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BETTER DEFINED GEOLOGICAL AND HAZARD MODELS FOR BELLAHOUSTON PARK, GLASGOW

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BETTER DEFINED GEOLOGICAL AND HAZARD MODELS FOR BELLAHOUSTON PARK, GLASGOW

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1 Introduction

1.1 BACKGROUND

Borehole records prove that the Knightswood Gas Coal (KDG) has been extensively worked in Bellahouston Park, Glasgow. In 2000, the British Geological Survey (BGS) undertook a commissioned research project for Glasgow City Council (GCC) to produce geological and hazard models related to abandoned mineworkings for Bellahouston Park (Rogers and Sowerbutts, 2000). The models identified some areas of the Park that have a thin drift cover and are crossed by the KDG outcrop*. These areas were classed as having the greatest likelihood of voids from mining of the KDG reaching the surface. Crown holes have previously developed within these areas. Other coal seams that crop out within Bellahouston Park did not appear to have been worked with the exception of the ?Banton Rider Coal in a small area beneath the Sports Centre and workings of the Pollock Stone Coal immediately to the east of the Park.

Glasgow City Council would like the key, south-central area of the Park to be used for public events and need to constrain further the areas of greatest hazard immediately down-dip of the KDG outcrop, and also adjacent areas of least hazard on the up-dip side of the KDG outcrop. GCC commissioned BGS to devise a drilling programme of 13 boreholes, undertake stratigraphical logging of the cores during the drilling period, and subsequent revision of the geological and hazard models.

1.2 AIM OF THE REPORT

This report describes the geological results of the borehole drilling programme that took place in the southern part of Bellahouston Park, between the running track in the west, housing estate in the east, and south of the drumlin (Figure 1). The report describes subsequent improvements to the geological and hazard models to enable GCC to understand adequately the hazards to public safety for future activities planned for Bellahouston Park. Specifically, the report defines more accurately the zone of greatest hazard along and immediately down-dip of the KDG outcrop, and the zone of least hazard on the up-dip side of the KDG outcrop, in the key areas of the Park that could be used for public events.

2 Borehole drilling programme

2.1 SITING OF THE NEW BOREHOLES

BGS prepared a plan for the sites of the 13 new boreholes in consultation with GCC. Boreholes were sited to constrain the outcrop of the KDG tightly, with emphasis on proving strata beneath the coal so that these areas could be classified as of least hazard with the greatest certainty. The estimated core lengths for each borehole were long enough such that the stratigraphy of each could be robustly defined. To obtain the optimum result, the locations of 6 of the boreholes were modified during the drilling programme, based on the results of the earlier-drilled boreholes and in consultation with Donald Linn from GCC. The final borehole locations are shown in Table 1 and Figure 1.

* outcrop is used throughout this report to mean the line where the coal seam reaches the top of the rock surface (rockhead). However superficial deposits up to 25m in thickness obscure the actual position.

GCC Borehole number	Easting	Northing	Start height	Summary
54/63/023	254998	663488	20.4	KNO c. 1.8m off, to BKME
54/63/024	254683	663462	23.1	intact KDG
54/63/026	254855	663461	20.2	JF missing, KDG void migrated?
54/63/027	254588	663535	24.2	KDG void
54/63/028	254928	663360	21.1	KDG a few m off, to KRIC
55.63/054	255240	663538	22.1	KDG void and JF
55/63/049	255023	663485	21.4	not far KNO outcrop, to BKME
55/63/050	255085	663421	20.6	KDG just off, KRIC, U2, fault
55/63/051	255137	663536	22.0	into KRIC and U2
55/63/052	255006	663420	20.0	KNO 1-2m off, to BKME
55/63/053	255106	663502	21.6	KRIC, U2 and KNO
55/63/055	255048	663372	20.3	KRIC just off, to KNO and BKME
55/63/056	255117	663460	21.5	shallow KDG void

Table 1. New borehole numbers, locations and summary of interpreted stratigraphy. See Appendix 2 for explanation of codes used.

2.2 BOREHOLE DRILLING AND STRATIGRAPHIC CORRELATION

Ritchies Ltd were contracted to drill the boreholes for GCC using 2 tractor-mounted rigs. The boreholes were open-holed to just below rockhead, from which 76mm diameter core was obtained to a depth advised by BGS and GCC. Ritchies installed piezometric monitoring equipment in a subset of the boreholes for GCC. Stratigraphical logging of the boreholes took place in the Bellahouston Nursery by Alison Monaghan, Mike Browne and David Ross of BGS. Fossil specimens were taken to BGS in Edinburgh and identified by Mark Dean and Peter Brand. Stratigraphical correlations were made using recognisable lithological sequences, key fossil occurrences and other characteristic features (e.g. bioturbation) in the interval of the Limestone Coal Formation between the Black Metals Member to just above the Jubilee Coal (Figure 2). Logs of the new boreholes are given in Appendix 1.

2.3 THE PROBLEMATIC 'POLLOCK BH13' BOREHOLE

A borehole numbered 'BH13' on the original drilling plan from Pollock & Co. or number BGS NS56SE166/13 (see Figure 1) was the only one constraining a fault block in the Rogers and Sowerbutts (2000) model. The borehole proved a 1.1m void at 22.2m depth (–1.7m OD). The void was interpreted as mineworkings in the Knightswood Gas Coal by BGS geologists and in the original site investigation report by Ross & Co. A fault block with throws of 10-26m was required to accommodate this stratigraphic interpretation in Rogers and Sowerbutts (2000). However, the interpretation and fault block were recognised as problematic as they were out of character for the area, and constrained only by the one data point. Also, the interval between the void and the overlying thin coal was thicker than the normal KDG-Jubilee Coal interval. Thus the geology around the problematic Pollock BH13 was a key area for the new borehole drilling program to test.

Checks on the original dataset were made to ensure that this borehole had not been sited wrongly or the record misnumbered. The record appears correct, but its site location needed a little modification. Comparing the original records for Pollock BH13 against historical maps showed the location in the BGS database needed to be moved 28m to the south-west, with the revised site at 255016, 663486 as shown on Figure 1 (green to yellow dot). However, this small change in position of the borehole is not enough to resolve any of the problems with the geological interpretation. The borehole was probably open-holed as other cored boreholes in this site investigation are labelled 'machine' and were examined by BGS

geologists, whereas BH13 was not. However, in this study the basic lithological description of the borehole and presence of a void in BH13 has been taken as correct.
Taking a revised look at the problematic Pollock BH13 along with the newly drilled boreholes surrounding it (see below), the succession is assessed to be similar to that below the Black Metals Member under the Bellahouston Sports Centre, where mineworkings were interpreted at the Banton Rider Coal level (Rogers and Sowerbutts, 2000). Pollock BH13 could also be correlated to beneath the Black Metals Member compared with the BGS Corkerhill Borehole (BGS number NS56SW/304) from some 1.4km south-west of Bellahouston Park. In this interpretation, the void in Pollock BH13 would be at the Banton Rider Coal level, from workings of thin ironstones and a thin coal. The significance of this borehole and its mineworking are discussed further below.

2.4 BOREHOLE RESULTS

The detailed logs of each borehole are given in Appendix 1, see Figure 1 for their locations. Depths are given as drilled depths apart from where labelled as relative to Ordnance Datum (e.g. 2mOD).

2.4.1 54/63/023

This borehole was drilled to test the results of the problematic Pollock BH13, to see if the workings identified in Pollock BH13 extended westwards and to investigate the problematic geology of this area. The borehole reached rockhead at 8.8m depth with 6.5m of till above rockhead. The stratigraphy of the borehole is well constrained starting in the sandstone beneath the Knott Coal, with the coal about 1.8m above rockhead when correlated with borehole 55/63/049. The borehole penetrates into the Black Metals Member mudstone and ironstone succession from about 14.9m to the base of the borehole at 26.9m. The Black Metals Member contains *Lingula*, marine shells and trace fossils typical for this area. The muddy ironstones below 26m could be correlated with the 'California Clayband Ironstones' that occur in the bottom third of the Black Metals Member in this area (Central Coalfield Area IV Economic Memoir, 1920). No evidence of any workings was found in this borehole. If Pollock BH13 represents strata beneath the Black Metals Member, then stratigraphical correlations relative to OD indicate that 54/63/023 must be in a different fault block (Figure 4). The stratigraphy of 54/63/023 is consistent with a southerly dipping succession in the same fault block B as BGS boreholes numbers NS56SW45/18 and NS56SW671 (Figures 1, 3) with a dip of 0.4-5° to the north of the borehole. 54/63/023 is consistent with 54/63/028 with a steeper dip of 16° to the south of the borehole (Figures 3, 4, 5).

2.4.2 54/63/024

This borehole was drilled to constrain the outcrop of the Knightswood Gas Coal (KDG) in the western part of the study area. The borehole reached rockhead at 7.8m depth with 2.3m of till above rockhead. The stratigraphy of the borehole is well constrained, initially penetrating the sandstone above the KDG and an intact KDG coal seam 0.72m thick. The characteristic siltstone roof of the KDG with *Lingula* enhances the certainty of the lithostratigraphical correlation. The top of the coal is 5.68m from rockhead and the outcrop of the KDG has been moved southwards from that of the Rogers and Sowerbutts (2000) model as a result of this borehole. The succession in 54/63/024 is consistent with nearby boreholes that lie in a north-east to easterly dipping fault block A with dips of *c.*6-10° (Figures 1, 6). The intact coal in 54/63/024 is interpreted as a stoop – whilst there was no evidence for working in the core such as staining, air was lost during drilling this interval and a blister appeared in the ground next to the standpipe to the KDG workings at 254760, 663542 (the same effect as when 54/63/027 was drilled). Excavation has shown that the blister developed over a drainage storage tank that is presumably linked to the standpipe (D. Linn, pers. comm. 2003). Most of the other bores in this area have voids at the KDG position, suggesting that interconnected workings are present at the KDG level in this fault block A.

Borehole 54/63/025 was not drilled as 55/63/056 was drilled instead

2.4.3 54/63/026

This borehole was drilled to further constrain the NNW-trending fault F_{AB} in the central part of the study area, and the depth of any KDG workings if the borehole was in fault block A (Figure 1). The borehole

encountered a thick drift succession to a depth of 20.6m with 13m of firm grey till above rockhead. The stratigraphy of the borehole can be correlated lithologically to fit within fault block A but no fossils or particular characteristic features were identified in the core. Thus, whilst the stratigraphic correlation is reasonable, there are some uncertainties with precise correlation. The core was very broken just below rockhead, but there were no traces of a mineworking such as watermarking or staining. A 0.87m void was encountered, with its base at 29.87m depth, and is taken to represent a working of the KDG. However, the void appears to have migrated upwards by *c.* 1m as there is no *Lingula* roof to the void as might be expected and the mudstone/siltstone overlying the void is thinner than expected (e.g. compared with 54/63/024). Also there is no staining above or below the void and no seatrock beneath it. However, if the correlation is correct the Jubilee Coal should be present at *c.* 24m. The coal does not appear to be present though the strata are carbonaceous and there is a seatrock beneath. A similar succession with the Jubilee Coal missing is found in nearby boreholes (BGS numbers NS56SW45/14, NS56SW 45/15, see Figure 3). The depth of the Jubilee Coal position and KDG in 54/63/026**,** together with nearby existing boreholes indicate that strata dip at *c.* 10° in an easterly orientation close to the NNW-trending fault F_{AB} (Figures 1,6).

2.4.4 54/63/027

This borehole was drilled to constrain the outcrop of the KDG in the westernmost part of the study area. The borehole encountered a drift succession 6.9m thick including 2.7m of till above rockhead. The stratigraphy of the borehole is well constrained and includes a 0.8m void of the KDG with the characteristic *Lingula* roof of the coal seam fallen to the base of the void. The top of the void is 2.5m below rockhead, meaning that the outcrop of the coal seam has been moved southwards compared to the Rogers and Sowerbutts (2000) model. Whilst the void was being drilled, no air was returned and a blister appeared in the ground by the standpipe to the KDG workings at 254760, 663542 and a pool of water collected nearby at 254750, 663541. As with 54/63/024 it appears that mine workings in this fault block in the western part of the study area are interconnected.

2.4.5 54/63/028

This borehole was drilled to constrain the outcrop of the KDG in the central part of the study area, just to the east of the NNW-trending fault F_{AB} that separates the north-easterly and south-easterly dipping zones of the Park (Figure 1). The borehole encountered a drift succession 18.65m thick, with 6.15m of firm till above rockhead and 2.2m of made ground from the surface. The stratigraphy of this borehole is based only on lithological considerations because no coals, fossils etc were found. The correlation is reasonably certain. The borehole starts in sandy mudstone (drillers log) and the sandstone just beneath the KDG, the coal position is probably less than 0.5m above rockhead. There is no evidence of mining in this borehole. The succession beneath is typical of the interval beneath the KDG, through the Knott Rider Coal position and down to the mudstone/siltstone that lies above the Knott Coal. The Knott Rider position is taken by ironstones and carbonaceous mudstones; similar features are seen in 55/63/050 and 55/63/051. The correlation between this borehole and BGS number NS56SW45/11 constrains the KDG outcrop tightly. To the north of 54/63/028 correlation with 54/63/023 requires a dip of *c.* 16°, whereas to the south of 54/63/028 correlation with NS56SW45/11 implies a dip of *c.* 5° (Figures 5, 6). These dip changes are consistent with those seen in the fault block C to the east.

2.4.6 55/63/049

This borehole was drilled to investigate the results of the problematic Pollock BH13 as discussed above. The borehole was sited *c.* 7m east of the revised site for Pollock BH13. The borehole proved 9m of drift with 3.5m of till above rockhead. The stratigraphy of the borehole is well constrained by the Knott Coal that is 0.25m thick at 11.34m depth and the Black Metals Member that contains marine fossils between about 18m and the base of the borehole. There is no evidence for mineworking in the borehole. The succession is stratigraphically well below that predicted if a KDG void is interpreted at –1.7mOD in Pollock BH13. Alternatively, it is well above the succession if a Banton Rider Coal void is interpreted in Pollock BH13. Therefore, a fault F_{CD} must exist between 55/63/049 and Pollock BH13 (Figures 3, 4). The stratigraphical interpretation is consistent with 55/63/049 being in a south-easterly dipping fault block D along with boreholes BGS number NS56SE786 and 792 and 55/63/050, and with a dip of *c.* 7° (Figures 1, 5, 6).

2.4.7 55/63/050

This borehole was drilled to constrain the outcrop of the KDG in the faulted eastern part of the study area. The borehole penetrated 4.2m of silt and clay but no till. The stratigraphy of the upper part of the borehole is fairly well constrained by lithological and fossil correlations and starts in the sandstone beneath the KDG with the KDG position off by 1-2m above rockhead. It then penetrates into the mudstone of the Knott Rider and the position of the Knott Coal, though coal is probably undeveloped rather than mined. In the upper parts of the borehole *Lingula* and megaspore beds can be correlated with 55/63/053 and 55/63/049 respectively. An abrupt lithological change from sandstone to mudstone between two core boxes at 22.5m, and the similarity of strata below 22.5m with those below the Knott Rider Coal in upper core boxes results in the interpretation of a fault at 22.5m, though there are no slickensides, broken strata etc. Along with the borehole BGS number NS56SE/792 (Figure 3), this borehole constrains the KDG outcrop in this fault block D tightly, within a south-easterly dipping succession of dip *c.* 7° (Figures 1, 5, 6). There was no evidence for mineworking in this borehole.

2.4.8 55/63/051

This borehole was drilled to constrain the outcrop of the KDG in the faulted eastern part of the study area. The drift in the borehole was 8.3m thick with 5.5m of sandy till above rockhead. The stratigraphy of the borehole is quite well constrained by lithological correlations of coals etc, but no fossil markers were found. The borehole starts in the siltstone/mudstone interval above the Knott Rider Coal, the cannel coal is present at 11.26m and the borehole then passes through a sandstone interval to the siltstone/mudstone above the Knott Coal, though the bore terminates at about the 'U2' marker coal level (see Figure 2, Appendix 2). The succession is very similar to those in boreholes 55/63/050, 55/63/053, 55/63/055. Both the cannel of the Knott Rider Coal at 11.26m and parts of the carbonaceous mudstone representing the 'U2' coal position at 17.83m were brecciated with polished surfaces, but the succession did not appear to be faulted. The position of the KDG is *c.* 5m above rockhead in this borehole and this results in the outcrop being farther south-east than in the Rogers and Sowerbutts (2000) model. The borehole is consistent with the south-easterly dipping succession in the same fault block F as 55/63/053 and BGS number NS56SE166/12 (Figures 1, 3). To the south-east of 55/63/051, dips are *c.* 8° but to the north they are lower at *c.* 3.5°, consistent with other fault blocks to the east and west (Figures 5, 6). There was no evidence for mineworking in this borehole.

2.4.9 55/63/052

This borehole was drilled to constrain the outcrop of the KDG and to investigate the geology around Pollock BH13 given the results of 55/63/049. The borehole penetrated 14m of drift with 5.5m of firm till above rockhead. The stratigraphy of the borehole is well constrained by lithological and fossil correlations to below the Knott Coal and into the Black Metals Member. This is much lower down in the sequence than predicted by the Rogers and Sowerbutts (2000) model in the fault block C constrained only by Pollock BH13. Based on lithological correlations the Knott Coal is about 2m above rockhead and the Black Metals Member is well constrained by *Lingula* and *Naiadites sp*. This borehole, Pollock BH13 and 54/63/055 appear to be in the same fault block C. However, a relatively steep dip of *c.* 19° is required to facilitate correlation between 55/63/052 and the revised interpretation that the sequence of Pollock BH13 lies beneath the Black Metals Member. This increase in dip is consistent with the fault block B to the west. There was no evidence for mineworking in this borehole.

2.4.10 55/63/053

This borehole was drilled to constrain the outcrop of the KDG in the faulted eastern part of the study area. The drift in this borehole was 8.4m thick with 3.8m of till above rockhead. The stratigraphy of the borehole is well constrained by lithological and fossil correlations with 55/63/049, 55/63/050, 55/63/055 and pre-existing boreholes. The borehole initially penetrates the siltstones and carbonaceous mudstones of the Knott Rider Coal position, continues down through the 'U2' cannel to the Knott Coal at 19.5m, and finally into the siltstone and mudstones of the Black Metals Member towards the base. The KDG is about 7m above rockhead, more than predicted by the Rogers and Sowerbutts (2000) model, and meaning the revised outcrop is farther south-eastwards. The position of the outcrop is tightly constrained between 55/63/053 and 55/63/056 within the south-easterly dipping fault block E (Figure 1). There was no evidence for mineworking in this borehole.

2.4.11 55/63/054

This borehole was drilled to prove the depth of the KDG in the easternmost part of the study area. The borehole encountered 2.5m of drift with 0.7m of till above rockhead. The stratigraphy of the borehole is well constrained by lithological correlations including the Jubilee Coal and the presence of a *Lingula* band above the 1.4m KDG void at 15.3m. Watermarking and staining occurs at three levels in the borehole, around the KDG void as expected, beneath the rockhead surface within the weathered zone and also between 5.9-6.34m drilled depth. The last occurrence is associated with broken and jointed core and it is possible that this represents a closed working to a thin seam that is sometimes found *c.* 1.5m above the Jubilee Coal, or alternatively a pathway for KDG minewaters. The result of this borehole and that of 55/63/051 in the same fault block F indicate that the revised outcrops of the KDG and Jubilee Coal should be farther south-east than in the Rogers and Sowerbutts (2000) model. The outcrop of the coal is now constrained much more tightly.

2.4.12 55/63/055

This borehole was drilled to deduce the geology in fault block C given the revised interpretation of Pollock BH13 and the results of 55/63/49 and 55/63/052. The borehole encountered 11.5m of drift with 3.4m of till above rockhead. The stratigraphy of the borehole is well constrained by lithological and fossil correlations and starts in the seatrock underneath the Knott Rider Coal position, passing down through the 'U2' coal position taken by ironstones with *Lingula*, to the Knott Coal 0.23m at 20.59m , and then down to the top of the Black Metals Member. The sequence is similar to that seen in 55/63/49, 55/63/51 and 55/63/53. The borehole is consistent with being in the same fault block C as 54/63/052 and aids significantly in refining the Rogers and Sowerbutts (2000) model such that the outcrop of the KDG is predicted just outside the southern edge of the Park when a dip of 6° is used for the strata. There was no evidence for mineworking in this borehole.

2.4.13 55/63/056

This borehole was drilled to constrain the outcrop of the KDG in the eastern, faulted part of the study area. The borehole encountered 2.6m thick of drift with 0.6m of till above rockhead. A 1.2m void interpreted to be that of the KDG was present 2.5m below rockhead. The void appears to be in place as it has a seatrock beneath it and waterstaining above. In this short borehole, the stratigraphical correlation is based on the lithology and the expected geology of the area. As the typical *Lingula* band was not present above the void (the 1.2m void is quite large and probably the roof has been removed), it is not absolutely certain that the void represents the KDG workings. There is a very small possibility that the void could represent working of another, higher coal such as the Jubilee, but this is considered unlikely as the contour model in fault block E can be constructed consistently when constrained by boreholes 55/63/053 and BGS number NS56SE793.

2.5 FEATURES SURVEYED IN THE PARK DURING THE DRILLING PERIOD

Boggy and uneven ground in the southern area of the Park was rapidly mapped during the drilling period, using GPS to define corner point locations. In Bellahouston Park there have been several generations of buildings, roads, drains and landscaping and these could produce the same boggy and uneven ground as ground movements due to mining-related subsidence. There may be an association with mineworkings between two large areas of uneven ground in fault blocks D and F in the eastern Park and their location down-dip of the revised KDG outcrop (Figure 13) but this is very tentative and could have numerous other causes such as previous buildings, drains etc.

3 The revised geological model

3.1 METHODOLOGY

Contour models were interpreted for rockhead, drift thickness, the most marine band in the Black Metals Member and seven coal seams using the new and pre-existing borehole datasets (Figures 4-11). The coal seams were the Knott, Knott Rider, Knightswood Gas, Jubilee, Glasgow Shale, Pollock Stone and Possil Main. The resultant structure contour models were also constrained by projecting stratigraphical horizons that were just above rockhead onto boreholes using the standard sequence shown in Figure 2 (e.g. level of Black Metals Member marine band in BH13 was projected to above rockhead). Coal seam outcrops on the base of the horizon were drawn where structure contours intersected the rockhead surface, calculated using a local dip and borehole thicknesses (Figures 11, 13). Standard intervals between horizons (Figure 2) were used where no borehole data was present. It should be noted that because of the substantial topography on the rockhead surface, that sometimes varies more quickly than the dip of the solid geology, the coal seam outcrops can be quite sinuous.

3.2 DRIFT THICKNESS AND ROCKHEAD

Minor adjustments were made to the rockhead and drift thickness models of Rogers and Sowerbutts (2000) to incorporate the new borehole dataset (Figures 10, 11). The main feature is a rockhead low and drift thickness high in the centre of the studied area.

3.3 SOLID GEOLOGY

The solid geology map is similar to that given in Rogers and Sowerbutts (2000) with the outcrop of the KDG proved to be farther south by the new boreholes (Figure 12). The biggest changes in the geological model reflect the revised interpretation of Pollock BH13 as beneath the Black Metals Member and the results of the new boreholes 55/63/052 and 55/63/055.

3.3.1 North-east to easterly dipping fault block A (Figure 12)

The overall structure of this fault block is that strata dip to the north-east and to the east-north-east; they are gently folded with the dip increasing from *c.* 6° to *c.* 10° towards the NNW-trending fault F_{AB} (Figures 1, 6, 7). Both the outcrop and structure contours of the KDG and Jubilee Coal were revised in this fault block from the Rogers and Sowerbutts (2000) model. The revisions were due to the new boreholes in the case of the position of the KDG outcrop and contours, and a re-assessment of the Jubilee Coal. The revised outcrop of the KDG is now positioned close to the southern edge of the Park and beneath Mosspark Boulevard (Figure 6)

In many boreholes in this fault block A the Jubilee Coal is not present, but based on experience gained in this study, existing boreholes were re-assessed to see whether they were up- or down-dip of the Jubilee Coal outcrop. This resulted in an approximately east-west fault with a throw of a few metres being added to the geological model (Figures 6, 7). This fault results in the KDG 10m and 5m structure contours being more widely spaced than expected between the Pitch and Putt and running track, and in the offset of the Jubilee Coal position outcrop. The sinuous outcrop of the Jubilee Coal in the other parts of the fault block is due to the intersection of a folded succession with an uneven rockhead surface.

3.3.2 South-easterly dipping fault blocks B-F (Figure 12)

The overall structure is a south-easterly dipping succession dissected into five fault blocks B-F defined by NNW-trending faults (Figures 4-9). The faults have throws of a few to twenty metres. The strike of the strata has been edited from the Rogers and Sowerbutts (2000) model in response to the data from the newly drilled boreholes and varies slightly between fault blocks. The outcrop of the KDG traverses the eastern part of the Park on a roughly north-east trend, and is well constrained by boreholes (Figure 6).

Correlation of new and existing borehole datasets results in varying dips within fault blocks, as would be expected in a faulted succession of Carboniferous age. On the north-west side of the area towards the drumlin hill, borehole correlations indicate a low dip of *c.* 0.4-5° within the succession below the Knott Coal or between the KDG and Knott Coal (Figures 4, 5). The general pattern is then a south-eastwards increase in dip to *c*. 6-19° and a subsequent decrease in dip to *c.* 6-9° towards the southern margin of the Park. The variations in dip are shown by the spacing of structure contours on Figures 5 to 9. The south-eastwards increase in dip is particularly acute in fault blocks B and C from *c.* 0.4-5 to 19° (Figures 4, 5). An alternative interpretation to varying dips across fault blocks B and C would be a roughly east-west fault thrown down to the south. In fault block C, the outcrop position of the ?Banton Rider Coal void level from Pollock BH13 was calculated using a dip of 6° and assuming a rockhead surface at 10m (Figure 12). However, if fault block C followed the changes in dip interpreted in fault block B, and the dip decreased northwards from to *c.* 5 to 0.4°, the Banton Rider Coal would not crop out until farther north, under the drumlin. Alternatively, fault block C could be closed by its bounding faults to the north.

The NNW-trending fault F_{EF} (Figure 1) is interpreted with a throw of less than 1m in the vicinity of the KDG outcrop, but increasing away from this point up to c. 10m (Figures 4-9). In reality this structure is likely to be two faults that have joined, or two, close en-echelon faults.

4 Hazard model

4.1 COAL SEAM WORKING IN THE KNIGHTSWOOD GAS COAL

Of the five boreholes that are interpreted to have penetrated the KDG level during this drilling programme, four penetrated open voids ranging from 0.8 to 1.4 m in thickness. The fifth borehole drilled through an intact coal with evidence that this was a stoop (see 54/63/024 above). The drilling supports the points made by Rogers and Sowerbutts (2000) that the KDG has been worked extensively by stoop and room methods across the Park and that rooms remain open. To the south of the Park, mine plans exist and longwall extraction is indicated. However, in this area of Bellahouston Park, open voids indicate that stoop and room workings are present. Taking into account the 4 boreholes that encountered voids in this study the average KDG void thickness has been revised to 0.92m.

4.2 CALCULATION OF HAZARD CLASSES

Given that the new boreholes have not changed our understanding of the type of coal working or markedly changed the areas of the Park at risk from mining-related subsidence, the same criteria as used in the Rogers and Sowerbutts (2000) model were used to calculate the revised hazard model related to mineworkings of the Knightswood Gas Coal presented in this report. A rule-of-thumb for migration of a void to the surface due to the collapse of mineworkings has been used (Bell 1978). This indicates that migration of a void to the surface is unlikely if the worked void height is less than one tenth the thickness of rock overlying the void, or one twentieth of the thickness of drift deposits. Given that drift cover is present throughout Bellahouston Park but does not exceed 20m in the vicinity of the KDG outcrop, and using a conservative average void spacing of the KDG of 0.94m, a conservative combination applying this rule-of-thumb to the solid and drift succession is that migration of the void to the surface would be unlikely with a drift thickness greater than 9.4m and/or the void more than 5.25m from rockhead.

The hazard class 1 areas were calculated in ArcView 3.3 by identifying areas from the geological model where the drift cover was less than 9.4m thick and the amount of rock from the base of the KDG to rockhead was less than 5.25m (assuming a flat rockhead and constant dip from the KDG outcrop; Tables 2, 3). A buffer of 10m was used for the position of faults and edited manually where boreholes constrained the uncertainty in fault position to less than 10m. A buffer of 10m was used to represent the uncertainty in the position of the KDG outcrop. The buffer was edited manually where boreholes constrained the uncertainty in the up-dip outcrop position to less than 10m. The buffer has been reduced from the 50m used in Rogers and Sowerbutts (2000) to 10m because of the increased certainty in the geological model due to the borehole drilling programme. The thickness of 5.25m from the KDG to

rockhead was calculated in each fault block, using a dip defined in each fault block by the KDG structure contours. The dip used and resultant distance from the outcrop for each fault block is shown in Table 2.

Hazard class areas A1, B2, C3, D2 and E3 for seams other than the Knightswood Gas Coal were defined using similar criteria, based on the combination of drift thickness and the distance from the Pollock Stone or Banton Rider coal to rockhead (see Table 3). The letters for these hazard classes are used to differentiate the hazards from the different coal seams, the numbers are used to signify that the same hazard class as is appropriate to the Knightswood Gas Coal.

Nine hazard classes have been designated in the southern part of Bellahouston Park (Table 3).

Fault block	**Calculated dip in degrees near the KDG outcrop**	**Horizontal distance in metres from outcrop to give 5.25m vertically between base KDG and rockhead (assuming flat rockhead)**	**Total buffer distance used, in metres, down-dip from KDG outcrop**
A	7	43	53
B	5.5	55	65
C	6.8	44	54
D	6.6	45	55
E	11.3	26	36
F	10.5	28	38

Table 2. Dips used in the calculation of the hazard class areas 1 and 2

Hazard Class	Definition	Hazard assessment	Subsidence features
Hazard Class 1 (greatest hazard)	Area with drift thickness less than 9.4m and less than 5.25m of rock between the base KDG and rockhead	Greatest likelihood of voids reaching the surface	Several crown holes have developed in this area
Hazard Class 2	Area with drift thickness greater than 9.4m and less than 5.25m of rock between the base KDG and rockhead	Reduced likelihood of voids reaching the surface due to thicker drift cover	One possible collapse feature in this area
Hazard Class 3	Area where base KDG is greater than 5.25m from rockhead. Coal is at increasing depth with increasing distance from outcrop	Possibility for collapses exists but worked coals at greater depth from rockhead	
Hazard Class 4 (least hazard)	No evidence of worked coal seams beneath this area	No direct evidence for mining related hazard on the up-dip side of the KDG outcrop	
Hazard Class A1	Area with drift thickness less than 9.4m and less than 5.25m of rock between the Pollock Stone Coal and rockhead (using a dip of 12°)	If the Pollock Stone Coal has been worked in the Park then there is a similar likelihood to Hazard Class 1 of voids reaching the surface. If the Pollock Stone Coal has not been worked, the area is of Hazard Class 3.	
Hazard Class B2	Area with drift thickness greater than 9.4m and less than 5.25m of rock between the Pollock Stone Coal and rockhead (using a dip of 12°)	If the Pollock Stone Coal has been worked in the Park then there is a reduced likelihood, similar to Hazard Class 2, of voids reaching the surface. If the Pollock Stone Coal has not been worked, the area is of Hazard Class 3.	
Hazard Class C3	Area with drift thickness greater than 9.4m and more than 5.25m of rock between the Pollock Stone Coal and rockhead (using a dip of 12°)	If the Pollock Stone Coal has been worked in the Park then the possibility for collapses exists but the coal is at increasing depth from rockhead. The hazard is similar to Hazard Class 3 but with the possibility for both Pollock Stone Coal and KDG workings at depth. If the Pollock Stone Coal has not been worked, the area is of Hazard Class 3.	
Hazard Class D2	Area with drift thickness more than 9.4m and less than 5.25m of rock between the Banton Rider Coal and rockhead (using a dip of 6° from Pollock BH13 void)	If the Banton Rider Coal has been worked in this part of the Park then there is a reduced likelihood, similar to Hazard Class 2, of voids reaching the surface. If the Banton Rider Coal has not been worked, the area is of Hazard Class 4.	
Hazard Class E3	Area with drift thickness greater than 9.4m and more than 5.25m of rock between the Banton Rider Coal and rockhead (using a dip of 6° from Pollock BH13 void)	Pollock BH13 shows that the Banton Rider Coal has been worked in this hazard class. The possibility for collapses exists but the coal is at increasing depth from rockhead. The hazard is similar to Hazard Class 3 and decreases to the SSE, down dip of the projected outcrop	

Table 3. Description of hazard classes for southern Bellahouston Park.

4.3 DISCUSSION

Figures 14 and 15 show the revised hazard model for the southern part of Bellahouston Park. The outcome of the borehole drilling program has been to increase the certainty in the position of the KDG outcrop such that the area of greatest hazard has been refined and has decreased, and the area of least hazard has increased, compared to the Rogers and Sowerbutts (2000) model. However, the limitations of the geological and hazard model as interpretations of site investigation data must be realised and Figure 15 shows the variable distribution of data points constraining the model. The boundaries of the hazard classes are inherently fuzzy apart from where tightly constrained by good quality data points.

In the western fault block A, the outcrop position of the KDG is now known with greater certainty and is farther south than in Rogers and Sowerbutts (2000), occurring on the southern margin of the Park (Figure 6). As the strata dip north-east there are areas of hazard classes 1 and 2 in the Park, south of the Pitch and Putt. The minimum drift thickness proved by a borehole in the hazard class 1 area east of the running track is 5m. The remainder of the area is of hazard class 3, with workings of the KDG greater than 5.25m from rockhead and a variably thick drift cover. The farther north-east within this class 3 area, the lower the hazard.

In the eastern part of the Park over fault blocks B-F (Figure 1), the outcrop of the KDG is constrained quite tightly trending north-east across the lower ground, or just south of the Park in fault block C (Figure 6, 12). As the strata dip south-east, hazard class 1 and 2 areas exist within the Park. Of particular concern may be an area of hazard class 1 that crosses the eastern part of the Park on a north-east trend where the minimum drift thickness proved in boreholes is 2.5m. To the south-east of the hazard class 1 and 2 areas, an area of hazard class 3 exists with the hazard decreasing to the south-east as the KDG is at increasing depth from rockhead.

In the western and eastern areas of the Park in hazard class 1, 2, 3 areas the possibility exists for entrances to the KDG workings i.e. unlocated shafts, the position of which cannot be predicted from the geological model.

Two areas of hazard class 4, least hazard have been interpreted up-dip of the KDG outcrop. In the western fault block A, hazard class 4 covers only a very small area of the Park. In the eastern fault blocks B and D-F, a much larger area of hazard class 4 land has been assigned. There is no evidence of working in any boreholes within the hazard class 4 area.

Areas of more uncertain hazard class A1, B2, C3, D2 and E3 have been assigned to the Pollock Stone Coal and Banton Rider Coal (Figures 14,15, Table 3). South-west of the 'Pavilions' site in fault block C (Figure 1), Pollock BH13 proved a 1.1m void at –1.7mOD, with 14.2m of rock between the void and rockhead and 8m of drift. The revised interpretation is that the worked horizon was the thin coal and ironstones that constitute the Banton Rider Coal, beneath the Black Metals Member. These strata exist relatively close to the surface only in the small upfaulted horst block C and it is possible that they were not worked extensively due to faulting, their depth, and the inferior quality of the resource. The void in Pollock BH13 does not pose a significant hazard because of its depth. At this location the hazard class E3 is assigned, with the similar characteristics to hazard class 3. Due to the dip, the farther SSE in fault block C, the lower the hazard. If the Banton Rider Coal workings extend up-dip to outcrop there would be a greater-class hazard D2, similar to hazard class 2 around the outcrop zone. However, as discussed above, there is the possibility within the geological model that the dip decreases northwards and that the Banton Rider outcrop and area of hazard class D2 would be farther north. Thus the position of hazard class D2 shown on Figures 14 and 15 is the worst-case scenario given the available geological information. There is also the possibility that fault block C might close northwards, again reducing the area of hazard class D2. Drilling another borehole NNW of Pollock BH13 might resolve some of these issues and quantify the hazard further. Any entrance (shaft) to the workings identified in Pollock BH13 poses an unlocated hazard.

Hazard classes A1, B2 and C3 have been assigned around, and immediately down-dip of the interpreted Pollock Stone Coal outcrop in the far south-east of the Park. The two boreholes that penetrate the Pollock Stone Coal within Bellahouston Park have shown it to be intact, but this coal has been worked immediately east of the Park. To the east, four boreholes proved packed waste of thickness 0.91-1.98 m at the Pollock Stone Coal position. A possibility therefore exists for workings of the Pollock Stone Coal within the Park. If there are workings, hazard classes A1 and B2 similar to hazard class 1 and 2 for the KDG would apply at the coal outcrop and immediately down dip. Hazard class C3 would apply at increasing distances from rockhead, similar to hazard class 3 for the KDG, but with the added

complication that both Pollock Stone and KDG workings may be present. Drilling further boreholes in the far south-east corner of the Park would give a better indication of whether the Pollock Stone Coal has been worked within the Park and therefore which hazard classes are appropriate to this area.

5 Conclusions

- The borehole drilling programme has greatly improved confidence in the geological and hazard models.
- The revised model is consistent with the position of crown holes and other subsidence features developing in areas with a thin drift cover and where the Knightswood Gas Coal is close to the rockhead surface, as described in Rogers and Sowerbutts (2000).
- The detection of voids and solid coal during drilling of the Knightswood Gas Coal confirms that coal was extracted beneath the Park using partial extraction (stoop and room) rather than total extraction methods.
- The presence of abandoned mineworkings under Bellahouston Park does restrict the activities that can be undertaken in the Park.
- Evidence suggests that areas designated hazard classes 1 and 2 represent those at risk from crown hole development from collapse of mineworkings in the Knightswood Gas Coal.
- It is recommended that no temporary or permanent buildings or structures of any kind be installed in hazard classes 1 and 2 zones without further investigation to confirm ground conditions and, if applicable, ground reinforcement. However, the risk of severe injury or death to pedestrian traffic is low.
- It is recommended that only pedestrians be allowed to use areas classified as hazard class 1.
- Pedestrians and cars could use areas classified as hazard class 2, but it is suggested that the Council consider reinforcing the ground to be used for cars with a geofabric.
- The same recommendations for usage apply to hazard class A1 as to hazard class 1. The same recommendations for usage apply to hazard classes B2 and D2 as to hazard class 2.
- Usage of the areas designated hazard class 3 is more complex. It is recommended that heavy equipment or point-loaded structures are not installed in these zones without further investigation to confirm ground conditions and, if applicable, ground reinforcement. However, hazard class 3 areas may not require ground stabilisation for heavier installations with well-distributed loads or for low loads such as cars. The risk to pedestrian traffic in hazard class 3 is very low and cars may be parked in this area.
- The same recommendations for usage apply to hazard classes C3 and E3 as to hazard class 3.
- The area designated hazard class 4 has been enlarged as a result of the borehole drilling programme. None of the new or pre-existing boreholes in this area showed evidence for mineworkings and, from the geological modelling, the area is assumed not to be undermined. The likelihood of any mining related incident occurring is extremely low. Usage of this area would be subject to foundation conditions appropriate for the drift and man-made deposits (not assessed here).
- The Council should be aware that a slow deterioration of mineworkings is likely to continue over the medium to long term assuming no significant changes are made to the site.

6 References

Bell, F. G. 1978. Subsidence due to mining operations. In: Bell, F. G. (ed.) Foundation engineering in difficult ground. London: Butterworths. 322-362.

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Hinxman, LW, Anderson EM and Carruthers RG. 1920. The Economic Geology of the Central Coalfield of Scotland Area IV, Paisley, Barrhead and Renfrew. Memoir of the Geological Survey, Scotland.

Rogers, S F and Sowerbutts, A A. 2000. The geology of Bellahouston Park, Glasgow and its influence upon mining-related subsidence. British Geological Survey Technical Report WN/2000/02C.

Appendix 1

Borehole logs - enclosed

Appendix 2

2A. Figure explaining ArcView generated keys

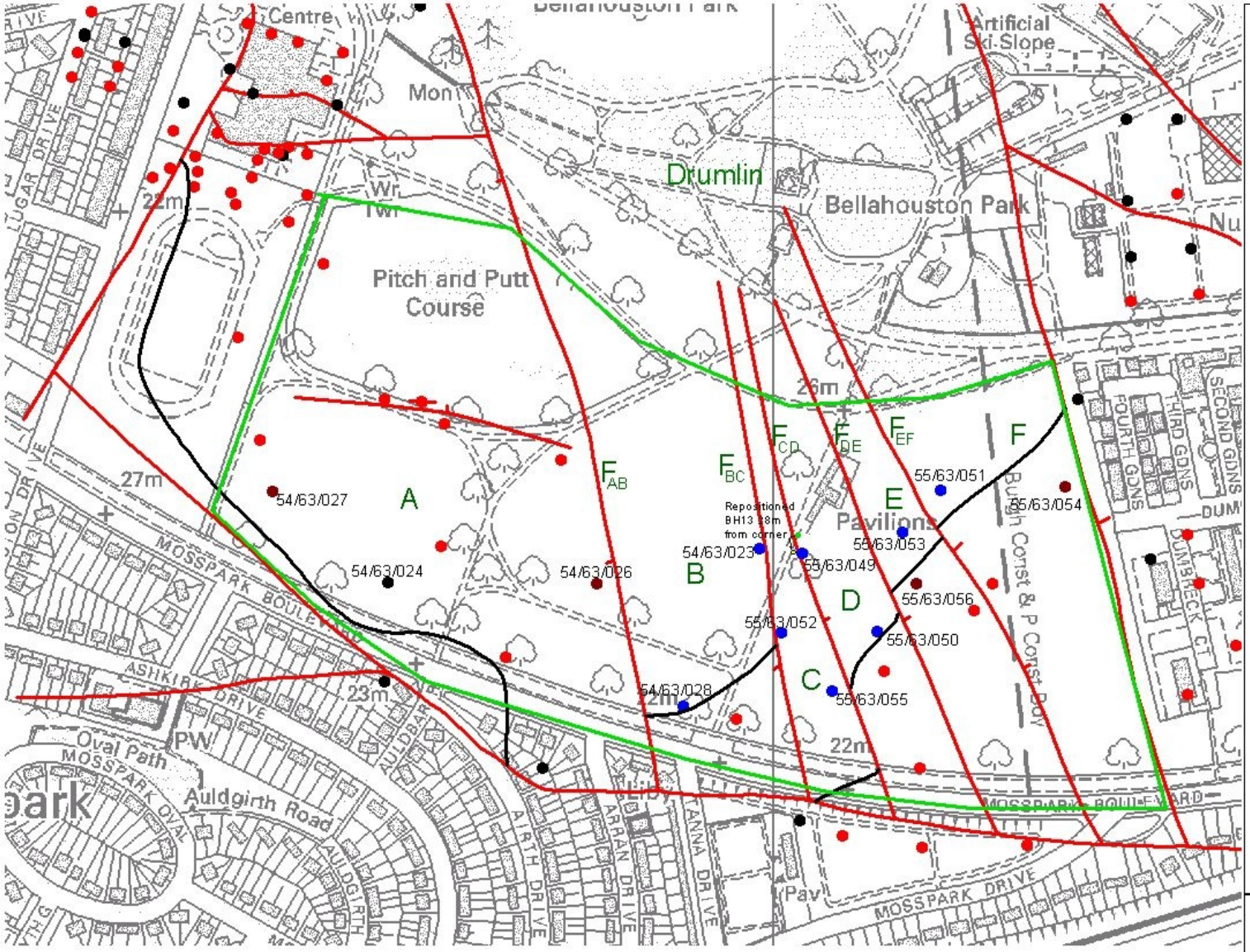
2B. Terminology used in the report and logs

From the BGS Rock Classification Scheme
SDST=sandstone
SLST=siltstone
MDST=mudstone
CMDST= carbonaceous mudstone
CANL= cannel
COAL=coal
FEST=ironstone
FEMDST=ironstone, mud grade
VOID =open void, coal working
DMTN=diamicton (used for boulder clay)
SANDU=sand
CLAY=clay
SOIL=soil
From the BGS stratigraphic Lexicon
JF=Jubilee Coal
KDG=Knightswood Gas Coal
KRIC=Knott Rider Coal
KNO=Knott Coal
BKME=Black Metals Member
MGR= made ground
DRFT=drift undifferentiated
BNRC= Banton Rider Coal
PMA=Possil Main Coal
PSTC= Pollock Stone Coal
Other terms
carb-mic-sid= carbonaceous-micaceous-sideritic
'U2' horizon or coal – a thin coal sometimes present between the Knott and Knott Rider Coals but not formally named. 'U2' was used by Ian Forsyth in the BGS records collection.
PDI = passes down into
ES = erosional surface, FT = fault, RH = rockhead, TD = total depth of the borehole

Appendix 2. Explanation of automatic keys on figures generated in ArcView

Revisedfaults2003.shp	Faults, tick on downthrow side
Revcoalcrops2003v2.shp	Coal outcrops
Revpstccontours2003.shp	Pollock Stone Coal contours relative to OD
Revgwsbh2003.shp	Boreholes penetrating Glasgow Shale Coal
Revgwscontours2003.shp	Glasgow Shale Coal contours relative to OD
Revjfbh2003.shp	Boreholes penetrating Jubilee Coal
Revjfcontours2003.shp	Jubilee contours relative to OD
Revkdgcrop2003.shp	Knightswood Gas outcrop
Revkdgbh2003.shp	Boreholes penetrating Knightswood Gas Coal
N	N=coal not worked
Y	Y=coal worked (void or waste)
Revkdgcontour2003.shp	Knightswood Gas contours relative to OD
Revknocontours2003.shp	Knott contours relative to OD
Knott3bh.shp	Boreholes penetrating Knott Coal
Bkmebh2003.shp	Boreholes penetrating Black Metals Member
Marinebkme.shp	Black Metals Member contours relative to OD
Updatedboreholes2003.shp	Boreholes from BGS database
Revdriftbh2003v3.shp	Drift boreholes labelled with drift thickness or rockhead
Revisedrockhead2003.shp	Rockhead contours in metres relative to OD
0	
5	
10	
15	
20	
23	
2.5	
Reviseddrthickness2003.shp	Drift thickness contours in metres
1	
5	
10	
15	
20	
25	
2.5	
Newboreholes.shp	Location of new boreholes, label described in figure
NA	blue dot=borehole in strata below KDG
NO	black dot=borehole encounters intact KDG
YES	dark red dot= borehole encounters void of KDG
Hazardareas2003v2.shp	Hazard class areas
Hazard Class 1	
Hazard Class 2	
Hazard Class 3	
Hazard Class 4	
Hazard Class A1	
Hazard Class B2	
Hazard Class C3	
Hazard Class D2	
Hazard Class E3	
Miscmappedfeatures.shp	Ground features mapped during the drilling programme
Pstcbh.shp	Boreholes penetrating Pollock Stone Coal

Bellahouston Park Project 2003. Figure 1. Location of new borehole sites, area studied and fault block labels.



KEY

New boreholes labelled with GCC number: blue dots indicate strata below KDG, dark red indicate KDG void encountered, black dot KDG intact. Existing boreholes encountering a KDG void are bright red dots, intact KDG black dots, revised crop of KDG shown in black, faults in red. Fault block letters and fault names in green

Note the old position of Pollock BH13 (in green) at the southern end of the pavilions and the revised position 28m SW (in yellow).

The area studied is within the green polygon

- Labels.shp
- Revkdgcrop2003.shp

Revkdgbh2003.shp
- N
- Y

Newboreholes.shp
- NA
- NO
- YES

- Revisedfaults2003.shp

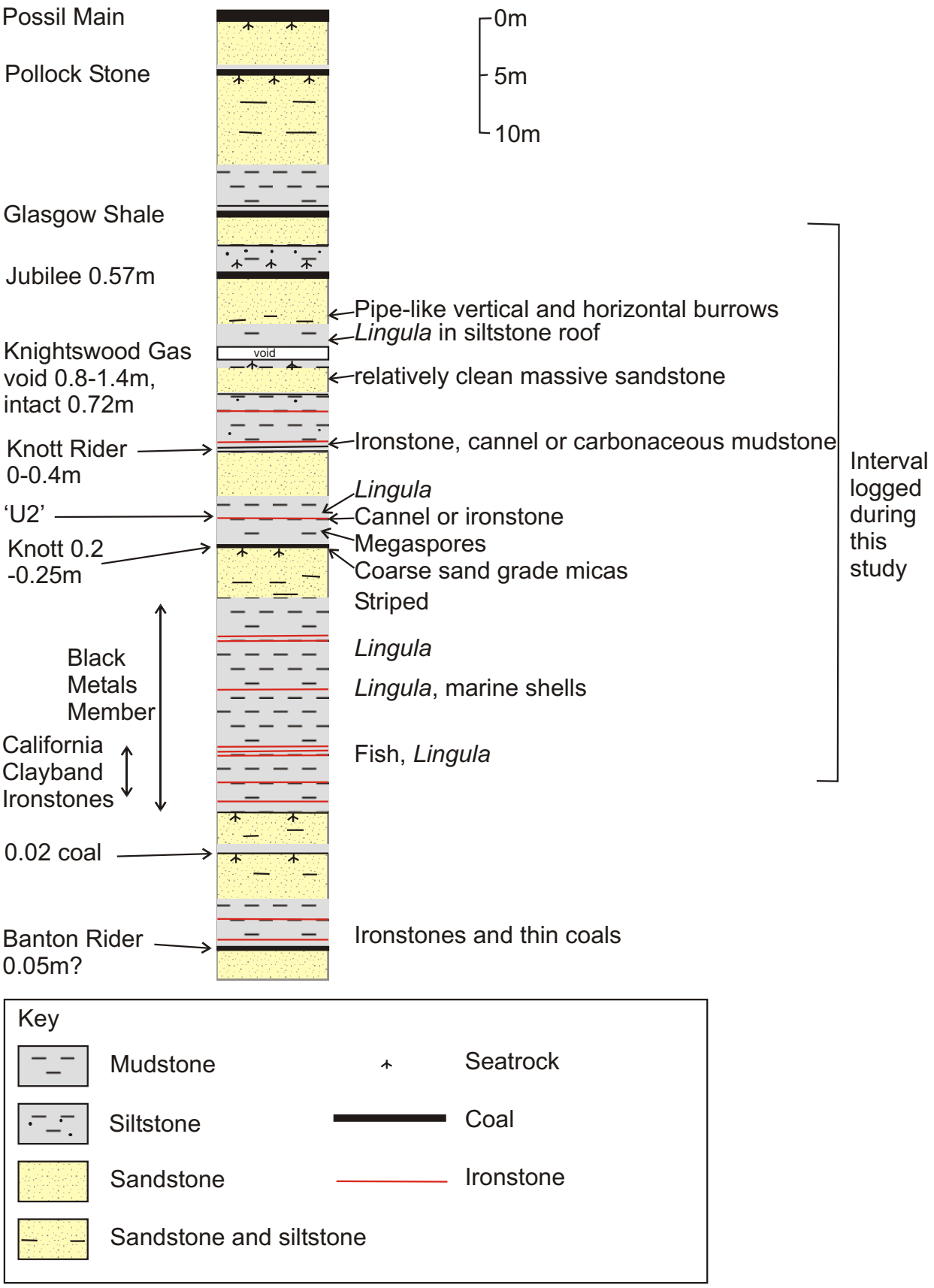
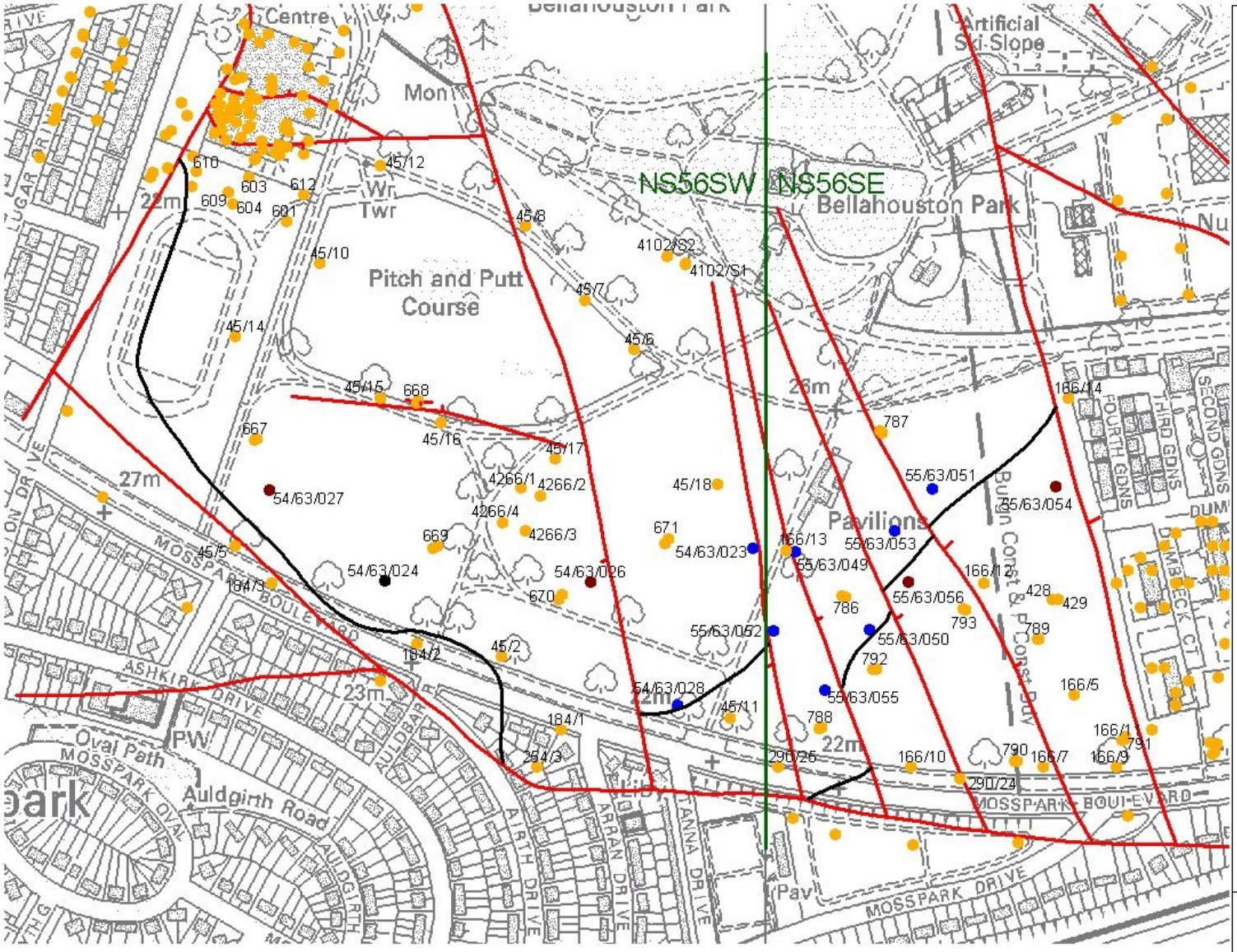


Figure 2. Summary log for the southern part of Bellahouston Park and features used for stratigraphical correlation in this study

Bellahouston Park Project 2003
Figure 3. Map showing BGS numbers for pre-existing borehole sites.

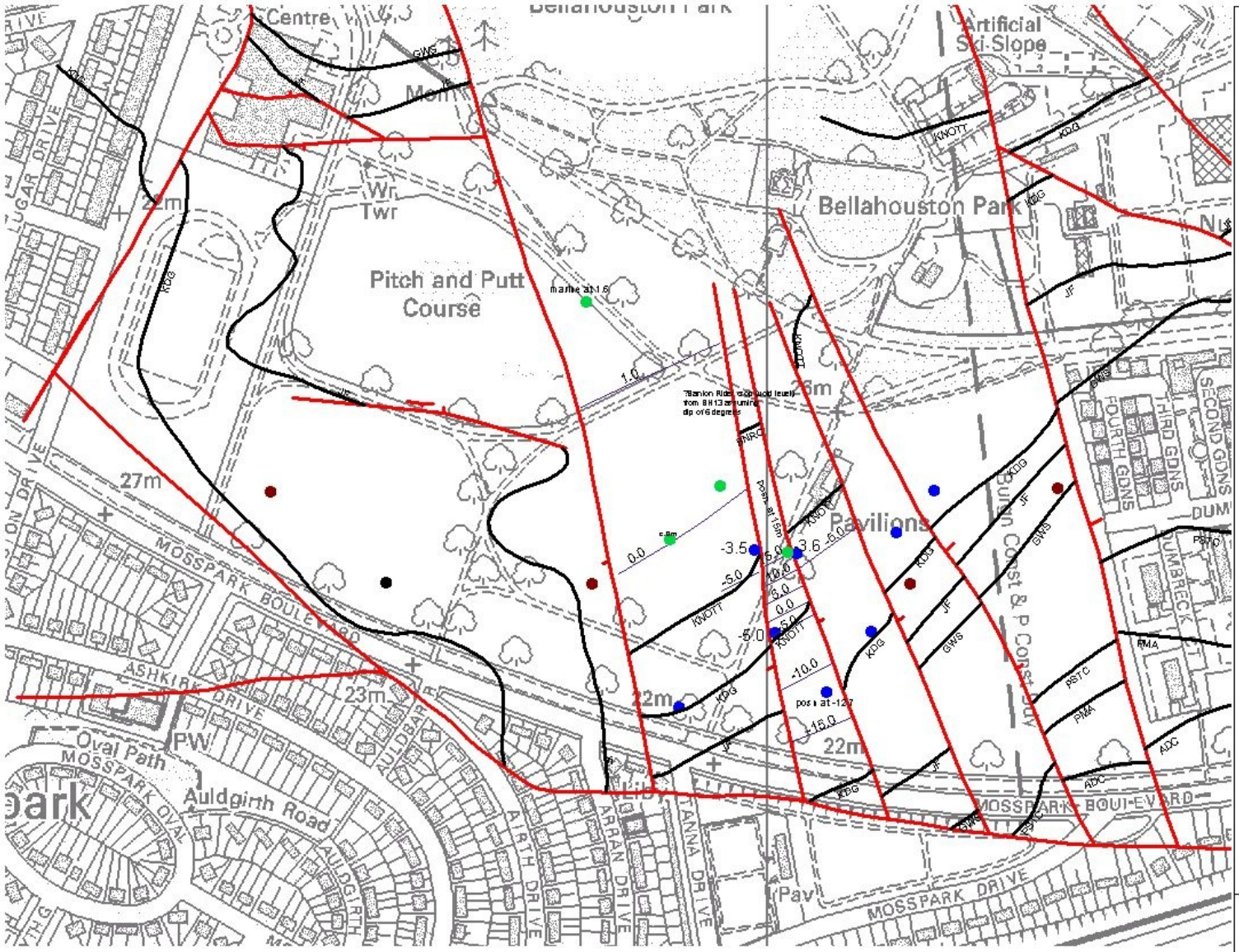


KEY

Existing borehole sites shown as orange dots and labelled with BGS number. New boreholes with GCC number, blue, dark red and black dots, revised outcrop of KDG shown in black, faults in red.

- Revkdgcrop2003.shp
- Updatedboreholes2003.shp
- Newboreholes.shp
  - NA
  - NO
  - YES
- Revisedfaults2003.shp

Bellahouston Park Project 2003
Figure 4. Black Metals Member marine band contour model



200 0 200 400 Meters

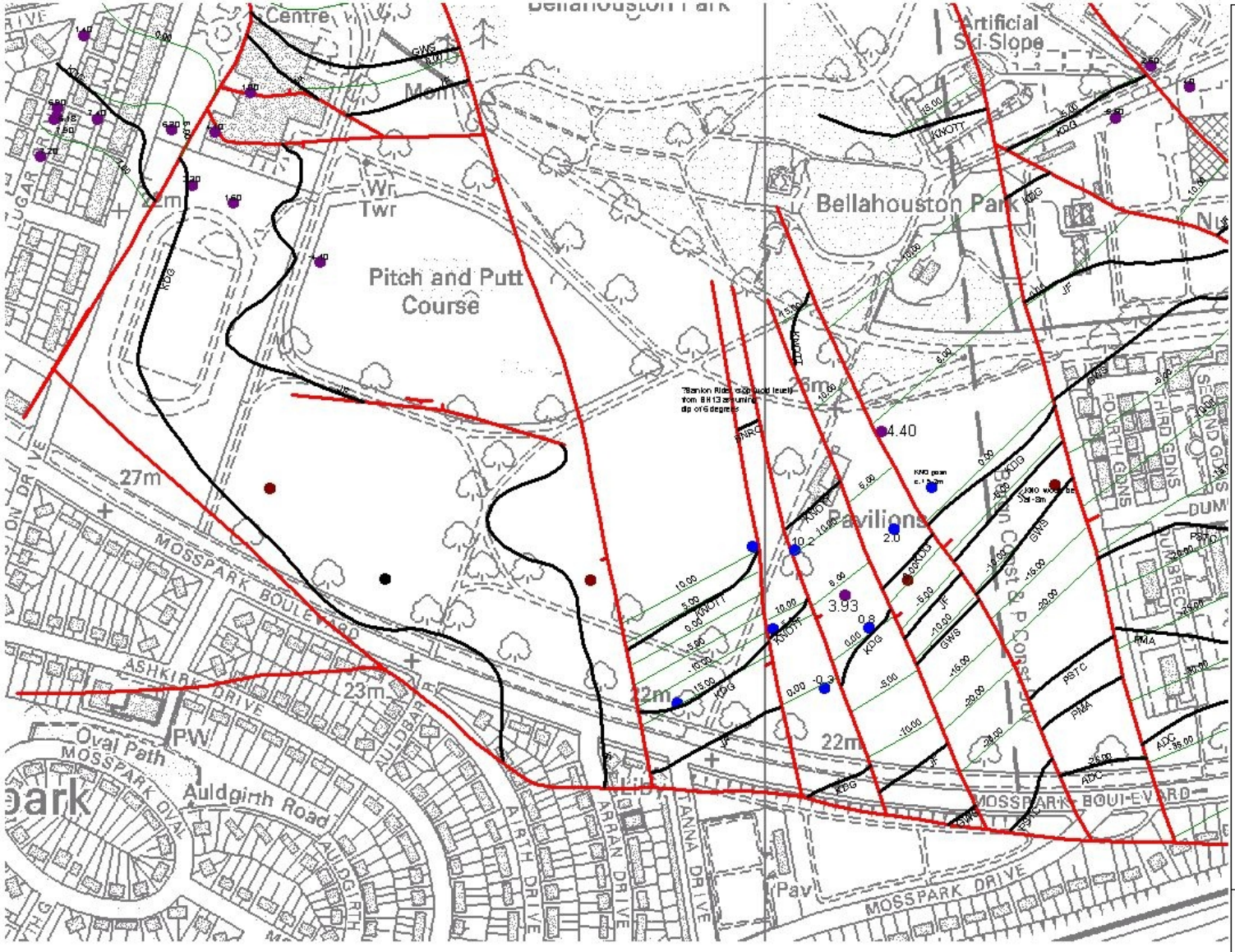
N W E S

KEY

Structure contours (blue lines) on the Black Metals Member marine band in metres relative to Ordnance Datum, constrained by existing boreholes in green and new boreholes in blue, each labelled with height relative to OD. Revised coal outcrops shown in black, faults in red.

Revcoalcrops2003v2.shp
Bkmebh2003.shp
Marinebkme.shp
Newboreholes.shp
NA
NO
YES
Revisedfaults2003.shp

Bellahouston Park Project 2003
Figure 5. Knott Coal (KNO) contour model

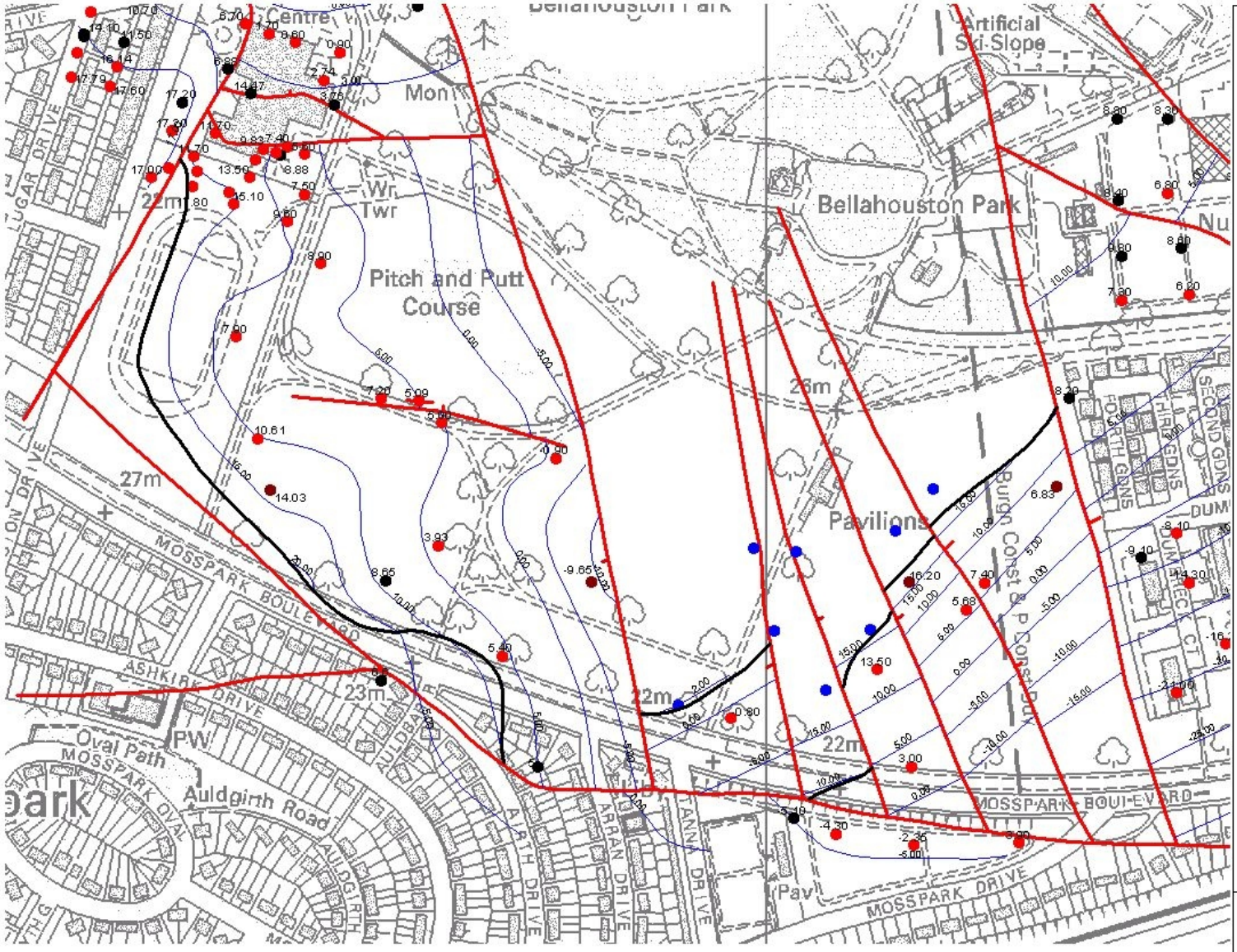


KEY

Structure contours (green lines) on the Knott Coal seam in metres relative to Ordnance Datum, constrained by existing boreholes in purple and new boreholes in blue, each labelled with height relative to OD. Revised coal outcrops shown in black, faults in red.

- **Revcoalcrops2003v2.shp**
- **Revknocontours2003.shp**
- **Knott3bh.shp**
- **Newboreholes.shp**
  - **NA**
  - **NO**
  - **YES**
- **Revisedfaults2003.shp**

Bellahouston Park Project 2003
Figure 6. Knightswood Gas Coal (KDG) contour model



KEY

Structure contours (blue lines) on the Knightswood Gas Coal seam in metres relative to Ordnance Datum. Constrained by existing boreholes in bright red (void encountered) and black (intact coal) and new boreholes in blue (strata beneath KDG), dark red (encountered KDG void) and black (intact KDG). Each labelled with height relative to OD. Revised KDG outcrop shown in black, faults in red.

Revkdgcrop2003.shp

Revkdgbh2003.shp

- **N**
- **Y**

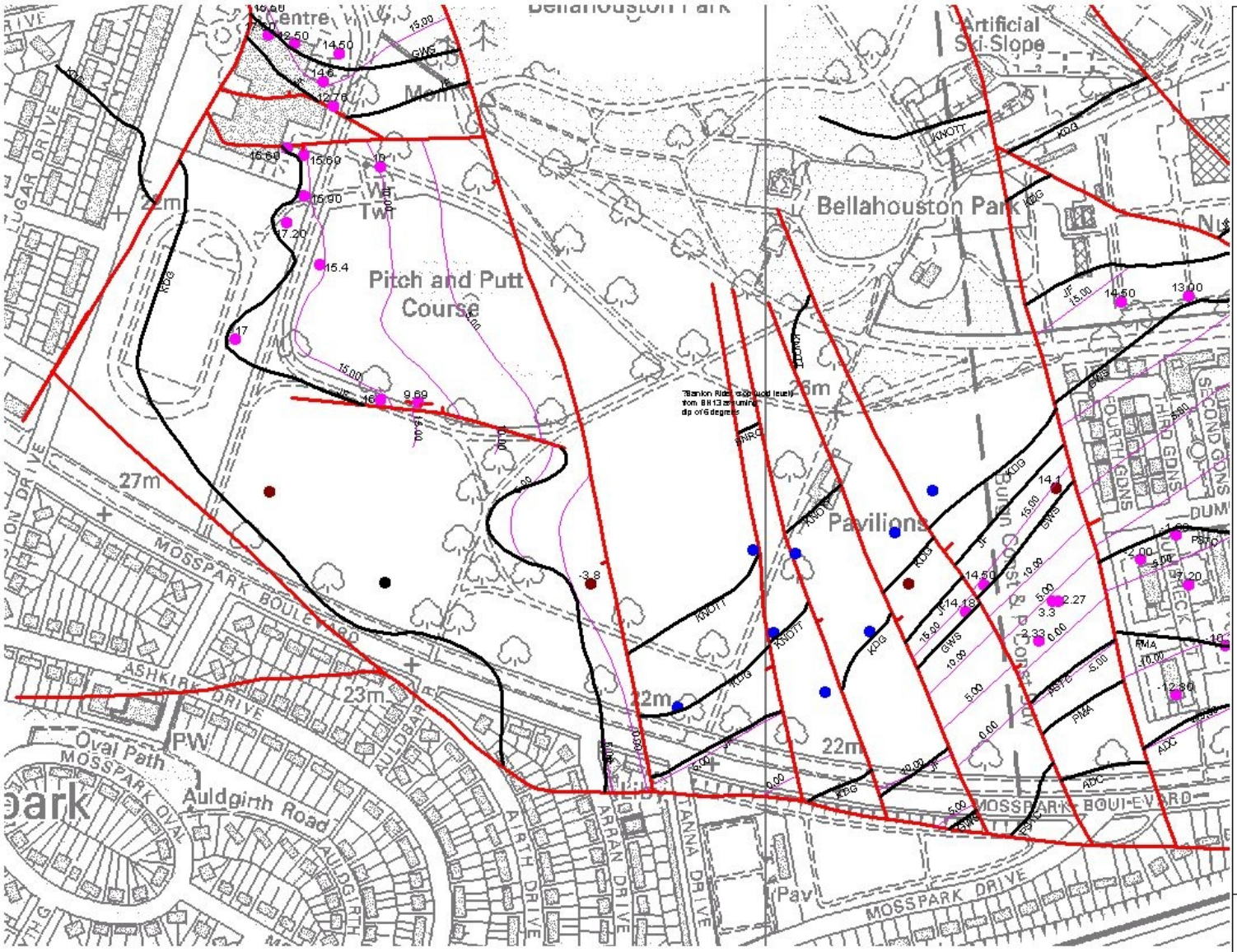
Revkdgcontour2003.shp

Newboreholes.shp

- **NA**
- **NO**
- **YES**

Revisedfaults2003.shp

Bellahouston Park Project 2003
Figure 7. Jubilee Coal (JF) contour model

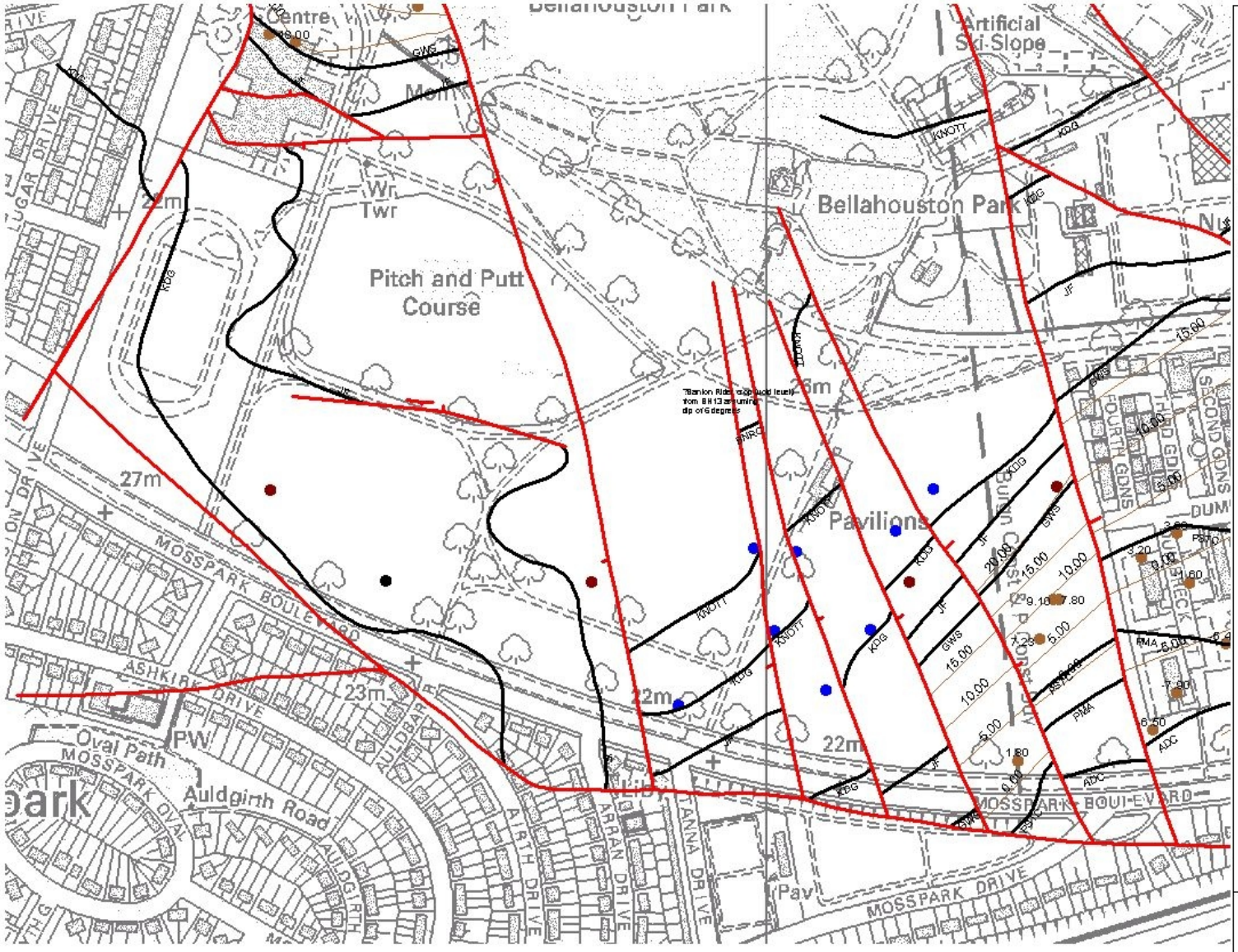


KEY

Structure contours (pink lines) on the Jubilee Coal seam (or seam position) in metres relative to Ordnance Datum, constrained by existing boreholes in pink and new boreholes in dark red each labelled with height relative to OD. Revised coal outcrops shown in black, faults in red.

- **Revcoalcrops2003v2.shp**
- **Revjfbh2003.shp**
- **Revjfcontours2003.shp**
- **Newboreholes.shp**
  - **NA**
  - **NO**
  - **YES**
- **Revisedfaults2003.shp**

Bellahouston Park Project 2003
Figure 8. Glasgow Shale Coal (GWS) contour model



200 0 200 400 Meters

N W E S

KEY

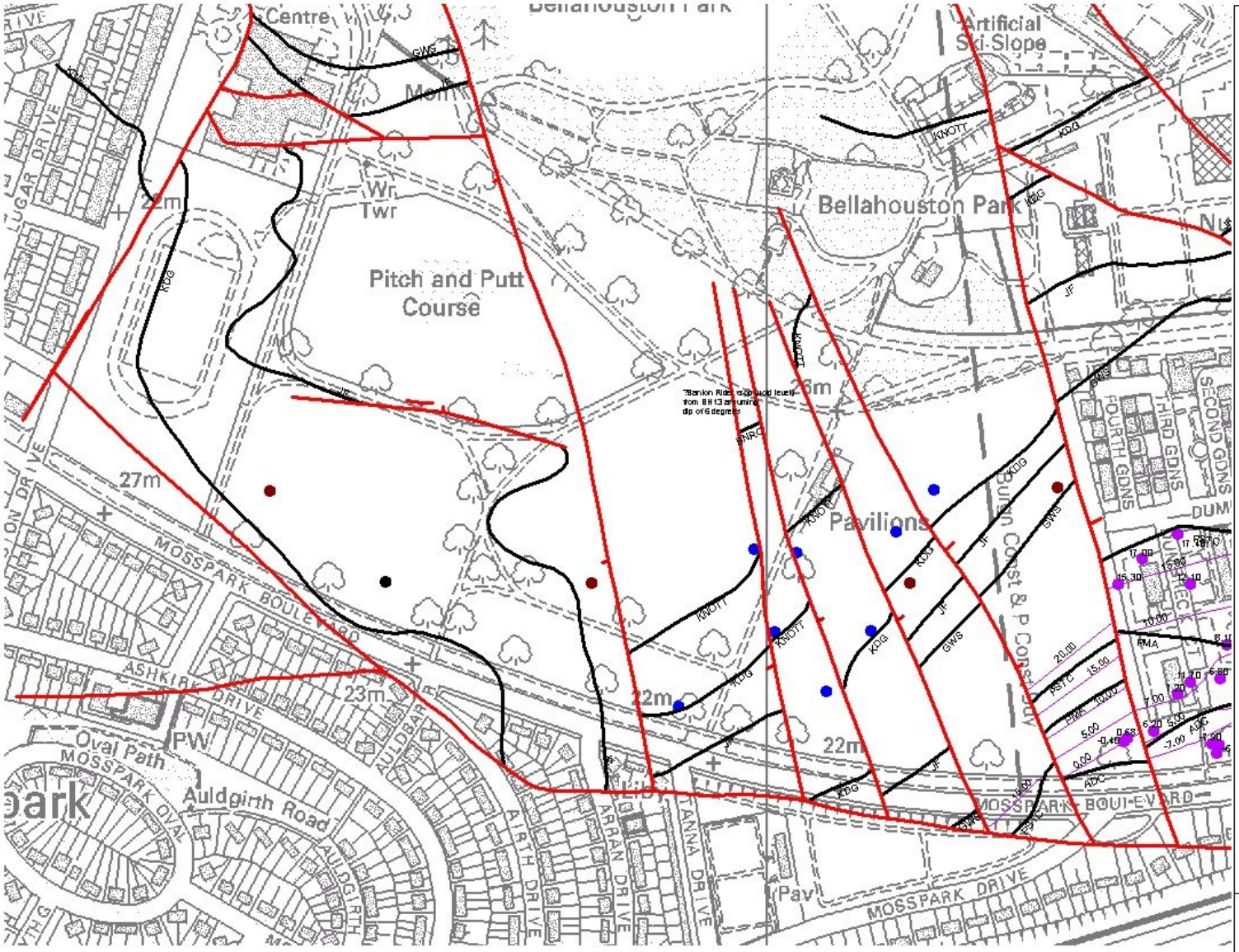
Structure contours (brown lines) on the Glasgow Shale Coal seam (or seam position) in metres relative to Ordnance Datum, constrained by existing boreholes in brown labelled with height relative to OD. Revised coal outcrops shown in black, faults in red.

- **Revisedfaults2003.shp**
- **Revcoalcrops2003v2.shp**
- **Revgwsbh2003.shp**
- **Revgwscontours2003.shp**

Newboreholes.shp

- **NA**
- **NO**
- **YES**

Bellahouston Park Project 2003
Figure 9. Pollock Stone Coal (PSTC) contour model

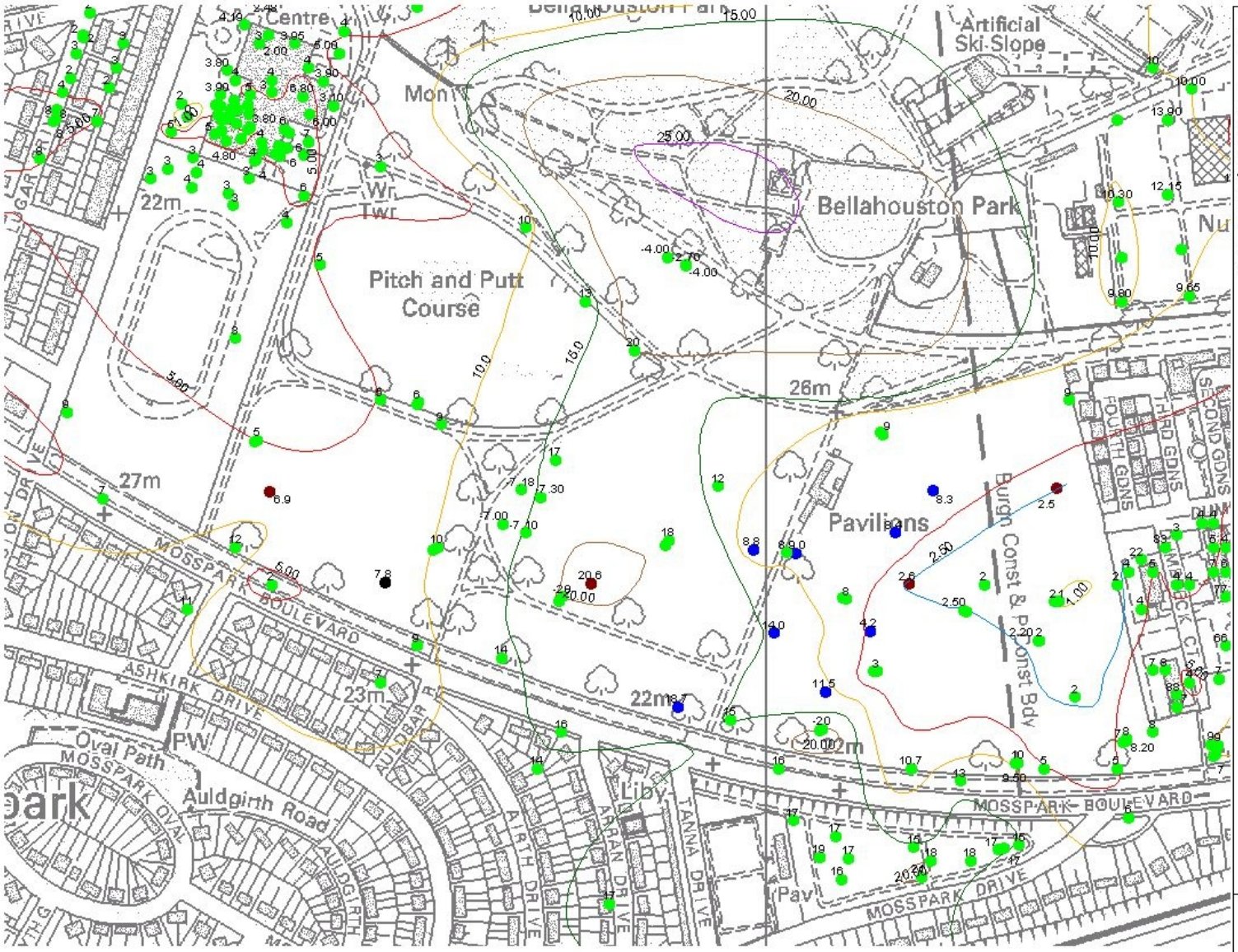


KEY

Structure contours (purple lines) on the Pollock Stone Coal seam in metres relative to Ordnance Datum, constrained by existing boreholes in purple, labelled with height relative to OD. Revised coal outcrops shown in black, faults in red.

Revisedfaults2003.shp
Revcoalcrops2003v2.shp
Revpstccontours2003.shp
Newboreholes.shp
- **NA**
- **NO**
- **YES**
- **Pstcbh.shp**

Bellahouston Park Project 2003
Figure 10. Drift thickness contour model



KEY

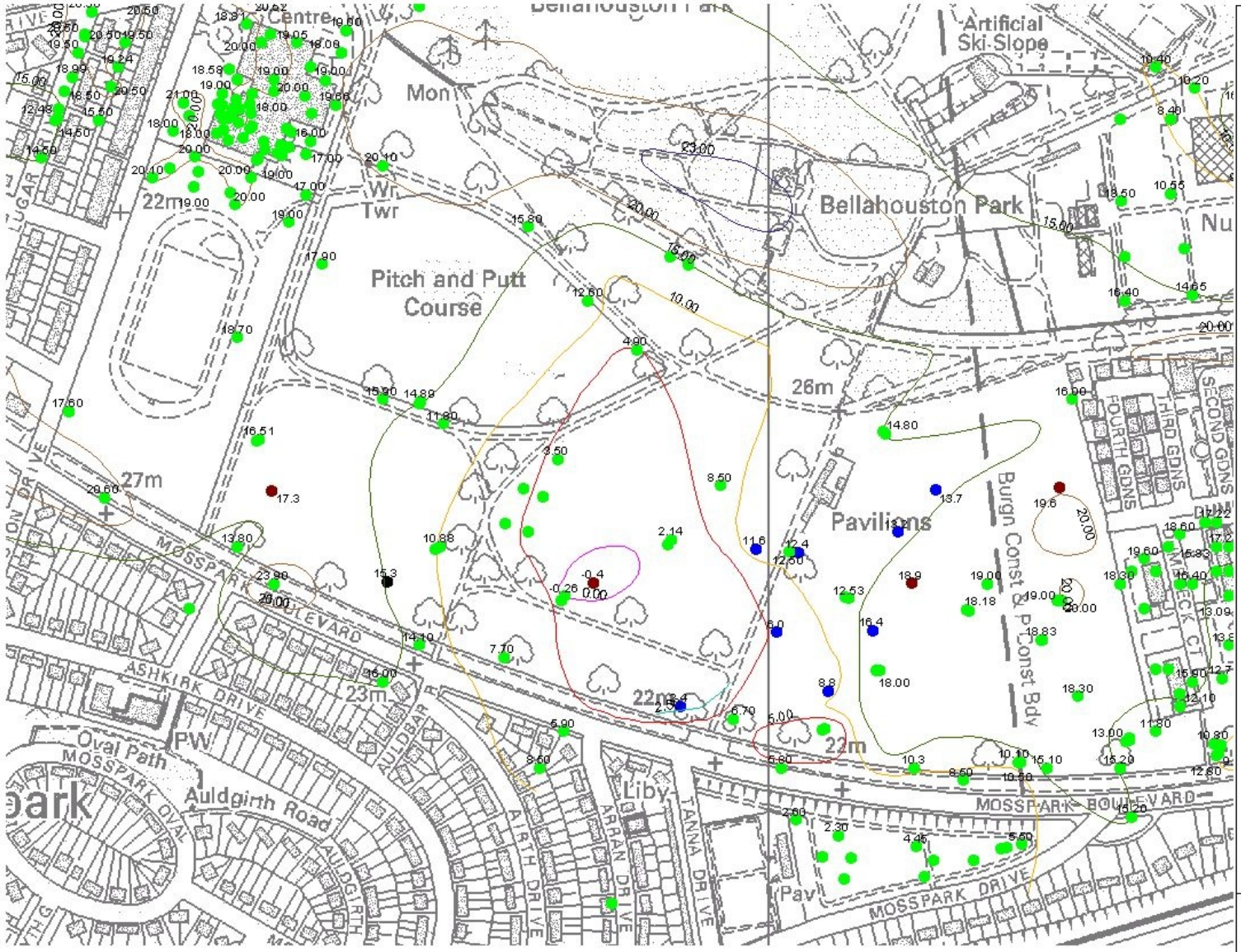
Drift thickness contours coloured as in shown below, in metres. Constrained by pre-existing boreholes in green, labelled with thickness, negative numbers where rockhead not reached. New boreholes in blue, dark red and black labelled with drift thickness.

- Revdriftbh2003v3.shp
- Reviseddrthickness2003.shp
  - 1
  - 5
  - 10
  - 15
  - 20
  - 25
  - 2.5
- Newboreholes.shp
  - NA
  - NO
  - YES

200 0 200 400 Meters

N W E S

Bellahouston Park Project 2003
Figure 11. Rockhead contour model



KEY

Rockead contours in metres relative to Ordnance Datum, colours as shown below. Constrained by existing boreholes in green and new boreholes in blue, dark red and black, each labelled with height relative to OD.

- Revdriftbh2003v3.shp

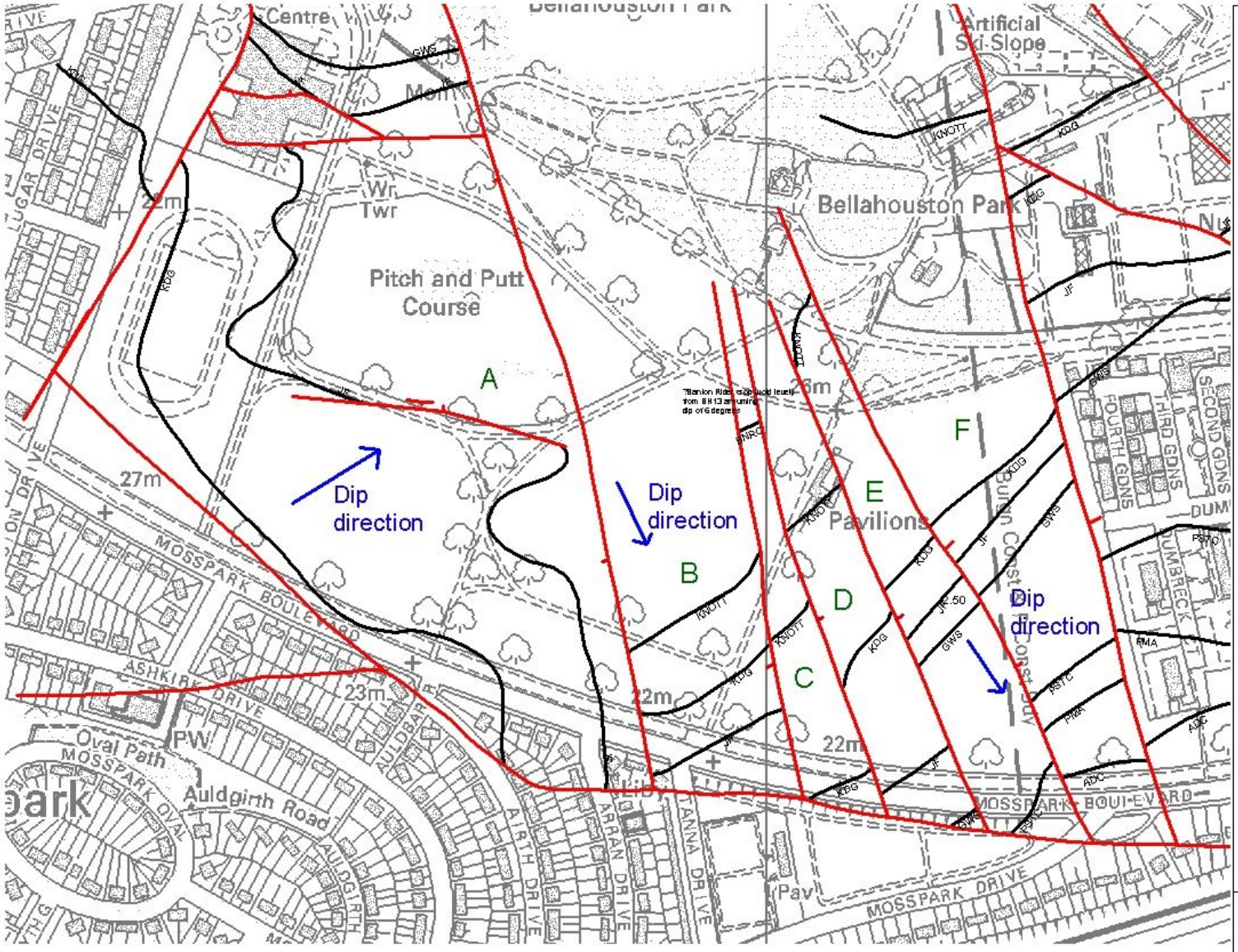
Revisedrockhead2003.shp

- 0
- 5
- 10
- 15
- 20
- 23
- 2.5

Newboreholes.shp

- NA
- NO
- YES

Bellahouston Park Project 2003
Figure 12. Solid geology map



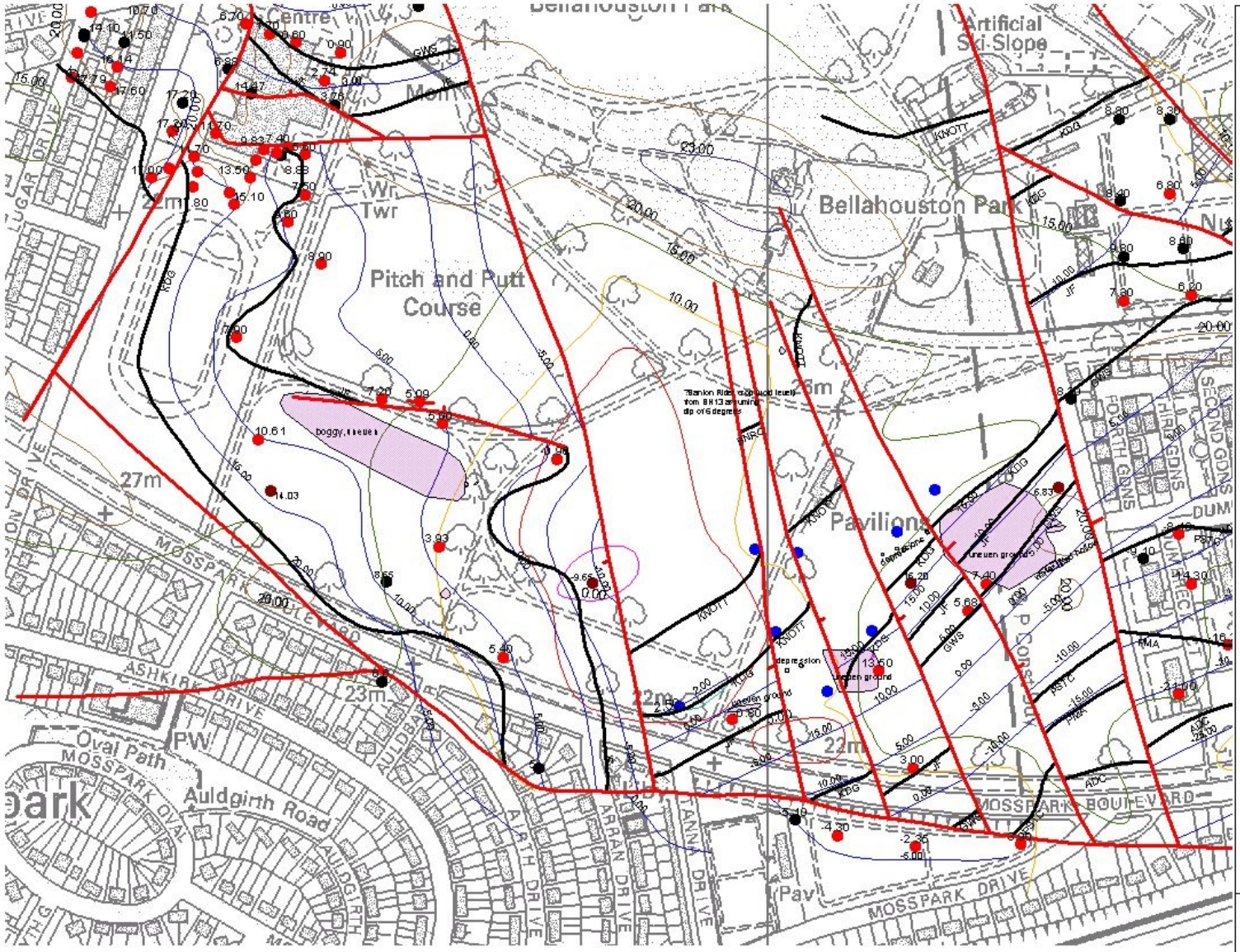
KEY

Solid geology map with faults in red, and coal seam outcrops in black. Fault blocks are labelled with green letters A-F. Dip directions are labelled.

The whole of the studied area is within the Carboniferous Limestone Coal Formation.

Revisedfaults2003.shp
Revcoalcrops2003v2.shp

Bellahouston Park Project 2003. Figure 13. Knightswood Gas Coal (KDG) contour model with rockhead contours and mapped features



KEY

Structure contours (blue lines) on the Knightswood Gas Coal seam in metres relative to OD. Constrained by existing boreholes in bright red (void encountered) and black (intact coal) and new boreholes in blue (strata beneath KDG), dark red (encountered KDG void) and black (intact KDG). Each labelled with height relative to OD. Revised coal seam outcrops shown in black, faults in red. Rockhead contours as shown below. Miscellaneous mapped ground features in pink, see text for discussion.

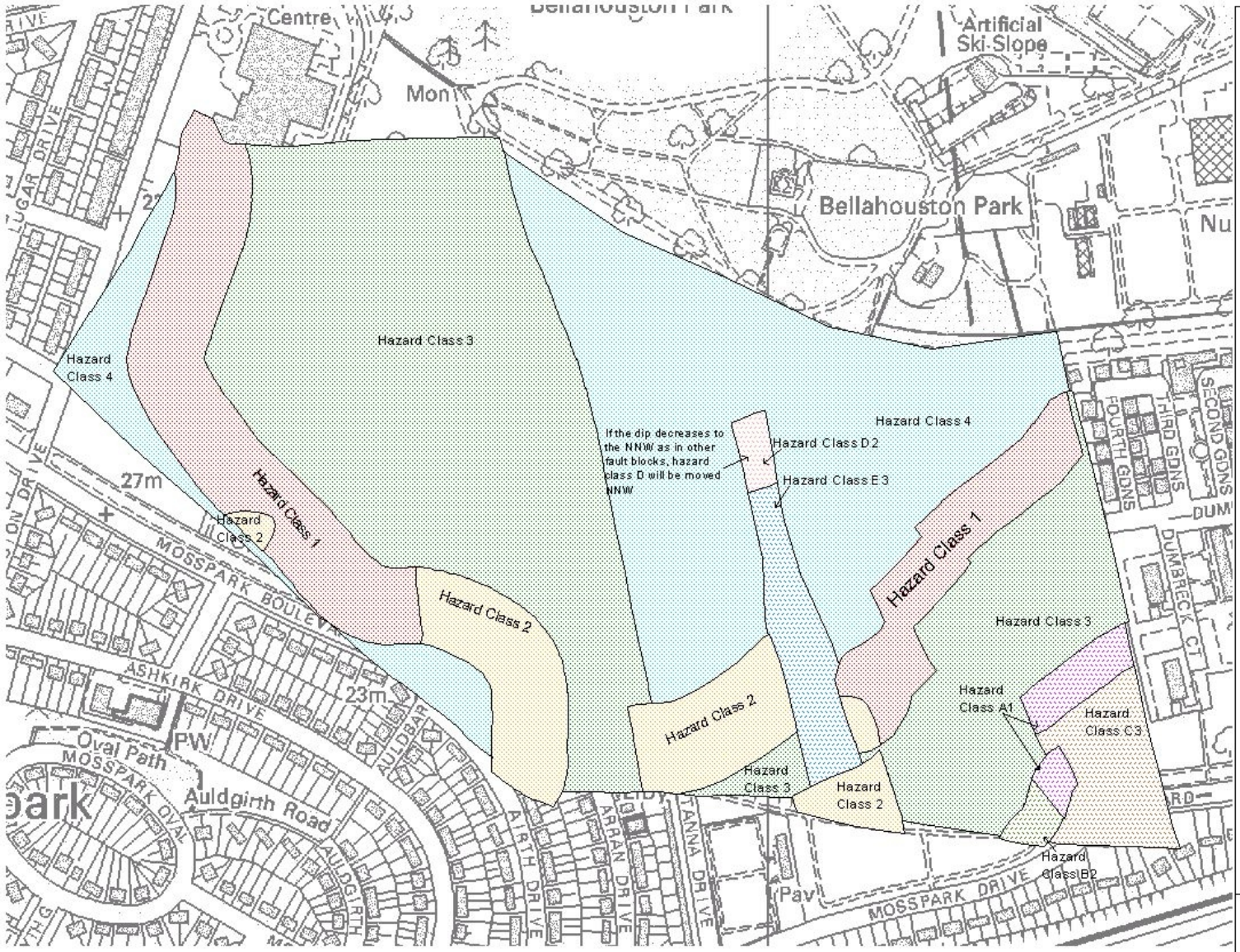
Revisedfaults2003.shp
Revcoalcrops2003v2.shp
Revkdgbh2003.shp
- **N**
- **Y**

Revkdgcontour2003.shp
Revisedrockhead2003.shp
- **0**
- **5**
- **10**
- **15**
- **20**
- **23**
- **2.5**

Newboreholes.shp
- **NA**
- **NO**
- **YES**

Miscmappedfeatures.shp

Bellahouston Park Project 2003
Figure 14. Hazard class areas



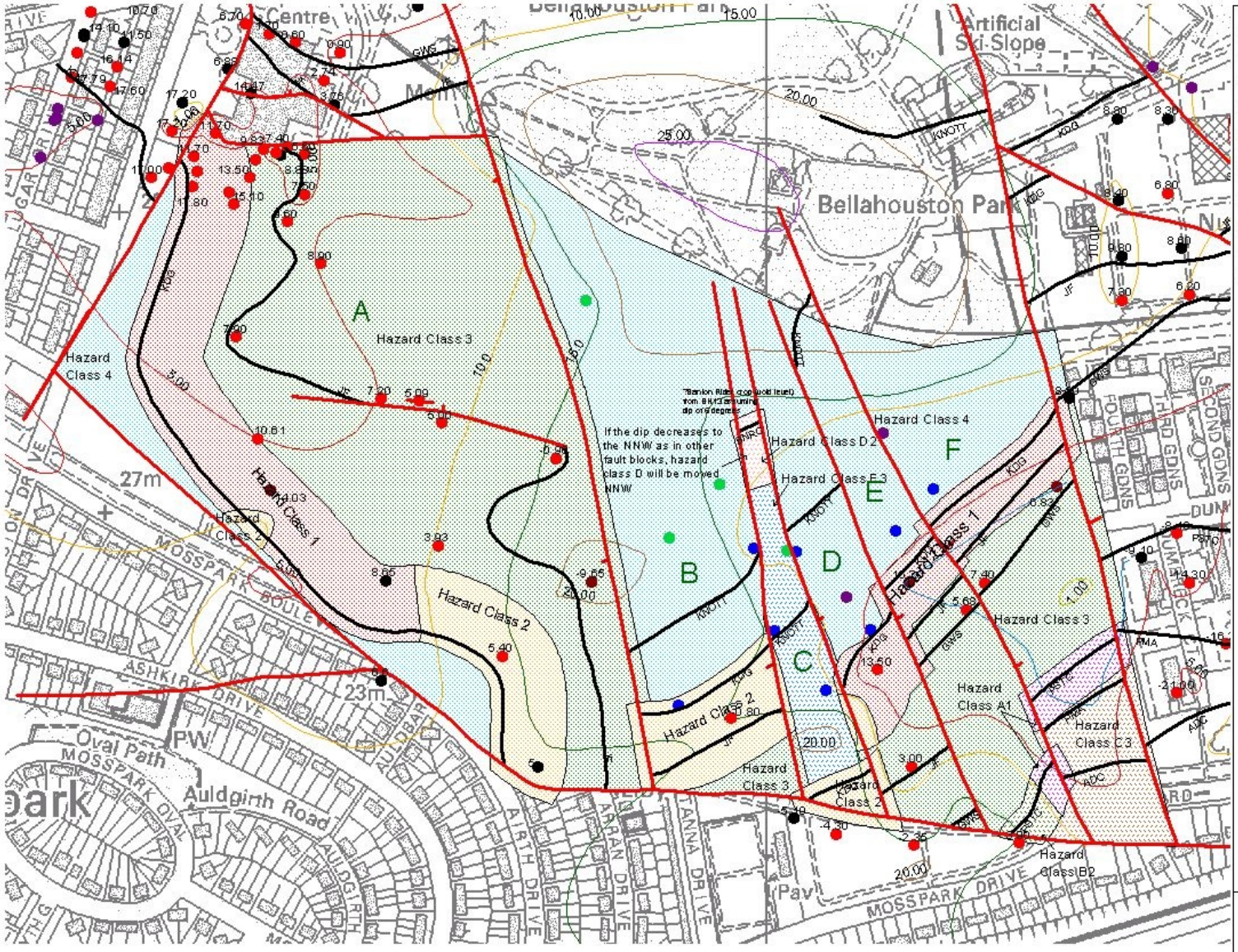
KEY

Hazard class areas 1-3 refer to the Knightswood Gas Coal, hazard class areas 4 and A1 - E3 include other seams. With respect to the KDG, hazard class 1 has the greatest likelihood of hazard, hazard class 4 the least. For other coal seams, hazard class A1 has the greatest likelihood of hazard, C3 and E3 the least, see text for discussion. Unlocated mine entrances (e.g.shafts) also form a hazard in the Park.

Hazardareas2003v2.shp

- Hazard Class 1
- Hazard Class 2
- Hazard Class 3
- Hazard Class 4
- Hazard Class A1
- Hazard Class B2
- Hazard Class C3
- Hazard Class D2
- Hazard Class E3

Bellahouston Park Project 2003
Figure 15. Hazard class areas with geological model constraints



KEY

Hazard class areas shown with coal outcrops and drift thickness. Borehole constraints on solid geology shown as dots, heights of KDG relative to sites labelled. Faults in red, drift thickness contours as in shown below. Fault blocks are labelled with green letters A-F. For the KDG, Hazard class 1 has the highest likelihood of hazard, hazard class 4 the lowest. See text for discussion.

- Revisedfaults2003.shp
- Revcoalcrops2003v2.shp
- Revkdgbh2003.shp
  - N
  - Y
  - Knott3bh.shp
  - Bkmebh2003.shp
- Reviseddrthickness2003.shp
  - 1
  - 5
  - 10
  - 15
  - 20
  - 25
  - 2.5
- Newboreholes.shp
  - NA
  - NO
  - YES
- Hazardareas2003v2.shp
  - Hazard Class 1
  - Hazard Class 2
  - Hazard Class 3
  - Hazard Class 4
  - Hazard Class A1
  - Hazard Class B2
  - Hazard Class C3
  - Hazard Class D2
  - Hazard Class E3

Bore Name: Bellahouston Park 54/63/023

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SW	**BNG easting**	254998.00	**Logged by**	MAEB/ALS
Record Type	BJ	**BNG northing**	663488.00	**Drilled by**	RITCHIES
Number		**Start Height**	20.43	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	25/04/03
				Chart Scale	1:40

DEPTH (m)	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0		SOIL	DRFT	0.000	0.300	0.3	Soil, drillers log
		CLAY	DRFT	0.300	2.300	2	Sandy clay, drillers log
2		DMTN	DRFT	2.300	8.800	6.5	Boulder clay, drillers log
8	RH	SDST	LSC	8.800	8.900	0.1	Sandstone, drillers log, KNO c. 1.8m off rockhead c.f. 55/63/049
9		SDST	LSC	8.900	10.520	1.62	Offwhite, medium to fine grained with some carb-mic-sid and much sideritic ripple laminae. Two carb-mic silty beds of 0.03 base 9.25m and 0.04 base 10.25m. Sharp base, subvertical fractures in top 30cm. ES
10		SLST	LSC	10.520	11.000	0.48	Grey, thinly bedded carbonaceous-micaceous with some plant fragments, with offwhite fine grained sdst laminae and a band of 0.04 base at 10.75m, dip 6 degrees, wavy base
11		SDST	LSC	11.000	11.260	0.26	Offwhite, fine grained with carb-mic-sid ripple lamination throughout, traces of soft sediment deformation PDI
		SLST	LSC	11.260	11.900	0.64	Grey, thinly bedded, micaceous-carbonaceous, plant remains, vague sand filled pipes (simple vertical and horizontal burrows?) interbeddded with fine grained offwhite sdst (70:30%). 10cm core loss
12		SDST	LSC	11.900	12.150	0.25	Offwhite, medium to fine grained one or two carb-mic partings and rip-up clasts up to 2cm of planty coaly material, horizontal and vertical bioturbation traces, gradational to unit below
		SLST	LSC	12.150	13.750	1.6	Grey, thinly bedded, carb-mic and sometimes sideritic striped beds with about 50:50% offwhite fine grained sdst in top 0.7m and less below, flat and some ripple lamination, slst dominated below 13.35m, planty, transistional base PDI
14		SLST	LSC	13.750	14.900	1.15	Grey, thinly bedded, planty, finely micaceous, PDI
15		MDST	BKME	14.900	15.200	0.3	Silty, grey, thinly bedded, finely micaceous, rare plant fragments, some subvertical jointing
		FEST	BKME	15.200	15.440	0.24	Bedded with 0.04m median mdst band, brownish-grey, muddy slst grade
16		MDST	BKME	15.440	18.200	2.76	Silty, dark grey, thinly bedded, finely micacecous, subvertical-subhorizontal joints quite common. Very rare pyritous plant fragments, small Fe nodules throughout, vague bioturbation (subhorizontal traces 0.75-4cm in size)
18		FEMDST	BKME	18.200	18.260	0.06	Grey, silty mudstone grade, massive
		MDST	BKME	18.260	19.300	1.04	Silty, dark grey, thinly bedded, finely micaceous, low dip. Lingula mytilloides and Lingula squamiformis at 18.4-18.9m, 0.03m ironstone base 19.20m, fissile near base
19		FEST	BKME	19.300	19.370	0.07	Grey, silty mdst grade, plant remains, massive
		MDST	BKME	19.370	19.470	0.1	Mdst as above
		FEST	BKME	19.470	19.510	0.04	Medium grained muddy slst grade, finely micaceous, massive
		MDST	BKME	19.510	20.770	1.26	Silty, dark grey, thinly bedded, finely micaceous, low dip
20		FEST	BKME	20.770	20.920	0.15	Grey, slst grade, massive, scattered pyritous and carbonated plant remains
21		MDST	BKME	20.920	21.120	0.2	Silty, dark grey, thinly bedded, marine shells
		FEST	BKME	21.120	21.200	0.08	Grey to brownish grey, slst grade, broken shell fragments
		MDST	BKME	21.200	21.600	0.4	Silty, dark grey, thinly bedded, abundant marine shells near top, crushed base, Serpuloides towards base
		FEST	BKME	21.600	21.780	0.18	Grey, slst grade, massive
22		MDST	BKME	21.780	26.020	4.24	Silty, grey, thinly bedded, small pyrite nodules, much core loss (70cm) taken to be below 22.55m, largely in pieces below this depth. Scattered marine shells, Lingula and Serpuloides to 23.90m, further 70cm missing between 23.90-24.90m.Lingula, plants, fish and carbonaceous base. Between 20.95-23m Serpuloides sp., trepostomatous bryozoan, ?Buxtonia sp., Lingula sp., Liralingula sp., Orbiculoidea sp., Pleuropugnoides sp., Productus concinnus, ostracods, fish material, burrow traces, coprolite? Between 25.95-26.05 Lingula sp., ostracods, fish material, coprolites
26		FEST	BKME	26.020	26.150	0.13	Grey, slst grade, bedded, finely micaceous, pyrites, Lingula fragments, subvertical joint
		MDST	BKME	26.150	26.380	0.23	Silty, dark grey, thinly bedded, basal 10cm crushed and polished. Finely micaceous, fish debris, slightly bituminous
		FEMDST	BKME	26.380	26.520	0.14	Grey, silty mdst grade, some carbonated plants, bedded
		MDST	BKME	26.520	26.630	0.11	Dark grey, fissile, large plant remains
		FEMDST	BKME	26.630	26.710	0.08	Grey, silty mdst grade, massive carbonated plants
		MDST	BKME	26.710	26.900	0.19	Dark grey, fissile thinly bedded, a little pyritous plant debris. Basal ironstones equivalent of 'California Clayband Ironstones CFI'

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT_HGT	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 54/63/023	NS56SW	BJ			254998	663488	20.4	S	MAEB/ALS	RITCHIES	GCC	25/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	0.3	SOIL		DRFT	Soil, drillers log							
0.3	2.3	CLAY		DRFT	Sandy clay, drillers log							
2.3	8.8	DMTN	RH	DRFT	Boulder clay, drillers log							
8.8	8.9	SDST		LSC	Sandstone, drillers log, KNO c. 1.8m off rockhead c.f. 55/63/049							
8.9	10.52	SDST		LSC	Offwhite, medium to fine grained with some carb-mic-sid and much sideritic ripple laminae. Two carb-mic silty beds of 0.03 base 9.25m and 0.04 base 10.25m. Sharp base, subvertical fractures in top 30cm. ES							
10.52	11	SLST		LSC	Grey, thinly bedded carbonaceous-micaceous with some plant fragments, with offwhite fine grained sdst laminae and a band of 0.04 base at 10.75m, dip 6 degrees, wavy base							
11	11.26	SDST		LSC	Offwhite, fine grained with carb-mic-sid ripple lamination throughout, traces of soft sediment deformation PDI							
11.26	11.9	SLST		LSC	Grey, thinly bedded, micaceous-carbonaceous, plant remains, vague sand filled pipes (simple vertical and horizontal burrows?) interbeddded with fine grained offwhite sdst (70:30%). 10cm core loss							
11.9	12.15	SDST		LSC	Offwhite, medium to fine grained one or two carb-mic partings and rip-up clasts up to 2cm of planty coaly material, horizontal and vertical bioturbation traces, gradational to unit below							
12.15	13.75	SLST		LSC	Grey, thinly bedded, carb-mic and sometimes sideritic striped beds with about 50:50% offwhite fine grained sdst in top 0.7m and less below, flat and some ripple lamination, slst dominated below 13.35m, planty, transistional base PDI							
13.75	14.9	SLST		LSC	Grey, thinly bedded, planty, finely micaceous, PDI							
14.9	15.2	MDST		BKME	Silty, grey, thinly bedded, finely micaceous, rare plant fragments, some subvertical jointing							
15.2	15.44	FEST		BKME	Bedded with 0.04m median mdst band, brownish-grey, muddy slst grade							

15.44	18.2	MDST		BKME	Silty, dark grey, thinly bedded, finely micacecous, subvertical-subhorizontal joints quite common. Very rare pyritous plant fragments, small Fe nodules throughout, vague bioturbation (subhorizontal traces 0.75-4cm in size)							
18.2	18.26	FEMDST		BKME	Grey, silty mudstone grade, massive							
18.26	19.3	MDST		BKME	Silty, dark grey, thinly bedded, finely micaceous, low dip. Lingula mytilloides and Lingula squamiformis at 18.4-18.9m, 0.03m ironstone base 19.20m, fissile near base							
19.3	19.37	FEST		BKME	Grey, silty mdst grade, plant remains, massive							
19.37	19.47	MDST		BKME	Mdst as above							
19.47	19.51	FEST		BKME	Medium grained muddy slst grade, finely micaceous, massive							
19.51	20.77	MDST		BKME	Silty, dark grey, thinly bedded, finely micaceous, low dip							
20.77	20.92	FEST		BKME	Grey, slst grade, massive, scattered pyritous and carbonated plant remains							
20.92	21.12	MDST		BKME	Silty, dark grey, thinly bedded, marine shells							
21.12	21.2	FEST		BKME	Grey to brownish grey, slst grade, broken shell fragments							
21.2	21.6	MDST		BKME	Silty, dark grey, thinly bedded, abundant marine shells near top, crushed base, Serpuloides towards base							
21.6	21.78	FEST		BKME	Grey, slst grade, massive							
21.78	26.02	MDST		BKME	Silty, grey, thinly bedded, small pyrite nodules, much core loss (70cm) taken to be below 22.55m, largely in pieces below this depth. Scattered marine shells, Lingula and Serpuloides to 23.90m, further 70cm missing between 23.90-24.90m.Lingula, plants, fish and carbonaceous base. Between 20.95-23m Serpuloides sp., trepostomatous bryozoan, ?Buxtonia sp., Lingula sp., Liralingula sp., Orbiculoidea sp., Pleuropugnoides sp., Productus concinnus, ostracods, fish material, burrow traces, coprolite? Between 25.95-26.05 Lingula sp., ostracods, fish material, coprolites							
26.02	26.15	FEST		BKME	Grey, slst grade, bedded, finely micaceous, pyrites, Lingula fragments, subvertical joint							

26.15	26.38	MDST		BKME	Silty, dark grey, thinly bedded, basal 10cm crushed and polished. Finely micaceous, fish debris, slightly bituminous							
26.38	26.52	FEMDST		BKME	Grey, silty mdst grade, some carbonated plants, bedded							
26.52	26.63	MDST		BKME	Dark grey, fissile, large plant remains							
26.63	26.71	FEMDST		BKME	Grey, silty mdst grade, massive carbonated plants							
26.71	26.9	MDST		BKME	Dark grey, fissile thinly bedded, a little pyritous plant debris. Basal ironstones equivalent of 'California Clayband Ironstones CFI'							

Bore Name: Bellahouston Park 54/63/024

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SW	**BNG easting**	254683.00	**Logged by**	MAEB
Record Type	BJ	**BNG northing**	663462.00	**Drilled by**	RITCHIES
Number		**Start Height**	23.05	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	29/04/03
				Chart Scale	1:40

DEPTH (m)	LITHOLOGY	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0			SANDU	DRFT	0.000	3.200	3.2	Sand, drillers log
3			SILT	DRFT	3.200	5.500	2.3	Coarse silt, drillers log
5			DMTN	DRFT	5.500	7.800	2.3	Firm boulder clay, drillers log
7		RH	ROCK	LSC	7.800	8.000	0.2	Sandstone, drillers log
8			SDST	LSC	8.000	11.530	3.53	Offwhite, fine to medium grained, compact, with some carb-mic-sid ripple and flat laminae, rare trace of cross-bedding, some subvertical jointing below 9.5-10m and from 10.8m. Dip 8 degrees at 10.75m. Sharp base ES
11			SDST	LSC	11.530	12.430	0.9	Offwhite, fine grained, thinly bedded with many carb-mic-sid and silty laminae increasing in frequency downwards, mainly flat bedded with traces of burrowing near top (pipe-like, horizontal), locally ripple laminated PDI
12			SLST	LSC	12.430	12.900	0.47	Grey, thinly bedded, micaceous and carbonaceous layers, plant fragments PDI
13			MDST	LSC	12.900	13.320	0.42	Silty, grey, thinly bedded, slightly finely micaceous, rare coaly and pyritic plant remains, simple sinuous burrows along bedding planes, 4cm silty ironstone PDI
			SLST	LSC	13.320	13.680	0.36	Sandy, dark grey micaceous, carbonaceous, bedded, hard, fish and Lingula sp. at 13.6m, 4cm dark bituminous mdst at base
14			COAL	KDG	13.680	14.400	0.72	Bright and dull banded near top otherwise canneloid, pyrite in joints, bright 14-14.08m, blackband ironstone in basal 10cm (40% BBI), jointed in places. Intact KDG interpreted as a stoop, no traces of working.
			SLST	LSC	14.400	14.750	0.35	Grey to dark grey, muddy top, finely micaceous, sandy laminae in basal 1cm, plant remains with some flat lying roots, one or two ironstone nodules (?or broken band)
15			SDST	LSC	14.750	16.200	1.45	Offwhite, fine to medium grained with dark carb-mic-sid laminae most common in top 25cm, sideritic ripple laminae in places below, sharp base ES
16		TD	SDST	LSC	16.200	16.250	0.05	Dark grey, fine grained, full of carbonaceous-micaceous silty flat laminae, dip 7 degrees
17								

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT_HGT	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 54/63/024	NS56SW	BJ			254683	663462	23.1	S	MAEB	RITCHIES	GCC	29/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	3.2	SANDU		DRFT	Sand, drillers log							
3.2	5.5	SILT		DRFT	Coarse silt, drillers log							
5.5	7.8	DMTN	RH	DRFT	Firm boulder clay, drillers log							
7.8	8	SDST		LSC	Sandstone, drillers log							
8	11.53	SDST		LSC	Offwhite, fine to medium grained, compact, with some carb-mic-sid ripple and flat laminae, rare trace of cross-bedding, some subvertical jointing below 9.5-10m and from 10.8m. Dip 8 degrees at 10.75m. Sharp base ES							
11.53	12.43	SDST		LSC	Offwhite, fine grained, thinly bedded with many carb-mic-sid and silty laminae increasing in frequency downwards, mainly flat bedded with traces of burrowing near top (pipe-like, horizontal), locally ripple laminated PDI							
12.43	12.9	SLST		LSC	Grey, thinly bedded, micaceous and carbonaceous layers, plant fragments PDI							
12.9	13.32	MDST		LSC	Silty, grey, thinly bedded, slightly finely micaceous, rare coaly and pyritic plant remains, simple sinuous burrows along bedding planes, 4cm silty ironstone PDI							
13.32	13.68	SLST		LSC	Sandy, dark grey micaceous, carbonaceous, bedded, hard, fish and Lingula sp. at 13.6m, 4cm dark bituminous mdst at base							
13.68	14.4	COAL		KDG	Bright and dull banded near top otherwise canneloid, pyrite in joints, bright 14-14.08m, blackband ironstone in basal 10cm (40% BBI), jointed in places. Intact KDG interpreted as a stoop, no traces of working.							
14.4	14.75	SLST		LSC	Grey to dark grey, muddy top, finely micaceous, sandy laminae in basal 1cm, plant remains with some flat lying roots, one or two ironstone nodules (?or broken band)							
14.75	16.2	SDST		LSC	Offwhite, fine to medium grained with dark carb-mic-sid laminae most common in top 25cm, sideritic ripple laminae in places below, sharp base ES							
16.2	16.25	SDST	TD	LSC	Dark grey, fine grained, full of carbonaceous-micaceous silty flat laminae, dip 7 degrees							

Bore Name: Bellahouston Park 54/63/026

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SW	**BNG easting**	254855.00	**Logged by**	MAEB/DLR
Record Type	BJ	**BNG northing**	663461.00	**Drilled by**	RITCHIES
Number		**Start Height**	20.22	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	28/04/03
				Chart Scale	1:40

DEPTH (m)	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0		CLAY	DRFT	0.000	0.500	0.5	Sandy clay, drillers log
		SILT	DRFT	0.500	7.600	7.1	Coarse silt (sandy), drillers log
8		DMTN	DRFT	7.600	20.600	13	Firm grey boulder clay, drillers log
20	RH	MDST	LSC	20.600	21.000	0.4	Grey mudstone, drillers log.
21		MDST	LSC	21.000	21.450	0.45	Silty, carbonaceous, finely micaceous, poorly bedded. Core very broken in top 0.3.m, 1.25m of core lost in the first run. Rapid transistion at base. PDI
		SLST	LSC	21.450	21.550	0.1	Dark grey, finely micaceous PDI
		SDST	LSC	21.550	21.820	0.27	Offwhite, fine grained, occasional silty laminae, dip 5 degrees, sharp base
22		SLST	LSC	21.820	22.250	0.43	Dark grey, micaceous
		MDST	LSC	22.250	25.350	3.1	Silty, grey, finely micaceous, dip less than 5 degrees, locally lipy, generally non-fissile, slightly carbonaceous to base becoming fissile beneath 24.0m to sharp micaceous base. Very little plant or fish scraps. Jubilee Coal (JF) position at c. 24m or below, coal missing (as with other nearby boreholes)
25		SEAT	LSC	25.350	25.680	0.33	Sandy, pale grey, micaceous, silty laminae, rootlets
		SDST	LSC	25.680	27.900	2.22	Offwhite, fine to medium grained, fine silty laminae. Core locally broken.
28		SDST	LSC	27.900	28.740	0.84	Offwhite, frequent dark grey silty laminae (striped beds), siltier to base
		SLST	LSC	28.740	28.840	0.1	Dark grey, fissile, abundant plant fragments
29		MDST	LSC	28.840	29.000	0.16	Silty, very finely micaceous
		VOID	KDG	29.000	29.870	0.87	?Migrated void of KDG by c. 1m upwards. No Lingula roof seen, mdst/slst roof to void thinner than expected, no seatrock beneath, no staining. No recovery driller records working pushed in, 50% air loss.
30	TD	SLST	LSC	29.870	30.000	0.13	Grey, micaceous, carbonaceous, no seatrock seen, no watermarking

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 54/63/026	NS56SW	BJ			254855	663461	20.2	S	MAEB/DLR	RITCHIES	GCC	28/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	0.5	CLAY		DRFT	Sandy clay, drillers log							
0.5	7.6	SILT		DRFT	Coarse silt (sandy), drillers log							
7.6	20.6	DMTN	RH	DRFT	Firm grey boulder clay, drillers log							
20.6	21	MDST		LSC	Grey mudstone, drillers log.							
21	21.45	MDST		LSC	Silty, carbonaceous, finely micaceous, poorly bedded. Core very broken in top 0.3.m, 1.25m of core lost in the first run. Rapid transistion at base. PDI							
21.45	21.55	SLST		LSC	Dark grey, finely micaceous PDI							
21.55	21.82	SDST		LSC	Offwhite, fine grained, occasional silty laminae, dip 5 degrees, sharp base							
21.82	22.25	SLST		LSC	Dark grey, micaceous							
22.25	25.35	MDST		LSC	Silty, grey, finely micaceous, dip less than 5 degrees, locally lipy, generally non-fissile, slightly carbonaceous to base becoming fissile beneath 24.0m to sharp micaceous base. Very little plant or fish scraps. Jubilee Coal (JF) position at c. 24m or below, coal missing (as with other nearby boreholes)							
25.35	25.68	SEAT		LSC	Sandy, pale grey, micaceous, silty laminae, rootlets							
25.68	27.9	SDST		LSC	Offwhite, fine to medium grained, fine silty laminae. Core locally broken.							
27.9	28.74	SDST		LSC	Offwhite, frequent dark grey silty laminae (striped beds), siltier to base							
28.74	28.84	SLST		LSC	Dark grey, fissile, abundant plant fragments							
28.84	29	MDST		LSC	Silty, very finely micaceous							
29	29.87	VOID		KDG	?Migrated void of KDG by c. 1m upwards. No Lingula roof seen, mdst/slst roof to void thinner than expected, no seatrock beneath, no staining. No recovery driller records working pushed in, 50% air loss.							
29.87	30	SLST	TD	LSC	Grey, micaceous, carbonaceous, no seatrock seen, no watermarking							

Bore Name: Bellahouston Park 54/63/027

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Quarter sheet	NS56SW	**BNG easting**	254588.00	**Logged by**	MAEB/ALS
Record Type	BJ	**BNG northing**	663535.00	**Drilled by**	RITCHIES
Number		**Start Height**	24.23	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	28/04/03
				Chart Scale	1:40

DEPTH (m)	LITHOLOGY	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0			SOIL	DRFT	0.000	0.300	0.3	Soil, drillers log
			SANDU	DRFT	0.300	4.200	3.9	Sand, drillers log
4			DMTN	DRFT	4.200	6.900	2.7	Boulder clay, drillers log
7		RH	SDST	LSC	6.900	7.500	0.6	Sandstone/siltstone (to 9.4m) drillers log
			SDST	LSC	7.500	7.710	0.21	Offwhite, fine to medium grained, flat and ripple laminated, carb-mic laminae, sideritic, sharp base
			SLST	LSC	7.710	8.350	0.64	Grey, bedded, interbedded with sdst, offwhite, fine grained in laminae and bands especially at the top - striped beds. Plant fragments, carbonaceous and micaceous PDI
			SLST	LSC	8.350	9.400	1.05	Grey, thinly bedded, finely micaceous, some plant fragments, 0.04m silty ironstone base 9.28m, muddy below to base, no watermarking seen. Dip 7 degrees
			VOID	KDG	9.400	10.200	0.8	Working of KDG, 0.3m of roof fallen in
10								Dark grey, bedded, finely micaceous becoming very silty downward.Lingula shards, carbonaceous, plants. Fallen roof of KDG
			MDST	LSC	10.200	10.280	0.08	Dark grey, sandy, micaceous-carbonaceous, Lingula, slightly rust stained. Fallen roof of KDG
			FEST	LSC	10.280	10.380	0.1	
			SLST	LSC	10.380	10.430	0.05	Dark grey, micaceous-carbonaceous, bedded, fish scraps, Lingula sp. shards, fish material, coprolites 10.29m. Fallen roof of KDG
			CANN	LSC	10.430	10.570	0.14	Cannel, fallen roof
			SEAT	LSC	10.570	10.740	0.17	Brown, sandy slst grade, bedded, fallen roof of KDG
			SLST	LSC	10.740	12.420	1.68	Slst grade, grey, rooty polished patches
11								Grey, finely micaceous with plant fragments, bedded, muddy in places
12								Offwhite, fine to medium grained, mainly massive, carb-mic layers rare except in top 0.12m
			SLST	LSC	12.420	13.020	0.6	Grey, bedded, carb-mic, plant fragments, mainly flat bedded, sandy base (85:15 slst:sdst), soft sediment deformation at base, sharp base
13		TD	SLST	LSC	13.020	13.500	0.48	Grey, thinly bedded, becoming muddy downwards, finely micaceous, planty, dip 5 degrees
14								

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 54/63/027	NS56SW	BJ			254588	663535	24.2	S	MAEB/ALS	RITCHIES	GCC	28/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	0.3	SOIL		DRFT	Soil, drillers log							
0.3	4.2	SANDU		DRFT	Sand, drillers log							
4.2	6.9	DMTN	RH	DRFT	Boulder clay, drillers log							
6.9	7.5	SDST		LSC	Sandstone/siltstone (to 9.4m) drillers log							
7.5	7.71	SDST		LSC	Offwhite, fine to medium grained, flat and ripple laminated, carb-mic laminae, sideritic, sharp base							
7.71	8.35	SLST		LSC	Grey, bedded, interbedded with sdst, offwhite, fine grained in laminae and bands especially at the top - striped beds. Plant fragments, carbonaceous and micaceous PDI							
8.35	9.4	SLST		LSC	Grey, thinly bedded, finely micaceous, some plant fragments, 0.04m silty ironstone base 9.28m, muddy below to base, no watermarking seen. Dip 7 degrees							
9.4	10.2	VOID		KDG	Working of KDG, 0.3m of roof fallen in							
10.2	10.28	MDST		LSC	Dark grey, bedded, finely micaceous becoming very silty downward.Lingula shards, carbonaceous, plants. Fallen roof of KDG							
10.28	10.38	FEST		LSC	Dark grey, sandy, micaceous-carbonaceous, Lingula, slightly rust stained. Fallen roof of KDG							
10.38	10.43	SLST		LSC	Dark grey, micaceous-carbonaceous, bedded, fish scraps, Lingula sp. shards, fish material, coprolites 10.29m. Fallen roof of KDG							
10.43	10.47	COAL		LSC	Cannel, fallen roof							
10.47	10.5	FEST		LSC	Brown, sandy slst grade, bedded, fallen roof of KDG							
10.5	10.57	SEAT		LSC	Slst grade, grey, rooty polished patches							
10.57	10.74	SLST		LSC	Grey, finely micaceous with plant fragments, bedded, muddy in places							
10.74	12.42	SDST		LSC	Offwhite, fine to medium grained, mainly massive, carb-mic layers rare except in top 0.12m							
12.42	13.02	SLST		LSC	Grey, bedded, carb-mic, plant fragments, mainly flat bedded, sandy base (85:15 slst:sdst), soft sediment deformation at base, sharp base							
13.02	13.5	SLST	TD	LSC	Grey, thinly bedded, becoming muddy downwards, finely micaceous, planty, dip 5 degrees							

Bore Name: Bellahouston Park 54/63/028

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SW	**BNG easting**	254928.00	**Logged by**	MAEB
Record Type	BJ	**BNG northing**	663363.00	**Drilled by**	RITCHIES
Number		**Start Height**	21.09	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	24/04/03
				Chart Scale	1:40

DEPTH (m)	LITHOLOGY	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0			FILLU	MGR	0.000	2.200	2.2	Made ground ash, brick, stone, fill etc, drillers log
2			SILT	DRFT	2.200	12.500	10.3	Coarse silt (sandy) drillers log
12			DMTN	DRFT	12.500	18.650	6.15	Firm boulder clay, drillers log
18		RH	MDST	LSC	18.650	19.000	0.35	Grey sandy mudstone, drillers log. ?KDG <0.5m off?
19			SDST	LSC	19.000	21.300	2.3	Offwhite, fine to medium grained, some carb-mic-sid laminae, mainly massive 20-21m otherwise vague traces of ripple or small scale cross-beds, assessed as sharp base
21			SDST	LSC	21.300	21.900	0.6	Offwhite, fine grained, bedded with upward decreasing frequency of slst, grey and dark carb-mic-sid laminae and thin layers, flat and ripple laminae, plant-rich layers
22			SLST	LSC	21.900	22.200	0.3	Grey, bedded, finely micaceous, plant rich layers
			SLST	LSC	22.200	22.920	0.72	Coarse, grey, thinly bedded, slightly finely micaceous, plant-rich layers, more fissile towards base but basal 10cm cored in very small broken pieces. Serpuloides sp., ?Myalina sp. at 22.6m
23			SLST	LSC	22.920	23.020	0.1	
			FEST	LSC	23.020	23.100	0.08	Silty
			SLST	LSC	23.100	23.500	0.4	Grey, bedded, finely micaceous, sandy top, dip 7 degrees, planty layers, PDI
			SDST	LSC	23.500	23.800	0.3	Offwhite and grey,fine grained, many carb-mic-sid laminae, flat bedded PDI
24			SLST	LSC	23.800	24.500	0.7	Grey, bedded, finely micaceous, planty layers, jointed near top with broken core, PDI
25			MDST	LSC	24.500	25.250	0.75	Very silty, grey, bedded, slightly finely micaceous, jointed and cored partly in pieces
			FEST	LSC	25.250	25.300	0.05	Silty
			MDST	LSC	25.300	25.600	0.3	as 24.5-25.25
			FEST	LSC	25.600	25.650	0.05	Silty
			MDST	LSC	25.650	25.700	0.05	as 24.5-25.25
26			MDST	LSC	25.700	26.110	0.41	Dark grey, silty, thinly bedded, slightly carbonaceous, fissile in part, jointed
			FEST	LSC	26.110	26.180	0.07	Ironstone
			MDST	LSC	26.180	26.600	0.42	As 25.7-26.11 with bituminous base with ironstone ribs (no cannel or fossils seen), basal 2cm very silty and micaceous
			SDST	LSC	26.600	30.000	3.4	
27								Offwhite, fine to medium grained, a few silty and carb-mic-sid laminae concentrated in top 80cm and throughout, traces of rootlets in top 45cm, flat and some ripple laminae, cross-bedded between 29.3-30m, erosive base
30			SDST	LSC	30.000	30.650	0.65	Offwhite, fine grained with carb-mic-sid laminae and bands, flat and some ripple laminae, dip almost flat. PDI
31		TD	MDST	LSC	30.650	31.000	0.35	Grey, bedded, silty, slst intercalated at top, finely micaceous

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 54/63/028	NS56SW	BJ			254928	663363	21.1	S	MAEB	RITCHIES	GCC	24/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	2.2	FILLU		MGR	Made ground ash, brick, stone, fill etc, drillers log							
2.2	12.5	SILT		DRFT	Coarse silt (sandy) drillers log							
12.5	18.65	DMTN	RH	DRFT	Firm boulder clay, drillers log							
18.65	19	MDST		LSC	Grey sandy mudstone, drillers log. ?KDG <0.5m off?							
19	21.3	SDST		LSC	Offwhite, fine to medium grained, some carb-mic-sid laminae, mainly massive 20-21m otherwise vague traces of ripple or small scale cross-beds, assessed as sharp base							
21.3	21.9	SDST		LSC	Offwhite, fine grained, bedded with upward decreasing frequency of slst, grey and dark carb-mic-sid laminae and thin layers, flat and ripple laminae, plant-rich layers							
21.9	22.2	SLST		LSC	Grey, bedded, finely micaceous, plant rich layers							
22.2	22.92	SLST		LSC	Coarse, grey, thinly bedded, slightly finely micaceous, plant-rich layers, more fissile towards base but basal 10cm cored in very small broken pieces. Serpuloides sp., ?Myalina sp. at 22.6m							
22.92	23.02	SLST		LSC	Grey, bedded, finely micaceous, sandy top, dip 7 degrees, planty layers, PDI							
23.02	23.1	FEST		LSC	Silty							
23.1	23.5	SLST		LSC								
23.5	23.8	SDST		LSC	Offwhite and grey,fine grained, many carb-mic-sid laminae, flat bedded PDI							
23.8	24.5	SLST		LSC	Grey, bedded, finely micaceous, planty layers, jointed near top with broken core, PDI							
24.5	25.25	MDST		LSC	Very silty, grey, bedded, slightly finely micaceous, jointed and cored partly in pieces							
25.25	25.3	FEST		LSC	Silty							
25.3	25.6	MDST		LSC	as 24.5-25.25							
25.6	25.65	FEST		LSC	Silty							
25.65	25.7	MDST		LSC	as 24.5-25.25							
25.7	26.11	MDST		LSC	Dark grey, silty, thinly bedded, slightly carbonaceous, fissile in part, jointed							
26.11	26.18	FEST		LSC	Ironstone							

26.18	26.6	MDST		LSC	As 25.7-26.11 with bituminous base with ironstone ribs (no cannel or fossils seen), basal 2cm very silty and micaceous							
26.6	30	SDST		LSC	Offwhite, fine to medium grained, a few silty and carb-mic-sid laminae concentrated in top 80cm and throughout, traces of rootlets in top 45cm, flat and some ripple laminae, cross-bedded between 29.3-30m, erosive base							
30	30.65	SDST		LSC	Offwhite, fine grained with carb-mic-sid laminae and bands, flat and some ripple laminae, dip almost flat. PDI							
30.65	31	MDST	TD	LSC	Grey, bedded, silty, slst intercalated at top, finely micaceous							

Bore Name: Bellahouston 55/63/049

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SE	**BNG easting**	255023.00	**Logged by**	ALS/MAEB
Record Type	BJ	**BNG northing**	663485.00	**Drilled by**	RITCHIES
Number		**Start Height**	21.44	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	16/04/03
				Chart Scale	1:40

DEPTH (m)	LITHOLOGY	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0			SOIL	DRFT	0.000	0.100	0.1	Soil, drillers log
			SANDU	DRFT	0.100	0.800	0.7	Clayey sand, drillers log
1			CLAY	DRFT	0.800	5.500	4.7	Brown silty clay, drillers log
2								
3								
4								
5								
6			DMTN	DRFT	5.500	9.000	3.5	Stiff grey boulder clay
7								
8								
9		RH	MDST	LSC	9.000	9.500	0.5	Grey sandy mudstone
			SLST	LSC	9.500	9.650	0.15	Dark grey, muddy, finely micaceous with ironstone patches up to a few cm thick, plant fragments, core broken.
			SLST	LSC	9.650	10.850	1.2	Dark grey, muddy, carbonaceous, micaceous, perhaps slightly muddier to top and base, core breaks along finely bedded planes, dip c. 7 degrees, quite hard, some iron cementation in parts, scattered plant debris and megaspores down to particularly rich beds at 10.39-10.55m, less plants beneath 10.6m
10								
			MDST	LSC	10.850	11.090	0.24	Very dark grey-black, silty, carbonaceous with rare scattered plant fragments, finely bedded, fissile, slight bituminous streak, Core largely intact with vertical fracture.
11			COAL	KNO	11.090	11.290	0.2	
			COAL	KNO	11.290	11.340	0.05	Broken, bright patches, ankerite and pyrite on cleat
			SEAT	LSC	11.340	11.700	0.36	Dull, ashy with large coarse sand grade scattered micas Pale to dark grey, medium with coarse patches, roots and Stigmaria, carbonaceous partings and erosive base at 11.44m. Beneath 11.44m pale grey with rootlet traces and carbonaceous fragments. Hard, intact core. Carbonaceous wisps at erosive base at 11.7m
			SDST	LSC	11.700	12.650	0.95	
12								Pale grey, medium with coarse patches, with carbonaceous wisps and beds, root traces, massive and parallel-bedded, dip c.5 degrees, well sorted, micaceous partings, carbonaceous bases at core breaks at 11.75, 12.22, 12.37, 12.45m. Hard, largely intact, some siderite cementation ?
			SLST	LSC	12.650	12.700	0.05	Pale and dark grey, finely interbedded fine white sdst and slst rich in plant fragments with hints of disruption by rootlets
			SDST	LSC	12.700	13.550	0.85	
13								Very pale grey, medium to coarse, rarer micacecous/carbonaceous laminae than above, fairly massive, core intact and hard apart from bottom 10cm where broken on carb-mic laminae
			SLST	LSC	13.550	14.700	1.15	
14								Striped succession of dark grey slst with abundant broken plant fragments, micas and spores finely interbedded with fine, pale grey sdst. Few cm thick sandy beds base at 13.4 and 14.0m. Some flaser and possible wavy bidirectional bedding at 14.10m, bioturbation or rootlet disruption at 14.42m. Good recovery, intact
			SDST	LSC	14.700	15.700	1	
15								Similar striped succession to above but sdst dominated. Pale grey sdst, fine to med grained, sometimes sideritic, cross-trough, ripple bedded ?bidirectional ripples, rootlet disruption. More silty interbeds to base commonly with coarse-sand grade micas, some coaly pieces. Good recovery, intact
			SLST	LSC	15.700	16.540	0.84	
16								Slst dominated striped succession, parallel and ripple bedded, pale grey, some rootlet disruption, numerous broken plant fragments, micas and rare spores. Good recovery, core intact.
			SLST	LSC	16.540	17.700	1.16	
17								Grey with some mm scale pale grey interlaminations of fine sdst, parallel-laminated, scattered broken plant remains rare to base ?Lingula at 17.65. Good recovery intact core
			SLST	LSC	17.700	17.950	0.25	Dark grey, fine (no sdst interbeds), rare plant fragments
18			MDST	BKME	17.950	19.230	1.28	Dark grey, monotonous with a few plant remains to top. More carbonaceous to base with lipy patches. Splits easily but core intact.
19								
			FEMDST	BKME	19.230	19.470	0.24	Grey, very hard, broken
			MDST	BKME	19.470	19.960	0.49	Dark grey, monotonous, carbonaceous
20			FEMDST	BKME	19.960	20.700	0.74	Dark grey Grey to dark grey, very silty, finely micaceous, thinly bedded, small ironstone nodules
			MDST	BKME	19.960	20.700	0.74	
			MDST	BKME	20.700	23.700	3	Grey to dark grey, silty, dip 5-10 degrees, bedded, ironstone patch at 20.95m, rare Lingula between 21.3-21.5m, subvertical tight joints in places, rare siltier banding, core very broken below 23.5-23.55m. Lingula cf. squamiformis 21.3-21.4m
21								
22								
23								Grey to dark grey, bedded, irregular blocky fracture, broken fragments of marine shells at 23.75m including Lingula down to base. Serpuloides sp., ?Buxtonia sp., Lingula mytilloides, Liralingua sp., Myalina sp., ?Orbiculoidea sp., burrow traces 23.75-23.90m.
			SLST	BKME	23.700	23.950	0.25	
24			FEST	BKME	23.950	24.030	0.08	Grey, slst grade, hard
			MDST	BKME	24.030	28.950	4.92	Grey to dark grey, silty in places, marine shells and Lingula, Serpuloides in places, less common below 24.5m. Core particularly broken between 26.7-26.9m, subvertical fractures 27.3-27.7, poor recovery broken 28.4-28.6, subvertical fractures 28.6-28.7. 0.5m core lost between 26.7-29.7m. Dip c. 5 degrees. Fish scales in bottom 50cm. ?Buxtonia sp., Lingula cf. squamiformis, Euphemites urii, Strebilpteria ornata between 26.7-27.35m. Lingula mytilloides, Lingula cf. squamiformis at 28.50m
25								
26								
27								
28								
29			FEST	BKME	28.950	29.050	0.1	Silty with fragments of Lingula, grey
			MDST	BKME	29.050	29.700	0.65	Grey to dark grey, fissile, slightly bituminous
			FEST	BKME	29.700	29.900	0.2	Silt grade, grey, ?scattered broken shell fragments
30			SLST	BKME	29.900	30.040	0.14	Dark grey, muddy with scattered micas, finely parallel bedded, hard and irony
		TD	MDST	BKME	30.040	32.200	2.16	
31								Dark grey, silty, scattered micas, 3cm ironstone base at 30.90m. 0.7m core loss. Fish scales and carbonated woody fragments scattered rarely throughout, core broken with some fractures and lipy fragments particularly between 30-31m.
32								

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT_	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston 55/63/049	NS56SE	BJ			255023	663485	21.4	S	ALS/MAEB	RITCHIES	GCC	16/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	0.1	SOIL		DRFT	Soil, drillers log							
0.1	0.8	SANDU		DRFT	Clayey sand, drillers log							
0.8	5.5	CLAY		DRFT	Brown silty clay, drillers log							
5.5	9	DMTN	RH	DRFT	Stiff grey boulder clay							
9	9.5	MDST		LSC	Grey sandy mudstone							
9.5	9.65	SLST		LSC	Dark grey, muddy, finely micaceous with ironstone patches up to a few cm thick, plant fragments, core broken.							
9.65	10.85	SLST		LSC	Dark grey, muddy, carbonaceous, micaceous, perhaps slightly muddier to top and base, core breaks along finely bedded planes, dip c. 7 degrees, quite hard, some iron cementation in parts, scattered plant debris and megaspores down to particularly rich beds at 10.39 10.55m, less plants beneath 10.6m							
10.85	11.09	MDST		LSC	Very dark grey-black, silty, carbonaceous with rare scattered plant fragments, finely bedded, fissile, slight bituminous streak, Core largely intact with vertical fracture.							
11.09	11.29	COAL		KNO	Broken, bright patches, ankerite and pyrite on cleat							
11.29	11.34	COAL		KNO	Dull, ashy with large coarse sand grade scattered micas							
11.34	11.7	SEAT		LSC	Pale to dark grey, medium with coarse patches, roots and Stigmaria, carbonaceous partings and erosive base at 11.44m. Beneath 11.44m pale grey with rootlet traces and carbonaceous fragments. Hard, intact core. Carbonaceous wisps at erosive base at 11.7m							
11.7	12.65	SDST		LSC	Pale grey, medium with coarse patches, with carbonaceous wisps and beds, root traces, massive and parallel-bedded, dip c.5 degrees, well sorted, micaceous partings, carbonaceous bases at core breaks at 11.75, 12.22, 12.37, 12.45m. Hard, largely intact, some siderite cementation ?							

12.65	12.7	SLST		LSC	Pale and dark grey, finely interbedded fine white sdst and slst rich in plant fragments with hints of disruption by rootlets							
12.7	13.55	SDST		LSC	Very pale grey, medium to coarse, rarer micacecous/carbonaceous laminae than above, fairly massive, core intact and hard apart from bottom 10cm where broken on carb-mic laminae							
13.55	14.7	SLST		LSC	Striped succession of dark grey slst with abundant broken plant fragments, micas and spores finely interbedded with fine, pale grey sdst. Few cm thick sandy beds base at 13.4 and 14.0m. Some flaser and possible wavy bidirectional bedding at 14.10m, bioturbation or rootlet disruption at 14.42m. Good recovery, intact							
14.7	15.7	SDST		LSC	Similar striped succession to above but sdst dominated. Pale grey sdst, fine to med grained, sometimes sideritic, cross-trough, ripple bedded ?bidrectional ripples, rootlet disruption. More silty interbeds to base commonly with coarse-sand grade micas, some coaly pieces. Good recovery, intact							
15.7	16.54	SLST		LSC	Slst dominated striped succession, parallel and ripple bedded, pale grey, some rootlet disruption, numerous broken plant fragments, micas and rare spores. Good recovery, core intact.							
16.54	17.7	SLST		LSC	Grey with some mm scale pale grey interlaminations of fine sdst, parallel-laminated, scattered broken plant remains rare to base ?Lingula at 17.65. Good recovery intact core							
17.7	17.95	SLST		LSC	Dark grey, fine (no sdst interbeds), rare plant fragments							
17.95	19.23	MDST		BKME	Dark grey, monotonous with a few plant remains to top. More carbonaceous to base with lipy patches. Splits easily but core intact.							
19.23	19.47	FEMDST		BKME	Grey, very hard, broken							
19.47	19.96	MDST		BKME	Dark grey, monotonous, carbonaceous							
19.96	19.98	FEMDST		BKME	Dark grey							
19.98	20.7	MDST		BKME	Grey to dark grey, very silty, finely micaceous, thinly bedded, small ironstone nodules							

20.7	23.7	MDST		BKME	Grey to dark grey, silty, dip 5-10 degrees, bedded, ironstone patch at 20.95m, rare Lingula between 21.3-21.5m, subvertical tight joints in places, rare siltier banding, core very broken below 23.5-23.55m. Lingula cf. squamiformis 21.3-21.4m							
23.7	23.95	SLST		BKME	Grey to dark grey, bedded, irregular blocky fracture, broken fragments of marine shells at 23.75m including Lingula down to base. Serpuloides sp., ?Buxtonia sp., Lingula mytilloides, Liralingua sp., Myalina sp., ?Orbiculoidea sp., burrow traces 23.75-23.90m.							
23.95	24.03	FEST		BKME	Grey, slst grade, hard							
24.03	28.95	MDST		BKME	Grey to dark grey, silty in places, marine shells and Lingula, Serpuloides in places, less common below 24.5m. Core particularly broken between 26.7-26.9m, subvertical fractures 27.3-27.7, poor recovery broken 28.4-28.6, subvertical fractures 28.6-28.7. 0.5m core lost between 26.7-29.7m. Dip c. 5 degrees. Fish scales in bottom 50cm. ?Buxtonia sp., Lingula cf. squamiformis, Euphemites urii, Strebilpteria ornata between 26.7-27.35m. Lingula mytilloides, Lingula cf. squamiformis at 28.50m							
28.95	29.05	FEST		BKME	Silty with fragments of Lingula, grey							
29.05	29.7	MDST		BKME	Grey to dark grey, fissile, slightly bituminous							
29.7	29.9	FEST		BKME	Silt grade, grey, ?scattered broken shell fragments							
29.9	30.04	SLST		BKME	Dark grey, muddy with scattered micas, finely parallel bedded, hard and irony							
30.04	32.2	MDST	TD	BKME	Dark grey, silty, scattered micas, 3cm ironstone base at 30.90m. 0.7m core loss. Fish scales and carbonated woody fragments scattered rarely throughout, core broken with some fractures and lipy fragments particularly between 30-31m.							

Bore Name: Bellahouston Park 55/63/050

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SE	**BNG easting**	255085.00	**Logged by**	MAEB/ALS
Record Type	BJ	**BNG northing**	663421.00	**Drilled by**	RITCHIES
Number		**Start Height**	20.57	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	18/04/03
				Chart Scale	1:40

DEPTH (m)	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0		CLAY	DRFT	0.000	3.000	3	Brown sandy clay, drillers log
3		SILT	DRFT	3.000	4.200	1.2	Silt, drillers log
4	RH	MDST	LSC	4.200	4.500	0.3	Sandy mudstone, drillers log
		SDST	LSC	4.500	6.500	2	Offwhite, fine to medium grained with carb-mic silty and muddy laminae, some sideritic patches, parallel and ripple laminated, dip 8-9 degrees, small rip-up clasts and plant fragments
6		SLST	LSC	6.500	7.000	0.5	Grey, and sdst offwhite interlaminated, thinly parallel bedded (60:40%), sdst up to 3cm thick
7		SDST	LSC	7.000	7.100	0.1	Offwhite, fine to medium, ripple laminated, sideritic, sharp top and base
		SLST	LSC	7.100	7.500	0.4	Grey, thinly bedded, sandy laminae and very planty in top 30cm, coarsening up with muddy beds to base. ?Myalina sp. at 7.4m
		MDST	LSC	7.500	7.960	0.46	Grey, silty, finely bedded with scattered plant remains, broken core
8		FEST	LSC	7.960	8.060	0.1	Pale grey silt grade
		SLST	LSC	8.060	8.620	0.56	Grey with some scattered micas and plant fragments
		SLST	LSC	8.620	8.940	0.32	Grey interbedded with pale grey fine sdst proportion increasing to 8.9m, stripy, parallel bedded with small scale soft sediment deformation
9		SLST	LSC	8.940	9.250	0.31	Grey micaceous with plant fragments
		MDST	LSC	9.250	9.500	0.25	Grey, very silty, broken core fractures and lipy pieces
		SLST	LSC	9.500	10.500	1	Grey bedded with silty mdst bands and small ironstone nodules in places
10		FEST	LSC	10.500	10.650	0.15	Fine silt grade, grey, subvertical fracture with fill, Lingula sp. at 10.55m
		MDST	LSC	10.650	11.400	0.75	Grey, very silty, bedded with fragments of Lingula at top
11		MDST	LSC	11.400	11.440	0.04	Dark grey, very finely micaceous, concoidal curved fracture, carbonaceous, canneloid
		FEST	LSC	11.440	11.500	0.06	
		CMDST	KRIC	11.500	11.900	0.4	Brownish grey, silty with cannel mdst on each side
12		SDST	LSC	11.900	15.320	3.42	Dark grey to black with scattered silt grade micas conciodal fracture and coaly fragments. Some coaly laminae to base. 0.03m ironstone at 11.75m silt grade, brownish grey with pyrite, silty to base, gradational to sdst PDI
13							Offwhite, fine to medium, silty seatearth top 0.15m, roots in top 1m, parallel and sideritic ripple laminae, carb-mic partings. More ripple laminated below 13.50m, rare ?bioturbation, silty parting 0.07m at 13.85m
15		SLST	LSC	15.320	15.900	0.58	Grey, striped, interbedded with grey sdst, plant fragments, micaceous, slst band 0.06m at 15.68m, dip 14 degrees
16		MDST	LSC	15.900	16.950	1.05	Dark grey, slightly carbonaceous, muddy slst, carbonaceous and silty mdst. Mottled or burrowed sdst 0.09m at 16.25m with micas and pyritised woody fragments. Beneath 16.5m dark grey, carbonaceousm finely micaceous and rich in Lingula at base. Between 16.25-16.95m plant fragments, Lingula mytilloides, Lingula cf. squamiformis, fish material, burrow traces, coprolite
17		CANL	LSC	16.950	17.070	0.12	Black, concoidal fracture, light brownish tinge
		MDST	LSC	17.070	17.230	0.16	Dark grey, very carbonaceous with silty ironstone band at top
		FEST	LSC	17.230	17.320	0.09	Coarse silt, grey with small plant fragments
		SLST	LSC	17.320	17.420	0.1	Grey with micas, bedded, plant remains
		MDST	LSC	17.420	17.500	0.08	Dark grey
		SLST	LSC	17.500	19.860	2.36	Grey micaceous with numerous plant fragments, bedded, ironstone 0.01m at 17.8m. Dip 9 degrees.Megaspores at 19.42-19.50m, mesh like plant 19.55m. KNO missing, expected at 19.8m.
20		SDST	LSC	19.860	22.500	2.64	Top 1cm very micaceous and rooted sdst characteristic beneath missing KNO. Offwhite, with medium and coarse bands, ripple and cross-laminated, roots in top 50cm. Sideritic. Some silty dark carbonaceous bands at 20.55-20.65m. Erosive base at 21.55m. Rooty coarse-med sdst to 21.84m, fine-medium below. ?Though no evidence in core base is faulted ? new box starts in mdst and succession from 22.50-25.50m appears very similar to that below KRIC?
22	FT	MDST	LSC	22.500	22.600	0.1	Dark grey, silty, carbonaceous, bituminous streak, bedded
		COAL	LSC	22.600	22.680	0.08	Broken, cored in pieces, mainly bright, some dull banding
		SDST	LSC	22.680	23.180	0.5	Off white, carb-mic-sid ripple laminae no roots, parallel bedded, sharp transistion
23		SLST	LSC	23.180	24.120	0.94	Striped succession with more sdst to top. Mainly flat bedded and wispy laminae carb-mic-sid laminae, plant remains in layers. Possible sinous burrows or roots ?
24	TD	SDST	LSC	24.120	25.500	1.38	Offwhite to pale grey to lower part, fine grained, generally striped with more carb-mic-sid to base. Top 0.23m dominantly sdst with ripple lamination and rootleted at top. PDI more striped parallel and rippled 50:50% sdst:slst

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT_	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 55/63/050	NS56SE	BJ			255085	663421	20.6	S	MAEB/ALS	RITCHIES	GCC	18/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	3	CLAY		DRFT	Brown sandy clay, drillers log							
3	4.2	SILT	RH	DRFT	Silt, drillers log							
4.2	4.5	MDST		LSC	Sandy mudstone, drillers log							
4.5	6.5	SDST		LSC	Offwhite, fine to medium grained with carb-mic silty and muddy laminae, some sideritic patches, parallel and ripple laminated, dip 8-9 degrees, small rip-up clasts and plant fragments							
6.5	7	SLST		LSC	Grey, and sdst offwhite interlaminated, thinly parallel bedded (60:40%), sdst up to 3cm thick							
7	7.1	SDST		LSC	Offwhite, fine to medium, ripple laminated, sideritic, sharp top and base							
7.1	7.5	SLST		LSC	Grey, thinly bedded, sandy laminae and very planty in top 30cm, coarsening up with muddy beds to base. ?Myalina sp. at 7.4m							
7.5	7.96	MDST		LSC	Grey, silty, finely bedded with scattered plant remains, broken core							
7.96	8.06	FEST		LSC	Pale grey silt grade							
8.06	8.62	SLST		LSC	Grey with some scattered micas and plant fragments							
8.62	8.94	SLST		LSC	Grey interbedded with pale grey fine sdst proportion increasing to 8.9m, stripy, parallel bedded with small scale soft sediment deformation							
8.94	9.25	SLST		LSC	Grey micaceous with plant fragments							
9.25	9.5	MDST		LSC	Grey, very silty, broken core fractures and lipy pieces							
9.5	10.5	SLST		LSC	Grey bedded with silty mdst bands and small ironstone nodules in places							
10.5	10.65	FEST		LSC	Fine silt grade, grey, subvertical fracture with fill, Lingula sp. at 10.55m							
10.65	11.4	MDST		LSC	Grey, very silty, bedded with fragments of Lingula at top							
11.4	11.44	MDST		LSC	Dark grey, very finely micaceous, concoidal curved fracture, carbonaceous, canneloid							
11.44	11.5	FEST		LSC	Brownish grey, silty with cannel mdst on each side							

11.5	11.9	CMDST		KRIC	Dark grey to black with scattered silt grade micas conciodal fracture and coaly fragments. Some coaly laminae to base. 0.03m ironstone at 11.75m silt grade, brownish grey with pyrite, silty to base, gradational to sdst PDI							
11.9	15.32	SDST		LSC	Offwhite, fine to medium, silty seatearth top 0.15m, roots in top 1m, parallel and sideritic ripple laminae, carb-mic partings. More ripple laminated below 13.50m, rare ?bioturbation, silty parting 0.07m at 13.85m							
15.32	15.9	SLST		LSC	Grey, striped, interbedded with grey sdst, plant fragments, micaceous, slst band 0.06m at 15.68m, dip 14 degrees							
15.9	16.95	MDST		LSC	Dark grey, slightly carbonaceous, muddy slst, carbonaceous and silty mdst. Mottled or burrowed sdst 0.09m at 16.25m with micas and pyritised woody fragments. Beneath 16.5m dark grey, carbonaceousm finely micaceous and rich in Lingula at base. Between 16.25-16.95m plant fragments, Lingula mytilloides, Lingula cf. squamiformis, fish material, burrow traces, coprolite							
16.95	17.07	COAL		LSC	Black, concoidal fracture, light brownish tinge							
17.07	17.23	MDST		LSC	Dark grey, very carbonaceous with silty ironstone band at top							
17.23	17.32	FEST		LSC	Coarse silt, grey with small plant fragments							
17.32	17.42	SLST		LSC	Grey with micas, bedded, plant remains							
17.42	17.5	MDST		LSC	Dark grey							
17.5	19.86	SLST		LSC	Grey micaceous with numerous plant fragments, bedded, ironstone 0.01m at 17.8m. Dip 9 degrees.Megaspores at 19.42-19.50m, mesh like plant 19.55m. KNO missing, expected at 19.8m.							

19.86	22.5	SDST		LSC	Top 1cm very micaceous and rooted sdst characteristic beneath missing KNO. Offwhite, with medium and coarse bands, ripple and cross-laminated, roots in top 50cm. Sideritic. Some silty dark carbonaceous bands at 20.55-20.65m. Erosive base at 21.55m. Rooty coarse-med sdst to 21.84m, fine-medium below. ?Though no evidence in core base is faulted ? new box starts in mdst and succession from 22.50-25.50m appears very similar to that below KRIC?							
22.5	22.6	MDST	FT	LSC	Dark grey, silty, carbonaceous, bituminous streak, bedded							
22.6	22.68	COAL		LSC	Broken, cored in pieces, mainly bright, some dull banding							
22.68	23.18	SDST		LSC	Off white, carb-mic-sid ripple laminae no roots, parallel bedded, sharp transistion							
23.18	24.12	SLST		LSC	Striped succession with more sdst to top. Mainly flat bedded and wispy laminae carb-mic-sid laminae, plant remains in layers. Possible sinous burrows or roots ?							
24.12	25.5	SDST	TD	LSC	Offwhite to pale grey to lower part, fine grained, generally striped with more carb-mic-sid to base. Top 0.23m dominantly sdst with ripple lamination and rootleted at top. PDI more striped parallel and rippled 50:50% sdst:slst							

Bore Name: BELLAHOUSTON PARK 55/63/051

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SE	**BNG easting**	255137.00	**Logged by**	ALS
Record Type	BJ	**BNG northing**	663421.00	**Drilled by**	RITCHIES
Number		**Start Height**	21.98	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	22/04/03
				Chart Scale	1:40

DEPTH (m)	LITHOLOGY	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0			SOIL	DRFT	0.000	0.300	0.3	Soil, drillers log
			CLAY	DRFT	0.300	2.800	2.5	Sandy clay, drillers log
3			DMTN	DRFT	2.800	8.300	5.5	Sandy boulder clay, drillers log
8		RH	SLST	LSC	8.300	8.900	0.6	Siltstone, drillers log
9			SLST	LSC	8.900	9.970	1.07	Grey, muddy, micaceous, plants and spores to top, some subvertical fractures between c.9.2-9.4m
10			FEST	LSC	9.970	10.050	0.08	Silty, grey
			SLST	LSC	10.050	10.720	0.67	Grey, muddy, finely micaceous with occasional lipy patches. Core fractured between 9.4-9.9m ?Drilling induced along high angle lipy planes
11			FEST	LSC	10.720	10.830	0.11	Silty, grey
			MDST	LSC	10.830	11.160	0.33	Very silty, grey with fine micas, some subvertical minor intact fractures and lipy patches
			CANL	KRIC	11.160	11.260	0.1	Core intact but brecciated, lipy rock. Fault rock ?
			CMDST	LSC	11.260	11.390	0.13	Very dark grey, numerous lipy patches, core badly broken to 11.34m then intact, less carbonaceous and silty with micas downwards
			SLST	LSC	11.390	11.630	0.24	Grey to dark grey, carbonaceous and muddy, some sand grade micas and rare ironstone nodules, dip c. 10 degrees
			FEST	LSC	11.630	11.700	0.07	Grey brown, muddy-silt grade
			SLST	LSC	11.700	11.880	0.18	Grey to dark grey, carbonaceous and muddy, some sand grade micas
12			SEAT	LSC	11.880	12.100	0.22	Grey brown, fine sdst and silt with coarser micas, heavily rootleted, soft
			SDST	LSC	12.100	14.900	2.8	Offwhite, fine to medium grained with some silty and carb-mic partings at 12.18, 12.36, 13.15, 13.2, 13.51m with rootlet traces down to 13.74m. Cross-bedding and medium to coarse from 13.9-14.49m. 30cm core lost from 12.9-14.9m.
15			SDST	LSC	14.900	16.410	1.51	Pale grey, medium with coarse sideritic cross-bedding to 15.4m, more massive 15.4-15.7m with subvertical fracture. Core broken from c. 15.7m to base with subvertical fracture 15.9-16.1m. Carb-mic laminae highlight finer bedding from 15.99-16.41m
16			SLST	LSC	16.410	17.190	0.78	Striped succession, slst grey to dark grey carb-mic, rich in broken plant remains. Sdst fine offwhite, finely laminated with some soft sediment deformation and flaser type lenses in slst
17			MDST	LSC	17.190	17.520	0.33	Grey, silty in top 0.1m, passing down to dark grey carbonaceous and ending with patchy ironstone development, bedded dip 5-10 degrees
			SLST	LSC	17.520	17.720	0.2	Dark grey very muddy, carbonaceous, rich in micas with ironstone patches to base
			CMDST	LSC	17.720	17.740	0.02	Brecciated lipy coaly fragments. Fault rock?
			CMDST	LSC	17.740	17.830	0.09	Dark grey-black with silt-sand grade micas
		TD	CMDST	LSC	17.830	17.900	0.07	Brecciated lipy coaly fragments. Fault rock ?
18								Grey with fine silt grade micas, irony, broken

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT_	STR	LOGGED	DRILLED	DRIL	DRILL_DT
BELLAHOUSTON PARK 55/63/051	NS56SE	BJ			255137	663421	22	S	ALS	RITCHIES	GCC	22/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	0.3	SOIL		DRFT	Soil, drillers log							
0.3	2.8	CLAY		DRFT	Sandy clay, drillers log							
2.8	8.3	DMTN	RH	DRFT	Sandy boulder clay, drillers log							
8.3	8.9	SLST		LSC	Siltstone, drillers log							
8.9	9.97	SLST		LSC	Grey, muddy, micaceous, plants and spores to top, some subvertical fractures between c.9.2-9.4m							
9.97	10.05	FEST		LSC	Silty, grey							
10.05	10.72	SLST		LSC	Grey, muddy, finely micaceous with occasional lipy patches. Core fractured between 9.4-9.9m ?Drilling induced along high angle lipy planes							
10.72	10.83	FEST		LSC	Silty, grey							
10.83	11.16	MDST		LSC	Very silty, grey with fine micas, some subvertical minor intact fractures and lipy patches							
11.16	11.26	COAL		KRIC	Core intact but brecciated, lipy rock. Fault rock ?							
11.26	11.39	CMDST		LSC	Very dark grey, numerous lipy patches, core badly broken to 11.34m then intact, less carbonaceous and silty with micas downwards							
11.39	11.63	SLST		LSC	Grey to dark grey, carbonaceous and muddy, some sand grade micas and rare ironstone nodules, dip c. 10 degrees							
11.63	11.7	FEST		LSC	Grey brown, muddy-silt grade							
11.7	11.88	SLST		LSC	Grey to dark grey, carbonaceous and muddy, some sand grade micas							
11.88	12.1	SEAT		LSC	Grey-brown, fine sdst and silt with coarser micas, heavily rootleted, soft							
12.1	14.9	SDST		LSC	Offwhite, fine to medium grained with some silty and carb-mic partings at 12.18, 12.36, 13.15, 13.2, 13.51m with rootlet traces down to 13.74m. Cross-bedding and medium to coarse from 13.9-14.49m. 30cm core lost from 12.9-14.9m.							
14.9	16.41	SDST		LSC	Pale grey, medium with coarse sideritic cross-bedding to 15.4m, more massive 15.4-15.7m with subvertical fracture. Core broken from c. 15.7m to base with subvertical fracture 15.9-16.1m. Carb-mic laminae highlight finer bedding from 15.99-16.41m							

16.41	17.19	SLST		LSC	Striped succession, slst grey to dark grey carb-mic, rich in broken plant remains. Sdst fine offwhite, finely laminated with some soft sediment deformation and flaser type lenses in slst							
17.19	17.52	MDST		LSC	Grey, silty in top 0.1m, passing down to dark grey carbonaceous and ending with patchy ironstone development, bedded dip 5-10 degrees							
17.52	17.72	SLST		LSC	Dark grey very muddy, carbonaceous, rich in micas with ironstone patches to base							
17.72	17.74	CMDST		LSC	Brecciated lipy coaly fragments. Fault rock?							
17.74	17.79	CMDST		LSC	Dark grey-black with silt-sand grade micas							
17.79	17.83	CMDST		LSC	Brecciated lipy coaly fragments. Fault rock ?							
17.83	17.9	CMDST	TD	LSC	Grey with fine silt grade micas, irony, broken							

Bore Name: Bellahouston Park 55/63/052

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SE	**BNG easting**	255006.00	**Logged by**	ALS
Record Type	BJ	**BNG northing**	663420.00	**Drilled by**	RITCHIES
Number		**Start Height**	20.04	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	10/04/03
				Chart Scale	1:40

DEPTH (m)	LITHOLOGY	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0			FILLU	MGR	0.000	0.700	0.7	Made ground, drillers log
			SILT	DRFT	0.700	8.500	7.8	Coarse silt, drillers log
8			DMTN	DRFT	8.500	14.000	5.5	Firm boulder clay, drillers log
14		RH	SDST	LSC	14.000	14.500	0.5	Sandstone, drillers log
			SDST	LSC	14.500	16.700	2.2	Offwhite, medium to fine with coarse carb-mic-sid laminae, cross and ripple bedded. Possible erosive base or slst parting at 15.03m. Core largely intact. Subvertical fracture from 15.75-16.45m, no cementation ?drilling induced
17			SLST	LSC	16.700	17.120	0.42	Grey, micaceous and rich in broken plant debris with some ironstone patches, interbedded with sdst, ripple laminated, pale grey
			SDST	LSC	17.120	18.180	1.06	Pale grey, fine with carb-mic partings, ripple laminated, interbedded with grey micaceous slst particularly between 17.25-17.30m, striped between 17.3-17.5m, more sdst dominated between 17.5-17.8m with siderite, striped between 17.8-18.18m, more slst to base
18			SLST	LSC	18.180	18.800	0.62	Striped succession with % sdst decreasing downwards. Slst, grey, finely micaceous, rich in broken plant fragments, parallel and ripple laminated with fine offwhite sdst. Dip c. 5 degrees
19			SLST	LSC	18.800	20.580	1.78	Grey, finely micaceous with abundant scattered plant fragments incluing well preserved pieces at 19.2, 19.4m. Bedded, dip c. 5 degrees. Some very thin sandy laminae in top 0.4m with occasional pyritised and coaly plant fragments. Core largely intact. Finely micaceous, rare megaspores c. 19.3m, finer and with less plants beneath 20m, fining to muddy slst. From 19.2-21.55m plant material, ?Lingula sp. and Naiadites at 20.34m.
20			MDST	BKME	20.580	20.800	0.22	Grey, silty, bedded with shell fragments e.g. at 20.6m, rare pyritised plant fragments
21			FEMDST MDST	BKME BKME	20.800 20.850	20.850 21.500	0.05 0.65	Dark grey Mdst grade, browny grey
								Grey to dark grey, bedded, low dip, fissile and weak but core largely intact. Common lipy patches and some irony patches to base
			FEST	BKME	21.500	21.630	0.13	Silty mdst grade, browny grey with a sealed high angle fracture and pyritised shell fragments (e.g. 21.55m)
			MDST FEST MDST	BKME BKME BKME	21.630 21.680 21.730	21.680 21.730 23.200	0.05 0.05 1.47	Grey, silty, micaceous Slst grade, micaceous
22								Grey to dark grey, silty, micaceous. Core broken with ironstone patches to 21.83m. Intact, bedded and fissile beneath. Hints of bioturbation, bituminous streak
23			SLST	BKME	23.200	23.640	0.44	Muddy, with thin silty laminae, grey, micaceous. Lingula at 23.4m, between 23.4-24.45m Lingula cf. squamiformis and ?Naiadites sp at 23.55m. Core stronger than mdst, intact
			MDST	BKME	23.640	23.920	0.28	Dark grey, silty, finely micaceous, variable iron cementation throughout. Core broken and hard
24			MDST	BKME	23.920	25.520	1.6	Dark grey, slightly micaceous and silty, shell fragments and Lingula throughout, samples from 24.24-24.45m. Carbonaceous some silty beds, no fossils seen beneath 25.50m
25			FEMDST MDST	BKME BKME	25.520 25.570	25.570 25.700	0.05 0.13	Mdst grade, grey Grey, silty, micaceous
			FEMDST	BKME	25.700	25.850	0.15	Mdst grade, grey with mdst parting
26		TD	MDST	BKME	25.850	26.500	0.65	Grey, silty, finely micaceous, carbonaceous, some irony patches. Core largely intact, some broken core c. 25.8-25.9m. Small fractures and lipy patches common.

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 55/63/052	NS56SE	BJ			255006	663420	20	S	ALS	RITCHIES	GCC	10/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	0.7	FILLU		MGR	Made ground, drillers log							
0.7	8.5	SILT		DRFT	Coarse silt, drillers log							
8.5	14	DMTN		DRFT	Firm boulder clay, drillers log							
14	14.5	SDST	RH	LSC	Sandstone, drillers log							
14.5	16.7	SDST		LSC	Offwhite, medium to fine with coarse carb-mic-sid laminae, cross and ripple bedded. Possible erosive base or slst parting at 15.03m. Core largely intact. Subvertical fracture from 15.75-16.45m, no cementation ?drilling induced							
16.7	17.12	SLST		LSC	Grey, micaceous and rich in broken plant debris with some ironstone patches, interbedded with sdst, ripple laminated, pale grey							
17.12	18.18	SDST		LSC	Pale grey, fine with carb-mic partings, ripple laminated, interbedded with grey micaceous slst particularly between 17.25-17.30m, striped between 17.3-17.5m, more sdst dominated between 17.5-17.8m with siderite, striped between 17.8-18.18m, more slst to base							
18.18	18.8	SLST		LSC	Striped succession with % sdst decreasing downwards. Slst, grey, finely micaceous, rich in broken plant fragments, parallel and ripple laminated with fine offwhite sdst. Dip c. 5 degrees							
18.8	20.58	SLST		LSC	Grey, finely micaceous with abundant scattered plant fragments incluing well preserved pieces at 19.2, 19.4m. Bedded, dip c. 5 degrees. Some very thin sandy laminae in top 0.4m with occasional pyritised and coaly plant fragments. Core largely intact. Finely micaceous, rare megaspores c. 19.3m, finer and with less plants beneath 20m, fining to muddy slst. From 19.2-21.55m plant material, ?Lingula sp. and Naiadites at 20.34m.							
20.58	20.8	MDST		BKME	Grey, silty, bedded with shell fragments e.g. at 20.6m, rare pyritised plant fragments							
20.8	20.82	CMDST		BKME	Dark grey							
20.82	20.85	FEMDST		BKME	Mdst grade, browny grey							

20.85	21.5	MDST		BKME	Grey to dark grey, bedded, low dip, fissile and weak but core largely intact. Common lipy patches and some irony patches to base							
21.5	21.63	FEST		BKME	Silty mdst grade, browny grey with a sealed high angle fracture and pyritised shell fragments (e.g. 21.55m)							
21.63	21.68	MDST		BKME	Grey, silty, micaceous							
21.68	21.73	FEST		BKME	Slst grade, micaceous							
21.73	23.2	MDST		BKME	Grey to dark grey, silty, micaceous. Core broken with ironstone patches to 21.83m. Intact, bedded and fissile beneath. Hints of bioturbation, bituminous streak							
23.2	23.64	SLST		BKME	Muddy, with thin silty laminae, grey, micaceous. Lingula at 23.4m, between 23.4-24.45m Lingula cf. squamiformis and ?Naiadites sp at 23.55m. Core stronger than mdst, intact							
23.64	23.92	MDST		BKME	Dark grey, silty, finely micaceous, variable iron cementation throughout. Core broken and hard							
23.92	25.52	MDST		BKME	Dark grey, slightly micaceous and silty, shell fragments and Lingula throughout, samples from 24.24-24.45m. Carbonaceous some silty beds, no fossils seen beneath 25.50m							
25.52	25.57	FEMDST		BKME	Mdst grade, grey							
25.57	25.7	MDST		BKME	Grey, silty, micaceous							
25.7	25.85	FEMDST		BKME	Mdst grade, grey with mdst parting							
25.85	26.5	MDST	TD	BKME	Grey, silty, finely micaceous, carbonaceous, some irony patches. Core largely intact, some broken core c. 25.8-25.9m. Small fractures and lipy patches common.							

Bore Name: Bellahouston Park 55/63/053

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SE	**BNG easting**	255106.00	**Logged by**	MAEB
Record Type	BJ	**BNG northing**	663502.00	**Drilled by**	RITCHIES
Number		**Start Height**	21.55	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	24/04/03
				Chart Scale	1:40

DEPTH (m)	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0		SOIL	DRFT	0.000	0.400	0.4	Soil, drillers log
		CLAY	DRFT	0.400	4.600	4.2	Sandy clay, drillers log
5		DMTN	DRFT	4.600	8.400	3.8	Sandy boulder clay, drillers log
8	RH	SLST	LSC	8.400	9.000	0.6	Siltstone, drillers log
							Dark grey with fine scattered micas, core broken
9		CMDST	KRIC	9.000	9.050	0.05	Fault rock? Semi-consolidated breccia of black, lipy pieces, coaly or carbonaceous mdst
		CMDST	KRIC	9.050	9.140	0.09	
		CMDST	KRIC	9.140	9.660	0.52	Dark grey, bedded, dip 8 degrees, core largely intact, more micaceous and coarsening downwards to muddy slst from 9.56-9.66m
		FEST	LSC	9.660	9.710	0.05	Muddy, silty
		MDST	LSC	9.710	9.890	0.18	Dark grey, silty, carbonaceous
10		SEAT	LSC	9.890	10.050	0.16	Pale grey, lipy with rootlets, sandy towards base
		SDST	LSC	10.050	14.000	3.95	Offwhite, fine to medium grained, bedded, fine hairy rootlets in top 0.8m, thin slst beds near top, carb-mic-sid laminae flat and ripple laminae, core broken 12 to 12.4m with 50% core loss. Some fine rootlets below to 12.85m, locally cross-bedded 13-13.3m, sharp base ES
14		SLST	LSC	14.000	14.700	0.7	Grey, thinly bedded with many thin sandy offwhite laminae, carb-mic-sid layers, dip 8 degrees, rapid transistion downwards
15		MDST	LSC	14.700	15.800	1.1	Very silty, grey, thinly bedded, mainly slst in top 0.1m, polished surfaces and patches, 0.25m core loss possibly in this item. Slightly carbonaceous and finely micaceous
		SLST	LSC	15.800	15.900	0.1	Grey, bedded, sandy in part, micaceous, hard and jointed
16		SLST	LSC	15.900	16.050	0.15	Grey, bedded, polished plant remains common, micaceous
		MDST	LSC	16.050	16.090	0.04	Dark grey, silty, thinly bedded, Lingula mytilloides, Lingula cf. squamiformis at 16.07m
		CARL	LSC	16.090	16.200	0.11	Dark grey, silty, carbonaceous, vitrain and pyritic plant remains
		CMDST	LSC	16.200	16.340	0.14	Cannel, black, concoidal fracture, rather broken core
		SLST	LSC	16.340	16.850	0.51	Dark grey, carbonaceous, with hard irony wisps and laminae, blackband ironstone aspect, silty micaceous base
							Grey, bedded, hard irony top 10cm, a few sandy laminae, micaceous, planty, PDI
17		MDST	LSC	16.850	19.300	2.45	Very silty, grey, thinly bedded, slightly finely micaceous, scattered small to medium sized plant remains (barely polished) rare megaspores below 18m, dark grey slightly fissile carbonaceous basal 0.2m
19		COAL	KNO	19.300	19.500	0.2	Bright and dull banded, dirty, cored in pieces
		SEAT	LSC	19.500	19.550	0.05	Dark grey, silty and sandy, carbonaceous and coarsely micaceous, polished patches
		SDST	LSC	19.550	22.000	2.45	Offwhite, medium to fine grained with coarse beds down to c. 21.20m, dark carbonaceous laminae concentrated in up to 0.02m thick zones in top 0.27m, traces of cross and ripple lamination, sharp base
22		SDST	LSC	22.000	24.800	2.8	Offwhite, fine to medium grained with grey slst interbedded. Dark carb-mic layers and bands, flat and some ripple laminated units, minor bioturbation, sideritic, minor erosional features and soft sediment deformation PDI
25		SLST	LSC	24.800	26.400	1.6	Grey, thinly bedded, micaceous, sandy laminae and thin bands, increase slowly in frequency above 25.90m, plant remains in many places, occasional ripple laminae, sideritic in places, vague bioturbation and soft sediment deformation, dip 9 degrees PDI
26	TD	MDST	BKME	26.400	27.000	0.6	Very silty, grey, thinly bedded, slightly finely micaceous, scattered small carbonate nodules, some plant remains and possible crushed shell fragments (indeterminate)

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 55/63/053	NS56SE	BJ			255106	663502	21.6	S	MAEB	RITCHIES	GCC	24/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	0.4	SOIL		DRFT	Soil, drillers log							
0.4	4.6	CLAY		DRFT	Sandy clay, drillers log							
4.6	8.4	DMTN	RH	DRFT	Sandy boulder clay, drillers log							
8.4	9	SLST		LSC	Siltstone, drillers log							
9	9.05	CMDST		KRIC	Dark grey with fine scattered micas, core broken							
9.05	9.14	CMDST		KRIC	Fault rock? Semi-consolidated breccia of black, lipy pieces, coaly or carbonaceous mdst							
9.14	9.66	CMDST		KRIC	Dark grey, bedded, dip 8 degrees, core largely intact, more micaceous and coarsening downwards to muddy slst from 9.56-9.66m							
9.66	9.71	FEST		LSC	Muddy, silty							
9.71	9.89	MDST		LSC	Dark grey, silty, carbonaceous							
9.89	10.05	SEAT		LSC	Pale grey, lipy with rootlets, sandy towards base							
10.05	14	SDST		LSC	Offwhite, fine to medium grained, bedded, fine hairy rootlets in top 0.8m, thin slst beds near top, carb-mic-sid laminae flat and ripple laminae, core broken 12 to 12.4m with 50% core loss. Some fine rootlets below to 12.85m, locally cross-bedded 13-13.3m, sharp base ES							
14	14.7	SLST		LSC	Grey, thinly bedded with many thin sandy offwhite laminae, carb-mic-sid layers, dip 8 degrees, rapid transistion downwards							
14.7	15.8	MDST		LSC	Very silty, grey, thinly bedded, mainly slst in top 0.1m, polished surfaces and patches, 0.25m core loss possibly in this item. Slightly carbonaceous and finely micaceous							
15.8	15.9	SLST		LSC	Grey, bedded, sandy in part, micaceous, hard and jointed							
15.9	16.05	SLST		LSC	Grey, bedded, polished plant remains common, micaceous							
16.05	16.09	MDST		LSC	Dark grey, silty, thinly bedded, Lingula mytilloides, Lingula cf. squamiformis at 16.07m							
16.09	16.11	MDST		LSC	Dark grey, silty, carbonaceous, vitrain and pyritic plant remains							

16.11	16.2	COAL		LSC	Cannel, black, concoidal fracture, rather broken core							
16.2	16.34	CMDST		LSC	Dark grey, carbonaceous, with hard irony wisps and laminae, blackband ironstone aspect, silty micaceous base							
16.34	16.85	SLST		LSC	Grey, bedded, hard irony top 10cm, a few sandy laminae, micaceous, planty, PDI							
16.85	19.3	MDST		LSC	Very silty, grey, thinly bedded, slightly finely micaceous, scattered small to medium sized plant remains (barely polished) rare megaspores below 18m, dark grey slightly fissile carbonaceous basal 0.2m							
19.3	19.5	COAL		KNO	Bright and dull banded, dirty, cored in pieces							
19.5	19.55	SEAT		LSC	Dark grey, silty and sandy, carbonaceous and coarsely micaceous, polished patches							
19.55	22	SDST		LSC	Offwhite, medium to fine grained with coarse beds down to c. 21.20m, dark carbonaceous laminae concentrated in up to 0.02m thick zones in top 0.27m, traces of cross and ripple lamination, sharp base							
22	24.8	SDST		LSC	Offwhite, fine to medium grained with grey slst interbedded. Dark carb-mic layers and bands, flat and some ripple laminated units, minor bioturbation, sideritic, minor erosional features and soft sediment deformation PDI							
24.8	26.4	SLST		LSC	Grey, thinly bedded, micaceous, sandy laminae and thin bands, increase slowly in frequency above 25.90m, plant remains in many places, occasional ripple laminae, sideritic in places, vague bioturbation and soft sediment deformation, dip 9 degrees PDI							
26.4	27	MDST	TD	BKME	Very silty, grey, thinly bedded, slightly finely micaceous, scattered small carbonate nodules, some plant remains and possible crushed shell fragments (indeterminate)							

Bore Name: BELLAHOUSTON PARK 55/63/054

British Geological Survey
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Quarter sheet	NS56SE	**BNG easting**	255240.00	**Logged by**	MAEB
Record Type	BJ	**BNG northing**	663538.00	**Drilled by**	RITCHIES
Number		**Start Height**	22.13	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	23/4/03
				Chart Scale	1:40

DEPTH (m)	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0		SOIL	DRFT	0.000	0.300	0.3	Soil, drillers log
		CLAY	DRFT	0.300	1.800	1.5	Sandy clay, drillers log
2		DMTN	DRFT	1.800	2.500	0.7	Boulder clay, drillers log
	RH	SDST	LSC	2.500	3.000	0.5	Sandstone, drillers log
3		SDST	LSC	3.000	4.620	1.62	Offwhite, fine to medium grained, partly stained yellow by oxidation in the weathering zone otherwise fresh, some carb-mic-sid layers and ripple laminae, sharp base
		SDST	LSC	4.620	5.000	0.38	Offwhite, fine grained with many carb-mic-sid laminae and wavy ripple laminated layers. PDI
5		SLST	LSC	5.000	5.900	0.9	Grey, bedded, rather jointed, finely micaceous, dip 8 degrees, 0.2m core loss probably in this item, yellow watermarked joint and bedding surfaces (mining related), plant remains
6		MDST	LSC	5.900	6.340	0.44	Silty, grey, bedded, rather broken, watermarking present, becoming dark grey, somewhat fissile and carbonaceous downwards, irony silty base (could be a closed working)
		SEAT	LSC	6.340	7.480	1.14	Siltstone grade, grey and brownish grey, polished surfaces and patches, clayey near top and sandy toward base, rooty, sdst rib 0.02m at 7.12 and 0.06m at 7.26m. Better bedded and silty base.
7		COAL	JF	7.480	8.050	0.57	Bright with dull banding 0.06m crushed coaly seat band at 7.62m, pyrite and carbonate on cleat, jointed, dip 11 degrees
8		SDST	LSC	8.050	11.800	3.75	Offwhite to buff, fine to medium grained, rooty in top 0.5m, a few silty carb-mic-sid laminae down to 8.70m mainly massive below but with traces of sideritic ripple laminae, assessed as a sharp base
12		SDST	LSC	11.800	12.900	1.1	Offwhite, fine grained with many dark silty or carb-mic-sid laminae increasing in frequency downwards, mainly flat but some ripple laminae, sand filled pipes (burrows or roots?) PDI
13		SLST	LSC	12.900	13.420	0.52	Grey, bedded, slightly finely micaceous, yellow watermarking on bedding fractures rare plant remains PDI
		MDST	LSC	13.420	13.800	0.38	Very silty, grey, bedded, somewhat finely micaceous, rare plant fragments, thin slst ribs near base PDI
		SLST	LSC	13.800	13.900	0.1	Grey, micaceous, bedded, sandy, bituminous, ?Serpuloides sp., Lingula mytilloides, Lingula cf. squamiformis, fish material, burrow traces
14		VOID	KDG	13.900	15.300	1.4	Working of KDG, water filled
15							Grey bedded micaceous, yellow, watermarked, some sandy laminae, especially towards base, rooty, PDI
		SLST	LSC	15.300	15.550	0.25	
16		SDST	LSC	15.550	18.160	2.61	Offwhite, fine to medium grained, carb-mic-sid laminae and wisps common in top 0.5m, traces of sideritic ripple and small scale cross-beds throughout, below sub-unit base at at 17.10m carb-mic-sid layers increase markedly to non-transistional base
18		SLST	LSC	18.160	18.800	0.64	Grey, bedded, with many thin sandy laminae and thin beds down to 18.60m, micaceous and carbonaceous, dip 9 degrees, some planty layers
19		SLST	LSC	18.800	19.350	0.55	Grey, thinly bedded, finely micaceous, many planty layers, ?Lingula sp. and indeterminate shell fragments at 19.3m. PDI
		MDST	LSC	19.350	19.380	0.03	Very silty, grey, bedded, slightly finely micaceous
		PEST	LSC	19.380	19.530	0.15	Sandy, brownish grey, micaceous, hard, massive
	TD	SLST	LSC	19.530	20.800	1.27	Grey, thinly bedded, finely micaceous, planty layers, sandy laminae around 20.12-20.30m, 0.02m brown silty ironstone at base
20							
21							

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT	STR	LOGGED	DRILLED	DRIL	DRILL_DT
BELLAHOUSTON PARK 55/63/054	NS56SE	BJ			255240	663538	22.1	S	MAEB	RITCHIES	GCC	23/4/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	0.3	SOIL		DRFT	Soil, drillers log							
0.3	1.8	CLAY		DRFT	Sandy clay, drillers log							
1.8	2.5	DMTN		DRFT	Boulder clay, drillers log							
2.5	3	SDST	RH	LSC	Sandstone, drillers log							
3	4.62	SDST		LSC	Offwhite, fine to medium grained, partly stained yellow by oxidation in the weathering zone otherwise fresh, some carb-mic-sid layers and ripple laminae, sharp base							
4.62	5	SDST		LSC	Offwhite, fine grained with many carb-mic-sid laminae and wavy ripple laminated layers. PDI							
5	5.9	SLST		LSC	Grey, bedded, rather jointed, finely micaceous, dip 8 degrees, 0.2m core loss probably in this item, yellow watermarked joint and bedding surfaces (mining related), plant remains							
5.9	6.34	MDST		LSC	Silty, grey, bedded, rather broken, watermarking present, becoming dark grey, somewhat fissile and carbonaceous downwards, irony silty base (could be a closed working)							
6.34	7.48	SEAT		LSC	Siltstone grade, grey and brownish grey, polished surfaces and patches, clayey near top and sandy toward base, rooty, sdst rib 0.02m at 7.12 and 0.06m at 7.26m. Better bedded and silty base.							
7.48	8.05	COAL		JF	Bright with dull banding 0.06m crushed coaly seat band at 7.62m, pyrite and carbonate on cleat, jointed, dip 11 degrees							
8.05	11.8	SDST		LSC	Offwhite to buff, fine to medium grained, rooty in top 0.5m, a few silty carb-mic-sid laminae down to 8.70m mainly massive below but with traces of sideritic ripple laminae, assessed as a sharp base							
11.8	12.9	SDST		LSC	Offwhite, fine grained with many dark silty or carb-mic-sid laminae increasing in frequency downwards, mainly flat but some ripple laminae, sand filled pipes (burrows or roots?) PDI							

12.9	13.42	SLST		LSC	Grey, bedded, slightly finely micaceous, yellow watermarking on bedding fractures rare plant remains PDI							
13.42	13.8	MDST		LSC	Very silty, grey, bedded, somewhat finely micaceous, rare plant fragments, thin slst ribs near base PDI							
13.8	13.9	SLST		LSC	Grey, micaceous, bedded, sandy, bituminous, ?Serpuloides sp., Lingula mytilloides, Lingula cf. squamiformis, fish material, burrow traces							
13.9	15.3	VOID		KDG	Working of KDG, water filled							
15.3	15.55	SLST		LSC	Grey bedded micaceous, yellow, watermarked, some sandy laminae, especially towards base, rooty, PDI							
15.55	18.16	SDST		LSC	Offwhite, fine to medium grained, carb-mic-sid laminae and wisps common in top 0.5m, traces of sideritic ripple and small scale cross-beds throughout, below sub-unit base at at 17.10m carb-mic-sid layers increase markedly to non-transistional base							
18.16	18.8	SLST		LSC	Grey, bedded, with many thin sandy laminae and thin beds down to 18.60m, micaceous and carbonaceous, dip 9 degrees, some planty layers							
18.8	19.35	SLST		LSC	Grey, thinly bedded, finely micaceous, many planty layers, ?Lingula sp. and indeterminate shell fragments at 19.3m. PDI							
19.35	19.38	MDST		LSC	Very silty, grey, bedded, slightly finely micaceous							
19.38	19.53	FEST		LSC	Sandy, brownish grey, micaceous, hard, massive							
19.53	20.8	SLST	TD	LSC	Grey, thinly bedded, finely micaceous, planty layers, sandy laminae around 20.12-20.30m, 0.02m brown silty ironstone at base							

Bore Name: Bellahouston Park 55/63/055

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SE	**BNG easting**	255048.00	**Logged by**	ALS
Record Type	BJ	**BNG northing**	663372.00	**Drilled by**	RITCHIES
Number		**Start Height**	20.27	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	23/04/03
				Chart Scale	1:40

DEPTH (m)	LITHOLOGY	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0			FILLU	MGR	0.000	0.900	0.9	Made up ground, drillers log
1			SILT	DRFT	0.900	8.100	7.2	Coarse silt, drillers log
8			DMTN	DRFT	8.100	11.500	3.4	Firm boulder clay, drillers log
11		RH	MDST	LSC	11.500	12.000	0.5	Grey sandy mudstone, drillers log
12			SEAT	LSC	12.000	12.270	0.27	Dark and pale grey mottled with rootlets plant remains and micas. 0.1m core loss over 0.27m.
			SDST	LSC	12.270	15.000	2.73	Offwhite, fine with medium carb-mic laminae, some sideritic beds, cross-bedding and ripple lamination. Cored in pieces from 0.05-0.4m size. Rootleted in top 0.3m. More dominant carbonaceous laminae from 14.43-14.6m and in basal 0.07m.
15			FEST	LSC	15.000	15.150	0.15	Sandy, grey-brown, cored in pieces
			SDST	LSC	15.150	16.000	0.85	Interbedded succession 60:40% sdst:slst. Dominantly offwhite, fine-med sdst, ripple laminated with plant rich grey micaceous slst between 15.2-15.56m and 15.9-16m and coarse grey sandy silt with sandy interbeds between 15.6-15.9m.
16			SLST	LSC	16.000	16.210	0.21	Grey with coarse micas and numerous plant fragments with fine sdst beds and lenses fining downwards. Dip c. 5 degrees
			MDST	LSC	16.210	16.470	0.26	Silty, grey to dark grey, finely micaceous, bedded quite carbonaceous down to broken core of irony mdst
			SLST	LSC	16.470	17.000	0.53	Muddy, very dark grey, finely micaceous, carbonaceous, ironstone 0.02 at 16.72m Silty with rootlets, plant fragments, Lingula mytilloides, Lingula cf. squamiformis, fish scale, burrow traces and coprolites from 17.05-17.33m
17			FEST	LSC	17.000	17.100	0.1	
			MDST	LSC	17.100	17.220	0.12	Dark grey, silty, carbonaceous, finely micaceous, bedded, Lingula well scattered throughout.
			FEMDST	LSC	17.220	17.460	0.24	Grey, broken core to 17.32m. Carbonaceous ironstone, pale grey, intact 17.32-17.42m
			FEST	LSC	17.460	17.800	0.34	Grey, silt-fine sand grade, micaceous, parallel-laminated with scattered plant fragments
18			SLST	LSC	17.800	20.200	2.4	Grey, micaceous with scattered plant fragments. Quite hard and iron rich between 17.84-17.88m and until 18m. Rich in megaspores and plant fragments at 19.76m and until 19.90m
20			MDST	LSC	20.200	20.360	0.16	Grey to dark grey, silty, increasingly carbonaceous to base, fissile with scattered plant remains
			COAL	KNO	20.360	20.590	0.23	Broken, bright and dull banded, pyrite on cleat
			SEAT	LSC	20.590	20.700	0.11	Seat-mdst in top 0.02m to seat-sdst. Offwhite and grey, fine to medium thoroughly rooted with carbonaceous partings
21			SDST	LSC	20.700	23.320	2.62	Offwhite, fine to medium with numerous carbonaceous wisps and laminations and rootlet traces in top 0.45m. Cross-bedded, massive and parallel bedded, very hard, sideritic in places
23			SDST	LSC	23.320	23.650	0.33	Interbedded offwhite fine-medium sdst and grey slst. Core badly broken and some lipy patches at 23.55-23.65m ?possible fault zone
24			SLST	LSC	23.650	24.480	0.83	Offwhite, fine, interbedded with grey slst, micaceous, rich in plant fragments and some megaspores. Sdst predominates 23.68-23.7m and 23.86-23.94m
			SDST	LSC	24.480	24.820	0.34	Striped. Offwhite, fine grained with carb-mic-silty laminae, ripple, trough and parallel bedded
25			SLST	LSC	24.820	26.100	1.28	Coarsening up striped succession. 50:50% sdst:slst at top to 80:20% at base. Slst grey, micaceous often rich in plant fragments and carbonaceous, sdst offwhite to grey, fine to medium grained
26		TD	SLST	LSC	26.100	27.000	0.9	Grey, micaceous with thin fine-med, grey sdst laminae, bedded, scattered plant fragments throughout. More irony patches at c. 26.90m. Down to top of BKME

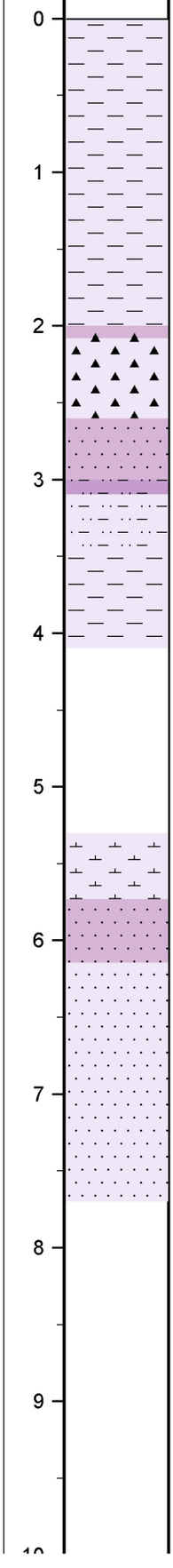
BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT_	STR	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 55/63/055	NS56SE	BJ			255048	663372	20.3	S	ALS	RITCHIES	GCC	23/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	0.9	FILLU		MGR	Made up ground, drillers log							
0.9	8.1	SILT		DRFT	Coarse silt, drillers log							
8.1	11.5	DMTN	RH	DRFT	Firm boulder clay, drillers log							
11.5	12	MDST		LSC	Grey sandy mudstone, drillers log							
12	12.27	SEAT		LSC	Dark and pale grey mottled with rootlets plant remains and micas. 0.1m core loss over 0.27m.							
12.27	15	SDST		LSC	Offwhite, fine with medium carb-mic laminae, some sideritic beds, cross-bedding and ripple lamination. Cored in pieces from 0.05-0.4m size. Rootleted in top 0.3m. More dominant carbonaceous laminae from 14.43-14.6m and in basal 0.07m.							
15	15.15	FEST		LSC	Sandy, grey-brown, cored in pieces							
15.15	16	SDST		LSC	Interbedded succession 60:40% sdst:slst. Dominantly offwhite, fine-med sdst, ripple laminated with plant rich grey micaceous slst between 15.2-15.56m and 15.9-16m and coarse grey sandy silt with sandy interbeds between 15.6-15.9m.							
16	16.21	SLST		LSC	Grey with coarse micas and numerous plant fragments with fine sdst beds and lenses fining downwards. Dip c. 5 degrees							
16.21	16.47	MDST		LSC	Silty, grey to dark grey, finely micaceous, bedded quite carbonaceous down to broken core of irony mdst							
16.47	17	SLST		LSC	Muddy, very dark grey, finely micaceous, carbonaceous, ironstone 0.02 at 16.72m							
17	17.1	FEST		LSC	Silty with rootlets, plant fragments, Lingula mytilloides, Lingula cf. squamiformis, fish scale, burrow traces and coprolites from 17.05-17.33m							
17.1	17.22	MDST		LSC	Dark grey, silty, carbonaceous, finely micaceous, bedded, Lingula well scattered throughout.							
17.22	17.46	FEMDST		LSC	Grey, broken core to 17.32m. Carbonaceous ironstone, pale grey, intact 17.32-17.42m							
17.46	17.8	FEST		LSC	Grey, silt-fine sand grade, micaceous, parallel-laminated with scattered plant fragments							

17.8	20.2	SLST		LSC	Grey, micaceous with scattered plant fragments. Quite hard and iron rich between 17.84-17.88m and until 18m. Rich in megaspores and plant fragments at 19.76m and until 19.90m							
20.2	20.36	MDST		LSC	Grey to dark grey, silty, increasingly carbonaceous to base, fissile with scattered plant remains							
20.36	20.59	COAL		KNO	Broken, bright and dull banded, pyrite on cleat							
20.59	20.7	SEAT		LSC	Seat-mdst in top 0.02m to seat-sdst. Offwhite and grey, fine to medium thoroughly rooted with carbonaceous partings							
20.7	23.32	SDST		LSC	Offwhite, fine to medium with numerous carbonaceous wisps and laminations and rootlet traces in top 0.45m. Cross-bedded, massive and parallel bedded, very hard, sideritic in places							
23.32	23.65	SDST		LSC	Interbedded offwhite fine-medium sdst and grey slst. Core badly broken and some lipy patches at 23.55-23.65m ?possible fault zone							
23.65	24.48	SLST		LSC	Offwhite, fine, interbedded with grey slst, micaceous, rich in plant fragments and some megaspores. Sdst predominates 23.68-23.7m and 23.86-23.94m							
24.48	24.82	SDST		LSC	Striped. Offwhite, fine grained with carb-mic-silty laminae, ripple, trough and parallel bedded							
24.82	26.1	SLST		LSC	Coarsening up striped succession. 50:50% sdst:slst at top to 80:20% at base. Slst grey, micaceous often rich in plant fragments and carbonaceous, sdst offwhite to grey, fine to medium grained							
26.1	27	SLST	TD	LSC	Grey, micaceous with thin fine-med, grey sdst laminae, bedded, scattered plant fragments throughout. More irony patches at c. 26.90m. Down to top of BKME							

Bore Name: **Bellahouston Park 55/63/056**

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Quarter sheet	NS56SE	**BNG easting**	255117.00	**Logged by**	MAEB/DJR
Record Type	BJ	**BNG northing**	663460.00	**Drilled by**	RITCHIES
Number		**Start Height**	21.50	**Drilled for**	GCC
Suffix		**Start Height type**	S	**Date drilled**	29/04/03
				Chart Scale	1:40



DEPTH (m)	BED BASE	LITHOLOGY CODE	STRATI-GRAPHY CODE	TOP (m)	BASE (m)	Thickness (m)	DESCRIPTION
0		CLAY	DRFT	0.000	2.000	2	Brown clay (sandy) drillers log
2		DMTN	DRFT	2.000	2.600	0.6	Grey boulder clay, drillers log
	RH	SDST	LSC	2.600	3.000	0.4	Sandstone, drillers log
3		SLST	LSC	3.000	3.500	0.5	Grey, thinly bedded, finely micaceous, off white sdst wisps, core fairly broken, gradational base
		MDST	LSC	3.500	3.900	0.4	Silty, carbonaceous, few plant scraps, dip 5 degrees, occasional slst laminae, rare iron staining on joints, core broken
		MDST	LSC	3.900	4.100	0.2	Cannel, concoidal fracturing, blackband aspect, watermarked
4		VOID	KDG	4.100	5.300	1.2	Open void, no recovery, drillers log, 100% air loss. ?KDG but Lingula band missing from roof (?mined as void is large)
5		SEAT	LSC	5.300	5.500	0.2	Dark grey, lipy, occasional rootlets, core broken
		SEAT	LSC	5.500	5.730	0.23	Light grey, sandy, micaceous, rooty, carbonaceous slst laminae
	TD	SDST	LSC	5.730	7.700	1.97	Offwhite, fine to medium grained, local dark grey slst laminae, dip 10 degrees
6							
7							
8							
9							

BORE_NAME	QS	RT	NUM	SUFFIX	BNG_E	BNG_N	STRT_HGT	STRT_TYPE	LOGGED	DRILLED	DRIL	DRILL_DT
Bellahouston Park 55/63/056	NS56SE	BJ			255117	663460	21.50	S	MAEB/DJR	RITCHIES	GCC	29/04/03
TOP	**BASE**	**LITH**	**BB**	**STRAT_C**	**DESC**							
0	2	CLAY		DRFT	Brown clay (sandy) drillers log							
2	2.6	DMTN	RH	DRFT	Grey boulder clay, drillers log							
2.6	3	SDST		LSC	Sandstone, drillers log							
3	3.5	SLST		LSC	Grey, thinly bedded, finely micaceous, off white sdst wisps, core fairly broken, gradational base							
3.5	3.9	MDST		LSC	Silty, carbonaceous, few plant scraps, dip 5 degrees, occasional slst laminae, rare iron staining on joints, core broken							
3.9	4.1	MDST		LSC	Cannel, concoidal fracturing, blackband aspect, watermarked							
4.1	5.3	VOID		KDG	Open void, no recovery, drillers log, 100% air loss. ?KDG but Lingula band missing from roof (?mined as void is large)							
5.3	5.5	SEAT		LSC	Dark grey, lipy, occasional rootlets, core broken							
5.5	5.73	SEAT		LSC	Light grey, sandy, micaceous, rooty, carbonaceous slst laminae							
5.73	7.7	SDST	TD	LSC	Offwhite, fine to medium grained, local dark grey slst laminae, dip 10 degrees							