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GEOTECHNICAL INVESTIGATION REPORT

88-98 Helen Street, Sefton NSW

Prepared for

La Salle Developments Pty Ltd

Report No: GS9266/2

22nd January 2025

GSNE Services Pty Ltd ATF Aargus Engineering Trust: ABN 71 387 576 812
Toll Free: 1300 137 038 PO Box 398 Drummoyne NSW 2047
Email: admin@aargus.net – Website: www.aargus.net
Offices Located: 46 Smithfield Road Smithfield NSW 2164 – 93 Eastwood Road Leppington NSW 2179 – 12/1 Bounty Close Tuggerah NSW 2259

1. Contents

1. INTRODUCTION

GSNE Services Pty Ltd ATF Aargus Engineering Trust ("Aargus Group") has been commissioned by La Salle Developments Pty Ltd to undertake a Geotechnical Site Investigation (GSI) within the property located at 88-98 Helen Street, Sefton NSW (the 'site'). The location of the site is presented in Figure 1 of Appendix B.

The Geotechnical investigation involves an assessment of the ground condition for the proposed new development. This report summarizes the results of our site observations together with our assessment and recommendations from a geotechnical engineering perspective.

2. SITE GEOLOGY

With reference to the Sydney 1:100,000 Geological Series Sheet 9130, Edition 1, 1983 by the Geological Survey of New South Wales, it indicates that the site is located on the border of Cainozoic era of Quaternary period of Qha and Wianamatta group (Rwb), consists of Shale, carbonaceous claystone, laminite fine to medium lithic sandstone, and silty to peaty qurtz sand silt.

3. FIELD WORK

The field works for this geotechnical investigation constituting this report was carried out on 14th May 2024 in accordance with the proposal agreement between the client and GSNE Services Pty Ltd and to the Australian engineering standard AS1726:2017 - Geotechnical Site Investigations. The field investigation involved the drilling of five boreholes (BH1-BH5), using track mounted rig and Standard Penetrometer testing (SPT) was performed at the boreholes to estimate the consistency/density of subsurface materials.

Our geotechnical engineer was present on site during the fieldwork and set out the borehole location, nominated the sampling and in-situ testing location, and prepared the logs of the strata encountered. The field observations and borehole logs were logged by a Geotechnical Engineer from GSNE Services.

4. SUBSURFACE CONDITIONS

The subsurface soils forming the site have been categorized as topsoil/fill material made of Clayey/Silty sand material of up to 0.8m depth. The material beneath this 0.8-6.0m below the ground is categorized as Residual soil, stiff to hard consistency, with Shale fragments,

The details of the subsurface material encountered during the investigation are tabulated below in the geotechnical model in Tables 1.

Table 1: Subsurface Soil Profile

Unit	Material Description	BH1(m)	BH2(m)	BH3(m)	BH4(m)	BH5(m)
FILL	Clayey sand with gravel, brown	0.0-0.5	0.0-0.5	0.0-0.4	0.0-0.6	0.0-0.8
Residual	Silty Clay, Firm	-	-	-	0.6-4.5	0.8-2.5
	Silty Clay with Sand, Stiff to very stiff	0.5-4.5	0.5-5.0	0.4-5.0	4.5-5.0	2.5-6.0
	Silty Clay with shale fragments, Hard	4.5-6.0	-	5.0-6.0	-	-

5. GROUNDWATER

No groundwater/and or sources of shallow groundwater was observed in the immediate vicinity of the investigation site.

No ground water was encountered during the site investigation. However, it should also be noted that the groundwater levels are subject to change due to seasonal changes and daily fluctuations influenced by factors such as heavy rainfall, broken services and use of the surrounding land. The groundwater levels are also sometimes associated with surface water infiltration through soils, surface water drainages and inflow from higher grounds during development in the adjacent properties leading to moisture change in the soil underneath.

6. LABORATORY TESTING

Recovered samples from the site were submitted to SGS, a NATA accredited materials testing laboratory, these tests included:

- Aggressivity and Salinity tests on seven (4) samples
- Atterberg's and Linear Shrinkage testing on three (3) samples.

All laboratory test results are attached to this report.

6.1 Salinity Assessment

Four (4) soil samples were sent to SGS Environmental testing laboratory, for salinity testing. Test results are summarised in Table 2 with laboratory report sheets in Appendix D

Table 2: Soil Salinity Test Results

Sample ID	Depth(m)	Conductivity µS/cm	ECe (dS/m)	Salinity Assessment
BH1	0.5	460	4.14	Moderately saline
BH3	1.5	130	1.17	Non saline
BH4	2.0	220	1.98	Non saline
BH5	1.0	130	1.17	Non saline

According to the Department of Land and Water Conservation (2002), Guidelines (Table 6.1& 6.2), for silty clay soils, a multiplication factor of 9 was applied and soil salinity classes were classified.

The ECe values determined through applying appropriate multiplication factors to the EC results indicate that the soils are generally non-saline to moderately saline

6.2 Aggressivity Assessment

Four (4) soil samples were sent to SGS Environmental testing laboratory, for salinity testing. Test results are summarised in Table 3 with laboratory report sheets in Appendix D

Table 3: Aggressivity Test Results

Sample ID	Depth (m)	pH	Chloride (mg/kg)	Sulphate (mg/kg)	Aggressivity Assessment
BH1	0.5	7.4	320	280	Non-aggressive
BH3	1.5	8.6	20	52	Non-aggressive
BH4	2.0	6.1	300	<5.0	Non-aggressive
BH5	1.0	8.7	29	16	Non-aggressive

The pH results indicate that the soils are considered to be non-aggressive in low permeability soils for steel piles.

The chloride and sulphate results indicate that the soils are considered to be non-aggressive in low permeability soils for reinforced concrete piles and for steel piles.

6.3 Atterberg Limits and Linear Shrinkage

Atterberg limit and linear shrinkage testing was carried out on disturbed soil samples recovered from the boreholes. The results of the tests are presented in Table 4 below and in Appendix D.

Table 4: Results of Atterberg Limit Tests:

Borehole ID	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
BH3	1.0	33	14	19	6.0
BH4	2.5	44	14	30	13.0
BH5	3.0	33	13	20	9.5

6.4 Exposure Classification

Exposure Classification for Concrete in Saline soils for this site is A2, and an exposure classification of A1 for concrete and steel in sulphate soils should be adopted for preliminary design of proposed concrete structures.

7. GEOTECHNICAL ASSESSMENT

7.1 General

Based on the ground conditions encountered during the investigation, it was found that the Stiff to Very Stiff to Hard material underlain by extremely weathered Shale, very low strength, material encountered for boreholes BH1 to BH6 at depths of between 0.5m to 3.5m below ground level.

Soil samples were collected by continuous flight auger (disturbed samples), in a small plastic bag for Atterberg, Salinity and Aggressivity tests.

Consideration needs to be given to specific geotechnical issues including excavation stability, foundation conditions. Geotechnical commentary regarding these geotechnical constraints and recommendations for the proposed development is presented in the following sections.

7.2 Site Classification

After considering the area geology, the soil profile encountered in the bores, the site is classified as **CLASS 'P'** with respect to foundation construction (Australian Standard 2870-2011 Residential Slabs and Footings). However, if the excavation is continued into the natural ground and the footings/foundations are founded on natural ground a Site classification "**M**" can be used for the lots.

It has been estimated that the Characteristic Surface Movement (ys) of the underlying natural soil material will be in the range of 20-40mm provided the building site is protected from "abnormal moisture conditions" and is drained as described in AS 2870.

Class M indicates moderately reactive clay sites, which may experience high ground movement from moisture changes.

This classification is based on the findings in this investigation, including visual-tactile identification of the soil profile for limited test locations and is combined with this writer's local knowledge, experience and the characteristic surface movement observed on this site.

7.3 Preliminary Geotechnical Design Parameters

Recommended geotechnical parameters for the design purposes of structures in the soils at this site are presented in table 5.

Table 5: Preliminary Geotechnical Design Parameters

Units	Unit Weight (kN/m3)	Cohesion C' (kPa)	Angle of Friction Φ'	Modulus of Elasticity (E') (MPa)
Silty Clay Firm to Stiff	19	5	26	20
Silty Clay Very Stiff	20	8	27	30
Silty Clay with shale fragments, Hard	22	10	28	60

7.4 Allowable Bearing Capacity for Pad/Strip Footings and Slabs

An engineer designed strip footing system can be used for this site provided the footing is founded on the similar strength to minimize the risk of differential settlement.

We recommend that the design engineer refer to AS2870-2011 to ensure design compliance with this document. Allowable Bearing Capacity for Pad/Strip footings are presented in table 6.

Table 6: Allowable Bearing Capacity for Pad/Strip Footing

Borehole No.	Founding Depth (m)	Material Description	Allowable Bearing Capacity (kPa)
BH1-BH3	1.0	Silty Clay, stiff	100
	4.5	Silty Clay, very stiff	250
	6.0	Silty Clay, Hard	350
BH4-BH5	4.5	Silty Clay, Firm	100
	6.0	Silty Clay, very stiff	250

Suitable footings for the land are therefore likely to comprise cast in-situ reinforced concrete raft foundation with thickened slab to support columns and walls. It is recommended that all footings be founded on consistent strength of soil. This could be achieved by pad or strip footings to support columns and walls respectively.

The strip footings should be found in the natural soil layer and penetrate through any fill material, tree roots and founded at least 400mm into the recommended founding material. It should be noted that the soil profile may vary across the site. The foundation depths quoted in this report are measured from the surface during our testing and may vary accordingly if any filling or excavation works are carried out. It is recommended that a geotechnical engineer be engaged during the footing excavation stage to confirm the founding depth and founding material.

7.5 Bored Piles/Screw Piers

Where the allowable end bearing pressures for shallow footings provided in Table 8 are inadequate to support structural loads, bored piles could be drilled down to a stronger bearing stratum to support the loads of the proposed slab.

Piles could be proportioned on the basis of the design parameters provided in Table 5. Allowable end bearing can be taken as 600kPa, At below 6.0m depth.

Minimum embedment depths of one (1) and three (3) pile diameters in/to the hard soil are necessary to achieve these allowable design values for end bearing. It is recommended for the piles to have a minimum length of 1.5m. Bored piles should be found with an embedment of at least one (1) pile diameter in the founding material for which the footing has been designed.
Additional embedment of three (3) pile diameters would be necessary to utilise adhesion for the embedment in the respective materials.

All bored piles should be inspected by an experienced geotechnical engineer during construction to check the adequacy of the foundation material.

7.6 Temporary Cut Batters

Batter slopes may be considered in areas where sufficient space exists between the lower ground level excavation and the boundary and where any adjacent buildings (or infrastructure) are located outside a zone of influence obtained by drawing a line up at 45° from the toe of the proposed excavation. Recommended maximum slopes for batters on horizontal surface, are provided in Table 7 below. It is assumed that any batter slopes would be permanent and would therefore require vegetation to increase stability and drainage to keep water away from the slope face and the toe.

Table 7: Recommended Batter Slopes

Unit/Material	Max. Batter Slope (H:V)
Residual- Stiff	2:1
Residual -Very Stiff to hard	1.5:1

Due to the close proximity of the excavation with the boundaries, the use of temporary batter slopes is not considered to be suitable in most areas and therefore shoring should be

provided. Shoring design should consider both short term (construction) and permanent conditions as well as the presence of adjacent swimming pools, buildings and roads. Where any adjacent structures (or infrastructure) are located within a zone of influence obtained by drawing a line up at 45° from the toe of the proposed excavation, consideration may be given to inspection pits to determine the requirement for underpinning in any affected adjacent properties.

Detailed construction supervision, monitoring and inspections will be required during piling and subsequent bulk excavation and should be carried out by an experienced Geotechnical Engineer, in addition to inspection of the structural elements by the Project Structural Engineer. The inspections should constitute as “Hold Points”

7.7 Earth Pressures

Earth retaining structures should be designed to withstand the lateral earth pressure, hydrostatic and earthquake (if applicable) pressures, and the applied surcharge loads in their zone of influence, including existing structures, traffic and construction related activities.

For the design of flexible retaining structures, where some lateral movement is acceptable, it is recommended the design should be based on active lateral earth pressure. Should it be critical to limit the horizontal deformation of a retaining structure, use of an earth pressure coefficient “at rest” should be considered such as the case when the shoring wall is in the final permanent state and is restrained by the concrete slab in its final state.

Table 8 below provides preliminary coefficients of lateral earth pressure for the soils encountered during the geotechnical site investigation. The coefficients provided are based on horizontal ground surface and fully drained conditions.

Table 8: Preliminary Coefficients of Lateral Earth Pressure

Units	Coefficient of Active Lateral Earth Pressure Ka	Coefficient of Active Lateral Earth Pressure at Rest Ko	Coefficient of Passive Lateral Earth Pressure Kp
Silty Clay Stiff to Very Stiff	0.38	0.55	2.66
Silty Clay Hard	0.36	0.53	2.77

- Coefficient of active and passive lateral earth pressure Ka and Kp, respectively, can be calculated using Rankine's or Coulomb's equations, as appropriate.
- Coefficient of lateral earth pressure at rest Ko for soils, can be calculated using Jacky's equation.

The coefficients of lateral earth pressure should be verified by the project Structural Engineer prior to use in the design of retaining walls. Simplified calculations of lateral active (or at rest) and passive earth pressures can be carried out for cantilever walls using Rankine's equation shown below:

$Pa = K\ \gamma\ H - 2c\sqrt{K}$ For calculation of lateral active or 'at rest' earth pressure

$Pp = Kp\ \gamma\ H + 2c\sqrt{Kp}$ For calculation of passive earth pressure

For braced retaining walls, a uniform lateral earth pressure should be adopted as follows:

$Pa = 0.65\ K\ \gamma\ H$ For calculation of active earth pressure where,

Pa = Active (or at rest) Earth Pressure (kN/m^2)

Pp = Passive Earth Pressure (kN/m^2)

g = Bulk density (kN/m^3)

K = Coefficient of Earth Pressure (Ka or Ko)

Kp = Coefficient of Passive Earth Pressure

H = Retained height (m), c = Effective Cohesion (kN/m^2)

8. REPORT LIMITATIONS

The geotechnical assessment of the subsurface profile and geotechnical conditions within the proposed development area and the conclusions and recommendations presented in this report have been based on available information obtained during the work carried out by GSNE Services and in the provided documents listed in this report. Inferences about the nature and continuity of ground conditions away from and beyond the locations of field exploratory tests are made but cannot be guaranteed.

It is recommended that should ground conditions, including subsurface and groundwater conditions, encountered during construction and excavation vary substantially from those presented within this report, GSNE Services be contacted immediately for further advice and any necessary review of recommendations. GSNE Services does not accept any liability for site conditions not observed or accessible during the time of the investigation or inspection.
This report and associated documentation and the information herein have been prepared solely for the use of the La Salle Group Holdings Pty Ltd., and any reliance assumed by third parties on this report shall be at such parties' own risk. Any ensuing liability resulting from the use of the report by third parties cannot be transferred to GSNE Services Pty Ltd, directors, or employees.
Thank you for the opportunity to undertake this work. We would be pleased to provide further information on any aspects of this report.

For and on behalf of
GSNE Services Pty Ltd.,

Murali. P

Murali Pamu
B. Tech, GradDipEng, ME Stud, MIE Aust

Senior Geotechnical Engineer

Appendix A

Important Information about your Geotechnical Report

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Aargus

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include the general nature of the structure involved, its size and configuration, the location of the structure on the site and its orientation, physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program.

To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should NOT be used:*

- when the nature of the proposed structure is changed: for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an un-refrigerated one,
- when the size or configuration of the proposed structure is altered,
- when the location or orientation of the proposed structure is modified,
- when there is a change of ownership, or

for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

Geotechnical reports present the results of investigations carried out for a specific project and usually for a specific phase of the project. The report may not be relevant for other phases of the project, or where project details change.

The advice herein relates only to this project and the scope of works provided by the Client.

Soil and Rock Descriptions are based on AS1726-1993, using visual and tactile assessment except at discrete locations where field and/or laboratory tests have been carried out. Refer to the attached terms and symbols sheets for definitions.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how

qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact. For this reason, most experienced owners retain their geotechnical consultants through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions, and thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

Subsurface conditions can change with time and can vary between test locations. Construction activities at or adjacent to the site and natural events such as flood, earthquake or groundwater fluctuations can also affect the subsurface conditions.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems.
No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professional develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

The interpretation of the discussion and recommendations contained in this report are based on extrapolation/interpretation from data obtained at discrete locations. Actual conditions in areas not sampled or investigated may differ from those predicted

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings because drafters may commit errors or omissions in the

transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimise the likelihood of boring log misinterpretation, give contractors ready access in the complete geotechnical engineering report prepared or authorized for their use. Those who do not provide such access may proceed under mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are not exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

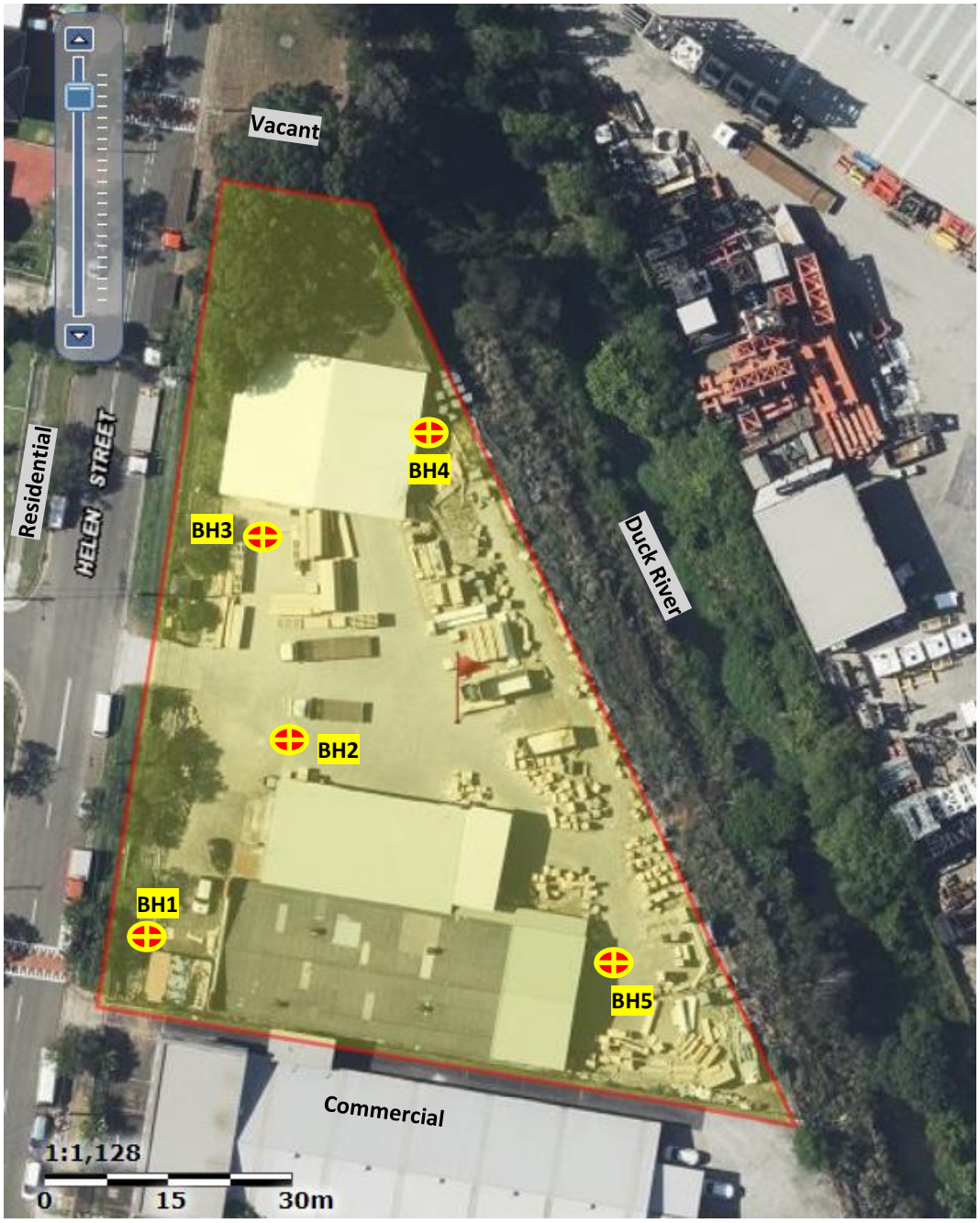
FURTHER GENERAL NOTES

Groundwater levels indicated on the logs are taken at the time of measurement and may not reflect the actual groundwater levels at those specific locations. It should be noted that groundwater levels can fluctuate due to seasonal and tidal activities.

Appendix B

Site Plan

SITE PLAN



Legend

Borehole

Source: http://maps.six.nsw.gov.au/

PROJECT DETAILS			DRAWING DETAILS			
Project Title	88 Helen Street		**Figure No.**	1	**Rev No.**	0
Project No.	GS9266-2A		**Scale**	As above	**Size**	A4
Client	La Salle Group Holdings Pty Ltd		**Drawn by**	MH	**Date**	21.05.2024
Site Address	88-98 Helen Street, Sefton NSW		**Approved by**	MP	**Date**	21.05.2024

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Appendix C

Bore Logs

BOREHOLE LOG

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BORE No: BH-1

Page: 1 **of** 2

Client:	La Salle Developments Pty Ltd	Drilling Co:	DrillTech Solutions	Easting:	-
Project:	Geotechnical Investigation	Driller:	Damien	Northing:	-
Job No:	GS9266-2A	Rig Type:	Comacchio GEO 205	Grid Ref:	See plan
Location:	88-98 Helen Street, Sefton	Inclination:	Vertical	Collar RL:	
Date Drilled:	14/05/2024	Bearing:	N/A	Logged by	MH Checked by: MP

Test Method: AS 1289.6.3.2-1997 & AS 1726-2017

Depth (m)	Drilling Method	Graphic Log	Group Symbol	MATERIAL DESCRIPTION Type, colour, particle size and shape, structure	Moisture	Consistency / Density	N-DCP Blows per 100mm	FIELD TESTS	Sampling / Runs	Water Levels	Depth (m)
0.00				Clayey Sand with gravel and silt, grey	D-M	WC		FILL			0.00
0.50											0.50
	Solid Auger		Cl	Silty Clay, grey brown, medium plasticity,	M	ST		SPT@0.5 3,4,7 N=11			
1.00											1.00
1.50								SPT@1.5m 4,4,9 N=13			1.50
2.00											2.00
2.50											2.50
3.00											3.00
3.50											3.50
4.00											4.00
4.50					M	VST		SPT@4.5m 7,7,10 N=17			4.50
5.00											5.00

consistency:

VS	very soft
S	soft
F	firm
ST	stiff
VST	very stiff
H	hard

relative density:

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

moisture:

D	Dry
M	Moist
W	Wet
S	Saturated

water: ▼ water level; level risen to; water inflow

notes:

PC Poorly Compacted
MC Moderately Compacted
WC Well Compacted

EL-Extremely low
VL - Very low

sampling / testing:

intact sample from core
Disturbed sample
T intact tube sample
B Bulk sample
Supp Su from Pocket Penetrometer
Suv Su from Field Vane Shear test

soil classification:
soil is classified in accordance with AS1726 unless otherwise noted

BOREHOLE LOG

GSNE SERVICES PTY LTD

BORE No: BH-1

Page: 2 **of** 2

Client:	La Salle Developments Pty Ltd	Drilling Co:	DrillTech Solutions	Easting:	-
Project:	Geotechnical Investigation	Driller:	Damien	Northing:	-
Job No:	GS9266-2A	Rig Type:	Comacchio GEO 205	Grid Ref:	See plan
Location:	88-98 Helen Street, Sefton	Inclination:	Vertical	Collar RL:	
Date Drilled:	14/05/2024	Bearing:	N/A	Logged by	MH Checked by: MP

Test Method: AS 1289.6.3.2-1997 & AS 1726-2017

Depth (m)	Drilling Method	Graphic Log	Group Symbol	MATERIAL DESCRIPTION Type, colour, particle size and shape, structure	Moisture	Consistency / Density	N-DCP Blows per 100mm	FIELD TESTS	Sampling / Runs	Water Levels	Depth (m)
5.00	Solid Auger		CI	Silty Clay with Shale fragments, grey brown, medium plasticity	D-M	H		SPT@6.0m 5,10,R			5.00
5.50											5.50
6.00				Borehole terminated @6.0m, Auger Refusal							6.00
6.50											6.50
7.00											7.00
7.50											7.50
8.00											8.00
8.50											8.50
9.00											9.00
9.50											9.50
10.00											10.00

consistency:

VS	very soft
S	soft
F	firm
ST	stiff
VST	very stiff
H	hard

relative density:

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

moisture:

D	Dry
M	Moist
W	Wet
S	Saturated

water:

▼ water level

▼ level risen to

● water inflow

notes:

PC Poorly Compacted
MC Moderately Compacted
WC Well Compacted

EL-Extremely low
VL - Very low

sampling / testing:

■ intact sample from core

● Disturbed sample

T intact tube sample

B Bulk sample
Supp Su from Pocket Penetrometer
Suv Su from Field Vane Shear test

soil classification:
soil is classified in accordance with AS1726 unless otherwise noted

BOREHOLE LOG

GSNE SERVICES PTY LTD

BORE No: BH-2

Page: 1 **of** 1

Client:	La Salle Developments Pty Ltd	Drilling Co:	DrillTech Solutions	Easting:	-
Project:	Geotechnical Investigation	Driller:	Damien	Northing:	-
Job No:	GS9266-2A	Rig Type:	Comacchio GEO 205	Grid Ref:	See plan
Location:	88-98 Helen Street, Sefton	Inclination:	Vertical	Collar RL:	
Date Drilled:	14/05/2024	Bearing:	N/A	Logged by	MH Checked by: MP

Test Method: AS 1289.6.3.2-1997 & AS 1726-2017

Depth (m)	Drilling Method	Graphic Log	Group Symbol	MATERIAL DESCRIPTION Type, colour, particle size and shape, structure	Moisture	Consistency / Density	N-DCP Blows per 100mm	FIELD TESTS	Sampling / Runs	Water Levels	Depth (m)
0.00				Clayey Sand with gravel and silt, grey	D-M	WC		FILL			0.00
0.50											0.50
	Solid Auger		Cl	Silty Clay, grey brown, medium plasticity,	M	ST		SPT@0.5 3,4,8 N=12			
1.00											1.00
1.50								SPT@1.5m 3,5,8 N=13			1.50
2.00											2.00
2.50											2.50
3.00											3.00
3.50											3.50
4.00											4.00
4.50											4.50
					M	VST		SPT@4.5m 7,5,10 N=15			
5.00				Borehole terminated @5.0m							5.00

consistency:

VS	very soft
S	soft
F	firm
ST	stiff
VST	very stiff
H	hard

relative density:

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

moisture:

D	Dry
M	Moist
W	Wet
S	Saturated

water:

▼ water level

▼ level risen to

● water inflow

notes:

PC Poorly Compacted
MC Moderately Compacted
WC Well Compacted

EL-Extremely low
VL - Very low

sampling / testing:

■ intact sample from core

● Disturbed sample

T intact tube sample

B Bulk sample
Supp Su from Pocket Penetrometer
Suv Su from Field Vane Shear test

soil classification:
soil is classified in accordance with AS1726 unless otherwise noted

GSNE SERVICES PTY LTD

BOREHOLE LOG

BORE No: BH-3

Page: 1 **of** 2

Client:	La Salle Developments Pty Ltd	Drilling Co:	DrillTech Solutions	Easting:	-
Project:	Geotechnical Investigation	Driller:	Damien	Northing:	-
Job No:	GS9266-2A	Rig Type:	Comacchio GEO 205	Grid Ref:	See plan
Location:	88-98 Helen Street, Sefton	Inclination:	Vertical	Collar RL:	
Date Drilled:	14/05/2024	Bearing:	N/A	Logged by	MH Checked by: MP

Test Method: AS 1289.6.3.2-1997 & AS 1726-2017

Depth (m)	Drilling Method	Graphic Log	Group Symbol	MATERIAL DESCRIPTION Type, colour, particle size and shape, structure	Moisture	Consistency / Density	N-DCP Blows per 100mm	FIELD TESTS	Sampling / Runs	Water Levels	Depth (m)
0.00				Clayey Sand with gravel and silt, grey	D-M	WC		FILL			0.00
0.50	Solid Auger		Cl	Silty Clay, grey brown, medium plasticity,	M	ST					0.50
1.00								SPT@1.5m 3,3,8 N=11			1.00
1.50											1.50
2.00											2.00
2.50						ST		SPT@2.5m 4,4,6 N=10			2.50
3.00											3.00
3.50											3.50
4.00											4.00
4.50											4.50
5.00					M	VST		SPT@4.5m 6,9,12 N=21			5.00

consistency:

VS	very soft
S	soft
F	firm
ST	stiff
VST	very stiff
H	hard

relative density:

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

moisture:

D	Dry
M	Moist
W	Wet
S	Saturated

water:

▼ water level

▼ level risen to

● water inflow

notes:

PC Poorly Compacted
MC Moderately Compacted
WC Well Compacted

EL-Extremely low
VL - Very low

sampling / testing:

■ intact sample from core

● Disturbed sample

T intact tube sample

B Bulk sample
Supp Su from Pocket Penetrometer
Suv Su from Field Vane Shear test

soil classification:
soil is classified in accordance with AS1726 unless otherwise noted

GSNE SERVICES PTY LTD

BOREHOLE LOG

BORE No: BH-3

Page: 2 **of** 2

Client:	La Salle Developments Pty Ltd	Drilling Co:	DrillTech Solutions	Easting:	-
Project:	Geotechnical Investigation	Driller:	Damien	Northing:	-
Job No:	GS9266-2A	Rig Type:	Comacchio GEO 205	Grid Ref:	See plan
Location:	88-98 Helen Street, Sefton	Inclination:	Vertical	Collar RL:	
Date Drilled:	14/05/2024	Bearing:	N/A	Logged by	MH Checked by: MP

Test Method: AS 1289.6.3.2-1997 & AS 1726-2017

Depth (m)	Drilling Method	Graphic Log	Group Symbol	MATERIAL DESCRIPTION Type, colour, particle size and shape, structure	Moisture	Consistency / Density	N-DCP Blows per 100mm	FIELD TESTS	Sampling / Runs	Water Levels	Depth (m)
5.00	Solid Auger		CI	Silty Clay with Shale fragments, grey brown, medium plasticity	D-M	H					5.00
5.50								SPT@6.0m Refusal			5.50
6.00				Borehole terminated @6.0m, Auger Refusal							6.00
6.50											6.50
7.00											7.00
7.50											7.50
8.00											8.00
8.50											8.50
9.00											9.00
9.50											9.50
10.00											10.00

consistency:

VS	very soft
S	soft
F	firm
ST	stiff
VST	very stiff
H	hard

relative density:

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

moisture:

D	Dry
M	Moist
W	Wet
S	Saturated

water:

▼ water level

▼ level risen to

● water inflow

notes:

PC Poorly Compacted
MC Moderately Compacted
WC Well Compacted

EL-Extremely low
VL - Very low

sampling / testing:

intact sample from core

Disturbed sample

T intact tube sample

B Bulk sample
Supp Su from Pocket Penetrometer
Suv Su from Field Vane Shear test

soil classification:
soil is classified in accordance with AS1726 unless otherwise noted

GSNE SERVICES PTY LTD

BOREHOLE LOG

BORE No: BH-4

Page: 1 **of** 1

Client:	La Salle Developments Pty Ltd	Drilling Co:	DrillTech Solutions	Easting:	-
Project:	Geotechnical Investigation	Driller:	Damien	Northing:	-
Job No:	GS9266-2A	Rig Type:	Comacchio GEO 205	Grid Ref:	See plan
Location:	88-98 Helen Street, Sefton	Inclination:	Vertical	Collar RL:	
Date Drilled:	14/05/2024	Bearing:	N/A	Logged by	MH Checked by: MP

Test Method: AS 1289.6.3.2-1997 & AS 1726-2017

Depth (m)	Drilling Method	Graphic Log	Group Symbol	MATERIAL DESCRIPTION Type, colour, particle size and shape, structure	Moisture	Consistency / Density	N-DCP Blows per 100mm	FIELD TESTS	Sampling / Runs	Water Levels	Depth (m)
0.00				Clayey Sand with gravel and silt, grey	D-M	WC		FILL			0.00
0.50											0.50
			Cl	Silty Clay with sand, grey brown, medium plasticity,	M	F					
1.00											1.00
1.50	Solid Auger							SPT@1.5m 1,2,4 N=6			1.50
2.00											2.00
2.50								SPT@2.5m 3,3,1 N=4			2.50
3.00											3.00
3.50											3.50
4.00											4.00
4.50					M	ST		SPT@4.5m 2,4,5 N=9			4.50
5.00				Borehole terminated @5.0m							5.00

consistency:

VS	very soft
S	soft
F	firm
ST	stiff
VST	very stiff
H	hard

relative density:

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

moisture:

D	Dry
M	Moist
W	Wet
S	Saturated

water: ▼ water level

soil classification: soil is classified in accordance with AS1726 unless otherwise noted

level risen to

water inflow

notes:

PC Poorly Compacted
MC Moderately Compacted
WC Well Compacted

EL-Extremely low
VL - Very low

sampling / testing:

intact sample from core

Disturbed sample

T intact tube sample

B Bulk sample
Supp Su from Pocket Penetrometer
Suv Su from Field Vane Shear test

BOREHOLE LOG

GSNE SERVICES PTY LTD

BORE No: BH-5

Page: 1 **of** 2

Client:	La Salle Developments Pty Ltd	Drilling Co:	DrillTech Solutions	Easting:	-
Project:	Geotechnical Investigation	Driller:	Damien	Northing:	-
Job No:	GS9266-2A	Rig Type:	Comacchio GEO 205	Grid Ref:	See plan
Location:	88-98 Helen Street, Sefton	Inclination:	Vertical	Collar RL:	
Date Drilled:	14/05/2024	Bearing:	N/A	Logged by	MH Checked by: MP

Test Method: AS 1289.6.3.2-1997 & AS 1726-2017

Depth (m)	Drilling Method	Graphic Log	Group Symbol	MATERIAL DESCRIPTION Type, colour, particle size and shape, structure	Moisture	Consistency / Density	N-DCP Blows per 100mm	FIELD TESTS	Sampling / Runs	Water Levels	Depth (m)
0.00				Concrete on top, Clayey Sand with gravel and silt, grey	D-M	WC		FILL			0.00
0.50											0.50
1.00	Solid Auger		Cl	Silty Clay with sand, grey brown, medium plasticity,	M	F		SPT@1.0m 2,2,3 N=5			1.00
1.50											1.50
2.00											2.00
2.50					M	ST		SPT@2.5m 3,3,6 N=9			2.50
3.00											3.00
3.50											3.50
4.00											4.00
4.50					M	ST		SPT@4.5m 5,6,6, N=12			4.50
5.00											5.00

consistency:

VS	very soft
S	soft
F	firm
ST	stiff
VST	very stiff
H	hard

relative density:

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

moisture:

D	Dry
M	Moist
W	Wet
S	Saturated

water: ▼ water level; level risen to; water inflow

notes:

PC Poorly Compacted
MC Moderately Compacted
WC Well Compacted

EL-Extremely low
VL - Very low

sampling / testing:

intact sample from core
Disturbed sample
T intact tube sample
B Bulk sample
Supp Su from Pocket Penetrometer
Suv Su from Field Vane Shear test

soil classification:
soil is classified in accordance with AS1726 unless otherwise noted

BOREHOLE LOG

GSNE SERVICES PTY LTD

BORE No: BH-5

Page: 2 **of** 2

Client:	La Salle Developments Pty Ltd	Drilling Co:	DrillTech Solutions	Easting:	-
Project:	Geotechnical Investigation	Driller:	Damien	Northing:	-
Job No:	GS9266-2A	Rig Type:	Comacchio GEO 205	Grid Ref:	See plan
Location:	88-98 Helen Street, Sefton	Inclination:	Vertical	Collar RL:	
Date Drilled:	14/05/2024	Bearing:	N/A	Logged by	MH Checked by: MP

Test Method: AS 1289.6.3.2-1997 & AS 1726-2017

Depth (m)	Drilling Method	Graphic Log	Group Symbol	MATERIAL DESCRIPTION Type, colour, particle size and shape, structure	Moisture	Consistency / Density	N-DCP Blows per 100mm	FIELD TESTS	Sampling / Runs	Water Levels	Depth (m)
5.00	Solid Auger		CI	Silty Clay with sand, grey brown, medium plasticity,	M	ST					5.00
5.50											5.50
6.00				Silty Clay, grey brown, medium plasticity	M	VST					6.00
				Borehole terminated @6.0m							
6.50											6.50
7.00											7.00
7.50											7.50
8.00											8.00
8.50											8.50
9.00											9.00
9.50											9.50
10.00											10.00

consistency:

VS	very soft
S	soft
F	firm
ST	stiff
VST	very stiff
H	hard

relative density:

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

moisture:

D	Dry
M	Moist
W	Wet
S	Saturated

water:

▼ water level

level risen to

water inflow

notes:

PC Poorly Compacted
MC Moderately Compacted
WC Well Compacted

EL-Extremely low
VL - Very low

sampling / testing:

intact sample from core

Disturbed sample

T intact tube sample

B Bulk sample
Supp Su from Pocket Penetrometer
Suv Su from Field Vane Shear test

soil classification:
soil is classified in accordance with AS1726 unless otherwise noted

Appendix D

Laboratory Results

Aargus Pty Ltd ACN: 050 212 710
Environmental - Remediation - Engineering - Laboratories - Drilling
Unit 12 1 Bounty Close, Tuggerah NSW 2259
Ph: (02) 4353 0332 Fax: (02) 4353 0221

ATTERBERG LIMITS AND LINEAR SHRINKAGE TEST REPORT

Client	La Salle Group			Job Number	LC9266-1a
Project	Geotechnicial Site Investigation			Date	27-05-2024
Location	88 Helen St, Sefton			Page	1 of 1
SAMPLE DETAILS					
Sample Number		MT1	MT2	MT3	
Date Sampled		14-05-2024	14-05-2024	14-05-2024	
Sample Location / Source		BH3	BH4	BH5	
Layer\Depth		1.0 m	2.5 m	3.0 m	
Material Description		Silty Clay, Brown	Silty Clay, Grey & Brown	Silty Clay with some rock fragments, Brown	
Sample History		Air Dried	Air Dried	Air Dried	
Method of Preparation		Dry Sieved	Dry Sieved	Dry Sieved	
Shrinkage Mould Length	mm	250	250	254	
TEST METHOD		**TEST RESULTS**			
Liquid Limit					
AS1289 3.1.2	☑ %	33	44	33	
RMS (NSW) T108	☐				
Plastic Limit					
AS1289 3.2.1	☑ %	14	14	13	
RMS (NSW) T109	☐				
Plasticity Index					
AS1289 3.3.1	☑ %	19	30	20	
RMS (NSW) T109	☐				
Linear Shrinkage					
AS1289 3.4.1	☑ %	6.0	13.0	9.5	
RMS (NSW) T113	☐				
Cracking Occurred		Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☐
Crumbling Occurred		Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☐
Curling Occurred		Yes ☐ No ☑	Yes ☐ No ☑	Yes ☑ No ☐	Yes ☐ No ☐

Notes:

NATA

Accredited for compliance with ISO/IEC 17025 - Testing
This document shall not be reproduced, except in full.
Accreditation No. 5452

Approved Signatory: Mark Hoveling

Date: 27-05-2024

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Mark Kelly
Client	GSNE SERVICES PTY LTD ATF AARGUS ENGINEERING T
Address	PO BOX 398 DRUMMOYNE NSW 2164
Telephone	1300137038
Facsimile	(Not specified)
Email	mark.kelly@aargus.net
Project	**GS9266-2A Geotechnical Investigation**
Order Number	**COD-GS9266-2A**
Samples	4

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE265241 R0**
Date Received	15/5/2024
Date Reported	21/5/2024

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Shane MCDERMOTT
Inorganic/Metals Chemist

Ying Ying ZHANG
Laboratory Technician

Soluble Anions (1:5) in Soil/Solids by Ion Chromatography [AN245] Tested: 17/5/2024

PARAMETER	UOM	LOR	BH1 0.5 SOIL - 15/5/2024 SE265241.001	BH3 1.5 SOIL - 15/5/2024 SE265241.002	BH4 2.0 SOIL - 15/5/2024 SE265241.003	BH5 1.0 SOIL - 15/5/2024 SE265241.004
Chloride	mg/kg	0.25	320	20	300	29
Sulfate	mg/kg	5	280	52	<5.0	16

pH in soil (1:5) [AN101] Tested: 17/5/2024

PARAMETER	UOM	LOR	BH1 0.5 SOIL - 15/5/2024 SE265241.001	BH3 1.5 SOIL - 15/5/2024 SE265241.002	BH4 2.0 SOIL - 15/5/2024 SE265241.003	BH5 1.0 SOIL - 15/5/2024 SE265241.004
pH	pH Units	0.1	**7.4**	**8.6**	**6.1**	**8.7**

Conductivity and TDS by Calculation - Soil [AN106] Tested: 17/5/2024

PARAMETER	UOM	LOR	BH1 0.5 SOIL - 15/5/2024 SE265241.001	BH3 1.5 SOIL - 15/5/2024 SE265241.002	BH4 2.0 SOIL - 15/5/2024 SE265241.003	BH5 1.0 SOIL - 15/5/2024 SE265241.004
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	**460**	**130**	**220**	**130**
Salinity (by calculation)*	mg/kg	5	**1500**	**430**	**710**	**410**

Moisture Content [AN002] Tested: 16/5/2024

PARAMETER	UOM	LOR	BH1 0.5 SOIL - 15/5/2024 SE265241.001	BH3 1.5 SOIL - 15/5/2024 SE265241.002	BH4 2.0 SOIL - 15/5/2024 SE265241.003	BH5 1.0 SOIL - 15/5/2024 SE265241.004
% Moisture	%w/w	1	**17.9**	**18.2**	**18.9**	**18.9**

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos /cm or µS/cm @ 25°C. For soils, an extract of as received sample with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2510 B.
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.