Riverside Park
Monash Drive, Swan Hill

Geotechnical Investigation
for
Swan Hill Rural City Council

Report 24C 0693
October 2024

GTS
GEOTECHNICAL TESTING SERVICES

Riverside Park,
Monash Drive, Swan Hill

Geotechnical Investigation

for

Swan Hill Rural City Council

Revision

Revision	Date	Authorised
24C 0693	9/10/2024	SEH

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APPENDIX

1 INTRODUCTION

Swan Hill Rural City Council commissioned Geotechnical Testing Services (GTS) to undertake a geotechnical investigation for the proposed development along the bank of the Murray River at the Riverside Park off Monash Drive, Swan Hill.

The purpose of the investigation was to assess general subsurface conditions at the site with a view to providing comments and design parameters for the proposed development.

It is understood that the proposed development consists of reconstruction of the existing steps and additions including retaining walls and mooring platform.

2 SITE AND GEOLOGY

2.1 SITE LOCATION AND GENERAL CONDITIONS

The site is located at the Riverside Park off Monash Drive, Swan Hill.

The site has a medium fall to the Murray River and currently occupied by the existing steps. There are few medium to large sized trees within proximity of the proposed development. At the time of the investigation, the surface of the site was moist with none to a moderate coverage of natural grass. There was no visual evidence of surface cracking or natural surface rock.

2.2 GEOLOGY

The Victorian Government's online "Geovic" map shows the site to be underlain by Quaternary aged sedimentary deposits, with this generally confirmed by the field data.

3 FIELDWORK

The geotechnical investigation was conducted on the 19th of August 2024 and involved the drilling of 6 boreholes (BH) by hand auger to termination depths of 2.0 metres. In-situ strength tests in the form of Dynamic Cone Penetrometer (DCP) were conducted within each of the boreholes with the results included on the engineering logs. In addition, samples of material were obtained for further laboratory analysis.

The field investigation was conducted by a technician under the direction of a Geotechnical Engineer, who logged the subsurface profile. The engineering logs are included in the Appendix with their locations shown on the enclosed site plan.

4 RESULTS

4.1 FIELD RESULTS – SOIL PROFILES

The field investigation indicated that the soil profile is relatively uniform across the site below the existing fill and may be summarised as follows:

FILL: Silty Sandy CLAY, medium plasticity, dark brown, fine to coarse sand, trace fine to medium gravel, stiff to very stiff.

To a depth of 0.6 metres

Overlying/Or

(Sandy) Silty CLAY, low to medium/medium plasticity, grey, red/brown, orange/brown, fine to coarse sand when present, stiff to very stiff.

To termination depths.

Reference should be made to the appended engineering logs for a full description of subsurface conditions at each location.

Groundwater inflow was not encountered over the investigated depths. However, due to the proximity to the Murray River and presence of wet material below 1.5 metres, groundwater may have formed in the boreholes if left open long enough. In addition, with the proximity to the Murray River, the depth to groundwater is it is expected to fluctuate.

4.2 LABORATORY TEST RESULTS

Samples retained from the investigation were submitted to the GTS Bendigo laboratory at the completion of the field investigation. The testing consisted of Atterberg Limit and Particle Size Distribution with the results summarised in the following table with full NATA accredited reports in the Appendix.

Table 1: Material Properties

Test Location	BH1 1.1-1.5m	BH2 0.0-0.4m	BH5 1.0-1.5m	BH6 0.0-0.6m
% Passing 19mm Sieve	100	100	100	100
% Passing 2.36mm Sieve	99	100	98	100
% Passing 0.075mm Sieve	86	93	83	74
Liquid Limit (%)	37	36	43	33
Plastic Limit (%)	14	14	20	14
Plasticity Index (%)	23	22	23	19
Linear Shrinkage (%)	10.5	10.5	11.5	8.5
Moisture Content (%)	20.4	20.7	14.4	26.4

5 ENGINEERING RECOMMENDATIONS

At this stage, the proposed development consists of the construction of new steps with retaining walls and mooring platform. As such, the development is expected to utilise shallow footings and/or deep footings (bored piers). Design parameters for the various founding options are included in the following sections.

5.1 SHALLOW FOOTINGS

Based on the results of this investigation, it is recommended that the founding material and minimum depth below existing surface level for shallow footings should be as follows:

- **(Sandy) Silty CLAY,** low to medium/medium plasticity, grey, red/brown, orange/brown, fine to coarse sand when present, stiff to very stiff.
  At depths below 0.1 metres in the region of BHs 1 to 3 and BH6 and at depths below 0.6 metres in the region of BHs 4 and 5.

For edge beams, strips and pad footings founded in the natural silty clay material as above there is an allowable bearing pressure of 100kPa available. All footings shall extend a minimum of 100mm into the above founding medium. Blinding concrete (minimum 15MPa strength) may be used to bring footings up to design levels.

Due to the potential for softening of the subsurface from groundwater infiltration from the Murray River, it is recommended that a Geotechnical Engineer inspect any footing excavations to ensure they meet the aforementioned allowable bearing pressures and material types.

Furthermore, the steps and mooring are expected to extend into the Murray River. As such, the riverbed/inundated embankments are expected to consist of soft silts/sands which are unsuitable founding material. Footings shall extend through this material and be confirmed to be on natural stiff ground by a Geotechnical Engineer.

5.2 BORED PIERS

Pending the type of construction, bored piers may be preferred. Bored piers shall be founded a minimum of 1.0 metres below surface level and may be proportioned for an allowable end bearing pressure of 150kPa and increasing to 250kPa below 2.0 metres. There is an allowable skin friction of 15kPa commencing from 1.0 metres below surface level.

5.3 SITE CLASSIFICATION

In as far as a site classification in accordance with AS2870-2011 is applicable to a development of this type, the site is classified as **Class P**, due to the evidence of uncontrolled fill material in excess of 0.4 metres and the proximity of trees which may cause abnormal moisture conditions across the site. The reactivity of the material across the site would typically lead to a Class H1-D.

5.4 EARTHWORKS

Suitable material may consist of site won Silty Clay. However, moisture conditioning (wetting up or drying back) will be required to attain proper compaction. Alternately, imported material consisting of Clayey Sand, Clayey Gravel, Sandy Gravel, or low to medium clays may be also used.

It is expected that excavation at the site will be readily achieved using conventional heavy earthmoving machinery in the fill materials and silty clay profile.

If the Silty Clay material is exposed during construction, should it become wet, it will be slippery and difficult to traffic. As such, crushed rock will be required in trafficked areas to ensure access remains available. Alternately, during dry weather, this material will dust up on the surface under traffic and therefore dust control measures such as water truck or crushed rock surfacing will be required.

Temporary excavations in the Silty CLAY material should remain stable in the short term at near vertical, however, due to the proximity to the Murray River it is recommended that it be battered back to a 1:1 (H:V) if unsupported. For any long-term batters in the clay material it is recommended that they be no steeper than 3:1 (H:V) and on completion be topsoiled and vegetated to ensure there stability against erosion. In addition, it is recommended that there are cut off drains along the top of the embankment to minimise surface water runoff down the face as well as drainage at the toe to prevent ponding of water.

It is recommended that heavy machinery maintain a minimum distance of 1.5 metres from the edge of unsupported excavations. This is to minimise the surcharge that the loading may cause and subsequent instability in the unsupported walls.

5.5 RETAINING WALL

At this stage, the type of construction for the retaining walls is unknown. However, all shallow footings (strip) should be founded as per Section 5.1 Shallow Footings. Alternatively, if bored piers are required for the retaining wall they should be founded as per Section 5.2 Bored Piers.

Soil parameters and pressure coefficients (triangular distribution) are provided for the design of retaining walls and estimated in the table below. The values of K_a and K_p allow for friction between the wall structure and the soil. These values should be modified for backfill slopes and surcharges that may apply post construction (e.g. vehicle loadings etc). Lightweight compaction equipment should only be used directly behind the retaining walls.

A drainage system comprising granular backfill and a suitable system of drainage pipes leading water away from the structure should be provided behind the walls. Even with a drainage system, it is recommended that hydrostatic pressures should be included in the design of the wall as a future safeguard.

Based on the subsurface profile the material to be retained will typically be a Silty Clay fill/natural material, with the design parameters outlined below.

DESIGN PARAMETERS	
Soil Parameters / Coefficients	**FILL/Natural: Silty CLAY**
Active earth pressure coefficient, K_a	0.5
Passive earth pressure coefficient, K_p	FILL: Not recommended Natural: 2.0
At rest earth pressure coefficient, K_0	0.95
Unit Weight, γ	18kN/m^3
Cohesion, c	FILL: 25 kPa Natural: 50 kPa
Friction Angle, ϕ	0^o

The friction angle for the clay material assumes it is saturated (zero air voids) and is a conservative assumption.

It is noted that any imported backfill material for the retaining wall may need to be assessed to determine the appropriate design parameters. Parameters for site won fill placed and compacted shall be as the Silty Clay as above.

Refer to Section 5.4 Earthworks for temporary and long-term batters in the material.

6 IMPORTANT NOTES ABOUT THIS REPORT

The results from this investigation relate to the specified sites labelled throughout this document, and hence the information obtained may need to be extrapolated to the rest of the designated area. While care has been taken throughout this investigation, soil conditions can vary between each individual test site and at depths greater than that drilled during this investigation. Hence, if variations from this report are found during excavations/construction then Geotechnical Testing Services should be notified so it can be assessed and appropriate advice provided.

The soil colours provided in the borelogs attached may vary with soil moisture content and individual interpretation, therefore colour alone should not be used to identify these soils.

Strength characteristics of soils often exhibit a large variation between wet and dry conditions. Soil characteristics of a soil profile are given on the soil conditions at the time of the investigation.

7 DISCLAIMER

This investigation has been carried out in goodwill and under the instructions of Swan Hill Rural City Council. The investigation has been undertaken with the care and skill of competent personnel as defined within Geotechnical Testing Services quality system. It is not a comprehensive investigation but a guide to the conditions throughout the designated area.

This document has been prepared for Swan Hill Rural City Council and hence no responsibility or liability is being accepted to any third party, where any part of the report is used in either isolation or without consideration of the whole document. This document is not appropriate where there has been a significant change in the project or either for the specific needs of the reader.

Please, don't hesitate to contact the undersigned, if you require any further information or assistance.

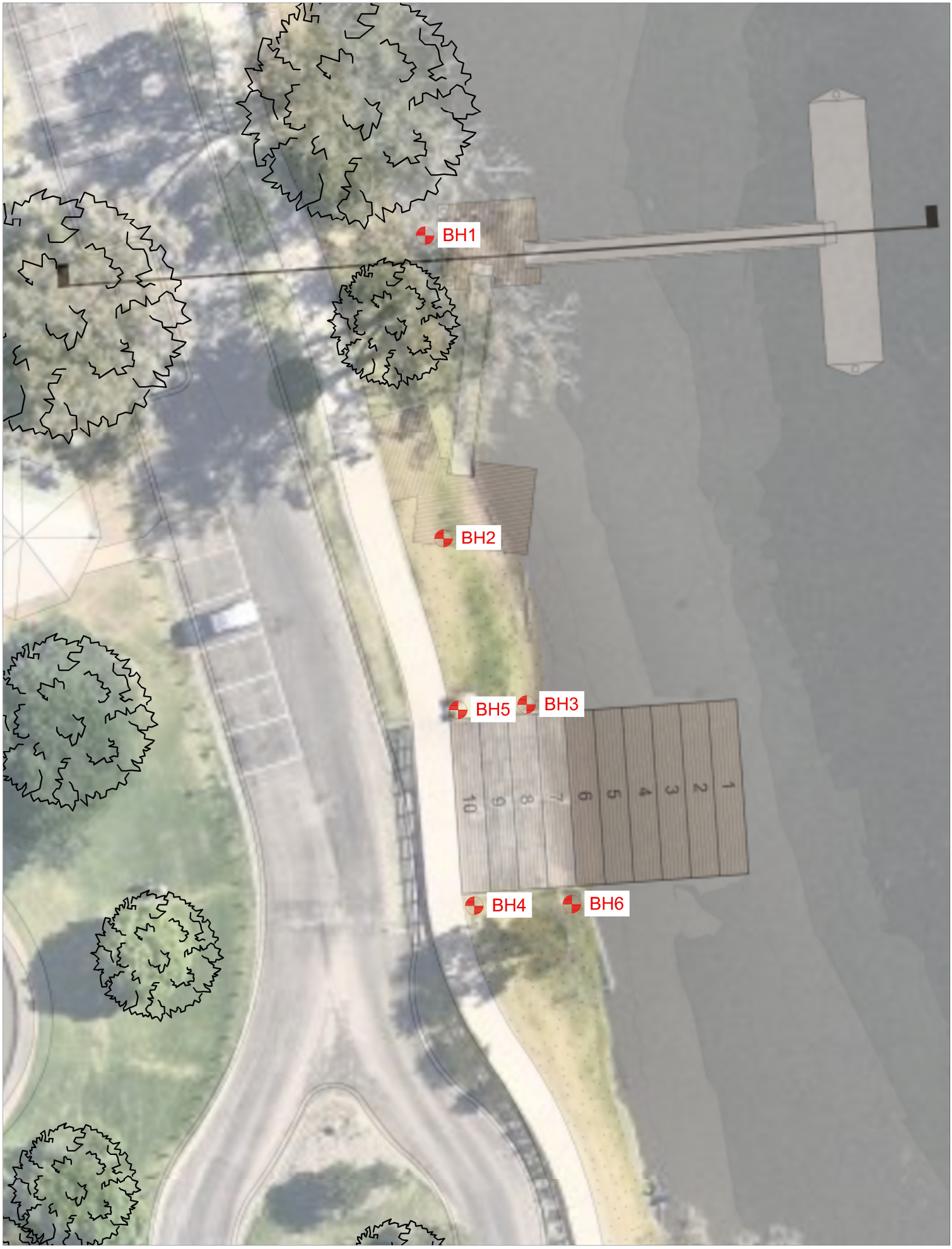
Prepared by

Corey Palmer BE (Hons) GradIEAust
Graduate Geotechnical Engineer

Reviewed by

Shane Hampton BE (Hons), MIEAust
Principal Geotechnical Engineer

APPENDIX



GTS GEOTECHNICAL TESTING SERVICES

GEOTECHNICAL INVESTIGATION

APPROXIMATE LOCATIONS
NOT TO SCALE

CLIENT: SWAN HILL RURAL CITY COUNCIL
PROJECT: MONASH DRIVE, SWAN HILL, VIC

GTS REF: 24C 0693
CLIENT REF:

DRAWN BY: VC
DATE: 4 SEPTEMBER 2024

GTS - Bendigo
13 Alstonvale Court East Bendigo VIC 3550
Phone: 03 5441 4881

Geotechnical Log - Borehole

BH 1

UTM	:	Drill Rig	: Hand Auger (Dia 75mm)	Job Number	: 24C 0693
Easting (m)	: 0.00	Driller Supplier	:	Client	: Swan Hill Rural City Council
Northing (m)	: 0.00	Logged By	: GF	Project	: Proposed retaining wall wall and mooring platform
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Monash Drive, Swan Hill VIC
Total Depth	: 2 m BGL	Date	: 19/08/2024	Loc Comment	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing			Remarks
									DCP	PP (kPa)	SPT	
		Natural		CL-CI	Silty CLAY CL-CI: stiff, low to medium plasticity, grey red brown, moist.	M		St	3			
									5			
									5			
									5			
	0.4	Natural		CI	Silty CLAY CI: stiff to very stiff, medium plasticity, grey red brown, trace fine grained sand, moist.	M		St-VSt	6			
									6			
									8			
									12			
									12			
									13			
	1.1								16			
		Natural		CL-CI	Silty CLAY CL-CI: very stiff to hard, low to medium plasticity, grey, trace fine to coarse grained sand, wet.	W		VSt-H	16			
									12			
	1.5	Natural		CI	Silty CLAY CI: very stiff, medium plasticity, grey orange brown, with fine grained sand, wet.	W		VSt				
					BH 1 Terminated at 2m							

GTS - Bendigo
13 Alstonvale Court East Bendigo VIC 3550
Phone: 03 5441 4881

Geotechnical Log - Borehole

BH 2

UTM	:	Drill Rig	: Hand Auger (Dia 75mm)	Job Number	: 24C 0693
Easting (m)	: 0.00	Driller Supplier	:	Client	: Swan Hill Rural City Council
Northing (m)	: 0.00	Logged By	: GF	Project	: Proposed retaining wall wall and mooring platform
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Monash Drive, Swan Hill VIC
Total Depth	: 2 m BGL	Date	: 19/08/2024	Loc Comment	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing			Remarks
									DCP	PP (kPa)	SPT	
		Natural		CL-CI	Silty CLAY CL-CI: stiff to very stiff, low to medium plasticity, grey orange brown, moist.	M		St-VSt				
									4			
									5			
									4			
									7			
									9			
									11			
									14			
	1.1								14			
		Natural		CL-CI	Silty CLAY CL-CI: very stiff to hard, low to medium plasticity, grey orange brown, trace fine to coarse grained sand, wet to moist.	W-M		VSt-H	20+			
	1.5											
		Natural		CI	Sandy CLAY CI: very stiff, medium plasticity, grey, fine grained sand, wet.	W		VSt				
					BH 2 Terminated at 2m							

GTS - Bendigo
13 Alstonvale Court East Bendigo VIC 3550
Phone: 03 5441 4881

Geotechnical Log - Borehole

BH 3

UTM	:	**Drill Rig**	: Hand Auger (Dia 75mm)	**Job Number**	: 24C 0693
Easting (m)	: 0.00	**Driller Supplier**	:	**Client**	: Swan Hill Rural City Council
Northing (m)	: 0.00	**Logged By**	: GF	**Project**	: Proposed retaining wall wall and mooring platform
Ground Elevation	: Not Surveyed	**Reviewed By**	:	**Location**	: Monash Drive, Swan Hill VIC
Total Depth	: 2 m BGL	**Date**	: 19/08/2024	**Loc Comment**	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing			Remarks
									DCP	PP (kPa)	SPT	
		Natural		CI	Silty to sandy CLAY CI: stiff to very stiff, medium plasticity, pale brown grey, fine to medium grained sand, moist.	M		St-VSt	2			
									5			
									5			
									5			
									8			
									11			
									11			
									13			
									15			
									14			
									16			
									15			
									18			
	1.6	Natural		CL-CI	Silty CLAY CL-CI: very stiff, low to medium plasticity, pale brown grey, trace fine to coarse grained sand, wet.	W		VSt				
					BH 3 Terminated at 2m							

GTS - Bendigo
13 Alstonvale Court East Bendigo VIC 3550
Phone: 03 5441 4881

Geotechnical Log - Borehole

BH 4

UTM	:	**Drill Rig**	: Hand Auger (Dia 75mm)	**Job Number**	: 24C 0693
Easting (m)	: 0.00	**Driller Supplier**	:	**Client**	: Swan Hill Rural City Council
Northing (m)	: 0.00	**Logged By**	: GF	**Project**	: Proposed retaining wall wall and mooring platform
Ground Elevation	: Not Surveyed	**Reviewed By**	:	**Location**	: Monash Drive, Swan Hill VIC
Total Depth	: 2 m BGL	**Date**	: 19/08/2024	**Loc Comment**	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing			Remarks
									DCP	PP (kPa)	SPT	
		Fill		CI	Silty to sandy CLAY CI: medium plasticity, dark brown, stiff to very stiff, fine to coarse grained sand, trace fine to medium sized gravel, moist.	M		St-VSt	6			
									12			
									8			
									6			
									5			
									5			
	0.6	Natural		CI	Silty CLAY CI: stiff to very stiff, medium plasticity, grey, trace fine to coarse grained sand, moist.	M		St-VSt	5			
									8			
									13			
									13			
									12			
									12			
									10			
					BH 4 Terminated at 2m							

GTS - Bendigo
13 Alstonvale Court East Bendigo VIC 3550
Phone: 03 5441 4881

Geotechnical Log - Borehole

BH 5

UTM	:	**Drill Rig**	: Hand Auger (Dia 75mm)	**Job Number**	: 24C 0693
Easting (m)	: 0.00	**Driller Supplier**	:	**Client**	: Swan Hill Rural City Council
Northing (m)	: 0.00	**Logged By**	: GF	**Project**	: Proposed retaining wall wall and mooring platform
Ground Elevation	: Not Surveyed	**Reviewed By**	:	**Location**	: Monash Drive, Swan Hill VIC
Total Depth	: 2 m BGL	**Date**	: 19/08/2024	**Loc Comment**	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing			Remarks
									DCP	PP (kPa)	SPT	
		Fill		CI	Silty to sandy CLAY CI: medium plasticity, dark brown, stiff to very stiff, fine to medium grained sand, trace fine to coarse sized gravel, moist.	M		St-VSt	8			
									8			
									8			
									8			
									10			
									6			
	0.6	Natural		CI	Silty CLAY CI: stiff to very stiff, medium plasticity, grey, with fine to coarse grained sand, moist.	M		St-VSt	5			
									9			
									12			
									15			
									13			
					BH 5 Terminated at 2m							

GTS - Bendigo
13 Alstonvale Court East Bendigo VIC 3550
Phone: 03 5441 4881

Geotechnical Log - Borehole

BH 6

UTM	:	**Drill Rig**	: Hand Auger (Dia 75mm)	**Job Number**	: 24C 0693
Easting (m)	: 0.00	**Driller Supplier**	:	**Client**	: Swan Hill Rural City Council
Northing (m)	: 0.00	**Logged By**	: GF	**Project**	: Proposed retaining wall wall and mooring platform
Ground Elevation	: Not Surveyed	**Reviewed By**	:	**Location**	: Monash Drive, Swan Hill VIC
Total Depth	: 2 m BGL	**Date**	: 19/08/2024	**Loc Comment**	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing: DCP	Testing: PP (kPa)	Testing: SPT	Remarks
		Natural		CL-CI	Silty CLAY CL-CI: stiff to very stiff, low to medium plasticity, grey, with fine grained sand, moist.	M		St-VSt	3			
									5			
									5			
									6			
									8			
									10			
									11			
									14			
									14			
									14			
									15			
									15			
									18			
	1.7	Natural		CL	Silty to sandy CLAY CL: very stiff, low plasticity, pale brown pale grey, fine to medium grained sand, wet.	W		VSt				
					BH 6 Terminated at 2m							

Material Test Report

Report Number: **P242787-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242787
Project Name: Proposed Steps and Retaining Walls
Project Location: Monash Drive, Swan Hill
Client Reference: 24C 0693
Work Request: 16154
Sample Number: B24-16154A
Date Sampled: 19/08/2024
Dates Tested: 30/08/2024 - 09/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH1 , Depth: 1.1-1.5m**
Material: Refer to Borehole Logs

Geotechnical Testing Services (Southern)
Bendigo Soil and Concrete Testing Laboratory
13 Alstonvale Court East Bendigo VIC 3550
Phone:
Email: jamess@gts.com.au

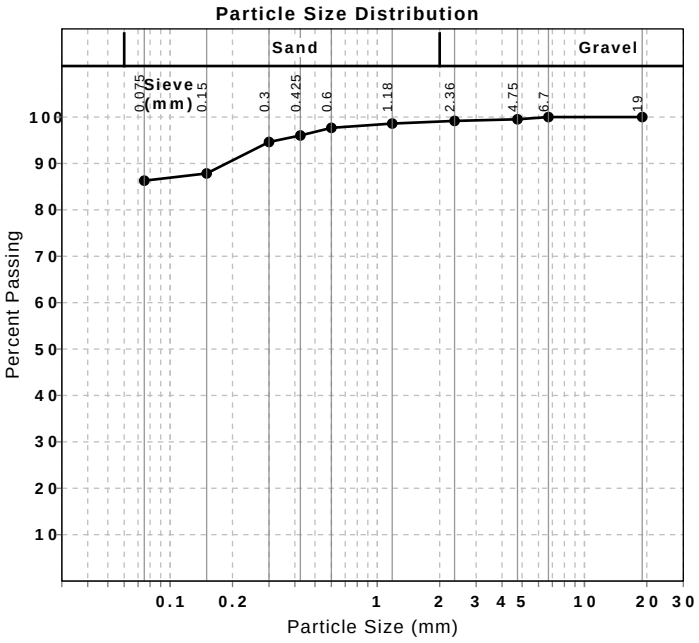
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

Particle Size Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
6.7 mm	**100**			0		
4.75 mm	**100**			0		
2.36 mm	**99**			0		
1.18 mm	**99**			1		
0.6 mm	**98**			1		
0.425 mm	**96**			2		
0.3 mm	**95**			1		
0.15 mm	**88**			7		
0.075 mm	**86**			2		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	37		
Plastic Limit (%)	14		
Plasticity Index (%)	**23**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**10.5**		
Cracking Crumbling Curling	Cracking & Curling		



Material Test Report

Report Number: **P242787-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242787
Project Name: Proposed Steps and Retaining Walls
Project Location: Monash Drive, Swan Hill
Client Reference: 24C 0693
Work Request: 16154
Sample Number: B24-16154B
Date Sampled: 19/08/2024
Dates Tested: 30/08/2024 - 06/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH2 (0.0-0.4m)**
Material: Refer to Borehole Logs

Geotechnical Testing Services (Southern)
Bendigo Soil and Concrete Testing Laboratory
13 Alstonvale Court East Bendigo VIC 3550
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Email: jamess@gts.com.au

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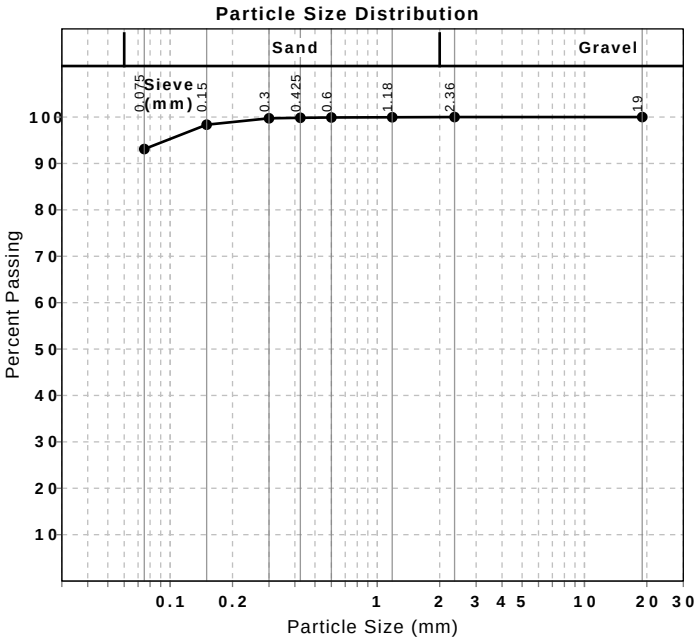
Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

Particle Size Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
2.36 mm	**100**			0		
1.18 mm	**100**			0		
0.6 mm	**100**			0		
0.425 mm	**100**			0		
0.3 mm	**100**			0		
0.15 mm	**98**			1		
0.075 mm	**93**			5		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	36		
Plastic Limit (%)	14		
Plasticity Index (%)	**22**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**10.5**		
Cracking Crumbling Curling	None		



Material Test Report

Report Number: **P242787-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242787
Project Name: Proposed Steps and Retaining Walls
Project Location: Monash Drive, Swan Hill
Client Reference: 24C 0693
Work Request: 16154
Sample Number: B24-16154C
Date Sampled: 19/08/2024
Dates Tested: 30/08/2024 - 09/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH5 , Depth: 1.0-1.5m**
Material: Refer to Borehole Logs

Geotechnical Testing Services (Southern)
Bendigo Soil and Concrete Testing Laboratory
13 Alstonvale Court East Bendigo VIC 3550
Phone:
Email: jamess@gts.com.au

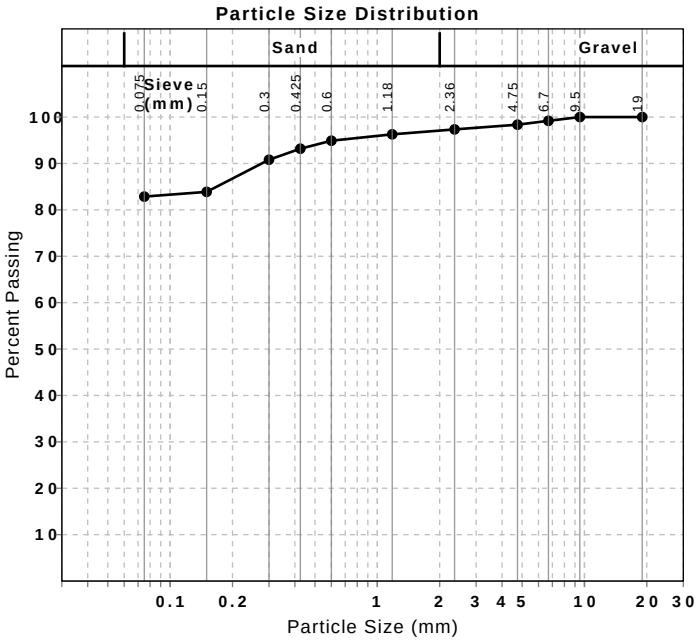
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

Particle Size Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
9.5 mm	**100**			0		
6.7 mm	**99**			1		
4.75 mm	**98**			1		
2.36 mm	**97**			1		
1.18 mm	**96**			1		
0.6 mm	**95**			1		
0.425 mm	**93**			2		
0.3 mm	**91**			2		
0.15 mm	**84**			7		
0.075 mm	**83**			1		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	43		
Plastic Limit (%)	20		
Plasticity Index (%)	**23**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**11.5**		
Cracking Crumbling Curling	Cracking		



Material Test Report

Report Number: **P242787-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242787
Project Name: Proposed Steps and Retaining Walls
Project Location: Monash Drive, Swan Hill
Client Reference: 24C 0693
Work Request: 16154
Sample Number: B24-16154D
Date Sampled: 19/08/2024
Dates Tested: 30/08/2024 - 09/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH6 (0.0-0.6m)**
Material: Refer to Borehole Logs

Geotechnical Testing Services (Southern)
Bendigo Soil and Concrete Testing Laboratory
13 Alstonvale Court East Bendigo VIC 3550
Phone:
Email: jamess@gts.com.au

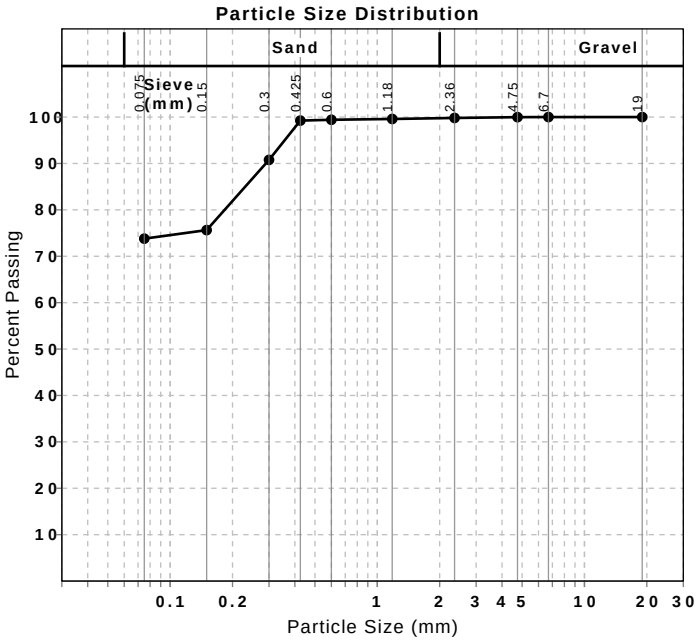
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

Particle Size Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
6.7 mm	**100**			0		
4.75 mm	**100**			0		
2.36 mm	**100**			0		
1.18 mm	**100**			0		
0.6 mm	**99**			0		
0.425 mm	**99**			0		
0.3 mm	**91**			8		
0.15 mm	**76**			15		
0.075 mm	**74**			2		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	33		
Plastic Limit (%)	14		
Plasticity Index (%)	**19**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**8.5**		
Cracking Crumbling Curling	Cracking & Curling		



Material Test Report

Report Number: **P242787-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242787
Project Name: Proposed Steps and Retaining Walls
Project Location: Monash Drive, Swan Hill
Client Reference: 24C 0693
Work Request: 16154
Dates Tested: 30/08/2024 - 30/08/2024
Location: Material Investigation - Monash Drive, Swan Hill - 24C 0693

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Moisture Content AS 1289 2.1.1					
Sample Number	Sample Location	Moisture Content (%)	Min	Max	Material
B24-16154A	BH1 , Depth: 1.1-1.5m	20.4 %	**	**	Refer to Borehole Logs
B24-16154C	BH5 , Depth: 1.0-1.5m	14.4 %	**	**	Refer to Borehole Logs

DESCRIPTIVE TERMS
BOREHOLE/EXCAVATION LOG

Classification Symbol & Soil Name

Classification of material and its description is based on the Unified Classification System as referenced in AS1726 – 1993 Geotechnical Site Investigations, Appendix A. A summary of the more common terms is included within.

Particle Size Descriptive Terms

Name	Subdivision	Size
Boulders		>200mm
Cobbles		63 – 200mm
Gravel	Coarse	20 – 63mm
	Medium	6 – 20mm
	Fine	2.36 – 6mm
Sand	Coarse	0.6 – 2.36mm
	Medium	200 – 600 micron
	Fine	75 – 200 micron
Silt		2 – 75 micron
Clay		< 2 micron

Consistency of Cohesive Soils

Term	Undrained shear strength, s_u (kPa)	Field Guide
Very Soft (VS)	<12	A finger can be pushed well into the soil with little effort
Soft (S)	12 – 25	A finger can be pushed into the soil to about 25mm depth
Firm (F)	25 – 50	The soil can be indented about 5mm with the thumb
Stiff (St)	50 – 100	The surface of the soil can be indented with the thumb
Very Stiff (VSt)	100 – 200	The surface of the soil can be indented by thumb nail
Hard (H)	>200	The surface of the soil can be marked only with the thumbnail
Friable (F)	-	Crumbles or powders when scraped by thumbnail

Density of Granular Soils

Term	Density Index (%)
Very Loose (VL)	< 15
Loose (L)	15 – 35
Medium Dense (MD)	35 – 65
Dense (D)	65 – 85
Very Dense (VD)	> 85

Minor Components

Term	Field Guide	Proportion of Minor Component In:
Trace of	Presence just detectable by feel or eye	Coarse grained soils: <5% Fine grained soils: <15%
Some	Presence easily detectable by feel or eye	Coarse grained soils: 5-12% Fine grained soils: 15-30%

Moisture Condition

Dry (D)	Looks & feels dry. Cohesive soils are usually hard, powdery or friable. Granular soils run freely through the hand.
Moist (M)	Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere. Free water does not form.
Wet (W)	As for moist, but with free water forming on hands when remoulded.

Method

S	Auger Screwing	**W**	Washboring	**B**	Blade/bucket
D	Auger Drilling	**N**	Natural Exposure	**C**	Coring
R	Roller/tricone	**E**	Existing Excavation	**H**	Hammer Drill

Support

*****	Nil
C	Casing
M	Mud/polymer

Water

*	Not observed
▽	Observed water level (date shown)
▶	Observed water inflow
◀	Observed water outflow
R	Refer to report for details

Notes, Samples, Tests

U63	Undisturbed sample, 63mm diameter
D	Disturbed sample
N*	Standard Penetration Test, (*) Sample Figure = results

Structures, Additional Observations

PP	Pocket Penetrometer test (kPa)
DCP	Dynamic Cone Penetrometer test (blows/100mm)

Surface

_____	Known boundary
- - - - - - - - - -	Probably boundary
-?-?-?-?-?-?-	Possible boundary