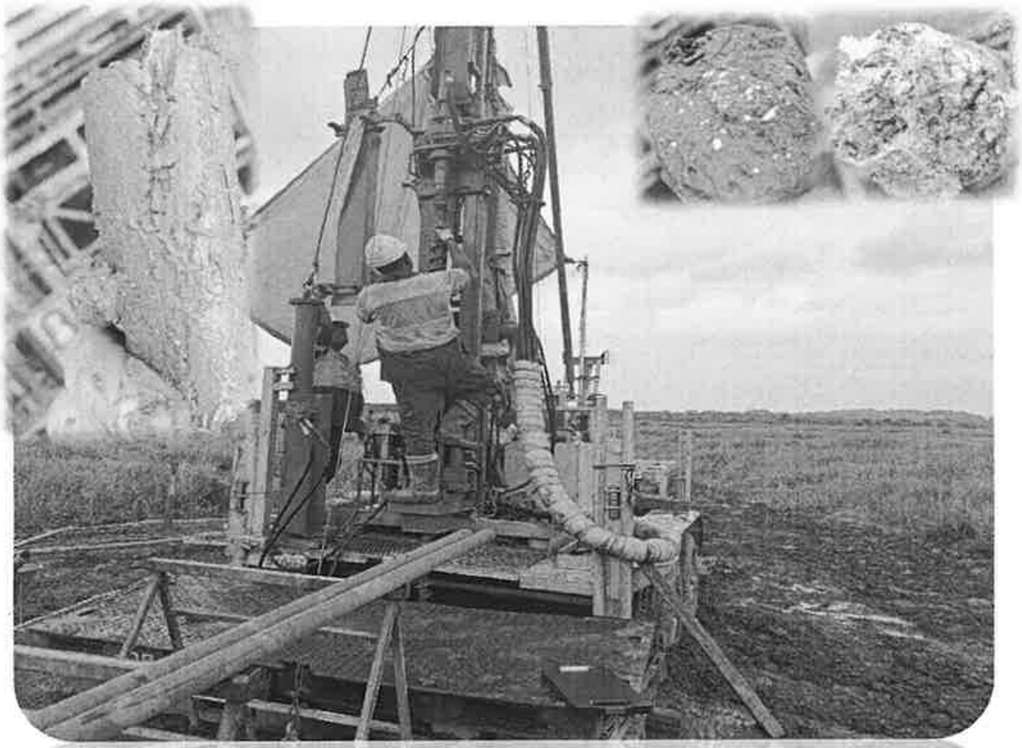
Civil Engineers, Structural Engineers, Geotechnical Engineers
& Project Managers

GEOTECHNICAL INVESTIGATION REPORT

Proposed Development for Public Rental Board at Namelimeli, Navua.



Report Prepared For :

Public Rental Board

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ENGINEERED DESIGNS

June 2025

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APPENDICES

1.0 Introduction

Engineered Designs Pte Limited (ED) was engaged by Public Rental Board (PRB) to undertake Geotechnical Investigations for the Proposed Development at Namelimeli, Navua.

The Scope of Work was presented in the Engineered Designs Pte Limited proposal dated 22nd March 2024 and authority to carry out the investigation was received from Mr Maloni Daurewa to proceed. This report presents the results of the investigations and includes analysis and interpretation of the findings.

2.0 Objective and Scope

In accordance with the requirements of the proposed development, the main focus of the investigation was to establish the following:

- Investigation of the subsurface profile at the proposed site area by drilling, sampling and in-situ testing with two boreholes.
- Laboratory testing on selected samples to assess the reactive nature and strength of the subsurface material.
- Engineering analysis of site investigation findings and laboratory test results to evaluate:
    - The nature and classification of subsurface material noting depth and condition of natural soils.
    - Soil design parameters for guidance on bulk earthwork and ground remediation procedures.
    - Foundation parameters for suitable foundation type.
    - Recommendation on site preparation.

In order to achieve the above objectives, the following sequence, investigation and test methods were undertaken for the site:

- Site walkover and observation of the site geology to determine consistency of site with published geology by Mineral Resources Department (MRD).
- Three (3) Dynamic Cone Penetrometer (DCP) tests across the site to determine indicative bearing pressures and CBR.
- Six (6) Excavator Test Pits to a maximum depth of 2.1 metres to ascertain the soil profile and check ground water table.
- Drilling of two (2) Machine Drilled Boreholes to a depth of 10 metres for the proposed new development area to map underground soil layers for classification including strength parameters in accordance with published guidelines by New Zealand Geotechnical Society Inc.
- Soil testing using Standard Penetrometer Tests (SPT) taken at 1.5m intervals.
- Samples for laboratory testing for Atterberg Limit.
- Ground remediation procedures.
- Analysis and preparation of this Report.

3.0 Site Description

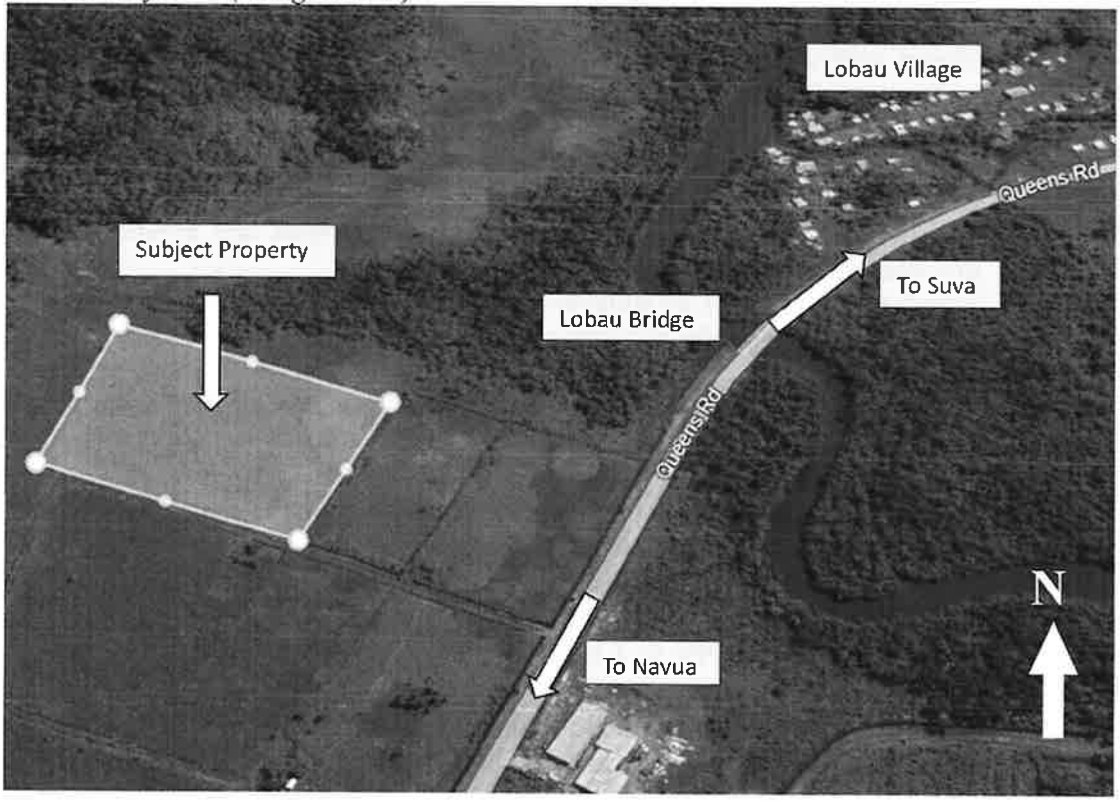
The site for the proposed new development is located off Queens Road in Navua as highlighted in **Figure 1.** During the time of investigation, the site was fully vegetated with tall grass and shrubs. The site is generally flat with minor undulations and is below Road level. Most of the site was in fully saturated state with stagnant water on the surface. A temporary working platform was made in order to access the desired test locations. Ground vibrations could be felt during passing of heavy machinery on site and during drilling process. A shallow drain was dug in the temporary working platform to facilitate drilling fluid and tailing flows from the boreholes annular space towards the temporary earthen drains.

The proposed location is approximately 215 metres from Lobau River and 2.9 kilometres from the River mouth/Coastline.

*Refer to **Appendix D** for **Site Photographs.***

Figure 1

Site Locality Plan (Google Earth)



3.1 Proposed Development

As per the Terms of Reference (TOR) and draft schmetic subdivisional drawings provided by PRB, it is presumed that the new development will consist of single storey residential structures, a double storey communinty hall, commercial center, childrens play area and road with fottpath network on the approximately 10 acres of land.

It has been envisaged that the proposed area will undergo bulk earthworks and ground remediation works to raise the formation level inorder to make sound foundation platform for the future development.

4.0 Site Investigations and Methodology

The site works was carried out on 12th February 2025 with shallow investigation and between 02nd May 2025 to 07th May 2025 with mainly drilling works. A preliminary reconnaissance of the site followed by field investigation and testing was carried out under Engineered Designs supervision to identify the sub-surface ground conditions. The location of testing was determined by way of engineering judgment, building types and past experience with similar types of projects.

*Refer to **Appendix A** for a **Test Locality Plan.***

Temporary working platform was made by backfilling with soapstone materials along the access and at the test locations as the natural ground was in a saturated state (swamp). A trailer mounted geotechnical drilling rig (conventional method) was employed for borehole investigation works. That is, the investigation and testing of the sub-surface soil stratum for the subject site. The maximum drill depth achieved was 10.95m below ground. Drilling was completed using auger drilling to approximately one and half (1.5) metres and wash bored thereafter upon encountering soft/ loose saturated material. All the extracted soil samples were stored in plastic bags for safe keeping and transferred to ED's laboratory for further 'visual' study and selecting specific soil samples for testing at specific depths of interest below the existing ground level for its material characteristics and consistencies.

*Refer to **Appendix B & C** for detailed investigation logs.*

5.0 Geotechnical Field and Laboratory Test Results

The Dynamic Cone Penetrometer (DCP) and the Standard Penetration (SPT) test results obtained for the site provided indicative bearing pressures of the soils at depth. The location and the number of test locations were selected as being representative of the development footprint and were selected based on the site clearance carried out by the Client.

5.1 Dynamic Cone Penetrometer (DCP)

Testing with a Scala penetrometer permitted assessment of subsoil strength up to a maximum depth of 3.0m. Only three (3) out of the ten (10) DCP tests were carried out within the proposed site to examine strength variation with depth. All the 3 tested areas were strategically located across the site due to the same nature of results generally exhibiting very soft soil substrate with no blow counts denoting that the DCP rods intruded under the self-weight of the hammer to the maximum test depth of 3m. Due to the consistent results, further DCP tests and progression to depths beyond 3m was deemed impractical. The results are presented in DCP logs in ***Appendix B***.

Furthermore, DCP tests indicate identical soil conditions at depth for the three (3) test locations with high groundwater table inferred from the presence of water on the retrieved DCP rods. These findings were further validated by excavator test pit observations, confirming the subsoil characteristics and groundwater levels.

For investigation at greater depths, the Standard Penetration tests are recommended, and should be used in cases where depth is of concern for large or tall structures.
Site testing for bearing capacity of the proposed area was established by hand method using a Dynamic Cone Penetrometer (DCP) in accordance with *NZS 4402: Method of Testing Soils for Civil Engineering Purposes Test 6.5.2:1988.*

The following table provides a Summary of the DCP test results with presumptive bearing pressures below ground based on each location as highlighted in Test Locality Plan and DCP Logs presented in ***Appendix A & B*** respectively.

Table 1
Allowable Bearing Pressure

	Allowable Bearing Capacity (kPa)		
Depth (m)	**DCP 1**	**DCP 2**	**DCP 3**
0.0 – 3.0	SW	SW	SW

Note: 'SW' - denotes Self Weight

From the DCP test, there were no blow count, therefore the CBR% correlated from this is 0%.

5.2 Test Pits (TP)

Six (6) excavator test pits were successfully carried out and observations from the test pit indicate that the site is underlain with amorphous PEAT material with minor organic clay to the test depth of 1.4m. However, beyond this depth to the maximum test depth of 2.1m, the site is underlain with medium to high plasticity SILT material and minor intrusions of Peat from the preceding layers. The site exhibits wet to saturated soil conditions from the surface due to high groundwater table and stagnant surface water attributed to dense vegetation and poor gradients impeding natural flow.

Table 2
Summary of Subsurface Profile

Stratum	Soil Description	Depth (m)
PEAT	Dark brown/black, amorphous PEAT with minor organic clay, very soft to soft, wet to saturated, low plasticity (pungent smell).	0.0 – 1.4
SILT	Grey, SILT with some intrusion of peat, soft, saturated, low plasticity to non-plastic.	1.4 – 2.1

All Six (6) test pits inferred similar soil profile across the site with minor variations in thickness of each layer. During the investigation, test pits were excavated to a maximum depth of 2.1m below the ground level and as a consequence soft spot would have been created at locations shown in the test locality plan, refer to ***Appendix A***.

Refer to ***Appendix B*** for detailed investigation logs.

5.3 Standard Penetration Test (SPT)

The Standard Penetration (SPT) test result was carried out in accordance with AS *1289.6.3.1 – 2004*. The SPT test results obtained provided indicative bearing pressures of the soil layers below the existing ground level.

The following table provides the uncorrected (field) SPT 'N' and provides an appropriate correlation for the relative consistencies of underlying soil layers.

Table 3
Borehole 01 & 02 - SPT 'N' value correlations for relative consistencies

Test Reference	Depth (m)	SPT Value (N)	Consistency	Friction Angle (ϕ')	Elastic Modulus, E_s (MPa)
BH01 & BH02	1.50 - 10.50	N/R	Very Soft	20	1.0

Note: 'N/R' - denotes N is not recorded. RW – Rod Weight and HW – Hammer Weight only caused full penetration.

No SPT 'N' value was recorded till 10.50m target depth, denoting underlying very soft/ loose marine sandy Silt and Peat with intermixed shell/coral fragments which is consistent with depth. The consequential 'N' value not recorded was achieved from self-hammer and rod weights causing full penetration while installing the SPT. It was noted that during installation of casing to hold the collapsible material, the casings dragged down without any applied mechanical force.

5.4 Atterberg Limits Test

As per the field investigations, the materials encountered throughout the site were mostly consistent, only the layer thickness of encountered material differed due to the intermittent layers.

Laboratory testing has been undertaken on selected SPT samples retrieved from the boreholes. These samples were tested to ascertain specific characteristics of subsoils at varying depths, mainly to assist in the classification of soils, assess any potential liquefaction issues and obtain relative soil strength below. The laboratory test results are attached in ***Appendix E*** and summarised below in **Tables 4 and 5**.

The samples were tested for Atterberg's Limit and Moisture Content at Engineered Designs Geotechnical Lab in accordance with *NZS 4402: 1986 Test 2.1, 2.2, 2.3, 2.4 & 2.6*.

Table 4
Summary of Laboratory Test Results - Atterberg

Test Reference	Dominant Soil	Sample Depth (m)	MC (%)	PI (%)	LL (%)	PL (%)	LS (%)	Soil Classification
BH 01	SILT	6	86.6	44	100	56	6	Elastic & Organic Silt (MH & OH)
	SILT	9	88.2	43	96	53	7	Elastic & Organic Silt (MH & OH)
BH 02	SILT	3	73.8	30	82	52	14	Elastic & Organic Silt (MH & OH)
	SILT	4.5	83.3	20	83	63	10	Elastic & Organic Silt (MH & OH)
	SILT	6	78.7	24	82	58	11	Elastic & Organic Silt (MH & OH)

MC = Moisture Content; LL= Liquid Limit; PL= Plastic Limit; PI= Plastic Index; LS= Linear Shrinkage

The Atterberg limit test results plot mainly below the A-line in the Plasticity Chart and are characterised as MH and OH (elastic and organic silts with high plasticity). Atterberg limit tests are also useful to assess liquefaction potential. All the material tested were wet/saturated and had high moisture content.

6.0 Geology

6.1 Sub-Surface Profile

With reference to the Geological Map of Viti Levu, 1:50,000 series [Sheet 19], as prepared by the Mineral Resources Department (MRD), the site is underlain by surficial deposits. The formation is specifically known as Quaternary Pleistocene and Recent Alluvium formed by the deposition of sediments from modern deltas. Due to the presence of the Lobau River and close proximity to the bay, weak alluvium deposits, mainly unconsolidated Silt, Clay, Sand and shell fragments are known to exist in the area.

The profile of soil encountered within the machine drilled borehole is generally consistent with published geology and detailed borehole logs of the soil profile are included in ***Appendix B*** and summarised below.

Table 5

Summary of Subsurface Profile (Based on BH01 and BH02)

Lithology/Descriptions	Depth to top of Stratum (m)	Typical Thickness (m)	Typical SPT (N)	Laboratory Testing
Backfill – Grey, SILTSTONE fragments with some gravel, dry, high plasticity	0	0.8 - 1.3	-	
Dark brown/black, amorphous/spongy/fibrous PEAT, rootlets, traces of fine sand and coral/shell fragments, distinctive smell, very soft, wet to saturated, low to medium plasticity	0.8 - 1.3	2.2 - 3.2	-	
Grey/dark grey, Sandy SILT/marine SILT (organic), with some fibrous peat/ shell fragments and trace of fine sand, very soft, moist to wet, high plasticity	3 - 4.5	> 6.5**	Not recorded	PI test – BH01 @ 6.0m - MC:86.6%, LL:100%, PL:56%, PI:44%, LS:6% @ 9.0m - MC:88.2%, LL:96%, PL:53%, PI:43%, LS:7% PI test – BH02 @ 3.0m - MC:73.8%, LL:82%, PL:52%, PI:30%, LS:14% @ 4.5m - MC:83.3%, LL:83%, PL:63%, PI:20%, LS:10% @ 6.0m - MC:78.7%, LL:82%, PL:58%, PI:24%, LS:11%

*Unknown** – Borehole 01 and 02 were terminated at target depth of 10.95 and 9.95m respectively, the layer thickness could not be confirmed*

6.2 Groundwater and Flood Level

Measurement of the ground water level could not be taken after the completion of the drilling works as there was stagnant water in all boreholes after completion of drilling works.

The depth of the water table would be dependent on tidal fluctuations within the Lobau River. For design purposes it should be assumed that the water table is close to the surface related to extreme high tide events occurring during spring tidal and storm surge periods.

A suitable freeboard normally be allowed (minimum 500mm recommended) to obtain the design ground floor level/formation level.

6.3 Material Properties

The material properties have been estimated for materials encountered, and adopted Geotechnical Parameters. These parameters were selected based on our recent and previous investigation in the area and its vicinity.

The following table summarises the dominant soil or rock material, and its corresponding recommended geotechnical parameters:

Table 6
Material Properties for Soil Parameters

Material	Angle of Friction, ϕ (°)	Unit Weight, γ_{sat} (kN/m^3)	Elastic Modulus, E_s (MPa)	Poisson's Ratio, u	Compression Index Cc**
Organic SILT	20	11-15	1.0	0.3	0.81
SILT	20	16-18	1.0	0.3-0.35	0.77

Based on Bowles 2004
*** - Primary Compression Index correlated from disturbed sample lab test - Terzhagi and Peck (1967)*

7.0 Geotechnical Discussions & Recommendations

7.1 Introduction

Recommendations and opinions in this report are based on data from borehole, ground sample testing and surface observations. Correlations were made across the site using two (2) boreholes within the site and the proposed sub-surface conditions (continuity of layers, weathering profile) cannot be guaranteed. It must be appreciated that ground conditions may vary from what is inferred from the field test locations.

7.2 Liquefaction Potential

Liquefaction occurs when excess pore water pressures are generated in loose, saturated, generally cohesion-less soil during earthquake shaking, causing soil to undergo a partial to complete loss of shear strength. Such loss of shear strength can result in settlement and/or horizontal movement (lateral spreading) of the soil mass. The occurrence of liquefaction is dependent on several factors, including the intensity and duration of ground shaking, soil density/stiffness, particle size distribution, plasticity and elevation of the groundwater table.

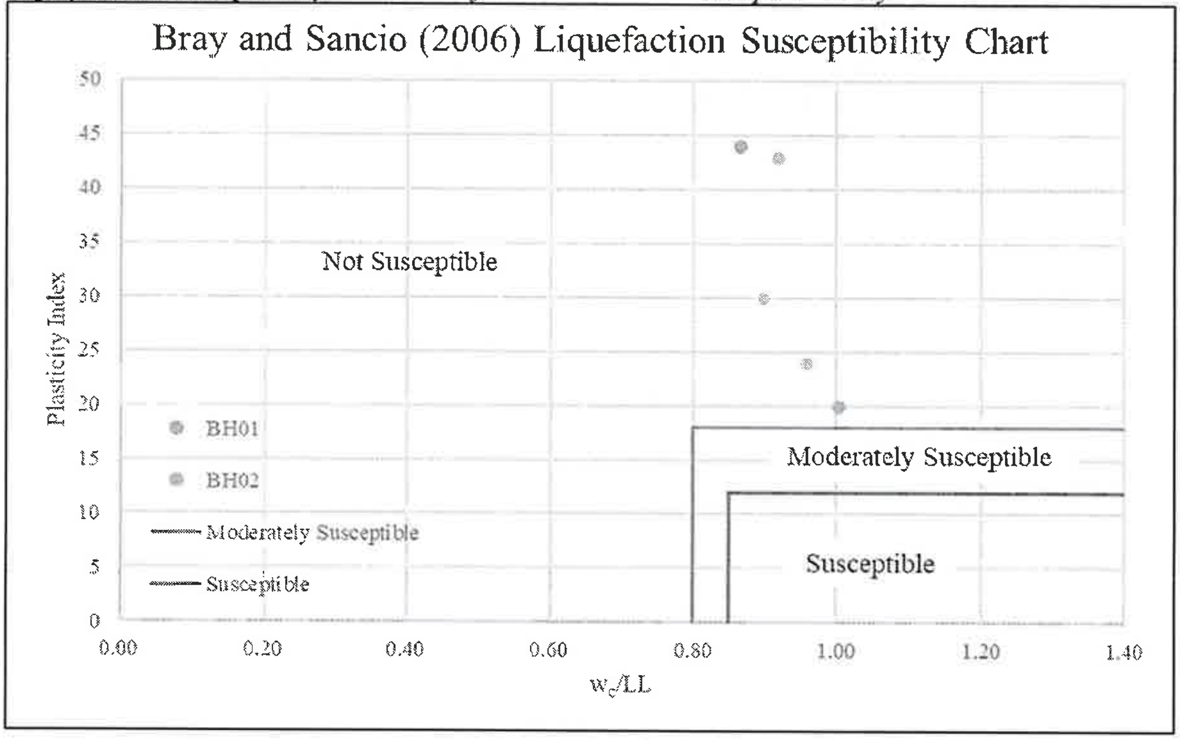
Generally, liquefaction occurs in loose to medium dense fine-grained soils such as fine sands, silty sands and sandy silts under saturated conditions. Poorly graded fine sands and silts are most susceptible to liquefaction causing volume changes in soils if the water table is between the liquefiable materials or near to the surface. Liquefaction is reduced with increasing density and the presence of an increase in coarse clean sands and gravels.

The potential for liquefaction on site has been assessed on the basis of Standard Penetrometer Tests (SPT) on field at depth intervals of 1.5m from ground level, Atterberg Limit Test [Plasticity Index] and noting the depth of ground water table. Settlement effects induced due to liquefaction have been estimated using liquefaction software "LiquefyPro".

Liquefaction susceptibility is influenced by the soil's ability to develop excess pore pressure. Generally, clays are not susceptible to liquefaction. The soil susceptibility to liquefaction for the subject site is from field sub-soil observations and laboratory test data.

Field testing confirmed no SPT 'N' values (0 constantly) over a depth up to 10.95m below ground level implying very soft/ loose stratum and signifying presence of potentially liquefiable material. Samples retrieved from the field investigation shows very soft/ loose fine-grained sand/organic silt and saturated medium plasticity silt.

Figure 2
Liquefaction Susceptibility Evaluation for BH01 to BH04 Samples – Bray and Sancio Criteria

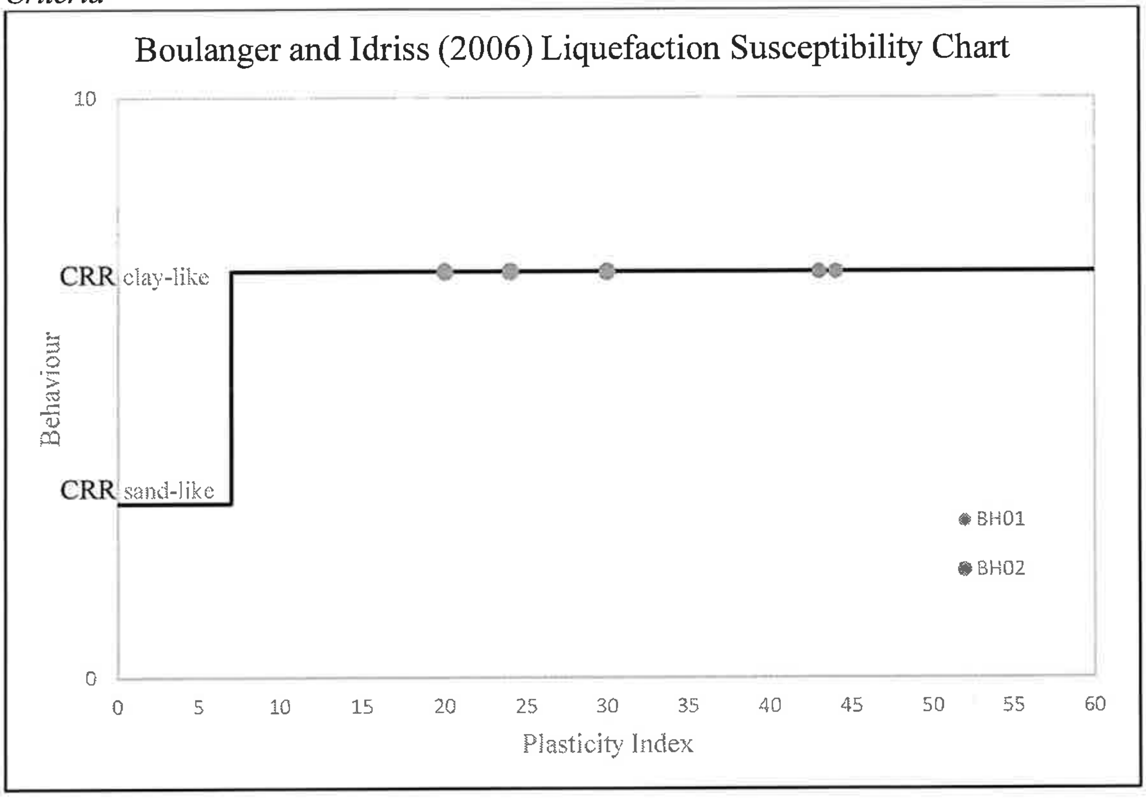


Bray and Sancio (2006) found that soils with plasticity index >12% are unlikely to liquefy during an earthquake event. All soil samples tested for Atterberg Limits in lab for boreholes 1 and 2 at various depths indicate medium to high plasticity within the liquefiable layers and as plotted and observed from Figure 2, are not susceptible to liquefaction triggering and are expected to exhibit "clay-like behaviour" during cyclic loading.

Clayey soils, particularly sensitive soil may exhibit strain-softening behaviour similar to that of liquefied soil but do not liquefy in the same manner as sandy/silty soils.

The Boulanger & Idriss (2006) criteria for liquefaction susceptibility is shown in Figure 3 and classifies soils as "sand-like" and "clay-like" based on PI, with a transition zone between these two categories. The primary purpose of the Boulanger & Idriss (2006) classification scheme is for purposes of determining appropriate testing procedures for assessing cyclic strength (Boulanger & Idriss 2006). For soils classifying as "sand-like," the Boulanger & Idriss (2006) criteria state that the simplified liquefaction evaluation procedure is suitable for evaluating the liquefaction potential. On the contrary, soils classifying as "clay-like" are evaluated using laboratory tests.

Figure 3
Liquefaction Susceptibility Evaluation for BH01 to BH04 Samples – Boulanger & Idriss Criteria



The findings reveal that: -

- Under Bray and Sancio criteria the tested soil samples Soils fall in the "Not Susceptible" zone and consequently are not considered to be susceptible to liquefaction triggering.
- Under Boulanger & Idriss criteria the soils are expected to exhibit clay-like behaviour during cyclic loading.

However, liquefaction susceptibility depends on the soil type. Silt has fine-grained soil particles, and its presence in sand or silty sands can alter their liquefaction behaviour. While clean sands are more susceptible, silty sands are also known to liquefy, especially under earthquake loading. Silty soils, while not as prone to liquefaction as clean sands, can still exhibit significant liquefaction susceptibility, particularly when they are loose and saturated. On this basis, it is concluded that the subsoils are likely to liquefy under the design earthquake.

Design Peak Ground Acceleration (PGA) for Serviceability Limit State (SLS) of 25 years and Ultimate Limit State (ULS) of 500 years were calculated as 0.049g and 0.196g respectively. The maximum predicted settlements obtained through liquefaction analysis using data from the machine drilled boreholes (BH01 and BH02) with accompanying Seismic Design Magnitude and PGA adopted without ground improvements is 470mm under ULS condition and 125mm under SLS condition. The settlement prediction is based on the Ishihara/ Yoshimine method for liquefaction.

It should be noted that the above-ground settlement is 'free field' settlements and the actual structure settlements may differ from the estimated ground settlement due to interaction between the structure and the ground beneath.

In order to mitigate the risk of liquefaction replacing perilous material with non-liquefiable material would not be viable and uneconomical due to the extent of liquefiable/ collapsible material present on site and considering the site area. Henceforth, grubbing the site and spreading geo-fabric as separator layer and raising the site with approved engineered fill will create a dense uniform ground to support lightweight structures placed within the fill layer.

7.3 Lateral Spreading Assessment

Lateral spreading is generally defined as the horizontal displacement of surficial blocks of soil towards an open slope face as a result of liquefaction of the underlying soils. Lateral spreading may affect 200m to 300m wide zones parallel to the face depending on the soils and the free face height. The occurrence of lateral spreading generally requires the presence of a relatively continuous liquefiable layer extending to an open slope face such as river bank or open channel.

Based on the liquefiable soil encountered on the proposed site and its close proximity to the Lobau River, nearby creeks and the main sea, there is high potential for lateral spreading to occur for the proposed site.

The potential of lateral spreading should be reviewed and taken into consideration during design stages of the project. One practical option to mitigate risk is to consider placing ELCOROCK (sand filled geotextile bag) provide stability along the edges of the river upto high water mark. Revetment options such as riprap/gabion walls maybe incorporated provided precautionary measures and excavation works along the fill areas are carried out during low tide.

7.4 Building Foundations

The field investigation performed at the proposed site confirms the presence of about 10.95m thick stratum of very soft and compressible marine deposits within the proposed development footprint. From envisaged building type, providing deep foundation would be cost prohibitive considering that no bedrock was encountered up till 10.95m termination depth.

From the bulk earthwork procedures and ground suitability, we recommend light weight structures and slab(s) on grade proportioned for a low estimated allowable bearing pressure demand using shallow foundation options placed within the approved engineered fill layer and above the mechanical raft.

- High level strip and or pad footing.
- Stiffened slab footing.

We highlight that sufficient amount of site clearing and grubbing is carried out and subsequently filled with approved engineered fill material according to proper earthwork guidance and monitored by competent personnel. It is recommended that footing options and bearing pressures be reviewed after further investigation, once the site remediation procedures for ground improvements have been completed as there is potential for differential settlement due to underlying compressible material at depth.

A standard compacted raft can create suitable base for shallow foundation provided the compacted ground is left as preload for approximately 6 months duration.

Detailed earthwork procedures are given below.

7.5 Earthwork Recommendations

The following general procedure is suggested for any site preparation and earthworks to be performed;

- Strip & remove topsoil, containing significant amounts of organic materials, 'uncontrolled' filling and also any deleterious soft, wet or highly compressible materials encountered.
- It is recommended that the working space is underlain with Bidim A64 geotextile fabric to avoid mixing of cobbles and the exposed sub-grade;
- Spread angular quarried cobbles of 150mm maximum dimension (similar to igneous rock properties with specific gravity of material more than 2.7) on top Geotextile to a depth of 300mm;
- Place Bidim A34 geotextile fabric on top of the cobbles. This will further create a separation layer to prevent fines getting inbetween cobbles during any ground vibration.
- Further place 200mm of GAP65 material on top of A34 geofabric. Compact using track rolling machines to reduce the depression/ heaving of ground due to underlain soft material;
- Place Tensar Tri-Ax (TX160) Geogrid on 200mm compacted GAP65 layer to minimise anticipated settlement. Continue to top up the fill with 200mm thick GAP65 material compacted to 98% standard proctor. The Tri-Ax Geogrid sandwiched within the 400mm of GAP65 will interlock and act as a raft layer to prevent extreme differential settlement.
- Place approved engineered fill material (sample shall be free of any organic or deleterious matter) on top of the mechanical raft level in compacted layers of 150mm to a maximum dry density of 98% proctor of a height of 600mm – formation level.
- Subsequently the surface can be topped up with 500mm of compacted fill material consisting of suitable clay or sanctioned dredged fill to a total preload height of 1.5m. The fill has to be placed in uniform layers 150mm thick and proof rolled by a minimum of ten passes of a 14 tonne vibrating roller.
- Approved controlled filling should be undertaken by placing fill in uniform horizontal layers, deposited systematically across the fill area and not exceeding 150mm loose uniform thickness and compacted to achieve a dry density ratio of at least 98% using standard proctor compaction for cohesive soil. The moisture content of any cohesive soil fill materials should be maintained at -2% to +2% of OMC, during and after compaction (fill material shall be tested for Optimum moisture content (OMC) and for Maximum Dry Density (MDD).

- The material and its moisture condition should be consistent as far as practicable throughout the depth before compaction of any loose layer of fill.
- Particle size of any rocks or other lumps within the layer after compaction should not be more than two-third of the compacted layer thickness. The use of GAP 65 or approved engineered fill is recommended.
- Due to circumstances, if there are delays in placement of subsequent fill layer, ensure that the fill before placement is confirmed to previous layer specification. If the layer has dried out or wetted up, this may inhibit compaction or cause heaving of subsequent layers.
- Ensure that compaction quality tests are carried out (NDM tests) at every 150/300mm compacted layer intervals.
- Any soft or spongy areas where a discernible ground deflection is observed and which do not respond to compaction should be excavated and backfilled.

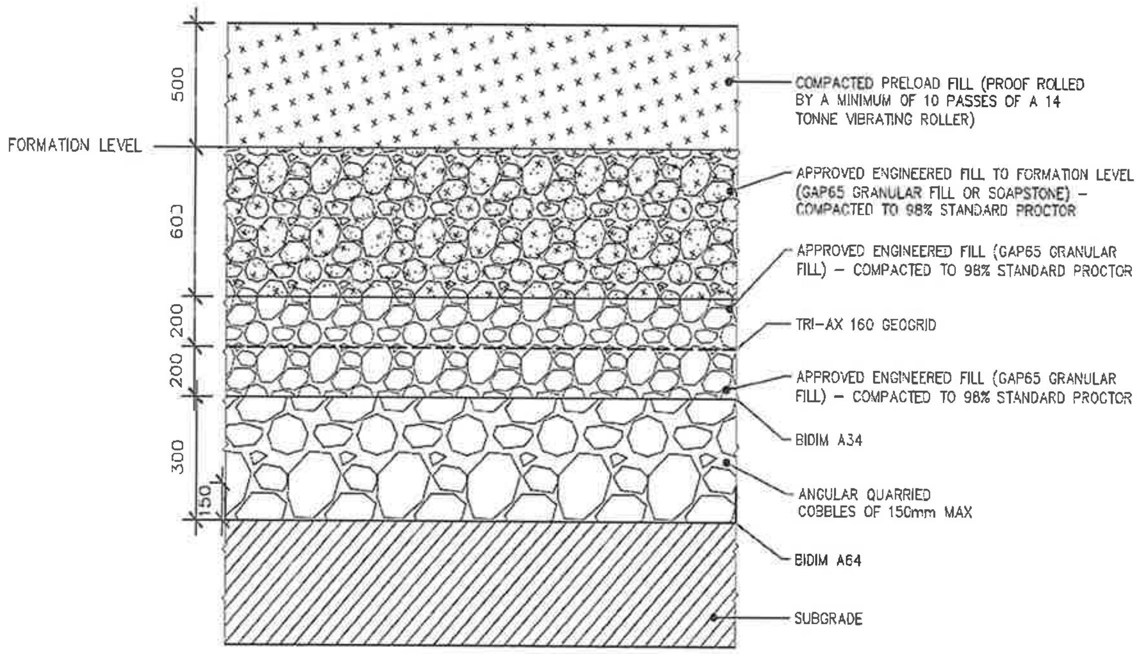
The engineered fill layer can be treated as preloading material and the site has to be left for preloading for a minimum period of 6 months with settlement markers prior to commencement of any construction works. Proper retainment has to be provided to avoid any displacement of fill material during the preloading period. Settlement has to be monitored frequently and reduced once the settlement data gets constant. Subsequently the preload shall be trimmed to formation level after preload period and when settlement becomes negligible.

In order for fill material to be considered 'controlled' any earthworks that are undertaken beneath any of the proposed structures or pavements are to be performed under full time 'Level 1' inspection and testing as described and in accordance with AS3798:2007.

The following figure shows the preliminary details of preloading for the proposed development.

Figure 4

Typical cross-section of proposed fill recommendation



7.6 Slab on Grade Preparation

To prepare the subgrade for a slab footing, all vegetation, root affected soil and degradable non-soil material should be stripped and removed to spoil from the underside of the concrete slab on ground prior to slab construction and backfilled with a base course of clean, free draining compacted hardfill. The minimum base course thickness should be taken as 150mm. The subgrade should be well compacted using a suitable compactor before placement of the base course. It is expected that the fill material be constructed to meet the minimum compaction requirement of 98% Standard/Modified, etc as required by the design.

Any soft or spongy areas where a discernible ground deflection is observed and which do not respond to compaction should be excavated and backfilled.

Any fill required to support the proposed foundation should be properly engineered in accordance with AS 3798-2007 (or similar NZ or other standard). Every layer of fill has to be tested and approved before proceeding to the upper layers. This needs to be performed and checked by a qualified Geotechnical Engineer.

7.7 Erosion and Sediment Control

Earthwork activity may increase the risk of the disturbed soil being eroded mostly by water. The loss of soil can result in the earthwork failing with consequent repair costs or impacts upon the receiving environment. Typically, erosion and sedimentation control measures include:

- Installing diversion and drainage structures before removing topsoil and starting the earthworks.
- Stability diversion and catch drains to prevent on contaminated runoff from outside the disturbed areas entering the site.
- Limiting area of erodible material exposed at any time to those areas being actively worked.
- Adequate protection of stockpile sites from erosion and containment of the surrounding site.

Adequate approved erosion and sediment controls shall be in place before earthwork commences, be maintained during the construction and only be removed once the site is fully stabilized to protect it from erosion.

7.8 Drainage

The site has poor natural subsurface drainage. Infiltrated rainwater can become contained in the upper semi-pervious silt stratum. Seepage water from the higher level may also enter the proposed site forming a catchment.

As poor drainage/ discharge system is evident, proper ground remediation with effective drainage system has to be implemented before any construction. Drains should be provided to collect and direct all water to suitable discharge areas.

7.9 Settlements

The geotechnical investigation indicates that a thick layer of compressible silt is present at the site which is likely to experience some settlement under the proposed ground improvements and building loads.

The maximum allowable vertical movement for framed structures is 100mm (Wahls, 1981).

Allowing 1.5m of engineered fill (0.4m of mechanical raft with 0.6m approved engineered fill and 0.5m of preload fill) with single storey building load of 5kPa, the consolidation settlement results indicated for a 32kPa surcharge may induce 250mm to 270mm of settlement in 6 months. Our immediate settlement analysis indicates 90mm to 160mm of settlement may occur. Assuming the bulk fill has a unit weight of $18kN/m^3$ with bedrock presumed to be situated at 30m depth.

The above estimated settlements will mitigate liquefaction induced settlement.

8.0 Seismicity

The most recent seismic zone factor study was commissioned in 2015 by the Fiji Roads Authority (FRA) and MWH. This international based study was undertaken by GNS Science of New Zealand. An evaluation was first made of the suitability of the NZS1170.5 code spectral shape for Fiji by comparing the unsmoothed 500year Class B spectrum for Fiji to the NZS1170.5 spectrum and also other selected spectra. The NZS1170.5 spectrum was found to provide the best match and consequently was used as a basis to construct the Z-factor map and associated spectra. The NZS1170.5 Z-factor is defined as half the 0.5 second spectral acceleration expected with a 10% possibility of exceedance in 50 years on shallow sites. According to the Z-factor map for Fiji, a Z-factor of 0.175g is applicable to this site.

The seismic design parameters are applicable for a structure of importance level 2 and design life of 50 years (NZ1170:2004). The design code indicated that the return period for the ULS and SLS design cases is 1/500 years and 1/25 years respectively. Based on the current geotechnical information, we recommend that site is treated as seismic **Class E (Very Soft Soil sites)**.

9.0 Conclusion

- The geotechnical investigation carried out comprised the drilling and logging of two boreholes at the proposed site to a depth of 10.95m and 9.95m respectively.
- Shallow investigation consisted with three (3) DCPs and six (6) excavator Test Pits.
- Subsurface conditions comprise organic marine SILT with shell fragments and medium/high liquid limits and plasticity index.
- Ground water table was encountered close to the surface for both boreholes. Stagnant/ trapped water was evident on site. Therefore, ground water table at 0m depth shall be adopted for foundation design and analysis.
- The site susceptibility of liquefaction is moderate due to presence of liquefiable material under saturated conditions underlain at the site.
- Liquefaction settlement is critical under seismic events, therefore significant earthworks is indicated. Shallow foundations placed within the fill layer is highly recommended incorporating light weight single/ double storey designs. Bearing pressures are to be confirmed once the ground remediation work is completed.
- The risk of lateral spreading is high as the site is in close proximity to Lobau River, nearby creeks and river mouth/coastline.
- The site shall be preloaded to approximately 6 months or more with settlement markers placed in the fill to monitor settlement.
- Seismic design parameters are presented in section 8.0 of this report. In accordance with NZS 1170.5:2004 the site is identified as **Class E (Very Soft Soil Sites)** with structural importance level 2 and design life of 50 years (NZS1170.0:2004).

10.0 Applicability

The conclusions and recommendations provided herein have been based on available data obtained from the review of pertinent reports and plans, subsurface exploratory drill boreholes as well as our experience with the soils and formational materials located in the general area. The materials encountered on the project site and utilised in the laboratory testing are believed representative of the total area; however, earth materials may vary in characteristics between boreholes.

This report has been prepared for the benefit of Public Rental Board [PRB] with respect to the particular brief and may not be relied upon on in other contexts or for any other purpose without our prior review and agreement.

During excavation and earthwork process, an engineer competent to judge whether the exposed sub-soils are compatible with the inferred conditions on which this report has been based should examine the site. We will be pleased to provide this service to you and believe your project will benefit from the continuity. However, it is important that we be contacted if there is any variation in subsoil conditions from those described in the report.

Please reproduce this report in full when transmitting to others or including in internal reports. If we can be of any further assistance, feel free to call us on Phone 3383788.

Yours faithfully

ENGINEERED DESIGNS

....

Vijay Krishnan
Principal

Reference

- A.C Waltham. 'Foundation on Engineering Geology'
- L.R Anderson. Soft Ground Improvement in Lowland and Other Environments
- Burt Look. 'Handbook of Geotechnical and design tables'.
- Hans. G. Excavations and foundations in Soft Soils, 2011
- NZGS: Field Description of Soil and Rock, December 2005.
- NZGS - Module 1: Earthquake Engineering Practice
- NZGS – Module 3: Identification, Assessment and Mitigation of Liquefaction Hazards.
- NZGS – Module 5: Ground Improvement of Soils Prone to Liquefaction.
- NZS1170.5- Structural Design Actions- Part 5 – Earthquake Actions.
- NZS1170.0 – Structural Design Actions – Part 0: General Principles
- Braja M. Das "Correlations of Soil and Rock Properties'.
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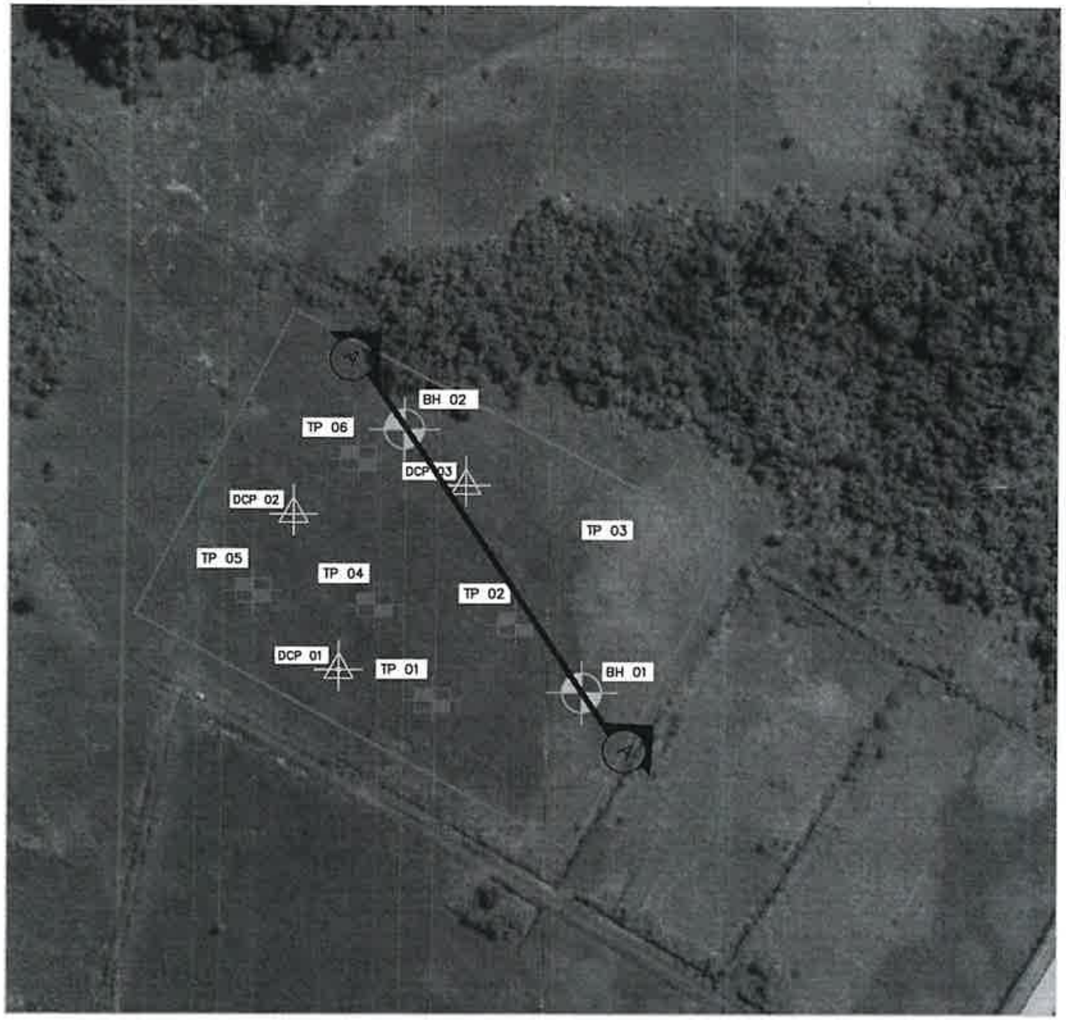
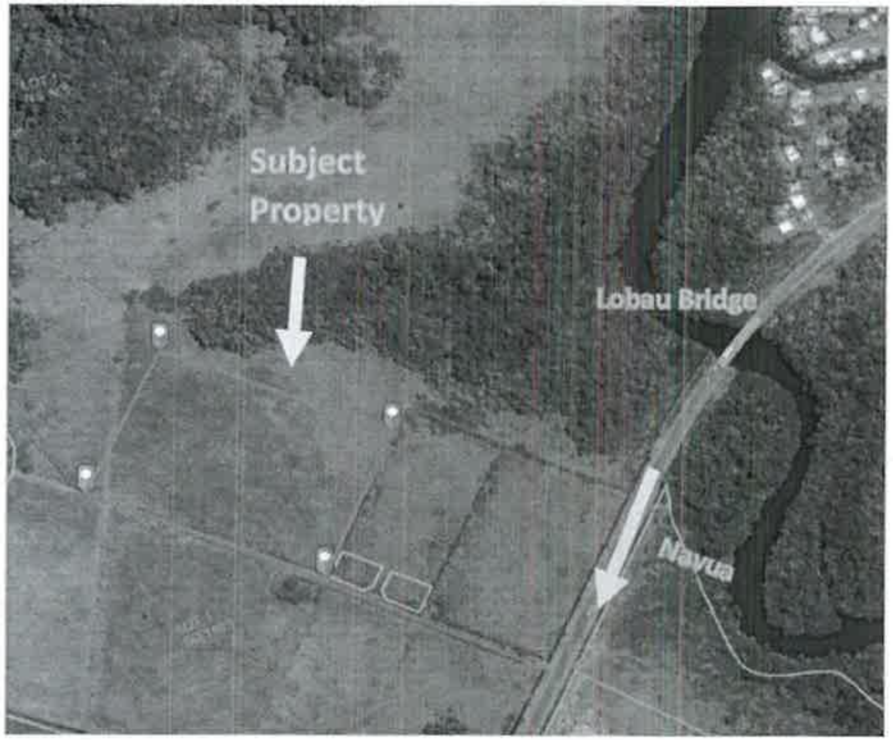
- Boulanger, R.W., & Idriss, I.M. 2006. Liquefaction susceptibility criteria for silts and clays. Journal of Geotechnical and Geoenvironmental Engineering. 132 (11): 1413–1426.J.A. Knappett and R.F. Craig. "Craig's Soil Mechanics", 8th Edition

Appendix A

Test Locality Plan



SOURCE: GOOGLE EARTH



SOURCE: BY CLIENT

LEGEND

- DCP – DYNAMIC CONE PENETROMETER TEST
- TP – TEST PIT TEST
- BH – BOREHOLE

N

GEOTECHNICAL INVESTIGATION

• Copyright of this drawing shall remain the property of Engineered Designs. • Figured dimensions shall take preference over scaled. • Precedence shall be given to the largest scale drawing. • The contractor shall verify all dimensions prior to preparation of shop drawings or commencement of any work. • The Engineer shall be notified immediately of any discrepancies.	Engineered Designs Consulting Civil & Structural Engineers Office 1-3, Flagstaff Plaza Bau Street, Suva, Fiji. PO Box 117, Suva. Tel: 338 3788	Client PUBLIC RENTAL BOARD	Project Title GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	Drawing Title BOREHOLE, DCP & TEST PIT TEST LOCATIONS	Ref / Date / Revision	Design: – ; Drawn: AA ; Job No: GEO50/24 ; Date: JUN 25 ; Division: G ; Scale: AS STATED ; Drawing No: 50/24-01D ; Revision: –

Appendix B

Borehole, DCP and Test Pit Logs

Engineered Designs
Consulting Civil & Structural Engineers

BOREHOLE LOGS

SHEET: 1 of 2

BOREHOLE NO. :	BH01	JOB NO. :	GEO 50-24
CUSTOMER :	PUBLIC RENTAL BOARD	DATE :	02.05.2025
PROJECT :	GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	REVIEWED BY :	V.K
SITE LOCATION :	NAMELIMELI, NAVUA	DRILL MODEL :	E.D DRILL RIG
LOGGED BY :	RD	BOREHOLE LOCATION :	REFER TO TEST LOCALITY PLAN

DEPTH (m)	CASING	DRILL TECHNIQUE	WATER LEVEL	GRAPHIC LOG	SPT RESULTS	SAMPLE RECOVERY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength	ROCK QUALITY DESIGNATION (RQD)	LABORATORY TEST RESULTS
1.0		AS					Grey, filled SILTSTONE with some gravel,dry, very soft, moist, non-plastic		Water Level at 0.0m
							Brown/Black mottled white, PEAT, very soft, moist,non-plastic		
2.0					SPT @ 1.50m [HW]	100%	Dark brown/Black/Light grey, Armophous plastic PEAT, with some silt and traces of coral fragments, very soft, moist to wet, non-plastic		
3.0		WB					Dark Brown/Black, PEAT		
					SPT @ 3.00m [HW]	100%	Dark brown/Black,armophous plastic PEAT with some silt and traces of shell fragments, very soft, moist to wet, non-plastic		
4.0		WB					Dark Brown/Black, PEAT		
5.0					SPT @4.50m [HW]		No - Recovery		
6.0		WB					Grey, SAND with some organic remains		
					SPT @ 6.00m [HW]	100%	Grey, SILT with minor PEAT, very soft, moist to wet, high plasticity		MC : 86.6% ATT :LL-100%, PL-56%, PI-44, LS-6%
7.0		WB					Grey, SILT		
8.0					SPT @ 7.50m [HW]	100%	Grey, SILT, very soft, moist, high plasticity		

TECHNIQUE

AS-AUGER SCREWING

WB-WASHBORE - NQ

CR-CORING

Water Level

SAMPLES AND TESTINGS

N SPT (Standard Penetrometer Tests)

3,6,12 N=18 (Full Penetration)

3,17,30/20mm N is not recorded [30 blows causes 20mm penetration]

3,12/60mm N is not Recorded [12 blows causes 60mm penetration]

HB - Hammer Rebound for 5 consecutive blows with no measurable penetration - test discontinued

LABORATORY TESTS

MC- Moisture Content

ATT - Atterberg Tests (LL: Liquid Limit, PL: Plastic Limit, PI: Plastic Index

PSD: Particle Size Distribution (G: Gravel, S: Sand, F: Fines)

UCS: Unconfined Compressive Strength (MPa)

RW - Rod Weight only causes full penetration (N not Recorded)

HW - Hammer and rod weight only causes full penetration, N is not recorded

ROCK DEFECTS

RZ: Rubble Zone

MB: Machine Break

B- Bedding

J- Joint

SH- Shear Zone

Engineered Designs

Consulting Civil & Structural Engineers

BOREHOLE LOGS

BOREHOLE NO.	BH01	JOB NO.	GEO 50-24
CUSTOMER	PUBLIC RENTAL BOARD	DATE	02.05.2025
PROJECT	GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	REVIEWED BY	V.K
SITE LOCATION	NAMELIMELI, NAVUA	DRILL MODEL	E.D DRILL RIG
LOGGED BY	RD	BOREHOLE LOCATION	REFER TO TEST LOCALITY PLAN

DEPTH (m)	CASING	DRILL TECHNIQUE	WATER LEVEL	GRAPHIC LOG	SPT RESULTS	SAMPLE RECOVERY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength	ROCK QUALITY DESIGNATION (RQD)	LABORATORY TEST RESULTS/ NOTES
		WB					Grey, SILT		
9.0					SPT @ 9.00m [HW]	100%	Grey, SILT, very soft, moist, high plasticity		MC : 88.2% ATT :LL-96%, PL-53%, PI-43, LS-7%
10.0		WB					Grey, SILT		
					SPT @ 10.50m [HW]	100%	Grey, SILT, very soft, moist, high plasticity		
11.0							END OF BOREHOLE 01 @ 10.95m		
12.0									
13.0									
14.0									
15.0									
16.0									

TECHNIQUE	SAMPLES AND TESTINGS	LABORATORY TESTS		ROCK DEFECTS
AS-AUGER SCREWING	N SPT (Standard Penetrometer Tests)	MC- Moisture Content	RW - Rod Weight only causes full penetration (N not Recorded)	RZ- Rubble Zone
WB-WASHBORE - NQ	3,6,12 N=18 (Full Penetration)	ATT - Atterberg Tests (LL: Liquid Limit, PL: Plastic Limit, PI: Plastic Index	HW - Hammer and rod weight only causes full penetration, N is not recorded	MB- Machine Break
CR-CORING	3,17,30/20mm N is not recorded [30 blows causes 20mm penetration]	PSD- Particle Size Distribution (G- Gravel, S: Sand, F: Fines)		B- Bedding
Water Level	3,12/60mm N is not Recorded [12 blows causes 60mm penetration] HB - Hammer Rebound for 5 consecutive blows with no measurable penetration - test discontinued	UCS: Unconfined Compressive Strength (MPa)		J- Joint SH- Shear Zone

Engineered Designs

Consulting Civil & Structural Engineers

BOREHOLE LOGS

SHEET: 1 of 2

BOREHOLE NO.	:	BH02	JOB NO.	:	GEO 50-24
CUSTOMER	:	PUBLIC RENTAL BOARD	DATE	:	07.05.2025
PROJECT	:	GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	REVIEWED BY	:	V.K
SITE LOCATION	:	NAMELIMELI, NAVUA	DRILL MODEL	:	E D DRILL RIG
LOGGED BY	:	RS	BOREHOLE LOCATION	:	REFER TO TEST LOCALITY PLAN

DEPTH (m)	CASING	DRILL TECHNIQUE	WATER LEVEL	GRAPHIC LOG	SPT RESULTS	SAMPLE RECOVERY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength	ROCK QUALITY DESIGNATION (RQD)	LABORATORY TEST RESULTS
		AS					Grey, backfill material SOAPSTONE ,dry,very soft, moist to wet , high plasticity		Water Level at 0.0m
1.0							Dark brown, armophous plastic PEAT, very soft, wet to saturated, non-plastic		
					SPT @ 1.50m [HW]		No Recovery		
2.0		WB					Dark Brown, organic soil (PEAT), distinctive smell, decomposed plants fibres/Dark grey marine SILT with shell fragments.		
3.0					SPT @ 3.00m [HW]	100%	Dark grey, fibrous PEAT with silt, very soft, moist to wet, non-plastic		MC : 73.8% ATT :LL-82%, PL-52%, PI-30, LS-14%
4.0		WB					Dark grey, fibrous PEAT with silt		
					SPT @4.50m [HW]		Dark grey, marine SILT with some shell fragments, very soft, moist to wet, high plasticity		MC : 83.3% ATT :LL-83%, PL-63%, PI-20, LS-10%
5.0		WB					Dark grey, marine SILT with some shell fragments,		
6.0					SPT @ 6.00m [HW]	100%	Dark grey, marine SILT with some shell fragments traces of fine sand, very soft, moist to wet, high plasticity		MC : 78.7% ATT :LL-82%, PL-58%, PI-24, LS-11%
7.0		WB					Dark grey, marine SILT with some shell fragments traces of fine sand		
8.0					SPT @ 7.50m [HW]		No Recovery		

TECHNIQUE

AS-AUGER SCREWING

WB-WASHBORE - NQ

CR-CORING

Water Level

SAMPLES AND TESTINGS

N SPT (Standard Penetrometer Tests)

3,6,12 N=18 (Full Penetration)

3,17,30/20mm N is not recorded [30 blows causes 20mm penetration]

3,12/60mm N is not Recorded [12 blows causes 60mm penetration]

HB - Hammer Rebound for 5 consecutive blows with no measurable penetration - test discontinued

LABORATORY TESTS

MC- Moisture Content

ATT - Atterberg Tests (LL: Liquid Limit, PL: Plastic Limit, PI: Plastic Index

PSD: Particle Size Distribution (G: Gravel, S: Sand, F: Fines)

UCS: Unconfined Compressive Strength (MPa)

RW - Rod Weight only causes full penetration (N not Recorded)

HW - Hammer and rod weight only causes full penetration, N is not recorded

ROCK DEFECTS

RZ: Rubble Zone

MB: Machine Break

B- Bedding

J- Joint

SH- Shear Zone

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BOREHOLE LOGS

SHEET: 2 of 2

BOREHOLE NO. :	BH02	JOB NO. :	GEO 50-24
CUSTOMER :	PUBLIC RENTAL BOARD	DATE :	07.05.2025
PROJECT :	GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	REVIEWED BY :	V.K
		DRILL MODEL :	E.D DRILL RIG
SITE LOCATION :	NAMELIMELI, NAVUA	BOREHOLE LOCATION :	REFER TO TEST LOCALITY PLAN
LOGGED BY :	RS		

DEPTH (m)	CASING	DRILL TECHNIQUE	WATER LEVEL	GRAPHIC LOG	SPT RESULTS	SAMPLE RECOVERY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength	ROCK QUALITY DESIGNATION (RQD)	LABORATORY TEST RESULTS/ NOTES
		WB					Grey/Brown, SILT		
9.0					SPT @ 9.00m [HW]	100%	Light brown mottled light grey, organic SILT, very soft, moist to wet, high plasticity		
							END OF BOREHOLE 01 @ 9.45m		
10.0									
11.0									
12.0									
13.0									
14.0									
15.0									
16.0									

TECHNIQUE
- AS-AUGER SCREWING
- WB-WASHBORE - NQ
- CR-CORING
- Water Level

SAMPLES AND TESTINGS
- N SPT (Standard Penetrometer Tests)
- 3,6,12 N=18 (Full Penetration)
- 3,17,30/20mm N is not recorded [30 blows causes 20mm penetration]
- 3,12/60mm N is not Recorded [12 blows causes 60mm penetration]
- HB - Hammer Rebound for 5 consecutive blows with no measurable penetration - test discontinued

LABORATORY TESTS
- MC- Moisture Content
- ATT - Atterberg Tests (LL: Liquid Limit, PL: Plastic Limit, PI: Plastic Index
- PSD: Particle Size Distribution (G: Gravel, S: Sand, F: Fines)
- UCS: Unconfined Compressive Strength (MPa)

- RW - Rod Weight only causes full penetration (N not Recorded)
- HW - Hammer and rod weight only causes full penetration, N is not recorded

ROCK DEFECTS
- RZ: Rubble Zone
- MB: Machine Break
- B- Bedding
- J- Joint
- SH- Shear Zone

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P O Box 117 Suva Fiji
Telephone: [679] 3383788
FAX: [679] 3370354
Email: edesigns@edesignsfiji.com

Site: Namelimeli, Navua — **Date:** 12/02/2025

Job: Geotechnical Investigation for Namelimeli Project — **Test No:** DCP 01

TEST METHOD USED: *NZS 4402 : 1988 Test 6.5.2 Dynamic Cone Penetrometer* — **Job No:** GEO 50-24

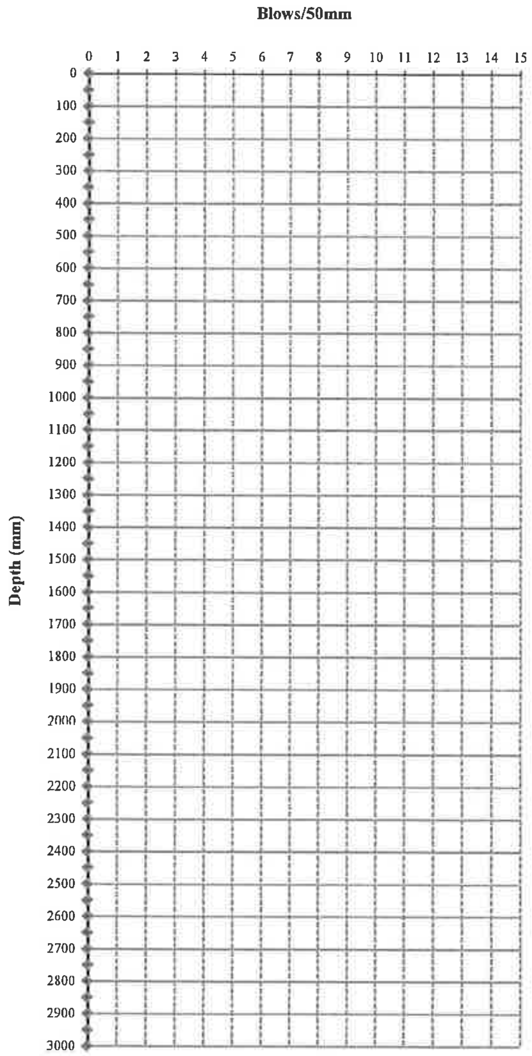
DYNAMIC CONE PENETROMETER - SCALA

Depth from Ground surface to commencement of penetration: 0.15m

Test Location : Refer to ***Appendix A*** - Test Locality Plan

Vertical Distance driven (mm)	Number of blows	Vertical Distance driven (mm)	Number of blows
50	SW	2050	-
100	-	2100	-
150	-	2150	-
200	-	2200	-
250	-	2250	-
300	-	2300	-
350	-	2350	-
400	-	2400	-
450	-	2450	-
500	-	2500	-
550	-	2550	-
600	-	2600	-
650	-	2650	-
700	-	2700	-
750	-	2750	-
800	-	2800	-
850	-	2850	-
900	-	2900	-
950	-	2950	-
1000	-	3000	-
1050	-	3050	-
1100	-	3100	
1150	-	3150	
1200	-	3200	
1250	-	3250	
1300	-	3300	
1350	-	3350	
1400	-	3400	
1450	-	3450	
1500	-	3500	
1550	-	3550	
1600	-	3600	
1650	-	3650	
1700	-	3700	
1750	-	3750	
1800	-	3800	
1850	-	3850	
1900	-	3900	
1950	-	3950	
2000	-	4000	

Blows/50mm Versus Depth



Logged By: RD — **Q.A Checked By:** — **Reviewed By:** VK

Note: 'SW' - Denotes Self Weight

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Email: edesigns@edesignsfiji.com

Site: Namelimeli, Navua — **Date:** 12/02/2025

Job: Geotechnical Investigation for Namelimeli Project — **Test No:** DCP 02

TEST METHOD USED: *NZS 4402 : 1988 Test 6.5.2 Dynamic Cone Penetrometer* — **Job No:** GEO 50-24

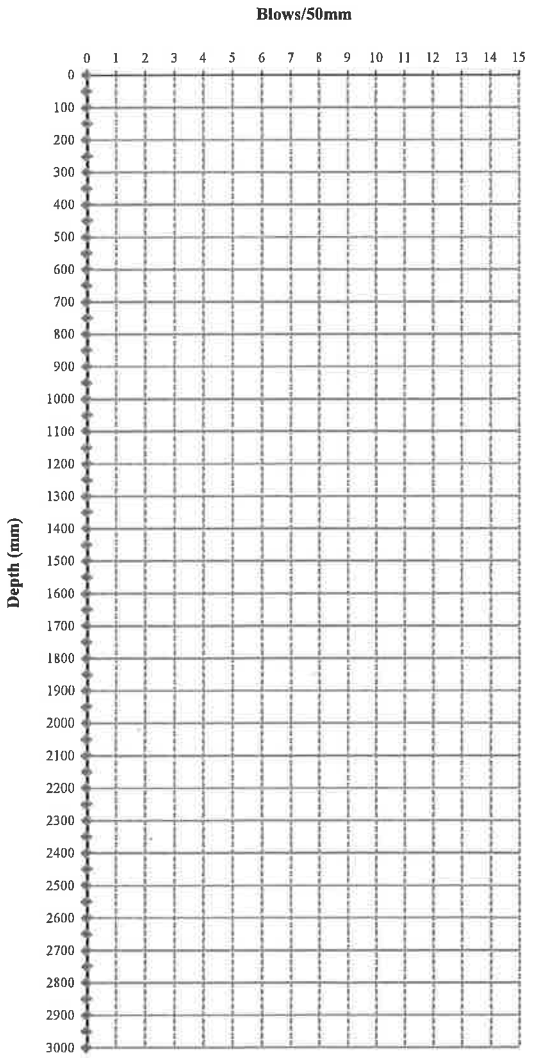
DYNAMIC CONE PENETROMETER - SCALA

Depth from Ground surface to commencement of penetration: 0.15m

Test Location : Refer to *Appendix A* - Test Locality Plan

Vertical Distance driven (mm)	Number of blows	Vertical Distance driven (mm)	Number of blows
50	SW	2050	-
100	-	2100	-
150	-	2150	-
200	-	2200	-
250	-	2250	-
300	-	2300	-
350	-	2350	-
400	-	2400	-
450	-	2450	-
500	-	2500	-
550	-	2550	-
600	-	2600	-
650	-	2650	-
700	-	2700	-
750	-	2750	-
800	-	2800	-
850	-	2850	-
900	-	2900	-
950	-	2950	-
1000	-	3000	-
1050	-	3050	-
1100	-	3100	
1150	-	3150	
1200	-	3200	
1250	-	3250	
1300	-	3300	
1350	-	3350	
1400	-	3400	
1450	-	3450	
1500	-	3500	
1550	-	3550	
1600	-	3600	
1650	-	3650	
1700	-	3700	
1750	-	3750	
1800	-	3800	
1850	-	3850	
1900	-	3900	
1950	-	3950	
2000	-	4000	

Blows/50mm Versus Depth



Logged By: RD — **Q.A Checked By:** — **Reviewed By:** VK

Note: 'SW' - Denotes Self Weight

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Site: Namelimeli, Navua | **Date:** 12/02/2025

Job: Geotechnical Investigation for Namelimeli Project | **Test No:** DCP 03

TEST METHOD USED: *NZS 4402 : 1988 Test 6.5.2 Dynamic Cone Penetrometer* | **Job No:** GEO 50-24

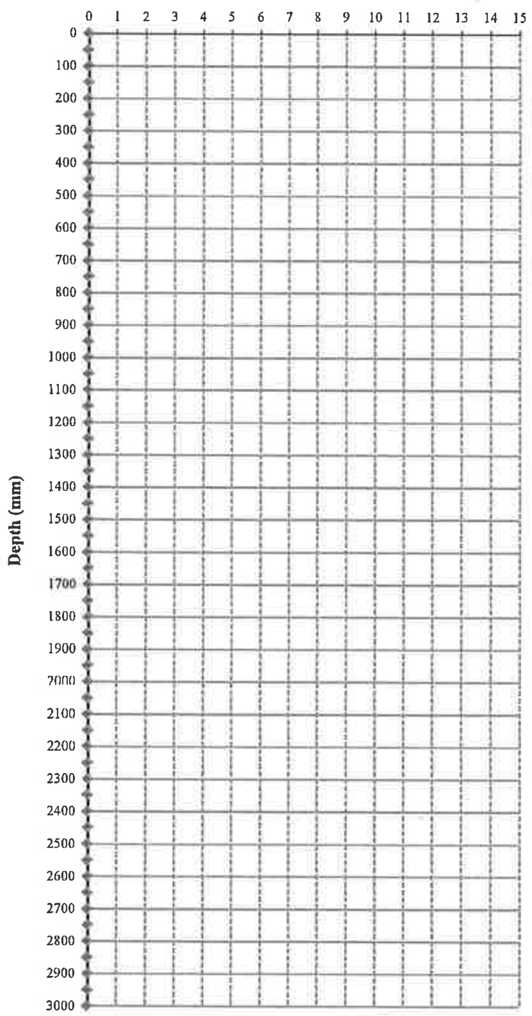
DYNAMIC CONE PENETROMETER - SCALA

Depth from Ground surface to commencement of penetration: 0.15m

Test Location : Refer to ***Appendix A*** - Test Locality Plan

Vertical Distance driven (mm)	Number of blows	Vertical Distance driven (mm)	Number of blows
50	SW	2050	-
100	-	2100	-
150	-	2150	-
200	-	2200	-
250	-	2250	-
300	-	2300	-
350	-	2350	-
400	-	2400	-
450	-	2450	-
500	-	2500	-
550	-	2550	-
600	-	2600	-
650	-	2650	-
700	-	2700	-
750	-	2750	-
800	-	2800	-
850	-	2850	-
900	-	2900	-
950	-	2950	-
1000	-	3000	-
1050	-	3050	-
1100	-	3100	
1150	-	3150	
1200	-	3200	
1250	-	3250	
1300	-	3300	
1350	-	3350	
1400	-	3400	
1450	-	3450	
1500	-	3500	
1550	-	3550	
1600	-	3600	
1650	-	3650	
1700	-	3700	
1750	-	3750	
1800	-	3800	
1850	-	3850	
1900	-	3900	
1950	-	3950	
2000	-	4000	

Blows/50mm Versus Depth



Logged By: RD | **Q.A Checked By:** | **Reviewed By:** VK

Note: 'SW' - Denotes Self Weight

Engineered Designs
Consulting Civil & Structural Engineers

TEST PIT LOG

TEST PIT NO.	TP01	JOB NO.	GEO 50-24
CUSTOMER	PUBLIC RENTAL BOARD	DATE	12.02.2025
PROJECT	GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	REVIEWED BY	V.K
SITE LOCATION	NAVUA	METHOD	EXCAVATOR PIT
LOGGED BY	RD/RL/AA	TEST PIT LOCATION	REFER TO TEST LOCALITY PLAN

GEOLOGICAL UNIT GENERIC NAME, ORIGIN, MINERAL COMPOSITION	WATER SEEPAGE	DEPTH (m)	SHEAR VANE	MOISTURE/WEATHERING	STRENGTH/DENSITY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength
Clayey PEAT	▽	1.0		Wet to Saturated	Very Soft to Soft	Topsoil: Dark brown/black, amorphous PEAT with minor organic clay, very soft, wet to saturated, low plasticity.
SILT		1.3				Grey, SILT with some intrusion of peat, soft, saturated, non-plastic

Test Pit Terminated @ 1.3m Due To High Ground Water Table

▽ Water Seepage at 0.75m

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TEST PIT LOG

TEST PIT NO. :	TP02	JOB NO. :	GEO 50-24
CUSTOMER :	PUBLIC RENTAL BOARD	DATE :	12.02.2025
PROJECT :	GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	REVIEWED BY :	V.K
SITE LOCATION :	NAVUA	METHOD :	EXCAVATOR PIT
		TEST PIT LOCATION :	REFER TO TEST LOCALITY PLAN
LOGGED BY :	RD/RL/AA		

GEOLOGICAL UNIT GENERIC NAME, ORIGIN, MINERAL COMPOSITION	WATER SEEPAGE	DEPTH (m)	SHEAR VANE	MOISTURE/WEATHERING	STRENGTH/DENSITY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength
Clayey PEAT	▽	0.9		Wet to Saturated	Very Soft to Soft	Topsoil: Dark brown/black, amorphous PEAT with minor organic clay, very soft, wet to saturated, low plasticity.

Test Pit Terminated @ 0.9m Due To High Ground Water Table

▽ Water Seepage at 0.60m

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TEST PIT LOG

TEST PIT NO. :	TP03	JOB NO. :	GEO 50-24
CUSTOMER :	PUBLIC RENTAL BOARD	DATE :	12.02.2025
PROJECT :	GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	REVIEWED BY :	V.K
		METHOD :	EXCAVATOR PIT
SITE LOCATION :	NAVUA	TEST PIT LOCATION :	REFER TO TEST LOCALITY PLAN
LOGGED BY :	RD/RL/AA		

GEOLOGICAL UNIT GENERIC NAME, ORIGIN, MINERAL COMPOSITION	WATER SEEPAGE	DEPTH (m)	SHEAR VANE	MOISTURE/WEATHERING	STRENGTH/DENSITY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength
Clayey PEAT	▽	1.0		Wet to Saturated	Very Soft to Soft	Topsoil: Dark brown/black, amorphous PEAT with minor organic clay, very soft, wet to saturated, low plasticity.
SILT		1.7				Grey, SILT with some intrusion of peat, soft, saturated, low plasticity

Test Pit Terminated @ 1.7m Due To High Ground Water Table

▽ Water Seepage at 0.50m

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TEST PIT LOG

TEST PIT NO.	: TP04		JOB NO.	: GEO 50-24
CUSTOMER	: PUBLIC RENTAL BOARD		DATE	: 12.02.2025
PROJECT	: GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT		REVIEWED BY	: V.K
SITE LOCATION	: NAVUA		METHOD	: EXCAVATOR PIT
			TEST PIT LOCATION	: REFER TO TEST LOCALITY PLAN
LOGGED BY	: RD/RL/AA			

GEOLOGICAL UNIT GENERIC NAME, ORIGIN, MINERAL COMPOSITION	WATER SEEPAGE	DEPTH (m)	SHEAR VANE	MOISTURE/WEATHERING	STRENGTH/DENSITY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength
Clayey-PEAT	▽	1.1		Wet to Saturated	Very Soft to Soft	Topsoil: Dark brown/black, amorphous PEAT with minor organic clay, very soft, wet to saturated, low plasticity (pungent smell).
SILT		2.1				Grey, SILT with some intrusion of peat, soft, saturated, low plasticity

Test Pit Terminated @ 2.1m Due To High Ground Water Table

▽ Water Seepage at 0.70m

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TEST PIT LOG

TEST PIT NO. :	TP05	JOB NO. :	GEO 50-24
CUSTOMER :	PUBLIC RENTAL BOARD	DATE :	12.02.2025
PROJECT :	GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	REVIEWED BY :	V.K
		METHOD :	EXCAVATOR PIT
SITE LOCATION :	NAVUA	TEST PIT LOCATION :	REFER TO TEST LOCALITY PLAN
LOGGED BY :	RD/RL/AA		

GEOLOGICAL UNIT GENERIC NAME, ORIGIN, MINERAL COMPOSITION	WATER SEEPAGE	DEPTH (m)	SHEAR VANE	MOISTURE/WEATHERING	STRENGTH/DENSITY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength
Clayey PEAT		1.4		Wet to Saturated	Very Soft to Soft	Topsoil: Dark brown/black, amorphous PEAT with minor organic clay, very soft, wet to saturated, low plasticity.
SILT	▽	1.8				Grey, SILT with some intrusion of peat, soft, saturated, low plasticity

Test Pit Terminated @ 1.8m Due To High Ground Water Table

▽ Water Seepage at 1.60m

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TEST PIT LOG

TEST PIT NO.	TP06	JOB NO.	GEO 50-24
CUSTOMER	PUBLIC RENTAL BOARD	DATE	12.02.2025
PROJECT	GEOTECHNICAL INVESTIGATION FOR NAMELIMELI PROJECT	REVIEWED BY	V.K
SITE LOCATION	NAVUA	METHOD	EXCAVATOR PIT
LOGGED BY	RD/RL/AA	TEST PIT LOCATION	REFER TO TEST LOCALITY PLAN

GEOLOGICAL UNIT GENERIC NAME, ORIGIN, MINERAL COMPOSITION	WATER SEEPAGE	DEPTH (m)	SHEAR VANE	MOISTURE/WEATHERING	STRENGTH/DENSITY	MATERIAL DESCRIPTION SOIL: Classification, colour, consistency, moisture, plasticity ROCK: Weathering, colour, rock name, strength
Clayey PEAT		1.4		Wet to Saturated	Very Soft to Soft	Topsoil: Dark brown/black, amorphous PEAT with minor organic clay, very soft, wet to saturated, low plasticity.
SILT	▽	1.9				Grey, SILT with some intrusion of peat, soft, saturated, low plasticity

Test Pit Terminated @ 1.9m Due To High Ground Water Table

▽ Water Seepage at 1.90m

Appendix C

Cross - Section Elevation