## APPENDIX 3 - SOIL INFORMATION

### *(a) Description of Representative Soil profiles*

The characteristics used to describe the soil profile of the mapping units appear in the following order where applicable.

(i) Moist soil colour: In terms of hue, value and chroma, using the Munsell soil colour charts (1954).

(ii) Mottles: Soils are said to be mottled where 10% of the soil mass had masses, blobs or blotches of colour with a different value/chroma rating to the dominant soil coulour.

(iii) Texture: Laboratory particle size analysis were used and the categories defined according to Fig. 2.

(iv) Soil Structure: the arrangement of all soil particles and the form in which they exist.

(v) Consistence: The measure of the forces of cohesion within a soil mass as indicated by the resistance of soil aggregates to rushing between thumb & forefinger.

(vi) pH: Field pH as determined using a C.S.I.R.O. Soil pH Test kit.

(vii) Factual Key: the factual key of Northcote (1971) has been extended by the soil Conservation Service of NSW. The addendum to this coding (last three numbers) refers to surface texture, surface structure, and depth of the A horizon in centimeters. Texture classes range from 0-3 (from structureless to strongly developed structure).

**Map Unit** : Steep Slopes (SS)
**Factual Key** : Uc 5.21 2/0/10
**Great Soil Group** : Earthy Sands
**Northcote Group** : Earthy Sands
**Site No** : 28

| Depth (cm) | Horizon | Description |
|---|---|---|
| 0-10 | A | Very dark greyish brown (10YR 3/2); sandy loam; apedal; dry hard; pH 5.8 gradual transition to: |
| 10-40 | B | Dark-brown (10YR 3/3); sandy loam; apedal; dray hard; pH 5.8 |
| 40+ | C | Decomposing granite; or hard rock |

**Map Unit** : Hilly Outcrop (HO)
**Factual Key** : Uc 5.21 1/0/25
**Great Soil Group** : Earthy Sands
**Northcote Group** : Earthy Sands
**Site No** : 29

| Depth (cm) | Horizon | Description |
|---|---|---|
| 0-5 | $A_1$ | Dark brown (10YR 3/3); loamy sand; apedal; dry hard; pH 5.8 clear transition to: |
| 5-25 | $A_2$ | Dark yellowish brown (10YR ¾); dry; sand; apedal; dry hard; pH 6.0 |
| 25-50 | B | Yellowish brown (10YR 5/4); clayey sand; weak structure; slightly moist, firm; pH 6.0 gradual transition to: |
| 50-70 | B/C | Dark yellowish brown (10 YR 4/4); apedal; slightly moist; firm; pH 5.8 |
| 70+ | C | Decomposing granite |

**Map Unit** : Hilly (H)
**Factual Key** : Uc 5.2 1/0/10
**Great Soil Group** : Earthy Sands
**Northcote Group** : Earthy Sands
**Site No** : 24

| Depth (cm) | Horizon | Description |
|---|---|---|
| 0-10 | A | Brown (7.5YR 4/2); loamy sand; apedal slightly moist; firm; pH 6.3 gradual transition to: |
| 10-85 | B | Reddish-Brown (5YR 4/3); sand; apedal; slightly moist, friable: pH 5.8 |
| 85+ | | Decomposing granite |

**Map Unit** : Rolling outcrop (RO)
**Factual Key** : Db 2.32 1/0/20
**Great Soil Group** : Soloth
**Northcote Group** : Hard pedal mottled-brown Duplex Soils
**Site No** : 21

| Depth (cm) | Horizon | Description |
|---|---|---|
| 0-10 | $A_1$ | Dark brown (7.5YR 3/2); coarse loamy sand; apedal; slightly moist, firm; pH 5.0 clear transition: |
| 10-20 | $A_2$ | Dark yellowish brown (10YR 3.4); coarse loamy sand; apedal; slightly moist, firm pH 5.5 abrupt transition to: |
| 10-45 | B | Brown (10YR 4/3); clay; strong angular blocky; slight moist, firm; pH 6.0 gradual transition to: |
| 45-60 | B/C | Dark gray (10YR 4/1); sandy clay; pH 6.5 |
| 60+ | | Decomposing granite |

**Map Unit** : Rolling R
**Factual Key** : Dy 3.43 1/0/25
**Great Soil Group** : Solodic Soils
**Northcote Group** : Hard Pedal Mottled Yellow Duplex Soils
**Site No** : 3

| Depth (cm) | Horizon | Description |
|---|---|---|
| 0-8 | $A_1$ | Very dark greyish brown (10YT 3/2); loamy sand; apedal; dray hard; pH 4.2 gradual transition to: |
| 8-25 | $A_2$ | Dark brown (10YR 3/3) loamy sand; apedal; dry hard pH 5.5 clear transition to: |
| 25-65 | B | Reddish brown (2.5YR 5/4) yellow-brown, gray & red mottled; clay; strong angular blocky; moist, very friable; pH 6.5 gradual transition to: |
| 60+ | B/C | Pale brown (10YR 6/3) yellow-brown & yellow mottles; clay; moderate angular blocky; moist; friable; pH 7.2 |

**Map Unit** : Undualting (U)
**Factual Key** : Dy 2.43 1/0/20
**Great Soil Group** : Solodic Soils
**Northcote Group** : Hard pedal yellow duplex soil
**Site No** : 10

| Depth (cm) | Horizon | Description |
|---|---|---|
| 0-5 | $A_1$ | Very dark grayish brown (10YR 3/2) loamy sand; apedal; pH 4.5 clear transition to: |
| 5-20 | $A_2$ | Very dark grayish brown (10YR 3/2, 10YR 6/2) dry; sand; apedal; pH 5.0 gradual transition to: |
| 20-50 | B | Dark brown (10YR 3/3); clay; strong angular blocky; pH 8.5 clear transition to: |
| 50-80 | B/C | Pale brown (10YR 6/3) light clay; moderate angular blocky; pH 8.5 |

| | | |
|---|---|---|
| 80+ | | Either sand or clay layer |
| **Map Unit** | : | Undulating (U) |
| **Factual Key** | : | Uc 5.21 1/0/5 |
| **Great Soil Group** | : | Earthy Sands |
| **Northcote Group** | : | Earthy Sands |
| **Site No** | : | 32 |

| **Depth (cm)** | **Horizon** | **Description** |
|---|---|---|
| 0-5 | A | Very dark grayish brown (10YR 3/2); loamy sand; apedal; dry hard; pH 6.0 clear transition to: |
| 5-35 | B1 | Dark yellowish brown (10YR ¾), (10YR 64) dry; clayey sand; apedal; dry hard; pH 6.5 gradual transition to: |
| 35+ | B2 | Dark yellowish brown (10YR 4/4, 10YR 7/2) dry; sand; apedal; dry hard; pH 6.5 |

| | | |
|---|---|---|
| **Map Unit** | : | Drainage Line (DL) |
| **Factual Key** | : | Ug 5.17 6/3/45 |
| **Great Soil Group** | : | Grey clays |
| **Northcote Group** | : | Black Cracking Clay |
| **Site No** | : | 11 |

| **Depth (cm)** | **Horizon** | **Description** |
|---|---|---|
| 0-45 | A | Black (10YR 2/1); heavy clay strong structure; wet, plastic; pH 6.0 gradual transition to: |
| 45-65 | B | Weak red (2.5YR 4/2); clay; moderate structure; wet, slightly plastic; pH 7.0 gradual transition to: |
| 60+ | C | Reddish brown (2.5YR 4/3); clayey sand; weak structure; moist friable; pH 9.0. |

### *(b) Laboratory analysis*

All results are expressed in terms of the oven-dry soil passing a 2 mm sieve (fine earth) except that gravel which is expressed as a percentage of the air-dry field sample (Table 26).

(i) Particle size analysis: The plummet balance method of Hutton (1956) was employed, with organic matter and carbonate removal where necessary. The hand decantation method of Piper (1942) was used to separate the sand from the finer fractions.

(ii) Electrical conductivity (E.C. 25°C): A 1:5 soil water suspension was shaken for one hour and the conductivity was measured with a "Phillips" conductivity bridge and dip cell

(iii) Soil Reaction (pH): The above suspension was used with measurements being made with a glass electrode pH meter.

(iv) Chloride ($CL^-$): The electrometric silver nitrate titration technique of R. J. Best was used, as detailed in Piper (1942).

(v) Atterberg limits [1]: Tests for determining the clay activity or plasticity of soil.

(a) Plastic limit: the plastic limit of a soil is the moisture content at which the soil passes from the solid to the plastic state.

(b) Liquid limit: the liquid limit is the moisture content at which the soil passes from the plastic to the liquid state.

(c) Plasticity Index: The plasticity index of a soil is the difference between the plastic and the liquid limits.

(vi) Linear Shrinkage: the linear shrinkage is the decrease in one dimension of a soil sample when oven dried (at 105°C for 24 hours) from the moisture content at the liquid limit expressed as a percentage of the original dimension.

(vii) Unified Soil classification system [2]: This is a system whereby 15 basic soil groups have been selected to define certain distinctive and peculiar engineering properties. Soils are classified into these groups according to their basic properties (Ingles & Metcalf 1972).

(viii) Emerson Classification: A classification of soil aggregate based on their coherence in water (Emerson 1967).

1. In 1911, a Swedish soils scientist, A. Atterberg developed a series of hand preformed tests which were subsequently mechanized by A. Casagrande.

2. Based on the AC system by A. Casagrande this system was adopted jointly in 1952 by the Corps of Engineers and the Bureau of reclamation (Earth Manual, 1968).

*Table 26 (b) - Laboratory Analysis*

| Site No, Map Unit | | Depth of Sample | Field Texture | Gravel | Particle size Distribution | | | | 1:5 Soil Water Suspension | | | Atteberg Limits | | | Linear Shrinkage | Unified Soil Classification | Emerson Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Coarse Sand | Field Sand | Silt | Clay | PH | E.C. 25°C | Cl- | Plastic Limit | Liquid Limit | Plasticity Index | | | |
| | | cm | | % | % | % | % | % | | µS/cm | % | | | | | | |
| 28 | A | 0-10 | SL | 27 | 59 | 17 | 7 | 12 | 5.6 | 55 | 0.004 | | | | | | 8 |
| Steep Slopes | B | 10-40 | SL | 26 | 52 | 18 | 9 | 19 | 5.6 | 50 | 0.003 | 15.3 | 28.7 | 13.4 | 7.8 | SC | 2 |
| 29 | A1 | 0-5 | LS | 18 | 61 | 21 | 5 | 8 | 5.5 | 34 | 0.002 | | | | | | 8 |
| | A2 | 5-25 | LS | 38 | 64 | 22 | 6 | 7 | 5.9 | 19 | 0.001 | | | | | | 2 |
| Hilly Outcrop | B | 25-50 | LS | 34 | 51 | 32 | 7 | 7 | 6.2 | 24 | 0.001 | 15.7 | 16.2 | 0.5 | 1.4 | SM | 2 |
| 24 | A | 0-10 | SL | 38 | 56 | 26 | 6 | 12 | 5.9 | 24 | 0.001 | | | | | | 8 |
| Hilly | B | 10-85 | S | 34 | 71 | 20 | 5 | 4 | 5.9 | 23 | 0.001 | 24.5 | 24.7 | 0.2 | 1.4 | SM | 2 |
| | A1 | 0-10 | L | 20 | 46 | 26 | 13 | 12 | 5.2 | 39 | 0.002 | | | | | | 8 |
| 21 | A2 | 10-20 | LS | 26 | 47 | 30 | 12 | 8 | 5.8 | 35 | 0.002 | | | | | | 2 |
| Rolling Outcrop | B | 20-45 | C | 21 | 35 | 20 | 4 | 39 | 6.0 | 120 | 0.008 | 16.1 | 54.3 | 38.2 | 15.0 | CH | 2 |
| | C | 45-60 | CL | 16 | 44 | 20 | 8 | 28 | 6.6 | 130 | 0.009 | | | | | | 2 |
| | A1 | 0-8 | | 44 | | | | | 5.0 | 49 | 0.002 | | | | | | 8 |
| 3 | A2 | 8-25 | LS | 35 | 53 | 29 | 11 | 5 | 4.9 | 72 | 0.007 | | | | | | 2 |
| Rolling | B | 25-65 | C | 9 | 21 | 22 | 8 | 46 | 7.0 | 1100 | 0.3 | 15.1 | 60.0 | 44.9 | 16.0 | CH | 2 |
| | C | 65+ | CL | 41 | 33 | 33 | 11 | 30 | 7.1 | 710 | 0.089 | | | | | | |
| | A1 | 0-5 | SL | 20 | 58 | 26 | 11 | 3 | 6.2 | 43 | 0.002 | | | | | | 8 |
| 32 | B1 | 5-35 | CS | 21 | 56 | 33 | 9 | 3 | 6.2 | 28 | 0.002 | 12.0 | 12.0 | 0.0 | 0.0 | SM | 2 |
| Undulating | B2 | 35-60 | S | 29 | 52 | 33 | 10 | 4 | 6.6 | 44 | 0.004 | | | | | | 2 |
| | A1 | 0-5 | LS | 15 | 45 | 30 | 12 | 6 | 4.5 | 54 | 0.003 | | | | | | 8 |
| 10 | A2 | 5-20 | S | 30 | 56 | 33 | 4 | 4 | 5.0 | 69 | 0.006 | 15.5 | 55.3 | 39.8 | 15.4 | CH | 2 |
| Undulating | B | 20-50 | C | 16 | 22 | 22 | 10 | 45 | 8.5 | 4400 | 0.13 | | | | | | 2 |
| | B/C | 50-80 | LC | 16 | 35 | 24 | 8 | 33 | 8.5 | 4400 | 0.13 | | | | | | |
| 11 | A | 0-45 | C | 9 | 25 | 18 | 8 | 49 | 6.0 | 680 | 0.071 | 27.7 | 109.0 | 82.3 | 20.0 | CH | 2 |
| Drainage Line | B | 45-65 | C | 17 | | | | | 7.0 | 1000 | 0.12 | | | | | | 2 |
| Sand Extraction | | 300+ | S | 34 | 63 | 24 | 5 | 8 | | | | | | | | SM | |

***Plates 1 & 2 – Intensive use has compacted and denuded many areas***

*Plate 3 – Surface runoff from steeper areas can increase the erosion hazard*

*Plate 4 – Severe gully erosion running through the reserve has been initiated by sand scraping operations in adjacent areas*

*Plate 5 – The existing walking track to Flinders Peak is ill-defined, devoid of vegetation and badly eroded.*

*Plate 6 – An alternative track to Flinders Peak exists and could be used to rest the main track*

***Plate 7 – Sand extraction operations have cleared and exposed large areas. Restoration will be both difficult and expensive.***