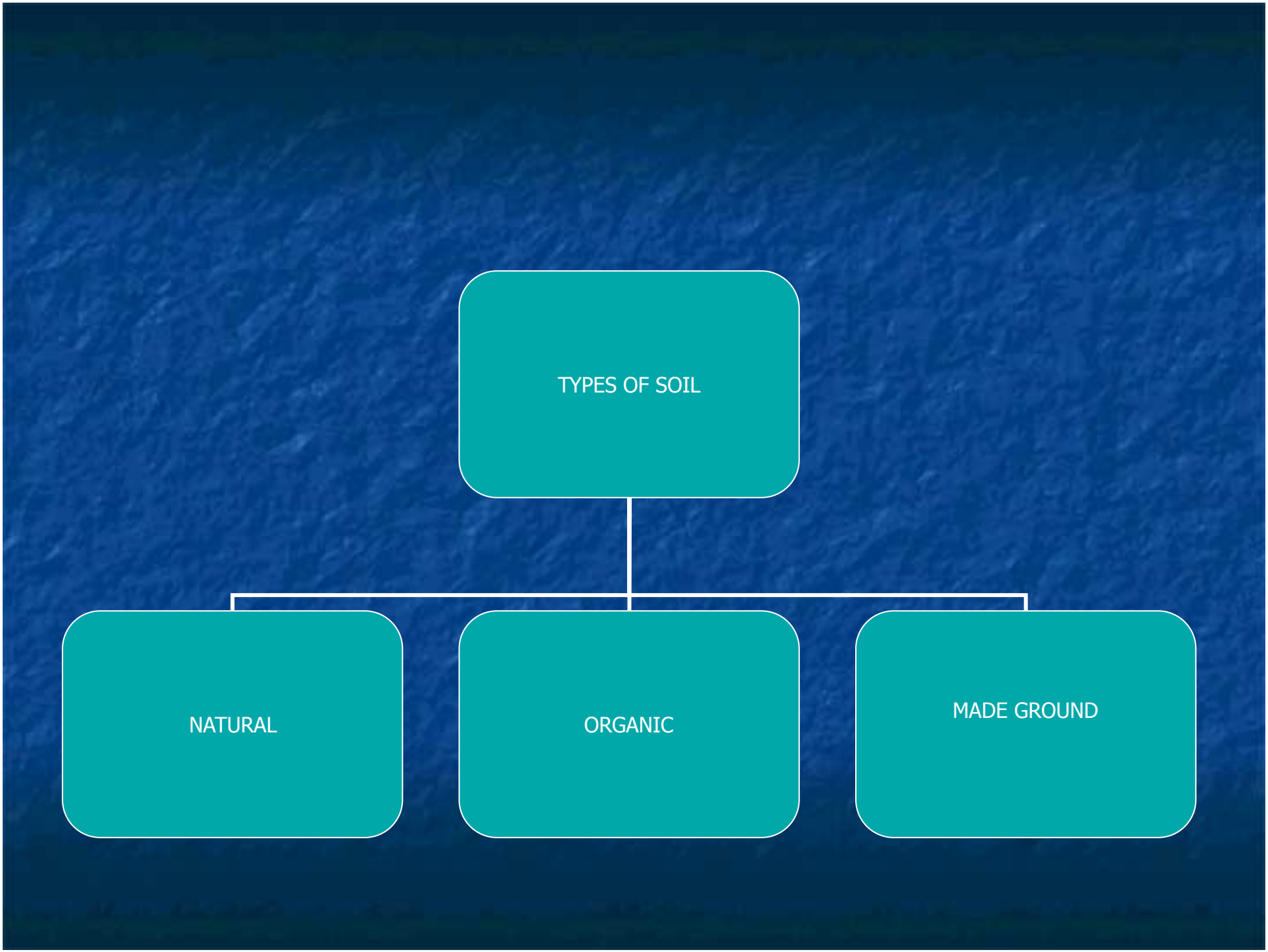
SOIL PROPERTY TESTING LTD

- FIELD DESCRIPTION OF SOILS
- encompassing Eurocode 7 changes
- BS EN ISO 14688-1:2002 +corrigenda Nos 1 and 2

- Nov 2008 / spt

WHAT IS "SOIL"

- COMPRISES AN ASSEMBLY OF:
- MINERAL PARTICLES
- BOTH INORGANIC OR/AND ORGANIC
- CONTAINS WATER AND AIR
- SOMETIMES GASES
- All in different proportions, either weathered from rock or sea or river sediments .
- ALL DESCRIPTIONS SHOULD BE DESCRIBED IN TERMS OF THEIR LIKELY ENGINEERING BEHAVIOUR – BS 5930:1999 Clause 41.2


TYPES OF SOIL
NATURAL
ORGANIC
MADE GROUND

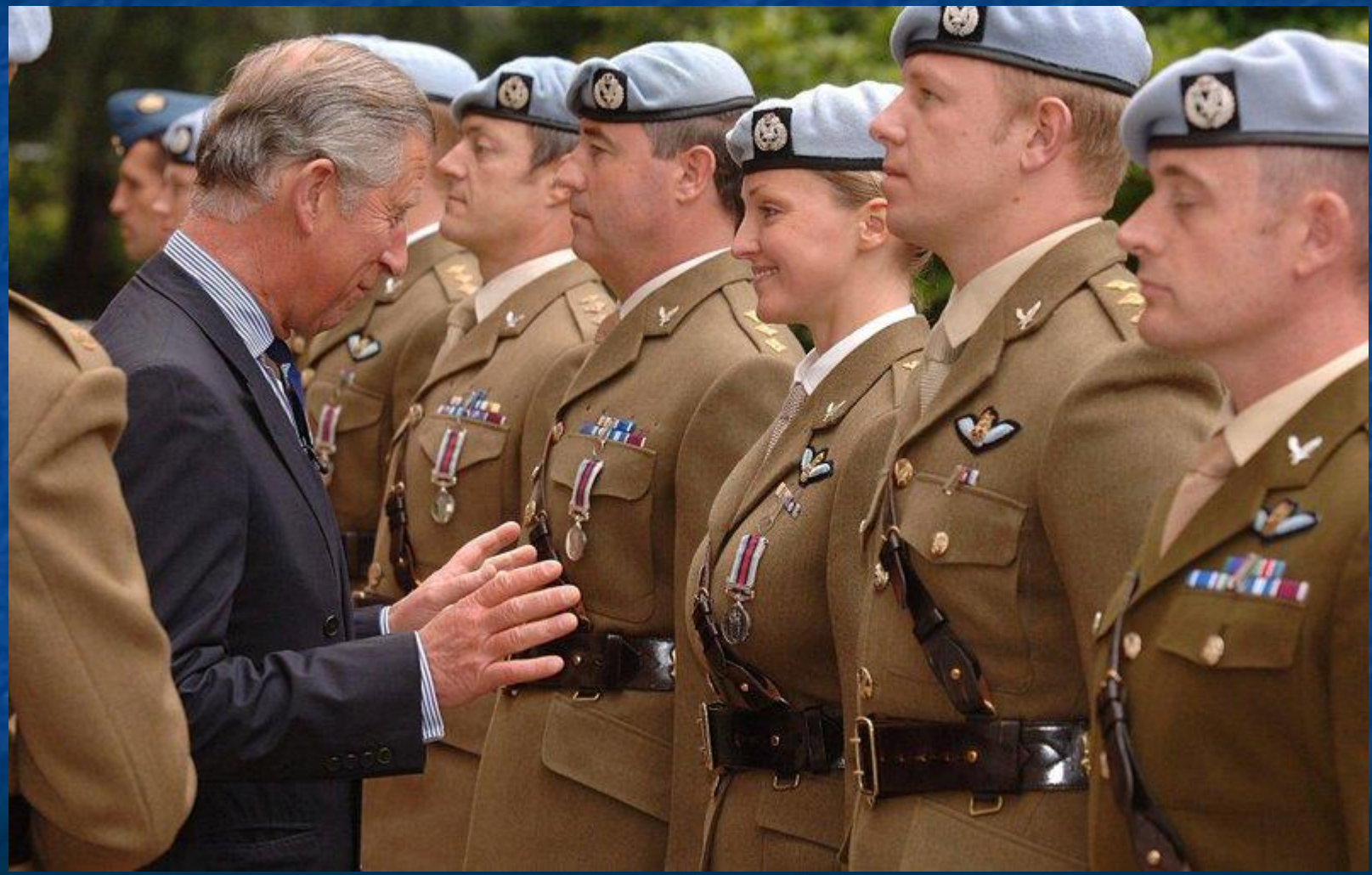
NATURAL SOILS – Engineering description by Particle Size

- 1 VERY COARSE SOILS – Boulders & cobbles
- 2 COARSE SOILS - Gravels and Sands
- 3 FINE GRAINED SOILS – Silts and Clays

1 - Very COARSE SOILS

- BOULDERS OVER 200mm
- COBBLES FROM 63mm to 200mm

COBBLES OR BOULDERS?



2 - COARSE SOILS

- GRAVEL coarse – 20 to 63mm
- medium – 6.3 to 20mm
- fine - 2.0 to 6.3mm

- SAND coarse - 0.63 to 2.0mm
- medium - 0.20 to 0.63mm
- fine - 0.063 to 0.20mm

3 - FINE GRAINED SOILS

- SILT coarse 0.02 to 0.063mm
- medium 0.0063 to 0.02mm
- fine 0.002 to 0.0063mm

- CLAY Less than 0.002mm or 2 microns

FUNDEMENTAL DIFFERENCES

- Soils that stick together when wet and can be rolled into a thread that supports the soils own weight (ie have cohesion & plasticity), contain sufficient clay or silt in them to be described as **FINE SOILS**.(Sometimes referred to as Cohesive)
- Soils that do NOT have these properties behave and should be described as **COARSE SOILS**. (Sometimes referred to as Granular)

DECSRIPTION OF COARSE GRAINED SOILS

- GRAVELS
- SANDS
- And varying proportions of:

PREDOMINANT SOIL IN CAPITALS, then describe secondary soil in more detail after full stop.

- Sandy ….. GRAVEL. Sand is brown fine and medium

- Gravelly …..SAND. Gravel is black and brown fine to coarse angular (chert/ sandstone/limestone etc)

Note the term Chert is used, rather than flint, unless the origin of the material is known to come from chalk , Chert is identical ie Silicon Dioxide but is formed in other ways

COARSE GRAINED – (GRANULAR SOILS)

- Term before PRINCIPAL GRANULAR SOIL TYPE
- Slightly sandy (or gravelly) less than 5%
- Sandy 5 to 20%
- Very sandy more than 20%
- SAND and GRAVEL about 50% of each

Relative density of Gravels and Sands from SPT tests

N Value	No of blows
Very loose	0-4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very dense	50+

ANGULARITY OF COARSE GRAINED SOILS

- Well rounded
- Rounded
- Sub-rounded
- Sub angular
- Angular
- Very angular

DESCRIPTION OF FINE SOILS

- SILTS
- CLAYS
- Varying proportions of:

FINE GRAINED SOILS (Cohesive soils)

- SILTS Passing 0.063mm to 0.002mm
- CLAYS Passing 0.002mm – (2 micron)

- Since 1999 until this amendment these terms have been MUTUALLY EXCLUSIVE>

- Amendment 1 allows for either silty CLAY, or clayey SILT where this aids the description

FIELD CONCISTENCY OF CLAYS AND SILTS (and cohesion to old BS5930.)

- Very soft - Finger easily pushed in to 25mm, exudes between fingers. 0-20 kPa
- Soft – Finger pushed in to 10mm, moulded by light finger pressure. 20 - 40 kPa
- Firm – Thumb makes impression easily, cannot be moulded by fingers. 40-75 kPa
- Stiff – Can be indented by Thumb Nail, crumbles in rolling thread , remoulds . 75 – 150 kPa
- Very Stiff – As stiff – but cannot be moulded, and crumbles. 150 – 300 kPa
- Hard – Can just be scratched by thumbnail >300 kPa

MIXTURES OF BOTH Fine and Coarse

- COMPOSITE SOILS

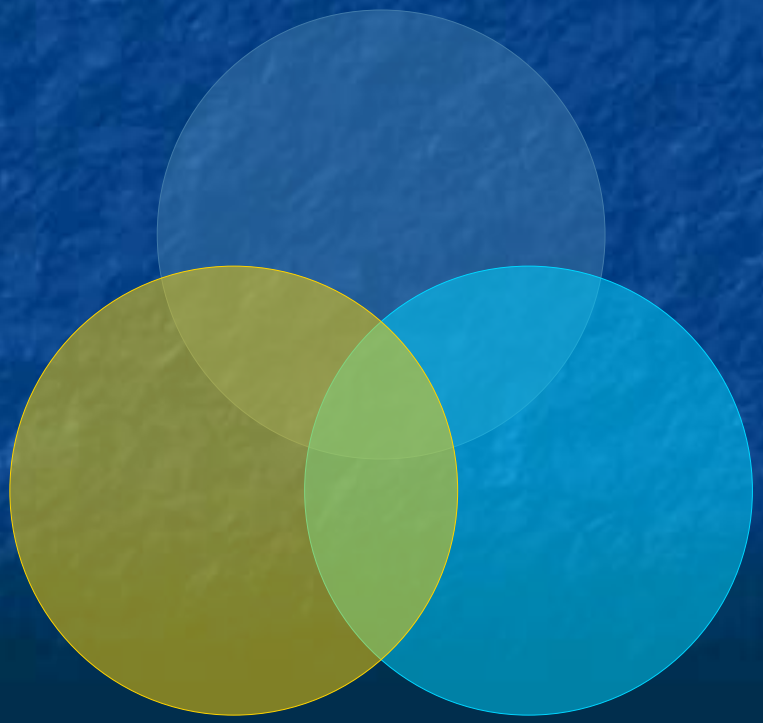
COMPOSITE SOILS

- MIXTURE OF BOTH COARSE AND FINE GRAINED
- FIRST STEP – DECIDE ON BEHAVIOUR AND THERFORE THE PRINCIPAL SOIL TYPE
- BASICALLY CLASSIFY with due regard to differing scales of proportions for both types.

COMPOSITE SOILS

- THE MIXTURE OF THESE SOILS DEPENDS ON HOW THEY BEHAVE
- THE USUAL RATIO IS 65/35% OF MATERIAL RETAINED AND PASSING THE 0.063mm SIEVE
- IE: IF MORE THAN 65% IS RETAINED IT IS CLASSED AS A **COARSE** GRAINED COMPOSITE SOIL
- IF MORE THAN 35 % PASSES , IT IS CLASSED AS A **FINE** GRAINED COMPOSITE SOIL – This is due to the influence in behaviour of silty and clayey material

Composite soils comprising



Composite Soils- DIFFERING SCALES BETWEEN COARSE & FINE

- COARSE GRAINED scales of secondary constituents:
- <5% = slightly
- 5 to 20% = sandy (gravelly , clayey silty)
- >20% = very
- FINE GRAINED scales of secondary constituents:
- <35 = slightly
- 35 to 65% = sandy (gravelly,)
- > 65% = very

COMPOSITE SOILS- behaving as COARSE GRAINED – GRANULAR SOILS – more than 65% retained on 0.063mm sieve GRAVELS or SANDS but including some fine grained clays or silts

- Term before PRINCIPAL GRANULAR SOIL TYPE
- Slightly clayey (or silty) less than 5%
- Clayey or silty 5 to 20%
- Very clayey or silty more than 20%
- Above may be in addition to terms sandy / gravelly etc
- Therefore a description may be structured – slightly clayey very sandy GRAVEL or slightly gravelly very silty SAND

COMPOSITE SOILS – FINE GRAINED ie more than 35% passing 0.063mm – CLAY or SILT including some coarse grained soil , ie gravel or sand

- Slightly sandy (or gravelly) - less than 35%
- Sandy - 35% to 65%
- Very sandy - more than 65%
- Silty CLAY
- or clayey SILT – where this is important
- May be some gravel too, description may be slightly sandy very gravelly CLAY

ORDER OF DESCRIPTIONS

- 1 – Consistency or Relative density
- 2 – Discontinuities
- 3 – Bedding
- 4 – Colour
- 5 – Secondary constituents / mixture
- 6 – Particle Shape & Size
- 7 – MAIN SOIL TYPE
- 8 – Additional information

BASIC FIELD/ LAB TECH TESTS

- 1 - DRY STRENGTH TEST-
- Low dry strength-indicated SILT
- Medium dry strength – indicates SILT +CLAY
- High dry strength – indicates CLAY

- 2 TOUGHNESS TEST or PLASTICITY
- Low – has some cohesion but cannot be rolled into 3mm thread – indicates high silt content
- High – Can be rolled into 3mm threads easily – indicates high clay content

- FIELD TESTS CONT.
- 3 - DILATANCY TEST
- Take 10 to 20mm dia ball and moisten if required, becomes shiny with water, squeeze between fingers, water disappears. Tap material and shake, if water appears and disappears easily – HIGH SILT CONTENT

- FIELD TESTS CONT.
- 4 - Determintion of SAND,SILT, and CLAY
- Take small sample rub between fingers
- Under water if neccesary.
- Sand content – gritty feel
- Silt content – also gritty but smoother but not visible
- CLAY content – feels soapy , sticks, to fingers and stains. Cut with knife Looks shiny

ORGANIC SOILS

- Inorganic soils that contain proportions of organic material
- Slightly organic – grey in colour – 2-6%
- Organic - Dark grey in colour 6-20%
- Very organic – Black greater than 20%

- PEATS – predominantly organic sometimes with inorganic secondary constituents

Carbonate content

- (0)- Carbonate free
- (+) – Calcareous
- (++) – Highly calcareous

- Above scale to BSEN ISO 14688-1:2002
- Using 10% or 3:1 dilute hydrochloric acid

PEATS

- Different scale of descriptions:
- Firm Fibres compressed together
- Spongy Very compressible and open structure
- Plastic Can be moulded in hand and smears fingers – almost clayey

PEATS

- Field weathering scale.
- FIBROUS – not weathered – Plant remains recognisable and retains some strength
- PSEUDO-FIBROUS – Plant remains recognisable – no strength
- AMORPHOUS – No recognisable Plant fibres
- NOTE – May also contain inorganic minerals and therefore can be slightly sandy etc

MADE GROUND

- Soils contains Man Made artifacts such as, brick, glass,pottery,wire,household waste, nasty cemicals, cinder etc etc.
- DESCRIBE; Made ground comprising: Principal soil type if obvious, with list of secondary artifacts
- FILL – Engineered MADE GROUND, made up of classified material and placed in controlled and compacted layers

CHALK – Weathered rock

- SPT IN-HOUSE DISCIPLINE FOR TECHS.
- IF ROCK CHALK – describe lumps in terms of coarse grained soils
- If STRUCTURELESS /PUTTY CHALK – describe in terms of fine grained soils
- IF MIXTURE = Assess and describe as for composite soils
- (Note presence , size and shape of any flints

DESCRIPTION EXERCISE

Soil Property Testing Ltd.

FIELD DESCRIPTION OF SOILS

NAME ..... Date .....

	Relative Density Consistency	Discontinuities	Bedding	Colour	Secondary Constituents/Mixture	Particle Shape & Size	Main Soil Type	Additional Information
For Example	Firm	fissured	Inter-laminated/Inter-bedded	mottled yellowish brown	slightly sandy		CLAY.	recently active roots
	Medium dense			yellow	silty gravelly	fine to medium	SAND.	Gravel is brown angular

Sample descriptions

- 1 Stiff fissured DARK GREY (silty) CLAY with occasional fine shell traces
- 2 Firm mottled grey and YELLOWISH BROWN (silty) CLAY with occasional calcareous aggregations and decayed roots
- 3 Stiff fissured mottled grey and BROWN slightly sandy/ silty CLAY with partings of yellow and grey silt and rare decayed roots, and selenite crystals
- 4 Firm mottled yellow and LIGHT GREY slightly gravelly slightly sandy CLAY. Gravel is fine to medium sub rounded flint and quartz

Sample Descriptions

- 5 Firm mottled yellow / orange and LIGHT GREY silty CLAY with occasional black organic pockets, (poss rare fine gravel?)
- 6 Very soft mottled black orange and LIGHT GREY CLAY with black organic pockets
- 7 MADE GROUND comprising: Very soft mottled DARK GREY and DARK BROWN slightly gravelly slightly sandy CLAY with frequent brick and black cinder fragments. Gravel is fine to coarse angular flint
- 8 Soft structureless (putty) white CHALK with lumps of harder chalk of sub angular to sub rounded medium and fine gravel size

Sample Descriptions

- 9 Firm BLACK PEAT – probably amorphous, ie no fibrous material. (Poss becoming consolidated into coal
- 10 Very stiff GREY slightly gravelly slightly sandy CLAY. . Gravel is white sub rounded to sub angular chalk. Sand is fine chalk
- 11 YELLOW slightly silty fine SAND (Feels soft)
- 12 Dark brown slightly silty fine to coarse SAND 9Possibly slightly gravelly
- 12 WRONG!!! Wet it up.

Sample Descriptions

- 13 BLACK and orangey BROWN clayey very sandy angular to sub rounded GRAVEL. Sand is brown fine to coarse. Clay is soft orangey brown
- 14 BROWN and WHITE fine to medium SAND and fine and medium sub angular GRAVEL (Prob 50/50%)
- 15 ORANGEY BROWN slightly gravelly fine and medium SAND. Gravel is brown fine and medium sub rounded flint
- 16 BLACK BROWN and WHITE sub rounded to sub angular medium flint GRAVEL
- 17 Very soft GREY clayey SILT
- 18- Brown thinly laminated CLAY with thin laminations or partings of light brown silt