

# DRENNAN MAUD (PTY) LTD

GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS

Incorporating Drennan Maud & Partners (Est.1975)



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Our Ref: 34223-Rev1

Your Ref:

12<sup>th</sup> June 2024

Gibb c/o Ramcon  
Unit 1A, Windsor Court  
4 Derby Place, Derby Downs  
WESTVILLE  
3629

Attention: Sharona Thakor

Email: [sharona@ramcon.co.za](mailto:sharona@ramcon.co.za)

Dear Madam/Sir,

## GEOTECHNICAL INVESTIGATION FOR THE DURBAN LIFTING SHED EXTENSION AND UPGRADE

### 1. INTRODUCTION AND TERMS OF REFERENCE

Following the tender submitted by Drennan Maud (Pty) Ltd, in response to the RQF document GIBB-J42000\_06/GI for provision of consulting services for the “Durban Lifting Shed Extension and Upgrade: Geotechnical Investigations”. Drennan Maud (Pty) Ltd submitted a work proposal and cost estimate to Gibb/Ramcon in our document Ref 91, dated 12<sup>th</sup> April 2024.

The geotechnical investigation was carried out over several days during May 2024, and in compliance with the scope of works as set out in the tender brief, comprised coring of concrete hardstand/floor-slabs/asphalt, hand auger excavations, dynamic cone penetrometer testing and material sampling for laboratory testing purposes.

The scope of the field investigation and findings thereof along with geotechnical assessment of the prevailing subsoil conditions are recorded below in this factual report.

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## 2. SUPPLIED / AVAILABLE INFORMATION

In addition to the RFQ document which indicated the number and approximate location of the various field test positions, information supplied for the purpose of the assessment included the following:

- P19711: PRASA Durban Lifting Workshop Topographic Survey (Ground Survey) Report dated, 14<sup>th</sup> December 2023.
- A 1:500 scale survey plan of the PRASA Durban Lifting Workshop (Drawing No. BFL295/2023).

The supplied ground survey drawing was used as the site plan for this report, included herewith as Drawing 34223-01, and indicates the GPS coordinated positions of the field tests.

The various structures/areas within the Prasa facility earmarked for development/upgrade along with the proposed respective renovations is summarized below;

- |  |   |
|--|---|
| <b>Lifting Shed:</b>                           | - New train inspection pits to be installed to unknown depth below floor level.                 |
|  | - Ensure forklift compatibility within Lifting shed.  |
| <b>Lifting Shed (RHS) Extension:</b>           | - 30m extension to existing building with forklift compatibility.                               |
|  | - New 50T overhead gantry crane installed with extra height requirement.                        |
| <b>Storage Building (LHS) of Lifting Shed:</b> | - Renovations to existing buildings for combined new structure with forklift compatibility.     |
| <b>Chemical Storage Building:</b>              | - Upgrade of existing structure along with forklift compatibility.                              |
| <b>Office Building:</b>                        | - Renovations to existing double volume structure including new mezzanine floor and lift shaft. |
| <b>Wash Facility:</b>                          | - Small wash building structure to be constructed along with possible drainage measures.        |

Drennan Maud (Pty) Ltd, formerly Drennan Maud and Partners, has carried out numerous investigations in the general vicinity including the Durban Station and Moses Mabhida Station. As such, information available from relevant nearby investigations was also reviewed as part of the current assessment.

In addition to the above available information, eThekweni GIS data base and Google Earth information was reviewed as part of the current assessment.

### 3. SCOPE OF WORKS

As per RFQ document the scope of works within each of the above-mentioned testing areas included the following;

- |  |   |
|--|---|
| <b>Concrete coring:</b>                          | <ul style="list-style-type: none"><li>- Determine the thickness and condition of the concrete.</li><li>- Obtain concrete core samples for UCS testing</li><li>- Reinstate floor slab upon completion of testing.</li></ul>                                      |
| <b>Dynamic Probe Super Heavy (DPSH) Testing:</b> | <ul style="list-style-type: none"><li>- Determine the consistency of the underlying soils to a depth of 5.0m depth.</li></ul>   |
| <b>Hand auger Excavations:</b>                   | <ul style="list-style-type: none"><li>- Determine the subsoil conditions underlying the site including problem soils, groundwater level and for material sampling.</li></ul>  |
| <b>Laboratory Testing:</b>                       | <ul style="list-style-type: none"><li>- Laboratory testing including Foundation Indicator, Atterberg Limits, Moisture Content, CBR, Mod AASHTO density and Corrosivity of selected representative materials along with UCS testing of concrete cores.</li></ul> |
| <b>Analysis and Reporting:</b>                   | <ul style="list-style-type: none"><li>- Compile geotechnical factual report along with all field-testing data.</li></ul>  |

Further to an initial meeting with Gibb engineer, it was agreed that the number of proposed concrete cores as per RFQ document was to be reduced (approximately halved), whilst DPSH testing was to be substituted with Dynamic Cone Penetrometer (light) testing, provided it was coupled with re-driving during testing.

4. SITE DESCRIPTION

The PRASA Durban Lifting Shed facility is located some 3km north-north east of the Durban CBD, it situated to the immediate south west of the Moses Mabhida stadium and accessible from Masabalala Yengwa Avenue near the Durban Station to the south of the site. The approximate centroid GPS coordinates of the facility and assessment area are as follows; 29°49'53.12"S; 31°01'41.07"E.

The area was originally occupied by an estuarine or delta environment prior to reclamation and development in the early 1900's, where the land in general was reclaimed by hydraulic pumping of fill to build the land to its current elevation.

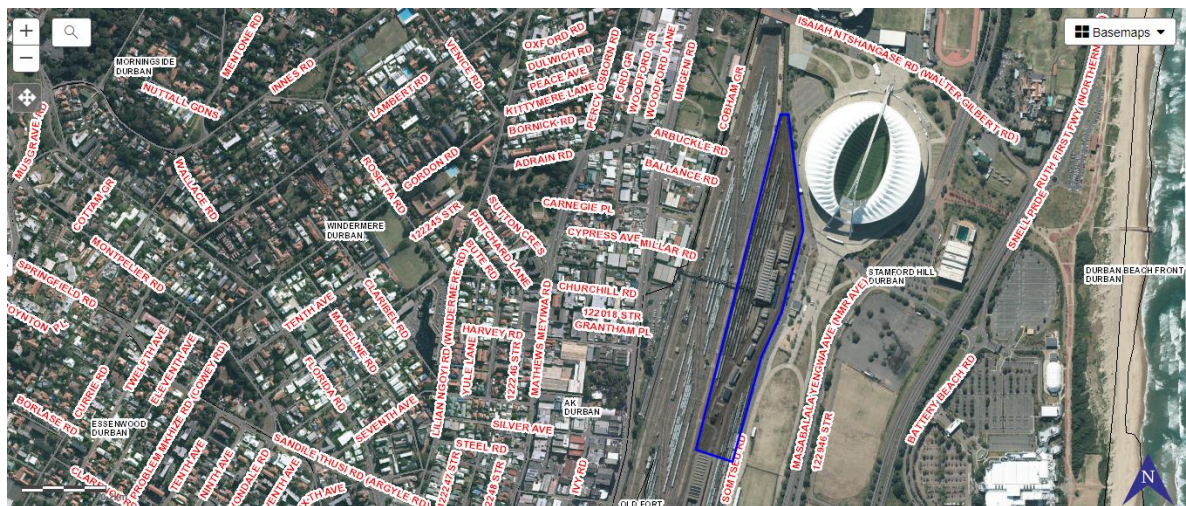


Figure 1: Location and extent of Prasa Lifting Shed facility (outline in blue) relative to Moses Mabhida Stadium.



Figure 2: Location/extent of proposed renovation areas/testing areas (outlined in yellow) within the Prasa Facility.

The site is currently occupied by storage structures, office buildings, lifting shed/workshop, rails/tracks, decommissioned locomotives, parking bays and associated access roads for vehicles. The layout of the premises (outlined in blue) can be seen in Figures 1 and 2 below, with the various assessment areas earmarked for renovations/additions outlined in yellow in Figure 2.

## 5. FIELD INVESTIGATION

The field investigation was carried out over the course of the 16<sup>th</sup>, 17<sup>th</sup>, 21<sup>st</sup> and 24<sup>th</sup> May 2024 and comprised coring and subsequent reinstatement of the existing hardstand/asphalt, hand auger excavations, dynamic cone penetrometer testing and sampling of representative materials for laboratory testing.

The locations of the field testing within the respective development areas were determined/set out by Ramcon representative during the initial hand-over meeting a site walk-over. The GPS co-ordinated locations of the field testing are shown on the site plan Drawing 34223-01, accompanying this report along with GPS coordinate table.

### 5.1 Concrete Coring

Coring of the existing concrete hardstand across the various development areas within the Prasa Facility to gain access to the underlying soils was undertaken at seventeen locations, designated Cores C1-C13, C15 and C17, with two cores (C14 and C16) within asphalt paved areas.

The 200mm diameter coring was carried out by independent contractor Holmes Cutting and Sawing under partial supervision by Drennan Maud (Pty) Ltd. Details of the concrete coring are included the Holmes reports included as Appendix C of this report and further discussed for ease of reference in Section 8 of this report.

### 5.2 Hand auger excavations

A total of twenty-one hand auger, designated AH1-21, were conducted across the assessment areas, with AH's 1-17 conducted within the corresponding cored voids (C1-17) to examine the subsoils underlying the proposed upgrades and extension.

Additional AH's 18 – 21 were conducted in various grassed areas in close proximity to the development areas. The hand augers progressed to depths ranging between 0.5m and 2.55m below surface level at which depth they were halted in very dense gravel material, on unknown obstructions at depth or due to poor recovery in saturated subsoils.

The subsoils removed from the auger holes were examined and logged by an Engineering Geologist in accordance with the Guidelines for Soil and Rock Logging in South Africa, edited by A.B.A Brink and R.M.H Bruin, 2<sup>nd</sup> Impression 2002.

The soil profiles and corresponding photographs are presented in Appendix A of this report.

### **5.3 Dynamic Cone Penetrometer (DCP) testing**

A total of nineteen DCP test, designated DCP 1-19, were carried out to determine the consistency of the subsoils underlying the assessment area, with DCP's 1-17 conducted within the corresponding cored voids, and additional DCP's 18-19 conducted in existing grassed areas surrounding the site.

As per request/instruction by Gibb engineer, the DCP testing involved driving a 25mm diameter 60° cone via 10kg hammer falling a distance of 450mm to full depth (5.40m) or refusal and recording the number of blows required to penetrate the probe a distance of 300mm. Thereafter, the rods were removed to surface level, and re-driven within the same void, recording the reduced blow count. The re-driving of the probes was conducted to determine the rod friction, and by subtracting from the initial penetration values determine the true point resistance and associated consistency of the soils.

The DCP probes were progressed to depths ranging between 0.55m and 5.4m below surface level, where not achieving the required 5.0m depth, this due to hard refusal in very dense gravel material (despite additional coring/hand chiselling efforts), or on unknown obstructions at variable depth.

The re-driven corrected DCP results are graphically presented in Appendix B of this report along with correlation table to aid in the interpretation of the DCP test results with regard to the correlation between number of hammer blows required to progress the probe a depth of 300mm, and the corresponding consistency of cohesive and non-cohesive materials. It should be noted that the table is based on the Drennan Maud (Pty) Ltd probe and should be used as a guide only.

In terms of the testing conducted with the cored voids across the site, Figure 3 below provides a summary of the depths achieved by hand auger excavations and DCP probes at each test position is provided in Figure 3.

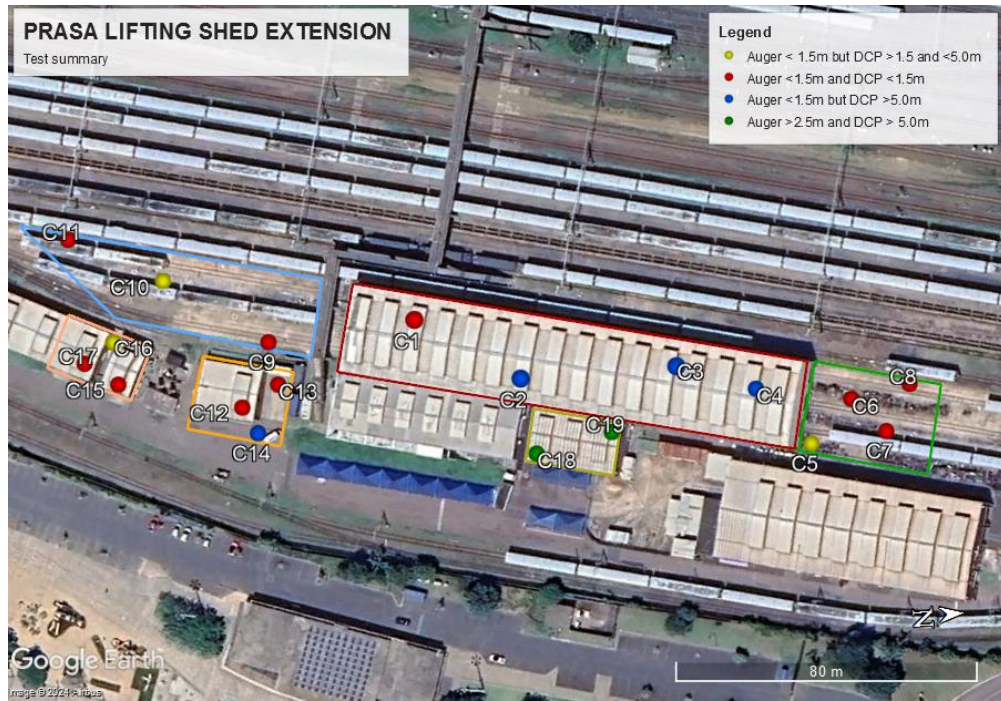


Figure 3: An overview of the depths reached by hand augers and DCP probes in each test position.

#### 5.4 Material Sampling

Concrete cores obtained on site were delivered to Contest in Westmead for Uniaxial Compressive Strength (UCS) testing.

Disturbed bulk/indicator samples were obtained from various representative soil horizons intersected within the auger holes and delivered to Thekwini Soils Laboratory for testing. The laboratory tests included the following:

- Full Grading Analysis (Particle Size Distribution and Atterberg Limits) (Ind)
- Mod AASHTO Dry Density (Mod)
- California Bearing Ratio (CBR)
- Natural Moist Content (NMC)

A schedule of the sampled materials and testing conducted thereon is included in Table 1 overleaf.

**Table 1: Summary of Sampled Materials and Laboratory Testing Schedule**

Position	Material Description	Depth (m)	Laboratory Testing				
			Ind	Mod	CBR	NMC	Corrosivity
<b>Lifting Shed</b>							
C2 - C4	Sandy Gravel	0.33/0.55 - 0.75/0.83	x	x	x		
<b>Proposed Wash Facility</b>							
C9 - C11	Sandy Gravel	0.17/0.23 - 0.52/0.65	x	x	x	x	x
C10	Clayey Sand	0.75 - 0.85	x			x	
<b>Chemical Storage &amp; Storage Building on LHS of Lifting Shed</b>							
C14-C16	Sandy Gravel	0.04/0.08 - 0.2/0.52	x	x	x	x	
C14-C16	Gravelly Sand	0.2/0.52 - 0.68/1.10	x	x	x	x	
C17	Gravelly Sand	0.18 - 0.40	x			x	
C17	Gravelly Sand	0.40 - 0.65	x			x	
<b>Office Building</b>							
C18-C19	Gravelly Sand	0.4/0.55 - 0.87/1.80	x	x	x	x	x
C18	Clayey Sand	1.80 - 2.55	x			x	x

It should be noted that given the limited size of the hand auger excavations, the materials deemed the same encountered within the various excavations within a specific were mixed to acquire the necessary amount of material required for testing.

The detailed laboratory test results summary along with Content UCS testing report are included in Appendix C of this report, and summarised for ease of reference in Section 7.

## 6. GEOLOGY, SOILS AND GROUNDWATER

### 6.1 Regional Geology

Review of the 1:50 000 scale Geological Series Map of Durban (2930) reveals that the Durban PRASA Lifting Workshop and the immediate surrounding areas are underlain by alluvial and estuarine deposits known colloquially as the 'Harbour Beds'. These unconsolidated sediments range from sands to clays to soft muds in places, being interstratified and characterised by variation both vertically and laterally which reflects their depositional environments.

From previous nearby investigations and in-house knowledge of the surrounding area, the unconsolidated sediment of the Harbour Beds is likely present to depths in the order of 10 - 12m below natural ground level where it overlies Cretaceous siltstone capping Pietermaritzburg Formation shale at depth.

As mentioned in Section 4, as part of the development of the general area surrounding the site area as a whole, various fill material was imported and hydraulically placed over the in-situ Harbour Beds to create building platforms to current ground levels which was in turn capped by engineered fill material associated with the development of the area (i.e. railway yards, road layerworks etc).

## 6.2 Prevailing Subsoil Profiles

The near surface subsoil conditions occurring below the various development areas within the Prasa Lifting shed facility, as encountered within the auger holes and inferred from DCP data, is summarised as follows;

### 6.2.1 Lifting Shed (AH/DCP 1 – 4)

Concrete coring within the Lifting Shed building revealed the upper floor slab to be consistently thick ranging between 150 to 170mm thick and locally thicker within Core 4 (200mm). Within Cores 1 and 3 only one concrete slab was encountered, whilst in Core 2 and Core 4, distinct additional slabs were encountered to a depth of 0.55m and 0.28m below floor level respectively.

Within the lifting shed the subsoil profiles encountered were somewhat variable. AH2 and AH4 were similar in the sense that below the thicker portions of concrete, yellow brown, dense to very dense, angular to subrounded, medium to coarse grained gravel in a matrix of slightly clayey fine to medium grained sand containing cobble/pebble sized ballast/hard rock fragments occurs. The gravel material occurs to depths of at least 0.75m and 0.83m below surface level, at which depth hand auger refusal was met despite hand chiseling/re-coring efforts to extend the holes.

In contrast to the above, AH1 revealed no such gravel material but rather horizons of red brown and grey brown, generally gravelly to clayey sand fill occurring to a maximum excavated depth of 1.04m where hand auger refusal was met on an unknown obstruction within the fill.

Lastly, AH 3 encountered a thin horizon of crushed stone aggregate directly below the concrete floor slab to a depth of 0.25m, it in turn underlain by very dark brown/grey, slightly clayey, gravelly sand fill to beyond the maximum excavated depth of 1.1m at which level hand auger refusal was met on an unknown obstruction in the fill.

In terms of the DCP results (refer to DCP results/summaries in Appendix B), with the exception of DCP1, the remaining DCP's within the lifting shed progressed to the required depth (5.0m) without meeting refusal, once the upper layerworks fill was partially re-cored/chiseled out.

DCP1 indicates medium dense to loose conditions in the upper sandy fill prior to abrupt refusal at similar depth to AH1 on an unknown obstruction.

With regards to DCP's 2-4, relatively variable consistency occurs within the upper gravel fill material to depths in the order of 1.8m, ranging between very loose to medium dense to dense, this likely due to variance in materials and possible re-coring efforts. However, below 1.8m the results reveal a somewhat similar consistency trend with medium dense conditions generally prevailing to depths ranging between 2.7 – 3.0m. Furthermore, below approximately 3m loose to occasionally very loose conditions occur in the underlying Harbour Beds sediment to beyond 5.1m depth, with the exception of DCP3 in which medium dense material occurs from 4.0-5.4m.

Whilst no groundwater seepage was encountered in any of the shallowly refusing auger holes, wet conditions noted on the DCP rods upon removal of DCP2 and DCP4 from approximately 2.4m depth are inferred to coincide with the water table. Furthermore, apparent ground water seepage into a nearby train inspection pit at a depth at approximately 2.5m further supports the inferred water table level.

In terms of the above, it is evident that a general profile of gravel fill to gravelly sandy fill occurs to depths in the order of 1.8m, and locally deeper, underlain by inferred medium dense to loose with depth sandy Harbour Beds sediment to in excess of 5.0m, the material being saturated below an inferred water table at approximately 2.4m.

### **6.2.2 Proposed Extension on RHS of Lifting Shed (AH/DCP5 – 8)**

Coring across the proposed extension area revealed the concrete hardstand to vary in thickness, ranging from 210mm to 280mm thick and comprising a single concrete slab in all cases.

AH5, conducted at the north eastern most corner of the Lifting shed structure, encountered yellow brown, generally medium dense to occasionally very dense (likely due to obstructions), slightly clayey, gravelly sand fill to a maximum depth of 0.7m at which level hand auger refusal was met on rock/brick fragment obstructions in the fill.

In contrast to AH5, AH's 6, 7 and 8 across the remainder of the extension area encountered very similar subsoils comprising yellow brown to grey brown, very dense, angular, medium to coarse gravel in a slightly clayey, sandy matrix containing cobble sized fragments of ballast/hard rock (similar to that encountered in AH2 and 4). Despite hand chiselling within the dense material, hand auger/chisel refusal was met at depths ranging between 0.5 – 0.7m below surface level.

Similar to the corresponding hand augers, DCP's 6, 7 and 8 met with refusal at depths ranging between 0.5 – 0.9m below surface level in the gravel material, reflecting very dense conditions consistently therein.

Where the dense gravel fill was apparently absent, DCP5 managed to penetrate to a depth of 2.4m prior to refusal on an unknown obstruction, it indicating generally medium dense conditions. DCP 4 conducted relatively nearby to the area reflects a similar consistency profile, with dense to medium dense conditions to 2.1m within the inferred fill, thereunder becoming loose to medium dense in inferred sand/clayey sandy Harbour Beds sediment.

In terms of the above, it is considered likely that below the upper very dense gravel, medium dense to dense gravelly sandy fill is likely to prevail to depths in the order of 2.1-2.4m, transitioning thereunder into loose to medium dense in-situ Harbour Beds sediment.

Although no groundwater seepage was not encountered in any of the auger holes/DCP's across the extension area, interpretation of the results of nearby tests and level nature of the area, it is inferred that ground water will likely be intersected at depths in the order of 2.4m below current ground level.

### **6.2.3 Proposed Wash Facility (AH/DCP 9 – 11)**

Coring across the proposed Wash Facility area revealed the concrete hardstand to vary in thickness, ranging from 170mm to 230mm thick and comprising a single concrete slab in all cases.

Very similar to the extension area (i.e. AH6-9) on the opposite end of the Lifting shed, below the hardstand AH's 9, 10 and 11 encountered yellowish/grey brown, dense to very dense, angular to subrounded, medium to coarse grained gravel aggregate in a matrix of slightly clayey fine to medium grained sand containing cobble sized ballast/hard rock fragments. Within AH9 and AH11 the material occurs to depths in excess of 0.52m and 0.60m (depth of hand auger/hand chisel refusal) however, within AH10 was penetrated at a depth of 0.55m below surface level.

Below the upper gravel in AH10, general fill material comprising slightly moist to moist, grey to red brown, slightly gravelly to gravelly sand occurs to a maximum excavated depth of 0.85m at which depth abrupt refusal was met on an unknown obstruction within the fill.

Predictably, DCP's 9 and 11 reflected very dense conditions in the upper gravel fill to refusal depth at 0.5m and 0.9m respectively. Similarly, DCP 10 also indicates very dense to dense conditions to 1.8m within the upper gravel and underlying sandy fill material, thereunder becoming medium dense prior to refusal on an unknown obstruction at a depth of 2.85m.

Whilst no groundwater seepage was encountered in any of the shallowly refusing auger holes, wet conditions noted on the DCP rods upon removal of DCP10 from approximately 2.1m depth, this inferred to coincide with the water table encountered elsewhere across the site.

#### **6.2.4 Chemical Storage (AH/DCP 12 – 14)**

AH 12 and 13, conducted within the chemical store structure and on an adjacent ramp access thereto respectively, encountered 170mm and 190mm thick concrete floorslab/hardstand at surface level. Below the floor slab in AH12, an additional 130mm thick slab occurs, whilst in AH13 additional concrete, reducing in quality with depth, was encountered to a depth of 0.51m below ramp surface level.

Below the concrete floorslab/hardstand in both excavations, typical yellow brown/grey, dense to very dense, medium to coarse gravel in a sandy matrix containing cobble/pebble sized ballast/hard rock fragments occurs to maximum achieved depths ranging between 0.6m and 0.76m below surface level (despite hand chiseling to remove as much as possible).

AH 14, conducted adjacent the store within an asphalt paved area encountered 80mm thick asphalt underlain to a depth of 0.35m by light grey brown, very dense, sandy gravel (crushed stone aggregate) pavement layerworks material. Below the upper layerworks fill, dark brown/dark grey, dense to medium dense, sandy gravel occurs to beyond the maximum excavated depth of 1.1m, at which hand auger/hand chisel refusal was met on an unknown obstruction within the fill.

Given the gravelly nature of the upper fill, both DCP's 12 and 13 refused shallowly within the respective cored voids at a depth of 0.85m below surface level on an unknown, likely hard rock, obstruction, the results indicating the gravel fill to be very dense to dense.

In addition to dense consistency in the upper layerworks fill, DCP14 revealed dense to occasionally medium dense conditions to a depth of 2.1m, this likely coinciding with the depth to which the underlying gravelly sandy fill progresses. Thereunder, medium dense conditions generally prevail to a depth of 4.8m in inferred sandy Harbour Beds sediment, becoming loose below 5.0m. A loose horizon at 2.7m within the inferred Harbour Beds material likely coinciding with the approximate depth of a perched water table.

#### **6.2.5 Storage Building to the LHS of Lifting Shed (AH/DCP 15 – 17 & AH20)**

With regards to AH15 and AH17 conducted within existing structures, both encountered upper concrete floor slabs ranging between 150mm and 170mm thick respectively, underlain by a second concrete slab (120mm and 60mm thick) to depths of 0.27m and 0.23m below floor level.

Below the floor slabs of the two storage structures fill material comprising slightly moist, dark brown/dark grey, dense, sandy gravel containing occasional brick and hard rock ballast occurs to maximum achieved depths of 0.98m and 0.65m in AH15 and AH17 respectively, at which depth hand auger refusal was met on unknown obstructions (likely hard rock fragments/bricks etc). Within AH17 the grey fill was capped by a thin horizon of orange brown gravelly sand fill directly below floor slab level.

AH 16, conducted within asphalt paved area between the two storage structures encountered pale grey/yellow grey, dense to very dense, sandy gravel (crushed stone aggregate) directly below the 40mm thick asphalt to a depth of 0.52m.

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Thereunder, dark brown, dense sandy gravel fill, similar to that encountered within AH's 15 and 17, occurs to a depth of 0.68m, where underlain by a lense of dense, yellow brown, gravelly sand fill containing slightly weathered cobble sized fragments of hard rock tillite, in which hand auger refusal was met.

Due to the shallow refusal of AH's 15-17, an additional auger (AH20) was conducted nearby in a grassed area. Below a 300mm thick upper sandy topsoil horizon, dark grey, sandy gravel/gravelly sand fill material (similar to that in AH15-17), was encountered to a depth of 1.5m below ground level. Thereunder a thin horizon of dark grey stiff silty clay material occurs to a depth of 1.6m, below which very moist to wet, brown/olive brown, loose, fine to medium sand of potential reclamation fill or Harbour Beds origin was encountered to a maximum achievable depth of 1.9m in the saturated material.

Similar to the corresponding auger hole excavations, DCP's 15 and 17 refused shallowly at depths ranging between 0.52m and 1.35m below floor level on unknown obstructions, with the DCP results indicating generally dense/medium dense conditions in the fill material prior to abrupt refusal.

Conversely, DCP 16 managed to penetrate to a maximum depth of 4.5m at which refusal was met. The results indicate the asphalt layerworks and upper fill is very dense to dense to a depth of 0.6m, thereunder becoming medium dense in the underlying sandy gravel/gravelly sand fill material to a depth of 2.4m. From 2.4m to 3.0m depth, loose conditions prevail, likely coinciding with the water table in likely Harbour Beds material, becoming medium dense and dense thereunder to depths of 3.6m and 4.5m respectively, the latter depth at which refusal was met at on an unknown obstruction.

Based on the above auger and DCP data, it is inferred that the soil texture and consistency profile across the storage building area footprint, as well as surrounding area, will closely mimic that observed in AH20 and DCP16.

Although no groundwater seepage was encountered with AH15-17, seepage was encountered in AH20 at 1.9m, whilst wet conditions were noted on DCP16 rods upon removal at approximately 2.7m. As such, ground water is expected to be located at depths ranging between 1.9m and 2.7m below surface level, this roughly coinciding with the general level encountered across the remainder of the site.

### **6.2.6 Office Building (AH/DCP 18 – 19)**

Within Cores 18 and 19 the upper concrete floor slab was 170mm thick however, within Core 18 additional concrete was encountered to 0.3m depth below floor level. Below the concrete surface bed within both excavations, floor slab layerworks was encountered to depths ranging between 0.4m and 0.55m below floor level, the material comprising yellowish brown, dense to very dense, angular to sub-rounded, medium to coarse grained gravel aggregate in a matrix of slightly clayey fine to medium grained sand with occasional larger rock particles (similar to that encountered elsewhere on site). Underlying the layerworks dark brown, dense becoming loose with depth, gravelly sandy fill material containing occasional brick fragments occurs to depths in the order of 1.8m below surface level, where it transitions into moist to wet, red brown and dark brown sandy clay to clayey sand of potential Harbour Bed origin to in excess of the maximum excavated depth of 2.4m and 2.55m.

DCP's 18 and 19 achieved the full probe depth (5.40m) without meeting refusal. The DCP results reflect dense conditions in the upper layerworks/fill material to 0.9/1.2m becoming medium dense to 1.5m. Thereunder, loose to medium dense conditions prevail to 2.4/2.7m, where a very loose horizon of material (likely saturated) occurs to depths of 3.0/3.3m. Below this level, medium dense conditions in the underlying Harbour Beds sediment occurs to the maximum probed depth with occasional loose/very loose or dense horizons at various levels.

Strong groundwater seepage was encountered in both auger holes at depths ranging between approximately 2.10 – 2.55m in DCP18 and at approximately 2.10m in DCP 19, with further excavation prevented due to sidewall collapse and poor recovery in the saturated clayey sand soils.

## **7. LABORATORY RESULTS**

### **7.1 Grading Analysis, Atterberg Limits and Natural Moisture Content**

The grading analysis/full indicator and natural moisture content testing was carried out on nine samples recovered the auger holes excavated. The results are summarised in Table 2, overleaf.

**Table 2: Summary of Full Indicator and NMC test results**

Position	Sample Depth (m)	Material Description	Particle Size (%)					GM	NMC (%)	LL %	PI	LS %	Revised US Classification
			Clay	Silt	Sand	Gravel	Cobble						
<b>Lifting Shed</b>													
C2 - C4	0.33/0.55 - 0.75/0.83	Sandy Gravel	7	4	18	63	8	2.4	-	23.2	1.4	1	A - 1 - a (0)
<b>Proposed Wash Facility</b>													
C9 - C11	0.17/0.23 - 0.52/0.65	Sandy Gravel	6	2	19	60	13	2.49	7.44	16.3	0	0	A - 1 - a (0)
C10	0.75 - 0.85	Gravelly Sand	10	7	51	31	0	1.79	9.18	19.6	6.8	1.3	A - 2 - 4 (0)
<b>Chemical Storage &amp; Storage Building on LHS of Lifting Shed</b>													
C14-C16	0.04/0.08 - 0.2/0.52	Sandy Gravel	6	1	26	66	0	2.41	10.14	20.3	0	0	A - 1 - a (0)
C14-C16	0.2/0.52 - 0.68/1.10	Sandy Gravel	5	1	28	64	2	2.44	12.21	21.8	0	0	A - 1 - a (0)
C17	0.18 - 0.40	Gravelly Sand	9	3	70	17	0	1.3	6.18	19.3	0	0	A - 2 - 4 (0)
C17	0.40 - 0.65	Sandy Gravel	7	4	40	48	0	2.03	9.11	22.7	0	0	A - 1 - b (0)
<b>Office Building</b>													
C18-C19	0.4/0.55 - 0.87/1.80	Gravelly Sand	7	1	56	34	2	1.72	9.98	20.3	0	0	A - 3 (0)
C18	1.80 - 2.55	Clayey Sand	32	22	39	1	0	0.56	35.2	19.6	6.8	1.3	A - 4 (1)

LL – Liquid Limit PI – Plastic Limit LS – Linear Shrinkage GM – Grading Modulus

In terms of the above analysis, the prevailing upper gravelly/sandy fill material behave in a non-plastic manner, due to low clay content, whilst more clayey Harbour Beds/fill materials at depth also have relatively low plasticity indices.

## 7.2 Mod AASTHO and California Bearing Ratio (CBR) testing

Mod AASTHO density and CBR determinations were carried out on five mixed samples collected from the auger holes excavated. The results are summarised in Table 3 below.

**Table 3: Summary of Modified AASTHO and CBR test results**

Position	Sample Depth (m)	Material Description	Modified AASTHO		CBR Results						TRH 14 Class
			MDD (kg/m <sup>3</sup> )	OMC(%)	90%	93%	95%	98%	100%	Swell %	
<b>Lifting Shed</b>											
C2 - C4	0.33/0.55 - 0.75/0.83	Sandy Gravel	2048	8.1	29	33	36	53	69	0	G6
<b>Proposed Wash Facility</b>											
C9 - C11	0.17/0.23 - 0.52/0.65	Sandy Gravel	2156	8	33	38	41	50	57	0	G6
<b>Chemical Storage &amp; Storage Building on the LHS of Lifting Shed</b>											
C14-C16	0.04/0.08 - 0.2/0.52	Sandy Gravel	2129	6.9	42	47	50	66	79	0	G5
C14-C16	0.2/0.52 - 0.68/1.10	Gravelly Sand	1874	10.3	10	21	35	54	72	0	G7
<b>Office Building</b>											
C18-C19	0.4/0.55 - 0.87/1.80	Gravelly Sand	1760	10.8	8.8	11	13	16	18	0	G8

In terms of the above results, the yellow/grey coarse gravel material underlying various surface beds/hardstand areas, in particular portions of the Lift shed, Lift shed extension area, wash bay area, and chemical store area to depths in the order of <1.0m, classifies as A-1-a, GP-GW (after Unified and AASTHO class.) and classifies as G6 type material.

As such, the material is considered suitable as base material if/where removed during development, provided oversized ballast/hard rock particles are removed.

General reclamation fill material expected below the capping upper gravel (where present), typically comprising grey to brown, gravelly sand/sandy gravel material, examples of which sampled below chemical store, storage building and office building, classify as A-1-a to A-3, GP-GM to SP-SM material, and in terms of TRH14 classify as G7-G8 material, thus deemed suitable for selected layer/subgrade material, if required. Less gravelly, sandy fill as may be encountered, are likely to classify as G9-G10 material, therefore also considered suitable as subgrade and bulk fill.

Gravel layerworks material directly below asphalt paved areas classifies as A-1-a, GW-GM material and meets the requirements of a G5 material. As such, if removed the material can be reused as subbase material.

### 7.3 Corrosivity Testing

Corrosivity (Langelier and Aggressiveness Index) testing was carried out on three representative samples taken from the site, namely the common ballast gravel fill, general gravelly sandy fill and clayey sand Harbour Beds sediment. The testing comprised filtering water through the soil samples and testing for parameters within the water sample to identify the potential corrosiveness. The test results summary sheet is included in Appendix C of this report, with the results of the potential corrosivity calculations summarised in Table 4 below along with ranges for various degrees of corrosivity. It should be noted that the testing is not qualitative but rather merely provides an indication to potential corrosivity as a general guide.

**Table 4: Corrosivity Testing Results Summary and Categories**

Sample	Calculation Results		Index Ranges		Corrosive Characteristics
	Langelier Index	Aggressiveness Index	Langelier Index	Aggressiveness Index	
C9-C11 (0.17/0.23 - 0.52/0.65m)	-0.6	11.1	<-2.0	<10.0	Highly Aggressive
C18-C19 (0.4/0.55 - 0.87/1.8m)	-0.22	11.5	>-2.0 < 0.0	10.0 - 12.0	Moderately Aggressive
C18 (1.8 - 2.55)	-1.37	10.4	>0.0	>12.0	Non-aggressive

The calculated results based on the laboratory derived parameters indicate that all of the representative soil samples fall within the ‘Moderately aggressive’ category.

#### 7.4 Uniaxial Compressive Strength (UCS) testing

Prior to testing the 200mm diameter cores were appropriately prepared (i.e. trimmed and re-cored to 54mm diameter) in accordance with standard UCS testing protocol. The UCS testing was carried out on seventeen prepared samples obtained from cored concrete hardstand/floor slabs, with an additional concrete core (Core 2B) comprising additional slab below the uppermost slab. The results of the UCS testing are summarised in Table 5 below.

**Table 5: Summary of UCS test results**

Name	Thickness (m)	Uncorrected Strength (MPa)	Corrected Strength (MPa)
Lifting Shed			
C1	0.17	42.3	44
C2	0.15	57.5	59.8
C2B	0.08	60.8	63.2
C3	0.16	47.7	51
C4	0.2	41	44.1
Proposed Extension on RHS of Lifting Shed			
C5	0.21	58.1	60.4
C6	0.28	61.4	63.8
C7	0.24	60.2	62.7
C8	0.28	66.7	71.3
Proposed Wash Facility			
C9	0.21	71.3	74.2
C10	0.17	68	74.8
C11	0.23	73.4	76.9
Chemical Storage			
C12	0.17	61.6	68.7
C13	0.19	53.8	55.9
Storage Building on the LHS of Lifting Shed			
C15	0.15	77.8	80.9
C17	0.17	62.2	69.2
Office Building			
C18	0.17	35.6	37.3
C19	0.17	27.6	31.1

\*Corrected UCS strength includes length corrected and Length/Steel corrected.

The above results indicate the concrete within the cored floor slabs/hardstand areas has an average corrected UCS strength of 60MPa, ranging between 31.1MPa to 80.9MPa.

## 8. CONCLUSION

This factual report presents the details and findings of the geotechnical assessment of the Prasa Lifting Shed facility for the proposed development thereof.

Whilst testing, as prescribed in the RFQ document, did not attain the required depths across all sections of the site, due to the nature of the subsoil conditions at shallow depth, this report has nonetheless aimed to describe the ground conditions that were encountered at the locations where the testing took place as best as possible.

Based on the field data it is apparent that the Prasa Lifting Shed facility is underlain by Harbour Beds sediment to depths in excess of 5m below existing ground level, comprising typically medium dense to loose/very loose in places, fine to medium sand to clayey sand material from depths in the order of approximately 2.0 – 2.5m below existing ground level.

The Harbour Beds sediment is overlain by a horizon of typically brown/dark brown sandy gravel to gravelly sand fill material, from +/-0.5 – 1.0m below ground level, it encountered as dense along its upper contact to medium dense with depth. A perched ground water table, encountered within auger holes and inferred from DCP data, occurs at depths in the order of 2.0 – 2.7m below ground level, it generally coinciding with, or just below the contact of the fill and underlying Harbour Beds.

Across most of the hardstand/floor slab areas, an approximately 0.6m thick (locally thicker) mantle of yellow brown, dense to very dense, medium to coarse gravel in a sandy matrix containing large cobble and pebble sized hard rock/ballast fragments, caps the underlying general fill. The concrete hard stand/floor slabs in turn directly rests on the dense gravel, the concrete in general very strong with an average UCS strength of 60MPa across all areas.

Notwithstanding the above, due to the nature of the general area ground conditions may differ from those encountered in the tested positions. However, information in this report was compiled in good faith, to provide an indication of the types of materials and conditions likely to be encountered during site development.

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In this regard we trust that the above factual information is helpful and meets with your immediate requirements in this matter, and will be pleased to furnish you with any additional information you may require.

Yours faithfully,

**DRENNAN MAUD (PTY) LTD**



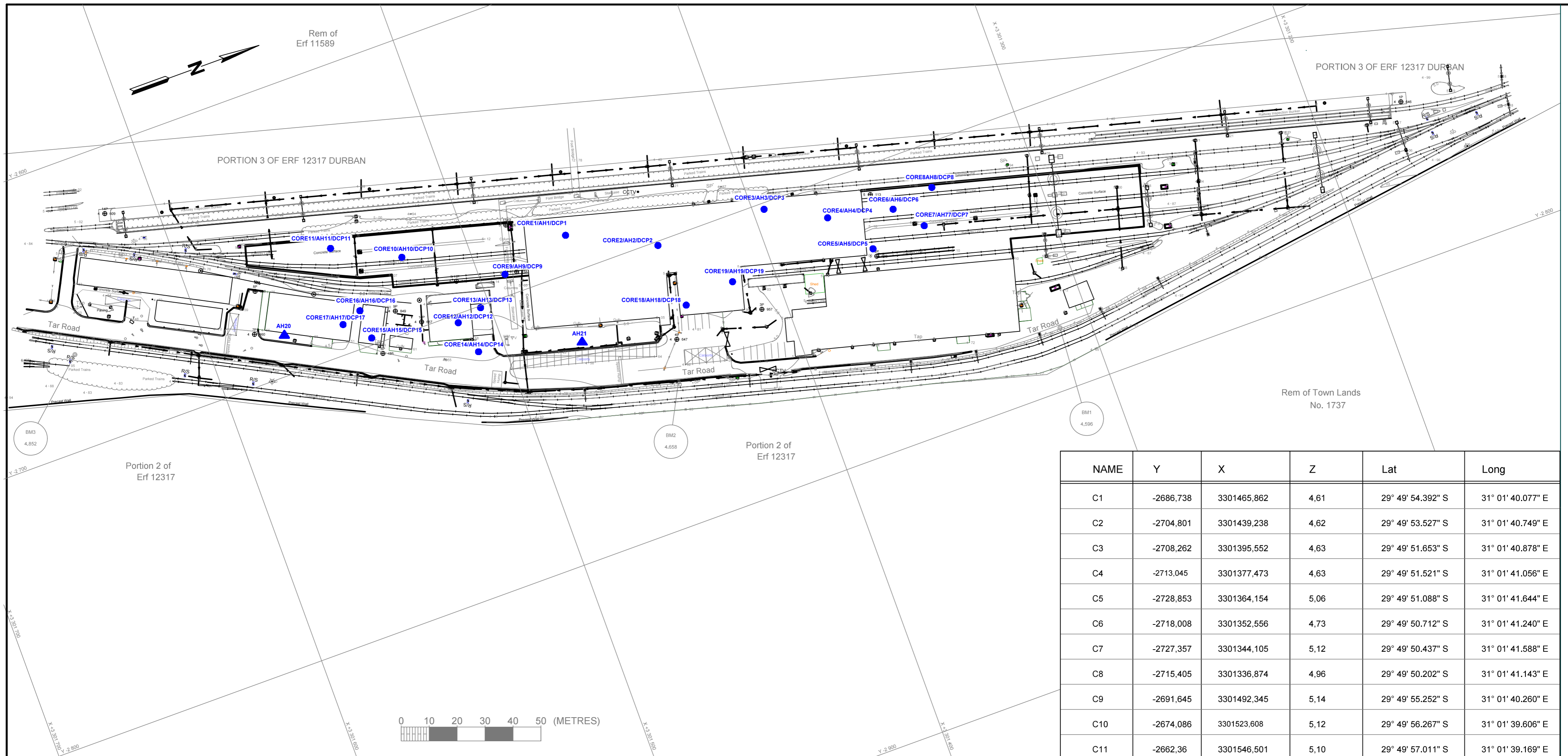
**A. JOUBERT Pr.Sci.Nat**

/aj

Enclosures:

<i>Appendix A</i>	-	<i>Soil Profiles (AH1 – 21)</i>
<i>Appendix B</i>	-	<i>DCP Test Results (DCP1 – 18)</i>
<i>Appendix C</i>	-	<i>Laboratory Test Results Summary</i>
<i>Drawing No. 34223-01</i>	-	<i>Site Plan</i>

**Site Plan**  
**(Drawing № 34223-01)**



NAME	Y	X	Z	Lat	Long
C1	-2686,738	3301465,862	4,61	29° 49' 54.392" S	31° 01' 40.077" E
C2	-2704,801	3301439,238	4,62	29° 49' 53.527" S	31° 01' 40.749" E
C3	-2708,262	3301395,552	4,63	29° 49' 51.653" S	31° 01' 40.878" E
C4	-2713,045	3301377,473	4,63	29° 49' 51.521" S	31° 01' 41.056" E
C5	-2728,853	3301364,154	5,06	29° 49' 51.088" S	31° 01' 41.644" E
C6	-2718,008	3301352,556	4,73	29° 49' 50.712" S	31° 01' 41.240" E
C7	-2727,357	3301344,105	5,12	29° 49' 50.437" S	31° 01' 41.588" E
C8	-2715,405	3301336,874	4,96	29° 49' 50.202" S	31° 01' 41.143" E
C9	-2691,645	3301492,345	5,14	29° 49' 55.252" S	31° 01' 40.260" E
C10	-2674,086	3301523,608	5,12	29° 49' 56.267" S	31° 01' 39.606" E
C11	-2662,36	3301546,501	5,10	29° 49' 57.011" S	31° 01' 39.169" E
C12	-2702,972	3301512,548	4,96	29° 49' 55.908" S	31° 01' 40.682" E
C13	-2700,678	3301503,3	5,76	29° 49' 55.607" S	31° 01' 40.596" E
C14	-2715,235	3301509,379	4,58	29° 49' 55.805" S	31° 01' 41.138" E
C15	-2697,504	3301543,627	4,69	29° 49' 56.917" S	31° 01' 40.478" E
C16	-2686,906	3301544,248	4,72	29° 49' 56.937" S	31° 01' 40.083" E
C17	-2686,515	3301551,599	4,51	29° 49' 57.176" S	31° 01' 40.069" E
C18	-2724,953	3301433,856	4,49	29° 49' 53.352" S	31° 01' 41.500" E
C19	-2722,491	3301415,414	5,13	29° 49' 52.753" S	31° 01' 41.408" E
AH20	-2685,726	3301572,684	4,55	29° 49' 57.861" S	31° 01' 40.040" E
AH21	-2724,593	3301473,353	4,45	29° 49' 54.635" S	31° 01' 41.487" E

**KEY**

● CORE14/AH14/DCP14 CO-ORDINATED POSITION OF CONCRETE CORES/  
AUGER HOLES/ DYNAMIC CONE PENETROMETER TESTS

▲ AH21 CO-ORDINATED POSITION OF AUGER HOLES

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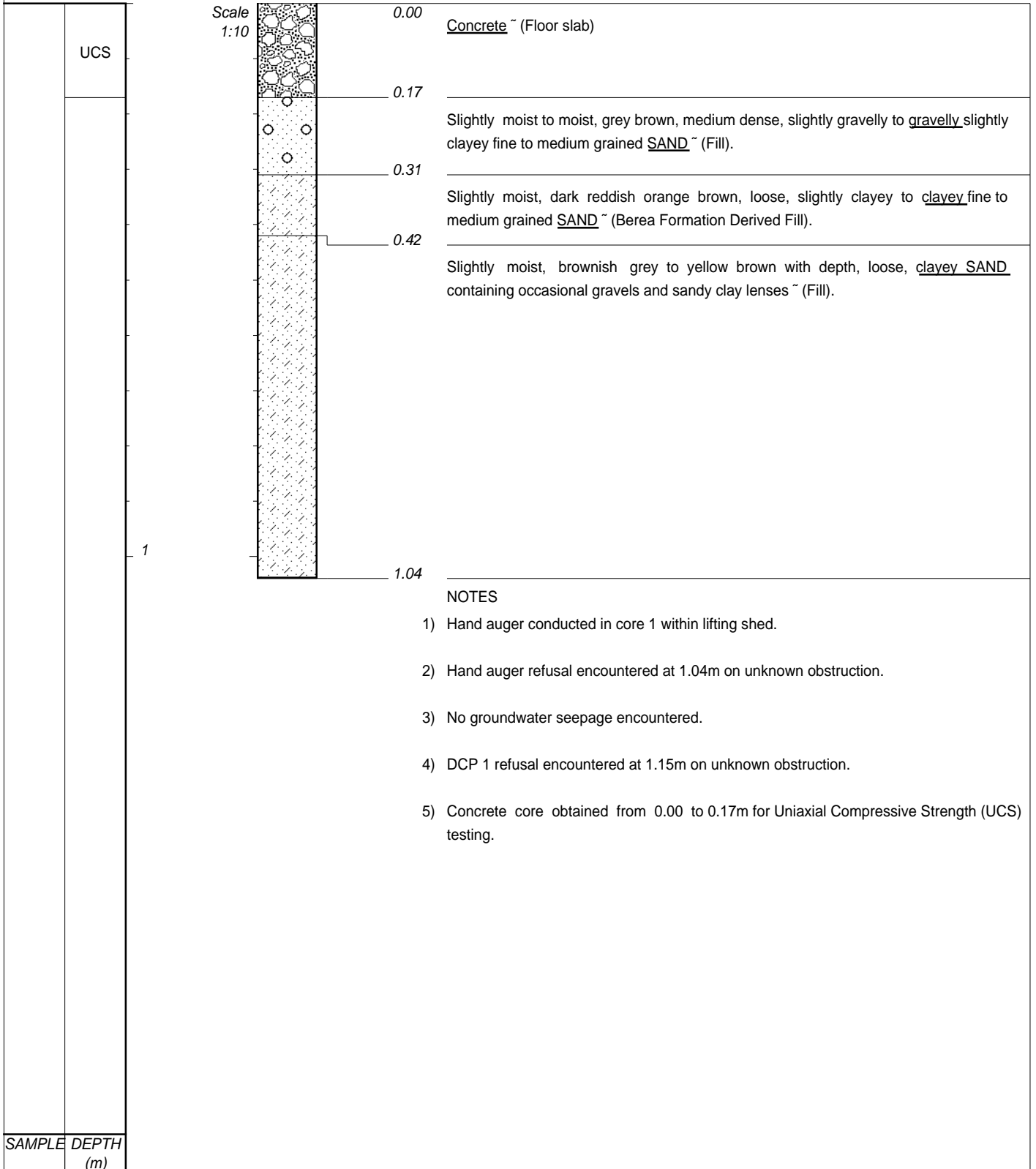
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DATE : 3-06-2024  
SCALE : 1:1000  
CHECKED :

**GEOTECHNICAL INVESTIGATION  
FOR THE DURBAN LIFTING SHED EXTENSION AND UPGRADE**

DRAWING NO.

**34223-01**

**APPENDIX A**  
**Soil Profiles and Photographs**  
**(AH 1 - AH 21)**



CONTRACTOR : NA  
 MACHINE : HAND AUGER  
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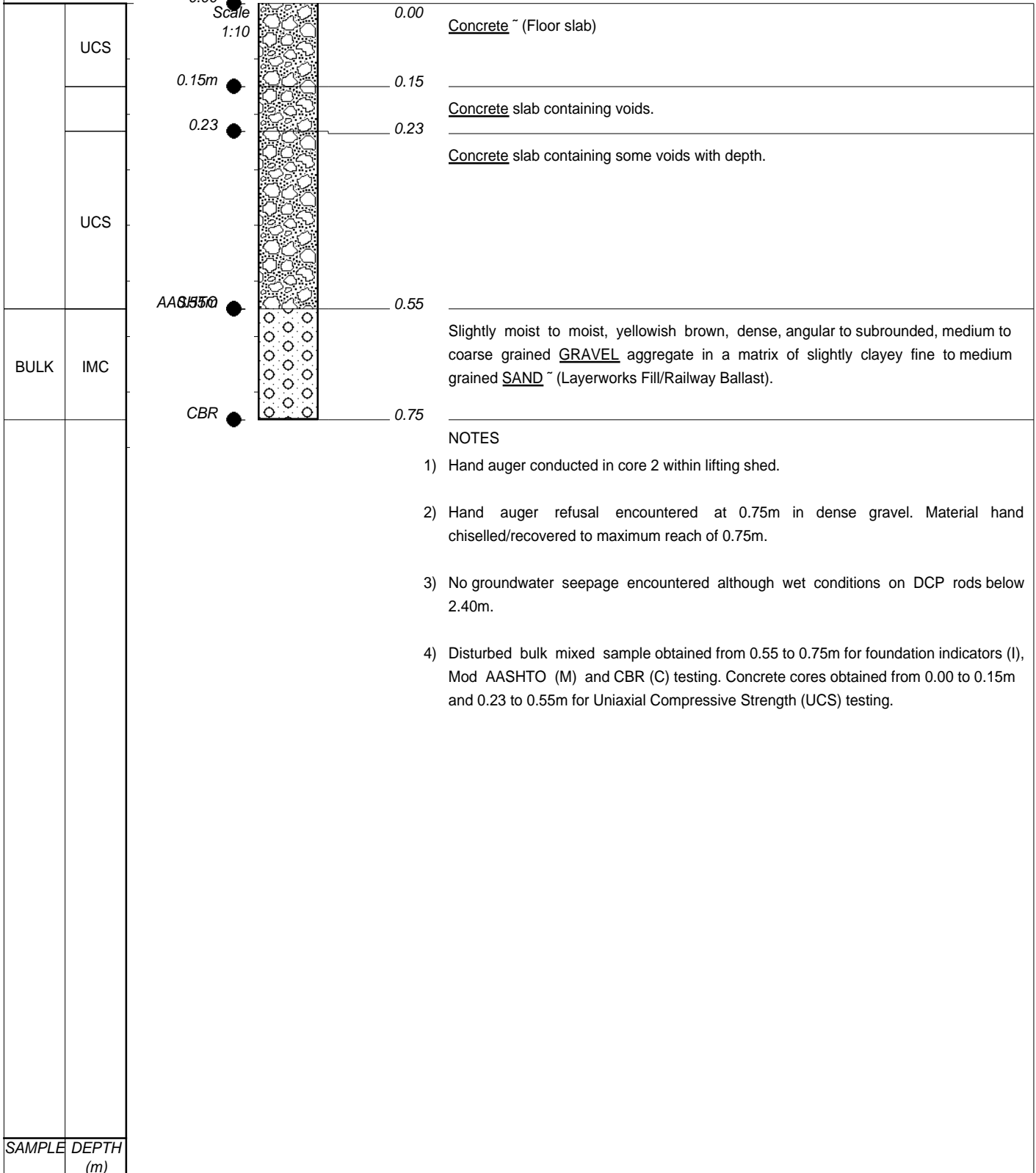


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C1.jpg





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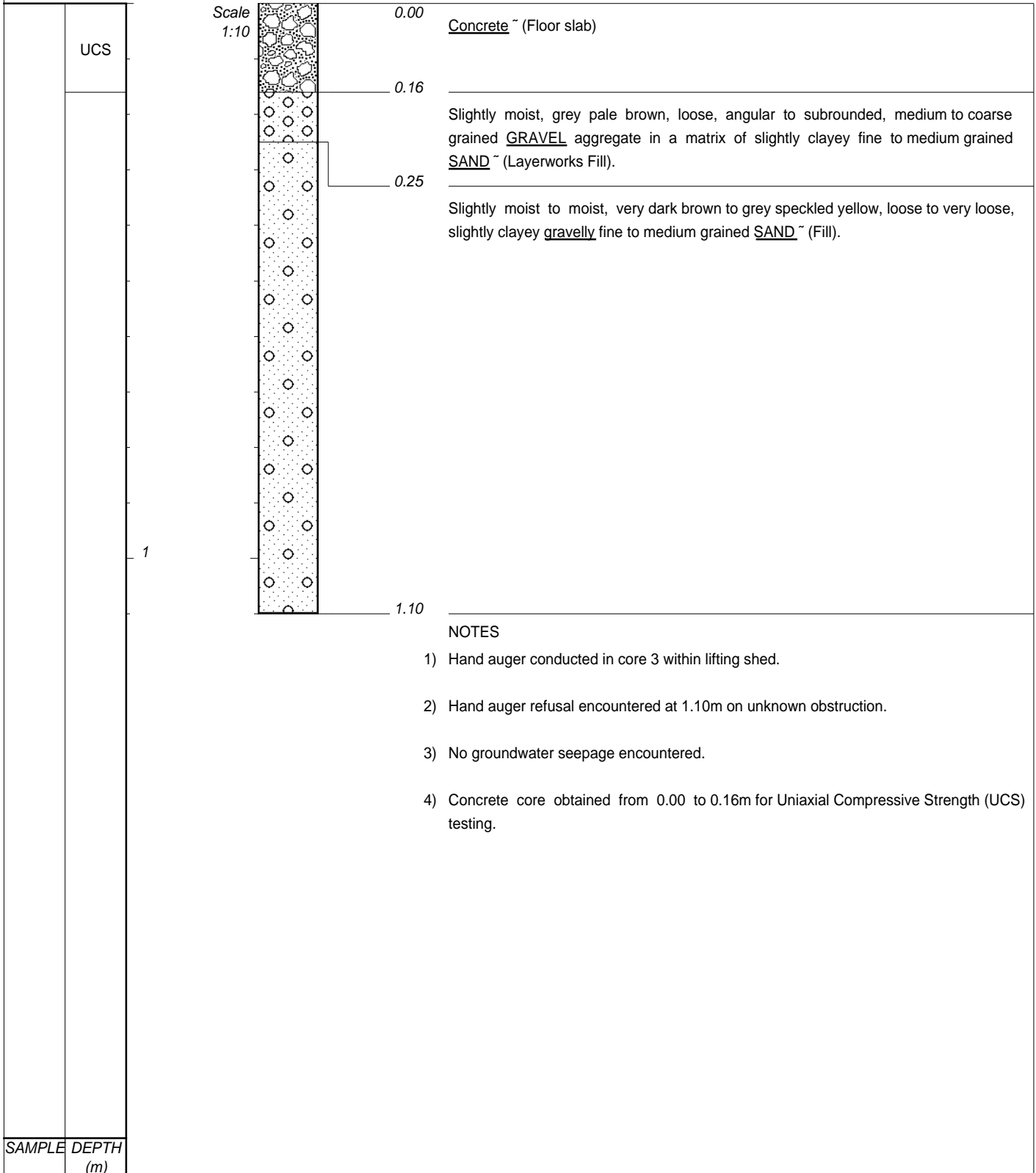


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C2.jpg





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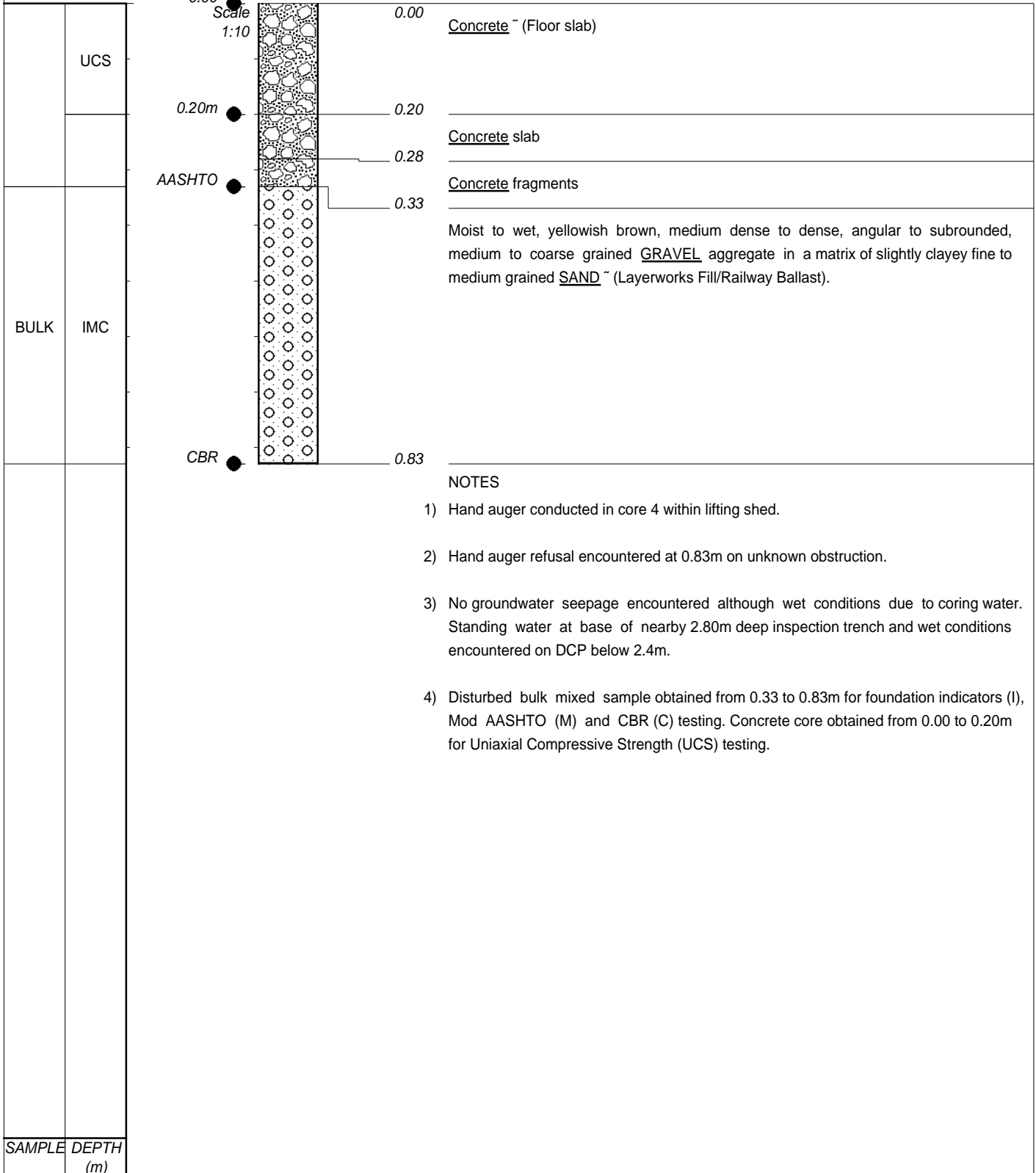
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C3.jpg



AH3.jpg



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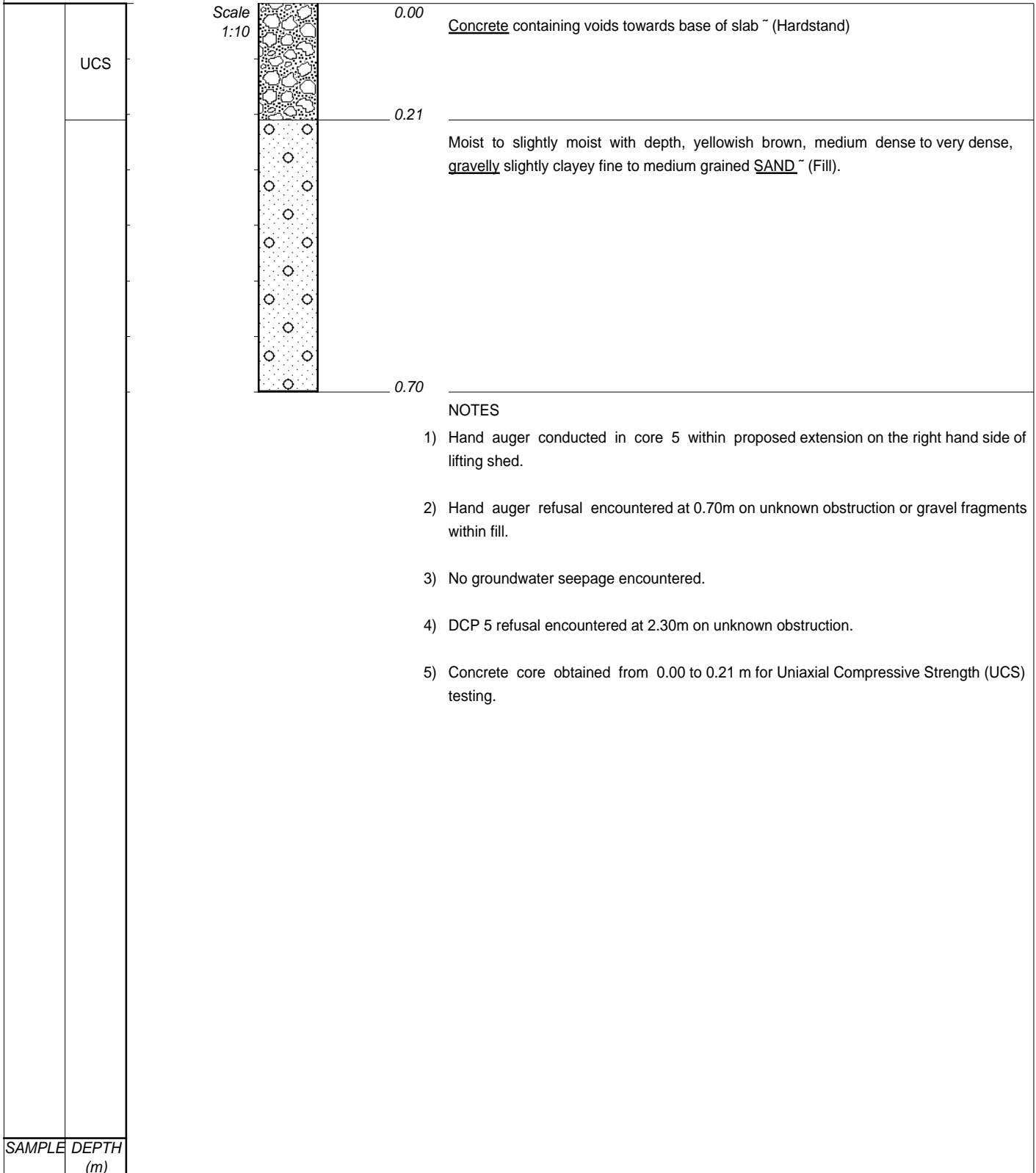


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C4.jpg





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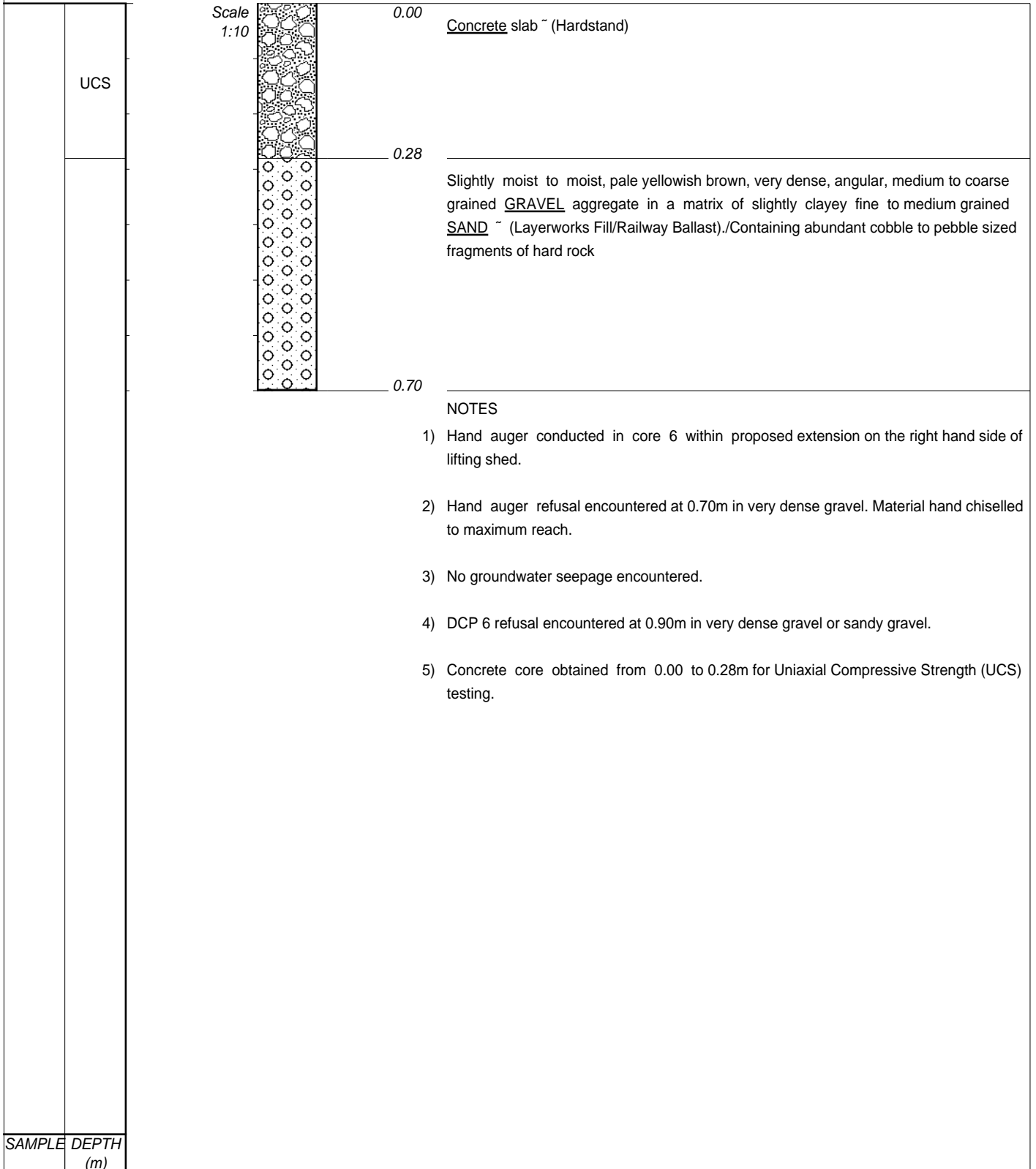


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C5.jpg





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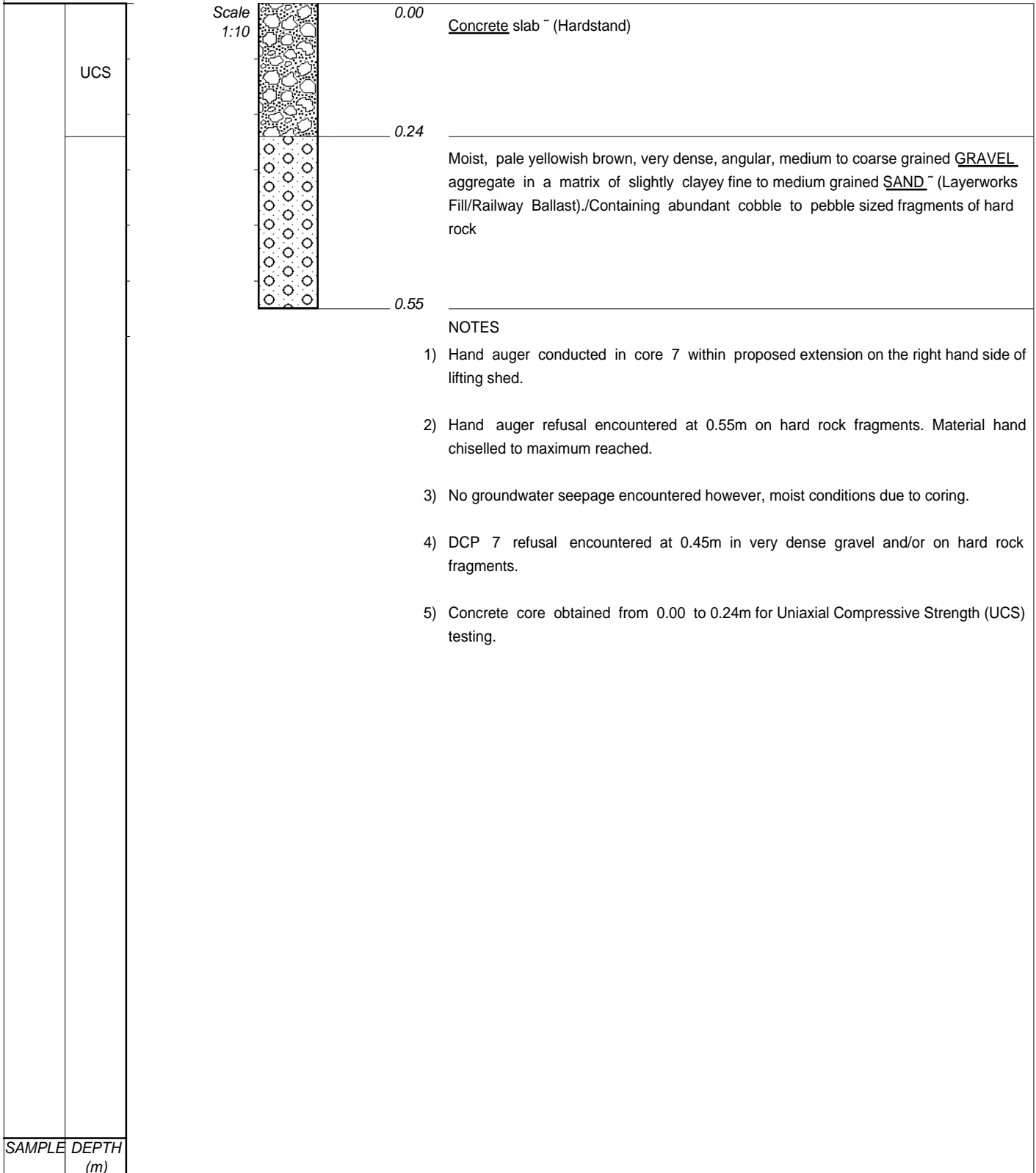


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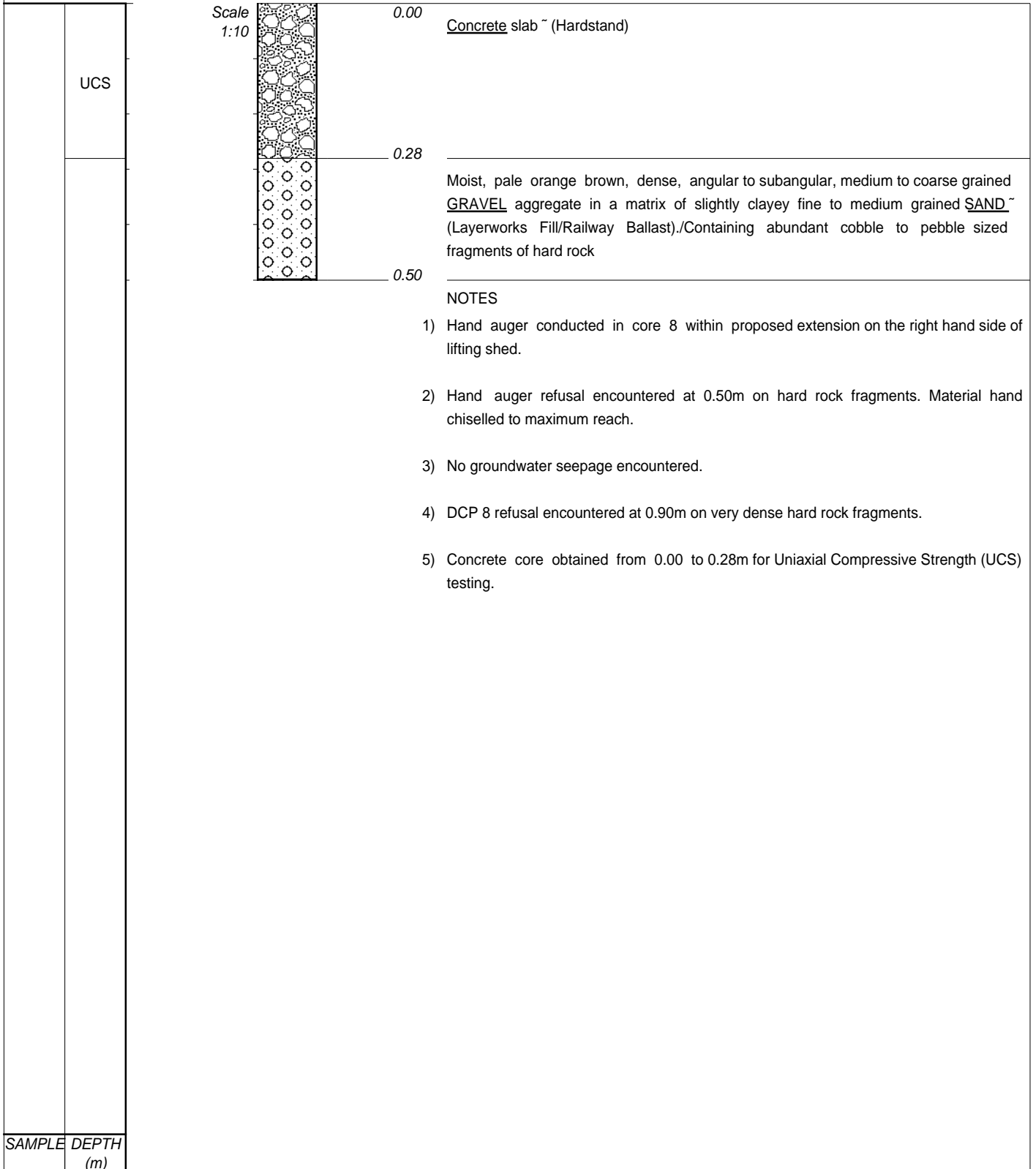


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C7.jpg





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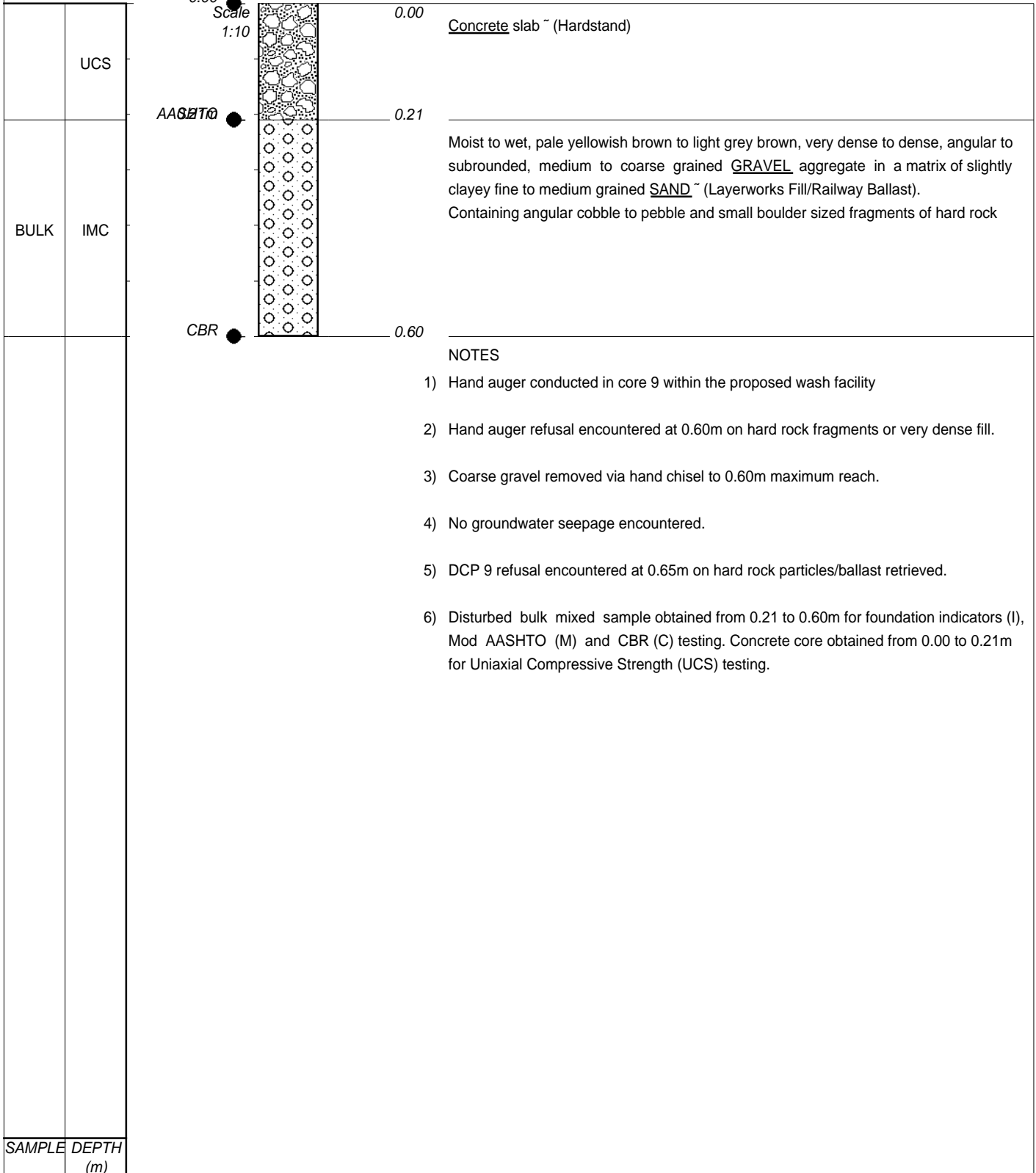


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C8.jpg





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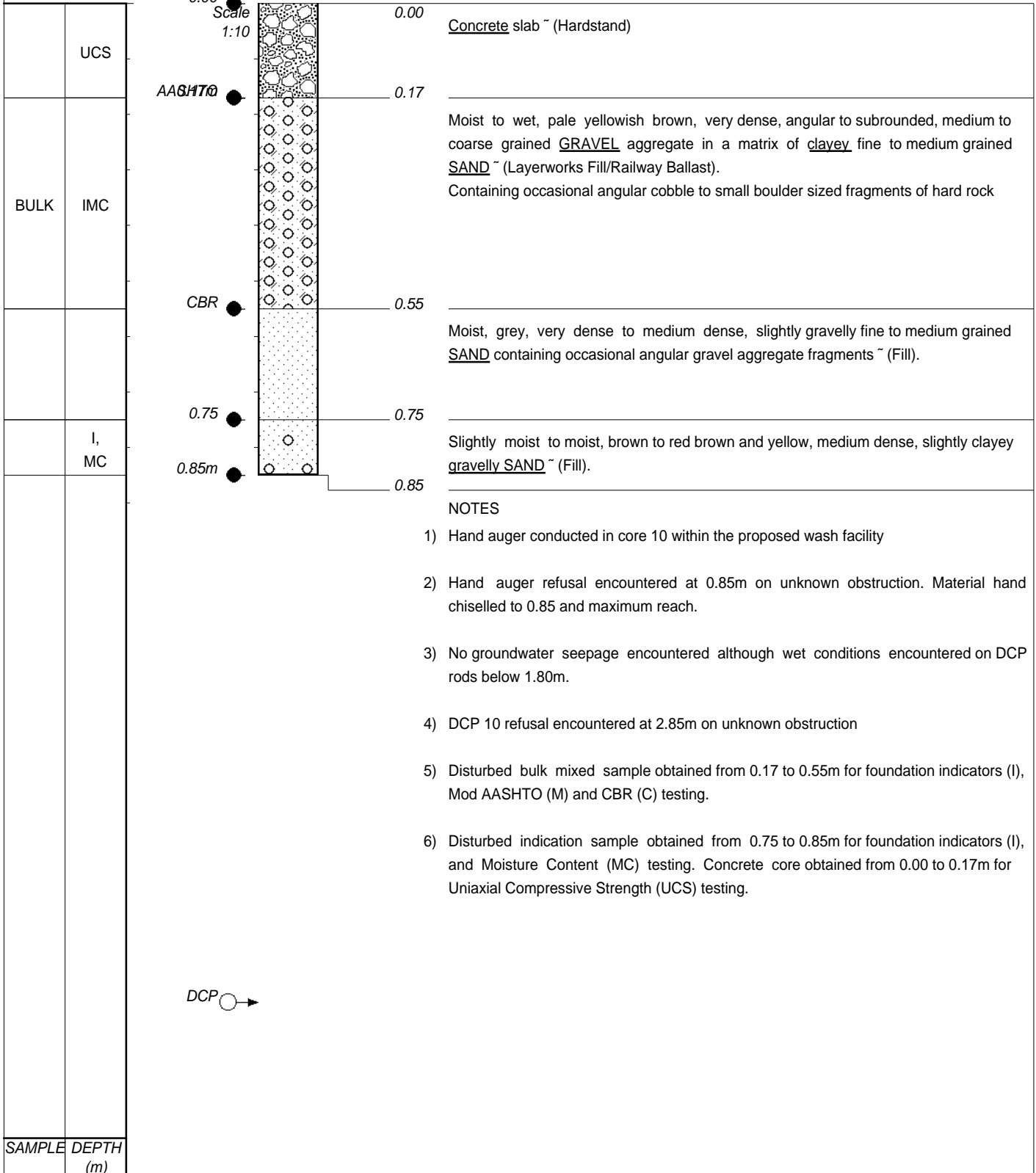


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C9.jpg





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C10.1.jpg



C10.jpg





	UCS	0.00	Concrete slab with slight voids towards the underside of slab ~ (Hardstand)
BULK	IMC, MC	0.23	Moist to wet, pale yellowish brown, very dense, angular to subrounded, medium to coarse grained <u>GRAVEL</u> aggregate in a matrix of <u>clayey</u> fine to medium grained <u>SAND</u> ~ (Layerworks Fill/Railway Ballast). Containing pebble and cobble sized fragments of hard rock
		0.52	NOTES 1) Hand auger conducted in core 11 within the proposed wash facility. 2) Hand auger refusal encountered at 0.52m in very dense fill or hard rock obstruction. Dense material hand chiselled to 0.52m (maximum reach). 3) No groundwater seepage encountered. 4) DCP 11 refusal encountered at 0.90m with hard refusal on inferred ballast/obstruction. 5) Disturbed bulk mixed sample obtained from 0.23 to 0.52m for foundation indicators (I), Mod AASHTO (M), CBR (C) and Moisture Content (MC) testing. Concrete core obtained from 0.00 to 0.23m for Uniaxial Compressive Strength (UCS) testing.
SAMPLE DEPTH	(m)		

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ELEVATION : 5.10 msl  
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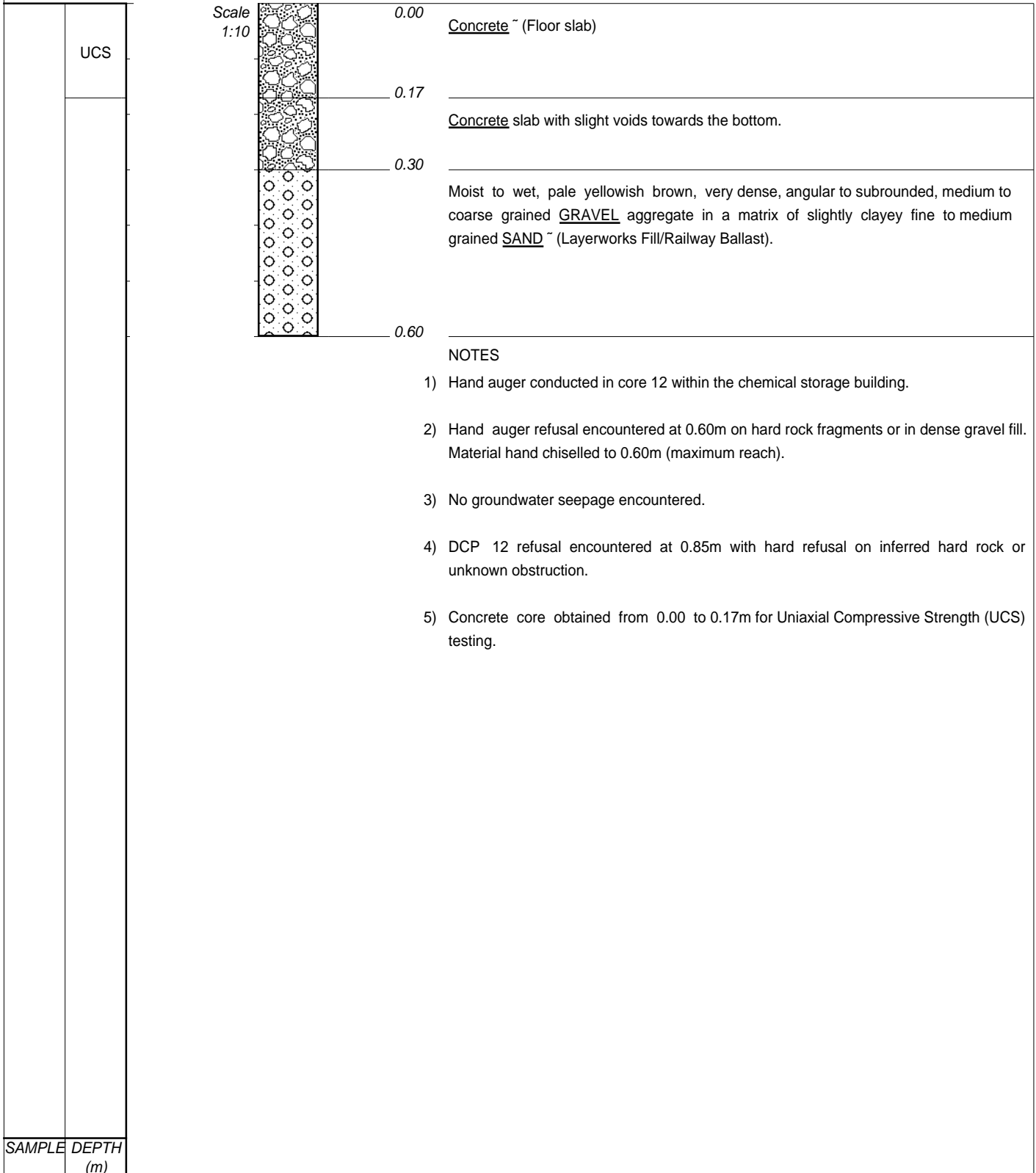


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C11.jpg





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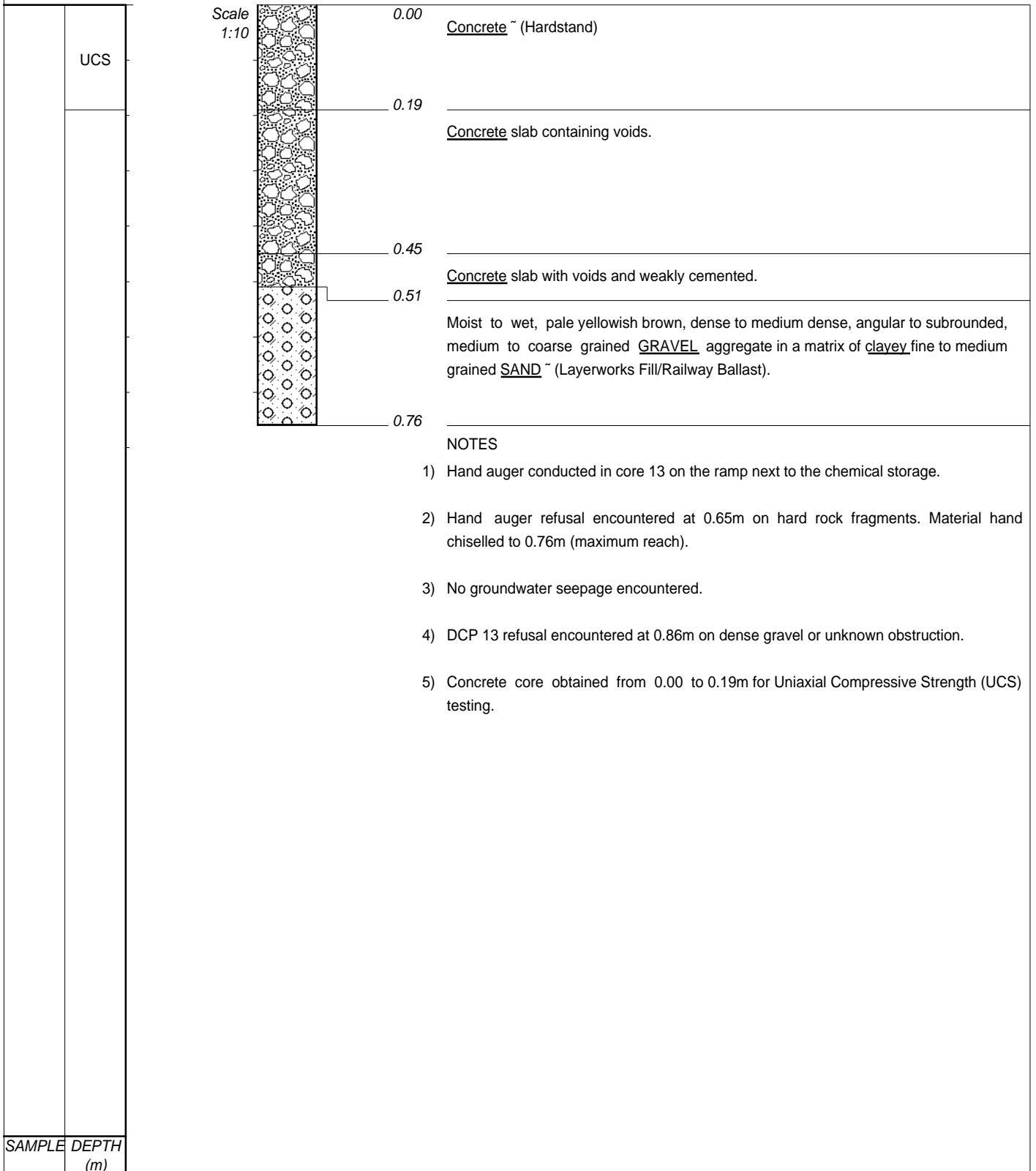


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C12.jpg





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ELEVATION : 5.76 msl  
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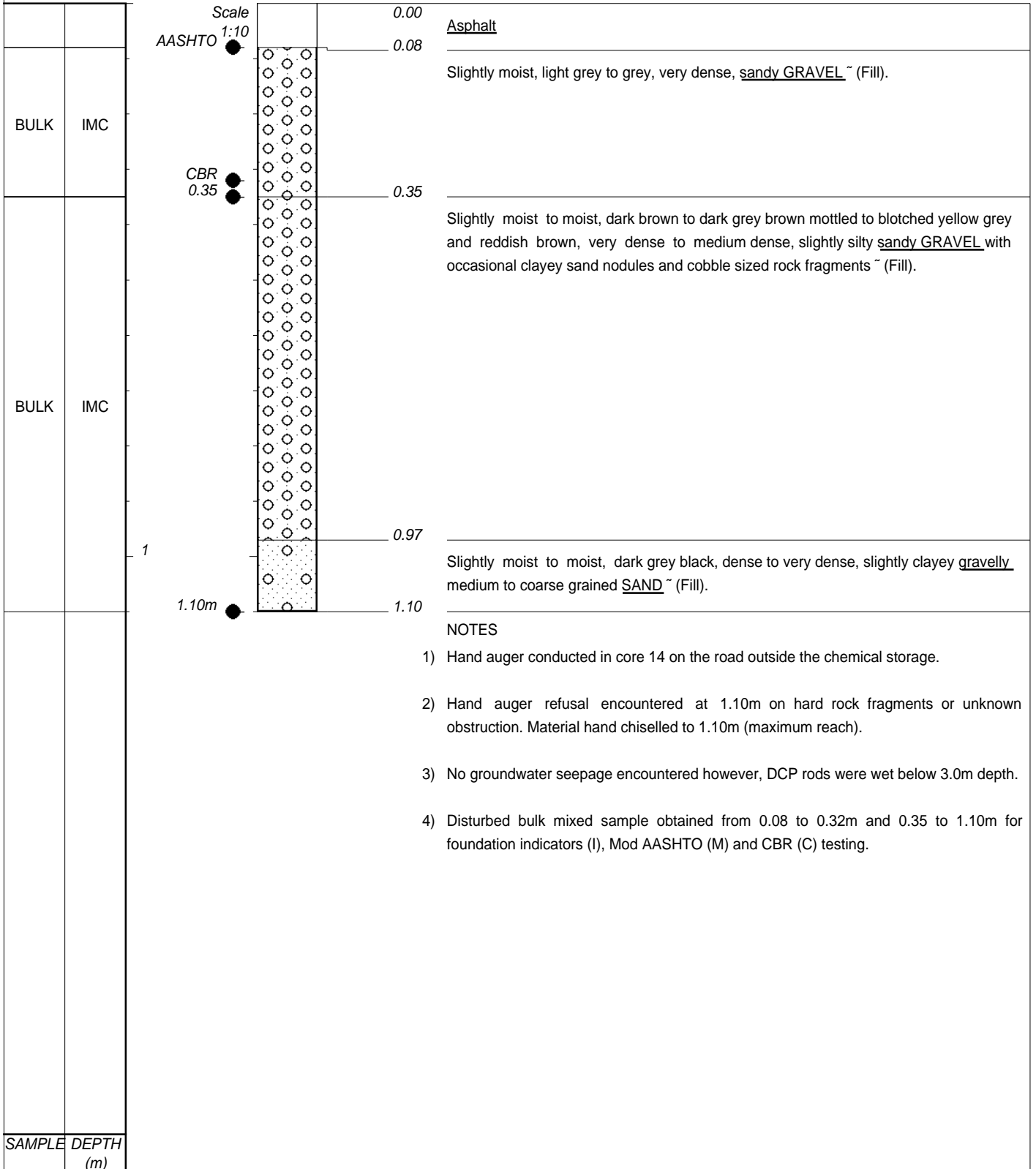


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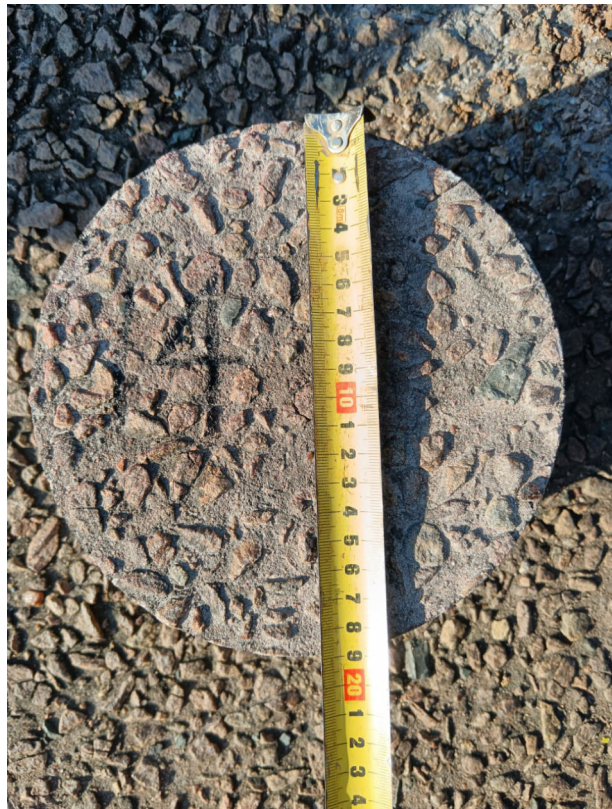
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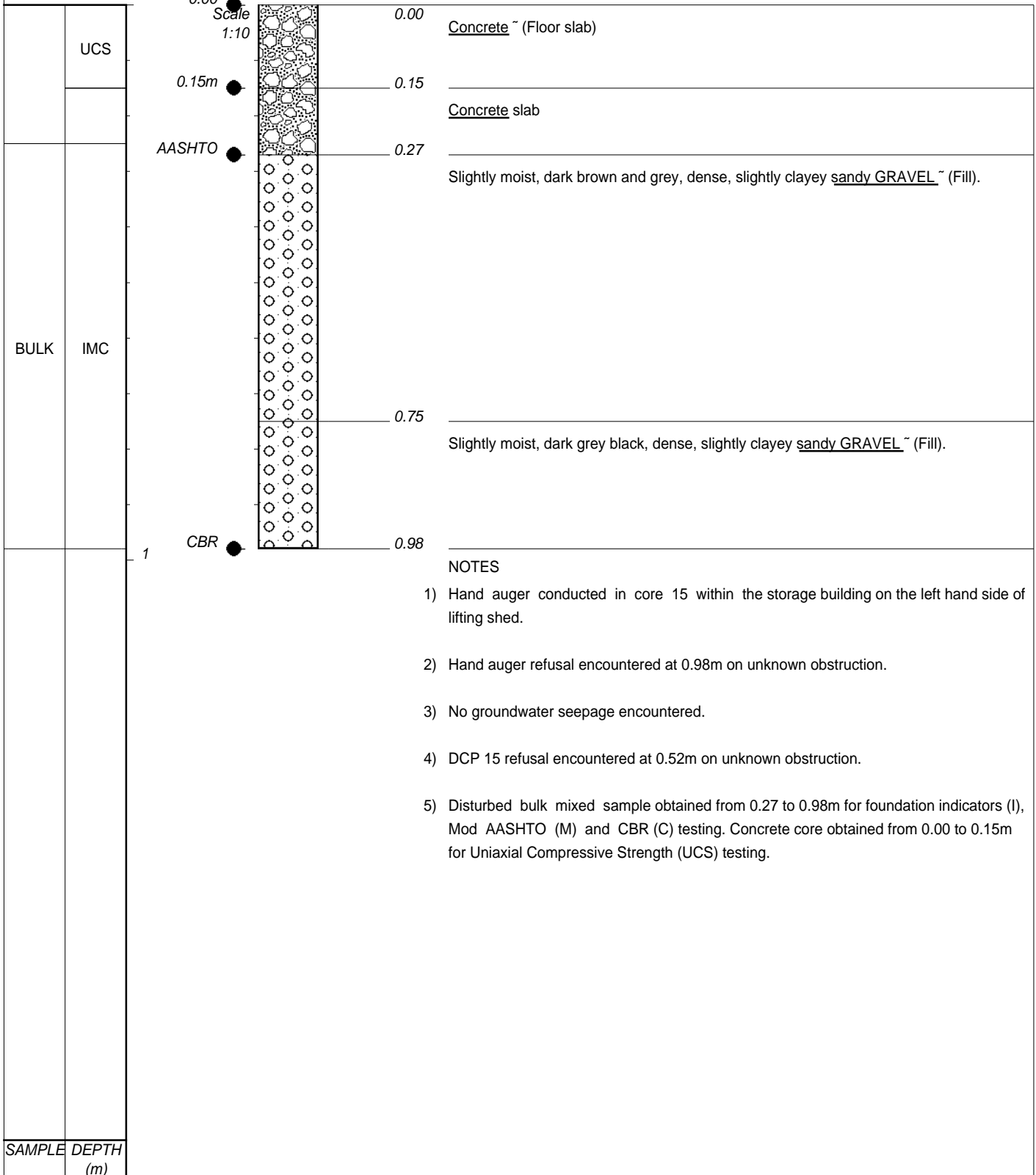


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C14.jpg





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C15.1.jpg



C15.jpg





			0.00	Asphalt
			0.04	Slightly moist to moist, pale yellowish brown to grey, very dense to dense, slightly clayey <u>sandy GRAVEL</u> ~ (Fill).
BULK	IMC			
			0.52	Slightly moist, dark brown to yellow brown, dense becoming medium dense, slightly clayey fine to medium grained <u>sandy GRAVEL</u> ~ (Fill).
BULK	IMC			
			0.68	Slightly moist, yellow brown and orange brown, medium dense, slightly clayey <u>gravelly SAND</u> containing coarse gravel and cobble size fragments of slightly weathered hard rock tillite ~ (Fill).
			0.75	
<p>NOTES</p> <ol style="list-style-type: none"> <li>1) Hand auger conducted in core 16 within the storage building on the left hand side of lifting shed.</li> <li>2) Hand auger refusal encountered at 0.75m on unknown obstruction. Material hand chiselled to 0.70m (maximum reach).</li> <li>3) No groundwater seepage encountered although DCP rods were wet below 2.70m</li> <li>4) Minor sidewall collapse encountered from 0.60m.</li> <li>5) DCP 16 refusal encountered at 4.38m on unknown obstruction.</li> <li>6) Disturbed bulk mixed sample obtained from 0.04 to 0.52m and 0.52 to 0.68m for foundation indicators (I), Mod AASHTO (M) and CBR (C) testing.</li> </ol>				
SAMPLE DEPTH				
(m)				

CONTRACTOR : NA  
 MACHINE : HAND AUGER  
 DRILLED BY : NA  
 PROFILED BY : TR  
 TYPE SET BY : TR  
 SETUP FILE : DMPSP - Copy.SET

INCLINATION :  
 DIAM : NA  
 DATE : NA  
 DATE : 16 & 17 MAY 2024  
 DATE : 12/06/2024 12:17  
 TEXT : C:\DOTIN\SPMASTER.DOC

ELEVATION : 4.72 msl  
 X-COORD : 3301544.248  
 Y-COORD : -2686.906

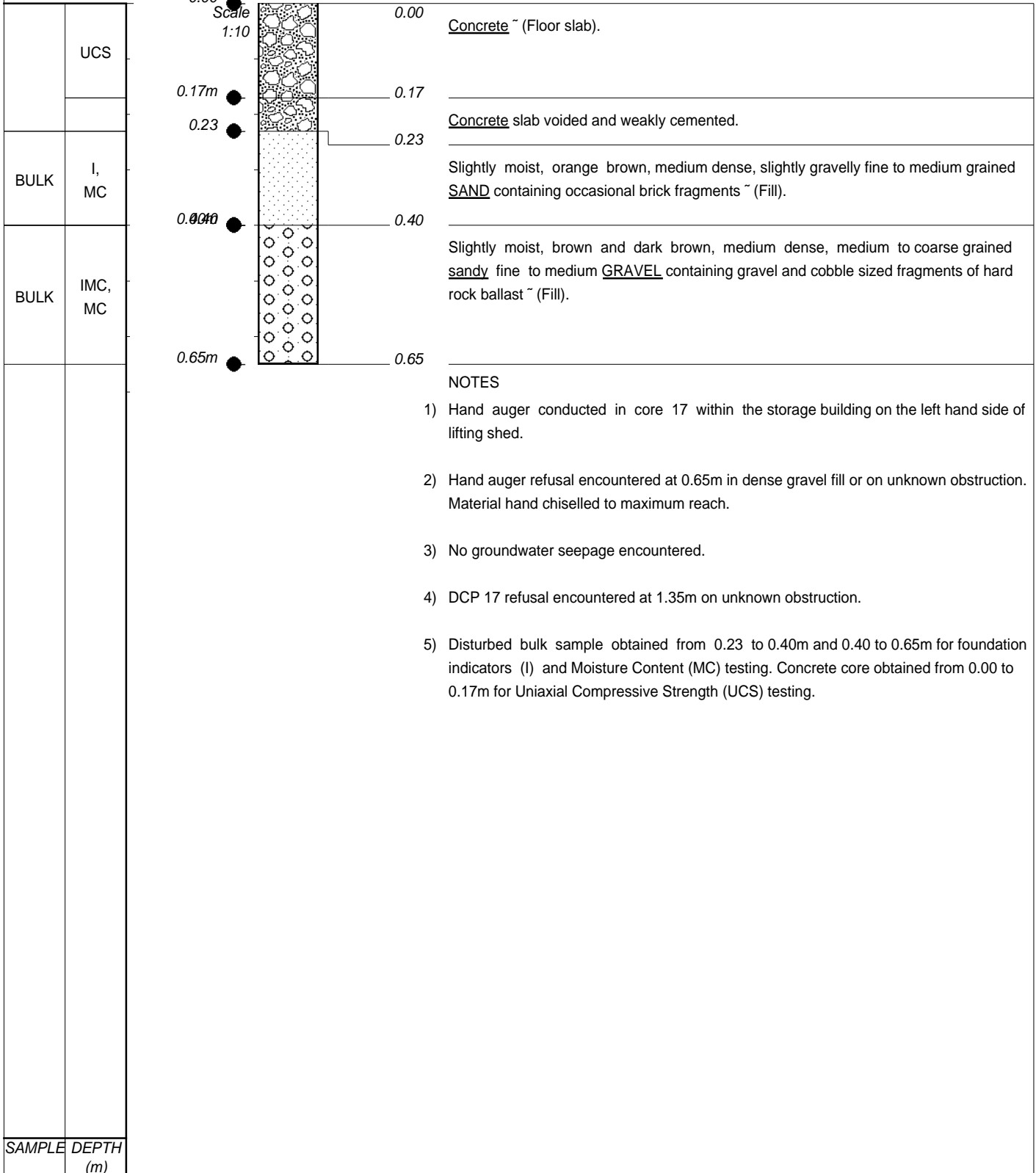


C16.1.jpg



C16.jpg





CONTRACTOR : NA  
 MACHINE : HAND AUGER  
 DRILLED BY : NA  
 PROFILED BY : TR  
 TYPE SET BY : TR  
 SETUP FILE : DMPSP - Copy.SET

INCLINATION :  
 DIAM : NA  
 DATE : NA  
 DATE : 16 & 17 MAY 2024  
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ELEVATION : 4.51 msl  
 X-COORD : 3301551.599  
 Y-COORD : -2686.515



C17.1.jpg



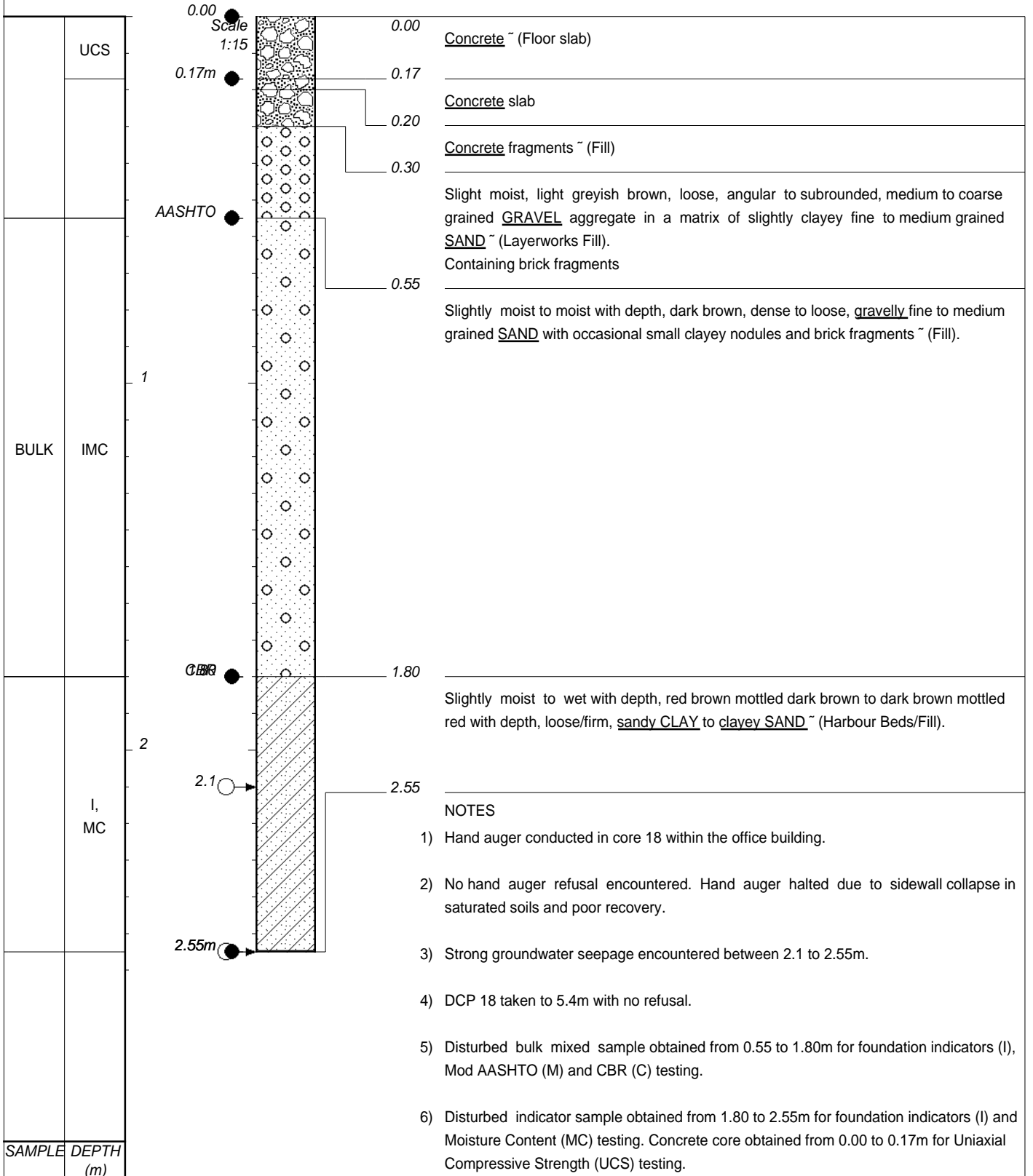
C17.jpg



AH17-1.jpg



AH17-2.jpg



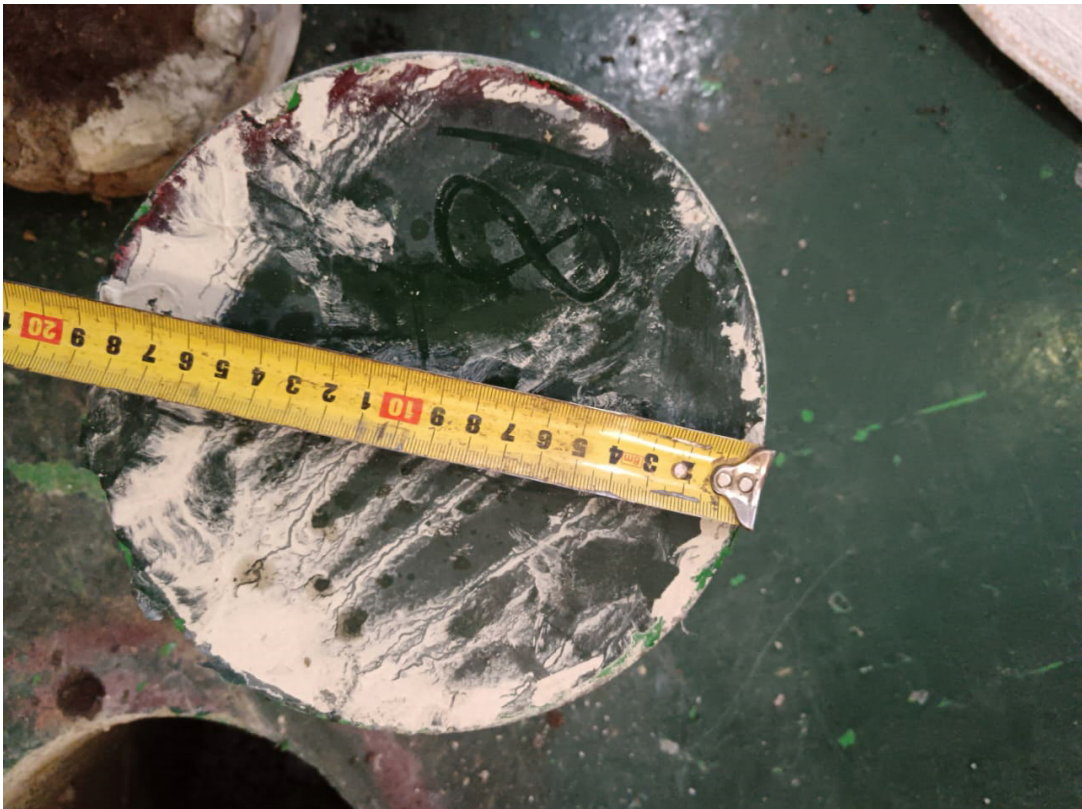
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 MACHINE : HAND AUGER  
 DRILLED BY : NA  
 PROFILED BY : TR  
 TYPE SET BY : TR  
 SETUP FILE : DMPSP - Copy.SET

INCLINATION :  
 DIAM : NA  
 DATE : NA  
 DATE : 16 & 17 MAY 2024  
 DATE : 12/06/2024 12:17  
 TEXT : C:\DOT\INSPMASTER.DOC

ELEVATION : 4.49 msl  
 X-COORD : 3301433.856  
 Y-COORD : -2724.953

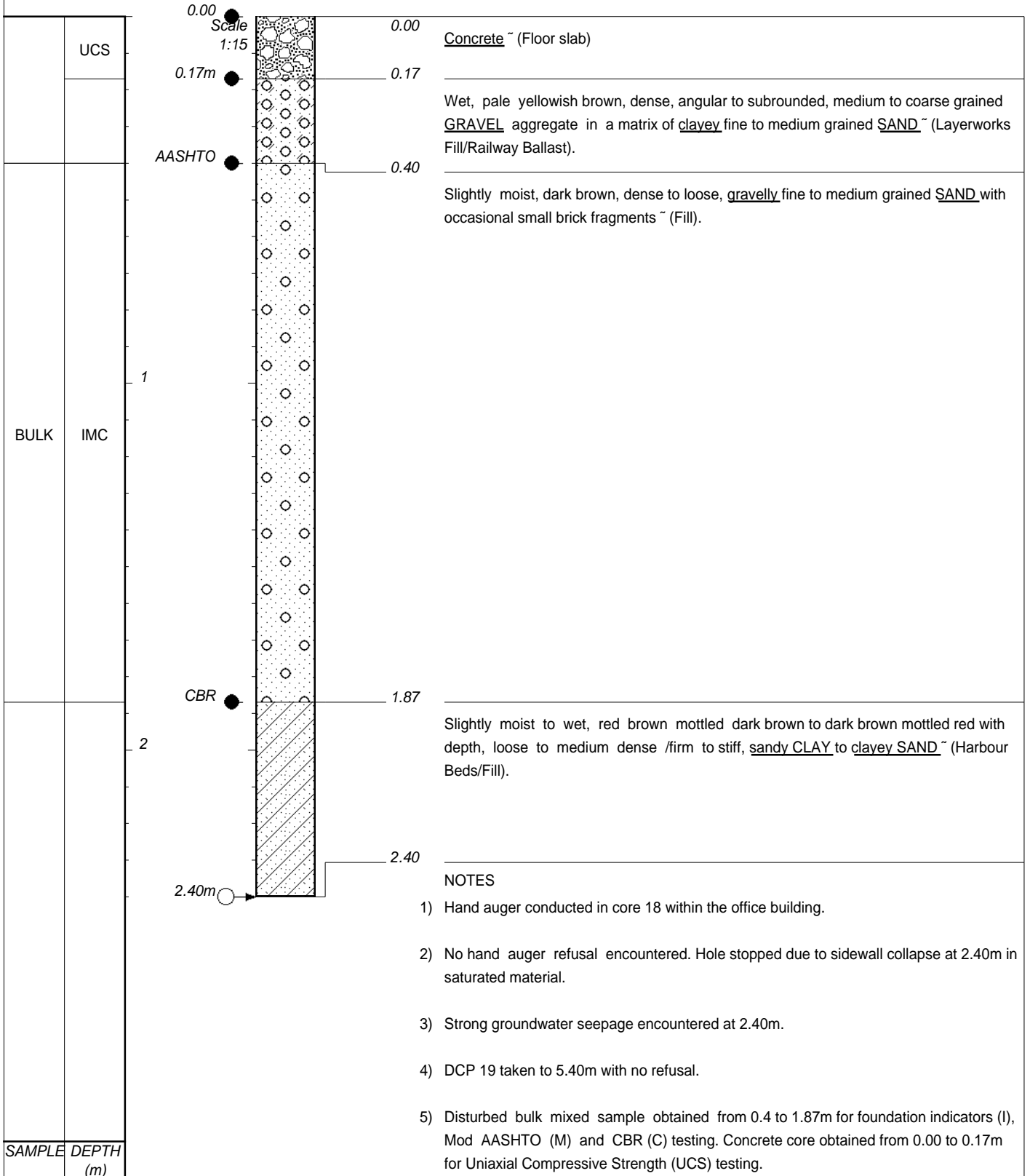


C18.1.jpg



C18.jpg





SAMPLE DEPTH (m)

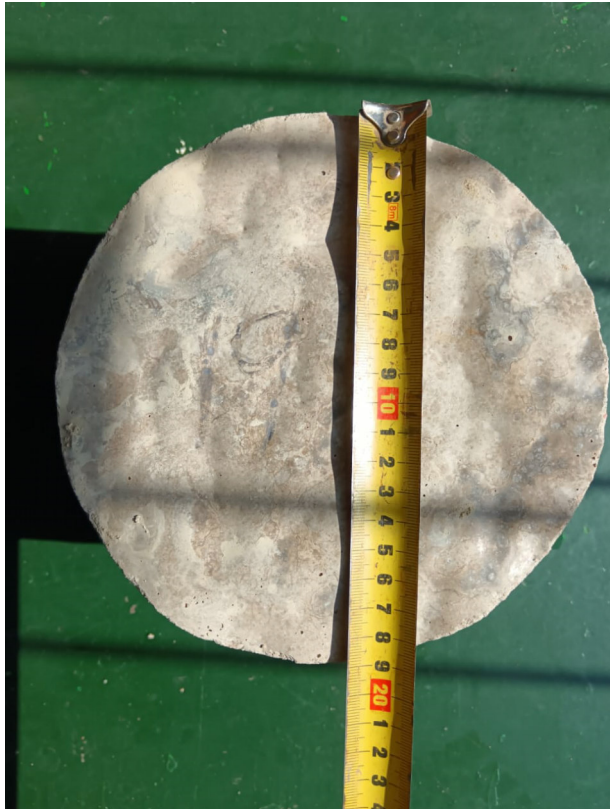
CONTRACTOR : NA  
 MACHINE : HAND AUGER  
 DRILLED BY : NA  
 PROFILED BY : TR  
 TYPE SET BY : TR  
 SETUP FILE : DMPSP - Copy.SET

INCLINATION :  
 DIAM : NA  
 DATE : NA  
 DATE : 16 & 17 MAY 2024  
 DATE : 12/06/2024 12:17  
 TEXT : C:\DOTIN\SPMASTER.DOC

ELEVATION : 5.13 msl  
 X-COORD : 3301415.414  
 Y-COORD : -2722.491

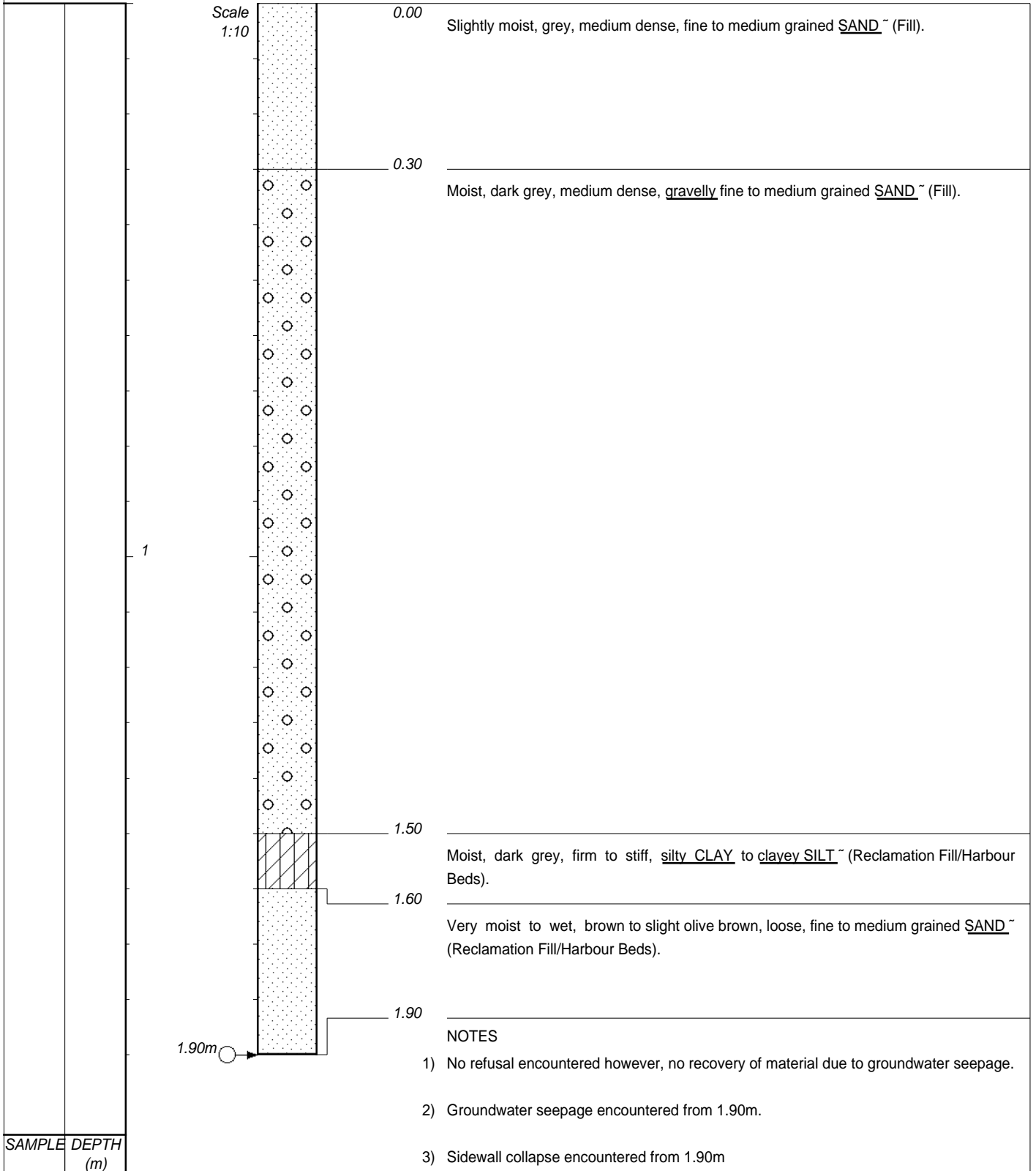


C19.1.jpg



C19.jpg

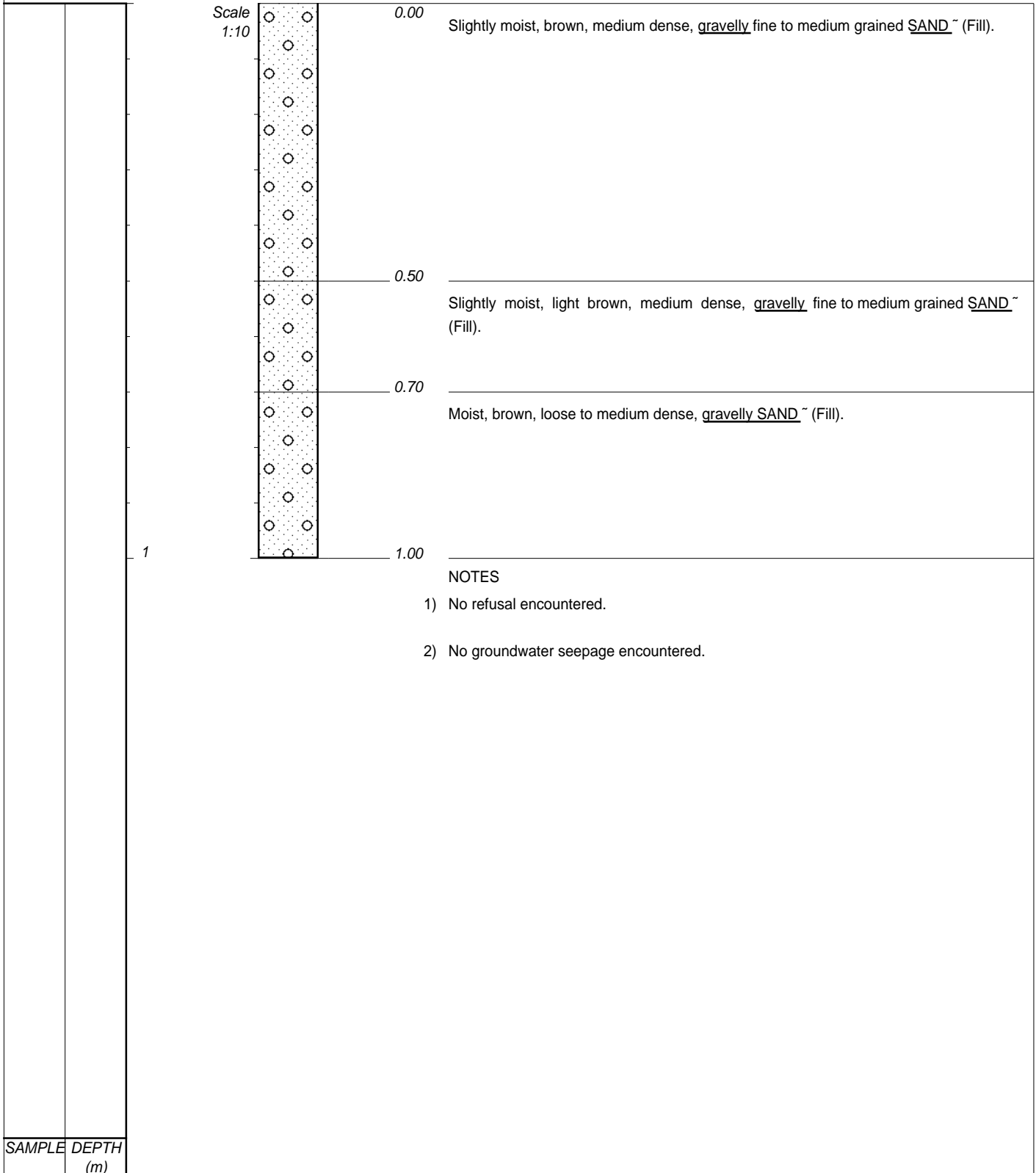




CONTRACTOR : NA  
 MACHINE : HAND AUGER  
 DRILLED BY : NA  
 PROFILED BY : TR  
 TYPE SET BY : TR  
 SETUP FILE : DMPSP - Copy.SET

INCLINATION :  
 DIAM : NA  
 DATE : NA  
 DATE : 16 & 17 MAY 2024  
 DATE : 12/06/2024 12:51  
 TEXT : C:\DOTIN\SPMASTER.DOC

ELEVATION : 4.55 msl  
 X-COORD : 3301572.684  
 Y-COORD : -2685.726



SAMPLE DEPTH  
(m)

CONTRACTOR : NA  
 MACHINE : HAND AUGER  
 DRILLED BY : NA  
 PROFILED BY : TR  
 TYPE SET BY : TR  
 SETUP FILE : DMPSP - Copy.SET

INCLINATION :  
 DIAM : NA  
 DATE : NA  
 DATE : 16 & 17 MAY 2024  
 DATE : 12/06/2024 12:51  
 TEXT : C:\DOT\INSPMASTER.DOC

ELEVATION : 4.45 msl  
 X-COORD : 3301473.353  
 Y-COORD : -2724.593

**APPENDIX B**  
**(DCP 1- DCP 19)**

REDRIVE CORRECTED DCP RESULTS SUMMARY TABLE																			
Depth (mm)	Lifting Shed				Proposed Extension on RHS of Lifting Shed				Proposed Wash Facility			Chemical Storage			Storage Building on the LHS of Lifting Shed			Office Building	
	DCP1	DCP2	DCP3	DCP4	DCP5	DCP6	DCP7	DCP8	DCP9	DCP10	DCP11	DCP12	DCP13	DCP14	DCP15	DCP16	DCP17	DCP18	DCP19
300	0	0	0	0	0	0	0	0	0	0	0	0	0	59	0	106	0	0	0
600	20	0	12	0	35	159	92	82	66	103	105	141	0	70	69	62	30	15	64
900	14	28	5	0	112	148		175	100	72	127	48	43	44		43	42	82	77
1200	14	28	6	40	68					84				67		41	10	61	43
1500		50	11	64	50					81				13		36	44	25	160
1800		33	63	55	28					61				85		52		14	17
2100		53	51	32	26					33				67		30		11	33
2400		25	40	11	60					39				31		19		10	22
2700		20	32	26						48				17		14		13	7
3000		15	18	16						100				25		14		3	4
3300		10	10	11										21		22		1	13
3600		12	14	9										31		41		39	33
3900		11	25	9										48		55		28	29
4200		7	37	17										34		72		29	55
4500		7	27	35										38		54		28	45
4800		14	19	14										33				40	35
5100		5	21	13										15				47	29
5400			20											12				6	34
5700																			
6000																			

Key		
Consistency		Blow Count
Very loose		1 - 8
Loose		8 - 18
Med dense		18 - 54
Dense		54 - 90
Very dense		> 90
Refusal		

Subsoil consistency and blows reference table			
Non Cohesive Soils		Cohesive Soils	
No Of Blows/300mm Penetration	Subsoil Consistency	No Of Blows/300mm Penetration	Subsoil Consistency
<8	Very Loose	<4	Very Soft
8 - 18	Loose	4 - 8	Soft
19 - 54	Medium Dense	9 - 15	Firm
55 - 90	Dense	16 - 24	Stiff
>90	Very Dense	25 - 54	Very Stiff
		>54	Hard

**Summary Table of Recorded Values for DCP & DCP Redrive Tests**

Depth (mm)	DCP1	DCP1 RD	DCP2	DCP2 RD	DCP3	DCP3 RD	DCP4	DCP4 RD	DCP5	DCP5 RD	DCP6	DCP6 RD	DCP7	DCP7 RD	DCP8	DCP8 RD	DCP9	DCP9 RD	DCP10	DCP10 RD	DCP11	DCP11 RD	DCP12	DCP12 RD	DCP13	DCP13 RD	DCP14	DCP14 RD	DCP15	DCP15 RD	DCP16	DCP16 RD	DCP17	DCP17 RD	DCP18	DCP18 RD	DCP19	DCP19 RD		
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61	2	0	0	110	4	0	0	0	0	0	0	0	
600	21	1	0	0	12	0	0	0	35	0	160	1	97	5	84	2	66	3	113	10	107	2	142	1	0	0	71	1	75	6	63	1	53	23	16	1	65	1		
900	15	1	35	7	5	0	0	0	117	5	154	6	Ref	Ref	183	8	12	Ref	85	13	132	5	58	10	64	21	46	2	Ref	Ref	47	4	43	1	85	3	81	4		
1200	15	1	30	2	6	0	50	10	69	1	Ref	Ref			Ref	Ref	Ref		90	6	Ref	Ref	Ref	Ref	Ref	Ref	70	3			46	5	11	1	62	1	44	1		
1500	Ref	Ref	55	5	13	2	67	3	53	3									85	4						20	7			39	3	56	12	26	1	161	1			
1800			36	3	69	6	64	9	31	3									66	5						97	12			61	9	Ref	Ref	15	1	18	1			
2100			59	6	53	2	45	13	37	11									36	3						74	7			40	10			12	1	35	2			
2400			27	2	42	2	13	2	73	13									47	8						35	4			27	8			11	1	24	2			
2700			23	3	35	3	27	1											98	50						20	3			20	6			14	1	14	7			
3000			16	1	20	2	17	1											Ref	Ref						28	3			21	7			8	5	11	7			
3300			11	1	11	1	12	1																		27	6			34	12			8	7	19	6			
3600			16	4	15	1	10	1																		37	6			62	21			48	9	43	10			
3900			12	1	36	11	15	6																		53	5			79	24			38	10	41	12			
4200			8	1	54	17	30	13																		43	9			107	35			44	15	73	18			
4500			11	4	38	11	39	4																		49	11			80	26			52	24	55	10			
4800			17	3	27	8	21	7																		41	8			Ref	Ref			60	20	45	10			
5100			17	12	31	10	27	14																		44	29							61	14	41	12			
5400					32	12																				47	35							32	26	46	12			
5700																																								
6000																																								

Denotes depth below which DCP rods were wet upon removal.

Ref. Refusal of DCP probe in very dense/dense gravel or on unknown obstruction



































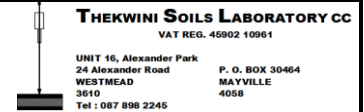




**APPENDIX C**  
**Laboratory Test Results**

# Laboratory Test Summary

**Job Description:** Prasa Lifting Shed - 34233  
**Job no.:** 9981  
**Date:** 06-06-2024



Lab no.		05097	05098	05099	05100	05101	05102	05103	05104	05105
Location		C2 - C4	C9 - C11	C10	C14 - C16	C14 - C16	C18 - C19	C18	C17	C17
Depth (m)		0.3/0.55-0.75/0.8	0.17/0.23-0.5/0.6	0.75 - 0.85	0.04/0.08-0.2/0.5	0.2/0.52-0.68/1.10	0.4/0.55-0.87/1.80	1.80 - 2.55	0.18 - 0.40	0.40 - 0.65
Description		yb sandy Gravel	yb sandy Gravel	rb & y gr Sand	gb - yb sa Gravel	dk gr bl sa Gr	dk br gr Sand	rb clayey Sand	ob gravelly Sand	br - dk br sa Gr
Binder Material		-	-	-	-	-	-	-	-	-
Particle Size (mm)	75	95	94			100	100			
	53	92	87		100	98	98			
	37.5	89	76		99	93	96			
	26.5	83	65		93	86	94			
	19	73	56	100	80	79	92		100	100
	13.2	57	47	97	58	66	81		99	95
	9.5	47	41	93	52	57	76	100	95	88
	4.75	36	34	84	46	46	68	100	88	68
	2	29	27	69	34	34	64	99	83	52
	0.425	20	17	34	17	16	56	85	74	34
	0.25	17	14	28	13	12	35	77	50	25
	0.15	13	10	22	11	8	11	66	18	15
	0.075	11	8	18	8	6	8	60	13	12
	0.05	10	7	16	8	6	7	58	12	11
	0.02	9	7	14	7	6	7	49	11	10
0.005	8	6	11	7	5	7	38	10	8	
0.002	7	6	10	6	5	7	32	9	7	
Soil Mortar	Coarse Sand <2.0 >0.425mm	29.9	35.9	50.4	50.3	53.8	12.7	13.5	10.3	35.0
	Fine Sand <0.425>0.05mm	62.9	59.5	41.5	45.7	43.4	80.7	36.0	79.1	57.9
	Silt <0.05 >0.005	1.3	0.5	2.4	0.8	0.3	0.5	17.5	1.6	1.7
	Clay <0.005	5.8	4.1	5.7	3.3	2.5	6.1	33.0	9.0	5.3
Atterberg Limits	Liquid Limit	23.2	16.3	19.6	20.3	21.8	20.3	19.6	19.3	22.7
	Plasticity Index	1.4	0	6.8	0	0	0	6.8	0	0
	Linear Shrinkage	1	0	1.3	0	0	0	1.3	0	0
	Natural MC	-	7.44	9.18	10.14	12.21	9.98	35.2	6.18	9.11
Mod AASHTO Density	Density Kg/m <sup>3</sup>	2048	2156		2129	1874	1760			
	OMC	8.1	8		6.9	10.3	10.8			
CBR	100%	69	57		79	72	18			
	98%	53	50		66	54	16			
	95%	36	41		50	35	13			
	93% (Inferred)	33	38		47	21	11			
	90%	29	33		42	10	8.8			
	CBR Swell	0.00	0.00		0.00	0.00	0.00			
AASHTO Soil Classification	A - 1 - a (0)	A - 1 - a (0)	A - 2 - 4 (0)	A - 1 - a (0)	A - 1 - a (0)	A - 3 (0)	A - 4 (1)	A - 2 - 4 (0)	A - 1 - b (0)	
Grading Modulus	2.40	2.49	1.79	2.41	2.44	1.72	0.56	1.30	2.03	
TRH 14 (1985) WT = Worse Than	G6	G6		G5	G7	G8				

# MATERIALS ANALYSIS



**THEKWINI SOILS LABORATORY CC**  
VAT REG. 45902 10961

UNIT 16, Alexander Park  
24 Alexander Road  
WESTMEAD 3510  
Tel : 087 898 2245

P. O. BOX 30464  
MAYVILLE  
4058

**Project:** Prasa Lifting Shed - 34233

**Ref no.:** 9981      **Lab no.:** 05097      **Borehole/Pit no.:** C2 - C4      **Fig no.:** -  
**Description:** yb sandy Gravel

**Depth (m):** 0.3/0.55-0.75/0.8

Grading Analysis	
Grain Size	%Passing
75 (mm)	94.5
53	92.1
37.5	89.3
26.5	82.6
19	73.2
13.2	56.9
9.5	47.4
4.75	36.4
2	28.8
0.425	20.2
0.25	16.7
0.15	12.6
0.075	10.7
0.05	10.2
0.02	9.4
0.005	8.3
0.002	7.5

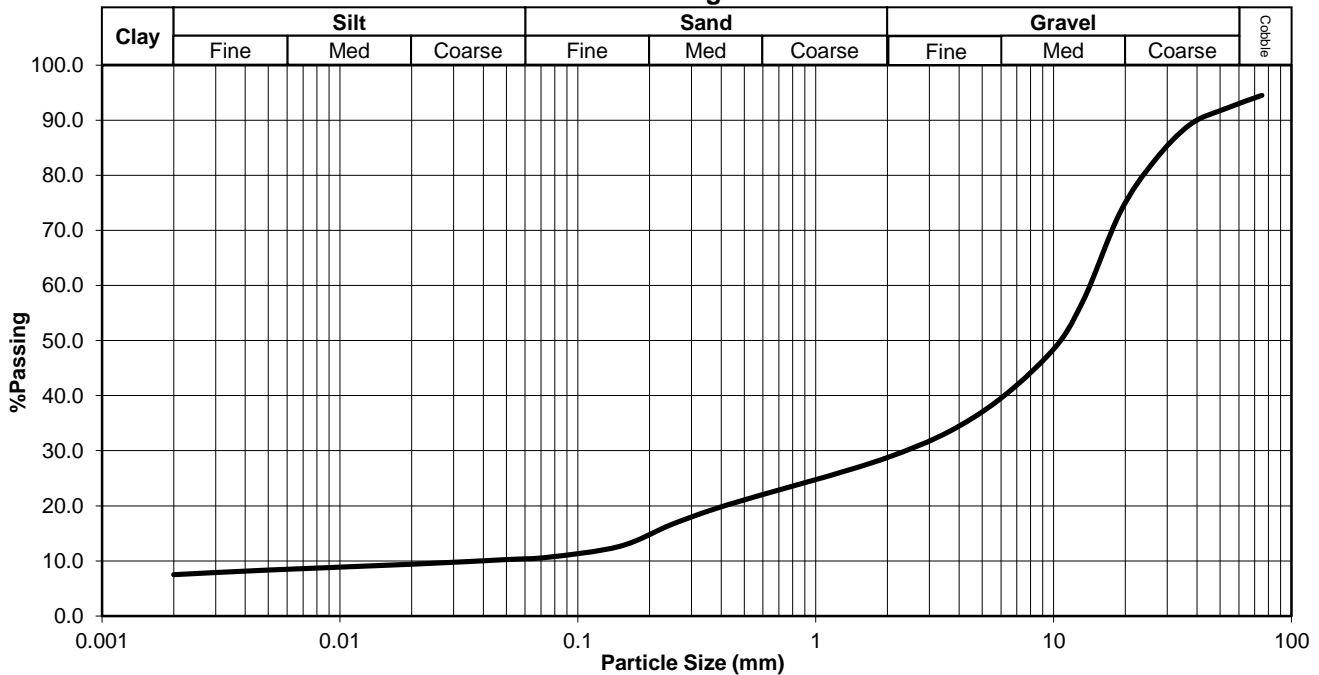
M.I.T SIZE CLASSIFICATION	
Cobble%	7.1
Gravel%	64.1
Coarse	18.4
Medium	35.2
Fine	10.5
Sand%	18.4
Coarse	7.6
Medium	6.5
Fine	4.3
Silt%	2.9
Coarse	1.0
Medium	1.0
Fine	0.9
Clay%	7.5

PLASTICITY	
Liquid Limit	23.2
Plasticity Index	1.4
Linear Shrinkage	1

GRADING	
D10 Size (mm)	0.039
Uniformity Coefficient	>99
Grading Modulus	2.40

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	0
AASHTO Soil Classification	A - 1 - a
Unified Classification	GP - GM

**Grading Curve**



Ref no.: 9981

Fig no.: -

# MATERIALS ANALYSIS



**THEKWINI SOILS LABORATORY CC**  
VAT REG. 45902 10961

UNIT 16, Alexander Park  
24 Alexander Road  
WESTMEAD  
3610  
Tel : 087 898 2245

P. O. BOX 30464  
MAYVILLE  
4058

**Project:** Prasa Lifting Shed - 34233

**Ref no.:** 9981      **Lab no.:** 05098      **Borehole/Pit no.:** C9 - C11      **Fig no.:** -  
**Description:** yb sandy Gravel

**Depth (m):** 0.17/0.23-0.5/0.6

Grading Analysis	
Grain Size (mm)	%Passing
75	93.9
53	87.3
37.5	76.5
26.5	65.0
19	56.1
13.2	46.6
9.5	40.8
4.75	33.5
2	26.7
0.425	17.1
0.25	13.5
0.15	9.5
0.075	7.6
0.05	7.2
0.02	6.6
0.005	6.4
0.002	5.8

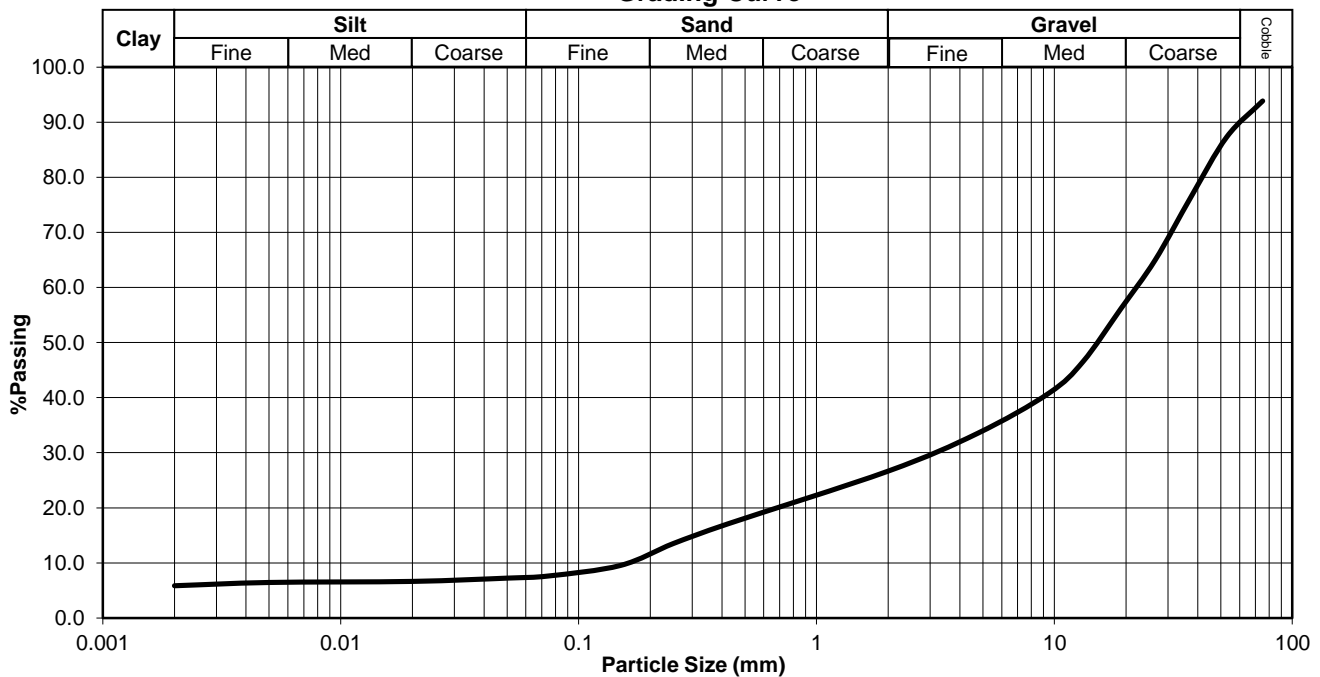
M.I.T SIZE	
CLASSIFICATION	
Cobble%	10.6
Gravel%	62.8
Coarse	32.1
Medium	21.9
Fine	8.8
Sand%	19.3
Coarse	8.5
Medium	6.6
Fine	4.1
Silt%	1.5
Coarse	0.8
Medium	0.2
Fine	0.6
Clay%	5.8

PLASTICITY	
Liquid Limit	16.3
Plasticity Index	0
Linear Shrinkage	0

GRADING	
D10 Size (mm)	0.16
Uniformity Coefficient	>99
Grading Modulus	2.49

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	0
AASHTO Soil Classification	A - 1 - a
Unified Classification	GW - GM

**Grading Curve**



Ref no.: 9981

Fig no.: -

# MATERIALS ANALYSIS



**THEKWINI SOILS LABORATORY CC**  
VAT REG. 45902 10961

UNIT 16, Alexander Park  
24 Alexander Road  
WESTMEAD  
3610  
Tel : 087 898 2245

P. O. BOX 30464  
MAYVILLE  
4058

**Project:** Prasa Lifting Shed - 34233

**Ref no.:** 9981      **Lab no.:** 05099      **Borehole/Pit no.:** C10      **Fig no.:** -  
**Description:** rb & y gravelly Sand

**Depth (m):** 0.75 - 0.85

Grading Analysis	
Grain Size (mm)	%Passing
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
13.2	97.1
9.5	92.9
4.75	84.2
2	69.4
0.425	34.4
0.25	28.4
0.15	21.7
0.075	17.6
0.05	16.3
0.02	13.9
0.005	11.4
0.002	10.2

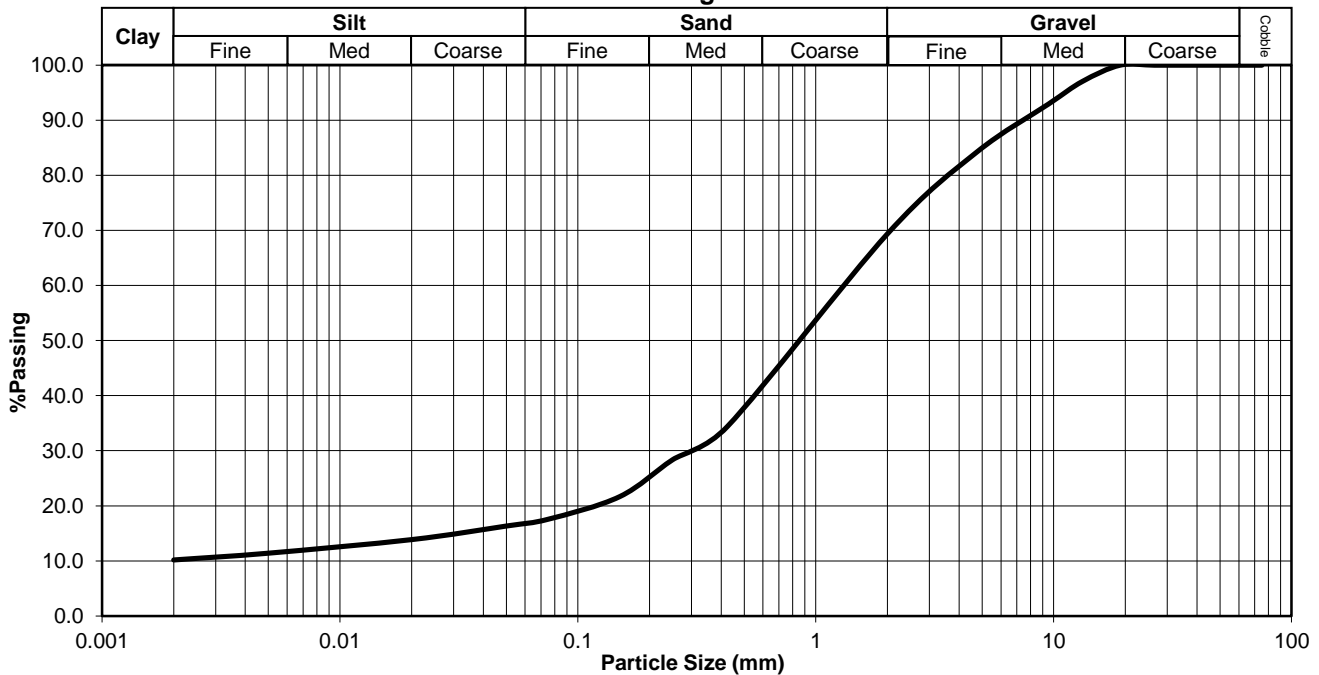
M.I.T SIZE	
CLASSIFICATION	
Cobble%	0.0
Gravel%	30.6
Coarse	0.0
Medium	13.5
Fine	17.1
Sand%	52.6
Coarse	31.1
Medium	13.3
Fine	8.2
Silt%	6.7
Coarse	3.0
Medium	2.3
Fine	1.4
Clay%	10.2

PLASTICITY	
Liquid Limit	19.6
Plasticity Index	6.8
Linear Shrinkage	1.3

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	1.79

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	0
AASHTO Soil Classification	A - 2 - 4
Unified Classification	SM - SC

**Grading Curve**



**Ref no.:** 9981

**Fig no.:** -

# MATERIALS ANALYSIS



**THEKWINI SOILS LABORATORY CC**  
VAT REG. 45902 10961

UNIT 16, Alexander Park  
24 Alexander Road  
WESTMEAD  
3610  
Tel : 087 898 2245

P. O. BOX 30464  
MAYVILLE  
4058

**Project:** Prasa Lifting Shed - 34233

**Ref no.:** 9981      **Lab no.:** 05100      **Borehole/Pit no.:** C14 - C16      **Fig no.:** -  
**Description:** gb - yb sa Gravel

**Depth (m):** 0.04/0.08-0.2/0.5

Grading Analysis	
Grain Size	%Passing
75 (mm)	100.0
53	100.0
37.5	99.0
26.5	92.9
19	79.7
13.2	57.9
9.5	51.6
4.75	45.7
2	34.1
0.425	16.9
0.25	13.0
0.15	10.6
0.075	8.3
0.05	8.1
0.02	7.5
0.005	6.6
0.002	6.2

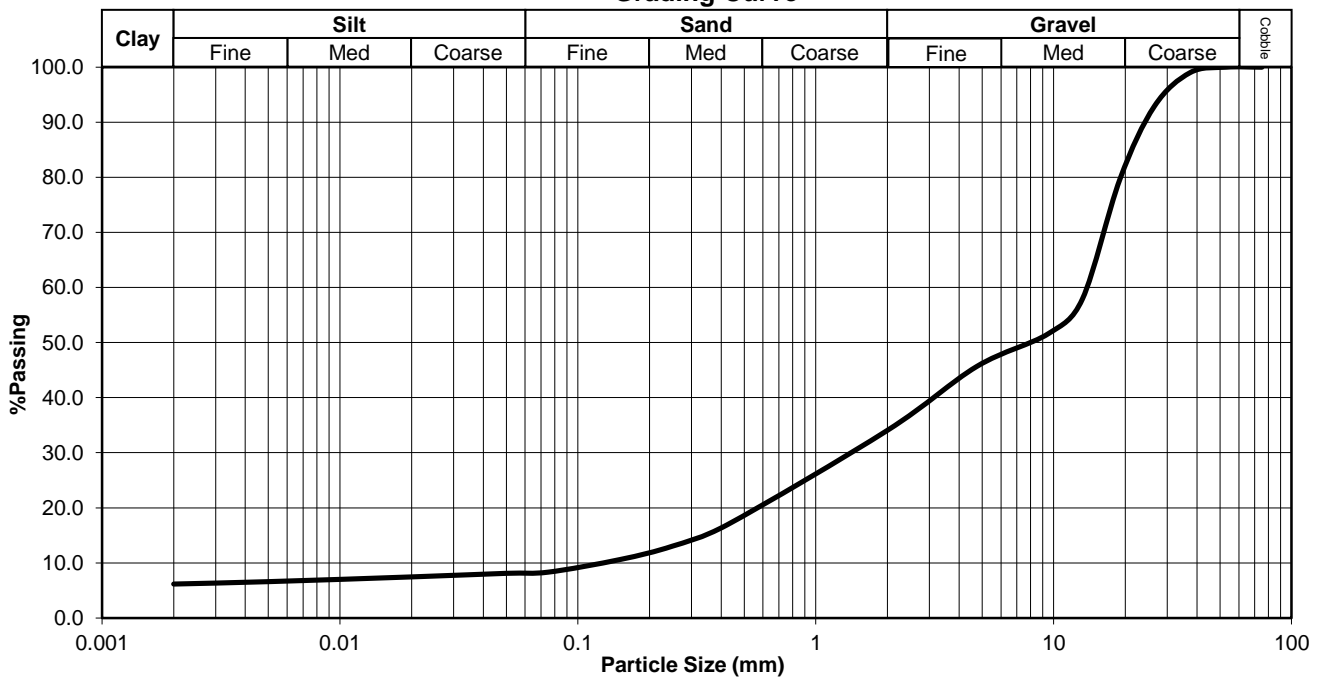
M.I.T SIZE	
CLASSIFICATION	
Cobble%	0.0
Gravel%	65.9
Coarse	18.5
Medium	34.2
Fine	13.2
Sand%	25.9
Coarse	15.2
Medium	7.0
Fine	3.6
Silt%	2.0
Coarse	0.7
Medium	0.8
Fine	0.5
Clay%	6.2

PLASTICITY	
Liquid Limit	20.3
Plasticity Index	0
Linear Shrinkage	0

GRADING	
D10 Size (mm)	0.13
Uniformity Coefficient	>99
Grading Modulus	2.41

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	0
AASHTO Soil Classification	A - 1 - a
Unified Classification	GW - GM

**Grading Curve**



Ref no.: 9981

Fig no.: -

# MATERIALS ANALYSIS



**THEKWINI SOILS LABORATORY CC**  
VAT REG. 45902 10961

UNIT 16, Alexander Park  
24 Alexander Road  
WESTMEAD  
3610  
Tel : 087 898 2245

P. O. BOX 30464  
MAYVILLE  
4058

**Project:** Prasa Lifting Shed - 34233

**Ref no.:** 9981      **Lab no.:** 05101      **Borehole/Pit no.:** C14 - C16      **Fig no.:** -  
**Description:** dk gr bl sa Gravel

**Depth (m):** 0.2/0.52-0.68/1.10

Grading Analysis	
Grain Size (mm)	%Passing
75	100.0
53	97.6
37.5	92.6
26.5	85.6
19	78.7
13.2	65.8
9.5	57.0
4.75	46.0
2	33.9
0.425	15.7
0.25	11.7
0.15	8.0
0.075	6.3
0.05	6.2
0.02	5.8
0.005	5.4
0.002	5.1

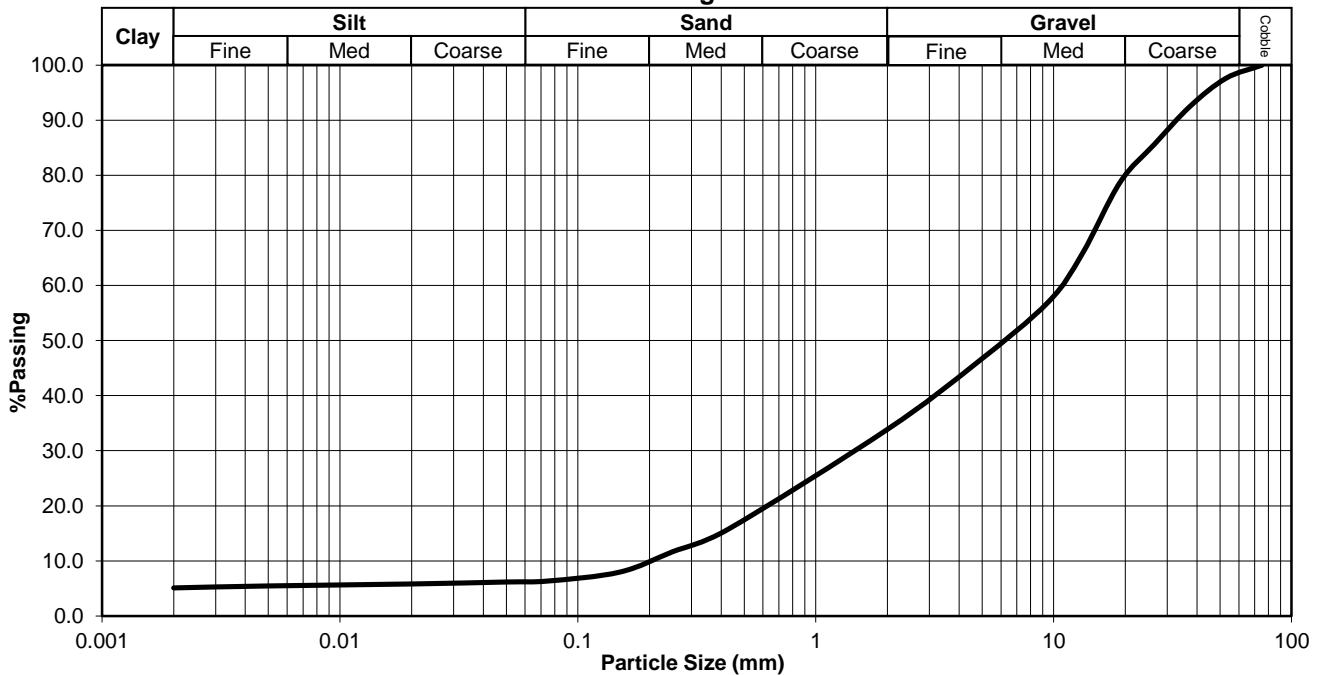
M.I.T SIZE	
CLASSIFICATION	
Cobble%	1.6
Gravel%	64.5
Coarse	18.7
Medium	30.8
Fine	15.0
Sand%	27.6
Coarse	16.2
Medium	7.9
Fine	3.6
Silt%	1.1
Coarse	0.4
Medium	0.3
Fine	0.4
Clay%	5.1

PLASTICITY	
Liquid Limit	21.8
Plasticity Index	0
Linear Shrinkage	0

GRADING	
D10 Size (mm)	0.2
Uniformity Coefficient	53.41
Grading Modulus	2.44

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	0
AASHTO Soil Classification	A - 1 - a
Unified Classification	GP - GM

**Grading Curve**



Ref no.: 9981

Fig no.: -

# MATERIALS ANALYSIS



**THEKWINI SOILS LABORATORY CC**  
VAT REG. 45902 10961

UNIT 16, Alexander Park  
24 Alexander Road  
WESTMEAD  
3610  
Tel : 087 898 2245

P. O. BOX 30464  
MAYVILLE  
4058

**Project:** Prasa Lifting Shed - 34233

**Ref no.:** 9981      **Lab no.:** 05102      **Borehole/Pit no.:** C18 - C19 **Fig no.:** -  
**Description:** dk br gr Sand

**Depth (m):** 0.4/0.55-0.87/1.80

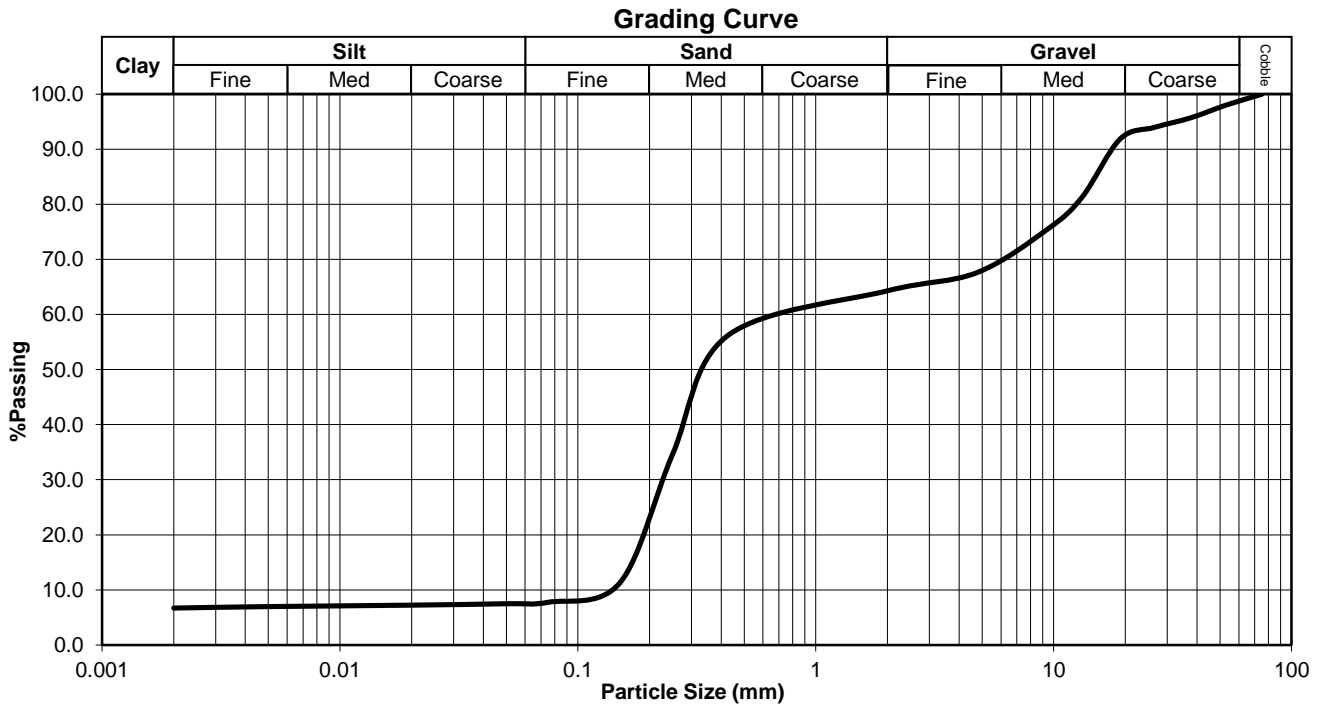
Grading Analysis	
Grain Size	%Passing
75 (mm)	100.0
53	98.0
37.5	95.7
26.5	94.0
19	91.9
13.2	81.4
9.5	75.6
4.75	67.6
2	64.3
0.425	56.1
0.25	34.6
0.15	11.3
0.075	7.8
0.05	7.5
0.02	7.2
0.005	7.0
0.002	6.7

M.I.T SIZE	
CLASSIFICATION	
Cobble%	1.4
Gravel%	34.3
Coarse	6.5
Medium	22.4
Fine	5.4
Sand%	56.7
Coarse	7.3
Medium	34.1
Fine	15.3
Silt%	0.9
Coarse	0.4
Medium	0.2
Fine	0.3
Clay%	6.7

PLASTICITY	
Liquid Limit	20.3
Plasticity Index	0
Linear Shrinkage	0

GRADING	
D10 Size (mm)	0.12
Uniformity Coefficient	7.57
Grading Modulus	1.72

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	0
AASHTO Soil Classification	A - 3
Unified Classification	SP - SM



**Ref no.:** 9981

**Fig no.:** -

# MATERIALS ANALYSIS



**THEKWINI SOILS LABORATORY CC**  
VAT REG. 45902 10961

UNIT 16, Alexander Park  
24 Alexander Road  
WESTMEAD  
3610  
Tel : 087 898 2245

P. O. BOX 30464  
MAYVILLE  
4058

**Project:** Prasa Lifting Shed - 34233

**Ref no.:** 9981      **Lab no.:** 05103      **Borehole/Pit no.:** C18      **Fig no.:** -  
**Description:** rb clayey Sand

**Depth (m):** 1.80 - 2.55

Grading Analysis	
Grain Size (mm)	%Passing
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
13.2	100.0
9.5	100.0
4.75	99.8
2	98.7
0.425	85.3
0.25	77.0
0.15	66.3
0.075	59.9
0.05	58.4
0.02	49.0
0.005	38.1
0.002	31.9

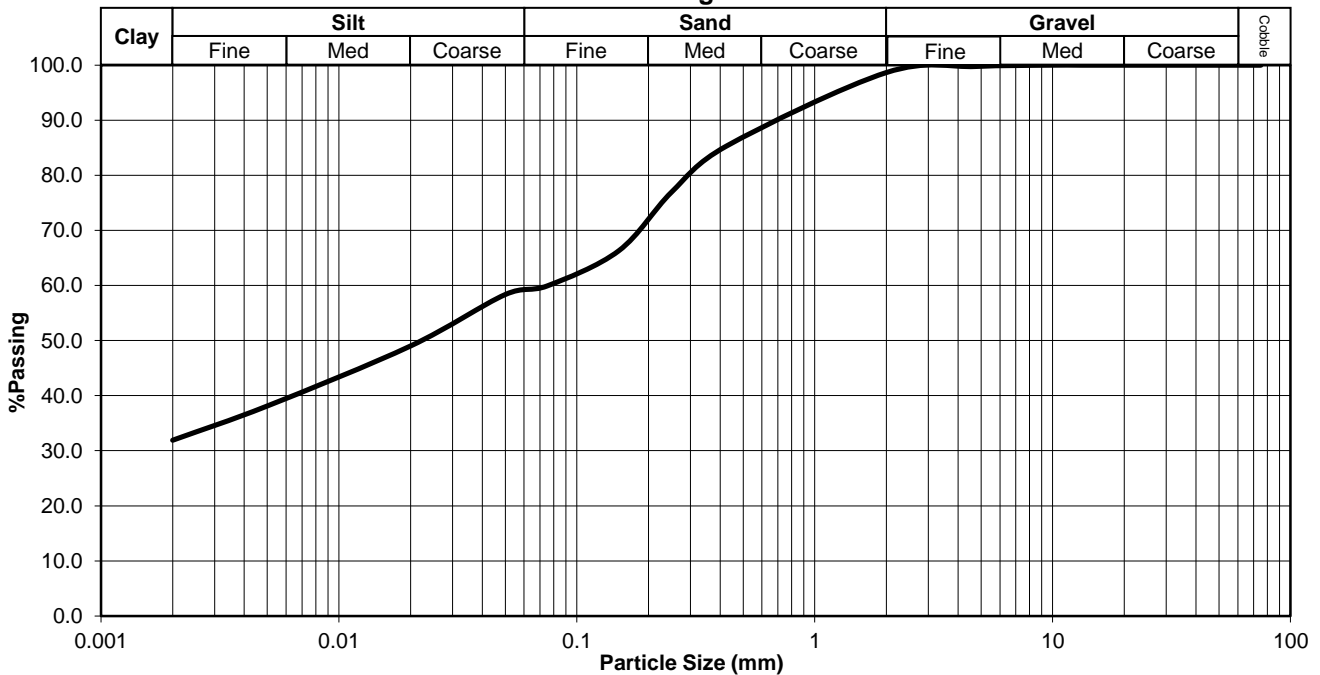
M.I.T SIZE	
CLASSIFICATION	
Cobble%	0.0
Gravel%	1.3
Coarse	0.0
Medium	0.2
Fine	1.2
Sand%	39.7
Coarse	11.9
Medium	15.2
Fine	12.6
Silt%	27.1
Coarse	10.0
Medium	10.2
Fine	7.0
Clay%	31.9

PLASTICITY	
Liquid Limit	19.6
Plasticity Index	6.8
Linear Shrinkage	1.3

GRADING	
D10 Size (mm)	<0.002
Uniformity Coefficient	NA
Grading Modulus	0.56

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	1
AASHTO Soil Classification	A - 4
Unified Classification	CL - ML

**Grading Curve**



**Ref no.:** 9981

**Fig no.:** -

# MATERIALS ANALYSIS



**THEKWINI SOILS LABORATORY CC**  
VAT REG. 45902 10961

UNIT 16, Alexander Park  
24 Alexander Road  
WESTMEAD  
3610  
Tel : 087 898 2245

P. O. BOX 30464  
MAYVILLE  
4058

**Project:** Prasa Lifting Shed - 34233

**Ref no.:** 9981      **Lab no.:** 05104      **Borehole/Pit no.:** C17      **Fig no.:** -  
**Description:** ob gravelly Sand

**Depth (m):** 0.18 - 0.40

Grading Analysis	
Grain Size (mm)	%Passing
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
13.2	98.6
9.5	94.8
4.75	87.8
2	82.8
0.425	74.3
0.25	49.7
0.15	18.2
0.075	12.6
0.05	11.8
0.02	10.9
0.005	10.0
0.002	9.1

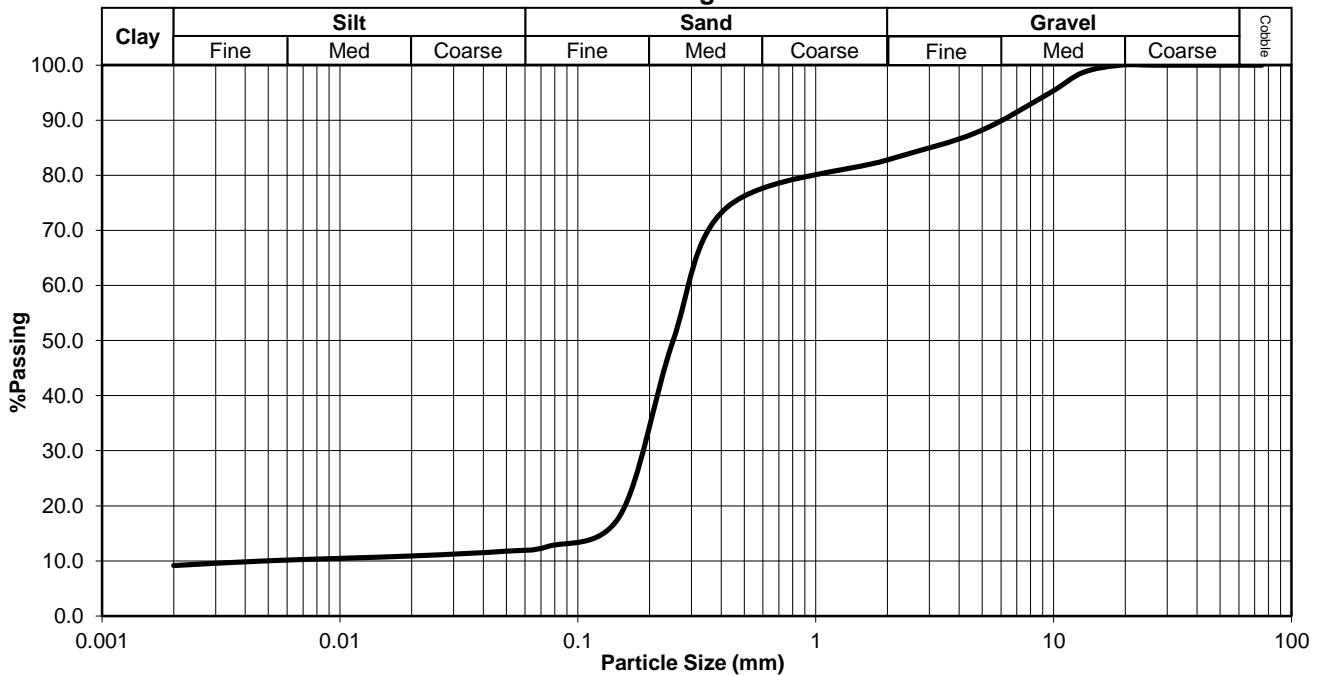
M.I.T SIZE	
CLASSIFICATION	
Cobble%	0.0
Gravel%	17.2
Coarse	0.0
Medium	10.3
Fine	6.8
Sand%	70.7
Coarse	7.6
Medium	41.3
Fine	21.8
Silt%	3.0
Coarse	1.2
Medium	0.8
Fine	0.9
Clay%	9.1

PLASTICITY	
Liquid Limit	19.3
Plasticity Index	0
Linear Shrinkage	0

GRADING	
D10 Size (mm)	0.0049
Uniformity Coefficient	63.67
Grading Modulus	1.30

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	0
AASHTO Soil Classification	A - 2 - 4
Unified Classification	SM

**Grading Curve**



**Ref no.:** 9981

**Fig no.:** -

# MATERIALS ANALYSIS



**THEKWINI SOILS LABORATORY CC**  
VAT REG. 45902 10961

UNIT 16, Alexander Park  
24 Alexander Road  
WESTMEAD  
3610  
Tel : 087 898 2245

P. O. BOX 30464  
MAYVILLE  
4058

**Project:** Prasa Lifting Shed - 34233

**Ref no.:** 9981      **Lab no.:** 05105      **Borehole/Pit no.:** C17      **Fig no.:** -  
**Description:** br - dk br sa Gravel

**Depth (m):** 0.40 - 0.65

Grading Analysis	
Grain Size (mm)	%Passing
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
13.2	95.5
9.5	87.7
4.75	68.1
2	51.9
0.425	33.8
0.25	24.6
0.15	15.0
0.075	11.5
0.05	10.9
0.02	9.5
0.005	8.2
0.002	6.9

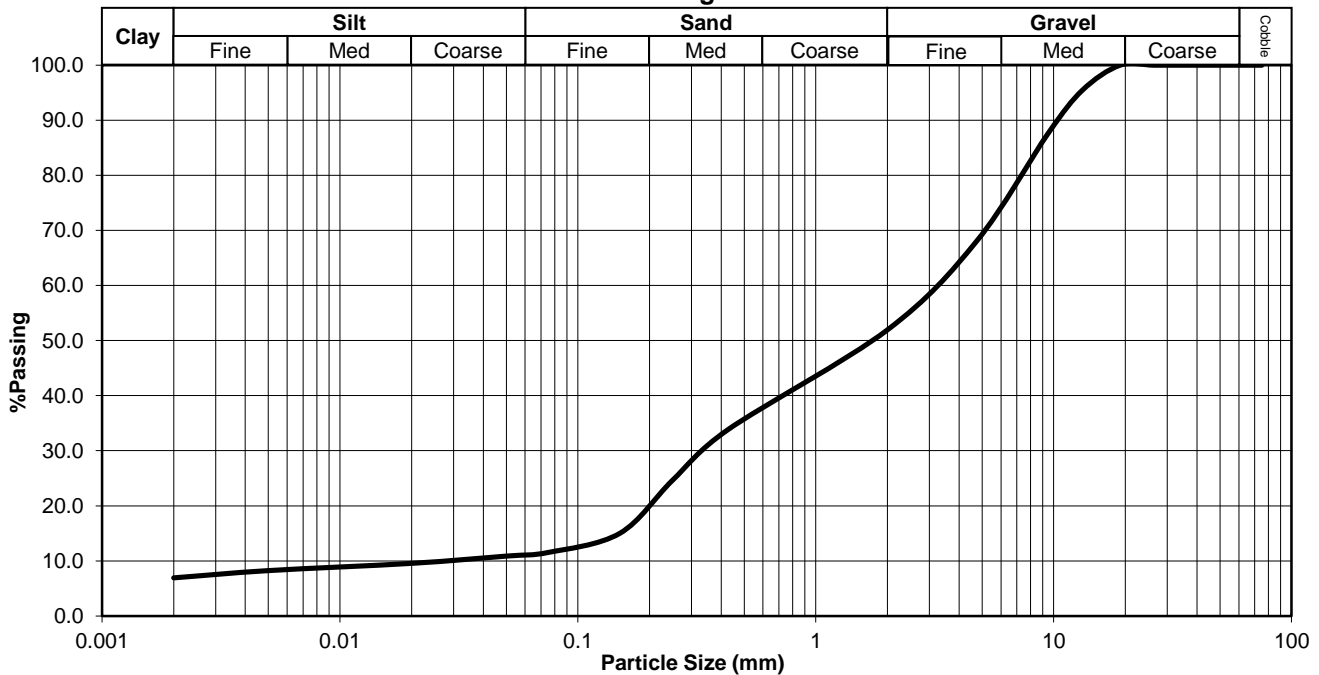
M.I.T SIZE	
CLASSIFICATION	
Cobble%	0.0
Gravel%	48.1
Coarse	0.0
Medium	26.8
Fine	21.3
Sand%	40.8
Coarse	16.2
Medium	16.0
Fine	8.7
Silt%	4.2
Coarse	1.6
Medium	1.2
Fine	1.4
Clay%	6.9

PLASTICITY	
Liquid Limit	22.7
Plasticity Index	0
Linear Shrinkage	0

GRADING	
D10 Size (mm)	0.027
Uniformity Coefficient	>99
Grading Modulus	2.03

CLASSIFICATION	
Potential Expansiveness	Low
Group Index	0
AASHTO Soil Classification	A - 1 - b
Unified Classification	SW - SM

**Grading Curve**



**Ref no.:** 9981

**Fig no.:** -

Report No: CD24/05/445-1  
Job No: CD24/05/445

04 June 2024



Client: Drennan Maud (Pty) Ltd

Project: PRASA Lifting Shed – Durban (34223)

O/N: 34223

### LABORATORY REPORT TESTING OF CORES

#### 1. CLIENT

1.1 Drennan Maud (Pty) Ltd, 68 Peter Mokaba Ridge, Musgrave, Berea, 4001

#### 2. BRIEF FROM CLIENT

2.1 Contest was requested to determine the compressive strength of nineteen concrete cores delivered to Contest by the client in accordance with SABS865:1994.

#### 3. SAMPLES

3.1 Nineteen cores were received at the Westmead based laboratory and referenced as follows:

Customer Marking	Location in structure	Customer Date Cast	Contest Marking	Date Received
C1	0.00-0.17m	Not Given	445/2188	21/05/2024
C2	0.00-0.15m		445/2189	
C2b	0.15-0.23m		445/2190	
C3	0.00-0.16m		445/2191	
C4	0.00-0.20m		445/2192	
C9	0.00-0.21m		445/2193	
C10	0.00-0.17m		445/2194	
C11	0.00-0.23m		445/2195	
C12	0.00-0.17m		445/2196	
C13	0.00-0.19m		445/2197	
C13b	0.19-0.45m		445/2198	
C15	0.00-0.15m		445/2199	
C17	0.00-0.17m		445/2200	
C18	0.00-0.17m		445/2201	
C19	0.00-0.17m		445/2202	
C5	Not Given		445/2397	30/05/2024
C6			445/2398	
C7			445/2399	
C8			445/2400	

3.2 The core with customer marking C13b and Contest marking 445/2198 was found to be unfit for testing.

3.3 Cores received on 21/05/2024 were tested on 27/05/2024 and reported in a separate report.

3.4 Cores with customer markings C5, C6, C7, C8 and Contest marking 445/2397, 445/2398, 445/2399, 445/2400 was tested and reported in this report.

#### 4. SAMPLE INFORMATION SUPPLIED BY THE CLIENT

4.1 Site : PRASA – Durban  
4.2 Location in structure : Lifting Shed  
4.3 Drilling Contractor : Holmes Cut & Seal (17-18/05/2024)

#### 5. TESTING

5.1 Four cores were tested on 03 June 2024, at the Westmead based laboratory, in accordance with SABS865:1994.

#### 6. CORE PREPARATION

6.1 Testing of the cores were carried out by our laboratories in Westmead.  
6.2 The cores were measured as received; any significant details recorded and then marked up for trimming.  
6.3 The cores were photographed in surface dry and wet states.  
6.4 After trimming to length the cores were weighed in air and water, in order to determine the density.  
6.5 Finally the cores were capped using sulphur mortar and soaked for 48 hours in water prior to testing for compressive strength.

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## 7. RESULTS

- 7.1 See attached Annexure A – Results (Pages 1 of 1).
- 7.2 See attached Appendix A – Photographs (Pages A1 to A4).
- 7.3 The above Annexure A and Appendix A form part of this report and should be read in conjunction with this report.

## 8. INTERPRETATION OF CORE COMPRESSIVE STRENGTH

- 8.1 If the core strengths given in this report are to be used for acceptance in accordance with SANS 10100-2 (or any other specification with similar requirements to those of SANS 10100-2) then the requirements must be complied with otherwise, acceptance based on core strengths using the results given in this report, cannot be made.
- 8.2 Results given in the attached core report have been adjusted to allow for the presence of transverse reinforcing bars, for length/diameter ratios that fall outside the prescribed ratio and for excess voids, when necessary. Adjustments have been made in accordance with the guidelines given in SABS865:1994.
- 8.3 The following extract from SANS 10100-2: 2010 (Edition 3) should be used when assessing the acceptability of concrete based on the compressive strength of cores. The extract is reproduced with the kind permission of the SABS.

### 14.4.2 CORE TESTS

*At least **three** representative cores shall be taken from each member or predetermined volume of concrete in locations that are considered potentially deficient.*

### 14.4.3 ACCEPTANCE OF CONCRETE ON THE BASIS OF CORE STRENGTHS


*14.4.3.1 If the average core strength is at least 80% of the specified strength (see 14.3.3), and if no single core strength is less than 70% of the specified strength, the concrete shall be accepted.*

*14.4.3.2 If the concrete in a certain area fails to comply with 14.4.3.1 because a single core result falls below 70% of the specified strength, a further set of three cores may be taken from the same area, to determine the extent of deficient concrete. If the new set of three cores complies with the requirements of 14.4.3.1, the area represented by this second set of cores shall be considered acceptable. If the new set of cores fails to comply with the requirements of 14.4.3.1, 14.4.3.3 applies.*

*14.4.3.3 If the concrete does not meet the acceptance criteria of 14.4.3.1 or 14.4.3.2, the following should be considered in relation to the deficient part of the structure:*

- a) strength requirements for the member(s);*
- b) performance of a full scale load test as in clause 15*
- c) strengthening of the deficient part of the structure; and*
- d) removal and replacement of the deficient part of the structure*

- 8.4 The acceptance criteria given above are based on internationally accepted norms and make allowance for the fact that concrete is specified on the compressive strength of cubes. Cubes give an indication of the potential strength of concrete as mixed, made and cured under standard conditions. The strength of a core is subject to the practical differences associated with the achievement of the cube strength under site conditions and hence the lower strength limits allowed in paragraph 14.4.3 of SANS 10100-2: 2010 (Edition 3)

  
**Giselle Dawson**  
NDip Civil Engineering (MICT)  
Technical Signatory

**Donovan J Leach**  
Technical Signatory

ANNEXURE A - Results					
Client	Drennan Maud (Pty) Ltd				
Project	PRASA Lifting Shed – Durban (34223)				
Job Number	CD24/05/445				
Date Cast	Not Given				
Date Tested	27/05/2024				
Age, Day	Not Given				
Date Received	21/05/2024				
Direction of Dilling	Vertical				
Report date	30 May 2024				
Location in structure	Lifting Shed				
Customer Marking	C1	C2	C2b	C3	C4
Contest Marking	445/2188	445/2189	445/2190	445/2191	445/2192
<b>DIMENSIONS</b>					
Max length (mm)	165	245	250	165	205
Min length (mm)	160	225	225	155	200
Diameter (mm)	100.00	100.00	100.00	100.00	100.00
Trim Length (mm)	94.00	94.00	94.00	94.00	94.00
Capped length (mm)	100.00	100.00	100.00	100.00	100.00
Trim diameter/length	1.06	1.06	1.06	1.06	1.06
Cap diameter/length	1.00	1.00	1.00	1.00	1.00
<b>REINFORCEMENT</b>					
	Steel 1	Steel 1	Steel 1	Steel 1	Steel 1
Dist. from end (mm)	0.0	0.0	0.0	31.0	35.0
Diameter (mm)	0.0	0.0	0.0	6.1	6.5
Mass (g)	0.0	0.0	0.0	19.7	25.1
	Steel 2	Steel 2	Steel 2	Steel 2	Steel 2
Dist. from end (mm)	0.0	0.0	0.0	0.0	0.0
Diameter (mm)	0.0	0.0	0.0	0.0	0.0
Mass (g)	0.0	0.0	0.0	0.0	0.0
<b>DENSITY</b>					
Mass in air (g)	1643.50	1727.50	1708.60	1718.70	1764.50
Density (kg/m3)	2329	2445	2430	2371	2426
Estimated Excess Voids %	0.50	0.50	0.50	0.50	0.50
<b>CORRECTIONS</b>					
Length	1.00	1.00	1.00	1.00	1.00
Steel reinforcement	1.00	1.00	1.00	1.03	1.03
Estimated Excess Voids	1.04	1.04	1.04	1.04	1.04
<b>LOADING</b>					
Load at failure (kN)	332.5	451.3	477.7	374.7	322.0
Failure mode	normal	normal	normal	normal	normal
<b>STRENGTH (MPa)</b>					
Uncorrected Strength	42.3	57.5	60.8	47.7	41.0
Length corrected	42.3	57.5	60.8	47.7	41.0
Length/Steel corrected	42.3	57.5	60.8	49.1	42.4
Length/Voids/Steel corrected	44.0	59.8	63.2	51.0	44.1

This Annexure forms part of the report with No: CD24/05/445-0 and should be read in conjunction with the full report.

  
**Giselle Dawson**  
 NDip Civil Engineering (MICT)  
 Technical Signatory

Page 1 of 1

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ANNEXURE A - Results				
Client	Drennan Maud (Pty) Ltd			
Project	PRASA Lifting Shed – Durban (34223)			
Job Number	CD24/05/445			
Date Cast	Not Given			
Date Tested	03/06/2024			
Age, Day	Not Given			
Date Received	30/05/2024			
Direction of Dilling	Vertical			
Report date	30 May 2024			
Location in structure	Lifting Shed			
Customer Marking	C5	C6	C7	C8
Contest Marking	445/2397	445/2398	445/2399	445/2400
<b>DIMENSIONS</b>				
Max length (mm)	190	230	260	190
Min length (mm)	185	220	235	180
Diameter (mm)	100.00	100.00	100.00	100.00
Trim Length (mm)	94.00	94.00	94.00	94.00
Capped length (mm)	100.00	100.00	100.00	100.00
Trim diameter/length	1.06	1.06	1.06	1.06
Cap diameter/length	1.00	1.00	1.00	1.00
<b>REINFORCEMENT</b>				
	Steel 1	Steel 1	Steel 1	Steel 1
Dist. from end (mm)	0.0	0.0	0.0	31.0
Diameter (mm)	0.0	0.0	0.0	6.1
Mass (g)	0.0	0.0	0.0	19.7
	Steel 2	Steel 2	Steel 2	Steel 2
Dist. from end (mm)	0.0	0.0	0.0	0.0
Diameter (mm)	0.0	0.0	0.0	0.0
Mass (g)	0.0	0.0	0.0	0.0
<b>DENSITY</b>				
Mass in air (g)	1622.20	1744.10	1695.20	1767.20
Density (kg/m <sup>3</sup> )	2429	2475	2461	2482
Estimated Excess Voids %	0.50	0.50	0.50	0.50
<b>CORRECTIONS</b>				
Length	1.00	1.00	1.00	1.00
Steel reinforcement	1.00	1.00	1.00	1.03
Estimated Excess Voids	1.04	1.04	1.04	1.04
<b>LOADING</b>				
Load at failure (kN)	456.2	482.0	473.2	524.0
Failure mode	normal	normal	normal	normal
<b>STRENGTH (MPa)</b>				
Uncorrected Strength	58.1	61.4	60.2	66.7
Length corrected	58.1	61.4	60.2	66.7
Length/Steel corrected	58.1	61.4	60.2	68.6
Length/Voids/Steel corrected	60.4	63.8	62.7	71.3

This Annexure forms part of the report with No: CD24/05/445-1 and should be read in conjunction with the full report.



**Giselle Dawson**  
NDip Civil Engineering (MICT)  
Technical Signatory

Page 1 of 1

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ANNEXURE B - Results					
Client	Drennan Maud (Pty) Ltd				
Project	PRASA Lifting Shed – Durban (34223)				
Job Number	CD24/05/445				
Date Cast	Not Given				
Date Tested	27/05/2024				
Age, Day	Not Given				
Date Received	21/05/2024				
Direction of Dilling	Vertical				
Report date	30 May 2024				
Location in structure	Lifting Shed				
Customer Marking	C9	C10	C11	C12	C13
Contest Marking	445/2193	445/2194	445/2195	445/2196	445/2197
<b>DIMENSIONS</b>					
Max length (mm)	205	200	230	165	180
Min length (mm)	200	165	185	160	190
Diameter (mm)	100.00	100.00	100.00	100.00	100.00
Trim Length (mm)	94.00	94.00	94.00	94.00	94.00
Capped length (mm)	100.00	100.00	100.00	100.00	100.00
Trim diameter/length	1.06	1.06	1.06	1.06	1.06
Cap diameter/length	1.00	1.00	1.00	1.00	1.00
<b>REINFORCEMENT</b>					
	Steel 1	Steel 1	Steel 1	Steel 1	Steel 1
Dist. from end (mm)	0.0	18.0	5.0	35.0	0.0
Diameter (mm)	0.0	6.3	6.3	6.4	0.0
Mass (g)	0.0	22.6	23.7	24.9	0.0
	Steel 2	Steel 2	Steel 2	Steel 2	Steel 2
Dist. from end (mm)	0.0	25.0	3.0	0.0	0.0
Diameter (mm)	0.0	6.4	6.2	0.0	0.0
Mass (g)	0.0	23.7	23.0	0.0	0.0
<b>DENSITY</b>					
Mass in air (g)	1827.70	1734.10	1824.40	1765.50	1714.30
Density (kg/m <sup>3</sup> )	2527	2396	2492	2398	2393
Estimated Excess Voids %	0.50	0.50	0.50	1.00	0.50
<b>CORRECTIONS</b>					
Length	1.00	1.00	1.00	1.00	1.00
Steel reinforcement	1.00	1.06	1.01	1.03	1.00
Estimated Excess Voids	1.04	1.04	1.04	1.08	1.04
<b>LOADING</b>					
Load at failure (kN)	560.2	533.8	576.5	483.5	422.5
Failure mode	normal	normal	normal	normal	normal
<b>STRENGTH (MPa)</b>					
Uncorrected Strength	71.3	68.0	73.4	61.6	53.8
Length corrected	71.3	68.0	73.4	61.6	53.8
Length/Steel corrected	71.3	71.9	73.9	63.6	53.8
Length/Voids/Steel corrected	74.2	74.8	76.9	68.7	55.9

This Annexure forms part of the report with No: CD24/05/445-0 and should be read in conjunction with the full report.



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ANNEXURE C - Results				
Client	Drennan Maud (Pty) Ltd			
Project	PRASA Lifting Shed – Durban (34223)			
Job Number	CD24/05/445			
Date Cast	Not Given			
Date Tested	27/05/2024			
Age, Day	Not Given			
Date Received	21/05/2024			
Direction of Dilling	Vertical			
Report date	30 May 2024			
Location in structure	Lifting Shed			
Customer Marking	C15	C17	C18	C19
Contest Marking	445/2199	445/2200	445/2201	445/2202
<b>DIMENSIONS</b>				
Max length (mm)	155	170	170	170
Min length (mm)	140	160	155	165
Diameter (mm)	100.00	100.00	100.00	100.00
Trim Length (mm)	94.00	94.00	94.00	94.00
Capped length (mm)	100.00	100.00	100.00	100.00
Trim diameter/length	1.06	1.06	1.06	1.06
Cap diameter/length	1.00	1.00	1.00	1.00
<b>REINFORCEMENT</b>				
	Steel 1	Steel 1	Steel 1	Steel 1
Dist. from end (mm)	0.0	22.0	7.0	15.0
Diameter (mm)	0.0	6.5	6.3	6.2
Mass (g)	0.0	23.8	23.3	21.3
	Steel 2	Steel 2	Steel 2	Steel 2
Dist. from end (mm)	0.0	30.0	0.0	35.0
Diameter (mm)	0.0	6.3	0.0	6.3
Mass (g)	0.0	22.6	0.0	23.0
<b>DENSITY</b>				
Mass in air (g)	1819.30	1756.00	1622.00	1732.30
Density (kg/m <sup>3</sup> )	2509	2414	2347	2341
Estimated Excess Voids %	0.50	0.50	0.50	0.50
<b>CORRECTIONS</b>				
Length	1.00	1.00	1.00	1.00
Steel reinforcement	1.00	1.07	1.01	1.08
Estimated Excess Voids	1.04	1.04	1.04	1.04
<b>LOADING</b>				
Load at failure (kN)	611.3	488.5	279.5	216.8
Failure mode	normal	normal	normal	normal
<b>STRENGTH (MPa)</b>				
Uncorrected Strength	77.8	62.2	35.6	27.6
Length corrected	77.8	62.2	35.6	27.6
Length/Steel corrected	77.8	66.6	35.8	29.9
Length/Voids/Steel corrected	80.9	69.2	37.3	31.1

This Annexure forms part of the report with No: CD24/05/445-0 and should be read in conjunction with the full report.

  
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Project: PRASA Lifting Shed – Durban (34223)

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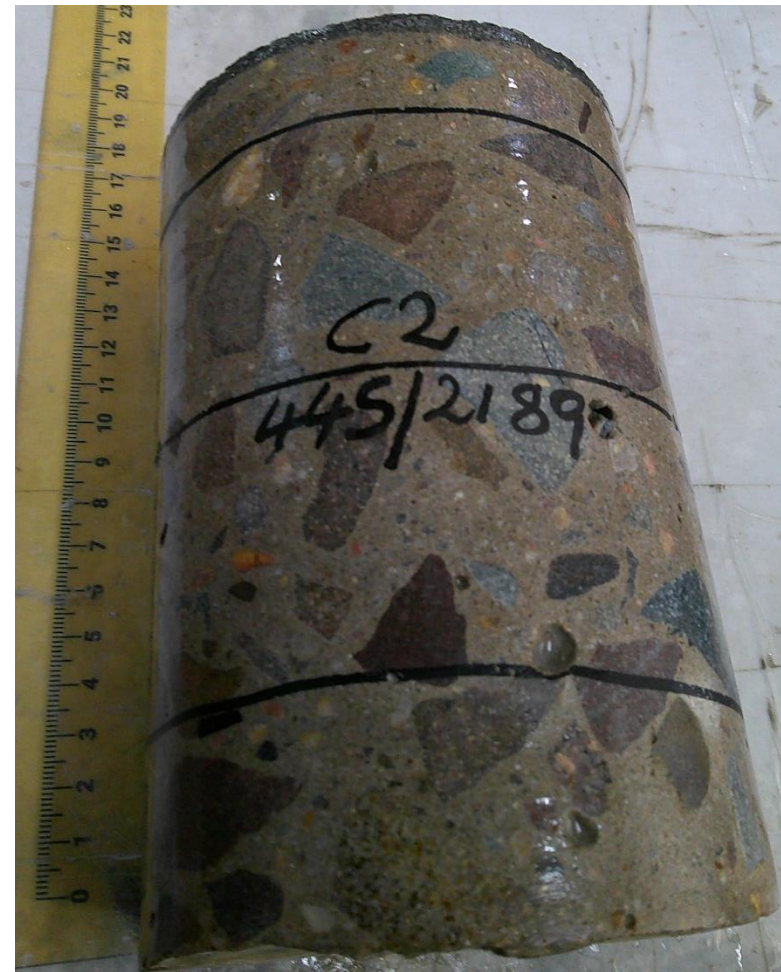
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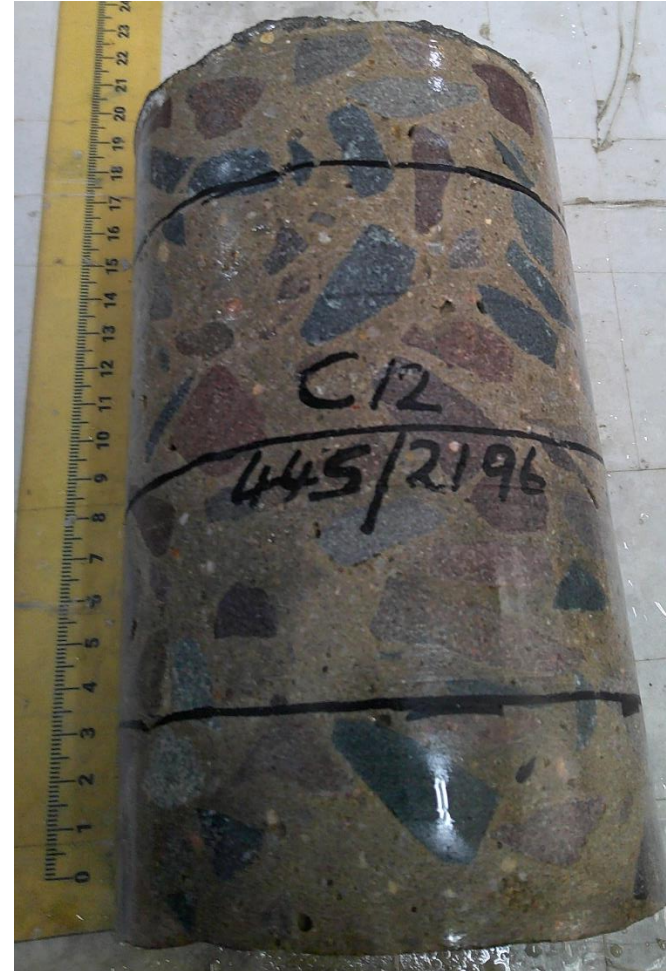
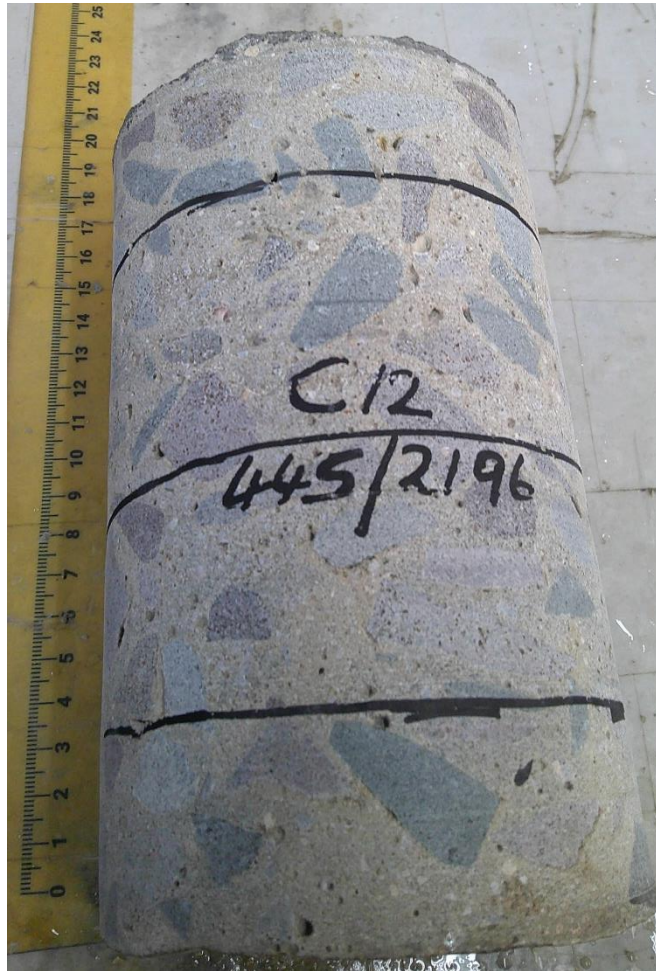
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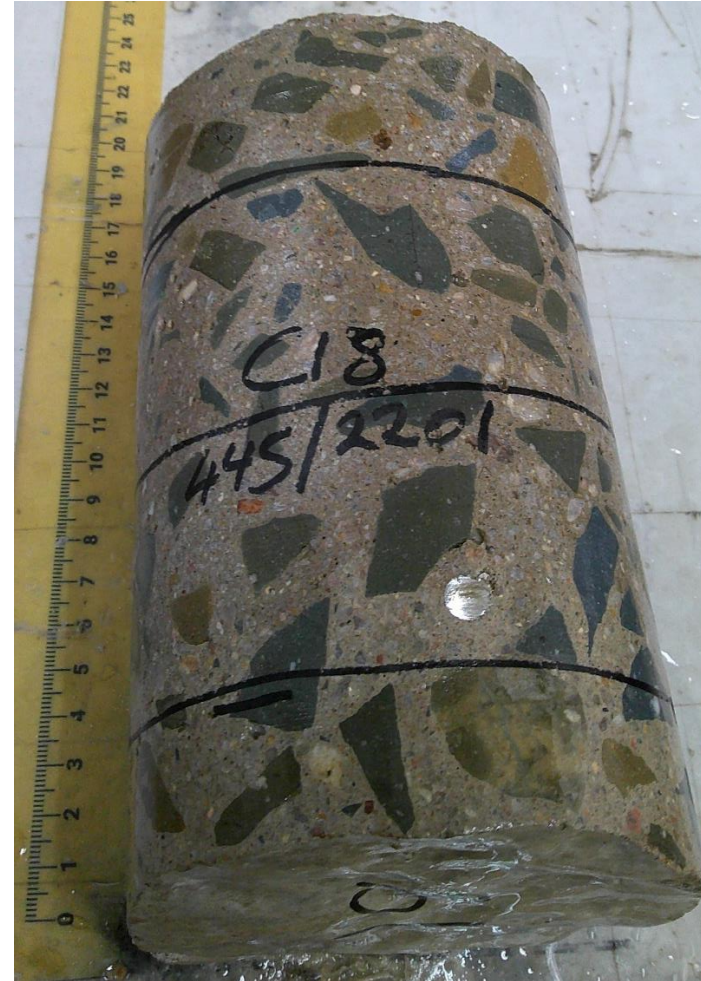
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