**Date: 13/12/2024**

**Attention**: **Mr. Iman Ahmadian**

**Re: Geotechnical Assessment**
**Project No: KFMGR-240309**
**Address: 78 Mccarrs Creek Road, Church Point NSW 2105**

## 1. INTRODUCTION

KFM Geotech (KFM) was engaged by Mr. Iman Ahmadian to carry out a geotechnical assessment of the site for the proposed retaining wall design at 78 Mccarrs Creek Road, Church Point NSW 2105. The site is bordered by residential properties to the south, north, and west, and Mccarrs Creek Road is located to the northeast. The site descends sharply from the roadside, presenting a striking slope that cascades towards the sea. The proposed development includes constructing a new retaining wall adjacent to the roadside to ensure structural stability and aesthetic integration. The height of the existing retaining wall is approximately 1.3-1.5m. As previously mentioned, the site has undergone significant earthworks, evident in the visible cuts and fills that have shaped the terrain. A timber retaining wall had initially been installed to manage the pressure of the roadside fill materials, though its condition now necessitates enhancement for long-term functionality.



**Figure 1. Site Plan**

## 2. SITE INSPECTION & FINDINGS

The site was inspected on 11 December 2024 by KFM Geotechnical Engineer. Two boreholes (BHs) were drilled at the upper level of the existing retaining wall using a hand auger to investigate subsurface conditions. Additionally, four (4) Dynamic Cone Penetration (DCP) tests were conducted to evaluate the strength of the soil layers and determine the potential depth of underlying rock. Two of the DCP tests were strategically positioned adjacent to the boreholes to correlate data, while the remaining two were conducted at the lower level of the retaining wall to assess soil conditions in critical areas influencing the stability and footing of the retaining wall. The location of BHs and DCPs is shown in Figure 1. The hand auger reached refusal at a maximum depth of 0.9m. The borehole logs and DCP test results are attached to this report. The borehole drilling observations and DCP test results indicate the site subsurface materials are assessed to comprise poorly to moderately compacted fill materials to a depth of around 2m. Below 2m is inferred to be natural soil considering the DCP test results. Note, that natural materials were not encountered during our site investigation using hand auger due to shallow refusal on hard layers. KFM Geotech cannot confirm the presence and depth of natural soil at the site, though it may become visible during excavation. Note, that the site subsurface materials across the site may differ from our assessment based on the investigation carried out in this report. The recommendations provided in this report can be updated during the foundation works subject to site inspections by a geotechnical engineer if the site subsurface materials differ from our assumption in this report.


**Figure 2. Borehole and DCP locations**

A summary of the subsurface profile encountered in the borehole/DCPs is presented in Table 1 with the detailed log attached to this report.

**Table 1. Summary of Site Subsurface Profile**

| Unit # | Material | Top of Unit (m, below ground level (bgl)) | |
|---|---|---|---|
| | | BH 1 | BH2 |
| 1 | **Fill,** gravel, sand, brown | 0.0 | 0.0 |
| 2 | **Possible Natural soil** | 1.9 | 2 |

Groundwater was not encountered in the boreholes/DCPs during the investigation. It should be noted that the fluctuations in the level of groundwater might occur due to variations in rainfall, temperature, and/or other factors. KFM believes that during the construction of the proposed retaining wall groundwater flow is unlikely to be encountered.

The regional geology map demonstrates that the site is underlain by Middle Triassic rocks of the Gosford Subgroup (Tngn) from the Constitue unit. Unit Tngn comprises Interbedded laminite, shale, and sandstone; white quartz to quartz-lithic, very fine- to medium-grained sandstone; minor shale breccia and pebble polymictic conglomerate (at base of sandstone units), minor red clays.

Considering the site subsurface profile, depth of fill materials, and foundation construction works, a site classification “P” is to be adopted for the site according to AS 2870-2011, Residential Slabs and Footings Standard.

## 3. FOOTING AND RETAINING WALL

Australian Standard AS 2870-2011, Residential Slabs and Footings can be adopted for the design of the proposed footing and retaining wall for a site class “P”. Engineer-designed foundations should be designed to support the load of the proposed development. An allowable bearing capacity of 60 kPa can be adopted for the retaining wall footing design. The lateral earth pressure parameters presented in Table 2 can be adopted for the retaining wall design.

**Table 2. Retaining Wall Design Parameters**

| Unit # | Unit weight ($kN/m^3$) | Active Earth Pressure Coefficient | At Rest Earth Pressure Coefficient | Passive Earth Pressure Coefficient/Ultimate Passive Resistance |
|---|---|---|---|---|
| **1- Fill** | 19 | 0.39 | 0.56 | 2.56 |

Free-draining granular backfills and appropriate subsurface drainage are to be considered in the design and construction of the retaining walls to ensure dissipation of the water pressure occurs. Otherwise, the retaining walls are to be designed against water pressure.

## 4. RECOMMENDATIONS ON EXCAVATION AND EARTHWORK

The excavation in fill materials can be achieved using conventional earth working plants such as small to medium excavators fitted with a digging bucket and with no vibration occurring during the excavation. We expect major excavation for the foundation works. The excavation class based on SANS 1200D is assessed as soft for the fill materials. The proposed development does not produce any major vibration and noise pollution on-site during the foundation works. The excavation in the fill materials (to 2m) to be battered with a slope not steeper than 1H:1V.

If any fill layer is required during the construction for raising up the foundations, suitable granular fill materials with proper compaction (controlled/rolled) is required to ensure that excessive surface settlement does not occur. All fill brought onto the site (if required) is to be certified as ‘clean fill’ with a VENM certificate or similar documentation in accordance with EPA guidelines. The required backfill density and minimum frequency of compaction tests as outlined in AS 3798 should be followed for any site filling. If required, the suitable fill materials to be placed in loose layers of 200mm and compacted to 95% of standard maximum dry density.

## 5. GENERAL RECOMMENDATIONS

- ✓ Utilize a stormwater drainage system to collect surface water and drainage from behind the retaining walls.
- ✓ Exercise caution during excavations near any footings or easements. If the excavation is within the zone of influence of any existing footing or easement, it must not go deeper than 100mm above the base of the existing footing. The zone of influence is determined by projecting a line upward at a 45° angle from the horizontal, starting from the invert of the existing footing or easement.
- ✓ All on-site earthworks must comply with Australian Standard AS3798, which provides guidelines for earthworks in commercial and residential developments.

## 6. LIMITATIONS AND CONDITIONS OF THE REPORT

This report is the copyright of KFM Geotech Pty Ltd and any unauthorized reproduction and usage by any person or third party other than the client for whom this investigation was commissioned is strictly prohibited. The results of this investigation should not be used for any other purpose other than that for which it is specifically intended.

This Geotechnical Site Investigation report has been prepared based only on the information provided at the time of this investigation and may not be valid if site conditions change. The findings presented in the report reflect the sub-surface conditions specifically at the designated sampling and testing locations, and only to the depths probed during the investigation and at the time of assessment. It's important to note that sub-surface conditions are subject to abrupt changes influenced by geological processes and human activities. These alterations might occur subsequent to KFM Geotech fieldwork.

KFM Geotech recommendations are formulated based on the observed conditions during the investigation. However, the accuracy of these recommendations may be impacted by undetected variations in ground conditions across the site, extending beyond the sampled areas. Additionally, budget constraints imposed by external parties or limitations in site accessibility may further constrain the scope of advice provided. We recommend that the

foundation excavation for any type to be inspected by a qualified geotechnical engineer to confirm the subsurface conditions and advice recommended in this report.

If the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and KFM accepts no responsibility whatsoever for the performance of the building where recommendations are not implemented in full and properly tested, inspected, and documented.
During the earthworks, if site conditions significantly differ from those indicated in this report, KFM Geotech to be contacted to provide further advice.

## 7. REFERENCES


- Australian Standard (AS 2870-2011), Residential Slabs and Footings
- Australian Standard (AS 1726-2017), Geotechnical Site Investigations
- Australian Standard (AS 3600-2009), Concrete structures
- Australian Standard (AS 4678-2002), Earth-retaining structures
- Australian Standard (AS 2159.2009), Piling-Design and installation
- Australian Standard (AS 3798-1996), Guidelines on earthworks for commercial and residential developments


For and on behalf of

**KFM Geotech Pty Ltd**

Dr. Mohammad Hossein Bazyar

Managing Director

# BH Logs

# Boring Log

| | | | |
|---|---|---|---|
| **Project:** 78 Mccarrs Creek Road, Church Point NSW 2105 | **Project Number**: KFMGR-240309 | **Client:** Mr. Iman Ahmadian | **Boring No. BH1** **Page 1 of 1** |
| **Logged By:** SK | **Drilling Date:** 11/12/2024 | **Drilling Type:** Hand Auger | **Driller:** SK |

| Depth (m) | Sample Type | Sample Number | Graphic Log | USCS | Lithology<br>**Soil Group Name:** type, color, grain size, other descriptors | Density/ Consistency | Moisture Content | DCP (blows per 100mm penetration) |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | **Fil:** gravel,sand, dark brown, trace rootlets | PC | M | 0 |
| | | | | | | | | 2 |
| | | | | | | | | 1 |
| | | | | | | | | 1 |
| | | | | | | | | 1 |
| 0.5 | | | | | | | | 3 |
| | | | | | | | | 11 |
| | | | | SP | Hand auger terminated at 070 m | | | 12 |
| | | | | | | | | 8 |
| | | | | | | | | 6 |
| 1.0 | | | | | | | | 5 |
| | | | | | | | | 5 |
| | | | | | | | | 5 |
| | | | | | | | | 5 |
| 1.5 | | | | | | | | 6 |
| | | | | | | | | 10 |
| | | | | | Potential Natural | | | 6 |
| | | | | | | | | 6 |
| | | | | | | | | 4 |
| 2.0 | | | | | | | | 5 |
| 2.5 | | | | | | | | |
| 3.0 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.0 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.0 | | | | | | | | |

| Consistency | | Density | | Moisture | | Compaction | |
|---|---|---|---|---|---|---|---|
| **S:** | Soft | **VL:** | Very Loose | **D:** | Dry | **PC:** | Poorly Compacted |
| **F:** | Firm | **L:** | Loose | **M:** | Moist | **MC:** | Moderatly Compacted |
| **St:** | Stiff | **MD:** | Medium Dense | **W:** | Wet | **WC:** | Well Compacted |
| **Vst:** | Very Stiff | **D:** | Dense | | | | |
| **H:** | Hard | **VD:** | Very Dense | B | Bouncing | R | Refusal |

# Boring Log

| | | | |
|---|---|---|---|
| **Project:** 78 Mccarrs Creek Road, Church Point NSW 2105 | **Project Number**: KFMGR-240309 | **Client:** Mr. Iman Ahmadian | **Boring No. BH2** **Page 1 of 1** |
| **Logged By:** SK | **Drilling Date:** 11/12/2024 | **Drilling Type:** Hand Auger | **Driller:** MT |

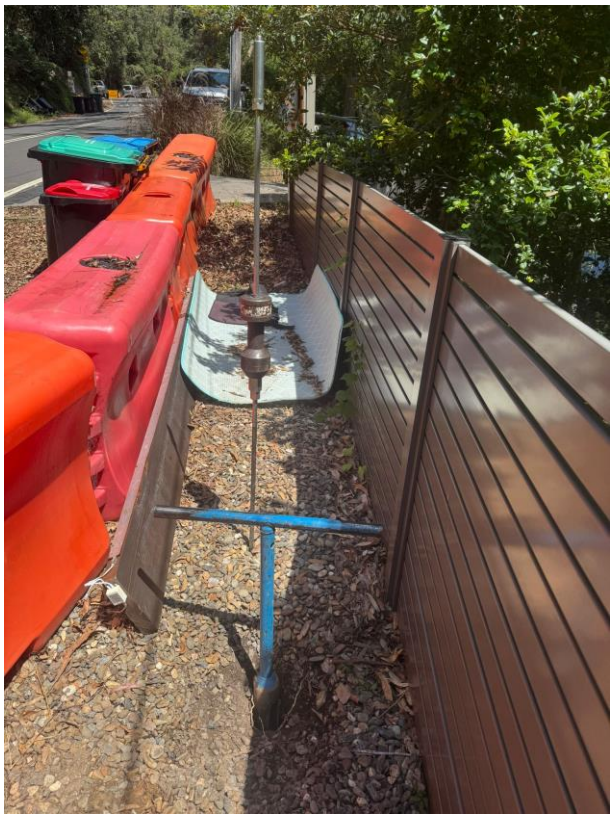
| Depth (m) | Sample Type | Sample Number | Graphic Log | USCS | Lithology<br>**Soil Group Name:** type, color, grain size, other descriptors | Density/ Consistency | Moisture Content | DCP (blows per 100mm penetration) |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | **Fil:** Silty sand, dark brown, trace rootlets | PC | M | 1 |
| | | | | | | | | 2 |
| | | | | | | | | 2 |
| | | | | | | | | 2 |
| 0.5 | | | | | | | | 1 |
| | | | | | | | | 2 |
| | | | | | | | | 3 |
| | | | | | | | | 5 |
| | | | | | | | | 3 |
| 1.0 | | | | | Hand auger terminated at 0.9 m | | | 3 |
| | | | | | | | | 4 |
| | | | | | | | | 5 |
| | | | | | | | | 7 |
| | | | | | | | | 4 |
| 1.5 | | | | | | | | 6 |
| | | | | | | | | 4 |
| | | | | | | | | 6 |
| | | | | | | | | 21 |
| | | | | | | | | 9 |
| | | | | | Potential Natural Soil | | | 6 |
| 2.0 | | | | | | | | 6 |
| 2.5 | | | | | | | | |
| 3.0 | | | | | | | | |
| 3.5 | | | | | | | | |
| 4.0 | | | | | | | | |
| 4.5 | | | | | | | | |
| 5.0 | | | | | | | | |

| Consistency | | Density | | Moisture | | Compaction | |
|---|---|---|---|---|---|---|---|
| **S:** | Soft | **VL:** | Very Loose | **D:** | Dry | **PC:** | Poorly Compacted |
| **F:** | Firm | **L:** | Loose | **M:** | Moist | **MC:** | Moderatly Compacted |
| **St:** | Stiff | **MD:** | Medium Dense | **W:** | Wet | **WC:** | Well Compacted |
| **Vst:** | Very Stiff | **D:** | Dense | | | | |
| **H:** | Hard | **VD:** | Very Dense | B | Bouncing | R | Refusal |

# DCP Results

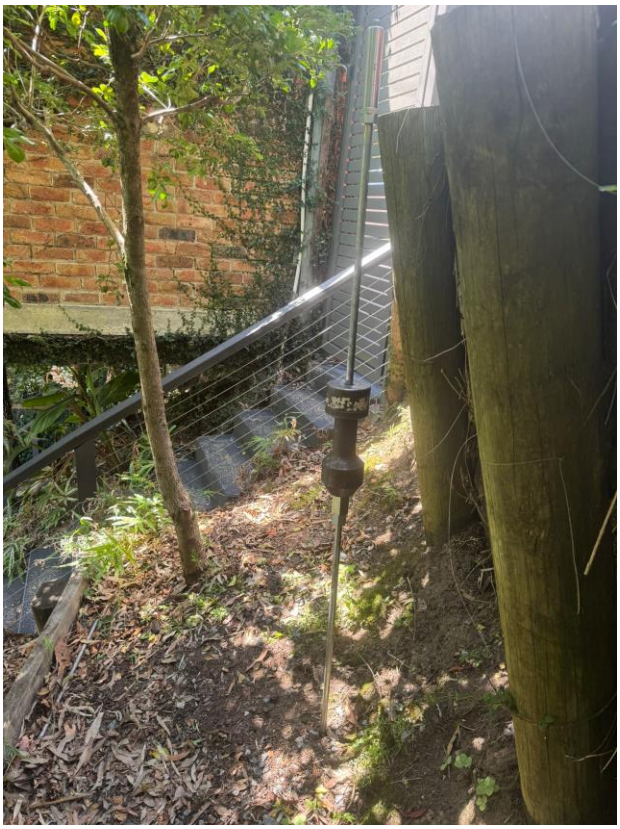
| | Number of Blows for 100mm Penetration | | | |
|---|---|---|---|---|
| **Depth (mm)** | DCP1 | DCP2 | DCP3 (1.3m lower than DCP1 and DCP2) | DCP4 (1.3m lower than DCP1 and DCP2) |
| **0.0-100mm** | 0 | 1 | 1 | 0 |
| **100-200mm** | 2 | 2 | 2 | 3 |
| **200-300mm** | 1 | 2 | 3 | 2 |
| **300-400mm** | 1 | 2 | 4 | 2 |
| **400-500mm** | 1 | 1 | 2 | 3 |
| **500-600mm** | 3 | 2 | 3 | 2 |
| **600-700mm** | 11 | 3 | 2 | 2 |
| **700-800mm** | 12 | 5 | 3 | 7 |
| **800-900mm** | 8 | 3 | 5 | B |
| **900-1000mm** | 6 | 3 | 5 | |
| **1000-1100mm** | 5 | 4 | 6 | |
| **1100-1200mm** | 5 | 5 | 5 | |
| **1200-1300mm** | 5 | 7 | | |
| **1300-1400mm** | 5 | 4 | | |
| **1400-1500mm** | 5 | 6 | | |
| **1500-1600mm** | 6 | 4 | | |
| **1600-1700mm** | 10 | 6 | | |
| **1700-1800mm** | 6 | 21 | | |
| **1800-1900mm** | 6 | 9 | | |
| **1900-2000mm** | 4 | 6 | | |
| **2000-2100mm** | 5 | 6 | | |

# Site Photographs



BH1/DCP1

BH2/DCP2



DCP3

DCP4

# GENERAL NOTES

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726-2017, the Geotechnical Site Investigations. Explanatory notes are located at the bottom of the drilling log sheets. In the "lithology" column, details about the soil/rock group, origin, geology, colour, density/consistency, grain size and other descriptions are presented. The depth of the excavation base for the logged section is noted in the same column at the appropriate depth. If there is a refusal of the excavation/drilling tool, it is documented. The explanatory notes define the terms and symbols used in the preparation of the logs, are described below. Subsurface conditions between the investigation points may vary significantly from conditions encountered at those locations.

## Materials Description-Soil

### Particle size characteristics of soils

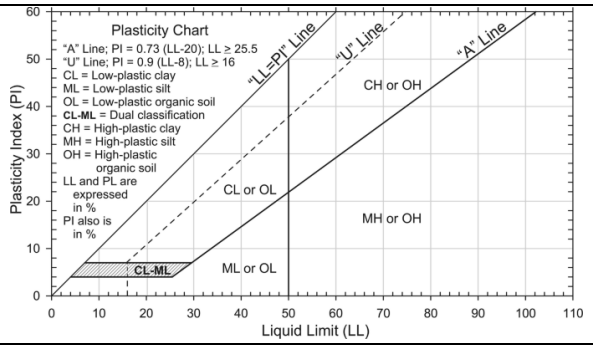
| Fraction | Components | Grain | Size (mm) |
|---|---|---|---|
| Oversize | Boulders | | >200 |
| | Cobbles | | 63-200 |
| Coarse-grained soil | Gravel | Coarse | 19-63 |
| | | Medium | 6.7-19 |
| | | Fine | 2.36-6.7 |
| | Sand | Coarse | 0.6-2.36 |
| | | Medium | 0.21-0.6 |
| | | Fine | 0.075-0.21 |
| Fine-grained soil | Silt | | 0.002-0.075 |
| | Clay | | <0.002 |

### Soil Group Symbols

| Major Divisions | | Symbol | Description |
|---|---|---|---|
| Coarse-grained soils | Gravel | GW | Well-graded gravel and gravel- sand mixtures, little or no fines, no dry strength. |
| | | GP | Poorly graded gravel and gravel-sand mixtures, little or no fines, no dry strength. |
| | | GM | Silty gravel, gravel-sand-silt mixtures, zero to medium dry strength. |
| | | GC | Clayey gravel, gravel-sand-clay mixtures, medium to high dry strength. |
| | Sand | SW | Well Graded Sand, gravelly Sand |
| | | SP | Poorly graded sand and gravelly sand, little or no fines, no dry strength. |
| | | SM | Silty sand, sand-silt mixtures, zero to medium dry strength. |
| | | SC | Clayey sand, sandy-clay mixtures, medium to high dry strength. |
| Fine-grained soils | Liquid limit < 50% | ML | Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands, zero to medium dry strength. |
| | | CL, CI | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, medium to high dry strength. |
| | | OL | Organic silts and organic silty clays of low plasticity, low to medium dry strength. |
| | Liquid limit > 50% | MH | Inorganic silts of high plasticity, high to very high dry strength. |
| | | CH | Inorganic clays of high plasticity, high to very high dry strength. |
| | | OH | Organic clays of medium to high plasticity, medium to high dry strength. |
| Highly organic soil | | PT | Peat muck and other highly organic soils. |

## Plastic properties and moisture condition

**Plastic properties**




**Moisture condition**

| Term | Symbol | Description |
|---|---|---|
| Dry | D | Dry, looks and feels dry. |
| Moist | M | Soils feel cool, darkened in colour. There is a tendency for soil to stick together. |
| Wet | W | Soils feel cool, darkened in colour. When handling cohesive soils, free water usually forms on hands; granular soils tend to cohere. |

It is important to describe the moisture content of cohesive soils according to their liquid limit (LL) or plastic limit (PL) as follows: Moist, dry of plastic limit (w < PL); Moist, near plastic limit (w ≈ PL); Moist, wet of plastic limit (w < PL); Wet, near liquid limit (w ≈ LL), Wet, wet of liquid limit (w > LL).

## Descriptive terms for plasticity of cohesive soils

| Descriptive term | Liquid limit range for silt | Liquid limit range for clay |
|---|---|---|
| High plasticity | >50 | >50 |
| Medium plasticity | Not applicable | >35 & ≤50 |
| Low plasticity | ≤50 | ≤35 |
| Non-Plastic | Not applicable | Not applicable |

## Consistency of Cohesive Soils- in accordance with AS1726-2017 & Geotechnical Engineering Handbook, R.L

| Symbol | Term | Undrained Cohesion (kPa) | Unconfined Strength-Pocket Penetrometer Strength (kPa) | DCP (blows/100mm penetration) | SPT (Blows per 300mm) (N-corrected) | Field Assessment |
|---|---|---|---|---|---|---|
| VS | Very Soft | <12.5 | 25 | 0-1 | <2 | Exudes between fingers when squeezed. |
| S | Soft | 12.5-25 | 25-50 | 1-2 | 2-4 | Can be moulded by light finger pressure. |
| F | Firm | 25-50 | 50-100 | 2-3 | 4-8 | Can be moulded by strong finger pressure. |
| St | Stiff | 50-100 | 100-200 | 3-7 | 8-15 | Cannot be moulded by fingers. Can be indented by thumb pressure. |
| Vst | Very Stiff | 100-200 | 200-400 | 7-12 | 15-30 | Can be indented by thumbnail. |
| H | Hard | >200 | >400 | >12 | >30 | Difficult to be indented by thumbnail. |

## The density of non-cohesive Soils- in accordance with AS1726-2017- Geotechnical Engineering Handbook, R.L

| Symbol | Term | Density Index (%) | DCP (blows/100mm penetration) | Corrected SPT (Blows per 300mm) | Field Assessment |
|---|---|---|---|---|---|
| VL | Very Loose | <15 | 0-1 | <4 | 50 mm peg easily driven. Foot imprints easily. |
| L | Loose | 15-35 | 1-3 | 4-10 | 12 mm reinforcing bar easily pushed by hand. Shovels easily. |
| MD | Medium Dense | 35-65 | 3-8 | 10-30 | 12 mm bar needs hammer to drive >200 mm. Shovelling difficult. |
| D | Dense | 65-85 | 8-15 | 30-50 | 50 mm peg hard to drive. 12 mm bar needs hammer to drive <200mm. Needs pick for excavation. |
| VD | Very Dense | >85 | >15 | >50 | 12 mm bar needs hammer to drive <60mm. Picking difficult. |

## Materials Description-Rock

Identification of rock type, composition and texture based on visual features in accordance with AS 1726-2017.

### Description of Weathering

| Term | Symbol | Weathering Definition |
|---|---|---|
| Residual Soil | Rs | Soil derived from the weathering of rock. The mass structure and substance fabric are no longer evident. There is a large change in volume, but the soil has not been significantly transported. |
| Extremely Weathered | EW | Rock substance affected by weathering to the extent that the rock exhibits soil properties - ie. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident. |
| Highly Weathered | HW | Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased, or decrease compared to the fresh rock usually because of iron leaching or deposition. The colour and strength of the original rock substance is no longer recognisable. |
| Moderately Weathered | MW | Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock is no longer recognisable. |
| Slightly Weathered | SW | Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable. |
| Fresh | Fr | Rock substance unaffected by weathering. |

### Description of Rock Strength

| Term | Symbol | Point Load Index (Is (50)) MPa | Weathering Definition |
|---|---|---|---|
| Extremely Low Strength | EL | <0.03 | Easily remoulded by hand to a material with soil properties. |
| Very Low Strength | VL | 0.03-0.1 | Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm can be broken by finger pressure. |
| Low Strength | L | 0.1-0.3 | Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling. |
| Medium Strength | M | 0.3-1 | Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty |
| High Strength | H | 1-3 | A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer. |
| Very High Strength | VH | 3-10 | Hand specimen breaks with pick after more than one blow; rock rings under hammer. |
| Extremely High Strength | EH | >10 | Specimen requires many blows with geological pick to break through intact material; rock rings under hammer. |

Note:
Relationship between rock strength test result (Is (50)) and unconfined compressive strength (UCS) will vary with rock type and strength, and should be determined on a site-specific basis. UCS is typically 10 to 30 x Is (50), but can be as low as 5 MPa. KFM uses UCS=16 x Is (50).

### Rock Core Recovery

Core recovery parameter describe the quality of core recovered from a borehole.

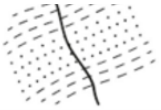
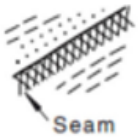
$$\text{TCR (Total Core Recovery (\%))} = \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$$

**Rock Quality Designation**
The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD (\%)} = \frac{\sum \text{Axial lengths of core} > 100 \text{ mm}}{\text{Length of core run}} \times 100$$

The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

## Rock Defect Types

| Type | Sub-type | Abbreviation | Definition | Diagram |
|---|---|---|---|---|
| Parting | | PT | A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering (e.g. bedding) or a planar anisotropy in the rock material (e.g. cleavage). May be open or closed. |  |
| Joint | | JT | A surface or crack with no apparent shear displacement and across which the rock has little or no tensile strength, but which is not parallel or sub-parallel to layering or to planar anisotropy in the rock material. May be open or closed. |  |
| Sheared Surface | | SH | A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement. |  |
| Sheared Zone | | SZ | Zone of rock material with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks. |  |
| Seams | Sheared Seam | SS | Seam of soil material with roughly parallel almost planar boundaries, composed of soil materials with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks. |  |
| | Crushed Seam | CS | Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties. |  |
| | Infield Seam | IS | Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface. |  |
| | Extremely Weathered Seam | XWS | Seam of soil material, often with gradational boundaries. Formed by weathering of the rock material in place. |  |

## Details of rock defect spacing

| Defect Spacing | | Stratification spacing | |
|---|---|---|---|
| **Term** | **Description** | **Term** | **Spacing(mm)** |
| Massive | No layering apparent | Thinly laminated | <6 |
| | | Laminated | 6 to 20 |
| Indistinct | Layering just visible; Properties are little affected | Very thinly bedded | 20 to 60 |
| | | Thinly bedded | 60 to 200 |
| Distinct | Layering (bedding, foliation, cleavage) distinct; rock breaks more easily parallel to layering | Medium bedded | 200 to 600 |
| | | Thickly bedded | 600 to 2000 |
| | | Very thickly bedded | >2000 |

### Degree of fracturing

| Term | Description |
|---|---|
| Fragmented | Fragments of <20 mm |
| Highly Fractured | 20-40 mm Core lengths with some fragments |
| Fractured | 40-200 mm core lengths with short and long sections |
| Slightly Fractured | 200-1000 mm core lengths with some shorter and longer sections |
| Unbroken | Core lengths mostly > 1000 mm |

### Descriptions defect shape and roughness

| Shape | Abbreviation | Description | Roughness | Abbreviation | Description |
|---|---|---|---|---|---|
| Planar | PR | Consistent orientation | Polished | POL | Shiny smooth surface. |
| Curved | CU | Gradual change in orientation | Slickensided | SL | Grooved or striated surface, usually polished. |
| Undulating | UN | Wavy surface | Smooth | SM | Smooth to touch. Few or no surface irregularities. |
| Stepped | ST | One or more well defined steps | Rough | RO | Many small surface irregularities (amplitude generally <1mm). Feels like fine to coarse sandpaper. |
| Irregular | IR | Many sharp changes in orientation | Very Rough | VR | Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper. |

### Abbreviations & descriptions for coating or Infilling term

| Coating | Abbreviation | Description | Defect Aperture | | |
|---|---|---|---|---|---|
| Clean | CN | No visible coating or infilling | **Aperture** | **Abbreviation** | **Description** |
| Stain | SN | No visible coating or infilling but surfaces are discoloured by staining | Closed | CL | Closed. |
| Veneer | VNR | A visible coating of soil or mineral substance but usually unable to be measured (<1mm); may be patchy | Open | OP | Without any infill material. |
| -------- | | | Infilled | inf | Soil or rock i.e. clay, silt, talc, pyrite, quartz, etc. |

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

| **Drilling/Excavation method** | | | | | | | |
|---|---|---|---|---|---|---|---|
| C | Core drilling | R | Rotary drilling | SFA | Spiral flight augers | HA | Hand Auger |
| DT | Diatube Coring | NDD | Non-destructive digging | AD | Auger Drilling | ADH | Hollow Auger |
| EX | Tracked Hydraulic Excavator | HAND | Excavated by Hand Methods | RT | Rotary Tricone bit | RAB | Rotary Air Blast |
| RC | Reverse Circulation | PT | Push Tube | WB | Washbore | V | V-Bit |
| T | TC-Bit | NMLC | Diamond Core - 52 mm dia | NQ | Diamond core - 47 mm dia | HQ | Diamond core - 63 mm dia |
| PQ | Diamond core - 81 mm dia | HMLC | Diamond Core - 63 mm dia | | | | |

| **Water** | |
|---|---|
| Standing Water Level | Partial water loss |
| Water Seepage | Complete Water Loss |

**GWNO** GROUNDWATER NOT OBSERVED – Because of drilling water, surface seepage or cave-in of the borehole/ test pit, observation of groundwater, whether present or not, was not possible.

**GWNE** GROUNDWATER NOT ENCOUNTERED – The borehole/ test pit was dry soon after excavation. In less permeable strata, however, groundwater may exist. It is possible that inflow could have been observed if the borehole/test pit had been left open longer.

## SAMPLING & TESTING

| **Sampling** | |
|---|---|
| A | Auger Sample |
| B | Bulk Sample |
| DS | Disturbed Sample |
| ES | Environmental Sample |
| WS | Water Sample |
| GS | Gas Sample |
| U50 | Undisturbed Tube Sample (50mm) |

| **Testing** | |
|---|---|
| PP | Pocket penetrometer (kPa) |
| PID | Photo ionisation detector reading in ppm |
| PM | Pressuremeter test over section noted |
| PL | Point load strength Is (50) MPa |
| FP | Field Permeability test over section noted |
| FVS | Field Vane Shear test expressed as uncorrected shear strength (sv= peak value, sr= residual value) |
| WPT | Water Pressure tests |
| DCP | Dynamic Cone Penetrometer test |
| CPT | Static Cone Penetration test |
| CPTu | Static Cone Penetration test with pore pressure (u) measurement |
| SPT | Standard Penetration Test to AS1289.6.3.1-2004 |