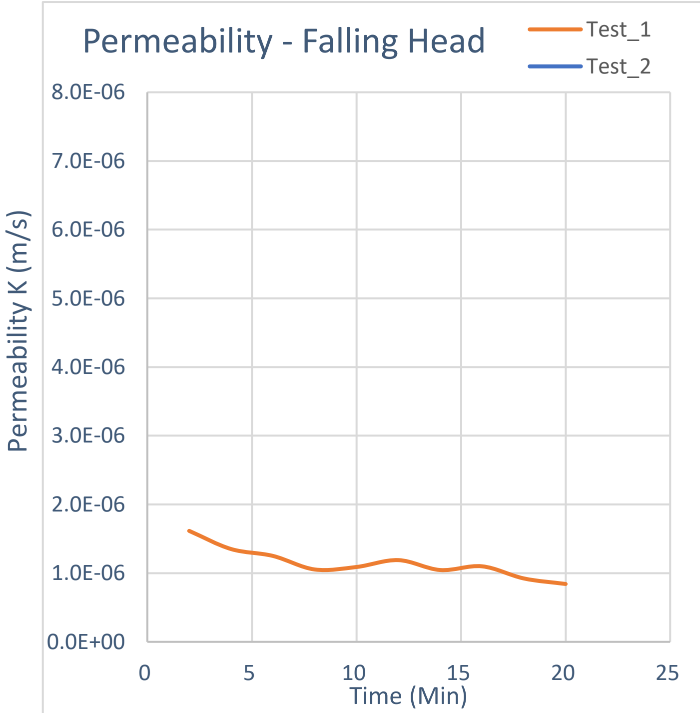
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT AS 1289.6.7.2

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4749_1_FHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4749
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification	TP59 (0.5-1)m	*Date Tested:*	30/3 - 5/04 - 6/04/2022

TEST RESULTS - FALLING HEAD PERMEABILITY

Sampling Method: Sampled by Client, Tested as Received



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modifed
% Retained of 19.0mm	1.6
Maximum Dry Density (t/m^3)	2.032
Optimum Moisture (%)	9.1
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.9
Laboratory Moisture Ratio (%)	100.8
Surcharge (kPa)	3

Coefficient of Permeability K_{20} (m/s) 1.15E-06

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

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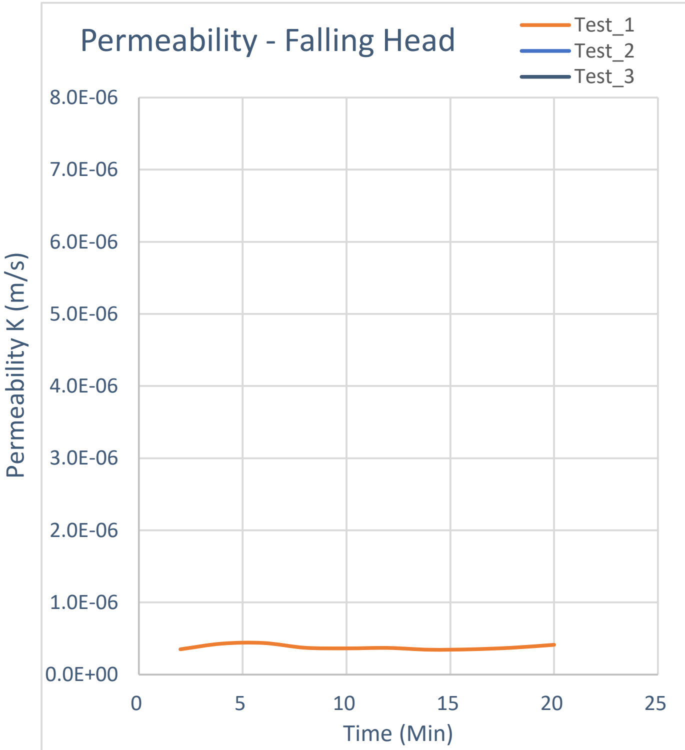
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT AS 1289.6.7.2

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_FHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification	TP13 (0.5-1)m	*Date Tested:*	31/3-5/4/22

TEST RESULTS - FALLING HEAD PERMEABILITY

Sampling Method: Sampled by Client, Tested as Received



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modifed
% Retained of 19.0mm	1
Maximum Dry Density (t/m^3)	2.107
Optimum Moisture (%)	9.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.8
Laboratory Moisture Ratio (%)	102.5
Surcharge (kPa)	3

Coefficient of Permeability K_{20} (m/s) **3.81E-07**

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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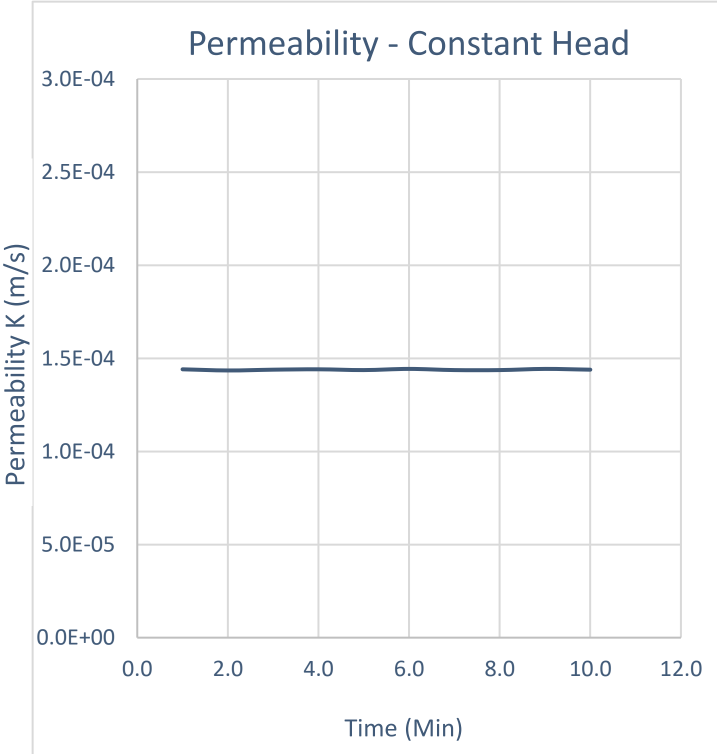
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	30/3 - 4/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	0.8
Maximum Dry Density (t/m3)	1.784
Optimum Moisture (%)	11.9
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.6
Laboratory Moisture Ratio (%)	103.8
Surcharge (kPa)	3.0
Hydraulic Gradient	0.9

Coefficient of Permeability K_{20} (m/s): 1.44E-04

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 11-April-2022

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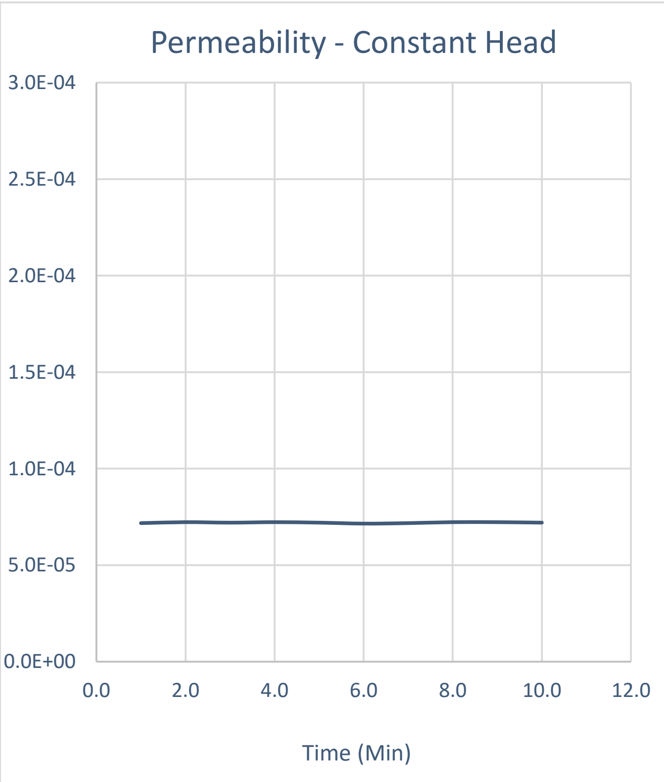
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4732_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4732
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0-0.4)m	*Date Tested:*	30/3-5/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	1.3
Maximum Dry Density (t/m3)	1.784
Optimum Moisture (%)	9.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.3
Laboratory Moisture Ratio (%)	97.0
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 7.21E-05

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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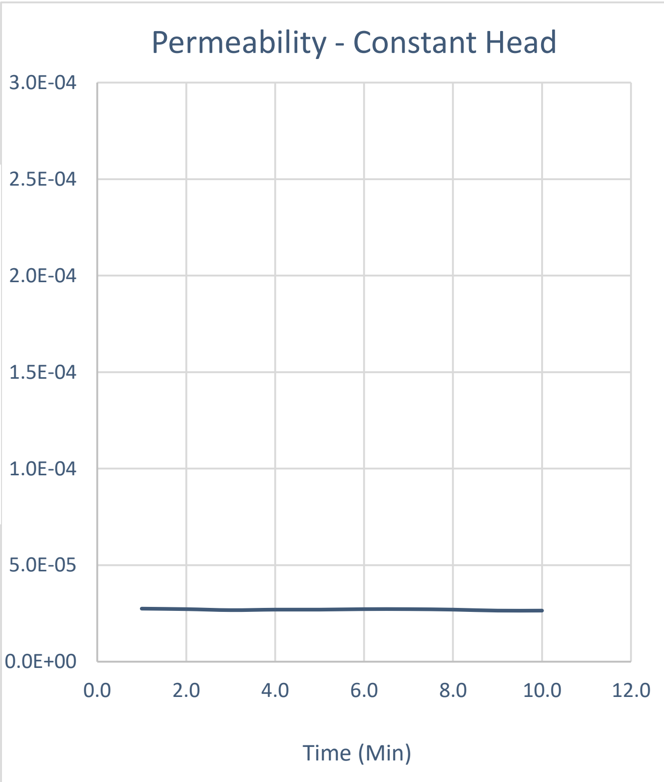
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4731_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4731
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP11 (1.3-2)m	*Date Tested:*	30/3-5/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	2.1
Maximum Dry Density (t/m3)	1.776
Optimum Moisture (%)	13.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.0
Laboratory Moisture Ratio (%)	99.6
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 2.69E-05

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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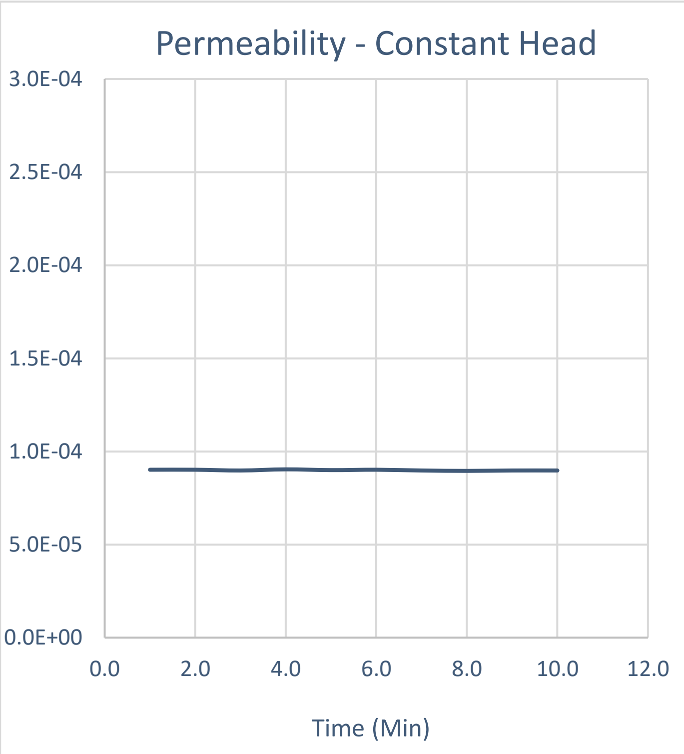
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4727_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4727
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP09 (1-1.5)m	*Date Tested:*	30/03 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	1
Maximum Dry Density (t/m3)	1.839
Optimum Moisture (%)	12.5
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.5
Laboratory Moisture Ratio (%)	95.9
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): **8.99E-05**

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

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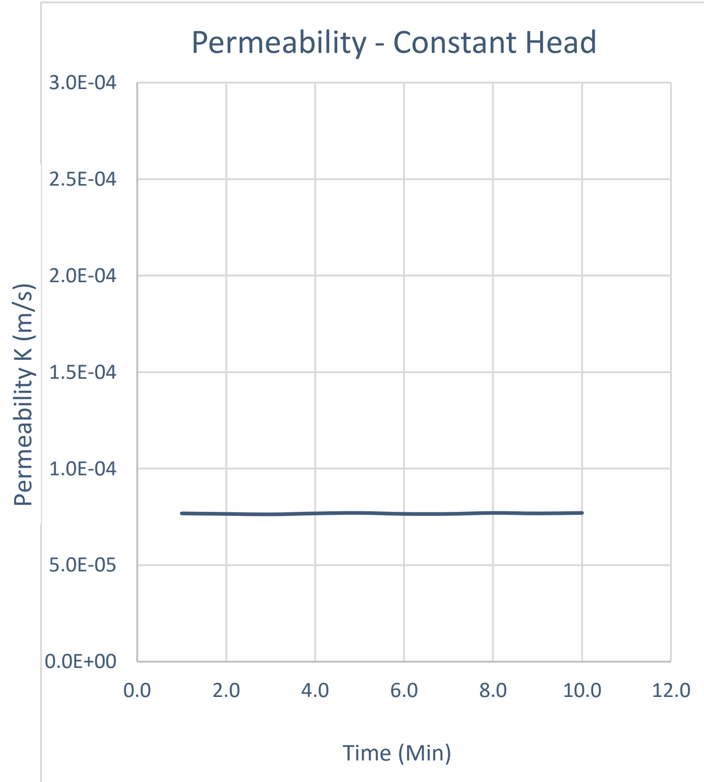
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4726_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4726
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP08 (1.5-2)m	*Date Tested:*	31/3-5/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	3
Maximum Dry Density (t/m3)	1.864
Optimum Moisture (%)	12.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.7
Laboratory Moisture Ratio (%)	102.3
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 7.68E-05

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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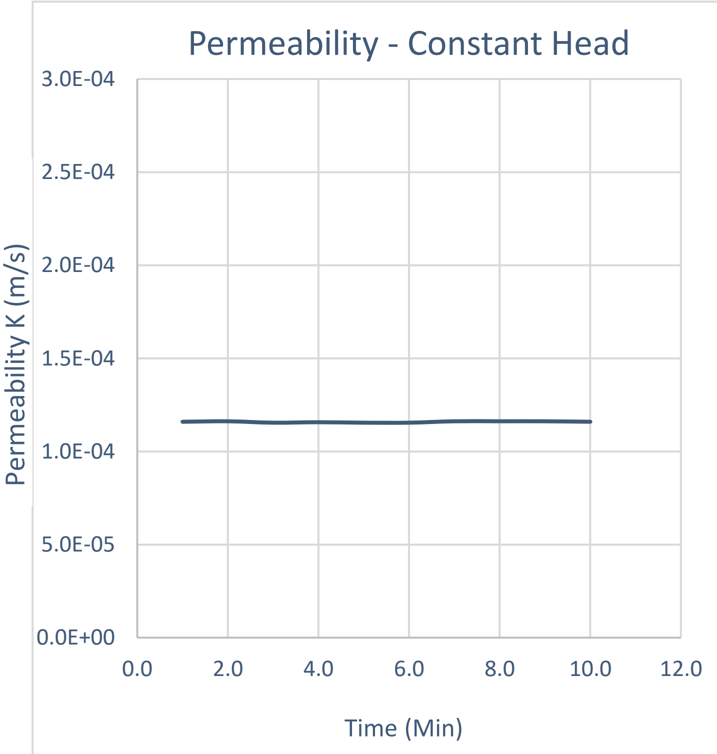
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	30/03 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: Sampled by Client, Tested as Received



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	0.7
Maximum Dry Density (t/m3)	1.851
Optimum Moisture (%)	12.9
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.2
Laboratory Moisture Ratio (%)	98.0
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 1.16E-04

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

NATA

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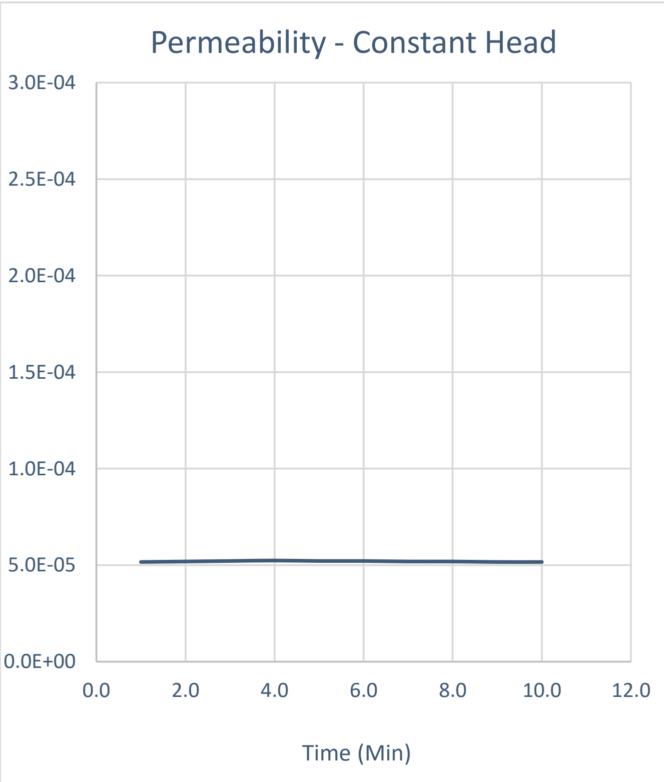
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4723_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4723
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (0-0.5)m	*Date Tested:*	31/3-5/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	16
Maximum Dry Density (t/m3)	2.08
Optimum Moisture (%)	6.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.5
Laboratory Moisture Ratio (%)	103.8
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 5.20E-05

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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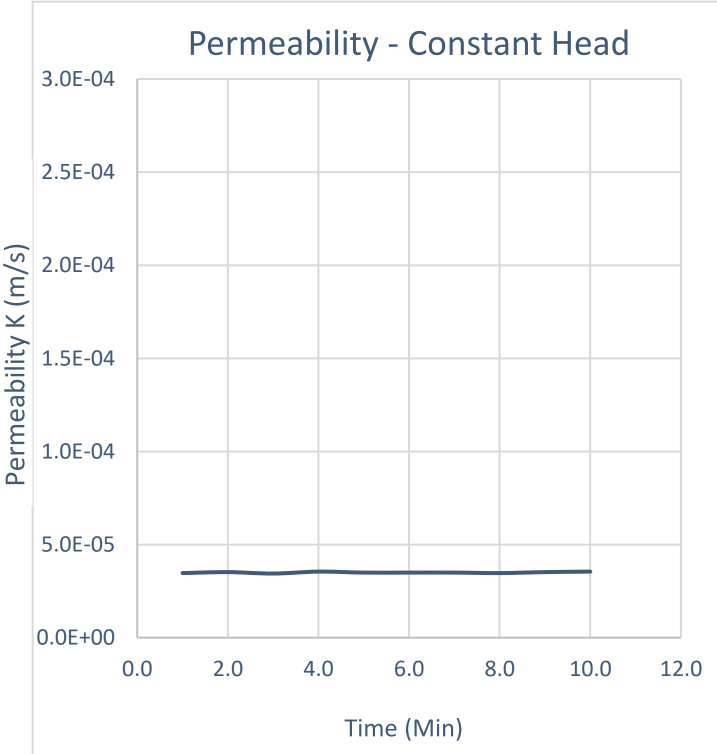
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	30/3 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	1
Maximum Dry Density (t/m3)	1.852
Optimum Moisture (%)	11.9
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.7
Laboratory Moisture Ratio (%)	103.1
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 3.50E-05

Comments:

Approved Signatory:

Name: Brooke Elliott
Date: 07-April-2022

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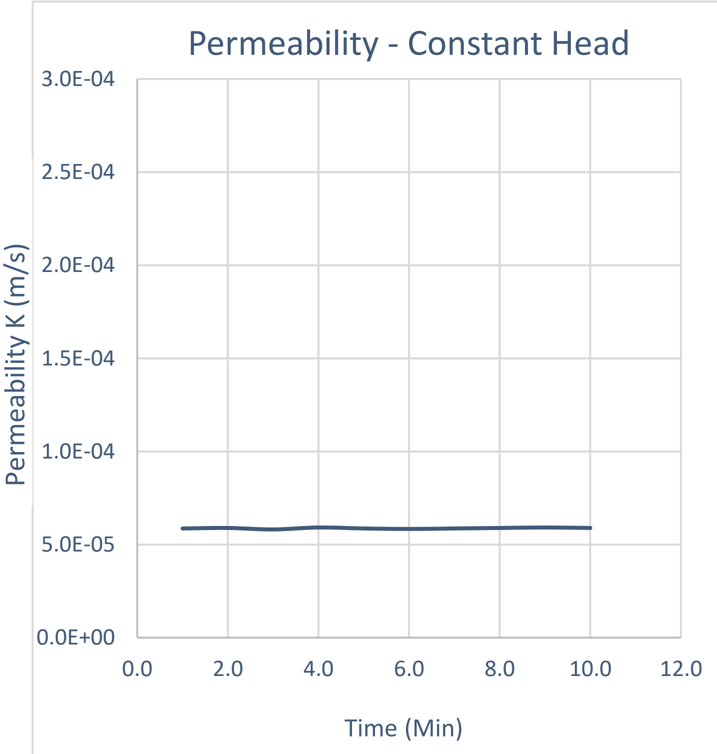
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4721_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4721
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (0-0.5)m	*Date Tested:*	31/03 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	1
Maximum Dry Density (t/m3)	1.834
Optimum Moisture (%)	11.9
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.8
Laboratory Moisture Ratio (%)	102.3
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 5.87E-05

Comments:

Approved Signatory:

Name: Brooke Elliott
Date: 07-April-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4756_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4756
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.6-1)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**19**
AS 1289.3.2.1	**Plastic Limit (%)**	**14**
AS 1289.3.3.1	**Plasticity Index (%)**	**5**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**2.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**17**
AS 1289.3.2.1	**Plastic Limit (%)**	**15**
AS 1289.3.3.1	**Plasticity Index (%)**	**2**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**1.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4754_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4754
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP71 (0.2-0.7)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**16**
AS 1289.3.2.1	**Plastic Limit (%)**	**14**
AS 1289.3.3.1	**Plasticity Index (%)**	**2**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**1.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4752_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4752
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP64 (0.7-1)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**19**
AS 1289.3.2.1	**Plastic Limit (%)**	**13**
AS 1289.3.3.1	**Plasticity Index (%)**	**6**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**3.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Cracked**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4747_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4747
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP54 (0-0.2)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP13 (0.5-1)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4729_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4729
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP10 (1.5-2)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.2, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4724_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4724
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (2-2.5)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.2	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen**	**-**

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

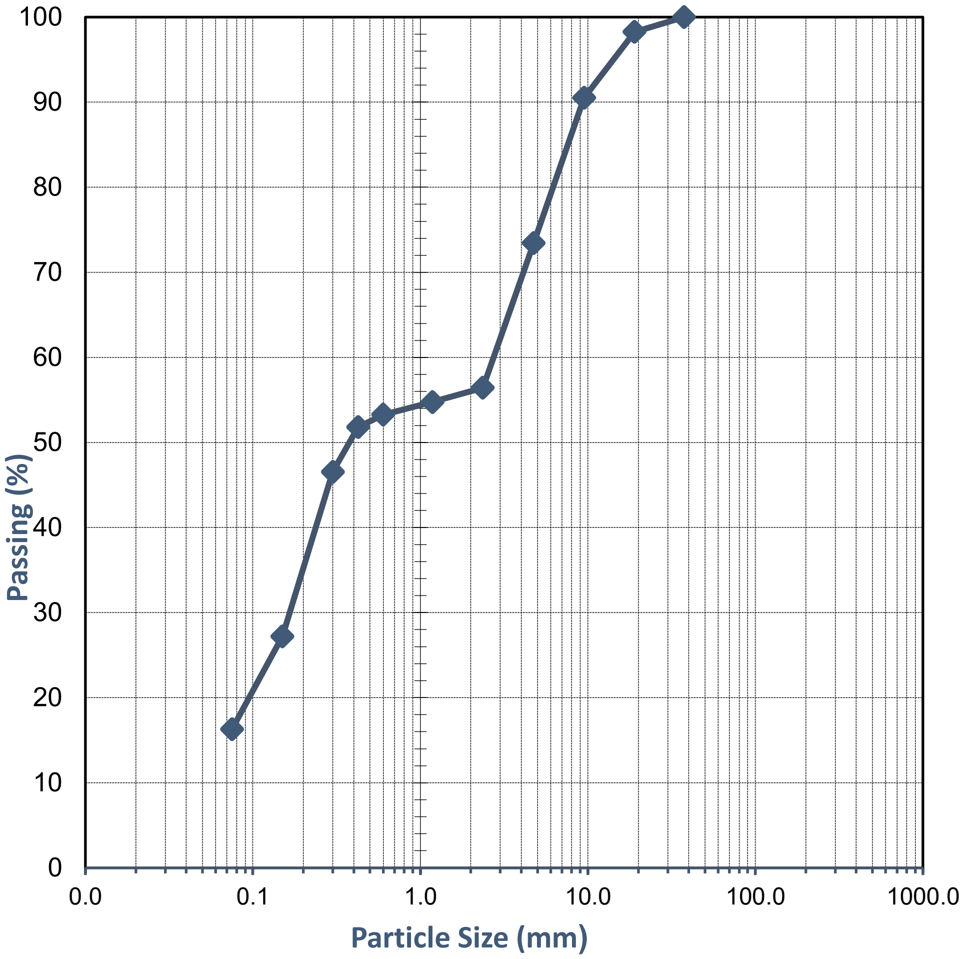
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4756_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4756
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.6-1)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	91
4.75	73
2.36	56
1.18	55
0.600	53
0.425	52
0.300	47
0.150	27
0.075	16



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

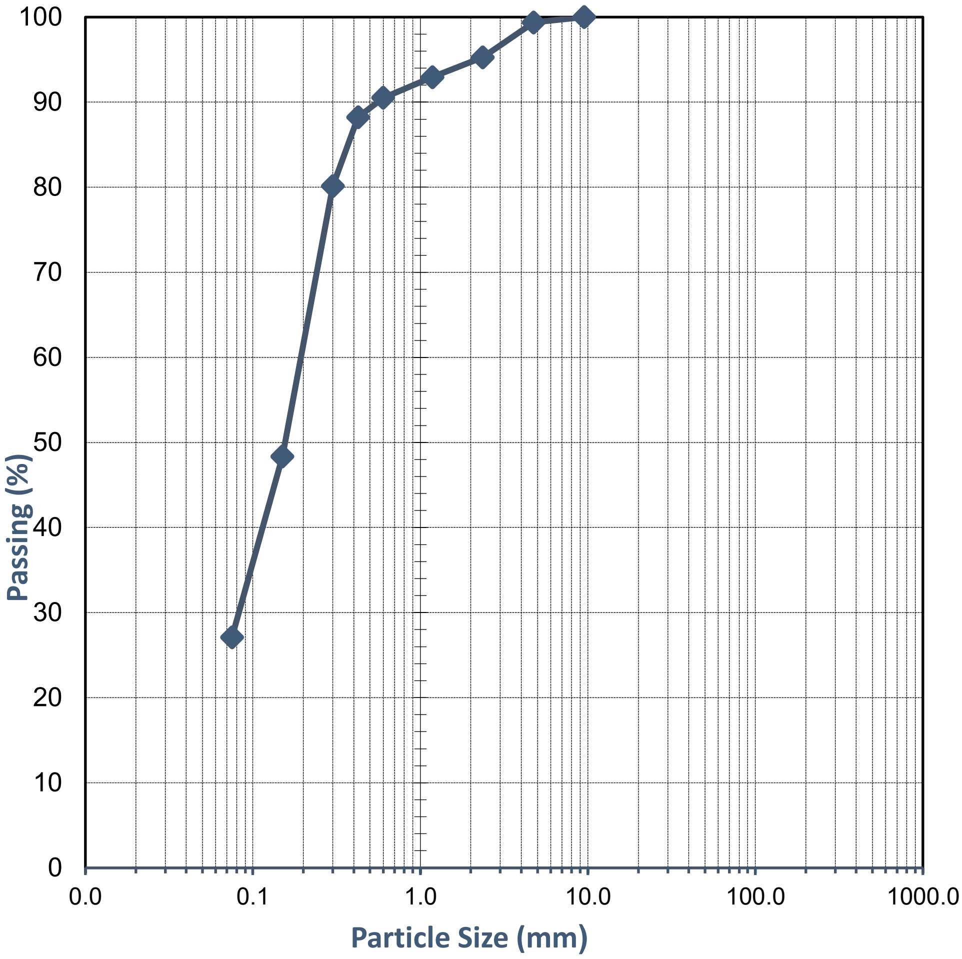
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	99
2.36	95
1.18	93
0.600	91
0.425	88
0.300	80
0.150	48
0.075	27



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

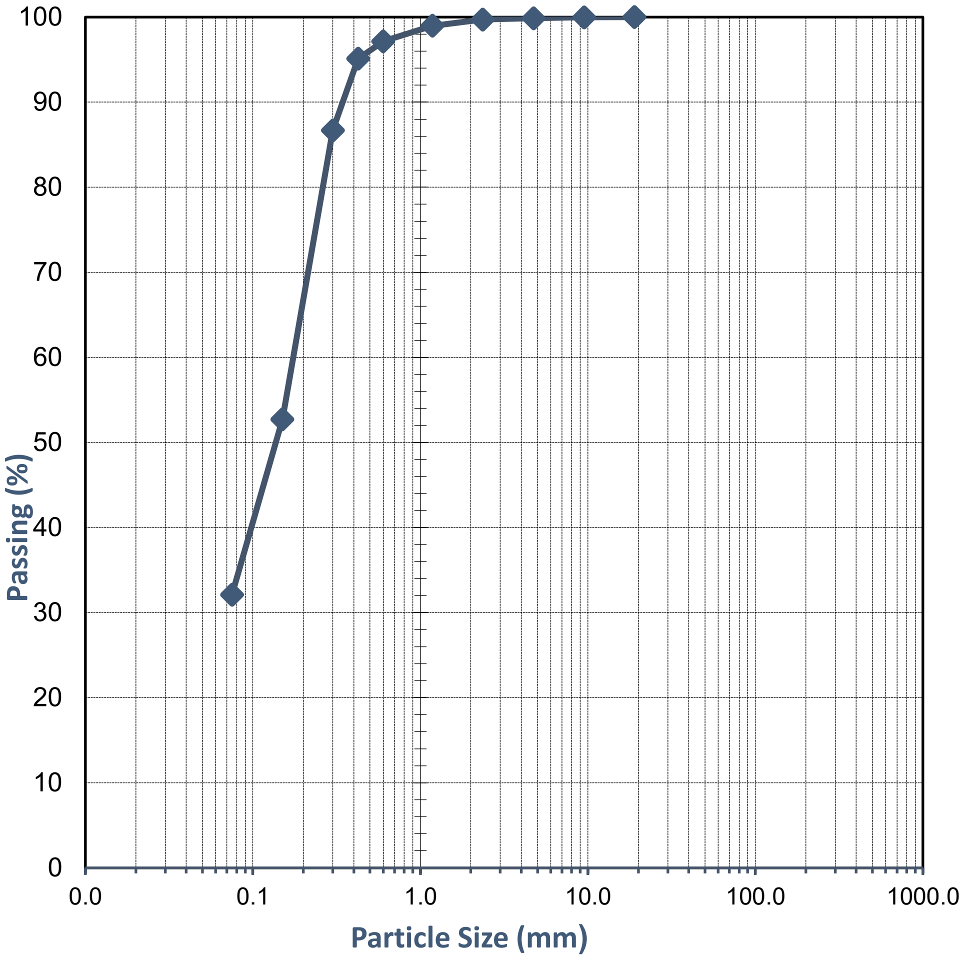
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4754_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4754
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP71 (0.2-0.7)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	100
2.36	100
1.18	99
0.600	97
0.425	95
0.300	87
0.150	53
0.075	32



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

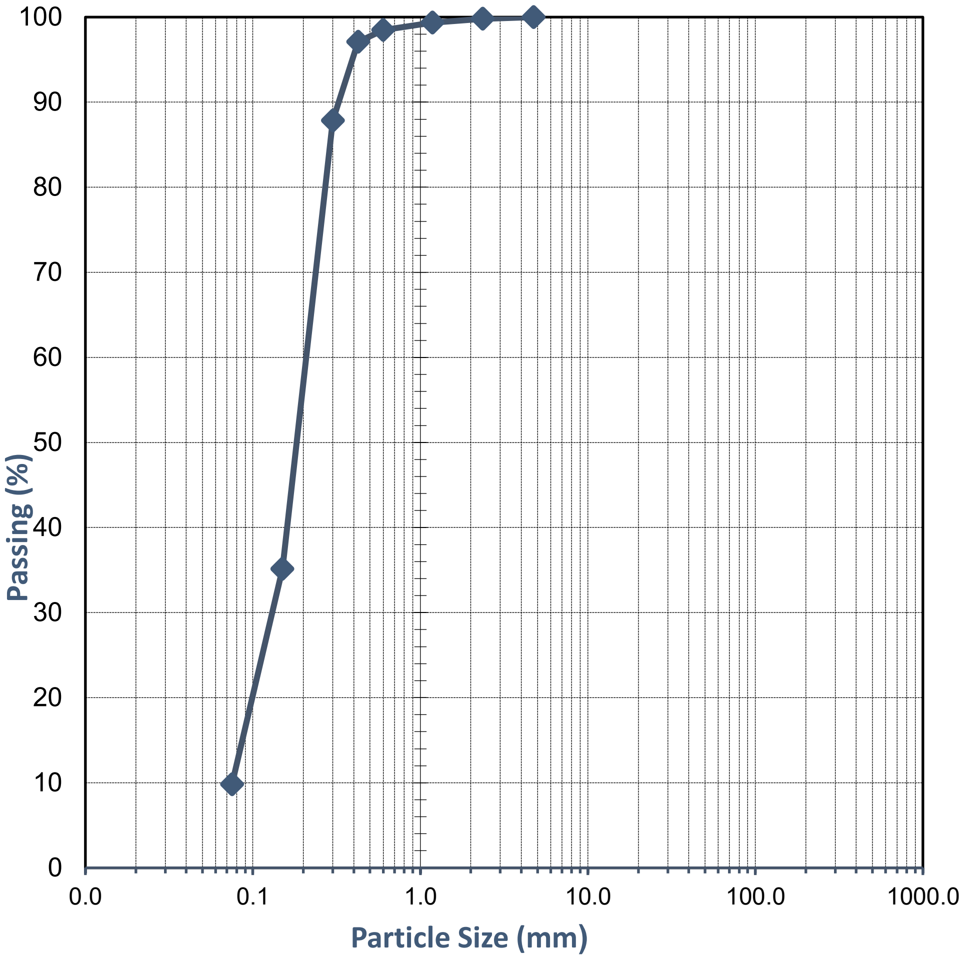
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4753_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4753
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP67 (1-1.5)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	100
2.36	100
1.18	99
0.600	99
0.425	97
0.300	88
0.150	35
0.075	10



Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

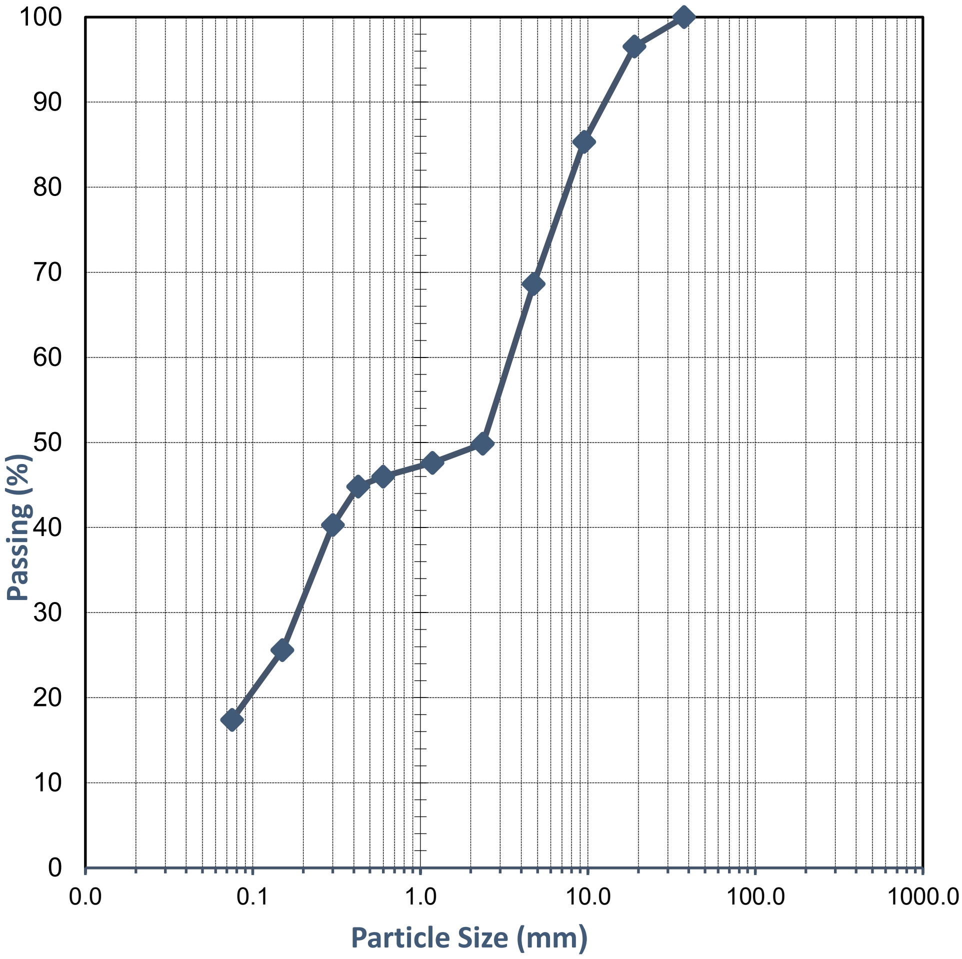
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4752_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4752
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP64 (0.7-1)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	97
9.5	85
4.75	69
2.36	50
1.18	48
0.600	46
0.425	45
0.300	40
0.150	26
0.075	17



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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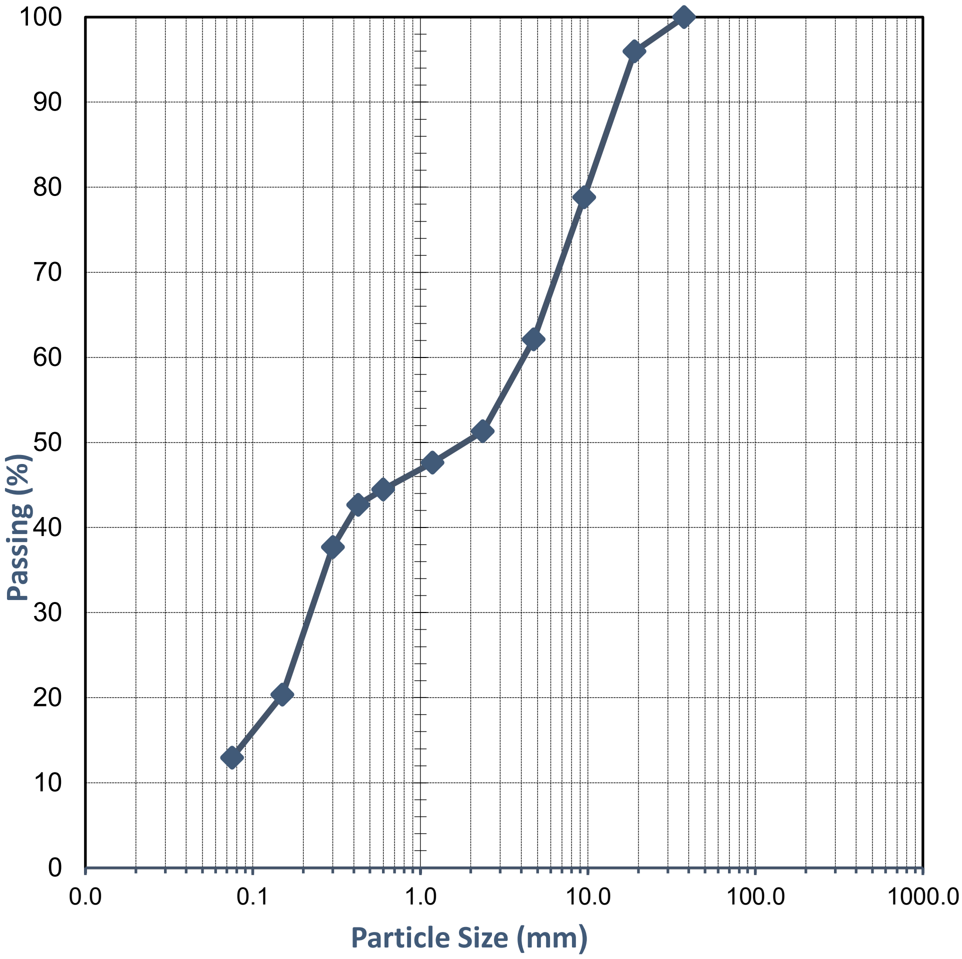
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4751_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4751
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP61 (0.5-1)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	79
4.75	62
2.36	51
1.18	48
0.600	44
0.425	43
0.300	38
0.150	20
0.075	13



Comments:

Approved Signatory:

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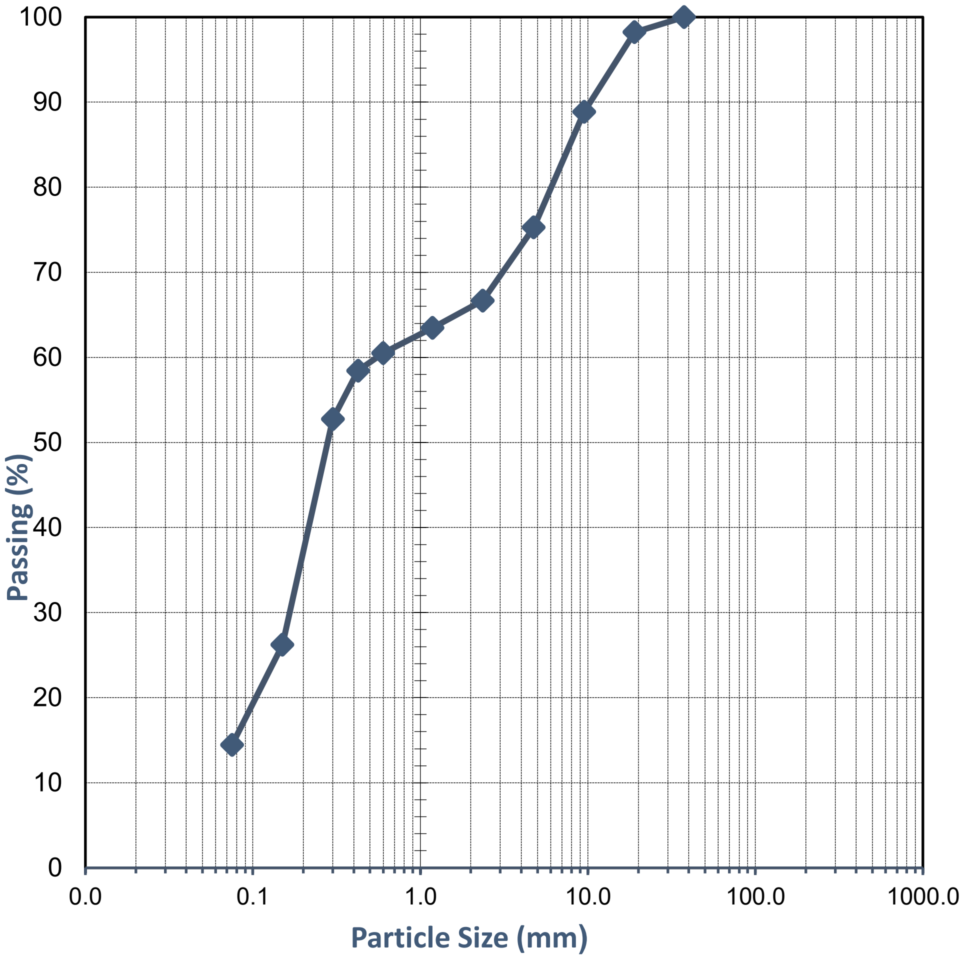
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4750_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4750
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP60 (0.5-1)m	*Date Tested:*	01/04 - 05/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	89
4.75	75
2.36	67
1.18	63
0.600	61
0.425	58
0.300	53
0.150	26
0.075	14



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Approved Signatory:

Name: Natasha Bielawski

Date: 05/April/2022

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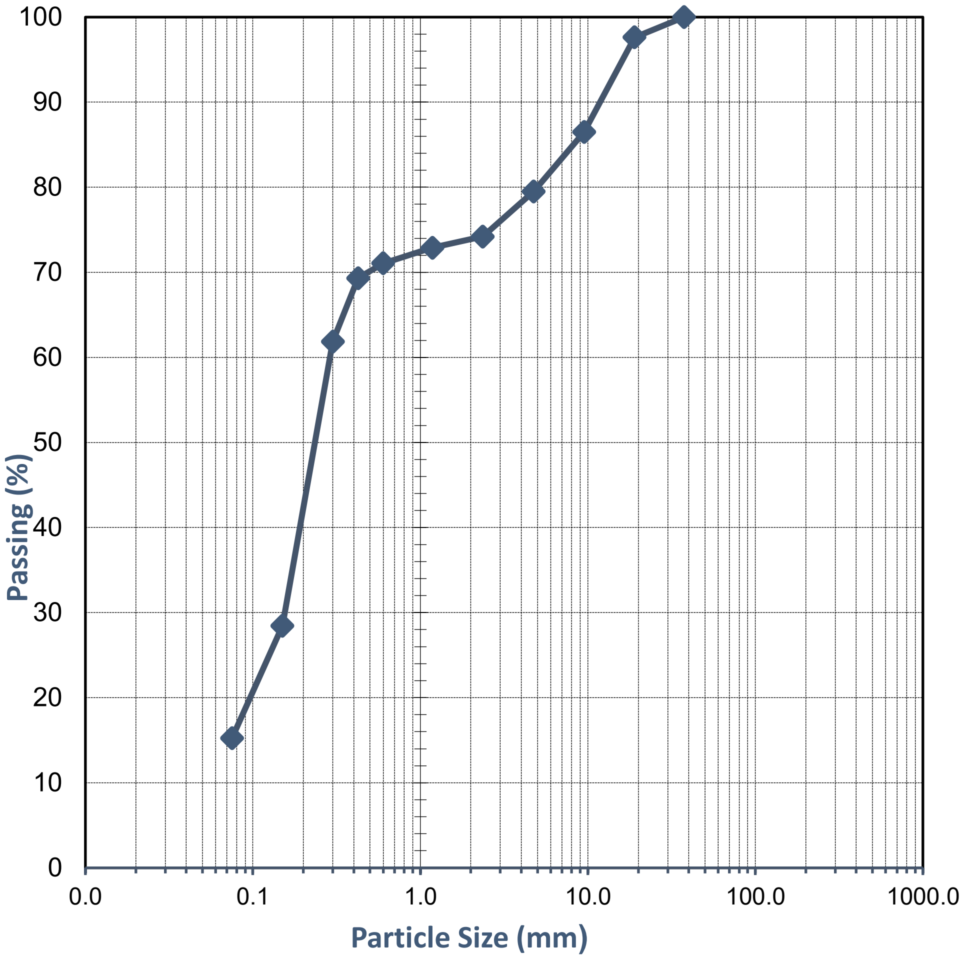
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4749_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4749
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP59 (0.5-1)m	*Date Tested:*	01/04 - 04/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	86
4.75	80
2.36	74
1.18	73
0.600	71
0.425	69
0.300	62
0.150	28
0.075	15



Comments:

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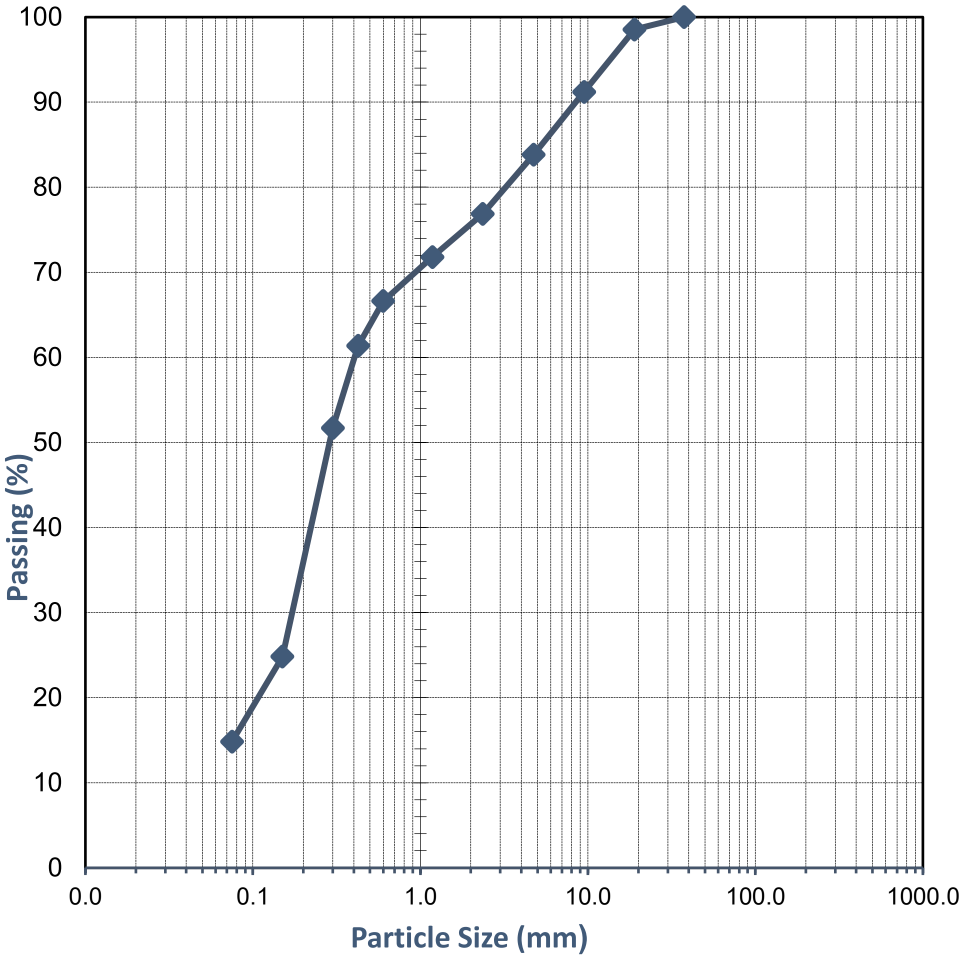
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4748_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4748
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP56 (0.5-1)m	*Date Tested:*	01/04 - 04/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	91
4.75	84
2.36	77
1.18	72
0.600	67
0.425	61
0.300	52
0.150	25
0.075	15



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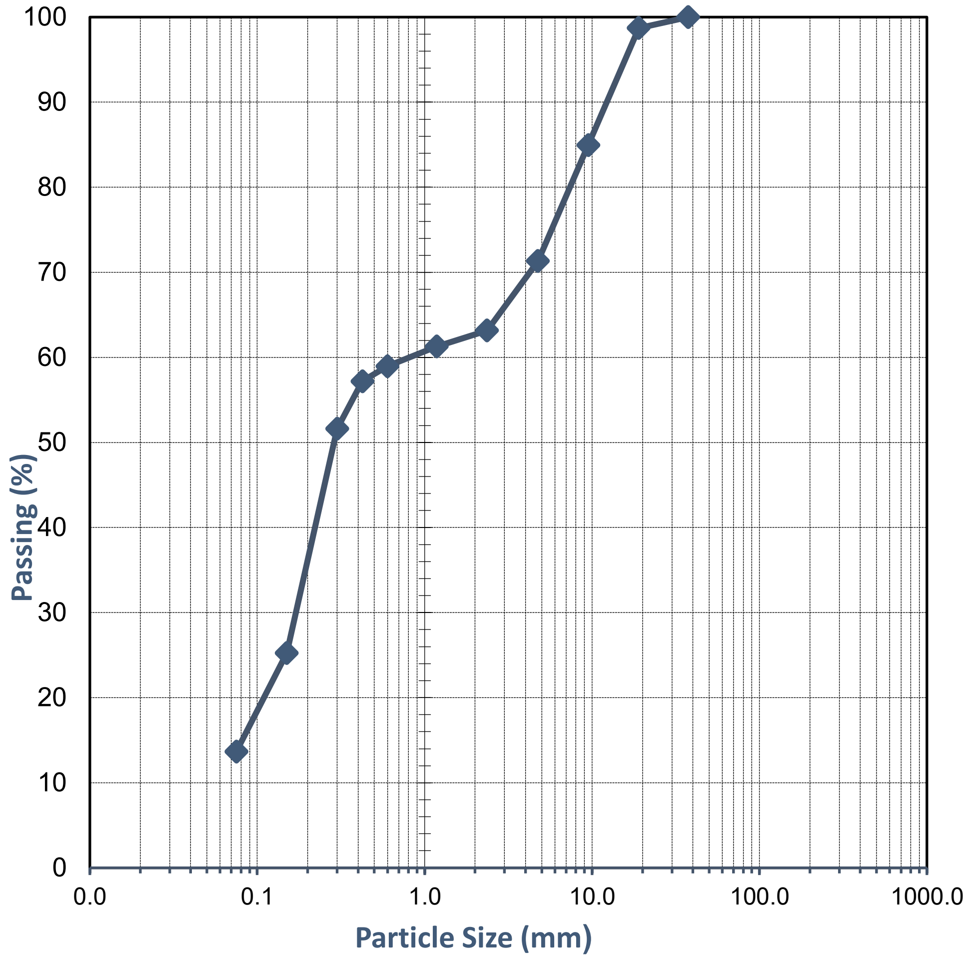
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4747_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4747
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP54 (0-0.2)m	*Date Tested:*	01/04 - 04/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	85
4.75	71
2.36	63
1.18	61
0.600	59
0.425	57
0.300	52
0.150	25
0.075	14



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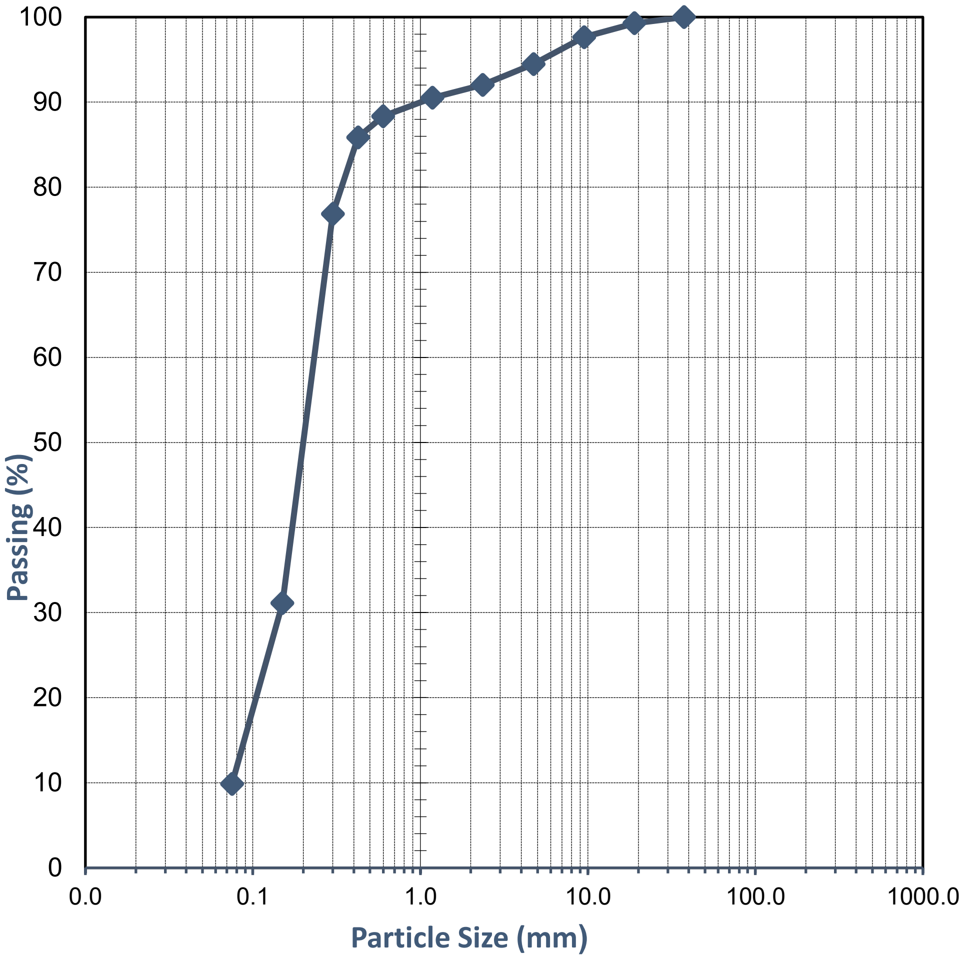
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4746_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4746
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP52 (0.3-0.7)m	*Date Tested:*	01/04 - 05/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	98
4.75	94
2.36	92
1.18	91
0.600	88
0.425	86
0.300	77
0.150	31
0.075	10



Comments:

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Name: Natasha Bielawski

Date: 05/April/2022

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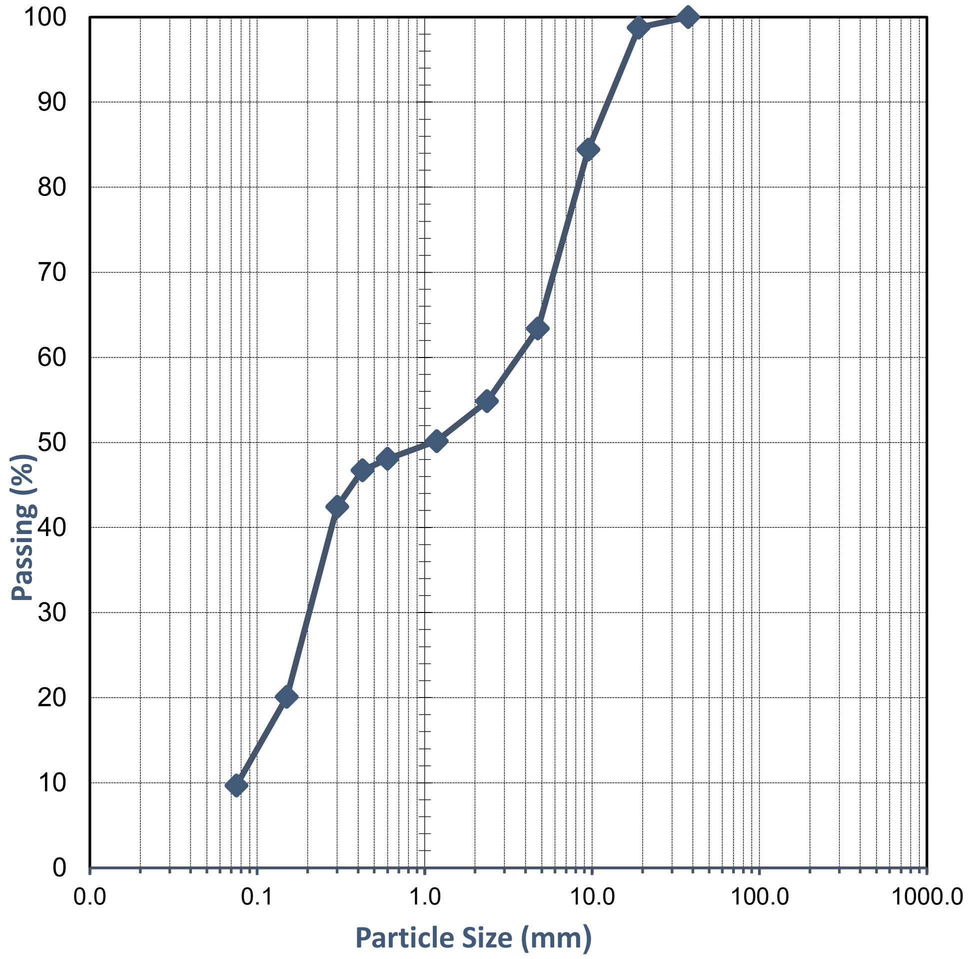
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4745_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4745
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP46 (1.5-2)m	*Date Tested:*	01/04 - 04/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	84
4.75	63
2.36	55
1.18	50
0.600	48
0.425	47
0.300	42
0.150	20
0.075	10



Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 04/April/2022

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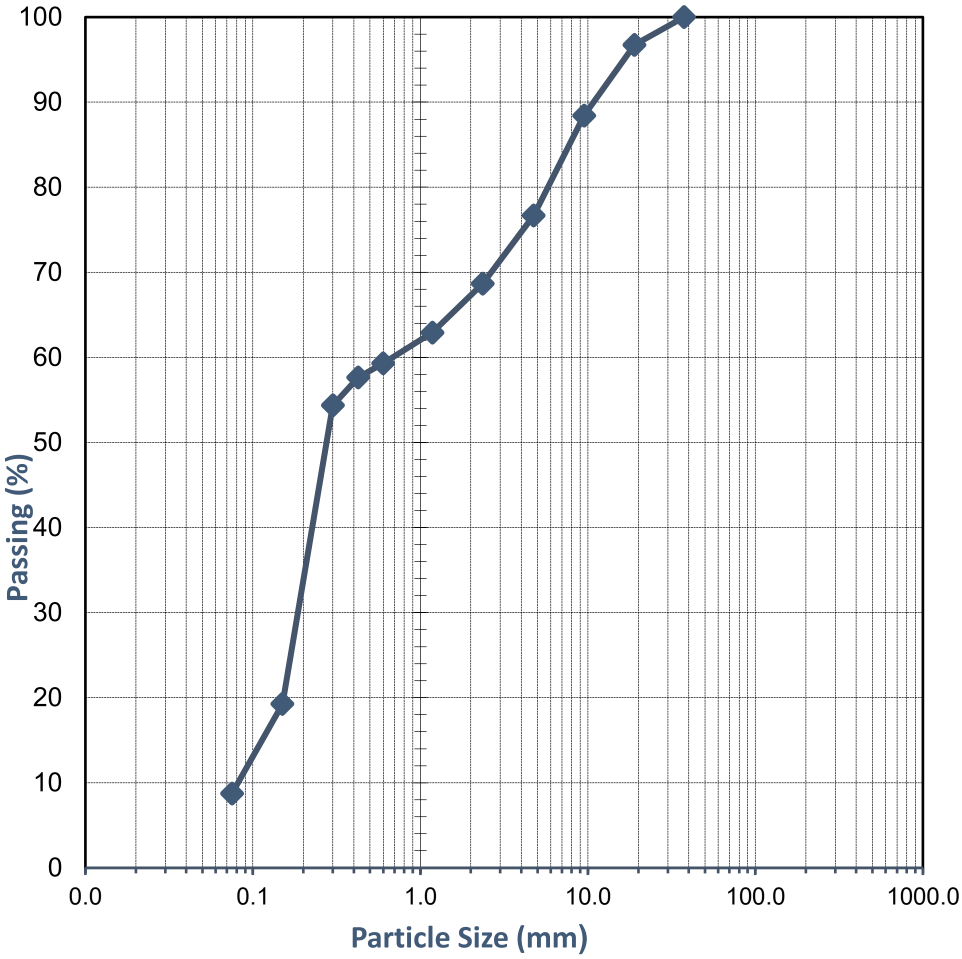
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4744_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4744
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP44 (0.5-1)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	97
9.5	88
4.75	77
2.36	69
1.18	63
0.600	59
0.425	58
0.300	54
0.150	19
0.075	9



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01-April-2022

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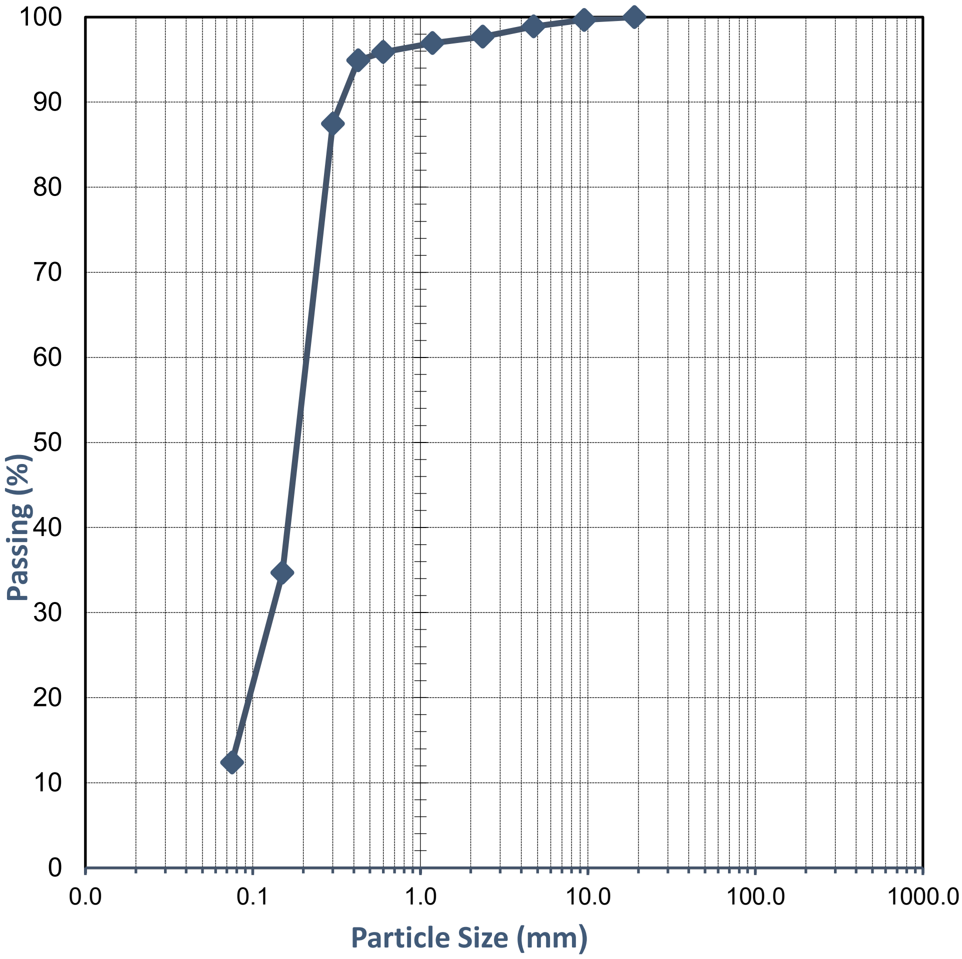
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4743_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4743
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP40 (2-2.5)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	99
2.36	98
1.18	97
0.600	96
0.425	95
0.300	87
0.150	35
0.075	12



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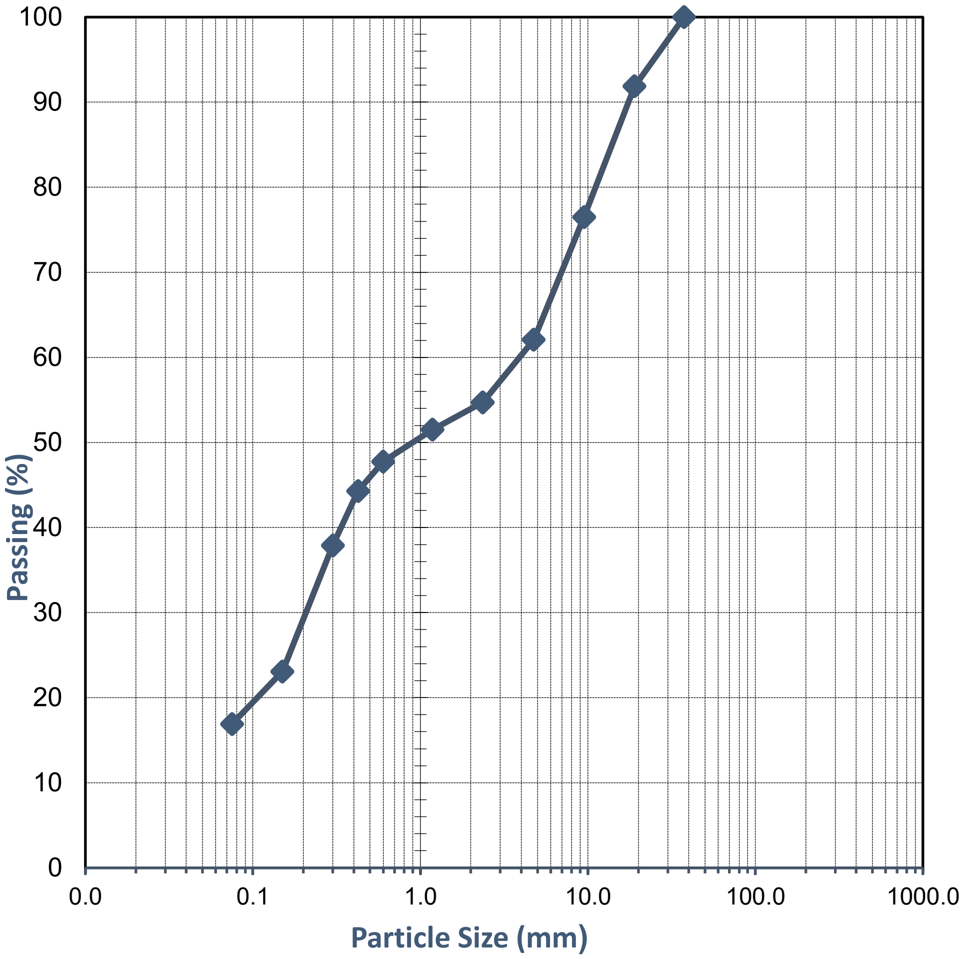
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4742_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4742
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP38 (0.5-1)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	92
9.5	76
4.75	62
2.36	55
1.18	52
0.600	48
0.425	44
0.300	38
0.150	23
0.075	17



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SOIL | AGGREGATE | CONCRETE | CRUSHING

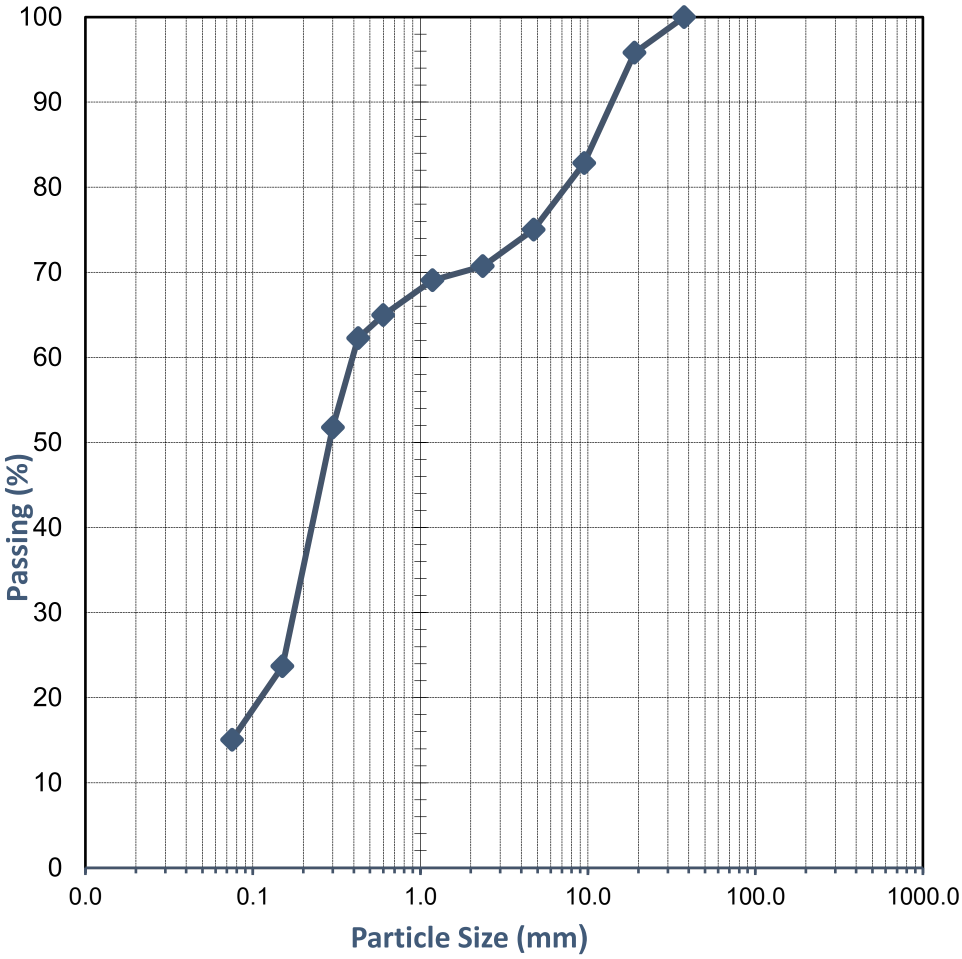
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4741_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4741
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP36 (0.5-1)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	83
4.75	75
2.36	71
1.18	69
0.600	65
0.425	62
0.300	52
0.150	24
0.075	15



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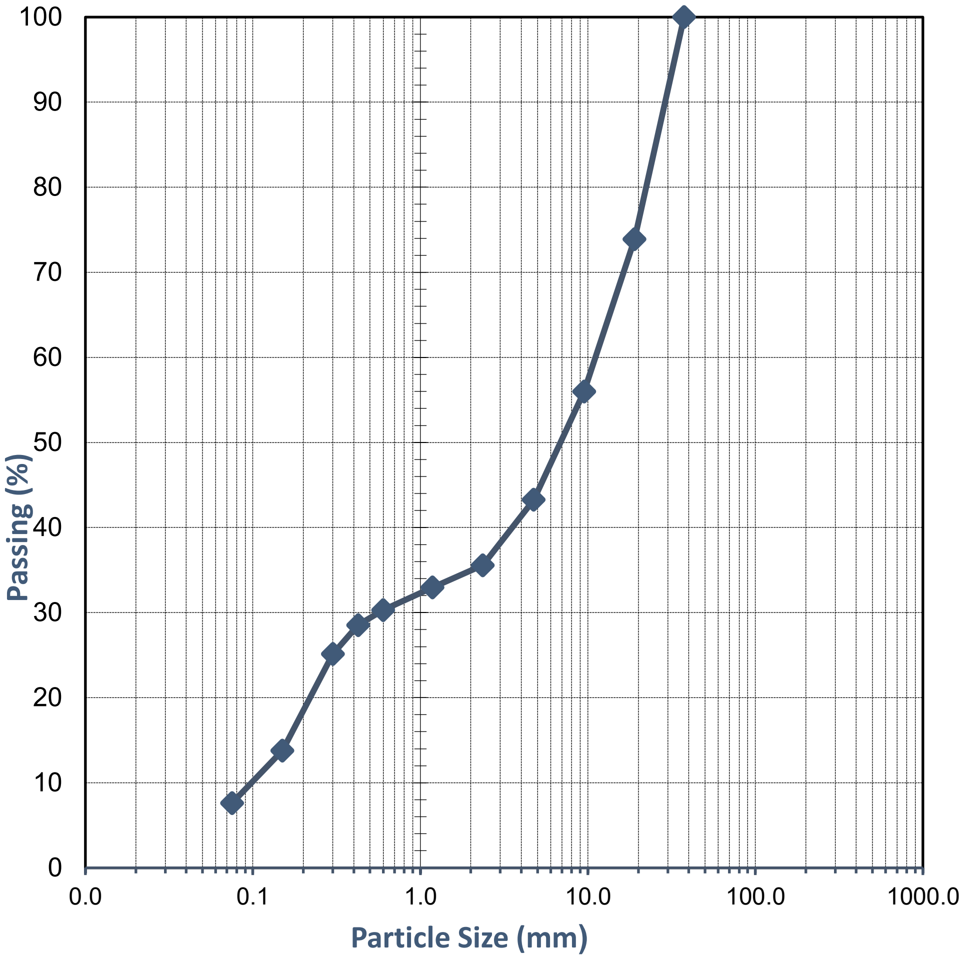
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4740_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4740
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP31 (2-2.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	74
9.5	56
4.75	43
2.36	36
1.18	33
0.600	30
0.425	29
0.300	25
0.150	14
0.075	8



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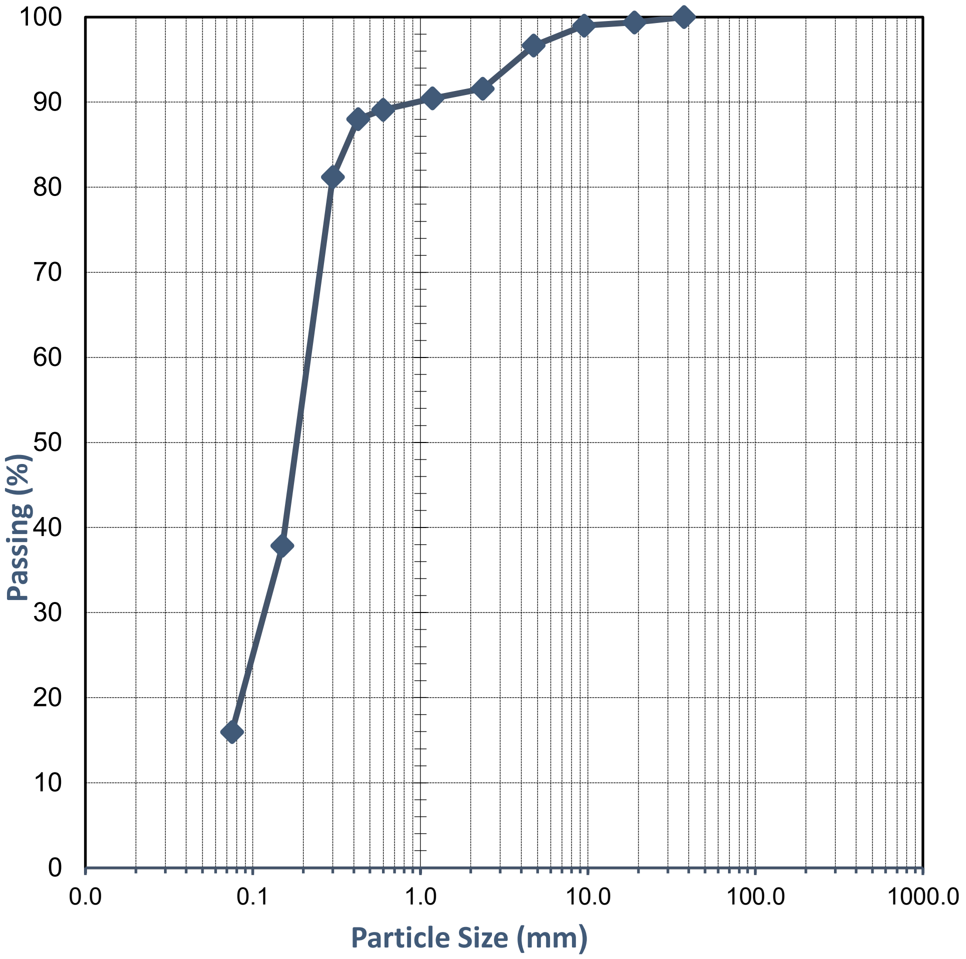
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4739_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4739
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP30 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	99
4.75	97
2.36	92
1.18	90
0.600	89
0.425	88
0.300	81
0.150	38
0.075	16



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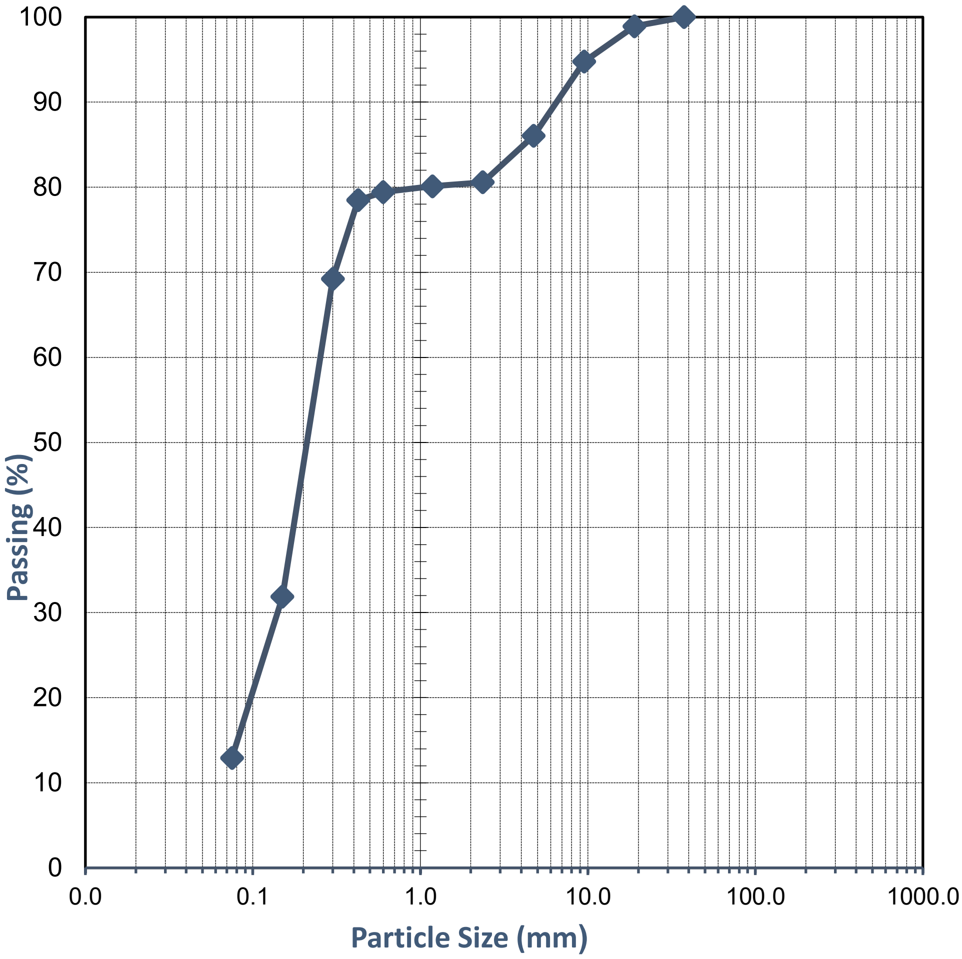
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	95
4.75	86
2.36	81
1.18	80
0.600	79
0.425	78
0.300	69
0.150	32
0.075	13



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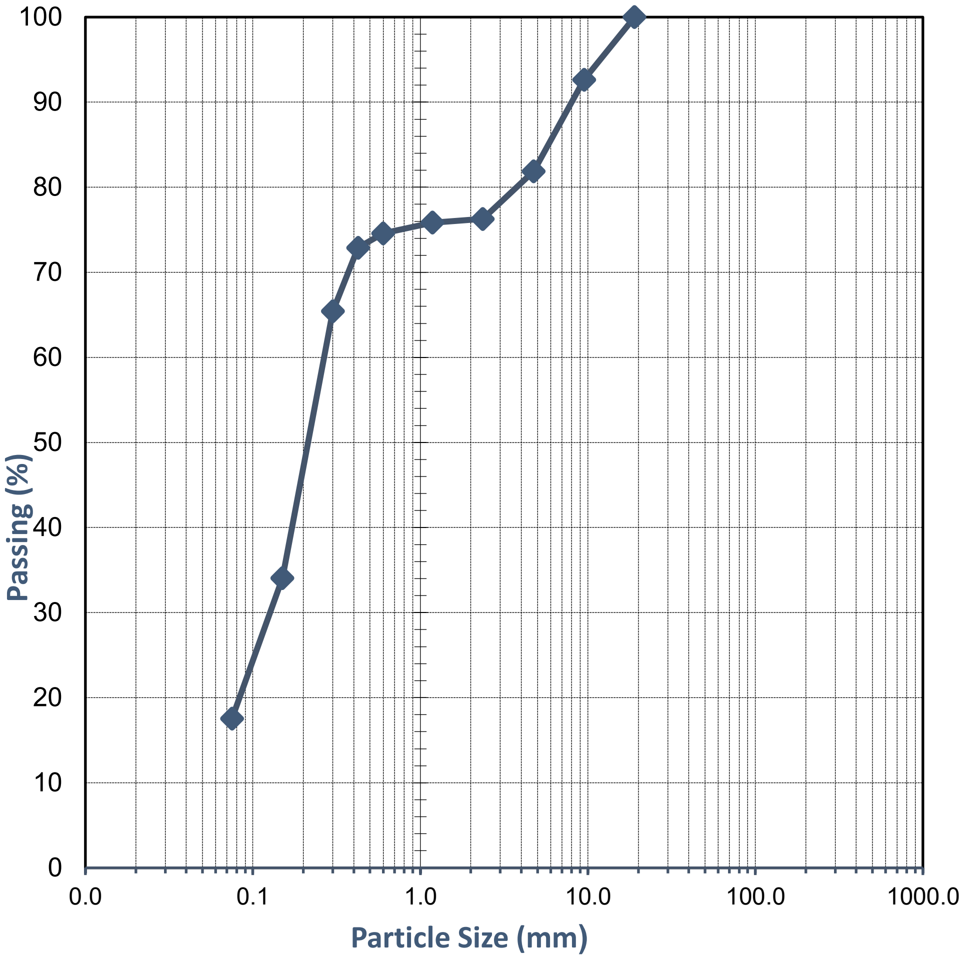
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	93
4.75	82
2.36	76
1.18	76
0.600	75
0.425	73
0.300	65
0.150	34
0.075	18



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

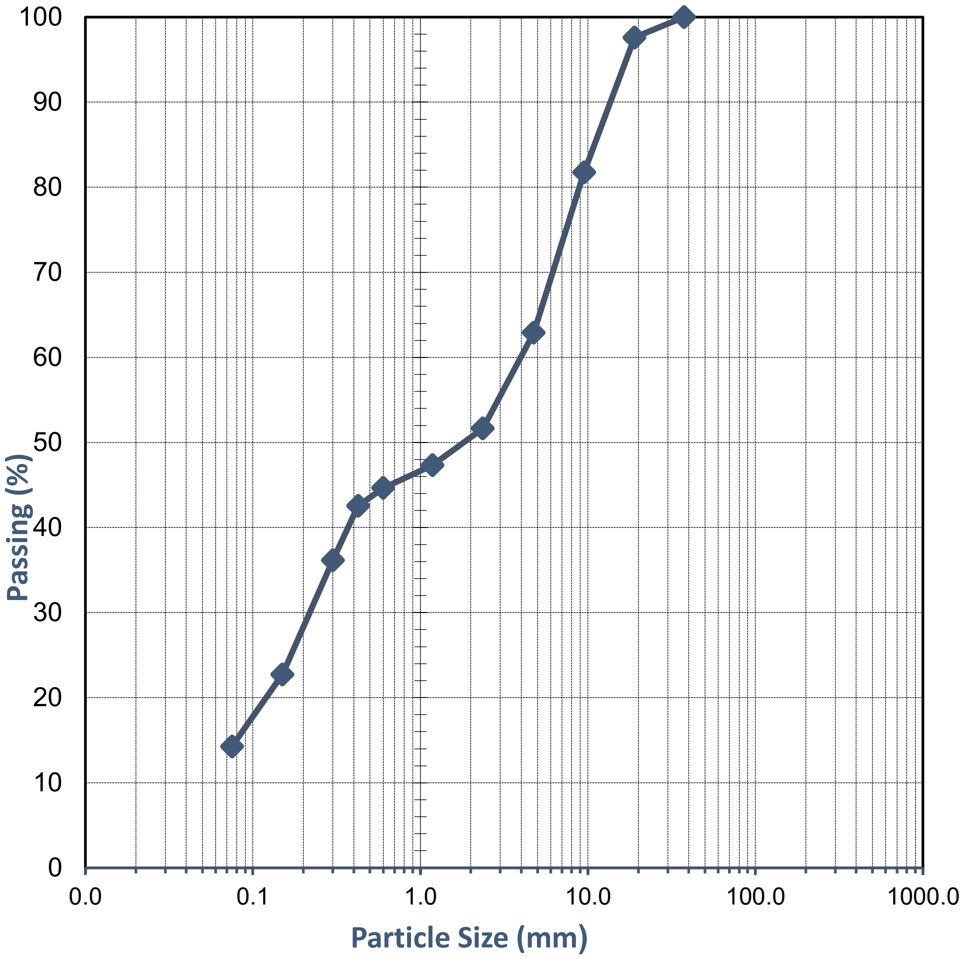
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4736_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4736
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP20 (0.6-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	82
4.75	63
2.36	52
1.18	47
0.600	45
0.425	43
0.300	36
0.150	23
0.075	14



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SOIL | AGGREGATE | CONCRETE | CRUSHING

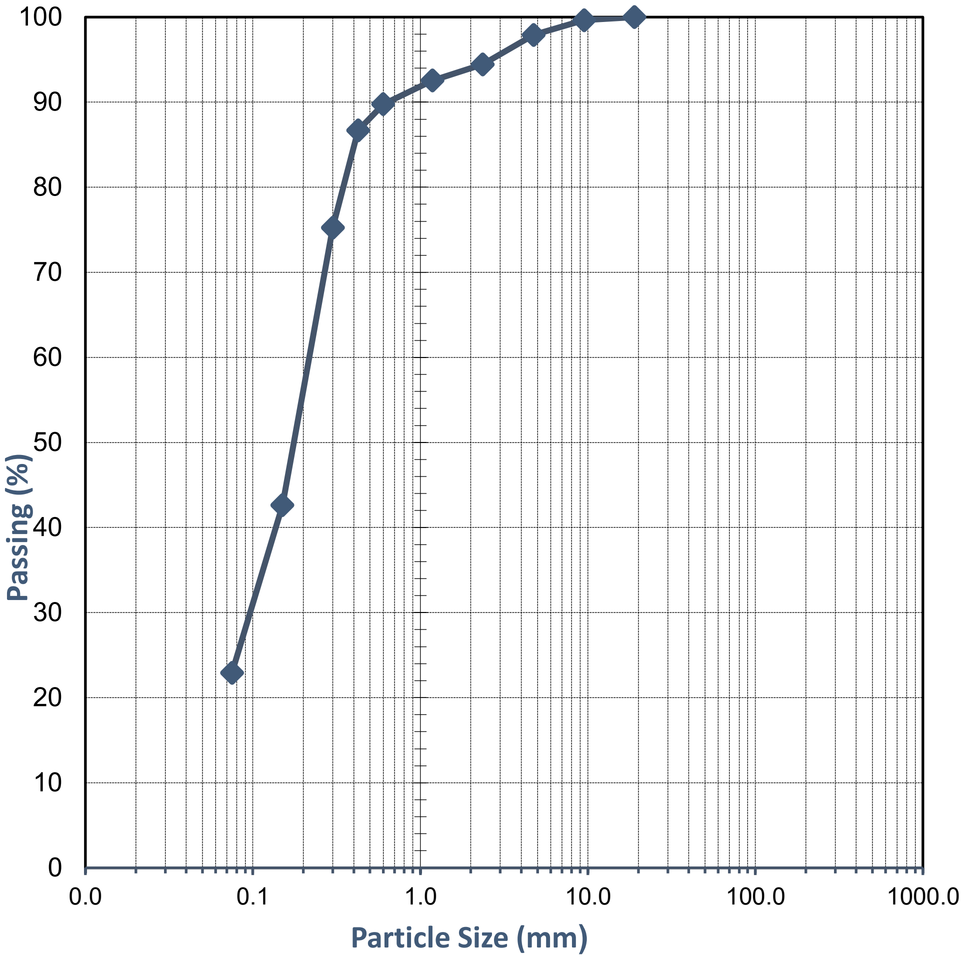
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4735_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4735
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP17 (0-0.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	98
2.36	94
1.18	93
0.600	90
0.425	87
0.300	75
0.150	43
0.075	23



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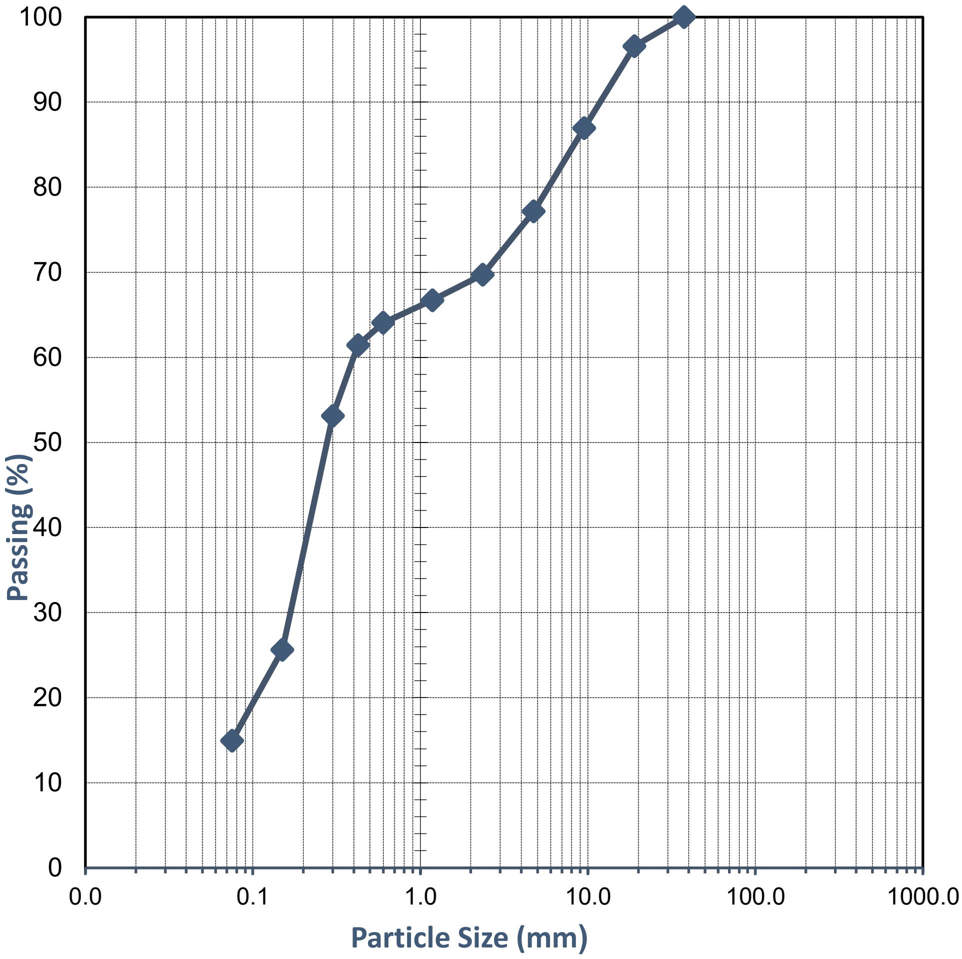
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP13 (0.5-1)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	97
9.5	87
4.75	77
2.36	70
1.18	67
0.600	64
0.425	61
0.300	53
0.150	26
0.075	15



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SOIL | AGGREGATE | CONCRETE | CRUSHING

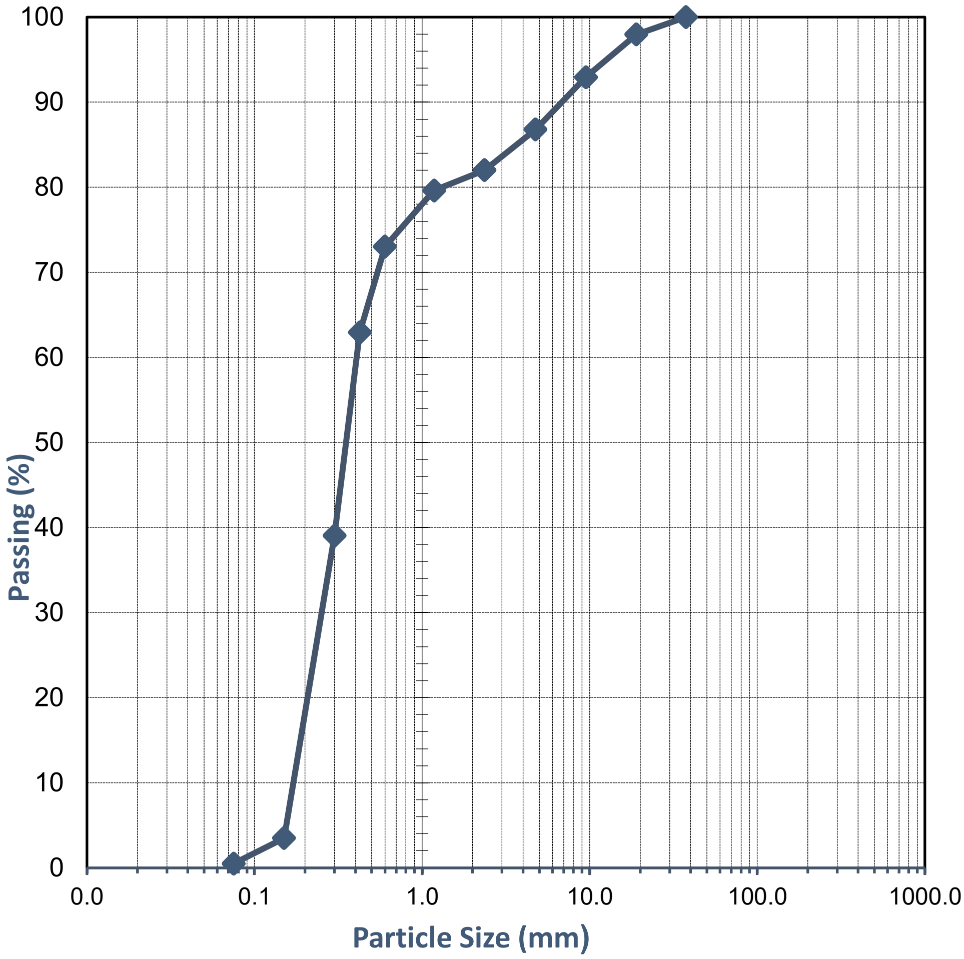
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	93
4.75	87
2.36	82
1.18	80
0.600	73
0.425	63
0.300	39
0.150	3
0.075	0



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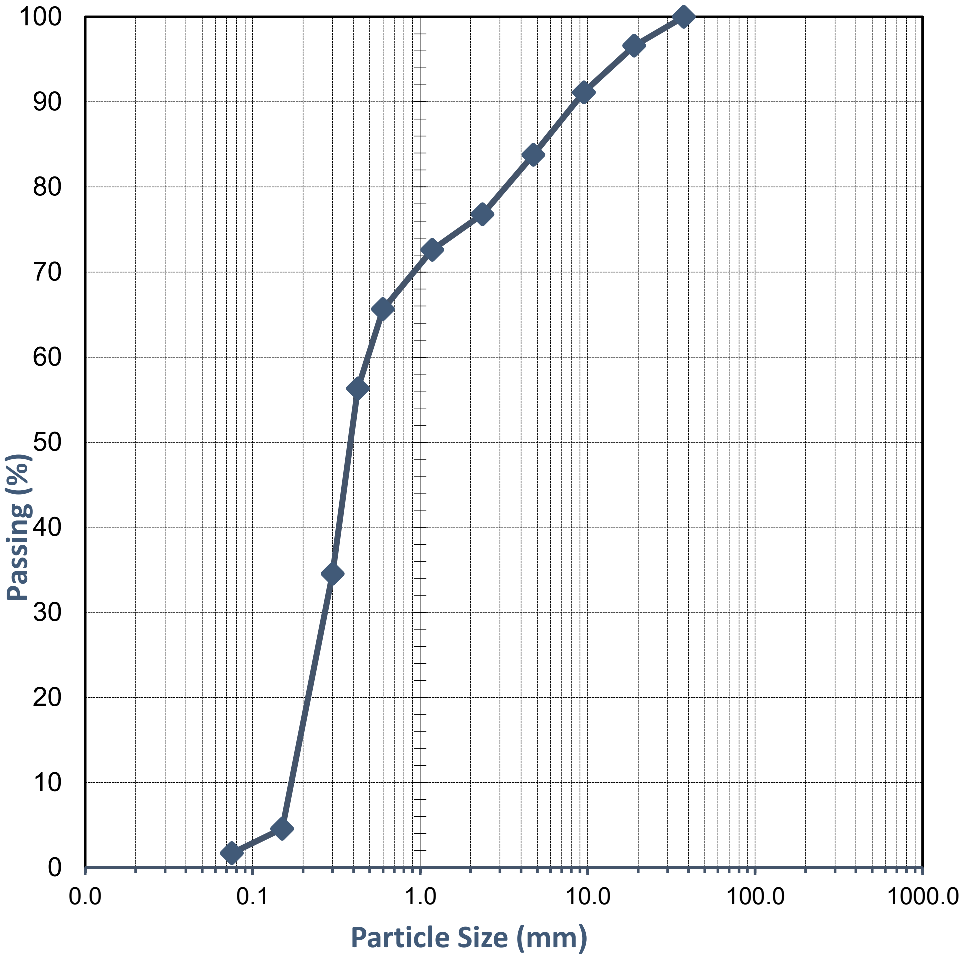
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4732_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4732
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0-0.4)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	97
9.5	91
4.75	84
2.36	77
1.18	73
0.600	66
0.425	56
0.300	35
0.150	5
0.075	2



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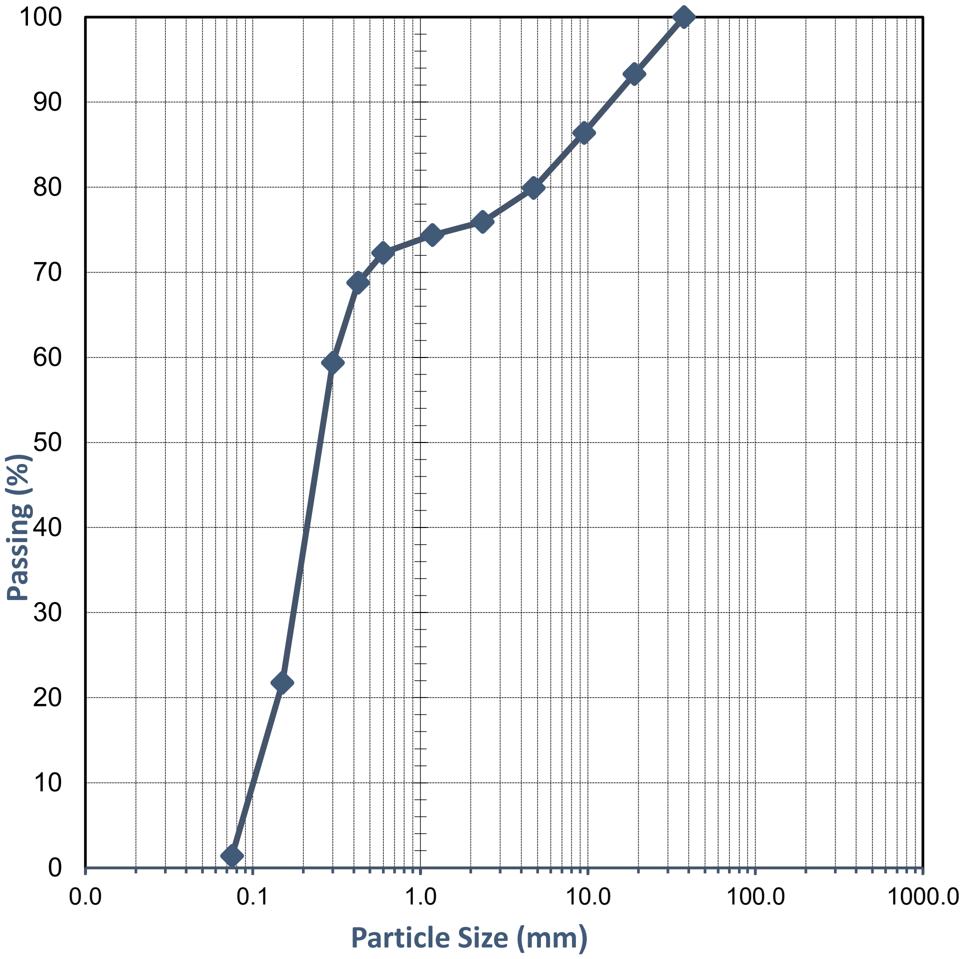
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4731_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4731
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP11 (1.3-2)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	93
9.5	86
4.75	80
2.36	76
1.18	74
0.600	72
0.425	69
0.300	59
0.150	22
0.075	1



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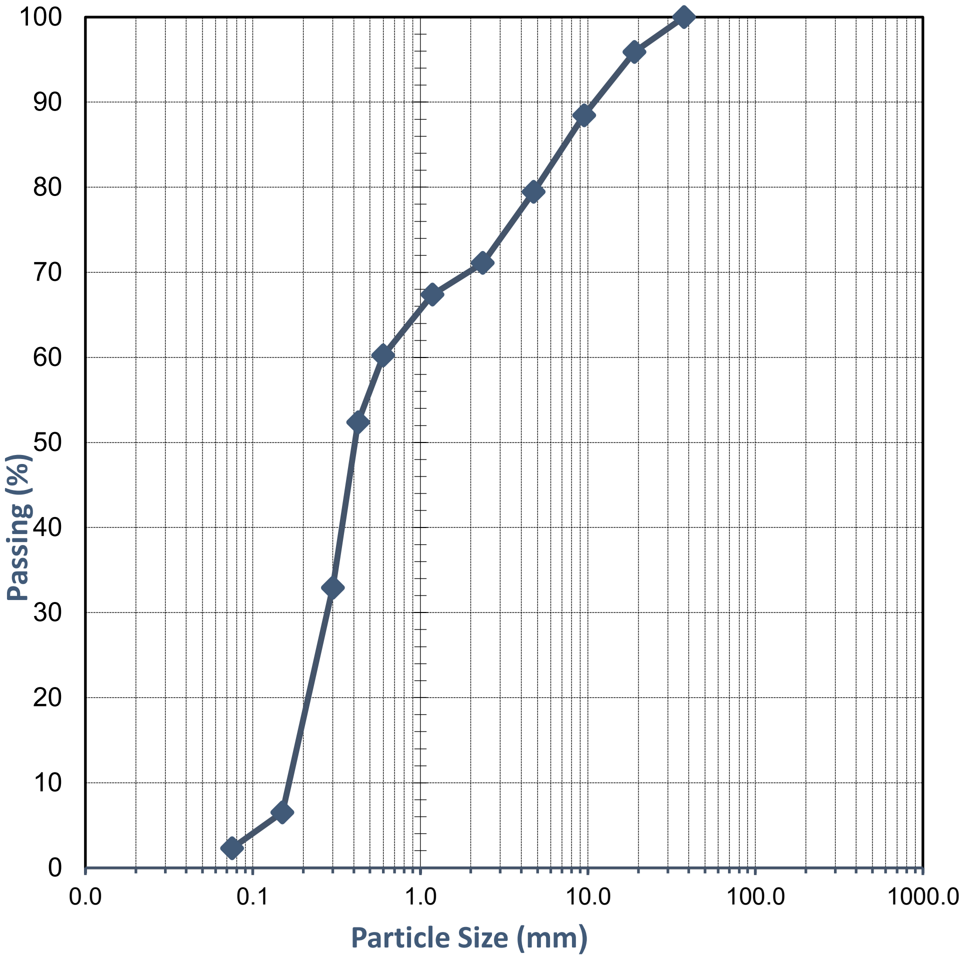
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4730_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4730
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP11 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	88
4.75	79
2.36	71
1.18	67
0.600	60
0.425	52
0.300	33
0.150	7
0.075	2



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SOIL | AGGREGATE | CONCRETE | CRUSHING

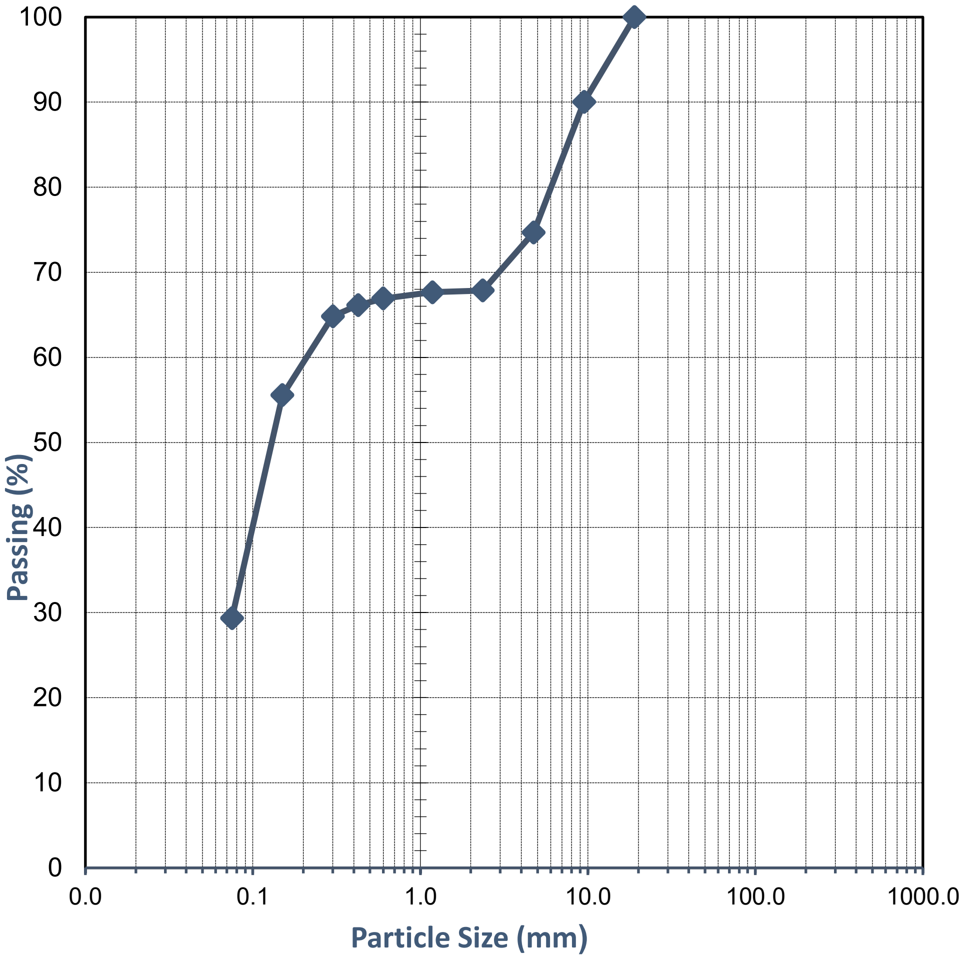
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4729_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4729
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP10 (1.5-2)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	90
4.75	75
2.36	68
1.18	68
0.600	67
0.425	66
0.300	65
0.150	56
0.075	29



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SOIL | AGGREGATE | CONCRETE | CRUSHING

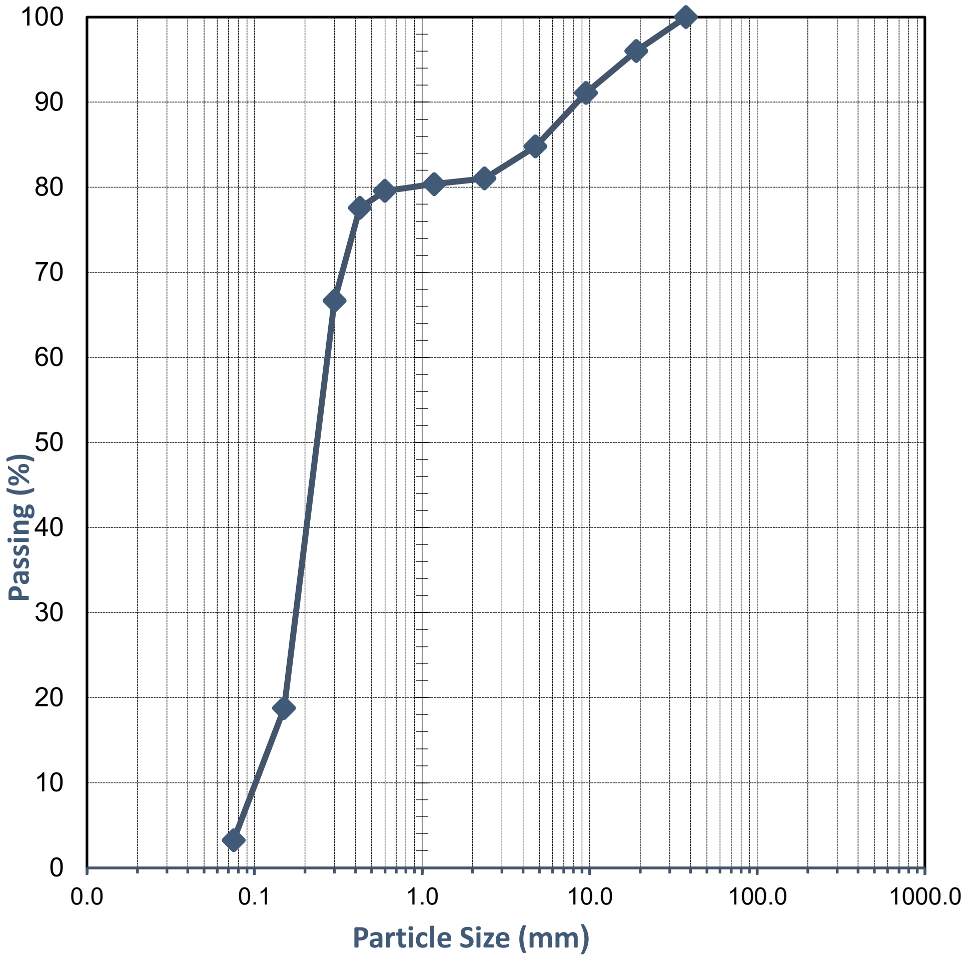
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4728_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4728
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP10 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	91
4.75	85
2.36	81
1.18	80
0.600	80
0.425	78
0.300	67
0.150	19
0.075	3



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SOIL | AGGREGATE | CONCRETE | CRUSHING

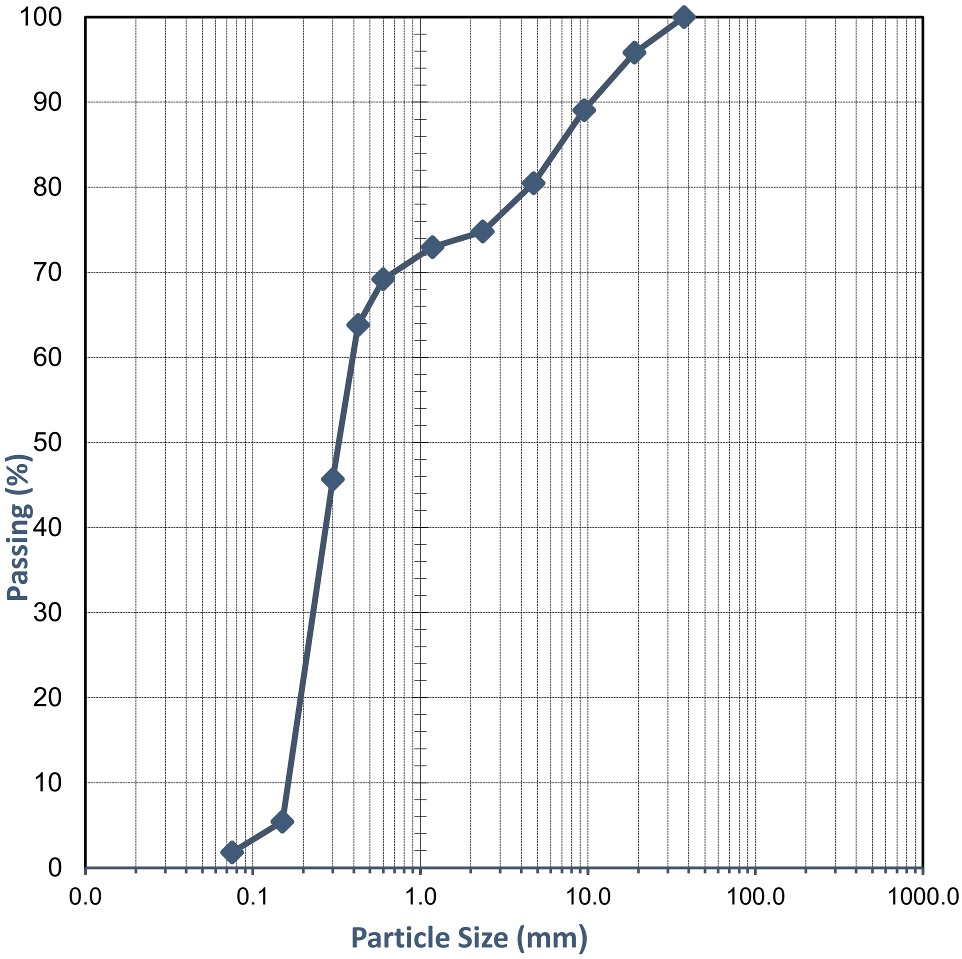
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4727_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4727
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP09 (1-1.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	89
4.75	80
2.36	75
1.18	73
0.600	69
0.425	64
0.300	46
0.150	5
0.075	2



Comments:

Approved Signatory:

Name: Natasha Bielawski

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SOIL | AGGREGATE | CONCRETE | CRUSHING

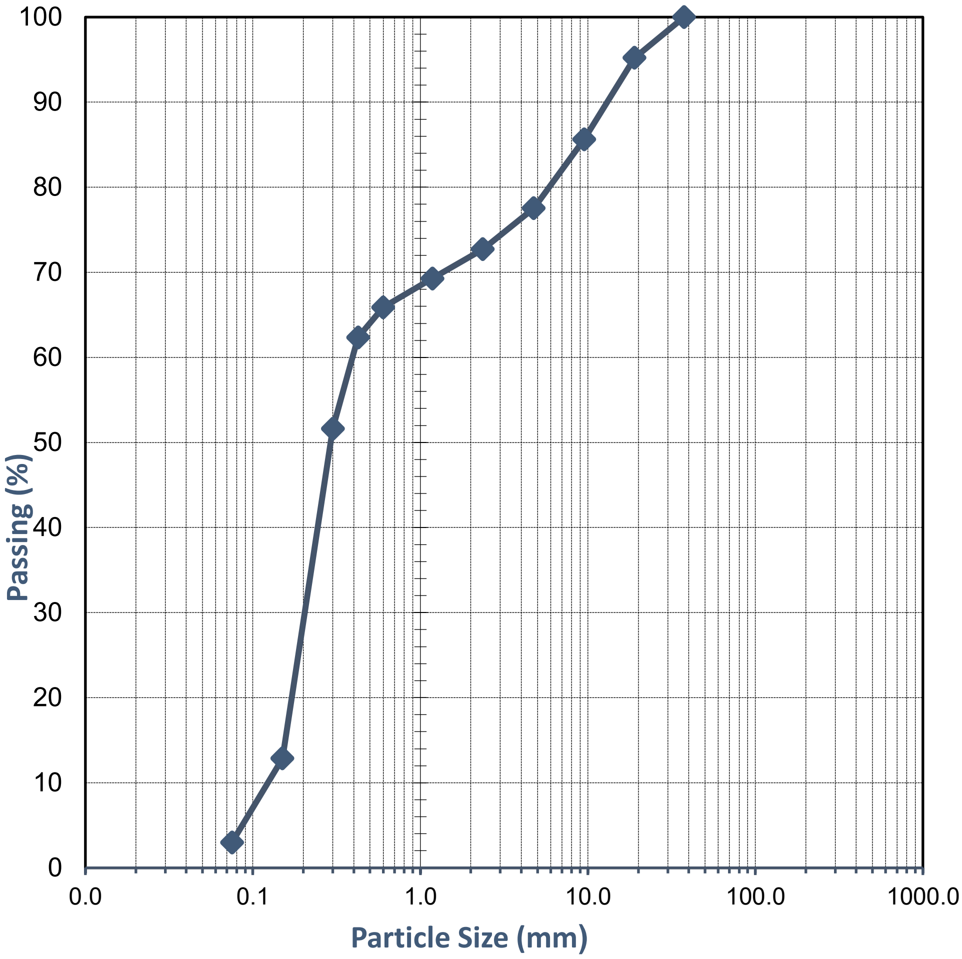
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4726_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4726
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP08 (1.5-2)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	95
9.5	86
4.75	78
2.36	73
1.18	69
0.600	66
0.425	62
0.300	52
0.150	13
0.075	3



Comments:

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SOIL | AGGREGATE | CONCRETE | CRUSHING

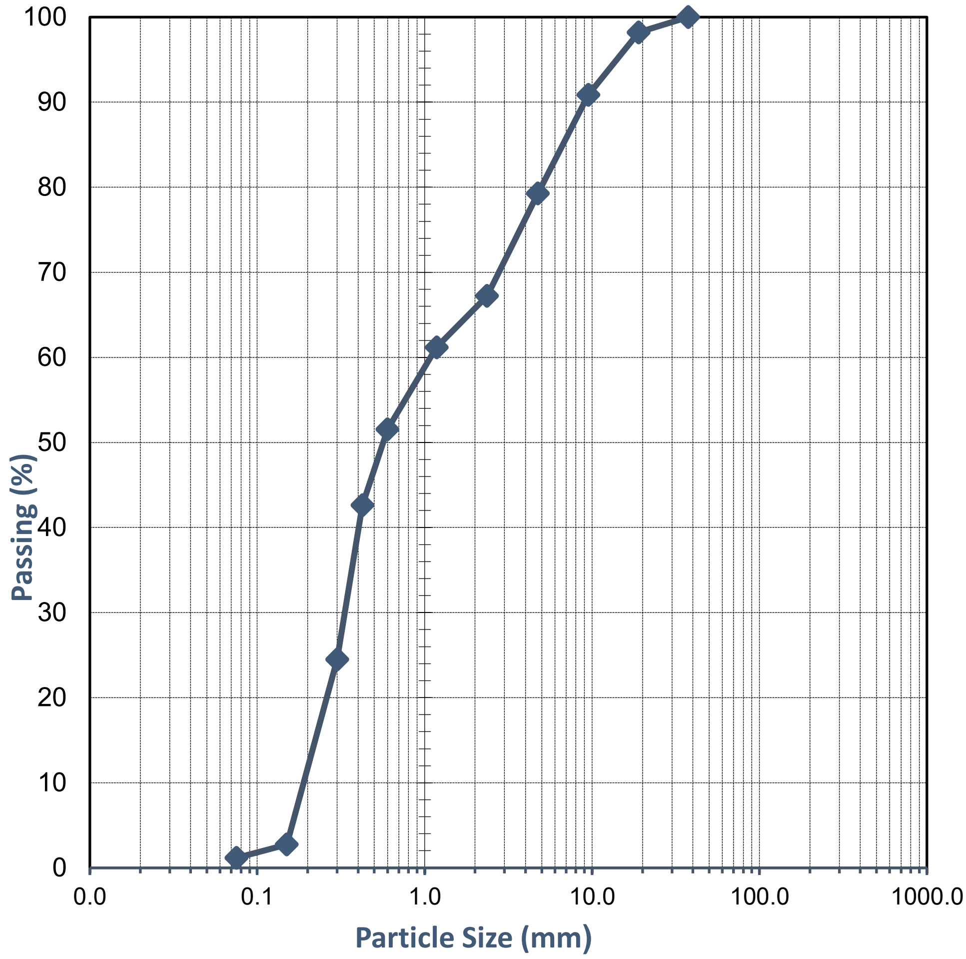
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	91
4.75	79
2.36	67
1.18	61
0.600	52
0.425	43
0.300	24
0.150	3
0.075	1



Comments:

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SOIL | AGGREGATE | CONCRETE | CRUSHING

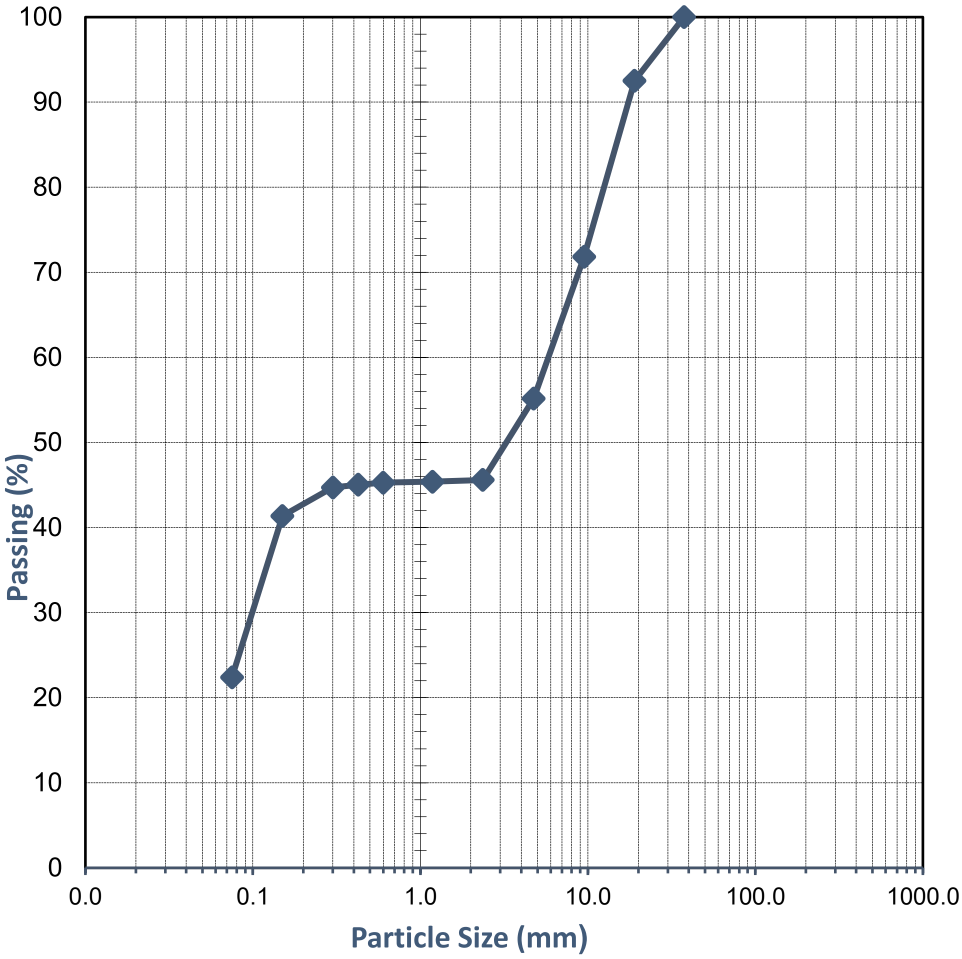
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4724_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4724
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (2-2.5)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	93
9.5	72
4.75	55
2.36	46
1.18	45
0.600	45
0.425	45
0.300	45
0.150	41
0.075	22



Comments: AS 1289.1.1- Deviation from standard: Insufficient sample according to test method requirements. NATA accreditation does not cover the performance of this service.

Approved Signatory:

Name: Natasha Bielawski
Date: 01/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

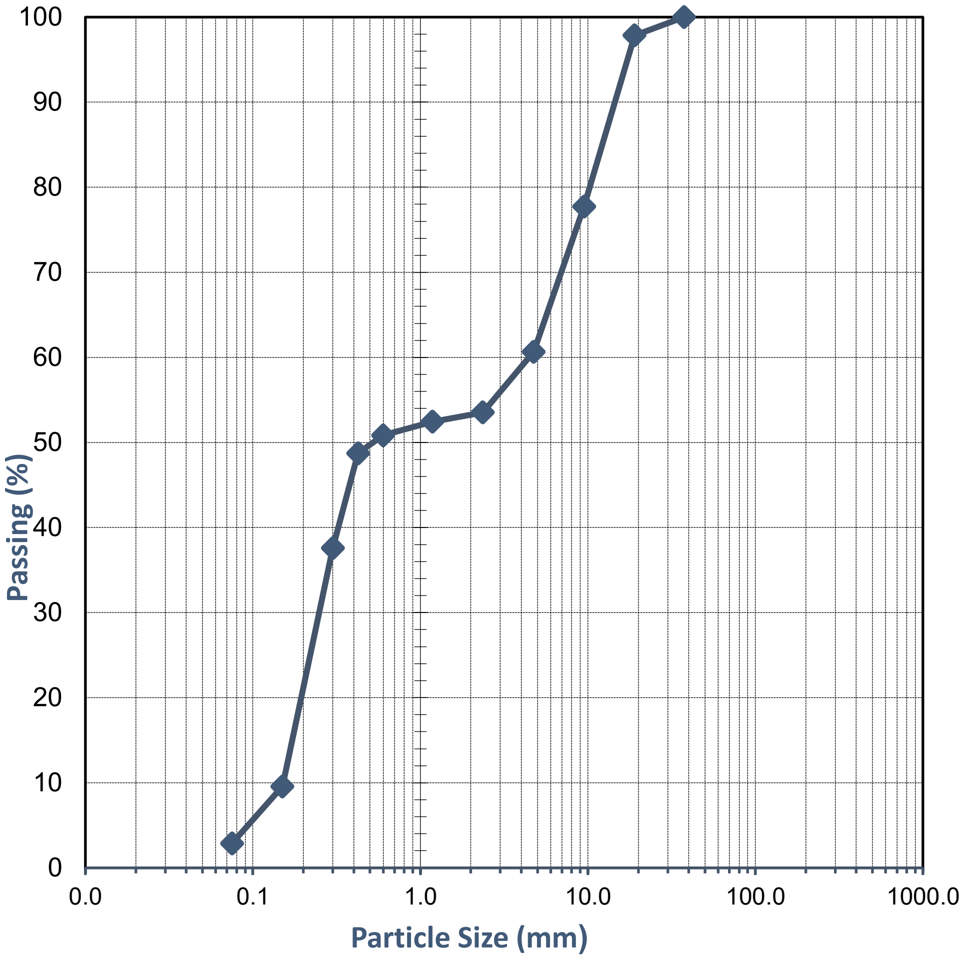
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4723_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4723
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (0-0.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	78
4.75	61
2.36	54
1.18	52
0.600	51
0.425	49
0.300	38
0.150	10
0.075	3



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SOIL | AGGREGATE | CONCRETE | CRUSHING

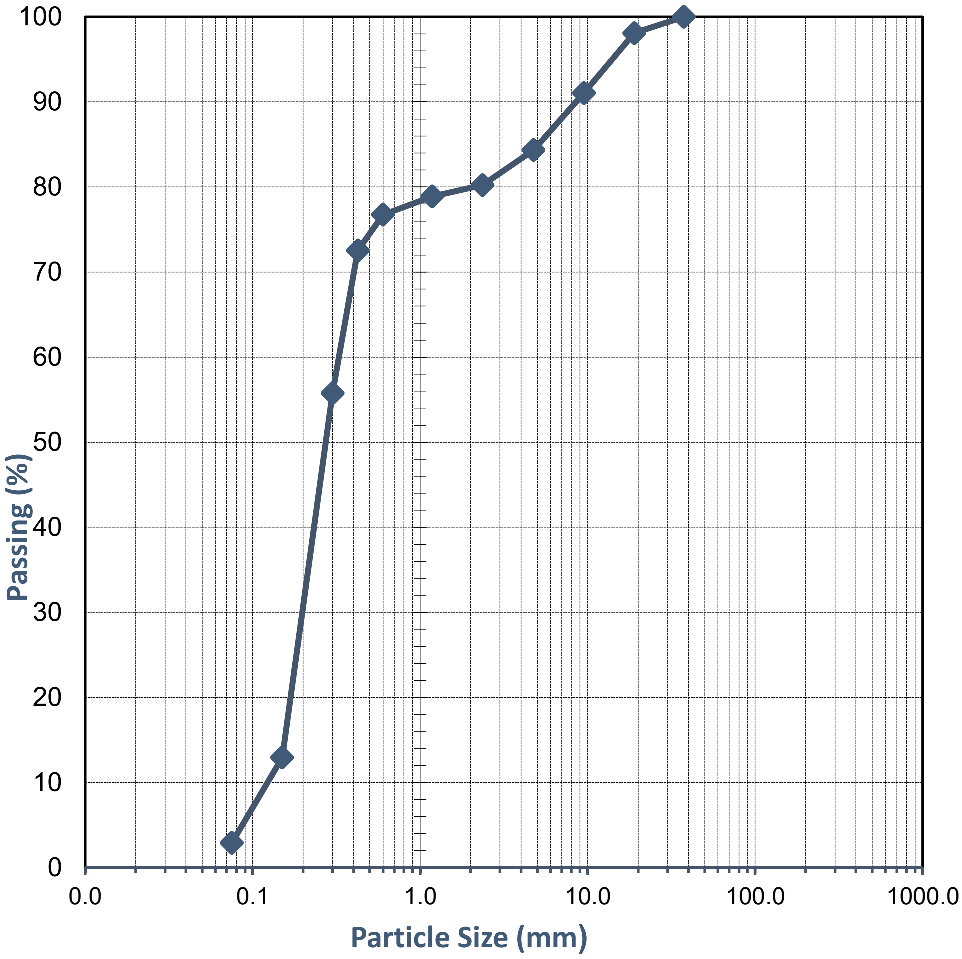
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	91
4.75	84
2.36	80
1.18	79
0.600	77
0.425	73
0.300	56
0.150	13
0.075	3



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SOIL | AGGREGATE | CONCRETE | CRUSHING

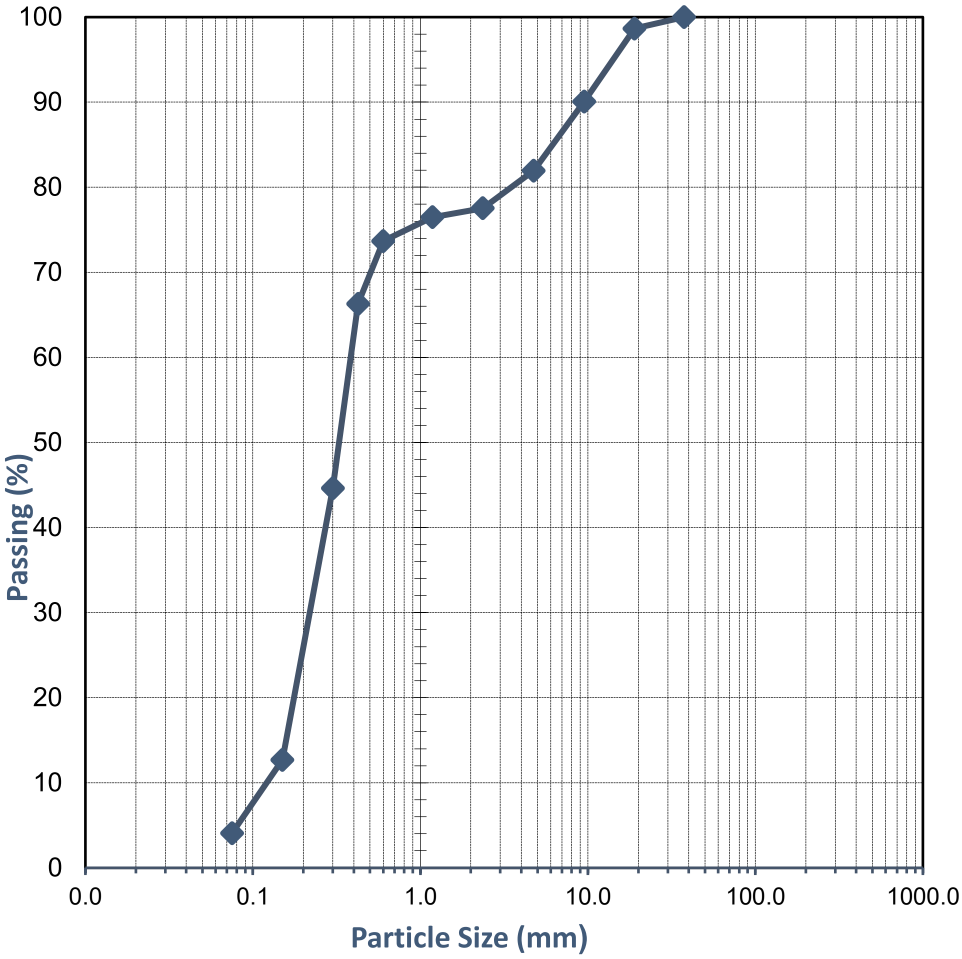
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4721_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4721
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (0-0.5)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	90
4.75	82
2.36	78
1.18	76
0.600	74
0.425	66
0.300	45
0.150	13
0.075	4



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TEST REPORT - AS 1289.6.1.1

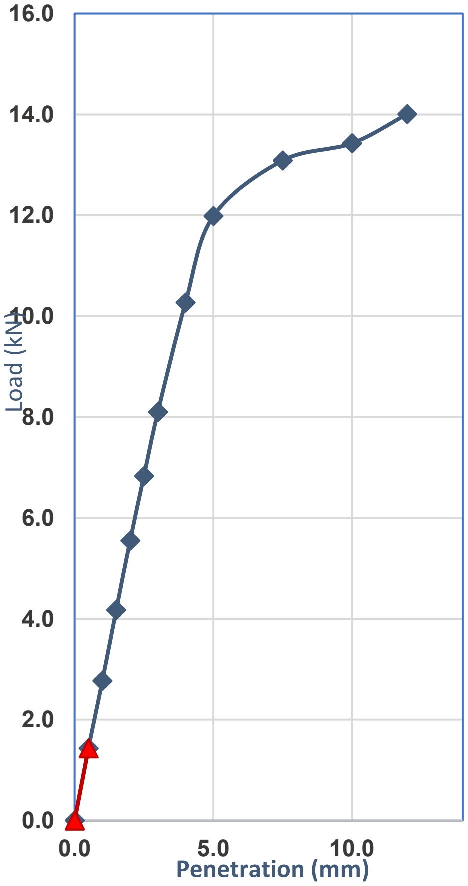
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	30/03 - 2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Silty Sand trace Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	2.11	Optimum Moisture (%)	8.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	2.01	Moisture Content (%)	8.2
Density Ratio (%)	95.5	Moisture Ratio (%)	97.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	2.01	Dry Density Ratio (%)	95.5
Moisture Content (%)	11.9	Moisture Ratio (%)	139.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	10.6	Remaining Depth (%)	11.2

Correction applied to Penetration: 0mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 60%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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TEST REPORT - AS 1289.6.1.1

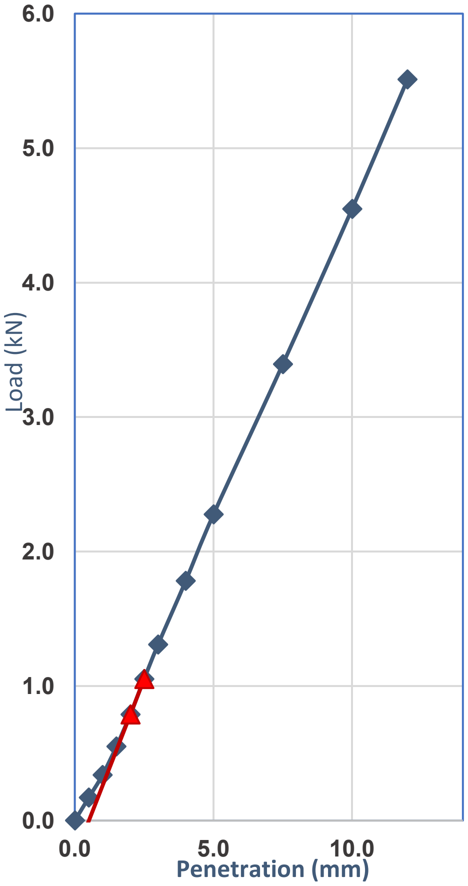
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4743_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4743
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP40 (2-2.5)m	*Date Tested:*	30/3 - 8/4/22

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	48.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.77	Optimum Moisture (%)	14.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.69	Moisture Content (%)	13.8
Density Ratio (%)	95.5	Moisture Ratio (%)	96.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m^3)	1.69	Dry Density Ratio (%)	95.5
Moisture Content (%)	16.0	Moisture Ratio (%)	112.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	13.8	Remaining Depth (%)	15.0

Correction applied to Penetration: 0.5mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 13%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 11-April-2022

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TEST REPORT - AS 1289.6.1.1

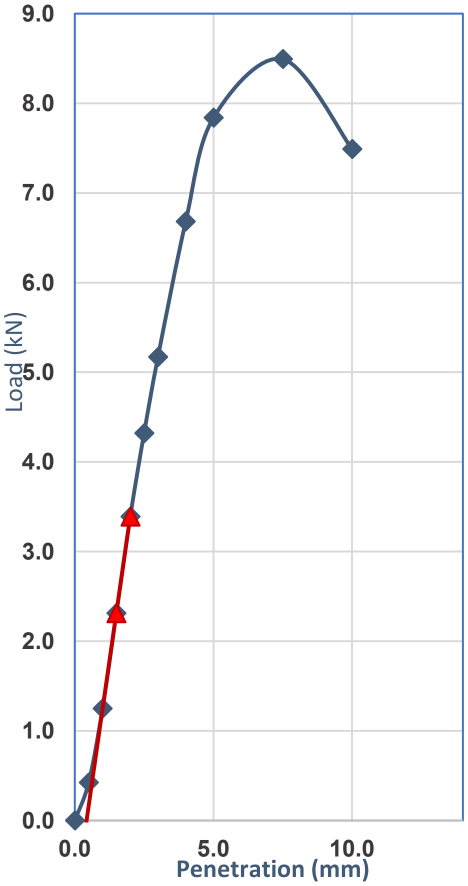
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	31/03 - 4/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	48.0
% Retained 19.0mm	2	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	2.00	Optimum Moisture (%)	8.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.90	Moisture Content (%)	8.4
Density Ratio (%)	95.0	Moisture Ratio (%)	98.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	5.00	Measured Swell (%)	0.0
Dry Density (t/m³)	1.89	Dry Density Ratio (%)	95.0
Moisture Content (%)	12.8	Moisture Ratio (%)	151.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	13.4	Remaining Depth (%)	13.3

Correction applied to Penetration: 0.4mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 40%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 05-April-2022

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TEST REPORT - AS 1289.6.1.1

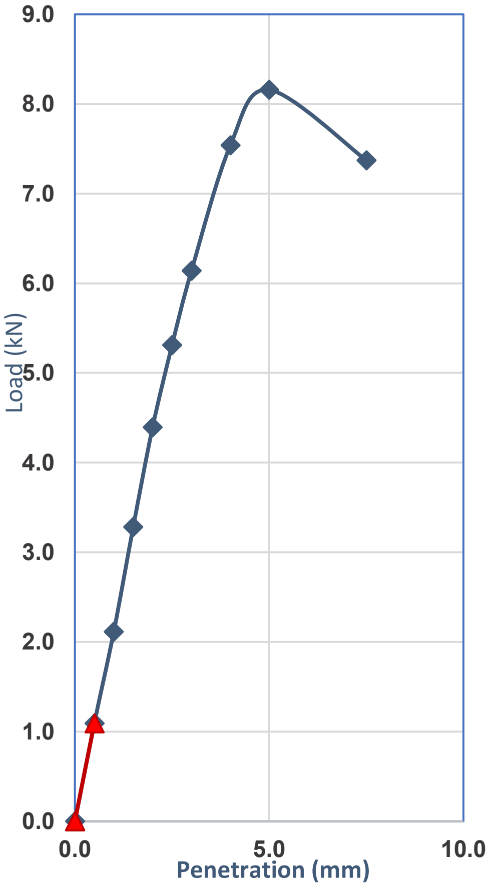
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	31/03 - 2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Silty Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24 hrs
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	2.07	Optimum Moisture (%)	8.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.97	Moisture Content (%)	7.8
Density Ratio (%)	95.5	Moisture Ratio (%)	96.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m^3)	1.97	Dry Density Ratio (%)	95.0
Moisture Content (%)	11.5	Moisture Ratio (%)	142.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	11.4	Remaining Depth (%)	11.7

Correction applied to Penetration: 0mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 40%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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TEST REPORT - AS 1289.6.1.1

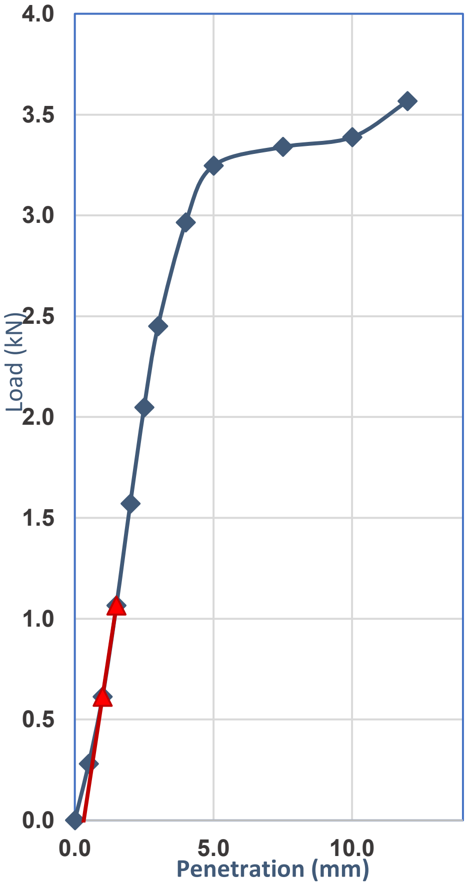
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	30/03 - 2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24.0
% Retained 19.0mm	1	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.78	Optimum Moisture (%)	12.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.69	Moisture Content (%)	12.1
Density Ratio (%)	95.0	Moisture Ratio (%)	101.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	1.69	Dry Density Ratio (%)	94.5
Moisture Content (%)	18.2	Moisture Ratio (%)	153.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	16.1	Remaining Depth (%)	17.8

Correction applied to Penetration: 0.3mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 17%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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TEST REPORT - AS 1289.6.1.1

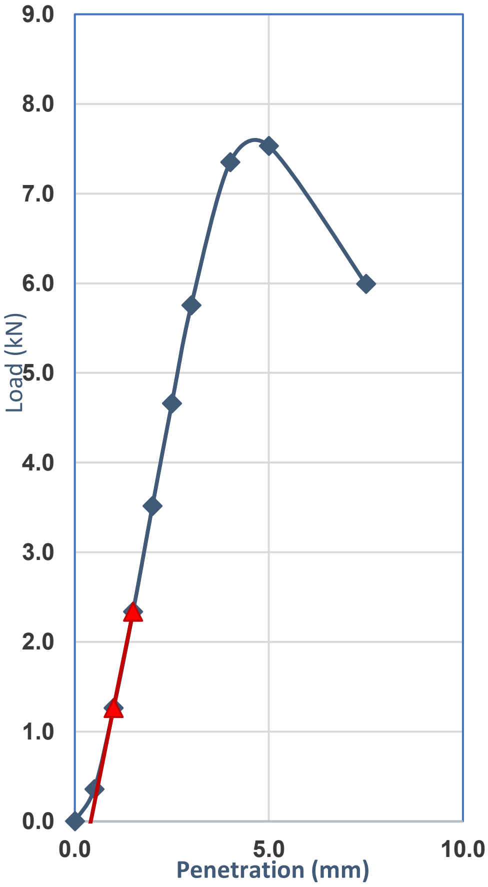
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4731_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4731
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP11 (1.3-2)m	*Date Tested:*	30/03 - 2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24 hrs
% Retained 19.0mm	2	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.78	Optimum Moisture (%)	13.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.68	Moisture Content (%)	13.7
Density Ratio (%)	95.0	Moisture Ratio (%)	102.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	1.68	Dry Density Ratio (%)	95.0
Moisture Content (%)	16.9	Moisture Ratio (%)	126.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	15.0	Remaining Depth (%)	15.9

Correction applied to Penetration: 0.4mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 40%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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TEST REPORT - AS 1289.6.1.1

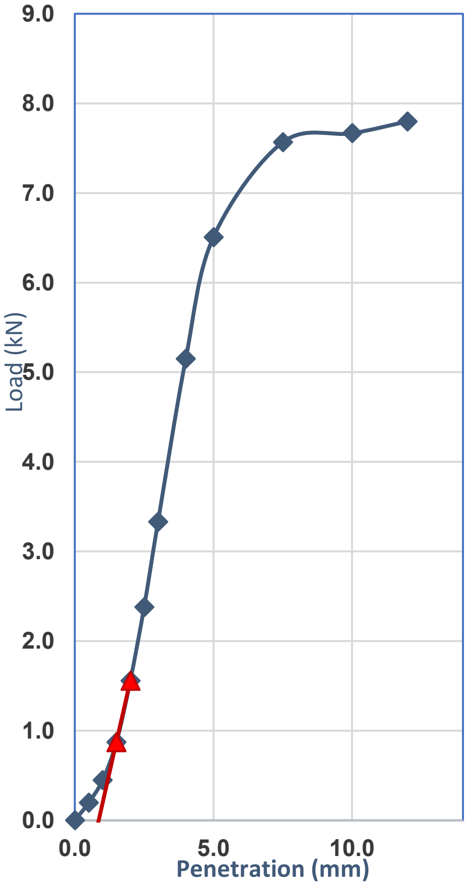
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	30/3-6/4/22

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24.0
% Retained 19.0mm	1	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.85	Optimum Moisture (%)	13.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.75	Moisture Content (%)	13.2
Density Ratio (%)	94.5	Moisture Ratio (%)	102.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	1.75	Dry Density Ratio (%)	94.5
Moisture Content (%)	16.8	Moisture Ratio (%)	130.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	15.5	Remaining Depth (%)	16.7

Correction applied to Penetration: 0.9mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 35%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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TEST REPORT - AS 1289.6.1.1

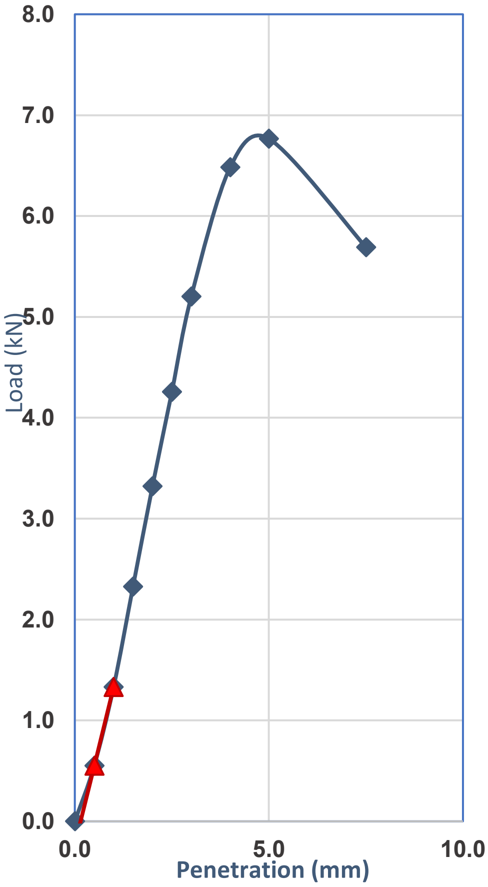
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24 hrs
% Retained 19.0mm	1	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.85	Optimum Moisture (%)	12.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.76	Moisture Content (%)	11.8
Density Ratio (%)	95.0	Moisture Ratio (%)	99.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m^3)	1.76	Dry Density Ratio (%)	95.0
Moisture Content (%)	15.0	Moisture Ratio (%)	126.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	14.3	Remaining Depth (%)	14.7

Correction applied to Penetration: 0.1mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 35%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4749_1_ORG
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4749
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	See Below	*Date Tested:*	30-03-2022

TEST RESULTS - Organic Content

Sampling Method: Sampled by Client, Tested as Received

Testing Completed By: WGLS - JG

Furnace Temperature (^{o}C): 440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG22.4749	TP59 (0.5-1)m	98.7	1.3

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4721-4747_1_ORG
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4721-4747
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	Various - See Below	*Date Tested:*	29/03/2022

TEST RESULTS - Organic Content

Sampling Method:	**Sampled by Client, Tested as Received**
Testing Completed By:	**WGLS-JG**
Furnace Temperature (^{o}C):	**440**

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG22.4721	TP01 (0-0.5)m	99.5	0.5
WG22.4723	TP03 (0-0.5)m	99.4	0.6
WG22.4724	TP03 (2-2.5)m	98.1	1.9
WG22.4728	TP10 (0.5-1)m	99.4	0.6
WG22.4729	TP10 (1.5-2)m	97.3	2.7
WG22.4731	TP11 (1.3-2)m	99.0	1.0
WG22.4732	TP12 (0-0.4)m	99.2	0.8
WG22.4735	TP17 (0-0.5)m	99.0	1.0
WG22.4747	TP54 (0-0.2)m	99.3	0.7

Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 30/March/2022

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CERTIFICATE OF ANALYSIS 279158

Client Details

Client	Western Geotechnical & Laboratory Services
Attention	Brooke Elliott
Address	235 Bank Street, Welshpool, WA, 6101

Sample Details

Your Reference	**Proposed Onslow Industrial Park / S5903**
Number of Samples	13 Soil
Date samples received	28/03/2022
Date completed instructions received	28/03/2022
Location	Lot 201 Onslow Road, Onslow WA

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	01/04/2022
Date of Issue	01/04/2022

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Results Approved By
Heram Halim, Operations Manager
Stacey Hawkins, Acid Soils Supervisor

Authorised By

Michael Kubiak, Laboratory Manager

Miscellaneous Inorg - soil						
Our Reference		279158-1	279158-2	279158-3	279158-4	279158-5
Your Reference	UNITS	WG22.4722 - TP01	WG22.4724 - TP03	WG22.4725 - TP04	WG22.4726 - TP08	WG22.4729 - TP10
Depth		1-1.5m	2-2.5m	0.5-1m	1.5-2m	1.5-2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Date analysed	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Electrical Conductivity (EC)	µS/cm	550	2,900	79	610	4,900

Miscellaneous Inorg - soil						
Our Reference		279158-6	279158-7	279158-8	279158-9	279158-10
Your Reference	UNITS	WG22.4732 - TP12	WG22.4733 - TP12	WG22.4734 - TP13	WG22.4735 - TP17	WG22.4737 - TP21
Depth		0.04m	0.5-1m	0.5-1m	0-0.5m	0.7-1.2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Date analysed	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Electrical Conductivity (EC)	µS/cm	88	110	4,300	880	2,000

Miscellaneous Inorg - soil						
Our Reference		279158-11	279158-12	279158-13	279158-14	279158-15
Your Reference	UNITS	WG22.4738 - TP26	WG22.4739 - TP30	WG22.4741 - TP36	WG22.4744 - TP44	WG22.4746 - TP52
Depth		0.5-0.75m	0.5-1m	0.5-1m	0.5-1m	0.3-0.7m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Date analysed	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Electrical Conductivity (EC)	µS/cm	70	290	240	150	330

Miscellaneous Inorg - soil		
Our Reference		279158-16
Your Reference	UNITS	WG22.4755 - TP76
Depth		0.2-0.5m
Type of sample		Soil
Date prepared	-	29/03/2022
Date analysed	-	29/03/2022
Electrical Conductivity (EC)	µS/cm	1,700

Phosphorus Retention Index						
Our Reference		279158-1	279158-2	279158-3	279158-4	279158-5
Your Reference	UNITS	WG22.4722 - TP01	WG22.4724 - TP03	WG22.4725 - TP04	WG22.4726 - TP08	WG22.4729 - TP10
Depth		1-1.5m	2-2.5m	0.5-1m	1.5-2m	1.5-2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Phosphorus Retention Index		3.27	36.9	3.26	4.75	79.6

Phosphorus Retention Index						
Our Reference		279158-6	279158-7	279158-8	279158-9	279158-10
Your Reference	UNITS	WG22.4732 - TP12	WG22.4733 - TP12	WG22.4734 - TP13	WG22.4735 - TP17	WG22.4737 - TP21
Depth		0.04m	0.5-1m	0.5-1m	0-0.5m	0.7-1.2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Phosphorus Retention Index		3.49	2.59	11.9	18.6	11.0

Phosphorus Retention Index						
Our Reference		279158-11	279158-12	279158-13	279158-14	279158-15
Your Reference	UNITS	WG22.4738 - TP26	WG22.4739 - TP30	WG22.4741 - TP36	WG22.4744 - TP44	WG22.4746 - TP52
Depth		0.5-0.75m	0.5-1m	0.5-1m	0.5-1m	0.3-0.7m
Type of sample		Soil	Soil	Soil	Soil	Soil
Phosphorus Retention Index		7.38	8.67	23.3	14.1	3.22

Phosphorus Retention Index		
Our Reference		279158-16
Your Reference	UNITS	WG22.4755 - TP76
Depth		0.2-0.5m
Type of sample		Soil
Phosphorus Retention Index		12.1

ESP/CEC						
Our Reference		279158-1	279158-2	279158-3	279158-4	279158-5
Your Reference	UNITS	WG22.4722 - TP01	WG22.4724 - TP03	WG22.4725 - TP04	WG22.4726 - TP08	WG22.4729 - TP10
Depth		1-1.5m	2-2.5m	0.5-1m	1.5-2m	1.5-2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Date analysed	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Calcium	mg/kg	450	650	240	330	1,400
Potassium	mg/kg	120	860	<100	<100	1,100
Magnesium	mg/kg	130	1,000	<100	<100	1,500
Sodium	mg/kg	<100	6,400	<100	<100	8,500
Aluminium	mg/kg	<20	<20	<20	<20	<20
Exchangeable Ca	meq/100g	2.2	3.2	1.2	1.6	6.9
Exchangeable K	meq/100g	0.3	2.2	<0.13	<0.13	2.9
Exchangeable Mg	meq/100g	1.0	8.5	<0.41	<0.41	12
Exchangeable Na	meq/100g	<0.22	28	<0.22	<0.22	37
Exchangeable Al	meq/100g	<0.07	<0.07	<0.07	<0.07	<0.07
Cation Exchange Capacity	meq/100g	4	42	1	2	59
ESP	%	<1	67	<1	<1	63

ESP/CEC						
Our Reference		279158-6	279158-7	279158-8	279158-9	279158-10
Your Reference	UNITS	WG22.4732 - TP12	WG22.4733 - TP12	WG22.4734 - TP13	WG22.4735 - TP17	WG22.4737 - TP21
Depth		0.04m	0.5-1m	0.5-1m	0-0.5m	0.7-1.2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Date analysed	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Calcium	mg/kg	250	200	1,100	990	1,100
Potassium	mg/kg	<100	<100	550	140	240
Magnesium	mg/kg	<100	<100	640	150	270
Sodium	mg/kg	<100	100	7,400	<100	<100
Aluminium	mg/kg	<20	<20	<20	<20	<20
Exchangeable Ca	meq/100g	1.2	1	5.7	5.0	5.6
Exchangeable K	meq/100g	<0.13	<0.13	1.4	0.4	0.6
Exchangeable Mg	meq/100g	<0.41	<0.41	5.2	1.3	2.2
Exchangeable Na	meq/100g	<0.22	0.4	32	<0.22	<0.22
Exchangeable Al	meq/100g	<0.07	<0.07	<0.07	<0.07	<0.07
Cation Exchange Capacity	meq/100g	1	1	45	7	8
ESP	%	<1	31	72	<1	<1

ESP/CEC						
Our Reference		279158-11	279158-12	279158-13	279158-14	279158-15
Your Reference	UNITS	WG22.4738 - TP26	WG22.4739 - TP30	WG22.4741 - TP36	WG22.4744 - TP44	WG22.4746 - TP52
Depth		0.5-0.75m	0.5-1m	0.5-1m	0.5-1m	0.3-0.7m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Date analysed	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Calcium	mg/kg	920	630	340	230	620
Potassium	mg/kg	190	140	130	<100	130
Magnesium	mg/kg	<100	190	160	<100	170
Sodium	mg/kg	<100	200	310	260	210
Aluminium	mg/kg	<20	<20	<20	<20	<20
Exchangeable Ca	meq/100g	4.6	3.1	1.7	1.1	3.1
Exchangeable K	meq/100g	0.5	0.4	0.3	<0.13	0.3
Exchangeable Mg	meq/100g	<0.41	1.6	1.3	<0.41	1.4
Exchangeable Na	meq/100g	<0.22	0.9	1.3	1.1	0.9
Exchangeable Al	meq/100g	<0.07	<0.07	<0.07	<0.07	<0.07
Cation Exchange Capacity	meq/100g	5	6	5	2	6
ESP	%	<1	14	29	50	16

ESP/CEC		
Our Reference		279158-16
Your Reference	UNITS	WG22.4755 - TP76
Depth		0.2-0.5m
Type of sample		Soil
Date digested	-	31/03/2022
Date analysed	-	31/03/2022
Calcium	mg/kg	1,100
Potassium	mg/kg	350
Magnesium	mg/kg	410
Sodium	mg/kg	120
Aluminium	mg/kg	<20
Exchangeable Ca	meq/100g	5.4
Exchangeable K	meq/100g	0.9
Exchangeable Mg	meq/100g	3.3
Exchangeable Na	meq/100g	0.5
Exchangeable Al	meq/100g	<0.07
Cation Exchange Capacity	meq/100g	10
ESP	%	5

Method ID	Methodology Summary
AGRI-003	Phosphorous Retention index (PBI) is equilibration of a sample with a solution containing Phosphorus in CaCl2 solution at a soil: solution ratio of 1:10. A portion of the leachate is centrifuged, then an aliquot is diluted with UHP water and the resultant solution is analysed for Phosphorus by a Discrete Analyser.
INORG-002	Conductivity and Salinity - measured using a conductivity cell at 25°C based on APHA latest edition Method 2510. Soils reported from a 1:5 water extract unless otherwise specified.
METALS-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
METALS-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
METALS-020	Determination of various metals by ICP-AES.

QUALITY CONTROL: Miscellaneous Inorg - soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			29/03/2022	1	29/03/2022	29/03/2022		29/03/2022	[NT]
Date analysed	-			29/03/2022	1	29/03/2022	29/03/2022		29/03/2022	[NT]
Electrical Conductivity (EC)	µS/cm	1	INORG-002	<1	1	550	540	2	104	[NT]

QUALITY CONTROL: Miscellaneous Inorg - soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	29/03/2022	29/03/2022		[NT]	[NT]
Date analysed	-			[NT]	11	29/03/2022	29/03/2022		[NT]	[NT]
Electrical Conductivity (EC)	µS/cm	1	INORG-002	[NT]	11	70	69	1	[NT]	[NT]

QUALITY CONTROL: Phosphorus Retention Index					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Phosphorus Retention Index			AGRI-003	[NT]	1	3.27	3.21	2	103	[NT]

QUALITY CONTROL: Phosphorus Retention Index					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Phosphorus Retention Index			AGRI-003	[NT]	11	7.38	7.83	6	[NT]	[NT]

QUALITY CONTROL: ESP/CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date digested	-			31/03/2022	1	31/03/2022	31/03/2022		31/03/2022	[NT]
Date analysed	-			31/03/2022	1	31/03/2022	31/03/2022		31/03/2022	[NT]
Calcium	mg/kg	50	METALS-020	<50	1	450	480	6	94	[NT]
Potassium	mg/kg	50	METALS-020	<50	1	120	130	8	117	[NT]
Magnesium	mg/kg	50	METALS-020	<50	1	130	140	7	91	[NT]
Sodium	mg/kg	50	METALS-020	<50	1	<100	<100	0	98	[NT]
Aluminium	mg/kg	10	METALS-020	<10	1	<20	<20	0	101	[NT]

QUALITY CONTROL: ESP/CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date digested	-			[NT]	11	31/03/2022	31/03/2022		[NT]	[NT]
Date analysed	-			[NT]	11	31/03/2022	31/03/2022		[NT]	[NT]
Calcium	mg/kg	50	METALS-020	[NT]	11	920	920	0	[NT]	[NT]
Potassium	mg/kg	50	METALS-020	[NT]	11	190	98	64	[NT]	[NT]
Magnesium	mg/kg	50	METALS-020	[NT]	11	<100	<100	0	[NT]	[NT]
Sodium	mg/kg	50	METALS-020	[NT]	11	<100	<100	0	[NT]	[NT]
Aluminium	mg/kg	10	METALS-020	[NT]	11	<20	<20	0	[NT]	[NT]

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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Certificate of Analysis

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Galt Environment P/L
50 Edward Street
Osborne Park
WA 6017

Attention: **Mariesa Greenwood**

Report **877205-S-V2**
Project name Onslow
Project ID J2201059
Received Date Apr 04, 2022

Client Sample ID			**TP01/0.0**	**TP01/0.5**	**TP04/0.0**	**TP04/1.5**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**L22-Ap0006939**	**L22-Ap0006940**	**L22-Ap0006941**	**L22-Ap0006942**
Date Sampled			**Mar 12, 2022**	**Mar 12, 2022**	**Mar 12, 2022**	**Mar 12, 2022**
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	49	42	37	44
>2mm Fraction	0.005	g	13	9.9	28	26
Analysed Material	0.1	%	80	81	57	63
Extraneous Material	0.1	%	20	19	43	37
Net Acidity (Excluding ANC)						
CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1	< 1
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	9.6	9.6	9.8	9.7
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	< 2	< 2	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	< 0.003	< 0.003	< 0.003
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	0.015	0.009	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	9.3	5.4	< 3	< 3
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	11	9.0	28	33
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	3.4	2.9	9.1	11
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	2100	1800	5600	6700
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1
% Moisture	1	%	< 1	3.7	2.9	2.7

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Client Sample ID			TP12/0.0	TP12/1.0	TP21/0.5	TP21/1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L22-Ap0006943	L22-Ap0006944	L22-Ap0006945	L22-Ap0006946
Date Sampled			Mar 12, 2022	Mar 12, 2022	Mar 12, 2022	Mar 12, 2022
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	47	58	49	53
>2mm Fraction	0.005	g	9.8	7.8	0.44	< 0.005
Analysed Material	0.1	%	83	88	99	100
Extraneous Material	0.1	%	17	12	0.9	< 0.1
Net Acidity (Excluding ANC)						
CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1	< 1
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	9.7	9.7	9.3	9.3
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	< 2	< 2	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	< 0.003	< 0.003	< 0.003
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	3.4	< 3	< 3	< 3
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	21	15	29	12
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	6.7	4.9	9.1	3.8
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	4100	3000	5700	2400
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1
% Moisture	1	%	< 1	1.9	6.5	5.9

Client Sample ID			TP30/0.0	TP30/1.0	TP40/0.5	TP40/1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L22-Ap0006947	L22-Ap0006948	L22-Ap0006949	L22-Ap0006950
Date Sampled			Mar 12, 2022	Mar 12, 2022	Mar 12, 2022	Mar 12, 2022
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	78	66	61	65
>2mm Fraction	0.005	g	< 0.005	8.3	11	< 0.005
Analysed Material	0.1	%	100	89	85	100
Extraneous Material	0.1	%	< 0.1	11	15	< 0.1

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Client Sample ID			TP30/0.0	TP30/1.0	TP40/0.5	TP40/1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L22-Ap0006947	L22-Ap0006948	L22-Ap0006949	L22-Ap0006950
Date Sampled			Mar 12, 2022	Mar 12, 2022	Mar 12, 2022	Mar 12, 2022
Test/Reference	LOR	Unit				
Net Acidity (Excluding ANC)						
CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1	< 1
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	9.5	9.4	9.5	9.4
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	< 2	< 2	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	< 0.003	< 0.003	< 0.003
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3	< 3	< 3	< 3
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	4.3	14	15	14
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	1.4	4.5	4.8	4.4
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	860	2800	3000	2800
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1
% Moisture	1	%	21	3.5	< 1	1.2

Client Sample ID			TP48/0.5	TP48/1.5	TP64/0.0	TP64/0.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L22-Ap0006951	L22-Ap0006952	L22-Ap0006953	L22-Ap0006954
Date Sampled			Mar 12, 2022	Mar 12, 2022	Mar 12, 2022	Mar 12, 2022
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	64	63	68	57
>2mm Fraction	0.005	g	< 0.005	< 0.005	< 0.005	6.9
Analysed Material	0.1	%	100	100	100	89
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	11
Net Acidity (Excluding ANC)						
CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1	< 1

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Client Sample ID			TP48/0.5	TP48/1.5	TP64/0.0	TP64/0.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L22-Ap0006951	L22-Ap0006952	L22-Ap0006953	L22-Ap0006954
Date Sampled			Mar 12, 2022	Mar 12, 2022	Mar 12, 2022	Mar 12, 2022
Test/Reference	LOR	Unit				
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	9.5	9.4	9.0	9.3
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	< 2	< 2	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	< 0.003	< 0.003	< 0.003
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3	< 3	< 3	< 3
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	6.6	4.9	5.6	17
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	2.1	1.6	1.8	5.6
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	1300	980	1100	3500
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1
% Moisture	1	%	1.7	3.3	1.7	4.9

Client Sample ID			TP67/0.0	TP67/1.0	TP72/0.5	TP72/1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L22-Ap0006955	L22-Ap0006956	L22-Ap0006957	L22-Ap0006958
Date Sampled			Mar 12, 2022	Mar 12, 2022	Mar 12, 2022	Mar 12, 2022
Test/Reference	LOR	Unit				
Extraneous Material						
<2mm Fraction	0.005	g	70	60	66	55
>2mm Fraction	0.005	g	< 0.005	< 0.005	< 0.005	23
Analysed Material	0.1	%	100	100	100	70
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	30
Net Acidity (Excluding ANC)						
CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1	< 1
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	9.4	9.5	9.4	9.5
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	< 2	< 2	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	< 0.003	< 0.003	< 0.003
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3	< 3	< 3	< 3

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Client Sample ID			TP67/0.0	TP67/1.0	TP72/0.5	TP72/1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L22-Ap0006955	L22-Ap0006956	L22-Ap0006957	L22-Ap0006958
Date Sampled			Mar 12, 2022	Mar 12, 2022	Mar 12, 2022	Mar 12, 2022
Test/Reference	LOR	Unit				
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	4.8	8.3	17	21
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	1.5	2.7	5.5	6.6
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	950	1700	3400	4100
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1	< 1
% Moisture	1	%	< 1	1.9	1.8	3.4

Client Sample ID			TP76/0.0	TP76/1.5	QC1
Sample Matrix			Soil	Soil	Soil
Eurofins Sample No.			L22-Ap0006959	L22-Ap0006960	L22-Ap0006961
Date Sampled			Mar 12, 2022	Mar 12, 2022	Mar 12, 2022
Test/Reference	LOR	Unit			
Extraneous Material					
<2mm Fraction	0.005	g	66	55	70
>2mm Fraction	0.005	g	< 0.005	5.7	< 0.005
Analysed Material	0.1	%	100	91	100
Extraneous Material	0.1	%	< 0.1	9.5	< 0.1
Net Acidity (Excluding ANC)					
CRS Suite - Net Acidity - NASSG (Excluding ANC)	0.02	% S	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Excluding ANC)	10	mol H+/t	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Excluding ANC)	1	kg CaCO3/t	< 1	< 1	< 1
Actual Acidity (NLM-3.2)					
pH-KCL (NLM-3.1)	0.1	pH Units	9.0	9.5	9.0
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	< 2	< 2	< 2
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	< 0.003	< 0.003	< 0.003
Potential Acidity - Chromium Reducible Sulfur					
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3	< 3	< 3
Extractable Sulfur					
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A

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Client Sample ID			TP76/0.0	TP76/1.5	QC1
Sample Matrix			Soil	Soil	Soil
Eurofins Sample No.			L22-Ap0006959	L22-Ap0006960	L22-Ap0006961
Date Sampled			Mar 12, 2022	Mar 12, 2022	Mar 12, 2022
Test/Reference	LOR	Unit			
Retained Acidity (S-NAS)					
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.02	% S	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)					
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	3.8	35	3.7
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	1.2	11	1.2
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	760	7000	730
ANC Fineness Factor		factor	1.5	1.5	1.5
Net Acidity (Including ANC)					
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	< 0.02	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	< 1
% Moisture	1	%	2.0	6.4	1.9

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Extraneous Material	Brisbane	Apr 05, 2022	6 Week
- Method: LTM-GEN-7050/7070			
Chromium Suite - NASSG (Excluding ANC)	Brisbane	Apr 05, 2022	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
% Moisture	Welshpool	Apr 05, 2022	14 Days
- Method: ARL135 Moisture in Solids			

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Company Name:	Galt Environment P/L	**Order No.:**	J2202059	**Received:**	Apr 4, 2022 4:35 PM
Address:	50 Edward Street Osborne Park WA 6017	**Report #:**	877205	**Due:**	Apr 11, 2022
		Phone:	08 6272 0200	**Priority:**	5 Day
		Fax:	08 9285 8444	**Contact Name:**	Mariesa Greenwood
Project Name:	Onslow				
Project ID:	J2202059				

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						Moisture Set	Chromium Suite - NASSG (Excluding ANC)
Perth Laboratory - NATA # 2377 Site # 2370						X	
Melbourne Laboratory - NATA # 1261 Site # 1254							
Sydney Laboratory - NATA # 1261 Site # 18217							
Brisbane Laboratory - NATA # 1261 Site # 20794							X
Mayfield Laboratory - NATA # 1261 Site # 25079							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	TP01/0.0	Mar 12, 2022		Soil	L22-Ap0006939	X	X
2	TP01/0.5	Mar 12, 2022		Soil	L22-Ap0006940	X	X
3	TP04/0.0	Mar 12, 2022		Soil	L22-Ap0006941	X	X
4	TP04/1.5	Mar 12, 2022		Soil	L22-Ap0006942	X	X
5	TP12/0.0	Mar 12, 2022		Soil	L22-Ap0006943	X	X
6	TP12/1.0	Mar 12, 2022		Soil	L22-	X	X

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Company Name:	Galt Environment P/L	**Order No.:**	J2202059	**Received:**	Apr 4, 2022 4:35 PM
Address:	50 Edward Street Osborne Park WA 6017	**Report #:**	877205	**Due:**	Apr 11, 2022
		Phone:	08 6272 0200	**Priority:**	5 Day
		Fax:	08 9285 8444	**Contact Name:**	Mariesa Greenwood
Project Name:	Onslow				
Project ID:	J2202059				

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						Moisture Set	Chromium Suite - NASSG (Excluding ANC)
Perth Laboratory - NATA # 2377 Site # 2370						X	
Melbourne Laboratory - NATA # 1261 Site # 1254							
Sydney Laboratory - NATA # 1261 Site # 18217							
Brisbane Laboratory - NATA # 1261 Site # 20794							X
Mayfield Laboratory - NATA # 1261 Site # 25079							
External Laboratory							
					Ap0006944		
7	TP21/0.5	Mar 12, 2022		Soil	L22-Ap0006945	X	X
8	TP21/1.0	Mar 12, 2022		Soil	L22-Ap0006946	X	X
9	TP30/0.0	Mar 12, 2022		Soil	L22-Ap0006947	X	X
10	TP30/1.0	Mar 12, 2022		Soil	L22-Ap0006948	X	X
11	TP40/0.5	Mar 12, 2022		Soil	L22-Ap0006949	X	X
12	TP40/1.0	Mar 12, 2022		Soil	L22-Ap0006950	X	X

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Company Name:	Galt Environment P/L	**Order No.:**	J2202059	**Received:**	Apr 4, 2022 4:35 PM
Address:	50 Edward Street Osborne Park WA 6017	**Report #:**	877205	**Due:**	Apr 11, 2022
		Phone:	08 6272 0200	**Priority:**	5 Day
		Fax:	08 9285 8444	**Contact Name:**	Mariesa Greenwood
Project Name:	Onslow				
Project ID:	J2202059				

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						Moisture Set	Chromium Suite - NASSG (Excluding ANC)
Perth Laboratory - NATA # 2377 Site # 2370						X	
Melbourne Laboratory - NATA # 1261 Site # 1254							
Sydney Laboratory - NATA # 1261 Site # 18217							
Brisbane Laboratory - NATA # 1261 Site # 20794							X
Mayfield Laboratory - NATA # 1261 Site # 25079							
External Laboratory							
13	TP48/0.5	Mar 12, 2022		Soil	L22-Ap0006951	X	X
14	TP48/1.5	Mar 12, 2022		Soil	L22-Ap0006952	X	X
15	TP64/0.0	Mar 12, 2022		Soil	L22-Ap0006953	X	X
16	TP64/0.5	Mar 12, 2022		Soil	L22-Ap0006954	X	X
17	TP67/0.0	Mar 12, 2022		Soil	L22-Ap0006955	X	X
18	TP67/1.0	Mar 12, 2022		Soil	L22-Ap0006956	X	X
19	TP72/0.5	Mar 12, 2022		Soil	L22-	X	X

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Company Name: Galt Environment P/L
Address: 50 Edward Street
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Project Name: Onslow
Project ID: J2202059

Order No.: J2202059
Report #: 877205
Phone: 08 6272 0200
Fax: 08 9285 8444

Received: Apr 4, 2022 4:35 PM
Due: Apr 11, 2022
Priority: 5 Day
Contact Name: Mariesa Greenwood

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						Moisture Set	Chromium Suite - NASSG (Excluding ANC)
Perth Laboratory - NATA # 2377 Site # 2370						X	
Melbourne Laboratory - NATA # 1261 Site # 1254							
Sydney Laboratory - NATA # 1261 Site # 18217							
Brisbane Laboratory - NATA # 1261 Site # 20794							X
Mayfield Laboratory - NATA # 1261 Site # 25079							
External Laboratory							
					Ap0006957		
20	TP72/1.0	Mar 12, 2022		Soil	L22-Ap0006958	X	X
21	TP76/0.0	Mar 12, 2022		Soil	L22-Ap0006959	X	X
22	TP76/1.5	Mar 12, 2022		Soil	L22-Ap0006960	X	X
23	QC1	Mar 12, 2022		Soil	L22-Ap0006961	X	X
Test Counts						23	23

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

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QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery									
Actual Acidity (NLM-3.2)									
pH-KCL (NLM-3.1)			%	97			80-120	Pass	
Titratable Actual Acidity (NLM-3.2)			%	104			80-120	Pass	
LCS - % Recovery									
Potential Acidity - Chromium Reducible Sulfur									
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)			%	93			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Net Acidity (Excluding ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Excluding ANC)	L22-Ap0006942	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Excluding ANC)	L22-Ap0006942	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Excluding ANC)	L22-Ap0006942	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
Actual Acidity (NLM-3.2)				Result 1	Result 2	RPD			
pH-KCL (NLM-3.1)	L22-Ap0006942	CP	pH Units	9.7	9.7	<1	30%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-Ap0006942	CP	mol H+/t	< 2	< 2	<1	30%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-Ap0006942	CP	% pyrite S	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Potential Acidity - Chromium Reducible Sulfur				Result 1	Result 2	RPD			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	L22-Ap0006942	CP	% S	< 0.005	< 0.005	<1	30%	Pass	
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	L22-Ap0006942	CP	mol H+/t	< 3	< 3	<1	30%	Pass	
Duplicate									
Extractable Sulfur				Result 1	Result 2	RPD			
Sulfur - KCl Extractable	L22-Ap0006942	CP	% S	N/A	N/A	N/A	30%	Pass	
HCl Extractable Sulfur	L22-Ap0006942	CP	% S	N/A	N/A	N/A	30%	Pass	
Duplicate									
Retained Acidity (S-NAS)				Result 1	Result 2	RPD			
Net Acid soluble sulfur (SNAS) NLM-4.1	L22-Ap0006942	CP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	L22-Ap0006942	CP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	L22-Ap0006942	CP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Duplicate									
Acid Neutralising Capacity (ANCbt)				Result 1	Result 2	RPD			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	L22-Ap0006942	CP	% CaCO3	33	34	1.0	30%	Pass	
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)	L22-Ap0006942	CP	% S	11	11	1.0	30%	Pass	
ANC Fineness Factor	L22-Ap0006942	CP	factor	1.5	1.5	<1	30%	Pass	
Duplicate									
Net Acidity (Including ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-Ap0006942	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-Ap0006942	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	L22-Ap0006942	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	L22-Ap0006946	CP	%	5.9	6.0	1.0	30%	Pass	

Duplicate									
Net Acidity (Excluding ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Excluding ANC)	L22-Ap0006952	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Excluding ANC)	L22-Ap0006952	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Excluding ANC)	L22-Ap0006952	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
Actual Acidity (NLM-3.2)				Result 1	Result 2	RPD			
pH-KCL (NLM-3.1)	L22-Ap0006952	CP	pH Units	9.4	9.4	<1	30%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-Ap0006952	CP	mol H+/t	< 2	< 2	<1	30%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-Ap0006952	CP	% pyrite S	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Potential Acidity - Chromium Reducible Sulfur				Result 1	Result 2	RPD			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	L22-Ap0006952	CP	% S	< 0.005	< 0.005	<1	30%	Pass	
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	L22-Ap0006952	CP	mol H+/t	< 3	< 3	<1	30%	Pass	
Duplicate									
Extractable Sulfur				Result 1	Result 2	RPD			
Sulfur - KCl Extractable	L22-Ap0006952	CP	% S	N/A	N/A	N/A	30%	Pass	
HCl Extractable Sulfur	L22-Ap0006952	CP	% S	N/A	N/A	N/A	30%	Pass	
Duplicate									
Retained Acidity (S-NAS)				Result 1	Result 2	RPD			
Net Acid soluble sulfur (SNAS) NLM-4.1	L22-Ap0006952	CP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	L22-Ap0006952	CP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	L22-Ap0006952	CP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Duplicate									
Acid Neutralising Capacity (ANCbt)				Result 1	Result 2	RPD			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	L22-Ap0006952	CP	% CaCO3	4.9	4.9	1.0	30%	Pass	
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)	L22-Ap0006952	CP	% S	1.6	1.6	1.0	30%	Pass	
ANC Fineness Factor	L22-Ap0006952	CP	factor	1.5	1.5	<1	30%	Pass	
Duplicate									
Net Acidity (Including ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-Ap0006952	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-Ap0006952	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	L22-Ap0006952	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	L22-Ap0006956	CP	%	1.9	1.9	2.0	30%	Pass	

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised by:

Douglas Todd	Analytical Services Manager
Rhys Thomas	Senior Analyst (WA)
Myles Clark	Senior Analyst (NSW)

Kim Rodgers
Business Unit Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

Appendix J: CSIRO Pamphlet

Foundation Maintenance and Footing Performance: A Homeowner's Guide

PUBLISHING
BTF 18-2011 replaces Information Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870-2011, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume, particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.

In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes

Notes
1. Where controlled fill has been used, the site may be classified A to E according to the type of fill used.
2. Filled sites. Class P is used for sites which include soft fills, such as clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soil subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise.
3. Where deep-seated moisture changes exist on sites at depths of 3 m or greater, further classification is needed for Classes M to E (M-D, H1-D, H2-D and E-D).

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay

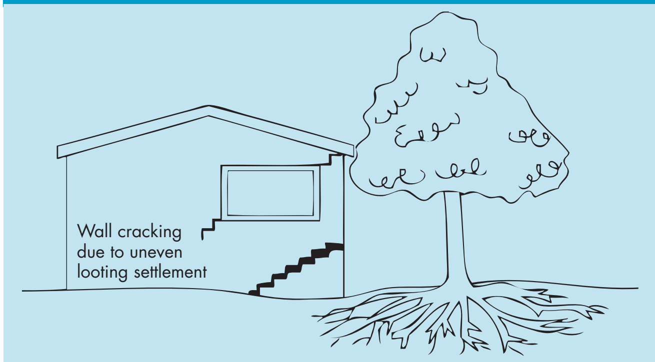
Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the

Trees can cause shrinkage and damage



external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures

Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation causes a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures

Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem. Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870-2011.

AS 2870-2011 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing

Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage

In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

Protection of the building perimeter

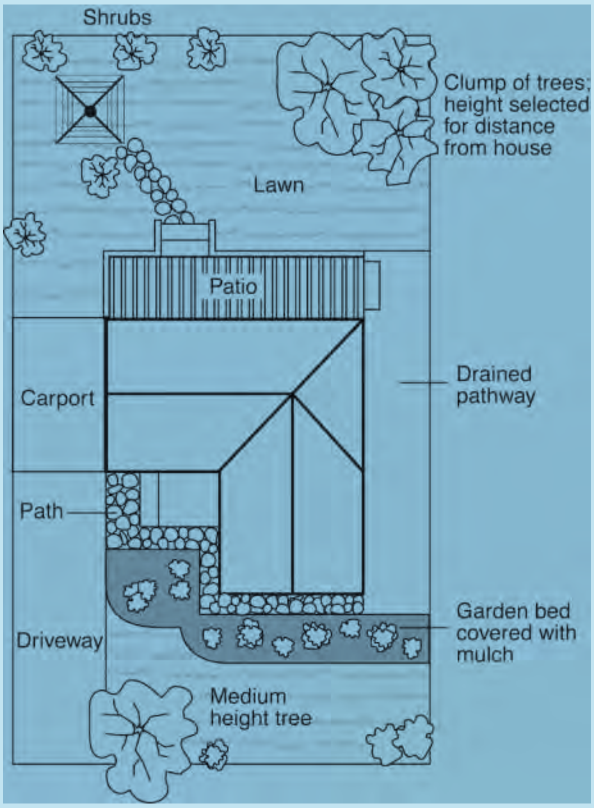
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving should

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly.	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired.	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 mm but also depends on number of cracks	4

Gardens for a reactive site



extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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Appendix K: Understanding Your Report

UNDERSTANDING YOUR REPORT

GALT FORM PMP11 Rev3

1. EXPECTATIONS OF THE REPORT

This document has been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

4. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

5. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

6. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

7. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

Geotechnical advice presented in a Galt Environmental report has been provided by Galt Geotechnics under a sub-contract agreement. Similarly, environmental advice presented in a Galt Geotechnics report has been provided by Galt Environmental under a sub-contract agreement.

Unless specifically noted otherwise, no parties shall draw any inferences about the applicability of the Western Australian state government landfill levy from the contents of this document.

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Report on

SITE AND SOIL EVALUATION

ONSLOW INDUSTRIAL PARK (PHASE 1 AND 2)

LOT 201 ONSLOW ROAD, ONSLOW

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22 April 2022

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APPENDIX G: UNDERSTANDING YOUR REPORT

1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics Pty Ltd's (Galt's) subdivision-level site and soil evaluation (SSE) for the proposed Onslow Industrial Park on Lot 201 Onslow Road, Onslow ("the site"). The location of the site relative to the surrounding area is shown on Figure 1, Site and Location Plan.

Two phases of the subdivision are proposed – Phase 1 and Phase 2. Concept plans are included in Appendix A.

2. DEFINITIONS

Site and Soil Evaluation (SSE) – an assessment of all relevant constraints and the risks to public health and the environment in accordance with AS1547-2012 "On-site domestic wastewater management". This SSE is a general assessment SSE, with the purpose being to undertake a site suitability assessment for onsite wastewater management and to recommend the type of onsite wastewater system for the proposed development. A specific assessment is required to support an "application to install" an onsite wastewater system. This is for when a particular type of system/model is proposed, and a detailed design, including management recommendations and operation requirements. This document is not a specific assessment.

Land Application Area (LAA) – The unencumbered plan area to which treated sewage from an on-site sewage system is distributed for further in-soil treatment and absorption or evaporation. This area is restricted to the distribution of treated sewage and may not be developed for other purposes.

Land Application System (LAS) - The system used to apply effluent from a wastewater treatment unit into or onto the soil for further in-soil treatment and absorption or evaporation.

Effluent – The liquid discharged from a wastewater treatment unit.

Primary Treatment – The separation of suspended material from sewage in septic tanks, primary settling chambers or other structures before discharge to either an LAS or secondary treatment process.

Secondary Treatment – Microbiological digestions and physical settling and filtering processes and decomposition of sewage constituents following primary treatment.

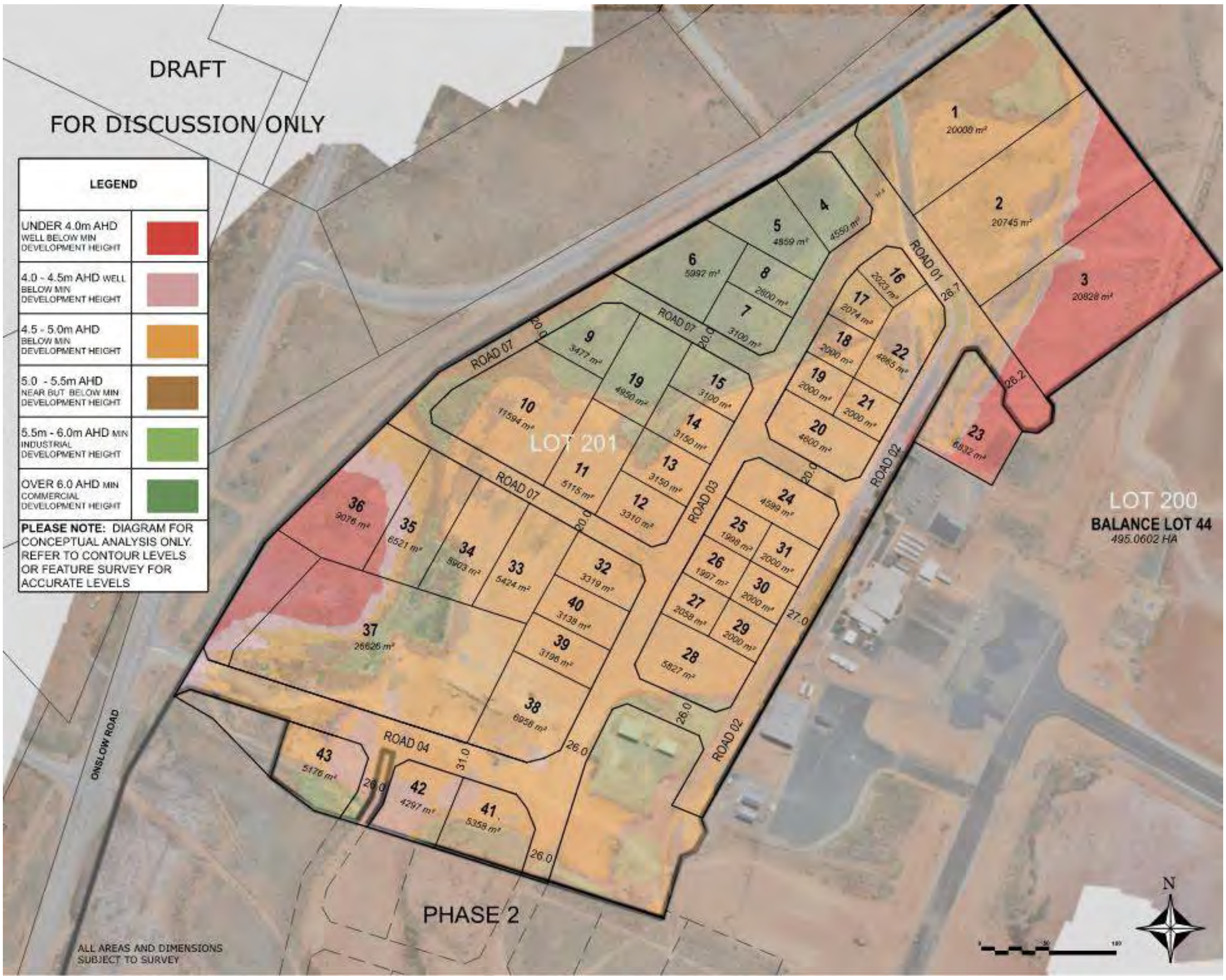
Sewage – Any kind of sewage, faecal matter or urine, and any waste composed wholly or in part of liquid.

Infiltrative Area – Is the area within an LAA that has treated effluent directly discharged onto and does not include setback areas. I.e., the base of leach drains, evapotranspiration beds etc.

3. SITE DESCRIPTION, HISTORY AND PROPOSED DEVELOPMENT

Based on the supplied information, the nominally 54 Ha site is bounded by Onslow Road to the north and west, Onslow Airport to the east, and a salt flat to the south (refer In-Line Image 1). Based on provided survey information, site levels range from about RL 2.0 m AHD to RL 10.3 m AHD. The majority of the Phase 1 area is between RL 4.5 m and RL 6.0 m AHD as per the below concept plan.

The site is partly undeveloped land (vegetated with spinifex and occasional trees) and partly cleared land as a result of construction of the adjacent Onslow airport. A substantial area of the site was used as a borrow area for the Onslow Airport.



Inline Image 1 - Approximate Existing Surface Levels (Phase 1 Area)

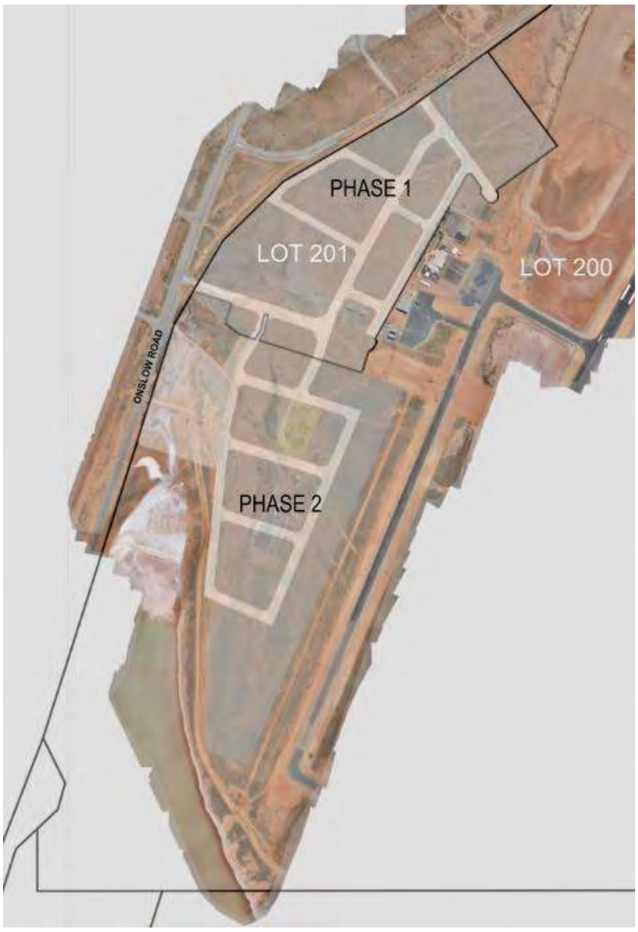
A ~0.5 ha area with stockpiles of fill is present in the southern portion of the site (generally over the proposed POS area in Phase 2). The stockpiles appear to have been derived from demolition and earthworks of the former runway at the Onslow Airport. South of this stockpile area is a portion of the site which was previously developed with temporary accommodation. The general areas of the site described above are shown on Figure 2.

To the north west of the site (outside the proposed development area) is a ~12 ha area with stockpiles of dredge fill. At the ground surface, the dredge fill is generally sandy, however, there are two areas where clayey dredge fill is exposed at the surface (refer Figure 2).

Based on historical aerial photography, the site was mostly undeveloped until about 2001. Some minor earthworks appear to have occurred over portions of the site between 2001 and 2012. Onslow Airport was constructed in 2013, which resulted in some associated earthworks (mostly excavation of fill from a large borrow area) in the eastern portion of the site. The above referenced stockpiles were placed at the site between 2018 and 2020.

The salt flats to the south of the site form part of the evaporation ponds of Onslow Salt, and are subject to flooding. Mapping prepared by DER, indicates the site is not near any environmentally sensitive estuaries, rivers, river catchments or wetlands.

We understand that the site is to be developed into 67 industrial lots and associated roadways, however a detailed civil design has not yet been undertaken. The development has been divided into an initial Phase 1 (about 33 Ha) followed by a second Phase 2 (about 21 Ha) as shown on Inline Image 2 and as per the concept plans included in Appendix A. For Phase 1, the use of imported fill (currently expected to be derived from the dredge spoil area) is proposed to achieve a lot level of about RL 4.9 m AHD. Relatively flat lots are proposed. It is currently proposed that sewage effluent is to be disposed of within each industrial lot.



Inline Image 2 - Proposed Phase 1 and Phase 2 Subdivision

4. PROJECT OBJECTIVES

Department of Health guidelines "Guidance on Site-and-soil evaluation for on-site sewage management"[1] notes that the overall objectives of the SSE process are to:

- *assess the capacity of the site to sustainably manage sewage within lot boundaries;*
- *identify public and environmental health risks of on-site sewage management especially the effect on groundwater and surface water on the site;*
- *identify the most appropriate on-site system in consideration of site conditions and the nature of the proposed development; and*
- *identify and implement a management program to minimise these risks if required.*

This report addresses the first 3 items above only. The last item must be addressed by individual lot owners depending on their specific requirements, sewage loading, etc.

[1] (https://ww2.health.wa.gov.au/~/media/Files/Corporate/general%20documents/water/Wastewater/Site-Soil-Evaluation.pdf)

Department of Health guidelines state that the SSE should be done in accordance with AS1547. Appendix B of AS1547-2012, "On-site domestic wastewater management" provides procedures for the SSE, which we understand is required at the "Subdivision" level as outlined in Inline Image 3 below.

Stages in Planning Process	Scale of Proposal	Level of Assessment Required	Purpose
Sub-regional/district plans and local planning strategies	• catchment-wide (multiple local government areas) • one local government area • part of an local government area	• broad SSE to determine areas which are most favourable for new developments • desktop analysis based on soil landscape maps, GIS (geographic information systems), reports, studies and local knowledge • representative testing of different soil landscape types (if necessary)	• review practicability of sewered versus unsewered option for wastewater management • determine broad suitability for on-site sewage management • eliminate areas not suitable for on-site sewage management or where technological solutions are cost prohibitive or ecologically unsustainable • evaluating environmental and public health risks • identify local government resourcing requirements to monitor on-site sewage management
Rezoning and local structure plan	• one local government area • part of an local government area • specific site	• detailed SSE for site-specific rezoning	• determine minimum lot sizes • identify appropriate treatment technologies and on-site sewage management system (e.g. disposal, reuse) • establish performance standards/criteria • determine management and monitoring options
Subdivision	• specific site	• detailed SSE if not done at the earlier planning stage	• determine capacity of proposed lots to contain sewage on-site without compromising environmental and public health outcomes • select and size treatment/on-site sewage management system, including land application area • identify management and monitoring options • define adequate on-site sewage management locations
Development	• individual lot	• site specific SSE if not done at the earlier planning stage	• determine capacity of site to contain proposed development and sewage on-site, without compromising environmental and public health outcomes • design precise treatment/on-site sewage management system • implement management and monitoring options
SSE – Site and Soil Evaluation			

Inline Image 3 - Table from Department of Health Guidelines (2019)

5. SITE AND SOIL ASSESSMENT

5.1 Fieldwork

Fieldwork was undertaken between 8 and 16 March 2022 and comprised:

- a walkover of the site including taking photographs;
- Test pit excavations at 76 locations (TP01 to TP76) across the site, extending to depths of between 0.1 m and 2.8 m;
- Installation of standpipes within test pits for monitoring of groundwater levels at 5 locations (TP14, TP31, TP42, TP52, and TP72);
- testing with a dynamic cone penetrometer (DCP) adjacent to selected test pit locations;
- falling head infiltration testing using the 'inverse auger' technique at 12 locations (IT01 to IT12) across the site, at depths of between 0.43 m and 0.73 m;
- constant head infiltration testing using a Guelph permeameter at 11 locations across the site (PERC01 to PERC11), at a depth of 0.35 m and 0.64 m; and
- collection of representative soil samples for inspection and testing.

General

A geotechnical engineer from Galt conducted the walkover survey, located and positioned the tests, observed the test pit excavations and conducted the constant head, falling head and penetrometer testing.

The approximate test locations are shown on Figure 1, Site and Location Plan. Photographs of the site are presented in Appendix B.

Test pit Excavations

Test pits were excavated using a 9 tonne Caterpillar 432F Backhoe fitted with a 600 mm wide rock bucket. The backhoe was owned and operated by Munro Contracting. Bulk samples were collected from the pits for subsequent laboratory testing. Test pit excavation reports are presented in Appendix C, along with a method of soil description and a list of explanatory notes and abbreviations used in the reports.

Installation of Standpipes

Standpipes were installed within five of the test pits for monitoring on groundwater levels (TP14, TP31, TP42, TP52, and TP72). Following their installation (from 8 to 11 March 2022), groundwater levels in the wells were monitored between 13 and 16 March 2022. The levels measured in the wells are summarised in Table 7.

Constant Head Infiltration Tests

Constant head infiltration tests were conducted using constant head permeameters. The tests were generally conducted in accordance with Appendix G of AS 1547 (2012) "On-site domestic wastewater management". The results of the testing are presented in Appendix D and summarised in Table 1.

Table 1: Constant Head Infiltration Test Results

Test	Test Depth (m)	Soil Description at Adjacent Test pit	k[1] (m/day)	Soil Category
TP16 / PERC01	0.40	Silty SAND	0.09	4
TP21 / PERC02	0.55	Silty SAND	0.10	4
TP29 / PERC03	0.35	Silty SAND	0.14	4

TP31 / PERC04	0.40	Gravelly SAND	0.55	3
TP38 / PERC05	0.55	Silty Sandy GRAVEL	0.20	4
TP42 / PERC06	0.53	SAND	1.87	3
TP48 / PERC07	0.60	Gravelly SAND	0.64	3
TP52 / PERC08	0.55	Gravelly SAND / SAND	0.24	4
TP65 / PERC09	0.55	Clayey SAND / SAND	0.02	6
TP73 / PERC10	0.58	Clayey SAND / Clayey Sandy GRAVEL	0.07	5
TP76 / PERC11	0.64	Silty SAND	0.003	6

Note:
1. k – saturated hydraulic conductivity
2. Groundwater not encountered at any test locations
3. Soil category is as per Table L1 of AS1547-2012.

<u>Falling Head Infiltration Tests</u>

Falling head infiltration tests using the 'inverse auger hole method' described by Cocks[2] were done at selected locations across the site, generally where higher permeability soils were identified. The results of the falling head infiltration tests are presented in Appendix E and summarised in Table 2.

Table 2: Summary of Falling Head Infiltration Test Results

Test Location	Pipe Embedment (m)	Soil Description at Adjacent Testpit	Minimum Unsaturated Conductivity, k (m/day)			Soil Category
			Test 1	Test 2	Test 3	
TP15 / IT01	0.62	Silty SAND	2.8	1.1	1.0	3
TP74 / IT02	0.58	Clayey SAND	0.1	0.1	0.1	5
TP20 / IT03	0.73	SILTY SAND / SAND	0.6	0.4	0.2	4
TP26 / IT04	0.67	Silty SAND	2.2	1.6	1.5	3
TP42 / IT05	0.58	SAND	5.2	3.0	3.0	2
TP30 / IT06	0.65	Silty SAND	5.4	2.1	0.9	3
TP41 / IT07	0.62	Sandy GRAVEL	0.4	0.5	0.4	4
TP46 / IT08	0.47	COBBLES / Sandy GRAVEL mixture	3.9	1.5	1.1	3
TP50 / IT09	0.74	CALCARENITE	6.4	2.2	1.7	3
TP67 / IT10	0.71	SAND	4.1	2.0	1.9	2
TP31 / IT11	0.50	Gravelly SAND	2.1	1.3	0.9	3
TP71 / IT12	0.43	Clayey SAND	9.8	2.2	2.2	3

5.2 Laboratory Testing

Laboratory testing on soil samples was undertaken by WGLS and MPL in their NATA accredited laboratories and comprised determination of:

- Particle size distribution on 36 samples;
- Atterberg limits on 9 samples;
- Constant head permeability on 12 samples;
- California Bearing Ratio on 8 samples;
- Modified Compaction on 16 samples;
- Organics content on 10 samples;
- Phosphorus Retention Index on 16 samples;
- Electric Conductivity on 16 samples;

2 Cocks, G (2007), "Disposal of Stormwater Runoff by Soakage in Perth Western Australia", Journal and News of the Australian Geomechanics Society, Volume 42 No. 3, pp 101-114.

- Exchangeable Sodium Percentage on 16 samples; and
- Emerson Class on 16 samples.

The results of the laboratory testing are presented in Appendix E and are summarised in Table 3 to Table 5.

Table 3: Summary of Laboratory Classification Test Results

Area	Test Location	Sample Depth (m)	Soil Description	Fines (%)	Sand (%)	Gravel (%)	LL (%)	PI (%)	LS (%)	OC (%)
Dredge Spoil	TP01	0 to 0.5	FILL: SAND	4	74	22				0.5
	TP01	1.0 to 1.5	FILL: SAND	3	77	20				
	TP03	0 to 0.5	FILL: GRAVELLY SAND	3	51	46				0.6
	TP03	2.0 to 2.5	SILTY GRAVEL	22	24	54	NO	NP	0	1.9
	TP04	0.5 to 1.0	FILL: GRAVELLY SAND	1	66	33				
	TP08	1.5 to 2.0	FILL: SAND	3	70	27				
	TP09	1.0 to 1.5	FILL: SAND	2	73	25				
	TP10	0.5 to 1.0	FILL: SAND	3	78	19				0.6
	TP10	1.5 to 2.0	FILL: SILTY GRAVELLY SAND	29	39	32	NO	NP	0	2.7
	TP11	0.5 to 1.0	FILL: SAND	2	69	29				
	TP11	1.3 to 2.0	FILL: SAND	1	75	24				1
	TP12	0 to 0.4	FILL: SAND	2	75	23				0.8
	TP12	0.5 to 1.0	SAND	0	82	18				
Phase 1 Natural Soils	TP13	0.5 to 1.0	SILTY GRAVELLY SAND / CALCARENITE	15	55	30	NO	NP	0	
	TP17	0 to 0.5	SILTY SAND	23	71	6				1
	TP20	0.6 to 1.0	SILTY SANDY GRAVEL	14	38	48				
	TP21	0.7 to 1.2	SILTY SAND	18	58	24	NO	NP	0	
	TP26	0.5 to 0.75	SILTY SAND	13	68	19	NO	NP	0	
	TP30	0.5 to 1.0	SILTY SAND	16	76	8				
	TP31	2.0 to 2.5	GRAVEL	8	28	64				
	TP36	0.5 to 1.0	SILTY SAND	15	56	29				
	TP38	0.5 to 10	SILTY SANDY GRAVEL	17	38	45				
	TP40	2.0 to 2.5	SAND	12	86	2				
Phase 1 Natural Soils	TP44	0.5 to 1.0	GRAVELLY SAND	9	60	31				
Phase 2 Natural Soils	TP46	1.5 to 2.0	GRAVELLY SAND	10	45	45				
	TP52	0.3 to 0.7	SAND	10	82	8				
Stockpiles	TP54	0 to 0.2	FILL: SILTY GRAVELLY SAND	14	49	37	NO	NP	0	0.7
	TP56	0.5 to 1.0	FILL: SILTY SAND	15	62	23				
	TP59	0.5 to 1.0	FILL: SILTY SAND	15	59	26				1.3
	TP60	0.5 to 1.0	FILL: SILTY GRAVELLY SAND	14	53	33				
	TP61	0.5 to 1.0	FILL: SILTY SANDY GRAVEL	13	38	49				
Phase 2 Natural Soils	TP64	0.7 to 1	CLAYEY SANDY GRAVEL	17	33	50	19	6	3	
	TP67	1 to 1.5	SAND	10	90	0				
	TP71	0.2 to 0.7	CLAYEY SAND	32	68	0	16	2	1	
	TP76	0.2 to 0.5	SILTY SAND	27	68	5	17	2	1	
	TP76	0.6 to 1	SILTY SANDY GRAVEL	16	40	44				

Note: LL – Liquid Limit, PI – Plasticity Index, LS – Linear shrinkage, OC – Organic Content

Table 4: Summary of Laboratory Compaction, CBR and Permeability Test Results

Area	Test Location	Sample Depth (m)	Soil Description	MMDD (t/m^3)	OMC (%)	Permeability (m/day)	Soil Category
Dredge Spoil	TP01	0 to 0.5	FILL: SAND	1.83	12.0	5.07	1
	TP01	1.0 to 1.5	FILL: SAND	1.85	12.0	3.02	1
	TP03	0 to 0.5	FILL: GRAVELLY SAND	2.08	6.5	4.49	1
	TP04	0.5 to 1.0	FILL: GRAVELLY SAND	1.85	13.0	10.02	1
	TP08	1.5 to 2.0	FILL: SAND	1.86	12.5	6.64	1
	TP09	1.0 to 1.5	FILL: SAND	1.84	12.5	7.77	1
	TP11	1.3 to 2.0	FILL: SAND	1.78	13.5	2.32	2
	TP12	0 to 0.4	FILL: SAND	1.78	9.5	6.23	1
	TP12	0.5 to 1.0	FILL: SAND	1.78	12.0	12.44	1
Phase 1 Natural Soils	TP13	0.5 to 1.0	SILTY GRAVELLY SAND CALCARENITE	2.11	9.5	0.03	5
	TP21	0.7 to 1.2	SILTY SAND	2.07	8.0		
	TP26	0.5 to 0.75	SILTY SAND	2.00	8.5		
	TP40	2.0 to 2.5	SAND	1.77	14.5		
Stock-piles	TP59	0.5 to 1.0	FILL: SILTY SAND	2.03	9.0	0.10	5
	TP61	0.5 to 1.0	FILL: SILTY SANDY GRAVEL	2.26	6.0	3.70	2
Phase 2 Natural Soils	TP76	0.2 to 0.5	SILTY SAND	2.11	8.5		
	TP76	0.6 to 1	SILTY SANDY GRAVEL	1.83	12.0		

Note: LL – Liquid Limit, PI – Plasticity Index, LS – Linear shrinkage, MMDD – Modified Maximum Dry Density, Optimum Moisture Content, Permeability testing undertaken at 99.5% to 100.5% of MMDD, Soil category is as per Table L1 of AS1547-2012.

Table 5: Summary of Laboratory Emerson Class and Chemical Test Results

Area	Test Location	Sample Depth (m)	Soil Description	ECN	EC (µS/cm)	PRI	ESP (%)
Dredge Spoil	TP01	1.0 to 1.5	FILL: SAND	4	550	3.27	<1
	TP03	2.0 to 2.5	SILTY GRAVEL	4	2900	36.9	67
	TP04	0.5 to 1.0	FILL: GRAVELLY SAND	4	79	3.26	<1
	TP08	1.5 to 2.0	FILL: SAND	4	610	4.75	<1
	TP10	1.5 to 2.0	FILL: SILTY GRAVELLY SAND	4	4900	79.6	63
	TP12	0 to 0.4	FILL: SAND	4	88	3.49	<1
	TP12	0.5 to 1.0	FILL: SAND	4	110	2.59	31
Phase 1 Natural Soils	TP13	0.5 to 1.0	SILTY GRAVELLY SAND / Calcarenite	4	4300	11.9	72
	TP17	0 to 0.5	SILTY SAND	4	880	18.6	<1
	TP21	0.7 to 1.2	SILTY SAND	4	2000	11	<1
	TP26	0.5 to 0.75	SILTY SAND	4	70	7.38	<1
	TP30	0.5 to 1.0	SILTY SAND	4	290	8.67	14
	TP36	0.5 to 1.0	SILTY SAND	4	240	23.3	29
	TP44	0.5 to 1.0	GRAVELLY SAND	4	150	14.1	50
Phase 2 Natural Soils	TP52	0.3 to 0.7	SAND	4	330	3.22	16
	TP76	0.2 to 0.5	SILTY SAND	4	1700	12.1	5

Note: ECN – Emerson Class number, EC – electrical conductivity, PRI – phosphorus retention index, ESP – exchangeable sodium percentage

5.3 Site Conditions

5.3.1 Site Surface Conditions

The site surface conditions are described in Section 3. The site is partly undeveloped land (vegetated with spinifex and occasional trees) and partly cleared / earth worked land as a result of construction of the adjacent Onslow airport. A ~0.5 ha area with stockpiles of fill is present in the southern portion of the site (generally over the proposed POS area in Phase 2). South of this stockpile area is a portion of the site which was previously developed with temporary accommodation. The general areas of the site described above are shown on Figure 2.

5.3.2 Geology

The Onslow sheet of the 1:250,000 scale geology series maps indicates that the area is underlain by coastal dunes, which can be interbedded with localised layers of calcarenite. We have noted the extension of mud flats below the surficial dunes in some areas adjacent to intertidal flats in other areas of Onslow.

Our investigation indicated that surficial dunes (if previously present) have been removed during borrow works at the site. Natural soils at the site typically comprise silty sand overlying calcarenite rock.

5.3.3 Sewage Sensitive Areas

The Department of Water and Environmental Regulation (DWER) maps the site as not being within a public drinking water source area (PDWSA).

The Department of Planning Lands and Heritage (DPLH) maps the site as not being a sewage sensitive area. However, several registered aboriginal heritage sites are present across the site.

Adjacent the southern boundary of Phase 2 is an evaporation pond operated by Onslow Salt. The evaporation ponds are routinely flooded with brine. Therefore, a setback will be required between effluent disposal systems and the evaporation ponds.

5.3.4 Subsurface Soil Conditions

The subsurface soil conditions for the general areas indicated on Figure 2 are summarised below. A detailed description of the soil types across the site can be found on the test pit reports presented in Appendix C.

NORTHERN DREDGE SPOIL AREA (TP01 to TP12)

NOTE: this area is not proposed for effluent disposal, however fill sourced from this area is currently proposed to elevate the site surface levels across Phase 1 and Phase 2 areas.

- **FILL: GRAVELLY SAND / SAND (SP)** – fine to coarse grained, sub-angular to sub-rounded, typically brown, variable content of fine to coarse grained, sub-angular to sub-rounded gravel, trace fines, with shell fragments, present from the ground surface maximum depth of investigation of 2.5 m; Includes
- **LAYERS / ZONES OF FILL: SILTY SANDY GRAVEL / SILTY SAND (SM / GM)** - fine to medium grained, sub-angular to sub-rounded, typically brown, variable content of fine to coarse grained, sub-angular to sub-rounded gravel, encountered in TP03 (2.0m to 2.5m, possibly natural ground), TP06 (2.0m to 2.5m, possibly natural ground), TP07 (2.0m to 2.5m, possibly natural ground) and TP10 (0.5 m to 2.0m). ***LIKELY MATERIAL IS A SANDY SILT WITHIN AREA DENOTED AS 'CLAYEY DREDGE' ON FIGURE 2 (refer Photograph 7, Appendix B).***

NORTH AND WESTERN ZONE OF NATURAL GROUND (TP13 to TP20, TP22, TP23, TP26, TP30, TP31, TP40, TP41, TP47, TP48 and TP67)

Natural soils present in generally undisturbed areas. Generally thicker sandy soil overlying rock.

- **SAND / SILTY SAND (SP / SM)** – fine to medium grained, sub-angular to sub-rounded, typically brown and red brown, typically trace gravel, some gravelly zones, trace shell fragments, trace / with roots in some surficial zones, variable fines content, some zones of Sandy SILT in TP18, DCP testing indicates soil is typically medium dense to very dense with some surficial loose layers, present from the ground surface to depths of between 0.2 m and greater than 2.8 m, layer generally becomes thicker to the west; overlying
- **SANDSTONE / CALCARENITE** – fine to medium grained, typically white and red brown (soil), surficial layers are generally a mixture of cobbles / boulders and typically Gravelly Silty SAND / Silty Sandy GRAVEL soils, typically medium with some high strength rock at refusal depths, some weathering of surficial layers. Test pits generally refused within unit (excavation with 9 tonne backhoe).

INFERRED AIRPORT BORROW AREA (TP21, TP24, TP25, TP28, TP29, TP32 to TP39, TP42 to TP45 and TP49)

Natural soils present below upper horizon which was excavated away and used for fill on the Onslow airport redevelopment. Generally thinner sandy and gravelly soil overlying rock.

- **SILTY SAND / SAND / GRAVELLY SAND / SANDY GRAVEL / SILTY SANDY GRAVEL (SP / SM / GP / GM)** – sand is fine to medium grained, sub-angular to sub-rounded, typically brown and red brown, variable gravel content, generally becomes more gravelly near interface with underlying sandstone / calcarenite, trace shell fragments, trace / with roots in some surficial zones, variable fines content, DCP's typically refuse in unit, present from the ground surface to depths of between 0.3 m to 1.4 m, not encountered in TP45, over 2.5 m thick in TP42; overlying
- **SANDSTONE / CALCARENITE** – fine to medium grained, typically white (rock) and red brown (soil), surficial layers are generally a mixture of cobbles / boulders and typically Gravelly Silty SAND / Silty Sandy GRAVEL soils, typically medium with some high strength rock at refusal depths, some weathering of surficial layers, Testpits generally refuse within unit.

SOUTH EASTERN ZONE OF NATURAL GROUND (TP46, TP50 to TP53, TP64, TP65, TP70 and TP72 to TP76)

Natural soils present in generally undisturbed areas. Generally thicker sandy and gravelly soil overlying rock.

- **SILTY SAND / SAND / GRAVELLY SAND / SANDY GRAVEL / SILTY SANDY GRAVEL (SP / SM / GP / GM)** – sand is fine to medium grained, sub-angular to sub-rounded, typically brown and red brown, variable gravel content, generally becomes more gravelly near interface with underlying sandstone / calcarenite, trace shell fragments, trace / with roots in some surficial zones, variable fines content, fines generally become clayey in TP64, TP65, TP70, TP73, TP74, and TP75, DCP testing indicates soil is typically medium dense to very dense, present from the ground surface to depths of between 0.1 m to over 2.5 m; overlying
- **SANDSTONE / CALCARENITE** – fine to medium grained, typically white (rock) and red brown (soil), surficial layers are generally a mixture of cobbles / boulders and typically Gravelly Silty SAND / Silty Sandy GRAVEL soils, typically medium with some high strength rock at refusal depths, some weathering of surficial layers. Test pits generally refuse within unit.

FILL STOCKPILE AREA IN SOUTHERN PORTION OF SITE (TP54 to TP63)

Stockpiles of material apparently derived from demolition and construction activities at the Onlsow Airport.

- **FILL: SILTY SAND / SANDY GRAVEL / SILTY SANDY GRAVEL (SM / GP / GM**) – sand is fine to medium grained, sub-angular to sub-rounded, typically brown, variable gravel content, trace shell fragments, trace roots in some zones, trace plastic, etc… variable fines content, variable cobble content, typically very loose to medium dense, **IN TP55, TP58, TP60 AND TP63: FILL IS A MIXTURE OF ABOVE SOIL UNITS AND ABOUT 10% TO 70% CALCARENITE COBBLES / BOULDERS.**

OLD ACCOMODATION AREA IN SOUTHERN PORTION OF SITE (TP66, TP68, TP69, TP71)

This area has been levelled and pavements are present. Soils typically natural sandy and gravelly soils overlying rock.

- **SILTY SAND / CLAYEY SAND / GRAVELLY SAND / SANDY GRAVEL / CLAYEY SANDY GRAVEL (SP / SM / SC / GP / GC)** – sand is fine to medium grained, sub-angular to sub-rounded, typically brown, variable gravel content, generally becomes more gravelly near interface with underlying sandstone / calcarenite, trace shell fragments, trace / with roots in some surficial zones, variable fines content, fines are low plasticity clays and silts, DCP's indicate soil is typically medium dense to very dense, present from the ground surface to depths of between 0.7 m to over 2 m; overlying
- **SANDSTONE / CALCARENITE** – fine to medium grained, typically white (rock) and red brown (soil), surficial layers are generally a mixture of cobbles / boulders and typically Gravelly Silty SAND / Silty Sandy GRAVEL soils, typically medium with some high strength rock at refusal depths, some weathering of surficial layers. Test pits generally refuse within unit.

5.3.5 Surface Water

5.3.5.1 Available Surface Water Information

Based on our review of historical aerial imagery, the lower elevation salt evaporation ponds to the south of the site can become inundated with water / brine. This appears to be at a lower elevation than the site surface and probably not more than about RL 2 m AHD.

Draft Surface Water Management Plan (SWMP) by GHD

We have been provided with a draft SWMP prepared by GHD (dated 26 October 2020) which has been relied upon. The report recommends all habitable floor levels are to be set at a minimum of RL 3.5 m AHD. This level accounts for the expected 1% AEP storm surge water level with sea level rise in 2070 of RL 2.99 m AHD, plus a 0.5 m freeboard. Table 5 of the draft SWMP gives tailwater constraint flood levels as presented below.

Table 6: Tailwater Constraints presented as Table 5 in Draft SWMP report dated 26 October 2020

AEP (1 in X year and % exceedance)	2015 present day Water Level (m AHD)	2070 climate change Water Level (m AHD)
10 (10%)	1.79	2.19
100 (1%)	2.41	2.99

5.3.5.2 Recommended Design Surface Water Levels

AS/NZS 1547:2012 recommends that effluent disposal systems are designed to the 1 in 20 year flood level. Based on the draft SWMP provided (refer Section 5.3.6.1), a surface water flood level of RL 2.19 m AHD is considered to be conservative. This level should not preclude the development described in Section 3, which indicates Phase 1 lot levels about RL 4.9 m AHD.

Stormwater must be diverted away from the development so that groundwater levels do not locally exceed the level recommended above. Stormwater must be diverted away from effluent disposal systems.

5.3.6 Groundwater

5.3.6.1 Available Groundwater Information

Published Groundwater levels

We are not aware of any published groundwater levels for the site.

Observations During Site Investigation

A summary of the groundwater depths and elevations recorded at monitoring well locations between 13 March and 16 March 2022 are presented in the table below.

Table 7: Groundwater Levels at Test Locations (March 2022)

Test Location	Estimated Surface Elevation (RL m AHD)	Depth to Groundwater (m below ground)	Estimated Groundwater Elevation (RL m AHD)
TP14	2.8	1.32 to 1.35	1.5
TP31	3.0	0.94 to 1.11	1.9
TP42	4.3	2.52 to 2.53	1.8
TP52	3.2	Dry (> 0.86)	<2.3
TP72	4.4	Dry (> 1.64)	<2.8

NOTES:
1. Surface elevation estimated from supplied survey information.
2. Only test locations where groundwater encountered are listed.
3. Water levels measured in standpipes between 13 March and 16 March 2022.
4. Standpipes not installed deeper at TP52 and TP72 due to refusal on rock and partial collapse of the pits during attempted installation of standpipes.

The results of the field testing indicate that the groundwater level is generally higher in the west, falling towards the east (where low-lying areas and tidal creeks are present to the east of the airport).

5.3.6.2 Recommended Design Groundwater Levels

We note that the site was relatively dry at the time of our investigation (summer). There are no defined 'wet' seasons in the Onslow area and groundwater levels are likely to respond to (isolated) rainfall events.

Given the findings of our study (groundwater present at RL 1.5 m to RL 1.9 m AHD) and the 10% AEP surface water level as presented in the GHD SWMP (RL 1.79 m AHD - which indicates that groundwater is unlikely to be driven higher on a regular basis due to surface water flooding), we consider that a design groundwater level of RL 1.9 m AHD can be assumed across the site for the purposes of effluent disposal.

5.3.7 Acid Sulfate Soils

Publicly available acid sulfate soils (ASS) mapping shows that the site has a moderate to low risk of ASS within 3 m of the ground surface. Testing done by Galt indicates that soils at the site (including the proposed fill) are non-ASS. Therefore disturbance of ASS is not expected.

5.4 Proposed Development

5.4.1 Earthworks

We understand the proposed development will involve stripping vegetation from the site and cut / filling of the site to the design lot levels. It is anticipated that filling is required over most of the site to achieve design lot levels.

For Phase 1, we understand that cut is generally required in areas of natural ground (up to about 1m), and filling is required over most of the site (generally up to about 0.5 m) to achieve a design lot level of about RL 4.9 m AHD. Deeper filling (about 1 m) is required in the north eastern and south western portions of the site. Fill materials will include:

- In situ sandy soils cut from areas of natural ground;
- Sand from stockpiles of dredge fill to the north west of the site (refer Figure 1). Pockets of clay dredge fill are not to be used; and
- Imported sand fill (if required).

Civil design is required so that stormwater is diverted away from the development. Stormwater must be diverted away from effluent disposal systems.

5.4.2 Groundwater Control

We understand that groundwater is to be controlled by raising lots above flood levels and diverting stormwater water away from the development.

Individual purchasers of lots are required to divert stormwater away from effluent disposal systems. Design of effluent disposal systems must consider the maximum groundwater levels presented in Section 5.3.6.2.

5.4.3 Land Application Area (LAA)

Land application areas (LAAs) must be constrained to a minimum of 100 m away from flooded areas. This will include flooding in the Onslow Salt evaporation ponds adjacent the southern site boundary of the Phase 2 site.

Individual LAAs on each lot must be compliant with the WA State Government sewerage guidelines in terms of setbacks from boundaries and buildings. As individual developments are not yet proposed (and will be done by individual lot purchasers), the LAAs will be selected at a later date by the purchaser with reference to the sewerage guidelines.

5.5 Site Suitability

Based on the development earthworks described at Section 3, most of the site is considered suitable for effluent disposal. Low permeability soils encountered in the southern portion of the Phase 2 site may require relatively large disposal areas.

Based on the results of our infiltration and permeameter testing, the ASNZ1547-2012 soil category for the various soils at the site are summarised as follows (refer Figure 2):

- ***Northern dredge spoil area:***
  - **FILL: Gravelly SAND / SAND (SP)** – Soil Category 1 to 2. Material is suitable for reuse as fill within the development; fill Includes
  - **LAYERS / ZONES OF FILL: Silty Sandy GRAVEL / Silty SAND / Sandy SILT (SM / GM)** – Although not tested, material likely to be Soil Category 4 to Category 6. Silty/clayey dredge spoils are not to be used as fill in the proposed development. As noted in Section 5.3.4, material encountered in TP03, TP06

and TP07 (from 2.0m to 2.5m, possibly natural ground) and TP10 (0.5 m to 2.0m). It is judged that Sandy SILT is present within area denoted as '*clayey dredge*' on Figure 2.

- ***Phase 1 site and northern portion of Phase 2 site:*** Soil Category 4 is considered appropriate for the insitu SAND / Silty SAND and GRAVEL soils overlying SANDSTONE / CALCARENITE encountered in this area. However, laboratory testing indicates that the silty sand and surficial layers of sandstone / calcarenite are Soil Category 5 when recompacted to about 100 % of MMDD. The reuse of insitu materials as fill is therefore not recommended.
- ***Southern Portion of Phase 2 Site (TP64 to TP66, TP70 to TP76):*** Soil Category 5 to 6 is considered appropriate for the typically Clayey SAND insitu soils encountered in this area.
- ***Fill stockpile area in southern portion of site:*** Laboratory testing on recompacted FILL: Silty SAND / Silty Sandy GRAVEL samples indicate variable permeability with Soil Category of 2 to 5. The reuse of this material as fill is not recommended unless the silty materials can be separated from sand stockpiles. The fill must also be screened to remove oversize inclusions (boulders, construction/demolition debris, etc).

The specific soil category will depend on the earthworks done and the sand used at each given discharge area (which is not yet known as earthworks have not taken place). Site-specific testing can be done to assess individual development lots once the disposal areas or known. Provided low permeability fill materials are not used:

- **Phase 1 and Northern Portion of Phase 2 Site**: A Soil Category of 4 is considered achievable. Any fill placed within the surficial 0.6 m of the ground surface must be Soil Category 1 to 2.
- **Southern Portion of Phase 2 Site (TP64 to TP66, TP70 to TP76):** A Soil Category of 5 to 6 is considered appropriate.

Laboratory testing indicates that the soils at the site may be somewhat erodible (due to electrical conductivity and ESP results, noting that the Emerson Class numbers indicate that the soil is non-dispersive), however the proposed subdivision will be essentially flat with minimal slopes/batters. Accordingly, the discharge of effluent into the natural soils and fill is not expected to cause any significant erosion.

We recommend that the base of any treated effluent discharge elements is no lower than RL 3.4 m AHD (1.5 m above the design groundwater level presented in Section 5.3.6.2). Civil design is required so that stormwater is diverted both away from the development and away from LAA within each lot.

Table L1 of AS1547-2012 indicates that ETA/ETS beds and trenches are suitable for Category 4 soils. Secondary treatment of effluent would be required in the southern portion of the Phase 2 Site where some Category 5 soils were encountered.

The PRI values for the soils at the site are variable but typically low. However there are no receiving water bodies within the immediate vicinity of the site and therefore soil amendment is not considered to be necessary, provided that secondary treatment of effluent is undertaken.

The development at the site (light industrial and industrial) is not understood to require groundwater for drinking water.

We understand that drainage swales will be used in road reserves and Onslow salt brine ponds to the south of the site are routinely flooded. Disposal sites must be selected in lots to be a minimum of 100 m away from any flood zone or swale. Building envelopes and other exclusion areas cannot be developed at this stage and must be assessed by individual proponents based on their particular development.

Assuming a typical industrial use for the lots, an Aquarius O2-NR system (which includes secondary treatment) is recommended, sized appropriate to the wastewater yield specific to the proposed development. ETA/ETS beds and trenches discharging into a suitably located LAA (with reference to the Government Sewerage Policy 2019 and the LAA exclusion areas discussed above).

On the basis of the above, we have evaluated the various site constraints in accordance with AS1547, as presented in Table 8 below.

Table 8: Site and Soil Risk-Based Assessment (AS1547)

Characteristic	Level of Constraint	Mitigation Measures
Climate	Low	None required.
Exposure	Low	-
Vegetation	Low	-
Landform & Drainage	Low	-
Slope	Low	-
Fill (Imported)	Moderate	Secondary treatment to account for low PRI fill
Surface Gravel and Rock Outcrops	Moderate	Some gravelly areas, can be treated during earthworks preparation at the site.
Erosion Potential	Low	-
Separation from Groundwater	Moderate	Low-lying areas of the site to be filled to increase separation to groundwater (required for flood mitigation in any case).
PDWSAs and SSAs	Low	-
Surface Water	Low	Offset required from brine ponds to the south of Phase 2
Rainfall Run-on	Moderate	Need for diversion of stormwater from leach drains and treatment units.
Flood Potential	Low	Site to be raised to be lifted above flood levels.
Available LAA	N/A	Site specific, to be addressed at a later stage.
Sufficient Profile Depth	Low	-
Depth to water table	Moderate	Some low lying areas of the site need to be filled, however this is already planned.
Coarse Fragments	Moderate	LAA may intersect rock in some areas, however rock is permeable and can also be ripped during preparation works if required.
Soil Colour & Mottling	Low	-
Soil Permeability and Design Loading Rates	Low-Moderate	Localised low permeability areas (primarily in Phase 2) need to have LAAs designed to suit.
pH	Low	Natural and soil pH 7-9, not expected to have a substantial impact given landform.
Dispersion	Low	-
Electrical Conductivity	Low	-
Sodicity	Moderate	Locally high ESP on natural soils and some fill, however Emerson class results indicate that the soil is non-dispersive.
Phosphorus adsorption	Moderate	Generally low PRI soils (natural and fill), secondary treatment is required.

We consider that all of the constraints at the site can be appropriately mitigated at the site using the risk-based approach outlined in AS1547-2012.

6. CLOSURE

We draw your attention to Appendix G of this report, “Understanding your Report”. The information provided within is intended to inform you as to what your realistic expectations of this report should be.

GALT GEOTECHNICS PTY LTD

Owen Woodland CPEng
Geotechnical Engineer

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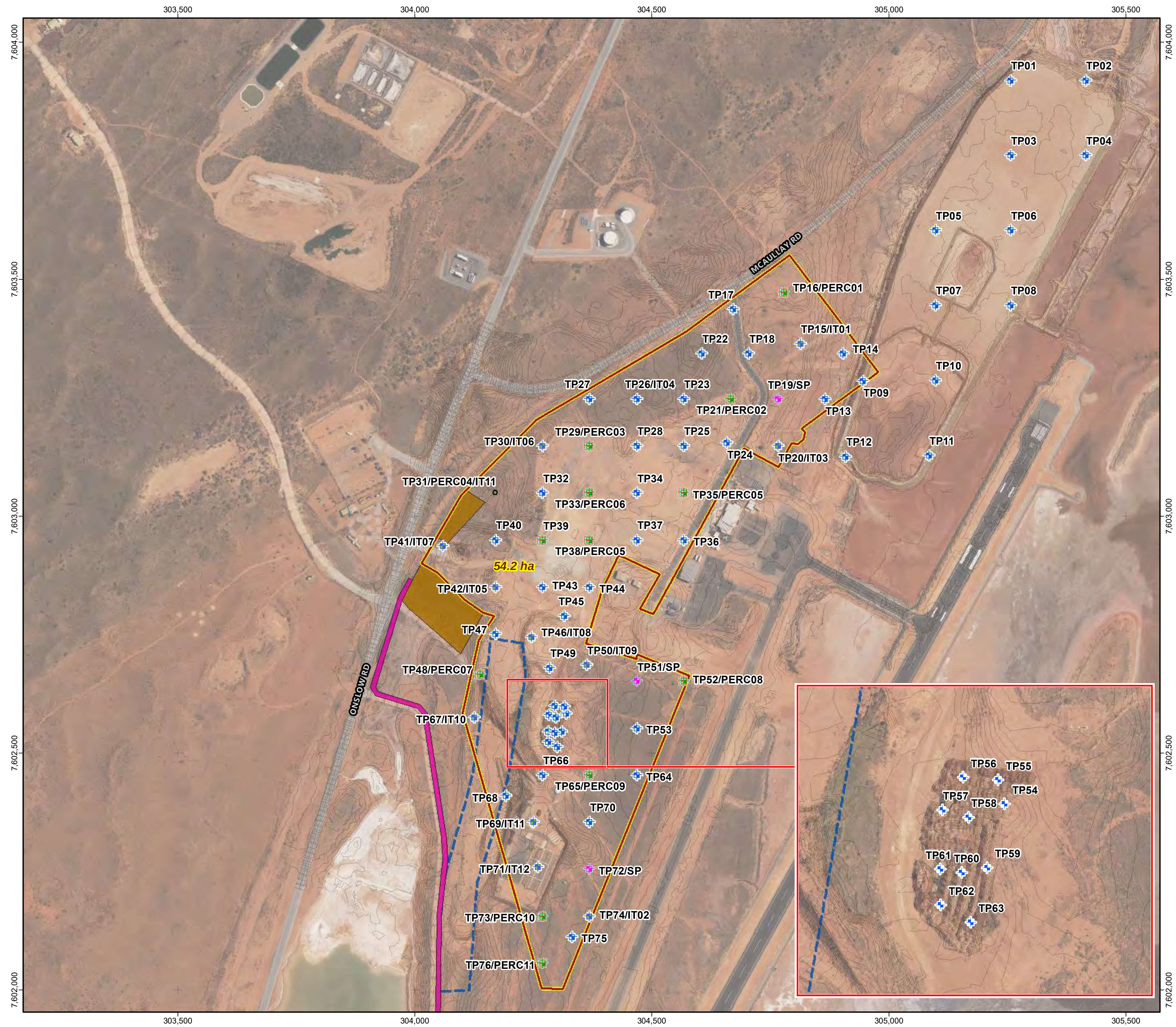
Figures

Attachment 15.1A - Proposed Development - Onslow Industrial Park



Legend

- Site Boundary
- Test Pit
- Test Pit / Infiltration Test
- Test Pit / Percolation Test
- Test Pit / Percolation Test / Infiltration Test
- Test Pit with Standpipe
- ACM Pipeline Corridor
- Indigenous Heritage
- Shell Scatter

N

0 130 260 390 520 650
Meters

NOTES
Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:8,000	(A3)
DRAWN	DAC	
DATE DRAWN	14/04/2022	
CHECKED	TM	
DATE CHECKED	11/04/2022	
PROJECTION	GDA 1994 MGA Zone 50	

Galt GEOTECHNICS

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CLIENT	SHIRE OF ASHBURTON
PROJECT	ONSLOW INDUSTRIAL PARK (PHASE 1 AND 2)
LOCATION	LOT 201 ONSLOW ROAD ONSLOW
TITLE	SITE & LOCATION PLAN
Job No	J2201059
Fig No	FIGURE 1
Rev	A

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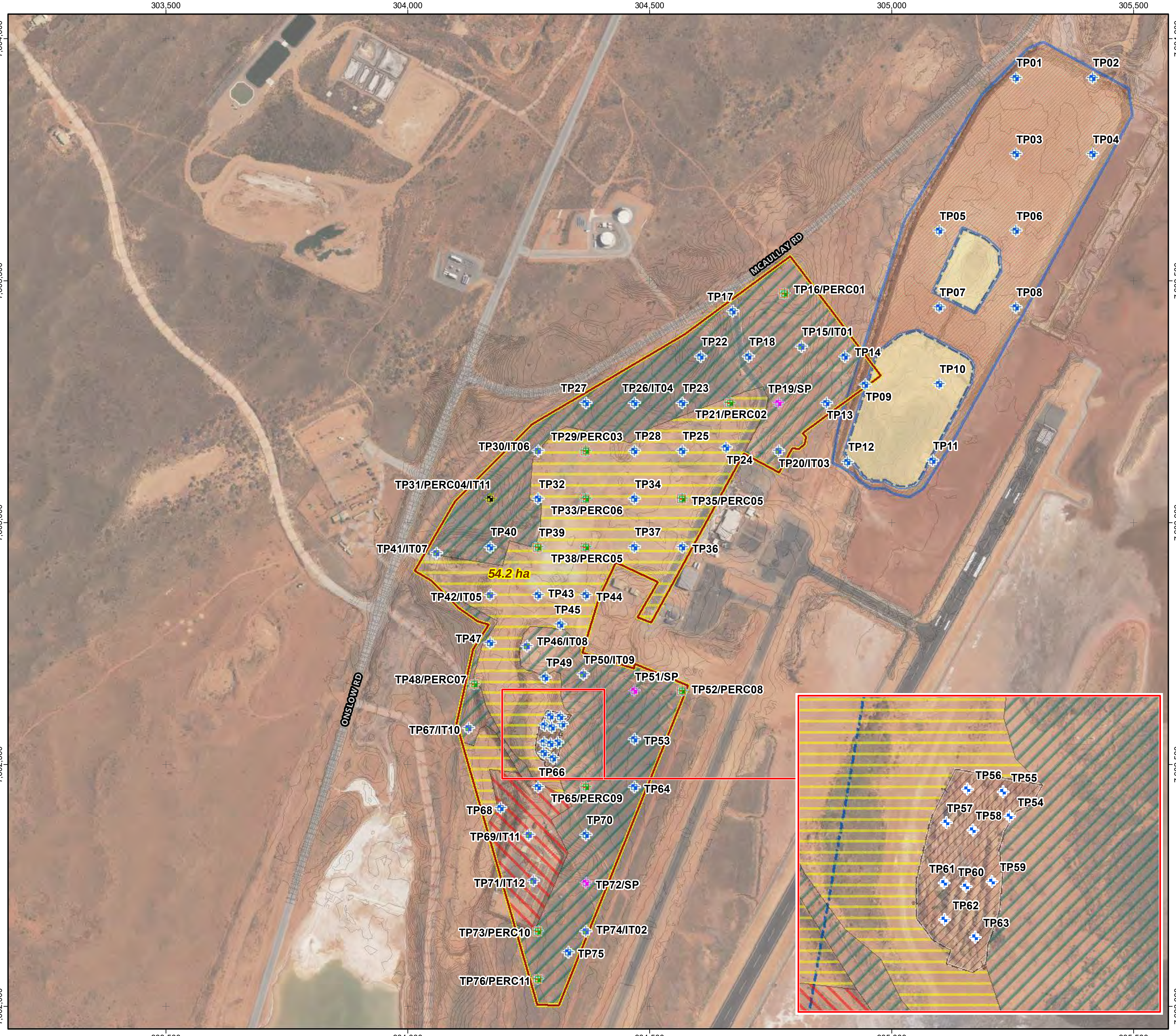

Legend

- Site Boundary
- Test Pit
- Test Pit / Infiltration Test
- Test Pit / Percolation Test
- Test Pit / Percolation Test / Infiltration Test
- Test Pit with Standpipe
- Clayey Dredge
- Dredge spoil stockpile location
- Fill stockpiles
- Inferred airport borrow area
- Natural Ground
- Old Accomodation

N

0 130 260 390 520 650
Meters

NOTES
Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:8,000	(A3)
DRAWN	DAC	
DATE DRAWN	14/04/2022	
CHECKED	TM	
DATE CHECKED	11/04/2022	
PROJECTION	GDA 1994 MGA Zone 50	

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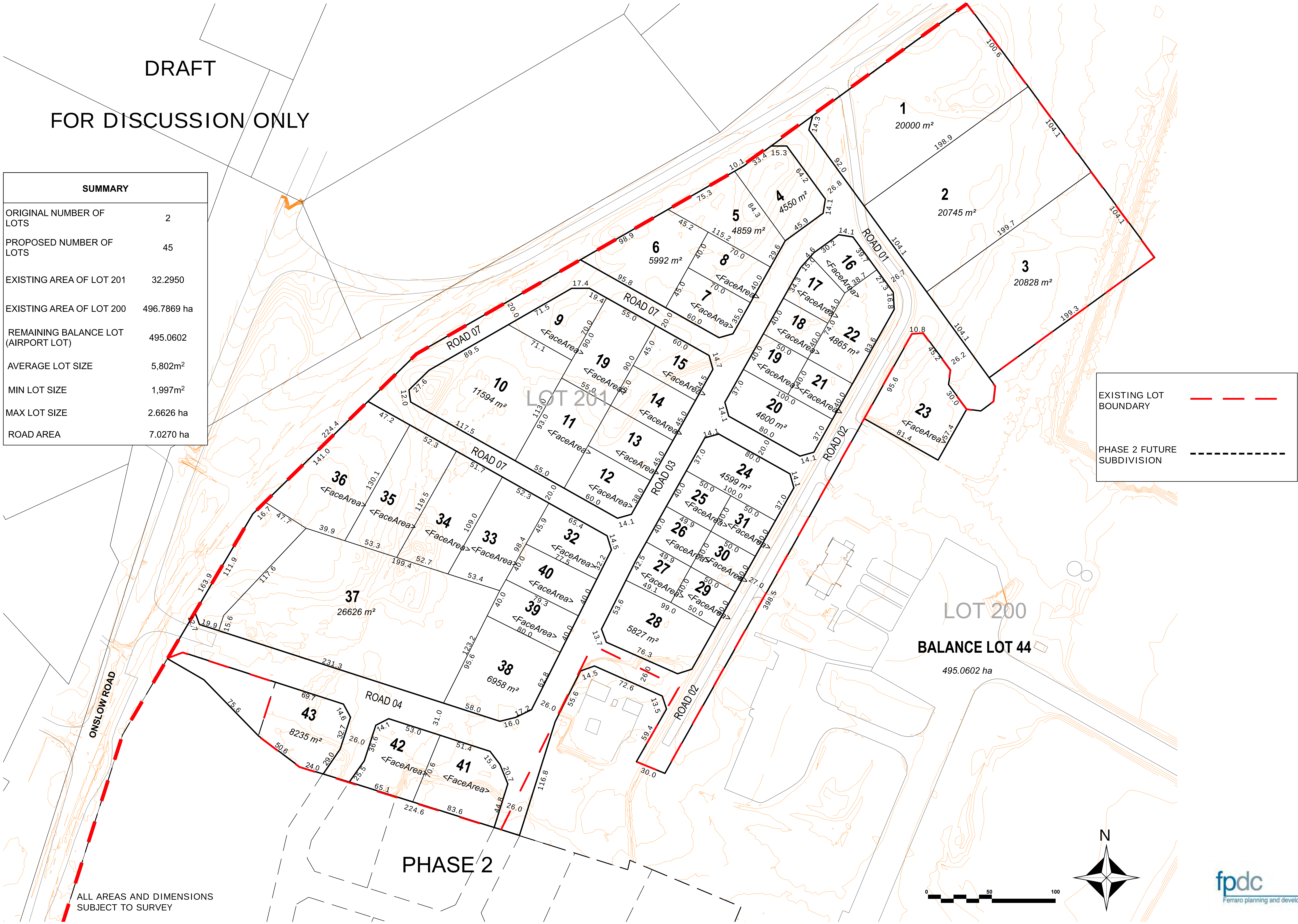
CLIENT	SHIRE OF ASHBURTON
PROJECT	ONSLOW INDUSTRIAL PARK (PHASE 1 AND 2)
LOCATION	LOT 201 ONSLOW ROAD ONSLOW
TITLE	ZONES
Job No	J2201059
Fig No	FIGURE 2
Rev	A

Appendix A: Concept Plans

SUMMARY

ORIGINAL NUMBER OF LOTS	2
PROPOSED NUMBER OF LOTS	45
EXISTING AREA OF LOT 201	32.2950
EXISTING AREA OF LOT 200	496.7869 ha
REMAINING BALANCE LOT (AIRPORT LOT)	495.0602
AVERAGE LOT SIZE	5,802m^2
MIN LOT SIZE	1,997m^2
MAX LOT SIZE	2.6626 ha
ROAD AREA	7.0270 ha

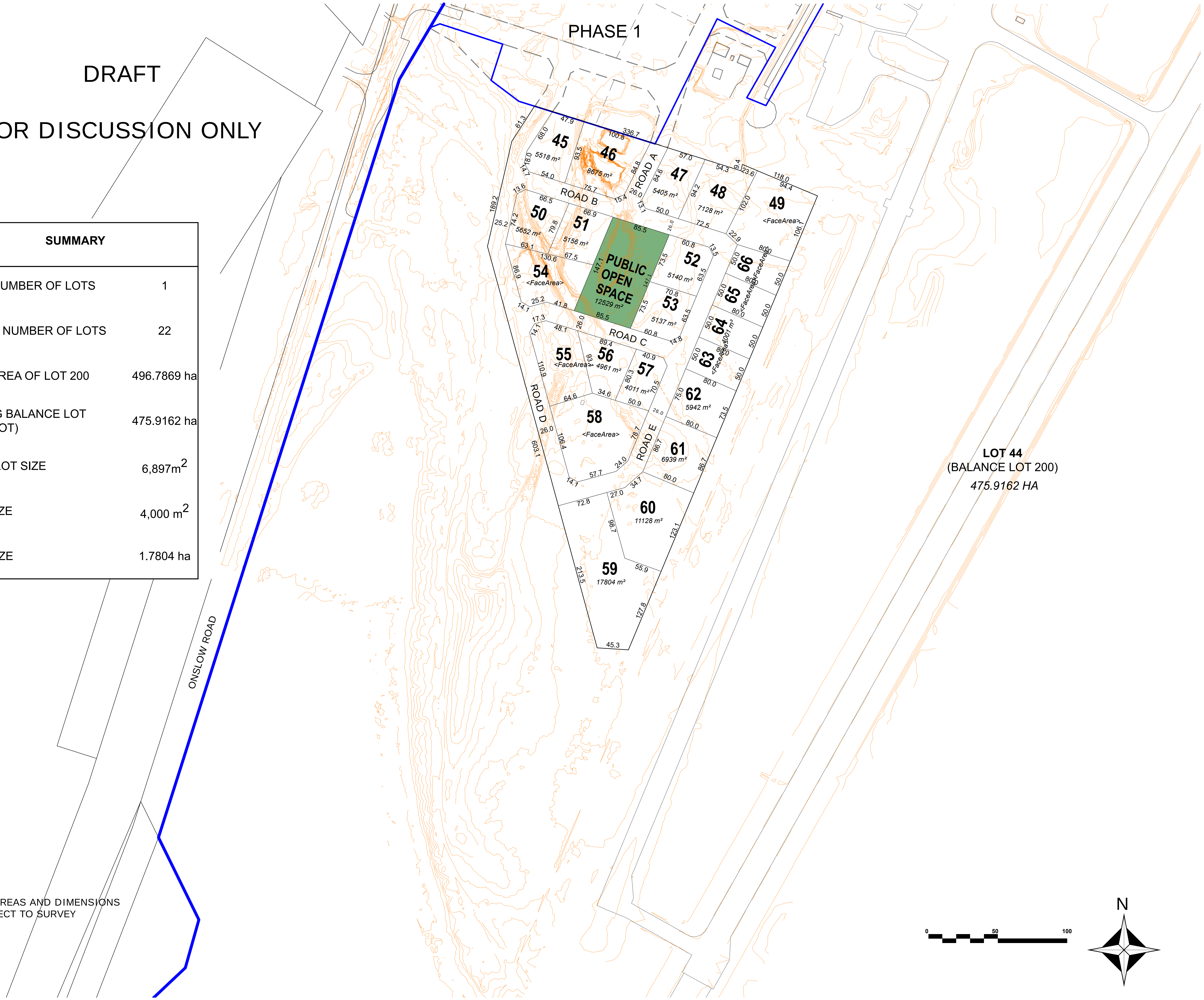


DRAWN	13 OCT 2021
REVISION	A: 18 OCT 2021
DRAWN BY	EF
SCALE	1:2,000 @ A2
LG	ASHBURTON

FIGURE 1.8 **ONSLOW INDUSTRIAL PARK PHASE 1 - PLAN OF SUBDIVISION**

DRAFT

FOR DISCUSSION ONLY



SUMMARY	
ORIGINAL NUMBER OF LOTS	1
PROPOSED NUMBER OF LOTS	22
EXISTING AREA OF LOT 200	496.7869 ha
REMAINING BALANCE LOT (AIRPORT LOT)	475.9162 ha
AVERAGE LOT SIZE	6,897m^2
MIN LOT SIZE	4,000 m^2
MAX LOT SIZE	1.7804 ha

fpdc
Ferraro planning and development consultancy

DRAWN	14 OCTOBER 2021
REVISION	C: 5 NOVEMBER 2021
DRAWN BY	EF
SCALE	1:4,000 @ A2
LG	ASHBURTON

FIGURE 2.5 ONSLOW INDUSTRIAL PARK PHASE 2 - PLAN OF SUBDIVISION

Appendix B: Site Photographs

Photograph 1: TP43 Area excavated for construction of adjacent airport

Photograph 2: TP22 Area of natural ground in northern portion of site

Photograph 3: TP64 Area of natural ground in southern portion of site

Photograph 4: Stockpiles of fill in southern portion of site

Photograph 5: near TP69, within old accommodation area

Photograph 6: Clayey dredge fill near TP12

Photograph 7: Sandy dredge fill near TP01

Appendix C: Test Pit Reports

METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

Galt GEOTECHNICS

GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

Graphic	USCS	Soil Name	Graphic	USCS	Soil Name
		FILL (various types)		SM	Silty SAND
		COBBLES / BOULDERS		ML	SILT (low liquid limit)
	GP	GRAVEL (poorly graded)		MH	SILT (high liquid limit)
	GW	GRAVEL (well graded)		CL	CLAY (low plasticity)
	GC	Clayey GRAVEL		CI	CLAY (medium plasticity)
	GM	Silty GRAVEL		CH	CLAY (high plasticity)
	SP	SAND (poorly graded)		OL	Organic SILT (low liquid limit)
	SW	SAND (well graded)		OH	Organic SILT (high liquid limit)
	SC	Clayey SAND		Pt	PEAT

NOTE: Dual classification given for soils with a fines content between 5% and 12%.

SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

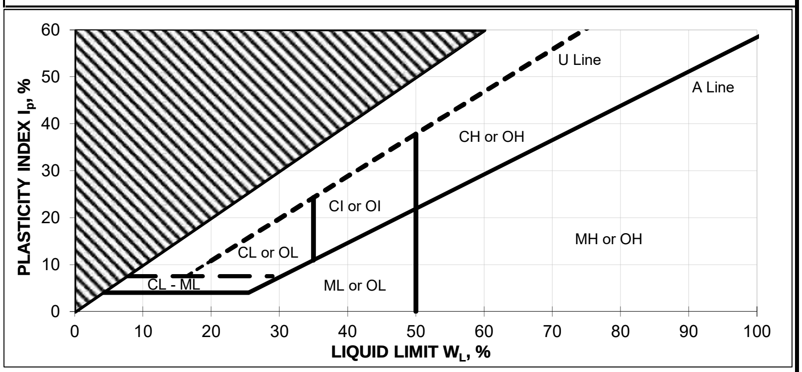
Soil descriptions are based on AS1726-2017. Material properties are assessed in the field by visual/tactile methods in combination with field and laboratory testing techniques (where used).

NOTE: AS 1726-2017 defines a fine grained soil where the total dry mass of fine fractions (<0.075 mm particle size) exceeds 35%.

PARTICLE SIZE

Soil Name		Particle Size (mm)
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	19 to 63
	Medium	6.7 to 19
	Fine	2.3 to 6.7
SAND	Coarse	0.6 to 2.36
	Medium	0.21 to 0.6
	Fine	0.075 to 0.21
FINES	SILT	0.002 to 0.075
	CLAY	<0.002

PLASTICITY - MODIFIED CASAGRANDE CHART - AS1726-2017



RESISTANCE TO EXCAVATION

Symbol	Term	Description
VE	Very easy	All resistances are relative to the selected method of excavation
E	Easy	
F	Firm	
H	Hard	
VH	Very hard	

MOISTURE CONDITION

Symbol	Term
D	Dry
M	Moist
W	Wet

CEMENTATION

Cementation	Description
Weakly cemented	Soil may be easily disaggregated by hand in air or water
Moderately cemented	Effort is required to disaggregate the soil by hand in air or water

CONSISTENCY

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

ORGANIC SOILS

Material	Organic Content % of dry mass
Inorganic soil	<2%
Organic soil	2% to 25%
Peat	>25%

DENSITY

Symbol	Term	Density Index (%)
VL	Very Loose	<15
L	Loose	15 to 35
MD	Medium Dense	35 to 65
D	Dense	65 to 85
VD	Very Dense	>85

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

Galt GEOTECHNICS

METHOD OF DRILLING OR EXCAVATION

AC	Air Core	E	Excavator	PQ3	PQ3 Core Barrel
AD/T	Auger Drilling with TC-Bit	EH	Excavator with Hammer	PT	Push Tube
AD/V	Auger Drilling with V-Bit	HA	Hand Auger	R	Ripper
AT	Air Track	HMLC	HMLC Core Barrel	RR	Rock Roller
B	Bulldozer Blade	HQ3	HQ3 Core Barrel	SON	Sonic Rig
BH	Backhoe Bucket	N	Natural Exposure	SPT	Driven SPT
CT	Cable Tool	NMLC	NMLC Core Barrel	WB	Washbore
DT	Diatube	PP	Push Probe	X	Existing Excavation

SUPPORT

T Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

VE	Very Easy	E	Easy	F	Firm
H	Hard	VH	Very Hard		

WATER

►	Water Inflow	▼	Water Level
◄	Water Loss (complete)		
◁	Water Loss (partial)		

SAMPLING AND TESTING

B	Bulk Disturbed Sample	P	Piston Sample
BLK	Block Sample	PBT	Plate Bearing Test
C	Core Sample	U	Undisturbed Push-in Sample
CBR	CBR Mould Sample		U50: 50 mm diameter
D	Small Disturbed Sample	SPT	Standard Penetration Test
ES	Environmental Soil Sample		Example: 3, 4, 5 N=9
EW	Environmental Water Sample		3,4,5: Blows per 150 mm
G	Gas Sample		N=9: Blows per 300 mm after
HP	Hand Penetrometer		150 mm seating interval
LB	Large Bulk Disturbed Sample	VS	Vane Shear; P = Peak
M	Mazier Type Sample		R = Remoulded (kPa)
MC	Moisture Content Sample	W	Water Sample

ROCK CORE RECOVERY

TCR = Total Core Recovery (%) $= \frac{CRL}{TCL} \times 100$

RQD = Rock Quality Designation (%) $= \frac{ALC>100}{TCL} \times 100$

TCL	Length of Core Run
CRL	Length of Core Recovered
ALC>100	Total Length of Axial Lengths of Core Greater than 100 mm Long

Galt GEOTECHNICS

TEST PIT: TP01

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**		**Date:**	12/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0		B(TP01-1)			SP	FILL: SAND, fine to coarse grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, with sub-angular to sub-rounded gravel, with shell fragments, trace fines	D	VD	TP01/0.00		
			0.5							D - M		TP01-1 TP01/0.50		
			1.0		B(TP01-2)							TP01/1.00		
			1.5									TP01-2 TP01/1.50		
			2.0									TP01/2.00		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered			TP01/2.50		
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP02

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 12/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	FILL: Gravelly SAND, fine to coarse grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, sub-angular to sub-rounded gravel (30%), trace fines, shell fragments	D	VD			
			0.5		B(TP02-2)			SP	FILL: SAND with Gravel, fine to coarse grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, sub-angular to sub-rounded Gravel (10-15%), trace fines	D - M		TP02-PRI		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log GH_EXCAVATION J2201059.GPJ <<DrawingFile>> 14/04/2022 07:45 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

TEST PIT: TP03

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	12/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 0.8		B(TP03-1)			SP	FILL: Gravelly SAND, fine to medium grained, sub-angular to sub-rounded, pale brown, grey and white, fine to medium grained, sub-angular to sub-rounded gravel, trace fines and shells		VD	TP03/0.00 TP03-1 TP03/0.50		
			0.8 – 2.0					SP	FILL: SAND with Gravel, fine to medium grained, sub-angular to sub-rounded pale brown, fine to medium grained, sub-angular to sub-rounded Gravel, trace fines			TP03/1.00 TP03/1.50		
			2.0 – 2.5		B(TP03-2)			GM	Silty GRAVEL: fine to medium grained, sub-angular to sub-rounded, dark brown/brown, with sand			TP03/2.00 TP03-2 TP03/2.50		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP04

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	12/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.5		B(TP04-1) (0.5 – 1.0)			SP	FILL: Gravelly SAND, fine to coarse grained, sub-angular to sub-rounded, pale brown, with shells, trace fines	D	VD	TP04/0.00 TP04/0.50 TP04-1 TP04/1.00 TP04/1.50 TP04/2.00 TP04/2.50		
			2.5 – 3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP05

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	12/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					GP	FILL: Sandy GRAVEL, fine to medium grained, sub-angular to sub-rounded pale brown/grey/white Gravel with pale brown soil, fine to medium grained, sub-angular to sub-rounded sand (20%), trace fines trace shells	D	D - VD			
			0.5						Becomes more sandy (30-35%)					
			1.5					SP	FILL: SAND with Gravel, fine to medium grained, sub-angular to sub-rounded, brown, fine to medium grained, sub-angular to sub-rounded Gravel (15%), trace shells	D - M				
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP06

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	12/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 1.0					GP	FILL: Sandy GRAVEL, fine to coarse grained, sub-angular to sub-rounded grey/pale brown/white Gravel with pale brown soil, fine to medium grained, sub-angular to sub-rounded sand, trace fines, trace shells	D	VD	TP06/0.00 TP06/0.50		
			1.0 – 2.0					SP	FILL: SAND with Gravel, fine to medium grained, sub-angular to sub-rounded, brown, fine to medium grained, sub-angular to sub-rounded Gravel (15%), trace fines	D - M		TP06/1.00 TP06/1.50		
			2.0 – 2.5					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, dark brown	M		TP06/2.00 TP06/2.50		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP07

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park
Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow
Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock
Date: 12/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					GP	FILL: Sandy GRAVEL, fine to coarse grained, sub-angular to sub-rounded pale brown/grey/white Gravel and pale brown soils, fine to medium grained, sub-angular to sub-rounded sand (20-30%), trace fines	D	VD			
			1.2					SP	FILL: SAND with Gravel, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to medium grained, sub-angular to sub-rounded Gravel (15%), trace fines	D - M				
			2.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, dark brown, trace Gravel	M				
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP08

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F	**Date:**	12/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	Backhoe		**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					GP	FILL: Sandy GRAVEL, fine to coarse grained, sub-angular to sub-rounded pale brown/white/grey Gravel and pale brown soils, fine to medium grained, sub-angular to sub-rounded sand (20-30%), trace shells	D	VD			
			0.5						Sand becomes brown	D - M				
			1.0					SP	FILL: SAND with Gravel, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to medium grained, sub-angular to sub-rounded Gravel (15-20%), trace fines					
			1.5		B(TP08-1)									
			2.0									TP08-1		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP09

Sheet 1 OF 1

Job Number: J2201059		**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	12/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 0.5					GP	FILL: Sandy GRAVEL, fine to coarse grained, sub-angular to sub-rounded, grey/pale brown/white Gravel and pale brown soils, fine to medium grained, sub-angular to sub-rounded sand (20%), trace shells	D	D - VD			
			0.5 – 1.0					SP	FILL: SAND with Gravel, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to medium grained, sub-angular to sub-rounded Gravel (15-20%), trace fines	D - M				
			1.0 – 2.5		B(TP09-1)				Gravel sized igneous rocks (basalt/dolerite) observed as gravel in soil			TP09-1		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP10

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 12/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow		**Logged:** PF
Project: Onslow Industrial Park		**Operator:** Colin	**Checked Date:** 13/04/2022
		Bucket: 600 mm wide rock	**Checked By:** TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 1.0		B(TP10-1) at 0.5			SP	FILL: SAND, fine to medium grained, sub-angular to sub-rounded, orange red/pale grey, trace fines, with gravel, trace shells		VL - MD	TP10-1		
			1.0 – 2.0		B(TP10-2) at 1.5			SM	FILL: Silty Gravelly SAND, fine to medium grained, sub-angular to sub-rounded, orange/red, fine to medium grained, sub-angular to sub-rounded gravel			TP10-2		
			2.0						Hole terminated at 2.00 m Target depth Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP11

Sheet 1 OF 1

Job Number: J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	12/03/2022
Client: Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project: Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
					Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 1.3		B(TP11-1)			SP	FILL: SAND with Gravel, fine to medium grained, sub-angular to sub-rounded, brown, fine to coarse grained, sub-angular to sub-rounded gravel, trace fines, trace shells	D	VD	TP11-1		
			1.3 – 2.0		B(TP11-2)				Trace cobbles and boulders, very minor isolated clayey material	D - M		TP11-2		
			2.0						Hole terminated at 2.00 m Refusal at test pit caves in Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP12

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 12/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.0		B(TP12-1); B(TP12-2)			SP	FILL: SAND with Gravel, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, sub-angular to sub-rounded gravel, trace fines	D	D to VD	TP12/0.00; TP12-1; TP12/0.50; TP12-2; TP12/1.00; TP12/1.50; TP12/2.00		
			1.5						Test pit caved					
			2.0						Hole terminated at 2.00 m Test pit keeps caving in on itself Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations


Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP13

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	08/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red brown, trace gravel, trace shell fragments, trace rootlets	D	VL - MD	TP13/0.00		
			0.5		B(TP13-1)				Highly Weathered (Distinctly) SANDSTONE/LIMESTONE with Silty SAND matrix observed as Silty Gravelly SAND, fine to medium grained, sub-angular to sub-rounded, white, fine to coarse grained, sub-angular to sub-rounded gravel		D - VD	TP13/0.50		
			1.0						Hole terminated at 1.00 m Refusal on hard rock Groundwater not encountered			TP13-1 TP13/1.00		
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP14

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	08/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red brown, trace gravel, trace shell fragments, trace roots	D	D			
			0.5						SANDSTONE/LIMESTONE: fine to medium grained, sub-angular to sub-rounded, white, with Silty SAND soil matrix as described above					
			1.0						Hole terminated at 1.00 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP15

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 08/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

Excavation					Sampling	Field Material Description								
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0 – 0.75					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red brown, silts (20-30%), low plasticity, trace gravel, trace fine roots	D	MD - VD			
E	H		0.75 – 1.0						SANDSTONE/LIMESTONE: fine to coarse grained, sub-angular to sub-rounded, white, with Silty SAND soil matrix as described above	D				
			1.0						Hole terminated at 1.00 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP16

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock
Date:	08/03/2022	**Logged:**	PF		
Checked Date:	13/04/2022	**Checked By:**	TM		

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0–0.75					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red brown, silts, low plasticity, trace gravel, trace fine roots	D	D - VD	TP16/0.00, TP16/0.50		
E	F (to 1.0), H (1.0–2.0)		0.75–2.0						SANDSTONE/LIMESTONE: fine to coarse grained, sub-angular to sub-rounded, white, with Silty SAND soil matrix (20-30%) as described above	D		TP16/1.00, TP16/1.50, TP16/2.00		
			2.0						Hole terminated at 2.00 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP17

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 08/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0–1.2		B(TP17-1)			SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red brown, trace Gravel, trace roots and rootlets	D	D - VD	TP17-1		
E	H		1.2–1.8						SANDSTONE/LIMESTONE (60-80%): fine to coarse grained, sub-angular to sub-rounded, white, with Silty SAND soil matrix described as fine to medium grained, sub-angular to sub-rounded, red/brown	D				
			1.8						Hole terminated at 1.80 m Refusal on solid rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP18

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	08/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0 – 0.70					SM	Sandy SILT/Silty SAND: fine to medium grained, red/brown, trace gravel, trace roots	D	D - VD			
E	H		0.70 – 1.50						SANDSTONE/LIMESTONE (80%): fine to coarse grained, sub-angular to sub-rounded, red/brown, with Sandy SILT, low plasticity, red/brown,, fine to medium grained, sub-angular to sub-rounded sand	D				
			1.50						Hole terminated at 1.50 m Refusal on solid rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP19

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 09/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	H		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, red/brown, trace / with Gravel (calcarenite), trace roots	D	VD			
			0.5						Hole terminated at 0.20 m Refusal on hard rock Groundwater not encountered					
			1.0											
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP20

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, with fines, trace roots	D				
	F		0.5					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, weakly to moderately cemented, with fines		D - VD			
	F-H				B(TP20-1)			GM	Silty Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white calcarenite with red/brown soils, fine to medium grained, sub-angular to sub-rounded sand (20%), trace fines			TP20-1		
	H		1.0						CALCARENITE: fine to carse grained, sub-angular to sub-rounded, white with red/brown soil matrix					1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP21

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E			0.0					SP	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, trace fine roots and organics		D - VD	TP21/0.00		
			0.5					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, trace Gravel			TP21/0.50		
					B(TP21-1)				Becomes dark brown					
			1.0 – 1.5					SM	Mix of Silty SAND (50%) as described above and CALCARENITE (50%), fine to coarse grained, sub-angular to sub-rounded, white with red/brown staining, distinctly weathered to slightly weathered, medium strength			TP21-1 TP21/1.00 TP21/1.50		1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			2.0 – 3.0						Hole terminated at 1.70 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP22

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F		**Date:**	09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	Backhoe		**Logged:**	PF
Project: Onslow Industrial Park		**Operator:**	Colin	**Checked Date:**	13/04/2022
		Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, trace roots, trace rootlets, trace organics	D	VD	TP22/0.00		
	F-H		0.5 – 1.0						Weathered CALCARENITE (Distinctly weathered) (80-90%), fine to coarse grained, sub-angular to sub-rounded, white, with Silty SAND matrix (10-20%), as described above			TP22/0.50 TP22/1.00		1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5 – 3.0						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP23

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace roots and shell fragments	D	VD	TP23/0.00		
E	E-F		0.5					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown	D		TP23/0.50		
E	H		1.0						CALCARENITE: fine to coarse grained, sub-angular to sub-rounded, pale red/brown and white, distinctly weathered to slightly weathered with depth, with red/brown staining, medium strength (dull and ring sound with hammer, approximately 20% of soil matrix described as Silty SAND	D		TP23/1.00		1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP24

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel	D	VD			
	F-H		0.5						CALCARENITE: fine to coarse grained, sub-angular to sub-rounded, white with red/brown staining, Distinctly weathered to slightly weathered at depth, medium strength, Silty SAND (10-20%) matrix as described above					0.90 : Destinctly weathered to slightly weathered with depth, medium strength
			1.0						Hole terminated at 0.90 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log GH_EXCAVATION J2201059.GPJ <<DrawingFile>> 14/04/2022 07:46 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

TEST PIT: TP25

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, trace gravel	D	VD			
E	F-H		0.5 – 1.0					SP	CALCARENITE (60-80%), fine to coarse grained, sub-angular to sub-rounded, white, with pale red/brown staining, Distinctly to slightly weathered with depth (staining in rock observed), medium strength (slight ring hard to break), Silty SAND (20-40%) soil matrix as described above	D				1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5 – 3.0						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP26

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow			**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel 15%), trace roots, organics and rootlets	D				
	F		0.5		B(TP26-1)			SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, with gravel	D	D	TP26-1		
	H		1.0						Weathered CALCARENITE: fine to coarse grained, sub-angular to sub-rounded, white, Distinctly weathered (60-80%), with Silty SAND soil matrix as described above	D				1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP27

Sheet 1 OF 1

Job Number: J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:** 09/03/2022
Client: Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:** PF
Project: Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:** 13/04/2022
					Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	H		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, red/brown, trace roots	D	D / L - MD			
									Hole terminated at 0.10 m Refusal on solid rock Groundwater not encountered					
			0.5											
			1.0											
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

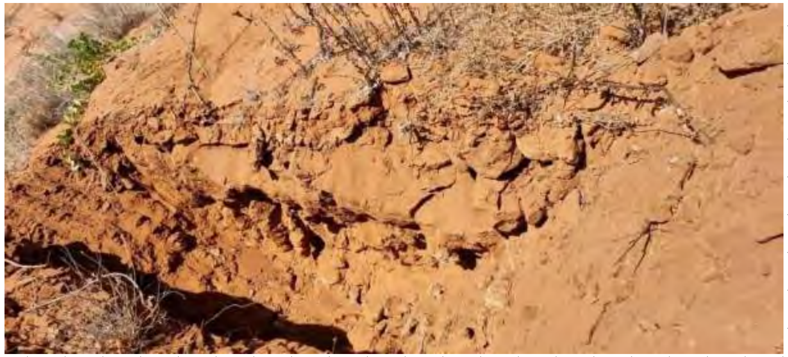
TEST PIT: TP28

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, trace roots	D	VD	TP28/0.00		
E	E-F		0.5					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown	D		TP28/0.50		
E	H		1.0						CALCARENITE (60-80%), fine to coarse grained, sub-angular to sub-rounded, white with red/brown staining, Distinctly to slightly weathered with depth, medium depth, Silty SAND (20-40%), matrix as described above	D		TP28/1.00 TP28/1.50		
			1.5						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

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TEST PIT: TP29

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown	D	VD	TP29/0.00		
	F-H		0.5						Becomes more silty			TP29/0.50		
			1.0									TP29/1.00		
			1.5						CALCARENITE: fine to medium grained, sub-angular to sub-rounded, white with red/brown staining, Distinctly weathered, medium strength, Silty SAND (20%), soil matrix as described above			TP29/1.50		
									Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP30

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, with fines, trace roots	D	VD	TP30/0.00		
	E-F		0.5		B(TP30-1)			SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded, red/brown			TP30/0.50		
			1.0									TP30-1 TP30/1.00		
			1.5									TP30/1.50		
			2.0									TP30/2.00		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered			TP30/2.50		
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP31

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, red brown, with fines , trace gravel, trace roots	D		TP31/0.00		
	E-F		0.5					SP	Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, fine to coarse grained, sub-angular to sub-rounded gravel (30%), trace fines, weakly to moderately cemented soils observed as gravel size		VL - MD / D - VD	TP31/0.50		
			1.0									TP31/1.00		
	F-H	Groundwater 1.45 m	1.5					GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white calcarenite Gravel with brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace fines		D - VD	TP31/1.50		
	H		2.0		B(TP31-1)			GP	GRAVEL with Sand: fine to medium grained, sub-angular to sub-rounded, brown, fine to medium grained, sub-angular to sub-rounded sand, with fines		MD / D - VD	TP31/2.00 TP31-1 TP31/2.50		
			2.5						Hole terminated at 2.50 m Target depth Groundwater encountered at 1.45 m					
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP32

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, red/brown, trace roots	D	D - VD	TP32/0.00		
			0.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, red/brown, trace fine roots			TP32/0.50		
	E-F		1.0 1.5 2.0					GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white Gravel (calcarenite) and red/brown sands, fine to medium grained, sub-angular to sub-rounded sand, with fines			TP32/1.00 TP32/1.50		
			2.5 3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP33

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty SAND with Gravel: fine to medium grained, sub-angular to sub-rounded, pale brown, fine to medium grained, sub-angular to sub-rounded gravel	D	VD			
	F-H		0.5					GP	Sandy GRAVEL with fines: fine to coarse grained, sub-angular to sub-rounded, white Gravel with pale brown sands, fine to medium grained, sub-angular to sub-rounded sand, with fines					
			1.0						Hole terminated at 0.90 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP34

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel, with fines	D	VD			
	F-H		0.5–1.0					GP	Sandy Gravel with fines: fine to coarse grained, sub-angular to sub-rounded, white calcarenite Gravel and red/brown soils, fine to medium grained, sub-angular to sub-rounded sand					1.20 : Destinctly weathered to slightly weathered with depth, medium strength
			1.5						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP35

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F		**Date:**	09/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	Backhoe		**Logged:**	PF
Project: Onslow Industrial Park		**Operator:**	Colin	**Checked Date:**	13/04/2022
		Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	H		0.0					GP	Sandy Gravel with fines: fine to coarse grained, sub-angular to sub-rounded, white Gravel calcarenite with red/brown soils, fine to medium grained, sub-angular to sub-rounded sand	D	VD			
									Hole terminated at 0.15 m Refusal on hard rock Groundwater not encountered					
			0.5											
			1.0											
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP36

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock
Date:	09/03/2022	**Logged:**	PF	**Checked Date:**	13/04/2022
Checked By:	TM				

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	Gravelly SAND with fines: fine to medium grained, sub-angular to sub-rounded, red/brown, fine to medium grained, sub-angular to sub-rounded gravel, with fines		VD			
	F-H		0.5		B(TP36-1)			SM	Silty SAND: fine to coarse grained, sub-angular to sub-rounded, with white calcarenite gravel and red/brown soil matrix, trace cobbles, trace boulders	D		TP36-1		
			1.5						Hole terminated at 1.40 m Refusal on hard rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP37

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow		Backhoe	**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown soil with blue metal and calcarenite Gravel, with fines, trace gravel	D	VD		
	F-H		0.5					SP	Gravelly SAND with fines: fine to medium grained, sub-angular to sub-rounded, red/brown, fine to coarse grained, sub-angular to sub-rounded gravel				
	H		1.0						CALCARENITE: fine to coarse grained, sub-angular to sub-rounded, white with red/brown staining, Distinctly to slightly weathered with depth				
			1.5						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered				
			2.0										
			2.5										
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP38

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	09/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow			**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND with Silt: fine to medium grained, sub-angular to sub-rounded, red/brown, trace gravel		MD - VD			
	F-H		0.5		B(TP38-1)			GM	Silty Sandy Gravel with fines: fine to coarse grained, sub-angular to sub-rounded, white calcarenite Gravel and red/brown soils, fine to medium grained sand, sub-angular to sub-rounded sand					
			1.0						Becomes more silty, dark brown			TP38-1		
			1.5											
			2.0						Hole terminated at 1.70 m Refusal on hard rock Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP39

Sheet 1 OF 1

Job Number: J2201059		**Contractor:** Munro Contractors		**Machine:** 9 Ton Cat432F Backhoe	**Date:** 10/03/2022
Client: Shire of Ashburton		**Location:** Lot 201 Onslow Road, Onslow		**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park				**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
					Checked By: TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale red/brown, trace gravel , trace roots	D	VD			
								SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, pale red/brown, low plasticity fines					
	F-H		0.5 – 1.0						CALCARENITE (60-90%) increasing with depth: fine to coarse grained, sub-angular to sub-rounded, white, with pale red/brown soil matrix described as SAND with fines (above) 10-40% reducing with depth					
			1.5 – 3.0						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP40

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale red/brown, trace gravel, trace cobbles, trace roots	D	MD - VD	TP40/0.00		
	F		0.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, pale red/brown, trace gravel, trace cobbles			TP40/0.50		
	E		1.0–2.5		B(TP40-1) (2.0–2.5)			SP	SAND: fine to medium grained, sub-angular to sub-rounded, red/brown, with fines, trace gravel			TP40/1.00 TP40/1.50 TP40/2.00 TP40-1 TP40/2.50		
			3.0						Hole terminated at 2.80 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP41

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale red/brown, with fines, trace gravel, trace roots	D	VD			
	F		0.5					GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white Gravel with pale brown soils, fine to medium grained, sub-angular to sub-rounded sand, with fines					
	F-H		1.0–1.5					SP	Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, pale red brown soils with white rocks (40-60%), fine to coarse grained, sub-angular to sub-rounded calcarenite gravel, trace cobbles, trace fines	D - M				
			2.0–3.0						Hole terminated at 1.60 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP42

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 0.5					SP	SAND: fine to medium grained, sub-angular to sub-rounded pale red brown, with low plasticity fines (5-12%), trace Gravel (5-10%), cementation moderate at 5% Soil becomes brown with depth as it becomes moist Small calcarenite gravel fragments observed in SAND	D	VD			
	E		0.5 – 2.5						Fines content increasing (from 1.5 m)	D - M (from 1.5 m)				
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP43

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, pale red/brown, fine to coarse grained, sub-angular to sub-rounded gravel	D	VD			
	F-H		0.5 – 1.0					GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white calcarenite Gravel with pale red/brown sands, fine to medium grained, sub-angular to sub-rounded sand, trace fines, trace cobbles Increasing fines content		D MD			
			1.5 – 3.0						Hole terminated at 1.40 m Refusal on hard rock Groundwater not encountered		D D L - MD			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP44

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation: METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	Sampling: SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	Field Material Description: SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					GP	Sandy GRAVEL with fines: fine to coarse grained, angular to sub-rounded, white calcarenite with pale red/brown soils, fine to medium grained sub-angular to sub-rounded sand	D	VD	TP44/0.00		
	F-H		0.5		B(TP44-1)			SP	Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, pale red/brown, fine to coarse grained, sub-angular to sub-rounded gravel (30-40%), with fines, trace cobbles			TP44/0.50		
			1.0									TP44-1 TP44/1.00		
	H								Becomes more blocky/larger rock fragments (cobbles)					
			1.5						CALCARENITE (70-90%); fine to coarse grained, sub-angular to sub-rounded, white with pale red/brown sandy matrix, fine to medium grained, sub-angular to sub-rounded sand, trace fines, calcarenite Distinctly to slightly weathered, medium strength			TP44/1.50		
									Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP45

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F-H		0.0 – 1.0						CALCARENITE (70-90%); fine to coarse grained, sub-angular to sub-rounded, white with pale red/brown soil described as SAND with fines, fine to medium grained, sub-angular to sub-rounded, Becomes blocky with depth (more cobbles) Distinctly to slightly weathered with depth, medium strength	D	VD			
			1.0						Hole terminated at 1.00 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP46

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation: METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	Sampling: SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0–0.5						CALCARENITE (50-60%) and SAND (40-50%): Sandy Gravelly COBBLES; white with pale red/brown staining and soils, fine to coarse grained, sub-angular to sub-rounded gravel, fine to medium grained, sub-angular to sub-rounded sand, trace fines, weakly to moderately cemented soils	D	VD	TP46/0.00		
E	F-E		0.5–2.5		B(TP46-1) (1.5–2.0)			GP	Sandy GRAVEL: fine to coarse grained, angular to sub-rounded, white with pale red/brown straining soil, fine to medium grained, sub-angular to sub-rounded sand, with fines, trace cobbles	D (to 1.5); D - M (1.5–2.5)		TP46/0.50 TP46/1.00 TP46/1.50 TP46-1 TP46/2.00 TP46/2.50		
			2.5–3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP47

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 10/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale red/brown, trace roots	D	VD			
			0.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded pale red/brown	D / D - M				
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

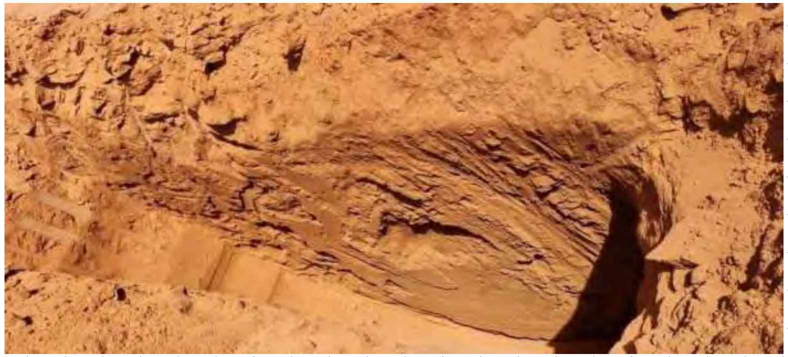
TEST PIT: TP48

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow		Backhoe	**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	Gravelly SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, sub-angular to sub-rounded gravel (30%), trace roots	D	D to VD	TP48/0.00		
E	F		0.5					SP	Gravelly SAND with fines: fine to medium grained, sub-angular to sub-rounded pale brown, fine to coarse grained, sub-angular to sub-rounded gravel	D		TP48/0.50		
E	F-H		1.0					GP	Silty Sandy Gravel: fine to medium grained, sub-angular to sub-rounded, dark brown, fine to medium grained, sub-angular to sub-rounded sand Weakly to moderately cemented soils observed	D		TP48/1.00		
			1.5						Hole terminated at 1.40 m Refusal on solid rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP49

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 10/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0 – 2.5					GP	Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white Gravel and cobbles with pale red/brown staining and soil, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles, trace boulders Lesser fines with depth Weakly to moderately cemented soils observed	D (0.0–1.0) D - M (1.0–2.5)	VD			
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP50

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 10/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SM	Silty SAND: fine to medium grained, sub-angular to sub-rounded brown, trace gravel, trace roots	D			
E	F-H		0.5						Weathered CALCARENITE (60-80%): fine to coarse grained, sub-angular to sub-rounded, white, Distinctly weathered to slightly weathered, medium strength, with fine to medium grained, sub-angular to sub-rounded, brown sand (10-40%), trace fines	D	VD		
			1.0						Hole terminated at 0.80 m Refusal on solid rock Groundwater not encountered				
			1.5										
			2.0										
			2.5										
			3.0										

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP51

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	Backhoe		**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F-H		0.0					SP	Gravelly SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale brown sands with white calcarenite gravel, fine to medium grained, angular to sub-angular gravel, trace roots	D	VD			
			0.5						CALCARENITE (70-80%) mix with SAND with fines (20-30%), Sandy Cobbly GRAVEL: fine to coarse grained, angular to sub-angular, white Gravel and cobbles with pale brown staining and soils, fine to medium grained, sub-angular to sub-rounded sand					
			1.0						Hole terminated at 0.40 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP52

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	Gravelly SAND with fines, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, sub-angular to sub-rounded gravel, trace roots	D	D - VD	TP52/0.00		
			0.5		B(TP52-1)			SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded pale brown, trace gravel			TP52-1 TP52/0.50		
	F-H		1.0					GM	Silty Sandy Gravel: fine to medium grained, sub-angular to sub-rounded, dark brown, fine to medium grained, sub-angular to sub-rounded sand Weakly to moderately cemented soils observed			TP52/1.00		
			1.5						Hole terminated at 1.40 m Refusal on solid rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP53

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, brown,trace roots	D	D - VD			
	F-H		0.5					GM	Silty Sandy GRAVEL: fine to medium grained, sub-angular to sub-rounded, brown, fine to medium grained, sub-angular to sub-rounded sand					
	H								CALCARENITE (60-80%) with Sand with fines soil (20-40%), fine to coarse grained, sub-angular to sub-rounded, white calcarenite with brown staining, fine to medium grained, sub-angular to sub-rounded sand, low plasticity silt (5-10%), Distinctly weathered to slightly weathered, medium strength					
			1.0						Hole terminated at 0.90 m Refusal on hard rock Groundwater not encountered					
			1.5											
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP54

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 1.1		B(TP54-1)			GM	FILL: Silty Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, white calcarenite gravel with pale brown staining soils, fine to medium grained, sub-angular to sub-rounded sand	D	VD	TP54/0.00 TP54-1 TP54/0.50 TP54/1.00		
	F		1.1 – 1.3					GM	Silty Sandy Gravel: hit the level ground soil observed as above					
	H		1.3 – 1.5						CALCARENITE: fine to coarse grained,sub-angular to sub-rounded, white calcarenite with pale brown staining and soil, fine to medium grained, sub-angular to sub-rounded, pale brown sand with fines, low plasticity silt					
									Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP55

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0–1.5						Mixture of CALCARENITE (30-50%) and Silty SAND: fine to medium grained, sub-angular to sub-rounded, brown, CALCARENITE observed as Gravel, cobbles and boulders, fine to medium grained, sub-angular to sub-rounded, pale brown/white and orange staining, Distinctly to moderately weathered, medium strength	D	VD			
			1.5						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP56

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0–1.8		B(TP56-1) (0.5–1.0)			SM	FILL: Silty SAND, fine to coarse grained, sub-angular to sub-rounded, brown with white calcarenite gravel, fine to medium grained, sub-angular to sub-rounded gravel, trace shell fragments, trace cobbles	D	VD	TP56-1		
									Hole terminated at 1.80 m Refusal on hard rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP57

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	10/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 1.1						FILL: Sandy GRAVEL with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown and white calcarenite Gravel and pale brown soils, fine to medium grained, sub-angular to sub-rounded sand weakly to moderately cemented soils observed	D	VD			
			1.1 – 2.0						Thin layer of blue metal gravel, trace black geofabric					
			2.0						Hole terminated at 2.00 m Refusal on hard rock Groundwater not encountered					

Depth scale: 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP58

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park
Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow
Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock
Date: 10/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0–2.0						Mixture of of CALCARENITE ROCKS (10-20%) and soil described as: Sandy GRAVEL with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown/white calcarenite and blue metal Gravel with brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles	D	VL - L			
			2.0						Hole terminated at 2.00 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP59

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.0		B(TP59-1) (0.5–1.0)			SM	FILL: Silty SAND, fine to coarse grained, sub-angular to sub-rounded, pale brown, with white calcarenite rocks, with fine to medium grained, sub-angular to sub-rounded gravel, trace cobbles, trace organics	D	D - VD (0.0–0.3); VL - MD (0.3–1.0)	TP59-1		
			2.0 – 2.5					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, red/brown					
			2.5 – 3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP60

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow		Backhoe	**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.5		B(TP60-1) (0.5 – 1.0)				FILL: Mixture of about 30% CALCARENITE COBBLES / BOULDERS and about 70% SILTY GRAVELLY SAND, fine to coarse grained, sub-angular to sub-rounded, pale brown, with white calcarenite and grey blue metal gravel, fine to medium grained, sub-angular to sub-rounded gravel	D	VL - L; L - MD	TP60-1		
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP61

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 10/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0–2.0		B(TP61-1) (0.5–1.0)			GM	FILL: Sandy GRAVEL with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown/white calcarenite of blue metal gravel and pale brown to brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace organics, trace roots Organics (shrubs, fluff) observed Thin layer of blue metal gravel A root observed	D	VD	TP61-1		
			2.0						Hole terminated at 2.00 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP62

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 10/03/0202
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.5					GM	FILL: Sandy Gravel with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown/white calcarenite and blue metal Gravel with pale brown sand/soils, fine to medium grained, sub-angular to sub-rounded sand, trace roots, plastic, etc fill, trace cobbles, trace boulders	D	VD L - MD			
			2.5 – 3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP63

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F Backhoe	**Date:** 11/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	**Operator:** Colin	**Logged:** PF
Project: Onslow Industrial Park		**Bucket:** 600 mm wide rock	**Checked Date:** 13/04/2022
			Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0 – 2.0						FILL: Mixture of CALCARENITE/ cobbles and boulders (60-70%) and Soil (30-40%) described as: SANDY GRAVEL, sub-angular to sub-rounded, pale brown/white calcarenite rocks with pale red/brown staining and soils, fine to coarse grained, sub-angular to sub-rounded gravel, with fines, trace roots, plastic etc fill, trace organics	D	VD			
			2.0 – 2.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, brown					
			2.5						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP64

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND with fines, fine to medium grained, sub-angular to sub-rounded, brown, trace gravel, rootlets, roots and organics	D	VD	TP64/0.00		
	F		0.5					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace gravel	D - M		TP64/0.50		
	F-H		1.0		B(TP64-1)			GC	Clayey Sandy Gravel: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite rocks and brown soils, fine to medium grained, sub-angular to sub-rounded sand, low plasticity clay, trace cobbles			TP64-1 TP64/1.00		
			1.5						Hole terminated at 1.10 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP65

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 11/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Clayey/Silty SAND, fine to medium rained, sub-angular to sub-rounded, pale brown, trace gravel, trace roots	D	D - VD			
			0.5					SP	SAND with fines: fine to medium grained, sub-angular to sub -rounded, brown					
	F-H		1.0					GP	Sandy GRAVEL with fines: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and brown soil, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles	D - M				
	H		1.5						Mix of CALCARENITE ROCK (60%) and Soil (40%): Fine to medium grained, sub-angular to sub-rounded, pale brown-white calcarenite, Distinctly weathered, medium strength, soil described as above					
			2.0						Hole terminated at 1.80 m Refusal on hard rock Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP66

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	FILL: SAND, fine to medium grained, sub-angular to sub-rounded, pale brown, trace fines, trace organics	D				
	E							SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, pale brown		MD to VD			
	F		0.5 – 1.0					GC	Clayey Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and pale brown soils and staining, fine to medium grained, sub-angular to sub-rounded sand					
									Organics (shrubs, fluff) observed					
	F-H		1.5						Mixture of CALCARENITE ROCKS and Soils observed as Sandy Gravel: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel (cobbles and boulders), pale brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace fines					
									Thin layer of blue metal gravel					
									A root observed					
			2.0						Hole terminated at 2.00 m Target depth Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP67

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, pale brown, trace fines, roots	D	VD	TP67/0.00		
E	E		0.5 – 2.5		B(TP67-1) (1.0 – 1.5)			SP	SAND: fine to medium grained, sub-angular to sub-rounded, pale brown, with fines	D (to 2.0); D - M (2.0 – 2.5)	L - MD	TP67/0.50; TP67/1.00; TP67-1 TP67/1.50; TP67/2.00; TP67/2.50		
			2.5 – 3.0						Hole terminated at 2.50 m Target depth Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP68

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	Gravelly SAND, fine to medium grained, sub-angular to sub-rounded, pale brown, fine to coarse grained, sub-angular to sub-rounded gravel, trace fines, trace cobbles and roots	D	VD			
			0.5					SP	SAND: fine to medium grained, pale brown, trace Gravel (10-15%), trace fines	D				
									Gravel content decreases					
			1.0						Trace calcarenite cobbles and boulders observed with depth Weakly to moderately cemented sand in deeper areas	D - M				
			1.5											
			2.0						Hole terminated at 2.00 m Target depth Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP69

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow			**Logged:**	PF
Project:	Onslow Industrial Park			**Operator:**	Colin	**Checked Date:**	13/04/2022
				Bucket:	600 mm wide rock	**Checked By:**	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, brown, moderately to well cemented sands	D	MD - VD			
E	F-H		0.5 – 1.0					GP	Sandy Gravel with fines: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite rocks and brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles and boulders with depth	D	MD - VD			
			1.5 – 3.0						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01 GLB Log GH_EXCAVATION J2201059.GPJ <<DrawingFile>> 14/04/2022 07:48 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

Galt GEOTECHNICS

TEST PIT: TP70

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SC	Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace gravel, roots	D		TP70/0.00		
	F		0.5					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, brown, weakly to moderately cemented soils observed		D to VD	TP70/0.50		
			1.0									TP70/1.00		
	H		1.5						Mixture of CALCARENITE ROCKS (Gravel, cobbles 50%) and Clayey SAND (50%); fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and brown soils, fine to medium grained, sub-angular to sub-rounded sand			TP70/1.50		
			2.0						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP71

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	F		0.0					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace roots	D	VD			
E	F		0.5		B(TP71-1)			SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace Gravel	D - M		TP71-1		
E	F-H		1.0 – 2.0						Mix of CALCARENITE ROCKS (50-60%) and Soils (40-50%) described as: Clayey Sandy Gravel: fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite rocks and brown soils, fine to medium grained, sub-angular to sub-rounded sand (20-30%), low plasticity clay (15-20%), trace cobbles (15%)	D - M	D / MD - D			
			2.5 – 3.0						Hole terminated at 2.10 m Refusal on hard rock Groundwater not encountered		D - VD			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log GH_EXCAVATION J2201059.GPJ <<DrawingFile>> 14/04/2022 07:48 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

TEST PIT: TP72

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SP	SAND, fine to medium grained, sub-angular to sub-rounded, brown, trace fines, trace roots	D	D to VD	TP72/0.00		
	E-F, H		0.3–1.7					SP	SAND with fines: fine to medium grained, sub-angular to sub-rounded, brown			TP72/0.50, TP72/1.00, TP72/1.50		
			1.7–2.0					GP	Sandy GRAVEL with fines: fine to medium grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and brown soils, fine to medium grained, sub-angular to sub-rounded sand			TP72/2.00		
			2.0						Hole terminated at 2.00 m Refusal on hard rock Groundwater not encountered					

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP73

Sheet 1 OF 1

Job Number: J2201059
Client: Shire of Ashburton
Project: Onslow Industrial Park

Contractor: Munro Contractors
Location: Lot 201 Onslow Road, Onslow

Machine: 9 Ton Cat432F Backhoe
Operator: Colin
Bucket: 600 mm wide rock

Date: 11/03/2022
Logged: PF
Checked Date: 13/04/2022
Checked By: TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SC	Clayey SAND, fine to medium grained, sub-angular to sub-rounded, low plasticity clay, trace roots	D	D to VD			
								SC	Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, brown, low plasticity clay, trace Gravel					
	F-H		0.5 – 1.0					GC	Clayey Sandy Gravel: fine to medium grained, sub-angular to sub-rounded pale brown to white Gravel and brown soil, fine grained, sub-angular to sub-rounded sand, low plasticity clay, trace cobbles, becoming more rocky with depth (Calcarenite)					
			1.5						Hole terminated at 1.30 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP74

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe	**Date:**	11/03/2022
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin	**Logged:**	PF
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock	**Checked Date:**	13/04/2022
						Checked By:	TM

Excavation					Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SC	Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, low plasticity clay, trace roots	D	L - MD			
	E-F		0.5					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown low plasticity clay, trace Gravel		D			
	F		1.0					GC	Clayey Sandy GRAVEL: fine to medium grained, sub-angular to sub-rounded, pale brown-white Gravel and brown soils, fine to medium grained, sub-angular to sub-rounded sand, low plasticity clay					
	H								Mixture of CALCARENITE ROCKS (40-50%) and Soils described as: Sandy GRAVEL with fines, fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite rocks and brown soils, fine to medium grained, sub-angular to sub-rounded sand, trace cobbles	D - M				
			1.5						Hole terminated at 1.20 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP75

Sheet 1 OF 1

Job Number: J2201059	**Contractor:** Munro Contractors	**Machine:** 9 Ton Cat432F		**Date:**	11/03/2022
Client: Shire of Ashburton	**Location:** Lot 201 Onslow Road, Onslow	Backhoe		**Logged:**	PF
Project: Onslow Industrial Park		**Operator:**	Colin	**Checked Date:**	13/04/2022
		Bucket:	600 mm wide rock	**Checked By:**	TM

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE		STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SM	Clayey/Silty SAND, fine to medium grained, sub-angular to sub-rounded, brown, trace gravel and roots	D	D - VD			
	F		0.5					SM	Clayey/Silty SAND: fine grained, sub-angular to sub-rounded, brown, trace gravel					
	F-H		1.0						Mixture of CALCARENITE ROCKS (60-70%) and Soil (30-40%) described as: Clayey Sandy Gravel, fine to coarse grained, sub-angular to sub-rounded, pale brown-white calcarenite Gravel and brown soil, fine to medium grained, sub-angular to sub-rounded sand					
			1.5						Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered					
			2.0											
			2.5											
			3.0											

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Galt GEOTECHNICS

TEST PIT: TP76

Sheet 1 OF 1

Job Number:	J2201059	**Contractor:**	Munro Contractors	**Machine:**	9 Ton Cat432F Backhoe
Client:	Shire of Ashburton	**Location:**	Lot 201 Onslow Road, Onslow	**Operator:**	Colin
Project:	Onslow Industrial Park			**Bucket:**	600 mm wide rock
Date:	11/03/2022	**Logged:**	PF	**Checked Date:**	13/04/2022
Checked By:	TM				

METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	SAMPLE	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0				SM	Silty SAND, fine to medium grained, sub-angular to sub-rounded, brown, trace Gravel, roots, rootlets and organics	D		TP76/0.00	
	E-F				B(TP76-1)		SM	Silty SAND: fine grained, sub-angular to sub-rounded, brown, trace Gravel		VD	TP76-1 TP76/0.50	
	F		0.5 – 1.0		B(TP76-2)		GM	Silty Sandy Gravel: fine to medium grained, sub-angular to sub-rounded, pale brown-white Gravel with brown staining and soils, fine grained, sub-angular to sub-rounded sand			TP76-2 TP76/1.00	
	H							Mix of CALCARENITE ROCKS (50%) and soils as described above - Clayey Sandy Gravel			TP76/1.50	
			1.5					Hole terminated at 1.50 m Refusal on hard rock Groundwater not encountered				
			2.0									
			2.5									
			3.0									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Appendix D: Constant Head Infiltration Test Results

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:		

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP16 / PERC01

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

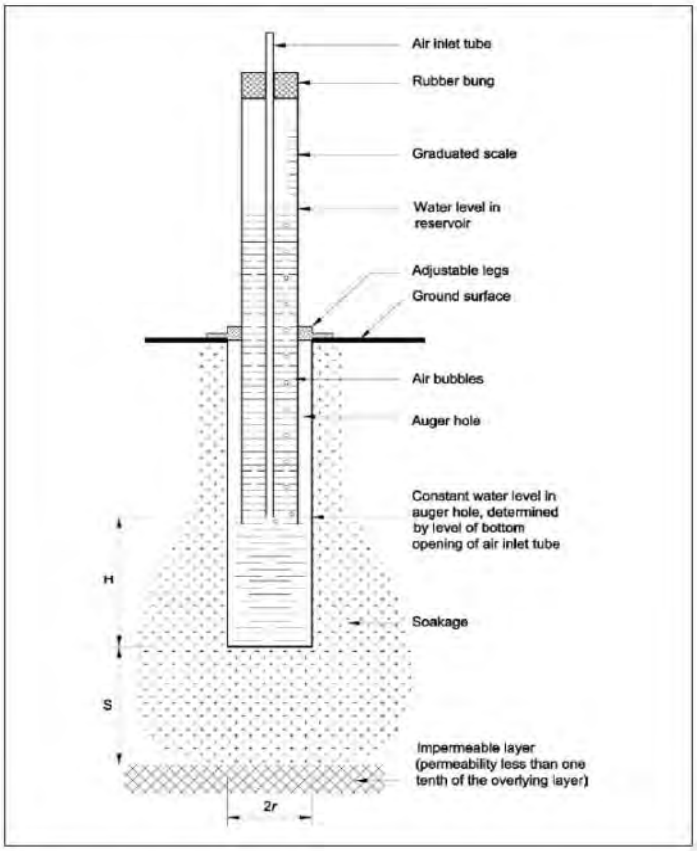
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	40	cm
H	Head of water above base	21	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
5.00	78.7	-78.70	-15.74
15.00	74	4.70	0.47
17.50	71.7	2.30	0.92
19.50	69.4	2.30	1.15
38.25	52	17.40	0.93
40.17	50.8	1.20	0.63
57.00	33.8	17.00	1.01
59.50	31.5	2.30	0.92
81.50	10	21.50	0.98
87.25	4.3	5.70	0.99
AVERAGE - LAST 5 READINGS			0.90

Calculation

Steady State Flow	0.90	cm/min
Flow from reservoir (Q)	6.40	cm^3/min
K_{sat}	0.006	cm/min
K_{sat}	1.026E-06	m/s
K_{sat}	**0.09**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP21/PERC02

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

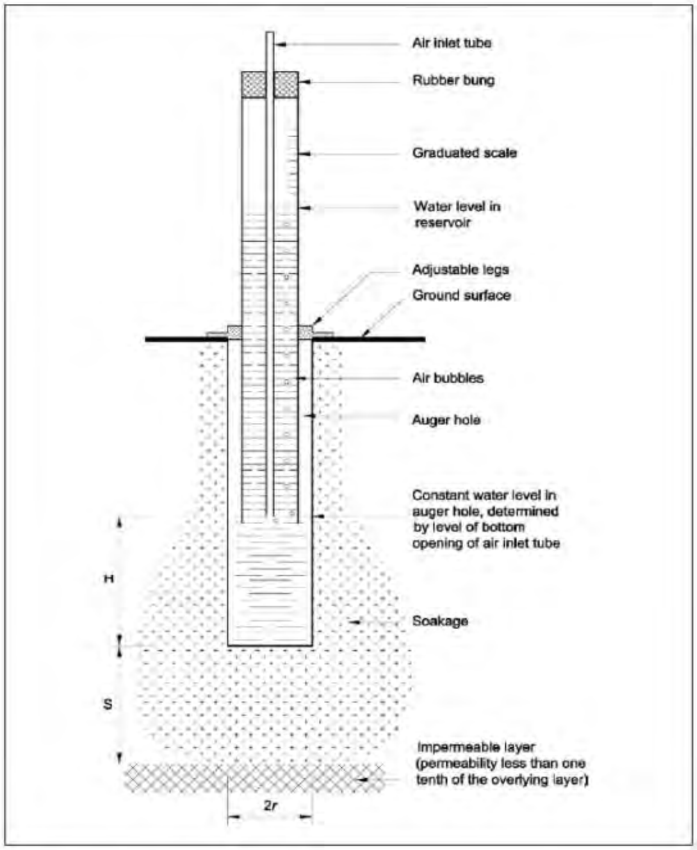
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	55	cm
H	Head of water above base	21	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
25.00	78.5	-78.50	-3.14
32.00	72.2	6.30	0.90
53.50	54.2	18.00	0.84
55.00	52	2.20	1.47
64.75	43.5	8.50	0.87
71.00	37	6.50	1.04
75.25	33	4.00	0.94
87.00	22	11.00	0.94
93.75	16	6.00	0.89
95.75	13.3	2.70	1.35
98.50	10.5	2.80	1.02
101.42	7.8	2.70	0.93
105.67	3.4	4.40	1.04
AVERAGE - LAST 5 READINGS			1.04

Calculation

Steady State Flow	1.04	cm/min
Flow from reservoir (Q)	7.38	cm^3/min
K_{sat}	0.007	cm/min
K_{sat}	1.183E-06	m/s
K_{sat}	**0.10**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP29/PERC03

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\ \pi H^2}$$

Spreadsheet Legend

- Required input
- Calculated field
- Comment field
- Field not used
- Fixed field

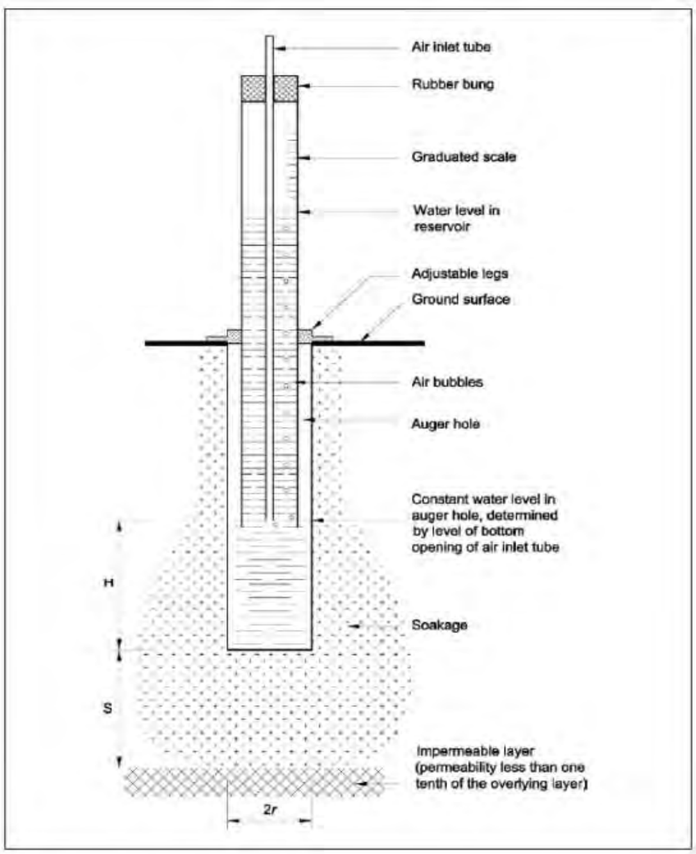
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	35	cm
H	Head of water above base	25	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	77		
2.75	72.8	4.20	1.53
3.50	71.5	1.30	1.73
4.00	70.5	1.00	2.00
5.42	68	2.50	1.76
6.00	67	1.00	1.71
6.83	65.5	1.50	1.80
7.42	64.5	1.00	1.71
8.00	63.5	1.00	1.71
25.33	34	29.50	1.70
25.75	33	1.00	2.40
35.83	16.5	16.50	1.64
37.25	14	2.50	1.76
AVERAGE - LAST 5 READINGS			1.84

Calculation

Steady State Flow	1.84	cm/min
Flow from reservoir (Q)	13.03	cm^3/min
K_{sat}	0.010	cm/min
K_{sat}	1.638E-06	m/s
K_{sat}	**0.14**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:		

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP31/PERC04

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

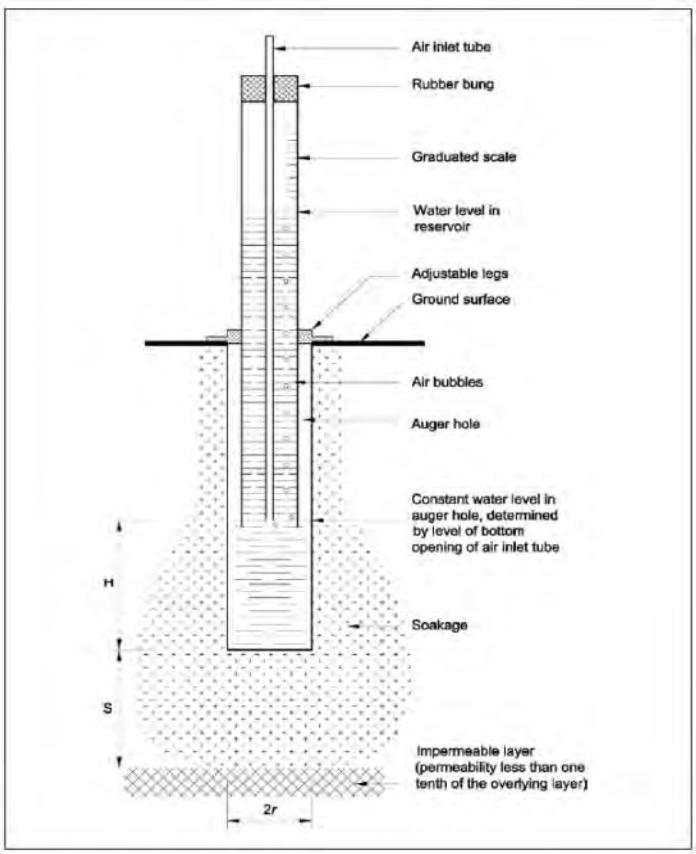
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	40	cm
H	Head of water above base	21	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
36.83	77.4	-77.40	-2.10
38.00	70	7.40	6.34
39.00	63.8	6.20	6.20
40.08	58	5.80	5.35
42.08	47	11.00	5.50
43.50	39.5	7.50	5.29
45.20	30	9.50	5.59
46.25	24.5	5.50	5.24
47.50	17	7.50	6.00
48.75	10	7.00	5.60
49.62	5	5.00	5.77
AVERAGE - LAST 5 READINGS			5.64

Calculation

Steady State Flow	5.64	cm/min
Flow from reservoir (Q)	39.87	cm^3/min
K_{sat}	0.038	cm/min
K_{sat}	6.391E-06	m/s
K_{sat}	**0.55**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP38/PERC05

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

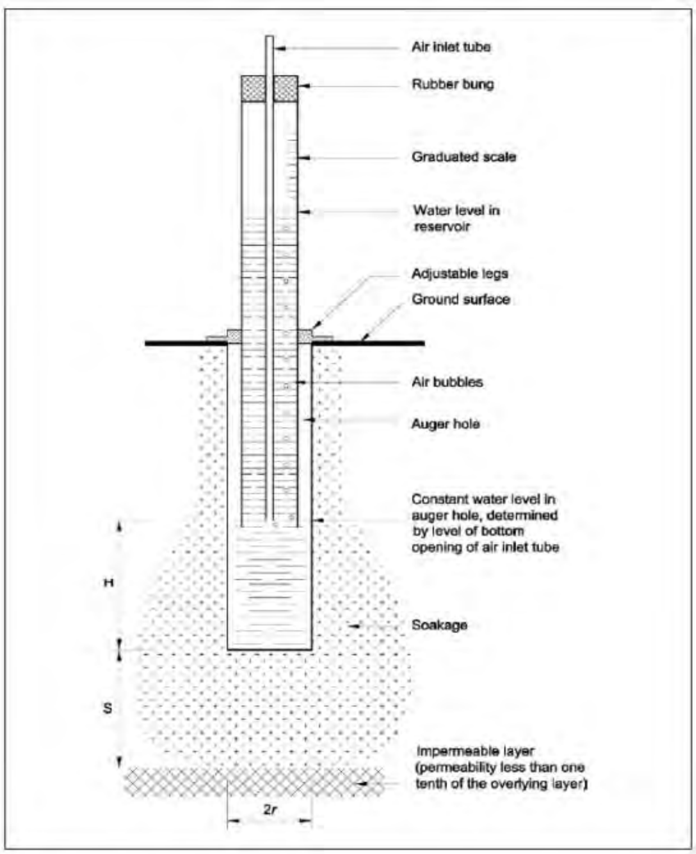
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	55	cm
H	Head of water above base	20	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	73.5		
11.83	52	21.50	1.82
20.25	40.5	11.50	1.37
27.83	29.1	11.40	1.50
36.75	16	13.10	1.47
43.25	6.5	9.50	1.46
43.75	5	1.50	3.00
44.5	3.5	1.50	2.00
45.5	2	1.50	1.50
AVERAGE - LAST 5 READINGS			1.89

Calculation

Steady State Flow	1.89	cm/min
Flow from reservoir (Q)	13.33	cm^3/min
K_{sat}	0.014	cm/min
K_{sat}	2.286E-06	m/s
K_{sat}	**0.20**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP42/PERC06

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

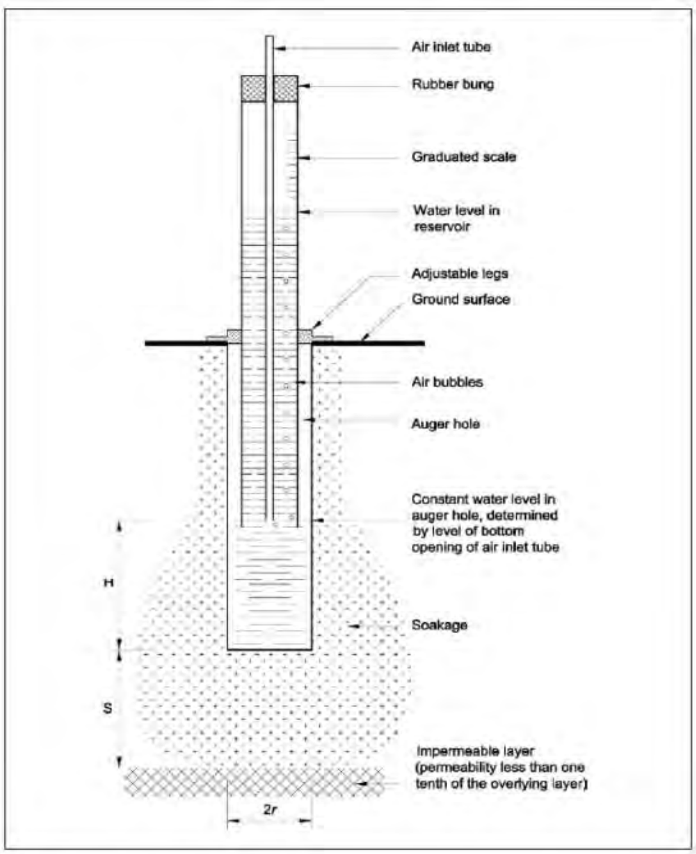
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	53	cm
H	Head of water above base	20	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	75.8		
0.50	70.5	5.30	10.60
0.83	65	5.50	16.50
1.42	55.8	9.20	15.77
1.83	48.8	7.00	16.80
2.17	42	6.80	20.40
2.75	33.5	8.50	14.57
3.17	25.5	8.00	19.20
3.75	16	9.50	16.29
4.00	10.5	5.50	22.00
4.42	3.5	7.00	16.80
4.58	1	2.50	15.00
AVERAGE - LAST 5 READINGS			17.86

Calculation

Steady State Flow	17.86	cm/min
Flow from reservoir (Q)	126.25	cm^3/min
K_{sat}	0.130	cm/min
K_{sat}	2.164E-05	m/s
K_{sat}	**1.87**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:		

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP48/PERC07

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

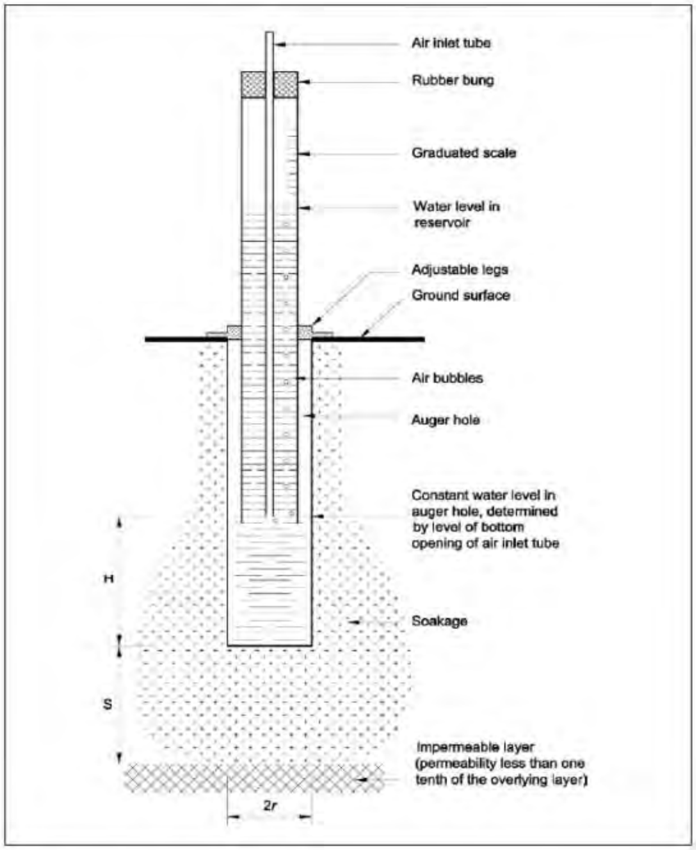
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	60	cm
H	Head of water above base	25	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	Outer	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	80.5		
0.33	78.5	2.00	6.00
3.10	60	18.50	6.69
4.47	51.3	8.70	6.37
5.25	46	5.30	6.77
5.60	43.5	2.50	7.14
6.58	35.5	8.00	8.14
8.00	24	11.50	8.12
8.92	15	9.00	9.82
9.50	10	5.00	8.57
AVERAGE - LAST 5 READINGS			8.36

Calculation

Steady State Flow	8.36	cm/min
Flow from reservoir (Q)	59.08	cm^3/min
K_{sat}	0.045	cm/min
K_{sat}	7.425E-06	m/s
K_{sat}	**0.64**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP52/PERC08

$$K = \frac{4.4Q\left[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}\right]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

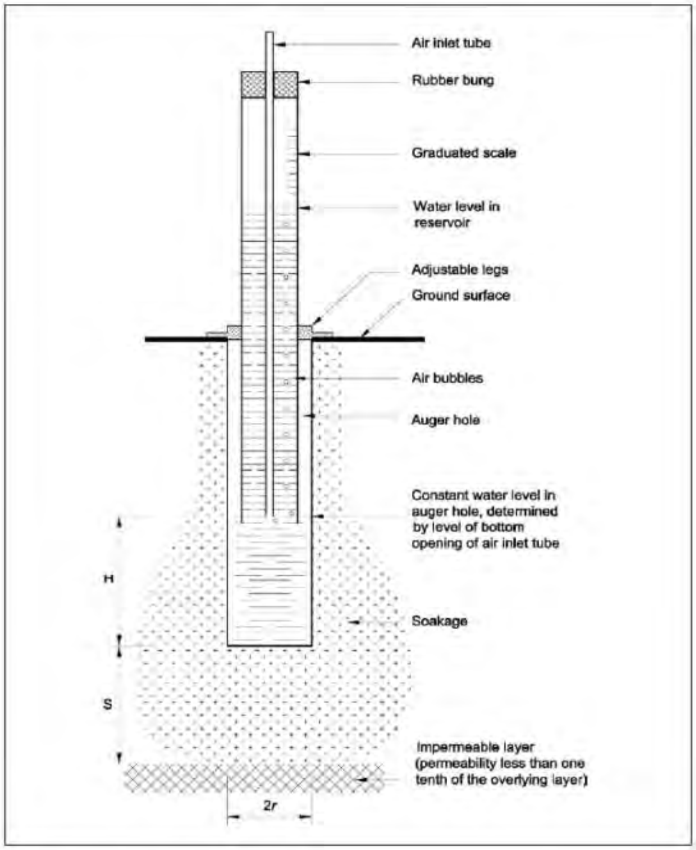
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	55	cm
H	Head of water above base	20	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	79		
1.5	76.5	2.50	1.67
6.5	63.5	13.00	2.60
8.75	57	6.50	2.89
15	41	16.00	2.56
20.25	28	13.00	2.48
20.5	26.7	1.30	5.20
25.5	14	12.70	2.54
26	13	1.00	2.00
27.5	9.5	3.50	2.33
28.5	7	2.50	2.50
29.5	4.5	2.50	2.50
31	1	3.50	2.33
AVERAGE - LAST 5 READINGS			2.33

Calculation

Steady State Flow	2.33	cm/min
Flow from reservoir (Q)	16.50	cm^3/min
K_{sat}	0.017	cm/min
K_{sat}	2.828E-06	m/s
K_{sat}	**0.24**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP65/PERC09

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

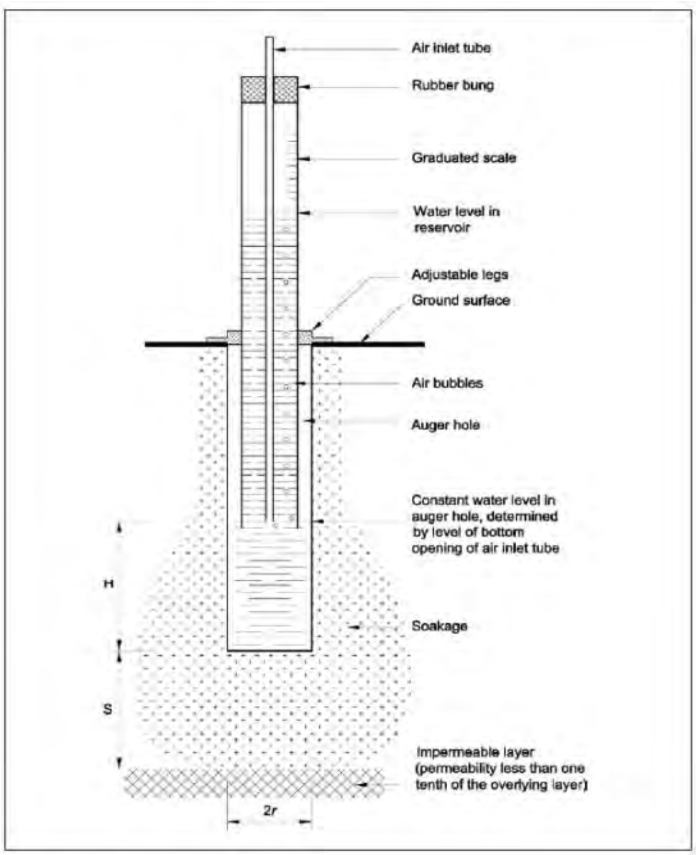
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	55	cm
H	Head of water above base	25	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
0.50	78.4	-78.40	-156.80
30.33	77.3	1.10	0.04
43.00	75	2.30	0.18
54.00	72.2	2.80	0.25
71.50	68.5	3.70	0.21
82.83	66	2.50	0.22
96.50	63.2	2.80	0.20
109.67	60.5	2.70	0.21
134.00	55	5.50	0.23
AVERAGE - LAST 5 READINGS			0.21

Calculation

Steady State Flow	0.21	cm/min
Flow from reservoir (Q)	1.51	cm^3/min
K_{sat}	0.001	cm/min
K_{sat}	1.898E-07	m/s
K_{sat}	**0.02**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP73/PERC10

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

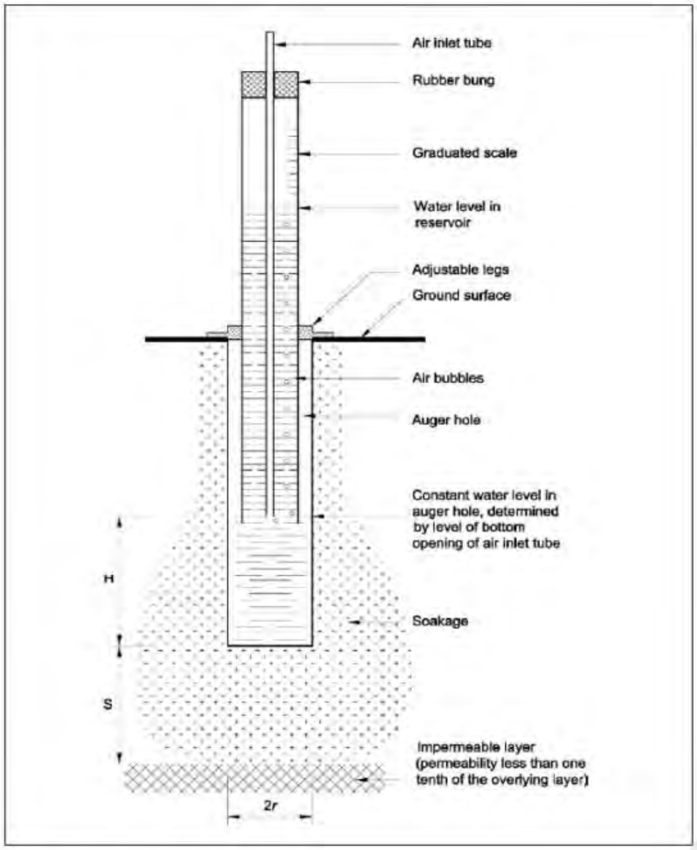
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	58	cm
H	Head of water above base	23	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	80		
7.75	78.8	1.20	0.15
16.33	78.5	0.30	0.03
32.50	77.3	1.20	0.07
40.25	74.5	2.80	0.36
52.50	69	5.50	0.45
78.00	56.7	12.30	0.48
101.00	43.3	13.40	0.58
121.92	29.8	13.50	0.65
127.00	25.7	4.10	0.81
145.67	10	15.70	0.84
150.25	5.7	4.30	0.94
AVERAGE - LAST 5 READINGS			0.76

Calculation

Steady State Flow	0.76	cm/min
Flow from reservoir (Q)	5.39	cm^3/min
K_{sat}	0.005	cm/min
K_{sat}	7.620E-07	m/s
K_{sat}	**0.07**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
Test Name	TP76/PERC11

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

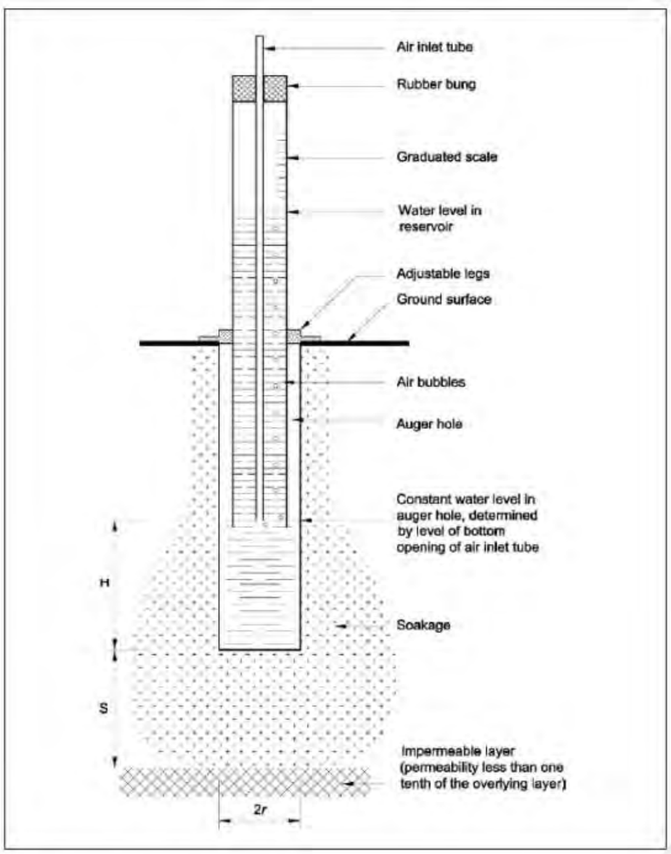
Paramete	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	64	cm
H	Head of water above base	24	cm
r	Radius of auger hole	3	cm
S	Depth to impermeable stratum	0	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	7.07	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0			
48.50	78.7	-78.70	-1.62
178.00	77.7	1.00	0.01
230.00	76	1.70	0.03
254.33	74.5	1.50	0.06
280.00	74.3	0.20	0.01
320.50	73	1.30	0.03
354.00	71.4	1.60	0.05
400.67	69	2.40	0.05
AVERAGE - LAST 5 READINGS			0.04

Calculation

Steady State Flow	0.04	cm/min
Flow from reservoir (Q)	0.28	cm^3/min
K_{sat}	0.000	cm/min
K_{sat}	########	m/s
K_{sat}	**0.00**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Appendix E: Falling Head Infiltration Test Results

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

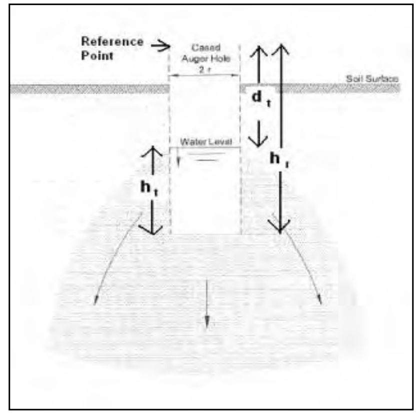
Galt Geotechnics

Spreadsheet author:	ORW	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP15/IT01
Test Depth:	0.62 m

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

(blue)	Required input
(green)	Calculated field
(orange)	Comment field
(crossed)	Field not used
(yellow)	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.03	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.95	0.08		
20	0.956	0.074	4.9E-05	4.2
40	0.96	0.07	4.2E-05	3.6
60	0.963	0.067	3.7E-05	3.2
80	0.965	0.065	3.2E-05	2.8
100	0.968	0.062	3.1E-05	2.7
120	0.972	0.058	3.3E-05	2.8
140	0.974	0.056	3.1E-05	2.7
160	0.976	0.054	3.0E-05	2.6
180	0.978	0.052	2.9E-05	2.5
210	0.982	0.048	2.9E-05	2.5
240	0.984	0.046	2.8E-05	2.4
270	0.987	0.043	2.7E-05	2.4
300	0.99	0.04	2.7E-05	2.4
360	1	0.03	3.1E-05	2.7
420	1.005	0.025	3.1E-05	2.7
		AVERAGE	3.3E-05	2.8

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.83	0.2		
60	0.84	0.19	1.2E-05	1.0
120	0.85	0.18	1.2E-05	1.1
180	0.86	0.17	1.3E-05	1.1
240	0.87	0.16	1.3E-05	1.1
300	0.877	0.153	1.2E-05	1.1
360	0.884	0.146	1.2E-05	1.0
420	0.89	0.14	1.2E-05	1.0
		AVERAGE	1.2E-05	1.1

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.813	0.217		
60	0.827	0.203	1.6E-05	1.3
120	0.835	0.195	1.2E-05	1.1
180	0.843	0.187	1.2E-05	1.0
240	0.85	0.18	1.1E-05	0.9
300	0.858	0.172	1.1E-05	0.9
360	0.867	0.163	1.1E-05	1.0
420	0.875	0.155	1.1E-05	1.0
		AVERAGE	1.2E-05	1.0

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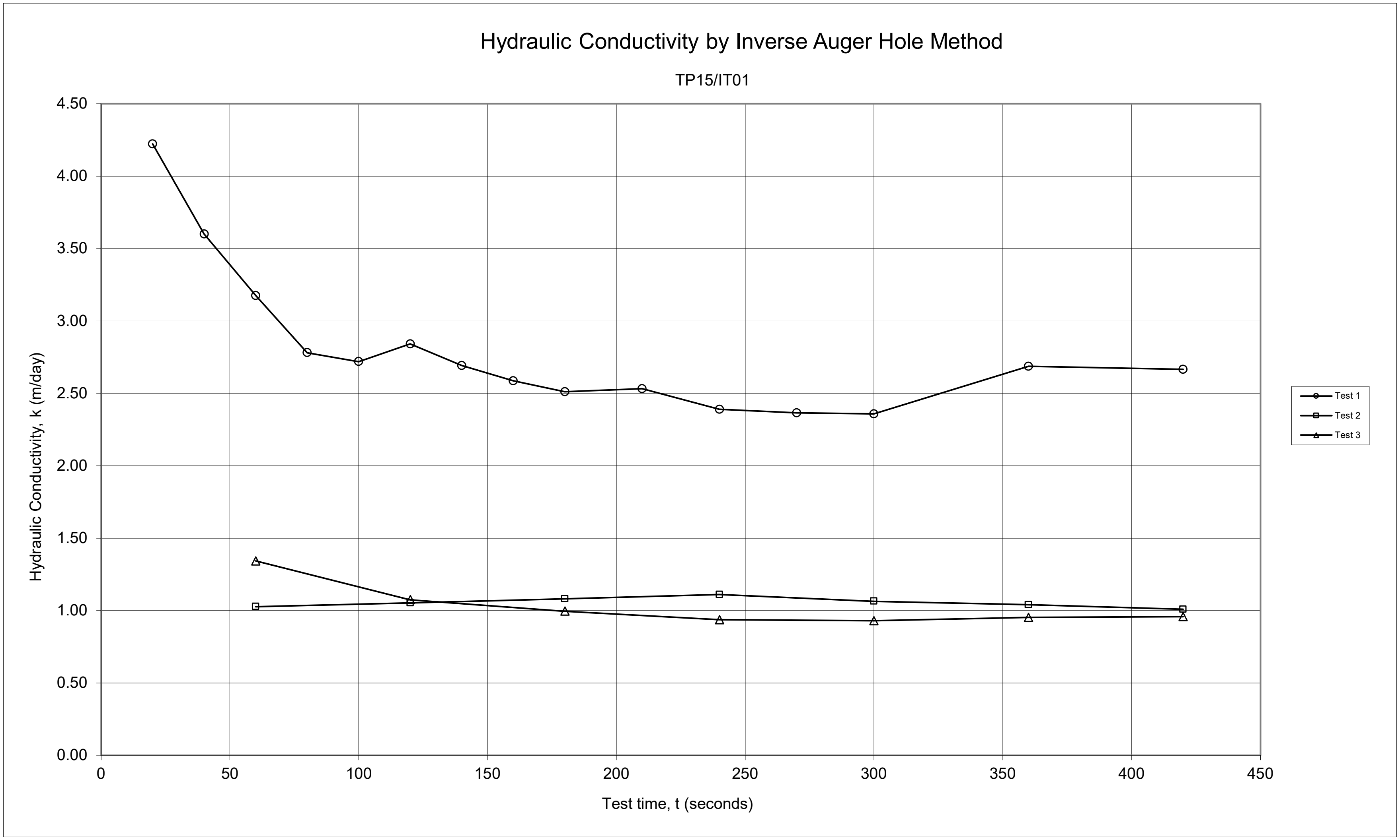

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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

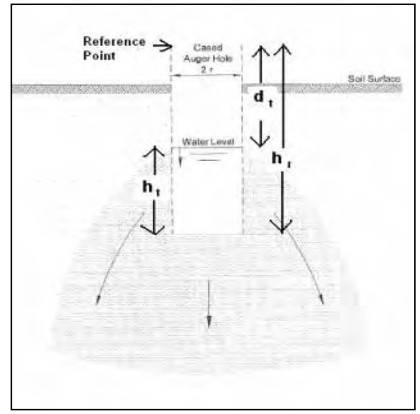
Galt Geotechnics

Spreadsheet author:	ORW	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP74/IT02
Test Depth:	0.58 m

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

(blue)	Required input
(green)	Calculated field
(orange)	Comment field
(crossed)	Field not used
(yellow)	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.015	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

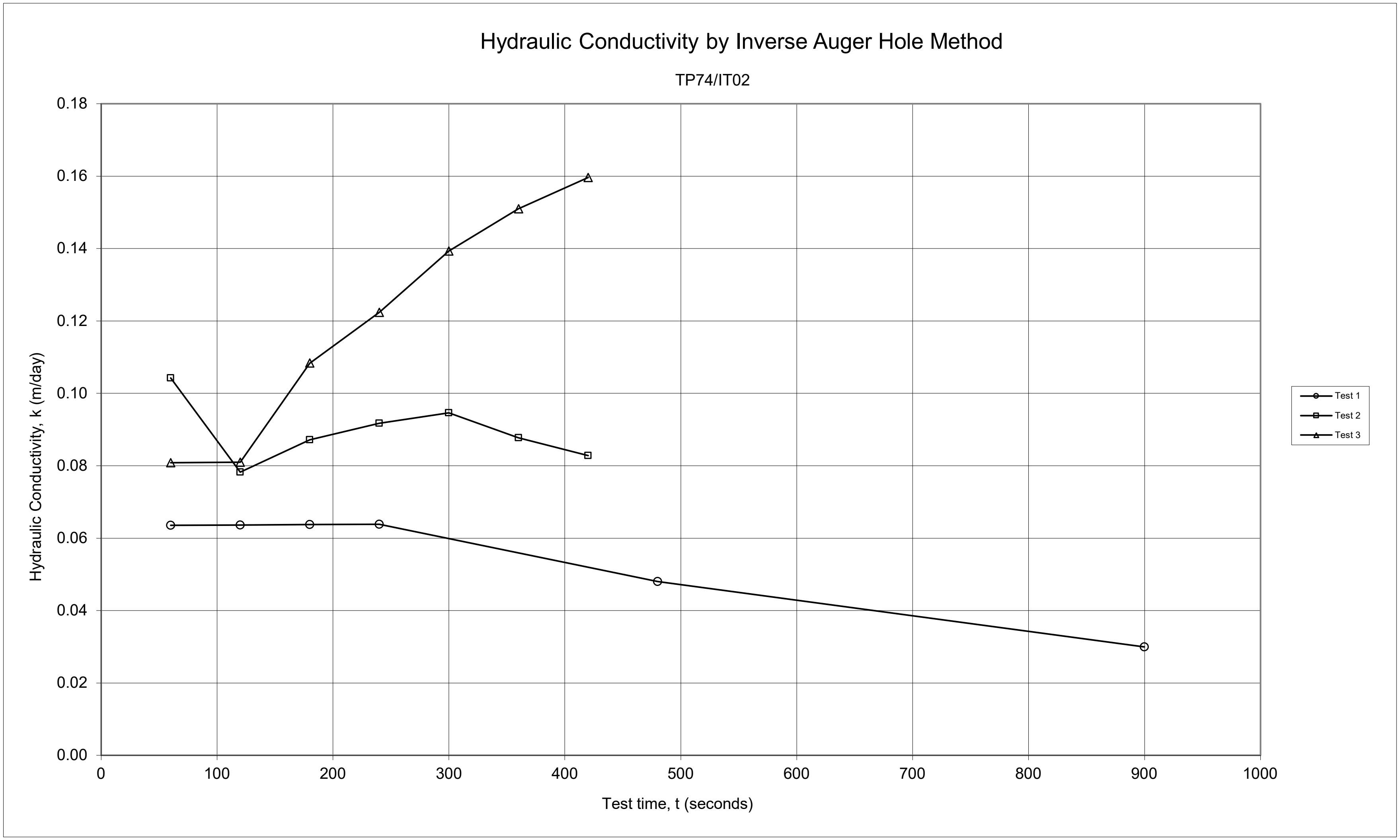
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.69	0.325		
60	0.691	0.324	7.4E-07	0.1
120	0.692	0.323	7.4E-07	0.1
180	0.693	0.322	7.4E-07	0.1
240	0.694	0.321	7.4E-07	0.1
480	0.696	0.319	5.6E-07	0.0
900	0.697	0.318	3.5E-07	0.0
		AVERAGE	6.4E-07	0.1

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.615	0.4		
60	0.617	0.398	1.2E-06	0.1
120	0.618	0.397	9.1E-07	0.1
180	0.62	0.395	1.0E-06	0.1
240	0.622	0.393	1.1E-06	0.1
300	0.624	0.391	1.1E-06	0.1
360	0.625	0.39	1.0E-06	0.1
420	0.626	0.389	9.6E-07	0.1
		AVERAGE	1.0E-06	0.1

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.495	0.52		
60	0.497	0.518	9.4E-07	0.1
120	0.499	0.516	9.4E-07	0.1
180	0.503	0.512	1.3E-06	0.1
240	0.507	0.508	1.4E-06	0.1
300	0.512	0.503	1.6E-06	0.1
360	0.517	0.498	1.7E-06	0.2
420	0.522	0.493	1.8E-06	0.2
		AVERAGE	1.4E-06	0.1



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

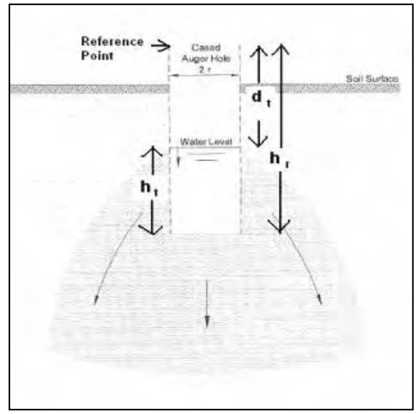
Galt Geotechnics

Spreadsheet author:	ORW
	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP20/IT03
Test Depth:	0.73 m

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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Calculated field	
Comment field	
Field not used	
Fixed field	

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.045	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

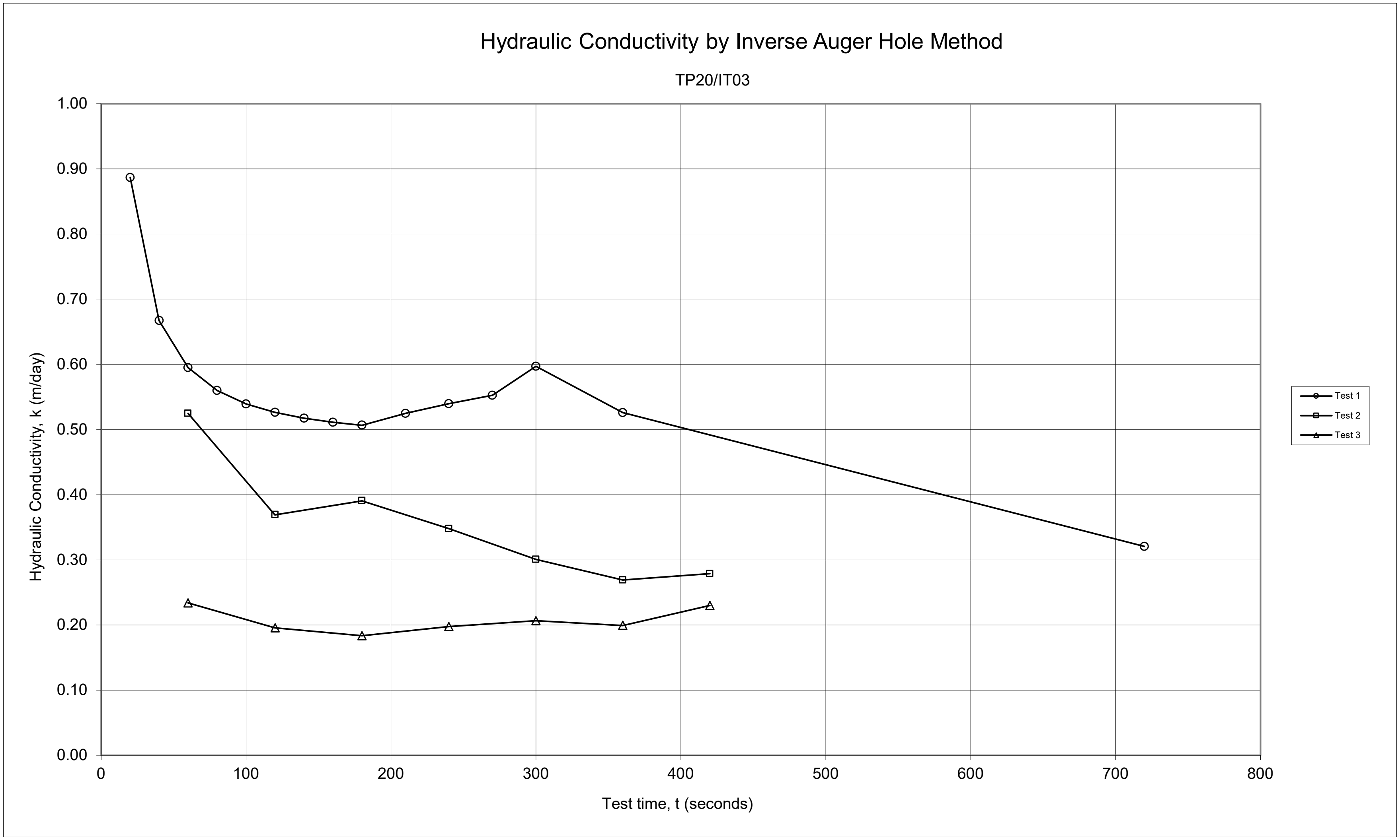
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.913	0.132		
20	0.915	0.13	1.0E-05	0.9
40	0.916	0.129	7.7E-06	0.7
60	0.917	0.128	6.9E-06	0.6
80	0.918	0.127	6.5E-06	0.6
100	0.919	0.126	6.2E-06	0.5
120	0.92	0.125	6.1E-06	0.5
140	0.921	0.124	6.0E-06	0.5
160	0.922	0.123	5.9E-06	0.5
180	0.923	0.122	5.9E-06	0.5
210	0.925	0.12	6.1E-06	0.5
240	0.927	0.118	6.2E-06	0.5
270	0.929	0.116	6.4E-06	0.6
300	0.932	0.113	6.9E-06	0.6
360	0.933	0.112	6.1E-06	0.5
720	0.937	0.108	3.7E-06	0.3
		AVERAGE	6.5E-06	0.6

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.852	0.193		
60	0.857	0.188	6.1E-06	0.5
120	0.859	0.186	4.3E-06	0.4
180	0.863	0.182	4.5E-06	0.4
240	0.865	0.18	4.0E-06	0.3
300	0.866	0.179	3.5E-06	0.3
360	0.867	0.178	3.1E-06	0.3
420	0.87	0.175	3.2E-06	0.3
		AVERAGE	4.1E-06	0.4

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.782	0.263		
60	0.785	0.26	2.7E-06	0.2
120	0.787	0.258	2.3E-06	0.2
180	0.789	0.256	2.1E-06	0.2
240	0.792	0.253	2.3E-06	0.2
300	0.795	0.25	2.4E-06	0.2
360	0.797	0.248	2.3E-06	0.2
420	0.802	0.243	2.7E-06	0.2
		AVERAGE	2.4E-06	0.2


Hydraulic Conductivity by Inverse Auger Hole Method
TP20/IT03
Hydraulic Conductivity, k (m/day)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
100
200
300
400
500
600
700
800
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

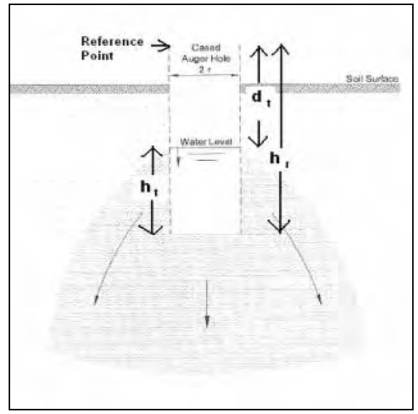
Galt Geotechnics

Spreadsheet author:	ORW
	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP26/IT04
Test Depth:	0.67 m

$$K = 1.15r\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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	Field not used
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Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

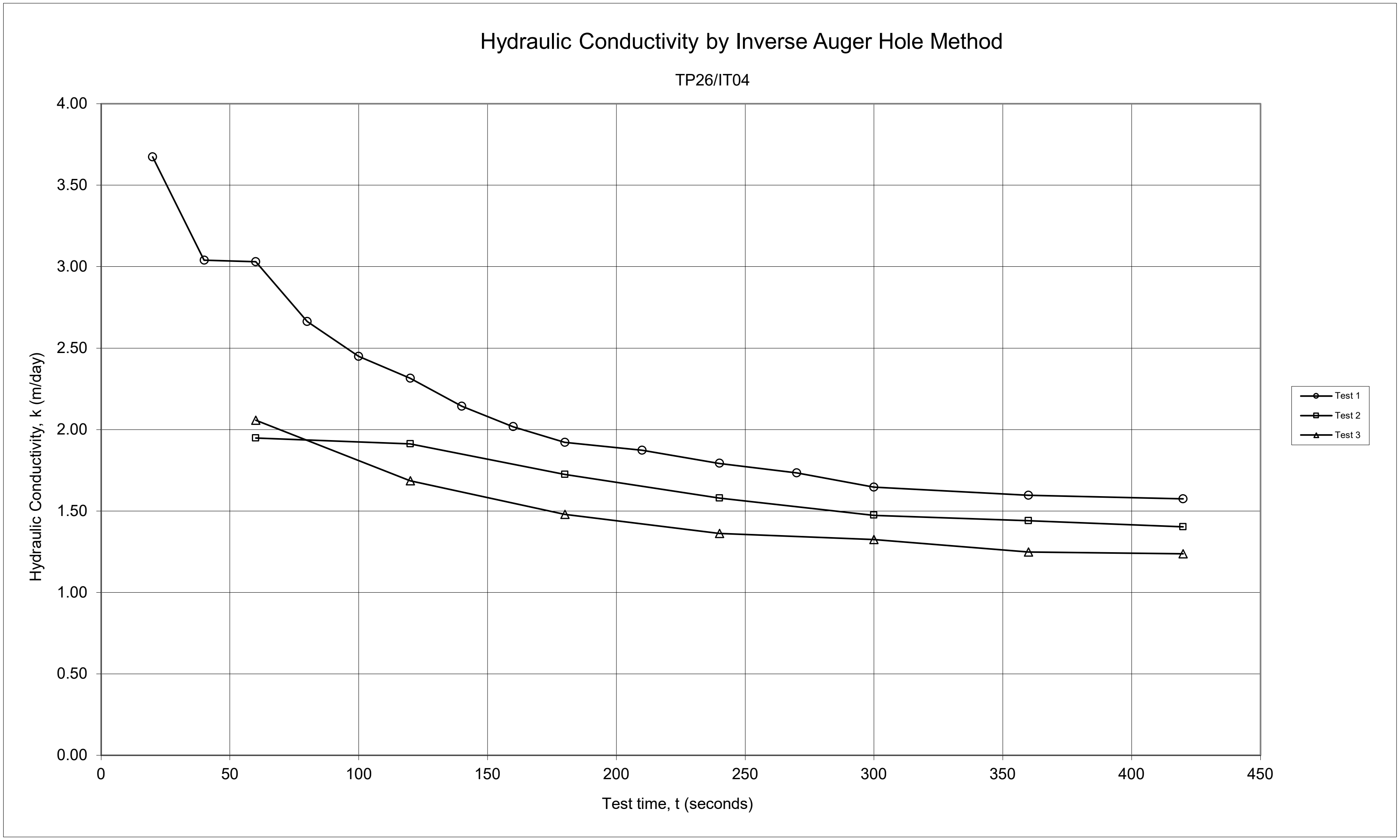
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.87	0.13		
20	0.878	0.122	4.3E-05	3.7
40	0.883	0.117	3.5E-05	3.0
60	0.889	0.111	3.5E-05	3.0
80	0.892	0.108	3.1E-05	2.7
100	0.895	0.105	2.8E-05	2.4
120	0.898	0.102	2.7E-05	2.3
140	0.9	0.1	2.5E-05	2.1
160	0.902	0.098	2.3E-05	2.0
180	0.904	0.096	2.2E-05	1.9
210	0.908	0.092	2.2E-05	1.9
240	0.911	0.089	2.1E-05	1.8
270	0.914	0.086	2.0E-05	1.7
300	0.916	0.084	1.9E-05	1.6
360	0.922	0.078	1.8E-05	1.6
420	0.928	0.072	1.8E-05	1.6
		AVERAGE	2.6E-05	2.2

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.818	0.182		
60	0.835	0.165	2.3E-05	1.9
120	0.85	0.15	2.2E-05	1.9
180	0.86	0.14	2.0E-05	1.7
240	0.868	0.132	1.8E-05	1.6
300	0.875	0.125	1.7E-05	1.5
360	0.883	0.117	1.7E-05	1.4
420	0.89	0.11	1.6E-05	1.4
		AVERAGE	1.9E-05	1.6

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.773	0.227		
60	0.795	0.205	2.4E-05	2.1
120	0.808	0.192	2.0E-05	1.7
180	0.818	0.182	1.7E-05	1.5
240	0.827	0.173	1.6E-05	1.4
300	0.837	0.163	1.5E-05	1.3
360	0.844	0.156	1.4E-05	1.2
420	0.853	0.147	1.4E-05	1.2
		AVERAGE	1.7E-05	1.5



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

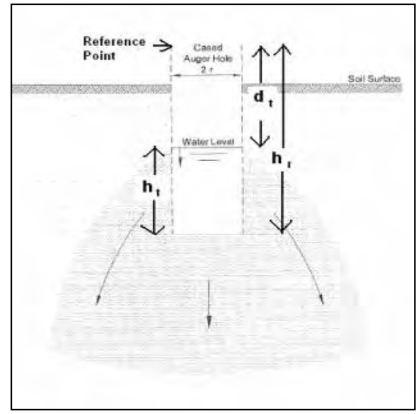
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP42 / IT05
Test Depth:	0.58 m

Spreadsheet author: ORW 17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

Legend	
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(green)	Calculated field
(orange)	Comment field
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(yellow)	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	0.98	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

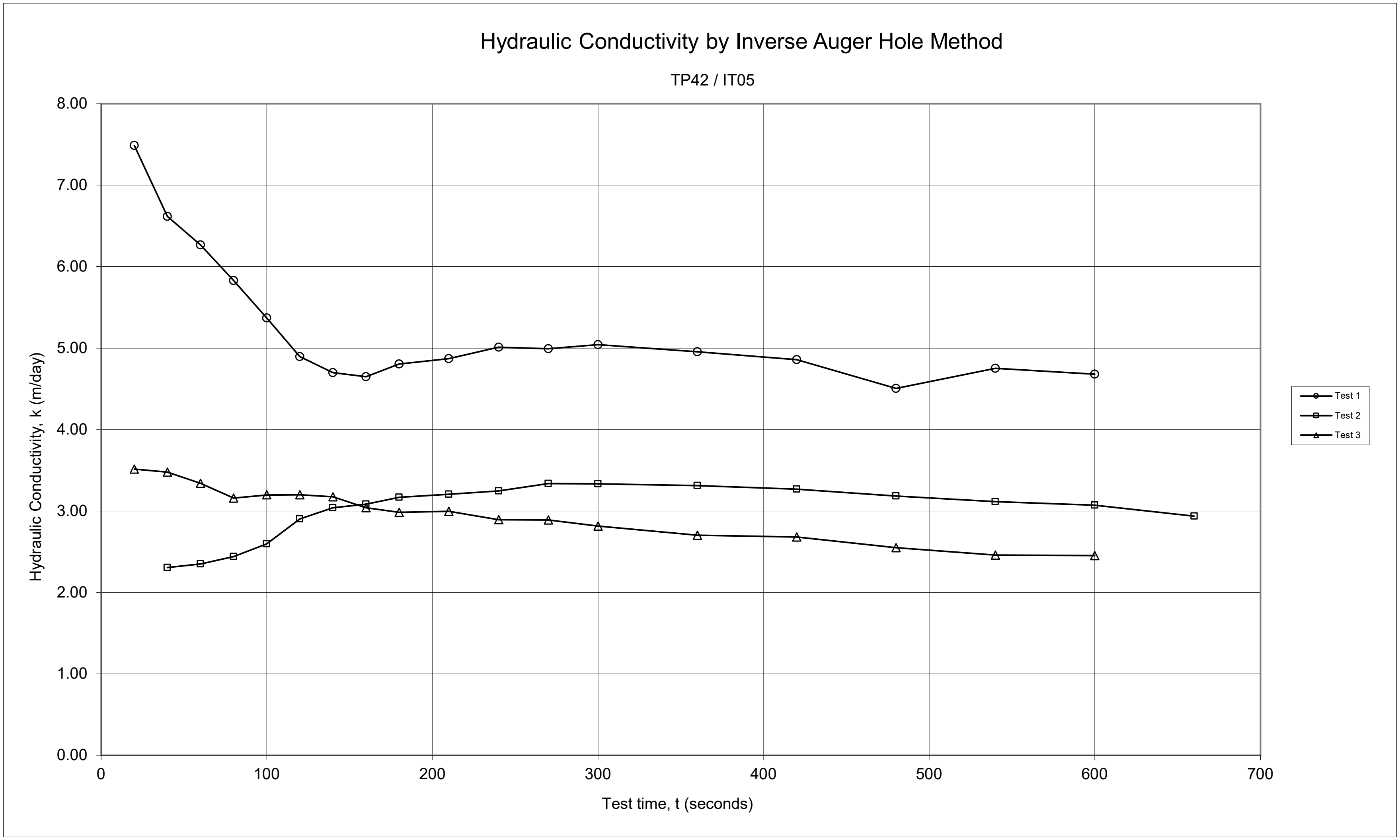
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.4	0.58		
20	0.465	0.515	8.7E-05	7.5
40	0.51	0.47	7.7E-05	6.6
60	0.55	0.43	7.3E-05	6.3
80	0.58	0.4	6.7E-05	5.8
100	0.602	0.378	6.2E-05	5.4
120	0.617	0.363	5.7E-05	4.9
140	0.637	0.343	5.4E-05	4.7
160	0.66	0.32	5.4E-05	4.6
180	0.69	0.29	5.6E-05	4.8
210	0.725	0.255	5.6E-05	4.9
240	0.76	0.22	5.8E-05	5.0
270	0.785	0.195	5.8E-05	5.0
300	0.81	0.17	5.8E-05	5.0
360	0.845	0.135	5.7E-05	5.0
420	0.872	0.108	5.6E-05	4.9
480	0.883	0.097	5.2E-05	4.5
540	0.913	0.067	5.5E-05	4.8
600	0.927	0.053	5.4E-05	4.7
		AVERAGE	6.1E-05	5.2

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.588	0.392		
40	0.616	0.364	2.7E-05	2.3
60	0.63	0.35	2.7E-05	2.3
80	0.645	0.335	2.8E-05	2.4
100	0.662	0.318	3.0E-05	2.6
120	0.684	0.296	3.4E-05	2.9
140	0.702	0.278	3.5E-05	3.0
160	0.717	0.263	3.6E-05	3.1
180	0.733	0.247	3.7E-05	3.2
210	0.753	0.227	3.7E-05	3.2
240	0.772	0.208	3.8E-05	3.2
270	0.792	0.188	3.9E-05	3.3
300	0.807	0.173	3.9E-05	3.3
360	0.833	0.147	3.8E-05	3.3
420	0.854	0.126	3.8E-05	3.3
480	0.87	0.11	3.7E-05	3.2
540	0.884	0.096	3.6E-05	3.1
600	0.897	0.083	3.6E-05	3.1
660	0.904	0.076	3.4E-05	2.9
		AVERAGE	3.5E-05	3.0

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.73	0.25		
20	0.744	0.236	4.1E-05	3.5
40	0.757	0.223	4.0E-05	3.5
60	0.768	0.212	3.9E-05	3.3
80	0.777	0.203	3.7E-05	3.2
100	0.788	0.192	3.7E-05	3.2
120	0.798	0.182	3.7E-05	3.2
140	0.807	0.173	3.7E-05	3.2
160	0.813	0.167	3.5E-05	3.0
180	0.82	0.16	3.5E-05	3.0
210	0.832	0.148	3.5E-05	3.0
240	0.84	0.14	3.3E-05	2.9
270	0.85	0.13	3.3E-05	2.9
300	0.857	0.123	3.3E-05	2.8
360	0.87	0.11	3.1E-05	2.7
420	0.884	0.096	3.1E-05	2.7
480	0.892	0.088	2.9E-05	2.5
540	0.9	0.08	2.8E-05	2.5
600	0.91	0.07	2.8E-05	2.5
		AVERAGE	3.4E-05	3.0



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

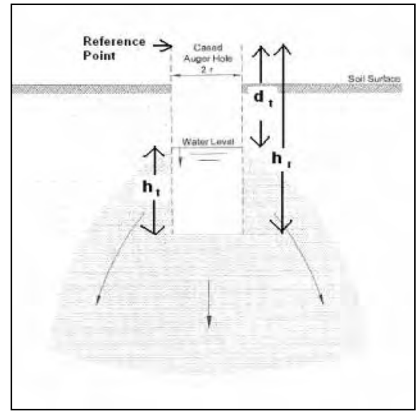
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP30/IT06
Test Depth:	0.65 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

Legend	
(blue)	Required input
(green)	Calculated field
(orange)	Comment field
(crossed)	Field not used
(yellow)	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.08	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

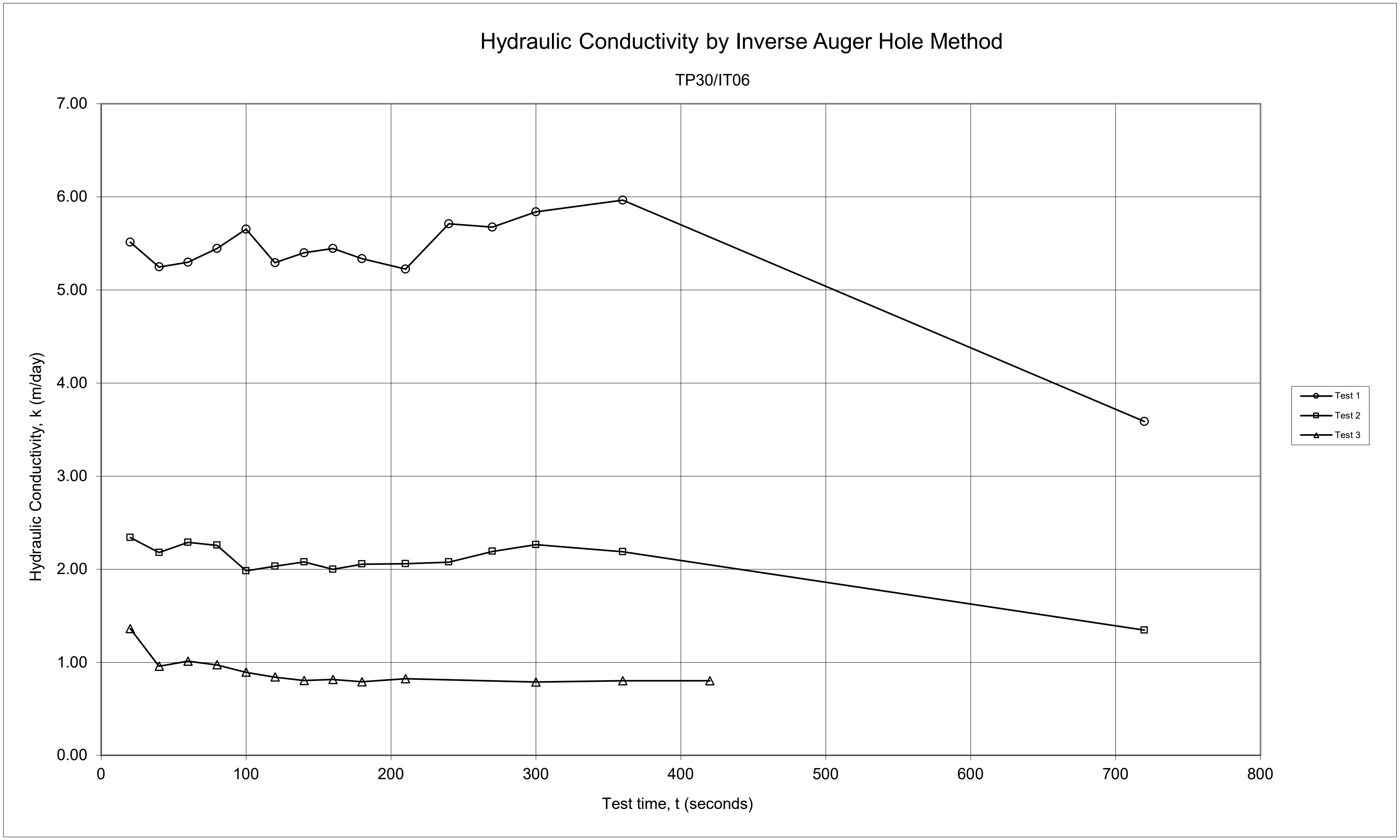
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.948	0.132		
20	0.96	0.12	6.4E-05	5.5
40	0.97	0.11	6.1E-05	5.2
60	0.98	0.1	6.1E-05	5.3
80	0.99	0.09	6.3E-05	5.4
100	1	0.08	6.5E-05	5.7
120	1.005	0.075	6.1E-05	5.3
140	1.013	0.067	6.2E-05	5.4
160	1.02	0.06	6.3E-05	5.4
180	1.025	0.055	6.2E-05	5.3
210	1.032	0.048	6.0E-05	5.2
240	1.044	0.036	6.6E-05	5.7
270	1.05	0.03	6.6E-05	5.7
300	1.057	0.023	6.8E-05	5.8
360	1.067	0.013	6.9E-05	6.0
720	1.075	0.005	4.2E-05	3.6
		AVERAGE	6.2E-05	5.4

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.926	0.154		
20	0.932	0.148	2.7E-05	2.3
40	0.937	0.143	2.5E-05	2.2
60	0.943	0.137	2.6E-05	2.3
80	0.948	0.132	2.6E-05	2.3
100	0.95	0.13	2.3E-05	2.0
120	0.955	0.125	2.4E-05	2.0
140	0.96	0.12	2.4E-05	2.1
160	0.963	0.117	2.3E-05	2.0
180	0.968	0.112	2.4E-05	2.1
210	0.974	0.106	2.4E-05	2.1
240	0.98	0.1	2.4E-05	2.1
270	0.988	0.092	2.5E-05	2.2
300	0.995	0.085	2.6E-05	2.3
360	1.003	0.077	2.5E-05	2.2
720	1.015	0.065	1.6E-05	1.3
		AVERAGE	2.4E-05	2.1

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.855	0.225		
20	0.86	0.22	1.6E-05	1.4
40	0.862	0.218	1.1E-05	1.0
60	0.866	0.214	1.2E-05	1.0
80	0.869	0.211	1.1E-05	1.0
100	0.871	0.209	1.0E-05	0.9
120	0.873	0.207	9.7E-06	0.8
140	0.875	0.205	9.3E-06	0.8
160	0.878	0.202	9.4E-06	0.8
180	0.88	0.2	9.2E-06	0.8
210	0.885	0.195	9.5E-06	0.8
300	0.895	0.185	9.1E-06	0.8
360	0.903	0.177	9.3E-06	0.8
420	0.91	0.17	9.3E-06	0.8
		AVERAGE	1.0E-05	0.9



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

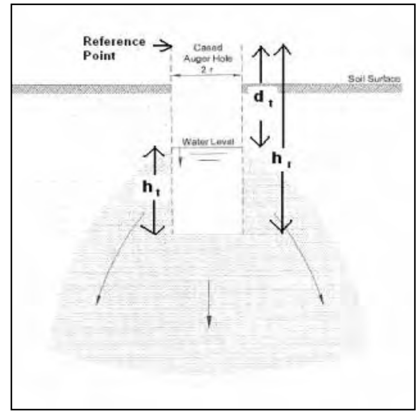
Galt Geotechnics

Spreadsheet author:	ORW	17-Oct-09	

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP41/IT07
Test Depth:	0.62 m

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

(blue)	Required input
(green)	Calculated field
(orange)	Comment field
(crossed)	Field not used
(yellow)	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.05	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.847	0.203		
40	0.849	0.201	3.5E-06	0.3
60	0.851	0.199	4.6E-06	0.4
80	0.853	0.197	5.2E-06	0.5
100	0.855	0.195	5.6E-06	0.5
120	0.857	0.193	5.9E-06	0.5
140	0.858	0.192	5.5E-06	0.5
160	0.859	0.191	5.3E-06	0.5
180	0.86	0.19	5.1E-06	0.4
210	0.863	0.187	5.4E-06	0.5
240	0.865	0.185	5.4E-06	0.5
270	0.867	0.183	5.3E-06	0.5
300	0.868	0.182	5.1E-06	0.4
360	0.872	0.178	5.1E-06	0.4
420	0.875	0.175	4.9E-06	0.4
		AVERAGE	5.1E-06	0.4

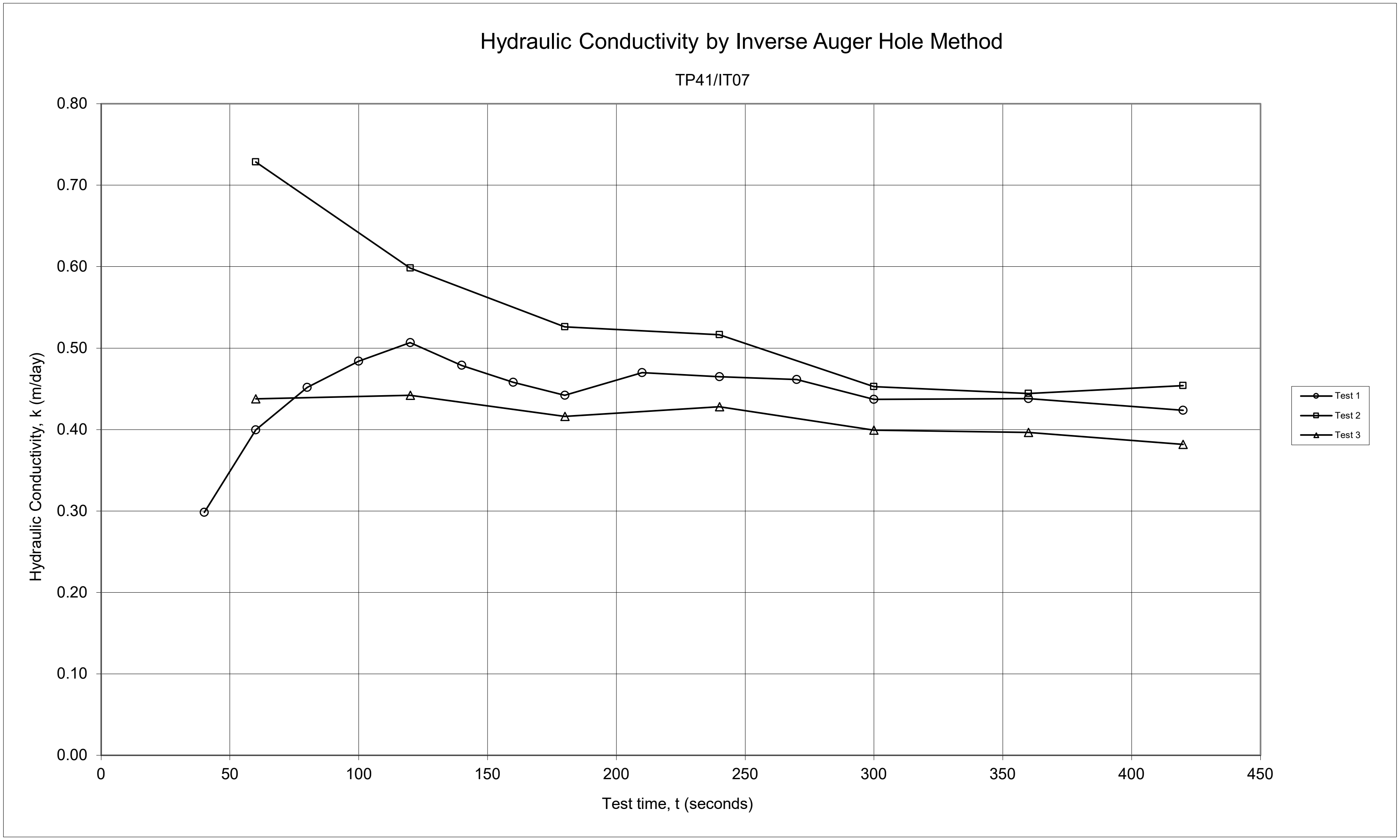
Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.824	0.226		
60	0.832	0.218	8.4E-06	0.7
120	0.837	0.213	6.9E-06	0.6
180	0.841	0.209	6.1E-06	0.5
240	0.846	0.204	6.0E-06	0.5
300	0.848	0.202	5.2E-06	0.5
360	0.852	0.198	5.1E-06	0.4
420	0.857	0.193	5.3E-06	0.5
		AVERAGE	6.2E-06	0.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.816	0.234		
60	0.821	0.229	5.1E-06	0.4
120	0.826	0.224	5.1E-06	0.4
180	0.83	0.22	4.8E-06	0.4
240	0.835	0.215	5.0E-06	0.4
300	0.838	0.212	4.6E-06	0.4
360	0.842	0.208	4.6E-06	0.4
420	0.845	0.205	4.4E-06	0.4
		AVERAGE	4.8E-06	0.4

\\galtgeo.local\OsbornePark\Data\Jobs\2022\J2201059 - SoA SI Onslow Industrial Park\08 Analysis\Permeability Inverse Auger Hole Method - Rev2


Hydraulic Conductivity by Inverse Auger Hole Method
TP41/IT07
Hydraulic Conductivity, k (m/day)
Test time, t (seconds)
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0
50
100
150
200
250
300
350
400
450
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

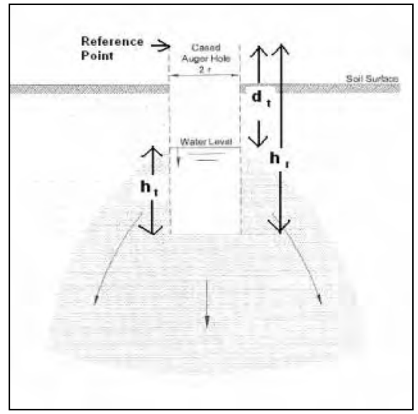
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP46/IT08
Test Depth:	0.47 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

Colour	Meaning
(blue)	Required input
(green)	Calculated field
(orange)	Comment field
(crossed)	Field not used
(yellow)	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.055	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.96	0.095		
20	0.968	0.087	5.7E-05	4.9
40	0.974	0.081	5.1E-05	4.4
60	0.98	0.075	5.0E-05	4.3
80	0.984	0.071	4.6E-05	4.0
100	0.99	0.065	4.8E-05	4.1
120	0.994	0.061	4.6E-05	4.0
140	1	0.055	4.8E-05	4.2
160	1.002	0.053	4.5E-05	3.9
180	1.004	0.051	4.3E-05	3.7
210	1.008	0.047	4.1E-05	3.5
240	1.014	0.041	4.2E-05	3.6
270	1.017	0.038	4.1E-05	3.5
300	1.02	0.035	3.9E-05	3.4
360	1.028	0.027	4.0E-05	3.5
420	1.032	0.023	3.8E-05	3.3
		AVERAGE	4.5E-05	3.9

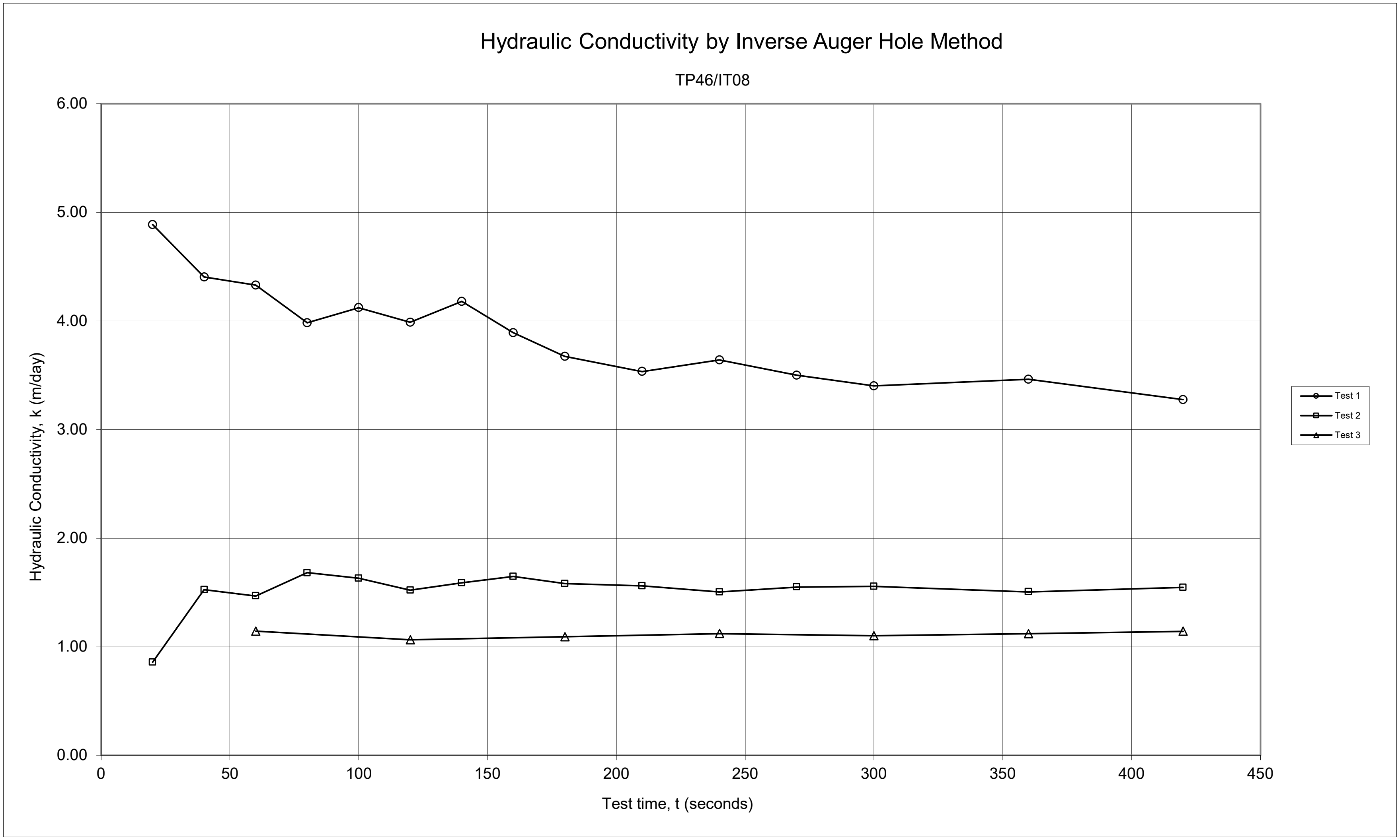
Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.918	0.137		
20	0.92	0.135	9.9E-06	0.9
40	0.925	0.13	1.8E-05	1.5
60	0.928	0.127	1.7E-05	1.5
80	0.933	0.122	1.9E-05	1.7
100	0.936	0.119	1.9E-05	1.6
120	0.938	0.117	1.8E-05	1.5
140	0.942	0.113	1.8E-05	1.6
160	0.946	0.109	1.9E-05	1.6
180	0.948	0.107	1.8E-05	1.6
210	0.952	0.103	1.8E-05	1.6
240	0.955	0.1	1.7E-05	1.5
270	0.96	0.095	1.8E-05	1.6
300	0.964	0.091	1.8E-05	1.6
360	0.97	0.085	1.7E-05	1.5
420	0.978	0.077	1.8E-05	1.5
		AVERAGE	1.8E-05	1.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.857	0.198		
60	0.868	0.187	1.3E-05	1.1
120	0.877	0.178	1.2E-05	1.1
180	0.887	0.168	1.3E-05	1.1
240	0.897	0.158	1.3E-05	1.1
300	0.905	0.15	1.3E-05	1.1
360	0.914	0.141	1.3E-05	1.1
420	0.923	0.132	1.3E-05	1.1
		AVERAGE	1.3E-05	1.1

Attachment 15.1A - Proposed Development - Onslow Industrial Park



Hydraulic Conductivity Calculation - Inverse Auger Hole Method

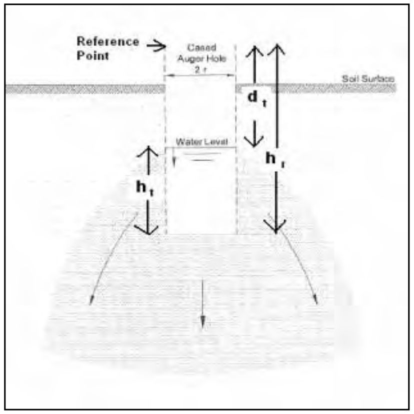
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP50/IT09
Test Depth:	0.74 m

Spreadsheet author: ORW 17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

Required input	
Calculated field	
Comment field	
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Fixed field	

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

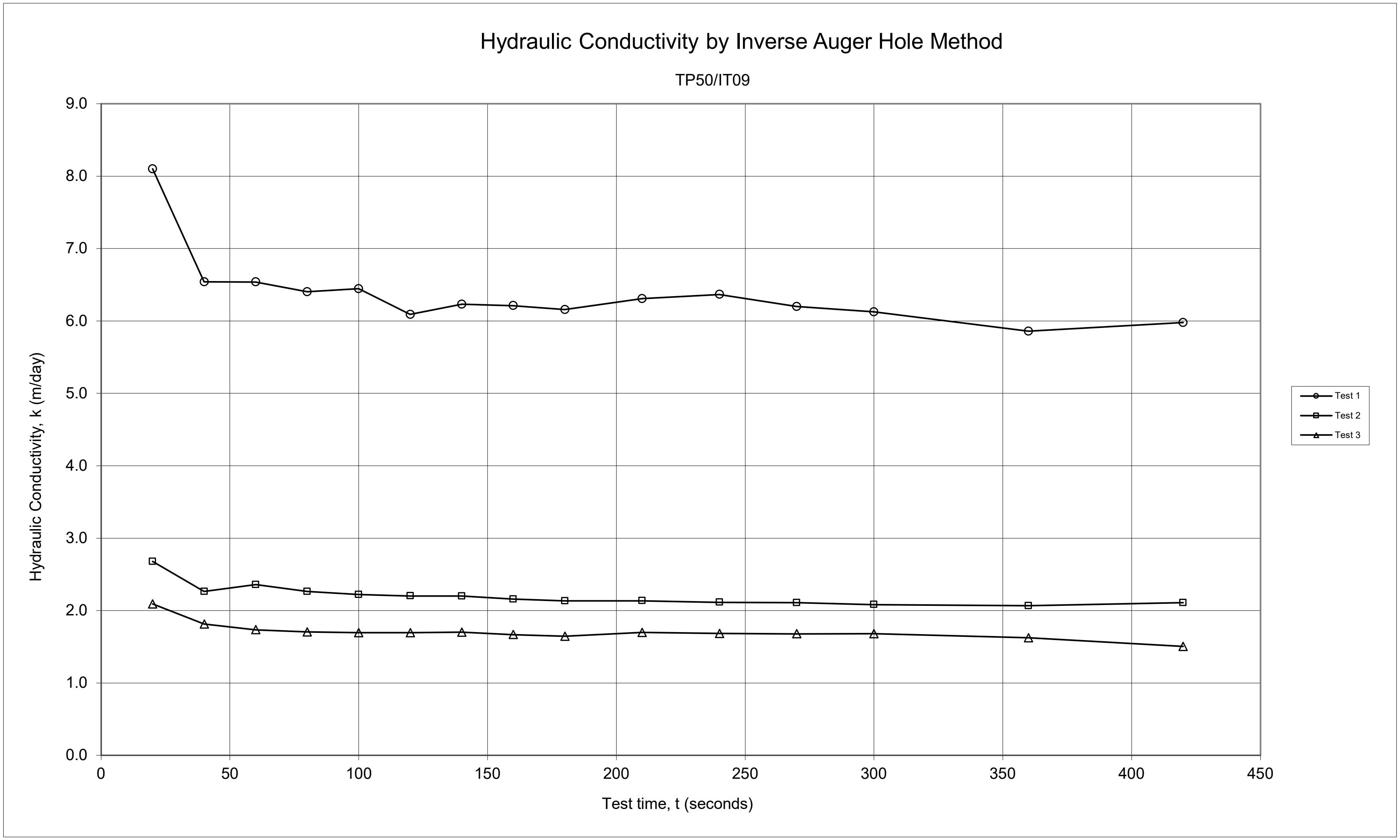
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.862	0.138		
20	0.88	0.12	9.4E-05	8.1
40	0.89	0.11	7.6E-05	6.5
60	0.902	0.098	7.6E-05	6.5
80	0.912	0.088	7.4E-05	6.4
100	0.922	0.078	7.5E-05	6.4
120	0.928	0.072	7.0E-05	6.1
140	0.937	0.063	7.2E-05	6.2
160	0.944	0.056	7.2E-05	6.2
180	0.95	0.05	7.1E-05	6.2
210	0.96	0.04	7.3E-05	6.3
240	0.968	0.032	7.4E-05	6.4
270	0.973	0.027	7.2E-05	6.2
300	0.978	0.022	7.1E-05	6.1
360	0.985	0.015	6.8E-05	5.9
420	0.993	0.007	6.9E-05	6.0
		AVERAGE	7.4E-05	6.4

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.793	0.207		
20	0.802	0.198	3.1E-05	2.7
40	0.808	0.192	2.6E-05	2.3
60	0.816	0.184	2.7E-05	2.4
80	0.822	0.178	2.6E-05	2.3
100	0.828	0.172	2.6E-05	2.2
120	0.834	0.166	2.5E-05	2.2
140	0.84	0.16	2.5E-05	2.2
160	0.845	0.155	2.5E-05	2.2
180	0.85	0.15	2.5E-05	2.1
210	0.858	0.142	2.5E-05	2.1
240	0.865	0.135	2.4E-05	2.1
270	0.872	0.128	2.4E-05	2.1
300	0.878	0.122	2.4E-05	2.1
360	0.89	0.11	2.4E-05	2.1
420	0.903	0.097	2.4E-05	2.1
		AVERAGE	2.6E-05	2.2

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.795	0.205		
20	0.802	0.198	2.4E-05	2.1
40	0.807	0.193	2.1E-05	1.8
60	0.812	0.188	2.0E-05	1.7
80	0.817	0.183	2.0E-05	1.7
100	0.822	0.178	2.0E-05	1.7
120	0.827	0.173	2.0E-05	1.7
140	0.832	0.168	2.0E-05	1.7
160	0.836	0.164	1.9E-05	1.7
180	0.84	0.16	1.9E-05	1.6
210	0.848	0.152	2.0E-05	1.7
240	0.854	0.146	1.9E-05	1.7
270	0.86	0.14	1.9E-05	1.7
300	0.866	0.134	1.9E-05	1.7
360	0.875	0.125	1.9E-05	1.6
420	0.88	0.12	1.7E-05	1.5
		AVERAGE	2.0E-05	1.7



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

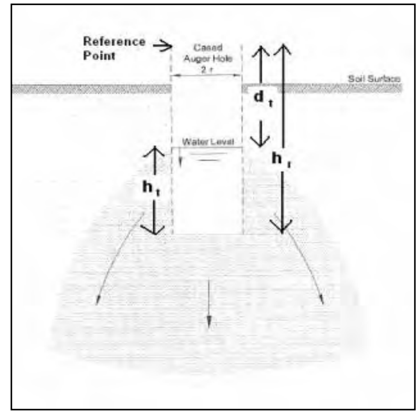
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP67/IT10
Test Depth:	0.71 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
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Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	0.96	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.783	0.177		
20	0.8	0.16	6.9E-05	6.0
40	0.81	0.15	5.7E-05	4.9
60	0.82	0.14	5.3E-05	4.6
80	0.83	0.13	5.3E-05	4.5
100	0.838	0.122	5.1E-05	4.4
120	0.843	0.117	4.7E-05	4.0
140	0.848	0.112	4.4E-05	3.8
160	0.855	0.105	4.4E-05	3.8
180	0.86	0.1	4.3E-05	3.7
210	0.868	0.092	4.2E-05	3.6
240	0.873	0.087	3.9E-05	3.4
270	0.882	0.078	4.0E-05	3.5
300	0.89	0.07	4.1E-05	3.5
360	0.903	0.057	4.1E-05	3.5
420	0.916	0.044	4.2E-05	3.6
		AVERAGE	4.7E-05	4.1

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.805	0.155		
20	0.81	0.15	2.2E-05	1.9
40	0.815	0.145	2.3E-05	2.0
60	0.822	0.138	2.6E-05	2.3
80	0.826	0.134	2.5E-05	2.1
100	0.83	0.13	2.4E-05	2.1
120	0.833	0.127	2.2E-05	1.9
140	0.837	0.123	2.2E-05	1.9
160	0.842	0.118	2.3E-05	2.0
180	0.847	0.113	2.4E-05	2.0
210	0.851	0.109	2.3E-05	1.9
240	0.857	0.103	2.3E-05	2.0
270	0.863	0.097	2.3E-05	2.0
300	0.868	0.092	2.3E-05	2.0
360	0.88	0.08	2.4E-05	2.1
420	0.888	0.072	2.4E-05	2.1
		AVERAGE	2.3E-05	2.0

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.79	0.17		
20	0.796	0.164	2.5E-05	2.1
40	0.802	0.158	2.5E-05	2.2
60	0.808	0.152	2.6E-05	2.2
80	0.812	0.148	2.4E-05	2.0
100	0.817	0.143	2.4E-05	2.0
120	0.82	0.14	2.2E-05	1.9
140	0.823	0.137	2.1E-05	1.8
160	0.828	0.132	2.2E-05	1.9
180	0.832	0.128	2.1E-05	1.9
210	0.837	0.123	2.1E-05	1.8
240	0.842	0.118	2.1E-05	1.8
270	0.848	0.112	2.1E-05	1.8
300	0.853	0.107	2.1E-05	1.8
360	0.865	0.095	2.2E-05	1.9
420	0.873	0.087	2.1E-05	1.8
		AVERAGE	2.2E-05	1.9

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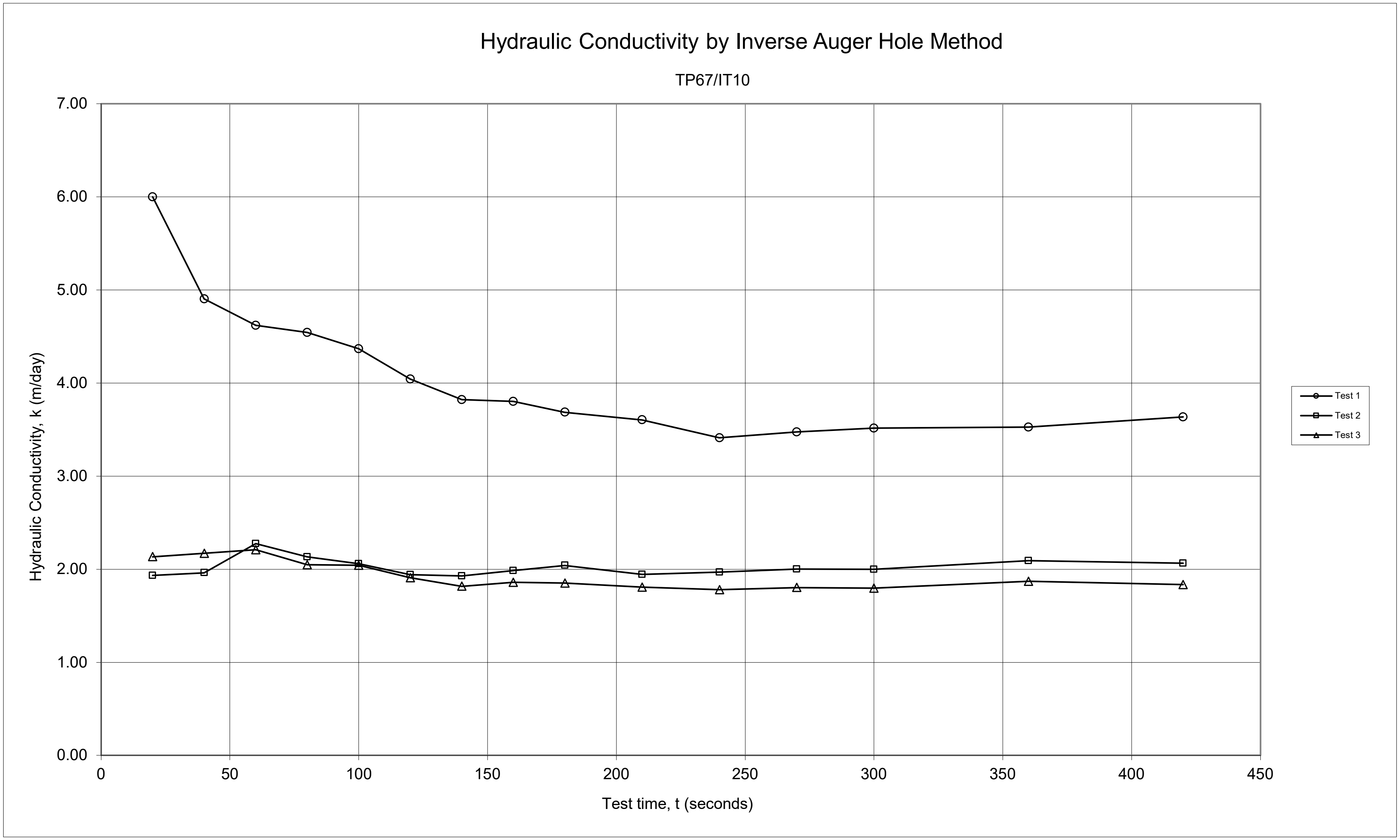
Attachment 15.1A - Proposed Development - Onslow Industrial Park



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Hydraulic Conductivity Calculation - Inverse Auger Hole Method

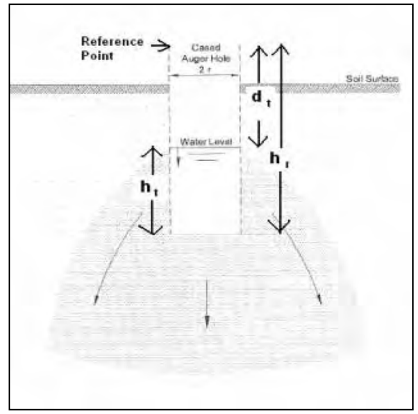
Galt Geotechnics

Spreadsheet author:	ORW	17-Oct-09

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP31/IT11
Test Depth:	0.50 m

$$K = 1.15r\,\frac{\log_{10}(h_0+\frac{1}{2}r)-\log_{10}(h_t+\frac{1}{2}r)}{t-t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

Required input	
Calculated field	
Comment field	
Field not used	
Fixed field	

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

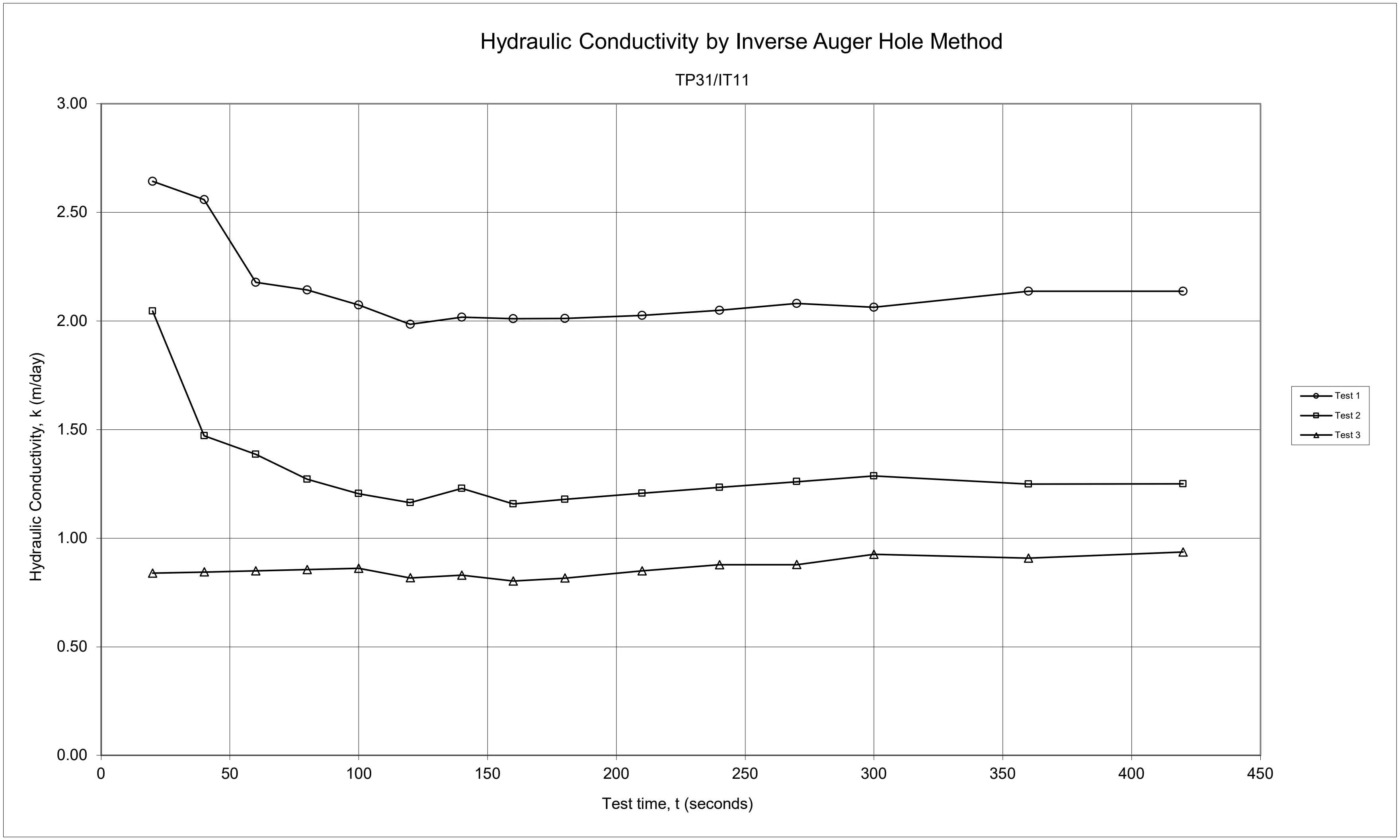
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.765	0.235		
20	0.775	0.225	3.1E-05	2.6
40	0.784	0.216	3.0E-05	2.6
60	0.789	0.211	2.5E-05	2.2
80	0.796	0.204	2.5E-05	2.1
100	0.802	0.198	2.4E-05	2.1
120	0.807	0.193	2.3E-05	2.0
140	0.814	0.186	2.3E-05	2.0
160	0.82	0.18	2.3E-05	2.0
180	0.826	0.174	2.3E-05	2.0
210	0.835	0.165	2.3E-05	2.0
240	0.844	0.156	2.4E-05	2.0
270	0.853	0.147	2.4E-05	2.1
300	0.86	0.14	2.4E-05	2.1
360	0.877	0.123	2.5E-05	2.1
420	0.89	0.11	2.5E-05	2.1
		AVERAGE	2.5E-05	2.1

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.79	0.21		
20	0.797	0.203	2.4E-05	2.0
40	0.8	0.2	1.7E-05	1.5
60	0.804	0.196	1.6E-05	1.4
80	0.807	0.193	1.5E-05	1.3
100	0.81	0.19	1.4E-05	1.2
120	0.813	0.187	1.3E-05	1.2
140	0.818	0.182	1.4E-05	1.2
160	0.82	0.18	1.3E-05	1.2
180	0.824	0.176	1.4E-05	1.2
210	0.83	0.17	1.4E-05	1.2
240	0.836	0.164	1.4E-05	1.2
270	0.842	0.158	1.5E-05	1.3
300	0.848	0.152	1.5E-05	1.3
360	0.856	0.144	1.4E-05	1.2
420	0.865	0.135	1.4E-05	1.2
		AVERAGE	1.5E-05	1.3

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.782	0.218		
20	0.785	0.215	9.7E-06	0.8
40	0.788	0.212	9.8E-06	0.8
60	0.791	0.209	9.8E-06	0.8
80	0.794	0.206	9.9E-06	0.9
100	0.797	0.203	1.0E-05	0.9
120	0.799	0.201	9.5E-06	0.8
140	0.802	0.198	9.6E-06	0.8
160	0.804	0.196	9.3E-06	0.8
180	0.807	0.193	9.4E-06	0.8
210	0.812	0.188	9.8E-06	0.8
240	0.817	0.183	1.0E-05	0.9
270	0.821	0.179	1.0E-05	0.9
300	0.827	0.173	1.1E-05	0.9
360	0.834	0.166	1.1E-05	0.9
420	0.843	0.157	1.1E-05	0.9
		AVERAGE	9.9E-06	0.9



\\galtgeo.local\OsbornePark\Data\Jobs\2022\J2201059 - SoA SI Onslow Industrial Park\08 Analysis\Permeability Inverse Auger Hole Method - Rev2

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

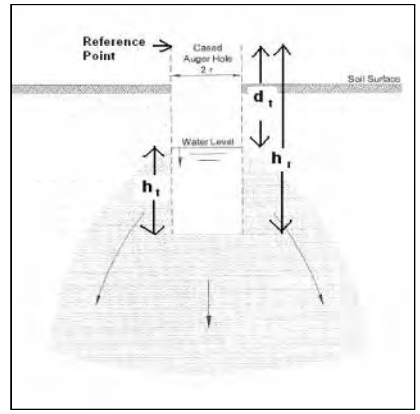
Galt Geotechnics

Job No:	J2201059
Client:	Shire of Ashburton
Project:	Proposed Onslow Industrial Park
Location:	Lot 201 Onslow Road, Onslow WA
Calc by:	TM
BH Name:	TP71 / IT12
Test Depth:	0.43 m

Spreadsheet author: ORW 17-Oct-09

$$K = 1.15r\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

Legend	
Required input	
Calculated field	
Comment field	
Field not used	
Fixed field	

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.03	m
t	time since start of measurement		s
h_r	reference point height above base	1.03	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.93	0.1		
20	0.95	0.08	1.4E-04	12.4
40	0.963	0.067	1.3E-04	10.9
60	0.975	0.055	1.2E-04	10.7
80	0.983	0.047	1.2E-04	10.0
100	0.99	0.04	1.1E-04	9.5
120	0.997	0.033	1.1E-04	9.4
140	1.002	0.028	1.1E-04	9.1
160	1.007	0.023	1.0E-04	9.0
180	1.01	0.02	9.9E-05	8.6
210	1.018	0.012	1.0E-04	8.9
240	1.025	0.005	1.1E-04	9.4
270	1.03	0	1.1E-04	9.8
		AVERAGE	1.1E-04	9.8

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.745	0.285		
20	0.758	0.272	3.3E-05	2.9
40	0.77	0.26	3.3E-05	2.8
60	0.78	0.25	3.1E-05	2.7
80	0.788	0.242	2.9E-05	2.5
100	0.798	0.232	2.9E-05	2.5
120	0.806	0.224	2.8E-05	2.5
140	0.815	0.215	2.8E-05	2.5
160	0.822	0.208	2.8E-05	2.4
180	0.83	0.2	2.8E-05	2.4
210	0.84	0.19	2.7E-05	2.3
240	0.85	0.18	2.7E-05	2.3
270	0.864	0.166	2.8E-05	2.4
300	0.872	0.158	2.7E-05	2.4
360	0.89	0.14	2.7E-05	2.4
420	0.905	0.125	2.7E-05	2.3
		AVERAGE	2.9E-05	2.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.822	0.208		
20	0.83	0.2	2.7E-05	2.4
40	0.836	0.194	2.4E-05	2.1
60	0.843	0.187	2.5E-05	2.1
80	0.847	0.183	2.2E-05	1.9
100	0.855	0.175	2.4E-05	2.1
120	0.862	0.168	2.5E-05	2.1
140	0.866	0.164	2.4E-05	2.0
160	0.87	0.16	2.3E-05	2.0
180	0.878	0.152	2.4E-05	2.1
210	0.885	0.145	2.4E-05	2.0
240	0.893	0.137	2.4E-05	2.1
270	0.9	0.13	2.4E-05	2.1
300	0.91	0.12	2.5E-05	2.2
360	0.925	0.105	2.6E-05	2.2
420	0.94	0.09	2.7E-05	2.3
480	0.955	0.075	2.8E-05	2.4
540	0.967	0.063	2.9E-05	2.5
600	0.98	0.05	3.1E-05	2.7
		AVERAGE	2.5E-05	2.2

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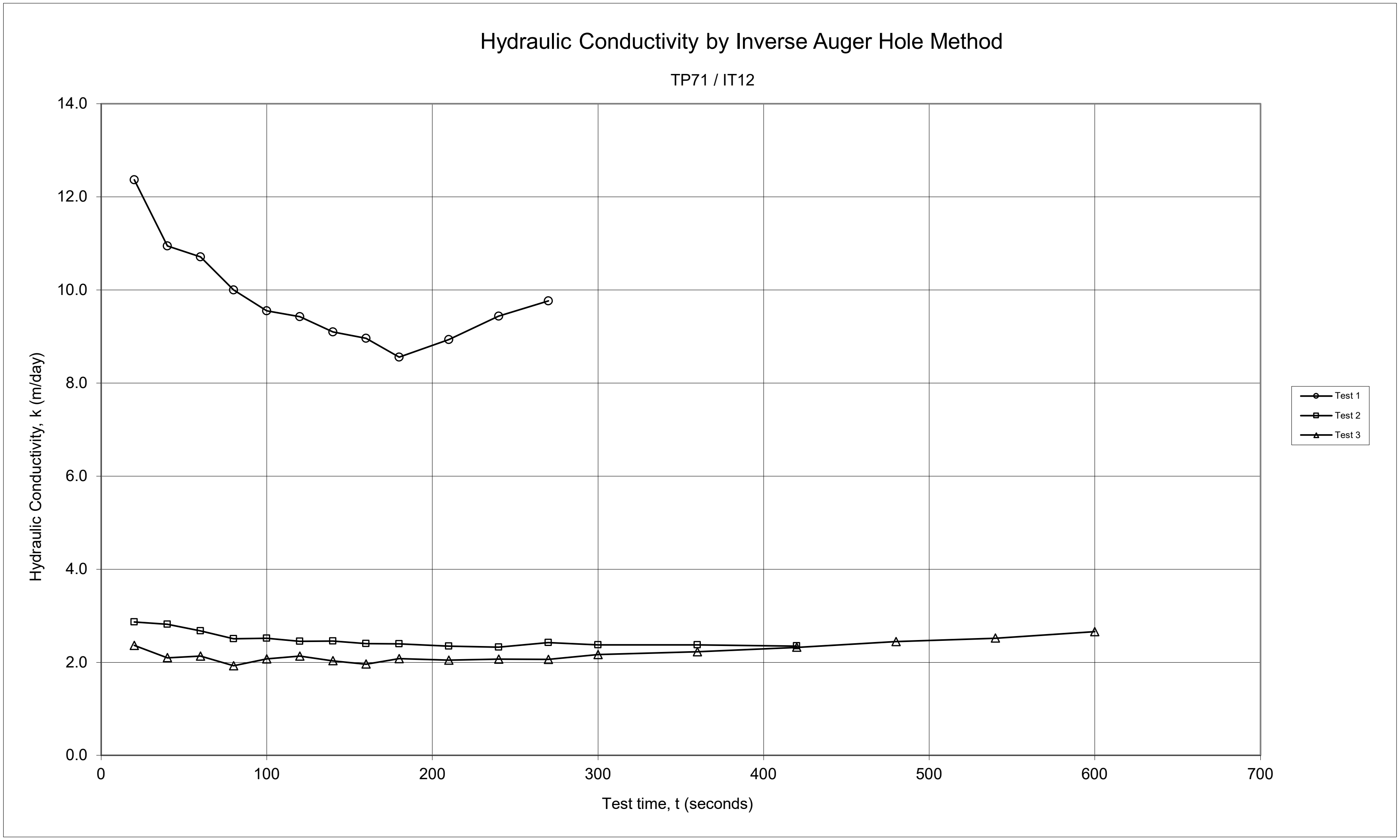

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Appendix F: Laboratory Test Results

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with Gravel and Shells**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4724_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4724
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (2-2.5)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Clayey Silt**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

Accreditation No. 20599
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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with Gravel and Shells**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

Accreditation No. 20599
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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4726_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4726
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP08 (1.5-2)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with Limestone and shells**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4729_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4729
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP10 (1.5-2)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4732_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4732
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0-0.4)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with Gravel and Shells**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with Shells and trace Gravel**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP13 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with Limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4735_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4735
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP17 (0-0.5)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Clayey Silt**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with Limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4739_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4739
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP30 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with trace Limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4741_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4741
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP36 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4744_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4744
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP44 (0.5-1)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Silty Sand with Gravel**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill
Date: 31/March/2022

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4746_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4746
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP52 (0.3-0.7)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Sand with trace of Limestone**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.8.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_ECN
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	30/03/2022

TEST RESULTS - Emerson Class Number

Sampling Method:	**Sampled by Client, Tested as Received**
Source of Material:	**Not Specified**
Soil Description:	**Clayey Silt**
Water Used:	**Distilled**

EMERSON CLASS NUMBER	**4**

Comments: Calcite present in sample.

Approved Signatory:

Name: Cody O'Neill

Date: 31/March/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

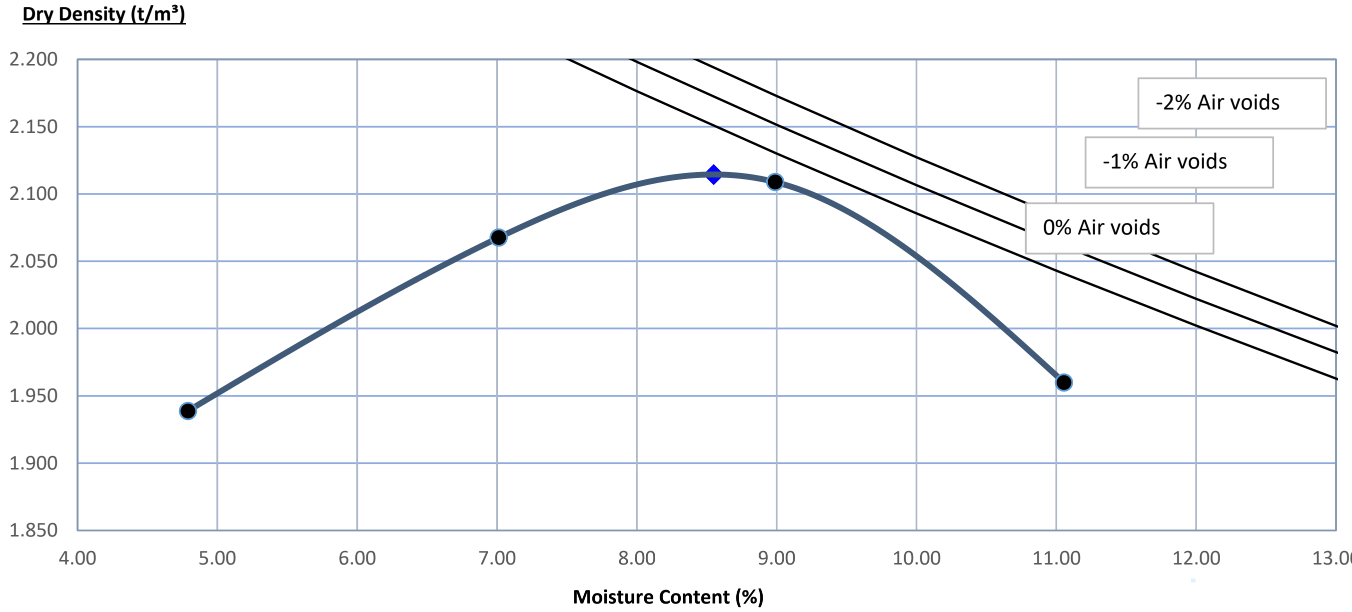
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**4.8**	**7.0**	**9.0**	**11.1**	
Dry Density (t/m³)	**1.939**	**2.068**	**2.109**	**1.960**	



Modified Maximum Dry Density (t/m³) **2.11**

Optimum Moisture Content (%) **8.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.635 t/m³***

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4751_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4751
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP61 (0.5-1)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

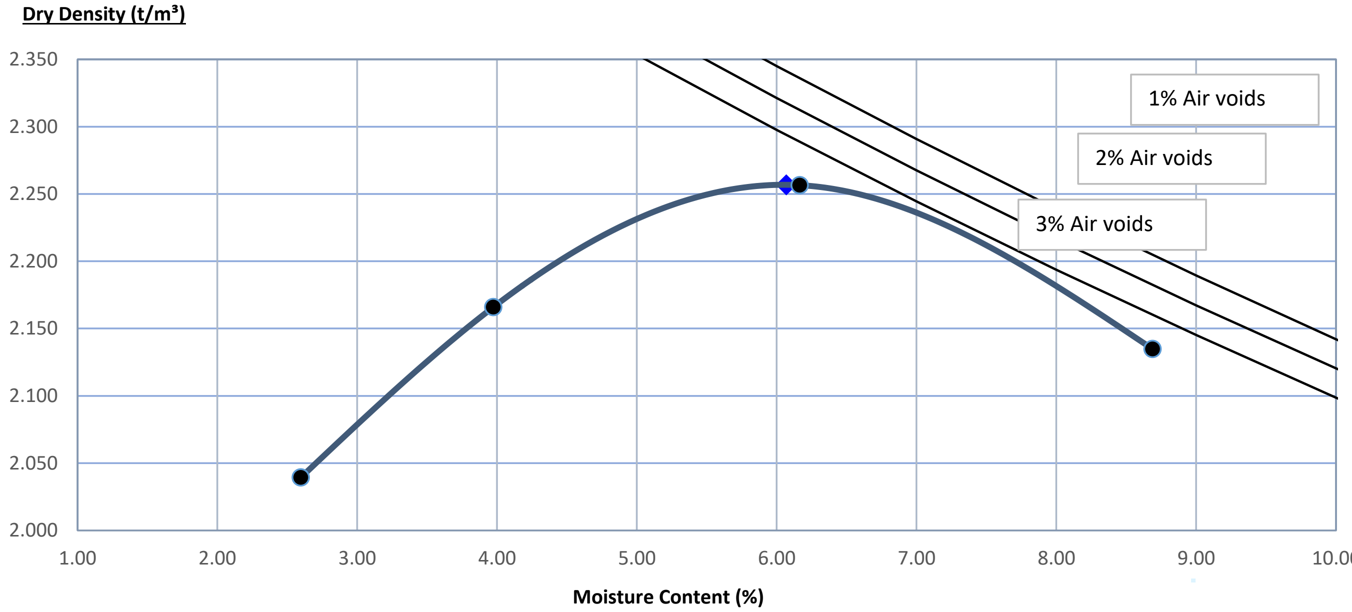
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **5** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**2.6**	**4.0**	**6.2**	**8.7**	
Dry Density (t/m³)	**2.039**	**2.166**	**2.257**	**2.135**	



Modified Maximum Dry Density (t/m³) **2.26**

Optimum Moisture Content (%) **6.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.761 t/m³*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4749_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4749
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP59 (0.5-1)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

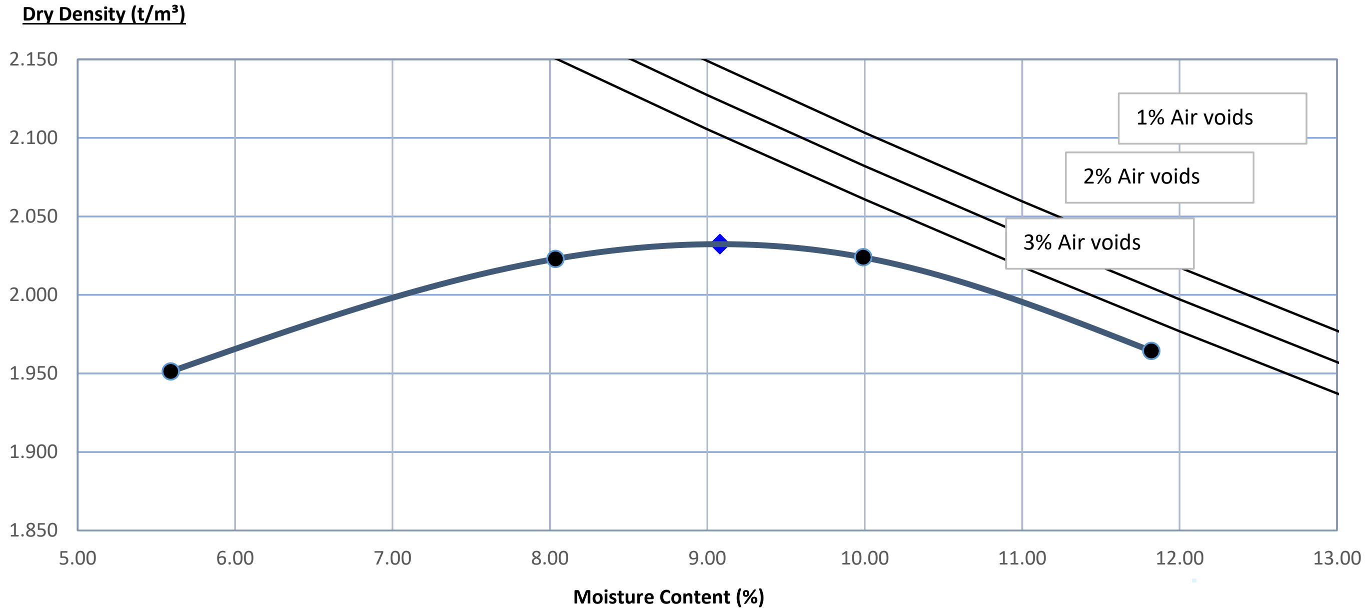
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **2** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**5.6**	**8.0**	**10.0**	**11.8**	
Dry Density (t/m³)	**1.951**	**2.023**	**2.024**	**1.964**	



Modified Maximum Dry Density (t/m³) **2.03**

Optimum Moisture Content (%) **9.0**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.698 t/m³***

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4743_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4743
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP40 (2-2.5)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

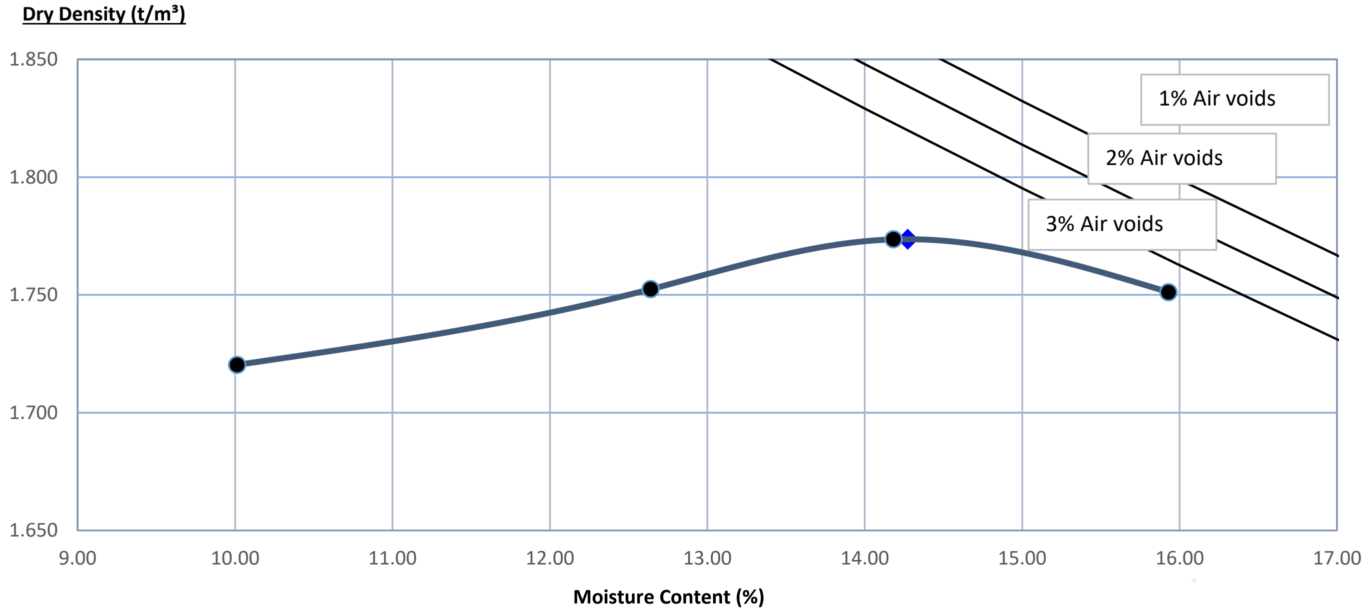
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	10.0	12.6	14.2	15.9	
Dry Density (t/m³)	1.720	1.752	1.774	1.751	



Modified Maximum Dry Density (t/m³) **1.77**

Optimum Moisture Content (%) **14.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.562 t/m³*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	28/03/2022

TEST RESULTS - Modified Maximum Dry Density

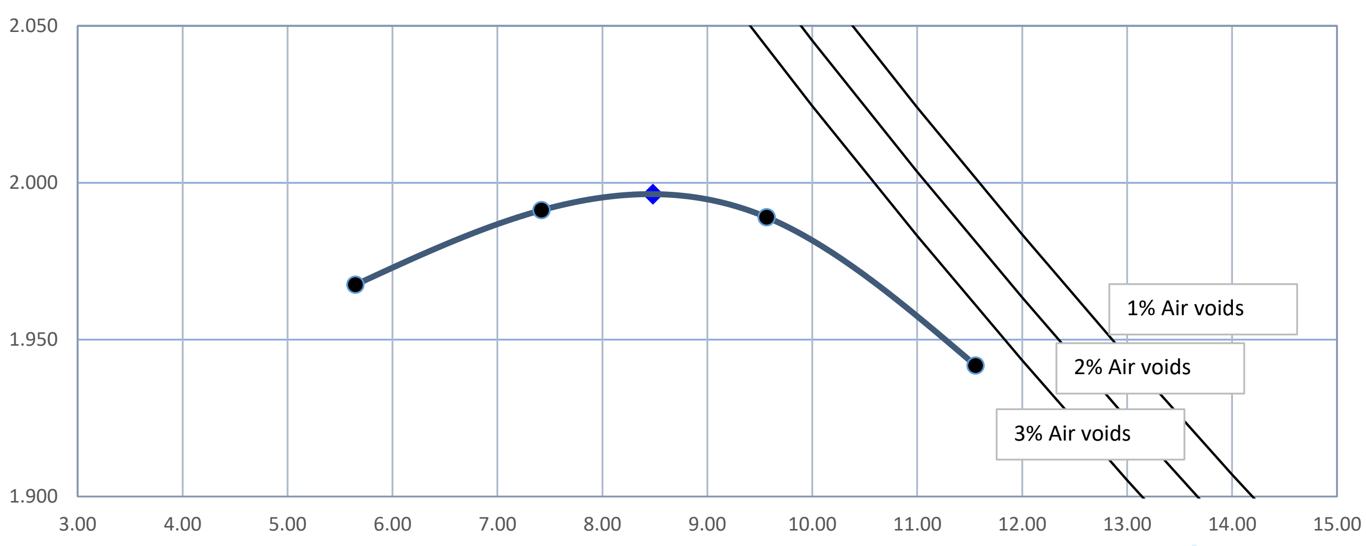
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **2** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**5.6**	**7.4**	**9.6**	**11.6**	
Dry Density (t/m³)	**1.967**	**1.991**	**1.989**	**1.942**	



Modified Maximum Dry Density (t/m³) **2.00**

Optimum Moisture Content (%) **8.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.638 t/m³***

Approved Signatory:

Name: Cody O'Neill

Date: 29/March/2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

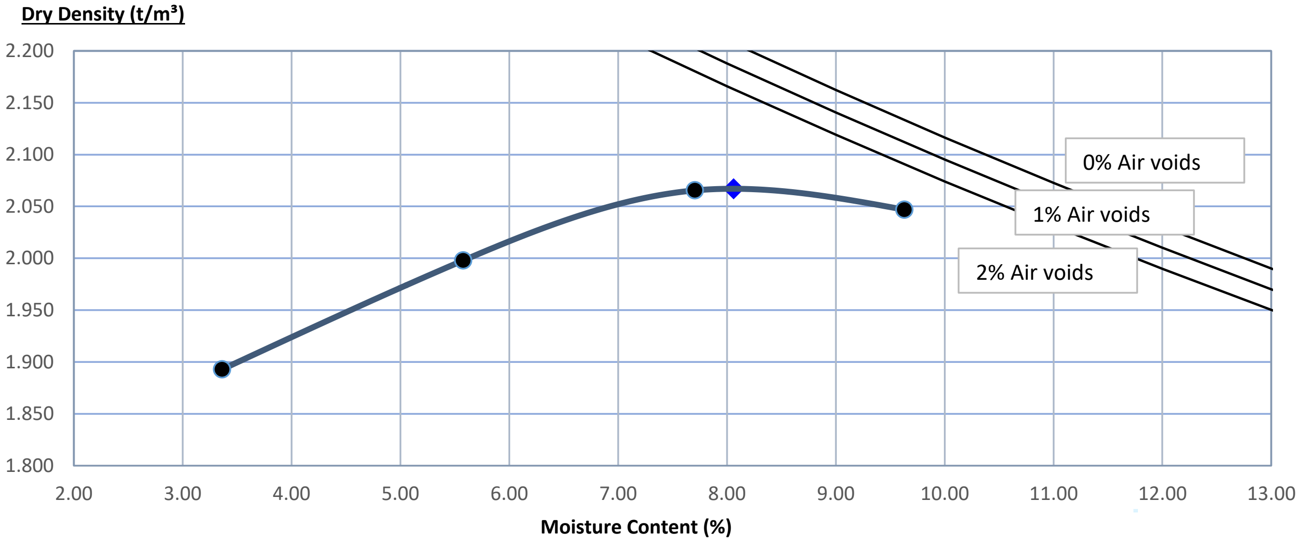
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 Hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **0** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**3.4**	**5.6**	**7.7**	**9.6**	
Dry Density (t/m³)	**1.893**	**1.998**	**2.065**	**2.047**	



Modified Maximum Dry Density (t/m³) **2.07**

Optimum Moisture Content (%) **8.0**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.685 t/m³***

Approved Signatory: Jwaldron

Name: Jason Waldron

Date: 01-April-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP13 (0.5-1)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

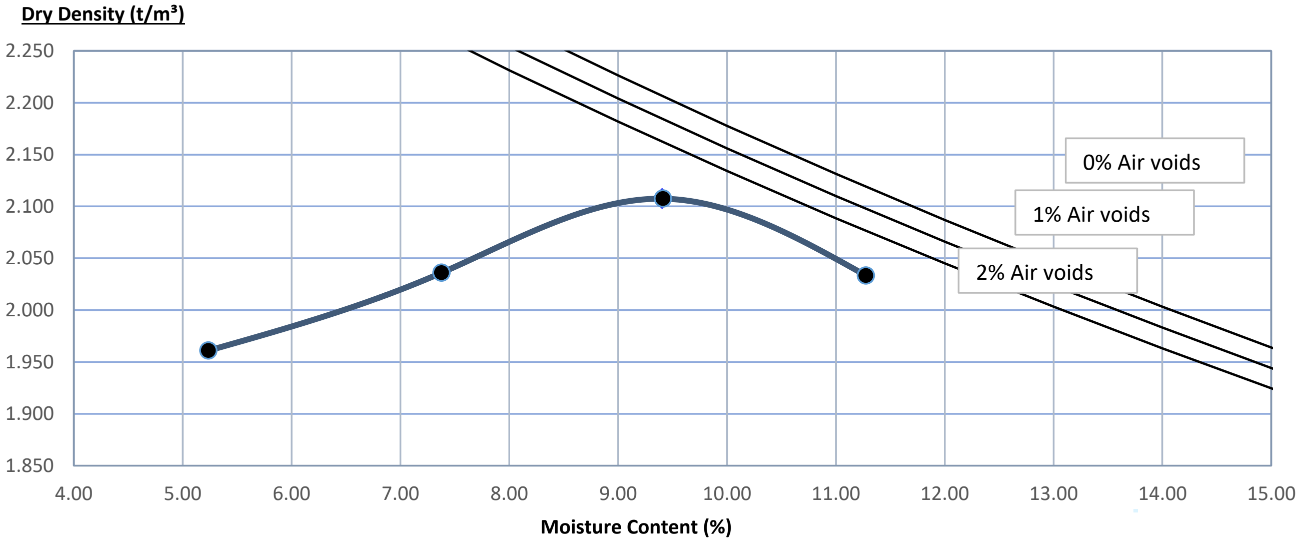
Sampling Method: Sampled by Client, Tested as Received

Sample Curing Time: 2 Hrs

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 1 **Material + 37.5mm (%)** -

Moisture Content (%)	5.2	7.4	9.4	11.3	
Dry Density (t/m³)	1.961	2.036	2.107	2.033	



Modified Maximum Dry Density (t/m³) **2.11**

Optimum Moisture Content (%) **9.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.784 t/m³*

Approved Signatory: JWaldron

Name: Jason Waldron

Date: 01-April-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

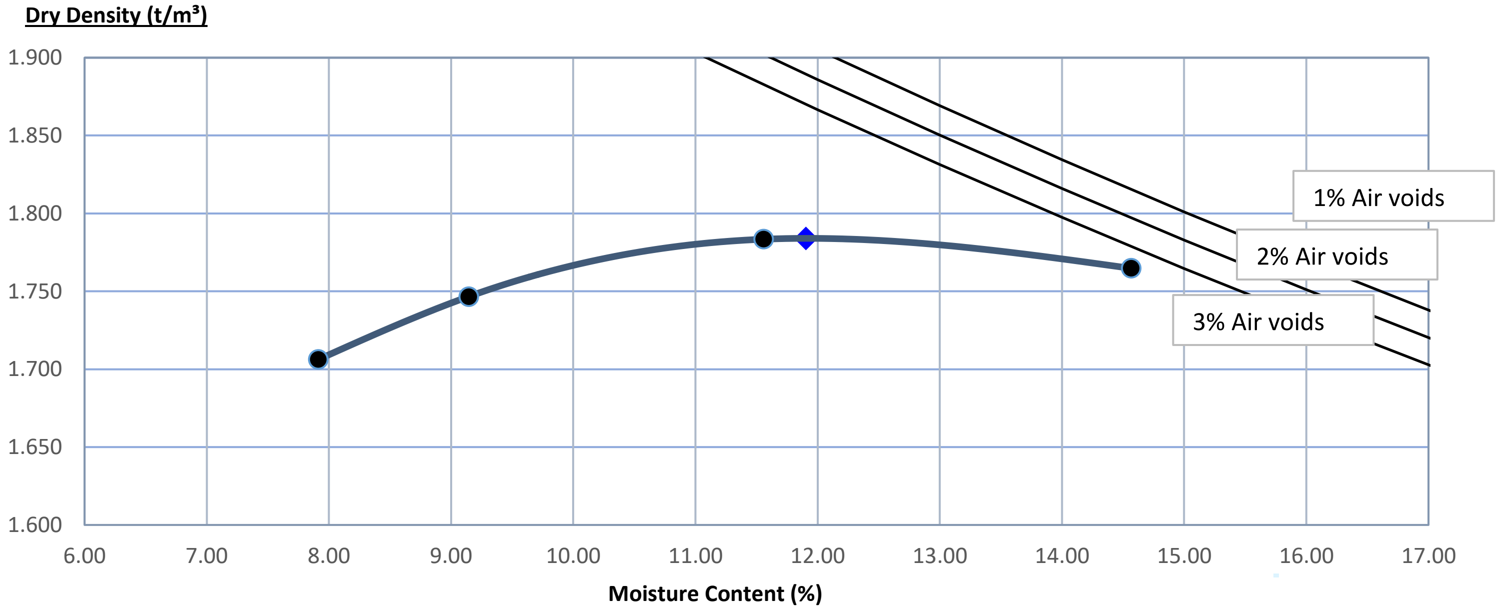
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **1** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**14.6**	**7.9**	**9.1**	**11.6**	
Dry Density (t/m^3)	**1.765**	**1.706**	**1.747**	**1.783**	



Modified Maximum Dry Density (t/m^3) **1.78**

Optimum Moisture Content (%) **12.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.502 t/m^3*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4732_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4732
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0-0.4)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

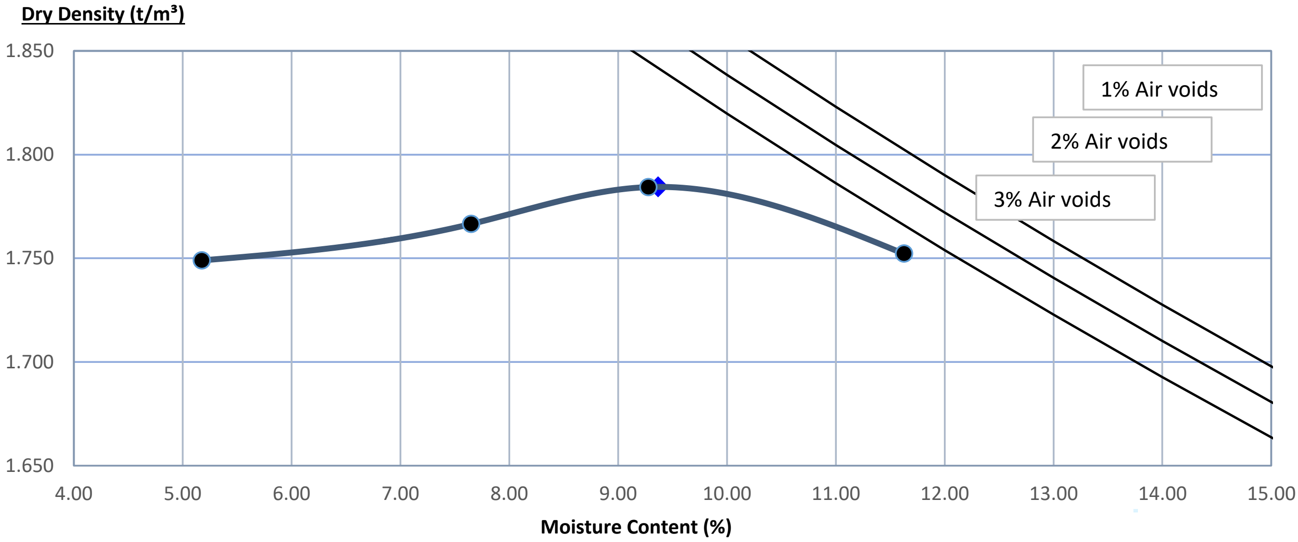
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **1** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**11.6**	**5.2**	**7.7**	**9.3**	
Dry Density (t/m³)	**1.752**	**1.749**	**1.767**	**1.784**	



Modified Maximum Dry Density (t/m³) **1.78**

Optimum Moisture Content (%) **9.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.309 t/m³***

Approved Signatory: J Waldron

Name: Jason Waldron

Date: 01-April-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4731_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4731
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP11 (1.3-2)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

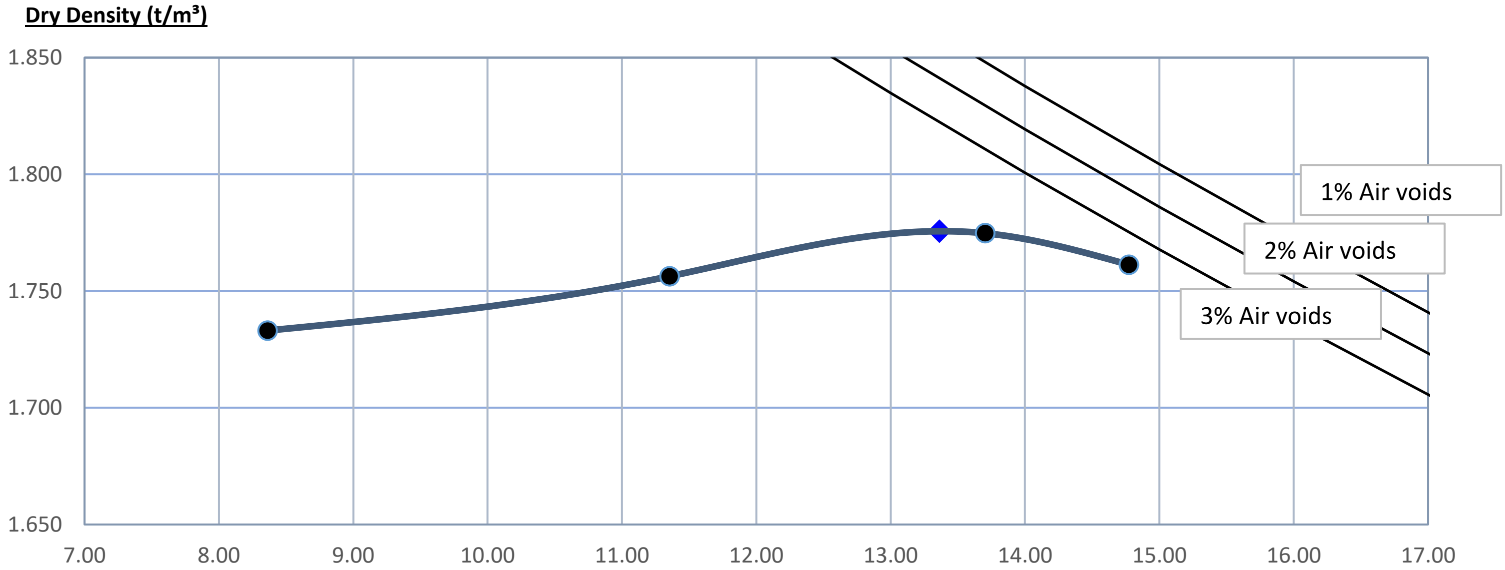
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **2** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**8.4**	**11.4**	**13.7**	**14.8**	
Dry Density (t/m^3)	**1.733**	**1.756**	**1.775**	**1.761**	



Modified Maximum Dry Density (t/m^3) **1.78**

Optimum Moisture Content (%) **13.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.508 t/m^3***

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4727_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4727
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP09 (1-1.5)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

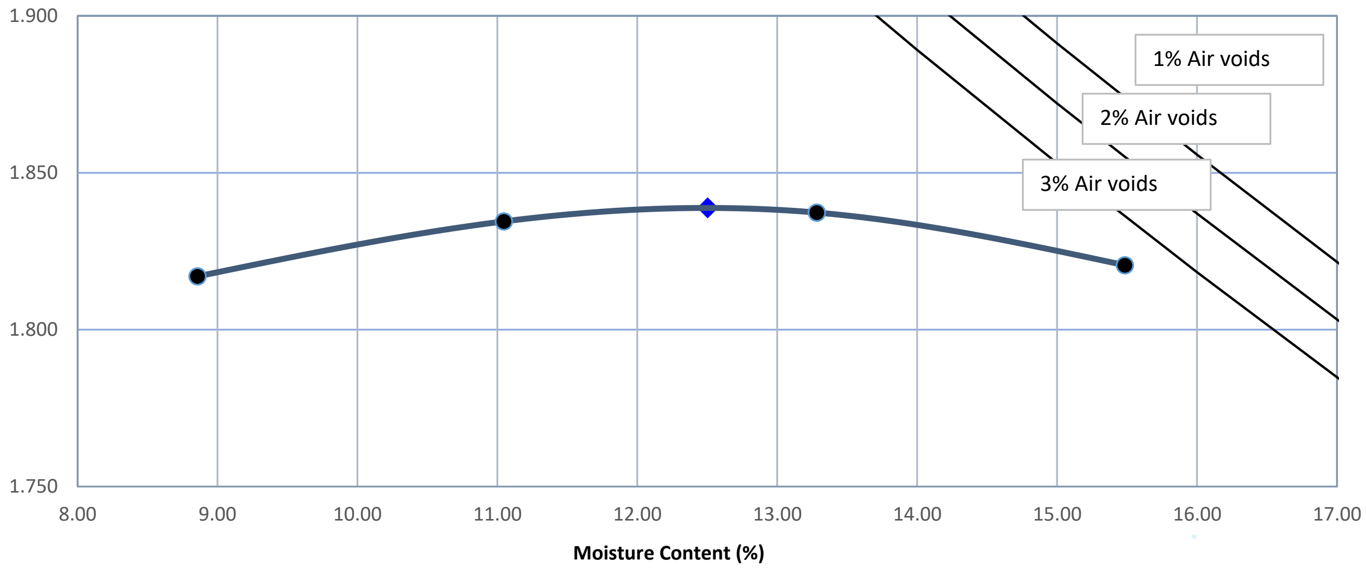
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **1** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**8.9**	**11.0**	**13.3**	**15.5**	
Dry Density (t/m³)	**1.817**	**1.834**	**1.837**	**1.821**	



Modified Maximum Dry Density (t/m³) **1.84**

Optimum Moisture Content (%) **12.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.678 t/m³*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4726_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4726
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP08 (1.5-2)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

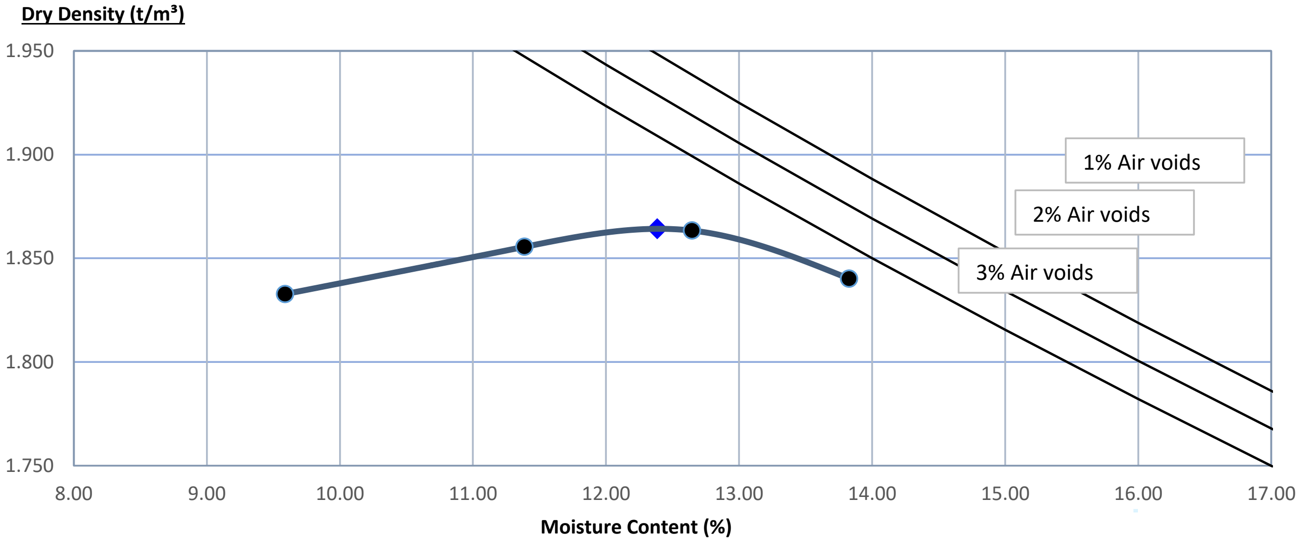
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 Hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **3** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**9.6**	**11.4**	**12.6**	**13.8**	
Dry Density (t/m³)	**1.833**	**1.855**	**1.863**	**1.840**	



Modified Maximum Dry Density (t/m³) **1.86**

Optimum Moisture Content (%) **12.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.602 t/m³***

Approved Signatory: [signature]

Name: Jason Waldron

Date: 01-April-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

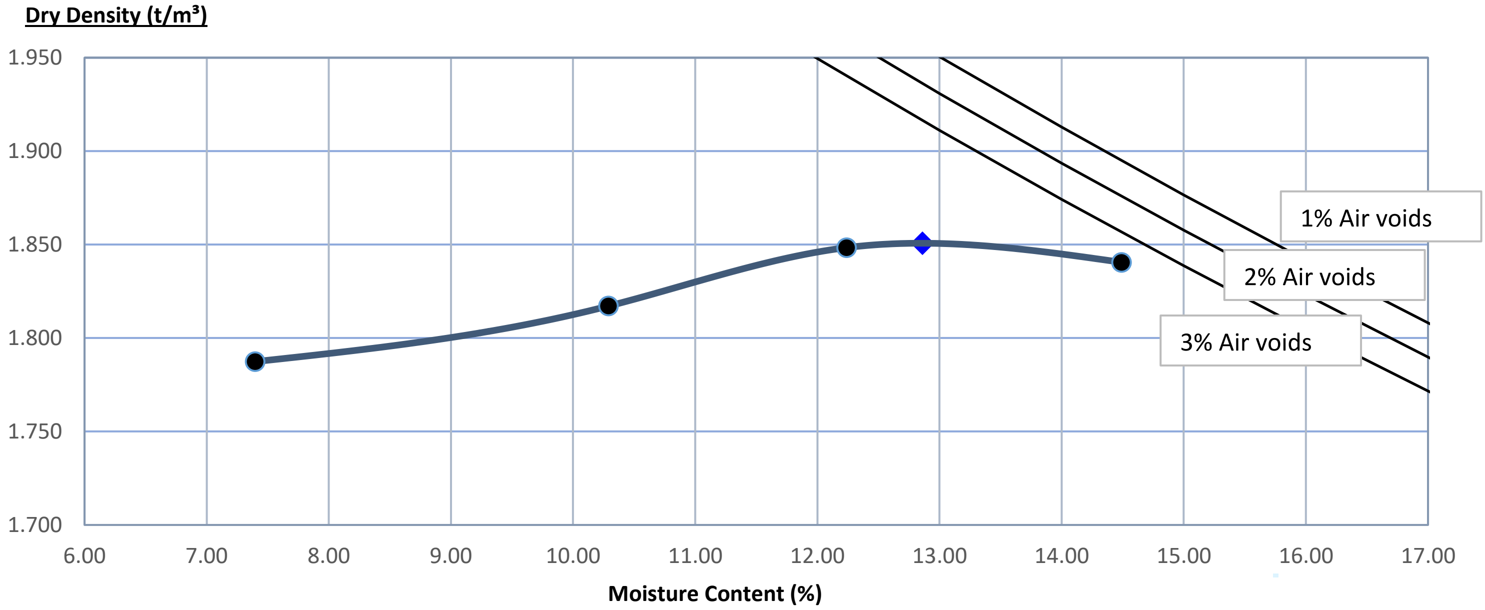
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **1** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**7.4**	**10.3**	**12.2**	**14.5**	
Dry Density (t/m^3)	**1.787**	**1.817**	**1.848**	**1.841**	



Modified Maximum Dry Density (t/m^3) **1.85**

Optimum Moisture Content (%) **13.0**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.649 t/m³***

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

Accreditation No. 20599
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WESTERN GEOTECHNICAL & Laboratory Services

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4723_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4723
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (0-0.5)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

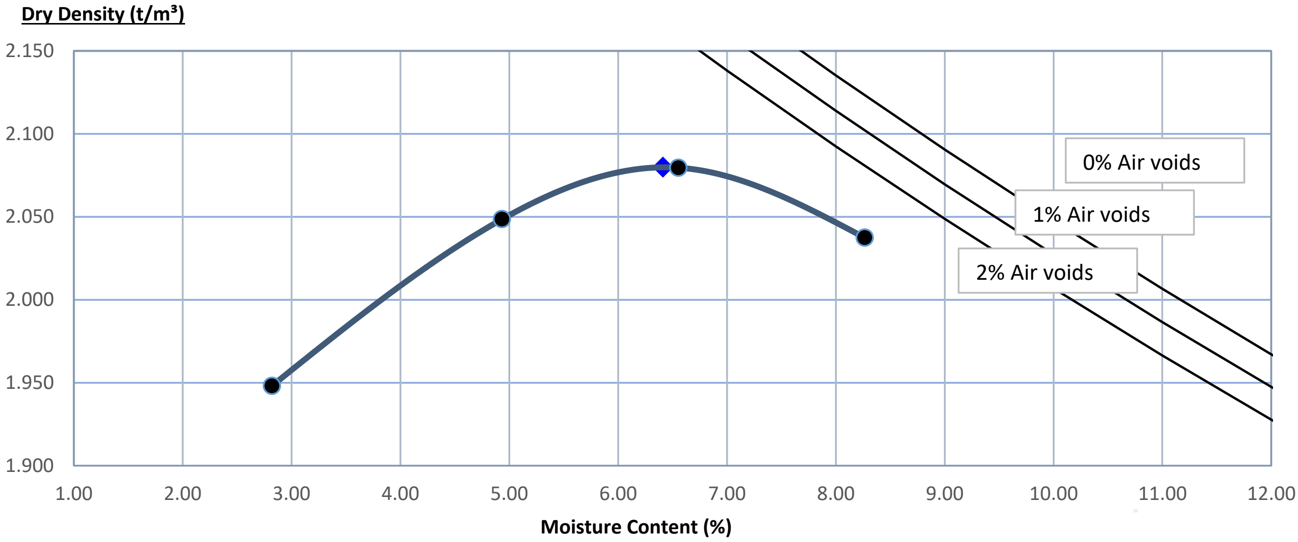
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 Hrs**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **16** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**2.8**	**4.9**	**6.6**	**8.3**	
Dry Density (t/m³)	**1.948**	**2.049**	**2.080**	**2.037**	



Modified Maximum Dry Density (t/m³) **2.08**

Optimum Moisture Content (%) **6.5**

Comments: ***The above air void lines are derived from a calculated apparent particle density of 2.575 t/m³***

Approved Signatory: Jwaldron

Name: Jason Waldron

Date: 01-April-2022

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TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	30-03-2022

TEST RESULTS - Modified Maximum Dry Density

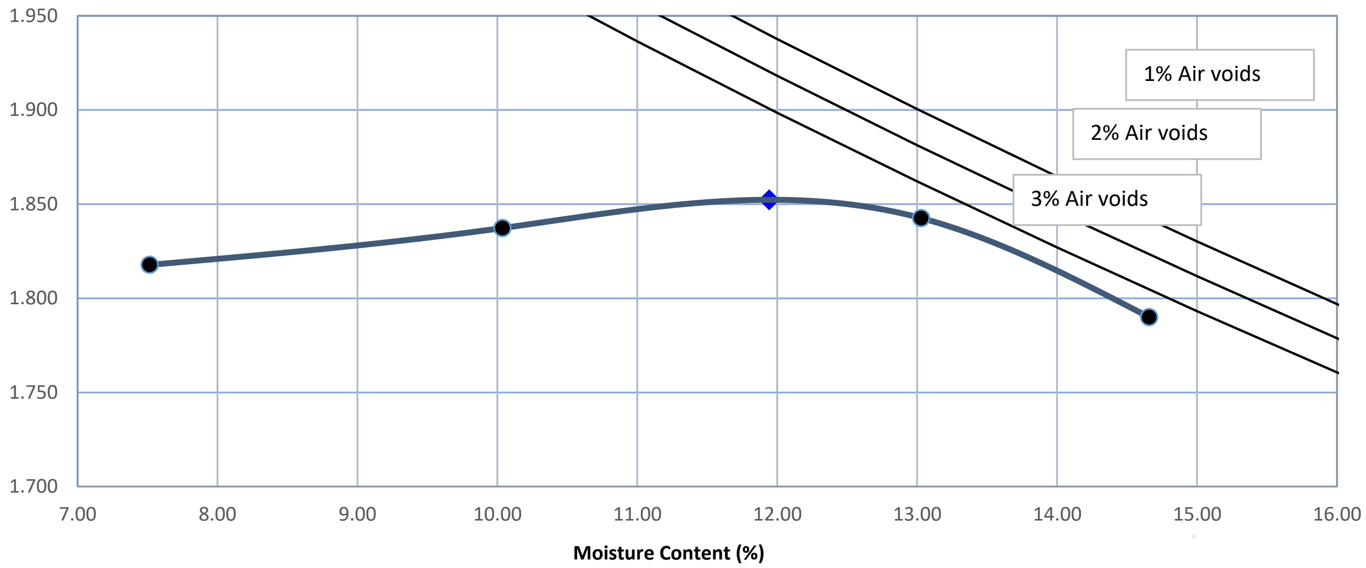
Sampling Method: **Sampled by Client, Tested as Received**

Sample Curing Time: **2 HRS**

Method used to Determine Liquid Limit: **Visual / Tactile Assessment by Competent Technician**

Material + 19.0mm (%): **1** **Material + 37.5mm (%)** **-**

Moisture Content (%)	**7.5**	**10.0**	**13.0**	**14.7**	
Dry Density (t/m³)	**1.818**	**1.837**	**1.843**	**1.790**	



Modified Maximum Dry Density (t/m³) **1.85**

Optimum Moisture Content (%) **12.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.558 t/m³*

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4721_1_MMDD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4721
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (0-0.5)m	*Date Tested:*	31-03-2022

TEST RESULTS - Modified Maximum Dry Density

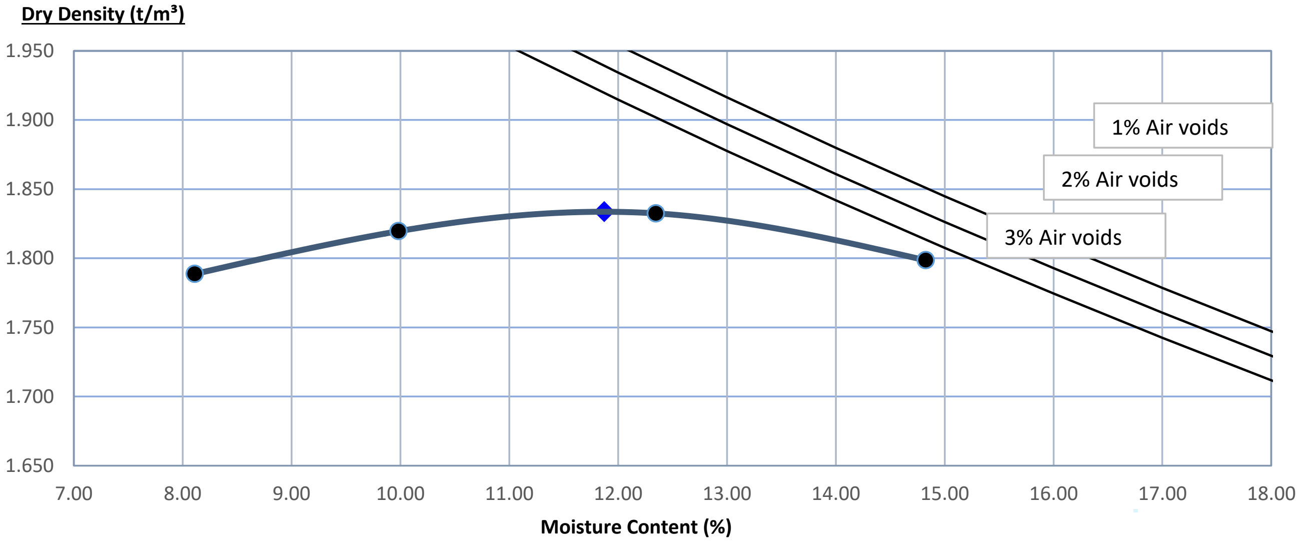
Sampling Method: Sampled by Client, Tested as Received

Sample Curing Time: 2 Hrs

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 1 **Material + 37.5mm (%)** -

Moisture Content (%)	8.1	10.0	12.3	14.8	
Dry Density (t/m^3)	1.789	1.820	1.832	1.799	



Modified Maximum Dry Density (t/m^3) **1.83**

Optimum Moisture Content (%) **12.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.586 t/m³*

Approved Signatory: [signature]

Name: Jason Waldron

Date: 01-April-2022

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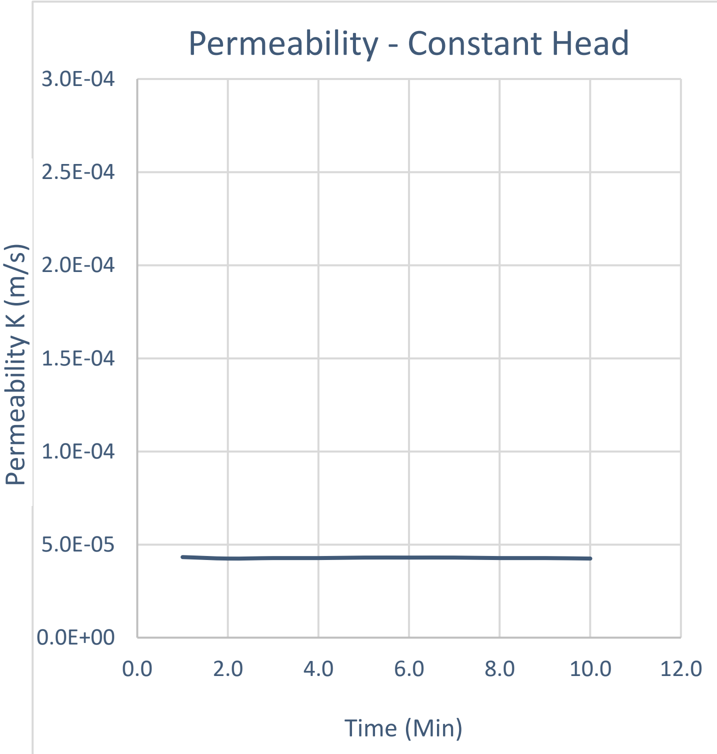
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4751_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4751
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP61 (0.5-1)m	*Date Tested:*	30/3 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	5
Maximum Dry Density (t/m3)	2.257
Optimum Moisture (%)	6.1
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.3
Laboratory Moisture Ratio (%)	95.0
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 4.28E-05

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

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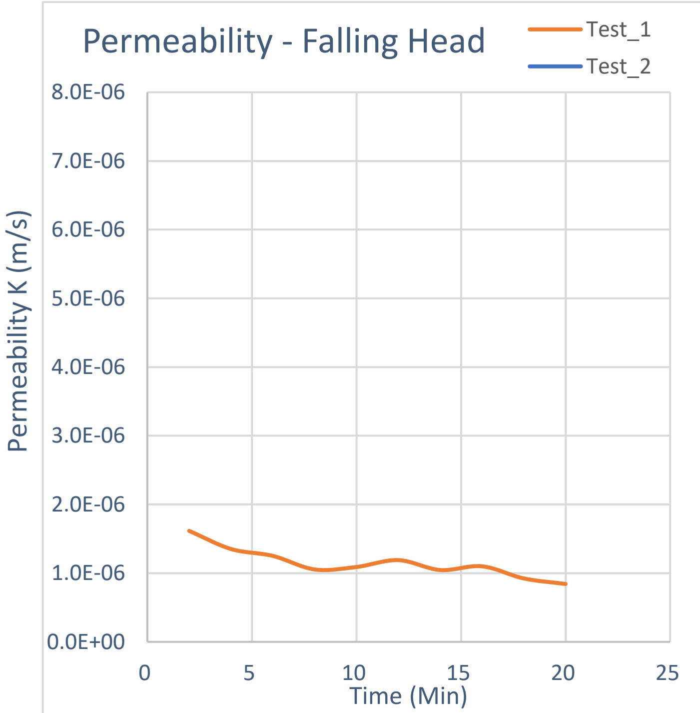
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT AS 1289.6.7.2

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4749_1_FHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4749
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification	TP59 (0.5-1)m	*Date Tested:*	30/3 - 5/04 - 6/04/2022

TEST RESULTS - FALLING HEAD PERMEABILITY

Sampling Method: Sampled by Client, Tested as Received



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modifed
% Retained of 19.0mm	1.6
Maximum Dry Density (t/m^3)	2.032
Optimum Moisture (%)	9.1
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.9
Laboratory Moisture Ratio (%)	100.8
Surcharge (kPa)	3

Coefficient of Permeability K_{20} (m/s) **1.15E-06**

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

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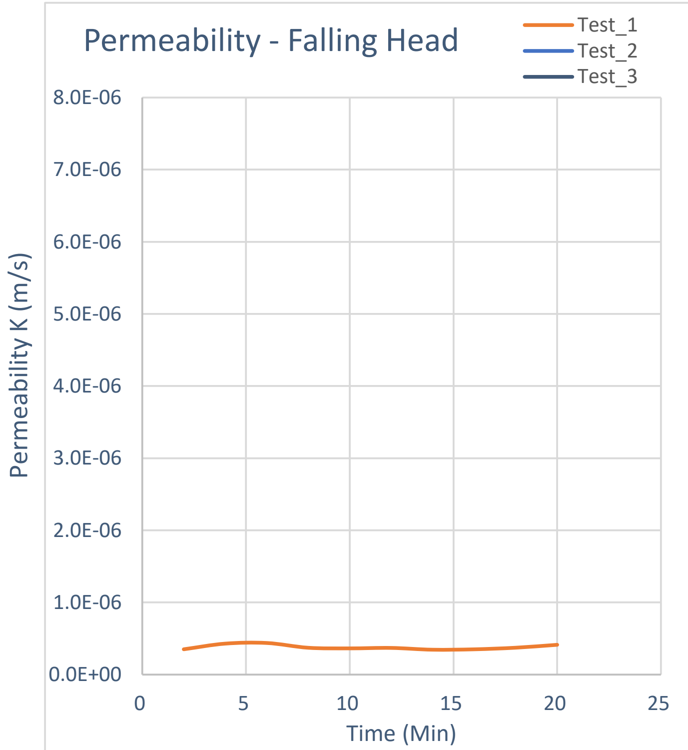
TEST REPORT AS 1289.6.7.2

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_FHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification	TP13 (0.5-1)m	*Date Tested:*	31/3-5/4/22

TEST RESULTS - FALLING HEAD PERMEABILITY

Sampling Method: Sampled by Client, Tested as Received



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modifed
% Retained of 19.0mm	1
Maximum Dry Density (t/m^3)	2.107
Optimum Moisture (%)	9.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.8
Laboratory Moisture Ratio (%)	102.5
Surcharge (kPa)	3

Coefficient of Permeability K_{20} (m/s) **3.81E-07**

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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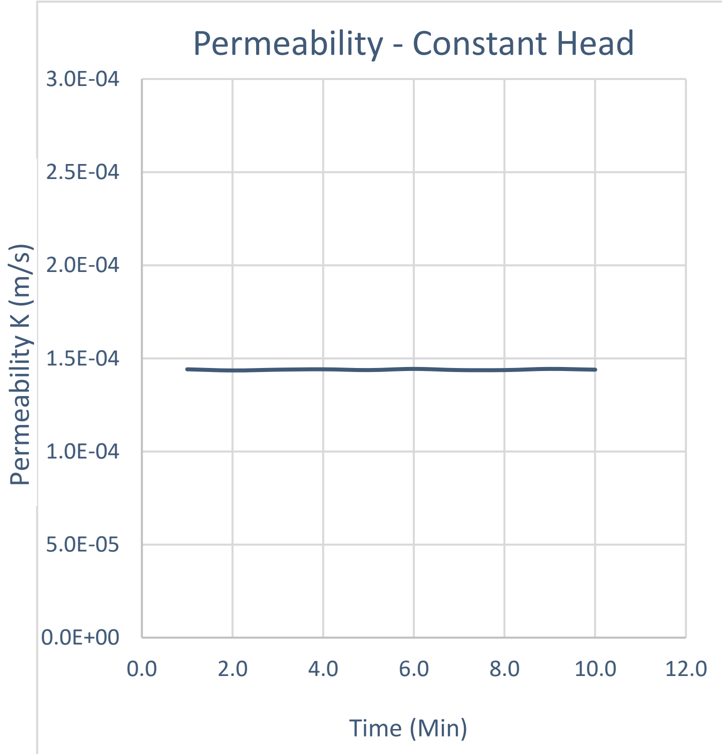
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	30/3 - 4/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	0.8
Maximum Dry Density (t/m3)	1.784
Optimum Moisture (%)	11.9
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.6
Laboratory Moisture Ratio (%)	103.8
Surcharge (kPa)	3.0
Hydraulic Gradient	0.9

Coefficient of Permeability K_{20} (m/s): 1.44E-04

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 11-April-2022

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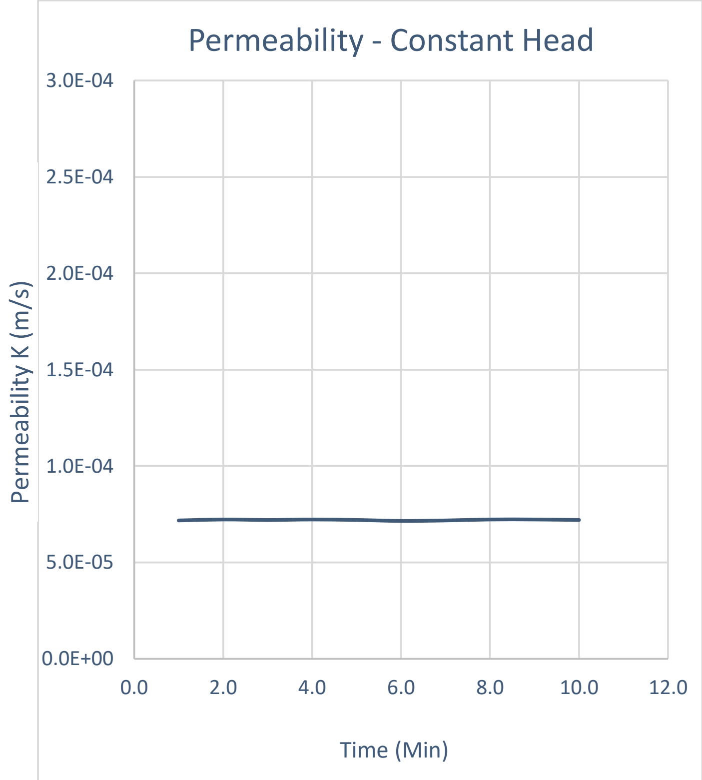
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4732_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4732
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0-0.4)m	*Date Tested:*	30/3-5/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	1.3
Maximum Dry Density (t/m3)	1.784
Optimum Moisture (%)	9.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.3
Laboratory Moisture Ratio (%)	97.0
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 7.21E-05

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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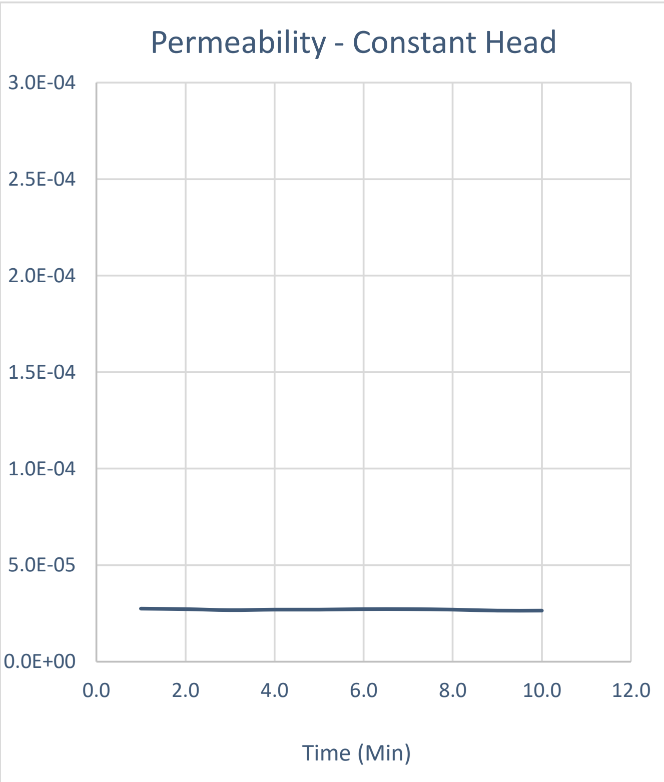
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4731_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4731
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP11 (1.3-2)m	*Date Tested:*	30/3-5/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	2.1
Maximum Dry Density (t/m3)	1.776
Optimum Moisture (%)	13.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.0
Laboratory Moisture Ratio (%)	99.6
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 2.69E-05

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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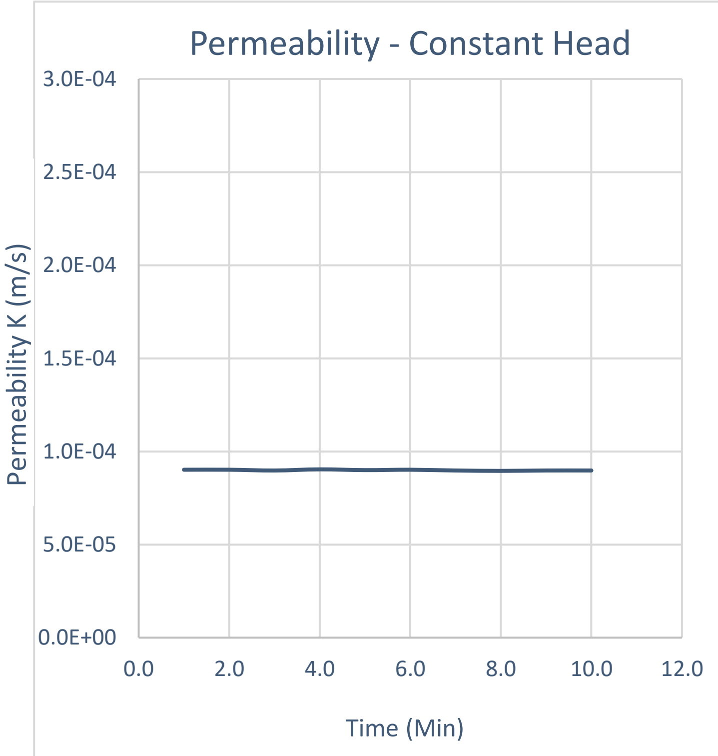
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4727_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4727
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP09 (1-1.5)m	*Date Tested:*	30/03 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	1
Maximum Dry Density (t/m3)	1.839
Optimum Moisture (%)	12.5
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.5
Laboratory Moisture Ratio (%)	95.9
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 8.99E-05

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

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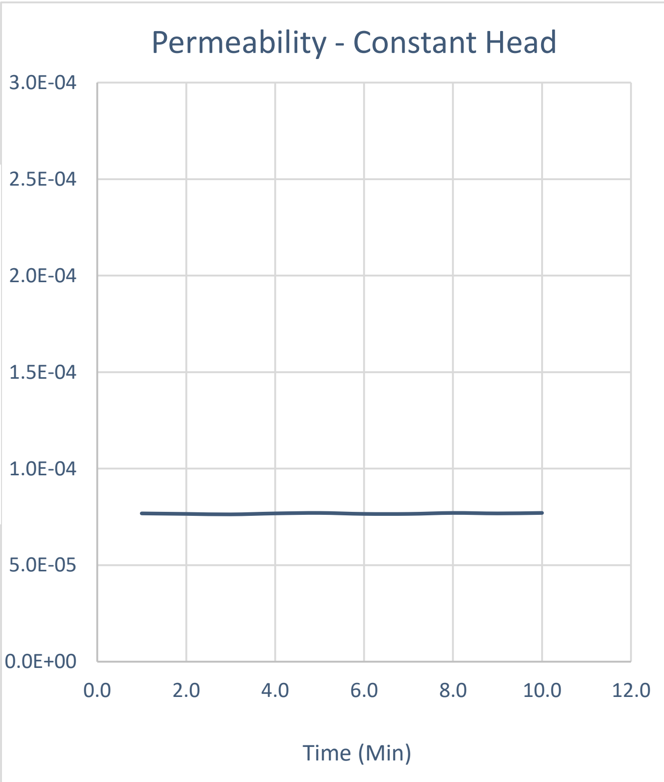
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4726_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4726
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP08 (1.5-2)m	*Date Tested:*	31/3-5/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	3
Maximum Dry Density (t/m3)	1.864
Optimum Moisture (%)	12.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.7
Laboratory Moisture Ratio (%)	102.3
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 7.68E-05

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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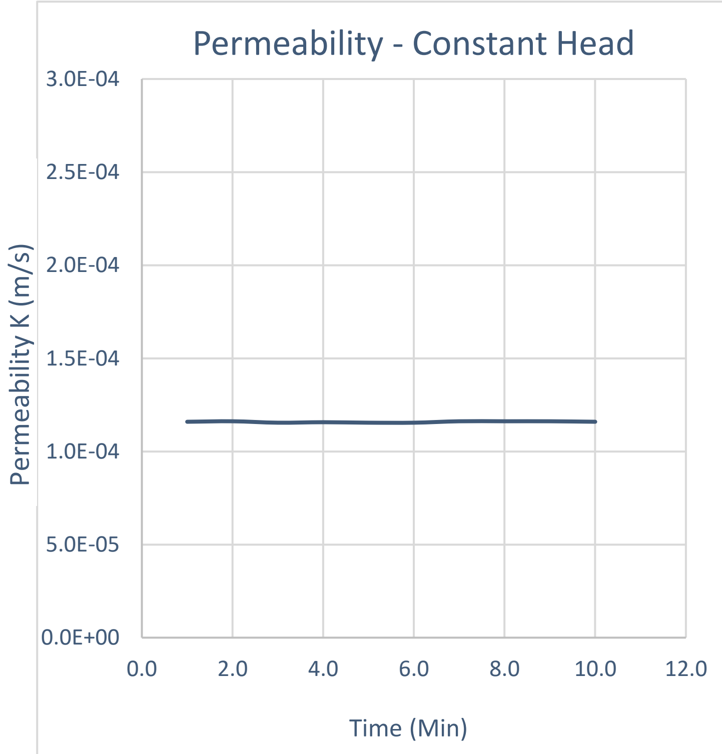
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	30/03 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	0.7
Maximum Dry Density (t/m3)	1.851
Optimum Moisture (%)	12.9
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	100.2
Laboratory Moisture Ratio (%)	98.0
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 1.16E-04

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

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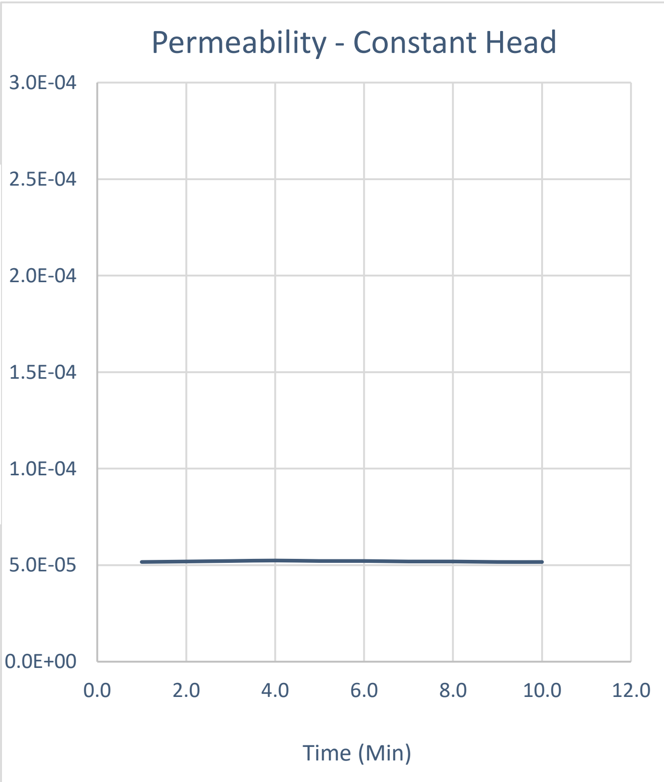
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4723_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4723
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (0-0.5)m	*Date Tested:*	31/3-5/4/22

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	16
Maximum Dry Density (t/m3)	2.08
Optimum Moisture (%)	6.4
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.5
Laboratory Moisture Ratio (%)	103.8
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 5.20E-05

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 06/April/2022

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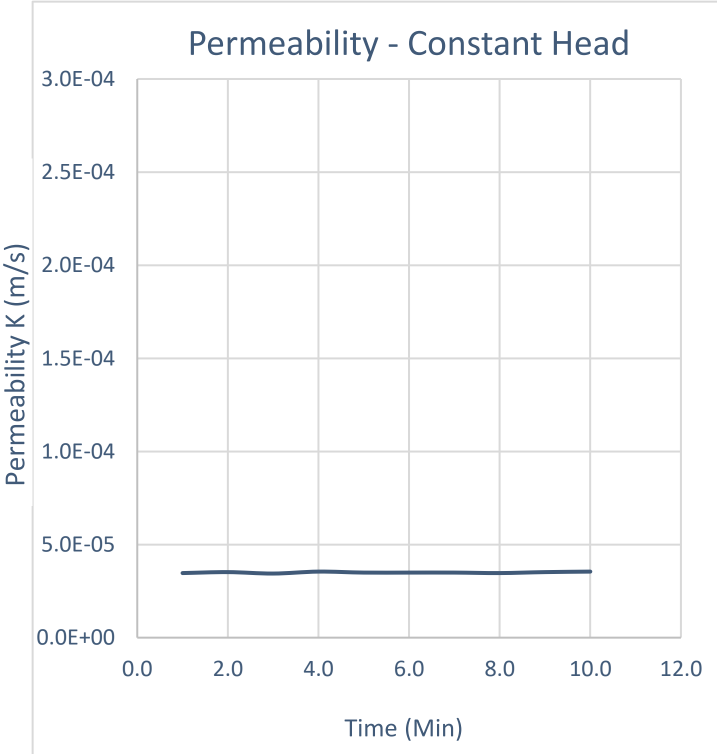
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	30/3 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	1
Maximum Dry Density (t/m3)	1.852
Optimum Moisture (%)	11.9
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.7
Laboratory Moisture Ratio (%)	103.1
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 3.50E-05

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

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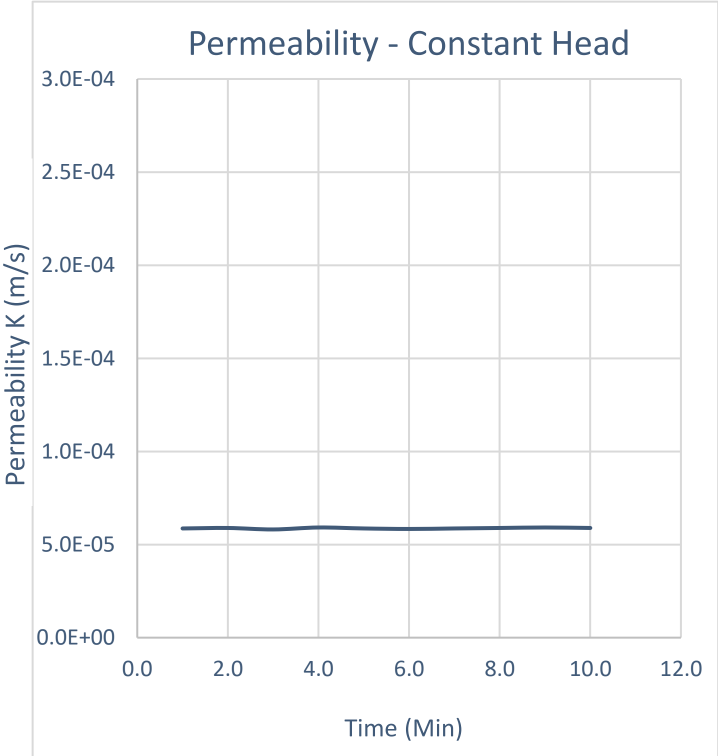
TEST REPORT - AS 1289.6.7.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4721_1_CHPERM
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4721
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (0-0.5)m	*Date Tested:*	31/03 - 6/04/2022

TEST RESULTS - CONSTANT HEAD PERMEABILITY

Sampling Method: **Sampled by Client, Tested as Received**



Compaction Details	
Compaction Method	AS 1289.5.2.1
Hammer Type	Modified
% Retained on 19.0mm	1
Maximum Dry Density (t/m3)	1.834
Optimum Moisture (%)	11.9
Target Dry Density Ratio	100
Target Moisture Ratio	100

Specimen Conditions at Compaction	
Laboratory Density Ratio (%)	99.8
Laboratory Moisture Ratio (%)	102.3
Surcharge (kPa)	3.0
Hydraulic Gradient	0.7

Coefficient of Permeability K_{20} (m/s): 5.87E-05

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 07-April-2022

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TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4756_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4756
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.6-1)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**19**
AS 1289.3.2.1	**Plastic Limit (%)**	**14**
AS 1289.3.3.1	**Plasticity Index (%)**	**5**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**2.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**17**
AS 1289.3.2.1	**Plastic Limit (%)**	**15**
AS 1289.3.3.1	**Plasticity Index (%)**	**2**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**1.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4754_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4754
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP71 (0.2-0.7)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**16**
AS 1289.3.2.1	**Plastic Limit (%)**	**14**
AS 1289.3.3.1	**Plasticity Index (%)**	**2**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**1.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4752_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4752
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP64 (0.7-1)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**19**
AS 1289.3.2.1	**Plastic Limit (%)**	**13**
AS 1289.3.3.1	**Plasticity Index (%)**	**6**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**3.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Cracked**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4747_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4747
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP54 (0-0.2)m	*Date Tested:*	4/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 06/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP13 (0.5-1)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4729_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4729
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP10 (1.5-2)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50^{o}C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.2, 3.2.1, 3.3.1 & 3.4.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4724_1_PI
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4724
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (2-2.5)m	*Date Tested:*	1/04/2022

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method: Sampled by Client, Tested as Received

History of Sample: Oven Dried <50^{o}C

Method of Preparation: Dry Sieved

AS 1289.3.1.2	Liquid Limit (%)	Not Obtainable
AS 1289.3.2.1	Plastic Limit (%)	Non-Plastic
AS 1289.3.3.1	Plasticity Index (%)	Non-Plastic
AS 1289.3.4.1	Linear Shrinkage (%)	0.0
AS 1289.3.4.1	Length of Mould (mm)	250
AS 1289.3.4.1	Condition of Dry Specimen	-

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

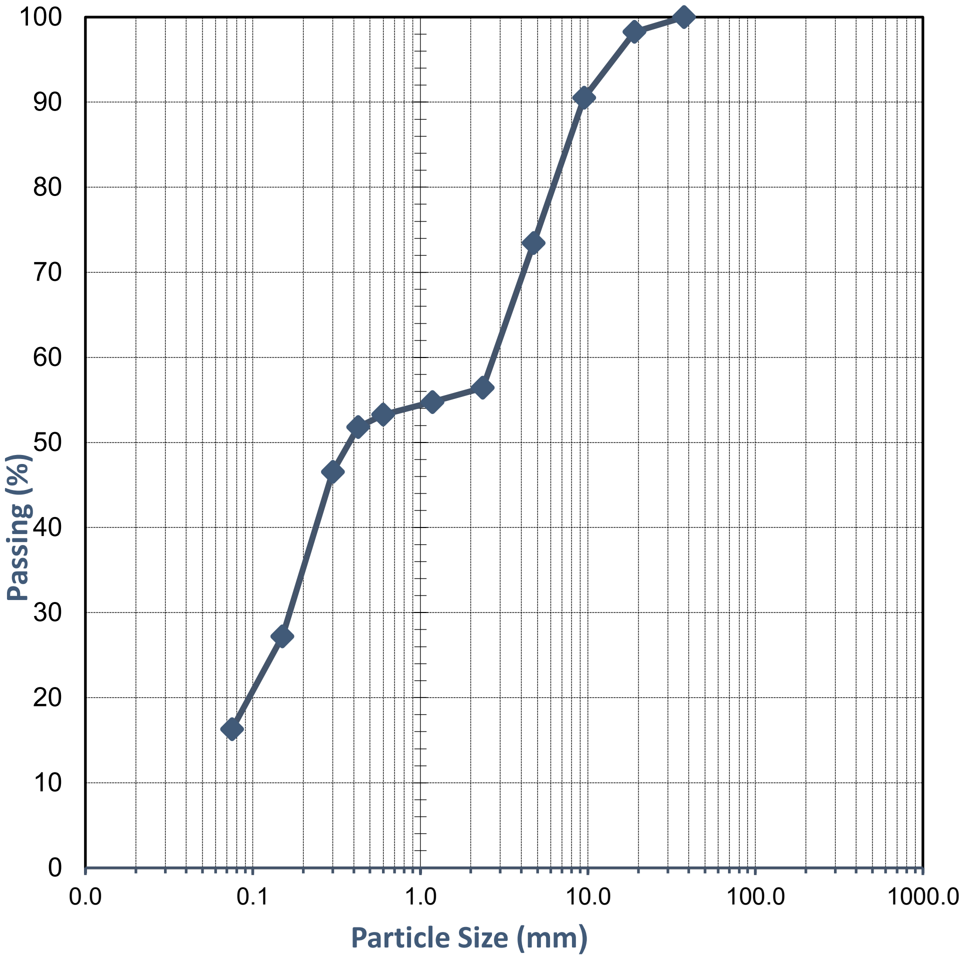
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4756_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4756
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.6-1)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	91
4.75	73
2.36	56
1.18	55
0.600	53
0.425	52
0.300	47
0.150	27
0.075	16



Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

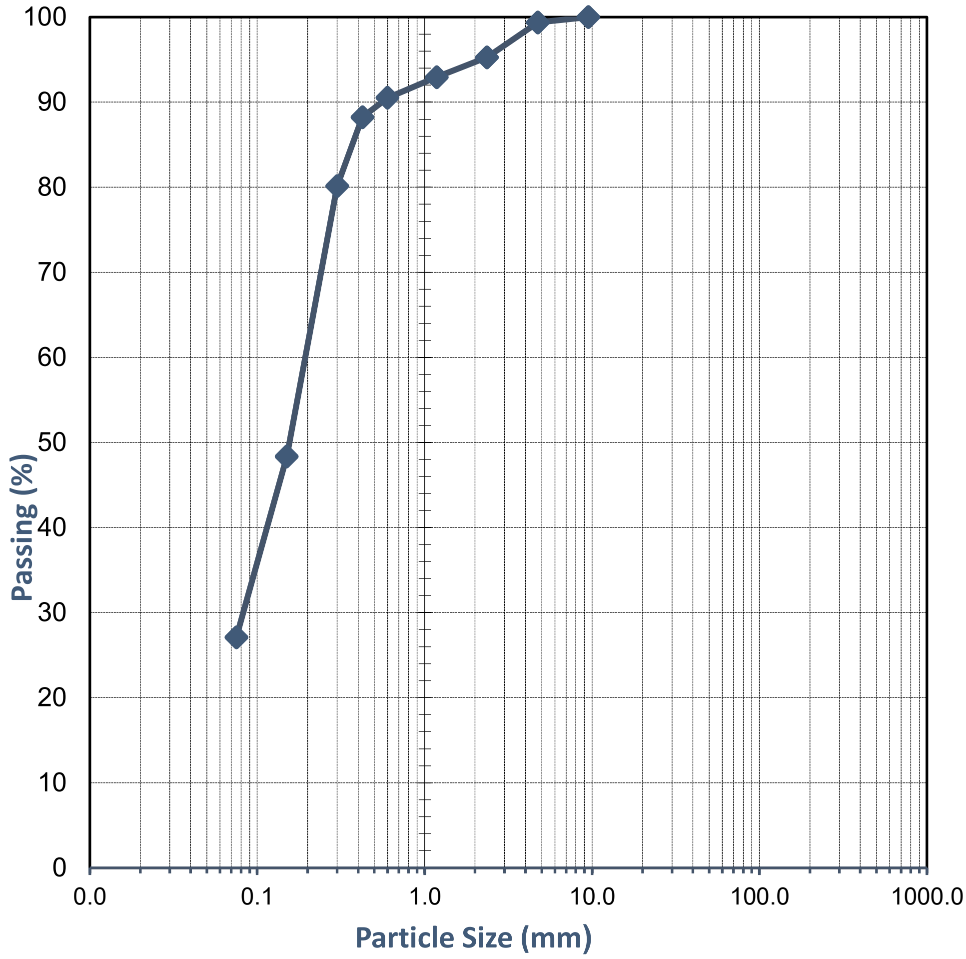
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	99
2.36	95
1.18	93
0.600	91
0.425	88
0.300	80
0.150	48
0.075	27



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

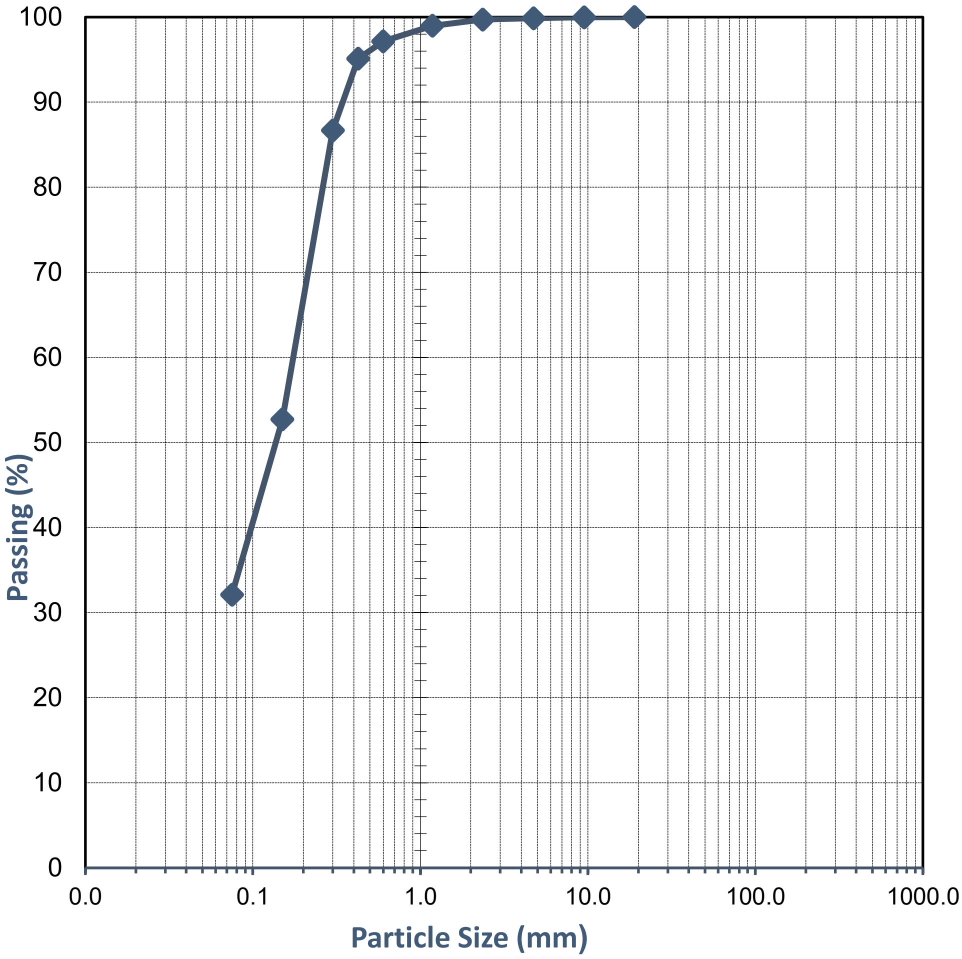
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4754_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4754
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP71 (0.2-0.7)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	100
2.36	100
1.18	99
0.600	97
0.425	95
0.300	87
0.150	53
0.075	32



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

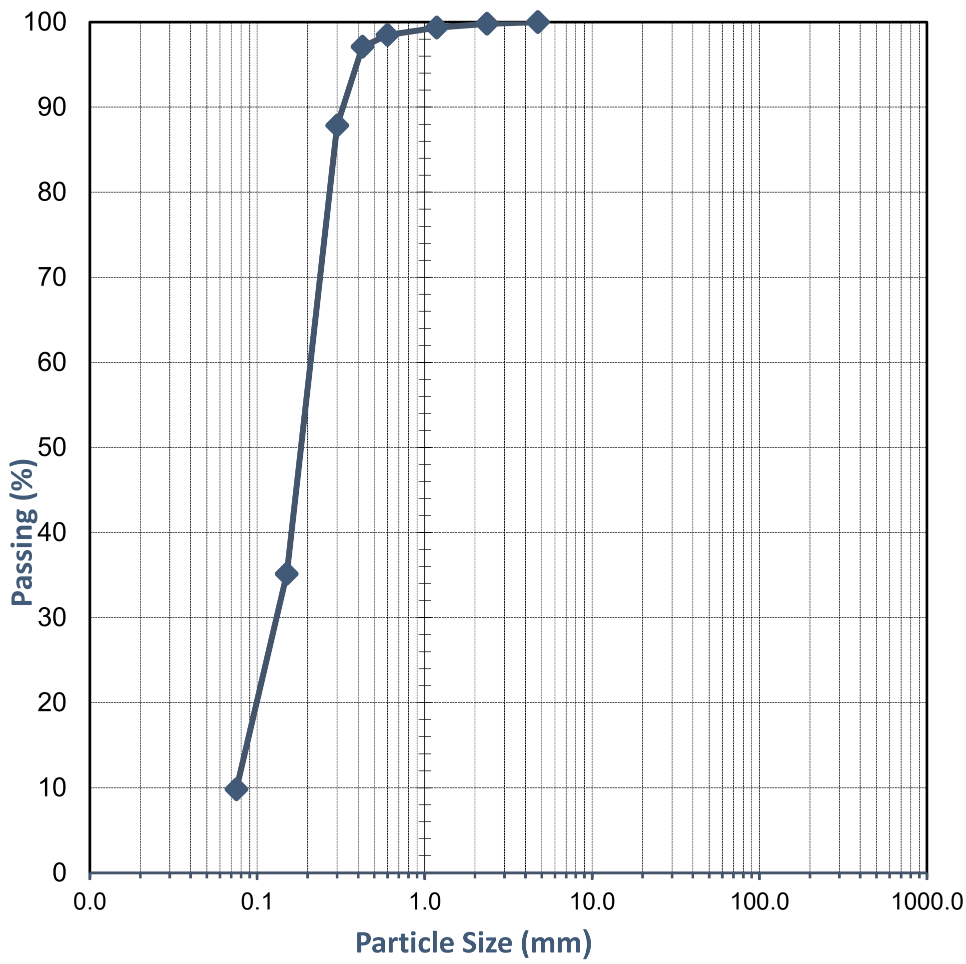
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4753_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4753
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP67 (1-1.5)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	100
2.36	100
1.18	99
0.600	99
0.425	97
0.300	88
0.150	35
0.075	10



Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

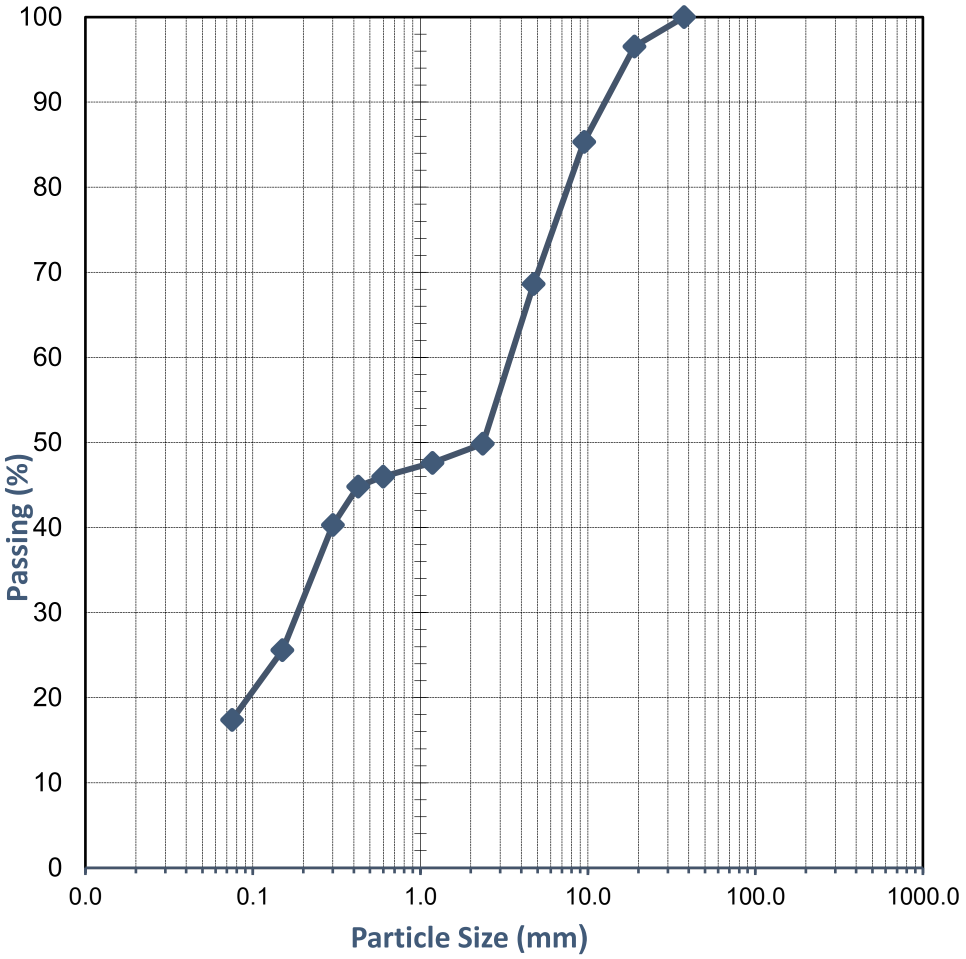
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4752_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4752
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP64 (0.7-1)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	97
9.5	85
4.75	69
2.36	50
1.18	48
0.600	46
0.425	45
0.300	40
0.150	26
0.075	17



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

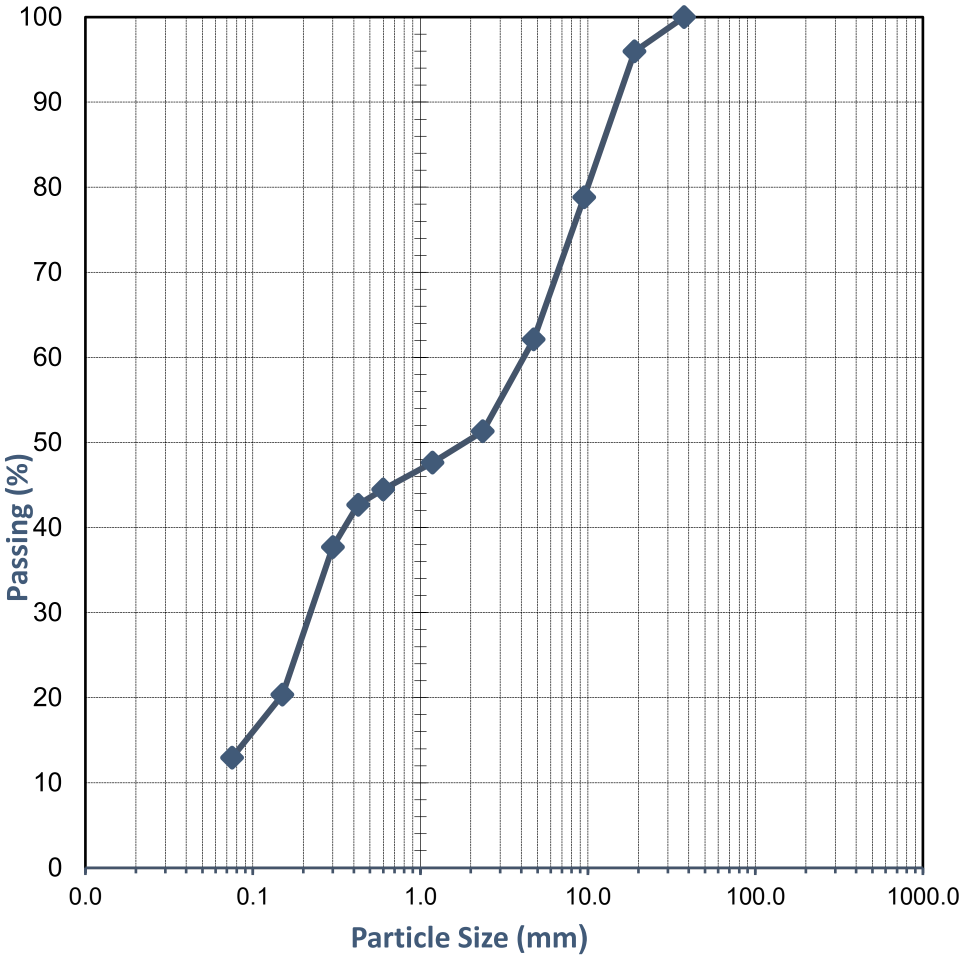
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4751_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4751
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP61 (0.5-1)m	*Date Tested:*	1/4-4/4/22

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	79
4.75	62
2.36	51
1.18	48
0.600	44
0.425	43
0.300	38
0.150	20
0.075	13



Comments:

Approved Signatory:

Name: Cody O'Neill
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

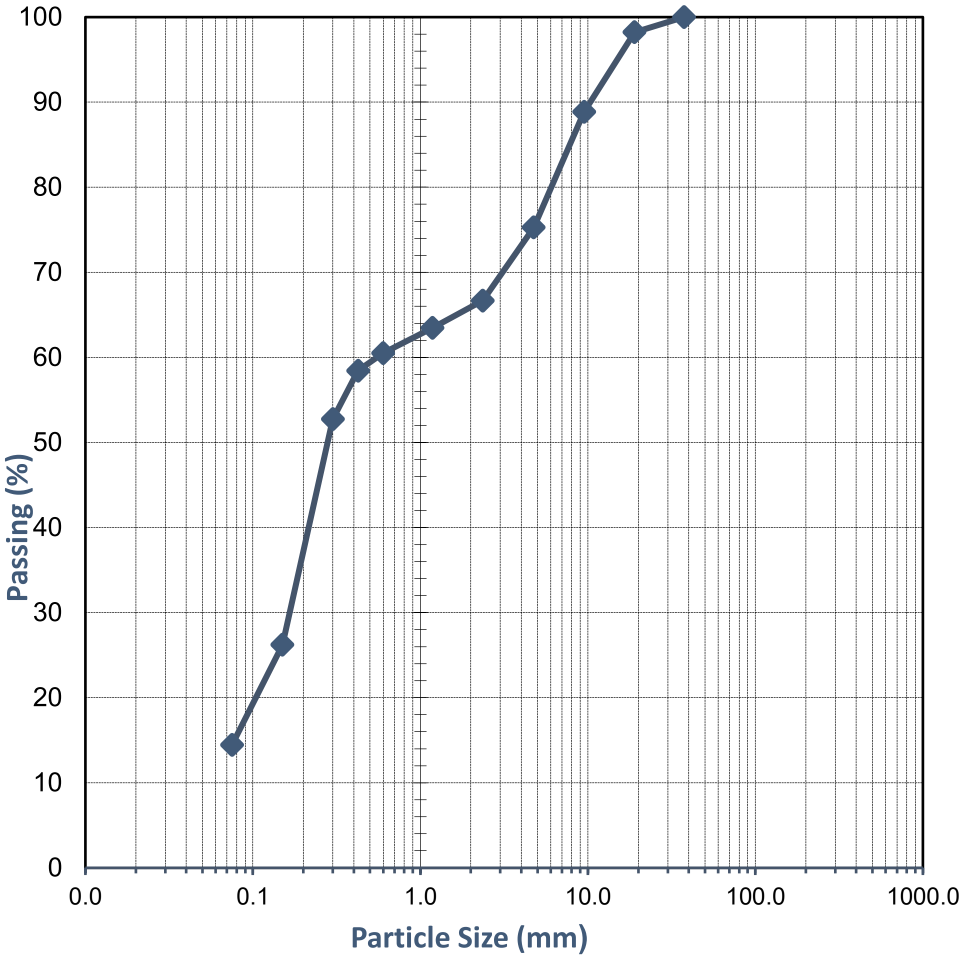
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4750_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4750
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP60 (0.5-1)m	*Date Tested:*	01/04 - 05/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	89
4.75	75
2.36	67
1.18	63
0.600	61
0.425	58
0.300	53
0.150	26
0.075	14



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 05/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

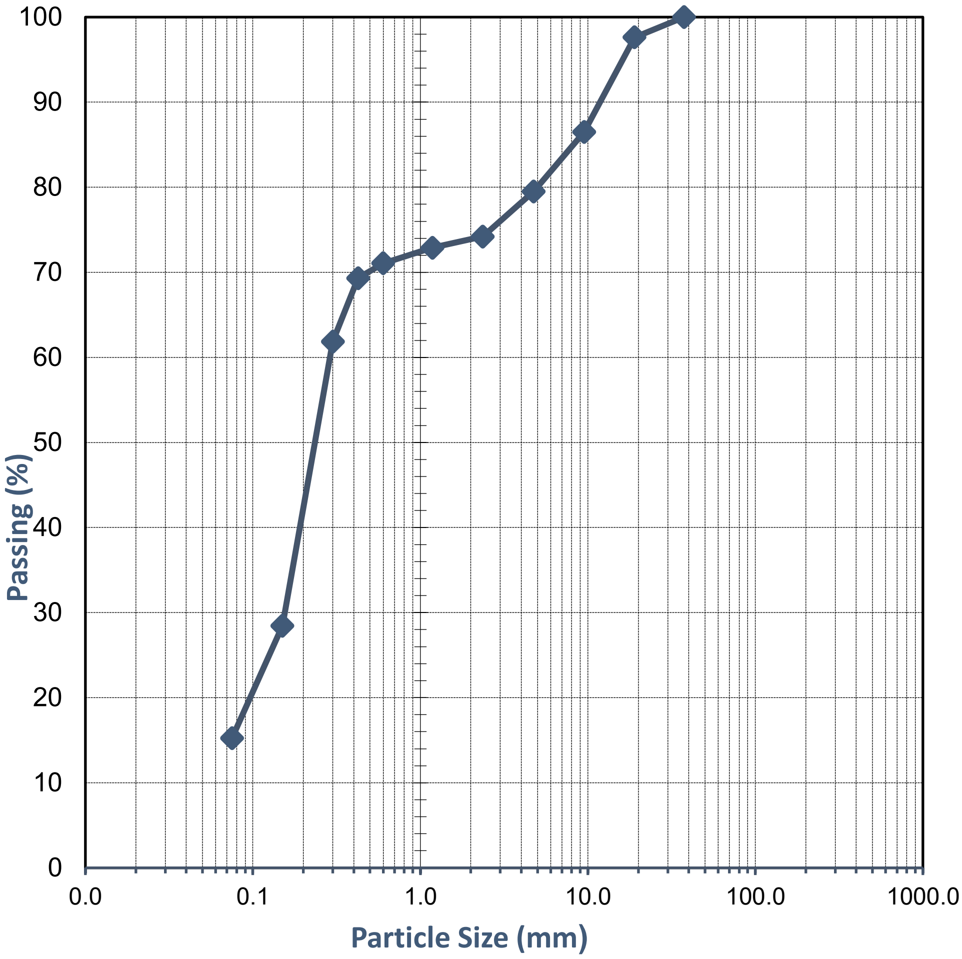
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4749_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4749
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP59 (0.5-1)m	*Date Tested:*	01/04 - 04/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	86
4.75	80
2.36	74
1.18	73
0.600	71
0.425	69
0.300	62
0.150	28
0.075	15



Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

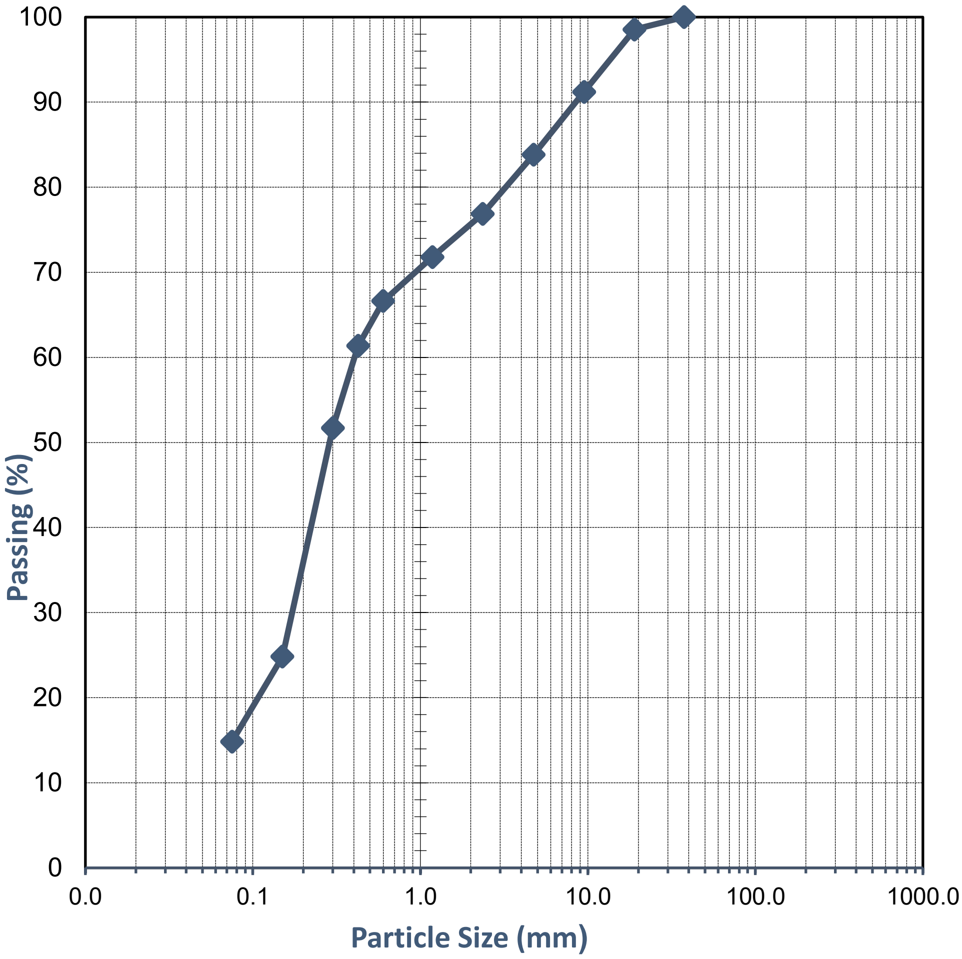
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4748_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4748
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP56 (0.5-1)m	*Date Tested:*	01/04 - 04/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	91
4.75	84
2.36	77
1.18	72
0.600	67
0.425	61
0.300	52
0.150	25
0.075	15



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

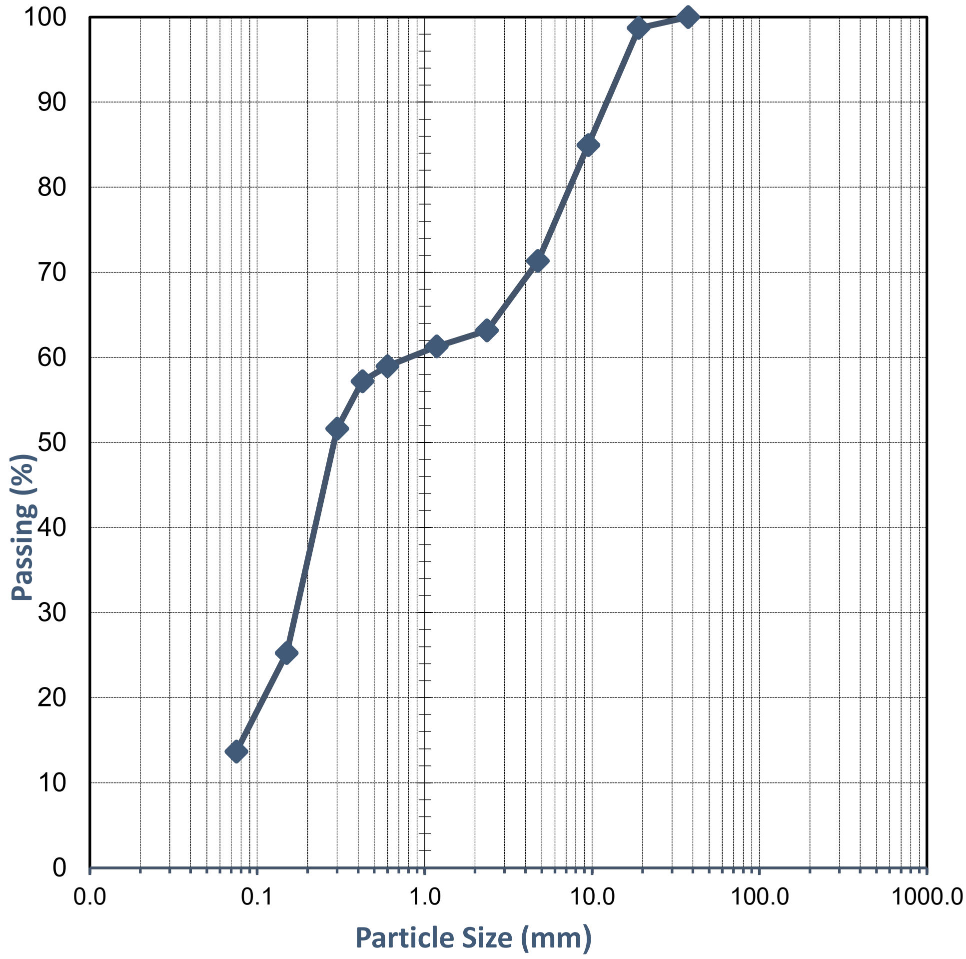
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4747_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4747
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP54 (0-0.2)m	*Date Tested:*	01/04 - 04/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	85
4.75	71
2.36	63
1.18	61
0.600	59
0.425	57
0.300	52
0.150	25
0.075	14



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 04/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

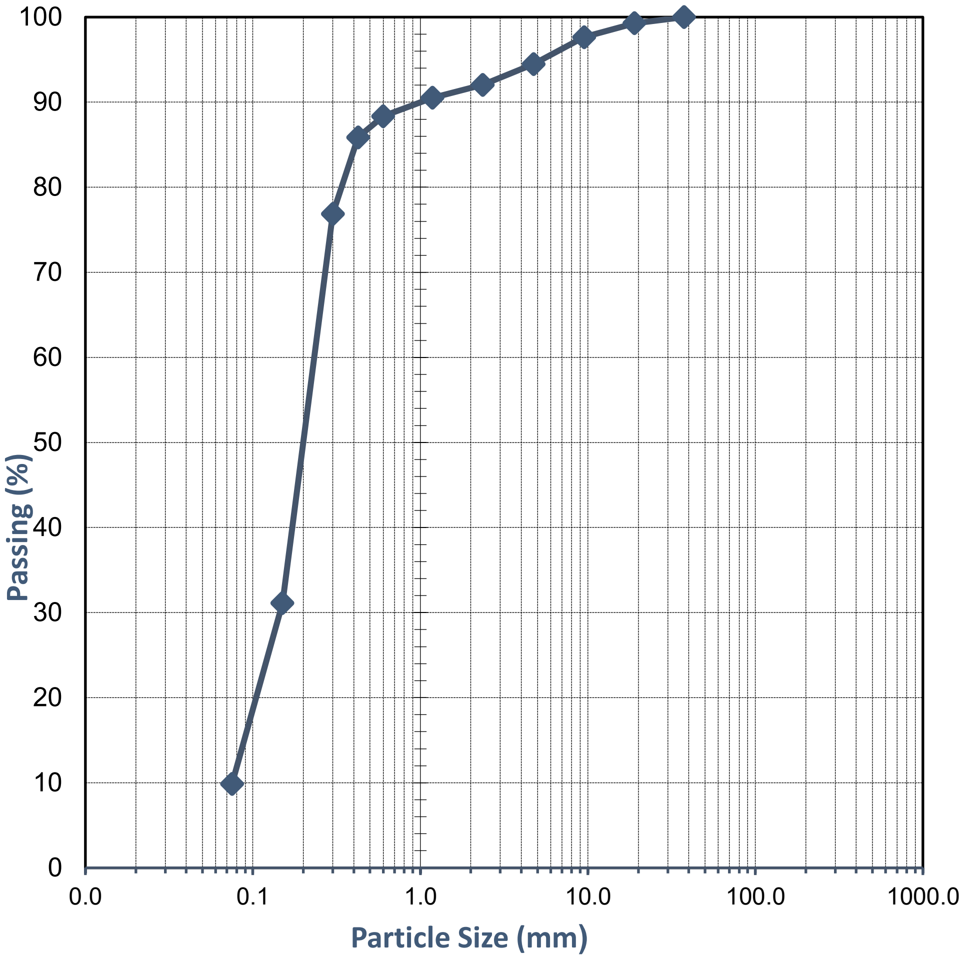
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4746_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4746
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP52 (0.3-0.7)m	*Date Tested:*	01/04 - 05/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	98
4.75	94
2.36	92
1.18	91
0.600	88
0.425	86
0.300	77
0.150	31
0.075	10



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 05/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

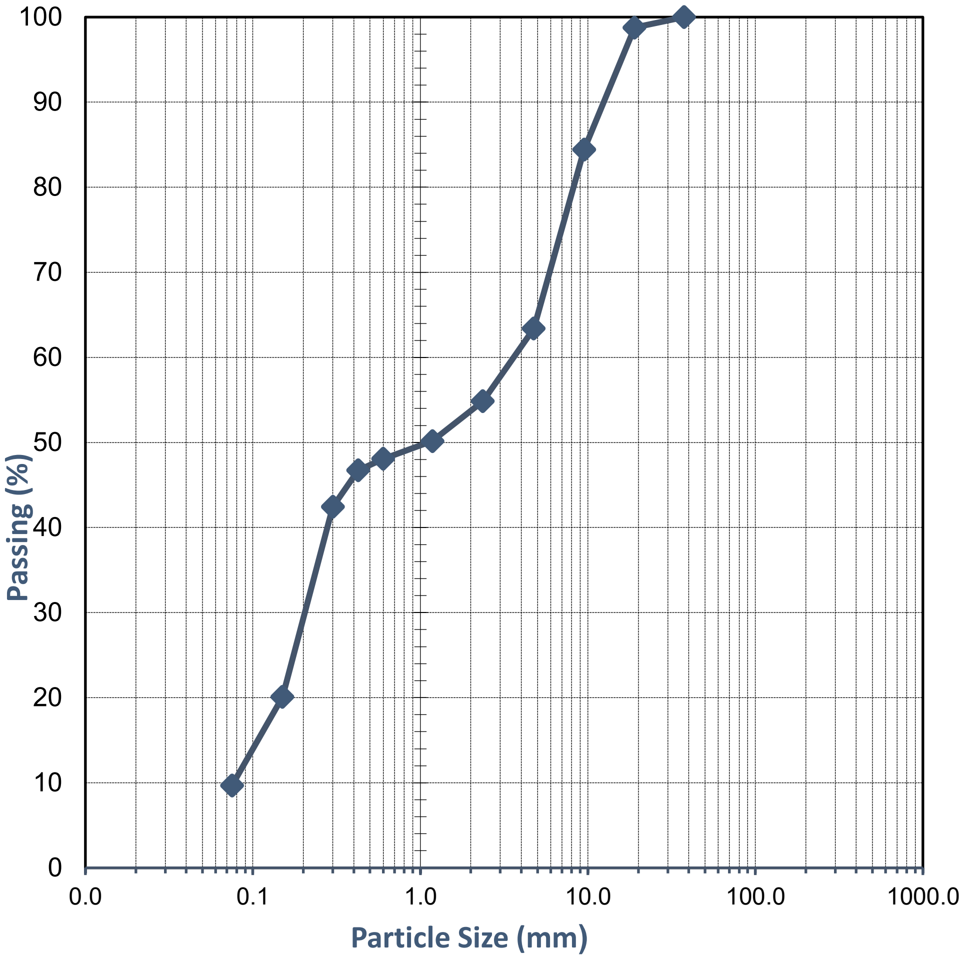
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4745_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4745
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP46 (1.5-2)m	*Date Tested:*	01/04 - 04/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	84
4.75	63
2.36	55
1.18	50
0.600	48
0.425	47
0.300	42
0.150	20
0.075	10



Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 04/April/2022

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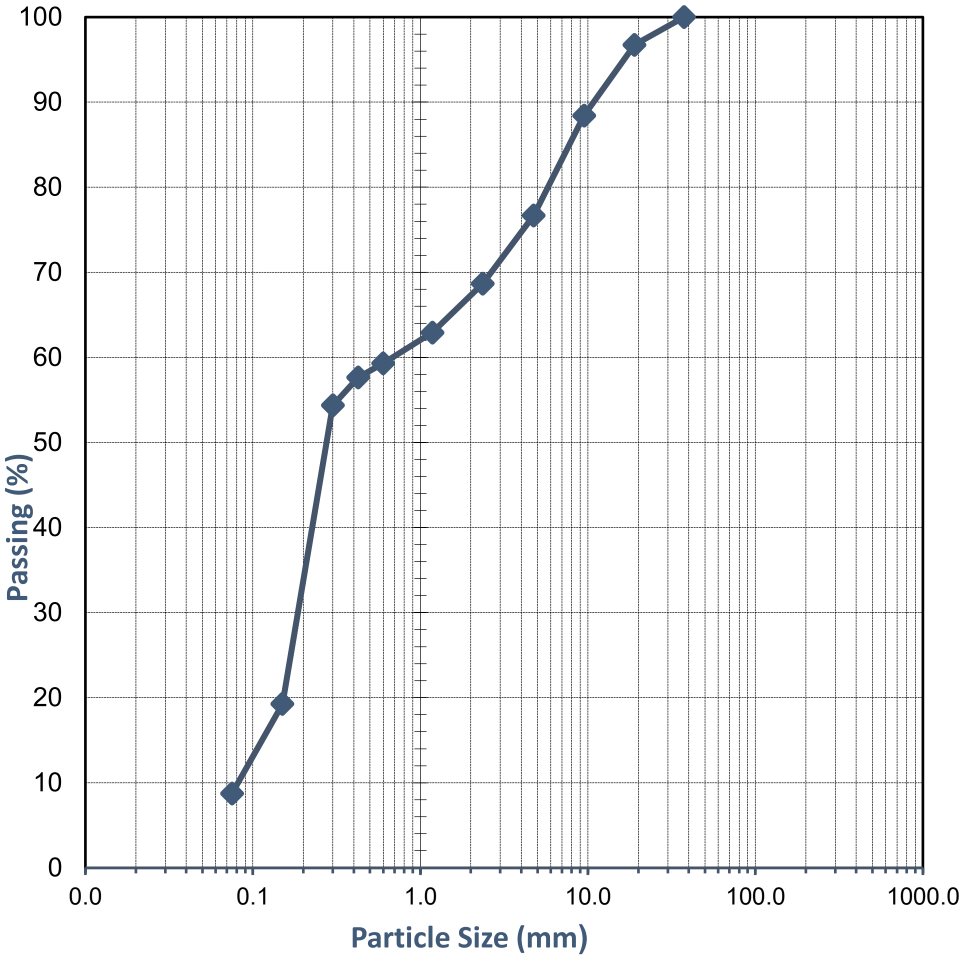
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4744_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4744
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP44 (0.5-1)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	97
9.5	88
4.75	77
2.36	69
1.18	63
0.600	59
0.425	58
0.300	54
0.150	19
0.075	9



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01-April-2022

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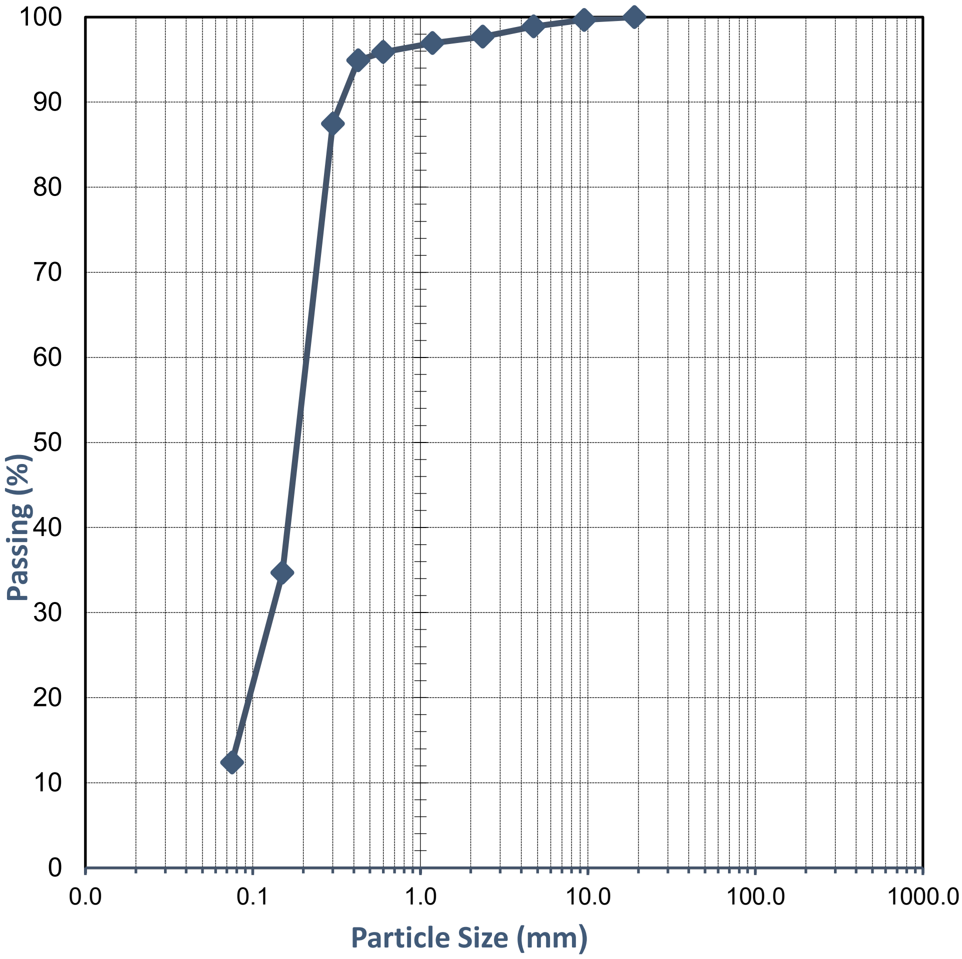
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4743_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4743
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP40 (2-2.5)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	99
2.36	98
1.18	97
0.600	96
0.425	95
0.300	87
0.150	35
0.075	12



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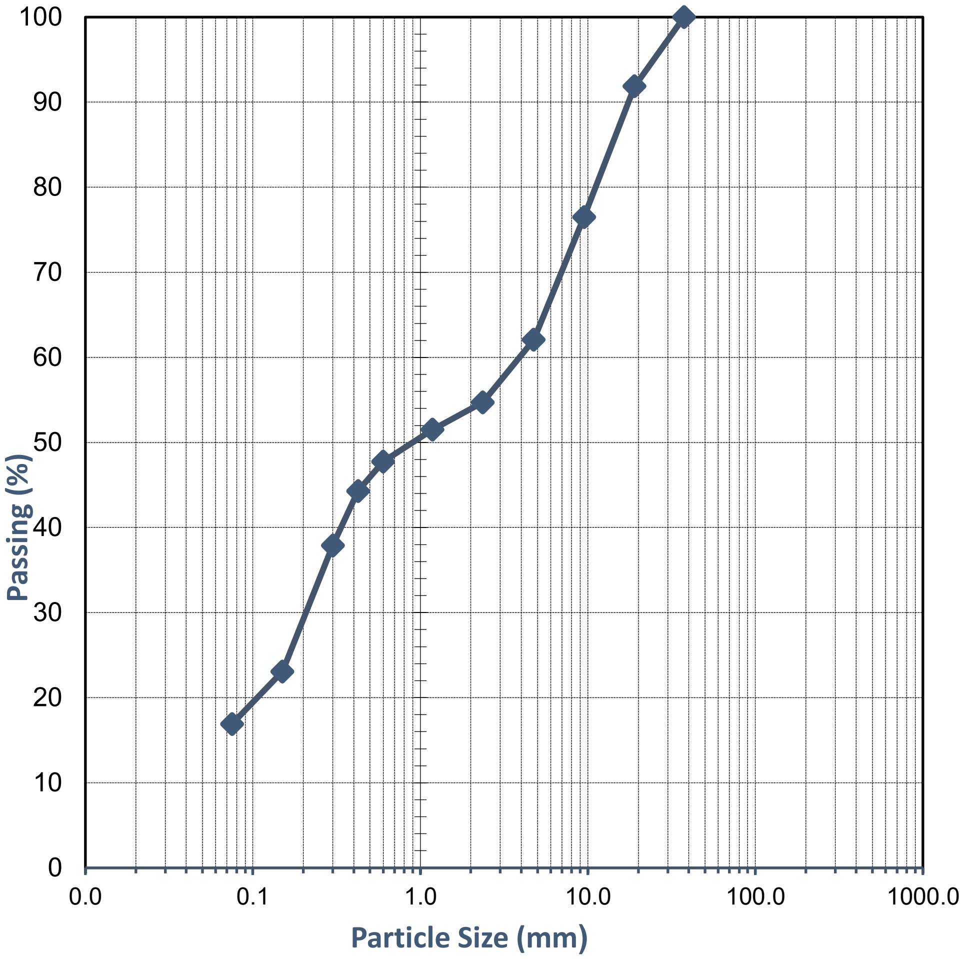
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4742_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4742
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP38 (0.5-1)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	92
9.5	76
4.75	62
2.36	55
1.18	52
0.600	48
0.425	44
0.300	38
0.150	23
0.075	17



Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 01-April-2022

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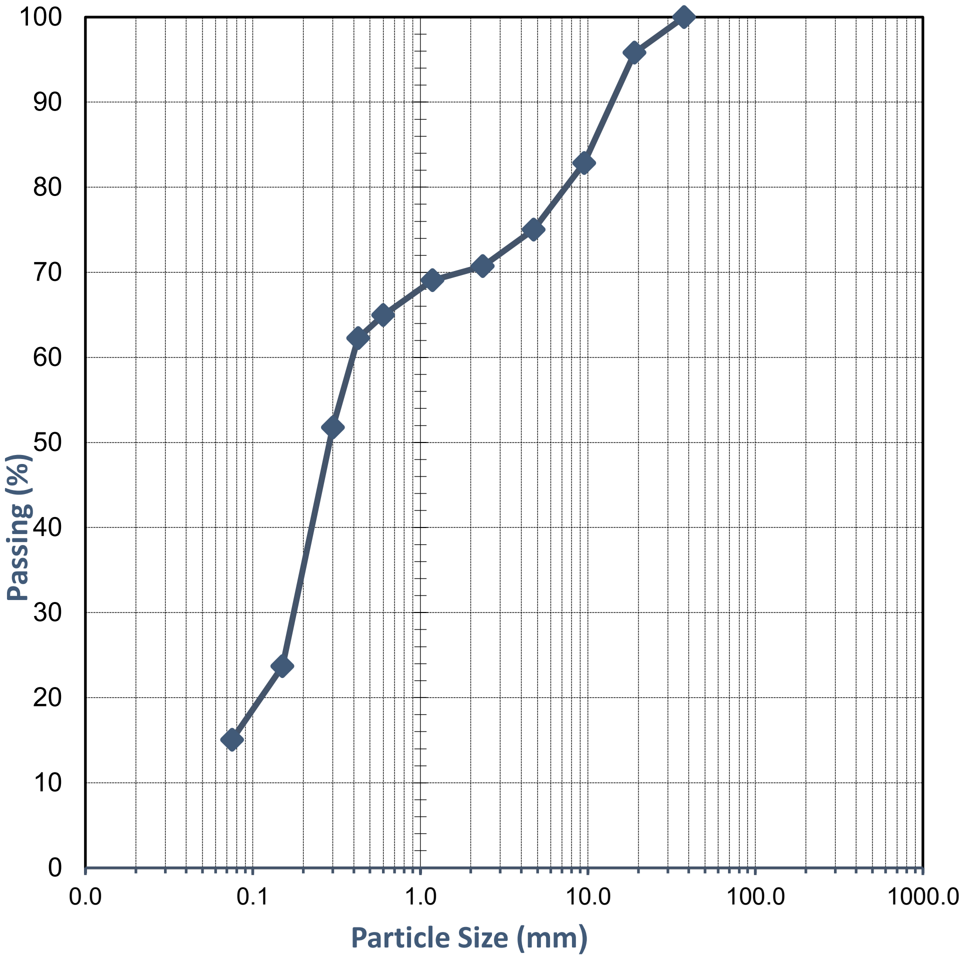
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4741_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4741
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP36 (0.5-1)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	83
4.75	75
2.36	71
1.18	69
0.600	65
0.425	62
0.300	52
0.150	24
0.075	15



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SOIL | AGGREGATE | CONCRETE | CRUSHING

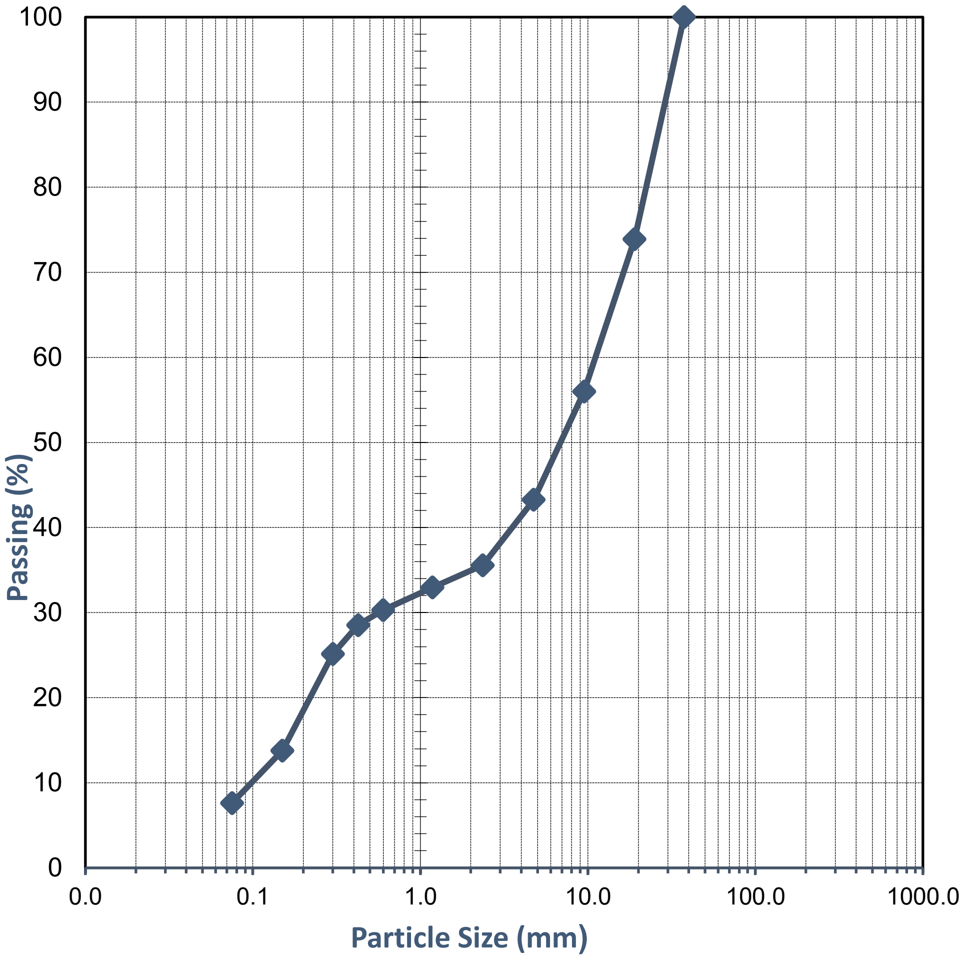
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4740_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4740
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP31 (2-2.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	74
9.5	56
4.75	43
2.36	36
1.18	33
0.600	30
0.425	29
0.300	25
0.150	14
0.075	8



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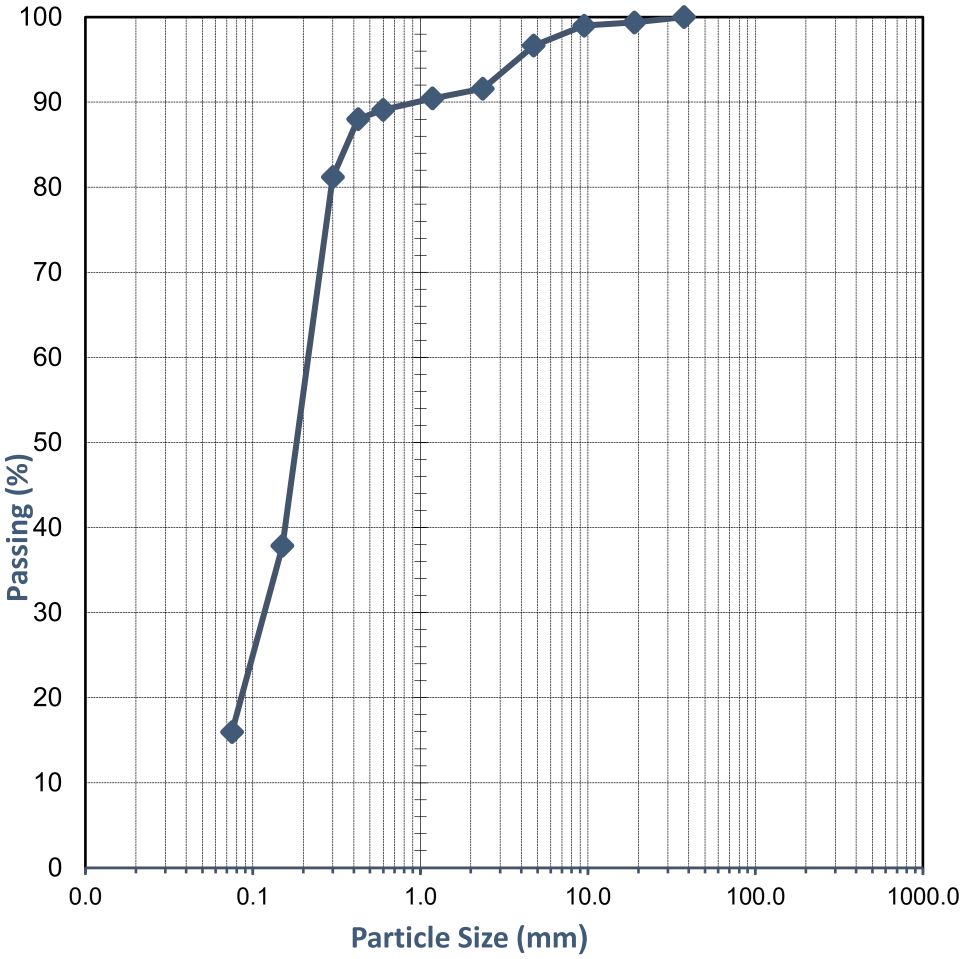
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4739_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4739
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP30 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	99
4.75	97
2.36	92
1.18	90
0.600	89
0.425	88
0.300	81
0.150	38
0.075	16



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SOIL | AGGREGATE | CONCRETE | CRUSHING

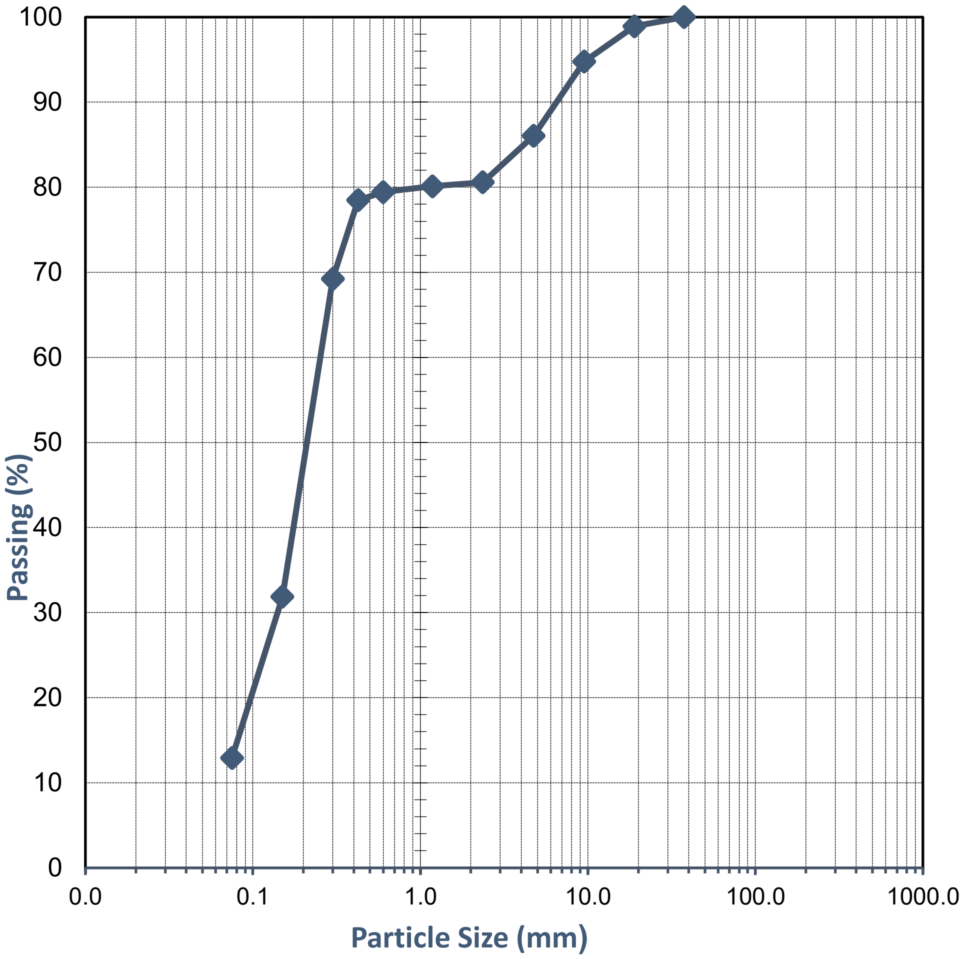
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	95
4.75	86
2.36	81
1.18	80
0.600	79
0.425	78
0.300	69
0.150	32
0.075	13



Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 01/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

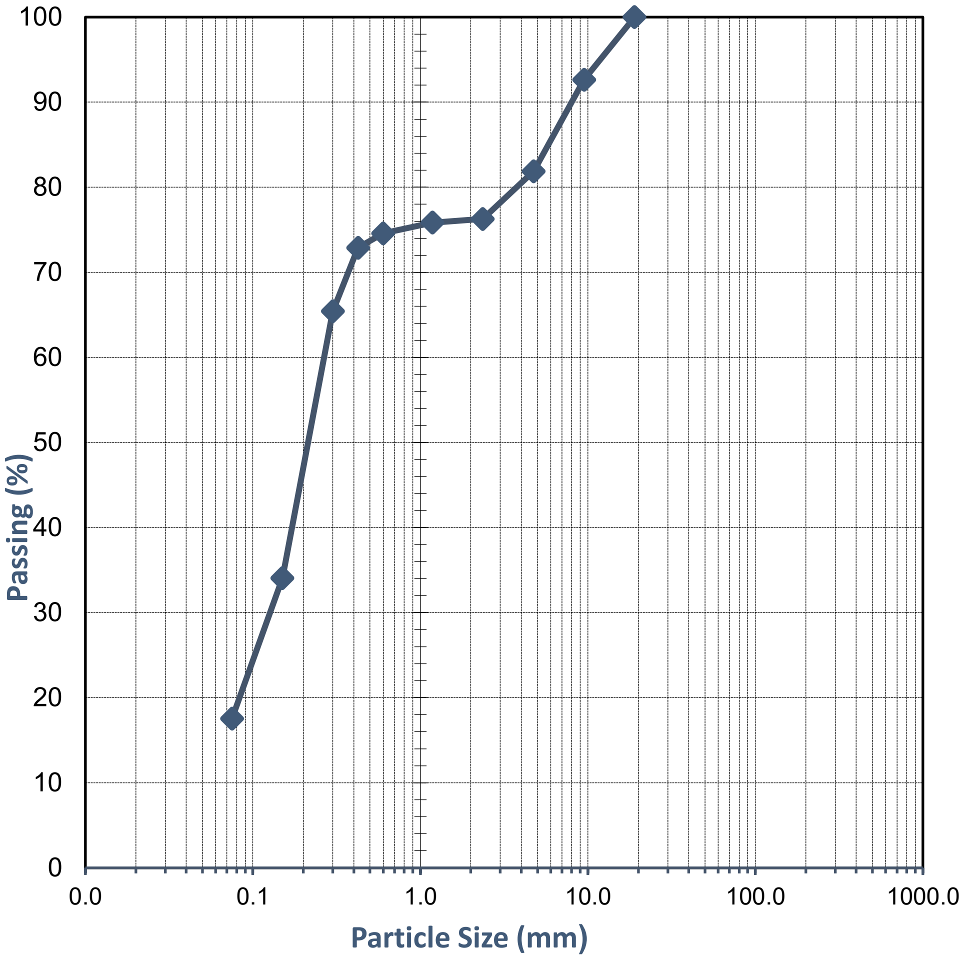
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	93
4.75	82
2.36	76
1.18	76
0.600	75
0.425	73
0.300	65
0.150	34
0.075	18



Comments:

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SOIL | AGGREGATE | CONCRETE | CRUSHING

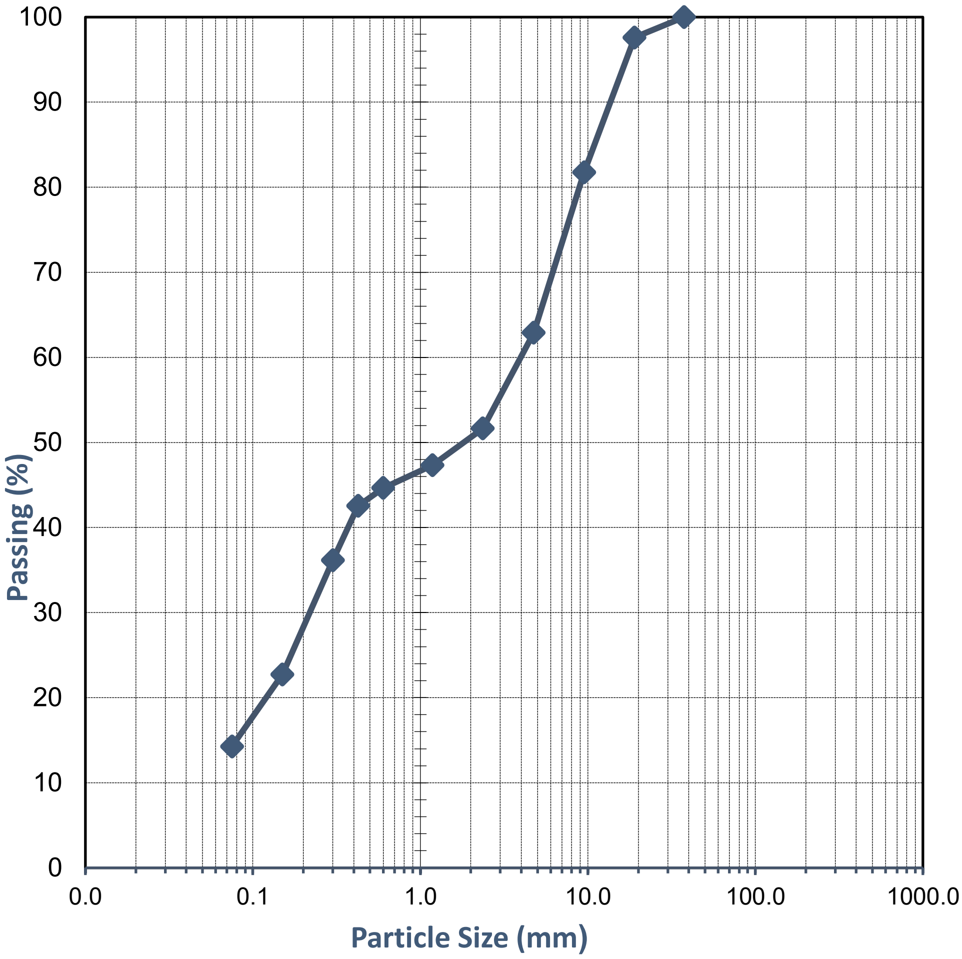
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4736_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4736
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP20 (0.6-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	82
4.75	63
2.36	52
1.18	47
0.600	45
0.425	43
0.300	36
0.150	23
0.075	14



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SOIL | AGGREGATE | CONCRETE | CRUSHING

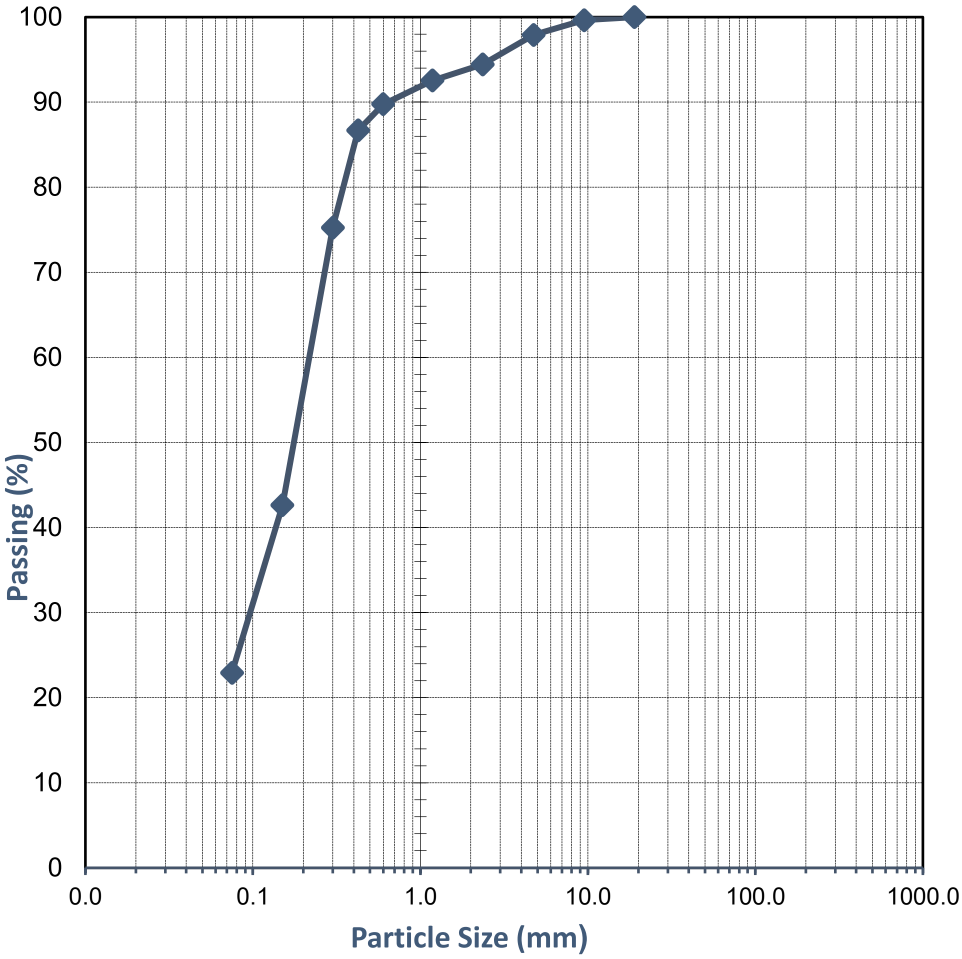
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4735_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4735
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP17 (0-0.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	98
2.36	94
1.18	93
0.600	90
0.425	87
0.300	75
0.150	43
0.075	23



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SOIL | AGGREGATE | CONCRETE | CRUSHING

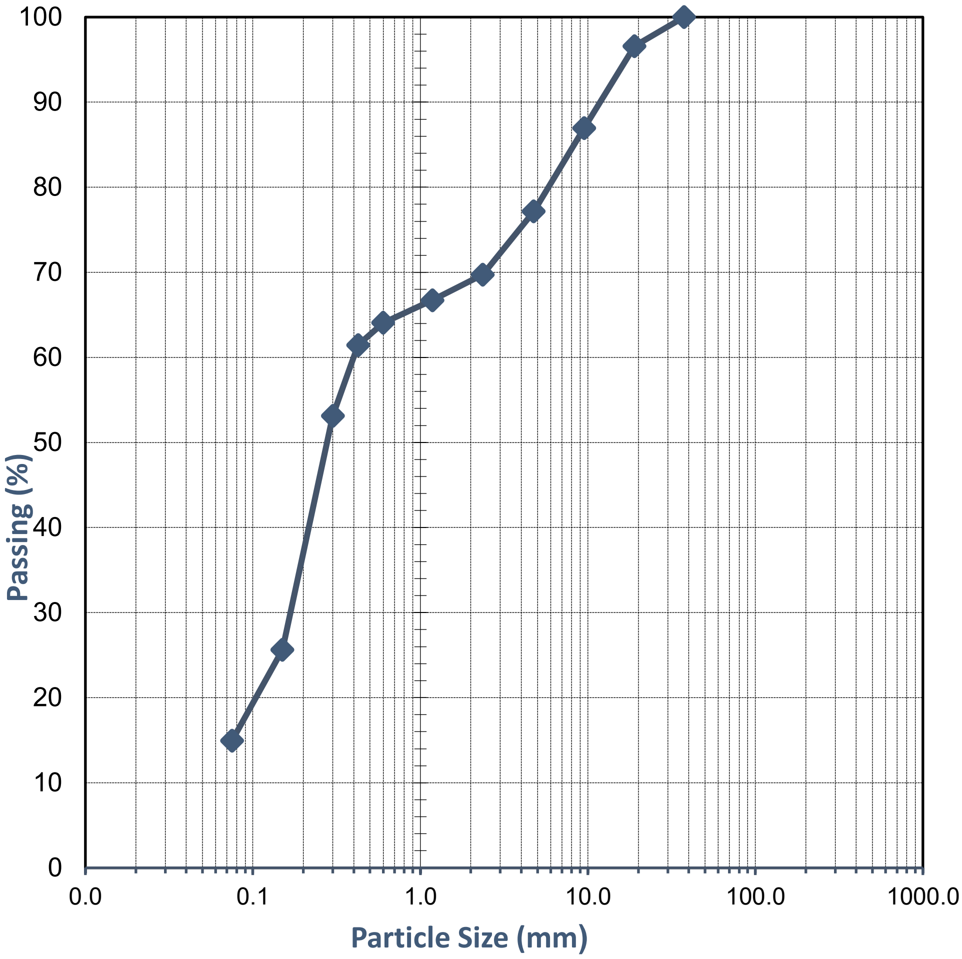
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4734_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4734
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP13 (0.5-1)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	97
9.5	87
4.75	77
2.36	70
1.18	67
0.600	64
0.425	61
0.300	53
0.150	26
0.075	15



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SOIL | AGGREGATE | CONCRETE | CRUSHING

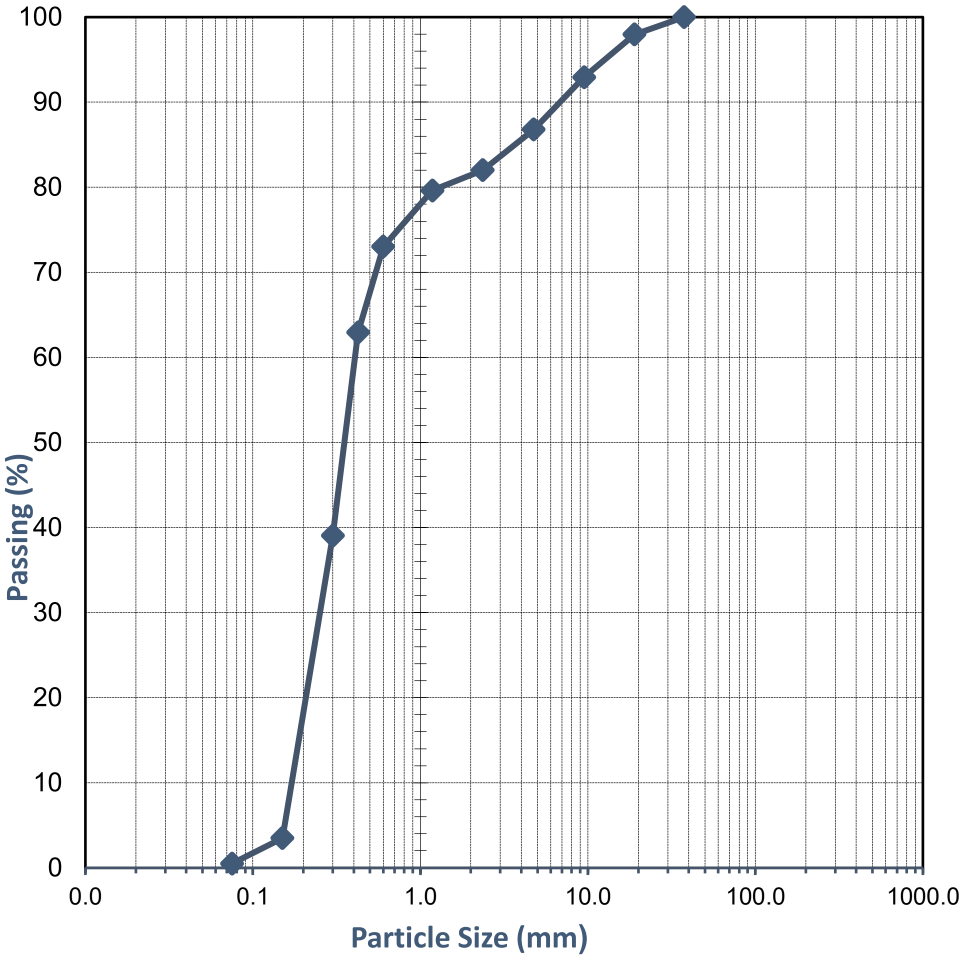
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	93
4.75	87
2.36	82
1.18	80
0.600	73
0.425	63
0.300	39
0.150	3
0.075	0



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SOIL | AGGREGATE | CONCRETE | CRUSHING

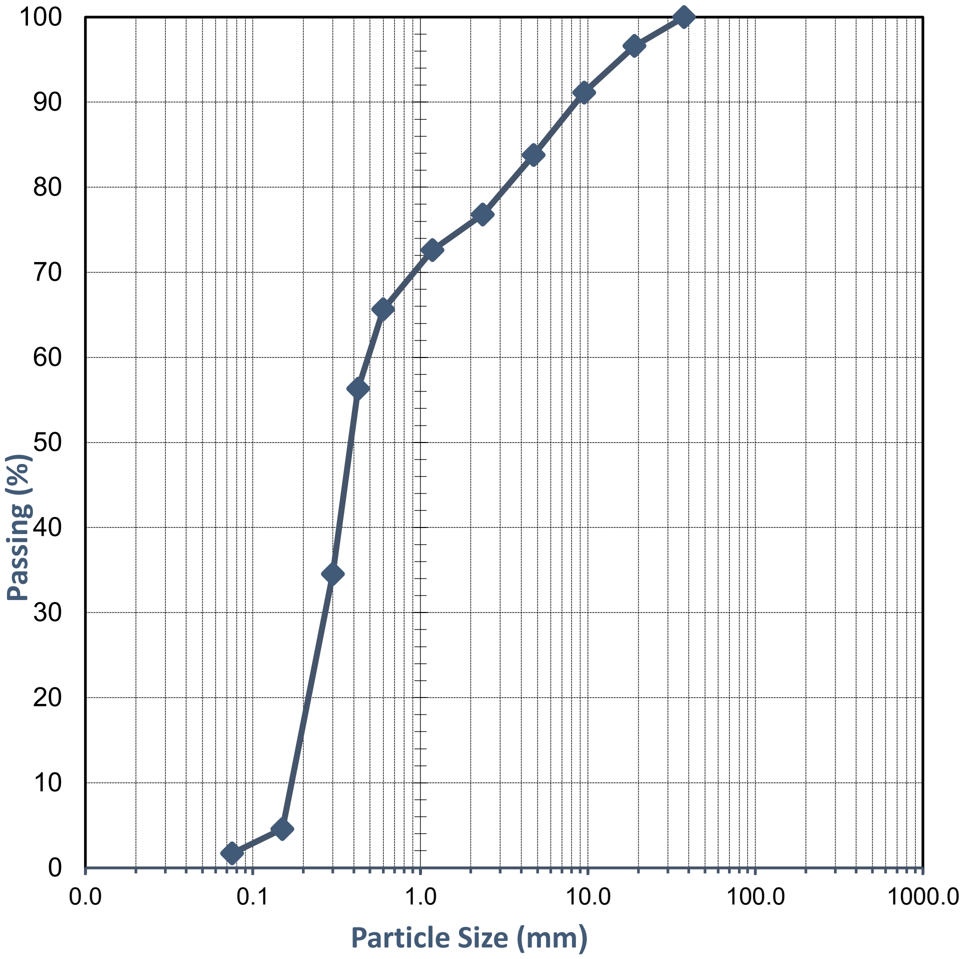
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4732_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4732
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP12 (0-0.4)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	97
9.5	91
4.75	84
2.36	77
1.18	73
0.600	66
0.425	56
0.300	35
0.150	5
0.075	2



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SOIL | AGGREGATE | CONCRETE | CRUSHING

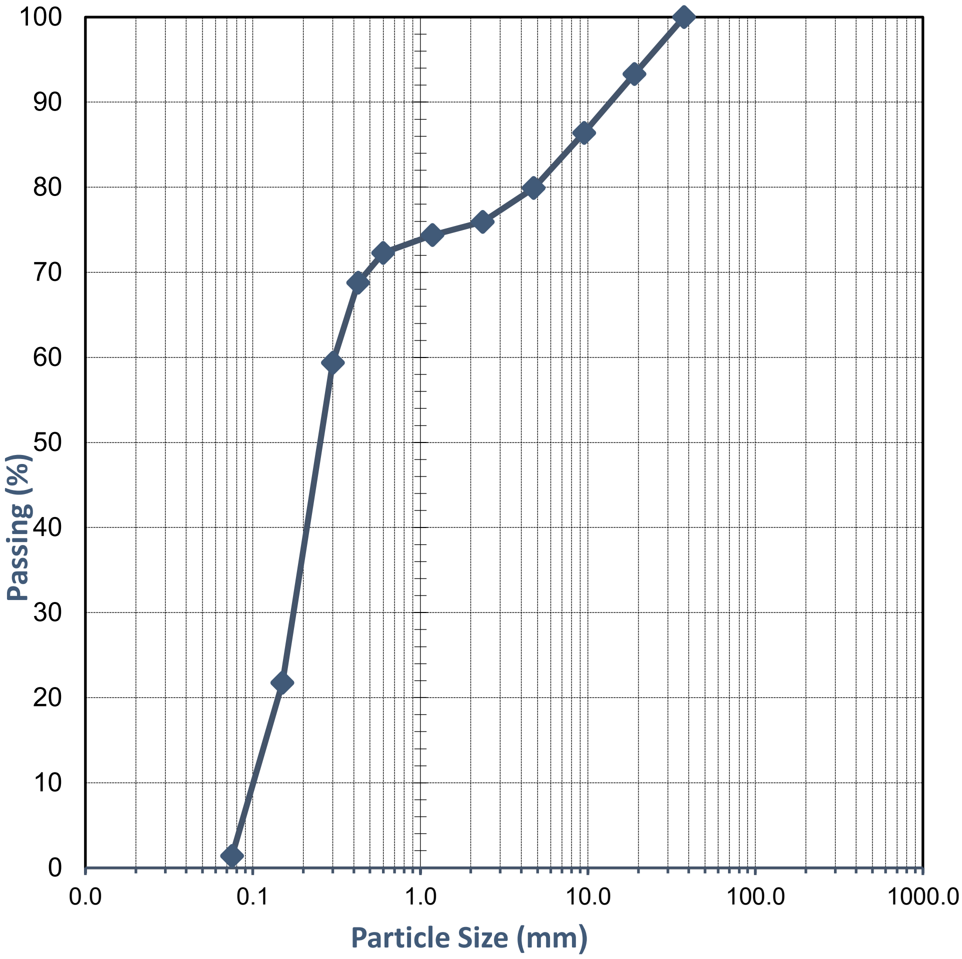
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4731_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4731
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP11 (1.3-2)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	93
9.5	86
4.75	80
2.36	76
1.18	74
0.600	72
0.425	69
0.300	59
0.150	22
0.075	1



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

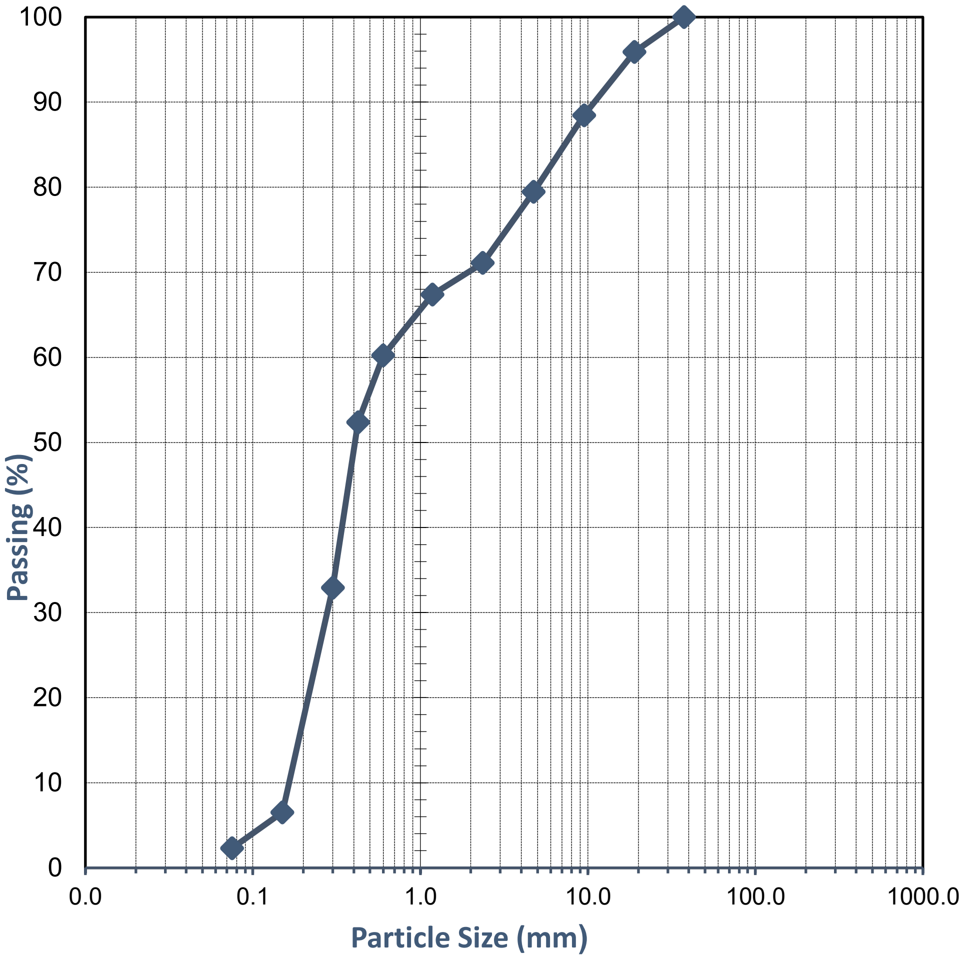
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4730_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4730
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP11 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	88
4.75	79
2.36	71
1.18	67
0.600	60
0.425	52
0.300	33
0.150	7
0.075	2



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01/April/2022

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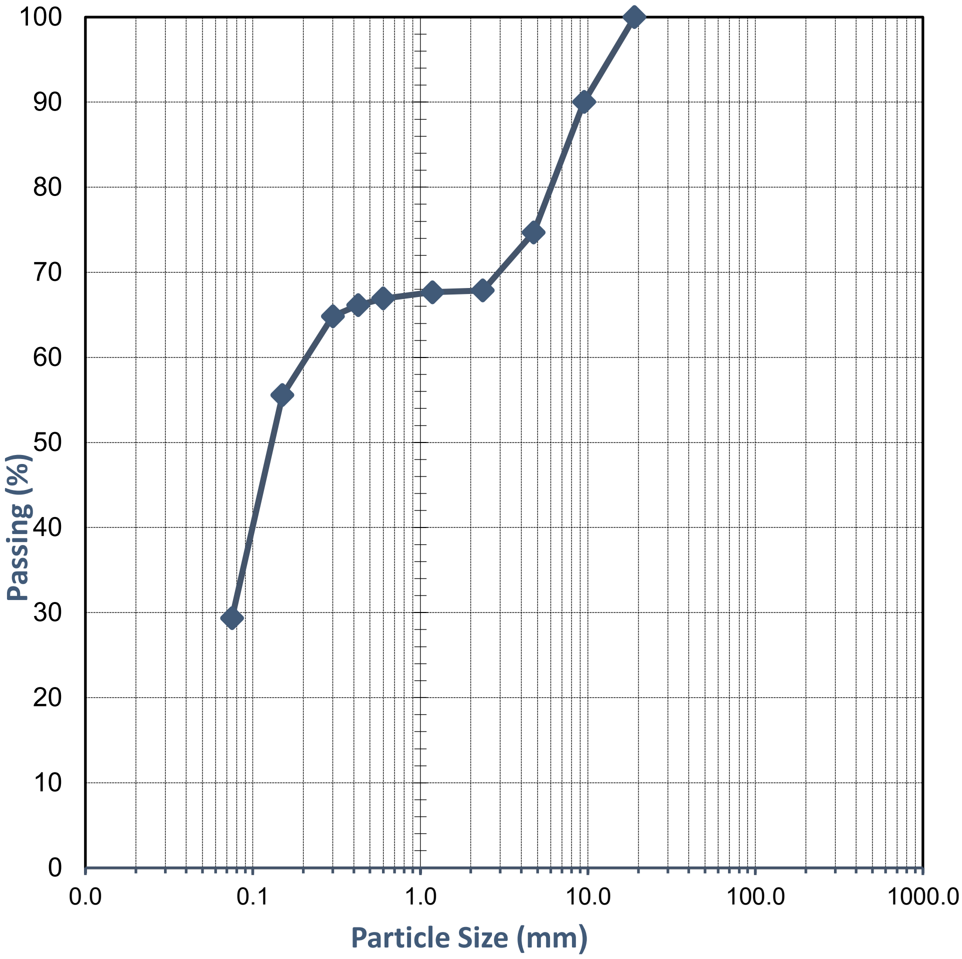
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4729_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4729
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP10 (1.5-2)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	90
4.75	75
2.36	68
1.18	68
0.600	67
0.425	66
0.300	65
0.150	56
0.075	29



Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 01/April/2022

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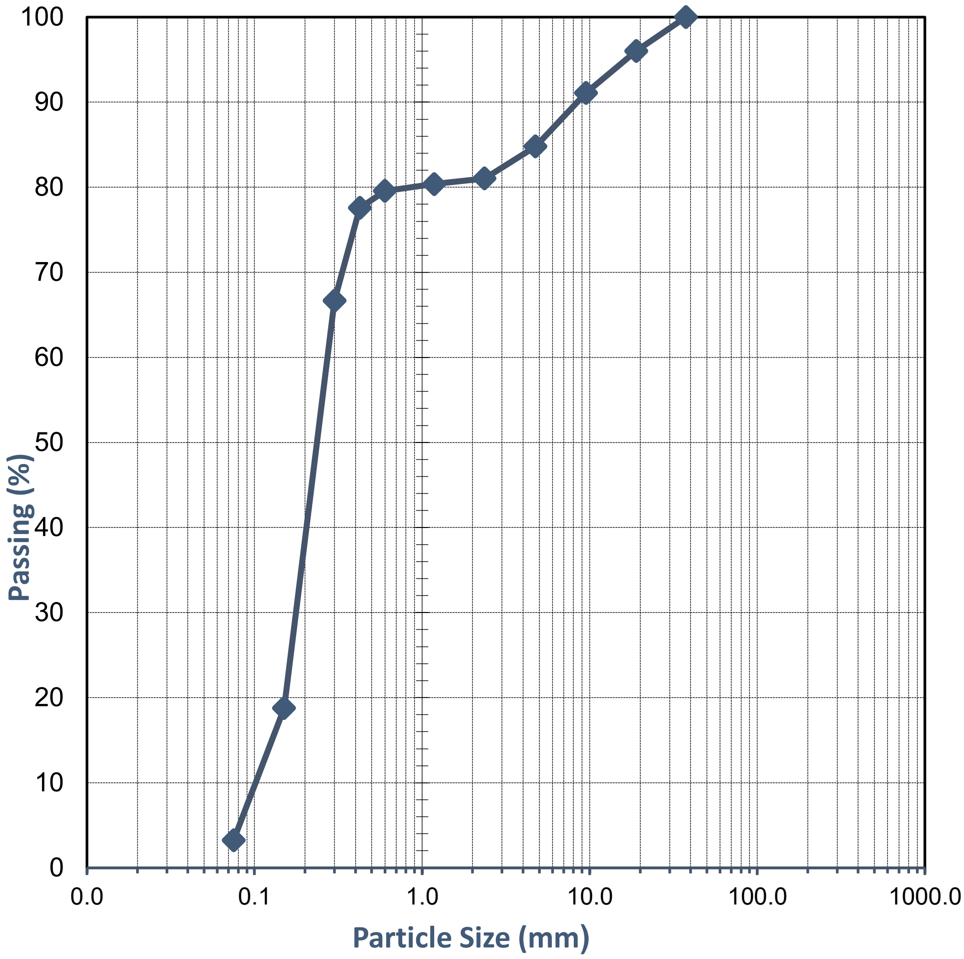
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4728_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4728
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP10 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	91
4.75	85
2.36	81
1.18	80
0.600	80
0.425	78
0.300	67
0.150	19
0.075	3



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01/April/2022

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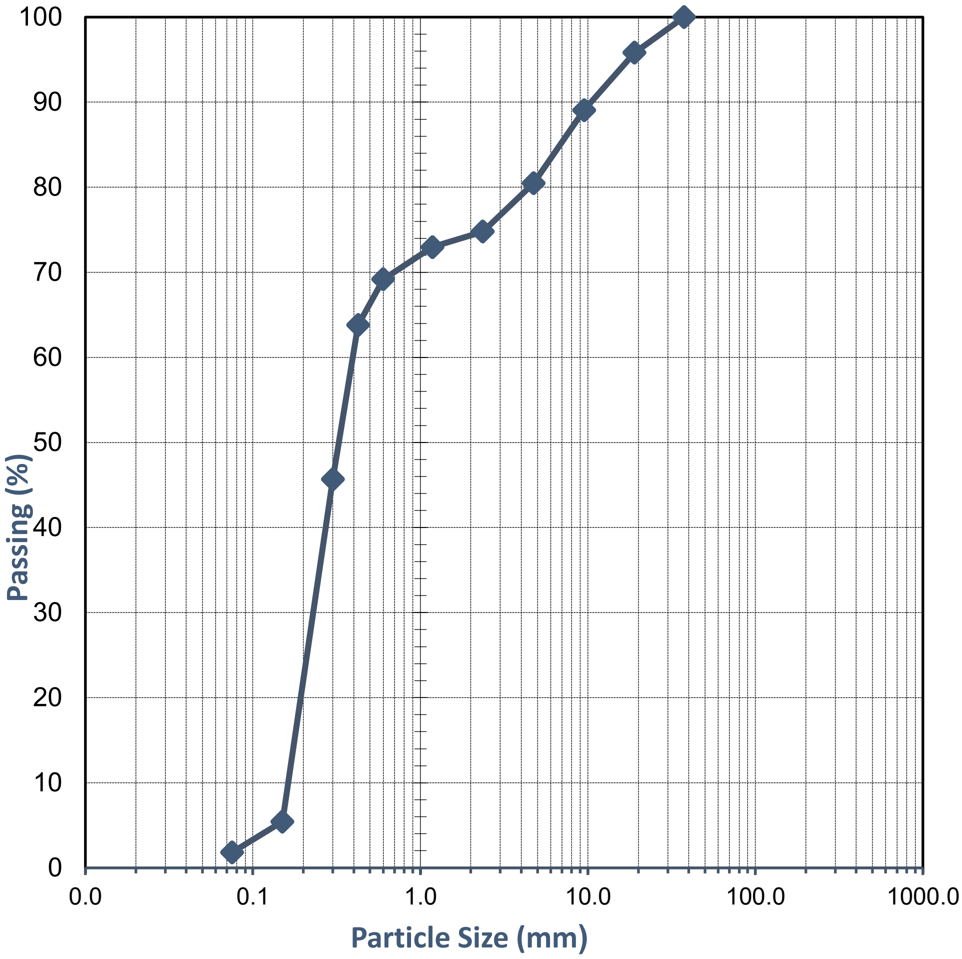
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4727_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4727
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP09 (1-1.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	96
9.5	89
4.75	80
2.36	75
1.18	73
0.600	69
0.425	64
0.300	46
0.150	5
0.075	2



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01/April/2022

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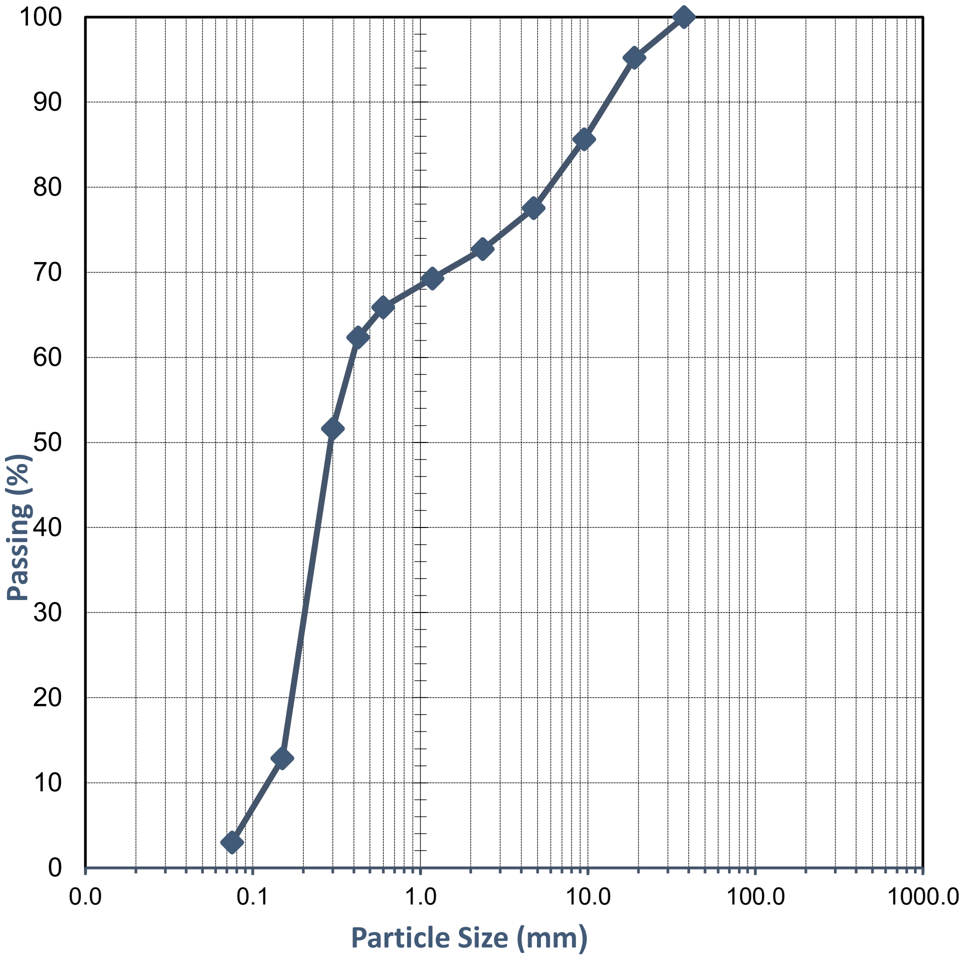
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4726_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4726
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP08 (1.5-2)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	95
9.5	86
4.75	78
2.36	73
1.18	69
0.600	66
0.425	62
0.300	52
0.150	13
0.075	3



Comments:

Approved Signatory:

Name: Natasha Bielawski
Date: 01/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

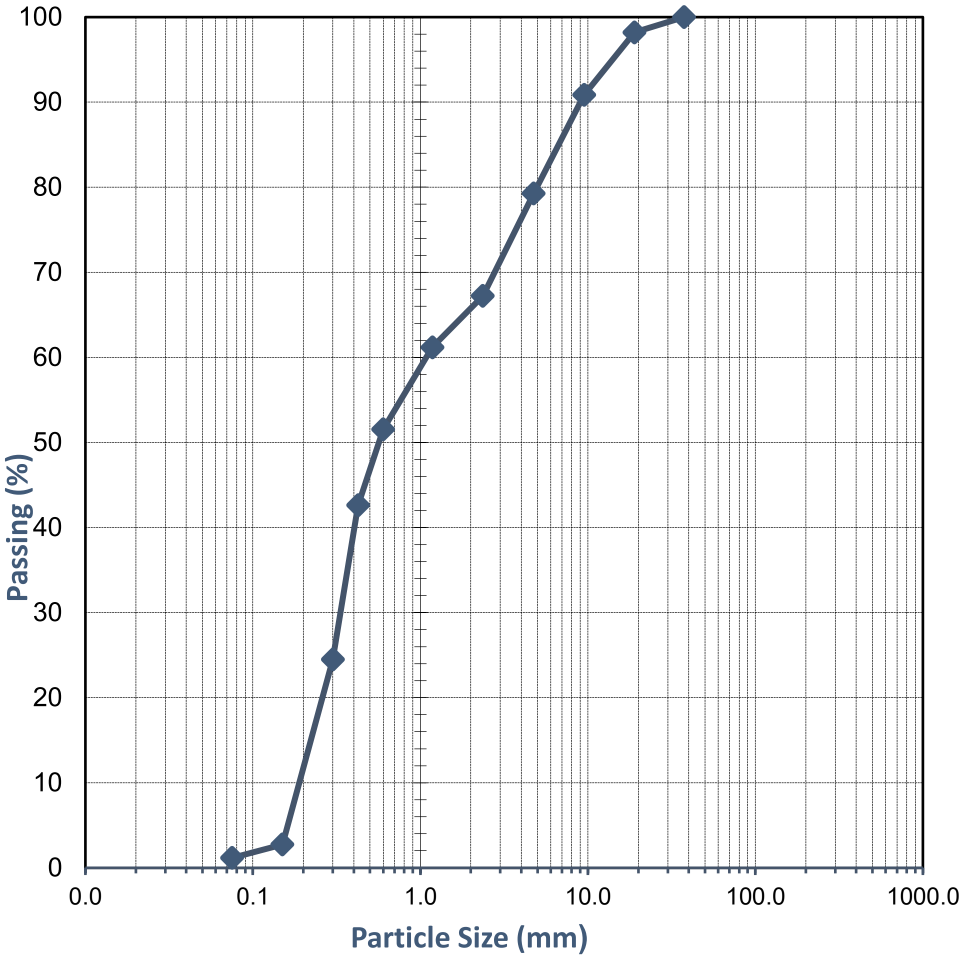
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	91
4.75	79
2.36	67
1.18	61
0.600	52
0.425	43
0.300	24
0.150	3
0.075	1



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01/April/2022

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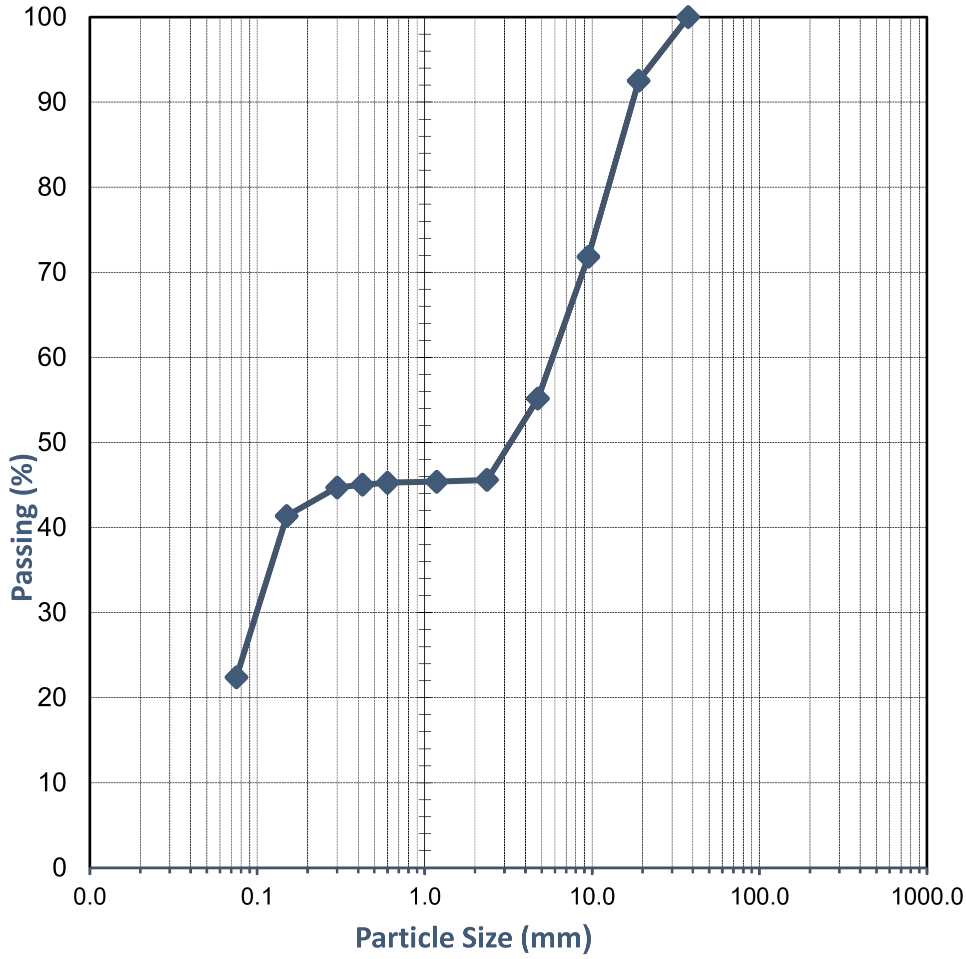
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4724_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4724
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (2-2.5)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	93
9.5	72
4.75	55
2.36	46
1.18	45
0.600	45
0.425	45
0.300	45
0.150	41
0.075	22



Comments: AS 1289.1.1- Deviation from standard: Insufficient sample according to test method requirements. NATA accreditation does not cover the performance of this service.

Approved Signatory:

Name: Natasha Bielawski

Date: 01/April/2022

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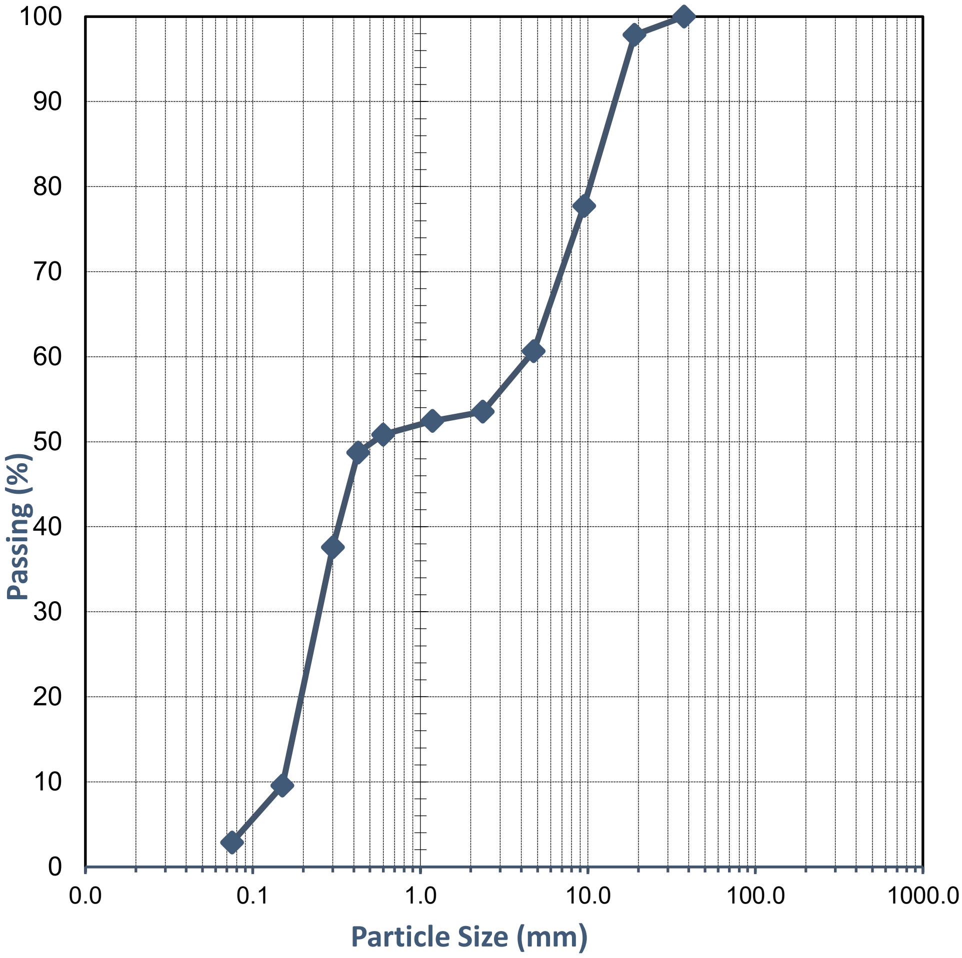
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4723_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4723
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP03 (0-0.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	78
4.75	61
2.36	54
1.18	52
0.600	51
0.425	49
0.300	38
0.150	10
0.075	3



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

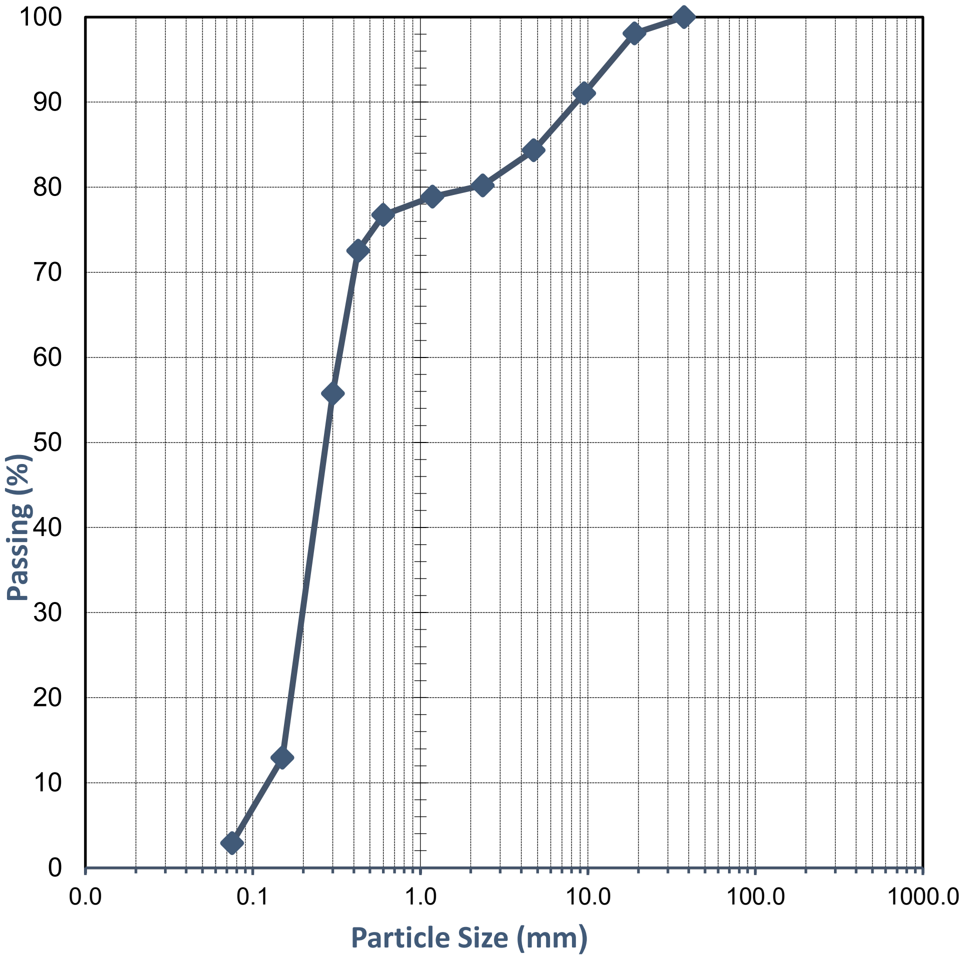
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	31/03 - 01/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	98
9.5	91
4.75	84
2.36	80
1.18	79
0.600	77
0.425	73
0.300	56
0.150	13
0.075	3



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

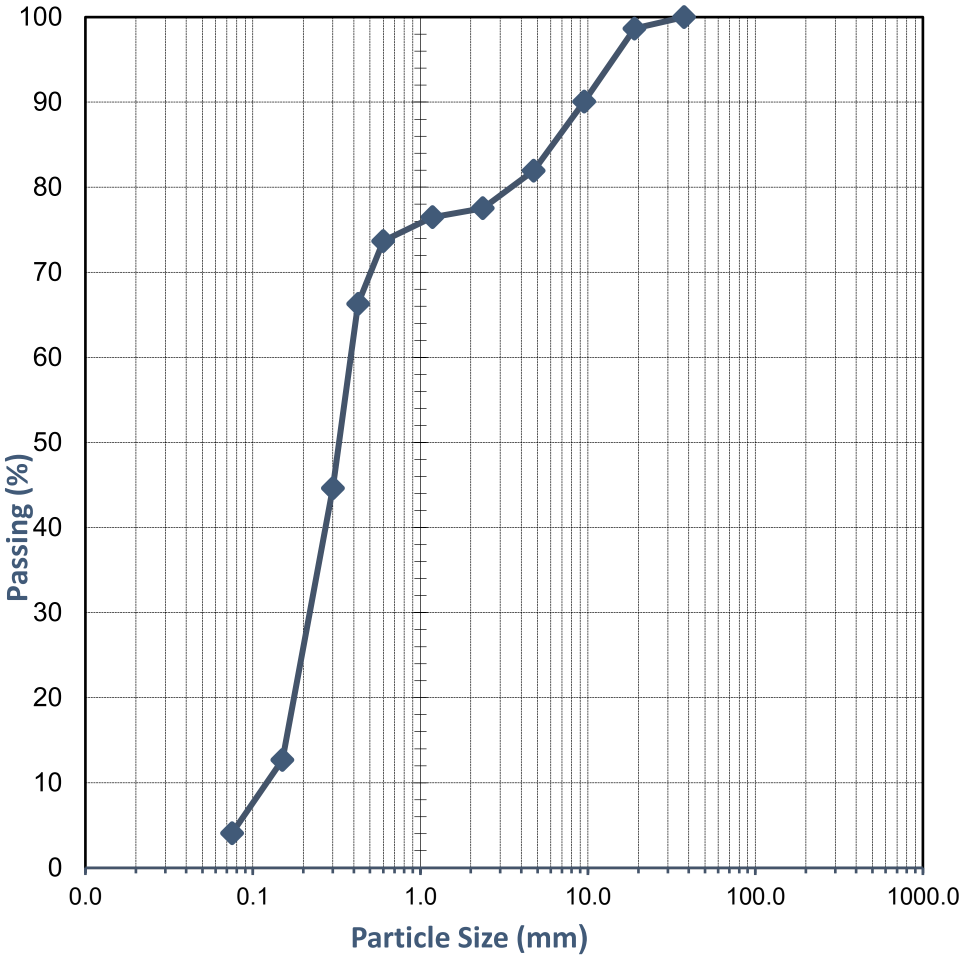
TEST REPORT - AS 1289.3.6.1

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4721_1_PSD
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4721
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	TP01 (0-0.5)m	*Date Tested:*	31/03 - 1/04/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: **Sampled by Client, Tested as Received**

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	99
9.5	90
4.75	82
2.36	78
1.18	76
0.600	74
0.425	66
0.300	45
0.150	13
0.075	4



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 01-April-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

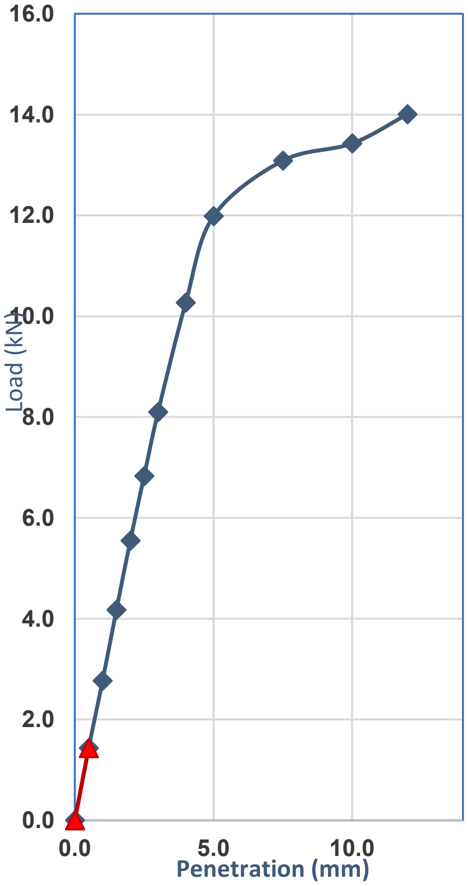
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4755_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4755
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP76 (0.2-0.5)m	*Date Tested:*	30/03 - 2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Silty Sand trace Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details

Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	2.11	Optimum Moisture (%)	8.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction

Dry Density (t/m3)	2.01	Moisture Content (%)	8.2
Density Ratio (%)	95.5	Moisture Ratio (%)	97.0

Specimen Conditions After Soak

Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m^3)	2.01	Dry Density Ratio (%)	95.5
Moisture Content (%)	11.9	Moisture Ratio (%)	139.5

Specimen Conditions After Test

Top 30mm Moisture (%)	10.6	Remaining Depth (%)	11.2

Correction applied to Penetration: 0mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 60%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

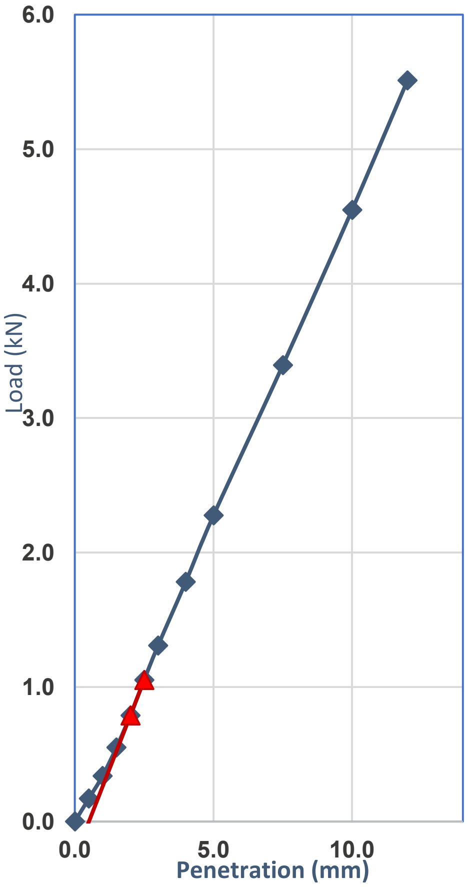
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4743_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4743
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP40 (2-2.5)m	*Date Tested:*	30/3 - 8/4/22

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details

Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	48.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.77	Optimum Moisture (%)	14.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction

Dry Density (t/m3)	1.69	Moisture Content (%)	13.8
Density Ratio (%)	95.5	Moisture Ratio (%)	96.5

Specimen Conditions After Soak

Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m^3)	1.69	Dry Density Ratio (%)	95.5
Moisture Content (%)	16.0	Moisture Ratio (%)	112.0

Specimen Conditions After Test

Top 30mm Moisture (%)	13.8	Remaining Depth (%)	15.0

Correction applied to Penetration: 0.5mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 13%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 11-April-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

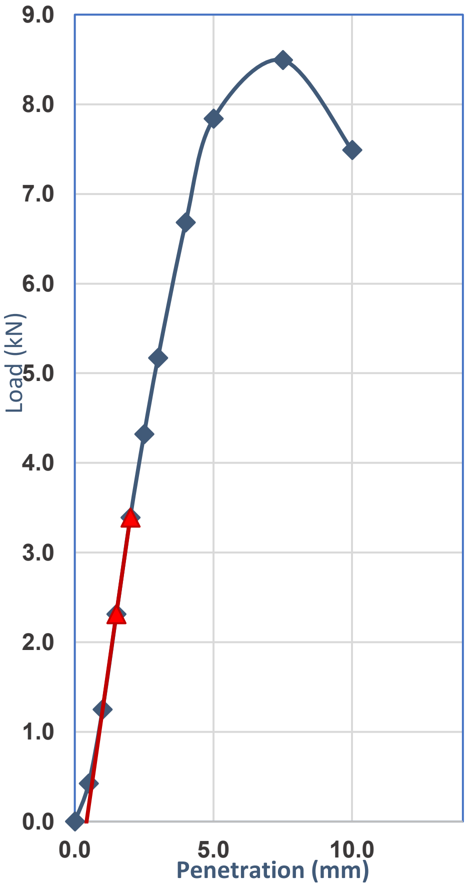
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4738_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4738
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP26 (0.5-0.75)m	*Date Tested:*	31/03 - 4/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	48.0
% Retained 19.0mm	2	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	2.00	Optimum Moisture (%)	8.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.90	Moisture Content (%)	8.4
Density Ratio (%)	95.0	Moisture Ratio (%)	98.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	5.00	Measured Swell (%)	0.0
Dry Density (t/m³)	1.89	Dry Density Ratio (%)	95.0
Moisture Content (%)	12.8	Moisture Ratio (%)	151.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	13.4	Remaining Depth (%)	13.3

Correction applied to Penetration: 0.4mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 40%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 05-April-2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

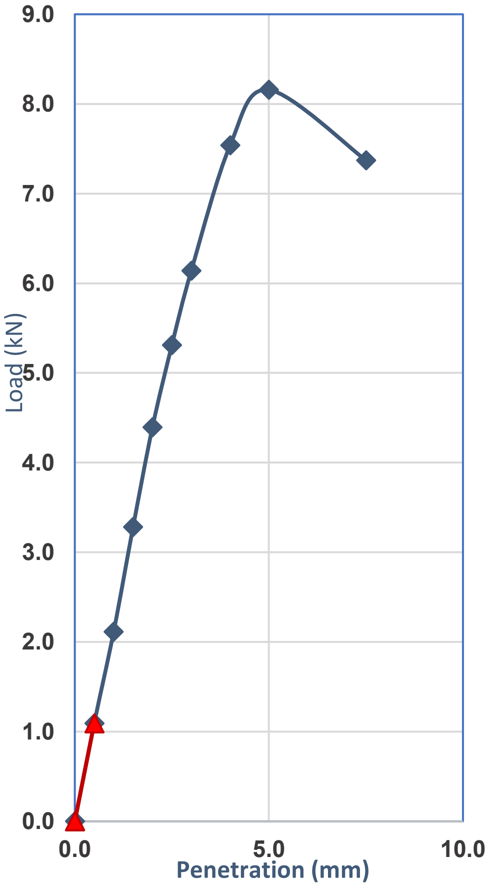
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4737_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4737
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP21 (0.7-1.2)m	*Date Tested:*	31/03 - 2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Silty Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24 hrs
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	2.07	Optimum Moisture (%)	8.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.97	Moisture Content (%)	7.8
Density Ratio (%)	95.5	Moisture Ratio (%)	96.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	1.97	Dry Density Ratio (%)	95.0
Moisture Content (%)	11.5	Moisture Ratio (%)	142.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	11.4	Remaining Depth (%)	11.7

Correction applied to Penetration: 0mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 40%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

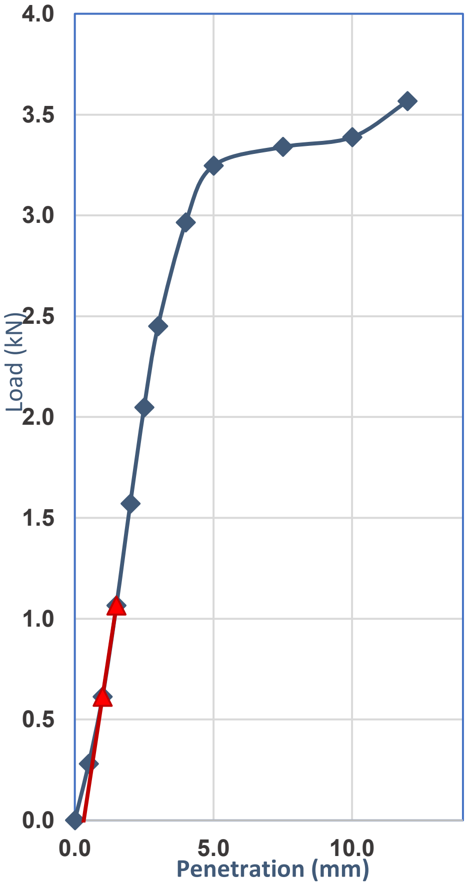
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4733_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4733
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP12 (0.5-1)m	*Date Tested:*	30/03 - 2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24.0
% Retained 19.0mm	1	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.78	Optimum Moisture (%)	12.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.69	Moisture Content (%)	12.1
Density Ratio (%)	95.0	Moisture Ratio (%)	101.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	1.69	Dry Density Ratio (%)	94.5
Moisture Content (%)	18.2	Moisture Ratio (%)	153.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	16.1	Remaining Depth (%)	17.8

Correction applied to Penetration: 0.3mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 17%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

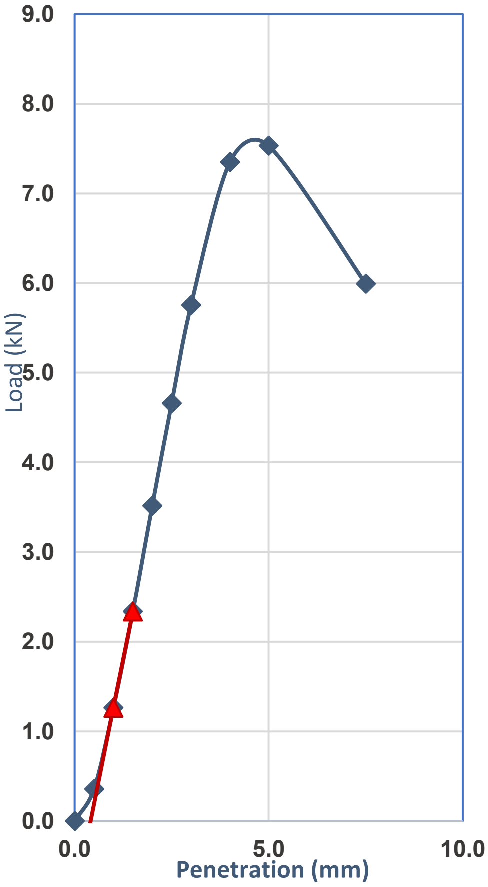
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4731_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4731
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP11 (1.3-2)m	*Date Tested:*	30/03 - 2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24 hrs
% Retained 19.0mm	2	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.78	Optimum Moisture (%)	13.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.68	Moisture Content (%)	13.7
Density Ratio (%)	95.0	Moisture Ratio (%)	102.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	1.68	Dry Density Ratio (%)	95.0
Moisture Content (%)	16.9	Moisture Ratio (%)	126.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	15.0	Remaining Depth (%)	15.9

Correction applied to Penetration: 0.4mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 40%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

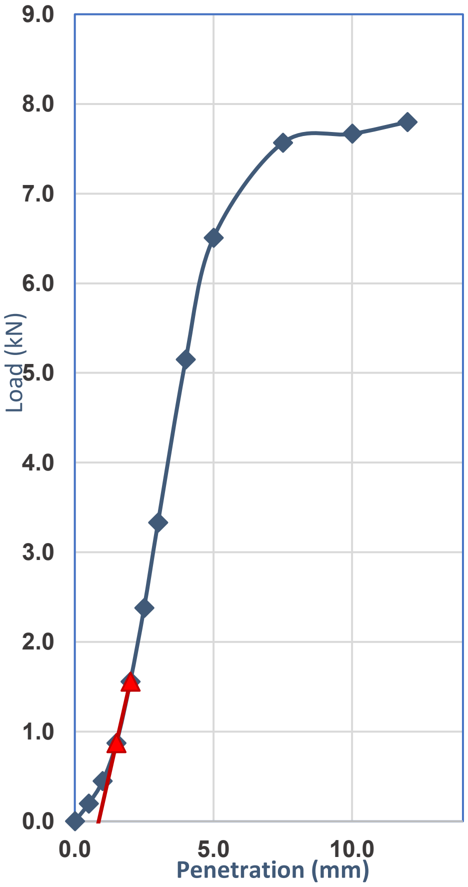
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4725_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4725
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP04 (0.5-1)m	*Date Tested:*	30/3-6/4/22

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24.0
% Retained 19.0mm	1	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.85	Optimum Moisture (%)	13.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.75	Moisture Content (%)	13.2
Density Ratio (%)	94.5	Moisture Ratio (%)	102.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m^3)	1.75	Dry Density Ratio (%)	94.5
Moisture Content (%)	16.8	Moisture Ratio (%)	130.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	15.5	Remaining Depth (%)	16.7

Correction applied to Penetration: 0.9mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 35%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

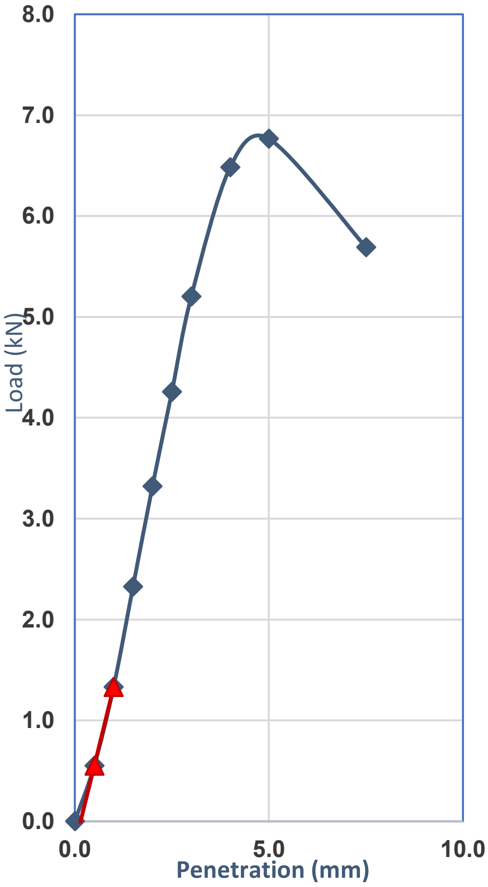
Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4722_1_SCBR
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4722
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specifed
Sample Identification:	TP01 (1-1.5)m	*Date Tested:*	2/04 - 6/04/2022

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand with Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	24 hrs
% Retained 19.0mm	1	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.85	Optimum Moisture (%)	12.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.76	Moisture Content (%)	11.8
Density Ratio (%)	95.0	Moisture Ratio (%)	99.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	1.76	Dry Density Ratio (%)	95.0
Moisture Content (%)	15.0	Moisture Ratio (%)	126.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	14.3	Remaining Depth (%)	14.7

Correction applied to Penetration: 0.1mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 35%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 07/April/2022

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4749_1_ORG
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4749
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	See Below	*Date Tested:*	30-03-2022

TEST RESULTS - Organic Content

Sampling Method: Sampled by Client, Tested as Received

Testing Completed By: WGLS - JG

Furnace Temperature (^{o}C): 440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG22.4749	TP59 (0.5-1)m	98.7	1.3

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 31-March-2022

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Shire of Ashburton	*Ticket No.*	S5903
Client Address:	-	*Report No.*	WG22.4721-4747_1_ORG
Project:	Proposed Onslow Industrial Park	*Sample No.*	WG22.4721-4747
Location:	Lot 201 Onslow Road, Onslow WA	*Date Sampled:*	Not Specified
Sample Identification:	Various - See Below	*Date Tested:*	29/03/2022

TEST RESULTS - Organic Content

Sampling Method:	**Sampled by Client, Tested as Received**
Testing Completed By:	**WGLS-JG**
Furnace Temperature (^oC):	**440**

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG22.4721	TP01 (0-0.5)m	99.5	0.5
WG22.4723	TP03 (0-0.5)m	99.4	0.6
WG22.4724	TP03 (2-2.5)m	98.1	1.9
WG22.4728	TP10 (0.5-1)m	99.4	0.6
WG22.4729	TP10 (1.5-2)m	97.3	2.7
WG22.4731	TP11 (1.3-2)m	99.0	1.0
WG22.4732	TP12 (0-0.4)m	99.2	0.8
WG22.4735	TP17 (0-0.5)m	99.0	1.0
WG22.4747	TP54 (0-0.2)m	99.3	0.7

Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 30/March/2022

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ph 08 9317 2505   fax 08 9317 4163
lab@mpl.com.au
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CERTIFICATE OF ANALYSIS 279158

Client Details

Client	Western Geotechnical & Laboratory Services
Attention	Brooke Elliott
Address	235 Bank Street, Welshpool, WA, 6101

Sample Details

Your Reference	**Proposed Onslow Industrial Park / S5903**
Number of Samples	13 Soil
Date samples received	28/03/2022
Date completed instructions received	28/03/2022
Location	Lot 201 Onslow Road, Onslow WA

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	01/04/2022
Date of Issue	01/04/2022

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Results Approved By
Heram Halim, Operations Manager
Stacey Hawkins, Acid Soils Supervisor

Authorised By

Michael Kubiak, Laboratory Manager

Miscellaneous Inorg - soil						
Our Reference		279158-1	279158-2	279158-3	279158-4	279158-5
Your Reference	UNITS	WG22.4722 - TP01	WG22.4724 - TP03	WG22.4725 - TP04	WG22.4726 - TP08	WG22.4729 - TP10
Depth		1-1.5m	2-2.5m	0.5-1m	1.5-2m	1.5-2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Date analysed	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Electrical Conductivity (EC)	µS/cm	550	2,900	79	610	4,900

Miscellaneous Inorg - soil						
Our Reference		279158-6	279158-7	279158-8	279158-9	279158-10
Your Reference	UNITS	WG22.4732 - TP12	WG22.4733 - TP12	WG22.4734 - TP13	WG22.4735 - TP17	WG22.4737 - TP21
Depth		0.04m	0.5-1m	0.5-1m	0-0.5m	0.7-1.2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Date analysed	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Electrical Conductivity (EC)	µS/cm	88	110	4,300	880	2,000

Miscellaneous Inorg - soil						
Our Reference		279158-11	279158-12	279158-13	279158-14	279158-15
Your Reference	UNITS	WG22.4738 - TP26	WG22.4739 - TP30	WG22.4741 - TP36	WG22.4744 - TP44	WG22.4746 - TP52
Depth		0.5-0.75m	0.5-1m	0.5-1m	0.5-1m	0.3-0.7m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Date analysed	-	29/03/2022	29/03/2022	29/03/2022	29/03/2022	29/03/2022
Electrical Conductivity (EC)	µS/cm	70	290	240	150	330

Miscellaneous Inorg - soil		
Our Reference		279158-16
Your Reference	UNITS	WG22.4755 - TP76
Depth		0.2-0.5m
Type of sample		Soil
Date prepared	-	29/03/2022
Date analysed	-	29/03/2022
Electrical Conductivity (EC)	µS/cm	1,700

Phosphorus Retention Index						
Our Reference		279158-1	279158-2	279158-3	279158-4	279158-5
Your Reference	UNITS	WG22.4722 - TP01	WG22.4724 - TP03	WG22.4725 - TP04	WG22.4726 - TP08	WG22.4729 - TP10
Depth		1-1.5m	2-2.5m	0.5-1m	1.5-2m	1.5-2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Phosphorus Retention Index		3.27	36.9	3.26	4.75	79.6

Phosphorus Retention Index						
Our Reference		279158-6	279158-7	279158-8	279158-9	279158-10
Your Reference	UNITS	WG22.4732 - TP12	WG22.4733 - TP12	WG22.4734 - TP13	WG22.4735 - TP17	WG22.4737 - TP21
Depth		0.04m	0.5-1m	0.5-1m	0-0.5m	0.7-1.2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Phosphorus Retention Index		3.49	2.59	11.9	18.6	11.0

Phosphorus Retention Index						
Our Reference		279158-11	279158-12	279158-13	279158-14	279158-15
Your Reference	UNITS	WG22.4738 - TP26	WG22.4739 - TP30	WG22.4741 - TP36	WG22.4744 - TP44	WG22.4746 - TP52
Depth		0.5-0.75m	0.5-1m	0.5-1m	0.5-1m	0.3-0.7m
Type of sample		Soil	Soil	Soil	Soil	Soil
Phosphorus Retention Index		7.38	8.67	23.3	14.1	3.22

Phosphorus Retention Index		
Our Reference		279158-16
Your Reference	UNITS	WG22.4755 - TP76
Depth		0.2-0.5m
Type of sample		Soil
Phosphorus Retention Index		12.1

ESP/CEC						
Our Reference		279158-1	279158-2	279158-3	279158-4	279158-5
Your Reference	UNITS	WG22.4722 - TP01	WG22.4724 - TP03	WG22.4725 - TP04	WG22.4726 - TP08	WG22.4729 - TP10
Depth		1-1.5m	2-2.5m	0.5-1m	1.5-2m	1.5-2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Date analysed	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Calcium	mg/kg	450	650	240	330	1,400
Potassium	mg/kg	120	860	<100	<100	1,100
Magnesium	mg/kg	130	1,000	<100	<100	1,500
Sodium	mg/kg	<100	6,400	<100	<100	8,500
Aluminium	mg/kg	<20	<20	<20	<20	<20
Exchangeable Ca	meq/100g	2.2	3.2	1.2	1.6	6.9
Exchangeable K	meq/100g	0.3	2.2	<0.13	<0.13	2.9
Exchangeable Mg	meq/100g	1.0	8.5	<0.41	<0.41	12
Exchangeable Na	meq/100g	<0.22	28	<0.22	<0.22	37
Exchangeable Al	meq/100g	<0.07	<0.07	<0.07	<0.07	<0.07
Cation Exchange Capacity	meq/100g	4	42	1	2	59
ESP	%	<1	67	<1	<1	63

ESP/CEC						
Our Reference		279158-6	279158-7	279158-8	279158-9	279158-10
Your Reference	UNITS	WG22.4732 - TP12	WG22.4733 - TP12	WG22.4734 - TP13	WG22.4735 - TP17	WG22.4737 - TP21
Depth		0.04m	0.5-1m	0.5-1m	0-0.5m	0.7-1.2m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Date analysed	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Calcium	mg/kg	250	200	1,100	990	1,100
Potassium	mg/kg	<100	<100	550	140	240
Magnesium	mg/kg	<100	<100	640	150	270
Sodium	mg/kg	<100	100	7,400	<100	<100
Aluminium	mg/kg	<20	<20	<20	<20	<20
Exchangeable Ca	meq/100g	1.2	1	5.7	5.0	5.6
Exchangeable K	meq/100g	<0.13	<0.13	1.4	0.4	0.6
Exchangeable Mg	meq/100g	<0.41	<0.41	5.2	1.3	2.2
Exchangeable Na	meq/100g	<0.22	0.4	32	<0.22	<0.22
Exchangeable Al	meq/100g	<0.07	<0.07	<0.07	<0.07	<0.07
Cation Exchange Capacity	meq/100g	1	1	45	7	8
ESP	%	<1	31	72	<1	<1

ESP/CEC						
Our Reference		279158-11	279158-12	279158-13	279158-14	279158-15
Your Reference	UNITS	WG22.4738 - TP26	WG22.4739 - TP30	WG22.4741 - TP36	WG22.4744 - TP44	WG22.4746 - TP52
Depth		0.5-0.75m	0.5-1m	0.5-1m	0.5-1m	0.3-0.7m
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Date analysed	-	31/03/2022	31/03/2022	31/03/2022	31/03/2022	31/03/2022
Calcium	mg/kg	920	630	340	230	620
Potassium	mg/kg	190	140	130	<100	130
Magnesium	mg/kg	<100	190	160	<100	170
Sodium	mg/kg	<100	200	310	260	210
Aluminium	mg/kg	<20	<20	<20	<20	<20
Exchangeable Ca	meq/100g	4.6	3.1	1.7	1.1	3.1
Exchangeable K	meq/100g	0.5	0.4	0.3	<0.13	0.3
Exchangeable Mg	meq/100g	<0.41	1.6	1.3	<0.41	1.4
Exchangeable Na	meq/100g	<0.22	0.9	1.3	1.1	0.9
Exchangeable Al	meq/100g	<0.07	<0.07	<0.07	<0.07	<0.07
Cation Exchange Capacity	meq/100g	5	6	5	2	6
ESP	%	<1	14	29	50	16

ESP/CEC		
Our Reference		279158-16
Your Reference	UNITS	WG22.4755 - TP76
Depth		0.2-0.5m
Type of sample		Soil
Date digested	-	31/03/2022
Date analysed	-	31/03/2022
Calcium	mg/kg	1,100
Potassium	mg/kg	350
Magnesium	mg/kg	410
Sodium	mg/kg	120
Aluminium	mg/kg	<20
Exchangeable Ca	meq/100g	5.4
Exchangeable K	meq/100g	0.9
Exchangeable Mg	meq/100g	3.3
Exchangeable Na	meq/100g	0.5
Exchangeable Al	meq/100g	<0.07
Cation Exchange Capacity	meq/100g	10
ESP	%	5

Method ID	Methodology Summary
AGRI-003	Phosphorous Retention index (PBI) is equilibration of a sample with a solution containing Phosphorus in CaCl2 solution at a soil: solution ratio of 1:10. A portion of the leachate is centrifuged, then an aliquot is diluted with UHP water and the resultant solution is analysed for Phosphorus by a Discrete Analyser.
INORG-002	Conductivity and Salinity - measured using a conductivity cell at 25°C based on APHA latest edition Method 2510. Soils reported from a 1:5 water extract unless otherwise specified.
METALS-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
METALS-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
METALS-020	Determination of various metals by ICP-AES.

QUALITY CONTROL: Miscellaneous Inorg - soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			29/03/2022	1	29/03/2022	29/03/2022		29/03/2022	[NT]
Date analysed	-			29/03/2022	1	29/03/2022	29/03/2022		29/03/2022	[NT]
Electrical Conductivity (EC)	µS/cm	1	INORG-002	<1	1	550	540	2	104	[NT]

QUALITY CONTROL: Miscellaneous Inorg - soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	29/03/2022	29/03/2022		[NT]	[NT]
Date analysed	-			[NT]	11	29/03/2022	29/03/2022		[NT]	[NT]
Electrical Conductivity (EC)	µS/cm	1	INORG-002	[NT]	11	70	69	1	[NT]	[NT]

QUALITY CONTROL: Phosphorus Retention Index						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Phosphorus Retention Index			AGRI-003	[NT]	1	3.27	3.21	2	103	[NT]

QUALITY CONTROL: Phosphorus Retention Index						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Phosphorus Retention Index			AGRI-003	[NT]	11	7.38	7.83	6	[NT]	[NT]

QUALITY CONTROL: ESP/CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date digested	-			31/03/2022	1	31/03/2022	31/03/2022		31/03/2022	[NT]
Date analysed	-			31/03/2022	1	31/03/2022	31/03/2022		31/03/2022	[NT]
Calcium	mg/kg	50	METALS-020	<50	1	450	480	6	94	[NT]
Potassium	mg/kg	50	METALS-020	<50	1	120	130	8	117	[NT]
Magnesium	mg/kg	50	METALS-020	<50	1	130	140	7	91	[NT]
Sodium	mg/kg	50	METALS-020	<50	1	<100	<100	0	98	[NT]
Aluminium	mg/kg	10	METALS-020	<10	1	<20	<20	0	101	[NT]

QUALITY CONTROL: ESP/CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date digested	-			[NT]	11	31/03/2022	31/03/2022		[NT]	[NT]
Date analysed	-			[NT]	11	31/03/2022	31/03/2022		[NT]	[NT]
Calcium	mg/kg	50	METALS-020	[NT]	11	920	920	0	[NT]	[NT]
Potassium	mg/kg	50	METALS-020	[NT]	11	190	98	64	[NT]	[NT]
Magnesium	mg/kg	50	METALS-020	[NT]	11	<100	<100	0	[NT]	[NT]
Sodium	mg/kg	50	METALS-020	[NT]	11	<100	<100	0	[NT]	[NT]
Aluminium	mg/kg	10	METALS-020	[NT]	11	<20	<20	0	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Appendix G: Understanding Your Report

UNDERSTANDING YOUR REPORT

GALT FORM PMP11 Rev3

1. EXPECTATIONS OF THE REPORT

This document has been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

4. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

5. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

6. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

7. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

Geotechnical advice presented in a Galt Environmental report has been provided by Galt Geotechnics under a sub-contract agreement. Similarly, environmental advice presented in a Galt Geotechnics report has been provided by Galt Environmental under a sub-contract agreement.

Unless specifically noted otherwise, no parties shall draw any inferences about the applicability of the Western Australian state government landfill levy from the contents of this document.

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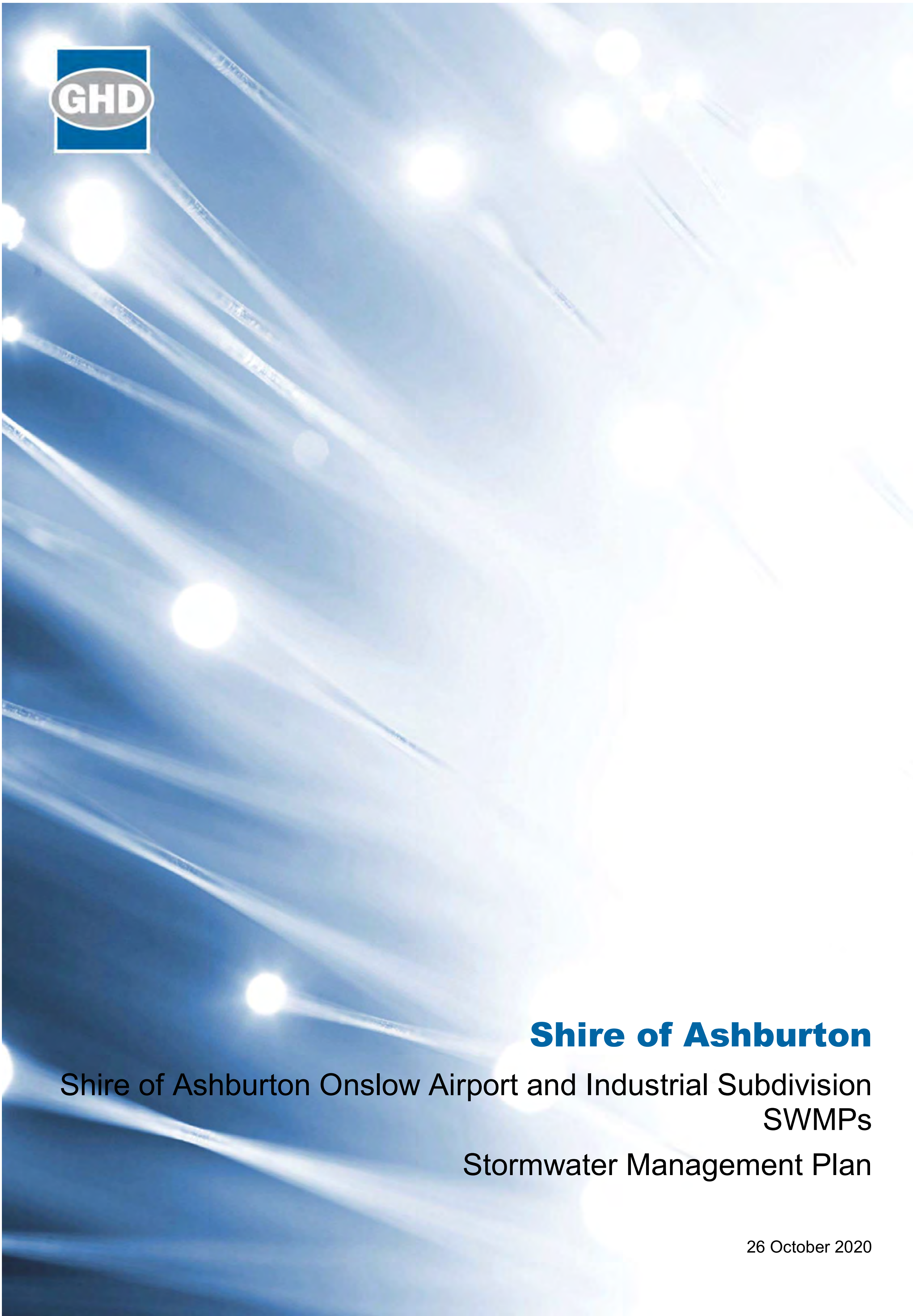

Shire of Ashburton

Shire of Ashburton Onslow Airport and Industrial Subdivision SWMPs

Stormwater Management Plan

26 October 2020

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Appendix B – Culvert data requests

Appendix C – DRAINS model schematics and results

1. Introduction

1.1 Project Background

A number of previous stormwater management plans have been prepared for the areas adjacent to or within the airport precinct. These plans include:

- David Wills and Associates Consulting Engineers (2013) Stormwater Management Plan (SWMP) for the Onslow Industrial Subdivision (known as Lot 9500) with a minor focus on Onslow Airport (Lot 9001).
- Hyd2o (2014) Urban Water Management Plan (UWMP) which covers a large residential area that discharges through the site.
- Lycopodium (2015) SWMP which covers Onslow Airport's infrastructure upgrade.

The main driver for this project is to update the existing Stormwater Management Plan (SWMP) to consolidate and amend the conditions associated with the proposed Onslow industrial subdivision and airport to aid the current and future planning of the site.

1.2 Proposed development

There are a number of proposed changes to Lot 9500 and Lot 9001 that require review. These are shown in Figure 1-1 and include:

- Taxiway Echo: This is the combination of a new taxiway ('Taxiway E'), General Aviation (G.A.) Apron and fence line that is being built to run off Taxiway B. The asphalt and G.A. Apron area only are shown. Taxiway E crosses an existing drainage channel, as discussed in Section 3.7. This may require diversion of that channel to an existing culvert, or a new culvert under the taxiway to continue discharging to the original location.
- Area A (37 hectares): The industrial land reclamation site adjacent to Onslow Airport runway that is currently holding 800,000 m^3 of dredge spoil, which has influenced surface water runoff in existing catchments and requires investigation. It is understood that the current lease owner is applying for an extension of this lease, with the intention of continuing to use it for laydown area. This is almost wholly within Lot 9001, with a small portion in Lot 9500.
- Area B (12 hectares): An area that is earmarked for development. The full nature of this is currently unknown, though there is likely to be a freight warehouse. It is assumed that the long thin strip of area between McAulley Road (formerly referred to as Onslow Road) and Area B will not be developed (Figure 1-1). The southern portion of this area is within Lot 9500, and the remainder is in Lot 9001.
- Area C (27 hectares): This area is solely within Lot 9500, located to the west of Onslow Airport, and was not included within the previous SWMP. This requires consideration with regards to stormwater management as there will be development within the area. This development is discussed in the SWMP for Onslow Industrial Subdivision (DWA, 2013).
- Area D (42 hectares): An area where development is not expected in the near future, but may occur on a longer term horizon. The nature of this development is currently unknown.

The other development that will discharge into the site is the Onslow residential township to the north (indicated as entering near Area A on Figure 1-1). This, based on a review of available aerial photography, does not currently appear to be developed to its ultimate built form.

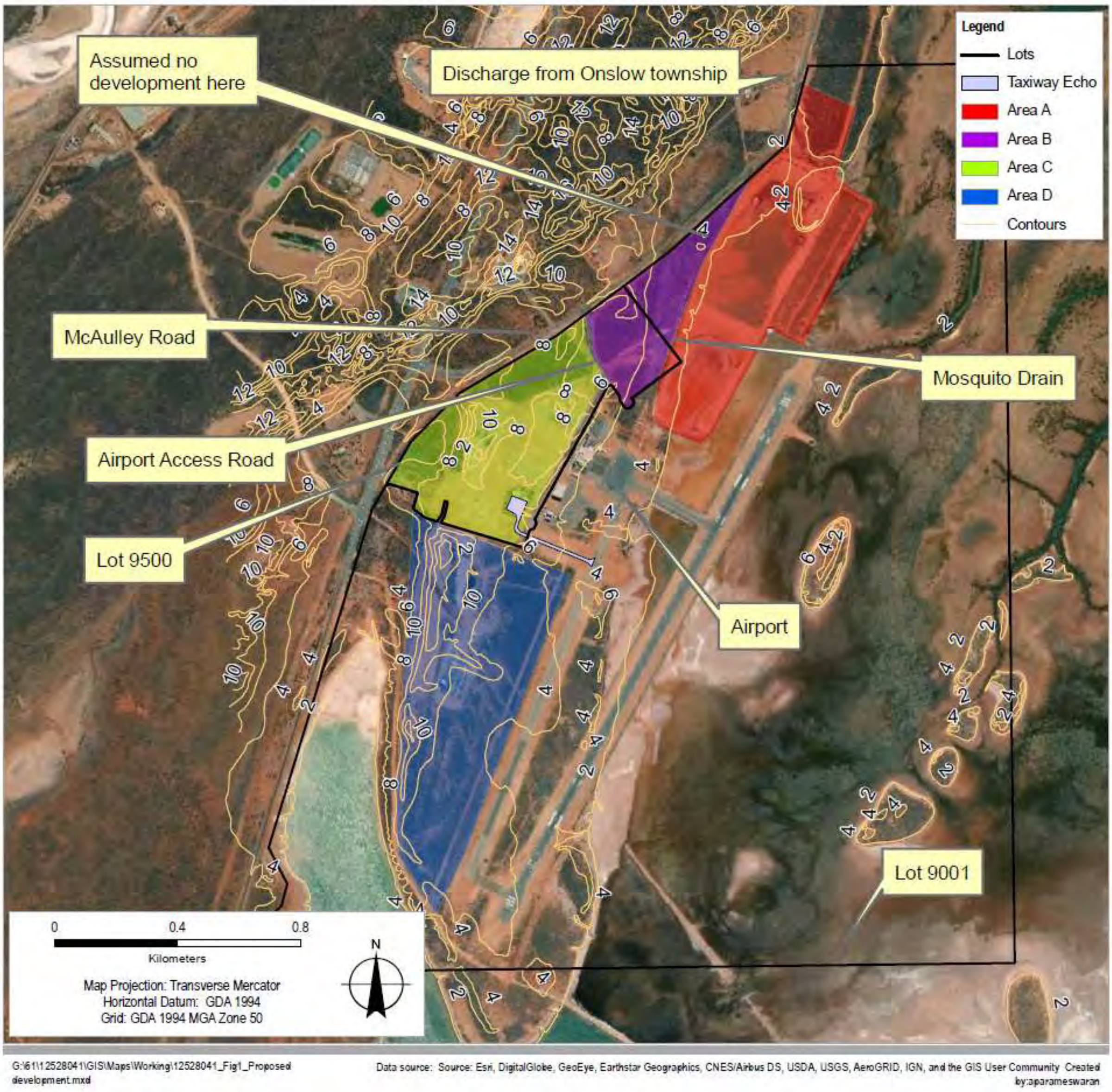


Figure 1-1 Proposed development

1.3 Purpose of this report

GHD was commissioned by Shire of Ashburton (the Shire) to amend the existing SWMP associated with the proposed Onslow industrial subdivision and airport. This report outlines the amended SWMP for the site.

1.4 Limitations

This report: has been prepared by GHD for Shire of Ashburton and may only be used and relied on by Shire of Ashburton for the purpose agreed between GHD and the Shire of Ashburton as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Shire of Ashburton arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (and in particular Section 1.6 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Shire of Ashburton and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.5 Scope of work

The scope of work for this project is as follows:

- Hold a kick-off meeting and submit a data request;
- Conduct a desktop review of all relevant data provided;
- Develop a combined hydrologic and hydraulic model using DRAINS software for existing and proposed site conditions;
- Prepare concept figures of the proposed solutions; and
- Prepare a simple summary SWMP that consolidates GHD’s concept design with the existing SWMP for the Onslow Townsite Development.

1.6 Assumptions

The following assumptions were made when developing this SWMP:

- Due to conflicting topographical data, a large number of assumptions were made as to what dataset would override others when assigning infrastructure invert levels in the modelling.
- The Shire have stated that the temporary wall that runs between the runway and the spoil dump is already partly removed and can be assumed to be fully removed such that water will flow out freely.
- The spoil dump is assumed to drain fully to the southern culverts. Provided survey data is inconclusive.
- It is assumed that there is an open channel drain on the northern side of McAulley Road that drains water to the northern culverts that also receive the Onslow residential development.

Further assumptions made in the development of modelling used to inform the SWMP are contained in Sections 3 and 4.

2. Design Managements and Objectives

2.1 Guiding principles

The key guiding documents that should be adhered to in the design of any stormwater system for the areas proposed to be developed are the:

- *Stormwater Management Manual for Western Australia* (DoW, 2004-2007), and in particular, the requirements of Chapter 4 – Decision Process for Stormwater Management in Western Australia (DWER, 2017);
- *Better Urban Water Management* (DoW, 2008), and in particular, Section 4.6 which outlines the work required to support water management on-site; and
- *Part 139 (Aerodromes) Manual of Standards 2019'* (CASA, 2019), and in particular, Sections 6.22 and Chapter 17 which discuss airport specific requirements of stormwater management and wildlife hazards.

Key overall objectives in relation to stormwater that are considered applicable to this lease agreement are as follows:

- **Water Quality and Quantity**: maintain or improve the surface water and groundwater quality and maintain the total water cycle balance within the development area relative to pre-development conditions;
- **Water Conservation**: to maximise the reuse of stormwater;
- **Ecosystem Health**: to retain natural drainage systems and protect ecosystem health;
- **Economic Viability**: to implement stormwater management systems that are economically viable in the long term;
- **Public Health**: to minimise the public risk, including risk from injury or loss of life, to the community;
- **Protection of Property**: to protect the built environment from flooding and waterlogging;
- **Social Values**: to ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater; and
- **Development**: to ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles.

2.2 Design criteria

The site discharges to an estuary with significant tidal influence through existing stormwater infrastructure, and therefore stormwater management focusses on water quality and discharge requirements. The design criteria for the area has been developed based upon application of the objectives of the Stormwater Management Manual for Western Australia (DOW 2004-2007), Better Urban Water Management (DoW, 2008) and the Manual of Standards 2019 (MOS) (CASA, 2019).

2.2.1 Principles and Objectives

This SWMP is developed in accordance with the principles and objectives outlined in the following sections.

Stormwater detention, treatment and discharge

The following is required:

- The stormwater and erosion management design will capture and retain stormwater on-site as far as practicable without creating new hazards and minimise the velocity, sediment load and peak discharge of any off-site stormwater flows.
- Development shall demonstrate at source management of runoff (both quantity and quality) from impervious surfaces through the treatment of the first 15 mm of rainfall from frequently occurring events, which is assumed to include events with equal to or greater than 1 Exceedance per Year (EY).
- The quality of stormwater discharged from the site will be such that it does not result in a deterioration of the water quality in the receiving environment.
- Development shall demonstrate compliance where possible with the current requirements of MOS Section 6.22, which states that effective drainage (but not involving open drains) must ensure that water does not pool or pond in the graded area of a runway strip.
- Development shall ensure that planned drainage does not increase the existing risk of wildlife hazards by ponding near the airport. Refer to MOS Chapter 17 for Wildlife Hazard Management guidelines for airports.
- Stormwater drainage systems (open drains, pipework and basins) must be sized to manage and contain the critical duration design storm event 10% Average Exceedance Probability (AEP) for the site.
- The stormwater conveyance systems shall also be designed to suitably manage the critical duration 1% AEP event such that discharge can occur without any flooding (with a minimum of 300 mm of freeboard) of infrastructure or hazard to public health or property.
- In particular, and in relation to the conveyance system the following have been established as key physical criteria that are targeted:
  - Upstream water level on culverts for the 10% AEP event should be no higher than the obvert and the 1% AEP event should not overtop the structure when it is adjacent to downstream infrastructure that is integral to the operation of the airport (e.g. runways, taxiways).
  - Channels should be designed to contain and convey the 10% AEP event with 300 mm freeboard, and contain the 1% AEP event within the channel without freeboard (where possible) or without causing impacts to surrounding key infrastructure (i.e. airport buildings).
- Discharge off-site for future or planned development should be limited to current pre-development flows for all critical duration 10% AEP events, and shall demonstrate that the 1% AEP discharge has been reduced to such a level that no adverse outcomes to the downstream receiving environment or drainage infrastructure will occur.
- Multiple discharge points of stormwater drainage off developed lots are preferred to limit the overall discharge to any single receiving system.

Flood management

The minimum habitable floor level shall be 500 mm above the 1% AEP flood level as per Figure 2-1 below. Structures constructed within the Flood Fringe such as runways and taxiways are to have sufficient freeboard to allow for ongoing operation of the airfield in accordance with Airport Operator licences.

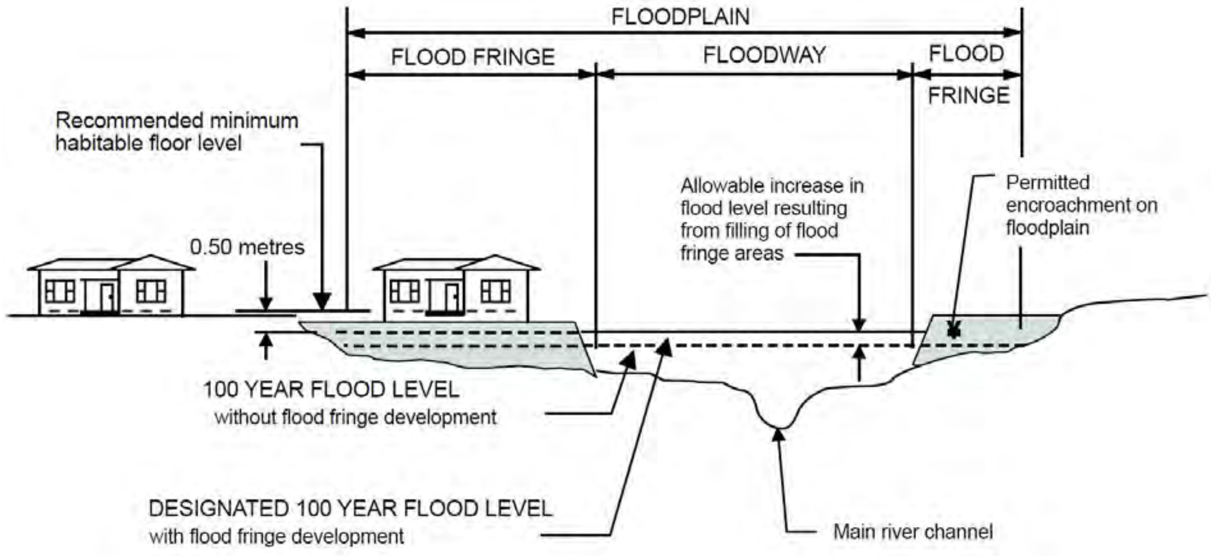


Figure 2-1 Required clearance for finished surface/floor levels (WRC, 2000)

This should be determined with consideration to both catchment flooding and coastal inundation information given the site's low elevations and proximity to Beadon Creek estuary.

Disease vector and nuisance management

All onsite storages must drain completely through infiltration or discharge following an event (must be demonstrated to be less than 96 hours following a design event) within the site to limit the potential of mosquito breeding occurring.

Erosion and maintenance

The following is required:

- The stormwater infrastructure should be periodically monitored/maintained throughout the period of the lease to ensure silt build up is not excessive, especially during and in preparation for the wet season. Cleaning of the system will allow infrastructure to operate at design capacity along with minimising the potential for interruption of airport operations. The developer of any future or existing development is to provide details of proposed maintenance strategies for acceptance at the time of submission of overall drainage design plans and calculations.
- Potential erosion shall be assessed by the Shire (or its engineering design consultant) and suitable erosion controls shall be designed and installed as part of the system, including those adjacent to the site at drainage connection points to the surrounding system.
- Erosion potential should be managed by limiting site velocities through minimising grades to acceptable levels, providing regular drainage lines which mimic natural conditions and where appropriate include provision of sediment/compensation basins to settle out and store fines or reduce velocities into the downstream environment.
- Proposed stormwater infrastructure designs, plans, typical sections, specifications and calculations should be submitted to the Shire of Ashburton for review and approval prior to implementation.

2.2.2 Time horizon

The time horizon envisaged for the SWMP is 50 years, based on the expected development in the area, however, this may change as a result of revised legislation, standards or impacts of climate change. It is recommended that this document undergo regular review, and if required, revision on a 10 year basis or at the time of significant redevelopment across the site.

3. Existing site characteristics

3.1 Climate

The site is located approximately 1.5 km to the south-east of Onslow township in Western Australia. The Köppen Climate Classification[1] for the region is 'Bwh', which is a tropical and subtropical desert climate, with the coldest month of the year in July and the warmest month in February.

Onslow has an average annual rainfall of 308.4 mm, with the majority experienced from January to June, which coincides with the hottest months. The significant rainfall events occur almost exclusively as a result of cyclonic activity. The highest monthly average rainfall occurs in March and the minimum is in October.

The closest weather station to the site is Onslow Airport (Station No. 005017), which is within the site boundary. Temperature and rainfall data has been recorded at this station from 1940 to present day. A summary of these observations is provided in Figure 3-1 and recorded historical data can be seen in Table 1[2].

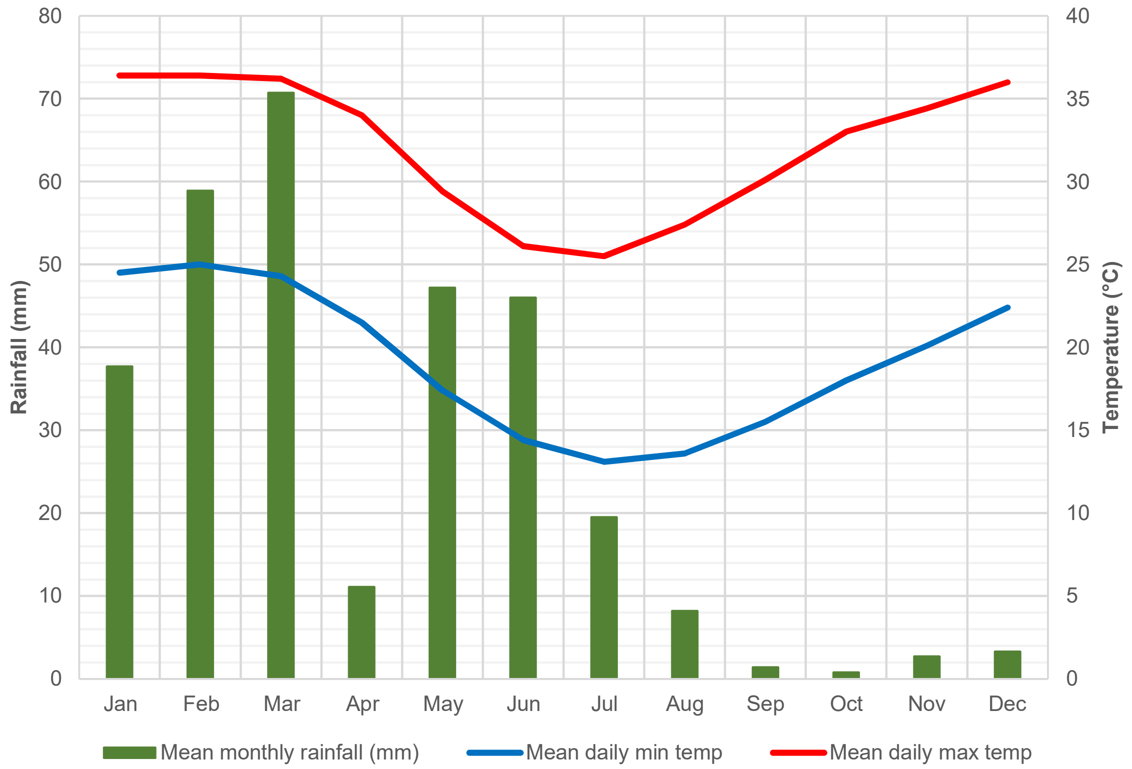


Figure 3-1 Onslow Airport (Station No. 005017) climate statistics (BOM, 2020)

[1] A classification system that subdivides terrestrial climates into different categories (https://www.britannica.com/science/Koppen-climate-classification)

[2] Data taken from http://www.bom.gov.au/climate/averages/tables/cw_005017.shtml

Table 1 Onslow Airport (Station No. 005017) annual climate statistics (BOM, 2020)

Station Name	Period	Mean Minimum Temperature Range		Mean Maximum Temperature Range		Mean Rainfall	Mean Rain Days
		Min °C	Max °C	Min °C	Max °C	mm/yr	Days ≥ 1 mm/yr
Onslow Airport	1940-2020	13.1 (Jul)	25.0 (Feb)	25.5 (Jul)	36.4 (Jan/Feb)	308.4	16.7

Rainfall Intensity-Frequency-Duration (IFD) data was obtained from the Bureau of Meteorology (BOM)[3] using a latitude of 21.6625 (S) and longitude 115.1125 (E). The data is presented in Table 2, and shows that daily totals of rainfall events far exceed long-term averages, which demonstrates the intensity of storm events that impact the area.

Table 2 Rainfall IFD at 21.6625 (S), 115.1125 (E) from BOM

Duration	63.20%	50%	20%	10%	5%	2%	1%
5 min	1.66	1.97	2.95	3.63	4.32	5.25	5.98
10 min	2.73	3.22	4.77	5.83	6.87	8.46	9.67
15 min	3.87	4.57	6.8	8.33	9.84	12.1	13.8
20 min	4.95	5.86	8.75	10.7	12.7	15.6	17.8
25 min	5.97	7.06	10.6	13	15.4	18.9	21.5
30 min	10	11.8	17.8	21.9	26.1	31.7	36.1
45 min	12.9	15.2	22.8	28.2	33.5	40.6	46.2
1 hour	15.1	17.8	26.7	32.9	39.1	47.4	53.8
1.5 hour	16.9	19.9	29.8	36.7	43.7	52.9	60.1
2 hour	18.4	21.7	32.5	40	47.5	57.5	65.4
3 hour	21.8	25.8	38.6	47.5	56.4	68.7	78.2
4.5 hour	24.3	28.8	43.3	53.4	63.5	77.5	88.5
6 hour	28.1	33.5	50.7	62.8	74.8	91.9	105
9 hour	31	37.1	56.7	70.5	84.4	104	120
12 hour	35.6	42.9	66.6	83.4	101	125	144
18 hour	40.9	49.6	78.5	99.4	121	151	175
24 hour	45.1	55	88.3	113	138	173	202
30 hour	51.7	63.7	104	134	166	210	246
36 hour	56.8	70.4	117	152	189	239	281
48 hour	64.4	80.4	136	177	222	282	332

3.2 Topography

The site is located very close to sea level, and adjacent to the estuary of a minor watercourse named Beadon Creek. Topography is generally flat, with a slope from west to east. Elevations within the site range from between approximately 0 to 12.8 mAHD, and the low point is located at the northeast corner of the dredge spoil dump which is near the northern end of the runway.

3.2.1 Survey

A number of survey datasets were provided to GHD for use in this SWMP, including regional contours from Landgate and ground surveys. The ground surveys had different projections, and were captured at varying dates and extents over the past six years. There was no dataset that had complete coverage of the site area, and many had contradictory information. Each dataset

3 http://www.bom.gov.au/water/designRainfalls/revised-ifd/

had to be analysed and in some cases, an assumption made on which had the most representative values for a given area. This was based on the capture date and quality. Table 3 shows the datasets provided and GHD's comments on each. A copy of the data is also presented in Appendix A.

Table 3 Review of available survey data

File Name	Format	Description	Dates	Comment
9953de-001A	.dwg	Survey Lot 9500	October 2015	Survey covers Lot 9500. Levels provided contradict the drainage survey in areas. Provides levels around Airport Access Road.
99109de-001a - drainage study	.dwg	Drainage Survey that does not include the airport area	October 2015	Critical areas surrounding the airport not included. Airport Access Road not picked up on survey.
40826de-002a	.dwg	Survey of area immediately surrounding Airport	August 2014	Data contradicts more recent survey data. Data does not cover a large enough extent
XSurvey201	.dwg	Survey of area around the old and new airport runway	March 2020	Provides levels around the airport runway Survey around airport does not cover a large enough extent
WGA181665-SK-11	.dwg	As-built Reclamation Drawings	November 2019	No levels provided.
Asbuilt Reclaimation	.dxf	As-built Reclamation area	November 2019	Survey covers the extent of the dredge area west of Beadon Creek. Levels do not show a consistent fall across the reclamation area. Dimensions of mosquito drain able to be determined from this data.

3.3 Geology and soils

3.3.1 Geology

The geology of the overall area was summarised in Hyd2o (2014) and was based on mapping from the Onslow Sheet of the 1:250,000 scale Geology Series Map (Geological Survey of WA, 1981). The summary was modified to reflect the smaller area that is being considered in this SWMP, with the geological units consisting of the following:

- Beach and coastal dunes (Qs) – light grey sand and unconsolidated and poorly consolidated quartzose calcarenite. This unit occurs over the western portion of the site and may comprise a variable cover of sand over limestone.
- Intertidal flats and mangrove swamps deposits (Qw) – calcareous clay, silt and sand. This unit occurs in the estuary environment of Beadon Creek.
- Supratidal flats (Qt) – calcareous clay, silt and sand with authigenic gypsum and superficial algal mats and salt crusts. This unit is most likely what large portions of the airport is situated on.

3.3.2 Soil

There is limited soil data available within the site boundary, but there is test pit information available from a geotechnical investigation conducted by Golders (2013) for the Onslow Township Redevelopment project nearby. This study looked at residential areas located to the north that drain to the site, and therefore may exhibit some similarities to the site, however this has not been confirmed. The investigations showed the following generalised soil profile (Hyd2o, 2014):

- Topsoil: Silty Sand/Sand: loose, fine to medium grained, quartz and calcareous, red brown and pale brown, extending to depths of between 0.2 m and 0.5 m below ground level, overlying
- Silty Sand/Sand: medium dense to dense, fine to medium grained, siliceous and calcareous, red brown/pale brown, extending to depths of between 0.4 m and 10.5 m, overlying
- Silty Gravelly Sand/Gravelly Sand/Sandy Gravel: loose to very dense, fine to coarse grained sand, fine to coarse, sub-rounded to angular and irregular, highly leached calcareous gravel, grey/grey-brown/pale grey/red-brown, inferred extremely leached limestone to gravel, extending to depths of between 1.0 m and 10.5 m, overlying
- Limestone: fine to coarse grained, pale grey-brown/yellow-brown/red-brown/brown, highly leached, extending to 10.5 m (maximum depth investigated, not found at all locations).

3.4 Acid sulphate soils

The Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Australian Soil Risk Information System (ASRIS) mapping shows the site as a combination of 'Extremely Low Probability of Occurrence' (western portion) and 'High Probability of Occurrence' (eastern portion) of Acid Sulphate Soils (ASS) based on a provisional classification (ASRIS, 2016). There are also two very small patches of 'Low Probability of Occurrence' on the eastern portion. An excerpt of this mapping database is shown in Figure 3-2.

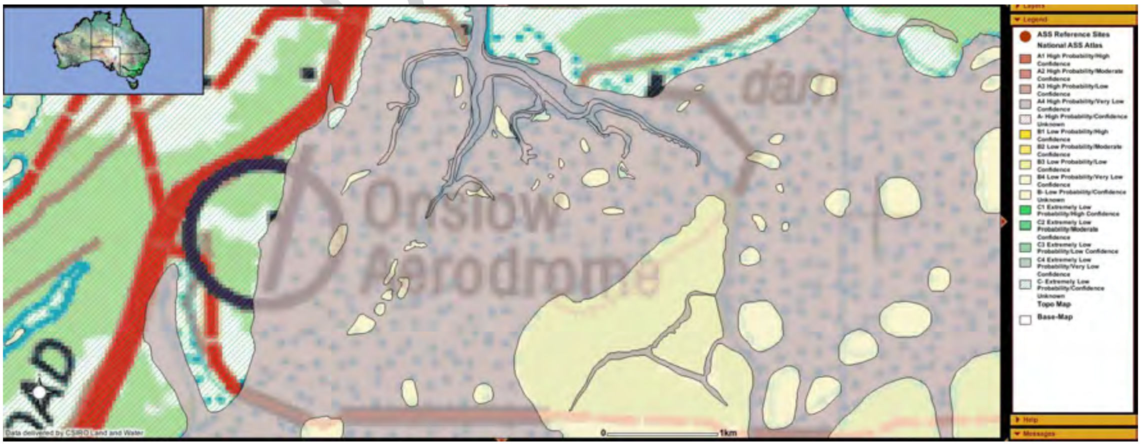


Figure 3-2 CSIRO ASRIS mapping excerpt

Golder (2013) also undertook a preliminary ASS assessment of the residential area to the north of the site and found that any proposed development (excavation or dewatering) extending to below approximately 0.5 to 1.0 mAHD are considered likely to encounter ASS.

Based on this, an ASS management plan is likely required to cover excavation work for any basins or other stormwater infrastructure that may be installed in the future.

3.5 Heritage

From inspection of the Department of Planning, Lands and Heritage (DPLH) Aboriginal Heritage Inquiry System (AHIS)[4], there are two heritage sites in the area, being:

- Registered Aboriginal Site 6620, JINTA 2: This is a water source and covers a large portion of the site.
- Other Heritage Place 32402, Onslow Airport 01: Described as a midden/scatter, camp type and covers a strip of land within Area D. Development within this area should be done with consideration to this heritage area.

3.6 Vegetation, reserves and conservation areas

Site vegetation consists of spinifex and grasses. There are also large portions of land that have been cleared and appear to be compacted (shown in Figure 3-3).

There are no known environmentally sensitive areas, wetlands, or Bush Forever sites within the study area.

3.7 Surface water

The site is within the Pilbara Surface Water Area as described under the Rights in Water and Irrigation Act, 1914 (RIWI). A license is required to take water from these areas.

Surface water drainage in the area consists of a mixture of open channels, culverts and a major basin that drain to Beadon Creek estuary, as shown in Figure 3-3. The culverts perform the following functions:

- Culverts 1 and 2 drain water from the township residential development and land upstream of McAullay Road[5]. Culvert 2 is a temporary asset under a site access road. This road is planned to be sealed and will provide an important access point in the future to portions of the site.
- Culvert 3 receives water from an open channel running along the Airport Access Road and facilities.
- Culvert 4 drains the retarding basin that is between Taxiway D and the runway.
- Culvert 5 is a minor pipe that drains water from the roof of one of the airport buildings.
- Culvert 6 drains a minor catchment under Taxiway B to the retarding basin.
- Culverts 7 and 8 are assumed to be owned by Main Roads Western Australia (MRWA), and drain water to a separate catchment that does not appear to be affected by the discharge constraints at the airport.
- Culvert 9 drains the spoil dump.

Culvert type, sizes and data sources for the information are presented in Table 4 and a record of the information received by the Shire is provided in Appendix B.

[4] https://espatial.dplh.wa.gov.au/AHIS/index.html?viewer=AHIS

[5] It is assumed that the land upstream of McAullay Road can drain via an open channel along the side of the road to Culvert 1. There is no survey available to establish this.

Table 4 Existing culvert details

Culvert number	Type	No. Barrels	Size (Width x Height)	Data source
1	RCBC	2	0.6 m x 0.45 m	Shire site inspection and documentation provide by the Shire
2	HDPE (Assumed from picture)	6	0.525 m	Documentation provided by the Shire
3	RCBC	1	0.9 m x 0.47 m	Documentation provided by the Shire.
4	RCP	1	0.9 m	Documentation provided by the Shire
5	RCP	1	0.3 m	Survey and Shire site inspection photos
6	RCBC	1	0.9 m x 0.47 m	Survey and Shire site inspection.
7 & 8	*NOT INCLUDED AS DRAINING TO ANOTHER CATCHMENT*			
9	RCP	5	0.225 m	Documentation provided by the Shire

Figure 3-3 Existing drainage assets

3.7.1 Existing drainage issues

The Shire has identified the following existing drainage issues:

- The area to the west of the spoil dump is poorly drained. Surface water flows are trapped against the spoil dump and cannot drain away. Design documentation for a mosquito drain running along the toe was provided, however, the Shire has maintained that the area remains moist for significant periods of time compared to before the dump was in place, resulting in conditions conducive to mosquito breeding. The drain may not have been installed as designed, or at all.
- The temporary pipes at Culvert 2 may not have sufficient capacity to pass flows during large events. Tidal influence is also significant at this location, potentially impairing culvert performance. Ponded water upstream of the culverts is evident for several weeks after an event, removed only through evaporation and infiltration. This highlights the potential for poor grading in the area.
- The spoil area does not have any formal drainage pathways and is therefore not drained effectively. The Shire has also informed GHD that the area marked 'Assumed removed' in Figure 3-3 which was part of a water quality treatment area used during the placement of the spoil on the adjacent areas has now been removed and rehabilitated.
- The Shire is proposing to develop a new taxiway named Taxiway E at the airport. This may require either diversion of a significant portion of Culvert 3's catchment to Culvert 6 to avoid the requirement for a culvert under the taxiway, or a new culvert under Taxiway E.

A wastewater disposal spray field is present to the north of the airport terminal buildings (Figure 3-3). The Shire operates this when the treatment infrastructure for the area fails and does not wish for this land to be used for anything else, some exclusion areas to ensure suitable health and environmental setbacks should also be considered.

3.8 Groundwater and hydraulic conductivity

Onslow is located within the Ashburton Sub-Area of the Pilbara Groundwater Area and therefore a license is required to extract groundwater.

No site specific groundwater information is available, however, Hyd2o (2014) provides a useful summary of work done using five long term monitoring bores at the nearby township residential development area with measured water levels from 1999 to 2013. Findings were as follows (Hyd2o, 2014):

- Hyd2o and JBA (2012) determined Average Annual Maximum Groundwater Levels (AAMGL) between 1.7 mAHD and 1.4 mAHD, flowing towards the coastline, and maximum recorded groundwater levels approximately 0.5 m higher than AAMGL.
- Additional groundwater level measurements during field work from Golder (2013) on May 7 2013 substantiated the longer term measurements.

No information on groundwater quality at these locations or within the site is available.

Hydraulic conductivity can be inferred from in-situ permeability testing undertaken by Golder (2013) during the geotechnical investigations at the township development to the north of the site, which found a range of 5-20 m/day. The lower bound of the range of 5 m/day was adopted for the site, however site specific investigations will be required to confirm this prior to development of any infiltration based stormwater flow or quality treatment system.

3.9 Tides, coastal hazard mapping and climate change

3.9.1 Tides

Tidal levels for Onslow are based on the Australian National Tidal Tables which were published in 2008. The High Astronomical Tide (HAT) level at the site is 1.40 mAHD.

3.9.2 Coastal hazard mapping and climate change

A Coastal Hazard Risk Assessment and Adaptation Plan (CHRMAP) was developed for the Onslow Coast by Cardno in 2016. This work is of particular importance to modelling undertaken in this project (Section 4.3) given the low lying land on which the site is located and its proximity to Beadon Creek estuary and the Indian Ocean to which it discharges.

Water level design criteria for the area including the site were produced for 2015 (present day), 2040, 2070 and 2110 climate scenarios. This was based on:

- Analysis of measured water levels at Beadon Creek tidal gauge from 1985 to 2015 to establish design water levels;
- Incorporation of Sea Level Rise (SLR) based on Intergovernmental Panel on Climate Change (IPCC, 2007) climate change projections and Department of Transport recommendations (DOT, 2010); and
- Consideration of the effect of detailed cyclone modelling distribution.

This SWMP adopted the 2015 (present day) and 2070 results as reasonable tailwater constraints, given the time horizon of 50 years outlined in Section 2.2.2. These levels are presented per Average Exceedance Probability (AEP) in Table 5. Note that the CHRMAP work also included an allowance for wave set-up which is not considered relevant for this SWMP given the site is located off of Beadon Creek estuary where the fetch[6] would not be significant.

Table 5 Tailwater constraints

AEP (1 in X year and % exceedance)	2015 present day Water Level (mAHD)	2070 climate change Water Level (mAHD)
10 (10%)	1.79	2.19
100 (1%)	2.41	2.99

The Cardno (2016) report also included flood modelling of the entire Onslow area which included the site. The model topography used a 12 m grid size in the site area but did not include any of the culverts identified in Section 3.7. No assessment of joint probability was undertaken to determine the likelihood of a catchment flood event coinciding a coastal one. The worst case was modelled, which assumes they occur at the same time (e.g. 1% AEP catchment flood event and 1% AEP coastal flood event occur simultaneously).

Flood depths for the 1% AEP under the 2015 and 2070 scenarios are presented in Figure 3-4 and Figure 3-5. These maps show significant flooding throughout the site, likely caused by tailwater conditions. The depths cannot be evaluated given the relatively coarse colour scale on the mapping, and the actual data presented in the figures was not made available during the preparation of the SWMP.

Keeping in mind the maps represent a worst case (prepared with no joint probability assessment), the following is highlighted:

- There are two locations marked on the figures where surface water flooding is shown to overtop roads – at the Airport Access Road and McAulley Road. Both of these flow paths discharge into the western side of the spoil dump and are likely contributors to the drainage

[6] The distance travelled by wind or waves across open water

issues noticed by the Shire. Note that Shire staff have confirmed that McAulley Road does overtop in several sections.

- Floodwater is present throughout the:
  - Land adjacent to the runway and Airport Access Road. This may impact any development planned in this area and will inhibit flows draining off upper catchments.
  - Retarding basin/area between Taxiway B, Taxiway D and runway. Whilst the existing discharge culvert under the taxiway was not included in the modelling done by Cardno (2016), this result is realistic as the tailwater levels from Table 5 would drown out this culvert, thereby preventing discharge from the basin.
  - Drainage channel that discharges the township development flows (shown in Figure 3-3). This has already been noted by the Shire as an area subject to significant tidal influence.
  - Area upstream of the terminal buildings. This is not influenced by tailwater conditions and could be worse than reality because the 12 m grid used may not pick up the drainage channel in the area.

Generally, the maps underline the significant exposure the site has to inundation from tailwater conditions, even without a coincident catchment flood. Under such an event, drainage infrastructure in the lower part of the site is rendered unusable and any development in these areas (which should be avoided wherever possible) will need to carefully consider the requirements outlined in Table 5 for building within the flood fringe, as per Section 2.2.1.

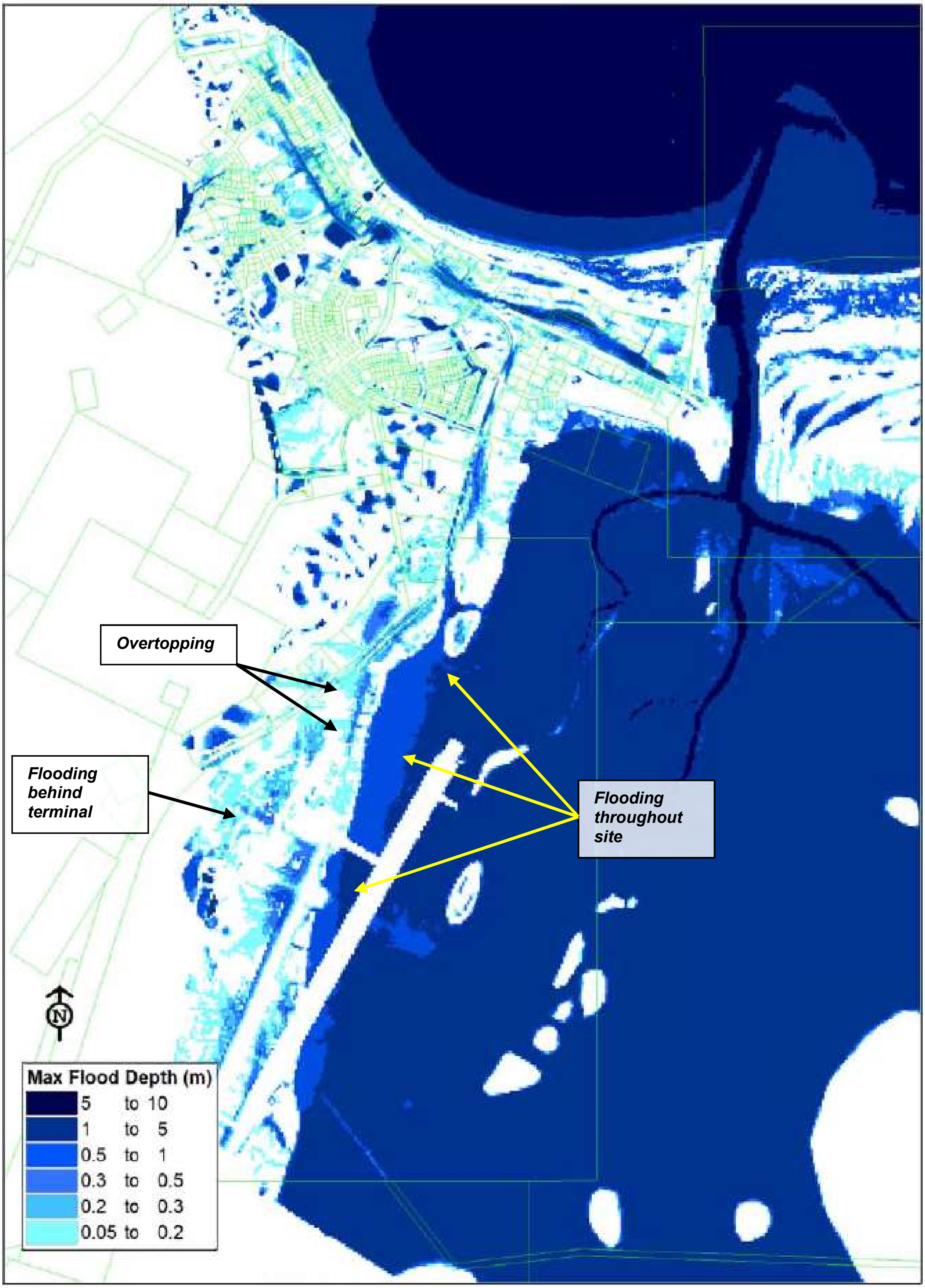


Figure 3-4 Flood depths, 2015 present day scenario, 1% AEP event (reproduction of Figure 3-46, Cardno, 2016)

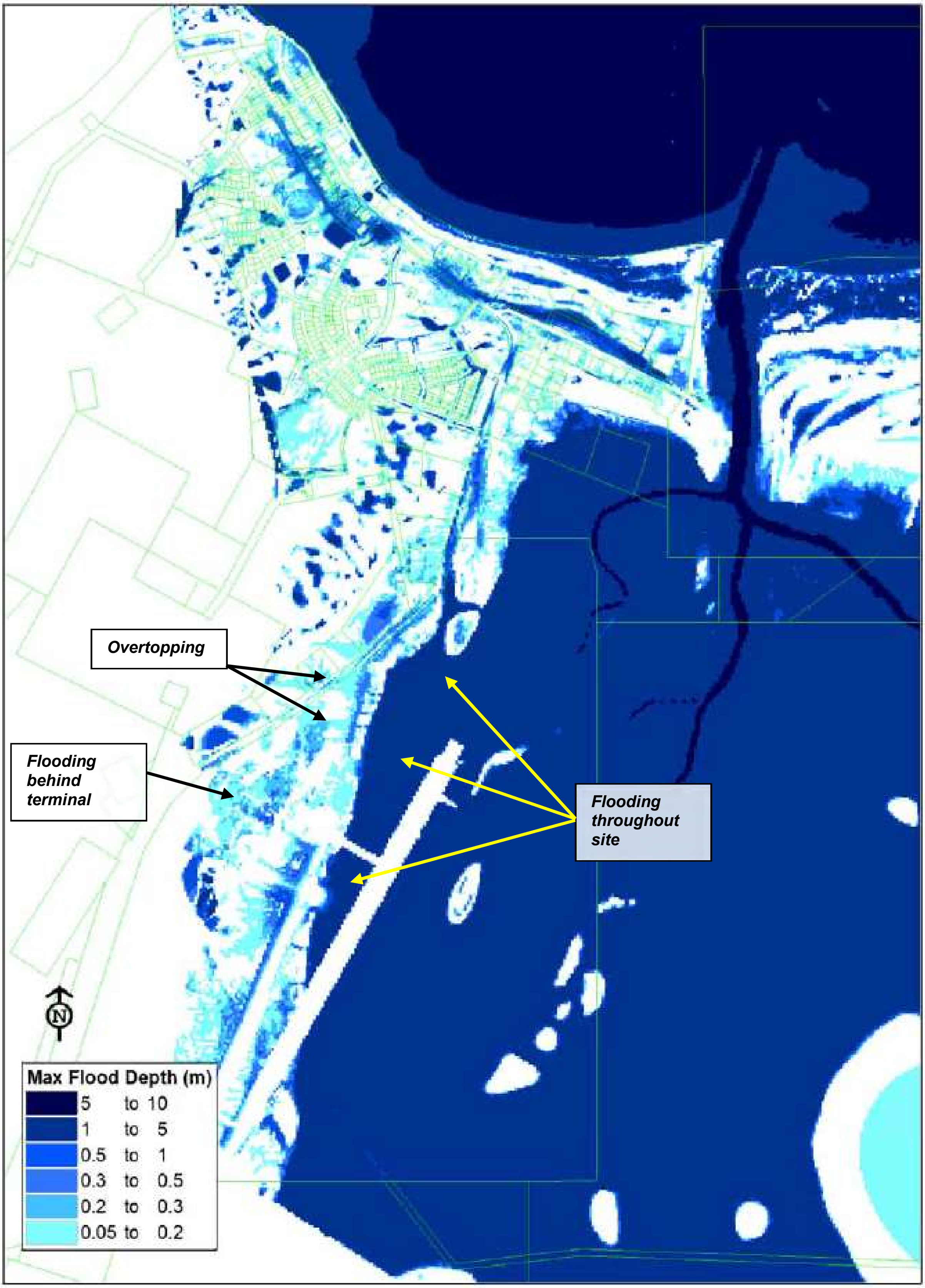


Figure 3-5 Flood depths, 2070 climate change scenario, 1% AEP event (reproduction of Figure 3-50, Cardno, 2016)

4. Drainage concept

4.1 Design events

The 10% AEP design event was selected for modelling to check capacity of open channel and drainage infrastructure and size any proposed upgrades. The 1% AEP event was chosen to check performance of the drainage system in an extreme event and ensure flooding can be controlled and provide adequate protection for people and property.

4.2 Hydrologic and hydraulic parameters

A hydrologic and hydraulic assessment was conducted to determine critical duration peak flows running off from the site for the sizing of stormwater management structures. The focus of the assessment was the main drainage assets in the area. Drainage off the apron and runway area was not included.

4.2.1 Catchments

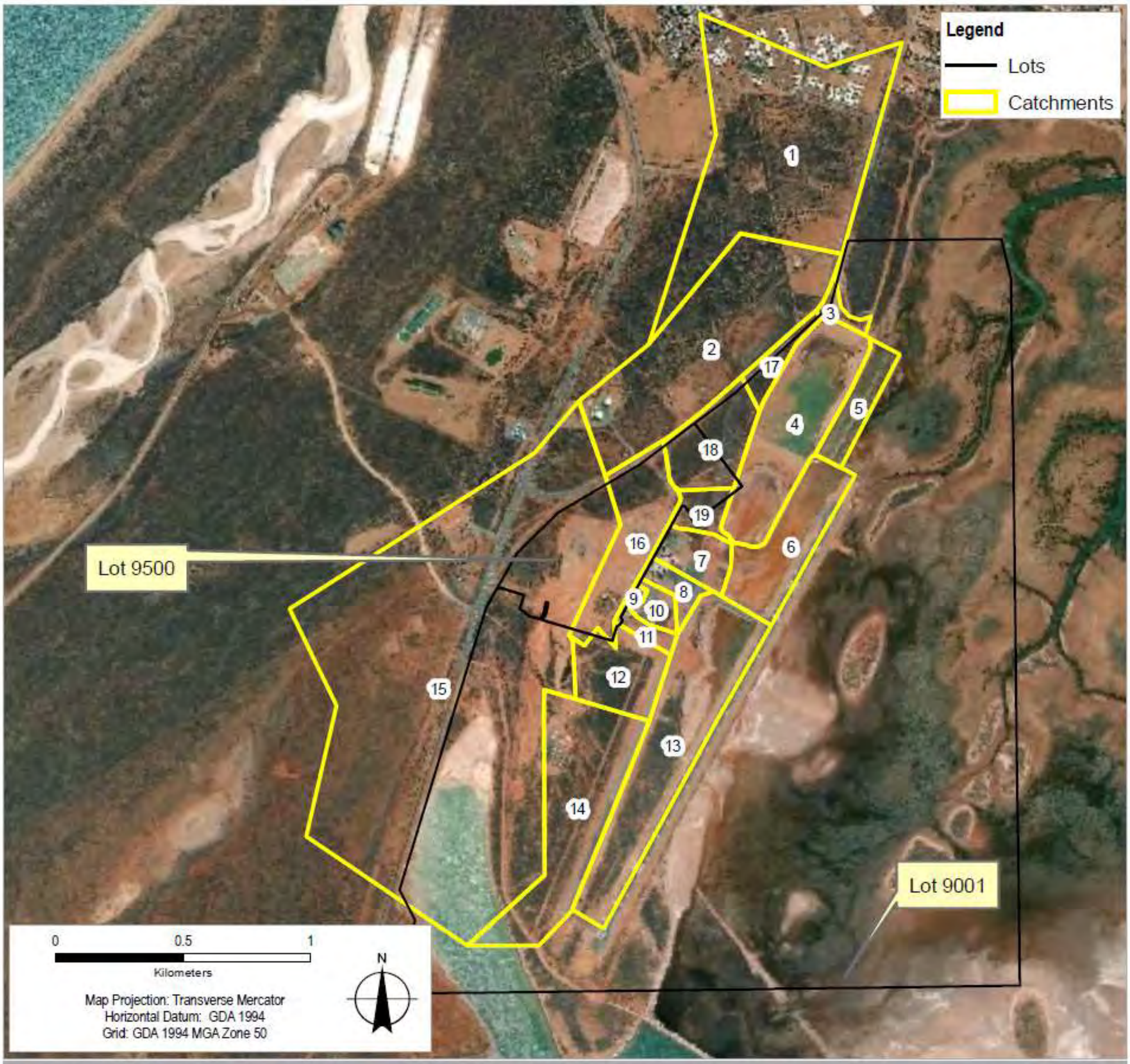
The hydrologic assessment included mapping of catchments external to and within the site using contours from the various survey files and Landgate data provided by the Shire. The assumed current catchments are shown in Figure 4-1 and the areas are in Table 6.

Table 6 Catchment areas

Catchment Name	Area (ha)	% Impervious	Catchment Name	Area (ha)	% Impervious
1	55.19	35	11	1.76	20
2	39.89	5	12	11.58	10
3	1.54	40	13	30.57	20
4	22.76	0	14	*Not modelled*	
5	*Not modelled*		15		
6	13.91	100	16	13.92	20
7	5.13	70	17	3.01	5
8	2.82	90	18	10.2	5
9	0.38	80	19	3.4	5
10	2.39	70	-	-	

The following catchments were not assessed in this SWMP:

- Catchment 15: The Lot 9500 boundary crosses into Catchment 15, and whilst development is potentially planned within that area, drainage to the waterbody at the south does not appear to be affected by the discharge constraints at the airport.
- Catchment 14: Area D covers Catchment 14, but as with Catchment 15, it is not considered constrained to discharge to the south.
- Catchment 5: This area is already within the floodplain of Beadon Estuary and is not being considered for development.



G:\61\12528041\GIS\Maps\Working\12528041_Fig6_Catchments.mxd

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Created by:aparameswaran

Figure 4-1 Existing catchments

4.2.2 Software and guidelines

The modelling was completed in DRAINS, which is a 1-dimensional stormwater drainage design and analysis software package, and was consistent with Australian Rainfall and Runoff 2019 (ARR19) procedures (Ball *et al*, 2019).

4.2.3 Rainfall and temporal patterns

Rainfall IFD data from Table 2 was used, and storm temporal patterns for Rangelands (West) were obtained using the same site coordinates of 21.6625 (S) and Longitude 115.1125 (E).

4.2.4 Storm losses

The Initial Loss (IL) and Continuing Loss (CL) model was used to represent losses to infiltration. The Australian Rainfall and Runoff (ARR) Data Hub (Babister *et al*, 2016) did not have recommended values for the area. A literature review was undertaken to identify commonly used values, which found the following:

- URS (2014) completed a study looking at increasing water supply to Onslow from Quick Mud Creek which is over 20 km away from the site. Losses adopted were based on recommended values for Pilbara loam soils from ARR87 (IEAust, 1987) and were equivalent to 52 mm IL and 5 mm/hr CL for the 10% AEP.

- Cardno's CHRMAP (2016) flood modelling used values from ARR87 (IEAust, 1987) of 30 mm IL and 5 mm/hr CL.
- PSM (2017) conducted a flood study for a high level waste facility near Onslow. The closest ARR Data Hub values to the site were quoted as 60 mm IL and 8.5 mm/hr CL on the northwestern portion of Ashburton River catchment. Final loss values adopted range from IL 30-60 mm and CL 6 mm/hr.
- Talis (2018) used the same values as the PSM study.

GHD adopted an IL of 30 mm and CL of 6 mm/hr for normal pervious area in line with ARR87 (IEAust, 1987), and half that (IL-15 mm, CL-3 mm/hr) for cleared areas that appear to be compacted (example of this type of area is marked on Figure 3-3).This was considered to be a conservative assumption in the absence of site specific infiltration information.

4.2.5 Tailwater constraints

Tailwater is a significant driver of flooding on-site. GHD adopted the following constraints:

1. Both 10% AEP and 1% AEP with no tailwater: Done to test overall drainage system performance under normal conditions without tailwater.
2. Both 10% AEP and 1% AEP catchment storm with Highest Astronomical Tide tailwater: design condition, and is considered reasonable to assume these events could coincide with HAT.
3. A 10% AEP catchment storm with 1% AEP 2015 (present day) tailwater: It is more unlikely for the same AEP catchment and tailwater to coincide. This combination follows the method that has been used in the past in Western Australia to assess catchment and coastal inundation when likelihoods of coincidence are not known.
4. 1% AEP catchment storm with 10% AEP 2015 (present day) tailwater: as Number 3.
5. Same as Numbers 3 and 4, except with 2070 (climate change) tailwater.

4.2.6 Existing drainage

Existing drainage elements were input in the model as channel sections and culverts as per Section 3.7. In particular, the following was done:

- A mosquito drain was placed along the western side of the spoil dump using the available design documentation, though information from the Shire suggested it has either not been built appropriately or is not effective.
- The overflow route/s across McAulley Road shown in the CHRMAP (Cardno, 2016) and noted by Shire staff was not modelled. No survey data was available to understand at what level the road would overtop, and therefore setting this level would be arbitrary without any further information. This should be assessed in more detail in the future.
- As previously mentioned, there was insufficient topographical information available to understand whether there is an appropriately sized and graded open channel running along on the northern side of McAulley Road that drains Catchment 2 to Culvert 1. This was however assumed to be the case as a worst case for Culvert 2 for the purposes of this SWMP.
- The overflow route across the Airport Access Road was set to activate when water levels reached the road elevation.

- For models with tailwater levels, stretches of flow path and some culverts became submerged. As this could not be modelled appropriately in DRAINS, these partially or fully submerged elements in the model were curtailed or removed, so as to not cause issues for the modelling.
- As previously mentioned, the provided survey data showed no clear drainage direction for the spoil dump. It was assumed that the entire site drains to the southern end and is discharged from Culvert 9.
- Peak discharge from Catchment 1 for the 1% AEP is listed in the Urban Water Management Plan (Hyd2o, 2014) as 10.1 m^3/s (the sum of Eastern Drainage Catchments from Table 5), from a catchment size of 38 ha. This is an ultimate development discharge. This area covers the residential footprint only, and does not include the catchment between there and the site. There is no estimate available for the 10% AEP. GHD used the Catchment 1 area for the modelling and made an assumption on % impervious split based on the current level of development for existing conditions.

A schematic of the model with no tailwater condition applied (i.e. all model segments included) is presented in Appendix C.

4.3 Existing conditions modelling

Existing conditions modelling showed that:

- A significant amount of water (peak flow of 0.36 m^3/s in the 10% AEP) overtops the Airport Access Road and discharges to the mosquito drain.
- Water levels in the mosquito drain are excessive and suggest a larger drain is necessary. This could also be caused by overtopping of the Airport Access Road.
- Culvert 6 is already undersized (based on the assumed criteria) in a 10% AEP event, as water levels exceed the culvert obvert.
- The temporary Culvert 2 and Culvert 4 only operate under the 'no tailwater' condition/scenarios, and are submerged on all other runs due to the high tailwater conditions.
- Culvert 2 currently overtops in the 1% AEP.
- The retarding basin has significant volume and does not overtop, though it is filled with tailwater on all events apart from the no tailwater and HAT runs.
- Culvert 1 is shown to be undersized (based on the assumed criteria) in a 10% AEP, with water well exceeding the culvert obvert. This may be because the model assumes all runoff from Catchment 2 can drain to it, whereas the reality may be that McAullay Road is overtopped prior to a significant amount of flow reaching it.

A summary of existing model information and results is shown in Appendix C.

4.4 Proposed concept

A drainage system concept design for future development of some parts of the site has been prepared based on the management objectives outlined in Section 2.

Proposed conditions modelling

The proposed conditions model was firstly run without any changes, apart from for the percentage impervious for catchments where future development is expected, in order to evaluate the impacts on existing drainage. These areas were adjusted to reflect future development. As the nature of future development was not known, it was assumed that an 80%

impervious – 20% pervious split was applicable, which is considered to be a worst case for ultimate development. The modelling showed that the issues highlighted in existing conditions worsened, as expected.

To address the inclusion of the taxiway development, the first option tested included a perimeter open channel to divert flows away from Taxiway E and into Culvert 6, and an additional perimeter open channel to take water around the new G.A. Apron and into Culvert 3. As Culvert 6 was found to be of insufficient capacity in the existing runs, a retarding basin was included just upstream of Culvert 6 to provide additional storage, and more culvert barrels of the same size as the existing culvert were trialled.

Whilst the system worked as intended, the Shire stated a preference to avoid use of a basin in this location, given the increased chance of wildlife frequenting the area which would pose a hazard to airport operations. The second option involved the same perimeter open channel to take water to Culvert 3, a new culvert sized to take flows under Taxiway E so that it could drain along the original pathway, and additional culvert barrels at Culvert 6.

The following further changes were made to the model to address the drainage issues:

- The mosquito drain along the eastern side of the spoil dump was upgraded with a larger cross-section of 0.5 m depth, 4 m top width with side slopes of 1:3.
- Two options were trialled to address the overtopping of the Airport Access Road:
  - Option A: Controlled discharge along overtopping flow path to the mosquito drain. This involved an increase in the road height, installation of a culvert under the road with the upstream being placed in a lowered section of the drain, and a downstream channel that ends once inverts match existing ground levels. This allows flows to pass in that direction without the road overtopping[7].
  - Option B: Prevention of overtopping, where the road height and Airport Access Road drainage channel cross-section was increased to convey all flows to Culvert 3.
- Inclusion of retarding basins to address the increase in impervious area for Area D and Area B. These were sized to reduce post-development flows to pre-development levels for the 10% AEP. Basins were not allowed for Area E (draining to Culvert 3) as this would be too close to the taxiway.
- Installation of additional culvert barrels at Culvert 3 and Culvert 5 to bring hydraulic performance in line with the assumed design criteria.
- Resizing of barrels at Culvert 2 to provide greater hydraulic capacity, raising of the road to above the 2070 tailwater constraint plus 0.5 m freeboard (i.e. to 3.49 mAHD), and inclusion of a channel connecting Culvert 1 and Culvert 2, noting this will only be effective under reduced tailwater condition.

A summary of proposed model information and results is shown in Appendix C.

Infrastructure

The proposed drainage, open channel, road raise and basin infrastructure along with sizes, levels and grades are shown in Figure 4-2 and Figure 4-3, and the indicative basin storage requirements are presented in Table 7.

[7] Note that invert levels modelled along the culvert outlet and downstream channel were assumed as survey was of poor quality in this location.

Table 7 Detention basin storage requirements

Basin No. and Development Area	Contributing Catchment Area (ha)	Volume (cu.m)	Top Surface Area m^2
Basin 1, Area D	3.92	1,700	830
Basin 2, Area D	2.47	1,300	560
Basin 3, Area D	3.43	1,400	800
Basin 4, Area D	0.93	370	275
Basin 5, Area D	2.79	1,600	650
Basin 7, Area B	10.20	3,900	3,050

Basins were indicatively sized and placed within each development area to store and infiltrate[8] runoff from the 10% AEP event, with discharges matching pre-development rates. For larger events, the basins will discharge to downstream drainage infrastructure via open channels.

The footprint was minimised by increasing the depth to allow for more developable land. The basin bottom levels were not set any lower than 3.0 mAHD, which is the highest tailwater condition considered for the site. This resulted in depths reaching up to 2 m which may be subject to ASS issues, or insufficient separation from groundwater (an issue which has not been established due to lack of site data related to groundwater).

Basin side slopes were 1V:3H, which requires inclusion of a fence line for public safety, and no freeboard was considered, given the industrial or commercial nature of likely development these slopes were considered acceptable.

Proposed infrastructure requirements and footprints should be studied further to finalise the sizes during concept and detailed design.

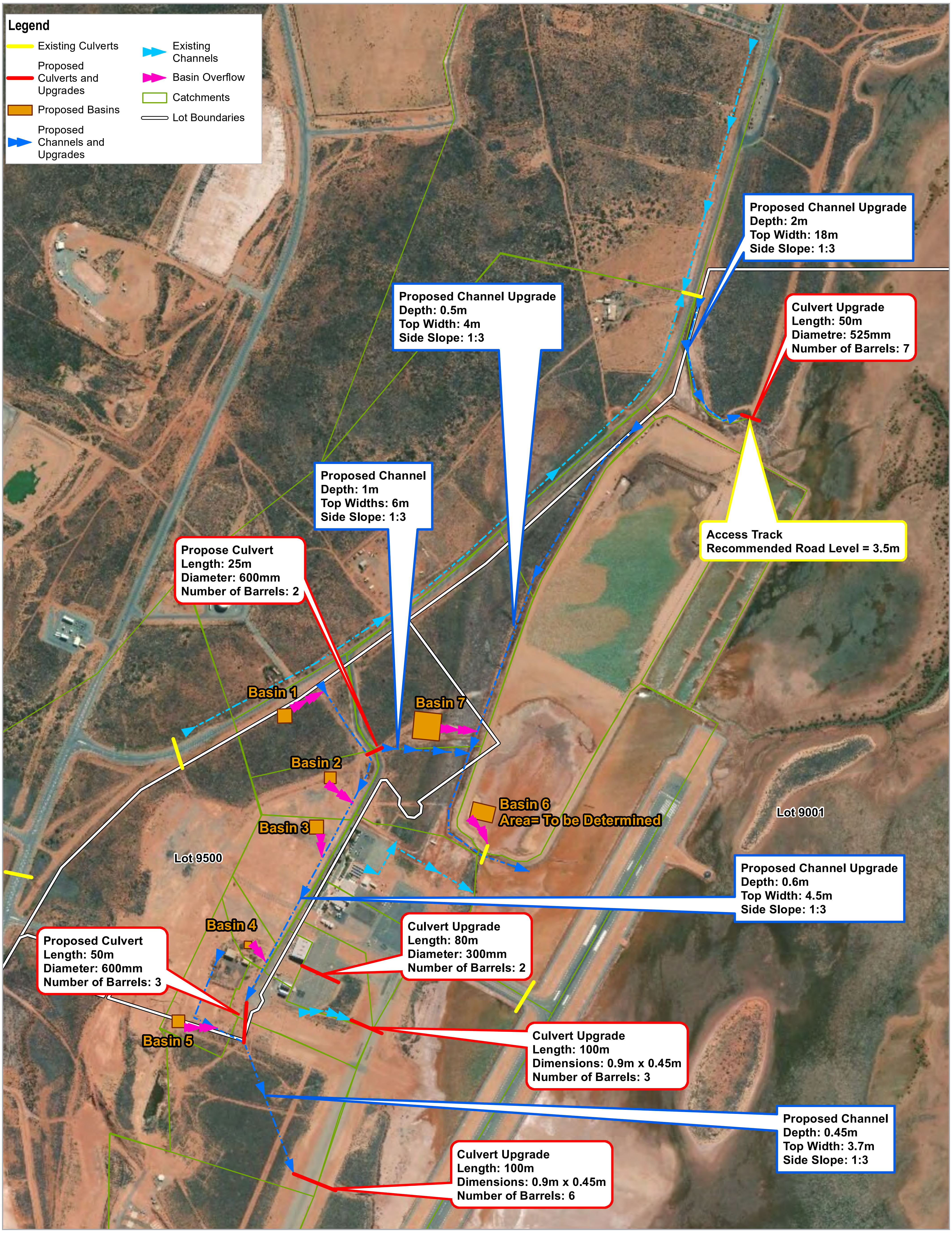
A sedimentation basin is also required to store all discharge from Area A prior to release through Culvert 9 and into the receiving environment. This will target the settlement of suspended fines from the stored material. As the nature of this material is not currently known, the basin could not be designed, but is shown as an indicative footprint in Figure 4-2 and Figure 4-3 (Basin 6).

Development floor levels

In accordance with Section 2.2.1, all habitable floor levels in Area B are recommend to be set at a minimum of 3.5 mAHD. This accounts for the expected 1% AEP storm surge water level with sea level rise in 2070 (Section 3.9.2) of 2.99 mAHD, plus a 0.5 m freeboard.

Ground surface elevations around Area D and Area E are already above this level. It is unknown whether Area A is built up to this level, but it should be to avoid submergence during this event.

[8] Using a hydraulic conductivity of 5 m/day



Paper Size ISO A3

0 0.05 0.1 0.15 0.2

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: BIO94

N

Shire of Ashburton

Proposed Infrastructure

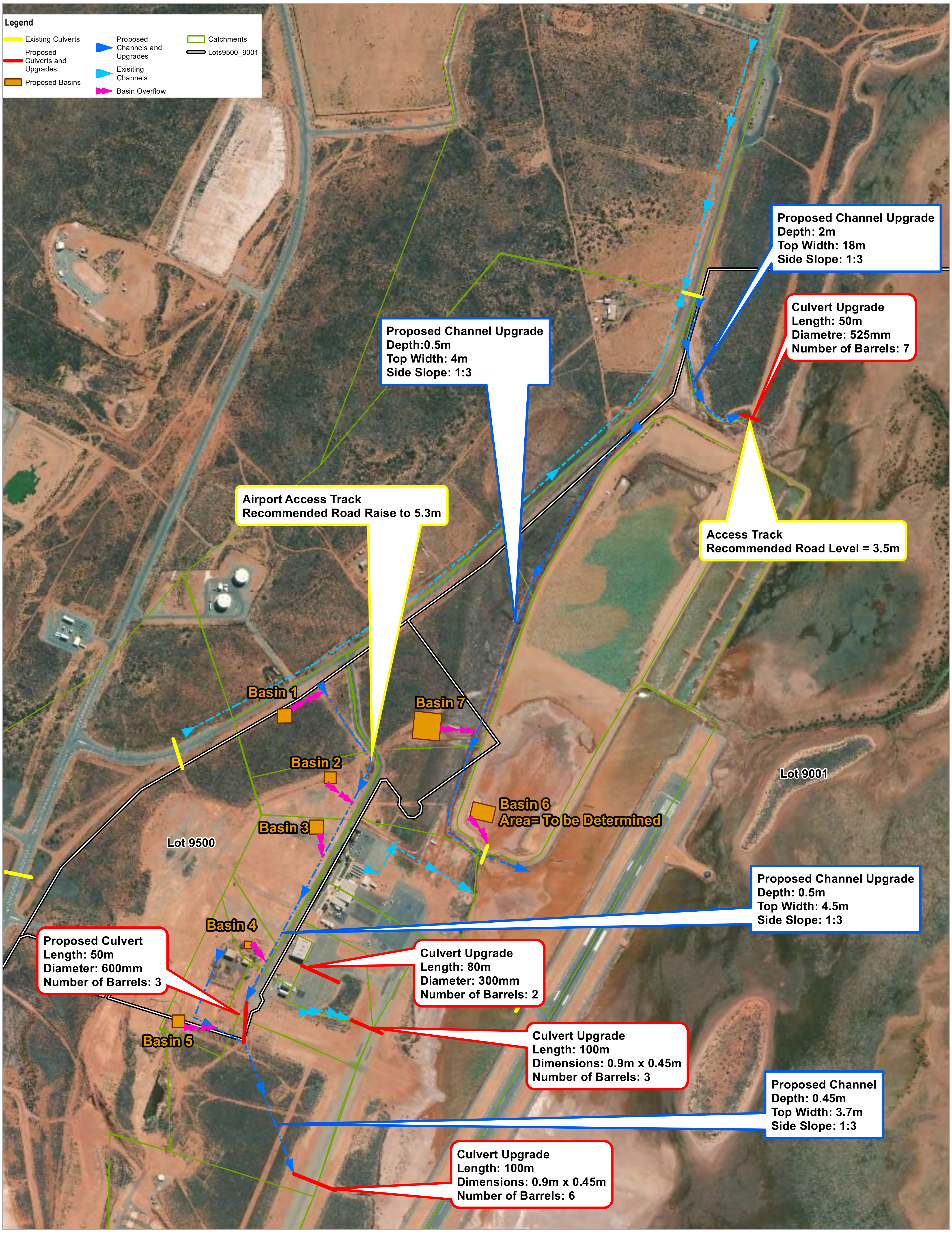
Option A

Project No. 12528041
Revision No. -
Date 15/10/2020

FIGURE 4-2

G:\61\12528041\GIS\Maps\Working\12528041- Fig9a_ProposedInfrastructure.mxd
Print date: 26 Oct 2020 - 16:34

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: hechild



Paper Size ISO A3
0 0.05 0.1 0.15 0.2
Kilometers
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: BIO94

N

Shire of Ashburton

Proposed Infrastructure

Option B

Project No. 12528041
Revision No. -
Date 15/10/2020

FIGURE 4-3

\\ghdnet\ghd\AU\Perth\Projects\61\12528041\GIS\Maps\Working\9b_Working.mxd
Print date: 26 Oct 2020 - 16:23

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: hechild

5. Monitoring and Management

5.1 Groundwater

No groundwater information is available for the site. The Shire has suggested that the recent construction and use of the laydown area could have resulted in groundwater being pushed to either side of the spoil due to its weight.

It is recommended that a minimum of four groundwater monitoring bores are established through the site and measurements of groundwater levels are taken a regular intervals. Installation of downhole loggers would allow for the impacts of rises and falls in level throughout the year to be more clearly understood. If downhole level loggers were not installed undertaking regular level measurement would be required (recommend monthly during wet season and quarterly otherwise).

The assessment of these results will better establish an understanding of site groundwater constraints and allow for future design that ensures:

- Separation of drainage inverts to the groundwater table,
- Help understanding the effects of tidal, storm and other influences on site groundwater, and
- Guide the construction of any future detention/compensation area to avoid adverse outcomes (i.e. mosquito risks, flooding due to under sizing of assets).

It is recommended that groundwater quality measures for a basic suite of metals and nutrients should be taken, typically up to 3 times in the first 12 months of installation and annually thereafter if any issues are identified.

The gather information can be reported on an annual basis in an ‘annual monitoring report’ to the Shire of Ashburton staff and should include a qualitative review of the data to establish the groundwater levels in the site, guiding future development. Reporting should be in accordance with Department of Water and Environmental regulation (DER) requirements so as to allow inclusion in DWER’s Water Information Network (WIN) database.

5.2 Inspections and operations

The undertaking of suitable maintenance of drainage systems is at times the difference between having a functioning and reliable system and one that fails. The following are a number of guiding recommendations for the implementation of suitable ongoing maintenance of the existing and any proposed upgraded sections of the stormwater management system.

- After significant runoff events (>80 mm rainfall in 24 hours or a single event), responsible staff should observe the levels of erosion, deposition and standing water on-site to confirm any issues requiring maintenance or repair;
- Inspect basins and other drainage infrastructure on an annual basis to ascertain the extent of accumulation of sediment and other materials, assess and structural damage and blockage, and note any maintenance requirements;
- Compile for inclusion in the annual monitoring report.

6. Conclusions and Recommendations

6.1 Developer commitments

Developers will need to undertake the following to comply with this plan:

- Design and construct a stormwater management system in accordance with this stormwater drainage management plan.
- Demonstrate compliance with regulatory requirements, including required licenses and approvals, Building Code of Australia and Plumbing Code of Australia.
- Endeavour to comply with any Shire of Ashburton development guidelines.
- Operate, maintain and monitor the stormwater management systems in accordance with this and any development specific stormwater drainage management plan/s.

6.2 Recommendations

The following items are recommended as an output of this SWMP:

- Proposed infrastructure sizes, grades and levels outlined in Figure 4-2 and Figure 4-3 be considered, and sizes and configurations confirmed using more up to date information when designing future development in the site.
- A sedimentation basin be designed for Area A to settle out fines from the laydown area prior to discharge through Culvert 9 and into the downstream receiving environment.
- All habitable floor levels in Area B be placed at a minimum of 3.5 mAHD to avoid flooding from the ocean. A check made on Area A to ensure it also meets these requirements.
- The land upstream of Culvert 2 be regraded to remove trapped low spots which store water and are a mosquito breeding habitat. The proposed drain between Culvert 1 and Culvert 2 installed to promote drainage of flows from Onslow residential township to the estuary after tailwater levels have rescinded.
- Detained immobile/trapped stormwater is to be infiltrated in no less than 96 hours following a rainfall event. This will require onsite infiltration testing and observation to determine areas of highest current risk

The following further work is recommended to improve on the output of this SWMP:

- An ASS Assessment be undertaken to determine if any areas are of specific risks and management strategies be reviewed upon gaining of this information (including this document).
- Survey be obtained of the open channel on the northern side of McAulley Road, surrounding land and the road elevations, and a study be undertaken to determine the extent of overtopping of the road during flood events. This study should also evaluate the performance of Culvert 1 to determine whether it is appropriately sized. Note that the size recommendations made for Culvert 2 were dependant on the assumptions made for drainage along McAulley Road and these may need to be revisited during or upon completion of this study.
- Detailed survey of the entire site undertaken to eliminate the issues (inconsistent information) faced in this SWMP, which included conflicting datasets that did not fully cover the site.
- Once development plans are at more detailed design, stormwater modelling be undertaken with an improved survey dataset to fully understand the flood risk. Ideally this would be

done in a 2D hydrodynamic modelling package using a new survey dataset and combined with the previous modelling undertaken by Cardno's.

7. References

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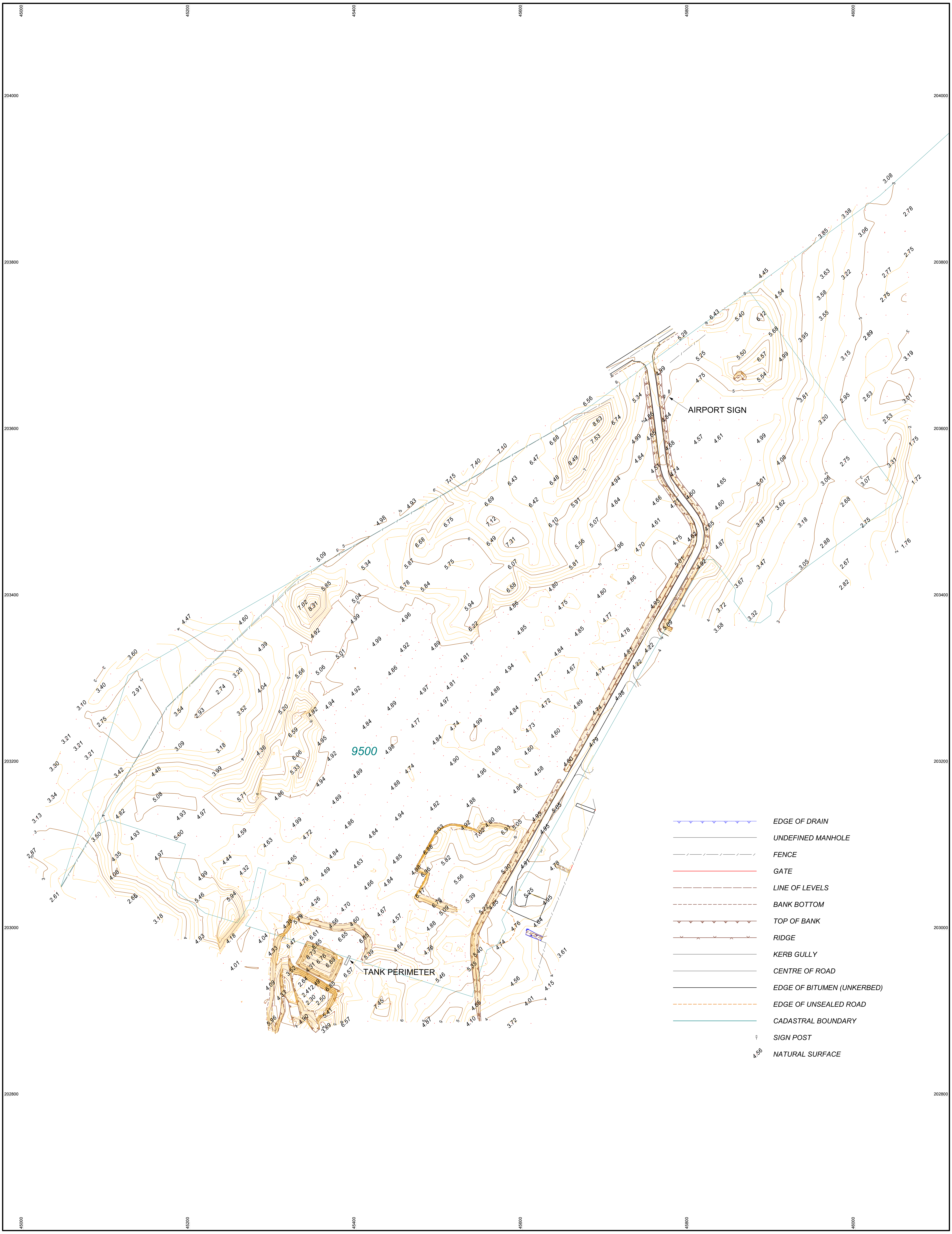
Appendices

Appendix A – Survey plans



Rev.	Description	Drawn	Date	Checked
A	Initial Issue	GPM	12/10/2015	TKI

ISO 9001 Quality Management — AS/NZS 4801:2001 Occupational Health and Safety Management

FS 565311 OSH 591267

Surveyor:- NPR
Survey Date:- 09/10/2015
Precal/Cad:-

N

LOT 9500
ONSLOW AIRPORT
DETAIL SURVEY

CLIENT:

SHIRE OF ASHBURTON

The contents of this plan are current and correct as of the date stated within the revision panel. All consultants and persons wishing to utilise this data should satisfy themselves of this plans currency by contacting the McMullen Nolan Group.

SCALE 1:2000 @ A1
0 100 200
ALL DISTANCES ARE IN METRES
For a true to scale reproduction of this plan, plot it to A1 with the Paging Scaling set to None.

The boundaries shown on this plan were not re-established as part of this survey, therefore this plan does not guarantee their accuracy. Existing easements, encumbrances or interests are not depicted and a title search is recommended to obtain this information. Re-establishment of the cadastral boundaries is recommended for any proposed works on or near existing boundaries.

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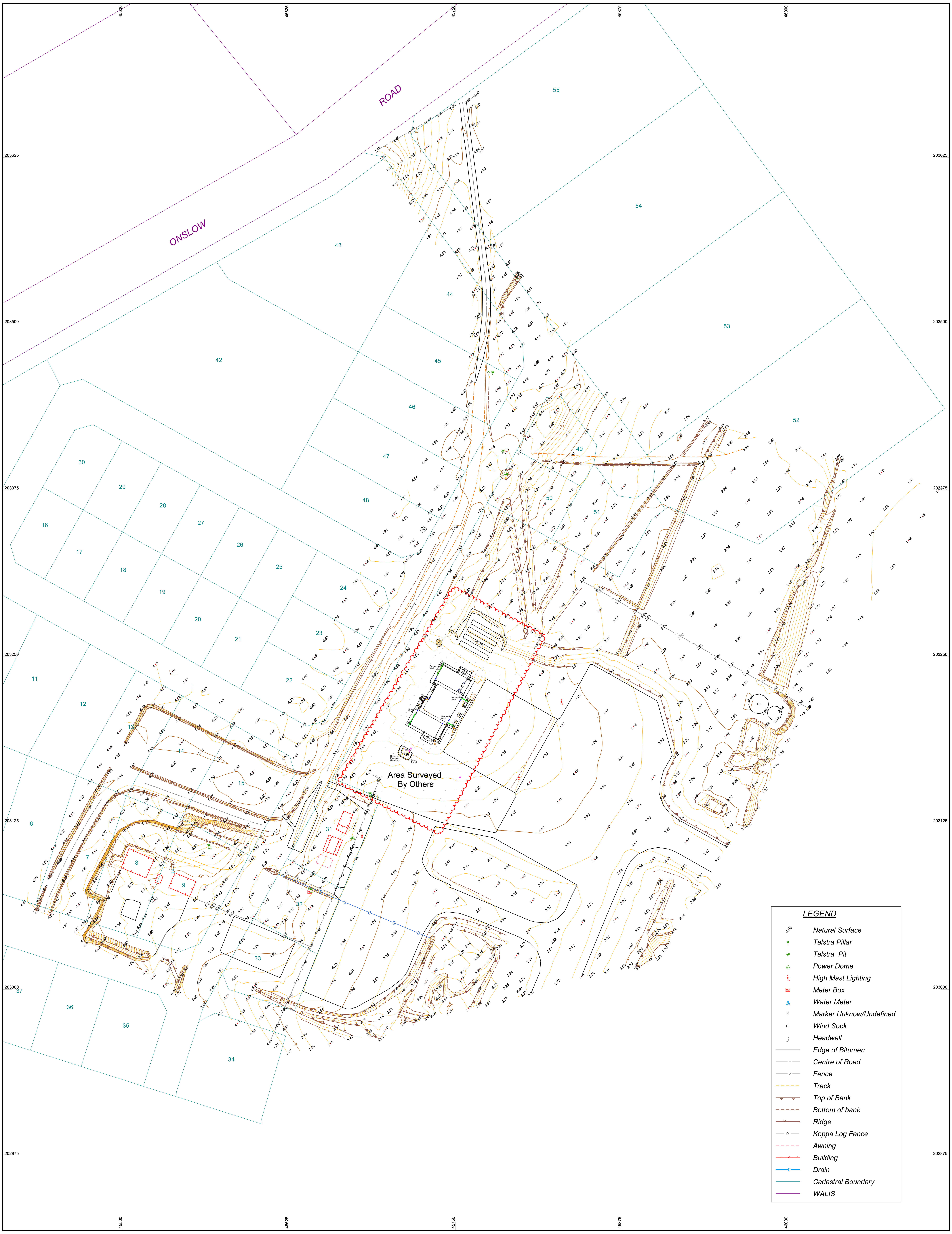
Offices in: Broome, Bunbury, Kununurra, Newman, Onslow, Port Hedland

Project Mngr.	Daniel Hitchen	Datum	BI094 / AHD

99534 - DE - 001 - A
Job Number / Type / Plan Number / Revision



Rev.	Description	Drawn	Date	Checked
A	Initial Issue	CEB	21/08/2014	BGI

ISO 9001 Quality Management

Surveyor:- MJA
Survey Date:- 20/08/2014
Precal/Cad:- SUPPLIED 08/2014
WALIS

N

ONSLOW AIRPORT
ONSLOW
DETAIL SURVEY

CLIENT:

SHIRE OF ASHBURTON

The contents of this plan are current and correct as of the date stated within the revision panel. All consultants and persons wishing to utilise this data should satisfy themselves of this plans currency by contacting the McMullen Nolan Group.

SCALE 1:1250 @ A1

0 25 50 75 100 125

ALL DISTANCES ARE IN METRES

For a true to scale reproduction of this plan, plot it to A1 with the Paging Scaling set to None.

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Offices in: Port Hedland, Margaret River, Broome, Kununurra

Project Mngr.	Brad Gillett	Datum	BI094 / AHD

40826 - DE - 002 - A
Job Number | Type | Plan Number | Revision

Rev.	Description	Drawn	Date	Checked
A	Initial Issue	DHI	24/03/2015	DHI

SCALE 1:2500 @ A1

0 50 100 150 200 250

ALL DISTANCES ARE IN METRES

For a true to scale reproduction of this plan, plot it to A1 with the Paging Scaling set to None.

The contents of this plan are current and correct as of the date stated within the revision panel. All consultants and persons wishing to utilise this data should satisfy themselves of this plans currency by contacting the McMullen Nolan Group.

Surveyor:- KRS
Survey Date:- 22/03/2015
Precal/Cad:-

ISO 9001 Quality Management
AS/NZS 4801:2001 Occupational Health and Safety Management
FS 565311 OSH 591267

N

The boundaries shown on this plan were not re-established as part of this survey, therefore this plan does not guarantee their accuracy. Existing easements, encumbrances or interests are not depicted and a title search is recommended to obtain this information. Re-establishment of the cadastral boundaries is recommended for any proposed works on or near existing boundaries.

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ABN 90 009 363 311

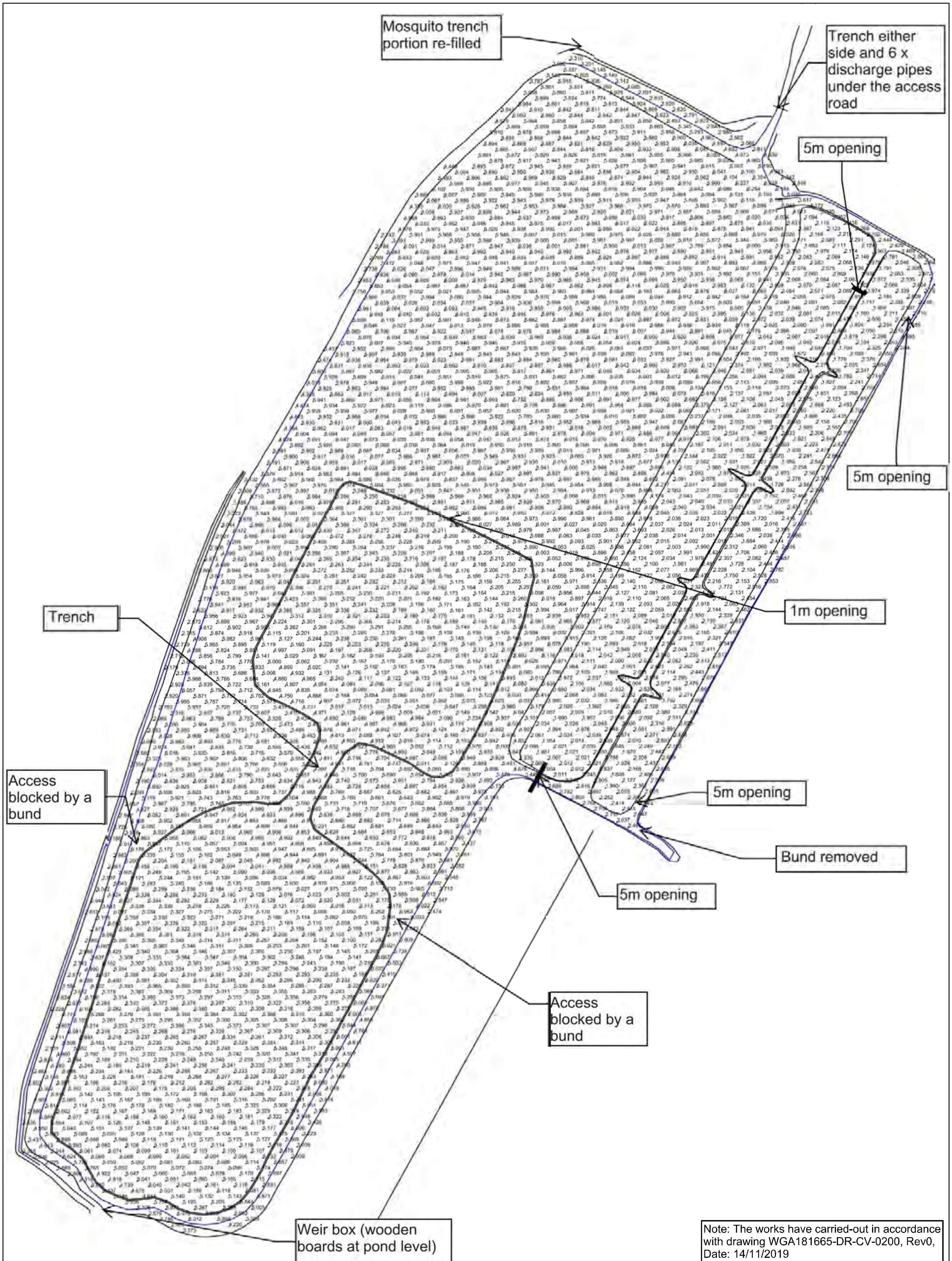
ONSLOW AIRPORT
Drainage Study
Feature Survey

CLIENT:
HQ Management

Project Mngr.	Dan Hitchen	Datum	BI094 / AHD

99109 - DE - 001 - A
Job Number / Type / Plan Number / Revision

Attachment 15.1A - Proposed Development - Onslow Industrial Park



NO#	BY	DESCRIPTION	APPROVED
1	OK	ISSUED	SD

REVISIONS

Surveys carried out using GPS and Sonar Survey Instruments.
1. Trimble GNSS RTK Base Station.
2. Trimble SPS985 Receiver Rover
3. Sonarmite BTX Single-beam Echo Sounder
4. Digibar Pro, used for underwater sound profiling.

Data is processed by MC surveyor using, Magnet office, Trimble Business Center and Autocad.

Surveyed Elevations are given in Metres and Decimetres.

Vertical Datum
Elevations are in Project Chart Datum.
Project Chart Datum is AHD +1.49m.

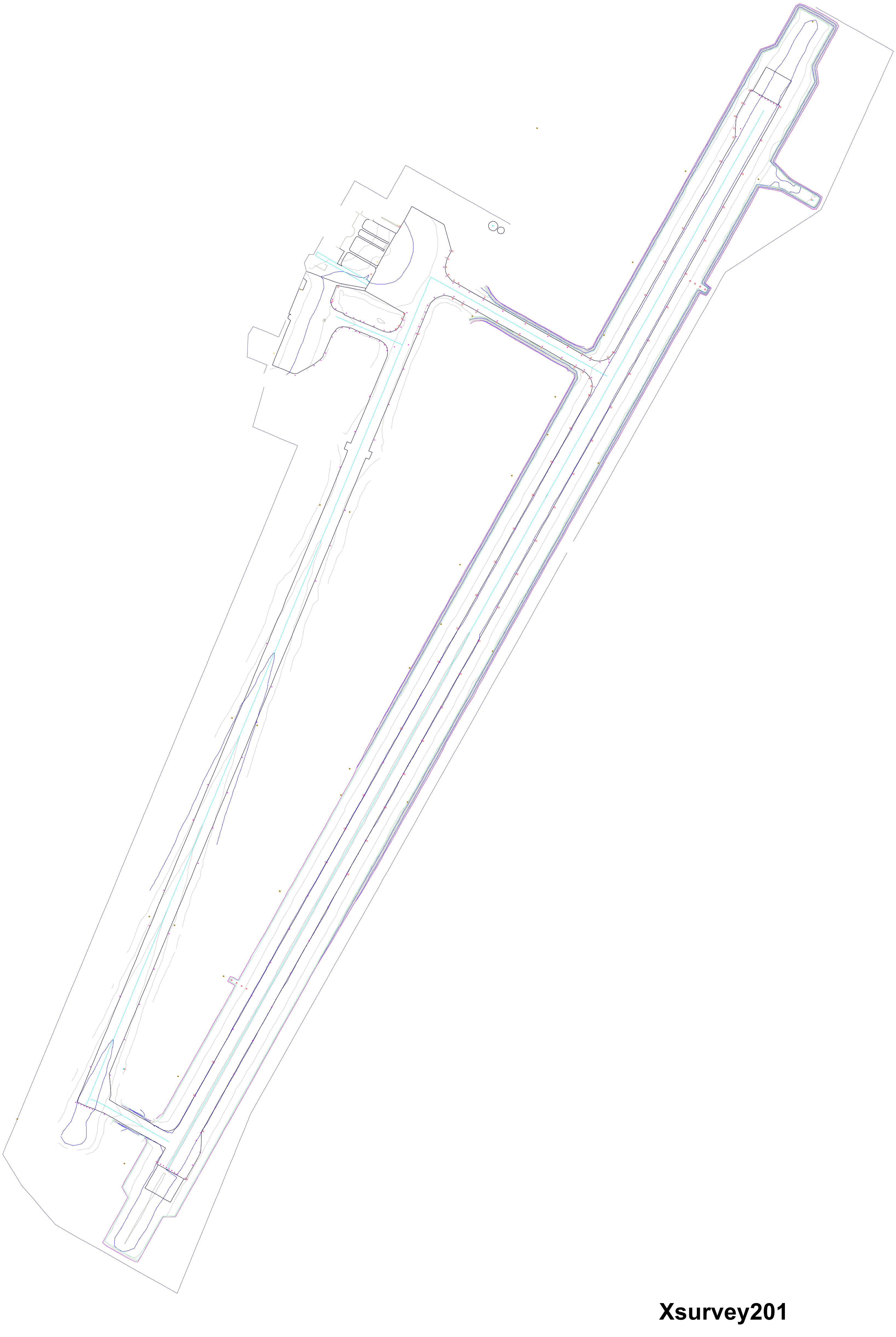
Horizontal Datum
Map grid of Australia 1994, Zone 50.

MARITIME CONSTRUCTIONS

ONSLOW MARINE SUPPORT BASE (OMSB)
BEADON CREEK, ONSLOW
CAPITAL DREDGE AND NAVIGATION AIDS

As-Built Reclamation Area

Job No# ME 0459
Sheet No# 1 of 1
Drawing No# MCE0459-DRWG-112
Surveyed - VAR.
25-11-2019



Xsurvey201

Appendix B – Culvert data requests

From: Brendon Woodbrook
To: Arun Parameswaran
Subject: FW: Onslow drainage - Some further queries
Date: Friday, 31 July 2020 12:38:01 PM
Attachments: image007.png
image a0d44e.PNG
image83a2ac.PNG
Culvert McAullay rd.docx
Culvert on Onslow RD.DOCX

Hi Arun
Major H 410 X W 1225
Onslow rd H 600 X W 2065 I have also put a map with new GPS for you
McAully H 500 X W 500
Another culvert does not exist .
I hope this helps I will now off until Monday if you need any more help.
King Regards

Brendon

Onslow ARO
Aerodrome Reporting Officer

D: **08 9153 2003**
M: **0448 899 641**
E: OnslowARO@ashburton.wa.gov.au

16 Onslow Road
P.O Box: 20, Onslow, WA, 6710
T: 08 9188 4444 F: 08 9189 2252
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From: Megan Walsh
Sent: Friday, 31 July 2020 9:25 AM
To: Brendon Woodbrook <OnslowARO@ashburton.wa.gov.au>
Subject: FW: Onslow drainage - Some further queries

Can you please follow up on these queries below

Megan Walsh

Manager Onslow Airport | Shire of Ashburton
D: 08 9153 2002 | M: 0448 774 789 | E: Megan.Walsh@ashburton.wa.gov.au

---

From: Arun Parameswaran [mailto:Arun.Parameswaran@ghd.com]
Sent: Thursday, 30 July 2020 7:31 PM
To: Megan Walsh <Megan.Walsh@ashburton.wa.gov.au>
Cc: Simon Cleary <Simon.Cleary@ghd.com>; Holly Child <Holly.Child@ghd.com>
Subject: RE: Onslow drainage - Some further queries

Hi Megan,

Thanks for that information. I would like to ask some further questions that have arisen after we looked into that culvert data you sent previously.

Please refer to the below screenshot:

Queries:

- Both ‘Culvert McAullay rd.docx’ and ‘Culvert on Onslow RD.DOCX’ plot at the same location. Can you please confirm which of the two is actually where it is shown in the above screenshot?
- You have said that the ones on the McAullay are 500. Does this mean 500mm height x 500mm width, as they are box culverts? May I ask which of the culverts in the two documents you are referring to as 500? The culverts pictured in those two documents are quite different in size. The one in ‘Culvert on Onslow RD.DOCX’ appears to be double or triple barrel with a greater width than height? I suspect ‘Culvert on Onslow RD.DOCX’ may have actually been the point I have marked as ‘Major Crossing’ on the screenshot but I am not sure.
- Can we please get some photos up close to the ‘Major Crossing’ culvert inlet and outlet (at a similar distance to photos taken at ‘Culvert McAullay rd.docx’), and then photos looking at the channel leading to it, and out from it? Can we also please get dimensions (height, width, no. of barrels) of the culverts at the crossing? We have a drawing in the UWMP (H11043Ev3 (1).pdf) which shows the culvert on a Plan-Profile on Page 146 of the PDF, but refers to a drawing (R20.1) which is not included in the UWMP. So we don’t actually have dimensions for this culvert.
- I have marked another location as ‘Another culvert??’. I suspect there is something there but would need you to confirm. Can you please take a look, and provide photos and size (width x height for box culvert or diameter for pipe culvert) if there is something?

Thanks,
Arun

From: Megan Walsh <Megan.Walsh@ashburton.wa.gov.au>
Sent: Tuesday, 21 July 2020 11:32 AM
To: Arun Parameswaran <Arun.Parameswaran@ghd.com>
Subject: RE: Onslow drainage - Some further queries

Hi Arun
The small culvert under the GA apron is approx. 300mm and the ones on the McAullay are 500.

Regards

Megan Walsh
Manager Onslow Airport

D: **08 9153 2002**
M: **0448 774 789**
E: Megan.Walsh@ashburton.wa.gov.au

From: Arun Parameswaran [mailto:Arun.Parameswaran@ghd.com]
Sent: Friday, 17 July 2020 6:07 PM
To: Megan Walsh <Megan.Walsh@ashburton.wa.gov.au>
Cc: Janelle Fell <Janelle.Fell@ashburton.wa.gov.au>; Simon Cleary <Simon.Cleary@ghd.com>
Subject: RE: Onslow drainage - Some further queries

Hi Megan,

So I think all we need now are the culvert sizes for the culverts that I mentioned below, and the CAD/digital format file of the OLW-201-SK-001-A.PDF that you sent on Wednesday.

Please advise if this is something that can be provided.

Cheers,
Arun

From: Arun Parameswaran
Sent: Wednesday, 15 July 2020 1:34 PM
To: Megan Walsh <Megan.Walsh@ashburton.wa.gov.au>
Cc: Janelle Fell <Janelle.Fell@ashburton.wa.gov.au>
Subject: RE: Onslow drainage - Some further queries

Hi Megan,

Thanks very much for that information. To close the loop on the other files you sent my last Friday – we have received that DWG file from you already.

I was wondering if you also picked up culvert sizes for those ones on the GA Apron, McAullay Rd and Onslow Rd? We will need that to include it in the modelling.

I will get back to you in a day or so if we need anything else.

Cheers,
Arun

From: Megan Walsh <Megan.Walsh@ashburton.wa.gov.au>
Sent: Wednesday, 15 July 2020 12:34 PM
To: Arun Parameswaran <Arun.Parameswaran@ghd.com>
Cc: Janelle Fell <Janelle.Fell@ashburton.wa.gov.au>
Subject: FW: Onslow drainage - Some further queries

Hi Arun
I have attached all the information of the culverts and yes I also found culverts on onslow Rd and McAullay rd. They look fairly new. I f I have to make a guess I think they may have been installed when the new access rd was constructed a few years ago.

We have also measured the pipes at the discharge point at the spoil and they are approx. 550mm each.. Is there any other information you require?

Regards

Megan Walsh
Manager Onslow Airport

D: **08 9153 2002**
M: **0448 774 789**
E: Megan.Walsh@ashburton.wa.gov.au

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From: Janelle Fell
Sent: Tuesday, 23 June 2020 10:20 AM
To: Megan Walsh <Megan.Walsh@ashburton.wa.gov.au>
Subject: FW: Onslow drainage - Some further queries

Comments below.

Janelle Fell

Manager Land & Asset Compliance | Shire of Ashburton
D: 08 9188 4440 | M: 0408 915 399 | E: Janelle.Fell@ashburton.wa.gov.au

From: Arun Parameswaran [mailto:Arun.Parameswaran@ghd.com]
Sent: Monday, 22 June 2020 8:21 PM
To: Megan Walsh <Megan.Walsh@ashburton.wa.gov.au>; Janelle Fell <Janelle.Fell@ashburton.wa.gov.au>
Cc: Simon Cleary <Simon.Cleary@ghd.com>; Holly Child <Holly.Child@ghd.com>
Subject: Onslow drainage - Some further queries

Hi Megan and Janelle,

I hope you are both well.

I wanted to let you know that we are starting our modelling but there are still a few bits and pieces we need. This includes:

- Being provided the digital file for the As-built Reclamation Area that Simon emailed Megan about last week.
- Confirmation of the date on which this drainage survey data was captured: "99109de-001a - drainage study.dwg" – October 2015
- Confirmation that this file is for Tom Price: "101634DE-001A" – likely, sorry!
- Can you please check whether this file - "OLW-201-SK-001" - has been corrupted, or confirm the contents of it, as we cannot view it in CAD, 12d or ArcGIS? - Pdf attached.
- Can you please confirm the location of the culvert in the attached photos (IMG_0325, IMG_0327, IMG_0328)? Perhaps coordinates or a mark on google map? Do you have the size of this?
- Can you please confirm that 'Discharge point – nth end dredge spoil (2)' and Discharge point – Nth end dredge spoil.jpg' are at the location marked by the red circle in the below screenshot, and can you please confirm the size of the pipes?

- We still cannot confirm whether there are any other MRWA drainage assets in the area that are discharging flows from the western side of Onslow Road into our area of concern. Janelle told us this may be in the UWMP, but we haven't been able to find any detail. Are you able to contact MRWA to determine this? Road trip. I'm not sure why there would be when this has traditionally been a Shire road hasn't it?

Cheers,
Arun

From:	Holly Child
To:	Arun Parameswaran
Subject:	FW: Onslow Drainage Queries
Date:	Monday, 10 August 2020 3:24:10 PM
Attachments:	image001.png image002.png image003.png image004.png imageea31e2.PNG

Holly Child
MPE (Environmental) Bsc
Graduate Environmental Engineer

GHD
Proudly employee owned
T: +61 8 6222 8388 | M: 0415688064 | E: Holly.Child@ghd.com
Shop 186 Pelago East Apartments, 26 Sharpe Avenue, Karratha WA 6714 Australia | www.ghd.com
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From: Brendon Woodbrook <OnslowARO@ashburton.wa.gov.au>
Sent: Friday, 7 August 2020 1:14 PM
To: Holly Child <Holly.Child@ghd.com>
Subject: RE: Onslow Drainage Queries

Hi Holly
Ok
Photo 1 Is the one down end of rwy no culverts
Photo 2 is the one going across Twy alfa both 900 mm
Photo 4 are the open channel it's very poor with no fall . the pipes come out of the vacant land from the dredging .
The that asks if there is a culvert yes have sent photos in past and for the one any culverts missing no there is not lol.

Regards

Brendon

Onslow ARO
Aerodrome Reporting Officer

D: **08 9153 2003**
M: **0448 899 641**
E: OnslowARO@ashburton.wa.gov.au

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From: Holly Child [mailto:Holly.Child@ghd.com]
Sent: Thursday, 6 August 2020 5:10 PM
To: Brendon Woodbrook <OnslowARO@ashburton.wa.gov.au>
Subject: Onslow Drainage Queries

Hey Brendon,

Thank you for your time on the phone earlier, as discussed, I have attached an updated figure locating the infrastructure that we are still missing information on.

If you were able to have a quick look on site tomorrow that would be greatly appreciated.

Please feel free to give me a buzz, I have highlighted my number below.

Thanks again!

Kind regards,

Holly Child
MPE (Environmental) BSc
Graduate Environmental Engineer

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Existing Culverts – Information Summary

Culvert 1	

Culvert 2	
Culvert 3	
Culvert 4	Details provided in Proposal Documents: ***Attachment 6: General Arrangement Reclamation Spoil***

Culvert 5	
Culvert 6	
Culvert 7	

Culvert 8	
Culvert 9	

Appendix C – DRAINS model schematics and results

Existing Model

PIT / NODE DETAILS — Version 15

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is	Internal Width (mm)	Inflow is Misaligned	Minor Safe Pond Depth (m)	Major Safe Pond Depth (m)
HW1	Headwall				0.5	3.8		0		46408.82	204322.28		4							
N13	Node					3.4		0		46449.626	204282.93		51		No					
US Node 2	Node					9		0		45416.348	203504.69		18		No					
N6	Node					3		0		46319.815	204127.2		21		No					
HW2	Headwall				0.5	4.2		0		45621.352	203079.71		42							
N53	Node					3.6		0		45738.962	203035.92		242		No					
HW3	Headwall				0.5	3.2		0		45748.265	202956.72		43							
N54	Node					3.2		0		45842.717	202924.77		247		No					
HW6	Headwall				0.5	3.6		0		45635.584	202672.81		63							
N55	Node					3.2		0		45715.226	202639.89		248		No					
DN2	Node					1.52		0		46387.309	204286.25		77		No					
DN1	Node					1.52		0		46414.066	204360.23		78		No					
US Node	Node					6.6		0		46603.522	205018.83		85		No					
N11	Node					5		0		45762.317	203316.6		202		No					
N14	Node					2.8		0		46121.717	203033.23		54		No					
N44	Node							0		45605.049	202994.03		213		No					
N52	Node					1.4		0		46089.663	203189.93		235		No					
N65	Node					5.2		0		45738.962	203669.85		319		No					
DN	Node					2		0		46209.389	202918.21		419		No					
US3	Node					6		0		45453.203	201907.08		435		No					
N98	Node					4.8		0		45721.376	203324.64		530		No					
OFN3	Node					4.4		0		45562.696	203025.91		539		No					
OFN2	Node					4.6		0		45600.421	203092.51		562		No					
N7	Node					4		0		45511.683	202817.34		619		No					
N115	Node					2.39		0		45740.89	202977.15		681		No					
DN4	Node					4		0		45752.838	202967.91		696		No					
N19	Node					5		0		46052.666	203322.38		932		No					
N30	Node					1.8		0		46050.522	203303.75		151		No					
DN31	Node					1.4		0		46657.06	204185.08		72561		No					
N87	Node					1.8		0		45996.433	203229.35		72588		No					
Overflow No	Node					4.9		0		45757.168	203518.09		72651		No					
Overflow No	Node					5.6		0		46095.779	203999.26		72677		No					
N27	Node					2.519		0		46116.304	203884.69		72678		No					
N26	Node					2.116		0		45993.005	203564.65		72699		No					
N36	Node					4.6		0		45853.093	203523.76		100079		No					

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length	id
South Basin	1.4	2638		Culvert	0.5					46090.122	202966.28	No			210
	1.6	24250													
	1.8	55403													
	3.2	231242													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	EIA %	Perv Area %	RIA %	EIA Time (min)	Perv Time (min)	RIA Time (min)	EIA Length (m)	Perv Length (m)	RIA Length (m)	EIA Slope(%) %	Perv Slope %	RIA Slope %	EIA Rough	Perv Rough	RIA Rough	Rainfall Multiplier
C9	HW2	0.375	80	20	0	0	0	0	101.9	88.4	0	1.17	1.13	0	0.01	0.053	0	1
C11	HW3	1.76	20	80	0	0	0	0	295	227	0	0.4	0.35	0	0.01	0.053	0	1
C12	HW6	11.582	10	90	0	0	0	0	499	434	0	0.4	0.8	0	0.01	0.053	0	1
C2 (2)	DN2	19.943	5	95	0	0	0	0	1453	1806	0	0.6	0.6	0	0.013	0.053	0	1
C1	DN1	68.343	35	65	0	0	0	0	1385	1181	0	0.9	0.9	0	0.013	0.053	0	1
C13	South Basin	30.56	20	80	0	0	0	0	1505	1310	0	0.29	0.3	0	0.01	0.053	0	1
C16(2)	N98	2.467	20	80	0	0	0	0	220	220	0	0.7	0.7	0	0.01	0.053	0	1
C16 (4)	OFN3	0.993	20	80	0	0	0	0	180	180	0	0.5	0.5	0	0.01	0.053	0	1
C16(3)	OFN2	3.433	20	80	0	0	0	0	260	260	0	0.5	0.5	0	0.01	0.053	0	1
C16(5)	N7	3.028	20	80	0	0	0	0	300	300	0	0.5	0.5	0	0.01	0.053	0	1
C10	N115	2.392	70	30	0	0	0	0	260	260	0	0.4	0.4	0	0.01	0.053	0	1
C8	DN4	2.822	90	10	0	0	0	0	360	310	0	0.3	0.3	0	0.01	0.053	0	1
C4	N19	22.765	100	0	0	0	0	0	965	0	0	0.4	0	0	0.033	0	0	1
C17(3)	N30	3.42	10	90	0	0	0	5	260	260	1	1.2	1.2	1	0.035	0.053	0.001	1
C3	DN31	1.155	40	60	0	0	0	0	285	355	0	1.7	0.1	0	0.033	0.053	0	1
C7	N87	5.13	70	30	0	0	0	0	453	268	0	0.7	0.8	0	0.01	0.053	0	1
C16 (1)	Overflow No	3.942	20	80	0	0	0	0	271	271	0	1	1	0	0.01	0.053	0	1
C2 (1)	Overflow No	19.943	5	95	0	0	0	0	1453	1806	0	0.6	0.6	0	0.013	0.053	0	1
C17(1)	N27	3.012	5	95	0	0	0	5	450	450	1	0.55	0.55	1	0.035	0.053	0.001	1
C17(2)	N26	10.202	5	95	0	0	0	5	430	430	1	0.8	0.8	1	0.035	0.053	0.001	1

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)
Pipe112	HW1	N13	15	1.51	1.45	0.4	Box culverts	0.6W x 0.45H		0.012	Existing	2	HW1	0					
GA Apron Cu	HW2	N53	80	3.7	2.8	1.13	Concrete, ur	300	300	0.013	NewFixed	1	HW2	0					
Culvert 1	HW3	N54	100	2.29	2.138	0.15	Box culverts	0.9W x 0.47H		0.012	NewFixed	1	HW3	0					
Culvert2	HW6	N55	100	2.9	2.1	0.8	Box culverts	0.9W x 0.47H		0.012	Existing	1	HW6	0					
Existing Culv	South Basin	N14	40	1.4	1.35	0.12	Concrete, ur	900	900	0.013	NewFixed	2	South Basin	0					
DischargePip	N19	N30	12	3.2	1.8	11.67	Concrete, ur	225	225	0.013	New	5	N19	0					

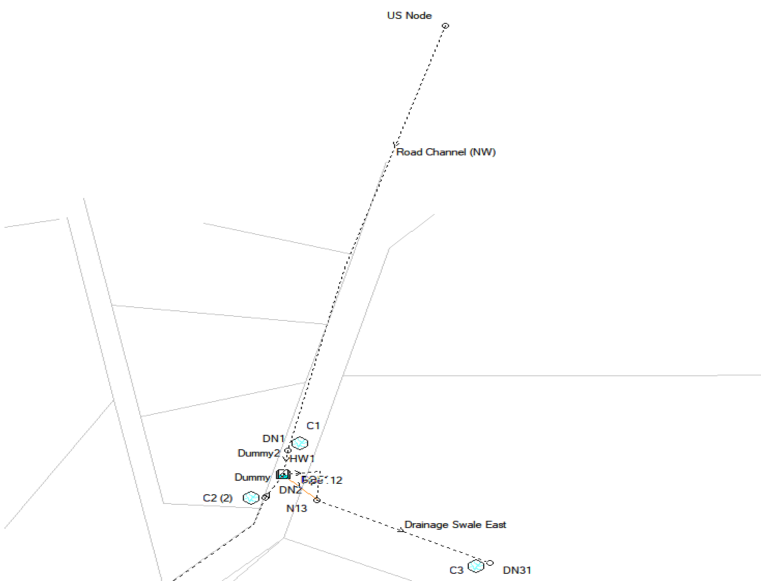
OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storm (m)	SafeDepth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %		id	U/S IL	D/S IL	Length (m)
DOF1	HW1	N13	0.1	3.8	10	1.7	Overflow ac	0.05	0	0.6	13	0		458	3.8	1.45	15
Drainage Sw	N13	DN31	0.3				Road West (	0.5	0.5	0.6	0.25	100		52	1.45	1.4	20
Road Chann	US Node 2	Overflow No	14.1				Road West (	0.5	0.5	0.6	0.58	100		17	9	5.1024	1300
Mosquito Dr	N6	N27	6.8				Mosquito Dr	0.8	0.8	0.6	0.13	100		72723	3	2.519	370
Overtopping	HW2	N53	1.3	4.2	10	1.7	Overflow ac	0.05	0	0.6	1.88	0		621	4.3	2.8	80
South GA Ba	N53	N115	1.5				East GA Gras	0.3	0.3	0.6	0.51	100		335	2.8	2.39	80
Overtopping	HW3	N54	0.7	3.2	20	1.7	Overflow ac	0.05	0	0.6	9.1	0		460	3.2	2.138	100
Dummy Ove	N54	South Basin	0.1				Overflow ac	0.05	0	0.6	3.38	0		385	2.138	1.8	10
DOF3	HW6	N55	1.8	3.6	10	1.7	Overflow ac	0.05	0	0.6	1.5	0		461	3.6	2.1	100
Dummy Ove	N55	South Basin	0.1				Overflow ac	0.05	0	0.6	3	0		386	2.1	1.8	10
Dummy	DN2	HW1	0.3				Road West (	0.5	0.5	0.6	0.5	0		109	1.52	1.51	30
Dummy2	DN1	HW1	0.3				Road West (	0.5	0.5	0.6	0.5	0		98	1.52	1.51	30
Road Chann	US Node	DN1	10.4				Road West (	0.5	0.5	0.6	0.54	100		10	6.6	1.52	940
Overflow Ca	N11	N87	1.5				South West	0.8	0.8	0.6	1.57	100		357	5	1.8	230
Overtopping	South Basin	DN	0.5	3.6	20	1.7	Overflow ac	0.05	0	0.6	4	0		403	3.6	2	40
Overtopping	South Basin	N14	0.6	3.4	20	1.7	Overflow ac	0.05	0	0.6	0.5	0		378	3.4	3.3	20
South GA Ch	N44	HW3	1.2				Southern GA	0.4	0.4	0.6	1.51	100		346	5	2.29	180
Road Chann	N65	Overflow No	4.5				Airport Acce	0.4	0.4	0.6	0.14	100		72796	5.2	4.9	220
C13 Overflov	US3	South Basin	0.1				Open Chann	0.3	0.3	0.6	0.6	100		225	6	1.8	10
OF1	N98	N11	0.1				Overflow ac	0.05	0	0.6	4	0		793	5.2	5	5
Road Chann	N98	OFN2	4.1				Airport Acce	0.4	0.4	0.6	0.11	100		532	4.8	4.6	180
OF3	OFN3	N44	0.1				Overflow ac	0.05	0	0.6	4	0		548	5.2	5	5
Road Chann	OFN3	N7	1.2				Airport Acce	0.4	0.4	0.6	0.4	100		541	4.4	4	100
OF2	OFN2	HW2	0.1				Overflow ac	0.05	0	0.6	4	0		785	5.2	5	5
Road Chann	OFN2	OFN3	2.5				Airport Acce	0.4	0.4	0.6	0.15	100		573	4.6	4.4	130
C12 Overflov	N7	HW6	4.2				Airport Acce	0.4	0.4	0.6	0.3	100		360	4	2.9	300
DummyFlow	N115	HW3	0.1				Northern Ba	0.3	0.3	0.6	2	0		844	2.39	2.29	1
DummyFlow	DN4	HW3	0.2				Overflow ac	0.05	0	0.6	8.55	0		700	4	2.29	20
Dummy Flov	N30	N52	0.1				Mosquito Dr	0.8	0.8	0.6	6	0		871	1.8	1.4	1
Basin Overfl	N87	N52	0.1				Northern Ba	0.3	0.3	0.6	8	0		72582	1.8	1.4	5
Overflow 2	Overflow No	N36	1.1				Overflow ac	0.05	0	0.6	1	0		72676	5.1	4.6	50
Road Chann	Overflow No	N98	6.8				Airport Acce	0.4	0.4	0.6	0.05	100		41	4.9	4.8	200
Road Chann	Overflow No	DN2	6.8				Road West (	0.5	0.5	0.6	0.57	100		72746	5.1024	1.52	628
Overflow 1	Overflow No	N27	1.4				Overflow ac	0.05	0	0.6	2.58	0		72679	5.28	2.519	100
Mosquito Dr	N27	N26	5.7				Mosquito Dr	0.8	0.8	0.6	0.13	100		72707	2.519	2.116	310
Mosquito Dr	N26	N30	4.6				Mosquito Dr	0.8	0.8	0.6	0.13	100		5	2.116	1.8	250
Overflow 2 (	N36	N26	1.4				Grass Area	0.3	0.3	0.6	1.25	0		100083	4.6	2.116	200

This model has no pipes with non-return valves

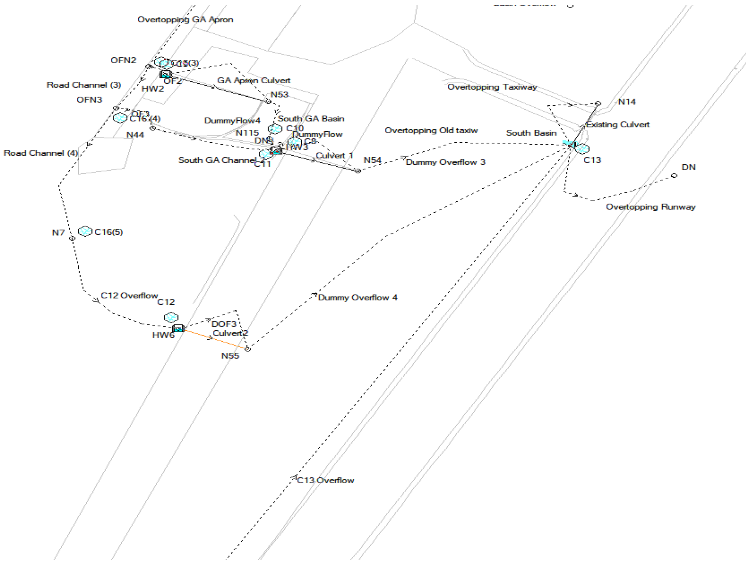
Existing Model Schematic

Part 1



Part 2

Part 3



Existing Model -10%

DRAINS results prepared from Version 2020.036

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW1	3.21		2.123		0.59	0	Headwall height/system capacity
N13	1.64		0				
US Node 2	9		0				
N6	3.22		0				
HW2	4.31		0.142		-0.11	0.004	Headwall height/system capacity
N53	2.92		0.004				
HW3	2.92		3.247		0.28	0	None
N54	2.19		0				
HW6	3.83		2.032		-0.23	1.689	Headwall height/system capacity
N55	2.21		1.689				
DN2	3.21		1.422				
DN1	3.21		3.274				
US Node	6.6		0				
N11	5		0				
N14	1.4		0				
N44	5		0				
N65	5.4		0				
US3	6		0				
N98	5.16		0.279				
OFN3	4.78		0.917				
OFN2	5.02		0.565				
N7	4.45		1.234				
N115	2.92		0.416				
DN4	4.04		0.857				
N19	23.94		3.364				
N30	2.19		1.021				
N87	1.81		0.619				
Overflow Node 2	5.17		0.334				
Overflow Node 3	5.21		0.5				
N27	3.08		0.151				
N26	2.81		1.201				
N36	4.62		0.768				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	EIA Max Q (cu.m/s)	Remaining Max Q (cu.m/s)	EIA Tc (cu.m/s)	RIA Tc (min)	PA Tc (min)	Due to Storm (min)
C9	0.142	0.136	0.016	4.03	0	10.16	10% AEP, 15 min burst, Storm 6
C11	0.287	0.067	0.22	14.18	0	34.3	10% AEP, 1 hour burst, Storm 6
C12	1.216	0.193	1.113	22.95	0	46.63	10% AEP, 2 hour burst, Storm 1
C2 (2)	1	0.14	0.909	45.16	0	119.58	10% AEP, 2 hour burst, Storm 1
C1	6.548	5.427	1.135	28	0	59.12	10% AEP, 30 min burst, Storm 8
C13	1.798	0.974	0.827	41.51	0	102.83	10% AEP, 1 hour burst, Storm 6
C16(2)	0.426	0.142	0.34	8.55	0	23.26	10% AEP, 30 min burst, Storm 8
C16 (4)	0.174	0.057	0.14	8.39	0	22.81	10% AEP, 30 min burst, Storm 8
C16(3)	0.563	0.134	0.429	12.29	0	33.44	10% AEP, 1 hour burst, Storm 6
C16(5)	0.489	0.116	0.375	13.39	0	36.43	10% AEP, 1 hour burst, Storm 6
C10	0.615	0.615	0	9.75	0	26.51	10% AEP, 15 min burst, Storm 6
C8	0.857	0.838	0.019	12.91	0	32.11	10% AEP, 15 min burst, Storm 6
C4	3.364	3.364	0	59.09	0	0	10% AEP, 1 hour burst, Storm 6
C17(3)	0.475	0.059	0.416	20.05	5.09	25.71	10% AEP, 1 hour burst, Storm 6
C3	0.18	0.149	0.031	13.66	0	48.43	10% AEP, 15 min burst, Storm 6
C7	1.239	1.239	0	11.5	0	21.93	10% AEP, 15 min burst, Storm 6
C16 (1)	0.672	0.227	0.534	8.71	0	23.68	10% AEP, 30 min burst, Storm 8
C2 (1)	1	0.14	0.909	45.16	0	119.58	10% AEP, 2 hour burst, Storm 1
C17(1)	0.303	0.022	0.288	41.57	5.11	53.32	10% AEP, 2 hour burst, Storm 1
C17(2)	1.094	0.077	1.038	36.15	5.11	46.37	10% AEP, 2 hour burst, Storm 1

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe112	1.64	3.04	1.96	1.9	10% AEP, 12 hour burst, Storm 6
GA Apron Culvert	0.115	1.78	3.956	3.056	10% AEP, 15 min burst, Storm 6
Culvert 1	0.631	1.9	2.659	2.507	10% AEP, 1 hour burst, Storm 6
Culvert2	0.896	2.61	3.282	2.482	10% AEP, 1 hour burst, Storm 6
Existing Culvert	0.962	1.74	1.804	1.754	10% AEP, 12 hour burst, Storm 6
DischargePipes	3.365	16.93	23.936	2.193	10% AEP, 1 hour burst, Storm 6

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
South Basin	2.05	27047.5	0.962	0.962	0

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
DOF1	0	0	1.04	0	0	0	0	
Drainage Swale East	1.64	1.665	8.497	0.191	0.12	14.15	0.64	10% AEP, 12 hour burst, Storm 6
Road Channel (SW1)	0	0.954	8.536	0.128	0.07	13.77	0.67	10% AEP, 15 min burst, Storm 6
Mosquito Drain (1)	0.003	0.291	0.872	0.556	0.24	2.43	0.43	10% AEP, 1 hour burst, Storm 6
Overtopping GA Apron	0.004	0.002	0.396	0.12	0	18.7	1.54	10% AEP, 15 min burst, Storm 6
South GA Basin	0.136	0.514	10.417	0.533	0.01	40	0.03	10% AEP, 30 min burst, Storm 8
Overtopping Old taxiw	0	0	0.87	0	0	0	0	
Dummy Overflow 3	0.634	0.634	0.531	0.255	0.08	27.29	1.62	10% AEP, 2 hour burst, Storm 1
DOF3	1.689	1.688	0.353	0.105	0.15	17.21	1.52	10% AEP, 1 hour burst, Storm 6
Dummy Overflow 4	2.582	2.582	0.5	0.255	0.23	27.29	2.17	10% AEP, 1 hour burst, Storm 6
Dummy	1.361	1.361	8.539	1.703	0.02	179.64	0.01	10% AEP, 2 hour burst, Storm 1
Dummy2	4.147	4.147	8.539	1.703	0.06	179.64	0.03	10% AEP, 30 min burst, Storm 8
Road Channel (NW)	0	5.215	8.517	1.693	0.25	178.27	0.85	10% AEP, 15 min burst, Storm 6
Overflow Catchment 4	0	1.219	3.546	0.152	0.22	6.11	1.62	10% AEP, 15 min burst, Storm 6
Overtopping Runway	0	0	0.577	0	0	0	0	
Overtopping Taxiway	0	0	0.204	0	0	0	0	
South GA Channel 2	0	0.282	3.493	0.633	0.04	8	0.68	10% AEP, 15 min burst, Storm 6
Road Channel (1-A)	0.015	0.653	0.73	0.335	0.36	3.04	1.29	10% AEP, 15 min burst, Storm 6
C13 Overflow	0	1.798	55.217	0.255	0.02	96.73	1.17	10% AEP, 15 min burst, Storm 6
OF1	0	0	0.577	0	0	0	0	
Road Channel (2)	0.303	0.838	0.647	0.429	0.37	3.61	0.88	10% AEP, 30 min burst, Storm 8
OF3	0	0	0.577	0	0	0	0	
Road Channel (4)	0.995	1.473	1.233	0.452	0.62	3.74	1.37	10% AEP, 1 hour burst, Storm 6
OF2	0	0	0.577	0	0	0	0	
Road Channel (3)	0.839	0.995	0.755	0.423	0.46	3.58	1.22	10% AEP, 1 hour burst, Storm 6
C12 Overflow	1.473	2.586	1.068	0.934	0.84	3.74	1.37	10% AEP, 1 hour burst, Storm 6
DummyFlow4	2.758	2.758	52.983	0.633	0.03	91.8	0.06	10% AEP, 1 hour burst, Storm 6
DummyFlow	0.856	0.856	0.844	0.633	0.12	30	2.59	10% AEP, 15 min burst, Storm 6
Dummy Flow 5	3.752	3.752	0.275	0.393	4.38	1.72	11.21	10% AEP, 1 hour burst, Storm 6
Basin Overflow	1.219	1.219	53.018	0.015	0.01	88.09	0.94	10% AEP, 15 min burst, Storm 6
Overflow 2	0.768	0.767	0.289	0.08	0.08	14.68	1.08	10% AEP, 30 min burst, Storm 8
Road Channel (1 -B)	0.115	0.308	0.436	0.358	0.15	3.18	0.41	10% AEP, 1.5 hour burst, Storm 6
Road Channel (SW2)	0.954	1.497	8.534	1.693	0.08	178.31	0.67	10% AEP, 2 hour burst, Storm 1
Overflow 1	0	0	0.463	0	0	0	0	
Mosquito Drain (2)	0.309	1.256	0.872	0.698	0.82	3.05	1.18	10% AEP, 2 hour burst, Storm 1
Mosquito Drain (3)	0.97	1.083	0.872	0.704	0.9	3.08	1.64	10% AEP, 2 hour burst, Storm 1
Overflow 2 (2)	0.751	0.745	74.261	0.698	0.01	140.94	0.39	10% AEP, 30 min burst, Storm 8

CONTINUITY CHECK for 10% AEP, 2 hour burst, Storm 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
HW1	15136.91	11129.92	0	26.5
N13	11129.92	10742.85	0	3.5
US Node 2	0	-3184.46	0	0
N6	0	-545.58	0	0
HW2	246.84	246.68	0	0.1
N53	246.68	-499.8	0	302.6
HW3	1484.58	4201.14	0	-183
N54	4201.14	4176.73	0	0.6
HW6	9928.16	9834.35	0	0.9
N55	9915.79	9895.86	0	0.2
DN2	2253.14	-2623.55	0	216.4
DN1	22718.77	17760.46	0	21.8
US Node	0	-15869.51	0	0
N11	0	-1551.74	0	0
South Basin	25556.89	5495.01	20094.37	-0.1
N14	3830.99	3830.99	0	0
N44	0	-482.24	0	0
N52	24239.95	24239.95	0	0
N65	0	-1079.97	0	0
DN	0	0	0	0
US3	0	-5744.24	0	0
N98	1601.36	653.3	0	59.2
OFN3	3958.7	3121.75	0	21.1
OFN2	3443.59	3159.2	0	8.3
N7	5598.01	3382.39	0	39.6
N115	1626.74	-1385.81	0	185.2
DN4	1909.44	1910.06	0	0
N19	15818.25	15818.04	0	0
N30	21149.12	21143.78	0	0
DN31	11709.57	11709.57	0	0
N87	3096.52	3096.17	0	0
Overflow Node 2	2151.66	1434.83	0	33.3
Overflow Node 3	4647.22	1375.91	0	70.4
N27	1049.97	-907.93	0	186.5
N26	5991.9	3594.22	0	40
N36	1864.85	1699.2	0	8.9

Design Model A

PIT / NODE DETAILS Version 15

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is	Internal Width (mm)	Inflow is Misaligned	Minor Safe Pond Depth (m)	Major Safe Pond Depth (m)
HW1	Headwall				0.5	3.8		0		46408.82	204322.278		4							
N13	Node					3.4		0		46449.626	204282.929		51		No					
US Node 2	Node					9		0		45416.348	203504.691		18		No					
N6	Node					3		0		46319.815	204127.202		21		No					
HW2	Headwall				0.5	4.2		0		45621.352	203079.714		42							
N53	Node					3.6		0		45738.962	203035.923		242		No					
HW3	Headwall				0.5	3.2		0		45748.265	202956.719		43							
N54	Node					3.2		0		45842.717	202924.774		247		No					
HW6	Headwall				0.5	3.6		0		45635.584	202672.814		63							
N55	Node					3.2		0		45715.226	202639.886		248		No					
DN2	Node					1.52		0		46387.309	204286.252		77		No					
DN1	Node					1.52		0		46414.066	204360.228		78		No					
US Node	Node					6.6		0		46603.522	205018.833		85		No					
N11	Node					5		0		45762.317	203316.601		202		No					
N14	Node					2.8		0		46121.717	203033.231		54		No					
N44	Node					5		0		45605.049	202994.028		213		No					
N52	Node					1.4		0		46089.663	203189.928		235		No					
N65	Node					5.2		0		45738.962	203669.847		319		No					
DN	Node					2		0		46209.389	202918.206		419		No					
US3	Node					6		0		45453.203	201907.075		435		No					
N98	Node					4.8		0		45721.376	203324.639		530		No					
OFN2	Node					4.55		0		45600.421	203092.506		562		No					
N7	Node					4.8		0		45511.683	202817.336		619		No					
DN4	Node					4		0		45757.906	202981.826		696		No					
N19	Node					5		0		46052.666	203322.375		932		No					
N30	Node					1.8		0		46050.522	203303.748		151		No					
Overflow Node 3	Node					5.6		0		46095.779	203999.262		72677		No					
N27	Node					2.519		0		46116.304	203884.685		72678		No					
N26	Node					2.116		0		45993.005	203564.645		72699		No					
N3	Node					5.2		0		45521.978	203008.506		100192		No					
N364	Node					1.8		0		45971.286	203236.272		100751		No					
N333	Node					1.4		0		46656.622	204190.537		100761		No					
N48	Node					2.3		0		45746.904	202977.095		133086		No					
HW5	Headwall				0.5	5.2		0		45755.78	203517.582		133239							
N36	Node					4.6		0		45853.093	203523.757		100079		No					
HW7	Headwall				0.5	5.2		0		45562.306	203026.225		133248							
N38	Node					4.9		0		45514.458	202899.518		133156		No					

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(r	id
South Basin	1.4	2638		Culvert	0.5					46090.122	202966.275	No			210
	1.6	24250													
	1.8	55403													
	3.2	231242													
	4.5	231242													
Basin 1	3.25	289		None						45718.076	203630.732	No			101328
	5.25	828													
	6	828													
Basin2	2.85	196		None						45704.574	203343.213	No			101349
	4.85	561													
	5.85	561													
Basin3	2.99	324		None						45592.4	203111.91	No			101370
	4.65	803													
	5.25	803													
Basin1476	2.99	100		None						45556.404	203029.325	No			101378
	4.45	227													
	5.55	227													
Basin 5	3.3	225		None						45469.687	202993.48	No			101409
	5.3	645													
	6.5	645													
Basin8	2.99	1681		None						46091.845	203888.034	No			101465
	3.99	3047													
	4.59	3047													

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	RI (m)	Chg (m)	RL (m)	etc (m)
Pipe112	HW1	N13	15	1.51	1.45	0.4	Box culverts (samples)	0.6W x 0.45H		0.012	Existing	2	HW1	0					
GA Apron Culvert	HW2	N53	80	3.7	2.8	1.13	Concrete, under roads, 1% minimum slope	300	300	0.013	NewFixed	2	HW2	0					
Culvert 1	HW3	N54	100	2.29	2.138	0.15	Box culverts (samples)	0.9W x 0.47H		0.012	NewFixed	3	HW3	0					
Culvert2	HW6	N55	100	2.9	2.1	0.8	Box culverts (samples)	0.9W x 0.47H		0.012	Existing	6	HW6	0					
Existing Culvert	South Basin	N14	40	1.4	1.35	0.12	Concrete, under roads, 1% minimum slope	900	900	0.013	NewFixed	2	South Basin	0					
DischargePipes	N19	N30	12	3.2	1.8	11.67	Concrete, under roads, 1% minimum slope	225	225	0.013	New	5	N19	0					
Proposed Culvert	HW5	N36	25	4.3	3.6	2.8	Concrete, under roads, 1% minimum slope	600	600	0.013	NewFixed	2	HW5	0					
Proposed Culvert 2	HW7	N38	50	4.35	4	0.7	Concrete, under roads, 1% minimum slope	600	600	0.013	NewFixed	3	HW7	0					

Attachment 15.1A - Proposed Development - Onslow Industrial Park

SUB-CATCHMENT DETAILS

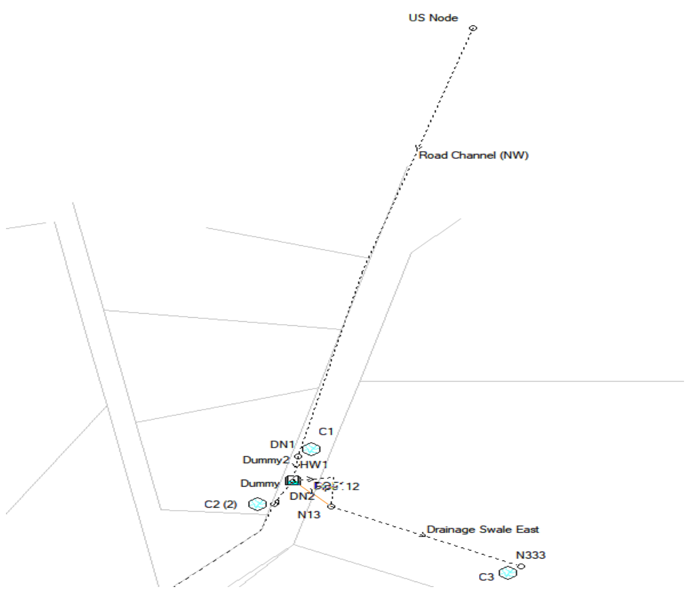
Name	Pit or Node	Total Area (ha)	EIA %	Perv Area %	RIA %	EIA Time (min)	Perv Time (min)	RIA Time (min)	EIA Length (m)	Perv Length (m)	RIA Length (m)	EIA Slope(%) %	Perv Slope %	RIA Slope %	EIA Rough	Perv Rough	RIA Rough	Rainfall Multiplier
C9	HW2	0.601	80	20	0	0	0	0	101.9	88.4	0	1.17	1.13	0	0.01	0.053	0	1
C11	HW3	2.379	20	80	0	0	0	0	295	227	0	0.4	0.35	0	0.01	0.053	0	1
C12	HW6	9.335	80	20	0	0	0	0	499	434	0	0.4	0.8	0	0.01	0.053	0	1
C2 (2)	DN2	19.943	5	95	0	0	0	0	1453	1806	0	0.6	0.6	0	0.013	0.053	0	1
C1	DN1	68.343	60	40	0	0	0	0	1385	1181	0	0.9	0.9	0	0.013	0.053	0	1
C13	South Basin	30.56	20	80	0	0	0	0	1505	1310	0	0.29	0.3	0	0.01	0.053	0	1
C8	DN4	2.822	90	10	0	0	0	0	360	310	0	0.3	0.3	0	0.01	0.053	0	1
C4	N19	22.765	1	99	0	0	0	0	965	965	0	0.4	0.4	0	0.0333	0.0333	0	1
C17(3)	N30	3.42	70	30	0	0	0	5	260	260	1	1.2	1.2	1	0.035	0.053	0.001	1
C2 (1)	Overflow Node 3	19.943	5	95	0	0	0	0	1453	1806	0	0.6	0.6	0	0.013	0.053	0	1
C17(1)	N27	3.012	15	85	0	0	0	5	450	450	1	0.55	0.55	1	0.035	0.053	0.001	1
C7	N364	5.13	70	30	0	0	0	0	453	268	0	0.7	0.8	0	0.01	0.053	0	1
C3	N333	1.155	40	60	0	0	0	0	285	355	0	1.7	0.1	0	0.033	0.053	0	1
C16 (1-A)	Basin 1	3.942	80	20	0	0	0	0	271	271	0	1	1	0	0.01	0.053	0	1
C16(2)	Basin2	2.467	80	20	0	0	0	0	220	220	0	0.7	0.7	0	0.01	0.053	0	1
C16(3)	Basin3	3.433	80	20	0	0	0	0	260	260	0	0.5	0.5	0	0.01	0.053	0	1
C16 (4)	Basin1476	0.933	80	20	0	0	0	0	180	180	0	0.5	0.5	0	0.01	0.053	0	1
C16(5)	Basin 5	2.787	90	10	0	0	0	0	300	300	0	0.5	0.5	0	0.01	0.053	0	1
C17(2)	Basin8	10.202	80	20	0	0	0	5	430	430	1	0.8	0.8	1	0.035	0.053	0.001	1
C10	N48	2.269	70	30	0	0	0	0	260	260	0	0.4	0.4	0	0.01	0.053	0	1

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storms (m)	SafeDepth Minor Storms (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %		id	U/S IL	D/S IL	Length (m)
DOF1	HW1	N13	0.1	3.8	10	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	13	0		458	3.8	1.45	15
Drainage Swale East	N13	N333	0.3				Drainage Swale East	0.3	0.3	0.6	0.25	100		52	1.45	1.4	20
Road Channel (SW1)	US Node 2	Overflow Nod	14.1				Road West Catchment	0.5	0.5	0.6	0.58	100		17	9	5.1024	1300
Mosquito Drain (1)	N6	N27	6.7				Dev Mosquito Drain	1.2	1.2	0.6	0.13	100		72723	3	2.519	370
Overtopping GA Apron	HW2	N53	1.3	4.2	10	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	1.88	0		621	4.3	2.8	80
South GA Basin	N53	N48	1.3				East GA Grass Basin	0.3	0.3	0.6	0.63	100		335	2.8	2.3	80
Overtopping Old taxiw	HW3	N54	0.7	3.2	20	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	9.1	0		460	3.2	2.138	100
Dummy Overflow 3	N54	South Basin	0.1				Overflow across road low point - parabola x = 15, y	0.05	0	0.6	3.38	0		385	2.138	1.8	10
DOF3	HW6	N55	1.8	3.6	10	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	1.5	0		461	3.6	2.1	100
Dummy Overflow 4	N55	South Basin	0.1				Overflow across road low point - parabola x = 15, y	0.05	0	0.6	3	0		386	2.1	1.8	10
Dummy	DN2	HW1	0.3				Road West Catchment	0.5	0.5	0.6	0.5	0		109	1.52	1.51	30
Dummy2	DN1	HW1	0.3				Road West Catchment	0.5	0.5	0.6	0.5	0		98	1.52	1.51	30
Road Channel (NW)	US Node	DN1	10.4				Road West Catchment	0.5	0.5	0.6	0.54	100		10	6.6	1.52	940
Overflow Catchment 4	N11	N364	1.6				South West Channel	0.8	0.8	0.6	1.39	100		357	5	1.8	230
Overtopping Runway	South Basin	DN	0.5	3.6	20	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	4	0		403	3.6	2	40
Overtopping Taxiway	South Basin	N14	0.6	3.4	20	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	0.5	0		378	3.4	3.3	20
South GA Channel 2	N44	HW3	1.4				Southern GA Apron Channels	0.4	0.4	0.6	1	100		346	5	2.29	180
Road Channel (1-A)	N65	HW5	5				Dev Airport Access Track (2)	0.3	0.3	0.6	0.14	100		72796	5.15	4.4	220
C13 Overflow	US3	South Basin	0.1				Open Channel (OldvsNew Runway)	0.3	0.3	0.6	0.6	100		225	6	1.8	10
OF1	N98	N11	0.1				Overflow across road low point - parabola x = 15, y	0.05	0	0.6	4	0		793	5.2	5	5
Road Channel (2)	N98	OFN2	6.2				Dev Airport Access Track (2)	0.3	0.3	0.6	0.06	100		532	4.75	4.55	180
OF2	OFN2	HW2	0.1				Overflow across road low point - parabola x = 15, y	0.05	0	0.6	4	0		785	5.2	5	5
Road Channel (3)	OFN2	HW7	2.8				Dev Airport Access Track (2)	0.3	0.3	0.6	0.15	100		573	4.55	4.35	130
C12 Overflow	N7	HW6	4				Airport Access Road Channel	0.4	0.4	0.6	0.33	100		360	3.9	2.9	300
DummyFlow	DN4	HW3	0.8				Overflow across road low point - parabola x = 15, y	0.05	0	0.6	8.55	0		700	4	2.29	100
DFO	N19	N30	0.1				Overflow across road low point - parabola x = 15, y	0.05	0	0.6	11.67	0		100129	3.2	1.8	12
Dummy Flow 5	N30	N52	0.1				Mosquito Drain	0.8	0.8	0.6	6	0		871	1.8	1.4	1
Road Channel (SW2)	Overflow Node 3	DN2	6.8				Road West Catchment	0.5	0.5	0.6	0.57	100		72746	5.1024	1.52	628
Overflow 1	Overflow Node 3	N27	1.4				Overflow across road low point - parabola x = 15, y	0.05	0	0.6	2.58	0		72679	5.28	2.519	100
Mosquito Drain (2)	N27	N26	5.6				Dev Mosquito Drain	1.2	1.2	0.6	0.13	100		72707	2.519	2.116	310
Mosquito Drain (3)	N26	N30	4.5				Dev Mosquito Drain	1.2	1.2	0.6	0.13	100		5	2.116	1.8	250
New Proposed Channe	N3	N38	0.9				Airport Access Road Channel	0.4	0.4	0.6	0.5	0		541	4.6	4	80
Basin Overflow	N364	N52	0.1				Northern Basin Channel	0.3	0.3	0.6	8	0		100752	1.8	1.4	5
Basin OF	Basin 1	N65	0.1	5.25	8	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	2	0		101346	5.25	5.15	5
Basin OF 2	Basin2	N98	0.1	4.85	8	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	4	0		101358	4.85	4.75	5
Basin OF 3	Basin3	OFN2	0.1	4.65	8	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	2	0		101376	4.65	4.55	5
Basin OF 4	Basin1476	HW7	0.1	4.45	8	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	2	0		101399	4.45	4.35	5
OF Basin 5	Basin 5	N3	0.1	5.3	8	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	2	0		101404	5.3	4.6	5
Basin OF 8	Basin8	N27	0.1	3.99	8	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	9.9	0		101471	3.99	2.519	10
DummyFlow5	N48	HW3	0.1				East GA Grass Basin	0.3	0.3	0.6	1	0		133087	2.3	2.29	1
Dummy Overflow	HW5	N36	0.5	5.2	10	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	1.67	0		133118	5.1	4.6	30
Road Channel (1 -B)	HW5	N98	7.5	5.2	10	1.7	Dev Airport Access Track (2)	0.3	0.3	0.6	0.05	100		41	4.85	4.75	200
Overflow Channel	N36	N26	0.9				Dev Mosquito Drain	1.2	1.2	0.6	1.48	0		100083	3.6	2.116	100
DummyOverflow	HW7	N38	1.5	5.2	10	1.7	Overflow across road low point - parabola x = 15, y	0.05	0	0.6	0.6	0		133120	5.2	4.9	50
New Proposed Channe	N38	N7	0.2				Airport Access Road Channel	0.4	0.4	0.6	0.5	0		133164	4	3.9	20

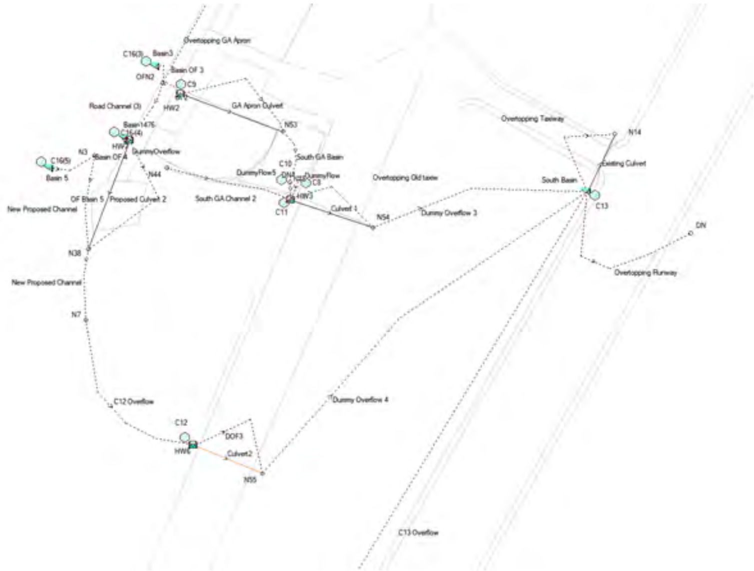
Design Model A Schematic

Part 1



Part 2

Part 3



Attachment 15.1A - Proposed Development - Onslow Industrial Park

DESIGN MODEL A - 10% Results

DRAINS results prepared from Version 2020.036

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW1	3.31		2.641		0.49	0	None
N13	1.7		0				
US Node 2	9		0				
N6	3.22		0				
HW2	4.26		0.227		-0.06	0	None
N53	2.83		0				
HW3	2.7		1.076		0.5	0	None
N54	2.2		0				
HW6	3.31		1.432		0.29	0	None
N55	2.2		0				
DN2	3.31		1.415				
DN1	3.31		4.989				
US Node	6.6		0				
N11	5		0				
N14	1.4		0				
N44	5		0				
N65	5.41		0.636				
US3	6		0				
N98	4.96		0.379				
OFN2	4.88		0.578				
N7	4.27		0.907				
DN4	4.07		0.857				
N19	3.27		2.468				
N30	2.21		3.883				
Overflow Node 3	5.21		0.5				
N27	3.17		1.169				
N26	2.84		1.47				
N3	4.81		0.463				
N364	1.81		0.619				
N48	2.7		0.482				
HW5	4.87		0.629		0.33	0	None
N36	3.92		0				
HW7	4.85		0.609		0.35	0	None
N38	4.35		0.463				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	EIA Max Q (cu.m/s)	Remaining Max Q (cu.m/s)	EIA Tc (cu.m/s)	RIA Tc (min)	PA Tc (min)	Due to Storm (min)
C9	0.227	0.218	0.025	4.03	0	10.16	10% AEP, 15 min burst, Storm 6
C11	0.388	0.09	0.298	14.18	0	34.3	10% AEP, 1 hour burst, Storm 6
C12	2.349	2.349	0	14.41	0	29.28	10% AEP, 15 min burst, Storm 6
C2 (2)	1	0.14	0.909	45.16	0	119.58	10% AEP, 2 hour burst, Storm 1
C1	9.978	9.303	0.698	28	0	59.12	10% AEP, 30 min burst, Storm 8
C13	1.798	0.974	0.827	41.51	0	102.83	10% AEP, 1 hour burst, Storm 6
C8	0.857	0.838	0.019	12.91	0	32.11	10% AEP, 15 min burst, Storm 6
C4	2.468	0.027	2.442	70.16	0	70.16	10% AEP, 2 hour burst, Storm 1
C17(3)	0.73	0.73	0	14.86	5.07	19.06	10% AEP, 15 min burst, Storm 6
C2 (1)	1	0.14	0.909	45.16	0	119.58	10% AEP, 2 hour burst, Storm 1
C17(1)	0.304	0.065	0.257	41.57	5.11	53.32	10% AEP, 2 hour burst, Storm 1
C7	1.239	1.239	0	11.5	0	21.93	10% AEP, 15 min burst, Storm 6
C3	0.18	0.149	0.031	13.66	0	48.43	10% AEP, 15 min burst, Storm 6
C16 (1-A)	1.296	1.239	0.082	7.59	0	20.64	10% AEP, 15 min burst, Storm 6
C16(2)	0.814	0.779	0.052	7.45	0	20.27	10% AEP, 15 min burst, Storm 6
C16(3)	1.079	1.026	0.059	9.11	0	24.79	10% AEP, 15 min burst, Storm 6
C16 (4)	0.31	0.297	0.02	7.31	0	19.88	10% AEP, 15 min burst, Storm 6
C16(5)	0.939	0.917	0.022	9.93	0	27.01	10% AEP, 15 min burst, Storm 6
C17(2)	1.977	1.9	0.092	26.04	5.08	33.41	10% AEP, 30 min burst, Storm 8
C10	0.583	0.583	0	9.75	0	26.51	10% AEP, 15 min burst, Storm 6

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe112	1.695	3.14	1.96	1.9	10% AEP, 12 hour burst, Storm 6
GA Apron Culvert	0.22	1.73	3.953	3.053	10% AEP, 15 min burst, Storm 6
Culvert 1	1.069	1.57	2.542	2.39	10% AEP, 30 min burst, Storm 8
Culvert2	2.182	2.01	3.101	2.301	10% AEP, 15 min burst, Storm 6
Existing Culvert	0.897	1.7	1.79	1.74	10% AEP, 12 hour burst, Storm 6
DischargePipes	0.16	3.05	3.27	2.207	10% AEP, 2 hour burst, Storm 1
Proposed Culvert	0.574	1.89	4.617	3.917	10% AEP, 1 hour burst, Storm 6
Proposed Culvert 2	0.709	1.4	4.696	4.346	10% AEP, 4.5 hour burst, Storm 6

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
South Basin	2.02	24735.7	0.897	0.897	0
Basin 1	5.44	1228.8	0.636	0	0.636
Basin2	4.98	797.7	0.383	0	0.383
Basin3	4.88	1088.9	0.48	0	0.48
Basin1476	4.89	331.8	0.326	0	0.326
Basin 5	5.41	904.2	0.463	0	0.463
Basin8	4.17	2891.2	1.026	0	1.026

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
DOF1	0	0	0	0	0	0	0	
Drainage Swale East	1.695	1.719	2.355	0.249	0.25	7.49	1.03	10% AEP, 12 hour burst, Storm 6
Road Channel (SW1)	0	0.95	8.536	0.128	0.07	13.77	0.67	10% AEP, 15 min burst, Storm 6
Mosquito Drain (1)	0.004	0.308	1.175	0.651	0.16	3.91	0.27	10% AEP, 1 hour burst, Storm 6
Overtopping GA Apron	0	0	0	0	0	0	0	
South GA Basin	0.203	0.706	11.578	0.398	0.02	40	0.2	10% AEP, 15 min burst, Storm 6
Overtopping Old taxiw	0	0	0	0	0	0	0	
Dummy Overflow 3	1.067	1.067	0	0.225	0.12	25.49	1.81	10% AEP, 30 min burst, Storm 8
DOF3	0	0	0	0	0	0	0	
Dummy Overflow 4	2.179	2.179	0	0.225	0.2	25.49	2.08	10% AEP, 15 min burst, Storm 6
Dummy	1.476	1.476	8.539	1.801	0.02	192.91	0.01	10% AEP, 2 hour burst, Storm 1
Dummy2	6.433	6.433	8.539	1.801	0.08	192.91	0.05	10% AEP, 30 min burst, Storm 8
Road Channel (NW)	0	7.964	8.517	1.791	0.37	191.52	0.98	10% AEP, 15 min burst, Storm 6
Overflow Catchment 4	0	1.215	3.563	0.152	0.22	6.11	1.63	10% AEP, 15 min burst, Storm 6
Overtopping Runway	0	0	0	0	0	0	0	
Overtopping Taxiway	0	0	0	0	0	0	0	
South GA Channel 2	0	0.381	3.568	0.408	0.06	8	0.86	10% AEP, 15 min burst, Storm 6
Road Channel (1-A)	0.629	0.585	0.532	0.467	0.28	4.3	1.06	10% AEP, 1 hour burst, Storm 6
C13 Overflow	0	1.798	55.217	0.225	0.02	96.55	1.17	10% AEP, 15 min burst, Storm 6
OF1	0	0	0	0	0	0	0	
Road Channel (2)	0.216	0.209	0.348	0.327	0.1	3.46	0.49	10% AEP, 1 hour burst, Storm 6
OF2	0	0	0	0	0	0	0	
Road Channel (3)	0.498	0.475	0.551	0.496	0.2	4.48	0.61	10% AEP, 1 hour burst, Storm 6
C12 Overflow	0.906	2.214	1.12	0.539	0.89	3.74	1.8	10% AEP, 4.5 hour burst, Storm 6
DummyFlow	0.848	0.839	0	0.408	0.09	30	1.36	10% AEP, 15 min burst, Storm 6
DFO	2.308	2.308	0	0.407	0.25	30	3.6	10% AEP, 2 hour burst, Storm 1
Dummy Flow 5	4.149	4.149	0.275	0.41	4.66	1.79	11.47	10% AEP, 2 hour burst, Storm 1
Road Channel (SW2)	0.95	1.586	8.534	1.791	0.08	191.59	0.67	10% AEP, 2 hour burst, Storm 1
Overflow 1	0	0	0	0	0	0	0	
Mosquito Drain (2)	1.16	1.163	1.175	0.721	0.59	4.32	0.91	10% AEP, 2 hour burst, Storm 1
Mosquito Drain (3)	1.449	1.713	1.175	0.735	0.98	4.41	1.69	10% AEP, 2 hour burst, Storm 1
New Proposed Channel	0.463	0.462	1.318	0.346	0.28	3.11	1.34	10% AEP, 1 hour burst, Storm 6
Basin Overflow	1.215	1.215	53.018	0.015	0.01	88.09	0.94	10% AEP, 15 min burst, Storm 6
Basin OF	0.636	0.636	0	0.261	0.04	27.65	0.28	10% AEP, 1 hour burst, Storm 6
Basin OF 2	0.383	0.383	0	0.207	0.03	24.44	0.31	10% AEP, 1 hour burst, Storm 6
Basin OF 3	0.48	0.48	0	0.327	0.03	30	0.12	10% AEP, 1 hour burst, Storm 6
Basin OF 4	0.326	0.326	0	0.496	0.01	30	0.04	10% AEP, 12 hour burst, Storm 6
OF Basin 5	0.463	0.463	0	0.211	0.08	24.65	2.95	10% AEP, 1 hour burst, Storm 6
Basin OF 8	1.026	1.026	0	0.651	0.14	30	3.34	10% AEP, 2 hour burst, Storm 1
DummyFlow5	0.449	0.449	14.586	0.408	0.01	40	0.03	10% AEP, 1 hour burst, Storm 6
Dummy Overflow	0	0	0	0	0	0	0	
Road Channel (1 -B)	0.009	0.051	0.318	0.207	0.03	2.74	0.23	10% AEP, 1 hour burst, Storm 6
Overflow Channel	0.574	0.573	0.565	0.721	0.6	4.32	1.91	10% AEP, 1 hour burst, Storm 6
DummyOverflow	0	0	0	0	0	0	0	
New Proposed Channel	0.907	0.907	1.318	0.372	0.44	3.26	1.28	10% AEP, 4.5 hour burst, Storm 6

CONTINUITY CHECK for 10% AEP, 2 hour burst, Storm 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
HW1	16719.17	12123.18	0	27.5
N13	12123.18	11722.61	0	3.3
US Node 2	0	-3184.46	0	0
N6	0	-598.66	0	0
HW2	395.61	395.61	0	0
N53	395.61	-274.01	0	169.3
HW3	4915.8	4879.47	0	0.7
N54	4879.47	4862.97	0	0.3
HW6	8361.69	8347.4	0	0.2
N55	8347.4	8323.45	0	0.3
DN2	613.77	-4989.76	0	913
DN1	27403.81	21708.92	0	20.8
US Node	0	-18900.11	0	0
N11	0	-1551.74	0	0
South Basin	24670.35	5640.42	19061.83	-0.1
N14	3976.41	3976.41	0	0
N44	0	-651.85	0	0
N52	21282.77	21282.77	0	0
N65	1178.12	1096.61	0	6.9
DN	0	0	0	0
US3	0	-5744.24	0	0
N98	652.29	586.14	0	10.1
OFN2	1602.69	1534.62	0	4.2
N7	2583.54	-338.16	0	113.1
DN4	1909.44	1854.83	0	2.9
N19	11678.67	11677.45	0	0
N30	18203.3	18181.42	0	0.1
Overflow Node 3	4493.89	1215.18	0	73
N27	3731.45	3327.59	0	10.8
N26	4645.45	3610.36	0	22.3
N3	787.71	772.46	0	1.9
N364	3101.47	3101.35	0	0
N333	12701.97	12701.97	0	0
Basin 1	2594.82	1658.22	936.77	0
Basin2	1623.9	989.58	634.44	0
Basin3	2259.77	1446.09	813.84	0
Basin1476	614.15	386.12	228.08	0
Basin 5	1885.75	1158.02	727.87	0
Basin8	6374.82	4311.25	2064.14	0
N48	1731.02	1707.44	0	1.4
HW5	1168.63	1130.2	0	3.3
N36	1171.29	1153.22	0	1.5
HW7	1818.5	1800.87	0	1
N38	2588.21	2583.54	0	0.2

Design Model B

PIT / NODE DETAILS — Version 15

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is	Internal Width (mm)	Inflow is Misaligned	Minor Safe Pond Depth (m)	Major Safe Pond Depth (m)
HW1	Headwall				0.5	3.8		0		46408.82	204322.278		4							
N13	Node					3.4		0		46449.626	204282.929		51		No					
US Node 2	Node					9		0		45416.348	203504.691		18		No					
N6	Node					3		0		46319.815	204127.202		21		No					
HW2	Headwall				0.5	4.2		0		45621.352	203079.714		42							
N53	Node					3.6		0		45738.962	203035.923		242		No					
HW3	Headwall				0.5	3.2		0		45748.265	202956.719		43							
N54	Node					3.2		0		45842.717	202924.774		247		No					
HW6	Headwall				0.5	3.6		0		45635.584	202672.814		63							
N55	Node					3.2		0		45715.226	202639.886		248		No					
DN2	Node					1.52		0		46387.309	204286.252		77		No					
DN1	Node					1.52		0		46414.066	204360.228		78		No					
US Node	Node					6.6		0		46603.522	205018.833		85		No					
N11	Node					5		0		45762.317	203316.601		202		No					
N14	Node					2.8		0		46121.717	203033.231		54		No					
N44	Node					5		0		45605.049	202994.028		213		No					
N52	Node					1.4		0		46089.663	203189.928		235		No					
N65	Node					5.2		0		45738.962	203669.847		319		No					
DN	Node					2		0		46209.389	202918.206		419		No					
US3	Node					6		0		45453.203	201907.075		435		No					
N98	Node					4.8		0		45721.376	203324.639		530		No					
OFN2	Node					4.55		0		45600.421	203092.506		562		No					
N7	Node					4.8		0		45511.683	202817.336		619		No					
DN4	Node					4		0		45757.906	202981.826		696		No					
N19	Node					5		0		46052.666	203322.375		932		No					
N30	Node					1.8		0		46050.522	203303.748		151		No					
Overflow Node 2	Node					4.9		0		45757.168	203518.088		72651		No					
Overflow Node 3	Node					5.6		0		46095.779	203999.262		72677		No					
N27	Node					2.519		0		46116.304	203884.685		72678		No					
N26	Node					2.116		0		45993.005	203564.645		72699		No					
N36	Node					4.6		0		45853.093	203523.757		100079		No					
N3	Node					5.2		0		45521.978	203008.506		100192		No					
N364	Node					1.8		0		45971.286	203236.272		100751		No					
N333	Node					1.4		0		46656.622	204190.537		100761		No					
N48	Node					2.3		0		45746.904	202977.095		133086		No					
HW7	Headwall				0.5	5.2		0		45562.105	203024.578		133156							
N38	Node					4.9		0		45499.721	202884.435		133116		No					

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	RI (m)	Chg (m)	RL (m)	etc (m)
Pipe112	HW1	N13	15	1.51	1.45	0.4	Box culverts (samples)	0.6W x 0.45H		0.012	Existing	2	HW1	0					
GA Apron Culvert	HW2	N53	80	3.7	2.8	1.13	Concrete, under roads, 1% minimum slope	300	300	0.013	NewFixed	2	HW2	0					
Culvert 1	HW3	N54	100	2.29	2.138	0.15	Box culverts (samples)	0.9W x 0.47H		0.012	NewFixed	3	HW3	0					
Culvert2	HW6	N55	100	2.9	2.1	0.8	Box culverts (samples)	0.9W x 0.47H		0.012	Existing	6	HW6	0					
Existing Culvert	South Basin	N14	40	1.4	1.35	0.12	Concrete, under roads, 1% minimum slope	900	900	0.013	NewFixed	2	South Basin	0					
DischargePipes	N19	N30	12	3.2	1.8	11.67	Concrete, under roads, 1% minimum slope	225	225	0.013	New	5	N19	0					
Proposed Culvert	HW7	N38	50	4.35	4	0.7	Concrete, under roads, 1% minimum slope	600	600	0.013	NewFixed	3	HW7	0					

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length	id
South Basin	1.4	2638		Culvert	0.5					46090.122	202966.275	No			210
	1.6	24250													
	1.8	55403													
	3.2	231242													
	4.5	231242													
Basin 1	3.25	289		None						45718.076	203630.732	No			101328
	5.25	828													
	6	828													
Basin2	2.85	196		None						45704.574	203343.213	No			101349
	4.85	561													
	5.85	561													
Basin3	2.99	324		None						45592.4	203111.91	No			101370
	4.65	803													
	5.25	803													
Basin1476	2.99	100		None						45556.404	203029.325	No			101378
	4.45	227													
	5.55	227													
Basin 5	3.3	225		None						45469.687	202993.48	No			101409
	5.3	645													
	6.5	645													
Basin8	2.99	1681		None						46091.845	203888.034	No			101465
	3.99	3047													
	4.59	3047													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	EIA %	Perv Area %	RIA %	EIA Time (min)	Perv Time (min)	RIA Time (min)	EIA Length (m)	Perv Length (m)	RIA Length (m)	EIA Slope(%) %	Perv Slope %	RIA Slope %	EIA Rough	Perv Rough	RIA Rough	Rainfall Multiplier
C9	HW2	0.601	80	20	0	0	0	0	101.9	88.4	0	1.17	1.13	0	0.01	0.053	0	1
C11	HW3	2.379	20	80	0	0	0	0	295	227	0	0.4	0.35	0	0.01	0.053	0	1
C12	HW6	9.335	80	20	0	0	0	0	499	434	0	0.4	0.8	0	0.01	0.053	0	1
C2 (2)	DN2	19.943	5	95	0	0	0	0	1453	1806	0	0.6	0.6	0	0.013	0.053	0	1
C1	DN1	68.343	60	40	0	0	0	0	1385	1181	0	0.9	0.9	0	0.013	0.053	0	1
C13	South Basin	30.56	20	80	0	0	0	0	1505	1310	0	0.29	0.3	0	0.01	0.053	0	1
C8	DN4	2.822	90	10	0	0	0	0	360	310	0	0.3	0.3	0	0.01	0.053	0	1
C4	N19	22.765	1	99	0	0	0	0	965	965	0	0.4	0.4	0	0.0333	0.0333	0	1
C17(3)	N30	3.42	70	30	0	0	0	5	260	260	1	1.2	1.2	1	0.035	0.053	0.001	1
C2 (1)	Overflow Node 3	19.943	5	95	0	0	0	0	1453	1806	0	0.6	0.6	0	0.013	0.053	0	1
C17(1)	N27	3.012	15	85	0	0	0	5	450	450	1	0.55	0.55	1	0.035	0.053	0.001	1
C7	N364	5.13	70	30	0	0	0	0	453	268	0	0.7	0.8	0	0.01	0.053	0	1
C3	N333	1.155	40	60	0	0	0	0	285	355	0	1.7	0.1	0	0.033	0.053	0	1
C16 (1-A)	Basin 1	3.942	80	20	0	0	0	0	271	271	0	1	1	0	0.01	0.053	0	1
C16(2)	Basin2	2.467	80	20	0	0	0	0	220	220	0	0.7	0.7	0	0.01	0.053	0	1
C16(3)	Basin3	3.433	80	20	0	0	0	0	260	260	0	0.5	0.5	0	0.01	0.053	0	1
C16 (4)	Basin1476	0.933	80	20	0	0	0	0	180	180	0	0.5	0.5	0	0.01	0.053	0	1
C16(5)	Basin 5	2.787	90	10	0	0	0	0	300	300	0	0.5	0.5	0	0.01	0.053	0	1
C17(2)	Basin8	10.202	80	20	0	0	0	5	430	430	1	0.8	0.8	1	0.035	0.053	0.001	1
C10	N48	2.269	70	30	0	0	0	0	260	260	0	0.4	0.4	0	0.01	0.053	0	1

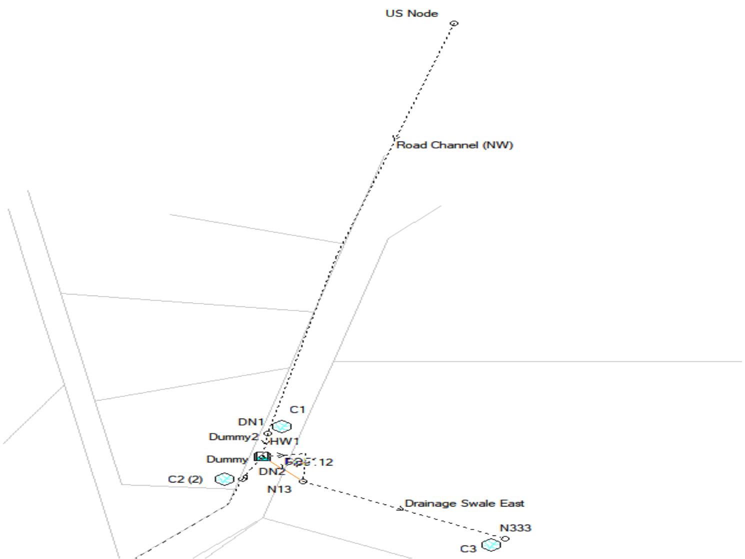
OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storms (m)	SafeDepth Minor Storm (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %		id	U/S IL	D/S IL	Length (m)
DOF1	HW1	N13	0.1	3.8	10	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	13	0		458	3.8	1.45	15
Drainage Swale East	N13	N333	0.3				Drainage Swale East	0.3	0.3	0.6	0.25	100		52	1.45	1.4	20
Road Channel (SW1)	US Node 2	Overflow No	14.1				Road West Catchment	0.5	0.5	0.6	0.58	100		17	9	5.1024	1300
Mosquito Drain (1)	N6	N27	11.3				Dev Mosquito Drain	0.3	0.3	0.6	0.13	100		72723	3	2.519	370
Overtopping GA Apron	HW2	N53	1.3	4.2	10	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	1.88	0		621	4.3	2.8	80
South GA Basin	N53	N48	1.3				East GA Grass Basin	0.3	0.3	0.6	0.63	100		335	2.8	2.3	80
Overtopping Old taxiw	HW3	N54	0.7	3.2	20	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	9.1	0		460	3.2	2.138	100
Dummy Overflow 3	N54	South Basin	0.1				Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	3.38	0		385	2.138	1.8	10
DOF3	HW6	N55	1.8	3.6	10	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	1.5	0		461	3.6	2.1	100
Dummy Overflow 4	N55	South Basin	0.1				Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	3	0		386	2.1	1.8	10
Dummy	DN2	HW1	0.3				Road West Catchment	0.5	0.5	0.6	0.5	0		109	1.52	1.51	30
Dummy2	DN1	HW1	0.3				Road West Catchment	0.5	0.5	0.6	0.5	0		98	1.52	1.51	30
Road Channel (NW)	US Node	DN1	10.4				Road West Catchment	0.5	0.5	0.6	0.54	100		10	6.6	1.52	940
Overflow Catchment 4	N11	N364	1.6				South West Channel	0.8	0.8	0.6	1.39	100		357	5	1.8	230
Overtopping Runway	South Basin	DN	0.5	3.6	20	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	4	0		403	3.6	2	40
Overtopping Taxiway	South Basin	N14	0.6	3.4	20	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	0.5	0		378	3.4	3.3	20
South GA Channel 2	N44	HW3	1.4				Southern GA Apron Channels	0.4	0.4	0.6	1	100		346	5	2.29	180
Road Channel (1-A)	N65	Overflow No	4.9				Dev Airport Access Track	0.3	0.3	0.6	0.14	100		72796	5.05	4.75	220
C13 Overflow	US3	South Basin	0.1				Open Channel (OldvsNew Runway)	0.3	0.3	0.6	0.6	100		225	6	1.8	10
OF1	N98	N11	0.1				Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	4	0		793	5.2	5	5
Road Channel (2)	N98	OFN2	6.1				Dev Airport Access Track	0.3	0.3	0.6	0.06	100		532	4.65	4.45	180
OF2	OFN2	HW2	0.1				Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	4	0		785	5.2	5	5
Road Channel (3)	OFN2	HW7	2.8				Dev Airport Access Track	0.3	0.3	0.6	0.15	100		573	4.45	4.35	130
C12 Overflow	N7	HW6	3				Airport Access Road Channel	0.4	0.4	0.6	0.63	100		360	3.9	2.9	300
DummyFlow	DN4	HW3	0.8				Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	8.55	0		700	4	2.29	100
DFO	N19	N30	0.1				Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	11.67	0		100129	3.2	1.8	12
Dummy Flow 5	N30	N52	0.1				Mosquito Drain	0.8	0.8	0.6	6	0		871	1.8	1.4	1
Overflow 2	Overflow Node 2	N36	1.1				Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	1	0		72676	5.3	4.6	50
Road Channel (1 -B)	Overflow Node 2	N98	7.4				Dev Airport Access Track	0.3	0.3	0.6	0.05	100		41	4.75	4.65	200
Road Channel (SW2)	Overflow Node 3	DN2	6.8				Road West Catchment	0.5	0.5	0.6	0.57	100		72746	5.1024	1.52	628
Overflow 1	Overflow Node 3	N27	1.4				Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	2.58	0		72679	5.28	2.519	100
Mosquito Drain (2)	N27	N26	9.5				Dev Mosquito Drain	0.3	0.3	0.6	0.13	100		72707	2.519	2.116	310
Mosquito Drain (3)	N26	N30	7.6				Dev Mosquito Drain	0.3	0.3	0.6	0.13	100		5	2.116	1.8	250
Overflow 2 (2)	N36	N26	1.4				Grass Area	0.3	0.3	0.6	1.25	0		100083	4.6	2.116	200
New Proposed Channel	N3	N38	1.2				Airport Access Road Channel	0.4	0.4	0.6	0.4	0		541	4.6	4	100
Basin Overflow	N364	N52	0.1				Northern Basin Channel	0.3	0.3	0.6	8	0		100752	1.8	1.4	5
Basin OF	Basin 1	N65	0.1	5.25	8	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	2	0		101346	5.25	5.05	5
Basin OF 2	Basin2	N98	0.1	4.85	8	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	4	0		101358	4.85	4.65	5
Basin OF 3	Basin3	OFN2	0.1	4.65	8	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	2	0		101376	4.65	4.45	5
Basin OF 4	Basin1476	HW7	0.1	4.45	8	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	2	0		101399	4.45	4.35	5
OF Basin 5	Basin 5	N3	0.1	5.3	8	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	2	0		101404	5.3	4.6	5
Basin OF 8	Basin8	N27	0.1	3.99	8	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	9.9	0		101471	3.99	2.519	10
DummyFlow5	N48	HW3	0.1				East GA Grass Basin	0.3	0.3	0.6	1	0		133087	2.3	2.29	1
DummyOverflow	HW7	N38	1.5	5.2	10	1.7	Overflow across road low point - parabola x = 15, y =	0.05	0	0.6	0.6	0		133122	5.2	4.9	50
New Proposed Channel	N38	N7	0.2				Airport Access Road Channel	0.4	0.4	0.6	0.5	0		133117	4	3.9	20

This model has no pipes with non-return valves

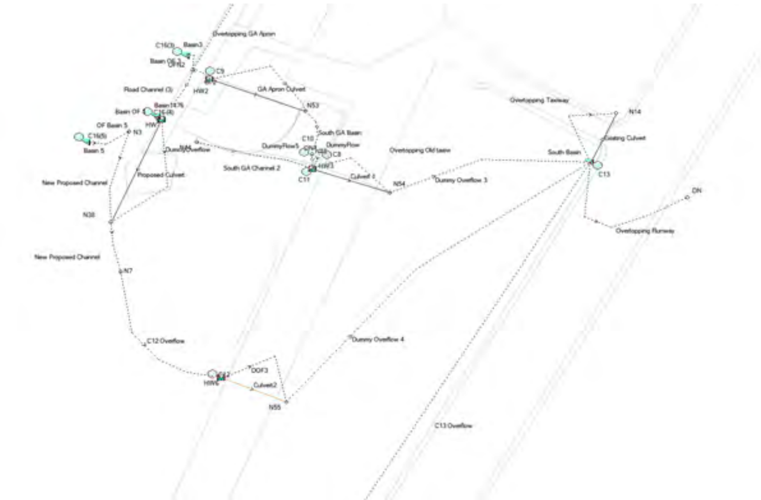
Design Model B Schematic

Part 1



Part 2

Part 3



DESIGN MODEL B - 10% Results DRAINS results prepared from Version 2020.036

PIT / NODE DETAILS — Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
HW1	3.33		2.641		0.47	0	None
N13	1.7		0				
US Node 2	9		0				
N6	3.22		0				
HW2	4.26		0.227		-0.06	0	None
N53	2.83		0				
HW3	2.7		1.076		0.5	0	None
N54	2.2		0				
HW6	3.31		1.471		0.29	0	None
N55	2.2		0				
DN2	3.33		1.415				
DN1	3.33		4.989				
US Node	6.6		0				
N11	5		0				
N14	1.4		0				
N44	5		0				
N65	5.38		0.627				
US3	6		0				
N98	5.02		0.626				
OFN2	4.94		0.776				
N7	4.3		1.059				
DN4	4.07		0.857				
N19	3.27		2.468				
N30	2.16		2.795				
Overflow Node 2	5.12		0.597				
Overflow Node 3	5.21		0.5				
N27	3.17		1.169				
N26	2.64		1.164				
N36	4.6		0				
N3	4.82		0.463				
N364	1.81		0.619				
N48	2.7		0.482				
HW7	4.9		0.838		0.3	0	None
N38	4.37		0.462				

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe112	1.705	3.16	1.96	1.9	10% AEP, 12 hour burst, Storm 6
GA Apron Culvert	0.22	1.73	3.953	3.053	10% AEP, 15 min burst, Storm 6
Culvert 1	1.069	1.57	2.542	2.39	10% AEP, 30 min burst, Storm 8
Culvert2	2.182	2.01	3.101	2.301	10% AEP, 15 min burst, Storm 6
Existing Culvert	1.098	1.82	1.833	1.783	10% AEP, 12 hour burst, Storm 6
DischargePipes	0.16	3.05	3.27	2.158	10% AEP, 2 hour burst, Storm 1
Proposed Culvert	0.833	1.5	4.723	4.373	10% AEP, 4.5 hour burst, Storm 6

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
South Basin	2.12	32356.8	1.098	1.098	0
Basin 1	5.42	1212.6	0.627	0	0.627
Basin2	5.02	820.5	0.422	0	0.422
Basin3	4.95	1142.7	0.541	0	0.541
Basin1476	4.93	340.6	0.31	0	0.31
Basin 5	5.41	904.2	0.463	0	0.463
Basin8	4.17	2891.2	1.026	0	1.026

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	EIA Max Q (cu.m/s)	Remaining Max Q (cu.m/s)	EIA Tc (cu.m/s)	RIA Tc (min)	PA Tc (min)	Due to Storm (min)
C9	0.227	0.218	0.025	4.03	0	10.16	10% AEP, 15 min burst, Storm 6
C11	0.388	0.09	0.298	14.18	0	34.3	10% AEP, 1 hour burst, Storm 6
C12	2.349	2.349	0	14.41	0	29.28	10% AEP, 15 min burst, Storm 6
C2 (2)	1	0.14	0.909	45.16	0	119.58	10% AEP, 2 hour burst, Storm 1
C1	9.978	9.303	0.698	28	0	59.12	10% AEP, 30 min burst, Storm 8
C13	1.798	0.974	0.827	41.51	0	102.83	10% AEP, 1 hour burst, Storm 6
C8	0.857	0.838	0.019	12.91	0	32.11	10% AEP, 15 min burst, Storm 6
C4	2.468	0.027	2.442	70.16	0	70.16	10% AEP, 2 hour burst, Storm 1
C17(3)	0.73	0.73	0	14.86	5.07	19.06	10% AEP, 15 min burst, Storm 6
C2 (1)	1	0.14	0.909	45.16	0	119.58	10% AEP, 2 hour burst, Storm 1
C17(1)	0.304	0.065	0.257	41.57	5.11	53.32	10% AEP, 2 hour burst, Storm 1
C7	1.239	1.239	0	11.5	0	21.93	10% AEP, 15 min burst, Storm 6
C3	0.18	0.149	0.031	13.66	0	48.43	10% AEP, 15 min burst, Storm 6
C16 (1-A)	1.296	1.239	0.082	7.59	0	20.64	10% AEP, 15 min burst, Storm 6
C16(2)	0.814	0.779	0.052	7.45	0	20.27	10% AEP, 15 min burst, Storm 6
C16(3)	1.079	1.026	0.059	9.11	0	24.79	10% AEP, 15 min burst, Storm 6
C16 (4)	0.31	0.297	0.02	7.31	0	19.88	10% AEP, 15 min burst, Storm 6
C16(5)	0.939	0.917	0.022	9.93	0	27.01	10% AEP, 15 min burst, Storm 6
C17(2)	1.977	1.9	0.092	26.04	5.08	33.41	10% AEP, 30 min burst, Storm 8
C10	0.583	0.583	0	9.75	0	26.51	10% AEP, 15 min burst, Storm 6

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
DOF1	0	0	0	0	0	0	0	
Drainage Swale East	1.705	1.729	2.355	0.25	0.26	7.5	1.03	10% AEP, 12 hour burst, Storm 6
Road Channel (SW1)	0	0.95	8.536	0.128	0.07	13.77	0.67	10% AEP, 15 min burst, Storm 6
Mosquito Drain (1)	0.004	0.309	0.147	0.647	0.16	3.88	0.28	10% AEP, 1 hour burst, Storm 6
Overtopping GA Apron	0	0	0	0	0	0	0	
South GA Basin	0.203	0.706	11.578	0.398	0.02	40	0.2	10% AEP, 15 min burst, Storm 6
Overtopping Old taxiw	0	0	0	0	0	0	0	
Dummy Overflow 3	1.067	1.067	0	0.32	0.12	30	1.81	10% AEP, 30 min burst, Storm 8
DOF3	0	0	0	0	0	0	0	
Dummy Overflow 4	2.179	2.179	0	0.32	0.2	30	2.08	10% AEP, 15 min burst, Storm 6
Dummy	1.477	1.477	8.539	1.819	0.02	195.39	0.01	10% AEP, 2 hour burst, Storm 1
Dummy2	6.433	6.433	8.539	1.819	0.08	195.39	0.04	10% AEP, 30 min burst, Storm 8
Road Channel (NW)	0	7.964	8.517	1.809	0.37	194.01	0.98	10% AEP, 15 min burst, Storm 6
Overflow Catchment 4	0	1.215	3.563	0.152	0.22	6.11	1.63	10% AEP, 15 min burst, Storm 6
Overtopping Runway	0	0	0	0	0	0	0	
Overtopping Taxiway	0	0	0	0	0	0	0	
South GA Channel 2	0	0.381	3.568	0.408	0.06	8	0.86	10% AEP, 15 min burst, Storm 6
Road Channel (1-A)	0.597	0.538	0.506	0.371	0.26	3.36	0.77	10% AEP, 1 hour burst, Storm 6
C13 Overflow	0	1.798	55.217	0.32	0.02	97.12	1.17	10% AEP, 15 min burst, Storm 6
OF1	0	0	0	0	0	0	0	
Road Channel (2)	0.557	0.539	0.331	0.495	0.23	3.97	0.63	10% AEP, 2 hour burst, Storm 1
OF2	0	0	0	0	0	0	0	
Road Channel (3)	0.731	0.729	0.524	0.552	0.27	4.26	0.54	10% AEP, 2 hour burst, Storm 1
C12 Overflow	1.059	2.214	1.266	0.539	0.89	3.74	1.8	10% AEP, 4.5 hour burst, Storm 6
DummyFlow	0.848	0.839	0	0.408	0.09	30	1.36	10% AEP, 15 min burst, Storm 6
DFO	2.308	2.308	0	0.358	0.25	30	3.6	10% AEP, 2 hour burst, Storm 1
Dummy Flow 5	2.93	2.93	0.275	0.358	3.83	1.57	10.92	10% AEP, 2 hour burst, Storm 1
Overflow 2	0	0	0	0	0	0	0	
Road Channel (1 -B)	0.502	0.491	0.302	0.371	0.21	3.36	0.57	10% AEP, 1 hour burst, Storm 6
Road Channel (SW2)	0.95	1.571	8.534	1.809	0.08	194.06	0.67	10% AEP, 2 hour burst, Storm 1
Overflow 1	0	0	0	0	0	0	0	
Mosquito Drain (2)	1.164	1.32	0.147	0.647	0.84	3.88	1.59	10% AEP, 2 hour burst, Storm 1
Mosquito Drain (3)	0.677	0.75	0.147	0.526	0.6	3.16	1.43	10% AEP, 2 hour burst, Storm 1
Overflow 2 (2)	0	0	74.261	0	0	0	0	
New Proposed Channel	0.462	0.461	1.233	0.373	0.28	3.27	1.23	10% AEP, 1 hour burst, Storm 6
Basin Overflow	1.215	1.215	53.018	0.015	0.01	88.09	0.94	10% AEP, 15 min burst, Storm 6
Basin OF	0.627	0.627	0	0.332	0.05	30	0.37	10% AEP, 1 hour burst, Storm 6
Basin OF 2	0.422	0.422	0	0.367	0.03	30	0.17	10% AEP, 1 hour burst, Storm 6
Basin OF 3	0.541	0.541	0	0.495	0.03	30	0.09	10% AEP, 1 hour burst, Storm 6
Basin OF 4	0.31	0.31	0	0.552	0.01	30	0.03	10% AEP, 12 hour burst, Storm 6
OF Basin 5	0.463	0.463	0	0.223	0.08	25.4	2.95	10% AEP, 1 hour burst, Storm 6
Basin OF 8	1.026	1.026	0	0.647	0.14	30	3.34	10% AEP, 2 hour burst, Storm 1
DummyFlow5	0.448	0.448	14.586	0.408	0.01	40	0.03	10% AEP, 1 hour burst, Storm 6
DummyOverflow	0	0	0	0	0	0	0	
New Proposed Channel	1.059	1.059	1.318	0.399	0.5	3.43	1.33	10% AEP, 4.5 hour burst, Storm 6

CONTINUITY CHECK for 10% AEP, 2 hour burst, Storm 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
HW1	16715.88	12117.79	0	27.5
N13	12117.79	11717.18	0	3.3
US Node 2	0	-3184.46	0	0
N6	0	-598.69	0	0
HW2	395.61	395.63	0	0
N53	395.63	-273.93	0	169.2
HW3	4914.01	4877.17	0	0.7
N54	4877.17	4860.54	0	0.3
HW6	9320.33	9295.04	0	0.3
N55	9295.04	9262.92	0	0.3
DN2	609.31	-4996.73	0	920.1
DN1	27408.79	21712.6	0	20.8
US Node	0	-18900.11	0	0
N11	0	-1551.74	0	0
South Basin	25607.27	5723.8	19915.49	-0.1
N14	4059.79	4059.79	0	0
N44	0	-651.85	0	0
N52	18660.06	18660.06	0	0
N65	1179.29	1082.16	0	8.2
DN	0	0	0	0
US3	0	-5744.24	0	0
N98	1786.76	1666.3	0	6.7
OFN2	2680.66	2570.08	0	4.1
N7	3583.29	656.97	0	81.7
DN4	1909.44	1854.87	0	2.9
N19	11678.67	11677.39	0	0
N30	15596.64	15558.59	0	0.2
Overflow Node 2	1171.04	1057.98	0	9.7
Overflow Node 3	4487.75	1208.81	0	73.1
N27	3730.57	3334.05	0	10.6
N26	3457.86	1073.76	0	68.9
N36	0	0	0	0
N3	787.71	767.56	0	2.6
N364	3101.6	3101.48	0	0
N333	12696.54	12696.54	0	0
Basin 1	2594.82	1658.98	936.01	0
Basin2	1623.9	979.77	644.26	0
Basin3	2259.77	1418.59	841.35	0
Basin1476	614.15	368.98	245.22	0
Basin 5	1885.75	1158.02	727.87	0
Basin8	6374.82	4311.25	2064.14	0
N48	1730.05	1705.54	0	1.4
HW7	2838.41	2806.57	0	1.1
N38	3593.68	3583.29	0	0.3

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12528041-33848-6/https://projectsportal.ghd.com/sites/pp18_05/shireofashburtononsl/ProjectDocs/12528041-REP-Draft SWMP.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	H Child A Parameswaran	S Cleary		S Cleary		26/10/20

www.ghd.com

A	1/7/22	ISSUED FOR APPROVAL	KJB	BO	BO
REV	DATE	ISSUE DESCRIPTION	DRAWN	DESIGN	CHECK

STATUS
ISSUED AS PRELIMINARY

SCALE

CLIENT
SHIRE OF ASHBURTON

DISCLAIMER
ALL DIMENSIONS TO BE CHECKED ON SITE BY CONTRACTOR PRIOR TO CONSTRUCTION. USE WRITTEN DIMENSIONS ONLY, DO NOT SCALE. NOT FOR CONSTRUCTION UNLESS STAMPED BY CERTIFYING AUTHORITY

Oversby Consulting

PROJECT
ONSLOW INDUSTIRAL ESTATE

LOT 9500 McAULLAY ROAD, ONSLOW

DRAWING TITLE
DRAINAGE CONCEPT PLAN

PROJECT No.	DRAWING No.	REVISION
B220..	C01	A

Kevin Pickering

From: Chantelle McGurk <Chantelle.McGurk@ashburton.wa.gov.au>
Sent: Tuesday, 5 July 2022 2:21 PM
To: Kevin Pickering
Subject: FW: Onslow Industrial Park

Follow Up Flag: Follow up
Flag Status: Flagged

Chantelle McGurk
Director Projects & Procurement
Direct: 08 9184 9315
Mobile: 0417 183 364
Chantelle.McGurk@ashburton.wa.gov.au
www.ashburton.wa.gov.au

From: Sam King <Sam.King@horizonpower.com.au>
Sent: Tuesday, 5 July 2022 1:27 PM
To: Chantelle McGurk <Chantelle.McGurk@ashburton.wa.gov.au>
Cc: Barry Bishop <Barry.bishop@horizonpower.com.au>
Subject: RE: Onslow Industrial Park

Afternoon

Thanks for flicking through. Have just had a chat with Barry, CC'd in, and we can provide the following feedback from our System Study Report in relation to the Onslow Industrial Park Stage 1 proposal.

"Based on the present demand and energy forecast, and no other committed large enterprise customer as of June 2022, there is no generation shortfall to supply this project "Onslow 1232kVA Industrial Park load".

We'll put the above into our Monthly Chat minutes as well.

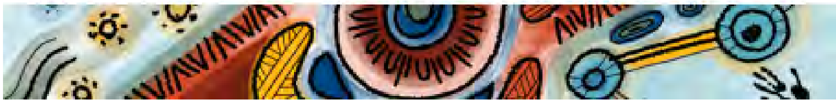
Hope this helps and if you need anything else let us know.

Cheers
Sam

Sam King
Customer & Community Manager
T (08) 9159 7261 | 0477 380 356
A Stovehill Road, Karratha WA 6714
E Sam.King@horizonpower.com.au
W horizonpower.com.au

Narnana mirnu Ngarluma-bura nyambarli ngurrai wanjila narnana barnigu, warrgum.

We acknowledge Ngarluma people as the original custodians of the lands where our West Pilbara office is located and extend that respect to all First Nations people across our service area.



From: Chantelle McGurk <Chantelle.McGurk@ashburton.wa.gov.au>
Sent: Monday, 4 July 2022 1:18 PM
To: Sam King <Sam.King@horizonpower.com.au>
Subject: Onslow Industrial Park

Hi Sam,

Would it be possible to get in writing from HP (Barry) about the power supply for the Industrial Park that Lot 1-3 would be able to be accommodated in the existing power station?

Cheers
Chantelle McGurk
Director Projects & Procurement
Direct: 08 9184 9315
Mobile: 0417 183 364
Chantelle.McGurk@ashburton.wa.gov.au
www.ashburton.wa.gov.au

shire of Ashburton
opportunity to community
Onslow - Pannawonica - Paraburdoo - Tom Price

GET UP! STAND UP! SHOW UP!
3-10 JULY 2022

Meeting Minutes & Agenda

Shire of Ashburton & Horizon Power Assets monthly catch up

Meeting date: 30.06.2022 – 2:15pm-2:45pm via MS Teams

Attendance: Chantelle McGurk, Barry Bishop & Sam King

Notes & Actions from Previous Catch Up:

Item	**27.05.2022**
Streetlights	352 billable to the Shire *SK provided copy of street light list via email to CM 29.04.22. Couple of poles damaged in recent weeks, HP and contractors changing out/replacing these as quickly as possible SK*
Customer funded works projects – current and upcoming	Memorial Park *Designs & project progressing well. Project on hold at the moment while SoA continues discussions internally & externally on budgets and project priority in conjunction with the below SK* Caravan Park Extension *Designs & project progressing well. SoA and designated contractor in discussions with HP surrounding cost estimates for supply upgrade as customer funded works SK* LIA Subdivision *HP provided feedback to SoA and Development Proponent to prioritise a staged approach to the subdivision for HP to better assess town wide generation requirements. HP Future Energy Systems reviewing Stage 1 generation capacity SK*
Horizon driven projects	Onslow DER Pilot *MPC system issues, ongoing support and local contractor capacity to respond to issues still ongoing. SK to enquire with Project Team for update from Project Contractors on findings and/or any requirements in response to Onslow Salt roof fire.* *SK provided CM on 23.05.22 an excel summary of SoA addresses with pics of each DC isolator for their records and any action by SoA if deemed necessary/appropriate*
SoA driven projects	
Any other business	Town Outage 07.05.2022 *Caused by two separate issues that occurred basically back to back. Car vs Light Pole tripped entire town feeder around midnight, crew attended from Karratha to make safe and town was reenergised approx. 3am. Shortly after a generation issue at the power station caused a town wide blackout which was restified around 11:30am SK*

	Fees & Charges and Tariff Changes *Upcoming new FY will see adjusted fees & charges including increases to street light charges. Please visit the below website for further information* [Changes to electricity prices, fees and charges 2022 (horizonpower.com.au)] General reminder as well to please reiterate to the works crews, projects and contractors is to be very mindful of electrical infrastructure such as green domes & mini pillars and avoid causing any damage to these. If they are hit or damaged in any way to call the Horizon faults line **13 23 51**.

Standing Agenda Items & Comments

Item	**30.06.2022**
Streetlights	Tariffs Changing *As of 1 July tariffs will be changing for all customers, including roughly a 5.9% increase in each of the streetlight tariffs.* *HP will be running down existing stock of streetlights in the 53W and 80W LED's and transitioning to a new standard of 43W and 70W LED's.* *This new standard also sees a reduction from 4000K to 3000K LED's meaning a warmer less white light SK*
Customer funded works projects – current and upcoming	Caravan Park *HP has provided design and quote for customer funded works. Project currently on hold and under further consideration by Council surrounding budget & timelines. Further updates to follow SK* Memorial Park *Project currently on hold. Caravan park upgrade taking precedence and SoA to provide further updates SK* LIA Subdivision *HP has provided generation and network feedback via DIP to proponent surrounding Stage 1 of this proposed development. For Stage 1, based on the present D&E forecast and no other committed large enterprise customer as of June 2022, there is no generation shortfall to supply this project "Onslow 1232kVA Industrial Park load".* *SoA and Council considering a briefing at the August 2022 Council meeting, further info to follow SK*
Horizon driven projects	

SoA driven projects	
Any other business	General reminder as well to please reiterate to the works crews, projects and contractors is to be very mindful of electrical infrastructure such as green domes & mini pillars and avoid causing any damage to these. If they are hit or damaged in any way to call the Horizon faults line **13 23 51**

From: Chantelle McGurk
To: Kevin Pickering
Subject: FW:
Date: Friday, 18 March 2022 3:49:00 PM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png
image007.png
image008.png
image009.png
image010.png
image672548.png
image808217.png
image454936.png
image930085.png
WAPC - 20210714 161079 Lot 9500 McAullay Road, Onslow - Subdivision Plan.pdf
Onslow Industrial Park Concept Layout (Stage 1).pdf

Chantelle McGurk
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shire of Ashburton
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Onslow - Pannawonica - Paraburdoo - Tom Price

From: Graham Hayward <Graham.Hayward@watercorporation.com.au>
Sent: Friday, 18 March 2022 3:31 PM
To: Chantelle McGurk <Chantelle.McGurk@ashburton.wa.gov.au>
Subject: RE:

Hi Chantelle,

First up on the wastewater front unfortunately we are unable to provide reticulated service to this or future stages of development, below is the pervious advice we have provided in relation to this site:

This proposal cannot connect to the existing wastewater scheme.
Industrial estates in the north-west of the state are currently not connected to sewerage,.
Wastewater treatment plants in regional centres employ facultative (biological) processes, which are highly sensitive to contaminants.
Wastewater from industrial areas presents a significant operational risk to the plant because of the potential to disrupt the biological treatment process.
The treated wastewater produced is typically re-used by Local Authorities to irrigate public open space and street trees.
There is currently no practicable way of mitigating the risk of wastewater contamination from industrial areas. In the Corporation's experience, the most effective risk management strategy is to not connect industrial land into the town's wastewater system

Water:
Attached is the proposed approved plan of subdivision of the site (WAPC 161079). This proposal creates 3 lots and a large balance title for future subdivision.

To satisfy the condition of subdivision to all three proposed lots a mains extension of approximately 800m will be required (shown in blue on the attached plan). For further subdivision of the balance title into smaller lots the second feed shown in green will be required as a security of supply (a further 900m of main).

Stage 1 as depicted on the attached plan would require the second security of supply connection (green line) I addition to this I estimate a further 1000m of internal reticulation mains would be required, bringing the total to about 2.7 km of reticulation mains.

If the Roadhouse is priority and you are looking to minimise the costs involved then I suggest just creating lot 1 and locating it there. This lot could be created as a staged clearance under the current application (161079). Lot 1 would have water services available without the need to construct any mains.

Standard Infrastructure Contributions (Headworks):
SICs are required to be paid for all new demands on scheme services. These payment are required to fund the major works to support development. They are calculated on a state-wide basis in line with the Minister Guidelines for scheme contribution and regulated by the ERA. They are recalculated yearly to reflect the actual costs of providing major works to support development.

Any queries please don't hesitate to contact me.

Cheers

Graham Hayward
TL – Infill Development

Development Services

E Graham.Hayward@watercorporation.com.au
T (08) 9420 2990

watercorporation.com.au

From: Chantelle McGurk <Chantelle.McGurk@ashburton.wa.gov.au>
Sent: Thursday, 17 March 2022 11:19 AM
To: Graham Hayward <Graham.Hayward@watercorporation.com.au>
Subject: RE:

Thanks for coming back to me Graham so promptly.

When you come back to me on the roadhouse as this being the number one priority are you also able to provide information for the Stage 1 development on the subdivision in it entirety?

Attached email is all about OVCP Stage 3 that will fill you in on where we are at, I'm struggling to understand why the Shire would have to contribute over $80k for headworks contribution, if the Shire are designing and installing the sewer extension.

Chantelle McGurk
Director Projects & Procurement
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shire of Ashburton
opportunity to community
Onslow - Pannawonica - Paraburdoo - Tom Price

From: Graham Hayward <Graham.Hayward@watercorporation.com.au>
Sent: Thursday, 17 March 2022 10:57 AM
To: Chantelle McGurk <Chantelle.McGurk@ashburton.wa.gov.au>
Subject:

Hi Chantelle,
My contact details below, I'll flick you some thing on the roadhouse site tomorrow. David has mentioned the Caravan park in his last email, can you please provide some details of the site and the proposed development plans?

Cheers

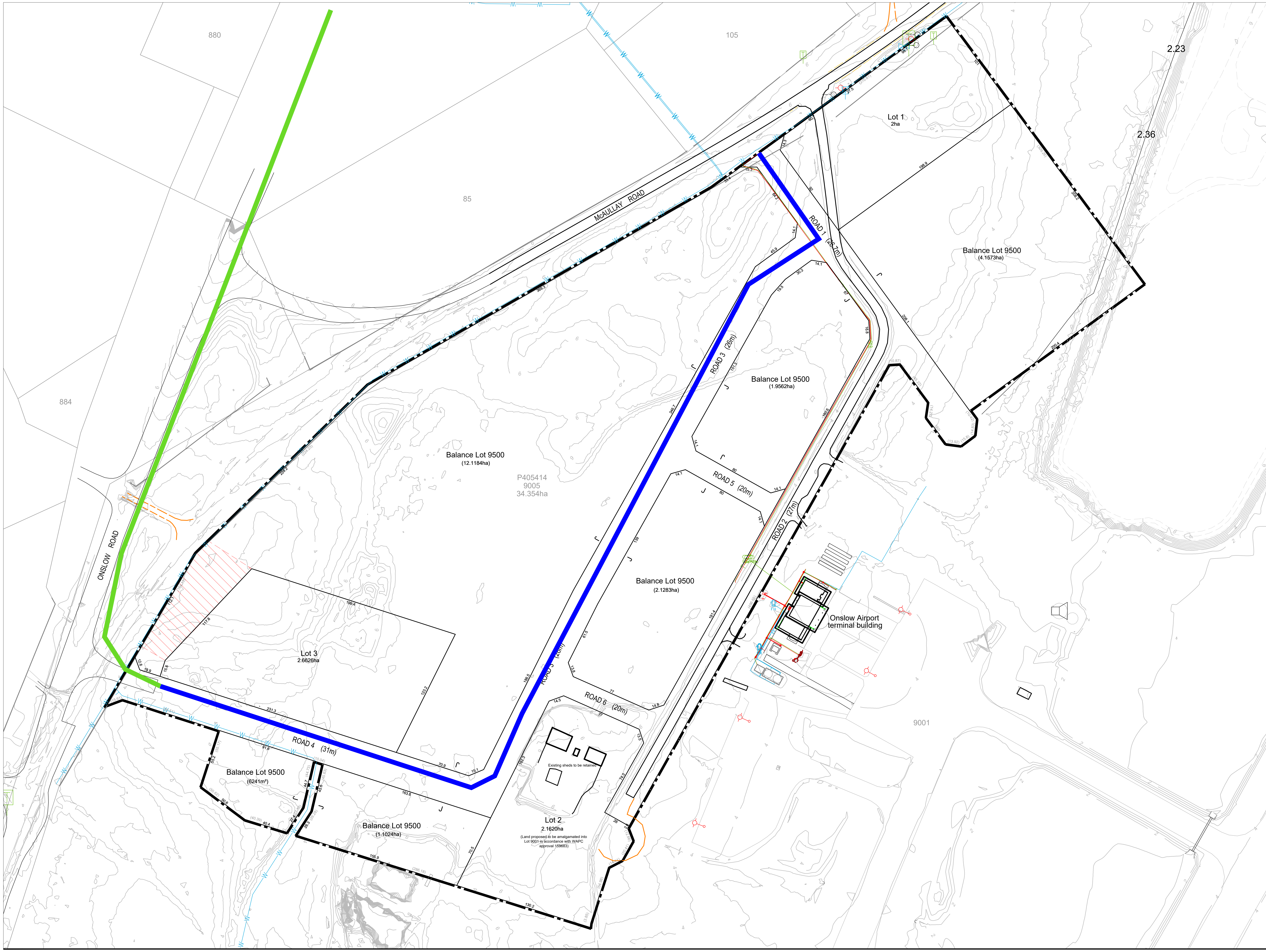
Graham Hayward

TL – Infill Development

Development Services

E Graham.Hayward@watercorporation.com.au
T (08) 9420 2990

watercorporation.com.au



LEGEND

- Application Area
- Existing cadastre
- Heritage area
- Existing contours (0.5m interval)
- Proposed lot
- Water main
- Underground power
- Telecommunications
- Road pavement

LOT SUMMARY

Subject Site (Lot 9500)	34.3537ha
Proposed Lot 1	2.0000ha
Proposed Lot 2	2.1620ha
Proposed Lot 3	2.6626ha
Balance Lot 9500	22.0867ha
Road	5.4424ha
Total	34.3537ha

Plan of Subdivision

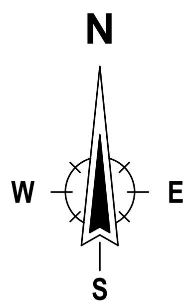
Lot 9500 (No.215) McAullay Road, Onslow

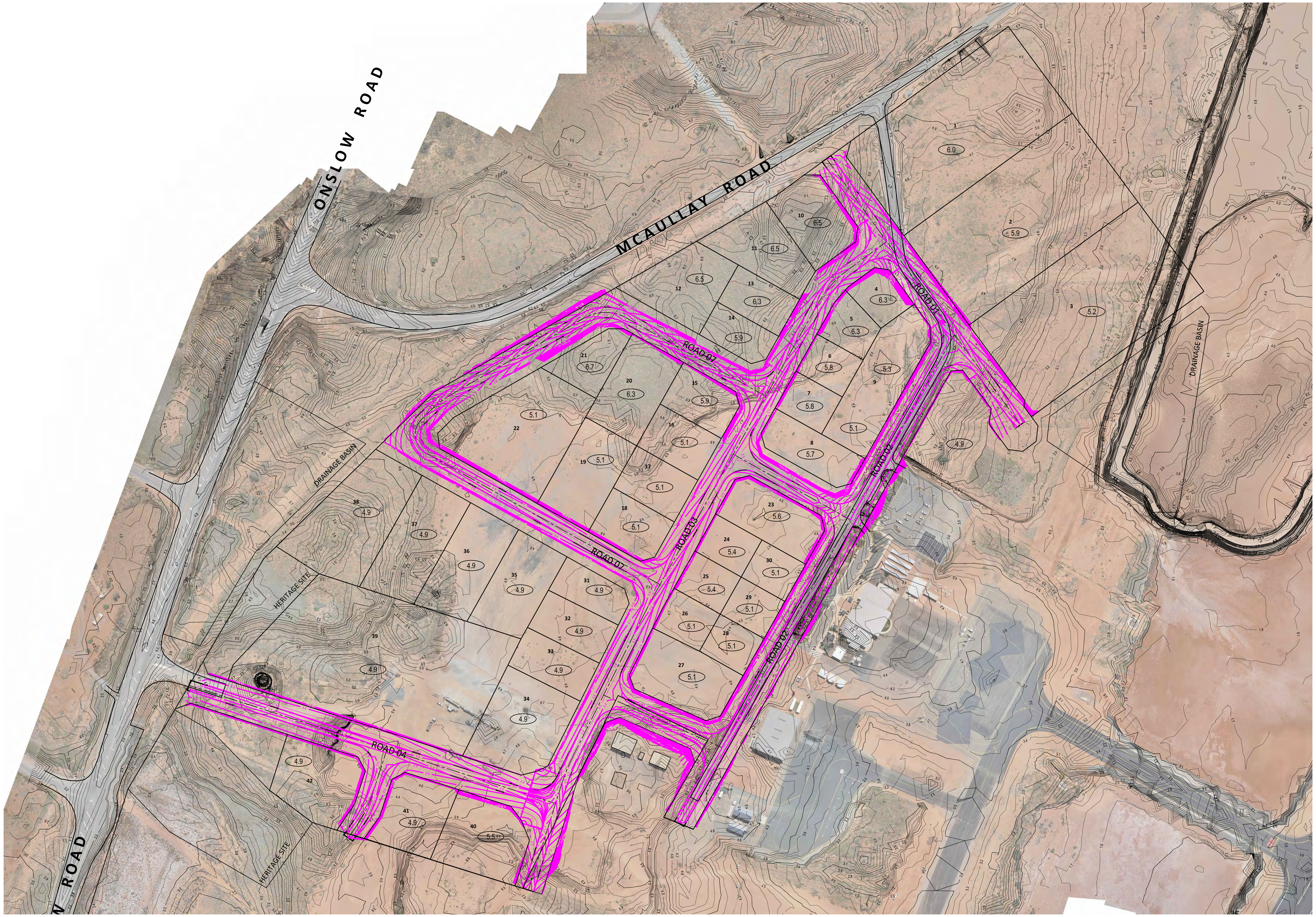
0 50m

Date: 19 June 2021 Scale: 1:2,500 @ A2 File: 21023 SU01B– Staff: LC / MR Checked: MR

element.

Level 18, 191 St Georges Terrace, Perth Western Australia 6000.
PO Box 7375 Cloisters Square, Perth Western Australia 6850.
T. +61 8 9289 8300 | E. hello@elementwa.com.au elementwa.com.au





A	6/7/22	ISSUED FOR CONCEPT DESIGN	KJB	RWE	RWE

GENERAL NOTES

1. ALL CONSTRUCTION TO BE IN ACCORDANCE WITH THE SPECIFICATION AND REQUIREMENTS OF THE SHIRE OF ASHBURTON.
2. THE CONTRACTOR SHALL LIAISE WITH ALL RELEVANT AUTHORITIES TO LOCATE ALL EXISTING SERVICES WITHIN THE CONTRACT AREA PRIOR TO THE COMMENCEMENT OF WORK.
3. THE CONTRACTOR SHALL CONTACT THE DIAL BEFORE YOU DIG SERVICE AND SHALL POTHOLE AND LOCATE ALL SERVICES IN CONJUNCTION WITH THE SERVICE BODIES PRIOR TO THE COMMENCEMENT OF ANY EXCAVATION. WHERE EXISTING AND PROPOSED WORKS INTERSECT, LEVELS ARE TO BE TAKEN AND SUPPLIED TO THE SUPERINTENDENT.
4. THE CONTRACTOR SHALL LOCATE ALL LEVELS FROM ESTABLISHED BENCH MARKS AS PROVIDED BY THE PROJECT SURVEYOR.
5. ALL BENCH MARKS ARE TO BE PROTECTED AND PRESERVED.
6. ALL WORKS TO BE RESTRICTED TO THE LIMIT OF CONTRACT BOUNDARY. NO MACHINERY MOVEMENT TO OCCUR OUTSIDE THE LIMIT OF CONTRACT BOUNDARY.

EARTHWORK NOTES

1. THE CONTRACTOR SHALL UNDERTAKE ALL WORKS IN ACCORDANCE WITH THE APPROVED DUST MANAGEMENT PLAN.
2. AREAS OF FILL TO BE COMPACTED IN LAYERS IN ACCORDANCE WITH THE SPECIFICATION. ALL COMPACTION TO BE IN ACCORDANCE WITH THE SPECIFICATION.
3. DISPOSE ALL TOPSOIL OFF SITE.
4. REFERENCE SHALL BE MADE TO THE RELEVANT CLAUSES OF THE EARTHWORKS SPECIFICATION WHERE WORK IS WITHIN PROPOSED ROAD RESERVES.
5. THE ENTIRE CONTRACT AREA (EXCEPT ROAD PAVEMENTS) SHALL BE STABILISED IN ACCORDANCE WITH THE SPECIFICATION.
6. THE CONTRACTOR SHALL TAKE CARE WITH THE USE OF COMPACTION EQUIPMENT WITHIN THE VICINITY OF THE EXISTING RESIDENCES SO AS TO AVOID VIBRATION DAMAGE TO BUILDINGS. COST OF REPAIRS FOR ANY DAMAGE INCURRED WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
7. NSL CONTOUR INTERVAL IS 0.1m.
8. FSL CONTOUR INTERVAL IS 0.1m.
9. WHERE ABUTTING AREAS OUTSIDE OF THE SITE OR STAGE BOUNDARY. THE CONTRACTOR SHALL BATTER AT SLOPE OF 1 IN 3.
10. THE CONTRACTOR SHALL PROTECT ALL TREES DESIGNATED AS BEING RETAINED.

LEGEND

13.60	EXISTING SURFACE CONTOUR - MINOR (0.1m)
13.60	PROPOSED SURFACE CONTOUR - MINOR (0.1m)
14.0	PROPOSED FINISHED SURFACE LEVEL

METADATA

SURVEY PROVIDED BY:	PLATINUM SURVEYS
SURVEY DATE:	18/03/2022
PROJECTION ZONE:	BARROW ISLAND GRID
HEIGHT DATUM:	AHD
WAPC No:	----

ISSUE

ISSUED FOR INFORMATION ONLY

EDGELOE Engineering

CLIENT
SHHIRE OF ASHBURTON

PROJECT
ONSLOW AIRPORT SUBDIVISION

ADDRESS
ONSLOW ROAD & MCAULLAY ROAD

DRAWING TITLE
EARTHWORKS PLAN

PROJECT No.	DRAWING No.			REVISION
22016	101	0 20 40 60 80 100 SCALE 1:2000	A 1	A

DIAL BEFORE YOU DIG www.1100.com.au

DISCLAIMER
ALL DIMENSIONS TO BE CHECKED ON SITE BY CONTRACTOR PRIOR TO CONSTRUCTION. USE WRITTEN DIMENSIONS ONLY, DO NOT SCALE. NOT FOR CONSTRUCTION UNLESS STAMPED BY CERTIFYING AUTHORITY

EDGELOE Engineering

PROPOSED SUBDIVISION: Onslow Industrial area Phase 1
PRELIMINARY OPINION OF PROBABLE COST
JOB NUMBER 22016

				Phase 1 (45 lots)		Phase 1 Stage 1 - (3 lot release)		
ITEM	**DESCRIPTION**	**UNIT**	**Est. QTY**	**Est. RATE**	**Est. TOTAL**	**Est. QTY**	**Est. RATE**	**Est. TOTAL**
	PRELIMINARIES							
	ESTABLISHMENT							
A1	Mobilisation / Demobilisation	Item	1	$ 146,940	$ 146,940.00	1	$ 50,000	$ 50,000.00
A2	Contractors Site Facilities and Services	Item	1	$ 424,255	$ 424,255.00	1	$ 150,000	$ 150,000.00
A3	Site Access	Item	1	$ 10,000	$ 10,000.00	1	$ 10,000	$ 10,000.00
A4	Project Board	Item	1	$ 2,000	$ 2,000.00	1	$ 2,000	$ 2,000.00
A5	Insurances	Item	1	$ 65,508	$ 65,508.00	1	$ 30,000	$ 30,000.00
A6	**AUTHORITIES AND FEES**							
A7	Construction Industry Training Fund Levy (0.2% of Contract Sum)	Item	1	$ 20,000	$ 20,000.00	1	$ 20,000	$ 20,000.00
A8	Liaison and Coordination of Service Bodies for Service Installation	Item	1	$ 10,000	$ 10,000.00	1	$ 10,000	$ 10,000.00
A9	**TESTING**							
A10	Specified Testing	Item	1	$ 20,000	$ 20,000.00	1	$ 20,000	$ 20,000.00
A11	**SURVEY/SUPERVISION/PROJECT MANAGEMENT**							
A12	As Constructed Details	Item	1	$ 20,000	$ 20,000.00	1	$ 20,000	$ 20,000.00
A13	Survey / Supervision/Project Management	Item	0	$ 337,270	$ -	0	$ 100,000	$ -
A14	**TRAFFIC MANAGEMENT**							
A15	Traffic Management- preparation, submission and approval of Traffic Management Plan	Item	1	$ 5,000	$ 5,000.00	1	$ 5,000	$ 5,000.00
A16	Traffic Management- implementation of Traffic Management Plan to the satisfaction of council	Item	1	$ 50,000	$ 50,000.00	1	$ 50,000	$ 50,000.00
A17	**CONSTRUCTION WATER**							
A18	Construction water	Item	1	$ 100,000	$ 100,000.00	1	$ 100,000	$ 100,000.00
A19	**OCCUPATIONAL HEALTH AND SAFETY**							
A20	Occupational Health and Safety Management	Item	1	$ 17,530	$ 17,530.00	1	$ 10,000	$ 10,000.00
A21	Safety Management Plan	Item	1	$ 5,000	$ 5,000.00	1	$ 5,000	$ 5,000.00
A22	**MANAGEMENT PLANS**							
A23	Construction Management Plan	Item	1	$ 5,000	$ 5,000.00	1	$ 5,000	$ 5,000.00
A24	Dust, Noise and Vibration Management Plan	Item	1	$ 5,000	$ 5,000.00	1	$ 5,000	$ 5,000.00
A25	Sediment Erosion Control Plan	Item	1	$ 5,000	$ 5,000.00	1	$ 5,000	$ 5,000.00
A26	**OTHER**							
A27	25% overheads charge on Ertech costs for earthworks, roads, drainage and water supply	Item	1	25%	$ 6,028,662.81	1	25%	$ 2,134,032.89
A28	Liaison with Aboriginal Heritage Monitors	Item	1	$ 20,000	$ 20,000.00	1	$ 10,000	$ 10,000.00
A29	Protection, preservation and monitoring of aboriginal sites	Item	1	$ 20,000	$ 20,000.00	1	$ 10,000	$ 10,000.00
A30	Other Items Necessary for Completion of the Works	Item	1	$ 20,000	$ 20,000.00	1	$ 10,000	$ 10,000.00
	SUBTOTAL PRELIMINARIES				$ 6,999,895.81			$ 2,661,032.89

ITEM	DESCRIPTION	UNIT	Est. QTY	Phase 1 (45 lots) Est. RATE	Phase 1 (45 lots) Est. TOTAL	Phase 1 Stage 1 - (3 lot release) Est. QTY	Phase 1 Stage 1 - (3 lot release) Est. RATE	Phase 1 Stage 1 - (3 lot release) Est. TOTAL
	SITEWORKS							
	CLEARING							
B1	Clearing, Grubbing and Dispose Off Site- roads and lots	m^2	329235	$ 1	$ 210,710.40	70217	$ 1	$ 44,938.88
B2	**DEMOLITION**							
B3	Remove Existing Wearing course, Pavement and Disposal	m^2	1500	$ 8	$ 11,520.00	1500	$ 8	$ 11,520.00
B4	**TOPSOIL**							
B5	Strip and Stockpile Topsoil (100mm thick)	m^2	329235	$ 4	$ 1,205,000.10	70217	$ 4	$ 256,994.22
B6	**EARTHWORKS**							
B7	Proof rolling of fill areas	m^2	329235	$ 1	$ 339,112.05	70217	$ 1	$ 72,323.51
B8	Import and Compact Sand Fill	m^3	152359	$ 68	$ 10,366,506.36	87126	$ 68	$ 5,928,053.04
B9	Cut / Fill Sand	m^3	34888	$ 15	$ 519,831.20	516	$ 15	$ 7,688.40
B10	Cut to dispose rock	m^3	1632	$ 91	$ 149,083.20	100	$ 91	$ 9,135.00
B11	Cut to dispose sand	m^3	0	$ 29	$ -	0	$ 29	$ -
B12	Cut/fill from basins	m^3	13178	$ 15	$ 196,352.20	4735	$ 15	$ 70,551.50
B13	Cut/fill from swales in sand- assume 50%	m^3	4350	$ 15	$ 64,815.00	750	$ 15	$ 11,175.00
B14	Cut to dispose from swales in rock- assume 50%	m^3	4350	$ 91	$ 397,372.50	750	$ 91	$ 68,512.50
B15	Final Trim and Shaping Lots	m^2	258965	$ 3	$ 776,895.00	61373	$ 3	$ 184,119.00
B16	Final Trim and Shaping Drains and verges	m^2	35135	$ 3	$ 105,405.00	4950	$ 3	$ 14,850.00
B17	Drainage channel diversion	Item	1	$ 50,000	$ 50,000.00	1	$ 50,000	$ 50,000.00
B18	**GEOTECHNICAL CERTIFICATION**							
B19	Geotechnical Certification of Earthworks and Site Classification (by GALT as nominated subcontractor)	Item	1	$ 15,000	$ 15,000.00	1	$ 15,000	$ 15,000.00
B20	**EROSION AND SEDIMENT CONTROL**							
B21	compliance with Sediment Erosion Control Plan	Item	1	$ 50,000	$ 50,000.00	1	$ 50,000	$ 50,000.00
B22	**STABILISATION OF FINAL SURFACES**							
B23	Soil Stabilisation Hydromulch	m^2	258965	$ 2	$ 517,930.00	61373	$ 2	$ 122,746.00
B24	**DUST CONTROL**							
B25	Prepare Dust Management Plan	Item	1	$ 5,000	$ 5,000.00	1	$ 5,000	$ 5,000.00
B26	Dust Control	Item	1	$ 187,340	$ 187,340.00	1	$ 75,000	$ 75,000.00
B27	10,000 water cart operation	weeks	20	$ 5,000	$ 100,000.00	8	$ 5,000	$ 40,000.00
B28	**DUST MONITORING**							
B29	Dust monitors solar power supply,battery backup, SMS/Email alerts security	weeks	20	$ 1,000	$ 20,000.00	8	$ 1,000	$ 8,000.00
B30	Dust monitor mobilsation to and from site	Item	1	$ 2,000	$ 2,000.00	1	$ 2,000	$ 2,000.00
	SUBTOTAL SITEWORKS				$ 15,289,873.01			$ 7,047,607.05

ITEM	DESCRIPTION	UNIT	Est. QTY	Phase 1 (45 lots) Est. RATE	Phase 1 (45 lots) Est. TOTAL	Phase 1 Stage 1 - (3 lot release) Est. QTY	Phase 1 Stage 1 - (3 lot release) Est. RATE	Phase 1 Stage 1 - (3 lot release) Est. TOTAL
	STORMWATER DRAINAGE							
	PIPEWORK/ EXCAVATE/ SUPPLY / LAY TRENCHES UP TO 2M DEEP							
	pipes							
C1	150 PVC DWV SN8	m	0	$ 187	$ -	0	$ 187	$ -
C2	300 Dia Class 2	m	0	$ 295	$ -	0	$ 295	$ -
C3	600 Dia Class 2	m	2142.32	$ 611	$ 1,308,614.75	339.16	$ 611	$ 207,172.49
C4	900 Dia Class 3	m	0	$ 1,105	$ -	0	$ 1,105	$ -
C5	**box culverts**							

C6	900 x 450 box culvert and base	m	0	$ 645	$ -	0	$ 645	$ -
C7	**PITS 1050 DIA TO SUIT PIPES UP TO 450 DIA**							
C8	Junction Pits - Heavy Duty	No.	0	$ 5,000	$ -	0	$ 5,000	$ -
C9	Junction Pits - Standard	No.	0	$ 5,000	$ -	0	$ 5,000	$ -
C10	Grated Pits with Bikesafe Lids	No.	0	$ 7,000	$ -	0	$ 7,000	$ -
C11	Bubble-up Pit with Raised Grated Lid and rock pitching complete	No.	0	$ 8,000	$ -	0	$ 8,000	$ -
C12	Side Entry Pits	No.	0	$ 5,000	$ -	0	$ 5,000	$ -
C13	Grated Combination Side Entry Pits	No.	0	$ 5,000	$ -	0	$ 5,000	$ -
C14	1800 dia Bubble Up pit complete	No.	0	$ 8,000	$ -	0	$ 8,000	$ -
C15	**SOAKWELLS**							
C16	1.8*1.8 Dia Soakwell Bikesafe Grated Lid	No.	0	$ 14,371	$ -	0	$ 14,371	$ -
C17	1.8*1.5 Dia Soakwell Bikesafe Grated Lid	No.	0	$ 13,377	$ -	0	$ 13,377	$ -
C18	1.8*1.2 Dia Soakwell Bikesafe Grated Lid	No.	0	$ 12,490	$ -	0	$ 12,490	$ -
C19	**PROTANK UNITS**							
C20	Protank soakage units (0.283m3 each)	No	0	$ 3,090	$ -	0	$ 3,090	$ -
C21	**STORMTECH INFILTRATION CELLS**							
C22	SC-310 Stormtech cells complete (1 No. 2.3m x 0.864m Unit)	No.	0	$ 2,759	$ -	0	$ 2,759	$ -
C23	Access Chambers	No.	0	$ 3,000	$ -	0	$ 3,000	$ -
C24	**KERB OUTLETS**							
C25	Rock Pitched kerb Outlets	No.	24	$ 1,000	$ 24,000.00	9	$ 1,000	$ 9,000.00
C26	**PIPE CULVERT OUTLETS**							
C27	300 Dia Outlet	No.	0	$ 3,479	$ -	0	$ 3,479	$ -
C28	600 Dia Outlet	No.	98	$ 3,719	$ 364,431.62	16	$ 3,719	$ 59,499.04
C29	900 Dia Outlet	No.	0	$ 4,529	$ -	0	$ 4,529	$ -
C30	900 by 450 box culvert headwall	No.	0	$ 4,469	$ -	0	$ 4,469	$ -
	SUB TOTAL STORMWATER DRAINAGE				$ 1,697,046.37			$ 275,671.53

				Phase 1 (45 lots)		Phase 1 Stage 1 - (3 lot release)		
ITEM	DESCRIPTION	UNIT	Est. QTY	Est. RATE	Est. TOTAL	Est. QTY	Est. RATE	Est. TOTAL
	ROADWORKS							
	SUBGRADE							
D1	Subgrade Preparation	m^2	34121	$ 6	$ 205,749.63	3584	$ 6	$ 21,611.52
D2	**PAVEMENT TYPES / FINISHES**							
D3	**Roadbase**							
D4	100 Thk Rock base Base	m^2	0	$ 34	$ -	0	$ 34	$ -
D5	150 Thk Rock base Base	m^2	34121	$ 43	$ 1,455,260.65	3584	$ 43	$ 152,857.60
D6	150 Thk Rock base SubBase	m^2	34121	$ 30	$ 1,040,008.08	3584	$ 30	$ 109,240.32
D7	200 Thk Rock base Base	m^2	0	$ 60	$ -	0	$ 60	$ -
D8	300 Thk Rock base Base	m^3	0	$ 85	$ -	0	$ 85	$ -
D9	**SEAL TYPES**							
D10	**sprayed seals- prime and first coats**							
D11	7mm prime seal	m^2	30844	$ 11	$ 349,770.96	3392	$ 11	$ 38,465.28
D12	**sprayed seals- second coats**							
D13	14mm Second Coat Seal	m^2	30844	$ 15	$ 462,660.00	3392	$ 15	$ 50,880.00
D14	**asphalt - black**							
D15	25mm AC7	m^2	0	$ 12	$ -	0	$ 12	$ -
D16	30mm AC10	m^2	0	$ 39	$ -	0	$ 39	$ -

D17	40mm AC14 intersection mix with A15E elastomeric polymer modified binder	m^2	8800	$ 49	$ 430,496.00	1600	$ 49	$ 78,272.00
D18	**INTERSECTION UPGRADE**							
D19	Intersection upgrade	Prov Item	2	$ 500,000	$ 1,000,000.00	1	$ 500,000	$ 500,000.00
D20	**KERBING**							
D21	Mountable Kerb	m	0	$ 94	$ -	0	$ 94	$ -
D22	Mountable Kerb to brick paving	m	0	$ 53	$ -	0	$ 53	$ -
D23	Semi Mountable Kerb- both sides of all roads	m	5360	$ 96	$ 514,560.00	640	$ 96	$ 61,440.00
D24	Barrier Kerb	m	0	$ 124	$ -	0	$ 124	$ -
D25	Flush Beam Reinforced	m	0	$ 90	$ -	0	$ 90	$ -
D26	**PATHS**							
D27	**concrete**							
D28	2.0m Wide Concrete Path	m2	0	$ 248	$ -	0	$ 248	$ -
D29	**LINEMARKING -by Main Roads**							
D30	Remove redundant line marking	Item	1	$ 5,000	$ 5,000.00	1	$ 5,000	$ 5,000.00
D31	Spotting of line marking and coordination with Main Roads	Item	1	$ 2,000	$ 2,000.00	1	$ 2,000	$ 2,000.00
D32	Linemarking by Main Roads	Prov Item	1	$ 10,000	$ 10,000.00	1	$ 10,000	$ 10,000.00
D33	**CROSSOVERS**							
D34	Crossovers to lots	Item	45	$ 10,000	$ 450,000.00	3	$ 10,000	$ 30,000.00
D35	**TURNAROUNDS**							
D36	Temporary Sealed Turnaround	No.	0	$ 10,000	$ -	1	$ 10,000	$ 10,000.00
	SUBTOTAL ROADWORKS				$ 5,925,505.32			$ 1,069,766.72

				Phase 1 (45 lots)		**Phase 1 Stage 1 - (3 lot release)**		
ITEM	**DESCRIPTION**	**UNIT**	**Est. QTY**	**Est. RATE**	**Est. TOTAL**	**Est. QTY**	**Est. RATE**	**Est. TOTAL**
	WATER SUPPLY							
	EXCAVATION OF COMMON SERVICE TRENCH							
E1	2.4m wide for all services (power, water, gas & Telstra/ NBN) in sand - assumed 75% of route	m	2685	$ 63	$ 168,698.55	262.5	$ 63	$ 16,492.88
E2	2.4m wide for all services (power, water, gas & Telstra/ NBN) in rock and backfill with sand- assumed 25% of route	m	895	$ 433	$ 387,266.50	87.5	$ 433	$ 37,861.25
E3	**PIPEWORK - SUPPLY, LAY, JOINT, TEST**							
E4	150 Dia UPVC cl 16	m	1880	$ 102	$ 191,534.40	230	$ 102	$ 23,432.40
E5	200 Dia UPVC cl 16 internal mains	m	800	$ 128	$ 102,624.00	120	$ 128	$ 15,393.60
E6	200 Dia UPVC cl 16 external upgrade link	m	900	$ 128	$ 115,452.00	0	$ 128	$ -
E7	250 Dia UPVC cl 16	m	0	$ 185	$ -	0	$ 185	$ -
E8	**HYDRANTS INCLUDING TEES, THRUST BLOCKS,RISERS, BOXES AND KERB / ROAD MARKERS**							
E9	Hydrant for 150 Dia	No.	19	$ 1,725	$ 32,766.07	2	$ 1,725	$ 3,449.06
E10	Hydrant for 200 Dia	No.	17	$ 2,229	$ 37,885.01	2	$ 2,229	$ 4,457.06
E11	Hydrant for 250 Dia	No.	0	$ 2,625	$ -	0	$ 2,625	$ -
E12	**VALVES INCLUDING BOXES, FITTINGS, THRUST BLOCKS, EXTENSIONS AND MARKERS**							
E13	Sluice Gate Valve for 150 Dia	No.	8	$ 3,000	$ 24,000.00	1	$ 3,000	$ 3,000.00
E14	Sluice Gate Valve for 200 Dia	No.	2	$ 3,500	$ 7,000.00	1	$ 3,500	$ 3,500.00
E15	Sluice Gate Valve for 250 Dia	No.	0	$ 4,000	$ -	0	$ 4,000	$ -
E16	**CAST IRON BENDS INCLUDING THRUST BLOCKS**							
E17	Bend 150	No.	8	$ 1,000	$ 8,000.00	1	$ 1,000	$ 1,000.00
E18	Bend 200	No.	8	$ 1,500	$ 12,000.00	1	$ 1,500	$ 1,500.00
E19	Bend 250	No.	0	$ 2,000	$ -	0	$ 2,000	$ -

E20	**CAST IRON TEES INCLUDING TAPERS AND THRUST BLOCKS**							
E21	Tee 250 X 250	No.	0	$ 2,500	$ -	0	$ 2,500	$ -
E22	Tee 250 X 200	No.	0	$ 2,500	$ -	0	$ 2,500	$ -
E23	Tee 250 X 150	No.	7	$ 2,500	$ 17,500.00	1	$ 2,500	$ 2,500.00
E24	Tee 250 X 100	No.	0	$ 2,500	$ -	0	$ 2,500	$ -
E25	Tee 200 X 150	No.	0	$ 2,500	$ -	0	$ 2,500	$ -
E26	Tee 200 X 100	No.	0	$ 2,500	$ -	0	$ 2,500	$ -
E27	Tee 200 X 200	No.	0	$ 2,500	$ -	0	$ 2,500	$ -
E28	Tee 150 X 100	No.	0	$ 2,500	$ -	0	$ 2,500	$ -
E29	Tee 150 X 150	No.	3	$ 2,500	$ 7,500.00	1	$ 2,500	$ 2,500.00
E30	**SERVICES**							
E31	Service Tapping off 250 dia pipe	No.	0	$ 1,000	$ -	0	$ 1,000	$ -
E32	Service Tapping off 200 dia pipe	No.	0	$ 1,000	$ -	0	$ 1,000	$ -
E33	Service Tapping off 150 dia pipe	No.	0	$ 1,000	$ -	0	$ 1,000	$ -
E34	32MM MDPE Long Dual Complete	No.	0	$ 500	$ -	0	$ 500	$ -
E35	25MM MDPE Long Single Complete	No.	0	$ 500	$ -	0	$ 500	$ -
E36	32MM MDPE Short Dual Complete	No.	0	$ 500	$ -	0	$ 500	$ -
E37	25MM MDPE Short Single Complete	No.	0	$ 500	$ -	0	$ 500	$ -
E38	Supply and Fit Tap Lock Boxes/ Service protectors	No.	0	$ 500	$ -	0	$ 500	$ -
E39	**WATER COPORATION FEES**							
E40	deferred services	Item	45	$ 1,000	$ 45,000.00	3	$ 1,000	$ 3,000.00
E41	connection to existing	Prov Item	2	$ 20,000	$ 40,000.00	1	$ 20,000	$ 20,000.00
E42	**OTHER**							
E43	Disinfection of water mains	No.	1	$ 5,000	$ 5,000.00	1	$ 5,000	$ 5,000.00
	SUBTOTAL WATER SUPPLY				$ 1,202,226.53			$ 143,086.25

PROPOSED SUBDIVISION: Onslow Industrial area Phase 1
PRELIMINARY OPINION OF PROBABLE COST
JOB NUMBER 22016

CONSTRUCTION COSTS	PREVIOUS JDSI ESTIMATE PHASE 1	PHASE 1 - 45 lots ESTIMATED TOTAL	Notes	Phase 1 Stage 1 - (3 lot release)	Notes
PRELIMINARIES	$ 3,797,464.00	$ 6,999,895.81		$ 2,661,033	
SITEWORKS	$ 9,370,162.00	$ 15,289,873.01		$ 7,047,607	
SEWER RETICULATION	$ 928,712.00	excl	not required as onsite disposal assumed	excl	not required as onsite disposal assumed
STORMWATER DRAINAGE	$ 949,169.00	$ 1,697,046.37		$ 275,672	
ROADWORKS	$ 3,282,069.00	$ 5,925,505.32		$ 1,069,767	
WATER SUPPLY	$ 559,537.00	$ 1,202,226.53		$ 143,086	
SEWER PUMPSTATION	$ 2,000,000.00	excl	not required as onsite disposal assumed	excl	not required as onsite disposal assumed
SEWER PRESSURE MAIN	$ 700,000.00	excl	not required as onsite disposal assumed	excl	not required as onsite disposal assumed
POWER SUPPLY / LIGHTING	$ 2,723,333.00	$ 2,723,333.00	JDSI estimate used	$ 1,000,000	Prov Item- study required
NBN	$ 406,403.00	$ 406,403.00	JDSI estimate used	$ 100,000	Prov Item- study required
LANDSCAPING	excl	$ 450,000.00	Prov allowance	$ 100,000	Prov Allowance
ENTRANCE STATEMENT	excl	$ 500,000.00	Prov allowance	$ 250,000	Prov Allowance

SUBTOTAL (EXCL GST)	**$ 24,716,849.00**	**$ 35,194,283.04**		**$ 12,647,164**	
ADD GST ALLOWANCE 10%	$ 2,471,684.90	**$ 3,519,428.30**		**$ 1,264,716**	
TOTAL CONSTRUCTION CONTRACT (INCL GST)	**$ 27,188,533.90**	**$ 38,713,711.34**		**$ 13,911,881**	
CONSTRUCTION CONTINGENCY 15%	$ 4,078,280.09	**$ 5,807,056.70**		**$ 2,086,782**	
CONSTRUCTION TOTAL (INCL GST)	**$ 31,266,813.99**	**$ 44,520,768.04**		**$ 15,998,663**	
DEVELOPMENT FEES AND CHARGES					
COUNCIL FEES AND CONTRIBUTIONS (INCL GST)	$ 86,000.00	**$ 86,000.00**	JDSI estimate used	**$ 17,200**	20% of JDSI estimate used
WATER HEADWORKS (INCL GST)	$ 261,000.00	**$ 115,065.00**	current rate	**$ 7,671**	current rate
SEWER HEADWORKS (INCL GST)	excl	**excl**	not required as onsite disposal assumed	**excl**	
POWER CHARGES (INCL GST)	$ 30,000.00	**excl**	JDSI estimate used	**$ 6,000**	20% of JDSI estimate used
MISCELANEOUS AUTHORITY FEES (INCL GST)	$ 47,400.00	**excl**	JDSI estimate used	**$ 9,480**	20% of JDSI estimate used
PROFESSIONAL FEES (INCL GST) (Engineering, Planning, Project Management)	$ 1,423,000.00	**$ 3,561,661.44**	8% assumed	**$ 1,279,893**	8% assumed
MARKETING AND SALES	excl	**$ 100,000.00**	Prov Sum	**$ 30,000**	Prov Sum
SCHEME FEES	excl	**excl**	unknown	**excl**	unknown
DEVELOPMENT FEES AND CHARGES TOTAL (INCLUDING GST)	**$ 1,847,400.00**	**$ 3,862,726.44**		**$ 1,350,244**	
TOTAL (INCLUDING GST)	**$ 33,114,213.99**	**$ 48,383,494.48**		**$ 17,348,907**	
TOTAL (EXCLUDING GST)	**$ 30,103,830.90**	**$ 43,984,994.99**		**$ 15,771,734**	
TOTAL (EXCLUDING GST) PLUS 2 YEARS ESCALATION AT ASSUMED 5% TOTAL INCREASE	**$ 31,609,022.44**	**$ 46,184,244.73**		**$ 16,560,320**	
	JDSI	**Phase 1 (45 lots)**		**Phase 1 Stage 1 - (3 lot release)**	

PRELIMINARY OPINION OF PROBABLE COST DISCLAIMER

The information provided in this estimate expresses the results of preliminary investigations only and represents an opinion of probable costs. It is based on preliminary design concepts only. It is provided to the reader as background material and to provide general assessment on possible project costs. No information in this estimate should be regarded as final or conclusive and the reader should not use this report as the basis for budgeting or investment decisions without obtaining independent analysis or detailed studies from the authors. The reader must acknowledge the underlying premise on which the information has been prepared may change significantly as a result of changes in Federal, State or Local Government or Departmental Policy, changing advice of officers in the bodies consulted, unforeseen geotechnical or contamination problems and latent conditions during the construction phase of the project, changes in market demands and variations in the wider Australian or world economies that may impact on the preliminary opinion of probable cost.