Agribusiness SOLUTIONS

Effluent Management Plan

Middlebrook

Agribusiness Solutions Pty Ltd
PO Box 1094, Deniliquin NSW 2710
Ph: (03) 5881 5680
Fax: (03) 5881 5680
Email: brian@agbizsolutions.com.au
ACN: 644 904 370
ABN: 92 644 904 370

Effluent Management Plan *Prepared by*

Name	Brian Crockart
Qualifications	MBA, B.Sc. Agric Economics, Registered Effluent System Designer
Position	Director/Consultant
Company	Agribusiness Solutions Pty Ltd
Address	597 Harfleur Street, PO Box 1094, Deniliquin NSW 2710
Phone	0427 129 004

In respect of development application for

Project name	Middlebrook Barn Development
Applicant	Peter, Jane & Sam Middlebrook
Primary Contact	Sam Middlebrook
Position	Owner/Operations Manager
Address	796 Maxwells Road, Finley , NSW 2710
Phone	0427 440
Email	
Secondary Contact	Peter Middlebrook
Position	Owner
Phone	0428 959 273

The Proposal Intensive Livestock Agriculture – 750 dairy cows (restricted) including the construction of 1 compost barn (600 cows) and effluent ponds. 150 cows to remain on dry lot through summer with grazing from April to November.

Subject Land 70/-/DP752297

Disclaimer While every reasonable effort has been made to ensure that this document is correct at the time of printing, Agribusiness Solutions and its employees make no representation, undertake no duty and accept no responsibility to any third parties who use or rely upon this document, or the information contained in it.

Table of Contents

List of Tables

Table of Figures

List of Maps

1. Statement of intention

This Effluent Management Plan outlines the design parameters of the proposed dairy effluent system and its capacity to handle the effluent and dairy water from a 600 Cow Compost Barn. 150 cows to remain on dry lot through summer with grazing from April to November (Total 750 cows).

The property is Located at 796 Maxwells Road, NSW 2710, within the Berrigan Shire Council.

Proposed development

- Compost barn to house 600 cows.
- 3 sedimentation basins.
- 1 storage pond.

Objective

- Improved cow comfort and productivity.
- Long term sustainability and economic viability.

Modelling Assumptions & Future development

Future development plans have been considered when developing the effluent management plan, hence all calculations in this Effluent Management Plan are based on 750 cows.

Related Documents

This document should be read in conjunction with the Statement of Environmental Effects (SEE) as it provides context for the Effluent Management Plan.

Statutory Requirements

This effluent management plan aims to enable the on-farm effluent system to be managed effectively, meeting the nutrient management needs of both the farm and the environment. It ensures compliance with water quality protection requirements as governed by the Protection of the Environment Operations Act 1997 (POEO Act), which provides the statutory framework for managing water pollution in NSW.

Reference Documents

Calculations used to develop the recommendations in this report have been based on recommendations and modelling from:

- Effluent and Manure Management Database for the Australian Dairy Industry, 2008.
- Effluent Tool Kit 11.7, DPI Victoria, 2018.

2. Farm Overview

The dairy has been operating as a dairy farm for the past 30 years, and Peter & Jane Middlebrook operated a dairy on the property since 2002. They currently milk 500 cows in a dry lot, with some grazing. The aim is to move 600 cows into a compost barn where cow comfort is significantly improved and management of manure, effluent and odour is also improved. The existing dry lots will be used for sick cows and heifers with the herd size increasing to a total of 750 milking cows.

Property and farm management details Summary	
Herd capacity	Current - 500 cows
Describe current infrastructure & management	50-unit Rotary dairy Grazing cows through autumn, winter and spring with cows in dry lot pens during summer
Fresh water use	Current water use – 39,900 litres/day
Cow production	≈ 8,000 litres per cow (annual milk)
Herd breed and average cow weight	Holstein herd 600kg average
Calving pattern	Daily calving pattern
Type of farming system	Current - Animal Production – grazing with drylot through summer months.
Type of development contemplating	Compost Barn to house 600 cows
Additional infrastructure (current proposal)	600 cow compost barn, 3 Sedimentation basins and storage.
Effluent application area	Currently 242 ha, via flood irrigation
Odour risks	Low, existing dairy enterprise. Compost barn is drier and less odourous than drylot
Impact on current effluent system	No impact as it will have a separate effluent system that allows for recycling of effluent water for flood wash and irrigation.
Native vegetation removal	None
Nearest neighbouring from development	1,246m NNE of proposed storage pond
Nearest neighbour from current facility	1,326m NNE of old dry lot
Nearest road network	379m Larkins Road
Nearest property boundary	370m
Nearest waterway	645m Myrtle Park Drain
Topography of site	Flat
General comments: Upgrading facilities to improve cow comfort, productivity and reduce odour	

3. Current Effluent System

3.1 Contribution to the effluent Stream

A critical factor in determining the required size of effluent system components is the volume of water and manure entering the system. The main sources of water entering the current effluent system include cleaning of the dairy facility, rainfall runoff from yard surfaces, and rainfall on pond surfaces.

Rainfall from the dairy roof is collected in a water tank, while rainfall from the yards flows into the anaerobic pond. Rainfall and runoff from the dry lot are directed to the drainage recycling system. The cows also generate both manure and urine, which contribute to the effluent system

3.2 Fresh Water Use

The table below summarises the freshwater requirements of the dairy facility

Table 1 - Summary of Water Use

Vat rinsing	1,350
Plant rinse	2,250
Pit area 7 platform hosing	10,500
Cup spray wetting	12,500
Platform wetting (during milking)	12,500
Teat wash	500
Yard Flood wash (recycled water)	0
Plate cooler (recycled water)	0
Total daily water use (fresh water only)	39,900

3.3 Runoff

Runoff from the dairy roof is directed to rainwater tanks alongside the dairy. Runoff from the dairy yard is directed to the Storage Ponds. The total catchment area of the dairy yards is calculated at 1,144m^2.

3.4 Current effluent System Design

The current effluent system consists of two effluent ponds that are connected to the drainage recycling system, allowing for the reuse of runoff and effluent. Water drains from the dairy and yards into the anaerobic pond, which overflows into storage pond 1. A pump located on the storage pond fills the flood wash tank at the dairy. Runoff from the dry lot roof and yards is directed to the recycling system.

The image below illustrates the current facility and effluent system. The storage pond is connected to the irrigation system, where recycled effluent water is used for crop irrigation. It is designed to store four months' worth of effluent during the winter storage period and can handle runoff from the 90th percentile rainfall from the dairy and yards.

Map 1 - Current Facility infrastructure

3.5 Current Effluent System Capacity.

The effluent system servicing the dairy and yards was designed to handle wet years. For this reason, the 90th percentile rainfall and 10th percentile (adjusted) evapotranspiration were used to calculate the pond sizes.

The winter storage period is defined as the time when 90th percentile rainfall exceeds 10th percentile evaporation. In this case, the period spans four months, from the start of May to the end of August. Since the majority of stored water on the farm is used for autumn irrigation in March and April, as well as the first irrigation in September, the storage period for 90th percentile rainfall is assumed to be the 123 days between May and August.

The table below summarizes the current effluent system capacity, which has been calculated to be fit for purpose.

Table 2 - Effluent Storage Capacity

Winter storage period required	123 days (1St May to 31st Augus)
Storage requirement	6.5 ML (Rainfall, runoff, water use and urine)
Total capacity required	9.95ML (includes freeboard and residual sludge)
Effective storage available	10.18 ML
Total pond capacity	13.63ML (includes freeboard)

3.6 Water Availability and Use

Stock and domestic water for facility cleaning and livestock drinking is sourced from the MIL channel system and stock and domestic bores.

Water quality from the MIL channel system (EC 350 or 0.35 dSm^{-1}) is suitable for both stock consumption and irrigation. Salinity in the stock and domestic bore is .85 dSm. There are no adverse impacts on dairy livestock when water salinity is less than 3,900 EC units (3.9 dSm^{-1}).

The tables below summarise water licensing & availability, water use in the dairy and irrigation water use for crop production. See Appendix A for bore water analysis.

Table 3 - Water Availability

Water Class	**Volume (ML)**
MIL Water entitlement	1,621
Stock & domestic shallow bore	182
Total	1,803

Table 4 - Cropping Program water use

Crop	**Area (Ha)**	**Yield (T DM/Ha)**	**Yield (T DM)**	**Water Use (ML/Ha)**	**Total Water (ML)**	**T DM/ML**
Maize	90	20	1,800	7	630	2.9
Pasture Grazing/Silage	242	7	3,091	4	968	3.2
Lucerne hay	81	13	1,053	8	648	1.6
Wheat for Grain/Silage	245	6	1,470	1.5	368	4.0
Total Area cropped	**658**		**7,413**	**4.0**	**2,613**	**2.8**

Table 5 - Total Annual Water Use Summary

Water Use	ML
Facility Water	14.6
Drinking Water	41.1
Irrigation Water	2,613
Total Requirement	2,669
Temporary Requirement	1,048

Note: water requirements will be met by purchasing water on the temporary market or adjusting the cropping program based on seasonal conditions.

4. Climate Data

Finley, located in the southern Riverina region of New South Wales, experiences a temperate climate characterized by hot summers and mild winters. Here's a summary of its climate data:

- **Rainfall**: Finley is in a low-rainfall zone, with an average annual rainfall of around 400-500 mm. Rainfall is relatively evenly distributed throughout the year, but there is a slight peak in late winter and spring.
- **Temperature**:
  - **Summer** (December to February): Hot, with daytime temperatures often exceeding 30°C. Maximum temperatures can sometimes reach 40°C or higher during heatwaves.
  - **Winter** (June to August): Mild, with average daytime temperatures around 13-15°C. Nights can be cold, with minimum temperatures occasionally dropping below freezing.
- **Evaporation**: High, particularly in the warmer months, where evaporation rates typically exceed rainfall. This is especially notable in the summer, when evaporation significantly surpasses precipitation.
- **Humidity**: Relatively low, especially in summer, contributing to the dry, arid conditions during the hotter months.
- **Wind**: The region experiences moderate winds, which can increase evaporation rates and exacerbate the dryness in summer.

Table 6 – Climate Data

Climate Data	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Avg
Avg Max Temp (°C)	32.6	31.5	28.4	23.4	18.2	14.8	14.3	16.7	20.6	24.8	28.3	31	23.6
Avg Min Temp (°C)	16.8	16.5	13.8	9.9	6.1	3.4	2.7	4.1	6.8	9.8	12.8	15.2	9.8
Avg Rainfall (mm)	29.3	34.5	30.5	24.2	29.4	36.3	33.8	33.0	33.5	37.2	41.5	30.7	394
Avg Evaporation	276	215	176	100	55	36	39	59	95	151	199	256	1657
Avg Humidity (%)	45	47	50	60	70	80	85	75	65	55	50	45	61.7
Avg Sunshine Hours	320	290	270	220	180	160	160	190	230	270	290	310	244.2
Avg Wind Speed (km/h)	15	14	15	14	12	12	13	14	16	17	16	15	14.3

(Source: BOM, 2024)

4.1 Current pond sizing – Anaerobic Pond & Storage Pond 1

4.1.1 Anaerobic Pond

Solids Pond

Type of solids pond: Anaerobic pond

Desludge period: 3 Years (0.6)

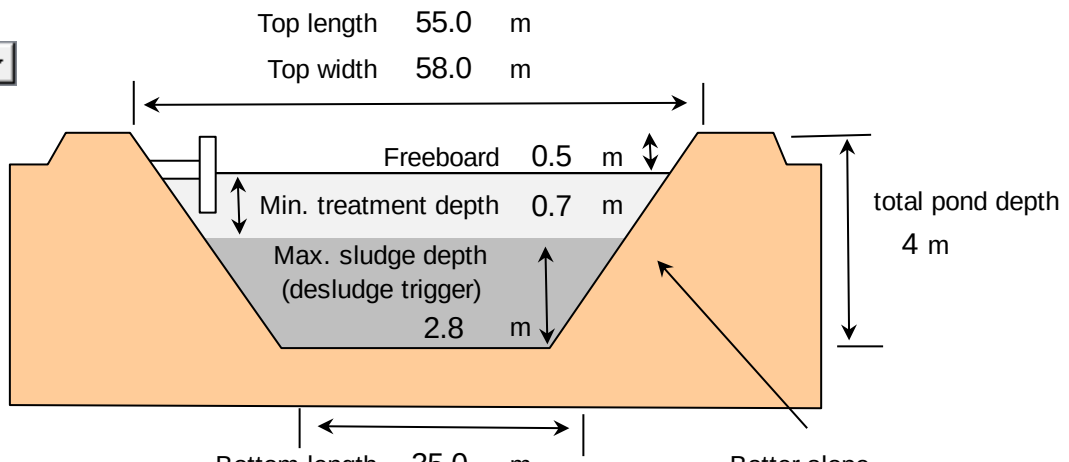
Freeboard (m): 0.5

Internal batter: 2.5 :1

Top length (m): 55

Top width (m): 58

Total depth (m): 4



Effective volume (sludge plus treatment) required	**12.73**	**ML**
Effective volume (sludge plus treatment) available	**7.25**	**ML**
Total pond capacity	**8.77**	**ML**

Breakdown of effective volume requirements

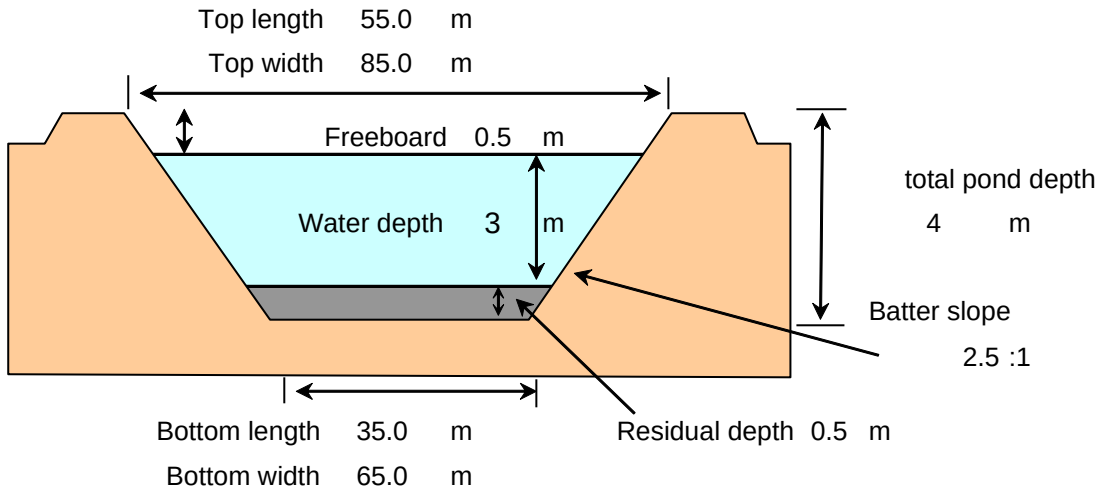
Sludge volume	5.38	ML
Active treatment volume	7.35	ML

The capacity of the Anaerobic Pond near the dairy is 8.77 megalitres. This pond will hold the majority of sludge and solids from the dairy and yards. The Anaerobic Pond overflows to the storage pond.

4.1.1 Storage Pond 1.

2nd pond **Used for storage**

Freeboard (m)	0.5	
Internal batter	2.5	:1
Residual depth (m)	0.5	
Top length (m)	55	
Top width (m)	85	
Total depth (m)	4	



Effective storage required	**6.50**	**ML**
Effective storage available	**10.18**	**ML**
Total pond capacity	**13.63**	**ML**

Breakdown of storage requirements

Net rain on pond surfaces	0.816	ML
Rainfall catchment	0.200	ML
water use + urine	5.484	ML
total effective storage required	***6.500***	***ML***
Freeboard	2.251	ML
Residual volume	1.201	ML
total capacity required	***9.952***	***ML***

Excess effluent from the Anaerobic Pond flows to the storage pond. Based on the water use in the dairy, runoff from yards and rainfall on the pond surfaces, the total storage capacity required for the dairy and surrounds is 9.95 megalitres. The current total capacity of the ponds is 13.63 megalitres

5. Proposed Effluent System

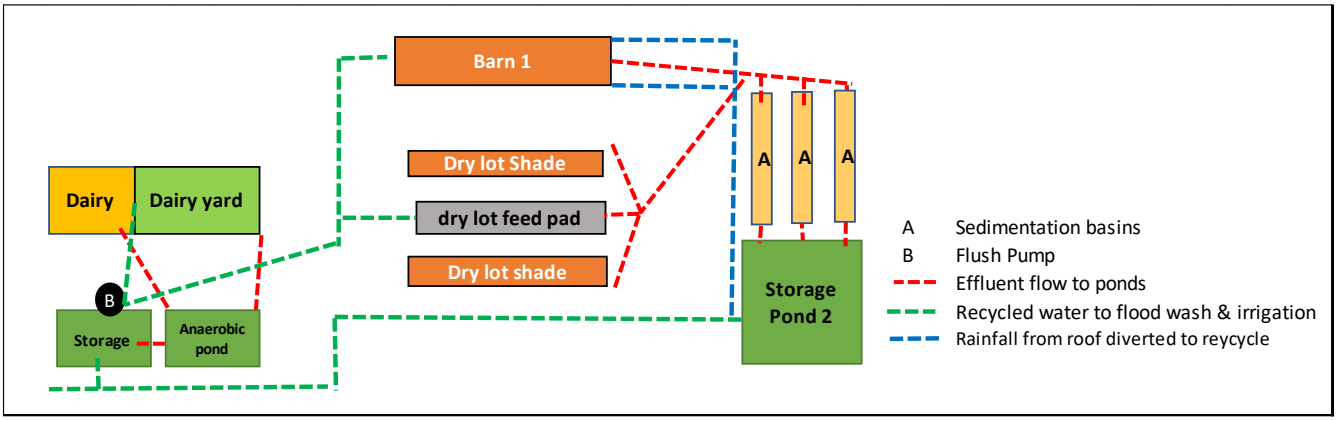
5.1 Effluent System

The diagram below represents a schematic of the new effluent system, which will be largely separate from the current system. If the effluent water for the flush system runs low, water will be pumped into the Storage Dam (1) from the recycle drain for use in the flood wash at the dairy and barn.

Effluent from the barn and dry lot will flow into the new system, which consists of 3 sedimentation basins and a storage pond. The number of sedimentation basins will be determined by the earthen fill requirements of the new facility. Rainfall from the barn roof will be diverted to the recycle drain and will not enter the sediment basin and storage pond.

Effluent from the cow alleys in the barn and the dry lot feed pad will be directed to the sedimentation basins, where solid manure will separate from the liquid effluent. The effluent will transfer from the sedimentation basins to Storage Pond B. Effluent pumped from Storage Pond B will be used to flood wash the cow alley and will also be transferred to the irrigation recycle sump for crop irrigation purposes.

Figure 1 - Effluent System Schematic



5.2 Flood Wash System

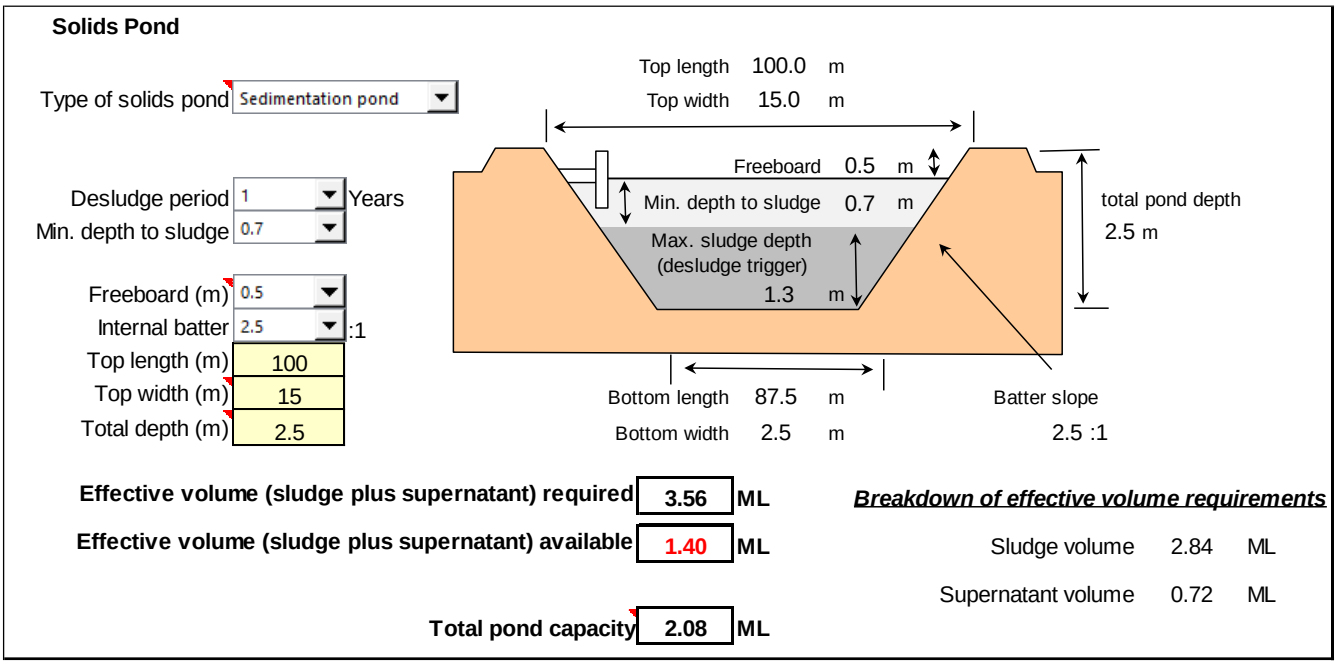
The flood wash system in the barn is designed to carry effluent and solid waste from the cow alley to a sump at the end of the barn, from where it is piped to the sedimentation ponds. A similar sump will be positioned at the bottom of the dry lot cow alley. To achieve this outcome, the slope of the alley needs to be a minimum of 1%, and the flow depth must be at least 50 mm. Given the length of the alley (200 m) and the width of the alley (4 m), the Dairy Flood Wash calculator (Skerman, 2008) requires a minimum flush volume for one-third alley length contact time of 18,092 litres and a contact time of 66 seconds.

Picture 1 - Cow Alley Flush System

5.3 Sedimentation Basins

Solid/liquid separation is a necessary process to avoid excessive buildup in the storage pond, as sludge is difficult to remove from large ponds. Sedimentation basins are typically designed to drain completely so that the material removed during clean-out can be handled as a solid. Three sedimentation basins, with provisions to divert flows to one while the others dry, provide the opportunity to maximize the solids content of the material removed. The basins are long and shallow to allow easy access for excavators and are spaced at a minimum of 15 meters apart to facilitate traffic between them.

Table 7 - Sedimentation Basin Capacity (per basin)



5.4 Operation and Maintenance

- Each basin will develop a thick, dry surface crust that will act as a biofilter to reduce odour emissions.
- The triple pond arrangement allows one basin to dry out while the other is in use. The solids are removed using an excavator and are suitable for immediate spreading with a conventional manure spreader.
- Concrete structures will be built to enable the diversion of effluent between the ponds.

5.5 Overflow to Storage Pond

The sedimentation basins will have concrete overflow structures or pipes that divert effluent to the storage pond and retain the solids in the basin. Effluent will gravity feed from the sedimentation basins to Storage Pond 2(slope 0.5%).

5.6 Storage pond

The effluent from the sedimentation basins will drain into the storage pond for reuse in the flushing system and the irrigation system. The effluent storage pond is calculated based on facility water use and the 90th percentile rainfall contributions over a specified winter storage period. This period typically occurs when rainfall exceeds evaporation. In this case, the winter storage period is 123 days, covering the months of May, June, July, and August.

From time to time, fresh water may need to be added to the storage pond to dilute the effluent and

reduce odours. The pond will also require desludging periodically, as sludge will separate from the liquid component of the effluent and settle on the pond floor. This will be accomplished by agitating the sludge to allow it to be suspended in the liquid phase and pumped into a tanker for spreading. Note that the storage pond has been oversized to provide fill for the barn development and to allow for future expansion of the dairy operation.

5.7 Water Balance and pond sizing

The tables below show the water balance and weather data used to calculate the required winter storage period. The winter storage period refers to the time of year when no effluent can be used for irrigation, and the ponds must store all effluent during this period. The winter storage period is calculated to be four months.

Given that the flood wash water is recycled from the storage ponds, one could argue that the pond requirements are overestimated. However, the storage ponds will also receive runoff from the dry lot and act as a buffer to ensure that flood wash effluent is always available. The storage capacity will also allow for the use of fresh water from time to time to dilute the effluent.

Table 8 – Winter Storage Period, Rainfall and Evaporation tables

Climate location chosen: **Finley**	Locality for K value: **2710 Deniliquin -35.22 145.03**	K= **0.73**

	1	2	3	4	5	6	7	8	9	10	11	12	13	
Climate data		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual (sum of months)**
Precipitation	MR^{90}_{adj} (mm)	40	55	45	35	42	45	46	42	39	49	55	46	541
E_{pan}	ME^{10}_{adj} (mm)	245	190	149	82	47	32	35	51	81	128	184	230	1,456
K_{pan}		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
ET_o	$ET_o{}^{10}_{adj}$ (mm)	196	152	119	66	38	25	28	41	65	103	147	184	1,165
K_c	Temperate perrennial pasture	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	
ET_c	$ET_c{}^{10}_{adj}$ (mm)	206	160	125	69	40	27	30	43	68	108	154	193	1,223
Deficit	mm	166	105	80	34	-2	-18	-16	1	29	59	99	147	719
Recommended Storage months		N	N	N	N	Y	Y	Y	Y	N	N	N	N	4
Recommended Storage days		0	0	0	0	31	30	31	31	0	0	0	0	123

Storage period chosen

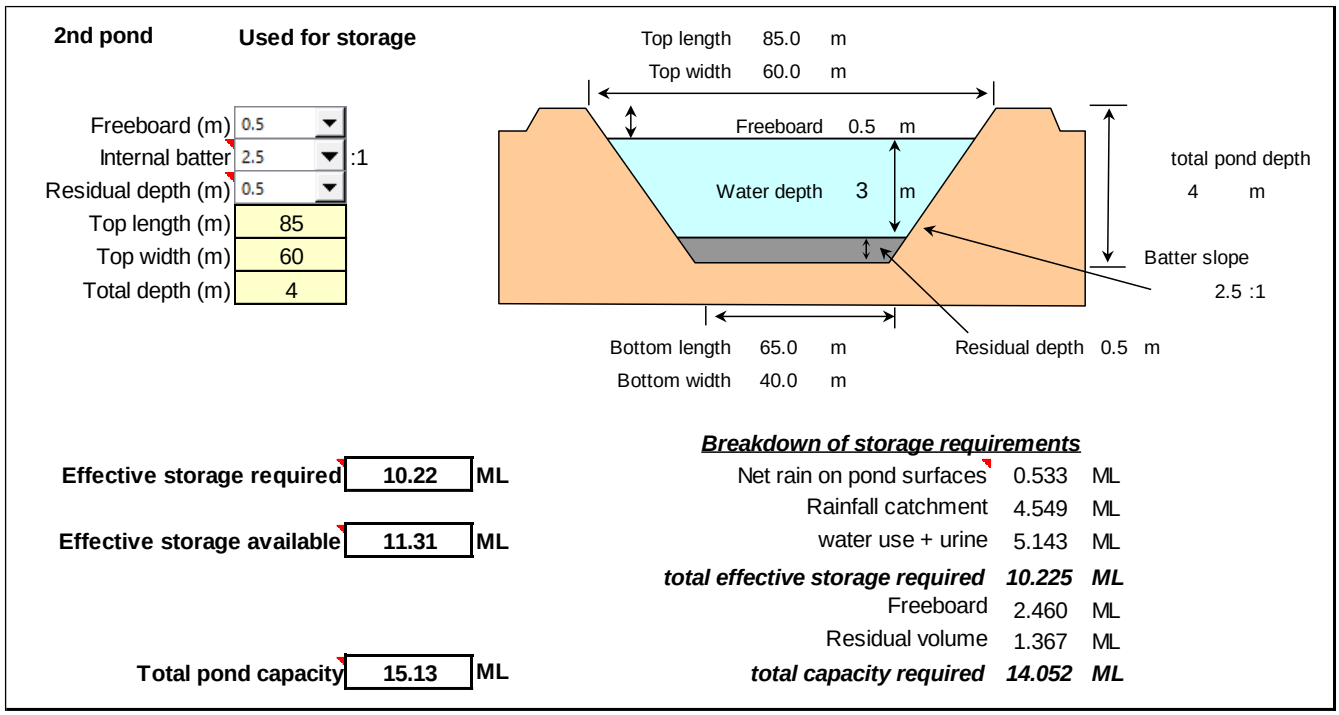
Storage months		N	N	N	N	Y	Y	Y	Y	N	N	N	N	4
Storage days		0	0	0	0	31	30	31	31	0	0	0	0	123
Rainfall during storage period		0	0	0	0	42	45	46	42	0	0	0	0	175
Evap during storage period		0	0	0	0	47	32	35	51	0	0	0	0	165

Mean Rainfall & Evap for application calculations

Climate location chosen: **Finley**	Locality for K value: **2710 Deniliquin -35.22 145.03**	K= **0.73**

Climate data		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual (sum of months)**
Precipitation	mean (mm)	29	35	31	24	29	36	34	33	33	37	42	31	394
E_{pan}	mean (mm)	276	215	176	100	55	36	39	59	95	151	199	256	1,657
K_{pan}		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
ET_o	mean (mm)	221	172	141	80	44	29	31	48	76	121	159	204	1,326
K_c	Temperate perrennial pastur	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	
ET_c	mean (mm)	232	180	148	84	46	30	33	50	80	127	167	215	1,392
Deficit	mm	203	146	117	60	17	-6	-1	17	47	90	126	184	1,006
mean rainfall during storage period		0	0	0	0	29	36	34	33	0	0	0	0	132
mean evap during storage period		0	0	0	0	55	36	39	59	0	0	0	0	190

Figure 2 – Pond Sizing Diagram



Operation and Maintenance

- Prior to autumn the level of the storage pond will dropped to ensure winter storage capacity of 123 days is easily achieved.
- The pond will be designed to allow for the freeboard portion of the pond to be above ground forming a turkey nest, which will prevent runoff from the surrounding cropping area entering the storage pond.

5.8 Manure Solids

Solids removed from the sedimentation basin will be loaded directly into a manure spreader and spread onto paddocks. This will be done at a time that minimises odour and reduces the risk of runoff. Dry lots will also have manure scraped from the surfaces at regular intervals. Once again, this is usually loaded directly into the manure spreader for distribution on paddocks.

The compost barn will have wood chips to a depth of 600mm. The shed will contain 4,080 cubic meters of woodchips at start up and each cow will have 11.3 square meters of loafing area on the bedding material. Cows will spend approximately 58% of their time lying down on the bedding and 58% of the manure and urine will be assigned to the bedded pack. The bedded pack is groomed twice daily to aerate and dry the pack and promote composting. Fans within the shed are positioned to encourage drying and composting. Due to the composting process, cleaning intervals are extended to 2 to 3 years, where composted material is removed from the shed and new material is added (wood chips). For nutrient budget calculation purposes it is assumed that 20% of the composted material is removed each year.

6. Soil Geotechnical Assessment

A soil geotechnical assessment of the pond sites was conducted by GTS (Geotechnical Testing Services). Based on the findings of the report, the proposed sediment basins and effluent storage pond sites are suitable for the intended purpose, however, to meet the EPA permeability requirements of less than $1x10^{-9}$ the ponds will need to be clay lined with a minimum liner thickness of 400mmm as per the geotechnical report recommendations.

7. Nutrient Management

Using undiluted dairy effluent as an irrigation water source will quickly lead to nutrient overloading. It is best applied based on nutrient levels. Effluent can be used shandied into irrigation water to supplement water supply and spread nutrient where it will be of most benefit.

Effluent and manure application will be integrated into the fertiliser program for the farm. Areas where effluent and manure have been applied will have their nutrient status checked and the nutrient budget adjusted on a regular basis to determine the need for fertilisers. Effluent application will be rotated around the available area and a record will be kept in the farms Environmental Management Plans.

7.1 Soil Assessment

A detailed soil description can be viewed in the Soil Geotechnical Assessment in the Appendix. Detailed Soil nutrient tests can be found in the appendix.

7.2 Nutrient Budgeting

Sustainable reuse of the nutrients from an intensive livestock operation protects the soils physical, chemical and biological properties. The protection of surface and groundwater is also dependent on careful management of those nutrients. Sustainable reuse is dependent upon the following factors;

- That the total amount of nutrients generated by the animals fed does not exceed the total agronomic requirements of the crops grown. That is, the balance of nutrients does not impact upon the capacity of the soil to assimilate nutrients over the long term.
- That the salt and sodium applied in manure and effluent does not lead to long term degradation of the soil's physical and chemical properties.

7.3 Nutrients in Manure

The table below has been developed from Nennich's (2005) manure production formulas. A total of 2,226 tonnes of solid manure will be produced. The nutrient contained within this manure will be apportioned to the solid manure in the bedding material, solids from the sedimentation basins and effluent water and sludge remaining in the storage ponds. A portion of the solids will decompose, and a large portion of the nitrogen will be volatilized as it moves through the effluent system. The balance of the nutrients will be available for distribution on the cropping land. It is assumed that 20% of the composted bedding material is removed each year for distribution on paddocks. Note these calculations include effluent and solid waste from both the original effluent system and the new effluent system.

Table 9 - Manure and Nutrient Budget

1. Daily Excretion Data	TS	VS	FS	N	P	K
(Nennich, 2005)	8.1	6.8	1.4	0.428	0.073	0.197

2. Dry Pack Barn & Dairy Yard						
Manure Deposited (kg/yr)	2,226,847	1,848,283	378,564	117,105	19,997	53,902
Total Solids Partitioned to Dairy Effluent System	371,141	308,047	63,094	19,517	3,333	8,984
Total Solids Partitioned to Barn Bedding/Dry lot loafing	1,298,994	1,078,165	220,829	68,311	11,665	31,443
Total Solids and Nutrient Partitioned to Barn Flushing	556,712	462,071	94,641	29,276	4,999	13,476

3. Nutrients depsoited on dry pack						
Nutirents deposited in bedding	1,298,994	1,078,165	220,829	68,311	11,665	31,443
Decomposition and Loss	50%	60%		80%		
Nurtrients in compost bedding	649,497	431,266	220,829	13,662	11,665	31,443

3. Nutrients Entering Effluent System						
Nutirents deposited on flush lanes/dairy yards	556,712	462,071	94,641	29,276	4,999	13,476
Loss of N on concrete yards & flush lanes				7%		
Nurtrients in Effluent to Ponds	556,712	462,071	94,641	27,305	4,999	13,476

3. Nutrients Removed in Pre-treatment						
Nutrient & solid Removal by pre-treatment (%)	59%	56%	62%	25%	70%	5%
Nutrients & solids removal by sedimentation basin	328,460	258,760	58,677	6,826	3,500	674

4. Nutrients & Solids to Pond						
Total Nutrients and solids to pond	228,252	203,311	35,964	20,479	1,500	12,802
Pond decomposition rate of solids & N volatilization rate	33%	80%	100%	30%	0%	0%
Losses/decomposition	75,323	162,649	35,964	6,144	0	0
Total Nutrient Available in pond	152,929	40,662	0	14,335	1,500	12,802
Nutrients partitioned to pond sludge (%)				20%	30%	10%

5. Summary						
Total nutrient generated (kg/year)	2,226,847	1,848,283	378,564	117,105	19,997	53,902
Less Losses & decomposition (Kgs/year)	1,095,961	1,117,595	157,735	82,281	3,333	8,984
Nutrient contained in bedded pack manure	649,497	431,266	220,829	13,662	11,665	31,443
Nutrient available in bedding for distribution (20%)	129,899	86,253	44,166	2,732	2,333	6,289
Remaining in pre-treatment waste - sediment basin (kg/y	328,460	258,760		6,826	3,500	674
Nutrient contained in sludge on cleanout (Kgs)	152,929	40,662		2,867	450	1,280
Nutrient retained in liquid effluent (Kgs/year)				11,468	1,050	11,522
Total Nutrients Available for Reuse (Kgs/year)	**1,260,785**			**23,894**	**7,332**	**19,764**

Table 10 - Nutrient Summary

Nutrient	N	P	K
Total Nutrient Collected (kgs)	117,105	19,997	53,902
Nutrient Available for distribution			
Nutrient in Effluent	11,468	1,050	11,522
Nutrient in Solid Waste	12,426	6,282	8,243
Total Nutrient Available for Distribution	23,894	7,332	19,764

7.4 Crop Nutrient Requirements

The nutrient requirements of the farm are driven by the agronomic program implemented on the property. The farm is 724 hectares in size, with 85% of the land being arable and 75% irrigable. Of the irrigable area, 242 hectares can be serviced by recycled effluent water.

A portion of the property will be double-cropped with maize in the summer and annual pasture in the winter for the production of silage. The remainder of the farming area will grow a combination of lucerne, winter cereals for grain and silage, and annual pastures for grazing and silage. This program is adjusted annually based on water availability and market prices.

Table 11 – Cropping Program

Crop	Area (Ha)	Yield (T DM/Ha)	Yield (T DM)	Water Use (ML/Ha)	Total Water (ML)	T DM/ML
Maize	90	20	1,800	7	630	2.9
Pasture Grazing/Silage	242	7	3,091	4	968	3.2
Lucerne hay	81	13	1,053	8	648	1.6
Wheat for Grain/Silage	245	6	1,470	1.5	368	4.0
Total Area cropped	**658**		**7,413**	**4.0**	**2,613**	**2.8**

Note: Maize doubled cropped on pasture area.

Table 12 - Crop Nutrient Removal Rates

				Nutrient Removal (Kgs/Ha)			Total Nutrient Removal (Kgs)		
Crop	Area (Ha)	Yield (TDM/Ha)	Yield (T DM)	N	P	K	Total N	Total P	Total K
Maize	90	20	1,800	340	60	300	30,600	5,400	27,000
Pasture Grazing/Silage	242	7	1,694	210	35	175	50,820	8,470	42,350
Lucerne hay	81	13	1,053	455	91	351	36,842	7,368	28,421
Wheat for Grain/Silage	245	6	1,470	150	24	75	36,750	5,880	18,375
			Total Nutrient Removed/Required				155,012	27,118	116,146
			Nutrient Removal (Kgs/Ha)				236	41	177

The table above shows that the nutrient requirements of the cropping program are 236 kgs Nitrogen per hectare, 41kgs Phosphorus per hectare and 177kgs Potassium per hectare.

7.5 Nutrient Distribution

Where significant amounts of nutrients are collected in dairy effluent, it is beneficial and more environmentally benevolent to spread these nutrients over areas that require nutrient increase based on soil test results and crop nutrient requirements. In this case, liquid effluent can be irrigated through the irrigation system. The ability to distribute the effluent via the on-farm channel system is limited to an area on the dairy farm of 242 hectares. The solid manure and pond sludge can be spread over the remaining property consisting of 374 hectares.

Table 13 - Minimum Area Required for Reuse of Nutrients

Area Available for Effluent (Ha)	242		
Area Available for Manure Solids (Ha)	374		
Area	**N**	**P**	**K**
Minimum area required for effluent (Ha)	49	4	49
Minimum area required for solids (Ha)	40	20	26
Total Area required	**88**	**24**	**75**

7.6 Conclusion

The Nutrient budget shows that a total area of 88 hectares is required to distribute the effluent and manure. The area available for distribution of effluent is 242 hectares and the area available for distribution of manure solids is 374 hectares. There is sufficient area to distribute manure and effluent to avoid any adverse impacts to the land.

8. Salinity Management

Salts will be added to the property through water used for irrigation, dairy equipment wash and stock consumption, and from imported feed rations. The relative contributions suggest that irrigation water is the most significant source of salts.

Salt from feed, stock water and dairy wash will end up in the effluent stream. The effluent will then be diluted with the irrigation water and applied to crops. Assuming 85% of the salt from the feed and drinking water enters the effluent stream, a total of 53 tonnes of salt will be added to the effluent stream from feed, drinking water and wash water. The balance will be distributed as manure.

Table 14 - Contribution of salt to the effluent stream

Feed	
Dry matter Intake (kgs)	24.2
Salt content (%)	0.23%
Salt Excreted (t per year)	18.6
Drinking Water	
Consumption (Litres/cow/day)	150
Salt Excreted (t per year)	10
Dairy Wash & cooling water	
Water use (ML/year)	15
EC dairy water (mg/L)	236
Salt in wash water (t/year)	3
Total Salt From Feed & Water (t/year)	32
Salt Entering effluent Stream (85%)	26.9

Assumes dairy wash consists of rainfall runoff & bore water. 85% of salt excreted enters the effluent stream (27 t/year). With an estimated average waste-water generation of 40 kl/d, and the contribution of salt to the system from feed and urine, the EC of the effluent from the anaerobic pond is estimated to be approximately 1.52 dSm.

Table 15 - Estimated dSm of Effluent Water

Water, urine and runoff (L/day)	75,884
Total salt entering system (kgs/yr))	26,908
Salt per day (kgs)	74
mg/l	972
Estimated dSm of effluent water	**1.52**

The table below shows the estimated amount of salt added to the property via irrigation water.

Table 16 - Salt Load in Irrigation Water

Volume Irrigated (Ml on reuse area)	1,598				
Area (Ha)	242				
Ml/Ha	6.6				
Salinity Irrigation Source	ML	mg/l	dS/m	kgs/ML	Kgs/year
MIL Channel Water (excluding effluent)	1,562	192	0.30	192	300,180

Salt applied to the cropping area in irrigation water is approximately 300 t/year. These salts will reduce crop yield if they accumulate in the rooting depth to damaging concentrations.

Table 17 - Salinity of diluted irrigation and effluent water

EC Channel water	0.3
EC Effluent water	1.52
Effluent water used (ML)	36
Irrigation water used	1,562
Proportion Effleunt water	0.02
Proportion Irrigation water	0.98
Concentration of Blended Water (dSm)	0.33
Irrigation application (Ml/ha)	6.6
Average Irrigation season rainfall (mm)	366
Estimated Rainfall Salinity (dSm)	0.05
Avearge irrigation and Rainfall Salinity (dSm)	0.23

8.1 Soil and Effluent Salinity

The effluent water has high salinity levels as well as a high Sodium Adsorption Ratio. For this reason, the effluent needs to be managed in a manner that reduces the risk of soil salinity and soil structural problems. Table 19. shows the soil related salinity factors for 4 soil test samples taken recently on the property. The tests show that the salinity levels are very low in the soil with soil extracted (se) Electrical Conductivity (dS/m) levels ranging from 0.25 to 0.68.

It is recommended that soil testing be carried out on a bi-annual basis to monitor the impact of saline effluent water on the soils. It is also recommended that effluent is always shadied with MIL channel water to dilute the effects of salt. The results below suggest that the soils are showing very little sign of salinity (EC) or sodicity (SAR). See Appendix C for detailed soil test results.

Table 18 - Soil Salinity factors

Paddock	Unit	Tree Line	Abott La 1-7	Abelard St 4-9	Bernies Pdk 1-10
Electrical conductivity (1:5 water)	dS/m	0.11	0.04	0.07	0.04
Electrical conductivity (se))	dS/m	0.68	0.25	0.43	0.25
Cation Exchange Capacity	cmol/kg	16.6	9.5	15.8	14.6
Chloride	mg/kg	<10	<10	12	<10
Calcium	cmol/kg	8.8	5.8	8.8	8.2
Mangesium	cmol/kg	5.8	2.6	5.1	4.7
Sodium	cmol/kg	0.31	0.27	0.27	0.15
Exchangeable Sodium %	%	1.9	1.9	1.7	1
Sodium Adsorption Ratio (SAR) *		0.11	0.13	0.10	0.06
* SAR = Exchangeable {(Na)/(Ca + Mg) $^{-0.5}$}					

Table 18 shows that the average irrigation water, effluent and rainfall salinity is 0.23 dSm which is considered low.

Table 19 - General irrigation water salinity ratings based on electrical conductivity

EC (dS/m)	Water salinity rating	Plant suitability
<0.65	Very low	Sensitive crops
0.65-1.3	Low	Moderately sensitive crops
1.3-2.9	Medium	Moderately tolerant crops
2.9-5.2	High	Tolerant crops
5.2-8.1	Very high	Very tolerant crops
>8.1	Extreme	Generally, too saline

(Source: Use of Effluent by Irrigation, 2003)

8.2 Conclusion

The average salinity of blended irrigation water, effluent water and rainfall is estimated to be 0.23 dSm-1. Using the salinity ratings in table 20, it can be concluded that the water salinity rating is very low and would not impact crop production.

8.3 Sodium Hazard (High SAR)

High sodium ions in water affects the permeability of soil and causes infiltration problems. This is because sodium when present in the soil in exchangeable form replaces calcium and magnesium adsorbed on the soil clays and causes dispersion of soil particles (i.e. if calcium and magnesium are the predominant cations adsorbed on the soil exchange complex, the soil tends to be easily cultivated and has a permeable & granular structure). This dispersion results in breakdown of soil aggregates. The soil becomes hard and compact when dry and reduces infiltration rates of water and air into the soil affecting its structure.

Table 20 - Sodium Hazard

Hazard	SAR	Notes
None	<3	No restriction on the use of recycled water
Slight to moderate	3 to 9	From 3 to 6 care should be taken to sensitive crops. From 6 to 8 gypsum should be used. Not sensitive crops. Soils should be sampled and tested every 1 or 2 years to determine whether the water is causing a sodium increase
Acute	>9	Severe damage. Unsuitable for irrigation

(Source: Lenntech, 2020)

It is likely that the effluent water will have high SAR levels, and should always be diluted with MIL water, and management practices implemented to monitor and manage the reuse of effluent.

8.4 Sustainable Reuse

Based on the nutrient budget and the salinity calculations it is deduced that effluent and manure can be managed in a sustainable manner, and will not have a detrimental impact on soils, surface water and ground water. Soil monitoring should be performed bi-annually, and effluent water should always be diluted with MIL channel water. The following management strategies are recommended.

- Soil test every 2 years.
- Record the distribution and volume of effluent to the reuse area.
- Use the soil tests as the basis for the application of gypsum and lime to ameliorate the soil.
- Apply the required leaching fraction to ensure there is no build up in salinity levels in the root zone and that yields are not compromised over the long term.
- Use of effluent water on paddocks P1-8 on Pineview should be avoided.

9. Contingency measures

All effluent systems have a risk of failure. The most common cause of system failure is lack of management. Maintain management schedules and ensure regular management occurs. Refer to the Environment Management Plan for details on effluent system management and monitoring.

Contingency plans outline procedures for when unexpected events occur such as machinery breakdowns, power failures and disease outbreaks. Contingency plans and procedures for emergency breakdowns are essential. Contingency plans should consider: flooding, milk disposal, power disruptions, pump breakdowns, pond overflows, breaches and pump and pipeline blockages. The following are potential risks associated with the effluent management system.

9.1 Pond wall breach/Overflow

Contingency plan

- Construct a temporary levy bank to contain the spill.
- Install a temporary spoon drains to direct uncontrolled overflows and seepage to the irrigation recycle system (F in figure 2) and the storage pond (D in figure 2).
- Empty the pond to the point where the walls can be safely reconstructed by directing effluent to the irrigation recycle system and the turkey nest dam.
- Repair walls and banks by removing topsoil and vegetative growth before reconstructing the area with more clay or other impermeable material.

9.2 Pump failure

Contingency plan

- Maintain a current list of local trades people that can repair the pump and have this accessible to all staff in the Environmental Management Plan.
- Access a temporary pump if repair or replacement will take more than 2 days.
- Establish a contingency storage area within proximity, which has bunding or levy banks to contain

the effluent until pump repairs are completed.

- Minimise facility water use (without compromising milk quality) to reduce wash down volumes entering the effluent stream.

9.3 Emergency disposal of milk

Contingency plan

- Drain the milk into the irrigation sump and recycle the water into the irrigation channel for irrigation. Ensure that it will not have an impact on the environment and community amenity.
- Schedule an irrigation event to dilute the milk (1:10) and return to appropriate paddocks.
- Store some for calf rearing.
- Note: Milk should not be disposed of into the effluent stream as it will have adverse impacts on the pond performance and cause odour.
-

9.4 Effluent discharge to waterway

Effluent is unable to leave the farm and is contained within the farm drainage system.

9.5 Significant storm event

Contingency plan

- Offload a proportion of the pond into the irrigation sump.
- Fill the flood wash tanks with fresh water if capacity in the fresh-water storage pond is limited.

9.6 Significant odour emissions from pond

Contingency plan

- Minimise spreading and irrigation of effluent on windy warm days.
- Avoid infrequent shock loadings of effluent to the pond.
- Monitor the pH within the primary effluent pond. The pH should be slightly alkaline. The addition of hydrated lime to acidic ponds can improve both pH and odour.
- Products for reducing odour or improving anaerobic digestion may be added to the ponds.
- Plant trees and shrubs between neighbouring residences. These can cause a disturbance in the wind pattern, forcing odour to rise upwards and away from sensitive areas.
- Remove manure stockpiles from sensitive areas more frequently.
- Avoid irrigation methods that lead to surface pooling.

10. Maintenance Schedules

Effluent systems are only effective when well managed and maintained. Effective management involves regular maintenance of system infrastructure, regularly utilising effluent on pastures and crops to achieve productivity gains and avoiding effluent application in unsuitable weather or soil conditions.

An ongoing maintenance and monitoring program is important for assessing potential problems and enabling them to be rectified before they eventuate. Refer to the Environmental Management Plan for a full maintenance schedule. A maintenance program should include the following key components:

10.1 Pond management

Ponds are designed for a specific function and therefore need to be maintained periodically to ensure they continue to function. Accumulating solids and nutrients overtime may begin to impact on pond performance, hence the reason for a sound maintenance schedule.

Key indicators of ponds underperforming may include:

- Heavy surface crusting and silting
- Odour emissions
- Excessive weed growth
- Dark brown discoloration

10.2 Pump maintenance

Almost all effluent systems require some type of pump to convey effluent either from the dairy to the pond or the pond to the irrigation system. Pump failure on the sump can easily lead to effluent backing up into dairy and surrounding area. Use only a qualified electrician to install all electrical requirements such as wiring, switches etc.

10.3 Conveyance pipes

The conveyance of effluent from the compost barns to the sedimentation basins is an essential part of the effluent system. Inadequate management will cause unnecessary blockages and pipe damage.

Fixing blockages in conveyance pipes is a tedious and time consuming job that can be avoided by regular cleaning of the sump at the end of the cow alley in the barn. Occasional flushing with clean water can help with maintaining clear flow and minimising bends in the pipe will help to avoid blockages.

10.4 Irrigation systems

The method in which effluent is conveyed and applied to pastures and crops is a vital component of any effluent system and therefore requires regular monitoring and maintenance.

10.5 Slurry and solid spreaders

Farm safety and accident prevention should be the highest priority on the farm, ensuring the farm surrounds are as safe as possible, for workers, children, visitors, livestock and pets. The management of effluent also requires the regular use of a range of equipment and machinery, which requires operator training and regular maintenance programs. Operators should be aware of the weather conditions to avoid unnecessary odour to local amenities.

11. Dairy Effluent Maintenance Checklist

The following is a checklist to assist with a regular maintenance program on the farm.

11.1 Pond management

- Annually review the pond effective storage to ensure it has sufficient capacity for the wetter months.
- Inspect pond banks for signs of cracking or deterioration and instigate repairs.
- Inspect pond surroundings for wet areas which may indicate pond seepage.
- Sample and analyse the pond effluent on an bi-annual basis to determine levels of nutrients, salts and organic content before land application. Use this information to match with soil nutrient profiles and fertility targets.
- Develop a schedule to empty the pond prior to the onset of the wetter months (June, July & August).
- De-sludge the pond on an annual basis to remove solids and nutrients in conjunction with the nutrient management plan.
- Annually check ponds outlet pipes for seepage and replace damaged rubber seals.
- Check fencing around ponds is adequately tensioned and secured.
- Spray weeds to keep the pond banks clean so that inspection is safe and easy.

Effluent systems can be hazardous places, and safety must always be considered when building and working around them.

12.1 Safe ponds

The objective of occupational health and safety is to provide a safe working environment and appropriate training for all staff, visitors and service providers.

12.2 Recommended management practices

- Identify and address potential risks and hazards associated with effluent systems and their management.
- Regularly maintain equipment.
- Implement training programs for staff, contractors and visitors to inform them of potential dangers

Good compaction is required for pond stability. Other important features include a gentle batter slope on both internal and external pond walls and wide pond banks to form a stable platform for machinery access. The pond should be machinery accessible on all sides if possible and designed to reduce the possibility of machinery slipping into the ponds. Ponds should be fenced, and weeds controlled regularly. Signage cautioning deep water, slippage and gases should be erected.

12.3 Safe operation of the system

- Never work alone around effluent systems.
- Ensure machinery around ponds is secured and in full working order.

- Restrict access to ponds to when it is required.
- Erect appropriate signage at the pond.
- Ensure staff and contractors are trained and understand safe working practices.
- Use long extension poles to collect effluent samples for nutrient analysis.

13. References

Dairy Australia, 2008*, "Effluent and Manure Management Database for the Australian Dairy Industry"*.

Department of Environment and Primary Industries 2009, Ag Note - AG 0444, "Safe Effluent Systems".

Department of Environment and Primary Industries 2009, Ag Note - AG 1374, "Maintenance schedules and contingency planning".

Department of Environment and Conservation 2003, *"Environmental Guidelines, use of effluent by irrigation"*, Website: www.environment.nsw.gov.au

Department of Planning and Environment, NSW 2019, *"Planning Guidelines - Intensive Livestock Agriculture Development".*

Department of Primary Industries, Victoria 2018, "*Effluent Tool Kit 11.7".*

Intensive Agriculture Consultative Committee 2008, *"Environmental management guidelines for the dairy industry"*, State of New South Wales through NSW Department of Primary Industries

Lenntech, 2020, SAR Hazard of Irrigation, viewed June 20, https://www.lenntech.com/applications/irrigation/sar/sar-hazard-of-irrigation-water.htm#ixzz6Q9CwCvie

McDonald, S. 2005, *"Water use in dairy sheds"*, Dept. of Primary Industries, Melbourne.

Nennich, et al, 2005, "Prediction of manure and nutrient excretion from dairy cattle", Journal of Dairy Science.

NSW Dairy Effluent Subcommittee 1999, *"Draft NSW guidelines for dairy effluent resource management"*, NSW Agriculture, Orange.

Skerman, 2008, Department of Primary Industries & Fisheries, QLD 2008, *"Dairy Flood Wash".*

14. Appendix

Middlebrook
Maxwells Road, Finley

Geotechnical Investigation
for
Rhys Tremble Concreting and Engineering

Report 24C 0720
October 2024

GTS
GEOTECHNICAL TESTING SERVICES

Middlebrook,
Maxwells Road
Finley

Geotechnical Investigation

for

Rhys Tremble Concreting and Engineering

Revision

Revision	Date	Authorised
24C 0720	4/10/2024	SEH

Distribution (this revision only)

Recipient	Format	Date
GTS	On file	4/10/2024
Rhys Tremble Concreting and Engineering Attn: Rhys Tremble	Email PDF rhystrembleag@hotmail.com	4/10/2024

TABLE OF CONTENTS

APPENDIX

1 INTRODUCTION

Rhys Tremble Concreting and Engineering commissioned Geotechnical Testing Services (GTS) to undertake a geotechnical investigation for the development at Middlebrook at corner of Larkins Road and Maxwells Road, Finley.

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 development includes new sheds and sediment/effluent ponds.

2 SITE AND GEOLOGY

2.1 SITE LOCATION AND GENERAL CONDITIONS

The site is located at corner of Larkins Road and Maxwells Road, Finley.

The site is relatively flat with the proposed development areas currently vacant of structures. There is 1 large tree in the vicinity of the shed development. At the time of the investigation, the surface of the site was moist and consisted of a good coverage of natural and seeded grass. There was no visual evidence of surface cracking or natural surface rock.

2.2 GEOLOGY

The New South Wales Government's online "MinView" map shows the site to be underlain by Tertiary aged sedimentary alluvial deposits, with this generally confirmed by the field data.

3 FIELDWORK

The geotechnical investigation was conducted on the 20th and 21st of October 2024 and involved the drilling of 16 boreholes (BH) by Drillman GT10 drilling rig to termination depths of 3.0 metres. In-situ strength tests including Dynamic Cone Penetrometer (DCP) and Pocket Penetrometer (PP) tests 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. Boreholes 1 to 8 were located in the region of the shed with BHs 9 to 16 in the region of the ponds.

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:

TOPSOIL: Sandy SILT, low plasticity, dark brown, fine to medium sand, soft to stiff.

To a depth of between 0.1 to 0.15 metres

Overlying

(Sandy) Silty CLAY, medium/high plasticity, brown, pale brown, orange/brown, fine to coarse sand when present, firm to very stiff.

To a depth of between 1.7 to 3.0 metres

Overlying

Clayey SAND, fine to coarse sand, pale brown, orange/brown, low/high plasticity fines, medium dense to dense.

To termination depths (BHs 8 to 14 and 16 only)

There are variations to the above including Clayey Silt at 0.8 to 1.3m material in BH9. As such, 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, wet material was encountered at depths below 2.7 metres in the region of BHs 10 to 14 and 16.

4.2 LABORATORY TEST RESULTS

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

Table 1: Material Properties

Test Location	BH1 0.5-1.0m	BH5 2.5-3.0m	BH9 0.7-1.2m	BH9 1.3-1.8m
% Passing 19mm Sieve	100	100	100	100
% Passing 2.36mm Sieve	99	99	99	99
% Passing 0.075mm Sieve	69	81	81	71
Liquid Limit (%)	43	61	23	41
Plastic Limit (%)	16	19	18	16
Plasticity Index (%)	27	42	5	25
Linear Shrinkage (%)	12.0	12.5	1.5	11.0
Emerson Class	5	4	4	4

Table 1 Continued: Material Properties

Test Location	BH11 0.6-1.1m	BH14 0.6-1.2m	BH15 0.1-0.7m	BH16 2.0-2.5m
% Passing 19mm Sieve	100	100	100	100
% Passing 2.36mm Sieve	100	100	99	100
% Passing 0.075mm Sieve	49	85	82	32
Liquid Limit (%)	24	46	53	54
Plastic Limit (%)	16	18	21	20
Plasticity Index (%)	8	28	32	34
Linear Shrinkage (%)	5.0	11.5	13.5	14.5
Emerson Class	5	5	4	5

Table 2: Permeability

Test Location	BH9 1.3-1.8m	BH14 0.6-1.2m
Permeability (m/s)	$1x10^{-10}$	$6x10^{-10}$

5 ENGINEERING RECOMMENDATIONS

At this stage, the proposed development consists of the construction of sheds and effluent ponds. As such, there may be slab on ground, 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,** medium/high plasticity, brown, pale brown, orange/brown, fine to coarse sand when present, firm to very stiff.

Table 3: Minimum founding depth (m)

Borehole	1	2	3	4	5	6	7	8
Depth (m)	0.1	0.2	0.1	0.1	0.1	0.1	0.4	0.1

For edge beams, strips and pad footings founded in the natural silty clay material as above there is an allowable bearing pressure of 50kPa available, increasing to 100kPa below 0.7 metres. All footings shall be founded a minimum of 100mm into the above founding medium. Blinding concrete (minimum 15MPa strength) may be used to bring footings up to design levels.

Alternate to the above, a raised building pad for the shed may be required. If the building pad is constructed under Level 1 supervision (discussed in Section 5.4), the footings may be located within the engineered fill.

5.2 BORED PIERS

Due to the variable strength of the upper subsurface, bored piers may be preferred. Bored piers shall be founded minimum of 1.0 metres below surface level and may be proportioned for an allowable end bearing pressure of 150kPa. Piers founded a minimum of 1.5 metres below surface level may be proportioned for an allowable end bearing pressure of 200kPa. There is an allowable skin friction of 15kPa commencing from 1.0 metres below surface level.

5.3 SITE CLASSIFICATION AND SLAB ON GROUND

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 proximity of a tree 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.

If the sheds are located a minimum distance of 1x the mature height of singular trees or 1.5x the mature height of lines/groups of trees, it may be designed in accordance with a Class H1-D. If not, the trees height, distance and grouping must be considered when designing the foundation.

In regards to slab on ground, the upper subsurface is of variable strength but the Silty Clay material below the topsoil layer is generally suitable for slab on ground construction with an allowable bearing pressure of 50kPa. However, there is notable soft material in the region of BH7 and with the variable strength it is recommended that a Geotechnical Engineer inspect the exposed base to ensure it is of suitable material type and strength. This may involve a proof roll with a fully laden dump/water truck with tyre pressures in excess of 400kPa (60psi).

5.4 EARTHWORKS

If a building pad for the shed is required, there are 2 options. The first is to place fill and compact with no geotechnical supervision or testing. If this is undertaken, all footings are to extend through the fill into the material as recommended in Sections 5.1 or 5.2. The second option is for the fill to be placed and compacted under Level 1 supervision as outlined in AS3798-2007. If this is undertaken, the footings may then be located in the controlled/engineered fill with an expected allowable bearing capacity of 100kPa. For engineered fill, it is recommended that the following method be undertaken:

- Excavate any topsoil/silt material in the vegetative zone (approximately 100mm to 150mm in depth) and stockpiled separately.
- The exposed base is to be inspected by an experienced Geotechnician or Geotechnical Engineer and proof rolled with a fully laden dump/water truck, 12 tonne roller or similar vehicle. A successful proof roll is where there is no visible/significant deformation or heaving of the surface. Areas that fail the proof roll may be moisture conditioned and recompacted until satisfactory or excavated and replaced with suitably compacted material.
- Suitable site won material may then be placed in loose layers no greater than 200mm, moisture conditioned to within 2% OMC and compacted with a vibrating pad foot roller to achieve a minimum density ratio of 98% standard (AS1289 5.1.1, 5.4.1 or 5.7.1).
- The compacted thickness of each layer shall not exceed 150mm and also be appropriate to the size of the compaction equipment in order for satisfactory compaction to be achieved. In between layers, the surface should be finished with a pad foot roller or tined a depth of 50mm so that the subsequent layer may bind.
- Compaction testing at the frequency outlined in Table 8.1 of AS3798-2007 is to be conducted to ensure a minimum density ratio of 98% Standard has been achieved.
- Once a design surface level has been achieved, the finished surface shall be finished with a smooth drum roller or grader to achieve finished surface levels and satisfactory drainage of the site.
- The excavated topsoil may be placed on the embankments to assist vegetation and minimise erosion.

Suitable material consists of site won clays and clayey sands from the pond excavations.

5.5 PONDS

It is understood that the proposed development includes the construction of a new sediment/effluent ponds that are expected to extend a minimum of 3 metres deep below existing surface levels. As per EPA requirements a permeability rate of less than $1x10^{-9}$ m/s for the pond base and walls is required.

Based on the results of the investigation and laboratory testing, the material at the site is relatively consistent with medium and high plasticity sandy silty clays in the upper profile that transitions to a low/high plasticity clayey sand below 1.7 metres.

Based on the remoulded permeability testing of BH9 and BH14 of the medium plasticity clays, when compacted to 95% Standard Dry Density (SDD) ratio, a permeability rate of $1x10^{-10}$ and $6x10^{-10}$ respectively is achieved. Additionally, the medium and high plasticity silty clay material is generally non-dispersive with an Emerson Class of 4 and 5. This material is considered satisfactory as a base and embankments of the proposed effluent pond. However, the Clayey Sand material at depth along with the Clayey Silt encountered in BH9 and 11 in the upper profile is not suitable for the base/walls of embankments, as such, a clay liner will be required for this material.

For construction of the ponds, it is expected to be excavated a minimum of 3 metres below existing surface level. Therefore, the following earthworks procedure shall be undertaken to achieve a clay lined pond:

- Excavate any topsoil/silt material in the vegetative zone (approximately 100mm to 150mm in depth) and stockpiled separately.
- The pond should be excavated to design levels, accounting for a minimum clay liner thickness of 400mm over the base and pond walls below 1.5 metres and where Clayey Silt is encountered. It is recommended that the base and walls be inspected by a Geotechnical Engineer to ensure it is suitable.
- The material in the upper 1.5 metres shall be blended together before placement of the clay liner. The medium and high plasticity (Sandy) Silty Clay from the upper 1.5 metres should be stockpiled separately to the Clayey Sand material that is below this layer.
- All batters should not exceed a 3:1 (H:V) slope.
- For the pond walls from surface to 1.5m metres, they should be ripped a depth of 300mm, moisture conditioned to within 2% of optimum moisture content (OMC) and compacted to achieve a minimum density ratio of 98% standard (AS1289 5.1.1, 5.4.1 or 5.7.1)

- For the pond walls below 1.5m and the base, a clay liner is required. Prior to placing the clay liner, the exposed base/walls shall be compacted with a pad foot roller to create a rough surface to bind the liner material. Suitable site won material (clay from the top 1.5 metres and deemed satisfactory by a Geotechnical Engineer) may then be placed in loose layers no greater than 200mm, moisture conditioned to within 2% OMC and compacted with a vibrating pad foot roller to achieve a minimum density ratio of 98% standard.
- The compacted thickness of each layer shall not exceed 150mm and also be appropriate to the size of the compaction equipment in order for satisfactory compaction to be achieved. In between layers, the surface should be finished with a pad foot roller or tyned a depth of 50mm so that the subsequent layer may bind.
- Once a minimum thickness of 300mm has been achieved, the finished surface shall be finished with a smooth drum roller or grader to achieve finished surface levels and satisfactory drainage of the site.

On completion of the construction, the topsoil material may be spread over the banks to aid in re-vegetation and prevent erosion. For areas subject to wave motion of filling points, it is recommended that beaching rock or concrete apron be placed to prevent erosion of the soil from the movement of water.

Additional permeability testing may be required in the base of the constructed clay liner to ensure a permeability rate of $1x10^{-9}$ has been achieved during construction to meet EPA requirements.

It is expected that excavation at the site will be readily achieved using conventional heavy earthmoving machinery to the required design levels in the sandy/silty clay and clayey sand profile.

If the Sandy/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. Alternatively, during dry weathered, this material will dust up on the surface under traffic, therefore, dust controls measures such as water truck or crushed rock surfacing will be required.

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 Rhys Tremble Concreting and Engineering. 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 Rhys Tremble Concreting and Engineering 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: RHYS TREMBLE
PROJECT: CORNER LARKINS AND MAXWELLS ROAD, FINLEY, NSW

GTS REF: 24C 0720
CLIENT REF:

DRAWN BY: VC
DATE: 03 SEPTEMBER 2024

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

Geotechnical Log - Borehole

BH 1

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 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
		TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.1	Natural		CI	Silty CLAY CI: stiff, medium plasticity, brown, trace medium grained sand, moist.	M		St				
									3			
	0.4	Natural		CI	Sandy to silty CLAY CI: firm to stiff, medium plasticity, grey, fine to coarse grained sand, moist.	M		F-St	3			
									3			
									1			
									2			
									3			
									4			
									6			
	1.7	Natural		CI-CH	Silty CLAY CI-CH: very stiff, medium to high plasticity, pale brown mottled grey brown, trace fine sized gravel, moist.	M		VSt		600+		
					BH 1 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 2

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 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
		TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.15	Natural		CI	Silty CLAY CI: firm to stiff, medium plasticity, brown, trace fine to medium grained sand, moist.	M		F-St				
	0.35	Natural		CI-CH	Silty CLAY CI-CH: firm to stiff, medium to high plasticity, grey, trace fine to medium grained sand, moist.	M		F-St	2 3 2 1 3 4 5 4			
	1.8	Natural		CI-CH	Silty CLAY CI-CH: very stiff, medium to high plasticity, pale brown mottled orange brown, trace fine sized gravel, trace fine to coarse grained sand, moist.	M		VSt		400		
					BH 2 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 3

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 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
		TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.1	Natural		Cl	Sandy CLAY Cl: firm, medium plasticity, brown mottled grey, fine to coarse grained sand, trace fine sized gravel, moist.	M		F	2			
									2			
									2			
	0.6	Natural		Cl-CH	Silty CLAY Cl-CH: firm to stiff, medium to high plasticity, grey mottled pale brown, with fine to medium grained sand, moist.	M		F-St	2			
									2			
									3			
									5			
	1.6	Natural		Cl-CH	Silty CLAY Cl-CH: very stiff, medium to high plasticity, brown mottled grey orange brown, trace fine to medium sized gravel, trace fine to coarse grained sand, moist.	M		VSt		600+		
					BH 3 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 4

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 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
	0.1	TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
		Natural		CH	Silty CLAY CH: firm, high plasticity, brown, trace fine to medium grained sand, moist.	M		F				
	0.4								2			
		Natural		CI-CH	Silty CLAY CI-CH: firm to stiff, medium to high plasticity, dark brown mottled brown, trace fine sized gravel, trace fine to coarse grained sand, moist.	M		F-St	1			
									2			
									4			
									3			
									6			
									8			
									9			
	1.2											
		Natural		CI	Sandy CLAY CI: very stiff, medium plasticity, pale brown mottled grey orange brown, fine to medium grained sand, moist to dry.	M-D		VSt				
										600+		
	2.6	Natural		CI	As above, but trace fine to coarse sized gravel.	M-D		VSt				
					BH 4 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 5

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 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
		TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.1	Natural		CH	Silty CLAY CH: firm, high plasticity, brown, trace fine to medium grained sand, moist.	M		F	2			
	0.5								1			
		Natural		CH	Silty CLAY CH: stiff, high plasticity, mottled brown pale brown, trace fine sized gravel, trace fine to coarse grained sand, moist.	M		St	4			
									4			
	0.8								4			
		Natural		CI	Sandy CLAY CI: stiff to very stiff, medium plasticity, mottled brown pale brown grey, fine to coarse grained sand, trace fine sized gravel, moist.	M		St-VSt	5			
									6			
	1.7	Natural		CH	Silty CLAY CH: very stiff, high plasticity, pale brown mottled orange brown, with fine to coarse grained sand, trace fine sized gravel, moist to dry.	M-D		VSt		440		
					BH 5 Terminated at 3m							

GTS - Bendigo

13 Alstonvale Court East Bendigo VIC 3550

Phone: 03 5441 4881

Geotechnical Log - Borehole

BH 6

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 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
	0.1	TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.4	Natural		CH	Silty CLAY CH: stiff, high plasticity, brown mottled grey, trace fine sized gravel, trace fine to coarse grained sand, moist.	M		St	3			
	1.2	Natural		CI-CH	Silty CLAY CI-CH: firm to stiff, medium to high plasticity, pale brown mottled orange brown, trace fine sized gravel, trace fine to medium grained sand, moist.	M		F-St	2 5 4 6 4 5			
	1.6	Natural		CI-CH	As above, but stiff, with fine to medium grained sand.	M		St				
		Natural		CI-CH	Sandy CLAY CI-CH: very stiff, medium to high plasticity, pale brown mottled orange brown, fine to coarse grained sand, trace fine sized gravel, moist.	M		VSt		600+		

BH 6 Terminated at 3m

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

Geotechnical Log - Borehole

BH 7

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 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
	0.1	TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
		Natural		Cl	Silty CLAY Cl: soft, medium plasticity, brown, with fine to medium grained sand, moist.	M		S				
	0.4								1			
		Natural		Cl-CH	Silty CLAY Cl-CH: firm to stiff, medium to high plasticity, mottled brown pale brown, trace fine sized gravel, trace fine to coarse grained sand, moist.	M		F-St	1			
									2			
									4			
									3			
									4			
									5			
									6			
	1.2											
		Natural		Cl	Sandy CLAY Cl: very stiff, medium plasticity, pale brown mottled orange brown, fine to coarse grained sand, trace fine to medium sized gravel, moist to dry.	M-D		VSt				
										550		
	2.1											
		Natural		CH	Silty CLAY CH: very stiff, high plasticity, pale brown mottled grey, trace fine to medium grained sand, moist.	M		VSt				
					BH 7 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 8

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	: Geotechnical Testing Services	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 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
		TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.1	Natural		CI	Silty CLAY CI: firm to stiff, medium plasticity, brown, with fine to medium grained sand, moist.	M		F-St	3			
	0.5	Natural		CI-CH	Silty CLAY CI-CH: firm to stiff, medium to high plasticity, mottled brown pale brown, trace fine sized gravel, trace fine to coarse grained sand, moist.	M		F-St	2 1 3 5 6 4 3			
	1.3	Natural		CI	Sandy CLAY CI: very stiff, medium plasticity, mottled orange brown pale brown, fine to medium grained sand, trace fine sized gravel, moist.	M		VSt				
	1.8	Natural		SC	Clayey SAND SC: dense, low plasticity clay, pale brown, fine to medium grained, moist to dry.	M-D		D		NA		
	2.7	Natural		SW	SAND SW: medium dense, pale brown, fine to coarse grained, moist.	M		MD				
					BH 8 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 9

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 m BGL	Date	: 20/09/2024	Loc Comment	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing: DCP	Testing: PP (kPa)	Testing: SPT	Remarks
	0.1	TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.3	Natural		CL	Silty CLAY CL: stiff, low plasticity, brown, with fine grained sand, moist.	M		St				
		Natural		CI-CH	Silty CLAY CI-CH: firm to stiff, medium to high plasticity, brown, trace fine grained sand, moist.	M		F-St	5			
									3			
									2			
									2			
	0.8								2			
		Natural		ML	Clayey SILT ML: firm to stiff, low plasticity, pale brown, with fine to coarse grained sand, moist.	M		F-St	2			
									4			
	1.3	Natural		CI	Silty CLAY CI: stiff, medium plasticity, pale brown mottled orange brown, with fine to coarse grained sand, moist.	M		St				
	1.8	Natural		SC	Clayey SAND SC: medium dense, low plasticity clay, pale brown, fine to medium grained, moist.	M		MD		NA		
					BH 9 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 10

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 m BGL	Date	: 20/08/2024	Loc Comment	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing: DCP	Testing: PP (kPa)	Testing: SPT	Remarks
	0.0	TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.1	Natural		CH	Silty CLAY CH: firm to stiff, high plasticity, brown, trace fine grained sand, moist.	M		F-St	4			
									2			
									2			
									4			
									5			
	0.9								5			
		Natural		CI	Silty to sandy CLAY CI: stiff, medium plasticity, pale brown mottled orange brown, fine to medium grained sand, moist.	M		St	6			
										300		
	2.1	Natural		SC	Clayey SAND SC: medium dense to dense, low plasticity clay, pale brown mottled orange brown, fine to coarse grained, moist.	M		MD-D				
	2.8	Natural		SC	As above, but medium dense, wet.	W		MD				
					BH 10 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 11

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 m BGL	Date	: 20/08/2024	Loc Comment	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing: DCP	Testing: PP (kPa)	Testing: SPT	Remarks
	0.1	TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
		Natural		CI	Sandy CLAY CI: stiff, medium plasticity, brown, fine to medium grained sand, moist.	M		St				
	0.4								3			
		Natural		CH	Silty CLAY CH: stiff, high plasticity, brown mottled orange brown, trace fine grained sand, moist.	M		St	3			
	0.6								4			
		Natural		CL	Sandy to silty CLAY CL: stiff to very stiff, low plasticity, pale brown mottled orange brown, fine to coarse grained sand, moist.	M		St-VSt	5			
									6			
									10			
									12			
	1.8	Natural		SC	Clayey SAND SC: medium dense to dense, low plasticity clay, pale brown mottled orange brown, fine to coarse grained, moist.	M		MD-D		250		
	2.7	Natural		SC	As above, but medium dense, wet.	W		MD				
					BH 11 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 12

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 m BGL	Date	: 20/08/2024	Loc Comment	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing: DCP	Testing: PP (kPa)	Testing: SPT	Remarks
	0.1	TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, dry.	D		St				
		Natural		CH	Silty CLAY CH: firm to stiff, high plasticity, brown, trace fine to medium grained sand, moist.	M		F-St	2			
									2			
	0.6								2			
		Natural		CI-CH	Silty CLAY CI-CH: firm to stiff, medium to high plasticity, brown mottled grey, trace fine to medium grained sand, moist.	M		F-St	3			
									2			
									8			
	1.1								6			
		Natural		CI	Silty CLAY CI: stiff, medium plasticity, orange brown mottled grey, with fine to medium grained sand, trace fine to medium sized gravel, moist.	M		St				
	2.1									150		
		Natural		SC	Clayey SAND SC: medium dense, low plasticity clay, grey, fine to coarse grained, moist.	M		MD				
	2.8											
		Natural		SC	As above, but wet.	W		MD				
					BH 12 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 13

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 m BGL	Date	: 20/08/2024	Loc Comment	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing: DCP	Testing: PP (kPa)	Testing: SPT	Remarks
	0.1	TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, dry.	D		St				
		Natural		CH	Silty CLAY CH: stiff to very stiff, high plasticity, brown, trace fine grained sand, moist.	M		St-VSt	4 4 3 5 8 7			
	0.9	Natural		CI-CH	Silty CLAY CI-CH: stiff to very stiff, medium to high plasticity, pale brown mottled grey, trace fine sized gravel, trace fine to coarse grained sand, moist.	M		St-VSt	6			
	1.3	Natural		CI	Sandy CLAY CI: very stiff, medium plasticity, pale brown mottled orange brown, fine to medium grained sand, moist.	M		VSt		250		
	2.2	Natural		SC	Clayey SAND SC: medium dense, low plasticity clay, pale brown, fine to coarse grained, moist.	M		MD				
	2.7	Natural		SC	As above, but wet.	W		MD				
					BH 13 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 14

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 m BGL	Date	: 20/08/2024	Loc Comment	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing: DCP	Testing: PP (kPa)	Testing: SPT	Remarks
	0.1	TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, brown, fine to medium grained sand, dry.	D		St				
		Natural		CH	Silty CLAY CH: stiff, high plasticity, brown, trace fine grained sand, moist.	M		St	4			
									3			
	0.6								3			
		Natural		CI	Silty CLAY CI: stiff to very stiff, medium plasticity, pale brown, with fine to coarse grained sand, moist.	M		St-VSt	5			
									8			
									7			
									9			
	1.7	Natural		SC	Clayey SAND SC: medium dense to dense, low plasticity clay, pale brown, fine to coarse grained, moist.	M		MD-D		220		
	2.8	Natural		SC	As above, but medium dense, wet.	W		MD				
					BH 14 Terminated at 3m							

GTS - Bendigo

13 Alstonvale Court East Bendigo VIC 3550

Phone: 03 5441 4881

Geotechnical Log - Borehole

BH 15

UTM	:	**Drill Rig**	: Drillman GT10 - Landcruiser Mount	**Job Number**	: 24C 0720
Easting (m)	: 0.00	**Driller Supplier**	:	**Client**	: Rhys Tremble
Northing (m)	: 0.00	**Logged By**	: PR	**Project**	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	**Reviewed By**	:	**Location**	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 m BGL	**Date**	: 20/08/2024	**Loc Comment**	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing: DCP	Testing: PP (kPa)	Testing: SPT	Remarks
		TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.1	Natural		CH	Silty CLAY CH: stiff, high plasticity, brown, with fine to coarse grained sand, moist.	M		St	3			
									4			
									4			
									5			
	0.8								7			
		Natural		CI	Silty CLAY CI: stiff, medium plasticity, pale brown mottled orange brown, trace fine to medium grained sand, moist.	M		St	7			
									6			
	1.3	Natural		CL-CI	Sandy CLAY CL-CI: firm to stiff, low to medium plasticity, pale brown mottled orange brown, fine to medium grained sand, moist.	M		F-St		120		
					BH 15 Terminated at 3m							

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

Geotechnical Log - Borehole

BH 16

UTM	:	Drill Rig	: Drillman GT10 - Landcruiser Mount	Job Number	: 24C 0720
Easting (m)	: 0.00	Driller Supplier	:	Client	: Rhys Tremble
Northing (m)	: 0.00	Logged By	: PR	Project	: Proposed Sheds and Ponds
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Corner Larkins Road & Maxwells Road, Finley NSW
Total Depth	: 3 m BGL	Date	: 20/08/2024	Loc Comment	:

Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Weathering	Consistency	Testing: DCP	Testing: PP (kPa)	Testing: SPT	Remarks
		TOPSOIL		ML	Sandy SILT ML: stiff, low plasticity, dark brown, fine to medium grained sand, moist.	M		St				
	0.1	Natural		CH	Silty CLAY CH: stiff, high plasticity, brown, trace fine grained sand, moist.	M		St	4 3 5			
	0.6	Natural		CI	Sandy CLAY CI: stiff to very stiff, medium plasticity, orange brown mottled pale brown, fine to medium grained sand, trace fine sized gravel, moist.	M		St-VSt	4 6 5 7			
	1.9	Natural		SC	Clayey SAND SC: medium dense, high plasticity clay, pale brown, fine to coarse grained, moist.	M		MD				
	2.6	Natural		SC	As above, but wet.	W		MD				
					BH 16 Terminated at 3m							

Material Test Report

Report Number: **P242782-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242782
Project Name: Proposed Sheds and Ponds
Project Location: Larkins and Maxwells Road, Finley
Client Reference: 24C 0720
Work Request: 16124
Sample Number: B24-16124A
Date Sampled: 20/08/2024
Dates Tested: 29/08/2024 - 04/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH1 (0.5-1.0m)**
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

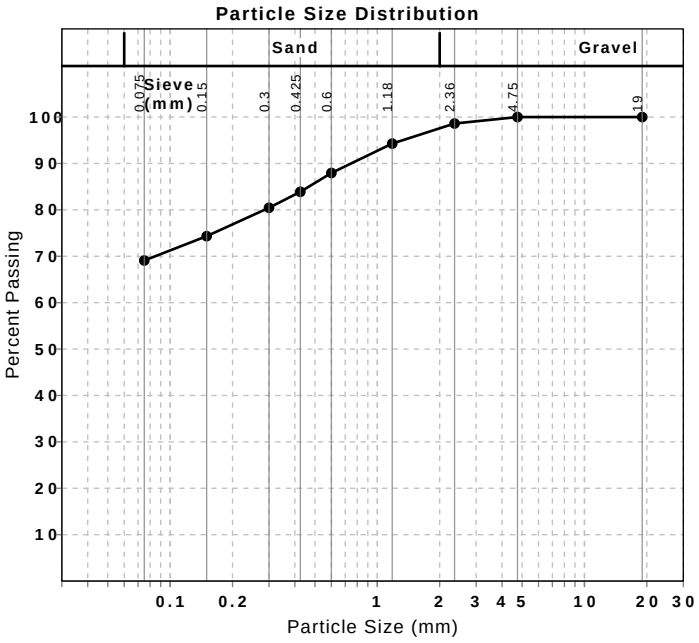
Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

Particle Size Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
4.75 mm	**100**			0		
2.36 mm	**99**			1		
1.18 mm	**94**			4		
0.6 mm	**88**			6		
0.425 mm	**84**			4		
0.3 mm	**80**			3		
0.15 mm	**74**			6		
0.075 mm	**69**			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 (%)	43		
Plastic Limit (%)	16		
Plasticity Index (%)	**27**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**12.0**		
Cracking Crumbling Curling	Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description	Refer to Borehole Logs		
Nature of Water	Potable		
Temperature of Water (^{o}C)	24.2		
* Mineral Present	Carbonate		



Material Test Report

Report Number: **P242782-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242782
Project Name: Proposed Sheds and Ponds
Project Location: Larkins and Maxwells Road, Finley
Client Reference: 24C 0720
Work Request: 16124
Sample Number: B24-16124B
Date Sampled: 20/08/2024
Dates Tested: 29/08/2024 - 04/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH5 (2.5-3m)**
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

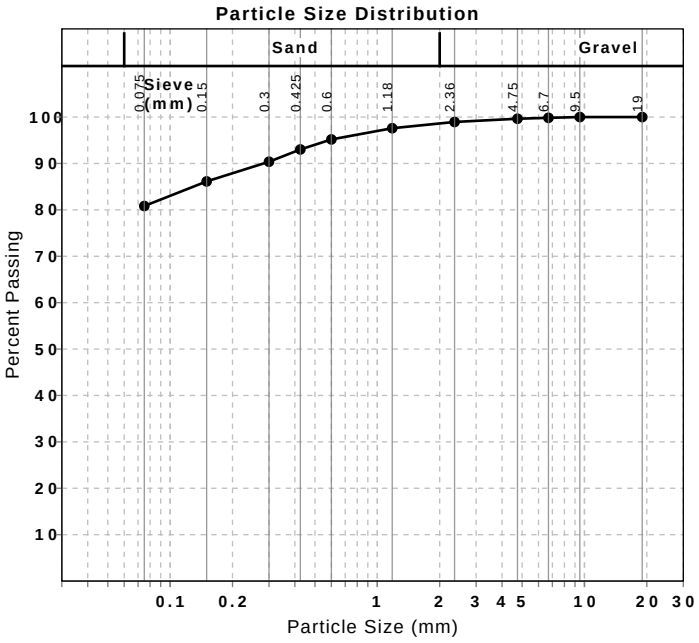
Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

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	**100**			0		
4.75 mm	**100**			0		
2.36 mm	**99**			1		
1.18 mm	**98**			1		
0.6 mm	**95**			2		
0.425 mm	**93**			2		
0.3 mm	**90**			3		
0.15 mm	**86**			4		
0.075 mm	**81**			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 (%)	61		
Plastic Limit (%)	19		
Plasticity Index (%)	**42**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**12.5**		
Cracking Crumbling Curling	Cracking & Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**4 ***		
Soil Description	Refer to Borehole Logs		
Nature of Water	Potable		
Temperature of Water (^{o}C)	23.7		
* Mineral Present	Carbonate		



Material Test Report

Report Number: **P242782-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242782
Project Name: Proposed Sheds and Ponds
Project Location: Larkins and Maxwells Road, Finley
Client Reference: 24C 0720
Work Request: 16124
Sample Number: B24-16124C
Date Sampled: 20/08/2024
Dates Tested: 29/08/2024 - 04/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH9 (0.7-1.2m)**
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

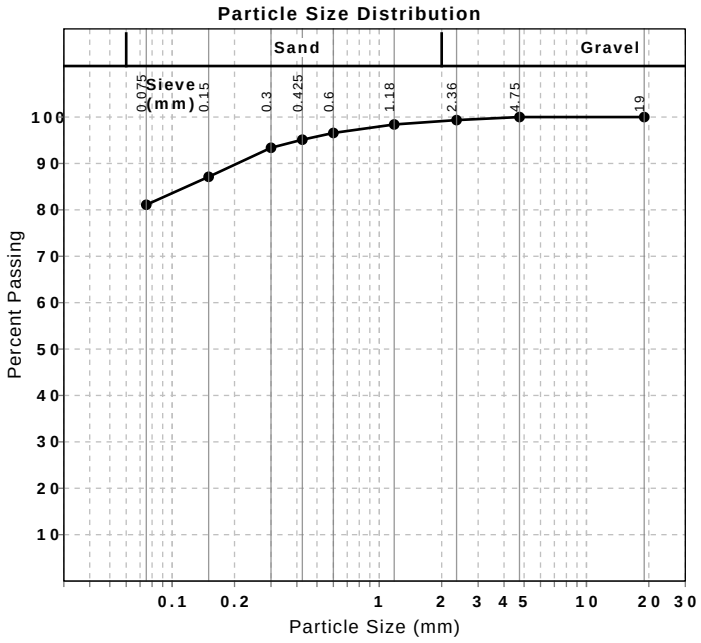
Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

Particle Size Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
4.75 mm	**100**			0		
2.36 mm	**99**			1		
1.18 mm	**98**			1		
0.6 mm	**97**			2		
0.425 mm	**95**			1		
0.3 mm	**93**			2		
0.15 mm	**87**			6		
0.075 mm	**81**			6		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	23		
Plastic Limit (%)	18		
Plasticity Index (%)	**5**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**1.5**		
Cracking Crumbling Curling	Cracking		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**4 ***		
Soil Description	Refer to Borehole Logs		
Nature of Water	Potable		
Temperature of Water (^{o}C)	24.2		
* Mineral Present	Carbonate		



Material Test Report

Report Number: **P242782-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242782
Project Name: Proposed Sheds and Ponds
Project Location: Larkins and Maxwells Road, Finley
Client Reference: 24C 0720
Work Request: 16124
Sample Number: B24-16124D
Date Sampled: 20/08/2024
Dates Tested: 29/08/2024 - 06/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH9 (1.3-1.8m)**
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

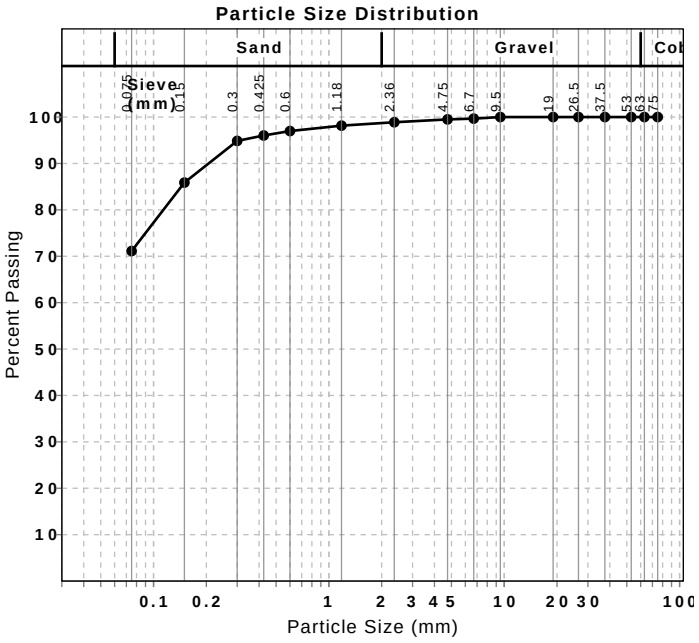
Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

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	**100**			0		
4.75 mm	**99**			0		
2.36 mm	**99**			1		
1.18 mm	**98**			1		
0.6 mm	**97**			1		
0.425 mm	**96**			1		
0.3 mm	**95**			1		
0.15 mm	**86**			9		
0.075 mm	**71**			15		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	41		
Plastic Limit (%)	16		
Plasticity Index (%)	**25**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**11.0**		
Cracking Crumbling Curling	Cracking & Crumbling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**4 ***		
Soil Description	Refer to Borehole Logs		
Nature of Water	Potable		
Temperature of Water (^{o}C)	24.2		
* Mineral Present	Carbonate		



Material Test Report

Report Number: **P242782-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242782
Project Name: Proposed Sheds and Ponds
Project Location: Larkins and Maxwells Road, Finley
Client Reference: 24C 0720
Work Request: 16124
Sample Number: B24-16124E
Date Sampled: 20/08/2024
Dates Tested: 29/08/2024 - 03/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH11 (0.6-1.1m)**
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

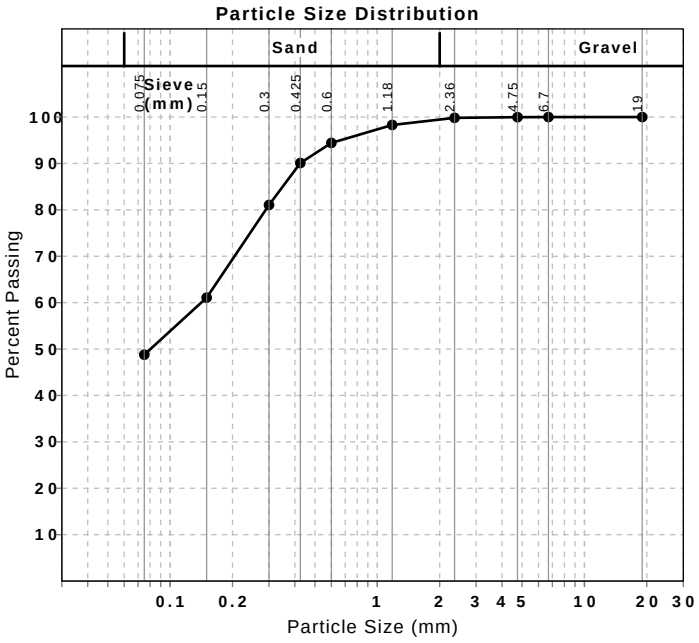
Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

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	**98**			2		
0.6 mm	**94**			4		
0.425 mm	**90**			4		
0.3 mm	**81**			9		
0.15 mm	**61**			20		
0.075 mm	**49**			12		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	24		
Plastic Limit (%)	16		
Plasticity Index (%)	**8**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**5.0**		
Cracking Crumbling Curling	Cracking & Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description	Refer to Borehole Logs		
Nature of Water	Potable		
Temperature of Water (^{o}C)	24.2		



Material Test Report

Report Number: **P242782-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242782
Project Name: Proposed Sheds and Ponds
Project Location: Larkins and Maxwells Road, Finley
Client Reference: 24C 0720
Work Request: 16124
Sample Number: B24-16124F
Date Sampled: 20/08/2024
Dates Tested: 29/08/2024 - 06/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH14 (0.6-1.2m)**
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

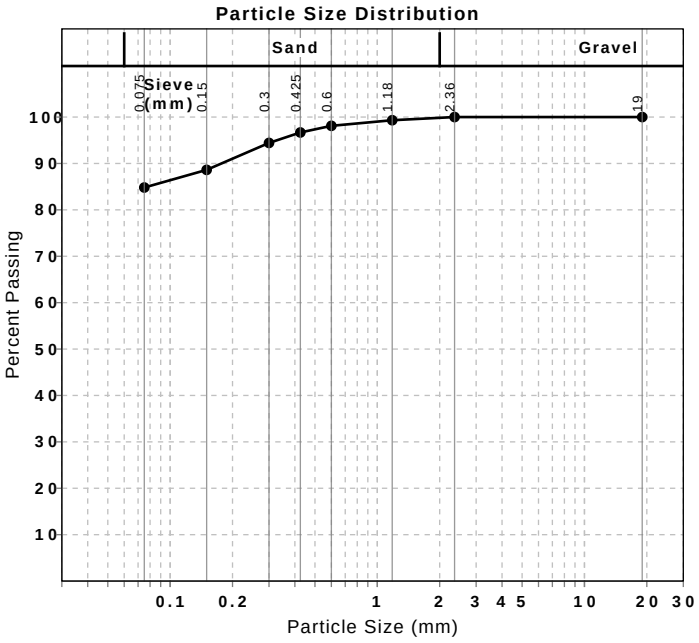
Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

Particle Size Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
2.36 mm	**100**			0		
1.18 mm	**99**			1		
0.6 mm	**98**			1		
0.425 mm	**97**			1		
0.3 mm	**94**			2		
0.15 mm	**89**			6		
0.075 mm	**85**			4		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	46		
Plastic Limit (%)	18		
Plasticity Index (%)	**28**		

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 & Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description	Refer to Borehole Logs		
Nature of Water	Potable		
Temperature of Water (^{o}C)	22.9		



Material Test Report

Report Number: **P242782-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242782
Project Name: Proposed Sheds and Ponds
Project Location: Larkins and Maxwells Road, Finley
Client Reference: 24C 0720
Work Request: 16124
Sample Number: B24-16124G
Date Sampled: 20/08/2024
Dates Tested: 29/08/2024 - 04/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH15 (0.1-0.7m)**
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

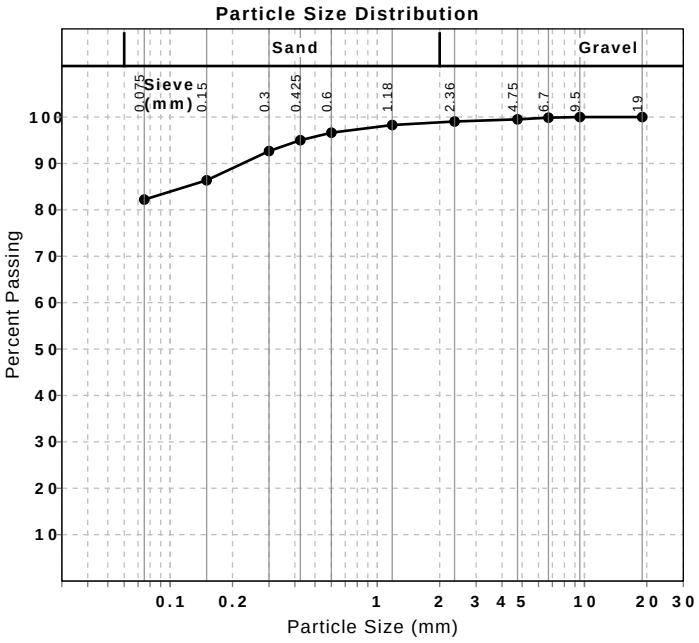
Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

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	**100**			0		
4.75 mm	**100**			0		
2.36 mm	**99**			0		
1.18 mm	**98**			1		
0.6 mm	**97**			2		
0.425 mm	**95**			2		
0.3 mm	**93**			2		
0.15 mm	**86**			6		
0.075 mm	**82**			4		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	53		
Plastic Limit (%)	21		
Plasticity Index (%)	**32**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**13.5**		
Cracking Crumbling Curling	Cracking & Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**4 ***		
Soil Description	Refer to Borehole Logs		
Nature of Water	Potable		
Temperature of Water (^{o}C)	24.2		
* Mineral Present	Carbonate		



Material Test Report

Report Number: **P242782-1**
Issue Number: 1
Date Issued: 09/09/2024
Client: GTS Consultancy Department
13 Alstonvale Court , East Bendigo VIC 3550
Contact: Shane Hampton
Project Number: P242782
Project Name: Proposed Sheds and Ponds
Project Location: Larkins and Maxwells Road, Finley
Client Reference: 24C 0720
Work Request: 16124
Sample Number: B24-16124H
Date Sampled: 20/08/2024
Dates Tested: 29/08/2024 - 04/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH16 (2-2.5m)**
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

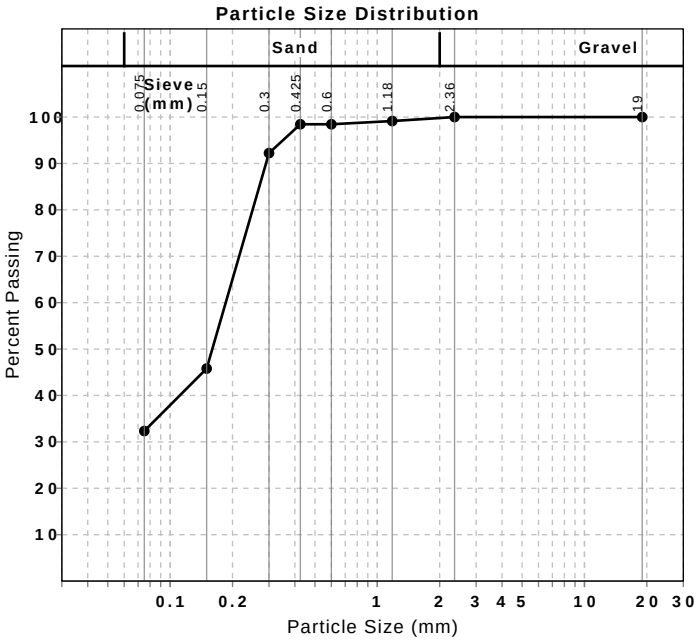
Approved Signatory: James Smith
CMT Laboratory Supervisor
NATA Accredited Laboratory Number: 19506

Particle Size Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
19 mm	**100**			0		
2.36 mm	**100**			0		
1.18 mm	**99**			1		
0.6 mm	**98**			1		
0.425 mm	**98**			0		
0.3 mm	**92**			6		
0.15 mm	**46**			46		
0.075 mm	**32**			13		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	54		
Plastic Limit (%)	20		
Plasticity Index (%)	**34**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**14.5**		
Cracking Crumbling Curling	Cracking & Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description	Refer to Borehole Logs		
Nature of Water	Potable		
Temperature of Water (^{o}C)	24.2		



Triaxial Permeability Test Report

Report Number:	**11585-1**
Date Issued:	20/09/2024
Client:	Geotechnical Testing Services Pty Ltd 13 Alstonvale Court, East Bendigo, 3550
Contact:	James Smith
Project Number:	11585
Project Name:	WR#16124
Project Location:	Bendigo
Date Sampled:	20/08/2024
Dates Tested:	9-19/09/2024
Sampling Method:	Sampled by client
Specification:	N/A
Sample Identification:	**B24-16124D**
Sample Number:	**TF/P/24/06282**
Location:	**B24-16124D**
Material Description:	silty CLAY,orange/brown

Pakenham Laboratory
47 National Avenue Pakenham VIC 3810
Phone: (03) 9769 5799
Email: pdiyawadana@terrafirmalabs.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: P Diyawadana

NATA Accredited Laboratory Number: 15357

Triaxial Permeability AS 1289 6.7.3-2016	
Permeant Used	NaCl (50000ppm)
Confining Pressure(kPa)	600
Head Pressure(kPa)	590
Bottom Pressure(kPa)	570
Mean Pressure(kPa)	20
Specimen Height(mm)	70
Specimen Diameter(mm)	63
Length to Height Ratio	1.11
Laboratory Density Ratio(%)	95
Laboratory Moisture Ratio(%)	100
Compactive Effort	Standard
Material Retained on the 37.5mm sieve (%)	0
Final Moisture Content (%)	23.5
Permeability(m/s)	**1.E-10**

Triaxial Permeability Test Report

Report Number:	**11585-2**
Date Issued:	20/09/2024
Client:	Geotechnical Testing Services Pty Ltd 13 Alstonvale Court, East Bendigo, 3550
Contact:	James Smith
Project Number:	11585
Project Name:	WR#16124
Project Location:	Bendigo
Date Sampled:	28/08/2024
Dates Tested:	10-18/09/2024
Sampling Method:	Sampled by client
Specification:	N/A
Sample Identification:	**B24-16124F**
Sample Number:	**TF/P/24/06283**
Location:	**B24-16124F**
Material Description:	silty CLAY,grey/brown

terra firma laboratories

Pakenham Laboratory
47 National Avenue Pakenham VIC 3810
Phone: (03) 9769 5799
Email: pdiyawadana@terrafirmalabs.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: P Diyawadana

NATA Accredited Laboratory Number: 15357

Triaxial Permeability AS 1289 6.7.3-2016	
Permeant Used	NaCl (50000ppm)
Confining Pressure(kPa)	600
Head Pressure(kPa)	590
Bottom Pressure(kPa)	570
Mean Pressure(kPa)	20
Specimen Height(mm)	70
Specimen Diameter(mm)	63
Length to Height Ratio	1.11
Laboratory Density Ratio(%)	95
Laboratory Moisture Ratio(%)	97
Compactive Effort	Standard
Material Retained on the 37.5mm sieve (%)	0
Final Moisture Content (%)	24.8
Permeability(m/s)	**6.E-10**

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
D Auger Drilling
R Roller/tricone
W Washboring
N Natural Exposure
E Existing Excavation
B Blade/bucket
C Coring
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

BACK PADDOCK SOILMATE

SoilMate Lab Result Status Report

Date Printed 01-Nov-2024 21:38:28

Trading Name	P Middlebrook
Farm	STRATHDRUMMOND
Paddock	Tree Line
Contact	PETER MIDDLEBROOK

Barcode 070298484 **Sample Date** 21 Oct 2024

Adviser Stacey Doolan **Analysis Date** 01 Nov 2024

Evaluation Pasture NSW Perennial Grass Legume 24 DSE PBI (70 - 140)

Test Code IP-E13 **Depth From:** cm **Depth To:** cm

Nutrient	Result	Sufficiency Range
pH (1:5 H2O)	7.100	5.5 - 8.5
pH (1:5 CaCl2)	6.400	4.7 - 7.7
EC (1:5 H2O) dS/m	0.110	0 - 0.3
EC (se) (dS/m)	0.680	0 - 2.3
EC (se) (dS/m)	0.680	0 - 2.3
EC (se) (dS/m) (Cladj)	0.390	0 - 2.3
EC (se) (dS/m) (Cladj)	0.390	0 - 2.3
Chloride (1:5 H2O) mg/kg	#Error	0 - 100
Organic carbon (Walkley Black) %	1.870	2 - 20
Nitrate nitrogen (KCl) mg/kg	3.400	10 - 25
Ammonium nitrogen (KCl) mg/kg	3.100	0 - 5
Phosphorus (Colwell) mg/kg	210.000	30 - 50
Phosphorus Buffer Index (Colwell) (PBIc)	150.000	15 - 280
Phosphorus Environmental Risk Index	1.400	0 - 0.65
Potassium (Amm-Acet.) cmol+/kg	1.700	0.3 - 2
Potassium % of CEC	10.200	1 - 10
Sodium:Potassium Ratio	0.200	0 - 5
Sulfate-S (KCl40) mg/kg	3.900	10 - 50
Calcium (Amm-Acet) cmol+/kg	8.800	1 - 100
Calcium % of CEC	53.000	55 - 90
Magnesium (Amm-Acet.) cmol+/kg	5.800	0.8 - 10
Magnesium % cations	34.900	0 - 25
Grass Tetany Risk Index (Soil)	0.120	0 - 0.07
Sodium (Amm-Acet.) cmol+/kg	0.310	0 - 0.8
Exch. sodium %	1.900	0 - 6
Electrochemical Stability Index	0.059	0.05 - 10
Aluminium (KCl) (prewash) cmol+/kg	#Error	0 - 0.3
Aluminium Saturation %	#Error	0 - 5
eCEC cmol+/kg	16.600	0 - 100
Copper (DTPA) mg/kg	2.100	0.3 - 5
Zinc (DTPA) mg/kg	2.900	0.5 - 5
Manganese (DTPA) mg/kg	22.000	2 - 200
Boron (hot CaCl2) (mg/kg)	1.200	0.5 - 8

SoilMate Lab Result Status Report

Date Printed 01-Nov-2024 21:38:28

Trading Name	P Middlebrook
Farm	STRATHDRUMMOND
Paddock	Tree Line
Contact	PETER MIDDLEBROOK

Barcode 070298484 **Sample Date** 21 Oct 2024

Adviser Stacey Doolan **Analysis Date** 01 Nov 2024

Evaluation Pasture NSW Perennial Grass Legume 24 DSE PBI (70 - 140)

Test Code IP-E13 **Depth From:** cm **Depth To:** cm

Low | Marginal | Sufficient | High | Excessive

BACK PADDOCK SOILMATE

SoilMate Lab Result Status Report

Date Printed 01-Nov-2024 21:38:47

Trading Name	P Middlebrook
Farm	STRATHDRUMMOND
Paddock	Abbott La 1-7
Contact	PETER MIDDLEBROOK

Barcode 070298485 **Sample Date** 21 Oct 2024

Adviser Stacey Doolan **Analysis Date** 01 Nov 2024

Evaluation Pasture NSW Perennial Grass Legume 24 DSE PBI (70 - 140)

Test Code IP-E13 **Depth From:** cm **Depth To:** cm

Nutrient	Result	Sufficiency Range
pH (1:5 H2O)	6.100	5.5 - 8.5
pH (1:5 CaCl2)	5.100	4.7 - 7.7
EC (1:5 H2O) dS/m	0.040	0 - 0.3
EC (se) (dS/m)	0.250	0 - 2.3
EC (se) (dS/m)	0.250	0 - 2.3
EC (se) (dS/m) (Cladj)	0.180	0 - 2.3
EC (se) (dS/m) (Cladj)	0.180	0 - 2.3
Chloride (1:5 H2O) mg/kg	#Error	0 - 100
Organic carbon (Walkley Black) %	2.380	2 - 20
Nitrate nitrogen (KCl) mg/kg	2.700	10 - 25
Ammonium nitrogen (KCl) mg/kg	5.500	0 - 5
Phosphorus (Colwell) mg/kg	170.000	30 - 50
Phosphorus Buffer Index (Colwell) (PBIc)	140.000	15 - 280
Phosphorus Environmental Risk Index	1.200	0 - 0.65
Potassium (Amm-Acet.) cmol+/kg	0.700	0.3 - 2
Potassium % of CEC	7.400	1 - 10
Sodium:Potassium Ratio	0.400	0 - 5
Sulfate-S (KCl40) mg/kg	3.700	10 - 50
Calcium (Amm-Acet) cmol+/kg	5.800	1 - 100
Calcium % of CEC	61.200	55 - 90
Magnesium (Amm-Acet.) cmol+/kg	2.600	0.8 - 10
Magnesium % cations	27.500	0 - 25
Grass Tetany Risk Index (Soil)	0.080	0 - 0.07
Sodium (Amm-Acet.) cmol+/kg	0.270	0 - 0.8
Exch. sodium %	2.900	0 - 6
Electrochemical Stability Index	0.014	0.05 - 10
Aluminium (KCl) (prewash) cmol+/kg	#Error	0 - 0.3
Aluminium Saturation %	1.100	0 - 5
eCEC cmol+/kg	9.500	0 - 100
Copper (DTPA) mg/kg	2.900	0.3 - 5
Zinc (DTPA) mg/kg	5.300	0.5 - 5
Manganese (DTPA) mg/kg	29.000	2 - 200
Boron (hot CaCl2) (mg/kg)	0.770	0.5 - 8

SoilMate Lab Result Status Report

Date Printed 01-Nov-2024 21:38:47

Trading Name	P Middlebrook
Farm	STRATHDRUMMOND
Paddock	Abbott La 1-7
Contact	PETER MIDDLEBROOK

Barcode 070298485 **Sample Date** 21 Oct 2024

Adviser Stacey Doolan **Analysis Date** 01 Nov 2024

Evaluation Pasture NSW Perennial Grass Legume 24 DSE PBI (70 - 140)

Test Code IP-E13 **Depth From:** cm **Depth To:** cm

Low | Marginal | Sufficient | High | Excessive

BACK PADDOCK SOILMATE

SoilMate Lab Result Status Report

Date Printed 01-Nov-2024 21:39:07

Trading Name	P Middlebrook
Farm	STRATHDRUMMOND
Paddock	ABELARD ST 4 TO 9
Contact	PETER MIDDLEBROOK

Barcode 070298486 **Sample Date** 21 Oct 2024

Adviser Stacey Doolan **Analysis Date** 01 Nov 2024

Evaluation Pasture NSW Perennial Grass Legume 24 DSE PBI (70 - 140)

Test Code IP-E13 **Depth From:** cm **Depth To:** cm

Nutrient	Result	Sufficiency Range
pH (1:5 H2O)	6.400	5.5 - 8.5
pH (1:5 CaCl2)	5.700	4.7 - 7.7
EC (1:5 H2O) dS/m	0.070	0 - 0.3
EC (se) (dS/m)	0.430	0 - 2.3
EC (se) (dS/m)	0.430	0 - 2.3
EC (se) (dS/m) (Cladj)	0.280	0 - 2.3
EC (se) (dS/m) (Cladj)	0.280	0 - 2.3
Chloride (1:5 H2O) mg/kg	12.000	0 - 100
Organic carbon (Walkley Black) %	2.650	2 - 20
Nitrate nitrogen (KCl) mg/kg	4.900	10 - 25
Ammonium nitrogen (KCl) mg/kg	5.200	0 - 5
Phosphorus (Colwell) mg/kg	220.000	30 - 50
Phosphorus Buffer Index (Colwell) (PBIc)	140.000	15 - 280
Phosphorus Environmental Risk Index	1.600	0 - 0.65
Potassium (Amm-Acet.) cmol+/kg	1.600	0.3 - 2
Potassium % of CEC	10.100	1 - 10
Sodium:Potassium Ratio	0.200	0 - 5
Sulfate-S (KCl40) mg/kg	5.700	10 - 50
Calcium (Amm-Acet) cmol+/kg	8.800	1 - 100
Calcium % of CEC	55.800	55 - 90
Magnesium (Amm-Acet.) cmol+/kg	5.100	0.8 - 10
Magnesium % cations	32.300	0 - 25
Grass Tetany Risk Index (Soil)	0.120	0 - 0.07
Sodium (Amm-Acet.) cmol+/kg	0.270	0 - 0.8
Exch. sodium %	1.700	0 - 6
Electrochemical Stability Index	0.041	0.05 - 10
Aluminium (KCl) (prewash) cmol+/kg	#Error	0 - 0.3
Aluminium Saturation %	#Error	0 - 5
eCEC cmol+/kg	15.800	0 - 100
Copper (DTPA) mg/kg	3.000	0.3 - 5
Zinc (DTPA) mg/kg	5.400	0.5 - 5
Manganese (DTPA) mg/kg	27.000	2 - 200
Boron (hot CaCl2) (mg/kg)	1.100	0.5 - 8

SoilMate Lab Result Status Report

Date Printed 01-Nov-2024 21:39:07

Trading Name	P Middlebrook
Farm	STRATHDRUMMOND
Paddock	ABELARD ST 4 TO 9
Contact	PETER MIDDLEBROOK

Barcode 070298486 **Sample Date** 21 Oct 2024

Adviser Stacey Doolan **Analysis Date** 01 Nov 2024

Evaluation Pasture NSW Perennial Grass Legume 24 DSE PBI (70 - 140)

Test Code IP-E13 **Depth From:** cm **Depth To:** cm

Low | Marginal | Sufficient | High | Excessive

BACK PADDOCK SOILMATE

SoilMate Lab Result Status Report

Date Printed 01-Nov-2024 21:39:25

Trading Name	P Middlebrook
Farm	STRATHDRUMMOND
Paddock	Bernies Pdk 1-10
Contact	PETER MIDDLEBROOK

Barcode 070298487 **Sample Date** 21 Oct 2024

Adviser Stacey Doolan **Analysis Date** 01 Nov 2024

Evaluation Pasture NSW Perennial Grass Legume 24 DSE PBI (70 - 140)

Test Code IP-E13 **Depth From:** cm **Depth To:** cm

Nutrient	Result	Sufficiency Range
pH (1:5 H2O)	6.900	5.5 - 8.5
pH (1:5 CaCl2)	6.100	4.7 - 7.7
EC (1:5 H2O) dS/m	0.040	0 - 0.3
EC (se) (dS/m)	0.250	0 - 2.3
EC (se) (dS/m)	0.250	0 - 2.3
EC (se) (dS/m) (Cladj)	0.180	0 - 2.3
EC (se) (dS/m) (Cladj)	0.180	0 - 2.3
Chloride (1:5 H2O) mg/kg	#Error	0 - 100
Organic carbon (Walkley Black) %	1.570	2 - 20
Nitrate nitrogen (KCl) mg/kg	3.000	10 - 25
Ammonium nitrogen (KCl) mg/kg	3.200	0 - 5
Phosphorus (Colwell) mg/kg	170.000	30 - 50
Phosphorus Buffer Index (Colwell) (PBIc)	120.000	15 - 280
Phosphorus Environmental Risk Index	1.400	0 - 0.65
Potassium (Amm-Acet.) cmol+/kg	1.600	0.3 - 2
Potassium % of CEC	10.900	1 - 10
Sodium:Potassium Ratio	0.100	0 - 5
Sulfate-S (KCl40) mg/kg	2.200	10 - 50
Calcium (Amm-Acet) cmol+/kg	8.200	1 - 100
Calcium % of CEC	56.000	55 - 90
Magnesium (Amm-Acet.) cmol+/kg	4.700	0.8 - 10
Magnesium % cations	32.100	0 - 25
Grass Tetany Risk Index (Soil)	0.120	0 - 0.07
Sodium (Amm-Acet.) cmol+/kg	0.150	0 - 0.8
Exch. sodium %	1.000	0 - 6
Electrochemical Stability Index	0.039	0.05 - 10
Aluminium (KCl) (prewash) cmol+/kg	#Error	0 - 0.3
Aluminium Saturation %	#Error	0 - 5
eCEC cmol+/kg	14.600	0 - 100
Copper (DTPA) mg/kg	1.600	0.3 - 5
Zinc (DTPA) mg/kg	1.700	0.5 - 5
Manganese (DTPA) mg/kg	12.000	2 - 200
Boron (hot CaCl2) (mg/kg)	1.100	0.5 - 8

SoilMate Lab Result Status Report

Date Printed 01-Nov-2024 21:39:25

Trading Name	P Middlebrook
Farm	STRATHDRUMMOND
Paddock	Bernies Pdk 1-10
Contact	PETER MIDDLEBROOK

Barcode 070298487 **Sample Date** 21 Oct 2024

Adviser Stacey Doolan **Analysis Date** 01 Nov 2024

Evaluation Pasture NSW Perennial Grass Legume 24 DSE PBI (70 - 140)

Test Code IP-E13 **Depth From:** cm **Depth To:** cm

Low | Marginal | Sufficient | High | Excessive

LABORATORY ANALYSIS RESULTS

DATE: 2024-11-01 09:39 PM
ADVISER NAME: Stacey Doolan
PHONE:
MOBILE: 0447 960 746
EMAIL: stacey.doolan@nutrien.com.
SAMPLING DATE: 21/10/2024
RECEIVED DATE: 25/10/2024
ANALYSIS DATE: 1/11/2024
LABORATORY: IPL

ANALYSIS	*LABORATORY RESULT*
Nitrate nitrogen (KCl) mg/kg	2.7
Soil Texture	Medium Clay
Phosphorus Environmental Risk Index	1.2
Boron (hot CaCl2) (mg/kg)	0.77
pH (1:5 CaCl2)	5.1
Sodium (Amm-Acet.) cmol+/kg	0.27
EC (1:5 H2O) dS/m	0.04
Aluminium Saturation %	1.1
Iron (DTPA) mg/kg	330
Sodium:Potassium Ratio	0.4
Calcium (Amm-Acet) cmol+/kg	5.8
Zinc (DTPA) mg/kg	5.3
Calcium % of CEC	61.2
Potassium (Amm-Acet.) cmol+/kg	0.70
Copper (DTPA) mg/kg	2.9
Sulfate-S (KCl40) mg/kg	3.7
Soil Colour	Brown
Potassium % of CEC	7.4
Chloride (1:5 H2O) mg/kg	<10
Ammonium nitrogen (KCl) mg/kg	5.5
Organic carbon (Walkley Black) %	2.38
Magnesium (Amm-Acet.) cmol+/kg	2.6
Manganese (DTPA) mg/kg	29
pH (1:5 H2O)	6.1
Calcium:Magnesium Ratio (cmol+/kg)	2.2
Aluminium (KCl) (prewash) cmol+/kg	<0.10
Phosphorus (Colwell) mg/kg	170
Grass Tetany Risk Index (Soil)	0.08

CALCULATED	*CALCULATED RESULT*
Phosphorus Buffer Index (Colwell) (PBIc)	140
eCEC cmol+/kg	9.5
Magnesium % cations	27.5
EC (se) (dS/m)	0.25
Exch. sodium %	2.9
Electrochemical Stability Index	0.014
EC (se) (dS/m) (Cladj)	0.18
Calcium:magnesium ratio	2.2

LABORATORY ANALYSIS RESULTS

DATE: 2024-11-01 09:38 PM
ADVISER NAME: Stacey Doolan
PHONE:
MOBILE: 0447 960 746
EMAIL: stacey.doolan@nutrien.com.
SAMPLING DATE: 21/10/2024
RECEIVED DATE: 25/10/2024
ANALYSIS DATE: 1/11/2024
LABORATORY: IPL

ANALYSIS	LABORATORY RESULT
Sodium (Amm-Acet.) cmol+/kg	0.31
Sodium:Potassium Ratio	0.2
Magnesium (Amm-Acet.) cmol+/kg	5.8
Zinc (DTPA) mg/kg	2.9
Sulfate-S (KCl40) mg/kg	3.9
Calcium:Magnesium Ratio (cmol+/kg)	1.5
Potassium (Amm-Acet.) cmol+/kg	1.7
Iron (DTPA) mg/kg	120
Soil Colour	Brown
Potassium % of CEC	10.2
Calcium (Amm-Acet) cmol+/kg	8.8
Copper (DTPA) mg/kg	2.1
Aluminium Saturation %	<1
Manganese (DTPA) mg/kg	22
Calcium % of CEC	53
Boron (hot CaCl2) (mg/kg)	1.2
pH (1:5 H2O)	7.1
Chloride (1:5 H2O) mg/kg	<10
Nitrate nitrogen (KCl) mg/kg	3.4
pH (1:5 CaCl2)	6.4
Aluminium (KCl) (prewash) cmol+/kg	<0.10
EC (1:5 H2O) dS/m	0.11
Soil Texture	Medium Clay
Grass Tetany Risk Index (Soil)	0.12
Phosphorus (Colwell) mg/kg	210
Ammonium nitrogen (KCl) mg/kg	3.1
Organic carbon (Walkley Black) %	1.87
Phosphorus Environmental Risk Index	1.4

CALCULATED	CALCULATED RESULT
EC (se) (dS/m)	0.68
Calcium:magnesium ratio	1.5
EC (se) (dS/m) (Cladj)	0.39
Exch. sodium %	1.9
eCEC cmol+/kg	16.6
Magnesium % cations	34.9
Electrochemical Stability Index	0.059
Phosphorus Buffer Index (Colwell) (PBIc)	150

LABORATORY ANALYSIS RESULTS

DATE: 2024-11-01 09:39 PM
ADVISER NAME: Stacey Doolan
PHONE:
MOBILE: 0447 960 746
EMAIL: stacey.doolan@nutrien.com.
SAMPLING DATE: 21/10/2024
RECEIVED DATE: 25/10/2024
ANALYSIS DATE: 1/11/2024
LABORATORY: IPL

ANALYSIS	LABORATORY RESULT
Boron (hot CaCl2) (mg/kg)	1.1
pH (1:5 H2O)	6.4
Magnesium (Amm-Acet.) cmol+/kg	5.1
Manganese (DTPA) mg/kg	27
Sulfate-S (KCl40) mg/kg	5.7
Calcium:Magnesium Ratio (cmol+/kg)	1.7
Phosphorus (Colwell) mg/kg	220
Ammonium nitrogen (KCl) mg/kg	5.2
Organic carbon (Walkley Black) %	2.65
Phosphorus Environmental Risk Index	1.6
Chloride (1:5 H2O) mg/kg	12
Nitrate nitrogen (KCl) mg/kg	4.9
pH (1:5 CaCl2)	5.7
Calcium (Amm-Acet) cmol+/kg	8.8
Copper (DTPA) mg/kg	3.0
Aluminium Saturation %	<1
Zinc (DTPA) mg/kg	5.4
Calcium % of CEC	55.8
Aluminium (KCl) (prewash) cmol+/kg	<0.10
EC (1:5 H2O) dS/m	0.07
Soil Texture	Medium Clay
Grass Tetany Risk Index (Soil)	0.12
Potassium (Amm-Acet.) cmol+/kg	1.6
Iron (DTPA) mg/kg	170
Soil Colour	Brown
Potassium % of CEC	10.1
Sodium (Amm-Acet.) cmol+/kg	0.27
Sodium:Potassium Ratio	0.2

CALCULATED	CALCULATED RESULT
eCEC cmol+/kg	15.8
Magnesium % cations	32.3
EC (se) (dS/m) (Cladj)	0.28
Electrochemical Stability Index	0.041
Phosphorus Buffer Index (Colwell) (PBIc)	140
Exch. sodium %	1.7
EC (se) (dS/m)	0.43
Calcium:magnesium ratio	1.7

LABORATORY ANALYSIS RESULTS

DATE: 2024-11-01 09:39 PM
ADVISER NAME: Stacey Doolan
PHONE:
MOBILE: 0447 960 746
EMAIL: stacey.doolan@nutrien.com.
SAMPLING DATE: 21/10/2024
RECEIVED DATE: 25/10/2024
ANALYSIS DATE: 1/11/2024
LABORATORY: IPL

ANALYSIS	LABORATORY RESULT
Boron (hot CaCl2) (mg/kg)	1.1
pH (1:5 H2O)	6.9
Phosphorus (Colwell) mg/kg	170
Ammonium nitrogen (KCl) mg/kg	3.2
Organic carbon (Walkley Black) %	1.57
Phosphorus Environmental Risk Index	1.4
Magnesium (Amm-Acet.) cmol+/kg	4.7
Zinc (DTPA) mg/kg	1.7
Sulfate-S (KCl40) mg/kg	2.2
Calcium:Magnesium Ratio (cmol+/kg)	1.7
Potassium (Amm-Acet.) cmol+/kg	1.6
Manganese (DTPA) mg/kg	12
Soil Colour	Brown
Potassium % of CEC	10.9
Chloride (1:5 H2O) mg/kg	<10
Nitrate nitrogen (KCl) mg/kg	3.0
pH (1:5 CaCl2)	6.1
Aluminium (KCl) (prewash) cmol+/kg	<0.10
EC (1:5 H2O) dS/m	0.04
Soil Texture	Medium Clay
Grass Tetany Risk Index (Soil)	0.12
Sodium (Amm-Acet.) cmol+/kg	0.15
Sodium:Potassium Ratio	0.1
Calcium (Amm-Acet) cmol+/kg	8.2
Copper (DTPA) mg/kg	1.6
Aluminium Saturation %	<1
Iron (DTPA) mg/kg	80
Calcium % of CEC	56

CALCULATED	CALCULATED RESULT
eCEC cmol+/kg	14.6
Magnesium % cations	32.1
EC (se) (dS/m) (Cladj)	0.18
Exch. sodium %	1
Electrochemical Stability Index	0.039
Phosphorus Buffer Index (Colwell) (PBIc)	120
EC (se) (dS/m)	0.25
Calcium:magnesium ratio	1.7