How Deep? How Much? Groundwork Issues and Solutions

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AGENDA

- What We Are Asked To Do
- What We Do It With – Equipment
- How We Do It – Techniques
- What We Leave Behind

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The Enquiry

Same 2 questions:

- How Deep?
- How Much?

Not that simple

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Initial Stages Before Drilling

- Customer or heating engineer makes contact with us.
- We need property details.
- We need post code for desk study.
- Assess Geology for feasibility.

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Variable Items

- Site location
- Size of project
- Type of project – open or closed loop
- Space restrictions
- Geology

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Geology

- British Geological Survey
- Geological database
- Borehole records
- Thermal Conductivity Guidance

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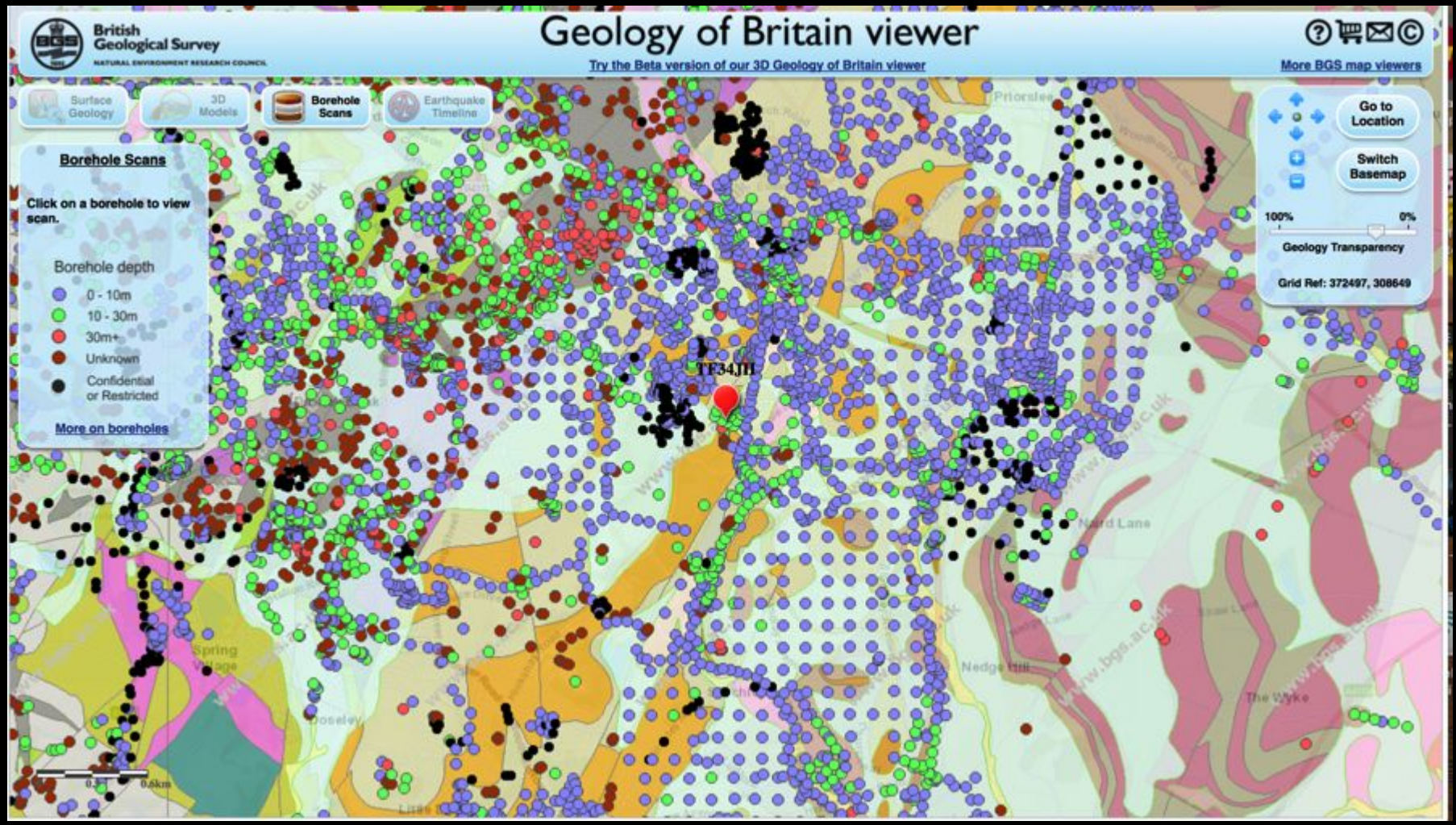
Desk Study for Telford International Centre



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Desk Study for Telford International Centre

Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

Borehole No. 1

Contract No. F5123
Location West Midlands Tennis Centre
Client Telford Development Corporation
Method of Boring Percussion
Diameter of Borehole 150 mm

70122 06460
SJ70NW 1590

Sheet 1 of 1
Chainage
Ground Level 145.600 m.A.O.D.
Date 4/1/82

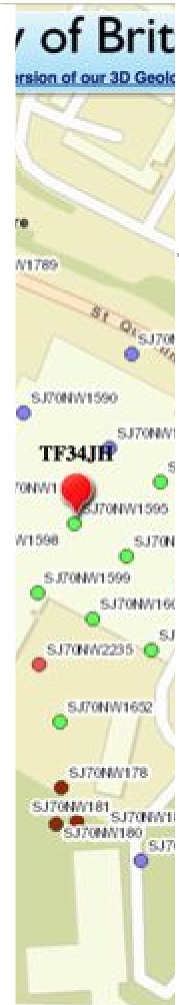
Description of Strata	Depth Below G.L. (m)	O.D. Level (m)	Sampling and Coring	"N"/ R.Q.D.%
MADE GROUND: Hardcore.	0.50	145.1	0.50	
MADE GROUND: Stiff brown clay with mudstone fragments.	2.00	143.6	2.00	
Stiff brown silty CLAY.	3.40	142.2	3.50	
Highly weathered brown silty MUDSTONE.	5.40	140.2	5.00	
Weathered grey shaly MUDSTONE.	6.10	139.5		
COAL.	6.30	139.3	6.50	50
Weathered grey shaly MUDSTONE.	10.00	135.6	8.00	80
			9.50	133

Type of Sample: S.P.T.; C.P.T.; Jar; Bulk; Undisturbed; Vane; Water; Piezometer

Remarks (Observations of Ground Water etc.)

Water struck at 6.10 m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant



SJ 7013 0832 SJ70/36

153/119

SECTION OF Shaft at Wharf Pit.

Maps: One-inch Six-inch 43NE County Salop
Height above O.D. Latitude Longitude
Communicated by (Marcus Scott. Proc. Geol. Soc. ...) Date of ... 6-1856
Made by

	Thickness		Depth from Surface	
Thick Rock	62	3	62	3
Blue Clod	84	6	146	9
Stinking Rock (3 small coal below)	43	6	190	3
Strong Bind	8	9	199	0
White rock & bind	78	6	277	6
Plate Pit & Red clod	15	0	292	6
Buckman's measure	15	0	307	6
Rough rock Calamineae Trace	17	6	325	0
Bass & slums	26	6	351	6
Double Coal rock	4	6	356	0
Double Coal	6	0	362	0
Pennystone and yellowstone clod	5	6	367	6
Yard coal	3	0	370	6
Blue & White Flat clod	25	3	395	9
Big Flint Coal	4	6	400	3
Flint rock	15	0	415	3
Pennystone clod	23	0	438	3
Stinking coal	4	0	442	3
Upper Clunches	20	0	462	3
Clunch coal	2	0	464	3
Clunch & Fireclay	1	6	465	9
Two foot coal	2	6	468	3
Clunch	1	4	469	7
Best coal Data Bank	1	4	470	11
Bass & slum	0	2	471	1
Randle coal	3	0	474	1
Clod coal	2	0	476	1
Clod	3	0	479	1
Hard sandstone	12	0	491	1
Little Flint Coal	1	8	492	9

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Desk Study for Telford International Centre
Summary of Borehole Information

- 12 boreholes on site ranging from 10m – 150m deep
- The 10m deep hole hit bedrock at 5.4m
- Geology is a mixture of siltstone, mudstone, coal and shale, with the possibility of sandstone
- Water level approximately 6m below ground

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Drilling

- How Deep Are We Drilling?
- How Many Boreholes Are Required?
- Where Are We Placing Each Borehole?
- Which Drilling Rig?
- What Drilling Techniques?
- Contingencies?

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Which Drilling Rig?

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Which Drilling Rig?

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Which Drilling Rig?

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Drilling Techniques

- Flight Auger

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Drilling Techniques

- Cased Drilling – used in unstable ground

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Drilling Techniques

- Drag Bit

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Drilling Techniques

- Tri-Cone Rock Roller Bit

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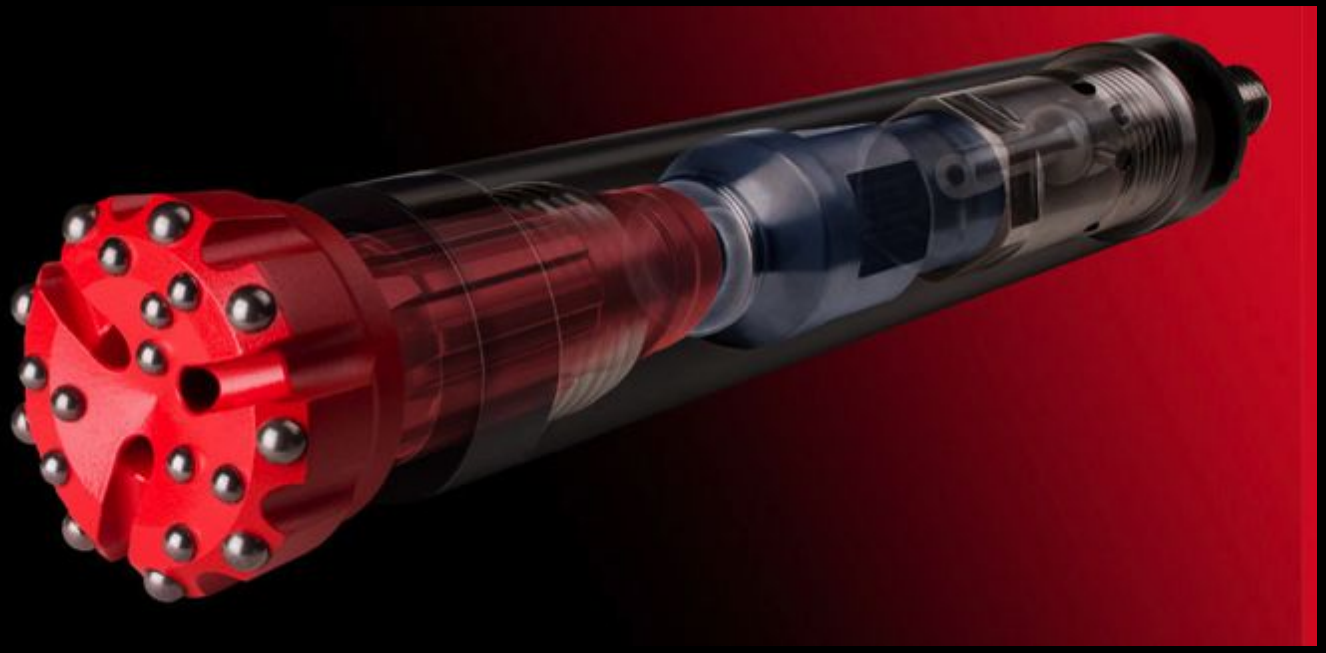
Drilling Techniques

- Down the Hole Hammer



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Drilling Techniques

- Mud – used in sands and gravels

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Drilling Techniques

- Mud Cleaning System

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Final Product

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How Deep?

- Thermal Conductivity range is between 1.1 – 3.5W/m/K
- Our Geologist recommends conductivity value of 2.56 W/m/K
- 100m borehole should deliver 4kW of energy
- Multiple boreholes to meet energy requirement

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How Much?

- Drilling rig – 12 tonne rig
- 0 - 5.4m Overburden – Symmetrix
- 5.4 - 100m – Mudstone – Tri-Cone
- Contingencies – Water Management
  - Fractured Strata
  - Drilling Mud
- Can now provide a quotation

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Other Issues

Active Sites

Access can change as building progresses

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Reinforced Concrete is not on any geological map!

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Novelty Obstruction

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Drilling – Not A Simple Operation

- Need Correct Equipment
- Need Skilled and Experienced Personnel

  Drillers

  Geologists
- Need to be Adaptable - Anticipate issues and have contingencies available.
- Innovative - No two sites are the same.

How Deep? How Much? Not that simple.

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Innovation

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