



Estimation of Soil Properties Using the Atlas of Australian Soils

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CSIRO Land and Water, Canberra ACT
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1 Soil Information at the Continental Level

The Atlas of Australian Soils still provides the only consistent source of spatial information for the complete continent. The Atlas was completed in 1968 (Northcote et al. 1960-1968) and made available in digital form in 1990. While large areas have been surveyed in more detail during the last 30 years, the various surveys have not been compiled to produce a new national map. A major effort to prepare a compiled coverage is being undertaken as part of the National Land and Water Resources Audit. The new Australian Soil Resource Information System (ASRIS) will be completed early in 2001 but it will be restricted to the more intensively used areas of the country. With this in mind, we have updated an earlier set of interpreted soil variables (McKenzie and Hook 1992) that can be used with the Digital Atlas to increase its utility. The earlier interpretations have been useful for a range of applications including catchment hydrology, carbon sequestration studies and broad scale land evaluation.

The Digital Atlas provides a map of soil types but these are often of limited use by themselves. Estimates of typical ranges for soil properties associated with each soil type are needed to make the Atlas more useful. The interpretations of soil physical and nutrient properties presented in McKenzie and Hook (1992) were a first approximation. In this work we have increased the number of variables and relied heavily on the soil profile database held by CSIRO Land and Water. This database contains descriptions of soil type, morphology, chemistry and in some instances physical properties for over 7,000 profiles from across Australia. The locations of sites are shown in Figure 1. While this database provides a good coverage of the major soils of Australia, a much larger database incorporating State and Territory agency holdings is being compiled as part of the ASRIS Project. As with the earlier set of interpretations, the current estimates are still an interim measure and will be superseded in the intensive land use zone by ASRIS.

The purpose of this report is to provide an account of methods used for interpreting the soil types of the Factual Key (Northcote 1979) along with some notes on using these with the Digital Atlas of Australian Soils. There are many limitations on these estimates and users of any predictions should exercise considerable care and be aware of the limitations of the source data. It is always worth bearing in mind that a very large proportion of soil variation within a region occurs over short distances and cannot be resolved by reconnaissance scale maps. The qualitative nature of the Atlas and restrictions associated with the classification scheme and structure of the soil-landscape model impose further constraints. Caveats on the use of the Digital Atlas of Australian Soils are presented at the end of this report and they should be heeded.

2 Soil Properties

The Factual Key of Northcote (1979) is a soil classification system that uses field observable soil morphological data. It has been widely used in Australia during the last 30 years and most notably formed the basis for characterising soils in the Atlas of Australian Soils. The Factual Key can be used at several levels of generalisation. It is most common to allocate soils at the level of the Principle Profile Form. This report provides estimates of soil properties for those classes of the Factual Key found in the Atlas.

Soil taxonomic classes are not always good predictors of individual soil properties and Butler (1980) provides a very good overview of the relevant issues. McKenzie and Austin (1989) provide an evaluation of the predictive utility of the Factual Key for an area in Central New South Wales. The following sections describe the soil properties along with the methodological issues in providing estimates using the Factual Key.

Soil properties are estimated using a simple two-layer model of the soil consisting of an A and B horizon. The following properties have been estimated for both the A and B horizon: horizon thickness, texture, clay content, bulk density, grade of pedality and saturated hydraulic conductivity. The estimates of thickness, texture, bulk density and pedality have been used to estimate parameters that describe the soil water retention curve - these allow calculation of the available water capacity for each layer. The reliability of each estimate can be determined from the associated confidence interval. Several interpretations relating to the complete soil profile have also been provided and these are presence or absence of calcrete and gross nutrient status. The latter attribute is taken from McKenzie and Hook (1992).

**CSIRO National Soil Database
Profile Locations**

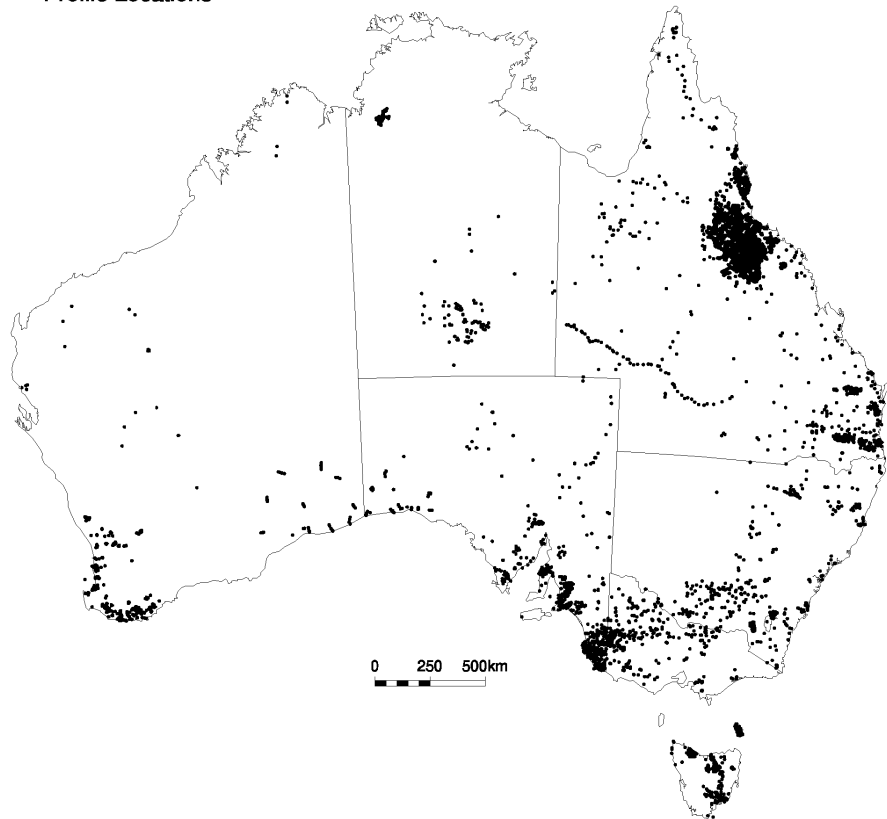


Figure 1: Locations of profiles held in the CSIRO National Soil Database

Interpretations

Summaries of the spreadsheet containing interpretations for the 725 soil types used in the Digital Atlas of Australian Soils are listed in Tables 1 and 2. The spreadsheet is available in digital form from the authors. Note that the spreadsheets have 726 records and include the designation “NS” for units without soil. The data are presented in Appendices One and Two.

As noted earlier, the interpretations for each soil type were based, wherever possible, on data held within the CSIRO National Soil Database. Data summaries were prepared for the soil types listed in the Digital Atlas and an example is presented in Appendix Three. The data summaries provided information on central tendency (mean or median) and dispersion (standard deviation, 5th and 95th percentiles) for each interpreted variable. The summaries from the database were used with other sources of information to assign an interpreted value for each variable. In each instance, an estimate has been made of the 5th percentile, median and 95th percentile to give users an indication of the confidence for each prediction. The resulting 90% confidence interval is often very broad. A qualitative estimate of the reliability has also been provided. This estimate is coded as “1” if more than 20 profile descriptions and ancillary data were available. A code of “2” is used when 5-20 profile descriptions were available with ancillary data. A code of “3” was used when interpretations were interpolated from interpretations of related soils. The most commonly used source of ancillary data was Northcote et al. (1975). It should be noted that the systematic structure of the Factual Key makes interpolation between classes relatively straightforward. The following sections consider each of the interpreted variables.

Table 1: Key to interpreted variables (ppfinterp.xls)

Variable	Data type	Description	Example value
PPF	Text	Principle profile form or higher level class	Dr2.12
Atext5	Integer	5 th percentile A horizon Northcote texture group	2
Atext50	Integer	Median A horizon Northcote texture group	3
Atext95	Integer	95 th percentile A horizon Northcote texture group	4
Btext5	Integer	5 th percentile B horizon Northcote texture group	5
Btext50	Integer	Median B horizon Northcote texture group	5
Btext95	Integer	95 th percentile B horizon texture group	6
Aclay5	Integer	5 th percentile A horizon clay %	15
Aclay50	Integer	Median A horizon clay %	20
Aclay95	Integer	95 th percentile A horizon clay %	30
Bclay5	Integer	5 th percentile B horizon clay %	40
Bclay50	Integer	Median B horizon clay %	45
Bclay95	Integer	95 th percentile B horizon clay %	50
Athick5	Numeric (x.xx)	5 th percentile A horizon thickness (m)	0.05
Athick50	Numeric (x.xx)	Median A horizon thickness (m)	0.12
Athick95	Numeric (x.xx)	95 th percentile A horizon thickness (m)	0.30
Bthick5	Numeric (x.xx)	5 th percentile B horizon thickness (m)	0.20
Bthick50	Numeric (x.xx)	Median B horizon thickness (m)	0.40
Bthick95	Numeric (x.xx)	95 th percentile B horizon thickness (m)	0.90
Solumthick5	Numeric (x.xx)	5 th percentile solum thickness (m)	0.30
Solumthick50	Numeric (x.xx)	Median solum thickness (m)	0.60
Solumthick95	Numeric (x.xx)	95 th percentile solum thickness (m)	1.00
Astruct5	Integer	5 th percentile A horizon grade of pedality	1
Astruct50	Integer	Median A horizon grade of pedality	1
Astruct95	Integer	95 th percentile A horizon grade of pedality	1
Bstruct5	Integer	5 th percentile B horizon grade of pedality	3
Bstruct50	Integer	Median B horizon grade of pedality	3
Bstruct95	Integer	95 th percentile B horizon grade of pedality	3
ABDensity5	Numeric (x.x)	5 th percentile A horizon bulk density (Mg/m ³)	1.4
ABDensity50	Numeric (x.x)	Median A horizon bulk density (Mg/m ³)	1.5
ABDensity95	Numeric (x.x)	95 th percentile A horizon bulk density (Mg/m ³)	1.6
BBDensity5	Numeric (x.x)	5 th percentile B horizon bulk density (Mg/m ³)	1.4
BBDensity50	Numeric (x.x)	Median B horizon bulk density (Mg/m ³)	1.6
BBDensity95	Numeric (x.x)	95 th percentile B horizon bulk density (Mg/m ³)	1.7
A Ks	Integer	A horizon log ₁₀ (saturated hydraulic conductivity mm/hr) – 50 th percentile	3
A Ks error	Integer	Log ₁₀ (Ks) error (ie plus or minus)	2
B Ks	Integer	B horizon log ₁₀ (saturated hydraulic conductivity mm/hr) – 50 th percentile	4
B Ks error	Integer	Log ₁₀ (Ks) error (ie plus or minus)	2
Calcrete	Integer	Absence (0) or Presence (1) of calcrete in or below the profile	0
Reliability	Integer	Reliability of interpretation (1: >20 profiles + ancillary data, 2: 5-20 profiles + ancillary, 3: interpolated from other PPF interpretations)	1
A 0.1 bar	Numeric (x.xx)	A horizon volumetric water content at 0.1 bar matric potential	0.26
A 15 bar	Numeric (x.xx)	A horizon volumetric water content at 15 bar matric potential	0.13
A AWHC mm/m	Numeric (xxx)	A horizon water holding capacity per unit depth	129 mm/m
A AWHC mm	Numeric (xxx)	A horizon water holding capacity	32 mm
A Reliability	Text	Reliability of water retention estimate for A horizon	
B 0.1 bar	Numeric (x.xx)	B horizon volumetric water content at 0.1 bar matric potential	0.33
B 15 bar	Numeric (x.xx)	B horizon volumetric water content at 15 bar matric potential	0.30
B AWHC mm/m	Numeric (xxx)	B horizon water holding capacity per unit depth	31 mm/m
B AWHC mm	Numeric (xxx)	B horizon water holding capacity	19 mm
B Reliability	Text	Reliability of water retention estimate for B horizon	
PAWHC mm	Numeric (xxx)	Available water holding capacity of the solum	51 mm
Nutrients	Integer	Nutrient Status low (1), moderate (2) and high (3)	1

Texture and Clay Content

Estimates have been made of the Northcote Texture Group for the notional A and B horizon. The Texture Groups are summarised in Table 2. An estimate of clay content has also been provided. Texture and particle size distribution (i.e. clay, silt and sand content) are not equivalent (McDonald et al. 1990). The estimated clay contents for each Texture Group are presented in Table 1 and were used as a guide. In many cases, the estimated clay content was increased or decreased depending on the type of soil. For example, soils with high levels of exchangeable sodium have a heavier field texture than suggested by the particle size analysis. In contrast, sub-plastic soils have a relatively light field texture but large clay content because of strong micro-aggregation. For example, Gn3.10 soils often have a clay loam texture but clay content in excess of 70%.

There are several structural features with the Factual Key that have a major impact on the degree to which estimates of texture can be derived. The Key uses soil texture as a differentiating character at several levels. At the highest level, four primary profile forms are recognized:

- Organic: Profiles with the top 0.30m containing $\geq 20\%$ organic matter when the clay content is $\leq 15\%$, or $\geq 30\%$ organic matter when the clay content is $> 15\%$.
- Uniform: Profiles with a small, if any, texture difference throughout.
- Gradational: Profiles with an increasing texture grade (ie. more clay rich) such that differences between horizons are less than 1.5 texture grades and the range down the profile exceeds a texture group.
- Duplex: Profiles with a clear to sharp transition between the A and B horizons and a texture contrast between these layers of ≥ 1.5 texture groups.

Subdivisions of the uniform primary profile form are made on the basis of texture with coarse (sand or sandy loam throughout the profile), medium (loam or clay loam throughout), fine (clay throughout) and cracking (shrink-swell clay throughout) classes being recognized.

From this it can be seen that estimation of texture for the uniform primary profile form is straightforward (eg. Uc profiles are by definition sands or sandy loams throughout the profile and Ug profiles are medium to heavy clays throughout). Uc, Um, Uf and Ug soils occupy around 58% of Australia. It is more difficult to be definite about other soil types. For example, duplex soils can have a range of surface textures (from sands to clay loams) - the only definite statement that can be made about these soils is that the B horizons have greater clay contents than A horizons and the former will always have texture of loam or heavier. Duplex soils occupy around 17.5% of Australia. Some other classes exhibit almost the full range of textures (eg. Gc and Gn soils) and these occupy the remaining 24.2% of Australia.

The discussion so far would suggest that reliable interpretations of texture are possible for only a limited part of the continent. However, many of the other criteria used throughout the Factual Key have some degree of correlation with texture. For example, Gn3.10 soils have gradational texture profiles, are not calcareous throughout, are strongly acid and have smooth-ped B horizons that are whole coloured and red. These soils nearly always have a loam to clay loam texture with a gradual increase throughout the profile. The reliability of estimates of texture for soil classes that do not have texture as a diagnostic or keying variable depends heavily on the strength of correlations between the relevant soil properties.

Horizon and Solum Thickness

The thickness of individual soil layers and depth of the overall soil profile are used sparingly as keying criteria in the Factual Key. This has been rectified in the new Australian Soil Classification (Isbell 1996) which includes depth at the Family level. Regardless of how well horizon thickness relates to a taxonomic class, in many landscapes, variations in thickness and total depth often occur at the scale of the hillslope. The resolution of the Atlas of Australian Soils is too coarse to represent this variation so the values for polygons are general averages by necessity.

Because thickness is used sparingly in the Factual Key, estimation has to rely on empirical correlations for particular soil types. For example, the Gn3.10 soil noted earlier is nearly always deep with an average depth between 2–3 m.

A major difficulty associated with the Factual Key, Atlas of Australian Soils and existing soil databases is the imprecise definition of the depth of soil or regolith that can be exploited by plant roots. The solum depth (i.e. depth of the A and B horizons) is not necessarily associated with the depth of root growth and in many landscapes, plants exploit deeper layers (C and D horizons) - these layers are not recorded in a consistent form in historical datasets.

Table 2: Texture grades and groups used in the Factual Key – estimated clay contents are adapted from McDonald et al. (1990).

Texture Group Number	Texture Group	Estimated Clay Content (Min., Mean, Max.)			Texture Grade
1	Sands	0	5	8	Sand Clayey Sand Loamy Sand
2	Sandy Loams	8	15	20	Sandy Loam Fine Sandy Loam Light Sandy Loam
3	Loams	10	20	30	Loam Loam, Fine Sandy Silt Loam Sandy Clay Loam
4	Clay Loams	20	30	40	Clay Loam Silty Clay Loam Fine Sandy Clay Loam
5	Light Clays	35	40	50	Sandy Clay Silty Clay Light Clay Light Medium Clay
6	Clays	45	55	100	Medium Clay Heavy Clay

A further problem is the large portion of censored data in existing databases. This is because the depth of characterisation has been limited by the method of observation (e.g. soil augers or backhoe pits are often restricted to one or two metres) or survey purpose (e.g. many agriculturally focussed surveys were only concerned with the first metre). Many of the frequency distributions for individual Principle Profile Forms generated from the CSIRO database were bimodal with peaks at around 1m and again at a larger depth (see Appendix Three). In these instances, the interpreted depth relied on the calculated median depth from the database records along with a qualitative adjustment to compensate for the apparently censored data.

Some Principle Profile Forms by definition are comprised of an A horizon only (e.g. Uc1, Um1 and Uf1 subdivisions). These are often young soils forming in alluvium or similar materials. They have an accumulation of organic carbon in the A horizon and minimal evidence of pedogenesis. However, the depth of material available for root exploration is much greater than the A horizon and this depth is difficult to estimate. The depth of solum is equivalent to the thickness of the A horizon.

Bulk Density

Bulk density data have not been collected in routine soil surveys despite their importance for a range of purposes. The CSIRO database at the time of the analysis had bulk density determinations for 1,755 soil layers although these were biased to soils used for agriculture and the Bago-Maragle forest soil survey study (McKenzie and Ryan 1999).

Bulk density is not used as a diagnostic criterion in the Factual Key although certain defining features have good correlations. For example, the hardsetting criterion is used to discriminate at the Section level between various forms of A horizons in duplex soils. Hardsetting A horizons nearly always have bulk densities of $\geq 1.4 \text{ Mg m}^{-3}$. Likewise, the presence of A2 horizons, colour mottling and pH can be used to make inferences. Mottled B horizons in duplex soils with bleached A2 horizons and alkaline reaction trends will invariably be sodic and as a consequence have bulk densities $\geq 1.6 \text{ Mg m}^{-3}$.

The uncertainty associated with bulk density estimates will be greater than those for texture. Bulk density data are not available for many groups of soils and there are many instances where bulk density will have little if any correlation with generalised soil types; for example, where land management practices have led to increases in bulk density across a range of soil types.

Grade of Pedality

Grade of pedality has been estimated because it is an explanatory variable used by Williams *et al.* (1992) for predicting the water retention curve (see below). Grade of pedality is estimated as single grain (1), massive (2), weak (3) moderate (4) or strong (5). Williams *et al.* (1992) convert these to a binary variable and this equals 1 for massive or single grain soils or 2 for soils with a grade of structure ranging from weak to strong. Pedality is used throughout the Factual Key either directly or through related variables (e.g. fabric, presence of hardsetting etc.).

Saturated Hydraulic Conductivity

Saturated hydraulic conductivity (K_s) is a strong determinant of the soil water regime. It typically exhibits substantial short-range variation and is relatively difficult to measure - there are few reliable sets of K_s data for Australia (Cresswell *et al.* 1999). Despite these problems, K_s can be related to soil morphological criteria and the classes of the Factual Key (Talsma and Hallam 1980; McKenzie and Jacquier 1997; Bird *et al.* 1996). The estimates of K_s presented here are based on experience gained in CSIRO Land and Water (McKenzie *et al.* 1991; Geeves *et al.* 1995; McKenzie and Jacquier 1997) and published data sets (e.g. Forrest *et al.* 1985; Williams 1983).

K_s has been estimated using the classes presented in Table 3. The median values for each class are approximately equidistant on a logarithmic scale (i.e. -1, -0.5, 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 using \log_{10}). Estimates of confidence intervals are given in terms of \pm number of classes - this provides an asymmetric estimate for the confidence interval for the back-transformed data. This is more realistic for K_s data because they are generally log-normally distributed. For example, a soil horizon may have an estimated K_s of 100 mm/hr (Class 8) \pm 1 class when variability is low (i.e. range is 30 - 300) or 100 mm hr⁻¹ \pm 2 classes when the estimate is less certain (i.e. range of 10 - 1000).

The descriptive names are approximately the same as McDonald and Isbell (1990). Descriptive names are provided for classes 2, 4, 6, 8, and 10 to provide a more approximate classification. The intervening class values are the boundaries for the descriptive class (i.e. the slow class has a mid-point of 1.0 mm/hr, a lower bound of 0.3 mm/hr and upper bound of 3.0 mm/hr). Descriptive names can be used for intervening classes if required (eg. class 3 would be "very slow to slow")

Table 3: Definition of classes for K_s .

Class	Median mm/hr	\log_{10}	Descriptive Name
1	0.03	-1.5	
2	0.1	-1.0	Very slow
3	0.3	-0.5	
4	1.0	0.0	Slow
5	3.0	0.5	
6	10	1.0	Moderate
7	30	1.5	
8	100	2.0	High
9	300	2.5	
10	1000	3.0	Extreme
11	3000	3.5	

Soil Water Retention and Available Water Capacity

The soil water retention curve, like K_s , is slow and expensive to measure. Several pedotransfer functions have been published to predict the curve from more readily observed data. Equation 7 from Williams *et al.* (1992) has been used here because it has been derived from a relatively large data set and testing on independent data sets has shown it to be robust (Paydar and Cresswell 1996).

Estimates have been provided of the volumetric water content at 0.1 bar and 15 bar for each layer. Available water capacity is presented on a per unit depth basis, as a total for each horizon, and as a total for the solum. The last estimate is likely to be the most useful. The available water capacities have been calculated as the difference in volumetric water content at matric potentials of -0.1 bar and -15 bar for a specified depth increment.

There are situations where empirical methods of prediction such as Williams *et al.* (1992) fail. The predictive equations are *unreliable* when applied to soils with a clay content exceeding 60% - this is outside of the range of soils on which the equations were developed. Reliability is also determined by evaluating the parameters in the soil water retention curves used for calculating the water retention properties against arbitrary

thresholds. Properties are labeled as *unreliable* if the Campbell *b* parameter (refer Williams et al. 1992) is predicted to be greater than 26 or if the Campbell air entry potential (refer Williams et al. 1992) is less than -0.120 bar. Properties are labeled as *low* reliability if the Campbell *b* parameter is predicted to be 2 - 22, or if the Campbell air entry potential is less than -0.09 bar. All of the water retention estimates provided here are first approximations based on limited information.

Note that the total available water capacity for the solum is constrained by limitations associated with the estimate of solum thickness noted earlier. There are many other physical and practical reasons why an estimate of available water capacity as presented here is only an approximate, and sometimes erroneous, estimate of the actual plant available water capacity (see Hillel 1980). Despite these limitations, it provides a reasonable first approximation of the water storage capacity of a soil. Note that if better estimates of layer thickness are available, then they should be used in conjunction with the estimate of available water per unit depth to calculate a more reliable profile available water capacity. Estimates of the parameters of the soil water retention curves used for calculating the water retention properties are available from the authors.

Nutrient Status

The rating system for gross nutrient status prepared by McKenzie and Hook (1992) has been included. The interpretations relate to the behaviour of profiles under agricultural development. Profiles with a low status (class 1) exhibit major responses to N, P and K along with most micronutrients. Profiles with a moderate nutrient status (class 2) respond to N and P with occasional responses to some micronutrients. It is uncommon for profiles with a high nutrient status (class 3) to respond to N and P except after intensive farming. The main sources of information for the assessment of nutrient status were Stace *et al.* (1968) and Northcote *et al.* (1975).

Coarse Fragments and Calcrete

Coarse fragment content does not usually correlate strongly with Principal Profile Form unless prefixes have been used (see below). Attempts were made to estimate coarse fragment percentages but they were deemed too unreliable to be useful. Most soil types can have coarse fragment abundances ranging from zero to moderate (i.e. <50%).

The Atlas of Australian Soils makes provision for very gravelly soils through the use of prefixes. Soils with a KS- prefix have more than 60% ironstone coarse fragments throughout the profile. Similarly, soils with a K- prefix have 60% or more coarse fragments other than ironstone. A default coarse fragment content of 60% can be used for these soils.

The presence or absence of calcrete is a keying property in parts of the Factual Key. The listing of Principle Profile Forms with calcrete presented here however is bound to be an underestimate for two reasons. Some Principle Profile Forms have a range of possible substrates, including calcrete, as a keying criterion (e.g. Uc2.1) but it is misleading to record calcrete as being present. Second, many Principle Profile Forms may overlie calcrete but this feature is not used as a keying criterion.

3 Generating Spatial Estimates of Soil Properties with the Atlas

Several general strategies, with large differences in resource requirements, can be used to develop interpretations from the Digital Atlas of Australian Soils. A preliminary understanding of the structure of the Atlas is necessary to appreciate the advantages and disadvantages of each strategy.

- The Atlas of Australian Soils uses 725 soil profile classes, normally at the level of Principle Profile Form (e.g. Ug5.15).
- The legend of the Atlas defines 3,060 map unit types. The map unit types have various combinations of the 725 soil profile classes. The map unit type descriptions identify dominant and subdominant soil profile classes.
- Many of the map unit types occur more than once and the Digital Atlas has 22,560 polygons.

McKenzie and Hook (1992) prepared interpretations of the 725 soil profile classes. The dominant soil in each map unit type was then identified and the interpreted values for each soil profile class were ascribed to the map unit type.

Another possible strategy would be to prepare interpretations for each of the 3,060 map units. McKenzie and Hook (1992) recognized that some soil profile classes required different interpretations depending on location. For example, a Uc1.22 soil in Western Australia may be very shallow whereas the same soil type in South Australia may be deep. Undertaking interpretations for each map unit clearly requires an excellent geographic knowledge of Australian soils.

A third possible strategy would be to provide interpretations for individual polygons. This would be a time consuming task but the level of experience needed would not differ greatly from the second strategy.

In this work, we have restricted ourselves to a revision of the McKenzie and Hook (1992) interpretations because of resource limitations. Two spreadsheets have been produced and the first was described above (Table 1). A second spreadsheet lists the dominant Principle Profile Form for each of the 3,060 map unit types (Table 4) and it is available from the authors. The spreadsheet also includes the subdominant Principle Profile Forms identified for each map unit type. The original map unit descriptions for the Atlas (Northcote et al. 1960-68) vary greatly in their detail. Some units have more than 20 Principle Profile Forms described while others record only a dominant taxon. The number of taxa recorded is a function of both mapping detail and landscape complexity - the two cannot be readily separated. As a compromise, we have listed the five most common Principle Profile Forms to provide a general idea of within-unit variability. Note that a large number of map units have only one or two subdominant Principle Profile Forms.

Table 4: Spreadsheet description for map unit types (atlasmap.xls 327kB). Note that Subdominant Principle Profile Forms are listed in approximate order of dominance.

Variable	Data type	Description	Example value
MAP_UNIT	Text	Map unit code	CC12
PPF1	Text	Dominant Principle Profile Form	Ug5.2
PPF2	Text	Subdominant Principle Profile Form	Dd2.33
PPF3	Text	Subdominant Principle Profile Form	Dy3.33
PPF4	Text	Subdominant principle profile form	Dy2.1
PPF5	Text	Subdominant principle profile form	Ug5.5

4 Concluding Caveats

Use of the interpretations requires an appreciation of the limitations associated with reconnaissance scale soil-landscape maps. Some of the more significant issues are as follows.

- Reconnaissance scale soil-landscape maps usually have a low predictive capability for individual soil properties (Beckett and Webster 1971). This predictive capability is further diminished by the uncertainty associated with each interpretation.
- The quality of the Atlas mapping varies substantially and an indication of reliability is provided with the original explanatory notes published during the 1960's (Northcote et al. 1960-68). These should be referred to when drawing conclusions about a particular region.
- A major restriction of the Atlas is the lack of information on the area within each polygon occupied by the component soil types – area-weighted averages cannot be calculated. While a dominant soil type can be specified for each unit, it may occupy a very limited area within a given unit (perhaps 20%). Any analysis based on an interpretation of the dominant soil is therefore of restricted value. An alternative is to calculate average values for the most common soils. However, an average value can be also misleading when there is a clear dominant soil and the minor soils have sharply contrasting properties. These problems are particularly evident for the Nullarbor Plain and many of the forested areas in south-eastern Australia.
- Very large variation within each map unit is normal. As noted earlier, some units have up to 20 soils listed. It is common for the within-unit variation to be as great as the between-unit variation. This is an inescapable problem with reconnaissance scale soil-landscape mapping. An indication of the variation within map units can be generated using the list of dominant and subdominant soils.
- As a consequence, it is essential to use the estimated value and confidence interval when making judgements on soil character and behaviour for any area.
- Some soil types are far more variable with respect to the interpreted properties than others.
- Many landscape processes (e.g. erosion, salinization etc.) do not correlate in a simple way with the Atlas units because the description of soils is based on profile morphology. Profile morphology may have a poor or complex relationship with soil physical and chemical properties and, as a consequence, soil processes. Furthermore, landscape processes require more information before synoptic predictions can be made.

- The spatial arrangement of soils within a landscape may have an overriding impact on landscape processes (e.g. erodible soils along stream banks). The Digital Atlas and its associated tables provide limited information on spatial arrangement.
- The interpretations have been prepared using published information supported by restricted first hand experience. The interpretations will be revised in the future when better information is available. In the interim, they should be used cautiously.

Despite these daunting limitations, the Digital Atlas of Australian Soils in conjunction with the interpretations of McKenzie and Hook (1992) have been useful for a range of applications at the continental level. The improved interpretations described in this report will hopefully increase the utility of the Digital Atlas and encourage more informed application of soil information for natural resource research, planning and management

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Appendix One: Interpreted Soil Properties

pdf	Alex5	Axlay5	Axext50	Axlay50	Axext95	Axlay95	Bext5	Bxlay5	Bxext50	Bxlay50	Bxext95	Bxlay95	Athick5	Athick50	Athick95	Bthick5	Bthick50	Bthick95	Solumenr5	Solumenr50	Solumenr95	Astruc5	Astruc50	Astruc95	Bstruc5	Bstruc50	Bstruc95	ABDwlay5	ABDwlay50	ABDwlay95	BBDwlay5	BBDwlay50	BBDwlay95	AKs	AKerror	BKs	BKerror	Calcrete	Reliability	A 0.1bar	A 15bar	A AWHC	rA AWHC	rA Reliab	B 0.1bar	B 15bar	B AWHC	rB AWHC	rB Reliab	PAWHC	Nutrients
D60.33	2	15	3	25	4	35	5	40	6	50	6	60	0.02	0.08	0.3	0.3	0.5	0.7	0.5	0.7	1.5	2	2	2	4	5	5	1.3	1.4	1.5	1.5	1.6	1.7	3	2	4	2	0	0.27	0.12	147	12	0.37	0.30	65.00	33	unreliable	44	1		
D60.43	2	15	3	25	4	35	5	40	6	50	6	60	0.02	0.08	0.3	0.3	0.5	0.7	0.5	0.7	1.5	2	2	2	4	5	5	1.3	1.4	1.5	1.5	1.6	1.7	3	2	3	2	0	0.27	0.12	147	12	0.33	0.30	31.00	16	unreliable	27	1		
D61.1	1	8	3	20	4	30	5	40	6	50	6	70	0.05	0.15	0.4	0.1	0.7	1.8	0.2	0.8	1.9	2	2	4	3	4	5	1	1.6	1.8	1.1	1.6	1.9	7	2	7	2	0	1	0.25	0.12	130	19	0.37	0.30	65.00	46	unreliable	65	1	
D61.11	1	8	3	20	4	30	5	40	6	50	6	70	0.05	0.15	0.3	0.1	0.8	1.7	0.5	1	2	2	2	3	3	4	5	1	1.3	1.6	1.1	1.5	1.8	7	2	7	2	0	2	0.28	0.12	157	24	0.4	0.30	94.00	75	99	1		
D61.12	1	8	3	20	4	30	5	40	6	50	6	70	0.05	0.15	0.2	0.8	0.1	0.5	0.9	0.2	0.8	1.2	2	2	4	3	4	5	1	1.4	1.7	1.1	1.5	1.8	7	2	7	2	0	1	0.27	0.12	147	29	0.4	0.30	94.00	47	76	1	
D61.13	2	15	4	30	4	40	5	40	6	50	6	70	0.05	0.1	0.3	0.2	0.6	1.3	0.3	1	2	2	2	5	3	4	5	1.1	1.4	1.8	1.2	1.8	1.9	7	2	6	2	0	1	0.29	0.15	146	15	0.37	0.30	65.00	52	unreliable	67	1	
D61.2	1	8	2	15	3	20	5	40	6	50	6	70	0.1	0.3	0.5	0.1	0.5	1.2	0.4	0.8	1.5	1	2	3	3	4	5	1	1.6	1.8	1.1	1.6	1.9	7	2	7	3	0	1	0.22	0.09	132	40	0.37	0.30	65.00	33	unreliable	72	2	
D61.21	1	8	2	20	2	30	5	40	6	50	6	70	0.1	0.2	0.3	0.4	0.5	0.7	0.5	0.7	1	2	2	3	3	3	4	1	1.3	1.6	1.1	1.5	1.8	7	2	7	2	0	2	0.25	0.09	156	31	0.4	0.30	94.00	47	78	2		
D61.22	1	8	2	15	3	20	5	40	6	50	6	70	0.2	0.3	0.7	0.1	0.3	0.6	0.4	0.7	1.2	2	2	3	2	3	5	1	1.3	1.6	1.1	1.5	1.8	7	2	7	2	0	1	0.25	0.09	156	47	0.4	0.30	94.00	28	75	2		
D61.23	1	8	3	20	4	30	5	40	6	50	6	70	0.1	0.2	0.5	0.3	0.7	1.3	0.5	0.9	1.5	1	2	3	3	4	5	1.1	1.5	1.8	1.2	1.6	1.9	7	2	6	2	0	1	0.26	0.12	138	28	0.37	0.30	65.00	46	unreliable	73	2	
D61.3	1	8	3	20	4	30	4	30	6	50	6	70	0.1	0.2	0.3	0.2	0.7	1.2	0.2	0.9	1.3	2	3	4	3	4	5	1.1	1.6	1.8	1.1	1.6	1.9	7	2	6	2	0	1	0.30	0.18	119	24	0.37	0.30	65.00	70	1			
D61.31	1	8	3	20	4	30	5	40	6	50	6	70	0.05	0.1	0.2	0.4	0.9	1.8	0.5	1	2	2	2	3	4	4	5	1.1	1.6	1.8	1.1	1.6	1.9	7	2	5	2	0	3	0.25	0.12	130	13	0.37	0.30	65.00	59	unreliable	72	1	
D61.32	1	8	3	20	4	30	5	40	6	50	6	70	0.05	0.1	0.2	0.4	0.9	1.8	0.5	1	2	2	2	3	4	4	5	1.1	1.6	1.8	1.1	1.6	1.9	7	2	5	2	0	2	0.25	0.12	130	13	0.37	0.30	65.00	59	unreliable	72	1	
D61.33	2	15	3	20	4	30	4	35	6	50	6	70	0.1	0.2	0.3	0.2	0.7	1.3	0.4	0.9	1.5	2	2	4	3	4	5	1.1	1.6	1.8	1.1	1.6	1.9	7	2	4	2	0	1	0.25	0.12	130	26	0.37	0.30	65.00	46	unreliable	72	1	
D61.4	1	5	2	20	4	30	5	40	6	50	6	70	0.1	0.3	0.5	0.1	0.5	1.1	0.8	1.4	2	2	2	3	3	4	5	1.1	1.6	1.8	1.1	1.6	1.9	7	2	6	3	0	1	0.22	0.09	132	40	0.37	0.30	65.00	33	unreliable	72	1	
D61.41	1	8	2	15	3	20	5	40	6	50	6	70	0.1	0.15	0.2	0.4	0.6	0.8	0.5	0.8	1	2	2	3	3	4	4	1.1	1.6	1.8	1.1	1.6	1.9	7	2	6	2	0	2	0.22	0.09	132	20	0.37	0.30	65.00	39	unreliable	59	1	
D61.42	1	8	3	20	3	30	5	40	6	50	6	70	0.1	0.2	0.3	0.5	0.2	0.6	1.3	0.4	0.9	1.6	1	2	3	2	4	5	1.2	1.6	1.8	1.3	1.6	1.9	7	2	4	2	0	1	0.25	0.12	130	26	0.37	0.30	65.00	39	unreliable	65	1
D61.43	1	8	3	20	4	30	5	40	6	50	6	70	0.1	0.2	0.5	0.1	0.4	0.7	0.3	0.7	0.9	1	2	2	2	2	2	1.1	1.6	1.8	1.1	1.6	1.9	7	2	6	2	0	2	0.25	0.12	130	26	0.3	0.18	124.00	50	76	1		
D61.5	2	15	3	20	4	30	4	30	5	40	6	60	0.1	0.2	0.5	0.1	0.4	0.7	0.3	0.7	0.9	2	2	2	2	2	2	1.1	1.6	1.8	1.1	1.6	1.9	7	2	6	2	0	3	0.25	0.12	130	26	0.3	0.18	124.00	50	76	1		
D61.62	2	15	3	20	4	30	4	30	5	40	6	60	0.1	0.2	0.5	0.1	0.4	0.7	0.3	0.7	0.9	2	2	2	2	2	2	1.1	1.6	1.8	1.1	1.6	1.9	7	2	6	2	0	3	0.25	0.12	130	26	0.3	0.18	124.00	50	76	1		
D61.81	1	8	2	15	3	25	5	40	6	50	6	60	0.1	0.2	0.3	0.4	0.6	0.8	0.5	0.8	1	1	3	3	2	2	3	1.2	1.6	1.8	1.2	1.6	1.9	7	2	6	2	0	3	0.26	0.13	129	26	0.33	0.21	121.00	72	98	1		
D62.1	2	15	3	20	4	30	4	30	5	40	6	70	0.1	0.2	0.5	0.2	0.6	1.6	1.3	0.8	1.7	2	2	4	3	4	5	1.2	1.6	1.9	1.2	1.7	2	7	2	6	3	0	1	0.25	0.12	130	26	0.33	0.26	74.00	45	unreliable	71	2	
D62.12	2	15	3	20	4	30	4	40	5	50	6	70	0.1	0.2	0.4	0.3	0.5	0.8	0.4	0.7	0.9	2	2	3	3	4	4	1.2	1.6	1.9	1.2	1.7	2	7	2	6	2	0	2	0.25	0.12	130	26	0.33	0.26	74.00	37	unreliable	63	2	
D62.13	2	15	3	20	4	30	5	40	5	50	6	70	0.05	0.1	0.4	0.2	0.7	1.6	0.2	0.9	1.8	2	2	4	3	4	5	1.2	1.6	1.9	1.2	1.7	2	7	2	4	2	0	2	0.25	0.12	130	13	0.33	0.26	74.00	52	unreliable	65	2	
D62.2	2	15	3	20	4	30	5	40	6	50	6	70	0.1	0.3	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	2	4	3	4	5	1.3	1.6	1.9	1.3	1.7	2	7	2	6	3	0	2	0.25	0.12	130	39	0.33	0.30	31.00	22	unreliable	61	2	
D62.21	2	15	3	20	4	30	5	40	6	50	6	70	0.1	0.3	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	2	4	3	4	5	1.3	1.6	1.9	1.3	1.7	2	7	2	6	2	0	2	0.30	0.18	119	36	0.33	0.30	31.00	22	unreliable	57	2	
D62.22	1	8	3	20	4	30	5	40	6	50	6	70	0.1	0.3	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	2	3	4	5	1.3	1.6	1.9	1.3	1.7	2	7	2	6	2	0	2	0.26	0.12	153	39	0.33	0.26	74.00	53	unreliable	49	2		
D62.31	2	15	3	20	4	30	5	40	6	50	6	70	0.1	0.3	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	2	4	3	4	5	1.3	1.6	1.9	1.3	1.7	2	7	2	6	2	0	3	0.30	0.18	119	36	0.33	0.30	31.00	22	unreliable	57	1	
D62.32	2	15	2	20	4	30	5	40	6	50	6	70	0.1	0.3	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	2	3	3	4	5	1.3	1.6	1.9	1.3	1.7	2	7	2	5	2	0	2	0.22	0.09	132	40	0.33	0.30	31.00	22	unreliable	61	1	
D62.33	1	8	2	15	3	20	5	40	6	50	6	70	0.1	0.15	0.4	0.2	0.4	0.7	0.4	0.6	0.9	1	2	3	3	4	5	1.3	1.6	1.9	1.3	1.7	2	7	2	4	2	0	2	0.22	0.09	132	20	0.33	0.30	31.00	13	unreliable	32	1	
D62.4	1	8	2	15	3	30	5	40	6	50	6	70	0.1	0.3	0.4	0.1	0.5	1.2	0.3	0.7	1.4	1	2	3	3	4	5	1.3	1.6	1.9	1.4	1.8	2	7	2	4	2	0	1	0.22	0.09	132	40	0.33	0.30	0.00	0	unreliable	40	1	
D62.41	1	5	1	8	3	20	5	40	6	50	6	70	0.1	0.2	0.3	0.1	0.5	1.2	0.3	0.7	1.4	1	2	2	3	4	5	1.3	1.6	1.9	1.4	1.8	2	7	2	4	2	0	2	0.19	0.06	132									

Appendix One: Interpreted Soil Properties

pdf	Alex5	Aclay5	Alex10	Aclay10	Alex15	Aclay15	Bext5	Bclay5	Bext10	Bclay10	Bext15	Bclay15	Athick5	Athick10	Athick15	Bthick5	Bthick10	Bthick15	Solumen5	Solumen10	Solumen15	Astruct5	Astruct10	Astruct15	Bstruct5	Bstruct10	Bstruct15	ABDw5	ABDw10	ABDw15	ABDw5	ABDw10	ABDw15	AKs	AKerror	BKs	BKerror	Calcrete	Reliability	A 0.1bar	A 15bar	A AWHC	rA AWHC	Reliabil	B 0.1bar	B 15 bar	B AWHC	rB AWHC	Reliabil	PAWHC	Nutrients
Dd3.33	1	8	3	30	4	40	5	40	6	50	6	70	0.05	0.1	0.4	0.2	0.8	1.2	0.2	1	1.5	2	2	3	3	4	5	1	1.2	1.6	1.4	1.6	1.9	8	2	3	2	0	3	0.29	0.12	169	17	0.37	0.30	65.00	52	unreliable	69	1	
Dd3.42	1	8	3	30	4	40	5	40	6	50	6	70	0.05	0.1	0.4	0.2	0.8	1.2	0.2	1	1.5	1	2	2	3	4	5	1	1.2	1.6	1.4	1.6	1.9	8	2	3	2	0	3	0.29	0.12	169	17	0.37	0.30	65.00	52	unreliable	69	1	
Dd3.43	1	8	3	30	4	40	5	40	6	50	6	70	0.05	0.1	0.4	0.2	0.8	1.2	0.2	1	1.5	1	2	2	3	4	5	1	1.2	1.6	1.4	1.6	1.9	8	2	2	1	0	3	0.29	0.12	169	17	0.37	0.30	65.00	52	unreliable	69	1	
Dd3.51	1	8	3	30	4	40	5	40	6	50	6	70	0.05	0.1	0.3	0.2	0.6	1.2	0.2	0.7	1.3	1	2	4	3	4	5	1	1.2	1.6	1.4	1.6	1.9	8	2	5	3	0	3	0.29	0.12	169	17	0.37	0.30	65.00	39	unreliable	56	2	
Dd4.13	1	8	3	30	4	40	5	40	6	50	6	70	0.05	0.1	0.2	0.2	0.7	1.2	0.2	0.8	1.3	2	3	5	3	4	5	1	1.2	1.6	1.4	1.6	1.9	8	2	3	2	0	3	0.29	0.12	169	17	0.37	0.30	65.00	46	unreliable	62	2	
Dd4.21	1	8	3	30	4	40	5	40	6	50	6	70	0.05	0.1	0.2	0.2	0.7	1.2	0.2	0.8	1.3	1	2	4	3	4	5	1	1.2	1.6	1.4	1.6	1.9	8	2	3	2	0	3	0.29	0.12	169	17	0.37	0.30	65.00	46	unreliable	65	2	
Dd4.43	1	8	3	30	4	40	5	40	6	50	6	70	0.05	0.1	0.4	0.2	0.8	1.2	0.2	1	1.5	1	2	2	3	4	5	1	1.2	1.6	1.4	1.6	1.9	8	2	2	1	0	3	0.29	0.12	169	17	0.37	0.30	65.00	52	unreliable	69	1	
Dd4.63	1	8	3	30	4	40	5	35	6	40	6	50	0.05	0.1	0.4	0.2	0.8	1.2	0.2	1	1.5	1	2	2	2	3	4	5	1	1.4	1.8	1.4	1.6	1.9	8	2	4	3	0	3	0.27	0.12	147	15	0.33	0.21	121.00	96	111	1	1
Dg1.41	2	15	3	20	4	30	5	40	6	50	6	70	0.1	0.2	0.5	0.3	0.9	1.5	0.5	1.1	1.8	2	2	2	3	4	4	1.2	1.5	1.7	1.2	1.6	1.9	7	2	3	2	0	3	0.26	0.12	138	28	0.37	0.30	65.00	59	unreliable	86	1	
Dg1.43	2	15	3	20	4	30	5	40	6	50	6	70	0.1	0.2	0.5	0.3	0.9	1.5	0.5	1.1	1.8	2	2	2	3	4	4	1.2	1.5	1.7	1.2	1.6	1.9	7	2	2	1	0	3	0.26	0.12	138	28	0.37	0.30	65.00	59	unreliable	86	1	
Dg1.81	2	15	3	20	4	30	5	40	6	50	6	70	0.1	0.2	0.5	0.3	0.9	1.5	0.5	1.1	1.8	2	2	2	2	3	4	1.2	1.5	1.7	1.2	1.6	1.9	7	2	3	2	0	3	0.26	0.12	138	28	0.32	0.20	112.00	101	128	1	1	
Dg2.21	2	15	3	20	4	30	5	40	6	50	6	70	0.1	0.2	0.5	0.3	0.9	1.5	0.5	1.1	1.8	2	2	2	3	4	4	1.2	1.5	1.7	1.2	1.6	1.9	7	2	3	2	0	3	0.26	0.12	138	28	0.37	0.30	65.00	59	unreliable	86	1	
Dg2.31	2	15	3	20	4	30	5	40	6	50	6	70	0.1	0.2	0.5	0.3	0.9	1.5	0.5	1.1	1.8	2	2	2	3	4	4	1.2	1.5	1.7	1.2	1.6	1.9	7	2	3	2	0	3	0.26	0.12	138	28	0.37	0.30	65.00	59	unreliable	86	1	
Dg2.41	2	15	3	20	4	30	5	40	6	50	6	70	0.3	0.6	0.8	0.4	1	1.5	0.8	1.5	2	2	2	4	3	4	5	1.2	1.5	1.7	1.2	1.6	1.9	7	2	2	1	0	2	0.26	0.12	138	83	0.37	0.30	65.00	65	unreliable	148	1	
Dg2.42	2	15	3	20	4	30	5	40	6	50	6	70	0.3	0.6	0.8	0.4	1	1.5	0.8	1.5	2	2	2	3	4	4	1.2	1.5	1.7	1.2	1.6	1.9	7	2	2	1	0	3	0.26	0.12	138	83	0.37	0.30	65.00	65	unreliable	148	1		
Dg2.43	1	8	2	20	3	30	5	40	6	50	6	70	0.2	0.6	0.8	0.4	1	1.5	0.8	1.5	2	2	2	3	3	4	5	1.2	1.5	1.7	1.2	1.6	1.9	7	2	2	1	0	3	0.23	0.09	139	83	0.33	0.30	31.00	31	unreliable	115	1	
Dg2.63	1	8	2	20	3	30	5	40	6	50	6	70	0.1	0.4	0.6	0.5	1	1.5	0.9	1.5	2	2	2	2	2	3	4	1.2	1.5	1.7	1.2	1.6	1.9	7	2	3	2	0	3	0.23	0.09	139	56	0.33	0.20	112.00	112	167	1	1	
Dg2.81	1	8	2	20	3	30	5	40	6	50	6	70	0.1	0.4	0.6	0.5	1	1.5	0.9	1.5	2.1	2	2	2	2	2	2	2	1.2	1.5	1.7	1.2	1.6	1.9	7	2	3	2	0	2	0.23	0.09	139	56	0.33	0.21	121.00	121	176	1	1
Dg2.82	1	8	2	20	3	30	5	40	6	50	6	70	0.1	0.4	0.6	0.5	1	1.5	0.9	1.5	2.1	2	2	2	2	2	2	2	1.2	1.5	1.7	1.2	1.6	1.9	7	2	3	2	0	2	0.23	0.09	139	56	0.33	0.21	121.00	121	176	1	1
Dg2.83	1	8	2	20	3	30	5	40	6	50	6	70	0.1	0.4	0.6	0.5	1	1.5	0.9	1.5	2.1	2	2	2	2	2	2	2	1.2	1.5	1.7	1.3	1.7	1.9	7	2	3	2	0	3	0.23	0.09	139	56	0.32	0.20	112.00	112	167	1	1
Dg3.43	1	8	2	20	3	30	5	40	6	50	6	70	0.2	0.6	0.8	0.4	1	1.5	0.8	1.5	2	2	3	4	2	2	2	1	1.4	1.6	1.3	1.7	1.9	7	2	2	1	0	3	0.28	0.14	147	88	0.32	0.20	112.00	112	200	1	1	
Dg4.81	1	5	1	10	4	30	5	40	6	50	6	70	0.1	0.2	0.4	0.2	0.5	1	0.4	0.8	1.4	1	2	3	2	2	2	1.2	1.5	1.7	1.2	1.6	1.9	7	2	3	2	0	2	0.20	0.06	138	28	0.33	0.21	121.00	60	88	1	1	
Dg4.11	1	5	1	10	4	30	5	40	6	50	6	70	0.1	0.2	0.4	0.3	0.6	1	0.6	1.2	1.8	2	2	3	3	4	5	0.8	1.1	1.6	1.2	1.6	1.9	7	2	3	2	0	3	0.23	0.06	173	35	0.33	0.20	65.00	39	unreliable	74	1	
Dg4.13	1	5	1	10	4	30	5	40	6	50	6	70	0.1	0.2	0.4	0.3	0.6	1	0.6	1.2	1.8	2	2	3	3	4	5	0.8	1.1	1.6	1.2	1.6	1.9	7	2	2	1	0	3	0.23	0.06	173	35	0.33	0.30	31.00	19	unreliable	53	1	
Dg4.21	1	8	3	20	4	30	5	40	6	50	6	70	0.2	0.3	0.4	0.3	0.5	1	0.5	0.8	1.2	2	2	3	3	4	5	0.8	1.1	1.6	1.2	1.6	1.9	7	2	3	2	0	2	0.31	0.12	183	55	0.37	0.30	65.00	33	unreliable	88	1	
Dg4.31	1	5	1	8	3	20	5	40	6	50	6	70	0.2	0.3	0.4	0.3	0.5	1	0.5	0.8	1.2	2	2	3	3	4	4	0.8	1.1	1.6	1.2	1.6	1.9	7	2	3	2	0	3	0.23	0.06	173	52	0.37	0.30	65.00	33	unreliable	85	1	
Dg4.41	1	5	1	8	3	20	5	40	6	50	6	70	0.1	0.4	0.6	0.2	0.4	0.7	0.4	0.9	1.2	1	2	3	2	4	4	0.8	1.1	1.6	1.2	1.6	1.9	7	2	3	2	0	2	0.23	0.06	173	69	0.37	0.30	65.00	26	unreliable	95	1	
Dg4.42	1	5	1	8	3	20	5	40	6	50	6	70	0.1	0.4	0.6	0.2	0.7	1	0.5	0.8	1.2	1	2	3	4	4	5	0.8	1.1	1.6	1.2	1.6	1.9	7	2	3	2	0	3	0.23	0.06	173	69	0.37	0.30	65.00	26	unreliable	95	1	
Dg4.43	1	5	1	8	3	20	5	40	6	50	6	70	0.1	0.4	0.6	0.2	0.7	1	0.5	1	1.5	1	2	2	4	4	5	0.8	1.2	1.7	1.2	1.7	1.9	7	2	2	1	0	3	0.23	0.06	162	65	0.33	0.30	31.00	22	unreliable	87	1	
Dg4.8	1	5	1	8	3	20	5	35	6	40	6	50	0.1	0.4	0.6	0.2	0.7	1	0.5	1	1.5	1	2	2	2	3	4	0.8	1.2	1.6	1.2	1.6	1.9	7	2	2	1	0	3	0.22	0.06	162	65	0.33	0.21	121.00	84	149	1	1	
Dg4.81	1	5	1	8	3	20	5	35	6	40	6	50	0.1	0.4	0.6	0.2	0.7	1	0.5	1	1.5	1	2	2	2	3	4	0.8	1.2	1.6	1.2	1.6	1.9	7	2	2	1	0	3	0.22	0.06	162	65	0.33	0.21	121.00	84	149	1	1	
Dr	1	5	3	30	4	30	4	30	6	50	6	70	0.05	0.2	0.4	0.15	0.5	1.2	0.3	0.8	1.5	2	2	3	3	4	5	0.9	1.2	1.6	1.2	1.6	1.9	7	2	3	6	4	0	1</											

Appendix One: Interpreted Soil Properties

pdf	Axtest5	Axlay5	Axtest10	Axlay10	Axtest15	Axlay15	Bxtest5	Bxlay5	Bxtest10	Bxlay10	Bxtest15	Bxlay15	Axtest20	Axlay20	Bxtest20	Bxlay20	Axtest25	Axlay25	Bxtest25	Bxlay25	Axtest30	Axlay30	Bxtest30	Bxlay30	Axtest35	Axlay35	Bxtest35	Bxlay35	Axtest40	Axlay40	Bxtest40	Bxlay40	Axtest45	Axlay45	Bxtest45	Bxlay45	Axtest50	Axlay50	Bxtest50	Bxlay50	Axtest55	Axlay55	Bxtest55	Bxlay55	Axtest60	Axlay60	Bxtest60	Bxlay60	Axtest65	Axlay65	Bxtest65	Bxlay65	Axtest70	Axlay70	Bxtest70	Bxlay70	Axtest75	Axlay75	Bxtest75	Bxlay75	Axtest80	Axlay80	Bxtest80	Bxlay80	Axtest85	Axlay85	Bxtest85	Bxlay85	Axtest90	Axlay90	Bxtest90	Bxlay90	Axtest95	Axlay95	Bxtest95	Bxlay95	Axtest100	Axlay100	Bxtest100	Bxlay100	Axtest105	Axlay105	Bxtest105	Bxlay105	Axtest110	Axlay110	Bxtest110	Bxlay110	Axtest115	Axlay115	Bxtest115	Bxlay115	Axtest120	Axlay120	Bxtest120	Bxlay120	Axtest125	Axlay125	Bxtest125	Bxlay125	Axtest130	Axlay130	Bxtest130	Bxlay130	Axtest135	Axlay135	Bxtest135	Bxlay135	Axtest140	Axlay140	Bxtest140	Bxlay140	Axtest145	Axlay145	Bxtest145	Bxlay145	Axtest150	Axlay150	Bxtest150	Bxlay150	Axtest155	Axlay155	Bxtest155	Bxlay155	Axtest160	Axlay160	Bxtest160	Bxlay160	Axtest165	Axlay165	Bxtest165	Bxlay165	Axtest170	Axlay170	Bxtest170	Bxlay170	Axtest175	Axlay175	Bxtest175	Bxlay175	Axtest180	Axlay180	Bxtest180	Bxlay180	Axtest185	Axlay185	Bxtest185	Bxlay185	Axtest190	Axlay190	Bxtest190	Bxlay190	Axtest195	Axlay195	Bxtest195	Bxlay195	Axtest200	Axlay200	Bxtest200	Bxlay200	Axtest205	Axlay205	Bxtest205	Bxlay205	Axtest210	Axlay210	Bxtest210	Bxlay210	Axtest215	Axlay215	Bxtest215	Bxlay215	Axtest220	Axlay220	Bxtest220	Bxlay220	Axtest225	Axlay225	Bxtest225	Bxlay225	Axtest230	Axlay230	Bxtest230	Bxlay230	Axtest235	Axlay235	Bxtest235	Bxlay235	Axtest240	Axlay240	Bxtest240	Bxlay240	Axtest245	Axlay245	Bxtest245	Bxlay245	Axtest250	Axlay250	Bxtest250	Bxlay250	Axtest255	Axlay255	Bxtest255	Bxlay255	Axtest260	Axlay260	Bxtest260	Bxlay260	Axtest265	Axlay265	Bxtest265	Bxlay265	Axtest270	Axlay270	Bxtest270	Bxlay270	Axtest275	Axlay275	Bxtest275	Bxlay275	Axtest280	Axlay280	Bxtest280	Bxlay280	Axtest285	Axlay285	Bxtest285	Bxlay285	Axtest290	Axlay290	Bxtest290	Bxlay290	Axtest295	Axlay295	Bxtest295	Bxlay295	Axtest300	Axlay300	Bxtest300	Bxlay300	Axtest305	Axlay305	Bxtest305	Bxlay305	Axtest310	Axlay310	Bxtest310	Bxlay310	Axtest315	Axlay315	Bxtest315	Bxlay315	Axtest320	Axlay320	Bxtest320	Bxlay320	Axtest325	Axlay325	Bxtest325	Bxlay325	Axtest330	Axlay330	Bxtest330	Bxlay330	Axtest335	Axlay335	Bxtest335	Bxlay335	Axtest340	Axlay340	Bxtest340	Bxlay340	Axtest345	Axlay345	Bxtest345	Bxlay345	Axtest350	Axlay350	Bxtest350	Bxlay350	Axtest355	Axlay355	Bxtest355	Bxlay355	Axtest360	Axlay360	Bxtest360	Bxlay360	Axtest365	Axlay365	Bxtest365	Bxlay365	Axtest370	Axlay370	Bxtest370	Bxlay370	Axtest375	Axlay375	Bxtest375	Bxlay375	Axtest380	Axlay380	Bxtest380	Bxlay380	Axtest385	Axlay385	Bxtest385	Bxlay385	Axtest390	Axlay390	Bxtest390	Bxlay390	Axtest395	Axlay395	Bxtest395	Bxlay395	Axtest400	Axlay400	Bxtest400	Bxlay400	Axtest405	Axlay405	Bxtest405	Bxlay405	Axtest410	Axlay410	Bxtest410	Bxlay410	Axtest415	Axlay415	Bxtest415	Bxlay415	Axtest420	Axlay420	Bxtest420	Bxlay420	Axtest425	Axlay425	Bxtest425	Bxlay425	Axtest430	Axlay430	Bxtest430	Bxlay430	Axtest435	Axlay435	Bxtest435	Bxlay435	Axtest440	Axlay440	Bxtest440	Bxlay440	Axtest445	Axlay445	Bxtest445	Bxlay445	Axtest450	Axlay450	Bxtest450	Bxlay450	Axtest455	Axlay455	Bxtest455	Bxlay455	Axtest460	Axlay460	Bxtest460	Bxlay460	Axtest465	Axlay465	Bxtest465	Bxlay465	Axtest470	Axlay470	Bxtest470	Bxlay470	Axtest475	Axlay475	Bxtest475	Bxlay475	Axtest480	Axlay480	Bxtest480	Bxlay480	Axtest485	Axlay485	Bxtest485	Bxlay485	Axtest490	Axlay490	Bxtest490	Bxlay490	Axtest495	Axlay495	Bxtest495	Bxlay495	Axtest500	Axlay500	Bxtest500	Bxlay500	Axtest505	Axlay505	Bxtest505	Bxlay505	Axtest510	Axlay510	Bxtest510	Bxlay510	Axtest515	Axlay515	Bxtest515	Bxlay515	Axtest520	Axlay520	Bxtest520	Bxlay520	Axtest525	Axlay525	Bxtest525	Bxlay525	Axtest530	Axlay530	Bxtest530	Bxlay530	Axtest535	Axlay535	Bxtest535	Bxlay535	Axtest540	Axlay540	Bxtest540	Bxlay540	Axtest545	Axlay545	Bxtest545	Bxlay545	Axtest550	Axlay550	Bxtest550	Bxlay550	Axtest555	Axlay555	Bxtest555	Bxlay555	Axtest560	Axlay560	Bxtest560	Bxlay560	Axtest565	Axlay565	Bxtest565	Bxlay565	Axtest570	Axlay570	Bxtest570	Bxlay570	Axtest575	Axlay575	Bxtest575	Bxlay575	Axtest580	Axlay580	Bxtest580	Bxlay580	Axtest585	Axlay585	Bxtest585	Bxlay585	Axtest590	Axlay590	Bxtest590	Bxlay590	Axtest595	Axlay595	Bxtest595	Bxlay595	Axtest600	Axlay600	Bxtest600	Bxlay600	Axtest605	Axlay605	Bxtest605	Bxlay605	Axtest610	Axlay610	Bxtest610	Bxlay610	Axtest615	Axlay615	Bxtest615	Bxlay615	Axtest620	Axlay620	Bxtest620	Bxlay620	Axtest625	Axlay625	Bxtest625	Bxlay625	Axtest630	Axlay630	Bxtest630	Bxlay630	Axtest635	Axlay635	Bxtest635	Bxlay635	Axtest640	Axlay640	Bxtest640	Bxlay640	Axtest645	Axlay645	Bxtest645	Bxlay645	Axtest650	Axlay650	Bxtest650	Bxlay650	Axtest655	Axlay655	Bxtest655	Bxlay655	Axtest660	Axlay660	Bxtest660	Bxlay660	Axtest665	Axlay665	Bxtest665	Bxlay665	Axtest670	Axlay670	Bxtest670	Bxlay670	Axtest675	Axlay675	Bxtest675	Bxlay675	Axtest680	Axlay680	Bxtest680	Bxlay680	Axtest685	Axlay685	Bxtest685	Bxlay685	Axtest690	Axlay690	Bxtest690	Bxlay690	Axtest695	Axlay695	Bxtest695	Bxlay695	Axtest700	Axlay700	Bxtest700	Bxlay700	Axtest705	Axlay705	Bxtest705	Bxlay705	Axtest710	Axlay710	Bxtest710	Bxlay710	Axtest715	Axlay715	Bxtest715	Bxlay715	Axtest720	Axlay720	Bxtest720	Bxlay720	Axtest725	Axlay725	Bxtest725	Bxlay725	Axtest730	Axlay730	Bxtest730	Bxlay730	Axtest735	Axlay735	Bxtest735	Bxlay735	Axtest740	Axlay740	Bxtest740	Bxlay740	Axtest745	Axlay745	Bxtest745	Bxlay745	Axtest750	Axlay750	Bxtest750	Bxlay750	Axtest755	Axlay755	Bxtest755	Bxlay755	Axtest760	Axlay760	Bxtest760	Bxlay760	Axtest765	Axlay765	Bxtest765	Bxlay765	Axtest770	Axlay770	Bxtest770	Bxlay770	Axtest775	Axlay775	Bxtest775	Bxlay775	Axtest780	Axlay780	Bxtest780	Bxlay780	Axtest785	Axlay785	Bxtest785	Bxlay785	Axtest790	Axlay790	Bxtest790	Bxlay790	Axtest795	Axlay795	Bxtest795	Bxlay795	Axtest800	Axlay800	Bxtest800	Bxlay800	Axtest805	Axlay805	Bxtest805	Bxlay805	Axtest810	Axlay810	Bxtest810	Bxlay810	Axtest815	Axlay815	Bxtest815	Bxlay815	Axtest820	Axlay820	Bxtest820	Bxlay820	Axtest825	Axlay825	Bxtest825	Bxlay825	Axtest830	Axlay830	Bxtest830	Bxlay830	Axtest835	Axlay835	Bxtest835	Bxlay835	Axtest840	Axlay840	Bxtest840	Bxlay840	Axtest845	Axlay845	Bxtest845	Bxlay845	Axtest850	Axlay850	Bxtest850	Bxlay850	Axtest855	Axlay855	Bxtest855	Bxlay855	Axtest860	Axlay860	Bxtest860	Bxlay860	Axtest865	Axlay865	Bxtest865	Bxlay865	Axtest870	Axlay870	Bxtest870	Bxlay870	Axtest875	Axlay875	Bxtest875	Bxlay875	Axtest880	Axlay880	Bxtest880	Bxlay880	Axtest885	Axlay885	Bxtest885	Bxlay885	Axtest890	Axlay890	Bxtest890	Bxlay890	Axtest895	Axlay895	Bxtest895	Bxlay895	Axtest900	Axlay900	Bxtest900	Bxlay900	Axtest905	Axlay905	Bxtest905	Bxlay905	Axtest910	Axlay910	Bxtest910	Bxlay910	Axtest915	Axlay915	Bxtest915	Bxlay915	Axtest920	Axlay920	Bxtest920	Bxlay920	Axtest925	Axlay925	Bxtest925	Bxlay925	Axtest930	Axlay930	Bxtest930	Bxlay930	Axtest935	Axlay935	Bxtest935	Bxlay935	Axtest940	Axlay940	Bxtest940	Bxlay940	Axtest945	Axlay945	Bxtest945	Bxlay945	Axtest950	Axlay950	Bxtest950	Bxlay950	Axtest955	Axlay955	Bxtest955	Bxlay955	Axtest960	Axlay960	Bxtest960	Bxlay960	Axtest965	Axlay965	Bxtest965	Bxlay965	Axtest970	Axlay970	Bxtest970	Bxlay970	Axtest975	Axlay975	Bxtest975	Bxlay975	Axtest980	Axlay980	Bxtest980	Bxlay980	Axtest985	Axlay985	Bxtest985	Bxlay985	Axtest990	Axlay990	Bxtest990	Bxlay990	Axtest995	Axlay995	Bxtest995	Bxlay995	Axtest1000	Axlay1000	Bxtest1000	Bxlay1000
D3.42	1	5	2	15	3	20	5	45	6	55	6	70	0.15	0.3	0.5	0.4	0.6	1.6	0.5	0.9	1.8	2	2	3	3	4	5	1.3	1.5	1.7	1.4	1.8	2	7	2	4	2	0	2	0.23	0.09	139	42	0.3	0.30	0.00	0	unreliable	42	2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
D3.43	1	5	2	15	3	20	5	45	6	55	6	70	0.1	0.2	0.4	0.3	0.8	1.6	0.4	0.9	1.8	2	2	3	3	4	5	1.3	1.5	1.7	1.5	1.8	2	7	2	3	2	0	2	0.23	0.09	139	28	0.3	0.30	0.00	0	unreliable	28	1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
D3.51	1	8	2	15	3	20	4	30	5	40	6	50	0.05	0.2	0.5	0.1	0.9	1.7	0.5	1	2	2	2	2	2	2	3	1.2	1.5	1.7	1.4	1.7	1.9	8	2	6	3	0	3	0.23	0.09	139	28	0.29	0.18	116.00	104	0.28	0.18	116.00	104	132																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
D3.61	1	5	2	15	3	20	3	30	5	40	6	50	0.2	0.3	0.4	0.2	1	1.6	0.5	1	2	2	2	2	2	2	3	1.3	1.5	1.7	1.4	1.7	1.9	8	2	6	3	0	3	0.23	0.09	139	42	0.29	0.18	116.00	116	0.28	0.18	116.00	116	158																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
D3.62	1	5	2	15	3	20	3	30	5	40	6	50	0.2	0.3	0.4	0.2	1	1.6	0.5	1	2	2	2	2	2	2	3	1.3	1.5	1.7	1.4	1.7	1.9	8	2	6	3	0	3	0.23	0.09	139	42	0.29	0.18	116.00	116	0.28	0.18	116.00	116	158																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
D3.71	1	5	2	15	3	20	4	30	5	40	6	50	0.2	0.3	0.4	0.2	1	1.6	0.5	1	2	2	2	2	2	2	3	1.3	1.5	1.7	1.4	1.7	1.9	8	2	6	2	0	3	0.23	0.09	139	42	0.29	0.18	116.00	116	0.28	0.18	116.00	116	158																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
D3.72	1	5	2	15	3	20	4	30	5	40	6	50	0.2	0.3	0.4	0.2	1	1.6	0.5	1	2	2	2	2	2	2	3	1.3	1.5	1.7	1.4	1.7	1.9	8	2	6	2	0	3	0.23	0.09	139	42	0.29	0.18	116.00	116	0.28	0.18	116.00	116	158																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
D3.73	1	5	2	15	3	20	4	30	5	40	6	50	0.2	0.3	0.4	0.2	1	1.6	0.5	1	2	2	2	2	2	2	3	1.3	1.5	1.7	1.4	1.8	2	8	2	4	2	0	3	0.23	0.09	132	40	0.28	0.18	109.00	109	0.28	0.18	109.00	109	149																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
D3.81	1	5	2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

Appendix One: Interpreted Soil Properties

ppf	Atex5	Actay5	Atex10	Actay10	Atex15	Actay15	Btex5	Bctay5	Btex10	Bctay10	Btex15	Bctay15	Athick5	Athick10	Athick15	Bthick5	Bthick10	Bthick15	Struact5	Struact10	Struact15	Bstruact5	Bstruact10	Bstruact15	ABDwaterK	SaturatedK	SaturatedK	ABDwaterK	ABDwaterK	ABDwaterK	ABDwaterK	AKs	AKerror	BKs	BKerror	Calcrete	Reliability	A 0.1bar	A 15bar	A AWHC	rA AWHC	rA Reliab	B 0.1bar	B 15bar	B AWHC	rB AWHC	rB Reliab	PAWHC	Nutrients	
Dy333	1	5	2	20	4	30	5	40	6	50	6	60	0.1	0.2	0.4	0.3	0.7	1.2	0.4	0.9	1.4	2	3	3	4	5	1.3	1.5	1.8	1.3	1.8	2	7	2	5	2	0	1	0.23	0.09	139	28	0.3	0.30	0.00	0	unreliable	28	1	
Dy34	1	5	2	15	4	30	5	40	6	50	6	70	0.1	0.3	0.6	0.1	0.6	1.3	0.4	0.9	1.7	1	2	3	2	4	5	1.3	1.6	1.8	1.4	1.7	2	7	3	5	3	0	1	0.22	0.09	132	40	0.33	0.30	31.00	19	unreliable	58	1
Dy341	1	5	2	20	4	30	5	40	6	55	6	70	0.1	0.3	0.6	0.2	0.6	1	0.5	0.9	1.4	1	2	3	3	4	5	1.4	1.6	2	1.4	1.7	1.9	7	2	5	2	0	1	0.22	0.09	132	40	0.33	0.30	31.00	19	unreliable	58	1
Dy342	1	5	2	15	4	30	4	40	5	50	6	70	0.1	0.3	0.6	0.1	0.4	0.8	1.5	1	2	3	3	4	5	1.1	1.4	1.6	1.4	1.7	2	7	2	5	2	0	1	0.24	0.09	147	44	0.33	0.26	74.00	30	unreliable	74	1		
Dy343	1	5	2	15	4	30	5	40	6	50	6	70	0.1	0.3	0.6	0.1	0.6	1.5	0.4	1	1.8	1	2	3	3	4	5	1.3	1.6	1.8	1.5	1.7	2	6	2	3	2	0	1	0.22	0.09	132	40	0.33	0.30	31.00	19	unreliable	58	1
Dy353	2	10	3	20	4	30	5	40	6	50	6	60	0.1	0.2	0.5	0.5	1.3	1.5	1	1.4	2	2	2	2	3	3	1.2	1.6	1.7	1.4	1.7	1.9	8	2	6	3	0	3	0.26	0.12	138	28	0.33	0.26	74.00	47	unreliable	124	1	
Dy36	1	5	2	15	3	20	4	30	5	40	6	60	0.2	0.4	0.8	0.1	0.5	0.8	0.6	0.8	1.1	2	2	3	2	2	2	1.2	1.5	1.8	1.4	1.6	2	8	3	7	3	0	1	0.23	0.09	139	56	0.3	0.18	124.00	62	unreliable	116	1
Dy361	1	5	2	15	4	30	4	30	5	40	6	60	0.2	0.3	0.5	0.2	0.6	0.9	0.7	0.8	1.5	2	2	3	2	2	2	1.2	1.5	1.8	1.4	1.6	1.8	8	2	7	2	0	2	0.23	0.09	139	42	0.3	0.18	124.00	75	unreliable	116	1
Dy362	1	5	2	15	3	20	5	35	5	40	6	50	0.2	0.3	0.6	0.2	0.6	0.9	0.5	0.8	1.3	2	2	3	2	2	2	1.2	1.5	1.8	1.4	1.6	1.9	8	2	7	2	0	2	0.23	0.09	139	42	0.3	0.18	124.00	75	unreliable	116	1
Dy363	1	5	2	15	3	20	5	35	5	40	6	50	0.1	0.2	0.6	0.3	0.6	0.9	0.5	1	1.5	2	2	2	2	2	2	1.2	1.5	1.8	1.4	1.7	2	8	2	6	3	0	3	0.23	0.09	139	28	0.29	0.18	116.00	70	unreliable	97	1
Dy371	1	5	2	15	4	30	4	30	5	40	6	60	0.2	0.3	0.5	0.2	0.6	0.9	0.7	0.9	1.5	2	2	3	2	2	2	1.2	1.5	1.8	1.4	1.6	1.9	8	2	6	2	0	3	0.23	0.09	139	42	0.3	0.18	124.00	75	unreliable	116	1
Dy373	1	5	1	10	3	30	3	30	5	40	6	60	0.1	0.3	0.6	0.4	0.7	1.4	0.5	1	2	1	2	3	2	3	1.3	1.6	1.9	1.4	1.8	2	7	2	5	2	0	2	0.19	0.06	132	39	0.3	0.26	40.00	28	unreliable	67	1	
Dy38	1	5	1	8	3	20	3	30	5	40	6	60	0.2	0.5	1.2	0.1	0.5	1.5	0.5	1.1	2.2	2	2	3	2	2	4	1.2	1.6	1.8	1.1	1.8	2.1	8	3	6	3	0	1	0.19	0.06	132	66	0.28	0.18	109.00	54	unreliable	120	1
Dy381	1	5	1	8	3	20	3	20	5	40	6	60	0.2	0.4	1	0.1	0.6	1.2	0.6	1.1	2.2	2	2	3	2	2	3	1.2	1.6	1.8	1.1	1.7	1.9	8	2	6	3	0	1	0.19	0.06	132	53	0.28	0.18	116.00	70	unreliable	122	1
Dy382	1	5	1	8	3	20	3	20	5	40	6	60	0.2	0.5	1.4	0.1	0.4	0.8	0.4	0.9	1.8	2	2	2	2	2	3	1.2	1.5	1.7	1.3	1.8	2	7	2	5	2	0	1	0.20	0.06	138	69	0.28	0.18	109.00	44	unreliable	112	1
Dy383	1	5	2	15	3	20	5	35	5	40	6	60	0.2	0.3	0.6	0.2	0.4	0.8	0.4	0.8	1.5	2	2	3	2	2	3	1.2	1.6	1.8	1.4	1.9	2.1	7	2	4	2	0	2	0.22	0.09	132	40	0.26	0.17	89.00	35	unreliable	75	1
Dy384	1	5	2	15	3	20	5	35	5	40	6	70	0.2	0.3	0.6	0.2	0.4	0.8	0.4	0.8	2	2	2	2	2	2	3	1.3	1.6	1.8	1.4	1.9	2	7	2	4	2	0	3	0.22	0.09	132	40	0.26	0.17	89.00	35	unreliable	75	1
Dy385	1	5	2	15	3	20	5	35	5	40	6	70	0.2	0.3	0.6	0.2	0.4	0.8	0.4	0.8	2	2	2	2	2	2	3	1.3	1.5	1.7	1.3	1.8	2.1	7	2	4	2	0	3	0.23	0.09	139	42	0.28	0.18	109.00	44	unreliable	85	1
Dy41	1	5	2	15	4	30	5	40	6	50	6	70	0.1	0.3	1.4	0.2	0.4	0.9	0.4	1	2	2	2	5	3	4	5	0.8	1.3	1.6	1.3	1.5	1.8	9	3	7	3	0	1	0.25	0.09	156	47	0.4	0.30	94.00	38	unreliable	84	2
Dy411	1	8	3	20	4	30	5	40	6	50	6	70	0.1	0.2	0.8	0.2	0.3	0.5	0.4	0.6	1.3	2	2	4	3	4	5	0.8	1.3	1.6	1.3	1.5	1.7	9	2	8	2	0	2	0.28	0.12	157	31	0.4	0.30	94.00	28	unreliable	60	2
Dy412	1	8	3	20	4	30	5	40	6	50	6	70	0.1	0.2	0.5	0.4	0.6	0.8	0.5	0.8	1.3	3	4	5	4	5	0.8	1.3	1.6	1.3	1.5	1.7	9	2	7	2	0	3	0.33	0.18	150	30	0.4	0.30	94.00	56	unreliable	86	2	
Dy413	1	5	2	15	3	20	5	40	6	50	6	70	0.2	0.5	0.8	0.3	0.6	1	0.5	1.2	1.8	2	2	3	4	5	0.8	1.3	1.6	1.4	1.6	1.8	9	2	6	3	0	2	0.25	0.09	156	78	0.37	0.30	65.00	39	unreliable	117	2	
Dy421	2	10	3	20	4	30	4	40	5	50	6	70	0.2	0.3	0.5	0.2	0.5	0.7	0.5	0.7	1.1	2	3	5	2	3	5	0.8	1.3	1.6	1.3	1.5	1.7	9	2	7	2	0	2	0.33	0.18	150	45	0.37	0.26	106.00	53	unreliable	98	2
Dy422	2	10	3	20	4	30	4	40	5	50	6	70	0.2	0.3	0.5	0.2	0.5	0.7	0.5	0.7	1.1	2	3	5	2	3	5	0.8	1.3	1.6	1.3	1.5	1.7	9	2	7	2	0	3	0.33	0.18	150	45	0.37	0.26	106.00	53	unreliable	98	2
Dy423	1	8	2	15	3	20	5	40	6	50	6	70	0.2	0.3	0.6	0.2	0.5	0.8	0.5	0.7	1	1	1	2	4	5	1	1.3	1.7	1.3	1.6	1.8	9	2	6	2	0	3	0.25	0.09	156	47	0.33	0.30	65.00	33	unreliable	80	2	
Dy432	1	8	2	15	3	20	5	40	6	50	6	70	0.2	0.4	0.7	0.2	0.5	0.8	0.5	0.7	1	1	2	2	3	4	5	1	1.4	1.8	1.3	1.6	1.9	8	2	6	2	0	3	0.24	0.09	147	59	0.37	0.30	65.00	33	unreliable	91	2
Dy433	1	8	2	15	3	20	5	40	6	50	6	70	0.2	0.4	0.7	0.2	0.5	0.8	0.5	0.7	1	1	2	2	3	4	5	1	1.4	1.8	1.3	1.6	1.9	8	2	5	2	0	3	0.24	0.09	147	59	0.37	0.30	65.00	33	unreliable	91	2
Dy441	1	8	3	20	4	30	5	40	6	50	6	70	0.1	0.3	0.5	0.3	0.5	0.7	0.7	1.2	1	2	3	3	3	5	1	1.4	1.8	1.3	1.6	1.8	9	2	6	2	0	2	0.24	0.09	147	44	0.37	0.30	65.00	33	unreliable	77	2	
Dy442	1	8	2	2																																														

Appendix One: Interpreted Soil Properties

ppf	Atex5	Actay5	Atex10	Actay10	Atex15	Actay15	Bttx5	Bctay5	Bttx10	Bctay10	Bttx15	Bctay15	Attk5	Attk10	Attk15	Btk5	Btk10	Btk15	Sutmmk	Sutmmk10	Sutmmk15	Astruc5	Astruc10	Astruc15	Bstruc5	Bstruc10	Bstruc15	ABDwvsk5	ABDwvsk10	ABDwvsk15	BDwvsk5	BDwvsk10	BDwvsk15	AKs	AKerror	BKs	BKerror	Calcrete	Reliability	A 0.1bar	A 15bar	A AWHC	rA AWHC	A Reliab	B 0.1bar	B 15 bar	B AWHC	rB AWHC	B Reliab	PAWHC	Nutrients
Gc3.56	3	20	4	30	5	40	4	30	6	50	6	70	0.05	0.15	0.3	0.3	1.2	2	0.4	1.6	3	3	4	5	3	4	5	0.6	1	1.3	1	1.2	1.6	9	2	8	3	0	3	0.42	0.22	196	29	0.45	0.31	140.00	168	198	2		
Gc3.6	2	15	3	20	5	40	4	30	6	50	6	70	0.1	0.2	0.4	0.2	0.5	1.5	0.4	1	2	2	3	5	3	4	5	0.8	1.1	1.4	1.1	1.4	1.6	8	2	7	3	0	2	0.36	0.18	180	36	0.41	0.31	107.00	54	90	2		
Gc3.61	2	15	3	20	5	40	4	30	6	50	6	70	0.1	0.2	0.4	0.2	0.5	1.5	0.4	1	2	2	3	5	3	4	5	0.8	1.1	1.4	1.1	1.4	1.6	8	2	7	3	0	2	0.36	0.18	180	36	0.41	0.31	107.00	54	90	2		
Gc3.64	2	15	3	20	5	40	4	30	6	50	6	70	0.1	0.2	0.4	0.2	0.5	1.5	0.4	1	2	2	3	5	3	4	5	0.9	1.2	1.5	1.2	1.5	1.7	8	2	6	3	0	3	0.34	0.18	164	33	0.4	0.30	94.00	47	80	2		
Gc3.7	2	20	4	30	5	40	3	20	6	50	6	70	0.05	0.2	0.4	0.2	0.9	1.9	0.4	1.1	2.1	3	4	5	3	4	5	0.8	1.3	1.5	1	1.5	1.7	8	2	7	3	0	1	0.36	0.22	142	28	0.4	0.30	94.00	85	113	2		
Gc3.71	3	20	4	30	5	40	4	30	6	50	6	70	0.05	0.2	0.4	0.3	1	1.7	0.4	1.2	2	3	4	5	3	4	5	0.8	1.3	1.5	1	1.5	1.7	8	2	7	3	0	2	0.36	0.22	142	28	0.4	0.30	94.00	94	122	2		
Gc3.72	1	8	3	20	5	40	3	20	6	50	6	70	0.05	0.2	0.4	0.15	0.7	1.5	0.3	0.8	1.8	2	3	5	3	4	5	1	1.3	1.5	1	1.5	1.7	8	2	7	2	0	1	0.33	0.18	150	30	0.37	0.26	106.00	74	104	2		
Gc3.73	1	8	3	20	5	40	4	30	6	50	6	70	0.1	0.3	0.6	0.2	0.5	0.8	0.4	0.8	1.2	2	2	3	3	4	5	1	1.3	1.6	1.1	1.5	1.8	8	2	7	2	0	2	0.28	0.12	157	47	0.37	0.26	106.00	53	100	2		
Gc3.74	2	15	3	20	5	40	4	30	6	50	6	70	0.1	0.2	0.4	0.4	1.1	2.4	0.7	1.4	2.7	2	4	5	3	4	5	0.8	1.3	1.5	1	1.5	1.7	8	2	7	3	0	1	0.36	0.22	142	28	0.4	0.30	94.00	103	132	2		
Gc3.75	2	15	3	20	5	40	4	30	6	50	6	70	0.1	0.2	0.4	0.4	1.1	2.4	0.7	1.4	2.7	1	3	5	3	4	5	0.8	1.3	1.5	1	1.5	1.7	8	2	7	3	0	3	0.33	0.18	150	30	0.37	0.26	106.00	117	147	2		
Gc3.8	2	15	3	20	5	40	4	30	6	50	6	70	0.2	0.4	0.6	0.2	0.8	2	0.6	1.2	2.4	2	2	4	3	3	5	1	1.3	1.6	1.4	1.5	1.7	8	2	7	3	0	1	0.28	0.12	157	63	0.37	0.26	106.00	85	148	1		
Gc3.81	2	15	3	20	5	40	3	20	6	50	6	70	0.2	0.4	0.6	0.2	0.8	2	0.6	1.2	2.4	2	2	4	3	4	5	1	1.3	1.6	1.4	1.5	1.7	8	2	7	3	0	2	0.28	0.12	157	63	0.37	0.26	106.00	85	148	1		
Gc3.82	2	15	3	20	4	30	4	30	6	50	6	70	0.2	0.4	0.6	0.2	0.8	2	0.6	1.2	2.4	2	3	5	3	4	5	1	1.3	1.6	1.4	1.5	1.7	8	2	7	3	0	3	0.33	0.18	150	60	0.37	0.26	106.00	85	145	1		
Gc3.83	2	15	3	20	4	30	4	30	6	50	6	70	0.2	0.4	0.6	0.2	0.8	2	0.6	1.2	2.4	2	3	5	3	4	5	1	1.3	1.6	1.4	1.5	1.8	8	2	7	3	0	3	0.33	0.18	150	60	0.37	0.26	106.00	85	145	1		
Gc3.84	2	15	3	20	4	30	4	30	6	50	6	70	0.2	0.4	0.6	0.4	1.1	2.7	0.6	1.6	3.1	2	3	4	2	3	4	5	1	1.3	1.6	1.4	1.5	1.7	8	2	6	2	0	2	0.33	0.18	150	60	0.37	0.26	106.00	117	177	1	
Gc3.85	1	15	2	20	4	30	3	20	6	50	6	70	0.2	0.4	0.6	0.2	0.8	2	0.6	1.2	2.4	1	2	3	2	3	5	1	1.3	1.6	1.4	1.6	1.8	8	2	6	2	0	2	0.25	0.09	156	62	0.36	0.26	95.00	76	139	1		
Gc3.9	3	20	4	30	5	40	4	30	6	50	6	70	0.05	0.2	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	4	5	3	4	5	0.6	1.2	1.4	1	1.5	1.6	7	2	5	2	0	1	0.38	0.22	157	31	0.4	0.30	94.00	66	97	2		
Gc3.90	3	20	4	30	5	40	4	30	6	50	6	70	0.05	0.2	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	4	5	3	4	5	0.6	1.2	1.4	1	1.5	1.6	7	2	5	2	0	3	0.38	0.22	157	31	0.4	0.30	94.00	66	97	2		
Gc3.91	3	20	4	30	5	40	4	30	6	50	6	70	0.05	0.2	0.4	0.4	0.8	1.4	0.5	1	1.7	2	4	5	3	4	5	0.6	1.2	1.4	1	1.5	1.6	7	2	5	2	0	1	0.38	0.22	157	31	0.37	0.26	106.00	85	116	2		
Gc3.92	3	20	4	30	5	40	4	30	6	50	6	70	0.05	0.2	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	5	5	3	4	5	1	1.3	1.5	1.1	1.5	1.7	7	2	5	2	0	2	0.36	0.22	142	28	0.4	0.30	94.00	66	94	2		
Gc3.93	3	20	4	30	5	40	5	40	6	50	6	70	0.05	0.2	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	4	5	3	4	5	0.6	1.2	1.4	1	1.5	1.7	7	2	5	3	0	2	0.38	0.22	157	31	0.4	0.30	94.00	66	97	2		
Gc3.94	3	20	4	30	5	40	4	30	6	50	6	70	0.1	0.2	0.3	0.6	0.9	1.2	0.8	1.1	1.4	2	4	5	3	4	5	0.8	1.2	1.4	1	1.5	1.6	7	2	5	3	0	2	0.38	0.22	157	31	0.4	0.30	94.00	85	116	2		
Gc3.95	3	20	4	30	5	40	4	30	6	50	6	70	0.05	0.2	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	3	4	3	4	5	1	1.3	1.5	1.2	1.5	1.7	7	2	5	3	0	3	0.36	0.22	142	28	0.4	0.30	94.00	66	94	2		
Gc3.96	3	20	4	30	5	40	4	30	6	50	6	70	0.05	0.2	0.4	0.2	0.7	1.3	0.4	0.9	1.6	2	3	4	3	4	5	1	1.3	1.6	1.2	1.5	1.8	7	2	5	3	0	3	0.36	0.22	142	28	0.4	0.30	94.00	66	94	2		
Gc4.1	3	40	4	50	5	60	4	40	5	60	6	70	0.05	0.2	0.4	0.2	0.9	2.2	0.2	1.1	2.6	2	4	5	3	4	5	0.5	0.9	1.5	0.7	1.2	1.7	9	2	8	2	0	1	0.45	0.23	222	44	0.41	0.26	149.00	134	179	2		
Gc4.11	3	40	4	50	5	60	4	40	5	60	6	70	0.1	0.15	0.3	0.3	1	2.2	0.2	1.1	2.5	3	4	5	3	4	5	0.5	0.9	1.3	0.7	1.2	1.4	9	2	8	2	0	1	0.45	0.23	222	33	0.41	0.26	149.00	149	182	2		
Gc4.12	3	40	4	50	5	60	4	40	5	60	6	70	0.05	0.15	0.3	0.15	0.6	1.2	0.2	0.7	1.4	2	3	4	3	4	5	0.5	0.8	1.1	1.5	1	1.3	1.7	8	2	8	2	0	2	0.40	0.22	175	26	0.4	0.26	132.00	79	106	2	
Gc4.13	3	20	4	30	5	40	4	30	6	50	6	70	0.05	0.2	0.4	0.3	1	2.2	0.2	0.3	1.1	0.2	0.4	1.5	2	3	5	2	4	5	1	1.4	1.6	1.1	1.5	1.7	8	2	7	2	0	3	0.35	0.20	139	26	0.37				

Appendix One: Interpreted Soil Properties

ppf	Axtest5	Axlay5	Axtest10	Axlay10	Axtest15	Axlay15	Bxtest5	Bxlay5	Bxtest10	Bxlay10	Bxtest15	Bxlay15	Athick5	Athick10	Athick15	Bthick5	Bthick10	Bthick15	Solumenick	Solumenick	Solumenick	Astruct5	Astruct10	Astruct15	Bstruct5	Bstruct10	Bstruct15	ABDsway10	ABDsway10	ABDsway10	ABDsway10	ABDsway10	AKS	AKerror	BKS	BKerror	Calcrete	Reliability A 0.1bar	A 15bar	A AWHC	rA AWHC	rA Reliabill	B 0.1bar	B 15 bar	B AWHC	rB AWHC	rB Reliabill	PAWHC	Nutrients									
K-Uc5.21	1	0	1	5	3	20	1	0	1	5	3	20	0.1	0.3	0.6	0.2	0.8	2.1	0.3	1.1	1.7	2	2	2	2	2	3	0.9	1.1	1.4	1.5	1.2	1.5	1.7	9	2	9	2	0	3	0.21	0.06	153	46	0.2	0.06	138.00	110	0.29	0.12	169.00	118	156	1				
K-Um	3	20	3	30	4	40	3	20	3	30	4	40	0.05	0.2	0.5	0.1	0.7	1.9	0.1	0.7	1.9	2	3	5	2	2	3	0.6	1.1	1.4	0.9	1.2	1.5	7	3	7	3	0	3	0.38	0.18	200	40	0.29	0.12	169.00	118	158	1									
K-Um1.4	3	20	4	30	4	40							0.1	0.3	0.5				0.1	0.3	0.5	2	3	4			1.2	1.3	1.6			7	3	0	3	0.31	0.15	157	47																			
K-Um1.42	3	20	4	30	4	40							0.1	0.3	0.5				0.1	0.3	0.5	2	2	4			1.2	1.3	1.6			7	3	0	3	0.31	0.15	157	47																			
K-Um1.43	3	20	4	30	4	40							0.1	0.3	0.5				0.1	0.3	0.5	2	2	4			1.2	1.3	1.6			7	3	0	3	0.31	0.15	157	47																			
K-Um4.2	3	20	3	30	4	40	3	20	3	30	4	40	0.1	0.4	1.1	0.15	0.5	1	0.5	1	1.7	2	4	2	2	2	3	0.9	1.1	1.4	1	1.2	1.5	8	2	7	2	0	3	0.31	0.12	163	73	0.39	0.12	169.00	84	0.32	0.15	170.00	51	91	1					
K-Um5.51	2	20	3	30	4	40	3	20	4	30	5	40	0.1	0.2	0.5	0.2	0.3	0.5	0.1	0.4	0.6	2	2	3	2	2	2	3	0.8	1.1	1.4	1	1.2	1.6	7	3	8	2	0	3	0.33	0.12	200	40	0.32	0.15	170.00	51	91	1								
K-Um6.24	3	20	4	30	5	40	3	20	4	30	5	40	0.1	0.3	0.5	0.2	0.3	0.4	0.1	0.4	0.8	3	5	5	3	4	5	0.7	1.1	1.3	0.9	1.2	1.4	8	2	8	2	0	3	0.40	0.22	175	52	0.38	0.22	157.00	47	100	1									
NS																																																										
O	1	0	3	30	7	50	1	0	3	30	7	50	0.1	0.5	1	0	0	0	0.1	0.5	1	2	3	4			0.4	0.8	1.1			9	2	0	2	0.44	0.19	253	127																			
Uc1.1	1	0	1	5	2	10							0.1	0.4	0.8				0.1	0.4	0.8	1	1	2			1.2	1.4	1.6			9	2	0	2	0.20	0.06	145	58																			
Uc1.11	1	0	1	5	1	8							0.1	0.5	0.8				0.1	0.4	0.8	1	1	2			1.2	1.4	1.6			9	2	0	2	0.20	0.06	145	72																			
Uc1.12	1	0	1	5	2	10							0.1	0.5	0.8				0.1	0.5	0.8	1	1	3			1.2	1.4	1.6			9	2	0	3	0.20	0.06	145	72																			
Uc1.13	1	0	1	5	2	10							0.1	0.5	0.8				0.1	0.5	0.8	1	1	3			1.2	1.4	1.6			9	2	0	3	0.20	0.06	145	72																			
Uc1.14	1	0	1	5	2	10							0.1	0.5	0.8				0.1	0.5	0.8	1	1	3			1.2	1.4	1.6			9	2	0	3	0.20	0.06	145	72																			
Uc1.2	1	0	1	5	2	10							0.05	0.3	0.8				0.05	0.3	0.8	1	2	3			1.2	1.4	1.6			9	2	0	3	0.20	0.06	145	43																			
Uc1.21	1	0	1	5	2	10							0.2	0.4	0.7				0.2	0.4	0.7	1	2	2			1.2	1.4	1.6			9	2	0	2	0.20	0.06	145	58																			
Uc1.22	1	0	1	5	2	10							0.05	0.2	0.4				0.05	0.2	0.4	1	1	2			1.2	1.4	1.6			9	2	0	2	0.20	0.06	145	29																			
Uc1.23	1	0	1	5	2	10							0.05	0.2	0.4				0.05	0.2	0.4	1	2	3			1.2	1.4	1.6			9	2	0	2	0.20	0.06	145	29																			
Uc1.3	1	5	2	15	3	20							0.05	0.4	0.8				0.05	0.4	0.8	2	2	3			1.3	1.5	1.7			9	2	1	3	0.23	0.09	139	56																			
Uc1.31	1	0	1	5	2	10							0.3	0.5	0.8				0.3	0.5	0.8	1	2	2			1.3	1.5	1.7			9	2	1	3	0.20	0.06	138	69																			
Uc1.4	1	5	2	15	3	20							0.05	0.4	0.8				0.05	0.4	0.8	2	2	3			1.3	1.5	1.7			9	2	0	3	0.23	0.09	139	56																			
Uc1.41	1	0	1	5	2	10							0.3	0.5	0.8				0.3	0.5	0.8	1	2	2			1.3	1.5	1.7			9	2	0	3	0.20	0.06	138	69																			
Uc1.42	1	0	1	5	2	10							0.05	0.15	0.5				0.05	0.15	0.5	1	2	2			1.3	1.5	1.7			9	2	0	3	0.20	0.06	138	21																			
Uc1.43	1	0	1	5	2	10							0.05	0.15	0.5				0.05	0.15	0.5	1	2	3			1.3	1.5	1.7			9	2	0	3	0.20	0.06	138	21																			
Uc2.1	1	0	1	5	2	10	1	0	1	5	2	10	0.2	0.5	0.8	0.1	0.4	0.8	0.2	0.6	1	1	2	2	1	2	2	2	1.2	1.4	1.6	1.3	1.5	1.6	9	2	9	2	1	3	0.20	0.06	145	72	0.2	0.06	138.00	55	127	1								
Uc2.11	1	0	1	5	2	10	1	0	1	5	2	10	0.2	0.5	0.8	0.1	0.4	0.8	0.2	0.6	1	1	2	2	1	2	2	2	1.2	1.4	1.6	1.3	1.5	1.6	9	2	9	2	1	3	0.20	0.06	145	72	0.2	0.06	138.00	55	127	1								
Uc2.12	1	0	1	5	2	10	1	0	1	5	2	10	0.1	0.5	0.8	0.1	0.4	0.7	0.2	0.6	0.9	1	2	2	1	2	2	2	1.1	1.3	1.6	1.3	1.4	1.6	9	2	9	2	0	1	0.20	0.06	145	72	0.2	0.06	138.00	55	127	1								
Uc2.2	1	0	1	5	3	15	1	0	1	5	3	15	0.2	0.7	1.3	0.1	0.5	1.4	0.4	1.1	1.8	1	2	3	1	2	3	1.1	1.3	1.6	1.3	1.5	1.8	9	2	9	2	0	1	0.21	0.06	153	107	0.2	0.06	138.00	69	176	1									
Uc2.21	1	0	1	5	3	15	1	0	1	5	3	15	0.2	0.7	1.3	0.1	0.5	1.4	0.4	1.1	1.8	1	2	3	1	2	3	1.1	1.3	1.6	1.3	1.5	1.8	9	2	9	2	0	2	0.21	0.06	153	107	0.2	0.06	138.00	69	176	1									
Uc2.211	1	0	1	5	3	15	1	0	1	5	3	15	0.2	0.6	1.1	0.1	0.5	1.1	0.4	0.9	1.8	1	2	3	1	2	3	1.1	1.3	1.6	1.3	1.5	1.8	9	2	9	2	0	1	0.21	0.06	153	92	0.2	0.06	138.00	69	160	1									

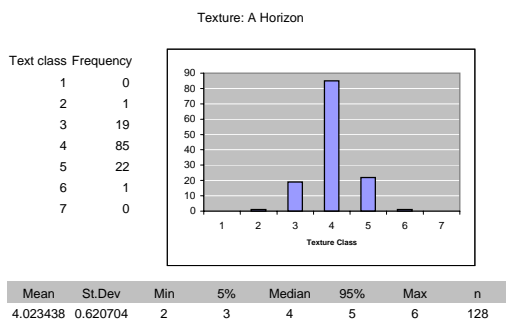
Appendix One: Interpreted Soil Properties

ppf	Alex5	Aclay5	Alex50	Aclay50	Alex95	Aclay95	Bext5	Bclay5	Bext50	Bclay50	Bext95	Bclay95	Athick5	Athick50	Athick95	Bthick5	Bthick50	Bthick95	Solumatic	Solumatic	Solumatic	Astruct5	Astruct50	Astruct95	Bstruct5	Bstruct50	Bstruct95	ABDsway5	ABDsway50	ABDsway95	BBDsway5	BBDsway50	BBDsway95	AKs	AKerror	BKs	BKerror	Calcrete	Reliability	A 0.1bar	A 15bar	A AWHC	AWHC	A Reliab	B 0.1bar	B 15bar	B AWHC	AWHC	B Reliab	PAWHC	Nutrients
US12	4	50	5	60	6	70	5	50	5	60	6	70	0.1	0.2	0.4	0.5	1.5	2.5	0.8	2	3	4	5	5	4	5	5	0.5	1	1.5	0.9	1.2	1.6	8	2	8	2	0	3	0.46	0.27	192	38	0.41	0.26	149.00	224	262			
US21	4	50	5	60	6	80	5	50	5	60	6	80	0.1	0.2	0.4	0.5	1.5	2.5	0.8	2	3	4	5	5	4	4	5	0.5	1	1.4	0.9	1.2	1.5	9	2	9	2	0	3	0.46	0.27	192	38	0.41	0.26	149.00	224	262	2		
US22	4	50	5	60	6	80	5	50	5	60	6	80	0.1	0.2	0.3	0.3	0.6	1	0.3	0.7	1	3	4	5	3	4	5	0.5	1	1.4	0.9	1.2	1.5	9	2	9	2	0	3	0.46	0.27	192	38	0.41	0.26	149.00	89	128	3		
US23	4	50	5	60	6	80	5	50	5	60	6	80	0.1	0.2	0.3	0.3	0.6	1	0.3	0.7	1	3	4	5	3	4	5	0.5	1	1.4	0.9	1.2	1.5	9	2	9	2	0	3	0.46	0.27	192	38	0.41	0.26	149.00	89	128	3		
US31	5	40	5	50	5	60	4	40	5	50	5	60	0.05	0.15	0.3	0.5	0.8	1	0.6	0.8	1.3	2	5	5	3	4	5	0.6	1	1.3	0.9	1.2	1.4	9	2	8	2	0	3	0.46	0.27	192	29	0.41	0.26	149.00	119	148	3		
UR6	4	40	5	50	6	70	4	40	5	50	6	70	0.05	0.15	0.3	0.2	0.8	1.9	0.7	0.9	2	2	4	5	2	4	5	0.6	0.9	1.5	0.8	1.2	1.5	6	4	6	4	0	1	0.49	0.27	220	33	0.45	0.31	140.00	112	145			
UR11	4	40	5	45	6	60	4	40	5	60	6	60	0.1	0.2	0.3	0.15	0.7	2.5	0.3	0.9	2.5	4	5	5	2	3	5	0.7	1	1.2	1	1.1	1.3	7	2	7	2	0	2	0.46	0.27	192	38	0.43	0.27	168.00	118	156	2		
UR12	4	30	5	40	6	60	4	35	5	45	6	60	0.05	0.15	0.25	0.25	1	2.4	0.2	1	2.5	3	4	5	2	4	5	0.7	0.8	1.1	0.8	1.1	1.5	7	2	7	2	0	2	0.53	0.27	255	38	0.43	0.27	168.00	168	207	2		
UR13	4	30	5	40	6	60	4	35	5	45	6	60	0.05	0.15	0.25	0.25	1	2.4	0.2	1	2.5	3	4	5	2	4	5	0.7	0.8	1.1	0.8	1.1	1.5	7	2	7	2	0	2	0.53	0.27	255	38	0.43	0.27	168.00	168	207	2		
UR2	4	40	5	50	6	70	4	45	5	55	6	70	0.05	0.15	0.4	0.3	1	1.4	0.4	1	1.5	2	4	5	2	4	5	0.6	0.9	1.2	0.7	1.1	1.3	6	2	6	2	0	1	0.49	0.27	220	33	0.43	0.27	168.00	168	201	2		
UR21	4	40	5	45	5	55	4	40	5	50	6	60	0.05	0.15	0.25	0.3	0.7	1.4	0.5	0.9	1.5	2	4	5	2	4	5	0.6	0.9	1.2	0.7	1.1	1.3	6	2	6	2	0	2	0.49	0.27	220	33	0.43	0.27	168.00	118	151	2		
UR22	5	40	6	50	6	70	5	40	6	50	6	70	0.1	0.2	0.4	0.6	1.1	1.3	0.5	1	1.5	3	4	5	3	4	5	0.8	1.1	1.3	0.9	1.2	1.4	5	2	5	2	0	2	0.47	0.31	161	32	0.45	0.31	140.00	154	187	2		
UR23	5	40	6	50	6	70	5	40	6	50	6	70	0.1	0.2	0.4	0.6	1.1	1.3	0.5	1	1.5	3	4	5	2	3	4	0.9	1.2	1.3	1	1.3	1.5	2	2	5	2	0	3	0.45	0.31	140	28	0.43	0.31	123.00	135	163	2		
UR3	4	40	5	50	6	60	4	40	6	60	6	70	0.05	0.1	0.3	0.2	0.8	1.8	0.2	0.9	2	2	4	5	3	4	5	0.7	0.9	1.3	0.9	1.1	1.4	7	2	5	2	0	1	0.49	0.27	220	22	0.47	0.31	161.00	129	151	2		
UR31	4	40	5	50	6	60	4	45	5	55	6	70	0.05	0.15	0.3	0.2	0.8	2.6	0.3	0.9	2.6	4	5	3	4	5	0.7	0.9	1.3	0.9	1.1	1.4	7	2	5	2	0	1	0.49	0.27	220	33	0.43	0.27	168.00	135	168	2			
UR32	4	35	5	40	6	60	4	40	5	50	6	60	0.05	0.1	0.15	0.15	1	1.4	0.2	1	1.5	3	4	5	3	4	5	0.7	0.9	1.3	0.9	1.1	1.4	7	2	5	2	0	2	0.49	0.27	220	22	0.43	0.27	168.00	168	190	2		
UR33	4	40	5	50	6	60	4	45	5	55	6	70	0.05	0.15	0.3	0.3	0.7	1.2	0.2	0.7	1.2	2	4	5	3	4	5	0.9	1.2	1.4	1	1.3	1.5	6	2	4	2	0	2	0.41	0.26	149	22	0.4	0.26	132.00	93	115	2		
UR34	5	40	5	50	6	60	5	45	6	55	6	70	0.05	0.15	0.3	0.2	0.6	1.7	0.3	0.8	1.7	4	5	5	3	4	5	0.9	1.2	1.4	1	1.3	1.5	6	2	4	2	0	2	0.41	0.26	149	22	0.43	0.31	123.00	74	96	2		
UR4	5	40	5	50	6	60	5	45	6	55	6	70	0.1	0.2	0.3	0.4	1	1.7	0.5	1.2	1.9	3	4	5	3	4	5	1.1	1.3	1.5	1.2	1.5	1.6	4	2	3	2	0	2	0.40	0.26	132	26	0.4	0.30	94.00	94	120	2		
UR41	5	40	5	50	6	60	5	45	6	55	6	70	0.1	0.2	0.3	0.5	1.1	1.7	0.6	1.2	2	3	4	5	3	4	5	1.1	1.3	1.5	1.2	1.5	1.6	4	2	3	2	0	1	0.40	0.26	132	26	0.4	0.30	94.00	103	130	2		
UR42	5	40	5	50	6	60	5	45	6	55	6	70	0.1	0.2	0.3	0.4	1	1.7	0.5	1.2	1.9	3	4	5	3	4	5	1.1	1.3	1.5	1.2	1.5	1.6	4	2	3	2	0	3	0.40	0.26	132	26	0.4	0.30	94.00	94	120	2		
UR5	4	40	5	50	6	60	4	50	6	60	6	70	0.05	0.1	0.3	0.5	1	1.5	0.6	1	1.8	2	3	2	2	2	4	1.2	1.4	1.6	1.3	1.5	1.7	4	2	3	2	0	3	0.38	0.26	118	12	0.34	0.21	130.00	130	142	1		
UR51	4	40	5	50	6	60	4	50	6	60	6	70	0.05	0.1	0.3	0.5	1	1.5	0.6	1	1.8	2	3	2	2	2	4	1.2	1.4	1.6	1.3	1.5	1.7	4	2	3	2	0	3	0.38	0.26	118	12	0.34	0.21	130.00	130	142	1		
UR6	5	40	5	50	6	60	5	40	6	60	6	70	0.05	0.1	0.3	0.5	1	1.5	0.6	1	1.8	2	2	2	2	2	4	1.2	1.4	1.6	1.3	1.5	1.7	3	2	2	2	0	2	0.32	0.18	144	14	0.4	0.30	94.00	94	108	1		
UR61	5	40	5	50	6	60	5	40	6	60	6	70	0.05	0.1	0.3	0.5	1	1.5	0.6	1	1.8	2	2	2	2	2	4	1.2	1.4	1.6	1.3	1.5	1.7	3	2	2	2	0	3	0.32	0.18	144	14	0.4	0.30	94.00	94	108	1		
UR62	5	40	5	50	6	60	5	40	6	60	6	70	0.05	0.1	0.3	0.5	1	1.5	0.6	1	1.8	2	2	2	2	2	4	1.2	1.4	1.6	1.3	1.5	1.7	3	2	2	2	0	3	0.32	0.18	144	14	0.4	0.30	94.00	94	108	1		
UR71	4	40	5	50	6	60	4	40	5	50	6	60	0.05	0.3	0.4	0.3	0.4	0.5	0.1	0.6	0.9	2	2	2	2	2	4	0.9	1	1.2	1	1.2	1.4	7	2	5	3	0	3	0.39	0.18	207	62	0.35	0.18	170.00	48	130	1		
UG52	6	45	6	55	6	65	6	45	6	55	6	65	0.05	0.1	0.2	0.1	1.2	1.5	0.7	1.4	1.8	3	4	4	2	4	5	1.1	1.4	1.6	1.2	1.5	1.7	4	2	1	1	0	3	0.40	0.26	132	11	0.4	0.30	94.00	113	124	1		
UG5	5	45	6																																																

APPENDIX TWO: Example of Summary Data from the CSIRO National Soil Database

PPF: Gn3.11

Natsoil Database: 26/02/01



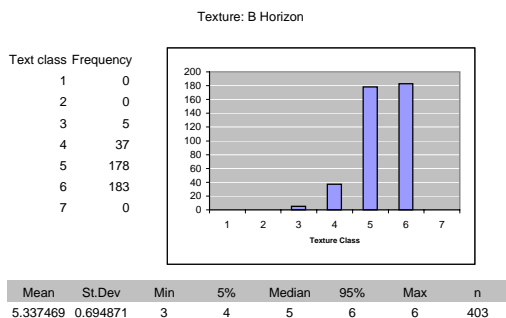
Texture: A Horizon Notes:

Lower: 3/40%

Estimate: 4/60%

Upper: 5/80%

Commonly subplastic; hence the high clay estimate



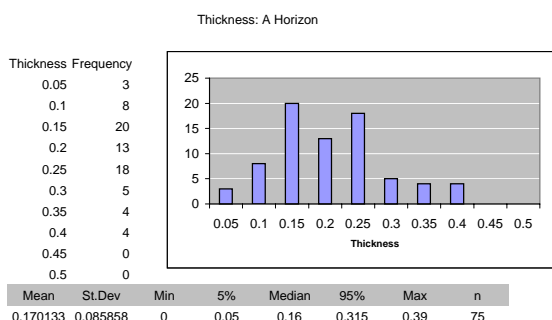
Texture: B Horizon Notes:

Lower: 4/50%

Estimate: 5/70%

Upper: 6/80%

Commonly subplastic; hence the high clay estimate



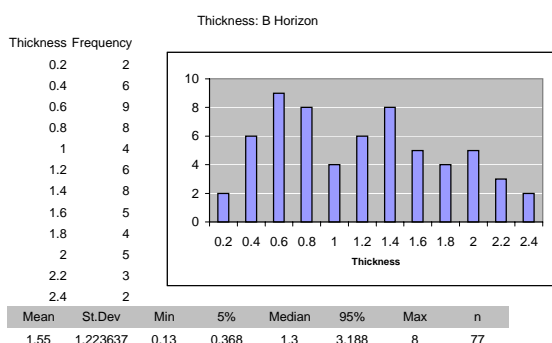
Thickness: A Horizon Notes:

Lower: 0.05

Estimate: 0.2

Upper: 0.3

—



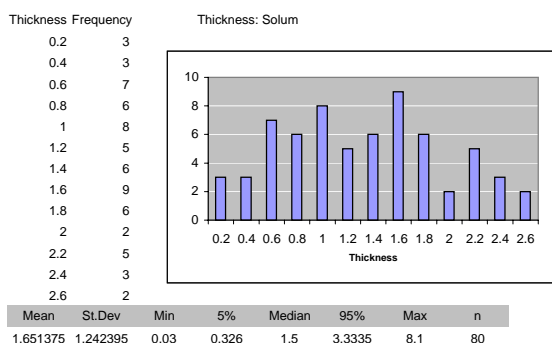
Thickness: B Horizon Notes:

Lower: 0.4

Estimate: 1.5

Upper: 3.2

Evidence for tri-modal distribution. Minima at 1.0m and 1.8m correspond with auger extension lengths.



Thickness: Solum Notes:

Lower: 0.3

Estimate: 1.7

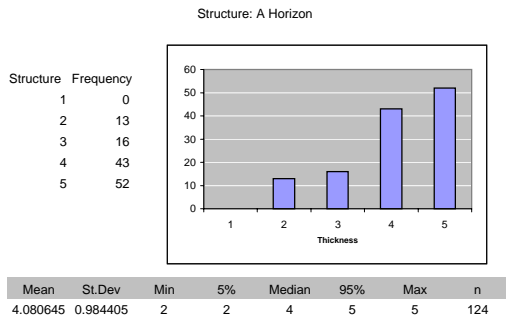
Upper: 3.3

Again, a tri-modal distribution. Data appear censored. These soils are often in excess of 5-10m.

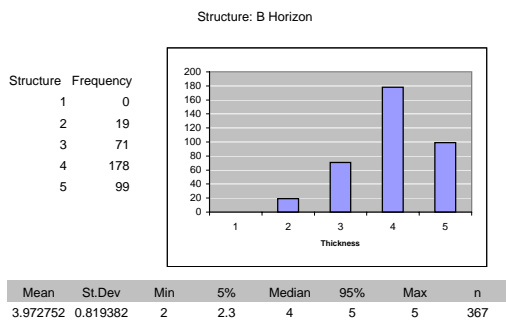
APPENDIX TWO: Example of Summary Data from the CSIRO National Soil Database

PPF: Gn3.11

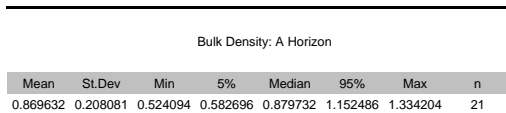
Natsoil Database: 26/02/01



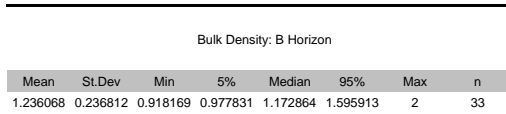
Structure: A Horizon		Notes:
Lower:	3	Class 2 ratings (massive) are unusual
Estimate:	4	
Upper:	5	



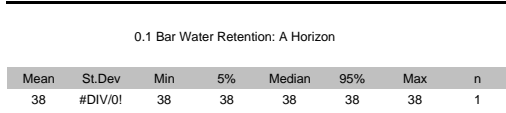
Structure: B Horizon		Notes:
Lower:	3	see above
Estimate:	4	
Upper:	5	



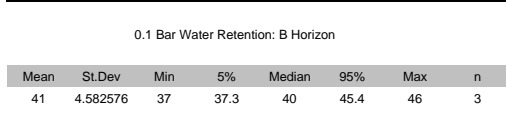
BD: A Horizon		Notes:
Lower:	0.6	
Estimate:	0.9	
Upper:	1.2	



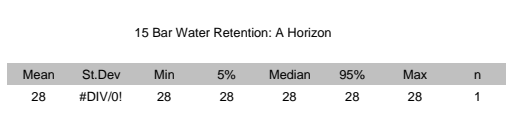
BD: B Horizon		Notes:
Lower:	1.0	
Estimate:	1.2	
Upper:	1.6	



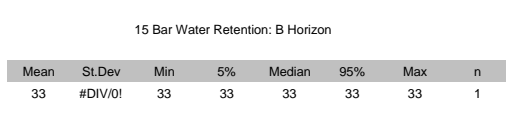
0.1 Bar: A Horizon		Notes:
Lower:		Not estimated directly (n=1)
Estimate:		
Upper:		



0.1 Bar: B Horizon		Notes:
Lower:		Not estimated directly (n=3)
Estimate:		
Upper:		



15 Bar: A Horizon		Notes:
Lower:		Not estimated directly (n=1)
Estimate:		
Upper:		



15 Bar: B Horizon		Notes:
Lower:		Not estimated directly (n=1)
Estimate:		
Upper:		

Ks: A Horizon

Class:

9 ± 2

Highly permeable, strongly pedal and stable

Range:

Ks: B Horizon

Class:

8 ± 2

As above

Range: