DRENNAN MAUD (PTY) LTD

GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
Incorporating Drennan Maud & Partners (Est.1975)

Reg. No. 2014/038872/07

Durban Head Office
68 Peter Mokaba Ridge, Tollgate, 4001
P.O. Box 30464, Mayville, 4058
T: +27 31 201 8992 F: +27 31 201 7920

Info@drennanmaud.com
www.drennanmaud.com

Margate Office
Unit 7 Gayridge Business Park No. 2
13 Wingate Avenue, Margate 4275
T: +27 39 3122 588 F: 0866 0275 53

Our Ref.: 31319-St04-PPS
Your Ref.:

13th August 2024

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

PORT SHEPSTONE HOSPITAL

NEW PSYCHIATRIC WARD

DEPARTMENT OF PUBLIC WORKS KZN SOUTHERN REGION

WIMS 044044

STAGE 4 - DOCUMENTATION & PROCUREMENT

PROJECT PILING SPECIFICATION

Attention: **Ms S. Taylor**

steph@tvaqs.co.za

CONTENTS

			page no.
1.	SCOPE OF WORK		1
	1.1	Lateral Support	1
	1.2	Founding	1
2.	DESCRIPTION OF THE SITE		1
3.	NATURE OF THE SUB-SOILS		1
4.	DRAWINGS		3
5.	PILING		4
	5.1	Pile Design	4
		5.1.1 *Lateral Support*	4
		5.1.2 *Founding*	4
	5.2	Pile Type / Description / Construction	4
	5.3	Concrete and Reinforcement for Use in Piles	4
		5.3.1 *Reinforcement Specification*	4
		5.3.2 *Concrete Specification*	5
		5.3.3 *Concrete Testing*	5
	5.4	Setting Out of Piles	6
	5.5	Tolerances	6
	5.6	Working Level	6
	5.7	Damaged Piles	6
	5.8	Testing of Piles	6
6.	CONCRETE (SMALL WORKS)		7
	6.1	Concrete (Small Works) Design / Description	7
		6.1.1 *Lateral Support*	7
		6.1.2 *Founding*	7
	6.2	Concrete and Reinforcement for Use in Small Works	7
		6.2.1 *Reinforcement*	8
		6.2.2 *Concrete*	8
	6.3	Tolerances	8
	6.4	Working Level	8
	6.5	Damaged Concrete (Small Works)	9
	6.6	Testing of Concrete (Small Works)	9
7.	SOIL NAILS		9
8.	SPRAYED CONCRETE		11
9.	EARTHWORKS		12
	9.1	Earthworks Description / Construction	12
	9.2	Cut Slopes	12
	9.3	Setting Out of Earthworks / Piling Platform	12
	9.4	Working Level	12
	9.5	Damage to Temporary Lateral Support	12

CONTENTS (continued. . .)

		page no.
10.	RECORDS	12
11.	CONSTRUCTION MONITORING	13
12.	BILL OF QUANTITIES	14
13.	PRICES	14
14.	PROGRAMME	14
15.	INFORMATION SUPPLIED BY CONTRACTORS	14
16.	WORKMANSHIP	14
17.	GUARANTEE	14
18.	ADDITIONAL INFORMATION	15

APPENDIX A - Borehole Logs
- Core Photographs
- Geological Sections
- Site Plan

APPENDIX B - Standardised Specification : Soil Nails

APPENDIX C - Standardised Specification : Sprayed Concrete

APPENDIX D - DMLtd Piling Record : Contiguous Piled Wall
- DMLtd Piling Record : Foundation Piles
- DMLtd Soil Nail Quality Control Sheet
- DMLtd Pull-out Test Record : Soil Nail Type 1
- DMLtd Pull-out Test Record : Soil Nail Type 2

1. SCOPE OF WORK

1.1 Lateral Support

The work generally comprises the setting out, installation, construction, and testing of; piles, pile caps, anchors, waler beams, and sprayed concrete to permanently laterally support the Basement excavation in Aeolian Dune Sand-derived fill material / Aeolian Dune Sand / Berea Formation sediments, overlying Residual / Weathered extremely to very soft rock Tillite encountered on the site allotted to the New Psychiatric Ward development at the existing Port Shepstone Provincial Hospital.

In the above regard, DRENNAN MAUD (PTY) LTD has prepared a lateral support design, comprising a permanent anchored contiguous piled wall (CPW), including pile cap and waler beams, finished with sprayed concrete to laterally support the excavation.

1.2 Founding

The work generally comprises the setting out, installation, and testing of piles to support (in skin-friction) the structural loads to which the piles will be subject by the New Psychiatric Ward development at the existing Port Shepstone Provincial Hospital. In this regard, DRENNAN MAUD (PTY) LTD has prepared a foundation design.

The following Specification pertains to both the lateral support and foundation designs.

2. DESCRIPTION OF THE SITE

The site is located at 7 Bazley Street at the southwest corner of the Port Shepstone Central Business District (CBD), approximately 110km southwest of the Durban City centre and 15km northeast of the Margate CBD. The site is bounded by Bazley Street at the northeast, George Street at the northwest, Colley Street at the southeast, and a Department of Education service road at the southwest. The site incorporates Price Street and is occupied by multiple structures associated with the Hospital facilities.

With reference to the Site Plan attached to this Specification (refer Appendix A), the New Psychiatric Ward is to be located at the site west corner and selected structures are to be demolished to accommodate the New Psychiatric Ward.

3. NATURE OF THE SUB-SOILS

Four boreholes have been drilled on site to determine contiguous piled wall and foundation pile design parameters. Standard penetrometer tests (SPT) were carried out in the upper

unconsolidated sediments prior to advancing the boreholes to the final 30.0m depth by rotary diamond drilling through bedrock. The borehole core boxes were delivered to the DRENNAN MAUD (PTY) LTD offices located in Durban, after which the SPT samples and core materials were photographed and logged by an Engineering Geologist in terms of the Guidelines for Soil And Rock Logging in South Africa, edited by A. B. A. Brink & R. M. H. Bruin, 2nd Impression 2002. The following parameters were recorded.

- For soil: moisture content, colour, consistency, structure (where applicable), soil texture, and origin.
- For rock: colour, weathering, fabric discontinuities, hardness, and rock name.

Both the core photographs and borehole logs are included in Appendix A attached to this Specification. An empirically derived table relating SPT 'N' values to soil consistency is presented hereunder for ease of reference.

Table1. Subsoil Consistency Inferred from SPT 'N' Values

Non-Cohesive Soils		Cohesive Soils	
SPT 'N'	**Subsoil Consistency**	**SPT 'N'**	**Subsoil Consistency**
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Firm
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		>30	Hard

Information obtained from the geotechnical investigation of the site indicates that the generalised subsoil profile for the majority of the site comprises the following materials.

- Fill Material: Light grey, very loose/loose, fine-grained sand. Material is predominantly derived from the surrounding dune SAND.
- Aeolian Dune Sand: Pale brown, very loose to loose, fine-grained SAND.
- Berea Formation Sediments: Red brown, predominantly medium dense with zones of dense and localised loose consistencies, very slightly clayey SAND to clayey SAND.
- Berea Formation Sediments (with fluctuating groundwater): Red brown becoming grey pale brown (leached), medium

dense to dense, slightly clayey SAND containing trace (<5%) quantities of very weakly cemented grit-sized ferricrete nodules (indicating a fluctuating ground water table).

- Residual Tillite: Olive grey, inferred very stiff, gravelly sandy CLAY. Material is borderline completely weathered extremely soft rock.

- Weathered Tillite: Olive dark grey, highly to predominantly medium weathered, very closely to predominantly closely-jointed, soft rock TILLITE.

To aid the understanding of the complex subsoil conditions across the site, a suite of simplified geological sections are included in Appendix A attached to this Specification. Note that the inferred geology between test positions is based on the information available and our experience in the area, and the geological sections are to be viewed as indicative only.

Additionally; at the time of drilling, standpipe piezometers were installed in each borehole to permit future ground water readings. Following drilling completion, ground water levels were permitted to stabilise prior to recording by DRENNAN MAUD (PTY) LTD. The following ground water levels were recorded at each of the dipped standpipe piezometers.

Table 2. Summary of Borehole Ground Water Measurements

Borehole №	Measured Groundwater Level (m below borehole collar level)
	16th June 2022
1	19.7
2	19.6
3	12.6
4	14.3

4. DRAWINGS

The following drawings are relevant to this document, and Contractors are to ensure that they are in possession thereof;

- Drawing № 31319-S01; “Contiguous Piled Wall Piling Layout & Details”
- Drawing № 31319-S02; “Contiguous Piled Wall Elevation”
- Drawing № 31319-S04; “Contiguous Piled Wall Sections & Details”
- Drawing № 31319-S23; “Foundation Piling Layout & Details”

5. PILING

5.1 Pile Design

5.1.1 *Lateral Support*

A total of 149№ reinforced concrete piles of 500-700mm diameter have been designed by DMLtd. The piles are designed to laterally resist the loads to which the CPW will be subject based on/in accordance with the geotechnical information logged at the time of geological mapping of the site.

5.1.2 *Founding*

A total of 241№ reinforced concrete piles of 350-450mm diameter have been designed by DMLtd. The piles are designed to support (in skin-friction) the structural loads to which the foundations will be subject based on/in accordance with the geotechnical information logged at the time of geological mapping of the site.

5.2 Pile Type / Description / Construction

The Pile Type is to be Continuous Flight Auger (CFA) based on the above geotechnical information.

The Piling Rig established on site to install the selected Pile Type is to be of sufficient capacity to achieve the designed Pile Length. Piles installed to a depth less than the designed Pile Length will not be accepted by the Engineer. In the event that the Contractor-selected Rig cannot drill to the required depth, the Contractor shall establish all Plant on site necessary to implement the Design. All costs (including; de/re-establishment, delays, etc.) in this regard shall be borne by the Contractor.

The Contractor is to supply a Construction Method Statement with his submission, inclusive of a description of the Pile Type and the capacity of the selected Piling Rig. The method statement is to detail how - in filling the hole with grout - the Contractor shall ensure that the grout column is of the full design cross-section, without cavities, and uncontaminated with ground water or soil.

5.3 Concrete and Reinforcement for Use in Piles

All concrete and reinforcement to be used in the construction of piles shall comply with the requirements of the SANS 1200G, unless noted otherwise.

5.3.1 *Reinforcement Specification*

Steel stress and bending of all reinforcement to be in accordance with SANS 920. Fixing of reinforcement to comply with the tolerances specified in SANS 1200G. Piles reinforced as follows.

- Pile Type 1: 28№ 600Ø - 7Y25 + R8-300 (1.22% A_s)
- Pile Type 2: 65№ 700Ø - 8Y25 + R8-300 (1.02% A_s)
- Pile Type 3: 14№ 700Ø - 8Y25 + R8-300 (1.02% A_s)
- Pile Type 4: 9№ 600Ø - 7Y20 + R8-240 (0.78% A_s)
- Pile Type 5: 33№ 500Ø - 6Y20 + R8-240 (0.96% A_s)
- Pile Type 6: 147№ 450Ø - 7Y16 + R8-190 (0.88% A_s)
- Pile Type 7: 36№ 350Ø - 5Y16 + R8-190 (1.04% A_s)
- Pile Type 8: 32№ 350Ø - 7Y12 + R8-140 (0.82% A_s)

*A_s = cross-sectional area of steel, represented as a percentage of cross-sectional area of concrete.

5.3.2 *Concrete Specification*

5.3.2.1 Lateral Support

Sand-cement grout for use in the construction of the pile shaft must have a minimum 28-day cube compressive strength of 35MPa, a water:cement ratio of 0.40 to 0.45 and a minimum slump of 175mm. The concrete mix design is to be submitted to the Engineer for approval prior to commencement of the works.

5.3.2.2 Founding

Sand-cement grout for use in the construction of the pile shaft must have a minimum 28-day cube compressive strength of 25MPa, a water:cement ratio of 0.40 to 0.45 and a minimum slump of 175mm. The concrete mix design is to be submitted to the Engineer for approval prior to commencement of the works.

5.3.3 *Concrete Testing*

Provision has been made in the Bill for sufficient concrete cube strength testing in accordance with SABS Method 863. Laboratory testing shall be carried out by a SANAS-accredited laboratory.

On site, test samples shall be taken in accordance with SABS Method 861. Each batch of premix concrete delivered to site shall be sampled as close as is practicable to the start of placing; however, only one set of samples shall be drawn from any one batch of concrete.

Early-strength test results will be used for construction/earthworks programming purposes as well as for early remedial measures (such as changing the mix design, if necessary). In this regard, one third of the scheduled concrete cubes are to be strength-tested at 3day, one third are to be strength-tested at 7day, and one third are to be strength-tested at 28day. Only samples tested at 28day will be used for assessment of the concrete strength in terms of the Specification criteria.

If any ‘valid’ test result (that is; the average result obtained from the testing of 3№ test cubes of

concrete) for a specific grade of concrete is more than 3MPa below the specified strength, the concrete yielding such result will be deemed not to comply with the requirements of the specification. Only if an examination by the Engineer satisfies the Engineer that the structural adequacy and durability of the part of the structure in which the concrete has been used is not impaired, the concrete shall be accepted and the mix design and other factors influencing the quality shall be reviewed in order to ensure that further concrete cast will be of acceptable quality. The cost of all remedial measures in this regard, including the Engineer's time-cost to undertake the aforementioned examination, shall be borne by the Contractor.

5.4 Setting Out of Piles

Initial setting out of the pile positions and checking of pile positions after installation shall be carried out by a registered Land Surveyor.

5.5 Tolerances

Tolerances shall be Degree of Accuracy II (SABS 1200F), except that piles shall not be more than 50mm from the designed position.

5.6 Working Level

The working level for piling operations shall be the site formation level as agreed with the Engineer and Client.

5.7 Damaged Piles

If any pile is damaged during installation such that its usefulness as a pile is impaired, it shall be replaced or strengthened by the installation of a new pile or piles, all as directed by the Engineer. The cost of all remedial measures in this regard shall be borne by the Contractor.

5.8 Testing of Piles

100% of the piles shall be integrity tested and the pile test reports shall be submitted to the Engineer for approval prior to commencement of construction of the pile cap. If any pile fails during integrity testing, it shall be replaced or strengthened by the installation of a new pile or piles, all as directed by the Engineer. The cost of all remedial measures in this regard shall be borne by the Contractor.

6. CONCRETE (SMALL WORKS)

6.1 Concrete (Small Works) Design / Description

6.1.1 *Lateral Support*

Reinforced concrete capping and waler beams (of the following dimensions) have been designed by DMLtd. The capping and waler beams are designed to unify the piles of the CPW.

- Capping Beam Type 1: 750 x 580 mm
- Capping Beam Type 2: 850 x 580 mm
- Capping Beam Type 3: 850 x 580 mm
- Capping Beam Type 4: 750 x 580 mm
- Capping Beam Type 5: 650 x 580 mm
- Waler Beam: 620 x 580 mm

Waler beams will be connected to the exposed face of the CPW by means of drilling and epoxying dowel bars into the piles. Note that percussion drilling of the anchors through either the piles or the waler beam will not be permitted by the Engineer and we recommend that the waler beam be constructed post installation of the anchors. With reference to Drawing № 31319-S04; typical void formers have been detailed (Details 2 and 3) - no provision has been made in the Bill for misalignment of formwork during concrete pours and/or consequent coring through the waler beam.

(Contractor-proposed deviations to the above may be submitted in the Construction Method Statement - refer Point 15 below - for the Engineer's approval / refusal.)

6.1.2 *Founding*

Reinforced concrete pile caps, ground beams and strip footings by Others.

6.2 Concrete and Reinforcement for Use in Small Works

All concrete and reinforcement to be used in the construction of capping and waler beams shall comply with the requirements of SANS 1200GA, unless noted otherwise.

6.2.1 *Reinforcement*

Capping and waler beams reinforced as follows.

- 95kg/m³ HT
- 20kg/m³ MS

*kg/m³ = kilograms of steel per cubic metre concrete, HT = high tensile, MS = mild steel

6.2.2 *Concrete*

Concrete for use in the construction of the capping beam to have a minimum compressive strength at 28day of 25MPa. Concrete for use in the construction of the waler beam to have a minimum compressive strength at 28day of 35MPa. The concrete mix design is to be submitted to the Engineer for approval prior to commencement of the works.

6.3 Tolerances

Permissible deviations for the capping and waler beams shall be Degree of Accuracy II (SABS 1200GA).

6.4 Working Level

The working level for concrete works shall be the site formation level as agreed with the Engineer. A top-down procedure is envisaged as follows. (All earthworks to be co-ordinated with the relevant Contractor.)

- Following demolition of existing structures (by others) and underpinning of adjacent structures on the site allocated to the New Psychiatric Ward, commence earthworks at the site South side and construct a piling platform at the North corner of the site.
- Install the Types 2, 3 and 4 CPW at existing ground level.
- Following integrity testing and approval of the Engineer, cast a pile cap over the Types 2, 3 and 4 CPW to brace the piles on one axis.
- Commence excavation of the site to Ground Floor level.
- As the depth of the excavation in front of the Types 2, 3 and 4 CPW advances, install wick drains and shotcrete/gunite* (refer Point 8 below). Temporarily suspend excavation at Ground Floor level.
- Commence installation of the Types 1 and 5 CPW at Ground Floor level. Following integrity testing and approval of the Engineer, cast a pile cap over the Types 1 and 5 CPW to brace the piles on one axis.
- Install the Types 2 and 4 CPW soil nails at soffit level of the Ground Floor slab and construct the reinforced concrete waler. Nail grout cubes to be taken at a minimum of 3 cubes per batch to confirm that 23MPa is achieved in 7day, and that 30MPa is achieved

prior to pull-out tests.

- 100% of the soil nails shall be tested. All soil nails to be locked off at 90% of their working load (WL).
- The Contractor is to record and supply the results of the pull-out tests to the Engineer for approval prior to recommencement of excavation of the site to Basement Parking level. (As the depth of the excavation in front of the CPW advances, install wick drains and shotcrete/gunite.)
- Excavation of the site is complete at Basement Parking level. Commence installation of the foundation piles at top-of-concrete (TOC) Pile Cap level.

* The in-situ soils exposed between the pile during excavation are to be lined with wick drains comprising a high-density polyethylene open-structure grid cut to suit the required width and wrapped in a light, non-woven geotextile. The wick drains are to extend beyond Basement Parking level to discharge to a subsoil drain constructed in front of the CPW to the Civil Engineer's specification. The wick drains are to be installed prior to fixing galvanised mesh reinforcement (Ref. 245) to the exposed face of the CPW and sprayed with shotcrete/gunite including a waterproofing admixture (Xypex or equal approved) and broom-finished.

6.5 Damaged Concrete (Small Works)

If any capping or waler beam is damaged during installation, or installation of anchors and/or sprayed concrete, it shall be replaced or strengthened all as directed by the Engineer. The cost of all remedial measures in this regard shall be borne by the Contractor.

6.6 Testing of Concrete (Small Works)

Refer Point 5.3.2 above.

7. SOIL NAILS

Please refer to the Standardised Specification : Soil Nails attached to this document as Appendix B for all criteria regarding the installation of the soil nails designed to reinforce the lateral support system. In general, the soil nail design/description is as follows.

- Soil Nail Type 1: 130Ø, 15.0m length (11.0m fixed length, 4.0m free length), reinforced with *DYWI* R32-250 (or equal approved) installed at 15° from the normal/horizontal. 120kN working load (WL).
- Soil Nail Type 2: 130Ø, 12.0m length (8.0m fixed length, 4.0m free length), reinforced with DYWI R32-210 (or equal approved) installed at 25° from the normal/horizontal. 88kN working load (WL).

General soil nail notes are as follows.

- Soil nail corrosion protection to comprise hot-dip galvanising to SANS 763/ISO 1461 (minimum 85µm).
- The Contractor is to supply the bar Delivery Note and both the bar and plate Mill reports to the Engineer for approval prior to the commencement of soil nail installation.
- Grout mix design to COLTO 7500:7507:Cii to be submitted to the Engineer for approval prior to commencement of the Works.
- All grout to have a minimum compressive strength of 35MPa at 28day. Grout cubes to be taken at a minimum of 3 cubes per batch to confirm that 23MPa is achieved in 7day, and that 30MPa is achieved prior to pull-out tests.
- All soil nails shall be fully grouted to the collar of the hole. The Contractor shall ensure that the grout cover to the anchors is continuous and completely fills the socket. The Contractor shall provide the Engineer with a grouting method statement prior to commencement of the Works.
- During drilling; the diameter, orientation, length, and spacing of the drill hole and soil nail is to be regularly checked. (Bars to be central on Face Plates.)
- The hole is to be drilled slightly beyond the design length and pressure-grouted from the base up.
- During drilling, the Contractor is to complete an Anchor Quality Control sheet. The grout take/quantity/pressure is to be recorded. Unexpected conditions are to be documented.
- Should caving occur, drilling is to be stopped and an alternative method employed. Bentonite MAY NOT be used.
- 100% of the soil nails shall be tested. The soil nail/grout strength is generally accepted based on the successful testing of the soil nail.
- The Contractor is to supply the jacking equipment calibration certificates. Calibration of the pressure gauges and load cells is to be performed (45day maximum) prior to soil nail testing.
- During testing, the base plate is to be positioned such that it is not jacking against the grout; that is, the composite soil nail pull-out is to be tested and not the bar/grout pull-out.
- A dial gauge is to be placed independent of the soil nail to measure movement. A second pressure gauge is to be kept on site for periodic checking.
- All soil nails to undergo pull-out tests to 125% of their working load (WL).
- All soil nails to be locked off at 90% of their WL. A greased-sleeve/free-length is required to transfer the active soil nail load to the passive wedge.
- A jack chair is to be placed on bar soil nails to permit access to the nut during transfer of the lock-off load.
- The ends of each soil nail are to be fitted with a Face Plate, Beveled Washer, and Hexagon Nut all with sufficient capacity to resist the loads to which they will be subject and galvanised to SANS 763/ISO 1461.
- The Contractor is to record and supply the results of the pull-out tests to the Engineer prior to commencement of excavation of the CPW.

8. SPRAYED CONCRETE

Please refer to the Standardised Specification : Sprayed Concrete attached to this document as Appendix C for all criteria regarding the installation of the sprayed concrete designed to both permanently laterally support the embankment and finish the lateral support system. In general, the sprayed concrete design/ description is as follows.

- 100mm thick galvanised mesh Ref. 245 reinforced 35MPa concrete. (The concrete mix design is to be submitted to the Engineer for approval prior to commencement of the works.)

General sprayed concrete notes are as follows.

- Shotcreting shall be carried out on the trimmed slope. Excavations to be cut to indicated batter and trimmed to a degree of Accuracy 1 (tolerance = 50mm).
- Surface run-off into the excavation is to be intercepted and conveyed away from the works.
- Sprayed concrete shall be placed in accordance with AC 1-506R-85. Only trained operators shall be used for guniting operations.
- No sprayed concrete is to be applied without prior approval from the Engineer.
- The surface to which sprayed concrete is to be applied shall first be cleared of any foreign material.
- All shotcrete to have a minimum compressive strength of 35MPa at 28day.
- The minimum specified layer thickness shall be controlled by depth pins attached to the reinforcement.
- Mesh reinforcement is to be centrally placed and lapped by 200mm.
- The mesh reinforcement is to be pulled tight into depressions where necessary.
- 50mm (minimum) cover to reinforcement.
- Mesh reinforcement to be galvanised in permanent applications.
- The positions of all construction joints not shown on the drawings are to be discussed with and approved by the Engineer. Construction joints shall be formed at 45° to the face. Precautions to be taken to prevent weak and unsightly edges at construction joints. (If necessary, temporary timber strips to be used to shutter a strong, neat construction joint.) Prior to placing the adjoining sprayed concrete the edges are to be cleaned and thoroughly wetted.
- Where sprayed concrete is to be applied over a previous layer, the previous layer shall first reach its initial set and then be cleaned of any loose material.
- There shall be no hollow areas and a broomed surface finish.
- The use of a sprayed surface-curing compound is not permitted. The sprayed concrete shall be kept moist continuously for three days by spraying with a fine mist of water at intervals not exceeding 4hr.
- All groundwater to be drained from the toe of the excavation.

9. EARTHWORKS

9.1 Earthworks Description / Construction

In general, all earthworks to be carried out by Others; however, the Piling Contractor is expected to co-ordinate with the relevant Contractor.

9.2 Cut Slopes

Where necessary, the slopes of the existing embankment shall be trimmed to a safe batter of 1:1,75 (or 30° from the horizontal) maximum. All loose rocks, stones, and nests of loose material shall be removed.

9.3 Setting out of Earthworks/Piling Platform

Initial setting out and checking of the Earthworks and Piling Platform extent shall be carried out by a registered Land Surveyor. An as-built survey is to be submitted to the Engineer on completion of the Earthworks.

9.4 Working Level

The working level for earthworks shall be as agreed with the Engineer and Client.

9.5 Damage to Temporary / Permanent Lateral Support

If any element of the lateral support system is damaged or becomes ineffective for any reason related to the Contractor's earthworks activities, it shall be repaired or replaced by the Contractor without additional payment.

10. RECORDS

A detailed record of the piling shall be kept by the Contractor. An example of such a piling record is attached to this document as Appendix D.

Included in Appendix D is an Anchor Quality Control Sheet, and Anchor Pull-out Test Record Sheet.

All records shall be countersigned by the site-foreman, and upon approval by the Engineer, become the property of the Engineer. Failure of the Contractor to keep records up-to-date for the duration of the Contract may result in delays (as a consequence of the Engineer not permitting the Contractor to proceed with the subsequent phase of construction), the cost of which shall be borne by the Contractor.

Additionally, it is recommended that a site instruction (minimum triplicate) book be kept on site for the duration of the Contract.

11. CONSTRUCTION MONITORING

The Contractor is to make sufficient provision for Construction Monitoring in accordance with the following.

- Following completion of the capping beam and prior to commencement of excavation of the Types 2, 3, and 4 CPW a registered Land Surveyor is to set out bench marks at the capping beam at 5.0m centres.
- During excavation to Ground Floor level, the capping beam bench marks are to be surveyed daily and the cumulative results of the survey are to be forwarded to the Engineer for the purpose of Construction Monitoring.
- Similarly, following completion of the Types 1 and 5 CPW capping beams and prior to commencement of excavation to Basement Parking level, the Land Surveyor is to set out bench marks at the capping beams at 5.0m centres. During excavation to Basement Parking level, the capping beam bench marks are to be surveyed daily and the cumulative results of the survey are to be forwarded to the Engineer.
- Following completion of installation of the soil nails, construction of the Waler Beam, Soil Nail Testing, and excavation of the Types 2, 3, and 4 CPW to Basement Parking level; the Surveyor is to set out 1 bench mark every 6No. piles at the mid-span of the piles exposed between the Ground Floor and Basement Parking levels.
- During excavation to Foundation Level, the capping beam and pile bench marks are to be surveyed daily and the cumulative results of the survey are to be forwarded to the Engineer.
- Following completion of the Basement Parking level layerworks, the capping beam and pile bench marks are to be surveyed 3No. days weekly.
- Following completion of the Ground Floor slab, the capping beam and pile bench marks are to be surveyed weekly.
- Following completion of the First Floor slab, surveying may be suspended.
- The system shall be deemed to have failed if horizontal movement at the capping beam exceeds 35mm, or 5mm midspan of the piles exposed between the waler beams and excavation base.
- Any vertical movement is to be reported to the Engineer immediately.
- Any cracks in the capping beam or piles during excavation are to be reported to the Engineer immediately.

A detailed record of the Construction Monitoring shall be kept by the Contractor and submitted to the Engineer daily. Failure of the Contractor to provide sufficient Construction Monitoring for the duration of the Earthworks or submit his records timeously may result in delays (as a consequence of the Engineer not permitting the Contractor to proceed with the subsequent phase of construction), the cost of which shall be borne by the Contractor.

12. BILL OF QUANTITIES

The Bill of Quantities to which this Specification is attached is to be completed in full by the Contractor. The Contractor is to report any discrepancies to the Engineer immediately.

13. PRICES

Prices for piling, concrete (small works), soil nailing, and sprayed concrete shall be deemed to include for complying with this Specification in all respects.

14. PROGRAMME

The Contractor is to include a detailed Programme of Work in his submission. The Contract commencement and completion dates shall be agreed upon by the Contractor and Client.

15. INFORMATION SUPPLIED BY CONTRACTORS

The following checklist is provided to ensure Contractors submit complete bids. Failure of the Contractor to submit a complete bid will result in disqualification.

- ☐ Proposed pile type and description.
- ☐ Proposed piling rig and capabilities.
- ☐ Construction Method Statement
- ☐ Bill of Quantities
- ☐ Programme

16. WORKMANSHIP

The Contractor shall produce the specified standards of workmanship necessary to implement the design in the actual conditions encountered so that the lateral support and foundation systems carry the design loads in the specified manner.

17. GUARANTEE

In the event of failure of any element of the lateral support or foundation systems, the Contractor shall make good the same at his own expense and shall indemnify the Employer against any loss or damage to any building or structure and any injury to any person caused by such failure.

18. ADDITIONAL INFORMATION

If the Contractor needs more information or has any questions concerning the above, he is to contact DRENNAN MAUD (PTY) LTD on (031) 201 8992 during office hours. (DMLtd project leader; Michael Cooper Pr. Sci. Nat, designer; Stacey Gordon Pr. Eng.)

/sjg

/encl.
- APPENDIX A
  - Borehole Logs
  - Core Photographs
  - Geological Sections
  - Site Plan
- APPENDIX B - Standardised Specification : Soil Nails
- APPENDIX C - Standardised Specification : Sprayed Concrete
- APPENDIX D
  - DMLtd Piling Record : Contiguous Piled Wall
  - DMLtd Piling Record : Foundation Piles
  - DMLtd Soil Nail Quality Control Sheet
  - DMLtd Pull-out Test Record : Soil Nail Type 1
  - DMLtd Pull-out Test Record : Soil Nail Type 2

APPENDIX A

Borehole Logs
Core Photographs
Geological Sections
Site Plan

DRENNAN MAUD (PTY) LTD.

Engineering Geologists & Geotechnical Engineers

KZN DEPARTMENT OF HEALTH
PORT SHEPSTONE
NEW PSYCHIATRIC WARD

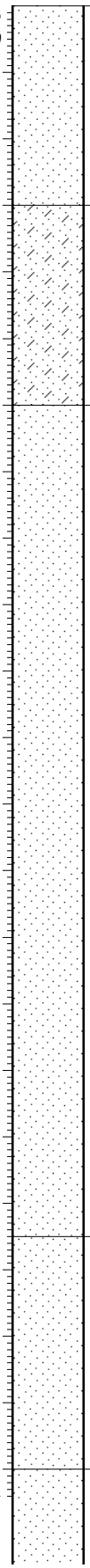
HOLE No: **BH 1**
Sheet 1 of 2

JOB NUMBER: 31319

Drill Type	Mat. Rec (%)	Core Rec (%)	RQD (%)	Fract. Freq.	SPT (N)	Smpl. (MPa)	Depth (m)
EXCA							
SPT					6		
NX							
SPT					13		
NX							
SPT					15		
NX							
SPT					10		
NX							
SPT					16		
NX							
SPT					20		
NX							
SPT					25		
NX							
SPT					18		
NX							
SPT					22		
NX							
SPT					22		
NX							
SPT					21		
NX							
SPT					21		
NX							
SPT					18		
NX							
SPT					16		
NX							

Scale 1:100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22



0.00 Yellow pale brown, very loose (inferred), fine grained SAND (Dune Sand)

3.00 Red brown, medium dense, clayey fine to medium grained SAND (Berea Formation)

6.00 Orange red brown, medium dense, very slightly clayey fine to medium grained SAND (Berea Formation)

18.50 Red brown speckled dark grey, medium dense, very slightly clayey fine to medium grained SAND containing less than 5% grit sized dark grey very weakly cemented ferricrete nodules (Berea Formation)

22.00

DRENNAN MAUD (PTY) LTD.

Engineering Geologists & Geotechnical Engineers

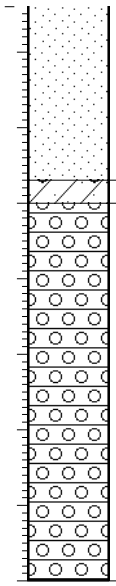
KZN DEPARTMENT OF HEALTH
PORT SHEPSTONE
NEW PSYCHIATRIC WARD

HOLE No: BH 1
Sheet 2 of 2

JOB NUMBER: 31319

Drill Type	Mat. Rec (%)	Core Rec (%)	RQD (%)	Fract. Freq.	SPT (N)	Smpl. (MPa)	Depth (m)
SPT					19		
NX							
SPT					18		
NWD4							
NWD4	100	92	28	16			
NWD4	104	104	18	19			
NDW4	95	95	32	20			
NWD4	105	105	74	12			

23 24 25 26 27 28 29 30



24.70

25.00

30.00

Grey pale brown, medium dense, very slightly clayey fine to medium grained SAND containing less than 5% grit sized dark grey very weakly cemented ferricrete nodules (Berea Formation)

Olive grey, very stiff (inferred), gravelly fine grained sandy CLAY (Residual Tillite). Borderline completely weathered extremely soft rock tillite.

Olive dark grey, highly weathered to predominantly medium weathered with completely weathered zones along natural joints, unstratified, closely to medium jointed, very soft to soft rock TILLITE (Dwyka Group)
Subvertical and horizontal joints typically closed with some stained dark grey to filled with olive green sandy clay.

NOTES

1) End of hole at 30.00 m.

2) Groundwater measured at 19.70m (Recorded on the 16.06.2022)

CONTRACTOR : TFI (PTY) LTD
MACHINE : TONE170
DRILLED BY : FB
PROFILED BY : AM

TYPE SET BY : AM
SETUP FILE : BOREHOLE LOG.SET

INCLINATION : VERTICAL
DIAM : NA
DATE : 24 MAY 2022
DATE : 15 JUNE 2022

DATE : 22/06/2022 12:36
TEXT : C\DOTIN\BHMASTER.DOC

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: BH 1

BOREHOLE 1

BOX 1 OF 1

DRENNAN MAUD (PTY) LTD.

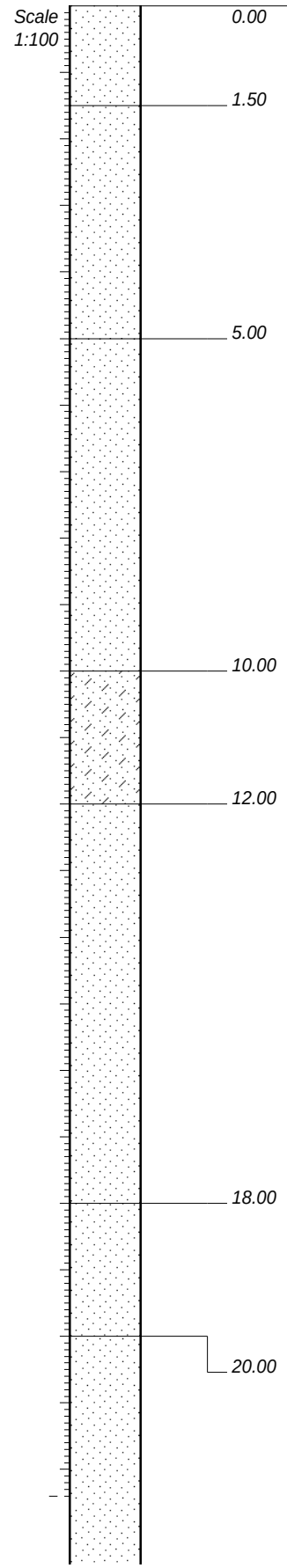
Engineering Geologists & Geotechnical Engineers

KZN DEPARTMENT OF HEALTH
PORT SHEPSTONE
NEW PSYCHIATRIC WARD

HOLE No: BH 2
Sheet 1 of 2

JOB NUMBER: 31319

Drill Type	Mat. Rec (%)	Core Rec (%)	RQD (%)	Fract. Freq.	SPT (N)	Smpl. (MPa)	Depth (m)
EXCA							
SPT					11		
NX							
SPT					22		
NX							
SPT					24		
NX							
SPT					22		
NX							
SPT					27		
NX							
SPT					25		
NX							
SPT					27		
NX							
SPT					33		
NX							
SPT					42		
NX							
SPT					29		
NX							
SPT					40		
NX							
SPT					34		
NX							
SPT					33		
NX							
SPT					41		
NX							



0.00 Pale brown, very loose, fine grained SAND (Dune Sand)

1.50 Red brown, medium dense, slightly clayey fine to medium grained SAND (Berea Formation)

5.00 Orange red brown, medium dense, very slightly clayey fine to medium grained SAND (Berea Formation)

10.00 Red brown, medium dense, slightly clayey to clayey fine to medium grained SAND (Berea Formation)

12.00 Red brown, dense, slightly clayey fine to medium grained SAND (Berea Formation)

18.00 Red brown speckled dark grey, dense, slightly clayey fine to medium grained SAND containing less than 5% grit sized dark grey very weakly cemented ferricrete nodules (Berea Formation)

20.00

DRENNAN MAUD (PTY) LTD.

Engineering Geologists & Geotechnical Engineers

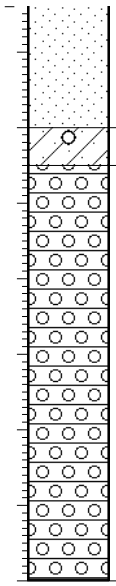
KZN DEPARTMENT OF HEALTH
PORT SHEPSTONE
NEW PSYCHIATRIC WARD

HOLE No: BH 2
Sheet 2 of 2

JOB NUMBER: 31319

Drill Type	Mat. Rec (%)	Core Rec (%)	RQD (%)	Fract. Freq.	SPT (N)	Smpl. (MPa)	Depth (m)
SPT					51		
NX							
SPT					ref		
NWD4	98	98	23	>20			
NWD4	101	101	17	20			
NDW4	95	95	32	15			
NWD4	87	87	0	>20			

23
24
25
26
27
28
29
30



24.00

24.50

30.00

Pale brown mottled red brown, dense, very slightly clayey fine to medium grained SAND containing less than 5% dark grey grit sized very weakly cemented ferricrete nodules (Berea Formation)

Olive grey, very stiff (inferred), gravelly sandy CLAY (Residual Tillite). Borderline completely weathered extremely soft rock tillite.

Olive dark grey, highly weathered to predominantly medium weathered with completely weathered zones along natural joints, unstratified, very close to closely jointed, soft rock TILLITE (Dwyka Group)
Vertical to subvertical joints typically slightly rough filled with olive green sandy clay
Horizontal joints are smooth to slightly rough clean to dark grey brown stained.

NOTES

1) End of hole at 30.00 m.

2) Groundwater measured at 19.60m (Recorded on the 16.06.2022)

CONTRACTOR : TFI (PTY) LTD
MACHINE : TONE170
DRILLED BY : A.Z
PROFILED BY : AM

TYPE SET BY : AM
SETUP FILE : BOREHOLE LOG.SET

INCLINATION : VERTICAL
DIAM : NA
DATE : 28 MAY 2022
DATE : 15 JUNE 2022

DATE : 22/06/2022 12:38
TEXT : C\DOTIN\BHMASTER.DOC

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: BH 2

BOREHOLE 2

BOX 1 OF 1

DRENNAN MAUD (PTY) LTD.

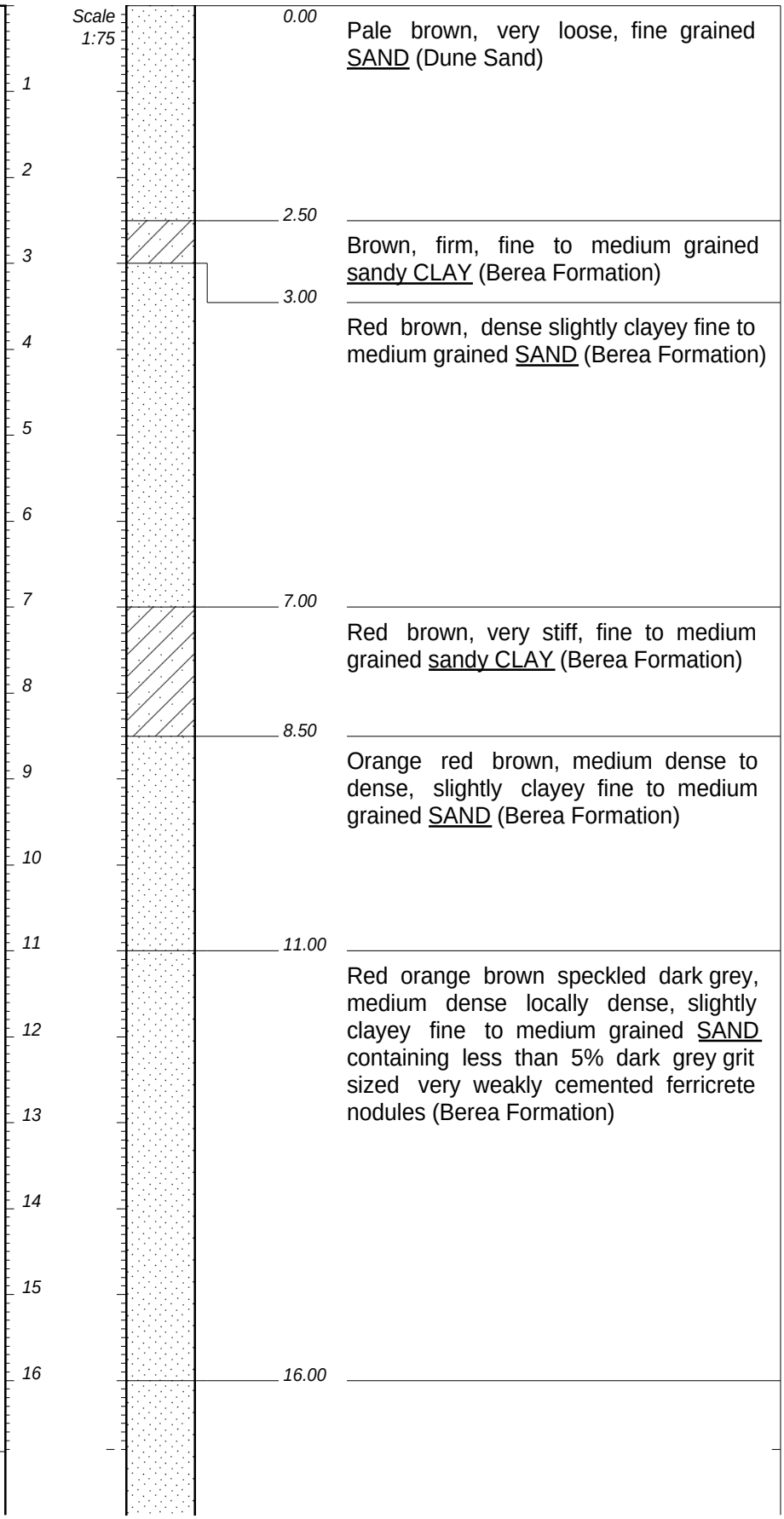
Engineering Geologists & Geotechnical Engineers

KZN DEPARTMENT OF HEALTH
PORT SHEPSTONE
NEW PSYCHIATRIC WARD

HOLE No: BH 3
Sheet 1 of 2

JOB NUMBER: 31319

Drill Type	Mat. Rec (%)	Core Rec (%)	RQD (%)	Fract. Freq.	SPT (N)	Smpl. (MPa)	Depth (m)
EXCA							
SPT					1		
NX							
SPT					5		
NX							
SPT					58		
NX							
SPT					53		
NX							
SPT					23		
NX							
SPT					29		
NX							
SPT					34		
NX							
SPT					25		
NX							
SPT					41		
NX							
SPT					23		
NX							



0.00 Pale brown, very loose, fine grained SAND (Dune Sand)

2.50 Brown, firm, fine to medium grained sandy CLAY (Berea Formation)

3.00 Red brown, dense slightly clayey fine to medium grained SAND (Berea Formation)

7.00 Red brown, very stiff, fine to medium grained sandy CLAY (Berea Formation)

8.50 Orange red brown, medium dense to dense, slightly clayey fine to medium grained SAND (Berea Formation)

11.00 Red orange brown speckled dark grey, medium dense locally dense, slightly clayey fine to medium grained SAND containing less than 5% dark grey grit sized very weakly cemented ferricrete nodules (Berea Formation)

16.00

DRENNAN MAUD (PTY) LTD.

Engineering Geologists & Geotechnical Engineers

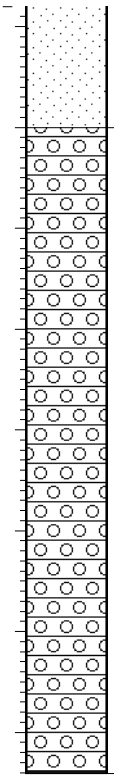
KZN DEPARTMENT OF HEALTH
PORT SHEPSTONE
NEW PSYCHIATRIC WARD

HOLE No: BH 3
Sheet 2 of 2

JOB NUMBER: 31319

Drill Type	Mat. Rec (%)	Core Rec (%)	RQD (%)	Fract. Freq.	SPT (N)	Smpl. (MPa)	Depth (m)
SPT					27		
NX							
NWD4	43	43	69	6			
NWD4	19	19	0	>20			
NWD4	93	93	31	20			
NWD4	111	111	63	18			
NWD4	73	73	12	12			
NWD4	100	100	66	14			

17 18 19 20 21 22 23 24



18.00

24.41

Reddish pale brown, medium dense, very slightly clayey fine to medium grained SAND containing less than 5% dark grey grit sized very weakly cemented ferricrete nodules (Berea Formation)

Olive dark grey, highly to medium weathered with localised completely weathered zones along natural joints, unstratified, very closely to close jointed, soft rock becoming borderline medium hard rock TILLITE (Dwyka Group)
Vertical to subvertical joints typically smooth to slightly rough yellow red brown stained and olive green sandy clay filled
Horizontal joints typically slightly rough closed to dark grey red brown stained.

NOTES

1) End of hole at 24.41 m.

2) Groundwater measured at 12.60m (Recorded on the 16.06.2022)

CONTRACTOR : TFI (PTY) LTD
MACHINE : TONE170
DRILLED BY : A.Z
PROFILED BY : AM

TYPE SET BY : AM
SETUP FILE : BOREHOLE LOG.SET

INCLINATION : VERTICAL
DIAM : NA
DATE : 31 MAY 2022
DATE : 15 JUNE 2022

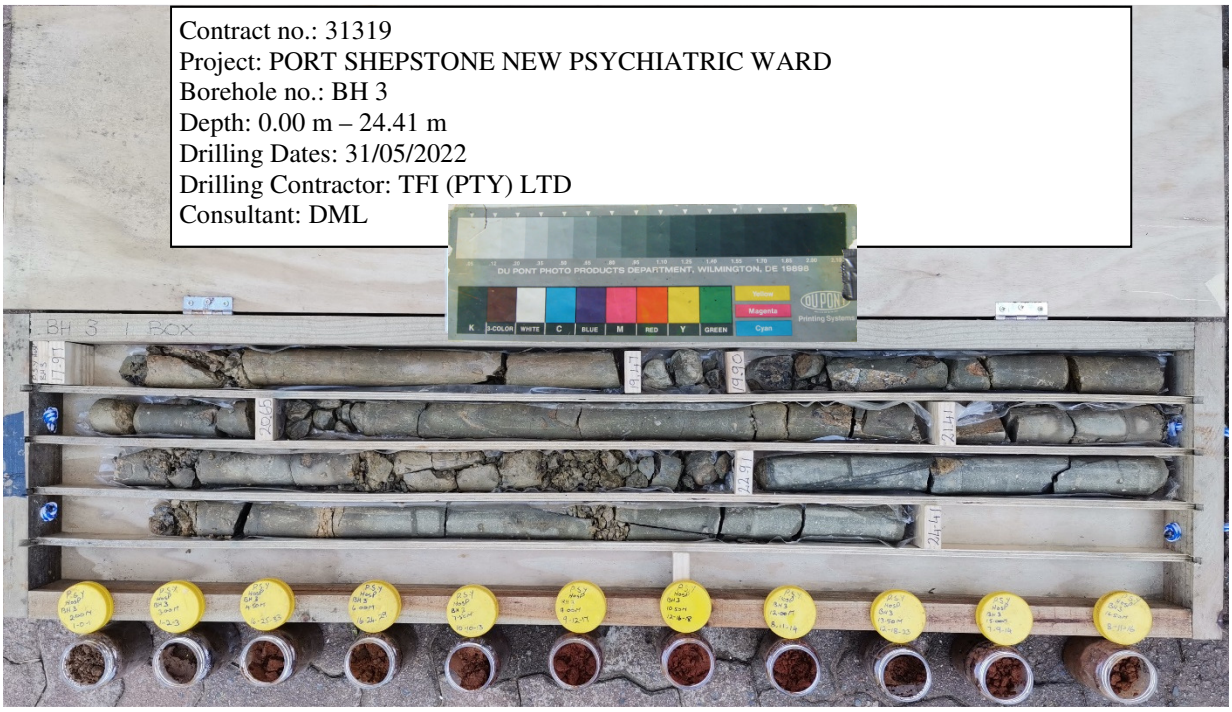
DATE : 22/06/2022 12:40
TEXT : C\DOTIN\BHMASTER.DOC

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: BH 3

BOREHOLE 3

BOX 1 OF 1



Contract no.: 31319
Project: PORT SHEPSTONE NEW PSYCHIATRIC WARD
Borehole no.: BH 3
Depth: 0.00 m – 24.41 m
Drilling Dates: 31/05/2022
Drilling Contractor: TFI (PTY) LTD
Consultant: DML

DRENNAN MAUD (PTY) LTD.

Engineering Geologists & Geotechnical Engineers

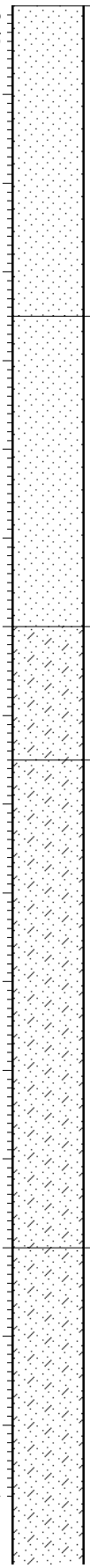
KZN DEPARTMENT OF HEALTH
PORT SHEPSTONE
NEW PSYCHIATRIC WARD

HOLE No: **BH 4**
Sheet 1 of 2

JOB NUMBER: 31319

Drill Type	Mat. Rec (%)	Core Rec (%)	RQD (%)	Fract. Freq.	SPT (N)	Smpl. (MPa)	Depth (m)
EXCA							
SPT					3		
NX							
SPT					8		
NX							
SPT					12		
NX							
SPT					28		
NX							
SPT					30		
NX							
SPT					67		
NX							
SPT					50		
NX							
SPT					33		
NX							
SPT					38		
NX							
SPT					16		
NX							

Scale 1:75



0.00	Yellow pale brown, very loose to loose, fine grained SAND (Aeolian Dune Sand)
3.50	Slightly red light brown, medium dense, very slightly clayey fine to medium grained SAND (Berea Formation)
7.00	Red light brown, medium dense, clayey fine to medium grained SAND (Berea Formation)
8.50	Red light brown, medium dense, clayey fine to medium grained SAND containing less than 5% dark grey grit sized very weakly cemented ferricrete nodules (Berea Formation)
14.00	Red light brown, medium dense, very clayey fine to medium grained SAND containing less than 5% dark grey grit sized very weakly ferricrete nodules (Berea Formation)

DRENNAN MAUD (PTY) LTD.

Engineering Geologists & Geotechnical Engineers

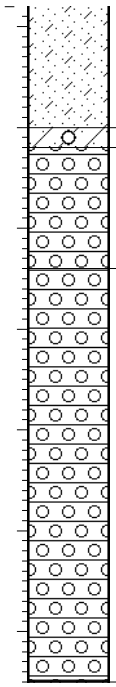
KZN DEPARTMENT OF HEALTH
PORT SHEPSTONE
NEW PSYCHIATRIC WARD

HOLE No: BH 4
Sheet 2 of 2

JOB NUMBER: 31319

Drill Type	Mat. Rec (%)	Core Rec (%)	RQD (%)	Fract. Freq.	SPT (N)	Smpl. (MPa)	Depth (m)
SPT					16		
NX							
NWD4	99	99	33	12			
NWD4	111	111	48	19			
NWD4	83	83	41	14			
NWD4	123	123	42	13			

17 18 19 20 21 22 23



18.00

Olive green, very stiff (inferred), gravelly sandy CLAY (Residual Tillite). Borderline completely weathered extremely soft rock tillite.

18.20

Olive dark grey, highly to medium weathered, unstratified, very closely to predominantly closely jointed, very soft to predominantly soft rock TILLITE (Dwyka Group)

19.40

olive dark grey, medium weathered, unstratified, very closely to predominantly closely jointed, soft rock to borderline medium hard rock TILLITE (Dwyka Group)
Vertical to subvertical joints typically smooth to slightly rough rusty orange brown stained to olive green sandy clay filled
Horizontal to subhorizontal joints typically slightly rough dark grey stained to locally clayey sand filled.

23.50

NOTES

1) End of hole at 23.50 m.

2) Groundwater measured at 14.30m (Recorded on the 16.06.2022)

CONTRACTOR : TFI (PTY) LTD
MACHINE : TONE170
DRILLED BY : FB
PROFILED BY : AM/JJ

TYPE SET BY : AM
SETUP FILE : BOREHOLE LOG.SET

INCLINATION : VERTICAL
DIAM : NA
DATE : 26 MAY 2022
DATE : 15 JUNE 2022

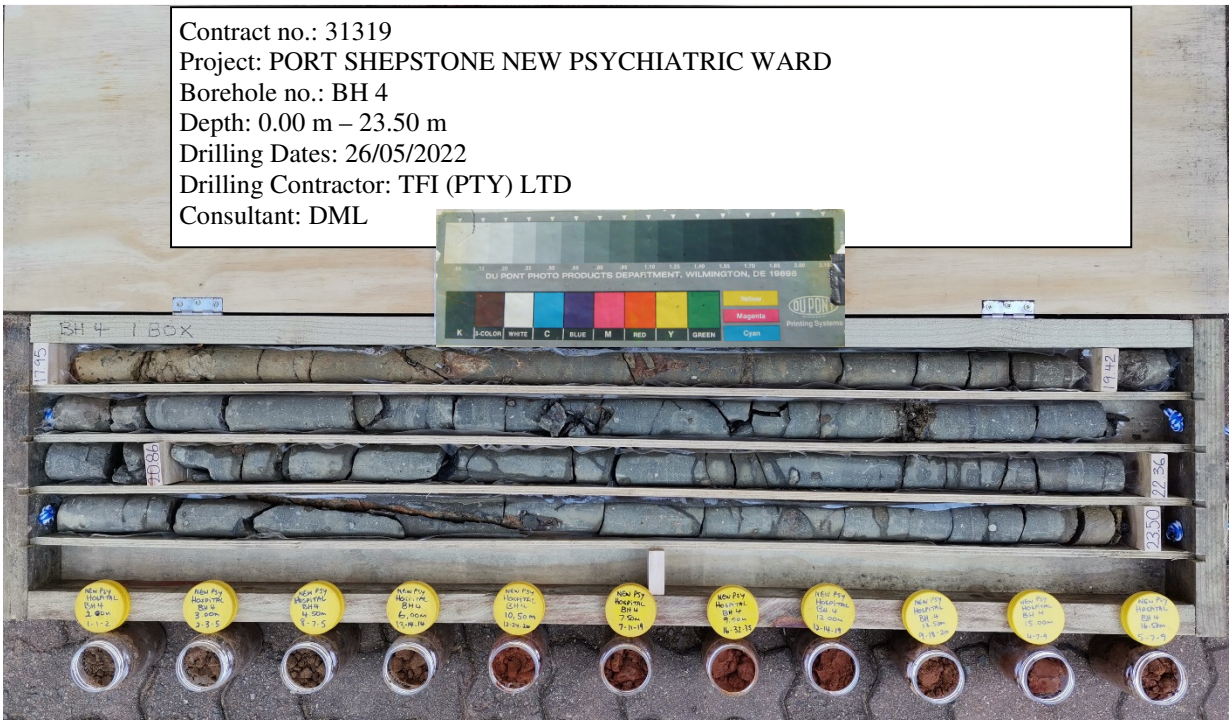
DATE : 22/06/2022 12:40
TEXT : C\DOTIN\BHMASTER.DOC

ELEVATION :
X-COORD :
Y-COORD :

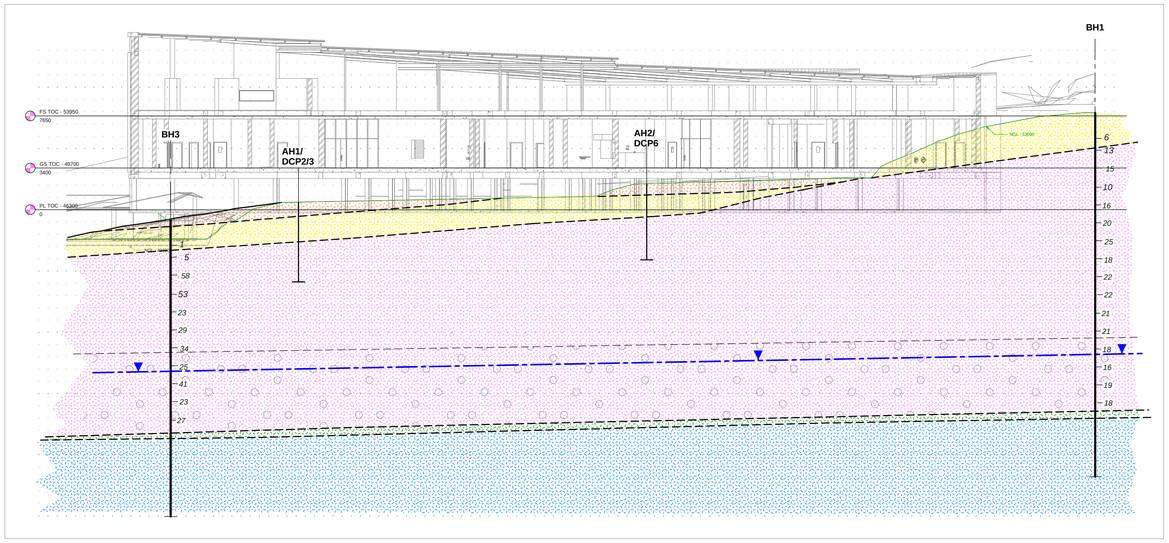
HOLE No: BH 4

BOREHOLE 4

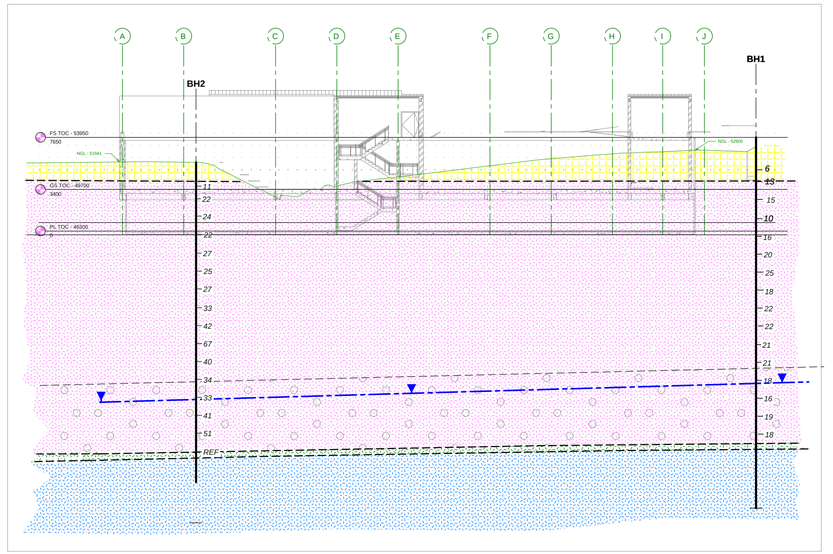
BOX 1 OF 1



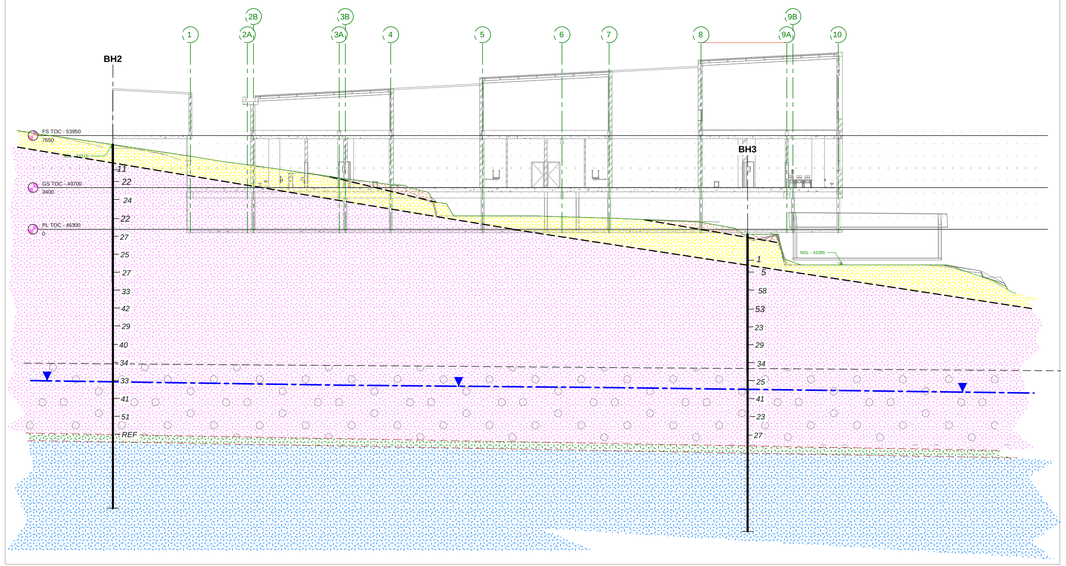
Contract no.: 31319
Project: PORT SHEPSTONE NEW PSYCHIATRIC WARD
Borehole no.: BH 4
Depth: 0.00 m – 23.50 m
Drilling Dates: 26/05/2022
Drilling Contractor: TFI (PTY) LTD
Consultant: DML



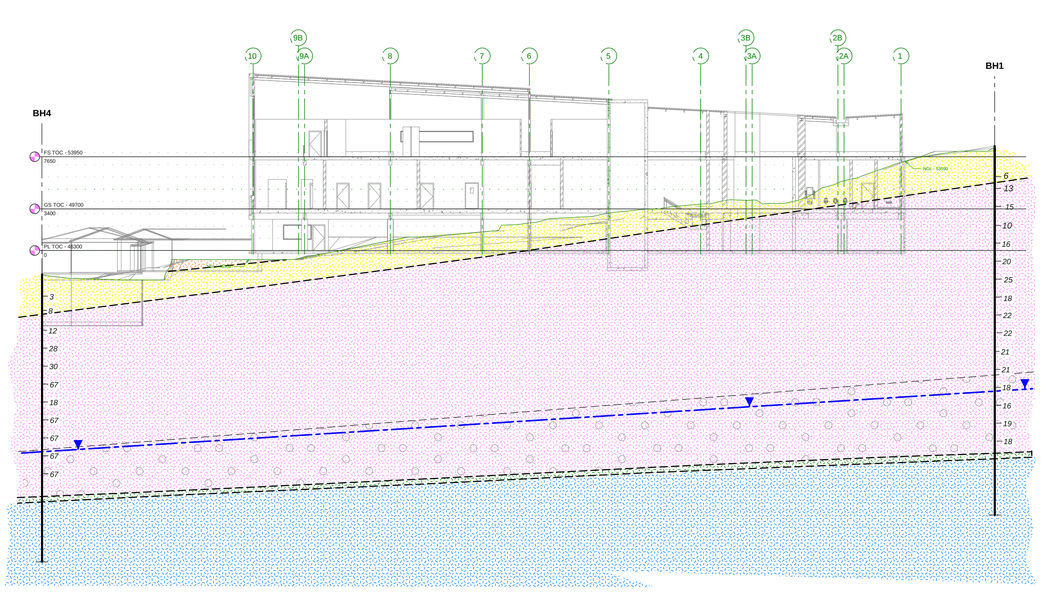
SECTION 1A - 10A



SECTION 1A - 1J



SECTION 1A - 10A



SECTION 1J - 10J

KEY

DUNE SAND DERIVED FILL - LIGHT GREY BROWN, ERY LOOSE, FINE GRAINED SAND.

DUNE SAND - PALE BROWN, VERY LOOSE TO LOOSE, FINE GRAINED SAND.

BEREA FORMATION - RED BROWN, PREDOMINATELY MEDIUM DENSE WITH ZONES OF DENSE AND LOCALISED LOOSE CONSISTENCIES, VERY SLIGHTLY CLAYEY SAND TO CLAYEY SAND.

BEREA FORMATION - RED BROWN BECOMING GREY PALE BROWN (LEACHED) MEDIUM DENSE TO DENSE, SLIGHTLY CLAYEY SAND CONTAINING TRACE (< 5%) QUANTITIES OF VERY WEAKLEY CEMENTED GRIT SIZED FERRICRETE NODULES (INDICATING A FLUCTUATING GROUNDWATER TABLE).

RESIDUAL TILLITE - OLIVE GREY, INFERRED VERY STIFF, GRAVELLY SANDY CLAY, MATERIAL IS BORDERLINE COMPLETELY WEATHERED EXTREMELY SOFT ROCK.

WEATHERED TILLITE - OLIVE DARK GREY, HIGHLY TO PREDOMINATELY MEDIUM WEATHERED, VERY CLOSELY TO PREDOMINATELY CLOSELY JOINTED, SOFT ROCK.

INFERRED GROUNDWATER TABLE

AH2/DCP6

APPROX. POSITION OF HAND AUGER & DYNAMIC CONE PENETROMETER TESTS FROM PREVIOUS 2011 GEOTECHNICAL INVESTIGATION

BH1

APPROX. POSITION OF BOREHOLES WITH SPT VALUES

NOTES

NO.	AMENDMENT	APPROVED	DATE

REVISIONS

CLIENT

DEPARTMENT OF HEALTH
C/O DEPARTMENT OF WORKS

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS & ENGINEERING GEOLOGISTS

eg. No. 2014/038872/07

DURBAN HEAD OFFICE
68 Peter Mokaba Ridge
Tollgate
4001
T: +27 31 201 8992

info@drennanmaud.com
www.drennanmaud.com

P.O. Box 20464
Mayville
4058
F: +27 31 201 7920

PROJECT

PORT SHEPSTONE HOSPITAL
NEW PSYCHIATRIC WARD

TITLE

INFERRED GEOLOGICAL CROSS SECTIONS

CONSULTING ENGINEER	DESIGNED :	K.G.
SIGNATURE:.....	DRAWN :	S.P.
PR. NO.:.....	CHECKED :	K.G.
DATE:.....	SCALE :	1:250
	DATE :	15-7-2022

DRAWING NO. **31319-G01-I1**

REVISION

Locality Plan

KEY

DCP1 APPROX. POSITION OF DYNAMIC CONE PENETROMETER TESTS

BH1 APPROX. POSITION OF BOREHOLES

AH1 APPROX. POSITION OF AUGER HOLES

10A 1J APPROX. POSITIONS OF GEOLOGICAL CROSS SECTIONS

LEGEND
NEW MENTAL HEALTH UNIT
COURTYARDS
HVAC PLANT ROOM
FUTURE PARKING GARAGE & NEW FACILITIES
SITE OFFICE

Description: Erven 203, 204, 210 and 1591 Port Shepstone

Address : 7 Bazley Street, Port Shepstone

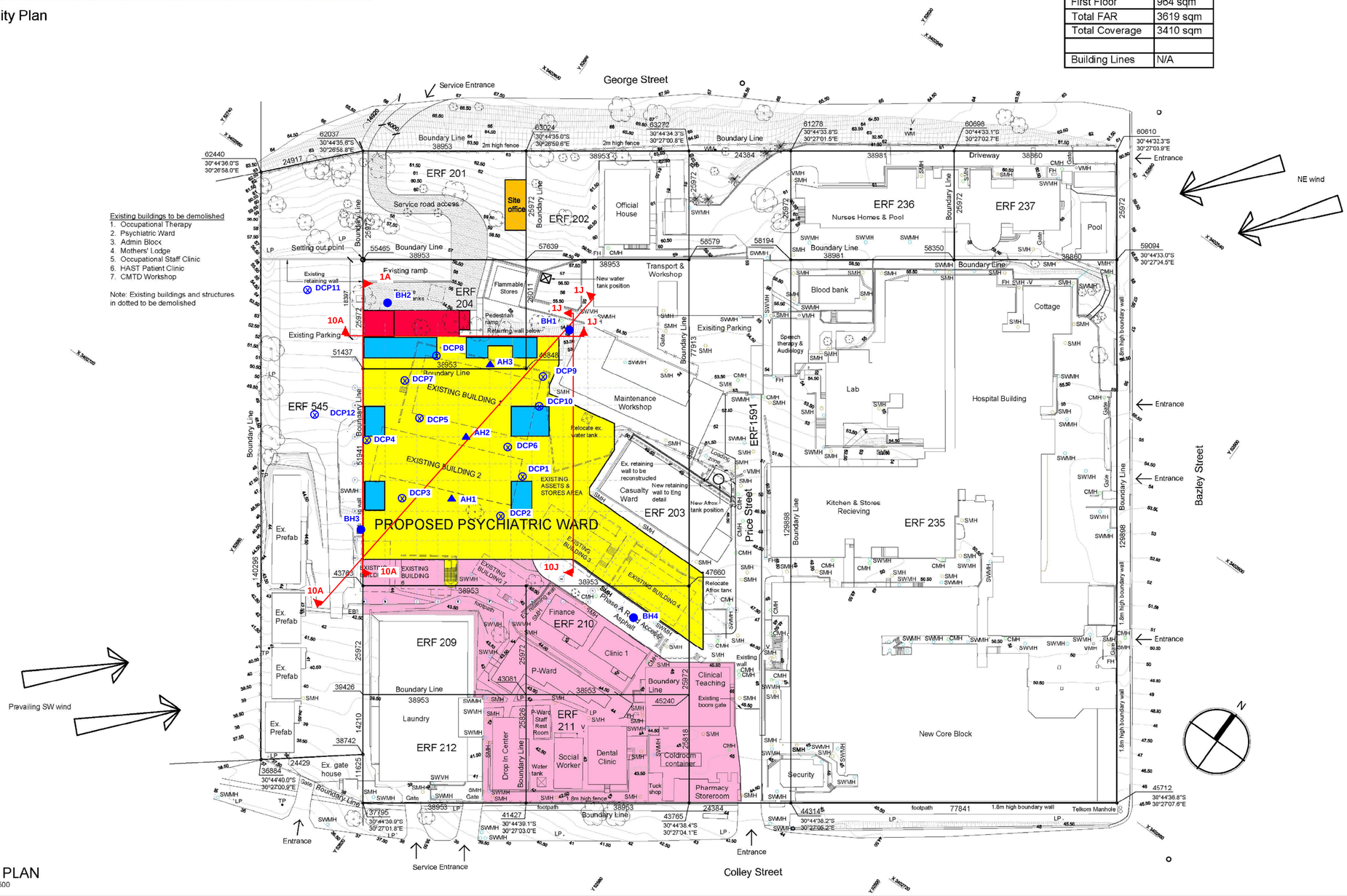
Site Description	Area
ERF 203	5059 sqm
ERF 204	1012 sqm
ERF 210	1012 sqm
ERF 1519	3800 sqm
Total	10883 sqm
Full Site Area	3,1552 he
Permitted Areas	
FAR	N/A
Coverage	N/A
Proposed Areas	
Parking Level	3224 sqm
Ground Floor	2655 sqm
First Floor	964 sqm
Total FAR	3619 sqm
Total Coverage	3410 sqm
Building Lines	N/A

Services Legend	
FH	Fire hydrant
CMH	Cable manhole
V	Valve
VMH	Valve manhole
EB	Electrical box
LP	Light pole
TP	Telephone pole
WM	Water meter
SMH	Sewer manhole
SWMH	Stormwater manhole

No.	Description	Date	By
A	Information only	17.02.2016	SG
A	For purpose of discussion	23.02.2016	SG
B	Adjusted retaining wall to be 700mm inclusive of finish. Passage door positions revised.	24.02.2016	SG
C	Increased size of basement parking. Adjusted DB positions. Increased size of lift.	15.03.2016	SG
D	Updated Structure	30.05.2016	SG
E	Service access revised.	25.09.2018	WP
F	Service entrances, circulation and site office & yard added.	14.01.2019	WP
G	Service access relocated.	12.03.2019	WP
H	Site service entrance adjusted. Entrance gate added. Fencing for hoarding added.	09.10.2019	WP
A2	New layout as per Clinical brief	17.09.2021	WP
A3	New layout as per Clinical brief	27.09.2021	WP
A4	HVAC Plant room size increased.	28.09.2021	WP
	Service road access & pedestrian ramp added.	01.10.2021	WP
	Site office added.	05.10.2021	WP
A5	List of existing buildings to be demolished added.	15.10.2021	WP
A6	Co-ordinates added to corner beacons. Sewer & stormwater manholes shown. Entrance points indicated. Boundary wall & fence heights added.	16.11.2021	WP
A7	Setting out point added from Grid A1	21.01.2022	WP
A8	Building footprint updated.	07.03.2022	WP
A9	New position of Afrox tank & water tank added. Chiller Plant Room updated. New retaining wall behind Casualty Ward added.	12.05.2022	WP

Existing buildings to be demolished
1. Occupational Therapy
2. Psychiatric Ward
3. Admin Block
4. Mothers' Lodge
5. Occupational Staff Clinic
6. HAST Patient Clinic
7. CMTD Workshop

Note: Existing buildings and structures in dotted to be demolished



SITE PLAN
SCALE 1:500

NO.	AMENDMENT	APPROVED	DATE

REVISIONS

CLIENT

DEPARTMENT OF HEALTH
C/O DEPARTMENT OF WORKS

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS & ENGINEERING GEOLOGISTS

eg. No. 2014/038872/07

DURBAN HEAD OFFICE
68 Peter Mokaba Ridge
Tollgate
4001
T: +27 31 201 8992

info@drennanmaud.com
www.drennanmaud.com

P.O. Box 20464
Mayville
4058
F: +27 31 201 7920

PROJECT

PORT SHEPSTONE HOSPITAL
NEW PSYCHIATRIC WARD

TITLE

SITE PLAN

CONSULTING ENGINEER	DESIGNED : K.G./S.G.
SIGNATURE:.....	DRAWN : S.P.
PR. NO.:.....	CHECKED : K.G.
DATE:.....	SCALE : NOT TO SCALE
	DATE : 15-7-2022

DRAWING NO. **31319-G02-I1**

REVISION

APPENDIX B

Standardised Specification : Soil Nails

DRENNAN MAUD (PTY) LTD

GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
Incorporating Drennan Maud & Partners (Est.1975)

Reg. No. 2014/038872/07

Durban Head Office
68 Peter Mokaba Ridge, Tollgate, 4001
P.O. Box 30464, Mayville 4058
T: +27 31 201 8992 F: +27 31 201 7920

info@drennanmaud.com
www.drennanmaud.com

Margate Office
Unit 7 Gayridge Business Park No. 2
13 Wingate Avenue, Margate 4275
T: +27 39 3122 588 F: 0866 0275 53

Our Ref.: 31319-AppB

13th August 2024

STANDARDISED SPECIFICATION : SOIL NAILS

This document has been prepared with reference to the COLTO Standard Specifications for Road and Bridge Works for State Road Authorities, Section 7500 and the British Standard Code of Practice for Ground Anchorages, BS 8081:1989.

1. SCOPE

This Specification pertains to; the supply, installation, construction, and testing of the following components of the required lateral support:

- Soil Nails

2. DEFINITIONS

Rock bolts / soil nails / anchors are permanent installations manufactured from a high-yield deformed bar of specified diameter and length, fully column-bonded with resin or cement grout, equipped with a face plate, washer and hemispherical or hexagon nut attached to the protruding end of the steel bar. (The use of resin or cement grout for column-bonding shall be at the Contractor's discretion, unless specifically detailed.) Greased-sleeve free lengths, and ribbed-sheath fixed lengths are often required.

3. GENERAL REQUIREMENTS

3.1 Protective Measures

Protective measures are the precautions which the Contractor must take to avoid any damage to the existing structures and materials below and within the work area as a result of the movement of plant and other construction activities required to undertake the soil nailing operations or any

other reason related to the Contractor's construction activities in this regard.

If any element of the lateral support system is damaged or becomes ineffective due to any cause, it shall be repaired or replaced. Such repair or replacement of damaged or ineffective lateral support elements shall be carried out by the Contractor without additional payment.

3.2 Access to Construction Area

Drive on access for the Contractor's plant, equipment, materials and other resources will be available. However, the Contractor is to coordinate with Others to construct bench working platforms from which to carry out the works. A top-down procedure is envisaged.

3.3 Inspections by Engineer

Excavation beyond/below (soil nail) installation level will only be undertaken once the soil nails have been tested and written approval of the Engineer has been obtained. The Contractor will give the Engineer at least 48hr advance notice of any inspection required.

The Contractor shall make available suitable equipment together with a qualified operator with which the specialist representative of the Engineer can be brought to within half a metre of any part of the surface of the slope.

4. MATERIALS AND EQUIPMENT

4.1 Materials for Rock Bolts / Soil Nails / Anchors

All soil nails shall be hot-rolled, continuously-threaded, high-tensile steel bars which comply with the requirements of SABS 920. 'Threadbars' shall be used in areas of anticipated 'favourable' geology. Self-drilling Hollow Anchors (SDA) shall be used in areas of anticipated 'adverse' geology (that is; in collapsible and/or saturated soils, clays, boulder horizons, etc.). All soil nails shall be corrosion protected as follows;

- Threadbar: Hot-dip galvanising to SANS 763/ISO 1461 (minimum 85µm)
- SDA: Thermal zinc diffusion (minimum 45µm) to SANS 53811.2006

*The free-length of the anchor to be encased in a greased sleeve.

The anchors shall be supplied with 200x200x10mm steel faceplates, washers, and hemispherical or hexagon nuts with sufficient capacity to resist the loads to which they will be subject. All faceplates, washers and nuts shall be galvanised to SANS 763/ISO 1461.

In general, the design of the lateral support system shall be based on the following.

Table 1. Design Data (DYWIDAG-SYSTEMS INTERNATIONAL, *GEWI* Threadbar System)

Bar Diameter (mm)	**Cross-sectional Area** (mm²)	**Tensile Strength** f_t (N/mm²)	**Ultimate Tensile Force** F_t (kN)	**Maximum Test Load** WL_{150} (kN)	**Maximum Working Load** WL (kN)
16	210	550	111	83	**55**
20	314	550	173	130	**87**
25	491	550	270	203	**135**
32	804	550	442	332	**221**

Notes: 1. $WL_{150} = 0.75F_t$ for geotechnical applications.
2. $WL_{150} = 1.5WL$

Table 2. Design Data (DYWIDAG-SYSTEMS INTERNATIONAL, *DYWI* Drill Hollow Bar System)

Bar Diameter (mm)	**Cross-sectional Area** (mm²)	**Load at Yield** F_y (N/mm²)	**Ultimate Tensile Force** F_t (kN)	**Maximum Test Load** WL_{150} (kN)	**Maximum Working Load** WL (kN)
R32-210	340	160	210	158	**105**
R32-250	370	190	250	188	**125**
R32-280	410	220	280	210	**140**
R32-320	470	250	320	240	**160**
R32-360	510	280	360	270	**180**
R32-400	560	330	400	300	**200**
R38-420	660	350	420	315	**210**
R38-500	750	400	500	375	**250**
R38-550	800	450	550	413	**275**

Notes: 1. $WL_{150} = 0.75F_t$ for geotechnical applications.
2. $WL_{150} = 1.5WL$

5. MANUFACTURE

5.1 Materials for Rock Bolts / Soil Nails / Anchors

Soil Nails shall be manufactured from high yield, deformed bar to the diameter indicated in the design drawing. The bar length specified shall be the required length of bar to be bonded to the

geological profile, and due extra allowance in the cutting length shall be made for any length (including the threaded portion protruding from the geological profile) as required for installation. The bar shall be threaded with a course thread which shall not reduce the overall specified bar diameter.

Faceplates shall be 200mm square, 10mm thick, load-indicating type, with working load carrying capacities as specified. Hemispherical and hexagon nuts shall also be manufactured to suit this loading requirement.

Hot-dip galvanising of soil nails and soil nail accessories is required.

6. HOMING AND GROUTING

6.1 Drilling

Holes for soil nails shall be drilled to a diameter of at least 130mm and to the angle indicated in the design drawing. Any drilling machine or procedure may be employed that can produce a stable hole that is of adequate dimension (within the permitted tolerance) and free of obstructions in order to freely accommodate the soil nail and grout.

The drilling method shall be such as to keep disturbance of the surrounding ground to a minimum and shall also ensure that drilling or flushing does not give rise to excessive loss of ground when compared to the nominal volume of the drill hole. The general geology is detailed in the Specification to which this document is attached. The Contractor shall have all the relevant equipment (bits, casings, etc.) available to drill efficiently in areas of both anticipated ‘favourable’ and ‘adverse’ geology.

Localised distortions such as sudden change of drill hole section or deviation from the straight shall not be permitted. Particular care in this respect is required when advancing the hole with handheld machines and extension steel.

After each hole has been drilled to its full length and flushed out by compressed air and water to remove all loose materials, the hole shall be probed to ensure that no collapse has occurred and that it has been cleaned over its full length. The hole shall be plugged immediately after drilling to prevent debris from entering.

6.2 Soil Nail Insertion

6.2.1 *Procedure*

The soil nails are to be fitted with non-metallic spacers and homed centrally in the holes and grouted for the full drill-hole length. There shall be free lengths (greased sleeves) for all soil nails as indicated in the design drawings, and ribbed sheaths for all ‘Threadbar’ anchors. The soil nail

must not protrude more than 150mm from the slope face on completion and shall be tensioned to a load specified by the Engineer.

6.2.2 *Tolerances*

Permissible deviations (PD) appropriate to the degree of accuracy required shall be applied to linear dimensions, position, verticality and level. The range of permissible deviation is given as follows:

- Diameter of Drill Hole PD of diameter of hole from specified diameter (PD = ± 5mm).
- Alignment PD of alignment of hole from that specified (PD = ± 5°).
- Length of Drill Hole PD of length of drill hole from that specified (PD = ± 100mm).
- Face Excavation as specified on drawings (PD = ± 50mm).

6.2.3 *Records*

During the drilling operations, all changes in penetration rate and changes in ground type shall be recorded together with notes on water levels encountered, drilling rates, flushing losses or gains, and stoppages.

The Contractor shall, notwithstanding the above, notify the Engineer immediately of any ground conditions encountered contrary to that indicated in the Specification to which this document is attached. The Contractor shall further record the date, times during which each hole is drilled, the soil material encountered at various depths in the drill hole, and the subsequent date on which the soil nails are grouted and installed. The Contractor shall submit these records to the resident engineer daily for approval and measurement purposes.

On completion, the Contractor is to submit an As-Built face drawing and the completed Quality Control Sheets with the Soil Nail Numbers referenced to the Quality Control Sheets. A typical Quality Control Sheet is attached to this document.

6.3 Grouting

6.3.1 *Procedure*

All soil nails shall be grouted the full length, as indicated in the design drawing. Grouting may be either by way of ordinary cement grouting with or without additives, or by using cement or resin cartridges all as approved by the Engineer. The holes must be filled by pressure-grouting (that is; pumped into the hole and filled from the base up). The Contractor shall ensure that whatever method he proposes to use, the grout cover to the soil nail is continuous and completely fills the annular space between the soil nail and wall of the hole. In the case of a high water table and potential hole collapse it is likely to be necessary to install a temporary casing, to be retracted as the grout is injected. Special precaution is required in this regard with respect to hole collapse,

the possible shrinkage of cement grouts upon setting, and the mixing of resin or cement filled cartridges respectively.

If, for any reason, grouting is interrupted and/or the installation of the soil nail is delayed beyond the setting period of the grout, the soil nail shall be removed from the hole. The grout shall then be removed by flushing or re-drilling, and the soil nail homing and grouting stages repeated.

The Contractor shall provide the Engineer with a method statement of his proposed method of grouting. The Contractor will be required to prove to the satisfaction of the Engineer the effectiveness of his proposed method. In particular the Contractor shall demonstrate to the Engineer that he is able to comply with the requirements of these specifications before approval will be given by the Engineer for the Contractor to proceed with his proposed method. It is integral that all soil nails are grouted from the base of the hole up.

Soil nail pull-out tests will be undertaken on 100% of all soil nails installed. The work associated with these trials shall be measured and paid for at the rates tendered for. Trials which are unsuccessful and/or, in the opinion of the Engineer, do not meet the requirements of the Specification will not be measured or paid for.

All soil nails are to be locked off at 75% of the working load for temporary structures and 90% of the working load for permanent soil nails once a grout strength of 25MPa (minimum) is achieved. The contractor must provide the necessary jacking equipment to achieve these lock off loads.

6.3.2 *Cement Grout*

Only Portland cement complying with SABS ENV 197-1 CEM-1 and which is less than one month old shall be used. The temperature of the cement shall be less than 40°C.

Fine aggregate shall consist of siliceous granules, finely ground limestone or very fine sand. It shall pass a 0.600mm sieve and shall be subject to the approval of the Engineer. The aggregate content in the grout shall not exceed 30% of the mass of the cement.

Admixtures shall not be used in the grout without the approval of the Engineer. Admixtures shall be free of any product liable to damage the steel or the grout itself, such as halides, nitrates, sulphides, sulphates, etc. The amount of admixture to be used shall be in accordance with the manufacturer's instructions. If groundwater/seepage is encountered, the Contractor will need to use a suitable curing agent additive to assist concrete curing below the water table. A suitable example product is CHRYSO Aquabeton. The mixed grout shall have the following properties:

- C1-ions content shall not exceed 750mg per litre.
- The viscosity shall be between 500 cP and 2500 cP. The viscosity, 20 minutes after mixing, shall not exceed 2 500 cP.
- Bleeding at 20°C shall not exceed 2% by volume, 3 hours after mixing, and the maximum bleeding shall not exceed 4%. In addition, the separated (bleed) water shall be

reabsorbed after 24 hours.

- The compressive strength of 100mm cubes made of the grout and cured in a moist atmosphere for the first 24 hours and thereafter in water at 20°C shall exceed 20MPa at 7 days and 35 MPa at 28 days.

6.3.3 *Resin Grout*

Resin grout shall comply with the recommendations of BS 8081 and be prepared and applied in accordance with the manufacturer's prescription.

A sufficient number of cartridges shall be used to ensure the annulus around the soil nail is completely full over the full length of the hole.

End cartridges for the anchorage zone shall be of fast-setting resin whilst the column shall be filled with slow-setting resin or cement cartridges. Tensioning shall be carefully controlled to ensure that it takes place after setting of the end cartridges but prior to commencement of setting of the column grout.

Those parts of the soil nails due to be grouted or surrounded with mortar or epoxy resin shall be cleaned of grease, oil, loose rust, or other matter that may impair the bond.

7. TESTING

7.1 Soil Nail Pull-out Tests

The Engineer will require the Contractor to undertake routine soil nail pull-out tests to demonstrate that the soil nails are able to resist the working loads specified. 100% of the soil nails installed will be tested after a minimum grout strength of 25MPa is achieved. The soil nails will be tested to 125% of the working load for temporary soil nails and 150% for permanent soil nails.

The tests will be undertaken with a suitably light hydraulic jack fitted with a dial gauge which can be read to an accuracy of 0.1kN. The jack and dial gauge will be required to be calibrated by an accredited laboratory approved by the Engineer at the commencement of the project, and again whenever this may be required by the Engineer. The certificate of calibration must be submitted to the Engineer for his acceptance.

All pull-out tests must be undertaken in the presence of and to the satisfaction of the Engineer. Table 2 below outlines the pull-out test procedure.

Table 2. Recommended Load Increments & Minimum Periods of Observation for On-site Pull-out Tests

Permanent Soil Nails			Temporary Soil Nails		
Loading Increments		Minimum Period of Observation	Loading Increments		Minimum Period of Observation
25%	Working Load	5min	25%	Working Load	5min
50%	Working Load	5min	50%	Working Load	5min
75%	Working Load	5min	75%	Working Load	5min
100%	Working Load	5min	100%	Working Load	5min
125%	Working Load	5min	125%	Working Load	5min
150%	Working Load	5min			

Should a soil nail fail a test, the Engineer will instruct the Contractor to either remove, re-drill and install the defective soil nail, or (if this is not possible) to drill and install a new soil nail at a position and at the orientation directed by the Engineer. This additional work will be undertaken at the Contractor's own expense. Payments for the soil nails which have been measured and subsequently found to be defective will be subtracted from the following payment certificate. The soil nail will be tested again once it has been re-installed/replaced. Once the Contractor has demonstrated that the soil nail can withstand the required load it will be re-measured for payment.

7.2 Tests on Cement Grouts

The fluidity of the grout shall be measured with a flow cone, immersion apparatus, or viscometer, as allowed. Test cubes of grout shall be made on site and the unconfined compressive strength thereof tested by an approved laboratory and the results submitted by the Contractor to the Engineer for his approval. The cost of all such tests shall form part of the Contractor's normal process control and shall be deemed to be included in his tendered rates and shall not be paid for separately.

8. MEASUREMENT AND PAYMENT

The cost of delays and disruption shall not be included under items for installation of lateral support elements. Such costs shall be deemed to be included in the relevant item for excavation.

8.1 Establishment on Site for Drilling

The tendered amount shall include full compensation for establishing on the site and subsequently removing all structural platforms, rafts and all special plant and equipment for drilling and for carrying out operations, the cost of which does not vary with the actual amount of drilling done.

This work will be paid for by way of a lump sum, 50% of which will become payable when all

equipment is on the site and the first hole has been drilled. The second instalment of 25% of the lump sum will be payable after half the total number of holes and the final instalment of 25% after all the holes have been drilled and the equipment has been removed from the site.

8.2 Moving to, and Setting Up the Equipment at Each Position for Drilling the Holes

The unit of measurement shall be the number of positions to which the installation equipment has to be moved and set up in position. The quantity measured shall be the number of holes drilled plus the number of holes re-drilled at the instruction of the Engineer, plus any holes provided in addition for load tests, which do not form part of a specific soil nail group.

The tendered rate shall include full compensation for all costs involved in moving and setting up any equipment.

8.3 Soil Nails

The unit of measurement shall be the number of effective soil nails installed and approved.

Any costs incurred due to soil nail installation delaying or disrupting the advance of the excavation shall be priced for by the Contractor under the soil nail items.

The rate tendered shall include full compensation for access to the slope, dismantling, moving, erecting and commissioning all plant, equipment and instruments required at each soil nail location.

The rate tendered shall include full compensation for the drilling of holes, temporary casing where necessary, supply and installation of the soil nails, and grouting of the annulus. The rate shall also include for undertaking the required pull-out tests, lock-off loading of all bars, and providing the Engineer with access to the slope face. This item shall be paid for only after the entire soil nailing operation has been completed and approved by the Engineer.

A motivated Variation Order will be required in the event that a suitable curing agent additive is necessary to assist concrete curing in areas of seepage or below the water table following consultation with/approval by the geotechnical professional.

APPENDIX C

Standardised Specification : Sprayed Concrete

DRENNAN MAUD (PTY) LTD

GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
Incorporating Drennan Maud & Partners (Est.1975)

Reg. No. 2014/038872/07

Durban Head Office
68 Peter Mokaba Ridge, Tollgate, 4001
P.O. Box 30464, Mayville 4058
T: +27 31 201 8992 F: +27 31 201 7920

info@drennanmaud.com
www.drennanmaud.com

Margate Office
Unit 7 Gayridge Business Park No. 2
13 Wingate Avenue, Margate 4275
T: +27 39 3122 588 F: 0866 0275 53

Our Ref.: 31319-AppC

13th August 2024

STANDARDISED SPECIFICATION : SPRAYED CONCRETE

This document has been prepared with reference to the COLTO Standard Specifications for Road and Bridge Works for State Road Authorities.

1. SCOPE

This Specification pertains to; the supply, installation, construction, and testing of the following components of the required lateral support:

- Welded Mesh Reinforcement
- Sprayed Concrete / Gunite / Shotcrete
- Subsoil Drains
- Wick Drains

2. DEFINITIONS

2.1 **Welded Mesh Reinforcement** comprises an integrated steel wire mesh that is laid in adjoining panels across a slope face to restrict the occurrence of rock fall or soil debris from the slope.

2.2 **Sprayed Concrete / Gunite / Shotcrete** comprises a wet* mix of coarse sand and cement that is sprayed onto the surface of a slope and allowed to set. The sprayed concrete is reinforced with steel mesh.

* Gunite is a dry concrete mix that mixes with water at the nozzle. Shotcrete refers to wet, fully-mixed concrete sprayed onto a final surface. (The use of gunite or shotcrete shall be at the Contractor's discretion, unless specifically detailed.)

2.3 **Subsoil Drains** comprise a 100mm diameter perforated geo-pipe in a 19mm crushed stone bedding wrapped in geotextile; the purpose of which is to intercept, collect and convey

groundwater away from the toe of the sprayed concrete wall.

2.4 **Wick Drains** comprise a high density polyethylene open structure grid that is cut to suit to the required width and wrapped in a light, non-woven geotextile to intercept subsurface water from behind the sprayed concrete wall and convey it to the toe of the wall where it is discharged into weepholes.

3. GENERAL REQUIREMENTS

3.1 Protective Measures

Protective measures are the precautions which the Contractor must take to avoid any damage to the existing structures and materials below and within the work area as a result of the movement of plant and other construction activities required to undertake the drapery activities or any other reason related to the Contractor's construction activities in this regard.

If any element of the lateral support system is damaged or becomes ineffective due to any cause, it shall be repaired or replaced. Such repair or replacement of damaged or ineffective lateral support elements shall be carried out by the Contractor without additional payment.

3.2 Access To Construction Area

Drive on access for the Contractor's plant, equipment, materials, and other resources will be available. However, the Contractor is to coordinate with Others to construct bench working platforms from which to carry out the Works. A top-down procedure is envisaged.

3.3 Inspections by Engineer

The installation of the welded mesh will only be undertaken once the stabilisation of the cut slope has been carried out by the installation of the required lateral support and written approval of the Engineer has been obtained. Once this has been completed the Contractor is in a position to proceed with the drapery work. The Contractor will give the Engineer at least 48 hours advance-notice of any inspection required.

The Contractor shall make available suitable equipment, together with a qualified operator, with which the specialist representative of the Engineer can be brought to within half a metre of any part of the surface of the slope.

4. MATERIALS AND EQUIPMENT

4.1 Welded Mesh Reinforcement (Drape Mesh)

Welded mesh reinforcement to be Mesh Ref. 245, comprising steel fabric to SABS 1024 utilising wire with the following characteristics.

- Wire diameter 6.3mm with tolerances as per SANS 675:1997.
- Tensile strength between 350-575 N/mm2 according to SANS 675:1997.
- Elongation not less than 10% (when carried out on a sample at least 25 cm long) in accordance with EN 10223-3.

The mesh shall be galvanized to SANS 935 and securely fixed at an optimum distance from the excavation/cut face for the application process such as to minimise sprayed concrete rebound and prevent voids. It shall be secured to the lateral support by means of 6mm diameter steel pins of suitable length set at a minimum of 1m centres so as to be drawn tight against the lateral support.

The minimum cover between the mesh and the exposed face of the sprayed concrete shall be 25mm, or greater cover if ordered by the engineer. The mesh shall be set at a normal distance of 50mm from the excavation/cut face. Joins shall be lapped by 2 full squares.

4.2 Gunite

The term 'gunite' will be used for sprayed concrete where the maximum aggregate size is less than 9.5mm, and the term 'shotcrete' where the maximum aggregate size is 9.5mm or greater.

Sprayed concrete may be applied by either a wet- or dry-mix process. The sprayed concrete (after completion) is not to be touched up, troweled, smoothed off, or worked in any way, but left undisturbed unless otherwise specified. The Engineer may direct that sprayed concrete be applied to the cut face as soon as possible after excavation. Areas to be treated shall be agreed with the Engineer prior to application.

Sprayed concrete shall be applied to the mesh reinforced excavation/cut face and to the final thickness or as specified on the drawings. Large radius irregularities will be permitted but local roughness and re-entrant angles are to be covered. Where specified by the Engineer sprayed concrete shall be applied in one or more layers to reach the specified total thickness.

4.2.1 *Materials*

4.2.1.1 *Cement, Cement Extenders and Water*

Cement, cement extenders, and water shall comply with the requirements of the COLTO Standard Specifications, Section 6400.

Silica fume shall comply with the requirements of SABS 1491, Part 3.

4.2.1.2 *Aggregates*

Aggregates shall comply with the requirements of the COLTO Standard Specifications, Section 6400 except with regard to the grading requirements given in Table 1. The combined aggregates shall normally lie within the following grading limits by mass. Aggregates with a grading outside these limits will not be accepted unless the contractor has demonstrated in full-scale trials that a satisfactory end product can be produced with such aggregates.

Table 1. Aggregate Grading Limits

Sieve Size (mm) ASTM	Percentage Passing	
	Gunite	Shotcrete
13.20		100
9.504		90 - 100
4.75	100	75 - 100
2.36	80 - 100	55 - 90
1.18	50 - 85	40 - 70
0.60	25 - 60	20 - 70
0.30	10 - 30	10 - 25
0.15	2 - 10	4 - 12

4.2.1.3 *Accelerators*

Accelerators shall not be caustic or corrosive to reinforcements and it shall be of a type with a history of satisfactory long-term performance. Reference shall be obtained from suppliers and submitted to the Engineer for approval.

4.2.1.4 *Compressed Air*

Compressed air used in the process shall be clean, dry, and free of oil.

4.2.1.5 *Steel Fibres*

Steel fibres shall comply with ASTM 820 - Standard Specifications for Steel Fibre for Fibre Reinforced Concrete or such other Standard acceptable to the Engineer. A minimum fibre tensile strength of 1000 MPa is required.

Steel fibres shall be Type I deformed or equivalent diameter 0.5 mm and aspect ratio of 40 to 80 or such type acceptable to the Engineer. The length of fibre should not exceed 70% of the internal

diameter of the hose or pipes to prevent blockage.

4.2.2 *Design of Sprayed Concrete*

Sprayed concrete shall meet the requirements of Table 2. The mix design shall be carried out by the Contractor and details thereof submitted to the Engineer.

The mixers for sprayed concrete shall lie within the following proportions:

- Cementitious content (kg/m^3) 330 - 450
- Aggregate/cement ratio 3.00 - 5.00
- Water/cement ratio 0.35 - 0.45
- Silica fume (kg/m^3) where required 30 - 50
- Steel Fibre (kg/m^3) where required 30 - 40

Water/cement ratio is defined as the mass of the free water in the mix divided by the total mass of the cementitious mixture in the mix.

Where the use of an accelerating admixture is required, the amount used shall be within the limits recommended by the Manufacturer but shall not exceed 4% by mass of total cementitious context unless the Contractor can satisfy the Engineer that the five-year strength is not detrimentally affected. In the case of the cement containing fly ash, the advice of the Manufacturer of the additive (and the cement if necessary) shall be sought before the Engineer will approve the use of the accelerating admixture. Minimum admixture should be used to obtain the specified early strength appropriate to the conditions.

In addition, the Engineer reserves the right at any time during the process of the work to instruct the Contractor to vary the proportions of the constituents of the sprayed concrete mix or order further trial applications to ensure that adequate densities and high early strengths are maintained.

Table 2. Sprayed Concrete Performance Requirements

Sprayed Concrete Class		**A**	**B**	**C**	**D**
Mix Description	**Test Method**	**P**	**Steel Reinforcement**	**Steel Reinforcement + Accelerator**	**Pla + Accelerator**
Equivalent Cube Strength					
MPa @ 8hr	SABS	N/A	N/A	5	5
MPa @ 24hr		N/A	N/A	9	9
MPa @ 28day		35	35	35	35
Peak Flexural Strength					
MPa @ 28day	ASTM C1018	3.5	4.0	4.0	4.0
Residual Flexural strength					
MPa @ 28day	ASTM C1018	N/A	3.2	3.2	N/A
Toughness Index					
1_{20} @ 28day	ASTM C6642	N/A	16	16	N/A
1_{30} @ 28day		N/A	22	22	N/A
1_{50} @ 28day		N/A	30	30	N/A
Boiled Absorption					
% Vol. of Permeable Voids	ASTM C403	8	8	9	9
% @ 7day		17	17	19	19
Setting Time					
Initial set, min	BS EN 196-3	N/A	N/A	3	3
Final set, min		N/A	N/A	9	9

Notes: 1. The above values are all "minimum" acceptable limits, except for boiled absorption and volume of permeable voids, which are "maximum" acceptable limits.
2. N/A indicates "non-applicable"

4.2.3 *Acceptance Testing*

Prior to commencement of spraying concrete in the works testing shall be carried out by the Contractor are as follows.

4.2.3.1 Test panels shall be constructed in the presence of the Engineer for each mix design. Cores shall be cut from the panels and three cores tested at each

specified strength requirement. The average of the three results tested at 24 hours and 28 days shall not be less than the 24hr and 28day specified strengths respectively. In addition, the values of each core tested shall be within 20% of the average value.

4.2.3.2 Sufficient testing to prove the acceptability of the sprayed concrete to meet the requirements with regard to:

- Boiled absorption.
- Volume of permeable voids.
- First crack and ultimate tensile strength.
- Toughness index.

4.2.4 *Equipment*

All equipment used for batching and mixing of the materials and the application of sprayed concrete shall be of approved design and in proper working order. The sprayed concrete gun and ancillary equipment shall be of adequate capacity for the volume to be applied. The equipment shall be capable of handling and applying 1 mm maximum size of aggregate. A standby gun and ancillary equipment shall be available at all times. Air for the equipment is to be provided at the equipment at not less than the operating pressure specified by the Manufacturer.

Dosing of additive by hand will not be permitted. Equipment for dosing of additives shall be adjustable for various quantities and provide a uniform rate of discharge evenly mixed with the other ingredients of the mix. The equipment shall be capable of delivering admixture to ensure the approved dosage ratio to an accuracy of ±5%.

Protective clothing and dust masks shall be provided for and used by all sprayed concrete Operators.

4.3 Subsoil Drains

Subsoil drains are supplied in lengths of 6m or rolls of 50m with couplings; Flopipe (or equal approved) is recommended and has the following characteristics.

- Outside diameter of 110mm
- Infiltration area > 5000mm2/m
- Ring stiffness > 450kPa

The subsoil drain shall be laid with the yellow marker on top ensuring correct positioning.

4.4 Wick Drains

Wick drains comprising a Flownet (or equal approved) shall be manufactured from an HDPE polymer with a tensile yield strength of 21MPa. The overall thickness of the HDPE grid when manufactured shall not be less than 4mm under 2KPa pressure with a rate of flow of not less than 150l/s/m^2 when sandwiched between two plates of glass applying a confining pressure of not less than 200kPa.

The wick drain shall comprise 2 layers of Flownet (or equal approved) wrapped in a non-woven polyester geotextile manufactured from continuous needlepunched filaments. The mass of the geotextile shall not be more than 200g/m^2.

5. MANUFACTURE

5.1 Manufacture of Sprayed Concrete

Materials shall be batched by mass and cement shall not be added more than one hour before the anticipated time of placing the sprayed concrete unless the use of a retarder has been approved by the Engineer. Mixed ingredients shall be placed before the initial set of the cement has taken place. Aged materials shall be discarded.

Feed systems for all materials are to be interconnected such that the correct proportions are maintained irrespective of feed rate and if one feed stops the whole plant stops.

Batching and mixing equipment shall be cleaned at least once per shift to prevent accumulations of aged material.

6. HOMING AND GROUTING

6.1 Welded Mesh

Ref. Mesh 245 (galvanized) is supplied in sheets or rolls which need to be cut on site to suit. The cut panels are fastened to each other and positioned prior to fixing.

6.2 Guniting

6.2.1 *Preparation of Surfaces*

Before sprayed concrete is applied, checking and correction of the excavated cross-section profile shall be carried out. The surfaces to which sprayed concrete is to be applied are to be barred down of all loose material and the area cleaned down of all loose and foreign material with a

mixture of water and air applied at high pressure (where applicable). All surfaces to receive sprayed concrete shall be moist and free of all traces of dirt, oil, rebound or other deleterious material.

Where sprayed concrete is to be placed over a previous layer, the layer shall be first allowed to reach its initial set and then cleaned of all rebound or other loose material to the approval of the Engineer.

Sprayed concrete shall not be applied to any surface without the prior inspection and approval of the Engineer.

The cost of wastage as a result of rebound and slump shall form part of the Contractor's normal process control and shall be deemed to be included in his tendered rates and shall not be paid for separately.

6.2.2 Placing

Sprayed concrete shall be placed in accordance with good practice as detailed in AC 1- 506R-85 Guide to Shotcrete except that with silica fume sprayed concrete it is usually possible to build up relatively thick layers in a single pass.

Where necessary freshly sprayed concrete shall be protected from rain or water until the surface is of sufficient hardness to prevent damage.

There shall be no inclusion of rebound in the finished work, any hollow areas, good adherence to the excavated/cut face and a reasonably smooth surface finish. Rebound shall be kept clear of sprayed concrete being placed.

The minimum specified layer thickness shall be controlled by depth pins attached to the lateral support surface and reinforcement, or by other approved means.

Before a succeeding layer is placed the existing work shall be checked for hollow or non-adhering areas and these shall be cut out and replaced to the satisfaction of the Engineer.

Construction joints in the layer shall be formed at 45° to the face and precautions shall be taken to prevent weak and unsightly edges at construction joints. If necessary, timber strips may be temporarily fixed in place to give a neat, strong edge. Before placing the adjoining work the edge shall be cleaned and thoroughly wetted.

6.2.3 Curing

The use of a sprayed surface curing compound will not be permitted. The sprayed concrete shall be kept moist continuously for three days by spraying with a fine mist of water at intervals not exceeding four hours.

6.2.4 Operators for Sprayed Concreting

Only trained and tested Operators shall be used for sprayed concreting operations. The Contractor shall satisfy the Engineer that the personnel are capable of doing work of a high standard prior to any sprayed concrete work being undertaken in the Works. For this purpose each nozzleman and backup team shall carry out a series of trial applications in the presence of the Engineer to demonstrate their ability in applying sprayed concrete on vertical surfaces. Test panels as described above shall be made by each Operator. No Operator will be approved unless the 28 day crushing strength of all tests exceeds the design requirements.

The engineer may at any time withdraw his approval of personnel if the quality of sprayed concrete applied falls below the specified standard.

6.3 Wick Drain

The wick drains shall be supplied to site complete with 2 layers of Flownet 500HP (or equal approved) wrapped in a non-woven geotextile and shall not be more than 100mm in width. The wick drain shall be placed behind the mesh and secured to the excavated/cut face to prevent slippage prior to application of sprayed concrete.

Wick drains to be installed on the excavated/cut face as per the design drawings behind the drape mesh. Wick drains to extend the full height of the slope to intercept subsurface water from behind the gunite wall and convey it to the foot of the wall where it is discharged into weepholes.

7. TESTING

7.1 Sprayed Concrete

7.1.1 *Checking of Applied Thickness*

The thickness of applied sprayed concrete shall be checked by the Contractor by means of randomly positioned test holes. An acceptable procedure for these test holes shall be such that, on average, in any 100m² area of sprayed concrete area at least 10 test holes shall be drilled with a percussion drill where directed by the Engineer.

The Contractor may drill additional holes if he wishes at points intermediate to those located by the Engineer.

The basis of acceptance shall be that in any area of 100m² the arithmetic mean thickness of all the points checked shall be equal to or greater than the specified thickness. In addition at no point checked shall the thickness be less than 70% of the specified thickness. When the thickness is not acceptable, the Engineer may order an additional layer of sprayed concrete to be applied and rechecked for thickness without additional payment until the placed thickness is acceptable.

7.1.2 *Routine Testing*

On average, one test panel shall be made and tested by the Contractor on each shift when sprayed concrete is applied. Such test panels shall be prepared by the nozzleman when doing the work during normal sprayed concreting operations for the first 50m cubed of sprayed concrete applied in each heading. Test panels shall be prepared and tested for each 10 m cubed applied.

Test panels are to be made and sprayed into modules 750mm x 450mm x 200mm deep with sides sprayed onwards at 45° to prevent the entrapment of the rebound. Panels shall be placed against the side wall. Panels shall be clearly marked to identify the time and date of spraying and the area where they were sprayed. Subject to satisfactory test results the testing frequency may be reduced at the discretion of the Engineer.

7.1.3 *Testing of Sprayed Concrete*

For acceptance and routine testing, 100 mm diameter cores of a length between 110mm and 150mm after the ends are cut and trimmed shall be drilled from test panels by the Contractor. The remainder of the test panel shall be broken up to provide samples for density testing. The panels shall be field cured in the same manner as the work, after which the Contractor shall deliver the panels to the laboratory where the panels shall be cured in water as specified in SABS Method 865.

Three cores shall be cut and tested for compressive strength at 3 or 7 and 28 days as directed by and in the presence of the Engineer. The compressive strength shall be corrected to the equivalent cube strength by multiplying the estimated actual strength, determined as set out in SABS 865, by a factor of 1.20.

In places where the thickness of the sprayed concrete layers are such that it will be possible to cut out 100mm test cores, the Engineer may specify that such cores be cut out for testing.

Three samples each shall be tested at 7 days for volume of permeable voids and boiled absorption (density tests).

For the purpose of sampling and testing sprayed concrete the contractor shall supply all the panel moulds and core sampling equipment.

7.1.4 *Failure of Sprayed Concrete*

For the purpose of routine testing the quality of the sprayed concrete will be considered satisfactory if every test result is at least 80% of the specified result and if at least 80% of all results exceed the specified result.

Should test samples of sprayed concrete not achieve the specified minimum result, the Engineer will (if necessary) order that additional test be carried out by the Contractor to determine new mix proportions and/or application methods to avoid further such failures. If the Engineer considers

that the low test results of the applied sprayed concrete may reduce the safety of the Works and personnel or be detrimental to the effectiveness of the support, he may order that the following action is taken.

7.1.4.1 Remove the defective sprayed concrete in strips or panels in such a way that the safety of the Works and personnel is not endangered and replace with sprayed concrete that is acceptable (which may also require the replacement of mesh), or

7.1.4.2 Apply an additional thickness of sprayed concrete not exceeding the thickness originally required.

In either case no payment will be made for the defective sprayed concrete already applied, nor for the work involved in removing it from the areas where it has been applied, nor for any mesh that must be replaced, including additional laps, nor for any work involved in removing the resultant rubble and spoiling it at an approved spoil dump. Payment will only be made for that sprayed concrete placed as specified.

8. MEASUREMENT AND PAYMENT

The cost of delays and disruption shall not be included under items for installation of lateral support elements. Such costs shall be deemed to be included in the relevant item for excavation.

8.1 Welded Mesh Reinforcement

The unit of measurement shall be the square meter for the drape mesh and all other incidentals required to complete the work to the Engineer's details. The rate tendered shall be full compensation for all labour, plant, material and everything necessary to install and fix the drape mesh to the slope in the required location as specified.

8.2 Establishment (Sprayed Concrete)

The tendered lump sum shall include full compensation for establishment on the site and subsequent removal of all structural platforms, rafts and all special plant and equipment for the application of sprayed concrete and for carrying out operations, the cost of which does not vary with the actual amount of sprayed concrete applied.

This work will be paid for by way of a lump sum, 50% of which will become payable when all the equipment is on the site and the first sprayed concrete has been applied. The second installment of 25% of the lump sum will be payable after half the application of sprayed concrete and the final installation installment of 25% after completion of the sprayed concrete and the equipment has been removed from the site.

6.3 Sprayed Concrete

The unit of measure of sprayed concrete will be the net area measured on the theoretical cross-section profile given on the drawings at the specified thickness, and is to include for all wastage, and up to 50mm overbreak.

The rate tendered for application of sprayed concrete for the thicknesses specified shall include for all work required for the preparation of surfaces and application of sprayed concrete, all materials including rebound, cleaning and disposal of rebound, thickness control measures, drilling of holes for checking thickness, all design testing and routine testing.

All costs incurred due to sprayed concrete delaying or disrupting the advance of the excavation shall be priced for by the Contract under the sprayed concrete items.

6.4 Install and Fix Wick Drains

The unit of measurement shall be to cover the square meter wall face with 100mm wide wick drains complete with 2 layers of HDPE open structure grid, wrapped in a non-woven geotextile and all other incidentals required to complete the work to the Engineer's detail. The rate tendered shall be full compensation for all labour, plant, material and everything necessary to supply, cut, wrap, install and fix the Flownet wick drain to drape over the complete face of the slope to tie into the subsoil drain. The rate tendered shall include the outlet drainage weepholes.

APPENDIX D

Piling Record : Contiguous Piled Wall
Piling Record : Foundation Piles
Soil Nail Quality Control Sheet
Pull-out Test Record : Soil Nail Type 1
Pull-out Test Record : Soil Nail Type 2

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
T: +27 31 201 8992
Reg. No. 2014/038872/07

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - CONTIGUOUS PILED WALL

PILE				LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Pile Base	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
P100	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				All information regarding obstructions and any other information regarding interruptions and delays in the sequence of work. Any circumstance that would effect load-carrying capacity.
P101	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P102	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P103	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P104	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P105	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P106	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P107	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P108	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P109	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P110	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P111	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P112	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P113	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P114	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P115	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P116	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P117	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P118	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P119	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P120	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P121	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P122	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P123	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P124	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P125	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P126	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P127	CFA	600	41 550	48 470	0.580		7.5		7	Y25	7.5	R8-300	35				
P200	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P201	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P202	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P203	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P204	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P205	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P206	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P207	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P208	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P209	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P210	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P211	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P212	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P213	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P214	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P215	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P216	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P217	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P218	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P219	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
T: +27 31 201 8992
Reg. No. 2014/038872/07

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - CONTIGUOUS PILED WALL

PILE				LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Pile Base	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
P220	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P221	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P222	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P223	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P224	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P225	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P226	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P227	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P228	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P229	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P230	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P231	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P232	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P233	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P234	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P235	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P236	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P237	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P238	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P239	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P240	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P241	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P242	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P243	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P244	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P245	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P246	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P247	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P248	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P249	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P250	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P251	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P252	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P253	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P254	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P255	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P256	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P257	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P258	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P259	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P260	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P261	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P262	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P263	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P264	CFA	700	36 855	52 775	0.580		16.5		8	Y25	16.5	R8-300	35				
P300	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P301	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P302	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
T: +27 31 201 8992
Reg. No. 2014/038872/07

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - CONTIGUOUS PILED WALL

PILE				LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Pile Base	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
P303	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P304	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P305	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P306	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P307	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P308	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P309	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P310	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P311	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P312	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P313	CFA	700	38 000	50 920	0.580		13.5		8	Y25	13.5	R8-300	35				
P408	CFA	600	37 000	50 920	0.580		14.5		7	Y20	14.5	R8-240	35				
P400	CFA	600	37 000	50 920	0.580		14.5		7	Y20	14.5	R8-240	35				
P401	CFA	600	37 000	50 920	0.580		14.5		7	Y20	14.5	R8-240	35				
P402	CFA	600	37 000	50 920	0.580		14.5		7	Y20	14.5	R8-240	35				
P403	CFA	600	37 000	50 920	0.580		14.5		7	Y20	14.5	R8-240	35				
P404	CFA	600	37 000	50 920	0.580		14.5		7	Y20	14.5	R8-240	35				
P405	CFA	600	37 000	50 920	0.580		14.5		7	Y20	14.5	R8-240	35				
P406	CFA	600	37 000	50 920	0.580		14.5		7	Y20	14.5	R8-240	35				
P407	CFA	600	37 000	50 920	0.580		14.5		7	Y20	14.5	R8-240	35				
P500	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P501	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P502	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P503	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P504	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P505	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P506	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P507	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P508	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P509	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P510	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P511	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P512	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P513	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P514	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P515	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P516	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P517	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P518	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P519	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P520	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P521	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P522	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P523	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P524	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P525	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P526	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P527	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				

DRENNAN MAUD (PTY) LTD

GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS

T: +27 31 201 8992

Reg. No. 2014/038872/07

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - CONTIGUOUS PILED WALL

PILE				LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Pile Base	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
P528	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P529	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P530	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P531	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				
P532	CFA	500	40 000	47 420	0.580		8.0		6	Y20	8.0	R8-240	35				

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
T: +27 31 201 8992
Reg. No. 2014/038872/07

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - FOUNDATION PILES

PILE			LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
B5p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				All information regarding obstructions and any other information regarding interruptions and delays in the sequence of work. Any circumstance that would effect load-carrying capacity.
B5p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B5p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B6p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B6p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B6p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B8p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B8p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B8p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B9p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B9p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B9p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
C2p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
C2p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
C2p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
C3p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
C3p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
C3p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
C9p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
C9p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
C9p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
D9p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
D9p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
D9p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
E2p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
E2p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
E2p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
E9p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
E9p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
E9p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
F2p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
F2p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
F2p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
F10ap1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
F10ap2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
F10ap3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
H5ap1	CFA	450	44 275	0.575		13.5		7	Y16	10.5	R8-190	25				
H5ap2	CFA	450	44 275	0.575		13.5		7	Y16	10.5	R8-190	25				
H5ap3	CFA	450	44 275	0.575		13.5		7	Y16	10.5	R8-190	25				
M13p1	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
M13p2	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
M13p3	CFA	450	45 125	0.575		13.5		7	Y16	10.5	R8-190	25				
B3p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
B3p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
B3p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
B3p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C5p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				

Reg. No. 2014/038872/07

DRENNAN MAUD (PTY) LTD

GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS

T: +27 31 201 8992

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - FOUNDATION PILES

PILE			LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
C5p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C5p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C5p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C6p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C6p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C6p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C6p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C8p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C8p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C8p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
C8p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D3p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D3p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D3p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D3p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D5p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D5p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D5p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D5p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D6p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D6p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D6p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D6p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D8p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D8p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D8p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
D8p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E3p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E3p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E3p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E3p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E5p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E5p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E5p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E5p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E6p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E6p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E6p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E6p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E8p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E8p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E8p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
E8p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F3p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F3p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F3p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F3p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
T: +27 31 201 8992
Reg. No. 2014/038872/07

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - FOUNDATION PILES

PILE			LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
F5p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F5p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F5p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F5p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F6p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F6p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F6p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F6p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F8p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F8p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F8p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F8p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F9p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F9p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F9p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
F9p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G6p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G6p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G6p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G6p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G8p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G8p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G8p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G8p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G9p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G9p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G9p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
G9p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
H6p1	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
H6p2	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
H6p3	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
H6p4	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
H8p1	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
H8p2	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
H8p3	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
H8p4	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
H9p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
H9p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
H9p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
H9p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
M12p1	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
M12p2	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
M12p3	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
M12p4	CFA	450	44 225	0.625		13.5		7	Y16	10.5	R8-190	25				
N12p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
N12p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
N12p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
N12p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
T: +27 31 201 8992
Reg. No. 2014/038872/07

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - FOUNDATION PILES

PILE			LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
O12p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
O12p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
O12p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
O12p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
P13p1	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
P13p2	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
P13p3	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
P13p4	CFA	450	45 075	0.625		13.5		7	Y16	10.5	R8-190	25				
A10p	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
M15p	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
N15p	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
O15p	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
Q15p	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
A6p1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
A6p2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
A7p1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
A7p2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
A8p1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
A8p2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
A10ap1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
A10ap2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
B10ap1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
B10ap2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
B10bp1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
B10bp2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
C10ap1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
C10ap2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
D10bp1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
D10bp2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
E10ap1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
E10ap2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
L13p1	CFA	350	44 425	0.425		11.0		5	Y16	9.0	R8-190	25				
L13p2	CFA	350	44 425	0.425		11.0		5	Y16	9.0	R8-190	25				
L14p1	CFA	350	44 425	0.425		11.0		5	Y16	9.0	R8-190	25				
L14p2	CFA	350	44 425	0.425		11.0		5	Y16	9.0	R8-190	25				
P12p1	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
P12p2	CFA	350	45 275	0.425		11.0		5	Y16	9.0	R8-190	25				
A9p1	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
A9p2	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
A9p3	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
E10bp1	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
E10bp2	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
E10bp3	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
L12p1	CFA	350	44 425	0.425		10.0		7	Y12	9.0	R8-140	25				
L12p2	CFA	350	44 425	0.425		10.0		7	Y12	9.0	R8-140	25				
L12p3	CFA	350	44 425	0.425		10.0		7	Y12	9.0	R8-140	25				
B2p1	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
B2p2	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
T: +27 31 201 8992
Reg. No. 2014/038872/07

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - FOUNDATION PILES

PILE			LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
B2p3	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
B2p4	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
D2p1	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
D2p2	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
D2p3	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
D2p4	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
N13p1	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
N13p2	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
N13p3	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
N13p4	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
O13p1	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
O13p2	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
O13p3	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
O13p4	CFA	350	45 275	0.425		10.0		7	Y12	9.0	R8-140	25				
LSp1	CFA	450	43 925	0.925		14.0		7	Y16	10.5	R8-190	25				
LSp2	CFA	450	43 925	0.925		14.0		7	Y16	10.5	R8-190	25				
LSp3	CFA	450	43 925	0.925		14.0		7	Y16	10.5	R8-190	25				
LSp4	CFA	450	43 925	0.925		14.0		7	Y16	10.5	R8-190	25				
LSp5	CFA	450	43 925	0.925		14.0		7	Y16	10.5	R8-190	25				
LSp6	CFA	450	43 925	0.925		14.0		7	Y16	10.5	R8-190	25				
LSp7	CFA	450	43 925	0.925		14.0		7	Y16	10.5	R8-190	25				
LSp8	CFA	450	43 925	0.925		14.0		7	Y16	10.5	R8-190	25				
SCp1	CFA	350	45 025	0.675		10.5		7	Y12	9.00	R8-140	25				
SCp2	CFA	350	45 025	0.675		10.5		7	Y12	9.00	R8-140	25				
SCp3	CFA	350	45 025	0.675		10.5		7	Y12	9.00	R8-140	25				
SCp4	CFA	350	45 025	0.675		10.5		7	Y12	9.00	R8-140	25				
SCp5	CFA	350	45 025	0.675		10.5		7	Y12	9.00	R8-140	25				
SCp6	CFA	350	45 025	0.675		10.5		7	Y12	9.00	R8-140	25				
SCp7	CFA	350	45 025	0.675		10.5		7	Y12	9.00	R8-140	25				
SCp8	CFA	350	45 025	0.675		10.5		7	Y12	9.00	R8-140	25				
RW6p1	CFA	350	45 475	0.225		11.0		5	Y16	9.00	R8-190	25				
RW6p2	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW6p3	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW6p4	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW7p1	CFA	350	44 625	0.225		10.0		7	Y12	9.00	R8-140	25				
RW7p2	CFA	350	44 625	0.225		10.0		7	Y12	9.00	R8-140	25				
RW7p3	CFA	350	44 625	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p1	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p2	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p3	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p4	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p5	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p6	CFA	350	45 475	0.225		11.0		5	Y16	9.00	R8-190	25				
RW8p7	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p8	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p9	CFA	350	45 475	0.225		11.0		5	Y16	9.00	R8-190	25				
RW8p10	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p11	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				

Reg. No. 2014/038872/07

DRENNAN MAUD (PTY) LTD

GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS

T: +27 31 201 8992

Project №:	WIMS 044044 / 31319	**Project Name:**	New Psych. Ward, PS Hospl.
Client:	DOH c/o DOPW	**Contractor:**	
Contract №:		**Foreman:**	
Weather conditions:			
		Signature:	
		Date:	

PILING RECORD - FOUNDATION PILES

PILE			LEVELS					REINFORCEMENT				CONCRETE				NOTES
Name / №	Type	Ø (mm)	Cut-off	Trim (m)	Groundwater (bel. EGL)	Pile Length (m)	Soil Sample №	№ bars	Ø	Cage length (m)	Links	Strength (Mpa)	Batch № / Date Cast	Volume (m^3)	Cube №	
RW8p12	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p13	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				
RW8p14	CFA	350	45 475	0.225		10.0		7	Y12	9.00	R8-140	25				

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
T: +27 31 201 8992
Reg. No. 2014/038872/07

Project №:	31319	**Project Name:**	New Psych Ward, PS Hospital
Client:	eThekwini Municipality	**Contractor:**	
Contract №:	WIMS 044044	**Foreman:**	
Weather conditions:		**Signature:**	
		Date:	

SOIL NAIL QUALITY CONTROL SHEET

REFERENCE					INSTALLATION					GROUT						LOAD TEST			NOTES
Name / №	Bar Type	Bar Ø (mm)	Design Length (m)	Installation Inclination (°)	Date Installed	Material Encountered (soil/rock)	Sample №	Hole/Drill Depth (m)	Hole Ø (mm)	Date Grouted	Volume of Grout (ℓ/m³)	Flow Test time (s)	Strength (MPa)	Cube №	Cement Manufacture Date	Test Date	Result	Approved by Engineer	
A100	*DYWI* SDA	32-250	15.0	15					130				35						All information regarding obstructions and any other information regarding interruptions and delays in the sequence of work. Any circumstance that would effect load-carrying capacity e.g. groundwater, hole collapse, etc.
A101	*DYWI* SDA	32-250	15.0	15					130				35						
A102	*DYWI* SDA	32-250	15.0	15					130				35						
A103	*DYWI* SDA	32-250	15.0	15					130				35						
A104	*DYWI* SDA	32-250	15.0	15					130				35						
A105	*DYWI* SDA	32-250	15.0	15					130				35						
A106	*DYWI* SDA	32-250	15.0	15					130				35						
A107	*DYWI* SDA	32-250	15.0	15					130				35						
A108	*DYWI* SDA	32-250	15.0	15					130				35						
A109	*DYWI* SDA	32-250	15.0	15					130				35						
A110	*DYWI* SDA	32-250	15.0	15					130				35						
A111	*DYWI* SDA	32-250	15.0	15					130				35						
A112	*DYWI* SDA	32-250	15.0	15					130				35						
A113	*DYWI* SDA	32-250	15.0	15					130				35						
A114	*DYWI* SDA	32-250	15.0	15					130				35						
A115	*DYWI* SDA	32-250	15.0	15					130				35						
A116	*DYWI* SDA	32-250	15.0	15					130				35						
A117	*DYWI* SDA	32-250	15.0	15					130				35						
A118	*DYWI* SDA	32-250	15.0	15					130				35						
A119	*DYWI* SDA	32-250	15.0	15					130				35						
A120	*DYWI* SDA	32-250	15.0	15					130				35						
A121	*DYWI* SDA	32-250	15.0	15					130				35						
A122	*DYWI* SDA	32-250	15.0	15					130				35						
A123	*DYWI* SDA	32-250	15.0	15					130				35						
A124	*DYWI* SDA	32-250	15.0	15					130				35						
A125	*DYWI* SDA	32-250	15.0	15					130				35						
A126	*DYWI* SDA	32-250	15.0	15					130				35						
A127	*DYWI* SDA	32-250	15.0	15					130				35						
A128	*DYWI* SDA	32-250	15.0	15					130				35						
A129	*DYWI* SDA	32-250	15.0	15					130				35						
A200	*DYWI* SDA	32-210	12.0	25					130				35						
A201	*DYWI* SDA	32-210	12.0	25					130				35						
A202	*DYWI* SDA	32-210	12.0	25					130				35						
A203	*DYWI* SDA	32-210	12.0	25					130				35						

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS

Reg. No. 2014/038872/07

T: +27 31 201 8992

PULL-OUT TEST RECORD SHEET

Project №: 31319
Client: DoH c/o DoPW
Contractor:
Foreman:

Signature:
Date:

Project Name: New Psychiatric Ward, Port Shepstone Hospital
Contract №: WIMS 044044

Witnessed by:

Signature:
Date:

Soil Nail Name / № A1--

Working Load WL (kN) = 120

Step	Loading (%)	Applied Load (kN)	Applied Pressure (Mpa)	Hold Time (min)	Bar Elongation (mm)	Jack Deflection into Ground (mm)
1	25	30		5		
2	50	60		5		
3	75	90		5		
4	100	120		5		
5	125	150		5		

The system shall be deemed to have failed if rapid or movements in excess of 30mm occur.

Lock-off Load 90%WL (kN) = 108

DRENNAN MAUD (PTY) LTD
GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS

Reg. No. 2014/038872/07

T: +27 31 201 8992

PULL-OUT TEST RECORD SHEET

Project №: 31319
Client: DoH c/o DoPW
Contractor:
Foreman:

Signature:
Date:

Project Name: New Psychiatric Ward, Port Shepstone Hospital
Contract №: WIMS 044044

Witnessed by:

Signature:
Date:

Soil Nail Name / № A2--

Working Load WL (kN) = 88

Step	Loading (%)	Applied Load (kN)	Applied Pressure (Mpa)	Hold Time (min)	Bar Elongation (mm)	Jack Deflection into Ground (mm)
1	25	22		5		
2	50	44		5		
3	75	66		5		
4	100	88		5		
5	125	110		5		

The system shall be deemed to have failed if rapid or movements in excess of 30mm occur.

Lock-off Load 90%WL (kN) = 79