Preface – July 2026

This report entitled "*Stoney Hill Landfill, Horsehay, Position Statement & Management Plan*" was prepared by Telford & Wrekin Council in May 2009. The report summarised information available for the site at the time of writing which informed the development of a five year management plan. This plan ended in 2014 and the site is now managed by a specialist organisation ensuring compliance with national criteria.

As a result, this report is now obsolete and has been superseded.

Stoney Hill Landfill, Horsehay

Position Statement
&
Management Plan

May 2009

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Introduction

This document has been prepared by Telford & Wrekin Council, Engineering Services Department for the Stoney Hill Landfill site which is located in the west of Telford. The document has been prepared in three parts as follows:

Part A: Stoney Hill Landfill Brief Desk Study
Part B: Stoney Hill Landfill Position Statement
Part C: Stoney Hill Landfill Management Plan

The content of each part is described in more detail below:

Part A (Brief Desk Study):
Part A comprises a brief desk study for the Stoney Hill Landfill site (and associated land in the ownership of Telford & Wrekin Council) which was prepared by Engineering Services in April 2009. The aim of this report is to summarise, amongst other things, the historical, geological, hydrological and topographical setting of the site. Most elements discussed in this desk study are addressed in significantly more detail in Part B and in appended reports (included in Appendix A – CD).

Part B: (Position Statement)
The aim of Part B is to summarise the key findings of all previous reports prepared for the Stoney Hill landfill site and adjacent areas. The report also serves to collate and review all existing information and key conclusions and recommendations relating to the site.

Part B has been used by Telford & Wrekin Council as the basis for determining whether Stoney Hill Landfill site should be designated under Part IIa of the Environment Protection Act (EPA) 1990. It has been concluded that such a designation is not appropriate in relation to Stoney Hill Landfill.

A CD included as Appendix A, electronically presents all key documents discussed in Part B.

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Part C: (Management Plan)

Part C of this report draws on the conclusions and recommendations of Part B in the development of Five Year Management Plan.

Part C will examine the:

- necessity for future investigation works in or adjacent to the site,
- necessity for future maintenance works within the landfill site,
- future management requirements for the site and
- Budget costs for each task.

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Part A: Desk Study

Introduction:

Telford & Wrekin Council Engineering Services Department has prepared a brief desk study for the site known as Stoney Hill Landfill site, Telford. The site is located off Jiggers Bank Roundabout in the west of Telford at the Junction of the A4169 (Ironbridge Bypass) and the A5223.

A location plan is presented as Figure No.1.

The site mainly comprises a closed landfill site which is accessed off the A4169. Further details relating to the landfill status is presented later in this desk study report. This brief is based on the findings of the Desk Study and a site walkover.

Land Ownership:

The landfill site passed to Telford & Wrekin Council (from Shropshire County Council) on becoming a Unitary Authority in 1998 and is currently in the ownership of and is managed by Telford & Wrekin Council. Engineering Services manage the site on behalf of Telford & Wrekin Council. The site is regulated by Environmental Health and the Environment Agency. The former Civic Amenity area, immediately to the south of the landfill, is understood to be owned and operated by Quick Skips Limited. Access to the landfill site must be taken through the former civic amenity area.

Current and Historic Uses

Current Use

The site currently comprises a closed landfill site and associated infrastructure.

The site has an area of approximately 8.2Ha. A current OS map is presented as Figure 2 and an aerial photograph is presented as Figure 3.

Historic Uses

The historic OS maps have been studied for the site and are presented as Figures 4 to 9 inclusive. The key observations are presented below:

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1882-1883; Figure 4:

- The site is bounded by roads to the northwest and south and a number of smaller roads and tracks, mainly in the south west, cross the site. Woodlands Lane is present immediately to the north east of the site.
- Buildings are present in the south western part of the site.
- A pond and/or pit (circular area of low ground) is present in the centre of the site. The overall 'depression' is estimated to be approximately 50m in diameter.
- The majority of the site comprises open fields with field boundaries.
- A large area of low lying marshy ground appears to be present in the west of the site. This area is bounded to the west and north by a 'batter' or 'slope'.
- Significant slopes are present approximately 100m to the south of the site in the area of Wynne's Coppice.
- A number of wells are present within a distance of approximately 300m from the south east of the site.

1902: Figure 5:

- The site and its environs are relatively unchanged from the previous map edition.
- Coalmoor Colliery is located approximately 100m to the north of the site.

1927: Figure 6

- The 'site' area is relatively unchanged from the previous map edition.
- New Coalmoor Pipeworks (including kilns) are present immediately outside the northern site boundary.
- Coalmoor Colliery is shown as 'Disused'. 'Old shafts' and 'old levels' are shown to the north of Coalmoor Colliery.

1954: Figure 7

- The area surrounding the site appears to be relatively unchanged.
- Two coal drifts (i.e. mine-entries) are present in the south of the site.

1966: Figure 8

- The site is shown to be in an area of opencast workings.
- An extensive area to the north west of the site is shown as 'opencast workings'.

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1991: Figure 9

- The layout of the site and the area surrounding the site appear broadly as they are currently (2009).
- Cropping Farm is no longer shown to the west and a depot is shown to the north of the site.

Geology

British Geological Survey (BGS) Records:

The BGS geological map SJ60NE has been studied to determine the nature of the geology underlying the site. An extract of the geological map is presented as Figure 10.

The Site:

- The majority of the site is shown to be underlain by Made Ground (i.e. hatched area).
- The site is shown to be underlain by Lower Coal Measures (LCM) strata which are indicated as comprising interbedded sandstones, mudstones, siltstones, coals and seatearths.
- No superficial deposits are shown to be present within or immediately adjacent to the site.
- The Lancashire Ladies, Little Flint, and Best, Randle and clod coals are shown to subcrop either within and/or close to the site.
- The regional dip is shown to be to the NNE.
- A geological fault is shown to run NNE to SSW through the centre of the site. The site is shown in solid line and has been proven within the area of the site (probably as observations during the opencast works). The fault is shown to down throw to the WNW.
- A large fault, labelled Stoneyhill Fault, runs parallel to the north west boundary of the site in a NE to SW orientation. The fault is shown to down throw to the NW.

(Note: The Little Flint Coal is considered to be the lowest workable coal seam in the Coal Measures sequence. There is, however, the possibility of deeper workings being present in the Crawstone Coal and Crawstone Ironstone).

Area Surrounding The Site:

- Clay Colliery opencast is present to the north west of the site.
- The Lydebrook Sandstone which underlies the LCM strata is shown to the east and south of the site.
- An extensive area within 50m of the south west of the site is denoted as an area of ‘active rotational landslips in Wenlock Shales’ with ‘movements to SE or SSE’.

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Several reports have been prepared historically for the Stoney Hill Landfill site and adjacent areas and these reports contain a significant amount of data and information relating to the ground conditions for the site. These reports are discussed in Part 2 of this report.

Hydrology & Hydrogeology:

The Groundwater Vulnerability 1:100,000 map Sheet 22, South Staffordshire and East Shropshire, published by the Environment Agency identifies the strata underlying the site as being a Minor Aquifer of high vulnerability. The nearest major aquifer is shown to be located approximately 2km to the north west of the site. A minor aquifer comprises fractured or potentially fractured rocks which do not have a high primary permeability, including unconsolidated deposits. Although these aquifers will seldom produce large quantities of water for abstraction, they are important for both local supplies and in supplying base flow to rivers.

The Groundwater Vulnerability map classifies the overlying soils as having high leaching potential. These comprise soils with little ability to attenuate source pollutants and in which no adsorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater. Soil information for urban areas and restored mineral workings is based on fewer observations than elsewhere. A worst case vulnerability classification is therefore assumed for these areas until proven otherwise.

Topography:

The site lies at the southern end of a spur of high ground projecting south eastwards towards Ironbridge Gorge. The site boundary lies at approximately 185mAOD and the landfill forms a mound with a summit elevation of approximately 194mAOD.

Mining and Mining Related Stability

Although the site was opencasted, opencasting works were preceded by underground mining (using pillar & stall/room) extraction techniques. A review of mining related information, copies of which are held by Telford & Wrekin Council, confirms that the following seams of coal were mined historically within and locally to the site by *underground mining methods*:

- The New Mine coal
- Two Foot coal
- Best coal

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- Randle coal
- Clod coal

It is understood that during the later opencast mining operations, the productive coal seams down to the Little Flint coal were removed.

A coal mining report for the site has been referred to as part of the desk study. The report included in Scott Wilsons report (i.e. in Appendix A prepared as part of the 'Part B - Position Statement' assessment) was obtained for the southern part of the site and is dated 14th July 2008. Although not intended for reference to all of the Stoney Hill Landfill site, the following main point was raised in the report:

- The property is within the likely zone of influence of workings in 1 seam of coal.

There are fifteen recorded TDC shafts in or within 20m of the site boundary as shown on Figure EI151/11, however Telford & Wrekin Council do not hold a complete record for the Borough.

A Coal Authority Coal Mining report dated 22nd June 1984 (i.e. pre-opencasting) was reviewed as part of the Stoney Hill Desk Study. A copy of the report s included in Appendix A (CD).

Although now superseded in many respects, it is clear that a significant number of mine-entries (in excess of 30) were present within the footprint of or close to the site. This number includes four recorded adits.

Currently (May 2009), Telford & Wrekin Council hold a number of reports and records, including TDC records and Coal Authority records, however, we do not hold a summary plan showing all mine entry information relating to the site.

Contamination and Soil Gases

The site is a registered landfill site known as Stoney Hill Landfill (reference C37). Stoney Hill Landfill was issued a waste disposal licence in 1984 to accept controlled waste. The site was operated by Shropshire County Council in the period 1985 to 1991. The controlled wastes were mainly domestic, commercial and industrial. However, lesser amounts of other wastes such as medical, surgical and veterinary wastes were also permitted.

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There are 2 further landfill sites within 250m of the site. These are:

Stoney Hill field Landfill site (Reference C23) located approximately 30m to the southwest:

- The site had a waste disposal licence which was issued on 3rd October 1986 by Shropshire County Council.
- The site was permitted to take waste from the construction industry, typically demolition rubble, excavated top soils and subsoils.
- No information is held relating to the exact composition of the waste, rates of infill, or the engineering design afforded to the repository or capping details.
- Landfill gas monitoring has taken place on 2 occasions; May 1991 and March 1992.
- In May 1991, gas was monitored by Shropshire County Council at 43 points across the landfill. Methane was recorded above 1% by volume from 2 points, the maximum reading being 20%. Carbon Dioxide was recorded above 1.5% by volume was recorded from 11 monitoring points, with the maximum being 4.8%.

Coalmoor Landfill site (Reference L90) located approximately 250m to the northwest:

- Telford & Wrekin Council has no detailed information relating to this site because it is regulated by the Environment Agency.

The Landfill boundaries are presented on Figure No.EI151/12.

Soil Gases

- The site comprises the Stoney Hill Landfill Site which has a complicated gas regime. The landfill gases, gas associated problems and gas mitigation details are discussed in more detail in Parts B and C of this report.
- The site is in a mining area and has been affected by opencasting and underground coal mining. Coal Measures strata are known to be a source of ground gases whether from the mine-workings or from reworked made ground Coal Measures strata. Therefore there is the potential for elevated ground gases such as carbon dioxide, methane, carbon monoxide and hydrogen sulphide to be present on the site.
- The Health Protection Agency (HPA) & The British Geological Survey have provided Telford & Wrekin Council with a licence to refer to Radon Potential Digital Data dated 2007.This data base confirms that

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the site is on the border of 2 radon areas, the worst case classification being that the site is in a radon affected area where between 1% and 3% of homes are above the action level. The data base confirms that no radon protection measures are required.

Utilities

A utility search has been carried out for the Stoney Hill Landfill site. The following are recorded in the area:

- Central Networks electricity service are located along the north western and northern site boundaries. Electricity supplies are also present in and adjacent to the south of the site along Stoney hill access road.
- Central Networks services are present outside the south west of the site on the southern side of the A4169.
- Severn Trent services are shown to be present to the south west of the site on the southern side of the A4169 and to the west of the site along the eastern side of the A5223.
- BT lines are shown to be present to the south west of the site on the both sides of the A4169 and to the west of the site along both sides of the A5223.
- Records indicate that the nearest commercial gas supplies are located at a significant distance (approximately 300m) to the north east of the site, close to Woodlands Lane. These have been constructed as part of the new Lightmoor residential development.

The utility plans received are included in Appendix B (Utility Information). The service information has been summarised on Drawing No.CA106/01, included in Appendix B.

Infrastructure

The site is readily accessible from the A4169, through the Civic Amenity Area (refer to Figure 2) however, the site is closed to the public.

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Stoney Hill Landfill Site: A Brief Chronology of Significant Events:

- Pre-1900: Extensive underground mining.
- 1950's to mid-1960's: Opencasting at Stoney Hill.
- 1984 To 1991: Construction of a landfill by Shropshire County Council. The 'recorded' footprint of the landfill falls completely within the 'recorded' extent of the historic opencast workings. A significant quantity of colliery spoil must have been removed during these works and the beneficiary of this material is not known.
- Post 1990 - 1991: Clay Colliery carried out further opencasting to the east of the landfill (i.e. Croppings Farm Opencast)
- 1990: Commencement of detailed environmental monitoring of the landfill with the construction of 20 gas monitoring boreholes.
- 1992: Gas monitoring points constructed to the east of the landfill site to address concerns regarding potential gas migration towards Croppings Farm. The construction of a gas control system. Passive venting wells constructed in landfill (i.e. approx. 150No. 110mm wells).
- 1993: Passive venting upgraded to active abstraction system to address Croppings Farm gas migration. A flare unit and two buried gas extraction lines were constructed.
- Mid-1990's: Pumped leachate extraction system constructed.
- 1998: The site passed to Telford & Wrekin Council on becoming a Unitary Authority.
- 2000: Leachate extraction system upgraded.
- 2008 Leachate pumping trials carried out by Biogas.
- 2009 (present): Leachate pumping and disposal by tanker & flaring on-going.

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Part B: Stoney Hill Position Statement

Stoney Hill Background Information:

To date there are 11 main documents or information packages available which relate to the Stoney Hill landfill site. These are listed below (1 to 11 in reverse Chronological order). Significant supplementary documents are also discussed.

Documents Dated 2008 (Recent Reports):

Report 1. (November 2008) Stoney Hill Mining Investigation Report dated November 2008 and prepared by Scott Wilson on behalf of Bournville Village Developments.

Report 2. (August-September 2008) Report for Landfill Gas Pumping Trial at Stoney Hill Landfill Site.

Report 3. (May to April 2008) Annual Report for Monitoring at Stoney Hill Closed Landfill Site dated April 2008 and prepared by Biogas on behalf of Telford & Wrekin Council.

Report 4. (February 2008) DSEAR (Dangerous Substances and Explosive Atmosphere Regulations) Assessment for Stoney Hill Landfill site dated February 2008 and prepared by Jacobs on behalf of Telford & Wrekin Council.

Report 5. (February 2008) Stoney Hill Closed Landfill Site Updated Conceptual Site Model dated February 2008 and prepared by Jacobs on behalf of Telford & Wrekin Council.

Documents Dated 2007

Report 6. (May 2007) Stoney Hill Closed Landfill Site Gap Assessment and Scoping Document dated May 2007 and prepared by Jacobs on behalf of Telford & Wrekin Council.

Report 7. (March 2007) DSEAR (Dangerous Substances and Explosive Atmosphere Regulations) Methodology and Risk Assessment for Stoney Hill Landfill site dated March 2007 and prepared by Jacobs on behalf of Telford & Wrekin Council.

Report 8. (February 2007) Stoney Hill Landfill, Assessment of Landfill Gas Flaring and Extraction Arrangements dated February 2007 (Draft), and prepared by Jacobs on behalf of Telford & Wrekin Council.

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Documents Dated 2002 to 2004

Report 9. Series of In-house drawings (dated May 2004 – i.e. Title Block date on drawings**)** These include a series of Drawings prepared by Telford & Wrekin Council, copies of which have been included in Scott Wilson's Report (Report 1 above). The drawings include topographical information for the surface and base of the landfill, geological summary information and geological sections through the landfill.

Report 10. (May 2004) Assessment of Contaminant Risks posed by Stoney Hill Landfill Site dated May 2004 and prepared by Geowater Environmental Geology on behalf of Telford & Wrekin Council.

Report 11. (April 2002) Lightmoor Village, Telford, Environmental Statement Report dated April 2002 and prepared by Campbell Reith Hill on behalf of Bournville Village Developments and English Partnerships.

Supplementary Documents

Item 1: Letter dated 22nd November 2007: from National Laboratory Service addressed to Telford & Wrekin Council, relating to gas analysis at Stoney Hill Landfill site.

Item 2: Photographs of Stoney Hill Landfill during construction received from Telford & Wrekin Council Environmental Health department on 11th December 2008.

Item 3: Drawings: Telford & Wrekin Council in-house Drawings dated 1980's.

A thorough study of all these reports has been carried out and this report (i.e. Part B) summarises the findings of this research.

The contemporary findings, conclusions and recommendations of the researched recent reports are presented below. It is emphasised that the points made in each report are based on research and/or works carried out up to the date of issue of the relevant report. The conclusions and recommendations listed below are not strictly the current views of the Council. Where the Councils current viewpoint varies significantly from that reported, an additional 'Telford & Wrekin Council Comment' will be added to the text.

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Note

A CD included as Appendix A to this report electronically presents all documents listed above and discussed below.

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Report 1. (November 2008) *Stoney Hill Mining Investigation Report dated November 2008 and prepared by Scott Wilson on behalf of Bournville Village Developments (BVD).*

Scott Wilson Ltd. were commissioned by BVD to undertake a ground investigation to develop a site model and to investigate the potential for shallow abandoned coal workings to the south east of Stoney Hill landfill site.

The ground investigation was designed to

- delineate the extent of historical opencast workings,
- assess the position and condition of the locally productive Little Flint and Randle coal seams and
- to disprove the presence of a series of adits associated with the former Stoney Hill Opencast Coal Mine.

The key findings of these works, which relate to the conceptual contamination model for Stoney Hill, are:

- The ground investigation did not identify subsurface voids associated with historical mine-workings.
- Interpretation of the ground investigation indicates that the Randle, Clod and Little Flint coal seams appear to have been fully excavated through opencast methods.
- The opencast has been backfilled in an uncontrolled manner.

The report confirms that:

- 'the extent of the opencast coal mining in the site area is greater than anticipated' (report pg.15, paragraph 2),
- 'the Lancashire Ladies coal was not identified in the boreholes' (report pg.15, paragraph 3),
- The opencast backfill is 'at the anticipated depth of the Little Flint coal seam' (pg.14, last paragraph).

Telford & Wrekin Council comments regarding Report 1:

The geological sections prepared by Scott Wilson, which are included in their report, shows coal to be present in many of the boreholes, within a few meters of the base of opencast. The report does not address this coal seam fully.

If the Lancashire Ladies coal seam is not present locally to the site and the Little Flint has been removed in the opencast works, it is Telford & Wrekin Council's opinion that further research or investigation works need to be

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carried out to establish which coal seam is potentially still present below the base of opencast. Based on local knowledge of the Telford area (and particularly the Lawley opencast site) it is known that the Little Flint coal had split into two leaves with the lower leaf being left in place in a number of locations. The spacing between base of the Stoney Hill opencast and coal seam identified is similar to the spacing between Little Flint leaves in Lawley. It is therefore possible that the coal identified is the lower leaf of the Little Flint coal.

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Report 2. (August-September 2008) ***Report for Landfill Gas Pumping Trial at Stoney Hill Landfill Site prepared by Biogas on behalf of Telford & Wrekin Council.***

In 2008 a pumping trial was undertaken at Stoney Hill site over a six week period for Telford & Wrekin Council. The trial was spread over two discrete waste deposition cells conjectured to represent the deepest cells. Three new gas extraction wells were drilled into each cell (borehole references GEW). One well in each cell was fitted with a pneumatic pump to draw down the leachate level.

The report confirms that:

- Leachate pumping during the gas pumping trial resulted in the reduction of leachate levels to varying degrees. The results were mixed as would be expected from landfill wastes of variable composition and permeability.
- During pumping, the new wells quickly exhausted their reservoir of gas indicating that the gas production in one cell is extremely low (i.e. cell with well reference GEW 1, 2 and 3). The reasons for this was conjectured to possibly be a high leachate level, post-methanogenic waste, inert wastes in the mix, the presence of void spaces or poorly compacted wastes as suggested by the mobility of the leachate and gas.
- Only GEW 6 provided a stable gas flow of high quality gas.
- The overall level of trace constituents was at the low end, indicating relatively clean emissions from any replacement combustion plant. At this stage there is no justification for gas treatment.
- In accordance with EA guidance, elevated flares are permitted on sites only for testing or emergence purposes for a period of time no longer than six months.
- The existing gas extraction points and boreholes that have been proven out of use and not crucial for migration control should be backfilled to prevent air ingress during active gas extraction phase.

Biogas Conclusions:

- The expected maximum gas flow from the landfill, based on the pumping trial results would be in the range of 90 to 120m^3/hour.
- A landfill gas flare at 150Nm^3/hour capacity with minimum turn down ratio of 5:1 should be sufficient to control the gas on site.

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- Containment of the waste and control of leachate levels are crucial in order to achieve the predicted gas yield.
- No power generation on site can be considered due to the unstable and relatively low flow gas supply.
- It is recommended to further review leachate levels on site in order to understand its influence on the gas control system and to make correct decisions about leachate management that is crucial for successful operation of gas management scheme.

Telford & Wrekin Council comments regarding Report 2:

Telford & Wrekin Council comments relating to the drawing included in Biogas's Report. These comments summarise selected key facts presented on an untitled drawing showing borehole information (including new boreholes GEWs 1 to 6).

- Borehole ground surface levels are shown to vary between approximately 190.25mAOD and 193.75mAOD.
- Liner cap ground levels are reported to be at approximately 182.75.
- Liquid (i.e. leachate) levels are shown to be very variable at depths of between 7.5m and 10.5mbgl.
- The clay 'cap' is diagrammatically shown to be between 2.5m and 8.5m in thickness in the GEW boreholes.

With regard to the following point made in the report, ……*In accordance with EA guidance, elevated flares are permitted on sites only for testing or emergence purposes for a period of time no longer than six months,*…... Telford & Wrekin Council confirms that this point does not apply to stoney Hill Landfill site.

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Report 3. (May to April 2008) ***Annual Report for Monitoring at Stoney Hill Closed Landfill Site dated April 2008 and prepared by Biogas on behalf of Telford & Wrekin Council.***

(Note: This report discusses 'new lines and well heads' which include 6 new wells, i.e. the GEW boreholes and an above ground system of connecting lines which lead to the flare).

Biogas Report Conclusions:
The new lines and well heads may have dramatically improved the operation of the flare, but the effect on gas migration appears to have been negligible. This is reported as possibly being due to the wells, particularly towards the boundary of the site, being very shallow with limited influence on the system and/or the boreholes being drilled into waste mass.

Biogas recommend the replacement of some of the perimeter boreholes to allow accurate flow measurements to be taken and suggest that boreholes which exhibit high gas quality are connected into the existing gas collection system (i.e. create perimeter gas extraction wells). Biogas suggest that this procedure would demonstrate that the gas migration problem is being tackled.

The gas flare system, although working well, is an older model and is no longer recognised as fit for purpose by legislation due to its elevated stack. The stack does not contain the combustion process completely and does not guarantee a combustion temperature exceeding 1000 degree Celsius. It is therefore not capable of completely breaking down the bulk trace and component gases. Replacement of the unit is now essential.

The eight pneumatic pumps in the landfill, although pumped continuously, do not appear to be capable of lowering the leachate level. Biogas report that this is due to the number of pumps and the depth of the wells in which they are placed.

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Report 4. (February 2008) ***DSEAR (Dangerous Substances and Explosive Atmosphere Regulations) Assessment for Stoney Hill Landfill site dated February 2008 and prepared by Jacobs on behalf of Telford & Wrekin Council.***

The summary of actions listed in the report include the following key points which relate to the 'engineering and contamination aspects' of the landfill:

- Cap all passive vents, leachate wells and dewatering points to prevent air ingress,
- Reduce extraction pressures at flare,
- Maintain the gas field and flare in good operational condition.

Numerous other recommendations are made within the report which relate to Health & Safety matters. These include, but are not limited to, the following points:

- Prohibit smoking on site,
- Use intrinsically safe gas monitoring equipment and certified pumping equipment and tools,
- Storage of propane gas cylinders,
- Necessity of induction training for operatives on site.

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Report 5. (February 2008) ***Stoney Hill Closed Landfill Site Updated Conceptual Site Model dated February 2008 and prepared by Jacobs on behalf of Telford & Wrekin Council.***

Jacobs comments are summarised as follows:

- The landfill is conjectured to be confined laterally by clay materials.
- There is limited evidence of groundwater in the reworked spoil materials outside the boundary of the landfill.
- A reasonable degree of containment of the landfill leachate has been assumed given the observed difference in head levels inside and outside the landfill.
- Little evidence of lateral contaminant transfer is observed.
- Groundwater in the vicinity of the site exhibits low pH conditions in the acid range. This suggests influence by acid mines waters. This is not mirrored in the leachate which suggests physical and hydraulic separation.
- Groundwater chemistry to the north of the landfill suggests the influence of an off site source or secondary contaminant source (ammoniacal nitrogen, aromatics and aliphatics to the north and malathion (pesticide) and sulphates in the sandstone), as levels observed in the receptors are significantly elevated when compared against results observed in the leachate.
- As significant levels of methane and carbon dioxide were recorded at multiple locations surrounding the site, it is considered that an alternative source to the landfill may be present e.g. coal measures. This should be reviewed in more detail to determine whether a significant Potential Pollution Linkage (i.e.PPL) is present.

The Jacobs risk assessment (Report 5) concludes the following:

Human Health:

- A pollution linkage has been determined for landfill gas.
- Much of the above ground gas migration has been attributed to an inefficient and temperamental gas flare.

Controlled waters:

- There is evidence of Organotin compound in the groundwater at levels similar to that found in the leachate but these are at very low concentrations.
- There is evidence of groundwater contamination from leachate, especially in borehole 9, mainly with list 1 and list 2 substances north of

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the site. Levels of aromatics and aliphatics have been detected in groundwater at concentrations greater than those detected in leachate samples, thus indicating additional external factors influencing the groundwater.

- Although levels of ammoniacal nitrogen and manganese were elevated in the ponds, these are not high enough to indicate leachate contamination and may be from other sources.

Ecosystems:

- No assessment carried out.

Property and Infrastructure:

- No assessment carried out.

Jacobs summary of significant Potential Pollution Linkages (as per Report 5):
(i.e. significant Source-Pathway-Receptor Relationship: Jacobs report Table 5.2):

These 'linkages' represent possible connected pathways along which pollutants could move. The possible key target (i.e. what could be adversely affected) is also reported.

- Linkage No.14: Landfill Gas: Human receptor: Elevated levels around the perimeter of the site.
- Linkages No.1 & 2: Ammoniacal Nitrogen: Groundwater (sandstone) & groundwater (colliery spoil). Lateral and vertical migration via groundwater. Analytical sample results have indicated leachate contamination.
- Linkages Nos. 5 & 6: List 2 metals: groundwater (sandstone) & groundwater (colliery spoil). Lateral and vertical migration via groundwater. Analytical sample results have indicated leachate contamination. Shallow groundwater regime is not as well understood as the deep groundwater regime.
- Linkage No.17 (Aliphatics) & Linkage No.20 (Aromatics): Groundwater (sandstone). Lateral and vertical migration via groundwater. Analysis has shown elevated levels in groundwater and in greater concentrations than in leachate. Other external sources may be contributing.
- Linkage No.29: Malathion: Lateral and vertical migration via groundwater (sandstone). Analysis has shown elevated levels in

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groundwater and in greater concentrations than in leachate. Other external sources may be contributing.

- Linkage No.38: Dibutyltin: Lateral and vertical migration via groundwater (sandstone). Elevated concentrations in one deep groundwater borehole and in leachate.

Jacobs Drawings included in Report 5:

- Drawing B0578400/CSM/02 'Current Conceptual Model'.
- Drawings B0578400/CSM/05 (Geological Cross sections) and B0578400/CSM/07 (Schematic Representation of Updated Conceptual Model).

Jacobs Recommended Further Works:

- A desk study to include a 1km area surrounding the Stoneyhill site.
- Further leachate and groundwater chemical characterisation.
- Trace gas analysis to establish the source of the gas.
- Gas monitoring programme to establish the degree of risk.

Telford & Wrekin Council comments regarding Report 5:

The drawing (B0578400/CSM/02) shows adits on both sides of landfill. There is no indication on the drawing of direction (e.g. north). The drawing doesn't show the gas flare which is an intentional engineered preferential gas pathway.

Drawings B0578400/CSM/05 and B0578400/CSM/07 do not show a mining pathway, which has not at this stage been fully dismissed with the necessary ground investigation works and research. Potentially, mine-workings could exist to the west of Stoney Hill Landfill site outside the footprint of the landfill. Records indicate a series of 'mineworkings fingers' extending to the west of the site.

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Report 6. (May 2007) ***Stoney Hill Closed Landfill Site Gap Assessment and Scoping Document dated May 2007 and prepared by Jacobs on behalf of Telford & Wrekin Council.***

Significant Points:

- (pg.8 last para.): A Waste Disposal Resolution (1984) specified that the base and sides of the containment areas should have been lined with a structurally sound layer of approved cohesive argillaceous material not less than 2m thick after compaction and free of voids and fissures with a permeability of no less than 10-9m/s. Permeability testing of the laid layer was also required.
- (pg.9 para.1): On several occasions the degree of compaction and permeability was not achieved.
- (pg.9 para.1): Anecdotal evidence from the Environment Agency suggests that former underground workings were found in Phases 4 or 5 (i.e. the deepest part of the site). Concerns were also raised as to whether the haul road into the site was fully lined prior to final waste deposits.

Jacobs significant Recommendations:

- Assess leachate outbreak
- Investigate pollution of groundwater in the colliery spoil in the north of the site (BH8, 9, 32 and 34)
- Investigate the source of the phthalate detected in BH9 and other hydrocarbons which could originate from the colliery spoil.
- Add additional boreholes on the perimeter of the site to better characterise the groundwater regime. (i.e. 2 in west adjacemt to the ponds, 1 in the south west adjacent to BH31 and 2 in the east adjacent to BHs 37 and 38.
- Sample ditches which drain into the ponds.
- Sample ponds.
- Investigate the elevated COD and chloride concentrations in Lydebrook Dingle.
- Trace gas analysis to be carried out on gas in BH's 32, 33, 37 and 38 to determine its origin.
- Determine the stage of the waste decomposition process within the landfill in order to assess the potential for continued gas production.
- Conduct ambient air monitoring around the gas flare to determine the risk to the public from gas migration.

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Supplementary Documents – Discussion:

Item 1: Letter dated 22nd November 2007:

From National Laboratory Service addressed to Telford & Wrekin Council, relating to gas analysis at Stoney Hill Landfill site.

This letter discusses the results of gas analysis for gas samples taken from the following points:

- Gas Line 1 (inside landfill)
- Gas Line 2 (inside landfill)
- BH21D (outside but adjacent to landfill)
- BH25D (outside but adjacent to landfill)

The letter concludes that 'the methane to carbon dioxide ratio, trace components and absence of helium in the borehole gas samples indicates the source (of the gas) is landfill'.

Item 2: Photographs:

Photographs of Stoney Hill Landfill during construction.

Telford & Wrekin Council comments regarding photographs:

The following comments are conjectured only and based on photographic evidence.

Items 2A and 2B: These photographs both show refuse being placed against what appears to be colliery spoil (i.e. opencast backfill) batters.

Item 2C: Again, this photograph shows refuse being placed against what appears to be colliery spoil. The photographs also show what appears to be internal clay bunds which presumably define landfill cells or discrete tipping areas. There is clearly hydraulic connectivity between these cells around the end of the internal bunds. The bunds themselves appear to be poorly constructed and show localised signs of instability and are conjectured to have a relatively high permeability.

There is no evidence in any of the limited available photographs of the construction of a well constructed landfill clay liner either at the base of the landfill or the sides. Instead, it would appear that a cut batter was formed in the colliery spoil (previous compacted opencast backfill) against which the refuse was placed.

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Item 3: Drawings:

(Telford & Wrekin Council in-house Drawings dated 1980's.)

Telford & Wrekin Council comments regarding photographs:

These comprise a detailed set of 'dye-line' drawings prepared in the early to mid 1980's by Shropshire County Council, which are now held in-house by Telford & Wrekin Council. It is understood that these drawings represent the design drawings (both preliminary and construction status) for the construction of Stoney Hill landfill site. The drawings do not however, show details which confirm that they are 'construction status' drawings. Additionally, the details of a number of the drawings conflict with each other. Notwithstanding this, specific drawings show the 'potential' division and basal levels of the landfill cells which were separated by clay bunds and which are likely to have accepted different classes of waste.

On Friday 6th March 2009 representatives from Telford & Wrekin Council spoke with a member of the public who historically was in part responsible for the preparation of the Stoney Hill Landfill construction drawings. The information from this discussion is anecdotal and the person in question is not held liable for any information or opinions provided. Notwithstanding this, the person was perceived to be very knowledgeable about the construction of the landfill hence the reason that Telford & Wrekin Council has reported the key details of the conversation.

A number of drawings were selected from the Telford & Wrekin Council's collection of drawings and were identified as being actual build or construction status drawings. These are drawings:

- No.929/16/1: Stoneyhill Waste Disposal Site, Final Contours, Access and drainage (Draft Plan), undated.
- No.929/13/7: Stoneyhill Waste Disposal Site, Working Contours before Settlement, dated May 1984.
- No.929/02/1: Stoneyhill Waste Disposal Site, dated February 1990.
- No.929/02/1: Stoneyhill Waste Disposal Site, Cross Sections 265 – 420, dated April 1984.
- No.929/10/2: Stoneyhill Waste Disposal Site, General Layout Plan and Method of Working – Scheme No.4, dated May 1984.

These selected drawings are presented electronically on the CD appended to this report (Appendix A).

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During the meeting it was confirmed, anecdotally, that…

- "*no construction materials were imported to the site to construct the landfill liner".* This indicates that the liner was likely to comprise colliery spoil waste.
- "*the construction of the entire landfill base (i.e. cells and base) was completed by Pearce Construction prior to the commencement of the deposition of landfill waste*".
- During the construction of cell 5 (i.e. the area of the landfill to the north west) a landslip was reported to have occurred in north west corner. Remedial works were undertaken, however, it was verbally confirmed that the overall form of the western part of the landfill was amended and the construction drawings were changed to reflect this alteration.

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Stoney Hill Landfill and Designation of Part 2A of the Environmental Protection Act (EPA) 1990:

Part 2A Designation Criteria:

The Definition of Part 2A as defined in Defra Circular 01/2006, dated September 2006 is as follows:

2.1 Section 78A(2) defines CONTAMINATED LAND for the purposes of Part 2A as:

"any land which appears to the LOCAL AUTHORITY in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –
"(a) SIGNIFICANT HARM is being caused or there is a SIGNIFICANT POSSIBILITY of such harm being caused; or
"(b) POLLUTION OF CONTROLLED WATERS is being, or is likely to be, caused".

Stoney Hill Part 2A Designation Conclusions:

In accordance with Part 2A, as defined in Defra Circular 01/2006 and the criteria set out in the Environmental Protection Act 1990, it is considered that some pollution linkages are likely to be present between the landfill and surrounding environment. However, it is considered, **based on the existing information that 'significant pollutant linkages' do not exist with which to determine the site as contaminated land**.

A document entitled 'Regulatory Assessment: Stoneyhill Landfill Site', prepared by Telford & Wrekin Councils Environmental Health Department and dated 11th December 2008 has been provided to Engineering Services. This document concludes that
"In accordance with statutory guidance circular 01/2006 and the provisions of section 57 of the EPA 1990, the investigation is deemed as suitable and sufficient. The investigations have been peer-reviewed by both the Environment Agency and the HPA (and tacitly by DEFRA through the successful bid for funding and subsequent regulatory discussions). It is the opinion of the regulator that significant pollutant linkages do not exist with which to formally determine the site as "Contaminated Land" under the provisions of the Environmental Protection Act 1990.

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However, this opinion has been formed on the basis that the following issues will be addressed within a reasonable timescale (to be agreed by the Environmental Health Department - EHD)":

- Implementation of all recommendations as per table 3 of the DSEAR Assessment and recommendations of the Biogas pumping trial report.
- Production and implementation of an updated site management plan to ensure that the site is adequately managed for the foreseeable future of the site. For the avoidance of doubt, this must put measures in place to address the excessive lateral gas migration, the excessively high leachate levels within the site, and is likely to include the advancement of ten new gas and leachate extraction wells within the site, as recommended by Biogas Ltd. The details of the plan are to be agreed by the Environmental Health Department.
- Replacement of the elevated flare by a ground flare in accordance with EA guidelines (N.B. regulatory discussions have taken place with the EA regarding waste management licence for the flare, and the EA confirm that there is only a requirement for a licence where ground gas electricity generation over 4MW is occurring). As such, a Waste Management Licence is not necessary in replacing the flare.

A letter prepared by the Environment Agency (EA), with a receipt date of 10th February 2009, was appended to the above Telford & Wrekin Council EHD document. The letter discusses Stoneyhill Landfill Site Capital Works and confirms that the EA agree that the format of investigation works and reporting carried out by Telford & Wrekin Council seems appropriate and value for money.

A letter (Draft) prepared by The Health Protection Agency (HPA), Chemical Hazards and Poisons Division, Birmingham, dated 12th February 2009, regarding an "independent peer review of information in relation to the Environmental Characterisation of Stoneyhill Landfill Site, Telford" and "Section 57 of the Environmental Protection Act 1990" has been reviewed.

The letter states that there does not appear to be any significant risks to local people from this site. It does however indicate that "the current flare system is clearly limited and does not meet with modern standards" and recommends that "the flare system is updated to a modern system" and an air quality assessment carried out. The HPA recommend that the study includes an assessment of dioxin emissions and consideration of the impact of local food chains.

Additionally, as there is some evidence of landfill gas migration in perimeter boreholes, the HPA recommend regular monitoring and assessment to collect further gas readings in order to more accurate understand the gassing problem. Should significantly elevated readings be recorded for gas, mitigation measures may need to be put into place to ensure that further migration does not occur.

The HPA conclude with the statement, "We recommend that the Council continue to adequately monitor and manage any landfill gas and leachate and, whenever it is reasonably practicable, ensure that failures do not result in the release of substances which could adversely impact on public health".

Stoney Hill Landfill: A Summary of contamination exceedences and issues:

Based on the reviewed reports, it is concluded that the significant exceedences are as follows:

- Elevated levels of 'landfill gas' and 'colliery spoil gas' around the perimeter of the site.
- Ammoniacal Nitrogen: Groundwater (sandstone) & groundwater (colliery spoil) conjectured to be associated with the landfill leachate.
- List 2 metals (Nickel): groundwater (sandstone) & groundwater (colliery spoil). Lateral and vertical migration via groundwater conjectured to be associated with the landfill leachate.
- Analysis has confirmed elevated hydrocarbon levels in groundwater and in greater concentrations than in leachate. Other external sources may be contributing.
- Malathion: Lateral and vertical migration via groundwater (sandstone). Analysis has shown elevated levels in groundwater and in greater concentrations than in leachate. Other external sources may be contributing.
- Linkage No.38: Dibutylin: Lateral and vertical migration via groundwater (sandstone). Elevated concentrations in one deep groundwater borehole and in leachate.
- Elevated ammoniacal nitrogen and manganese in the ponds.

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Understanding the hydrology of the site:

The leachate and groundwater monitoring has confirmed that the leachate levels inside the landfill are significantly higher than the groundwater levels outside the landfill. Although the records indicate that there was a specification for the landfill construction, it would appear that the landfill waste is sitting in an excavation within the colliery spoil backfill. It is expected that the colliery spoil would have been nominally compacted during its placement (following the opencast works) and would have a relatively high permeability. Consequently, it would be expected that the leachate, which has a proven hydraulic head, would significantly influence the colliery spoil surrounding the site. The monitoring results and groundwater testing carried out to date indicates that this is not the case.

Although a function of the leachate head (i.e. the hydraulic driving force provided by the landfill leachate), the following information is presented as a 'tool' for understanding the potential for leachate migration away from the landfill:

Colliery Spoil Permeability (m/s)	*Leachate migration Distance*
10^{-7}	500m
10^{-8}	50m
10^{-9}	5m

(Note: for example, 10^{-7} meters per second, i.e. m/s, means that in a single second, given a suitable hydraulic driving force, the leachate would move one one-thousandth of a millimetre).

If the landfill 'liner' was constructed to specification (e.g. 10^{-9}m/s or better), and given the duration since the landfill was completed (say 16 years), by calculation, the leachate would theoretically be expected to have migrated approximately 5m from the landfill into the colliery spoil. Colliery spoil is generally very varied with pockets and layers of clayey materials mixed with more granular layers (which would act as highly permeable preferential pathways for leachate migration).

If leachate has not been identified outside the site, it is conjectured that the monitoring points are either located too far from the migrating leachate or are in the cohesive well compacted or consolidated opencast backfill materials.

As with all clay lined landfills, the landfill liner is usually constructed to a specification to give the landfill a design life. Even at the specified

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permeability, it would be expected that some lateral migration of the leachate would occur which is both time and 'head' dependent.

It is clear that since the landfill was completed, the leachate levels within the landfill have risen significantly. No valid mechanism can be identified whereby the liquid within the landfill can be recharged form an external source. Since the leachate levels in the landfill are higher than the groundwater levels outside the landfill, the hydraulic gradient should be *from* the waste materials. The potential for artesian flow into the landfill (from the Little Flint Coal or mine-entries) was considered but research could not substantiate this theory. The potential for water to enter the landfill from the landfill to the west of the site, via mine-workings and adits, has also been considered, but this would require a hydraulic driving head (greater than that in the Stoney Hill landfill) which is unlikely to exist.

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Part C: Stoney Hill Management Plan

Following a thorough review of the existing information, Telford & Wrekin Council consider that there are a number of issues relating to the landfill which need to be addressed. These include, but are not limited to, issues concerning landfill monitoring (gas and leachate) and instrumentation, the gas flare, leachate disposal, ground investigation, the contamination conceptual model and the actual management strategy for the landfill.

These points are discussed in more detail below and constitute the strategic tasks which form the overall management plan for the landfill site.

Proposed Strategy for Stoney Hill Landfill Site

The tasks which form the Stoney Hill Five Year Management are presented in Table 1 (attached). Telford & Wrekin Council considers that these tasks should be carried out in the management of the landfill. The tasks have been numbered 1 to 8 inclusive and have been broken into a series of sub-tasks, each which has been given a priority status, i.e. High (H), Medium (M), Low (L) or on-going (O).

The table presents a timescale within which these tasks could be completed and indicative costs. These cost estimates are included for budget purposes only and are calculated based on current cost estimates and professional fee charge out rates for 2009/2010. For the years following 2009/2010, a 3% increase in costs has been added cumulatively.

The costs and timescale for completing the works are preliminary estimates and proposals only and relies on funding availability.

Tasks 1 & 2: Mitigate against elevated Leachate levels within the landfill:

Introduction:

Leachate levels are in breach of the permitted level as stated in the site Waste Disposal Resolution issued in 1984. It is reported that approximately 90m^3 of leachate per week is removed from the site by tanker and disposed of at a licensed site. A pumping trial carried out in 2008 confirmed that there was some minimal effects on leachate levels using small pumps which were operational for a continuous trial period. It is conjectured, that in order to reduce the leachate levels more significantly, a greater frequency of larger pumps will be needed. This will obviously result in a requirement to construct/install larger leachate holding tanks within the site and will have an associated substantially larger disposal cost should the Council continue to dispose of the leachate by tanker. It may be possible to discharge to public

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sewer with a different cost(s) implication. This option will be discussed later in this report.

Based on the available information, it is considered that the leachate level is not recharging. Any historic measured rises in the levels of the leachate within the landfill are conjectured to be due entirely to a differentiation in the waste between liquids and solids (i.e. self weight creep settlement of the solid with closure of void spaces and a rise in the liquid level).

At this stage there are likely to be three leachate disposal options, as follows:

- Continued pumping to storage tank followed by tanker disposal off site.
- Discharge to storage tank followed by controlled discharge to Severn Trent's foul sewer. This option would incur significant costs for civil engineering works to connect the landfill leachate system to Severn Trent's Sewer system. Expensive pre-treatment works may be necessary to alter the chemistry of the leachate prior to disposal.
- Tanker disposal to Severn Trent's foul sewer over a short haulage distance. As stated previously, expensive pre-treatment works may be necessary to alter the chemistry of the leachate prior to disposal.

Irrespective of which option is ultimately chosen, it will be necessary to increase the pumped volumes of leachate in an attempt to reduce the leachate levels and consequently there will be a cost implication for the installation of new pumps and the construction of new larger storage tank(s).

***Task 1: Potential leachate disposal to Severn Trent's Foul water System*:**

Theoretically, it is possible that the leachate from Stoney Hill Landfill could be discharged directly into Severn Trent's Foul Water System. This would be subject to a feasibility study and cost analysis (by Telford & Wrekin Council) and permission from Severn Trent to discharge to their system. Severn Trent would require a significant amount of information prior to being able to comment on this proposal. This information would include, amongst other things, chemical analysis of the leachate, disposal quantities and proposed point of discharge. This information would be input to Severn Trent's Trade Effluent Notice (TEN) requesting permission to discharge to a public sewer.

Since the chemistry of landfill leachate is known to vary with time, it is recommended that new leachate samples are collected from the storage tank and chemically analysed for selected constituents. This information would be

attached to the TEN and would be a key document in Severn Trent's decision making process.

Based on the chemistry of the selected samples (and other factors e.g. disposal quantities), Severn Trent may, or may not, require the leachate to be pre-treated on-site prior to discharge to sewer. The pre-treatment methodology would be dependent on the chemical alteration required which would make the leachate acceptable for discharge. A pre-treatment budget cost has been included in Table 1, Item 1H. This assumes that the treatment required would include simple aeration or agitation. It is considered that more complex treatment would incur unacceptably high costs which would make disposal to sewer inefficient.

Should the leachate be acceptable for disposal to sewer, civil engineering works will be required to construct the drainage system between the holding tanks adjacent to the landfill and the public sewer.

A brief has been prepared by Telford & Wrekin Council Engineering Services Department highlighting the issues which will need to be considered to implement this solution. The brief also includes 'budget' costs for the works (selected elements of which have been included in Table 1). It is envisaged that should permission be granted to discharge to sewer, the optimal solution would be to pump the leachate to the north, through council owned land, therefore requiring no third party involvement. This solution would require annual maintenance costs and the provision of three phase electrical supply to the pumps.

As an alternative to the above, leachate could be disposed of to sewer direct by tanker/road vehicle without the construction of a connecting drainage system. This solution would dramatically reduce the haulage distance of the leachate tanker which would have a beneficial environmental impact. Assuming Severn Trent would allow the disposal quantity to be discharged, a reduced haulage distance would reduce the tankers turnaround time and increase the tankers potential to dispose of a greater quantity of leachate. This disposal method would have two cost elements, namely, tanker costs and Severn Trent's discharge costs.

Should Severn Trent allow disposal to their sewer at 'an affordable rate' and the civil engineering works to link the landfill to the sewer be completed, this once off cost would save leachate disposal costs in the long term (as compared with continued disposal by tanker).

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***Task 2: Preparation of tender documents for continued leachate disposal*:**

Currently, the leachate pumped from Stoney Hill landfill is collected from the site by tanker and disposed of at a licensed disposal site. The disposal costs for Stoney Hill Landfill for the period 2007/08 are understood to be approximately £44,000. To continue to demonstrate 'best value' practice, it is recommended that the leachate disposal is tendered.

It should be noted however, that due to the very specialist nature of the work, there is likely to be an extremely limited number of companies licensed to dispose of the leachate.

Task 3: Replace and modernise Gas Flare system:

The current gas flare does not meet current legislation and guidelines and a residue of dioxins is noted to accumulate around the gas flare due to its inefficient burning temperature. The elevated flare needs to be replaced by a ground flare as a matter of urgency to comply with the recommendations made by the Environment Agency.

Task 4: Proposed Investigation Works:

Following a review of the reports discussed earlier, it is concluded that the presence of mineworkings immediately to the west and north of the landfill site (within Telford & Wrekin Council's land ownership boundary) has not been discounted or fully addressed. It is recommended that a ground investigation is designed and carried out to target adits, coal and groundwater, outside but immediately adjacent to the landfill (i.e. similar to the 2008 Scott Wilson investigation to the east of the site). Water and gas standpipes would be installed for future monitoring purposes. Water and soil samples would be collected and analysed to determine the possible influence of leachate on the land surrounding the landfill.

The findings of the ground investigation would be used to update the sites conceptual model and would allow a more comprehensive understanding of the potential for the site to have a contaminative impact.

Task 5: Monitoring Installations:

The existing landfill monitoring installations, both within and adjacent to the landfill, needs to be reviewed. A comprehensive understanding of what instrumentation is active and available for future use is required and the

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potential for any gaps and shortcomings in field apparatus needs to be determined:

This will require completion of the following tasks:

- Prepare a comprehensive drawing showing **all** boreholes and wells inside and adjacent to the landfill.
- Identify all boreholes and wells which are redundant or active/usable.
- Seal/cap the redundant holes which act as gas migration pathways (from the landfill) and rainwater infiltration pathways (into the landfill).
- Create an updated landfill installations drawing.
- Tabulate on the drawing the co-ordinates, construction details and depth of all active 'holes'.
- Overlay the appropriate landfill cell details onto this drawing and identify which cells have insufficient sampling points.
- Design new installations required to give full landfill coverage for monitoring purposes.

Previous monitoring and testing has indicated that landfill gas is likely to be migrating from the north east flank of the landfill. Although this is currently not perceived to be a significant risk, the problem needs to be monitored in the field and further field apparatus may need to be installed and monitored.

In their report dated 26th November 2009 entitled Regulatory Assessment, Environmental Health confirm that in order to demonstrate due diligence, a number of landfill management tasks will need to be completed. This includes the necessity to put into place measures to address excessive lateral gas migration.

In order to increase the volume of disposed leachate, it will be necessary to both upgrade the existing pumps within the landfill AND to add further pumps. These pumps will need to be strategically positioned to maximise the efficiency of the pumping system and to draw down the leachate across 'all' of the landfill rather than in discrete landfill cells.

The new leachate pumping system will need to be designed based on our conceptual understanding of the landfill geometry. The cost of these works will need to allow for upgrading the leachate collector system (i.e. above ground pipe network) and the construction/installation of leachate tanks with a greater capacity than the existing tanks.

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Task 6: Data Collation:

A large amount of readings and information, both historic and more recent, are available for the following (both inside and outside the landfill):

- gas monitoring,
- groundwater monitoring,
- groundwater geochemical analysis,
- leachate monitoring and
- leachate geochemical analysis.

This information has been presented in previous studies and reports, but currently, no central database presenting and summarising this information has been compiled. Therefore it is difficult to graphically present the information so that the findings can be fully interrogated and the interpretation incorporated into the Conceptual Site Model. A central database would set the 'background' for a new period of monitoring, testing and analysis and would guide Telford & Wrekin Council Engineers in determining the sampling regimes, chemical testing suites and monitoring frequencies required when managing the landfill.

Task 7: Mine-entries:

A significant amount of information is available relating to the mine-entries recorded within Stoney Hill landfill site. Although numerous reports have been prepared historically for the site, no report comprehensively deals with the issue of mine-entries (i.e. shafts and adits recorded within the footprint of the landfill). Mine-entries potentially could form differential pathways for contaminated waters from the landfill and for groundwater into the landfill. Although the likelihood of both of these scenarios occurring is considered to be extremely low, it is considered good practice to formally discount the shafts and adits from the conceptual model through more thorough research.

Task 8: Telford & Wrekin On-Going Management:

Notwithstanding the previous recommended 'tasks', Telford & Wrekin Council has a duty to manage Stoney Hill Landfill site indefinitely. Biogas currently holds the maintenance contract for the site and a maintenance role will be on-going for the foreseeable future. Therefore, as part of our on-going management plan, Engineering Services intend to carry out six-monthly walkover suveys and maintenance checks of field apparatus with a specialist contractor (e.g. Biogas) carrying out more frequent monitoring and maintenance visits. This shall include sampling of leachate from the tank for chemical analysis to monitor the leachates change in chemistry with time.

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Tasks 1 to 8 Budget Costs:

In Table 1, a 'budget cost' column has been added and a cost has been estimated for each sub task. The breakdown of these costs has not been included in this report as it includes sensitive information relating to staff costs and information which could prejudice future tendering processes.

Each task has been given a priority status which is directly linked to the proposed spend.

The total estimated budget cost for each main task is presented below:

Main Task	Capital , including associated prelims and fees £	Ongoing Revenue costs pa £
1	370,000	0
2	3,000	100,000
3 (Urgent)	103,000	0
4	34,000	0
5 (Urgent)	180,000	0
6	1,500	0
7	3,000	0
8 (Urgent elements)	100,000	48,000
Total	**794,500**	**148,000**
Existing Budget Allocation	**0**	**72,000**
Additional Budget Requirement 2009/10	**£794,500**	**£76,000 pa**

These costs should not be added to give an overall budget cost as this would result in the cost elements for different options for leachate disposal to be added (i.e. items 1H/1J relating to potential leachate disposal to foul sewer and item 2B relating to continued leachate disposal by tanker).

Tasks 1 to 8 Timescale:

Table 1 lists the tasks included in the management strategy for the landfill. Those tasks listed as 'H' (i.e. high priority) need to be addressed in the next year. These include dealing with issues relating to the elevated leachate levels, the gas flare and gas migration.

Conclusions & Recommendations:

Stoney Hill Landfill site is located off Jiggers Bank Roundabout in the west of Telford at the Junction of the A4169 (Ironbridge Bypass) and the A5223. The landfill site passed to Telford & Wrekin Council (from Shropshire County Council) on becoming a Unitary Authority in 1998. Engineering Services manage the site on behalf of Telford & Wrekin Council. The site is regulated by Environmental Health and the Environment Agency.

Stoney Hill site has been assessed under part IIa of the EPA and has not been designated as such. Nevertheless, to avoid future designation, and in accordance with EA and EH recommendations, mitigation measures dealing with gas migration from the landfill and elevated leachate levels within the landfill are high priority tasks. The replacement of the gas flare is also urgently required as the current flare is inefficient and does not meet current legislation.

In order to complete these essential tasks, it is necessary for a capital investment of £794.5k in Stoney Hill Landfill site now in addition to the routine on-going management and maintenance costs. It is strongly recommended that the remedial construction works commence within the next year.

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Stoney Hill Landfill Site

Position Statement & Management Plan

APPENDIX A

CD

Scott Wilson

LIGHTMOOR
TELFORD

Bournville Village Developments

Stoney Hill
Mining Investigation Report

Final

November 2008

BOURNVILLE VILLAGE DEVELOPMENTS

STONEY HILL
MINING INVESTIGATION REPORT

FINAL

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D111050/GTR/001 November 2008

BOURNVILLE VILLAGE DEVELOPMENTS

STONEY HILL
MINING INVESTIGATION REPORT

FINAL

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D111050/GT/002 – Site Area and Land Ownership Plan

D111050/GT/003 – Zones of Workings and Coal Outcrops

D111050/GT/004 – Published Geology

5056573/199/001 – Atkins Limited Ecological Survey

D111050/GI/001_RevB – Exploratory Hole Location Plan

D111050/GT/005 – Plan of Section Lines

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APPENDICES

Appendix A – Telford & Wrekin Council Mine Abandonment Plans

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Appendix D – Coal Authority Letter of Ownership of Assets

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Appendix I – Resistivity Survey

1. INTRODUCTION

In April 2008, Bournville Village Developments commissioned Scott Wilson Ltd to undertake a ground investigation to develop a site model and to investigate the potential for shallow abandoned coal workings at the Stoney Hill site, Telford to allow sign off of Condition 3 (W2007/1038).

The site is part of the Lightmoor Urban Village Development, a mixed residential, education, leisure, retail and light commercial development designed to establish community. Specifically, the site is associated with the construction of the proposed public highway Lightmoor Way South, Stoney Hill Junction and a link to the existing Stoney Hill Lane.

The site is situated off the A4169 Queensway, centred on National Grid Reference 366954, 305872. It is on land associated with and adjacent to the site of the former Stoney Hill Landfill, which operated between 1984 and 1991, receiving municipal, commercial, industrial and special waste. There are three residential properties within 65m of the site; these comprise Croppings Farm, Croppings Cottage and Severn Cottage. The site location is shown in Drawing D111050/GT/001.

A preliminary resistivity survey of the site at Stoney Hill was undertaken by Scott Wilson Ltd in February 2008 (Appendix I). The findings of this survey recommended that further intrusive ground investigation works be undertaken in order to assess the ground conditions on site.

The ground investigation was designed to delineate the extent of historical opencast workings, assess the position and condition of the locally productive Little Flint and Randle coal seams and to prove the presence of a series of adits associated with the former Stoney Hill Opencast Coal Mine.

The ground investigation comprised 31 No. exploratory positions including trial pits and boreholes. Two of these boreholes were drilled for the installation of gas monitoring standpipes to replace existing standpipes, which will be destroyed during the construction of Lightmoor Way South.

This report presents the findings of the ground investigation, along with interpretation of the ground conditions encountered and their implications for the current proposals.

2. SITE SETTING

2.1 Site Description

The site is partly situated adjacent to the northern and southern sides of Stoney Hill Lane and is approximately 200m in length and 50m in width at its longest and widest points respectively, with its long axis oriented approximately east - west. For the purposes of the ground investigation the site has been divided into three areas. These are shown in Drawing D111050/GT/002 and comprise:

- Area A: Adjacent to the former Stoney Hill Landfill and under ownership of Telford & Wrekin Council (TWC);
- Area B: On the site of the former Croppings Farm Opencast coal mine and under the ownership of English Partnerships (EP);
- Area C: Land to the south of Stoney Hill Lane and west of Croppings Farm, under the ownership of EP.

These three areas are separated by track ways, fence and hedge lines and tracts of privately owned land.

The site topography is dominated by a landscaped gentle and shallow valley between ground investigation Areas A and C, with Stoney Hill Lane at its base. This is considered to be a result of landscaping associated with opencast operations and the construction of Stoney Hill Lane. Elevations range from approximately 171m to 180m Above Ordnance Datum (AOD) across the site. However, it has not been possible to obtain site details regarding the surface topography, prior to the opencast works.

Present land use is dominated by light agriculture, comprising pasture and grazing, and scrub land. Parts of Area C are currently employed for works associated with the development of the road junction.

2.2 Historic Land Use

The site is dominated by the presence of the Former Stoney Hill and the Former Croppings Farm Opencast Coal Mines which removed the Randle and Clod and Little Flint coal seams respectively. Opencast coal mining in the site was preceded by deep mining and pillar and stall extraction of the New Mine and the Randle coal seams respectively. The boundaries of the phases of historical opencast mining are presented in drawing D111050/GT/003.

Mine Abandonment plans compiled by TWC in 2004, were made available for review and inclusion in this report. The number and title of the plans regarding opencast and deep mining methods are presented in Table 2.1. The drawings and sections are presented in Appendix A.

Table 2.1 Drawings supplied by Telford & Wrekin Council

Drawing Number	Drawing Title
E1027/002	Topographical Survey and Ground Investigations
E1027/004	Location Plan – Deep Mining
E1027/005	Location Plan – Opencast Mining
E1027/008	Section A-A (Sheet 1/2)
E1027/009	Section A-A (Sheet 2/2)
E1027/010	Section B-B (Sheet 1/3)
E1027/011	Section B-B (Sheet 2/3
E1027/012	Section B-B (Sheet 3/3)

Coal seams anticipated to have been worked beneath the site are presented in Table 2.2.

Table 2.2: Summary of Worked Seams

Coal Seam	Anticipated Depth	Thickness (m)	Method Worked
New Mine	Near Surface	0.9 – 1.8	Unknown
Randle	3 – 4mbgl	0.1 – 1.2	Pillar and Stall
Clod	5 mbgl	0.4 – 1.3	Opencast
Little Flint	8 – 10mbgl	0 - 1	Opencast
Lancashire Ladies (Base of Productive Measures in the area of interest)	20 mbgl	-	Generally not worked due to impersistence and poor quality

2.2.1 Deep Mining

The TWC Mine Abandonment Plans report that the geometry of the seam extraction was dominated by exploitation of the Randle Coal seam and the overlying New Mine Coal to the north of the site. The positions of Coal Authority reported adits associated with the Randle coal seam workings are shown, with three being of significance to the ground investigation site area. The southern boundary of the Stoney Hill pillar and stall mining, which borders the northern extent of ground investigation Area A is shown to have five southward-projecting 'fingers' of workings which require investigation.

The extent of the pillar and stall extraction of the Randle coal seam is shown in TWC drawing E1027/004 to largely match the lateral extent of the Former Stoney Hill Landfill. The TWC cross sections, drawings E1027/008 - 12, show the elevation of workings following the extraction of the New Mine and Randle coal seams. Drawing D111050/GT/003 shows the boundaries of the historical mining phases and the landfill boundary.

2.2.2 Opencast

The first phase of opencast coal mining comprises the Stoney Hill Opencast Coal Mine. The southern extent of this phase of mining passes through the centre of ground investigation Area A and extends to the north. This phase of coal extraction represents the removal of the remaining pillars of the Randle coal seam.

The second phase of opencast coal mining, undertaken between 1990 and 1991, comprised the Croppings Farm Opencast Coal Mine. The Croppings Farm Open Cast Coal Mine is shown to have been located adjacent to the eastern and southern boundaries of the Stoney Hill Opencast Coal Mine in ground investigation Areas B and A respectively, extending off site to the north in Area B. According to Coal Authority Mine Abandonment Plans this phase of opencast coal extraction is reported to have removed the Two Foot, Best, Randle, Clod and the Little Flint Coal seams. It is reported by CampbellReith Ltd, 2004, that it was backfilled with inert colliery spoil and arisings from the construction of a nearby road by 1991 and capped with an impermeable clay layer. Coal Authority Mine Abandonment Plans indicate that backfill was not placed with any degree of compaction.

2.2.3 Landfill

The site of the former Stoney Hill Opencast Coal Mine is reported to have been left derelict between its closure in the 1950s and 1984 when it was employed for the disposal of domestic, industrial and special waste.

The landfill was closed in 1991 and reportedly capped with clay, although desk study review of the available information has not confirmed the details of any lining or capping system.

Post-completion mechanical and electrical engineering has included the installation of a landfill gas and leachate collection system, however large quantities of methane were still reported in the CampbellReith Ltd report, 2004, to be migrating from the landfill margins.

Present land use of ground investigation areas comprises:

- Area A is un-maintained grass and scrub land.
- Area B is predominantly used for grazing and hay production.
- Area C is being utilised by the Principal Contractor undertaking the (ongoing) road junction works at Stoney Hill. Excavation required for the construction of the junction has resulted in several large stockpiles of topsoil and superficial material being formed to the south of Area C. In addition clay and coal rich made ground and bedrock have been exposed as a result of the excavations.

2.3 Land Ownership

Due to the nature of the investigation and the required positions of the exploratory holes falling on land belonging to multiple land owners, illustrated in Drawing D111050/GT/002, the following permissions were obtained prior to commencement of works:

- English Partnerships, 'Licence to Enter English Partnerships Land at Stoney Hill Junction and Link Road abutting Croppings Farm, document reference PG/PW/Lightmoor PRG3. Presented in Appendix B.
- Telford & Wrekin Council, 'Licence. Land at Stoney Hill Tip, Horsehay, Telford' Document reference PAP002/05834. Presented in Appendix C.

In order to determine the ownership of any coal underlying the site and as such determine the requirement for permission to investigate it liaison with The Coal Authority was undertaken, this confirmed that the coal seams at Stoney Hill were indeed under the ownership of the Coal Authority and not an 'alienated' asset. The Coal Authority issued a 'Letter of Ownership of the Assets for Stoney Hill', document reference CA 13/05/08/37, presented in Appendix D, which confirmed that any coal seams underlying the site area were under the ownership of the Coal Authority. It followed that prior to the commencement of site works 'Permission to Enter or Disturb Coal Authority Mining Interests' was required. This is presented in Appendix E.

2.4 Geology

A review of the published geology was undertaken as part of the desk study stage of reporting. The following reference materials were consulted:

- British Geological Survey (BGS) 1:50,000 Series England and Wales Sheet 152 Shrewsbury Solid Edition
- BGS 1:10,560 Series Ordnance Survey Sheet SJ 60 NE
- BGS 'Geology of Telford and the Coalbrookdale Coalfield', 1995. London: HMSO.

An extract of the geological maps is presented in Drawing D111050/GT/004.

2.4.1 Former Stoney Hill Landfill

The former Stoney Hill Landfill is reported to have been capped with a clay layer, the details of which are unknown. The thickness of waste within the landfill is reported in the CampbellReith Ltd report, 2004, to be approximately 8m with a 2m compacted clay liner at its base. The former Croppings Farm Opencast is reported to be separated from the former landfill by a barrier of compacted clay up to 3m thick, this area is also capped with a low permeability seal, presumed clay, intended to restrict the migration of landfill gas and leachate from the landfill. However, no primary evidence discussing the details of this liner were obtained during the commission period.

2.4.2 Made Ground

The former mining activities which have dominated the site's recent history have led to variable thicknesses of Made Ground across the site. This is considered to comprise mine spoil, waste arisings and opencast backfill.

The Former Stoney Hill Opencast Coal Mine is reported to have been derelict from its closure in the 1950s until its reinstatement for landfill in 1984. According to the CampbellReith Ltd report, 2004, the Former Croppings Farm Opencast Coal Mine was backfilled in 1991 using a combination of opencast spoil and arisings from the construction of a nearby road. No records pertaining to the engineering specification of the backfill have been received however anecdotal evidence from the resident of Croppings Farm reports that it was compacted to a degree that proves difficult for farming.

Current excavation activities for the road junction within Area C have exposed clay and coal rich fill (or Made Ground) passing northeast to southwest across the centre of Area C, which is considered likely to represent the southern extent of extraction of the Little Flint coal seam. This, in plan, abuts solid geology comprising moderately weak to moderately strong sandstone attributed to the Lower Coal Measures (LCM).

2.4.3 Superficial Deposits

The available published geology for the site indicates no significant superficial deposits within the site. However, laterally inconsistent cover of Glacial Till was reported on the land surrounding the site in the CampbellReith Ltd report, 2004.

Superficial deposits are not anticipated to have been removed by opencast operations in ground investigation Area C and are expected to be present in association with a buried valley feature identified by the Scott Wilson Ltd resistivity survey (Appendix I).

2.4.4 Solid Geology

The available published geology indicates that the site is directly underlain by the Carboniferous LCM. These have a recorded thickness of 20 – 70m but are anticipated to be nearer 10m thick at the site. They comprise interbedded units of pale grey-brown sandstones, siltstones and mudstones with subordinate seams of coal, fireclay and ironstone.

The 1:10,560 series BGS Ordnance Survey Sheet reports several coal seams within the LCM to outcrop within the site boundary.

The Randle and Clod coal seams are reported to be the nearest productive coal seams to the original ground surface. The Randle and Clod are reported in the BGS publication, 'Geology of Telford and the Coalbrookdale Coalfield' to occur together in this region and to have a maximum combined thickness of 3m, but varies widely.

The deepest productive and worked seam, at around 10 metres below original ground level (mbogl), is reported to be the Little Flint coal seam, the thickness of which is reported to range from 0.4 to 0.8m in this region.

The deepest coal seam anticipated in this region is the Lancashire Ladies projected by the BGS to outcrop to the south and east of the site area.

Bedrock, presumed to be the LCM and comprising pale brown, medium bedded sandstones and thin mudstone laminations has been exposed by the construction earthworks for the road junction in the south of ground investigation Area C.

The LCM are reportedly underlain unconformably by the Carboniferous Lydebrook Sandstones, the maximum thickness of which is approximately 30m. These are referred to as orangey-brown sandstones with subordinate shales and conglomerates.

The Lydebrook Sandstones are in turn reported to be underlain by the Wenlock Shale, the maximum thickness of which is some 240m. These are silty mudstones with rubbley, nodular limestone bands.

2.5 Hydrogeology

The Environmental and Geotechnical Interpretive Report, CampbellReith Ltd 2004, states that the Environment Agency has identified the Lydebrook Sandstone and LCM as minor aquifers.

A review of the Environment Agency Groundwater Vulnerability Map, Sheet 22, identifies the site as a high risk aquifer as a worst case. This classification is deliberately onerous as, noted on the map, it is based on fewer observations than normal.

2.6 Previous Reports

A number of reports, documents and plans have been prepared which relate to the Stoney Hill landfill and its environs. The following reports have been prepared and/or reviewed by Scott Wilson during this commission, or previous commissions relating to the site.

2.6.1 CampbellReith Ltd, 'Environmental and Geotechnical Factual Report and Supporting Documentation', July 2004.

This report provides a factual account of the site investigations undertaken on the Lightmoor Urban Village Development site up to the time of issue. This includes summary reviews of previous reports and investigations undertaken within the Lightmoor Urban Village Development site focusing on the ground conditions and historic mining activities.

2.6.2 Telford & Wrekin Council Mine Abandonment Plans, 2004.

Composite Mine Abandonment Plans supplied by TWC, compiled in 2004, indicate the extent of opencast workings at the former Stoney Hill Opencast Coal Mine and interpret the degree to which each seam was mined.

The Mine Abandonment Plans indicate adits or roadways within subsurface works projecting to the south from the former Stoney Hill Opencast coal mine within Area A. Cross sections prepared by Telford & Wrekin Council are presented in Appendix A and show interpreted depths of coal seams and the geometry of the opencast coal mine.

2.6.3 Coal Authority Mine Abandonment Plans, 1991

Mine Abandonment Plans obtained from the Coal Authority show seam extraction at the former Croppings Farm Opencast Coal Mine, indicating the boundary of the site, which seams have been worked and to what degree.

The plans show the 'authorised site boundary' to coincide with ground investigation Area A and Area B. The seams from which coal was won comprise the Two Foot, Best, Randle, Clod and Little Flint in stratigraphic order. The most extensively worked laterally was the Little Flint, with working extending to a maximum depth of 166.62m AOD.

Despite the 'authorised site boundary' extending into ground investigation Area A, all coal extraction took place outside this section of the site.

2.6.4 Coal Authority Mining Report, reference 00028762-07, 2007.

The site specific Coal Authority Coal Mining Report provides specific information for the site regarding subsurface and opencast coal extraction, both past and present. The presence and likelihood of hazards arising from proximity to such workings are presented and a plan indicating the location of mine entries known to The Coal Authority is also provided.

The report states that shallow mining activities are on record as having been operational until 1925 and that opencasting has taken place on site. No existing operations are reported within 200m of the site and no other mining hazards have been identified by The Coal

2.6.5 Scott Wilson Ltd, 'Stoney Hill Geophysical Survey, Stoney Hill, Lightmoor Urban Village, Telford', D118518, February 2008.

The findings of this report are summarised below, the report and associated drawings are included in full in Appendix I.

In February 2008, Scott Wilson Ltd was commissioned to undertake a geophysical survey of the proposed road junction and proposed road Lightmoor Way South. The aim was to non-intrusively assess the ground conditions and identify subsurface anomalies that may be indicative of the former open cast and deep coal mining underlying the site.

The method of geophysical survey adopted was resistivity and the survey comprised nine section lines, each containing 64 electrodes at 2m centres.

The findings of the report are summarised below;

Within ground investigation Areas A and C the southern extent of the opencast coal mine workings and the positions of the suspected adits closely match those shown in Mine Abandonment Plans provided by TWC.

The former Stoney Hill Opencast coal mine appears to have a stepped highwall. The orientation of this feature could potentially have resulted in adits and incomplete coal extraction at the periphery of the area of works, these however do not appear to cross the alignment of the proposed road and only marginally encroach on ground investigation Area A.

The former Croppings Farm Opencast Coal Mine, underlying ground investigation Areas A and B, was not found to have a highwall and the workings appear to extend to a depth of 7-8m.

In the southern part of ground investigation Area C a large area of low density material was interpreted to be a 'buried valley', the content of which could not be determined but is anticipated to be natural, possibly glacigenic. This may influence the southern part of the alignment of the proposed road.

The geophysical report concluded that the site may be underlain by features arising from historical mining and that any further redevelopment on the site should include a targeted intrusive ground investigation.

2.6.6 Atkins Limited, 'Ecological Advice for Stoney Hill junction Ground Investigation Works', June 2008.

In June 2008, Atkins Limited were commissioned by Bournville Village Developments to undertake an ecological survey of the proposed intrusive ground investigation site at Stoney Hill. The aim of the survey was to identify and advise on measures to mitigate the potential for negative ecological impact from the ground investigation works.

The ecological survey identified a pond with a small breeding population of Great Crested Newts (GCN) approximately 500m to the south of the site, on land belonging to Croppings Farm. The report highlights that suitable habitat for feeding and resting includes drainage ditches and hedgerows such as those found at the Stoney Hill site.

There is a shallow ditch that runs parallel with the northern side of Stoney Hill Lane, along the southern boundary of the TWC owned land. The report identified this and the small area of scrubland located by the entrance to the former landfill as potential habitats for newts.

The report concluded with guidance for four key situations where mitigation measures should be adopted, these are summarised in Table 2.3, on the next page.

Table 2.3: Summary of Ecological Situations and Mitigation Measures

Situation	Impact	Mitigation Measure
Grassland	Migration of Great Crested Newts	Mow grass to 30mm length, finger tip search for Great Crested Newts
Hedges	Badger setts Nesting birds	Position exploratory holes outside 5m stand-off from hedgerows
Tree Canopy	Root damage	Position exploratory holes and arisings outside of tree canopy to avoid root damage.
Topsoil Stockpile	Great Crested Newt burrows	Position exploratory holes outside of 5m stand-off from topsoil stockpile to prevent disturbing newt burrows.

3. WORK UNDERTAKEN

Acting on the recommendations of Scott Wilson geophysical survey report, an intrusive investigation was commissioned by the client.

The purpose of the ground investigation is to characterise the ground conditions at the site sufficiently to make an assessment of the possible requirement to treat subsurface voids arising from historic mining. The scope of the ground investigation comprised:

- Delineation of the extent of phased historical opencast coal excavations
- Locating the Little Flint and Randle coal seams and any abandoned workings within, and assessment of their condition
- Locating up to seven suspected mine adits / entrances associated with the former Stoney Hill Opencast Coal Mine operations.
- Locating and further assessing the 'buried valley' identified by the geophysical survey.

The proximity of the site works to the former Stoney Hill Landfill (for which the origin of the waste cannot be confirmed) and the potential for abandoned mineworkings underlying the site resulted in the site being classified as Red. This is in accordance with the Site Investigation Steering groups' publication, 'Guidelines for the safe investigation by drilling of landfills and contaminated land'. Thomas Teford, London, 1993.

3.1 Field Verification

Following the design of the ground investigation, visual field verification of the exploratory hole positions and an ecological assessment was undertaken.

The following considerations were made when finalising the exploratory hole positions:

- Ecological - Minimum off-set from the ditch, hedgerows, tree canopies and the topsoil stockpile. This was agreed by a representative of Atkins Ltd.
- Health & Safety – Minimum off-set from overhead powerlines and subsurface services.

3.2 Exploratory Holes

The ground investigation comprised:

- 15 No. machine excavated trial pits, undertaken in order to attempt to locate seven suspected abandoned adits associated with historical abandoned subsurface mining and the former Stoney Hill Opencast Coal Mine
- 7 No. machine excavated trial pits, undertaken to investigate the buried valley feature identified during the geophysical survey.
- 2 No. rotary cored boreholes to a depth of 40m, to allow detailed characterisation of the solid geology and to assess the condition of any encountered insitu coal seams or workings.
- 4 No. rotary openhole boreholes to a depth of 40m, positioned to allow interpolation of the changes in strata identified in the rotary cored boreholes and to indicate areas of broken or worked ground.
- 2 No. rotary openhole boreholes drilled to rockhead (encountered at 6.5 and 7.0mbgl) for the installation of gas monitoring standpipes to replace two existing standpipes

which will be destroyed during the construction of the road junction and Lightmoor Way South.

The As-Built positions of the exploratory positions can be seen in Drawing D111050/GI/001_RevB

3.3 Sampling and Laboratory Testing

Disturbed samples were collected from three trial pit positions to be tested for:

- 6 No Moisture content
- 3 No Atterberg Limits (Liquid Limit, Plastic Limit and Plasticity Index)
- 3 No Particle size distribution (PSD) with optional sedimentation testing where required

The results of these tests are presented in Section 4.5. The full results of the laboratory testing are presented in Appendix G.

4. GROUND MODEL

Assessment of the graphic logs for the exploratory holes and the information gathered pertaining to historic land use within the site boundaries is discussed area by area below.

Graphic logs for the exploratory holes are presented in Appendix F of this report

4.1 Made Ground

A summary of the made ground encountered in the exploratory boreholes undertaken for this ground investigation is presented in Table 4.1.

Table 4.1: Summary of Made Ground

Area	Depth Encountered (mbgl)	Thickness (m)	Character
Area A	Ground Level	3.8 – 7.3	Variable proportions of clay, sand and gravel with coal, mudstone and sandstone gravel and cobbles and brick, wood, tile, ceramic and metal fragments.
Area B	Ground Level	3.85 - 7.8	Variable proportions of clay, sand and gravel with coal, mudstone and sandstone gravel and cobbles and wood, and metal fragments.
Area C	Ground Level	Not present – 5.4	Coal rich clay fill.

4.1.1 Discussion

In Area A trial pits A2a and A2b identified clay rich Made Ground to 0.9 and 1.1m below ground level (mbgl) respectively, which was considered possible to be representative of the landfill capping layer anticipated to be present in association with the former Stoney Hill Landfill. However, this material was not recorded in the other trial pits within Area A or Area B.

The Made Ground identified in Area A was typically unconsolidated clay and coal rich sand and gravel. In Area B it was recorded as typically firm to stiff coal rich sandy and gravelly clay fill. These materials have been interpreted as backfill within the former opencast coal mining area, unconsolidated in Area A and possibly engineered to some degree in Area B.

In the western extent of ground investigation Area C significant excavations during the earthworks phase of construction for the road junction have removed much Made Ground which may have been present. However, borehole BH6 encountered 5.4m of Made Ground within 3m laterally of exposed sandstone at approximately the same elevation, before encountering competent coal. It is thought that this may delineate the southern extent of the former opencast coal mining.

East of borehole BH6, in Area C, trial pit BV1 encountered 0.5m of topsoil overlying rockhead.

None of the exploratory holes encountered materials considered to be associated with the adjacent landfill operations.

4.2 Superficial Geology

A summary of the superficial geology encountered in the exploratory boreholes undertaken for this ground investigation is presented in Table 4.2

Table 4.2: Summary of Superficial Geology

Area	Depth Encountered (mbgl)	Thickness (m)	Character
Area A	None Encountered		
Area B	None Encountered		
Area C	Ground Level	Not present – 5.2	Loose gravelly sand with clay.

4.2.1 Discussion

Trial pits BV2 and BV3 and borehole BH5 encountered superficial deposits of sand and clay at depths ranging 0.9 to 5.2mbgl, increasing in depth to the east and east-south-east. This is considered likely to be indicative of the 'buried valley' feature identified in the geophysical survey which is included in Appendix I.

4.3 Solid Geology

A summary of the solid geology encountered in the exploratory boreholes undertaken for this ground investigation is presented in Table 4.3

Table 4.3: Summary of Solid Geology

Area	Depth Encountered (mbgl)	Thickness (m)	Character
Area A	3 – 7.3	12.8 - 9	Grey-brown, thinly laminated mudstone, pale brown medium bedded sandstone and thin coal. (Lower Coal Measures)
	12 – 17.8	7 - 11.9	Orange-brown, medium bedded sandstone (Lydebrook Sandstone)
	23.9 – 24.8	Unproven	Grey, thinly laminated mudstone (Wenlock Shales)
Area B	4.1 - 7.8	10.4 – 11.86	Grey, thinly laminated mudstone, pale brown, medium bedded sandstone, medium-coarse quartz conglomerates and thin coal. (Lower Coal Measures)
	18.2 – 19.1	3.1 – 5.43	Orange-brown medium bedded sandstone (Lydebrook Sandstone)
	21.3 – 24.53	Unproven	Grey, thinly laminated mudstone (Wenlock Shales)
Area C	0.33 – 5.4	6.12 - 11	Grey, thinly laminated mudstone, pale brown, medium bedded sandstone, medium-coarse quartz conglomerates and thin coal. (Lower Coal Measures)
	6.5 - 11.52	3.08 – 9.7	Orange-brown medium bedded sandstone and grey-brown mudstone (Lydebrook Sandstone)
	14.6 - 16.2	Unproven	Grey, thinly laminated mudstone (Wenlock Shales)

4.3.1 Discussion

Within ground investigation Area A the LCM were encountered at depths ranging 3 to 7.3mbgl. In borehole GM01 and GM02 the LCM were identified by sandstone, with borehole BH1 passing into coal at 7mbgl. Borehole BH2 is recorded to have passed from Made Ground to 'coal with mudstone' at 3mbgl, however this may have been colliery spoil and opencast fill. Solid coal is recorded at 6.4mbgl in borehole BH2, followed by hard drilling and pale sandstone at 8mbgl, which is more typical of the bedrock profile shown in other exploratory holes. It is interpreted that the coal identified in these boreholes may represent the Lancashire Ladies at the base of the LCM due to the thickness and that it had not been removed through the historic local coal mining.

In Area B the LCM are typically encountered at a depth range between 7 and 8mbgl with reported thickness up to 11.86m.

The ground level in ground investigation Area C is typically at a lower elevation that in Areas A and B, significantly so in the west following the excavation works for the road junction. In Area C the LCM are encountered from ground level to 5.4mbgl. The LCM here are represented by sandstones.

In all ground investigation areas the LCM are reported to be underlain by the Lydebrook Sandstone. Boreholes BH1 to BH6, inclusive, report the thickness of the Lydebrook Sandstone to range from 3.08 to 11.9m and vary in composition from grey and brown sandstones to mudstones. In borehole BH6 in Area C the Lydebrook Sandstone is also represented by a weak, poorly cemented conglomerate of rounded sand and gravel.

Underlying the Lydebrook Sandstone are the Wenlock Shales. These are recorded in all boreholes to be moderately weak – moderately strong, thinly laminated grey mudstones.

4.4 Groundwater

A summary of the groundwater encountered in the exploratory boreholes undertaken for this ground investigation is presented in Table 4.4

Table 4.4: Summary of Groundwater

Area	Depth Encountered (mbgl)	Character
Area A	None Encountered	
Area B	2.95 – 3.5	Moist soils
Area C	None Encountered	

4.4.1 Discussion

Little groundwater was observed in the exploratory holes, even following periods of rainfall during the ground investigation works. It is considered that the moisture noted in trial pit BV7 and borehole BH+1 was perched within the clay-rich opencast fill and not truly representative of the local groundwater regime.

4.5 Laboratory Soil Testing Results

A summary of the soil testing results encountered in the exploratory boreholes undertaken for this ground investigation is presented in Table 4.5. The soil testing results and laboratory accreditation is presented in Appendix G.

Table 4.5: Summary of Soil Testing Results

Area	Soil Sample	Sample Depth	Moisture Content (%)	Plasticity Ip	Particle Size Distribution
Area A (East)	TPA2b	0.5	25	14 (CL)	Gravelly SAND/SILT
Area A (East)	TPA2b	0.5	19		
Area A (West)	TPA7b	0.5	26	20 (CI)	Slightly gravelly sandy SILT/CLAY
Area A (West)	TPA7b	0.5	23		
Area C	TPBV2	0.5	20	NP	Slightly silty sandy GRAVEL
Area C	TPBV2	0.5	21		

4.5.1 Discussion

The samples were obtained from within the top metre of soil in order to characterise the made ground.

The moisture content results range 19 to 26% which is representative of the soil descriptions and the lack of groundwater encountered during the ground investigation works.

The variable plasticity results, ranging from low plasticity (CL) to intermediate plasticity clay (CI), reinforces the variable nature of the made ground and the presence of potentially compressible cohesive materials.

Sample TPBV2 at 0.5m depth was collected from the natural superficial geology overlying the LCM and is reported as non-plastic (NP). This contradicts the log of the trial pit, which indicates slightly sandy, very gravelly clay. Photographs of trial pit BV2, presented in Appendix H, illustrate the variability of the material attributed to the buried valley; however this is not anticipated to underlie the proposed road alignment for Lightmoor Way South.

4.6 Interpretation

Interpretation of the ground conditions encountered and assessed during the ground investigation has been undertaken through the production of ground profile sections across the site. The ground profile section positions are shown in drawing D111050/GT/005, the ground profile sections are presented in drawings D111050/GT/006 to 008.

Ground investigation Areas A and B have been interpreted as being predominantly underlain by backfilled opencast mine workings with clay-rich colliery spoil, including coal, wood and metal. This has resulted in the backfill having great variation in cohesive and granular properties.

Findings from the trial pit excavations to prove the presence of shallow subsurface workings (as indicated in TWC Mine Abandonment Plans, The Coal Authority Mining Report and the geophysical survey), did not identify adits, fingers of workings, or any other indication of broken ground, backfilled workings (within a seam) or any other indication of abandoned shallow coal workings.

It is interpreted that the anomalies identified on the geophysical survey were variations in compaction and composition of the backfill which correlates with the variations noted throughout the Made Ground encountered in the intrusive positions. Interpretation of the boreholes undertaken across all ground investigation areas has identified broken ground or made ground interpreted as opencast backfill at the anticipated depth of the Little Flint coal seam. This indicates that the two phases of anticipated opencast coal mining were excavated

to a proven depth of 7.8mbgl, this being sufficient depth to remove the Little Flint coal seam in addition to the Randle coal seam.

This interpretation suggests that the extent of opencast coal mining in the site area is greater than anticipated and that the backfilled area will have a significant influence on the design of the road junction and Lightmoor Way South. The interpreted extent of the opencast workings and as such the associated highwall is shown on drawing D111050/GT/009. The area covered by the landfill cap and landscaping of the Croppings Farm Opencast Coal Mine in 1991 is interpreted to have extended beyond the eastern site boundary, this is also shown in drawing D111050/GT/009.

The Lancashire Ladies coal seam was not identified in the boreholes, however the published geology for the area reports the Lancashire Ladies coal seam as inconsistent in it's presence in this region. It may be that the undisturbed bands of coal encountered in trial pit A3a and boreholes BH+1, BH2, BH3, BH5 and BH6 are representative of the southerly limit of the Lancashire Ladies coal seam.

The buried valley feature was identified on site by the presence of loose gravelly sand with clay interpreted as natural superficial deposits. The thickness of superficial deposits above rockhead increased to the south, away from the road alignment, confirming the general presence of the buried valley as initially indicated in the geophysical survey. The northern extent of the buried valley is not considered to effect the proposed road alignment for Lightmoor Way South. Features such as this are not uncommon elsewhere in the region immediately surrounding the site at Stoney Hill.

5. POTENTIAL FOR MINING AND GROUND INSTABILITY

5.1 Area A – Telford & Wrekin Council Land Adjacent to the South of Stoney Hill

The ground investigation in Area A aimed to prove the presence of a series of mine entries or adits associated with the former Stoney Hill Opencast coal mine. Features thought to be adits and/or workings had been indicated in previous non-intrusive studies and on existing plans.

The trial pitting undertaken in Area A, was specifically targeted on the conjectured location of these mine adits but failed to identify evidence for collapsed ground, voids, or other features associated with abandoned mining. A thick covering of Made Ground was present to a proven depth 7.8mbgl.

The suspected adits investigated were originally identified by the Scott Wilson geophysical survey and review of the TWC Mine Abandonment Plans. It is considered that the anomalies thought to be adits were variations in the composition and consolidation of the Made Ground i.e. material of lower density due to lower levels of compaction during backfilling operations.

No voids were recorded in the boreholes undertaken in Area A. Considering the depth of the boreholes, to 40m, and based on current industry guidance CIRIA Special Publication 32 the indication is that there are no significant voids present within influencing distance beneath the site area and proposed highway formation level.

5.2 Area B – English Partnerships Land South-East of Stoney Hill

Anecdotal evidence suggests that the former Croppings Farm Opencast was operated to win material from the Clod and Little Flint coal seams, with Coal Authority Mine Abandonment Plans indicating the extraction of the Two Foot, Best and Randle also. From the available published information given in the CampbellReith Ltd report, 2004, the thickness of Made Ground was anticipated to be approximately 10mbgl.

No evidence of workings at depth was encountered indicating that the Little Flint coal seam was fully extracted through opencast methods. As such the thin and inconsistent coal encountered across the whole site, specifically in Area B at 7.8mbgl in borehole BH3, may be interpreted as the Lancashire Ladies coal seam.

The results of the intrusive works suggest that the Croppings Farm Opencast mining operations fully exploited both the Clod, Little Flint and all overlying coal seams as indicated by the Coal Authority Mine Abandonment Plans. Consequently, there is no deeper seam of economic value beneath this area of the site.

5.3 Area C – English Partnerships Land South of Stoney Hill

The ground investigation for Area C was designed to further investigate the possible buried valley feature identified by the geophysical survey. The investigation also aimed to identify the presence of the Little Flint coal seam as BGS geological plans indicate it to outcrop within ground investigation Area C.

Exploratory holes undertaken in Area C indicated a variable thickness of apparently natural, potentially glacial, superficial deposits which increase in thickness to the south away from Stoney Hill Lane. This supports the presence of such a buried valley feature as previous noted in the geophysical survey, though its precise nature remains unclear.

The soils of the buried valley infill are recorded as loose gravelly sand with clay which may pose geotechnical hazards to future developments through consolidation and differential settlement. However, they are not interpreted to underlie the footprint of the proposed road Lightmoor Way South. The absence of recorded workings at depth indicates there is little or no potential for surface instability resulting from worked coal seams.

5.4 Treatment Requirements and Discussion

No voids were identified during the ground investigation and while there were significant losses of water flush during drilling in several of the boreholes, these are attributed to loss in natural fractures in the LCM and Lydebrook Sandstone.

The lack of evidence for voids at depth indicates that during the various phases of opencast coal mining the Randle, Clod and Little Flint coal seams were totally extracted. This removes the need for a programme of drilling and grouting to stabilise the ground underlying the road junction and Lightmoor Way South.

6. CONCLUSIONS AND RECOMMENDATIONS

Following a non-intrusive resistivity survey an intrusive ground investigation was commissioned to further investigate the areas of interest highlighted by the resistivity survey and to further develop the site model and to investigate the potential for shallow voids arising from abandoned mining operations.

The ground investigation did not identify subsurface voids associated with historical mine workings. Interpretation of the ground investigation indicates that the Randle, Clod and Little Flint coal seams appear to have been fully excavated through open cast methods. Where these seams have been removed the opencast workings have been backfilled in an uncontrolled manner with clay-rich coal fill and this lies, in part, beneath the proposed road junction and the alignment of Lightmoor Way South.

Consequently the proposed road development of Lightmoor Way South is not considered to require any remedial treatment works to be undertaken to protect the finished highway from ground subsidence arising from historical abandoned shallow mineworkings.

The alignment and design of the proposed road, Lightmoor Way South, through ground investigation Areas A and B requires the excavation of a shallow cutting to accommodate the limits of the highway boundary. The stability of any such excavations in both the temporary and permanent case have not been analysed as part of the existing commission. It is recommended that analysis of the stability of the proposed cutting is undertaken as the variability of the Made Ground is not conducive to stable earthwork construction.

The excavation of the proposed cutting through the Made Ground, which has been detailed as very variable and contains potentially combustible material, may require the design of a sealing layer to prevent degradation or ignition.

The opencast backfill materials underlying the proposed alignment of Lightmoor Way South are considered to be highly variable in strength and composition and likely to be susceptible to differential settlement. In response to these findings it is recommended that the designer of Lightmoor Way South consider targeted assessment of the ground conditions. This should be designed to quantify the range in strengths and composition of the fill materials and develop an appropriate ground engineering approach to mitigate the anticipated differential settlement.

It should also be noted that the juxtaposition of the opencast backfill material and the mine highwall in ground investigation Area C and underlying the road junction and link to Lightmoor Way South poses the potential risk of differential settlement between the more competent material of the highwall and the backfill material. The extent of the opencast coal workings, or highwall, is shown on drawing D111050/GT/009. Where this underlies the footprint of the road junction it is recommended that the upper extents of the opencast backfill be removed and replaced with engineered fill to mitigate the disparity in ground strengths and the potential for differential settlement. This exercise should also include benching into natural materials to allow the re-engineered fill to be replaced in a uniform manner.

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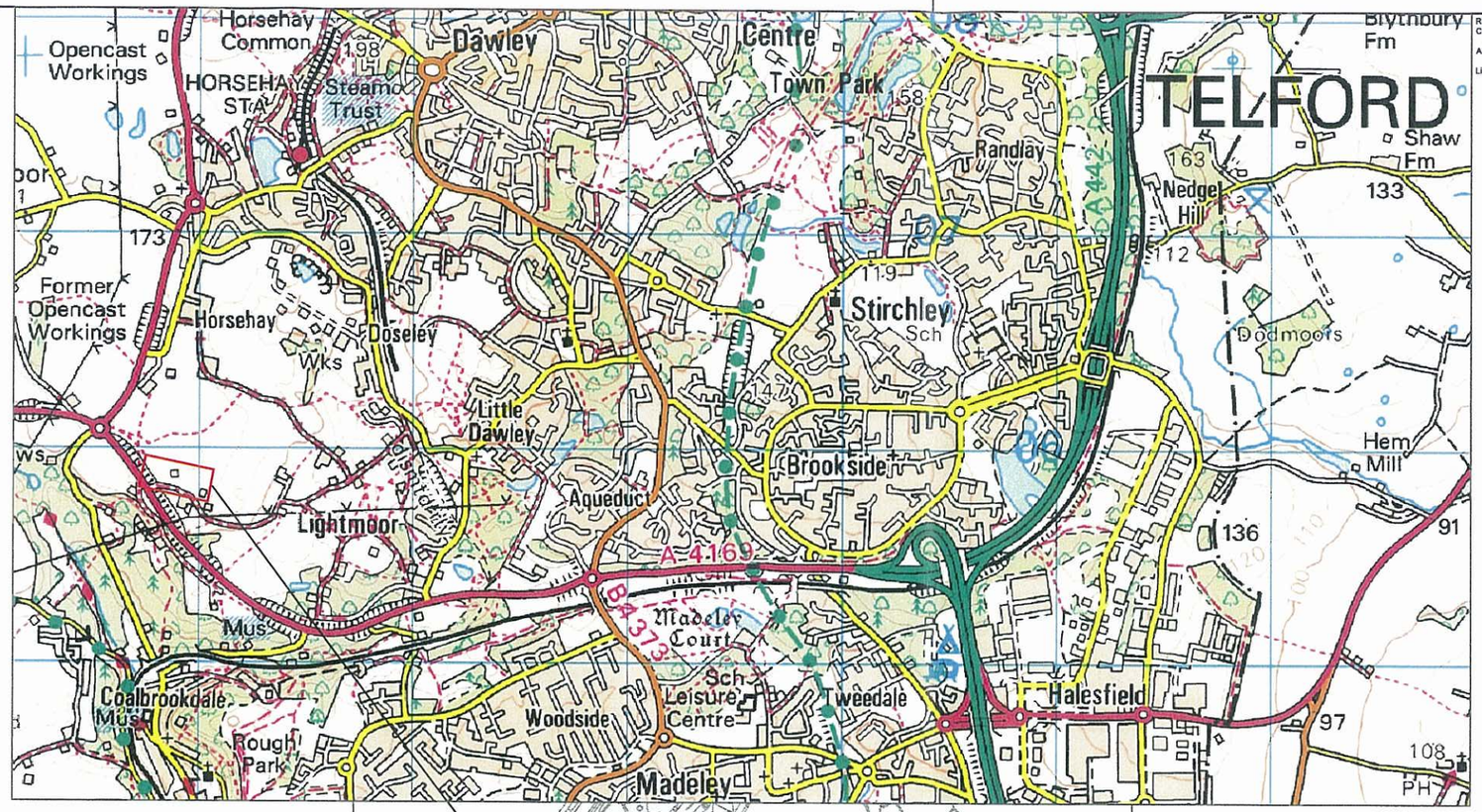
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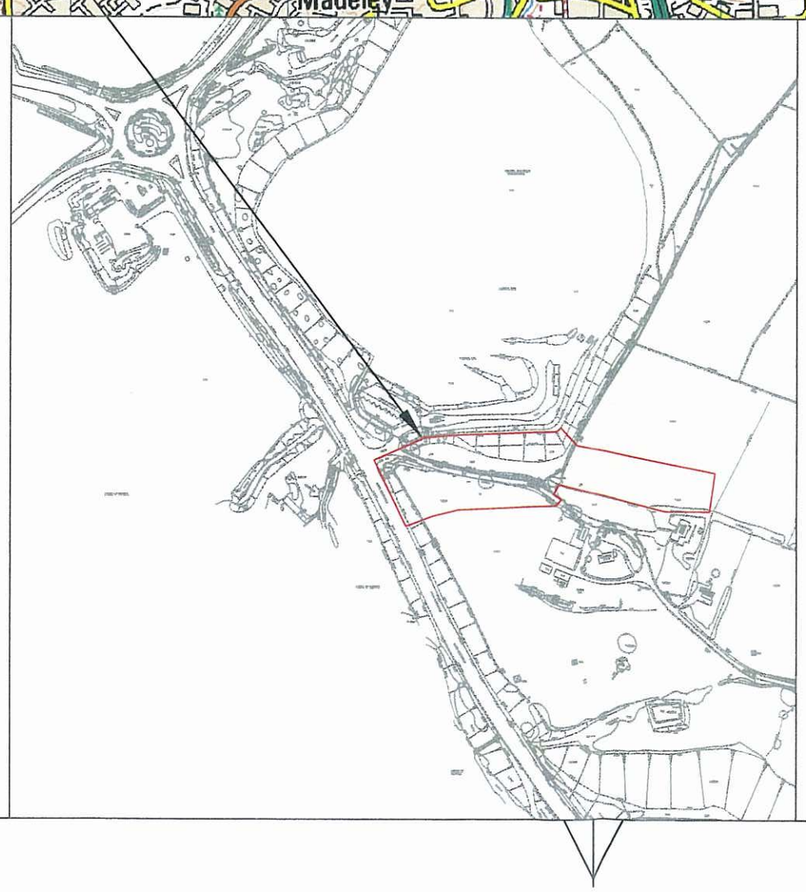
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DRAWINGS





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KEY

Site Boundary

Revision Details	By / Check	Date	Suffix
Amend to Final Issue	CHF / SOG	14.11.08	01
Amend title to Mining Investigation Report	CHF / SOG	04.11.08	01

Drawing Status

FINAL

Job Title

STONEY HILL
MINING INVESTIGATION
REPORT

Drawing Title

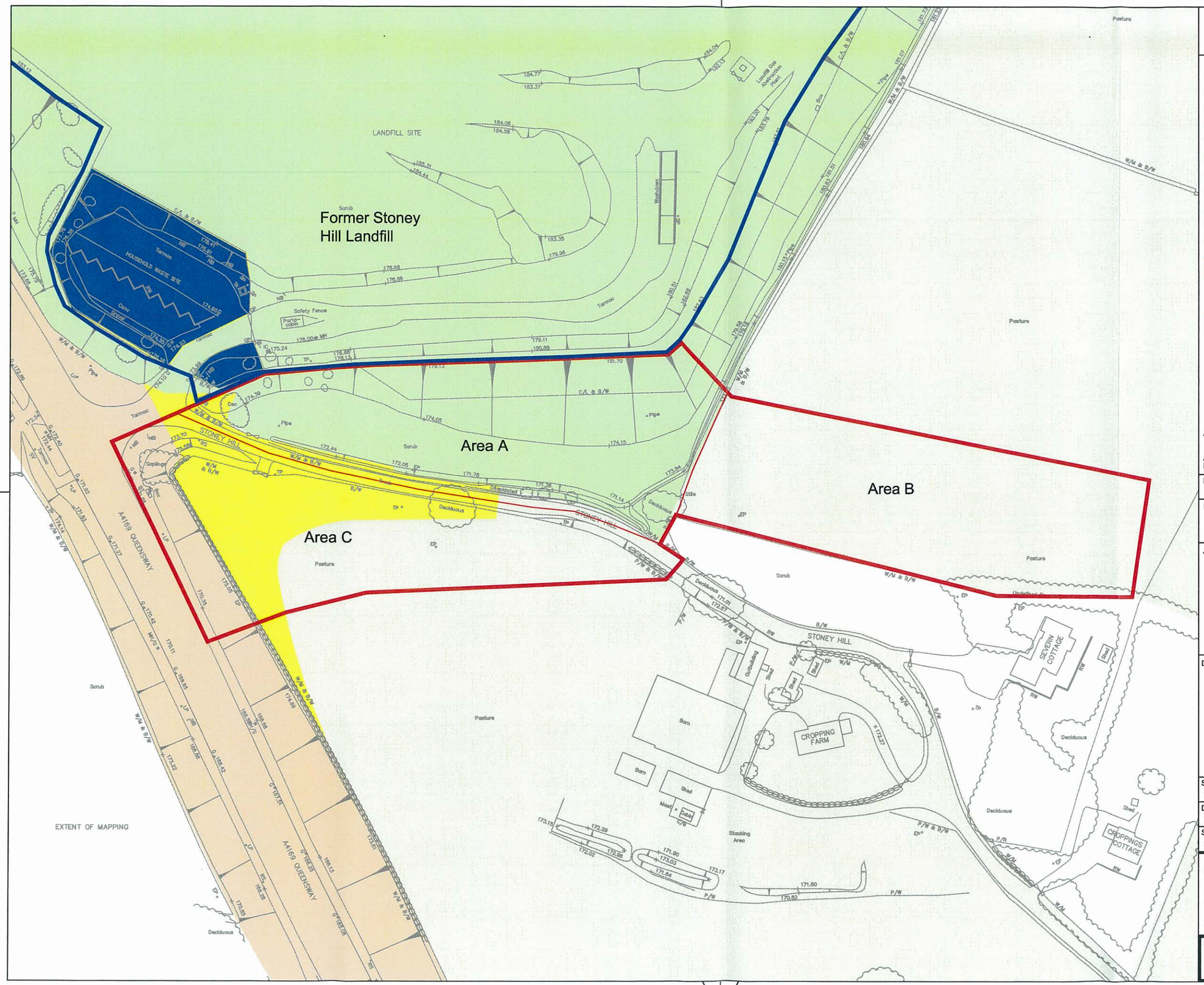
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LOCATION
PLAN

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Drawn	Date	Stage 2 check	Date
CL/CHF	02.09.08	-	-
Stage 1 check	Date	Approved	Date
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KEY

- English Partnerships Ownership Boundary
- Adopted Highway
- Land owned by Telford & Wrekin Council
- Land owned by Mr P Marshall
- Land to be dedicated by English Partnerships
- Site Boundary
- Ground Investigation Area Boundaries
- Former Stoney Hill Landfill Boundary

Revision Details	By / Check	Date	Suffix
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REPORT

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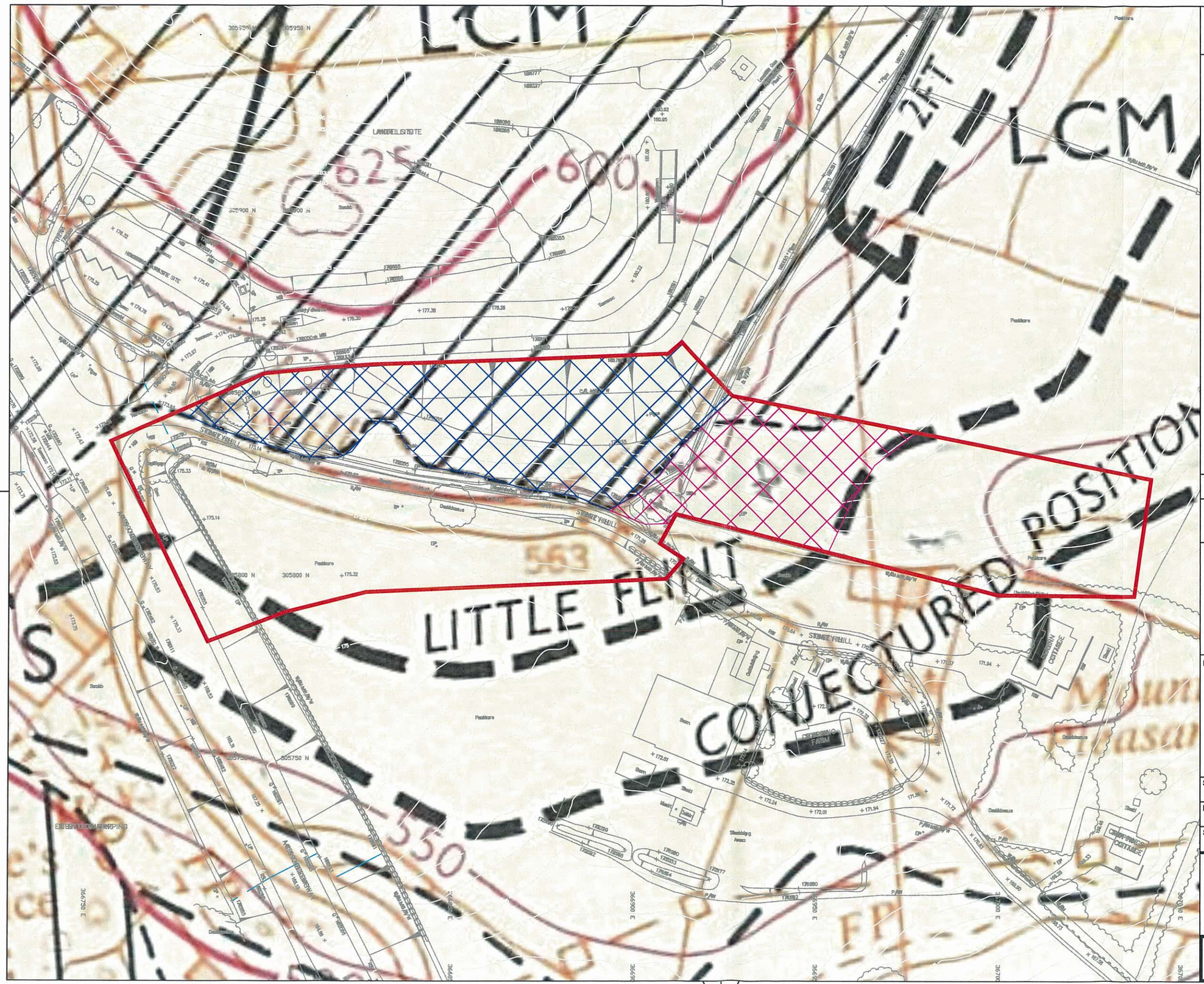
SITE AREA
AND
LAND OWNERSHIP
PLAN

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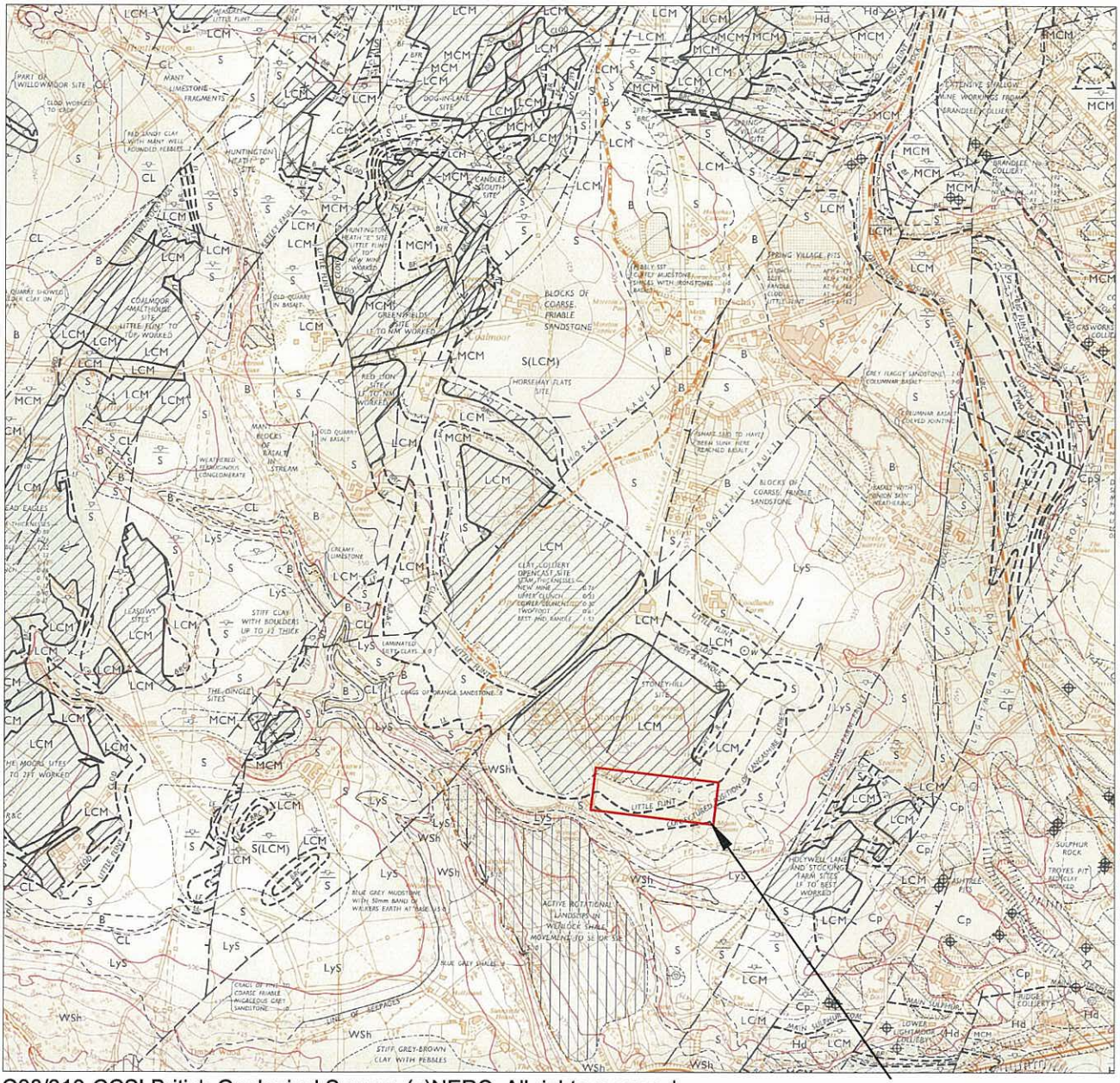
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LCM
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LCM
LITTLE FLINT
CONJECTURED POSITION
STONEY HILL
LANDFILL SITE
625
600
563
550
Peatmoss
Peatmoss
Peatmoss

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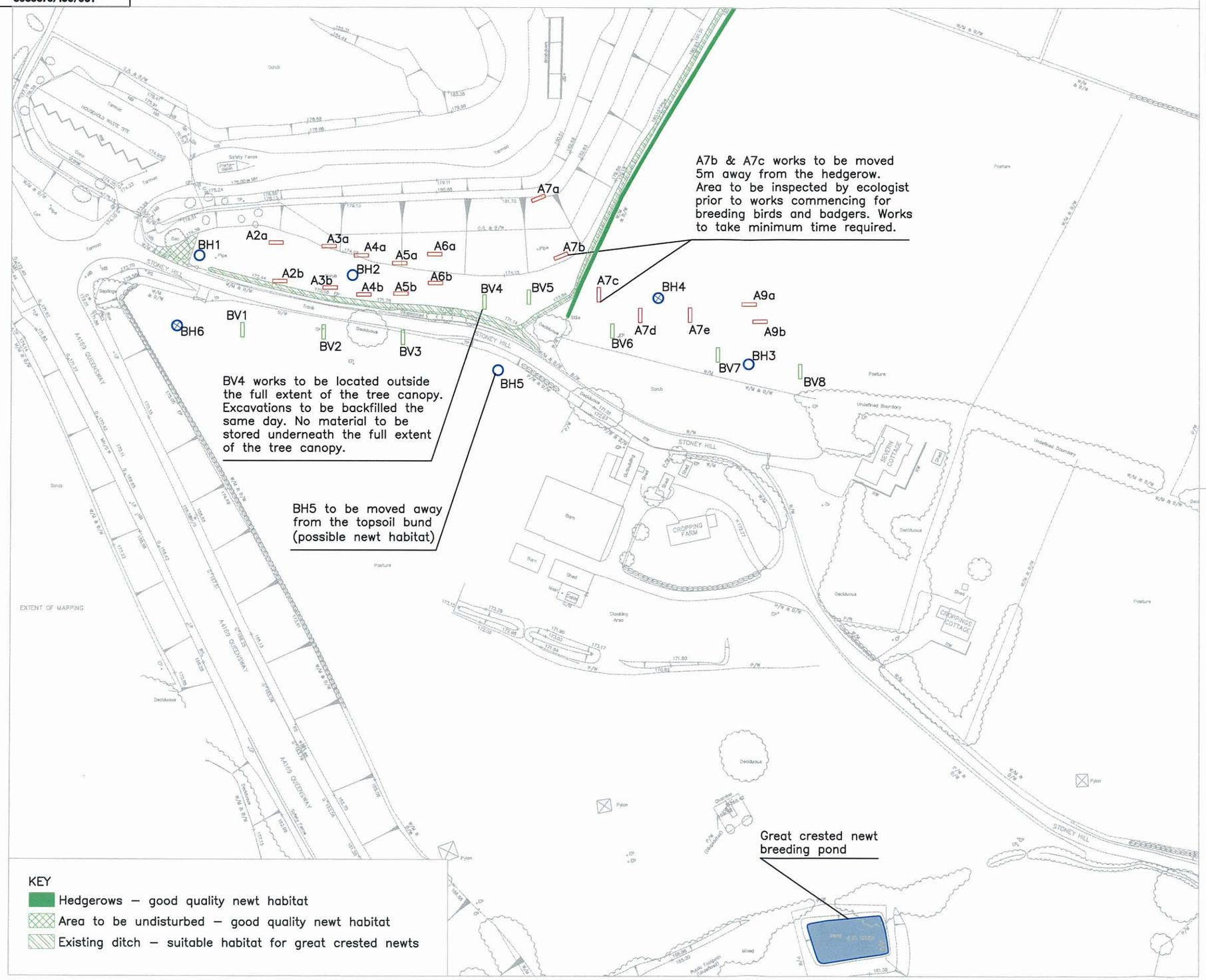
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Geological Plan Extract

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	D111050/GT/004	02

Plot Date :
AutoCAD File Name :
DB4H

ATKINS
5056573/199/001



NOTES

All BH's, BV's & A's can be accessed from the Stoney Hill Lane

All exploratory hole positions are subject to direction from English Partnerships, Telford & Wrekin Council and field verification by the Engineer during site works.

The GI works are within 500m of the pond at Croppings Farm which has a small population of great crested newts. The newts will use suitable habitat for feeding and resting (such as hedges and ditches). It is reasonably unlikely that the newts will use the sites of the GI works which are located in grassland and no Natural England licence is required.
Nevertheless, reduction in the risk of finding a newt requires implementation of a precautionary method of working for each GI site involving:
a) removing debris (stones, plastic) and strimming the grass to 30mm in height before any works take place;
b) stopping work and contacting an ecologist if any newt is found.

REVISIONS	Drawn By	Checked By	Date
Bournville Village Trust – for information	–	JB	17.06.08
PURPOSE OF ISSUE	Rev.	Authorised for Issue	Date

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CLIENT
English Partnerships
The National Regeneration Agency

PROJECT
LIGHTMOOR URBAN VILLAGE

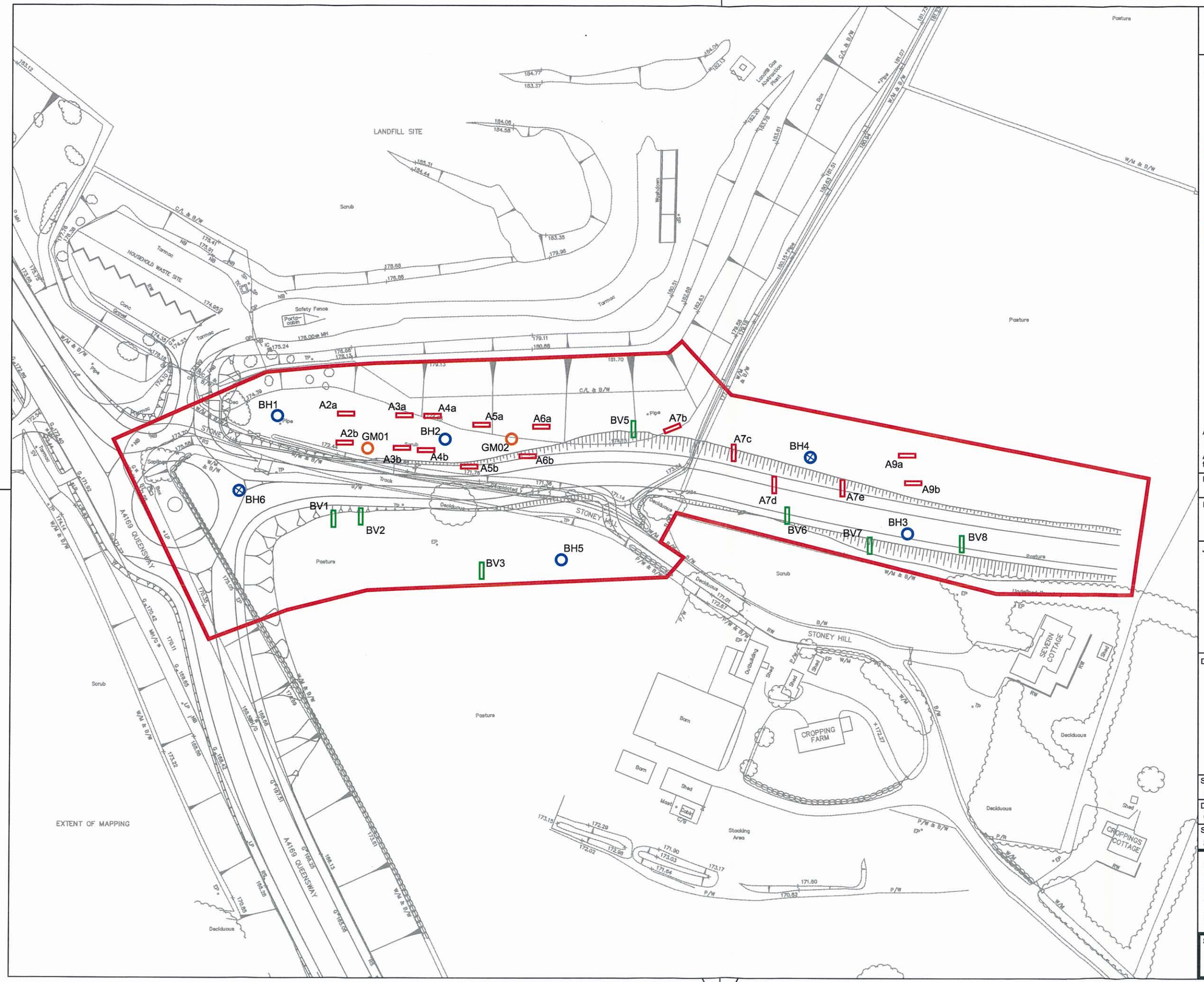
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KEY

- Rotary Borehole - Open Hole
- Rotary Borehole - Cored
- Trial Pit - Randle Coal Seam
- Trial Pit - Buried Valley
- Gas Monitoring Standpipe
- Site Boundary

Revision Details	By / Check	Date	Suffix
Amend title to Mining Investigation	CHF / SOG	04.11.08	C
Amend exploratory hole positions following field verification	CHF / SOG	10.09.08	B

Drawing Status

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Job Title

STONEY HILL MINING INVESTIGATION REPORT

Drawing Title

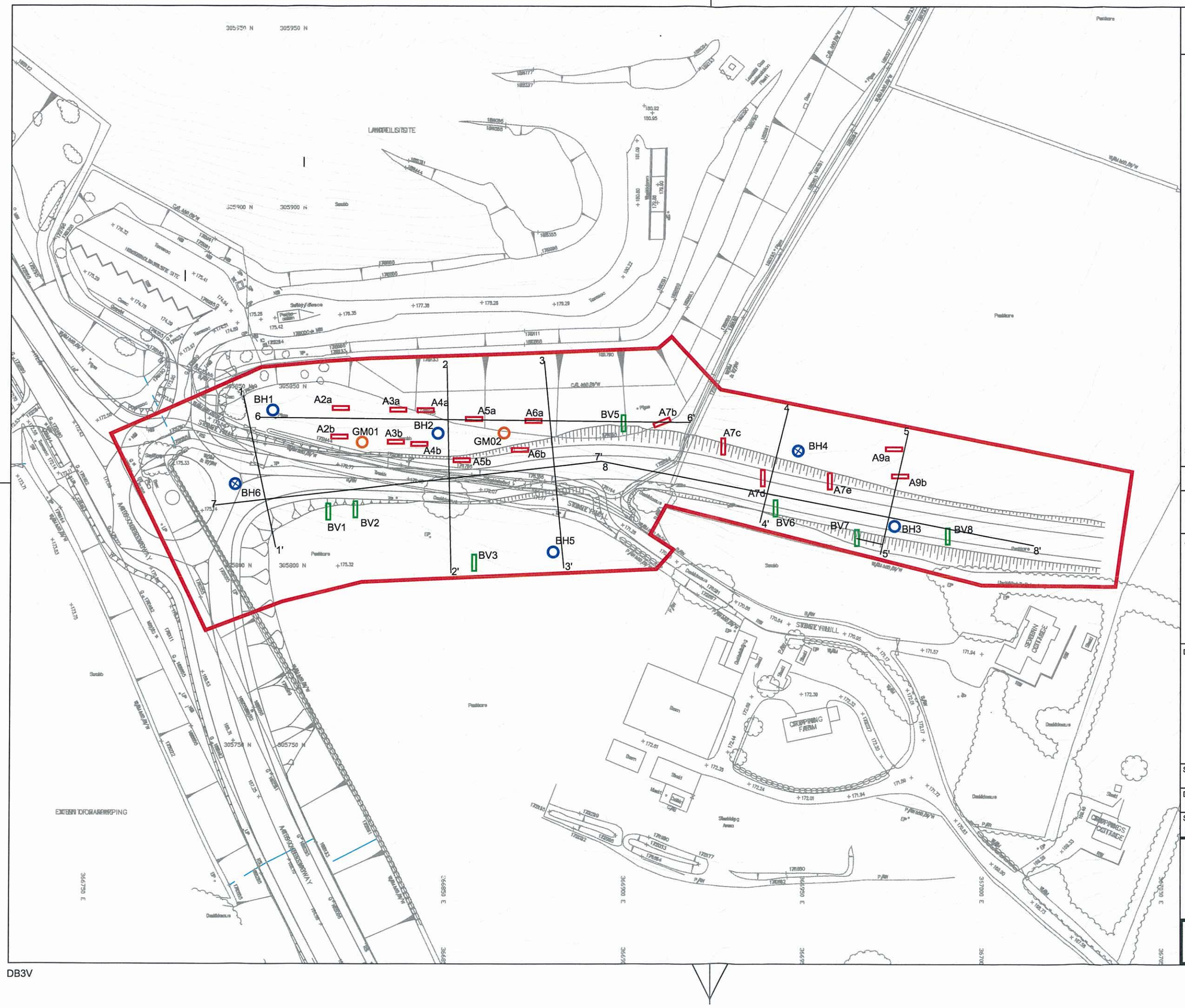
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KEY

Site Boundary

1 — 1' Section Line

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Amend title to Mining Investigation Report	CHF / SOG	04.11.08	01

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Job Title: STONEY HILL MINING INVESTIGATION REPORT

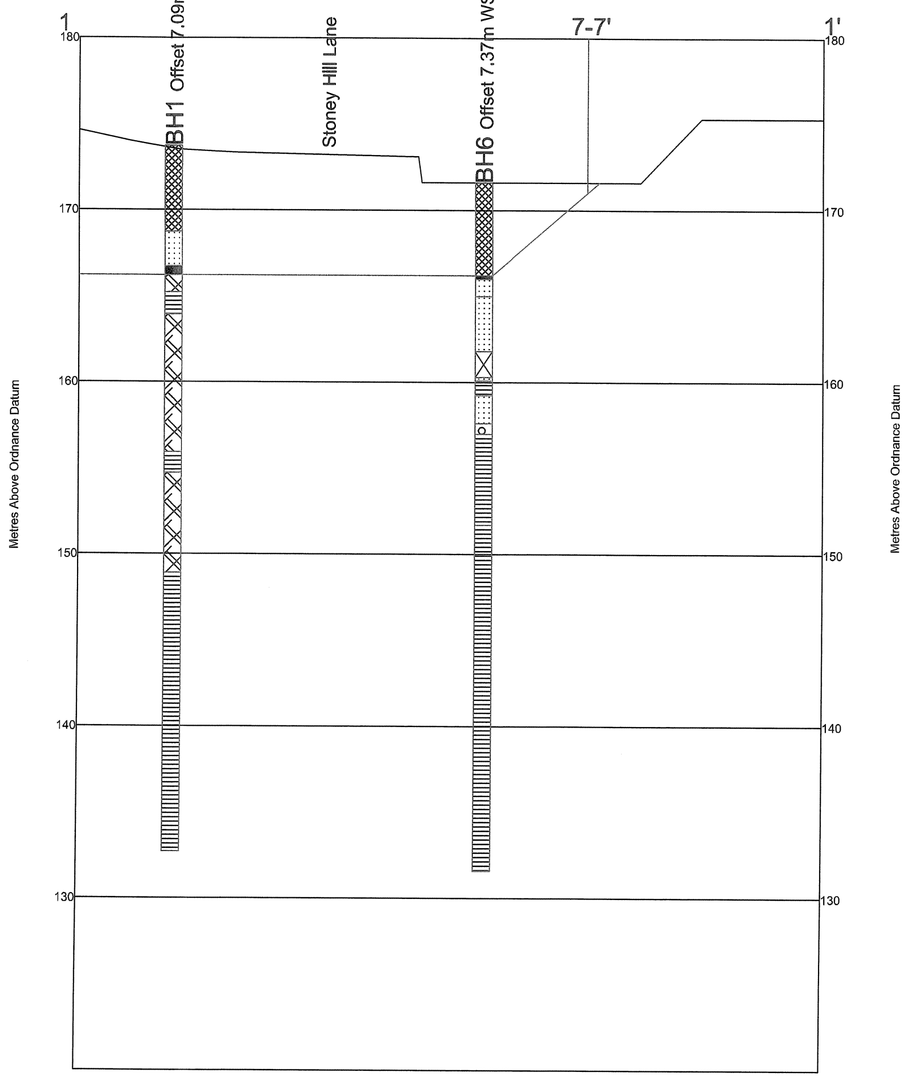
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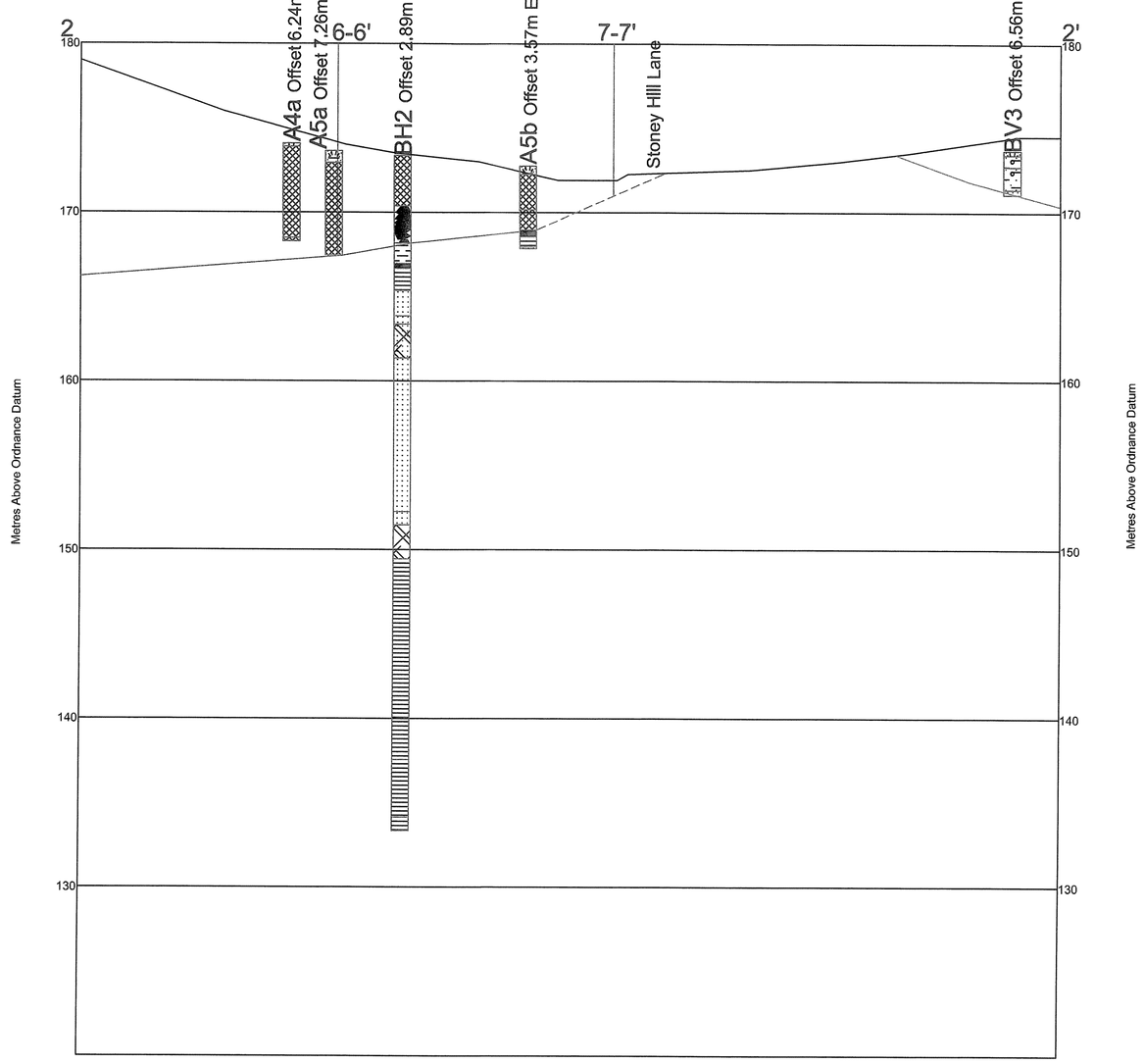
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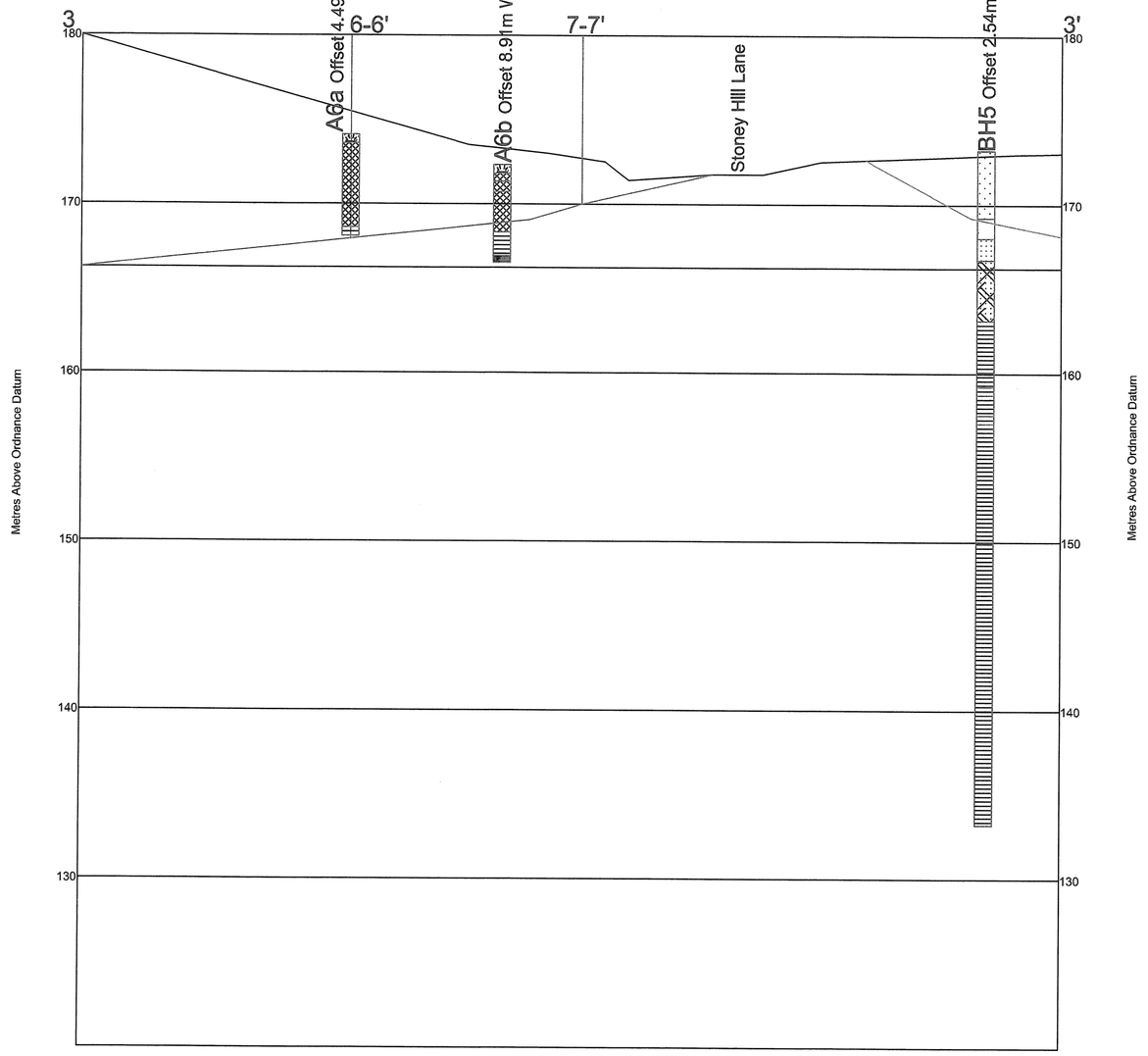
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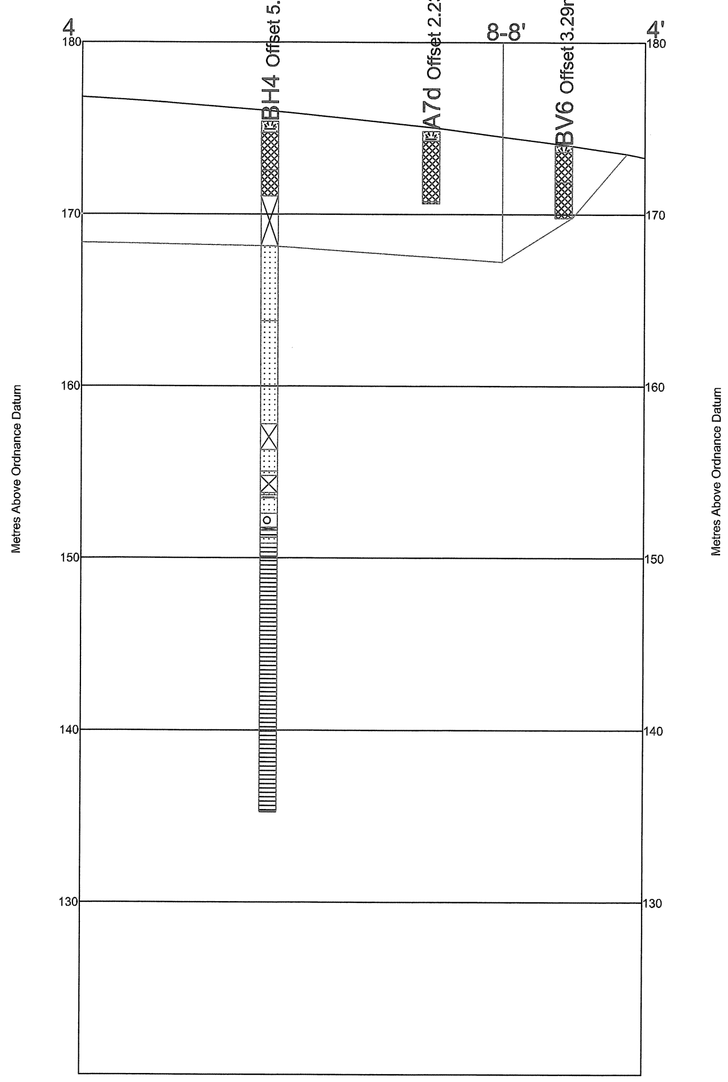
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Key

- Topsoil
- Made Ground (Opencast Backfill)
- Clay
- Clayey gravelly sand
- Coal
- Coal with Mudstone
- Mudstone
- Sandstone
- Broken Sandstone
- Conglomerate
- Broken Ground
- No Recovery
- Interpreted Base of Workings
- Interpreted Base of Buried Valley

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Job Title: STONEY HILL MINING INVESTIGATION REPORT

Drawing Title: SECTION LINES

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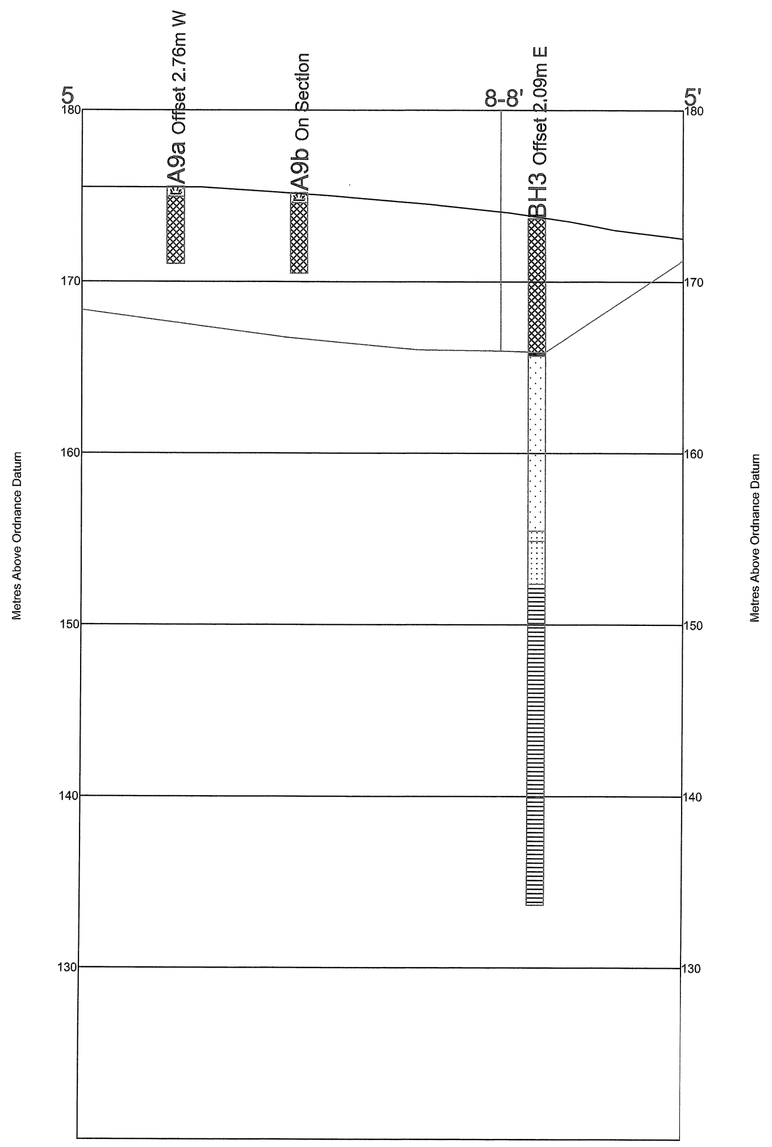
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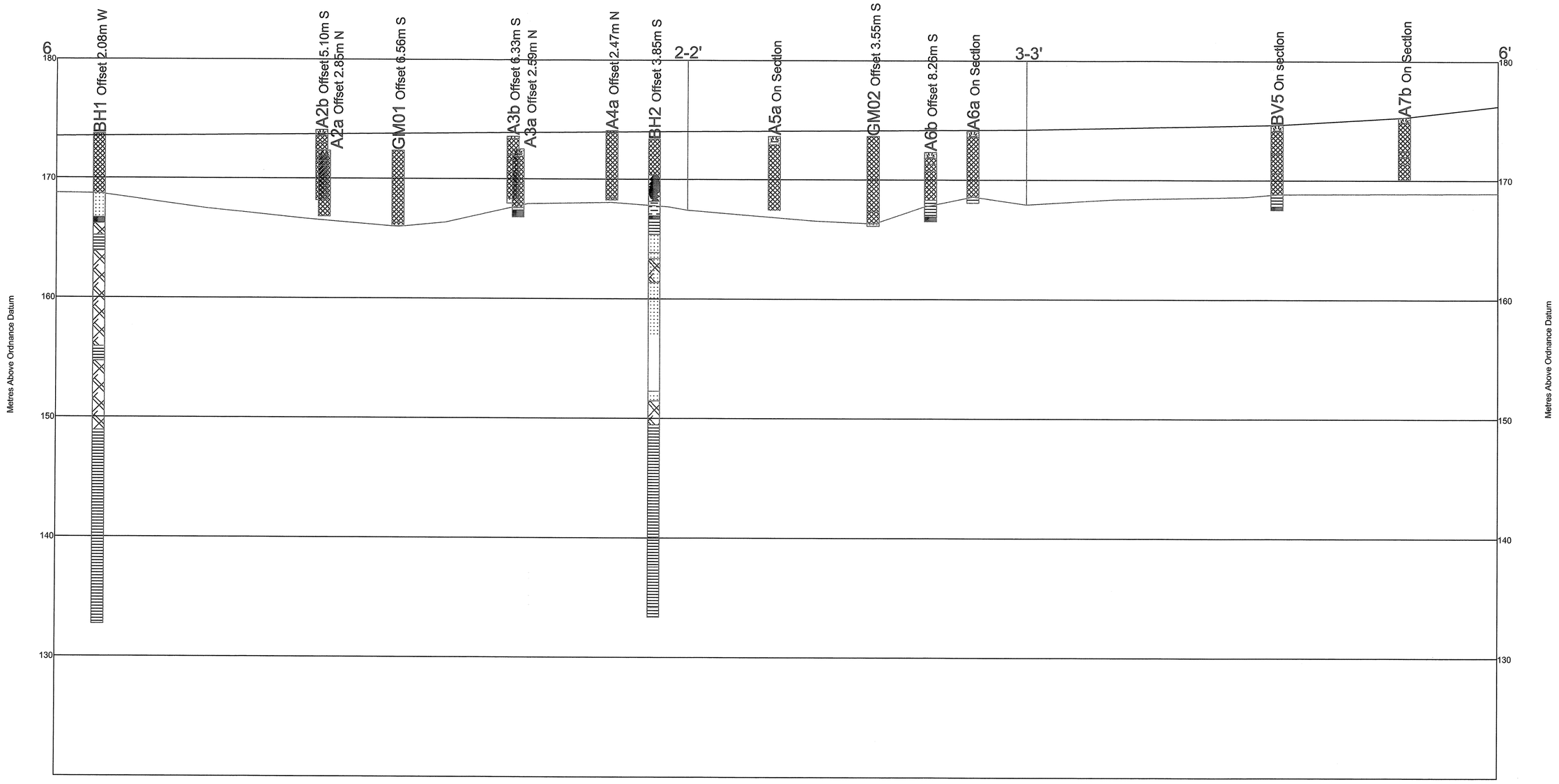
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Key

- Topsoil
- Made Ground (Opencast Backfill)
- Clay
- Clayey gravelly sand
- Coal
- Coal with Mudstone
- Mudstone
- Sandstone
- Broken Sandstone
- Conglomerate
- Broken Ground
- No Recovery
- Interpreted Base of Workings

Revision Details	By / Check	Date	Suffix
Amended to Final Issue	CHF / SOG	14.11.08	02
Amended title to Mining Investigation Report	CHF / SOG	04.11.08	01

Drawing Status

FINAL

Job Title

STONEY HILL MINING INVESTIGATION REPORT

Drawing Title

SECTION LINES

SHEET 2 OF 3

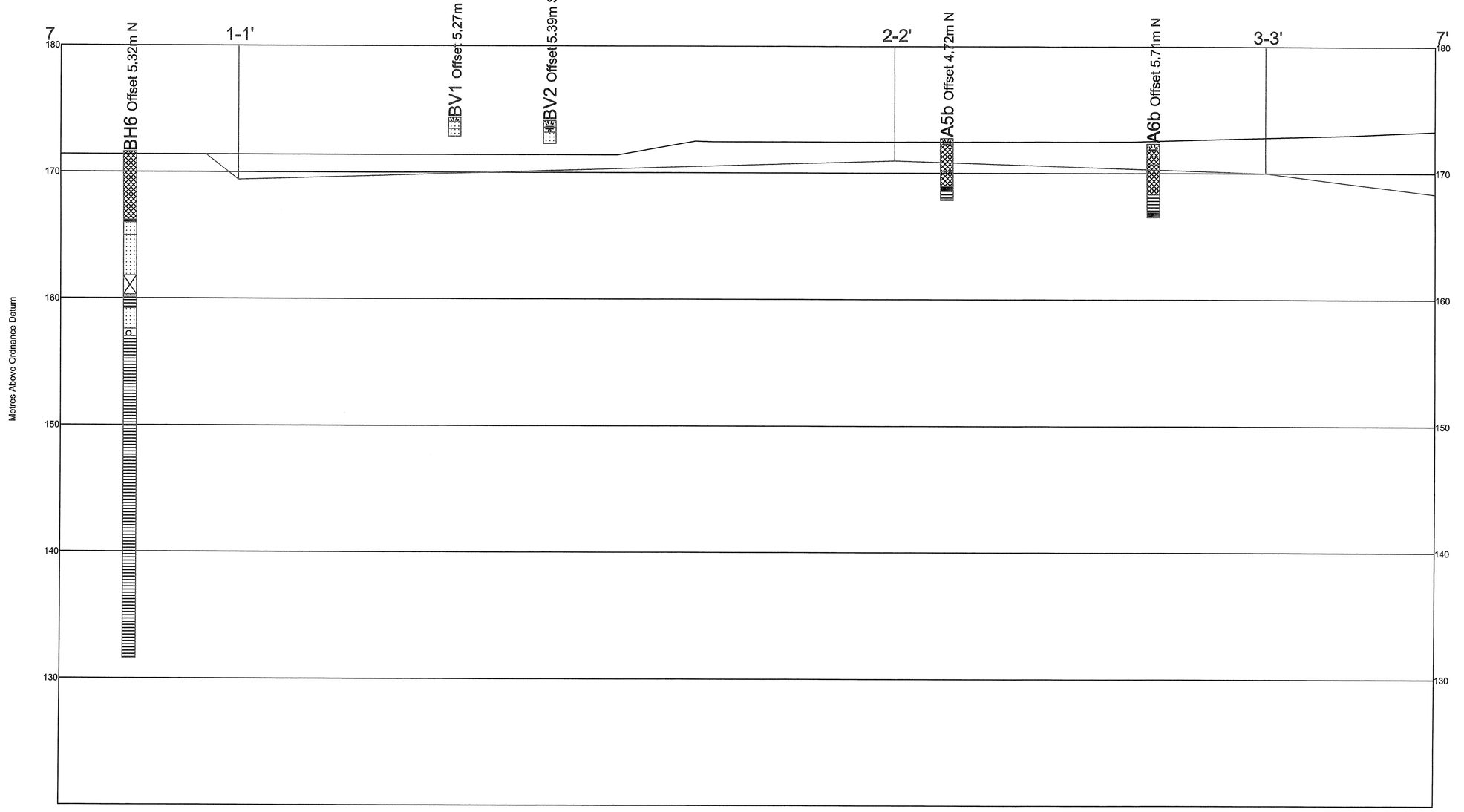
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Drawn	Date	Stage 2 check	Date
CHF/CL	11.09.08		
Stage 1 check	Date	Approved	Date
SOG	11.09.08		

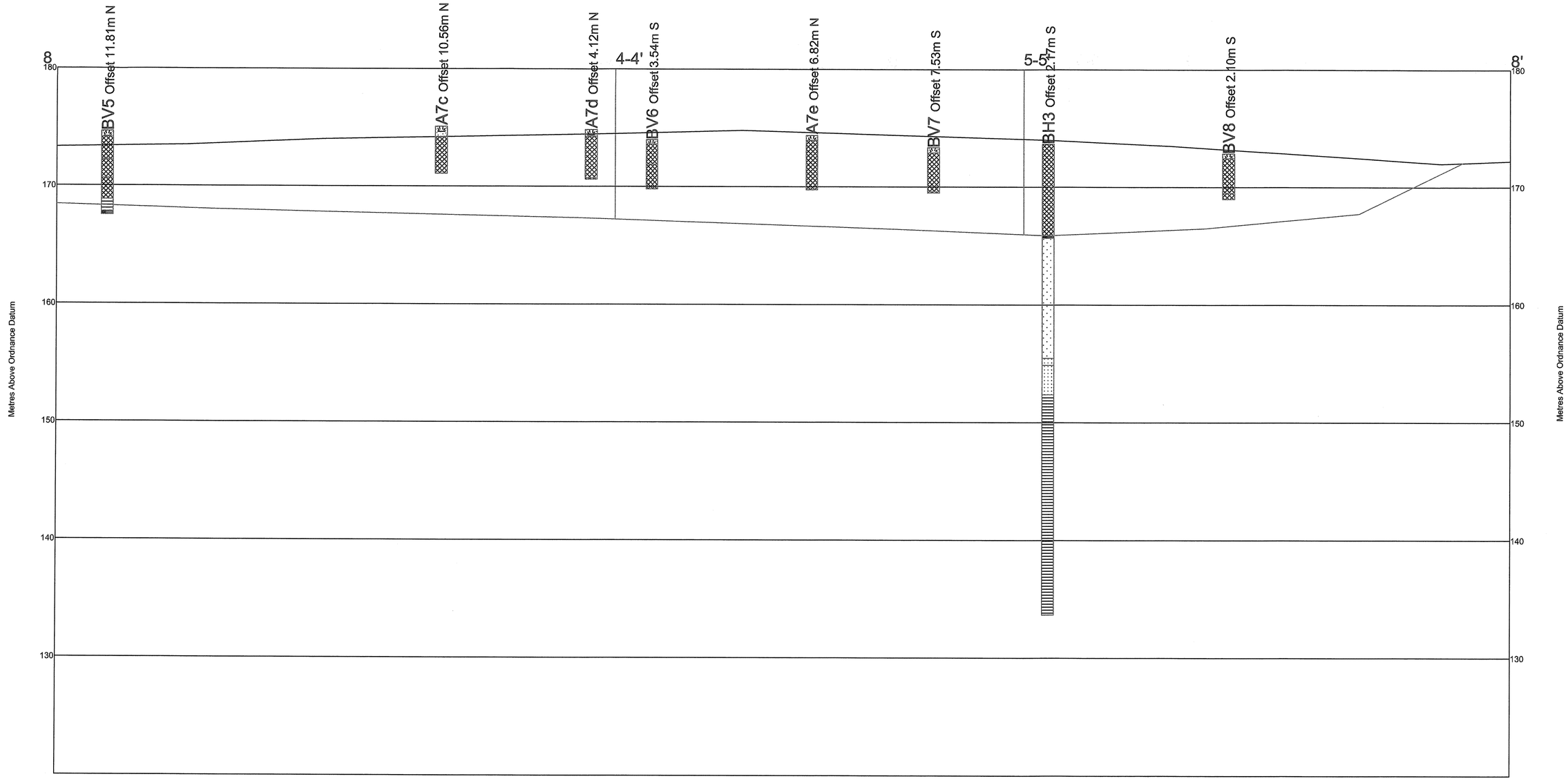
Scott Wilson
3 Pemberton House
Stafford Court, Stafford Park,
Telford, Shropshire, TF3 3AP
Telephone (01952) 235600
Fax (01952) 235650
www.scottwilson.com

Status Drawing Number: D111050/GT/007 Rev: 02

AutoCAD File Name :

DB1V





THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

Key

- Topsoil
- Made Ground (Opencast Backfill)
- Clay
- Clayey gravelly sand
- Coal
- Coal with Mudstone
- Mudstone
- Sandstone
- Broken Sandstone
- Conglomerate
- Broken Ground
- No Recovery
- Interpreted Base of Workings

Revision Details	By / Check	Date	Suffix
Amended to Final Issue	CHF / SOG	14.11.08	02
Amended title to Mining Investigation Report	CHF / SOG	04.11.08	01

Drawing Status

FINAL

Job Title

STONEY HILL MINING INVESTIGATION REPORT

Drawing Title

SECTION LINES

SHEET 3 OF 3

Scale at A1		Design Office	
1:250		Telford	
Drawn	Date	Stage 2 check	Date
CHF/CL	11.09.08		
Stage 1 check	Date	Approved	Date
SOG	11.09.08		

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3 Pemberton House
Stafford Court, Stafford Park,
Telford, Shropshire, TF3 3AP
Telephone (01952) 235600
Fax (01952) 235650
www.scottwilson.com

Status Drawing Number Rev

D111050/GT/008 02

AutoCAD File Name :

DB1V

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

KEY

- Site Boundary
- Extent of Landscaping Cover
- Southern Extent of Workings

Revision Details	By / Check	Date	Suffix
Amend to Final Issue	CHF / SOG	14.11.08	02
Amend title to Mining Investigation	CHF / SOG	04.11.08	01

Drawing Status

FINAL

Job Title

STONEY HILL
MINING INVESTIGATION
REPORT

Drawing Title

EXTENT OF
OPEN-CAST
WORKINGS
AND
LANDSCAPING COVER

Scale at A3		Design Office	
1:1000		TELFORD	
Drawn	Date	Stage 2 check	Date
CL/CHF	16.09.08	-	-
Stage 1 check	Date	Approved	Date
SOG		-	-

Scott Wilson
3 Pemberton House
Stafford Court, Stafford Park,
Telford, Shropshire, TF3 3AP
Telephone (01952) 235600
Fax (01952) 235650
www.scottwilson.com

Status	Drawing Number	Rev
	D111050/GT/009	02

DB3V

APPENDICES

APPENDIX A

Telford & Wrekin Council Mine Abandonment Plans



Legend:-

Worked horizons

Sulphur Coal	Top Coal	Clunch
Main Sulphur	Double Coal	2ft
Red Clay	Yard Coal	Best
Dressed Clay	Big Flint	Randle
Tile Clay	Ironstone - Pennystone	Clod
Gaynie Clay	New Mine	Little Flint
Fire Clay	Vigar	Ironstone - Crawstone

- Fault
- Hollows
- Soughs
- Boreholes
- Approximate position of Disused Mine shafts
- Approximate position of Disused Mine Adits

PLAN 1:1250

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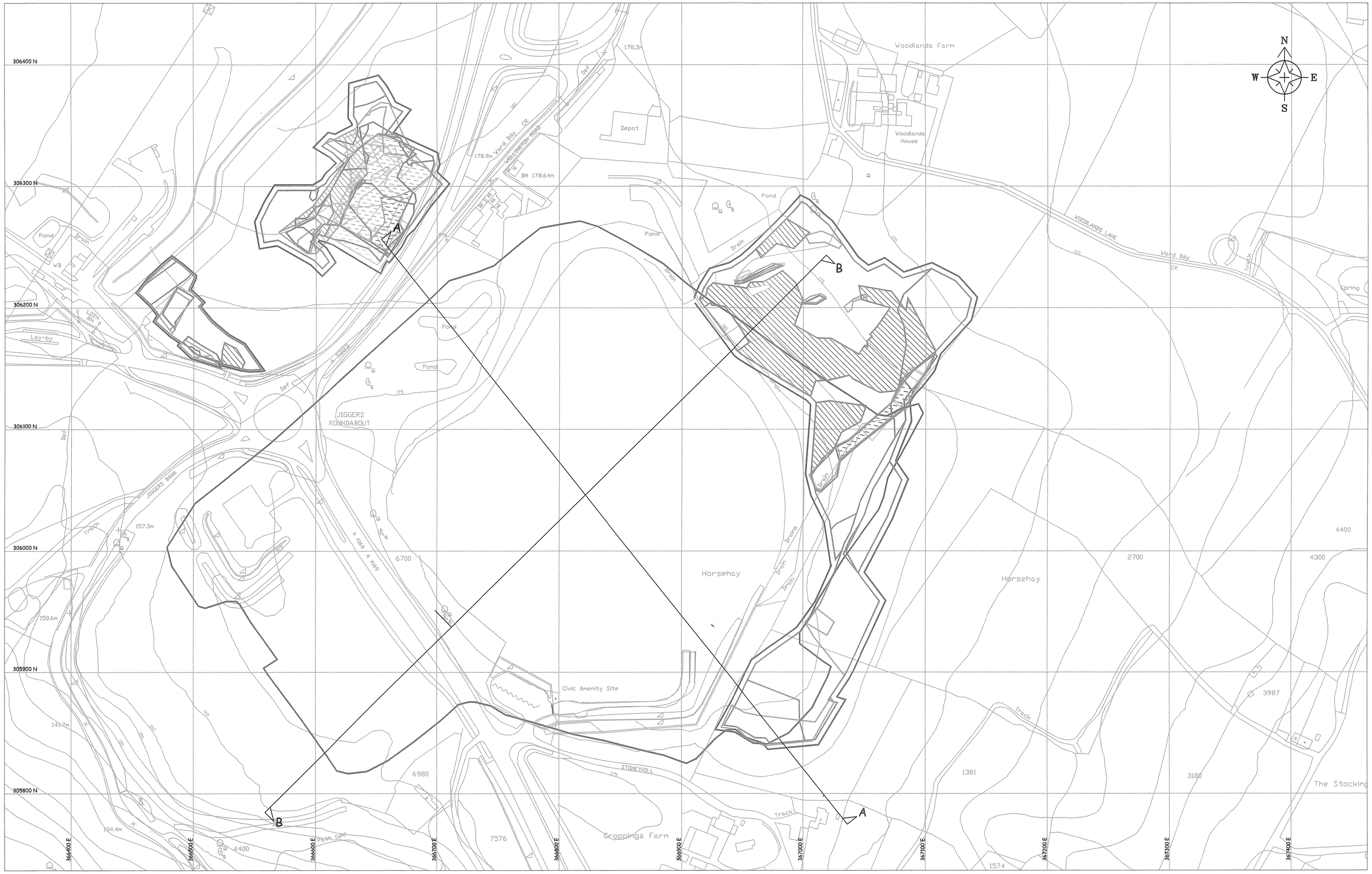
Carl Longland
Head of Mobility and Development

Civic Offices, PO Box 222,
TELFORD TF3 4LB
DX712322 Telford 6

PROJECT: Stoney Hill Landfill Site, Horsehay - Desk Study

DWG. TITLE: Location Plan - Deep Mining

SCALE	DRAWN	DATE	DWG. NO.
As Shown	IRV	May 2004	EI027/004



PLAN 1:1250

Legend:-

Worked horizons

Sulphur Coal	Top Coal	Clunch	Opencast
Main Sulphur	Double Coal	2ft	
Red Clay	Yard Coal	Best	
Dressed Clay	Big Flint	Randle	
Tile Clay	Ironstone - Pennystone	Clod	
Gaynie Clay	New Mine	Little Flint	
Fire Clay	Vigar	Ironstone - Crawstone	

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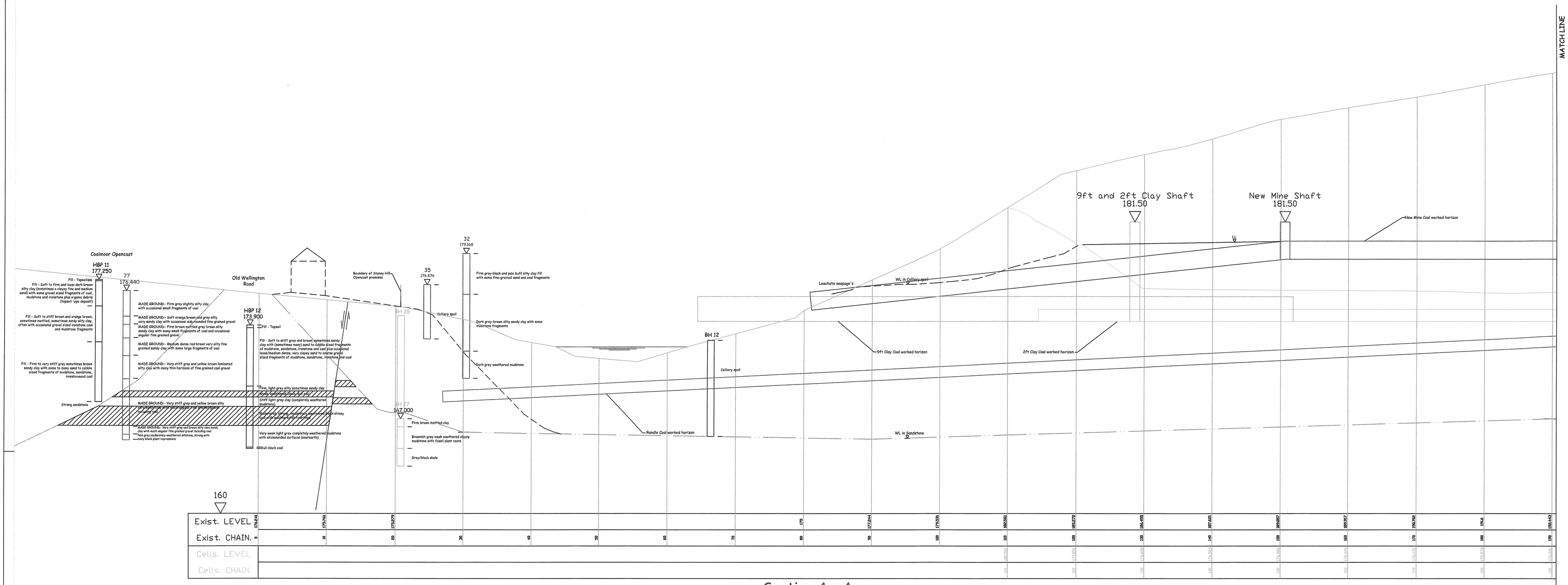
Carl Longland
Head of Mobility and Development

Civic Offices, PO Box 212,
TELFORD TF3 4LB
DX712122 Telford 6

PROJECT: Stoney Hill Landfill Site, Horsehay - Desk Study

DWG. TITLE: Location Plan - Opencast Mining

SCALE	DRAWN	DATE	DWG. NO.
As Shown	IRV	May 2004	EI027/005



Section A - A

Horiz. 1:200 Vert. 1:100

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TELFORD & WREKIN COUNCIL

Carl Longland
Head of Mobility and Development

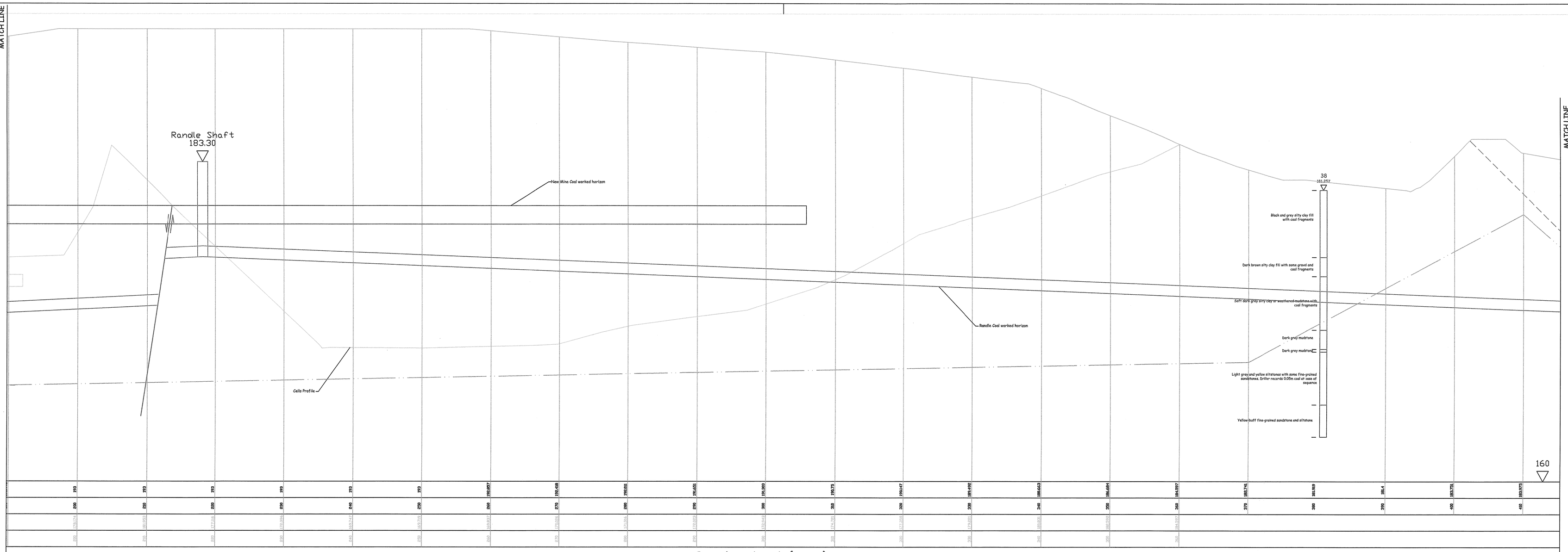
Civic Offices, PO Box 292,
TELFORD TF3 4LB
DX 712022 Telford 6

PROJECT: Stoney Hill Landfill Site, Horsehay - Desk Study

DWG. TITLE: Section A - A (Sheet 1 of 2)

SCALE	DRAWN	DATE	DWG. NO.
1:200	IRV	07/06/04	EI027/008

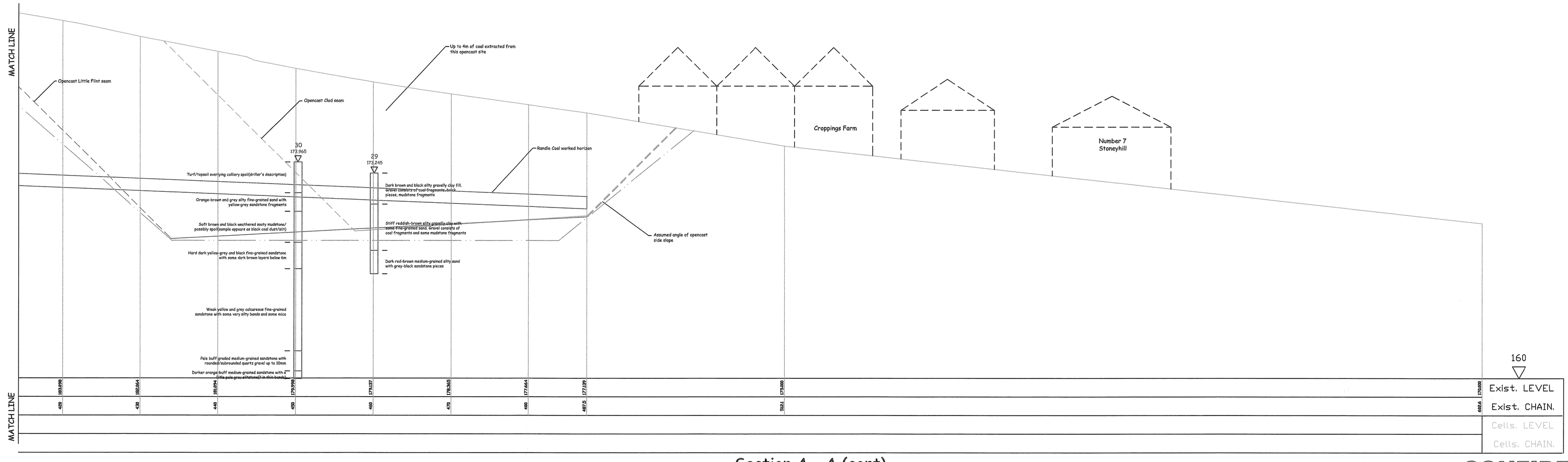
MATCH LINE



Section A - A (cont)

Horiz. 1:200 Vert. 1:100

MATCH LINE



MATCH LINE

Section A - A (cont) Horiz. 1:200 Vert. 1:100

MATCH LINE

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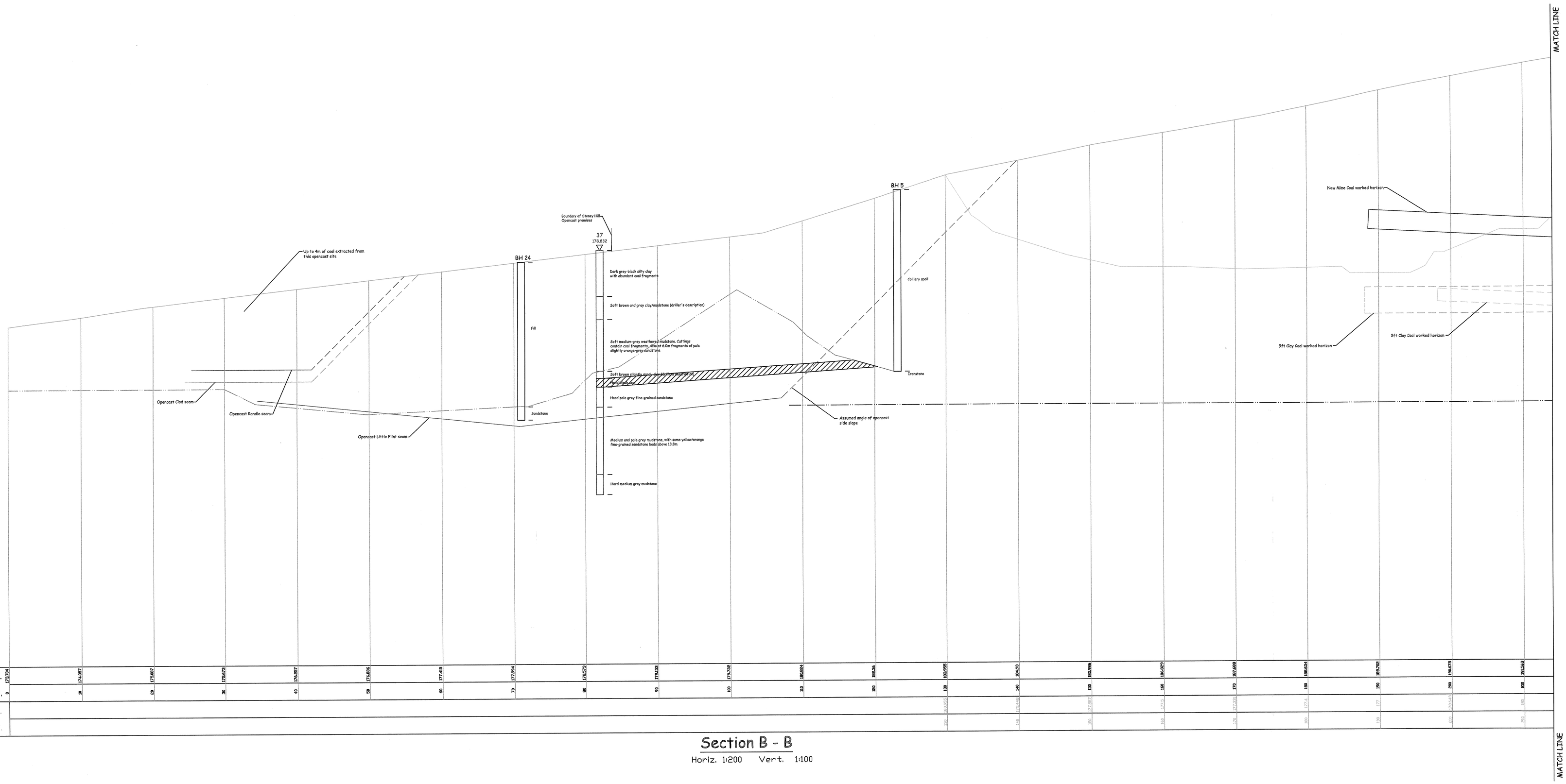
Carl Langland
Head of Mobility and Development

Civic Offices, PO Box 222,
TELFORD TF3 4LB
DX712122 Telford 5

PROJECT: Stoney Hill Landfill Site, Horsehay - Desk Study

DWG. TITLE: Section A - A (Sheet 2 of 2)

SCALE	DRAWN	DATE	DWG. NO.
1:200	IRV	07/06/04	E1027/009



Section B - B

Horiz. 1:200 Vert. 1:100

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TELFORD & WREKIN COUNCIL

Carl Longland
Head of Mobility and Development

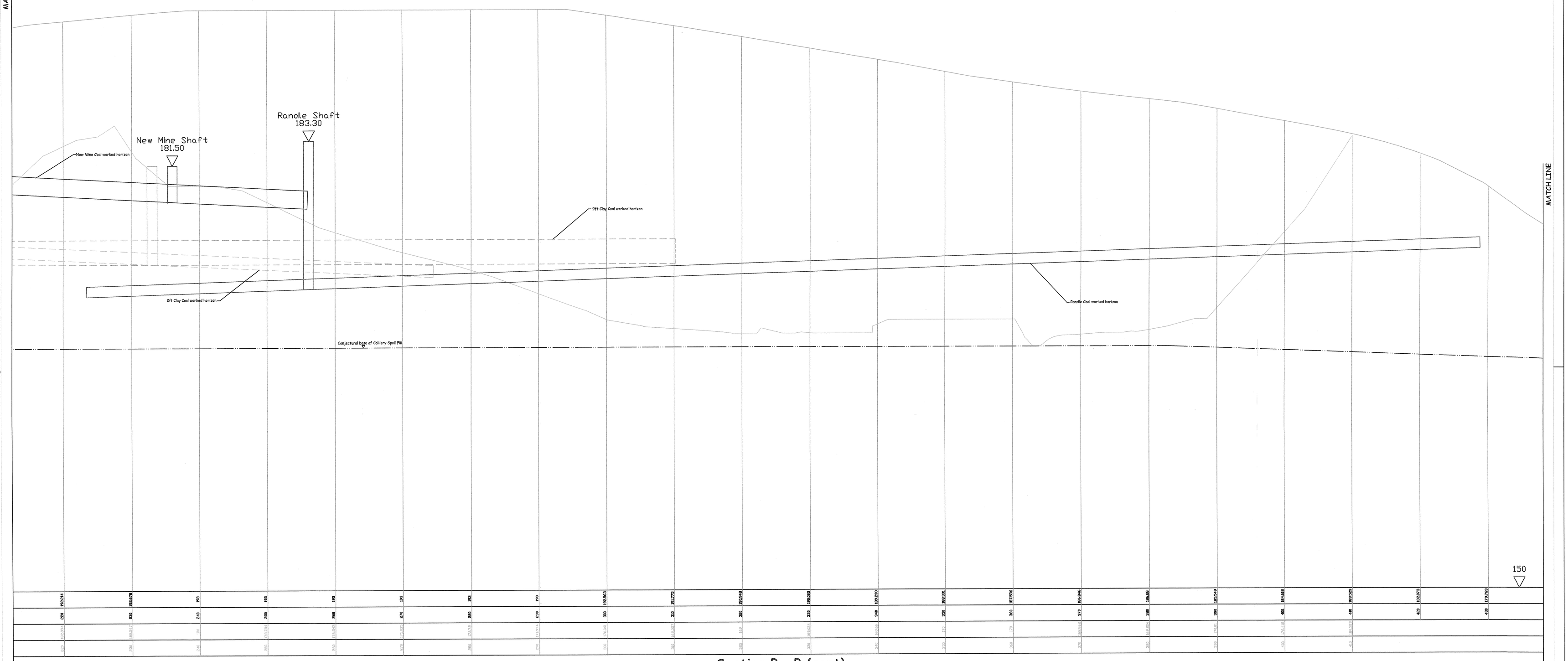
Civic Offices, PO Box 212,
TELFORD TF3 4LB
DX:716222 Telford 5

PROJECT: Stoney Hill Landfill Site, Horsehay - Desk Study

DWG. TITLE: Section B - B (Sheet 1 of 3)

SCALE	DRAWN	DATE	DWG. NO.
1:200	IRV	07/06/04	E1027/010

MATCH LINE



MATCH LINE

MATCH LINE

Section B - B (cont)

Horiz. 1:200 Vert. 1:100

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TELFORD & WREKIN COUNCIL

Carl Longland
Head of Mobility and Development

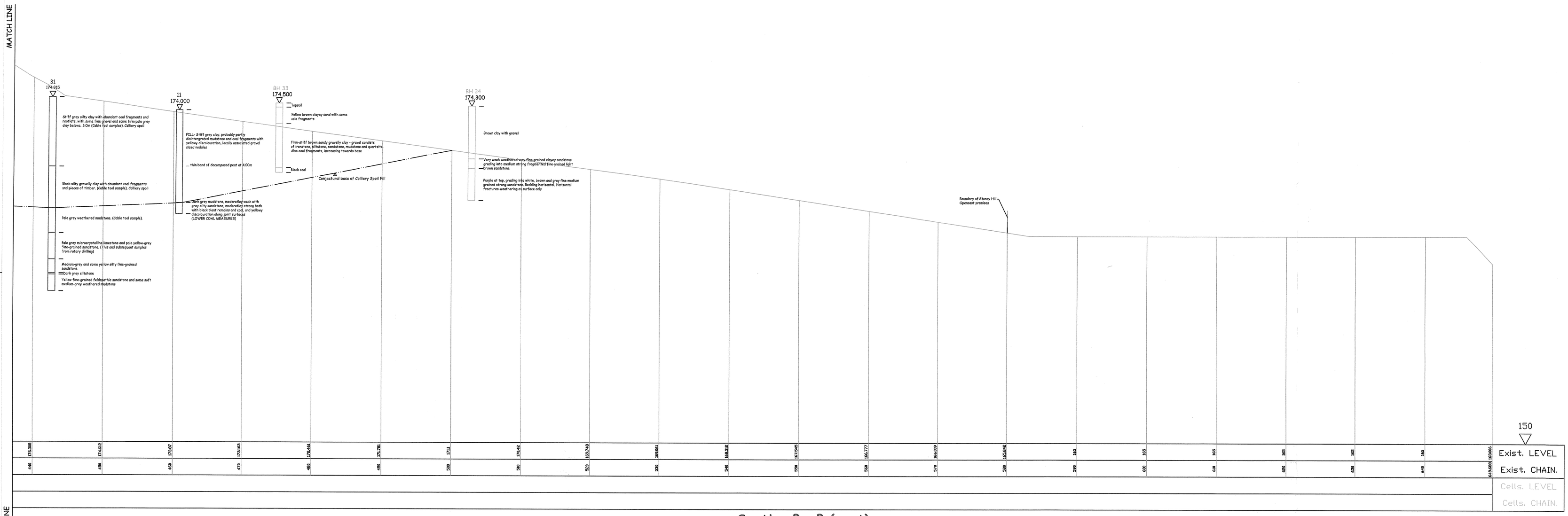
Civic Offices, PO Box 212,
TELFORD TF3 4LB
DX712122 Telford 5

PROJECT: Stoney Hill Landfill Site, Horsehay - Desk Study

DWG. TITLE: Section B - B (Sheet 2 of 3)

SCALE	DRAWN	DATE	DWG. NO.
1:200	IRV	22/06/04	E1027/011

MATCH LINE



MATCH LINE

Section B - B (cont)

Horiz. 1:200 Vert. 1:100

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TELFORD & WREKIN COUNCIL

Carl Longland
Head of Mobility and Development

Civic Offices, PO Box 212,
TELFORD TF3 4LB
DX712122 Telford 5

PROJECT: Stoney Hill Landfill Site, Horsehay - Desk Study

DWG. TITLE: Section B - B (Sheet 3 of 3)

SCALE	DRAWN	DATE	DWG. NO.
1:200	IRV	22/06/04	EI027/012

APPENDIX B

English Partnerships Permission for Works

Jordan House West, Hall Court
Hall Park Way, Telford TF3 4NN
Tel: 01952 293131
Fax: 01952 293132
www.englishpartnerships.co.uk

Job	
Original	CHF
Enclosures	
Action	
SW - TELFORD	
RECEIVED	
25 JUL 2008	
Copy	
Copy	
Copy	
Copy	
Copy	

English Partnerships
The National Regeneration Agency

Your Ref:
Our Ref: PG/PW/ Lightmoor - PRG3

Mr L Nichol
M & J Drilling Services Ltd
Holloway Street
Lower Gornal
Dudley
DY3 2EF

23 July 2008

Dear Sir

GRANT OF LICENCE TO ENTER ENGLISH PARTNERSHIPS LAND AT LAND STONEYHILL JUNCTION AND LINK ROAD ABUTTING CROPPINGS FARM.

I refer to a works order placed by Bournville Village Developments to carry out Ground Site Investigations and herby grant permission for your company to enter the above site for the purposes of carrying out the site investigation works specified in the tender documents submitted to you by our engineering consultant Scott Wilson.

I can confirm that I am prepared to grant M&J Drilling Services Ltd a licence to enter, subject to the following terms and conditions:-

1. M&J Drilling Services Ltd are to fully indemnity COMMISSION FOR THE NEW TOWNS known as ENGLISH PARTNERSHIPS against any claims arising out of the Licence hereby granted.

2. M&J Drilling Services Ltd shall provide COMMISSION FOR THE NEW TOWNS known as ENGLISH PARTNERSHIPS with a plan showing the location of any trial pits and boreholes if carried out, together with a copy of the results and analysis once completed.

3. M&J Drilling Services Ltd shall undertake a photographic schedule of condition prior to commencement of any investigation works being made. The investigations will commence from 28th July until 30th August 2008 and any variation to this will be by prior agreement with COMMISSION FOR THE NEW TOWNS known as ENGLISH PARTNERSHIPS.

4. Full reinstatement if required will be carried out by M&J Drilling Services Ltd to the complete satisfaction of COMMISSION FOR THE NEW TOWNS known as ENGLISH PARTNERSHIPS within 14 days of completion of the investigations.

   Should satisfactory reinstatement not occur, COMMISSION FOR THE NEW TOWNS known as ENGLISH PARTNERSHIPS reserves the right to carry out any necessary works and recharge the costs to M&J Drilling Services Ltd.

English Partnerships
The National Regeneration Agency

5. COMMISSION FOR THE NEW TOWNS known as ENGLISH PARTNERSHIPS reserves the right to advise other parties of the results of the investigations if requested.

6. For the avoidance of doubt CDM in relation to any activity carried out under this licence is the responsibility of M&J Drilling Services Ltd.

Please discuss with Kevin Webb of Bournville Village Trust regarding access arrangements and coordination with other contractors on site.

I trust the above information is sufficient for your purposes and I would be grateful if you would complete and sign the attached Indemnity form and return to me as soon as possible and in any event prior to your contractor going on site.

Yours faithfully

Paul Gascoine
Regeneration Manager
Tel: 01952 237754

cc Kevin Webb – Bournville Village Trust
cc Chloe French – Scott Wilson Engineering Consultants
cc Nick Ashcroft – Land Manager English Partnerships

English Partnerships
The National Regeneration Agency

INDEMNITY

In consideration of English Partnerships granting permission to M&J Drilling Services Ltd and/or their approved contractor to enter the site known as identified on Plan SCC445 for the purposes of a site investigations, M&J Drilling Services Ltd agree to indemnify COMMISSION FOR THE NEW TOWNS known as English Partnerships against all actions, clams and demands, costs, losses charges, damages and expenses arising by reason of accident, injury or damage to persons of property occasioned by, or in any way whatsoever attributable to, the use of the premises/land herein before mentioned and will satisfactorily reinstate the premises/land to a condition no worse than prior to entry.

Signed.....

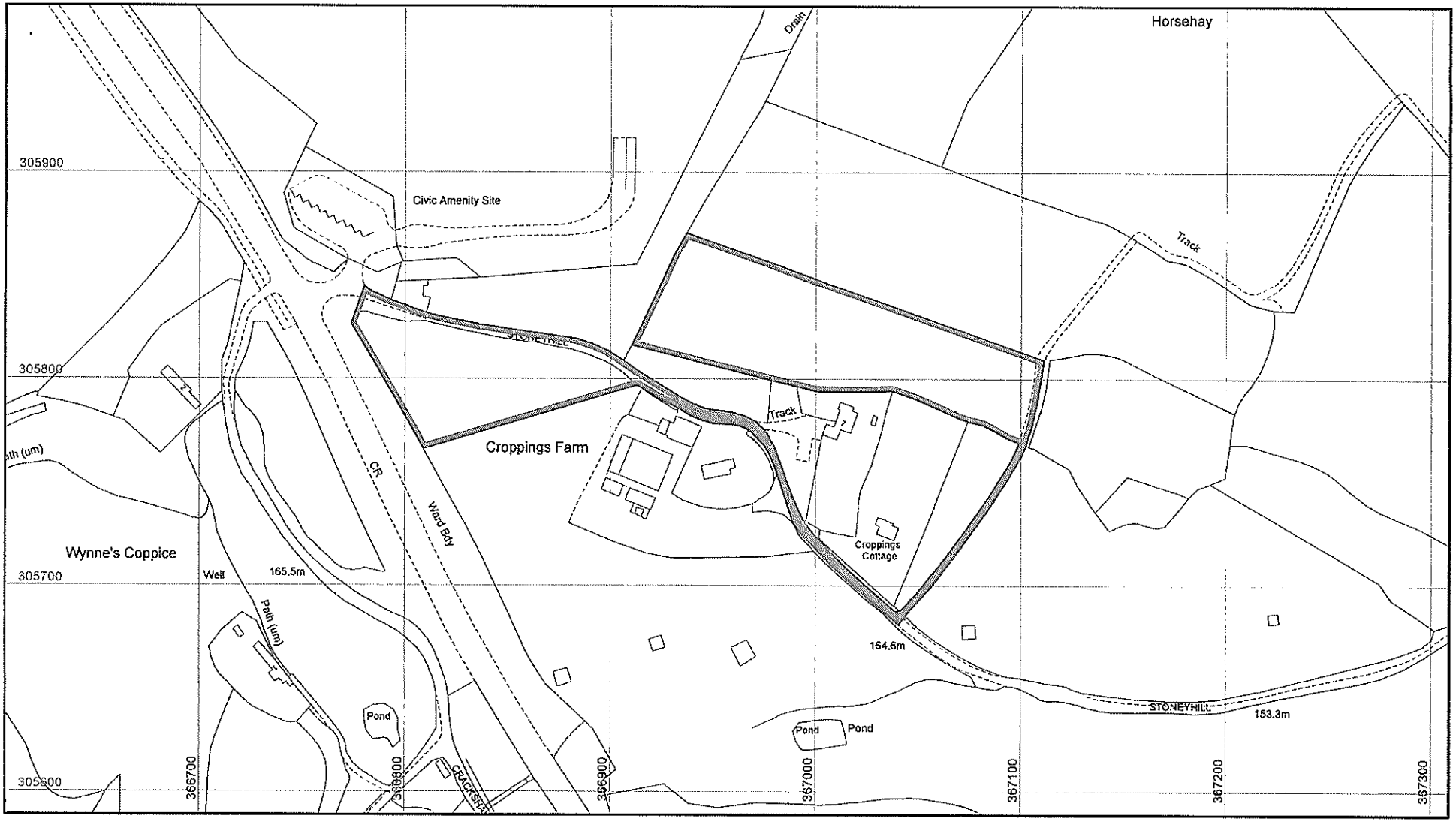
Status.....

Date.....

Witnessed by.....

Name of Contractor.....

.....



TITLE Geotechnical Survey Licence Stoney Hill Road Lightmoor Telford				
	PURPOSE OF ISSUE	REV	DATE	INITIALS
DRG NO SCC445	ITP NO.			
DATE 23/7/08	SCALE 1:2,500	SIZE A4		

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N

English Partnerships
The National Regeneration Agency
Spatial Intelligence
Tel: 01908 692692 - Fax: 01908 691333
Email - GIS@englishpartnerships.co.uk
www.englishpartnerships.co.uk

APPENDIX C

Telford & Wrekin Council Permission for Works

Borough of TELFORD & WREKIN

Cheque in box
£300
M & J Drilling Services

BOROUGH OF TELFORD & WREKIN

- and –

M & J DRILLING SERVICES LTD

L I C E N C E

Land at Stoney Hill Tip Horsehay
Telford

THIS LICENCE is made the day of Two thousand and **BETWEEN BOROUGH OF TELFORD AND WREKIN** of Civic Offices Telford TF3 4LF (hereinafter called "the Council") of the one part and **M & J DRILLING SERVICES LIMITED** ("the Licensee") of Holloway Street Lower Gornal Dudley DY3 2EF

WHEREAS:

(1) The Council is seised in fee simple in possession of land situate and known as Stoney Hill Tip Horsehay Telford (hereinafter called "the Land") shown for identification purposes only edged green on the plan annexed hereto

(2) The Licensee has requested the Council to grant to it licence to occupy the land for the purpose of carrying out a site investigation ("the Works") which the Council have agreed to do upon the terms and conditions hereinafter appearing

(3) This Licence shall be deemed to have commenced on the day of Two thousand and for a period of three months

(4) The consideration will be **ONE POUND (£1.00)** whether demanded or not

NOW IT IS HEREBY AGREED as follows:-

1. **THE** Council hereby grants to the Licensee privilege and liberty to use the Land only for the purpose aforesaid

2. **THE** Licensee agrees and undertakes with the Council as follows:-

   (a) To use the Land only for the Works and for no other purposes whatsoever

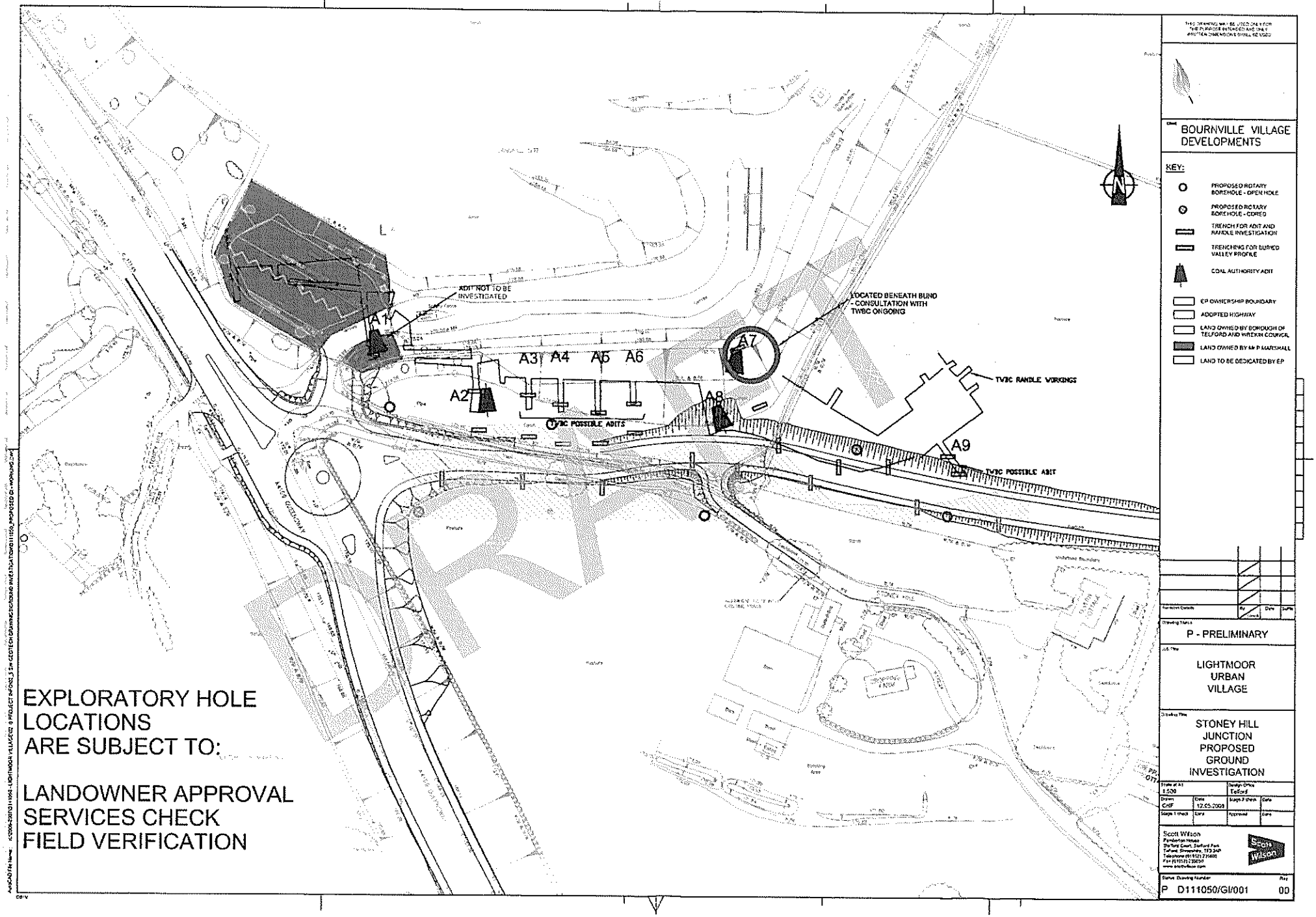
   (b) To reinstate the Land to its former condition to the satisfaction of the Head of the Council's Environmental Maintenance Department and the Licensee is to also ensure that:

   i. any planting or reseeding is to be carried out during the growing season and maintained until established any plants or seeding not established within 8 weeks of the completion of works are to be replaced and maintained until established

   ii.The finished surface of the ground is to match the existing ground and areas compacted due to the use by plant are to be aerated

   iii.Any damaged or removed trees will be replaced within the vicinity of the works in a location to be agreed by the Council or its representatives

   (c) To remove from the site any material remaining from the excavations to an authorised and licensed waste disposal site


ADIT NOT TO BE INVESTIGATED
LOCATED BENEATH BUND - CONSULTATION WITH TWBC ONGOING
A1
A2
A3
A4
A5
A6
A7
A8
A9
TWBC RANDLE WORKINGS
TWBC POSSIBLE ADITS
TWBC POSSIBLE ADIT
EXPLORATORY HOLE LOCATIONS ARE SUBJECT TO:
LANDOWNER APPROVAL
SERVICES CHECK
FIELD VERIFICATION
BOURNVILLE VILLAGE DEVELOPMENTS
KEY:
PROPOSED ROTARY BOREHOLE - OPEN HOLE
PROPOSED ROTARY BOREHOLE - CORED
TRENCH FOR ADIT AND RANDLE INVESTIGATION
TRENCHING FOR BURIED VALLEY PROFILE
COAL AUTHORITY ADIT
EP OWNERSHIP BOUNDARY
ADOPTED HIGHWAY
LAND OWNED BY BOROUGH OF TELFORD AND WREKIN COUNCIL
LAND OWNED BY Mr P MARSHALL
LAND TO BE DEDICATED BY EP
P - PRELIMINARY
LIGHTMOOR URBAN VILLAGE
STONEY HILL JUNCTION PROPOSED GROUND INVESTIGATION
Scott Wilson
P D111050/GI/001 00

(d) To provide copies of the Practise/Method Statement and risk assessment setting out Health & Safety matters for the Works

(e) To indemnify the Council against all actions claims demands costs losses and expenses whatsoever in respect of any injury damage or liability in respect of or arising out of this Licence whether caused by the Licensee his contractors agents servants or workmen and the Licensee shall maintain or ensure that any such third parties shall maintain such Public Liability insurance as the Council may require in respect of this Licence and to provide to the Council a copy of the Insurance Certificate on demand within 7 days

(f) Not to cause of permit to be caused any annoyance nuisance damage or disturbance to any adjoining or neighbouring property

(g) To obtain any necessary Planning or Building Regulations consents in relation to the Works and provide copies of such documents on request within 7 days

(h) Not to erect or use on the site any advertising boards or hoardings

(i) To take all necessary precautions in respect of the proximity of the Works to the landfill site

3. **THIS** Licence shall be personal to the Licensee and the Licensee shall not assign transfer or otherwise dispose of its interest in the same in any manner whatsoever

4. **THIS** Licence does not constitute any tenancy or lease of the Land and possession thereof is retained by the Council subject to the rights created by this Licence

5. **IN** the event of any breach of the foregoing conditions on the part of the Licensee the Council may terminate this Licence forthwith by Notice in writing but without prejudice to any claim against the Licensee in respect of any antecedent breach of the Licensee's obligations hereunder

6. **ANY** Notice under this Licence shall be in writing and shall be sufficiently served on the Licensee if served either personally or by sending it by registered post or the recorded delivery service to the Licensee's last known address and in the case of a Notice to be served on the Council it shall be sufficiently served if addressed to the head of Asset and Property Management of the Council and sent by pre-paid post

7. **TO** pay the Council's legal and surveyors fees associated with the Licence in the sum of **THREE HUNDRED POUNDS (£300.00)**

8. **THE** Council retains the right to enter the Land to view the state and progress of the Works and upon default repair make good re-instate or complete the works and recover such costs from the Licensee

IN WITNESS whereof the parties hereto have executed this Licence on the day and year first before written

SIGNED BY
BOROUGH OF TELFORD AND WREKIN

SIGNED BY
M & J DRILLING SERVICES LTD

Dated **20**

Roger Woliter
Solicitor

Borough of Telford & Wrekin
Civic Offices
P.O. Box 215
Telford
TF3 4LF

APPENDIX D

Coal Authority Letter of Ownership of Assests

The COAL AUTHORITY

INVESTOR IN PEOPLE

200 Lichfield Lane
Berry Hill
Mansfield
Notts
NG18 4RG
Tel: 01623 637235 (Direct)
01623 637000 (Switchboard)
Fax: 01623 629100
Email: davidclarke@coal.gov.uk
elaineclayton@coal.gov.uk
Web: www.coal.gov.uk

Chloe French
Senior Assistant Engineering Geologist – UK Central
Scott Wilson Ltd
Pemberton House
Stafford Court
Stafford Park
Telford
TF3 3AP

Our Reference: CA13/05/08/37
Your Reference:
Date 16th May 2008

Dear Chloe

Re: **Site at Stoney Hill, Lightmoor, Telford**

In response to your e-mail dated 15th May 2008, the Mining Records Office holds all the coal abandonment plans which have been deposited, via the Mines Inspectorate, since the passing of the relevant Act of Parliament in 1872. These plans, which number in excess of 120,000 in total, depict not only the extents of the coaling operations but also the locations of the mine entries associated therewith.

Examination of the above collection reveals that we hold plans depicting workings in one seam of coal and one opencast site, relevant to your given search area, the extents of which are shown on the following abandonment plans :-

- No. WM.85/1 Randle seam
- No. 16602 Opencast

Enclosed is a quotation for the provision of copies of the above plans, which if required will be despatched on receipt of a cheque made payable to The Coal Authority. Alternatively, payment can be made by credit/debit card which can be undertaken by contacting Elaine Clayton on the above telephone number.

With regard to the ownership position, all coal was vested in the State by virtue of two Acts of Parliament, namely The Coal (Registration of Ownership) Act 1937 and The Coal Act 1938. This ownership passed to the National Coal Board on its formation in 1947 and as successors the ownership is now vested in The Coal Authority. Anyone wishing to work the coal either as an opencast operation or subsequent to other works being undertaken

In line with Government led initiatives the Coal Authority is committed to the delivery of efficient, high quality services supported by information technology. To support this we prefer communication in electronic format wherever possible.

must first obtain a Licence which can be done by contacting Mr Simon Cooke of the Authority's licensing department which can be done by either telephone on 01623 637 344 or by e-mail to simoncooke@coal.gov.uk.

Yours sincerely

Dave Clarke MBE
Mining Information Manager

In line with Government led initiatives the Coal Authority is committed to the delivery of efficient, high quality services supported by information technology. To support this we prefer communication in electronic format wherever possible.

APPENDIX E

Coal Authority Permission to Enter / Disturb Coal Authority Mining Interests

The COAL AUTHORITY

200 Lichfield Lane
Berry Hill
Mansfield
Nottinghamshire
NG18 4RG

Tel: 01623 637205
Fax:01623 620363
E-mail: arahamlaw@coal.gov.uk

INVESTOR IN PEOPLE

Job	
Original	SCS
Enclosures	
Action	
SW - TELFORD	
RECEIVED	
2 JUL 2008	
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Copy	
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Copy	

Our Ref: 3699

Scottt Wilson
3 Pemberton House
Stafford Park
Telford
TF3 3AP

For the attention of Scott O'Neill

22nd July 2008

Dear Sir

Investigation of Shallow Mine Workings at Stoney Hill, Telford

" Application for Permission to Enter or Disturb Coal Authority Mining Interests"

Thank you for signing and returning the permit document. Payment of the £700 fee is acknowledged and attached to this letter is the counter-signed permit and supporting documentation which, subject to the terms and conditions contained therein now allows you to carry out the works within "the site" (as shown on the plan which is part of the mining report attached hereto) to the specification referred to in the documents provided by yourselves.

Please note that some of the mine entries have been conveyed to Telford Development Corporation in the past and as such are not the responsibility of the Coal Authority. They are listed on the attached mining report for you information.

In carrying out this work you should be aware that unrecorded mine workings (and possibly associated unrecorded mine entries) may exist within this area at shallow depth. Whilst mine water levels have generally recovered in this region, any mine workings that sit above this level will probably contain mine gases (primarily oxygen deficient air with elevated levels of carbon dioxide along with methane and possibly hydrogen sulphide) within the voids/ broken ground and possibly any overlying permeable strata.

In light of the above information it is imperative that regular monitoring for mine gas is carried out, especially at times of low barometric pressure. The possibility of on and off site gas emissions should be taken into account when devising any risk assessment and safe method of work for this activity and care taken to ensure that gas is not forced out of the mine workings and into adjacent properties by the flush from the drill rig during drilling and grouting operations. If gas or water is encountered, would you please ensure that such occurrences are documented, and if necessary, the appropriate actions taken as outlined in the attached Terms & Conditions document. Furthermore any surface construction must take account of the risks associated with building on land that may be susceptible to surface emissions of mine gases.

You should also note that exposure of coal to air, (particularly when flushing boreholes with compressed air) can, under certain circumstances, cause it to spontaneously combust, (the resultant fire producing, amongst other things, quantities of carbon monoxide). This risk should be borne in mind and care given to ensure that any boreholes or exposed coal faces are effectively sealed at the earliest opportunity.

Would you please ensure that the content of the permit (in particular this letter and the terms and conditions document) are passed on to all interested parties, especially the drilling contractor.

Under no circumstances should any investigation/treatment works be carried out, other than those specified, without the prior written permission of the Authority. Should any unrecorded mine entries be encountered you will provide the Authority with the results of your investigations plus the proposed specification for any treatment, for comment, prior to stabilisation.

I look forward to receiving your completion report when the works are finished, but in the meantime, should you wish to discuss this or any other matter, please do not hesitate to contact me. I would be grateful if you would keep me informed of the anticipated start date for these works in order that a site visit can be arranged at a suitable time.

Yours faithfully

G Law

Graham Law
Mining Property Manager

THE COAL AUTHORITY

Permit Reference Number 3699

Permission to Enter or Disturb Coal Authority Mining Interests

Name and Address of Applicant:

Bourneville Village Trust
Bourneville Village Developments
Courtside House
Telford Square

Site Location:

Stoney Hill
Telford

This certificate hereby grants the above named Applicant permission to carry out *Investigation of Shallow Mine Workings* within the Authority's mining interests at the identified site location for the period of 12 months from the effective date shown below. The granting of this Permission does not constitute advice given by the Authority in relation to the proposed operations. It is the Applicant's responsibility to obtain appropriate health, safety, environmental, technical and legal advice.

Signed: ..... Effective Date: 22nd July 2008

For and on behalf of The Director of Mining Projects and Property at the Coal Authority

Nominated Representative: Mr Graham Law, Mining Property Manager;
The Coal Authority, Licensing & Permits Office, 200 Lichfield Lane, Mansfield, Notts, NG18 4RG
Tel: 01623 637205; e-mail grahamlaw@coal.gov.uk

THE COAL AUTHORITY

Terms and Conditions for Entering or Disturbing Coal Authority Mining Interests

Before permission can be given to enter or disturb Coal Authority mining interests, each applicant must agree with the following terms and conditions in support of their application and return a signed copy to the Coal Authority along with the original application and supporting documentation.

1) The Applicant will take all steps, including the erection and maintenance of fences and warning notices, necessary to prevent any person from accidentally entering, falling into, or interfering with any mine entry, mine working, mining collapse, excavation or borehole during the works and as a consequence of the work.

2) The Applicant will ensure that nothing is deposited, falls or flows into any mine entry, mine working, mining collapse, excavation or borehole which by itself, or in combination with anything else which may be or which might reasonably be expected to be, in or adjacent to any such mine entry, mine working, mining collapse, excavation or borehole, could block or weaken any underground excavations within or beyond the Site, or could cause or aggravate pollution of underground water, or could cause any nuisance or harm to persons or property on the surface or underground, including any mining operations.

3) The Applicant will ensure that appropriate equipment is available on the Site and that procedures are adopted to detect the emission of any flammable or noxious gas from any part of the Site, and will take appropriate action to protect members of the public and workmen. Furthermore, the Applicant will take all appropriate measures to prevent mine gasses migrating into neighbouring properties as a result of the works and where it is necessary to ensure public safety extend his gas monitoring regime to include offsite properties

4) The Applicant will notify the Authority's Surface Hazards Office, using the **24 hour Emergency Call Out Service** on **01623-646333**, immediately there is evidence of spontaneous combustion of coal, uncontrolled emissions of mine gas or water or other hazard directly or indirectly caused by or related to the above mentioned activities both during and following completion of works. Furthermore, the Applicant will seek proper advice and take all necessary steps for the purpose of controlling, extinguishing and making safe any of the above mentioned hazards.

5) The Applicant will comply with all reasonable directions given by the Authority which the Authority in its absolute discretion believes is necessary to safeguard coal, mine workings, mine entries, the environment or public safety.

6) The Applicant will provide to the Authority and it's representatives all necessary facilities at all reasonable times to inspect the Site, and ensure that all permissions, consents and private or other rights are adequate to entitle the Authority or those authorised by it to gain access to the Site for any purpose connected with the carrying out of its statutory duties, powers and obligations. The Applicant will notify the Authority's Licensing & Permits Office at least **48 hours** prior to starting intrusive work on the Site and supply contact details of a nominated Site supervisor.

7) Should it be found necessary to significantly change the method of treatment, design or specification of the works from that contained in the application to the Authority, the prior permission of the Authority must be obtained before proceeding (such permission not to be unreasonably withheld).

8) The Applicant will take account of the possibility of unrecorded mine workings and unrecorded disused mine entries within the site.

9) The Applicant should be conversant with all current applicable legislation and will adopt appropriate practices and procedures for working and drilling in hazardous conditions associated with mine workings and mine entries and seek advice as necessary from suitably qualified persons. The Applicant should ensure that contractors are competent and have the necessary experience to enter mine workings.

The Coal Authority
Mining Reports Office

For Internal Use Only

Run on 15/07/2008 at 14:57:52
CON001 Report

THE COAL AUTHORITY,
DX 716176 MANSFIELD 5

Person dealing with this matter:	**Keith Pennington**
Our reference:	**00049292-08**
Your reference:	.366
Electronic Ref:	
RRUID:	007.00023328590001
Date of your enquiry:	**14 July 2008**
Date we received your enquiry:	**14 July 2008**
Date of issue:	

This report is for the property described in the address below and the attached plan.

Coal and Brine Report

Land At, Stoney Hill, Telford, Shropshire

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Coal mining	Yes
Brine extraction	No

Information from the Coal Authority

Underground Coal Mining

Past

The property is in the likely zone of influence from workings in 1 seam of coal at 340m depth, and last worked in 1900.

Any ground movement from these coal workings should have stopped by now.

In addition the property is in an area where the Coal Authority believe there is coal at or close to the surface. This coal may have been worked at some time in the past.

Present

The property is not in the likely zone of influence of any present underground coal workings.

Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

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Future

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

Coal-mining subsidence

The Coal Authority has not received a damage notice or claim for the property since 1 January 1984. There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority has not received a request to carry out preventive work before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.

Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

Withdrawal of Support

The property is not in an area for which a notice of entitlement to withdraw support has been published.

The property is not in an area for which a notice has been given under section 41 of the Coal Industry Act 1994, revoking the entitlement to withdraw support.

Working Facilities Orders

The property is not in an area for which an Order has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

Payments to Owners of Former Copyhold Land

The property is not in an area for which a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Comments on Coal Authority information

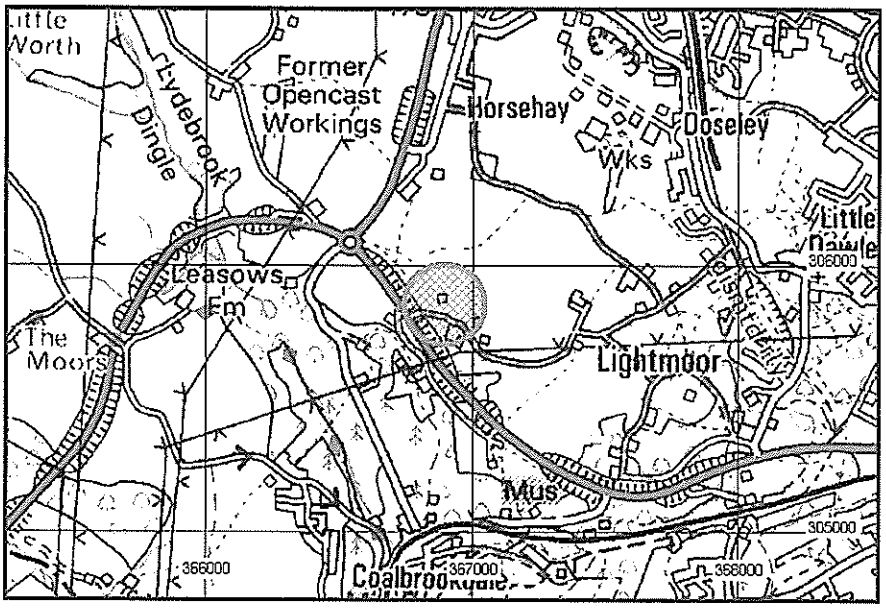
Where development proposals are being considered, technical advice should be obtained before beginning work on site. All proposals should apply good engineering practice developed for mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or mines of coal without the permission of the Coal Authority. This is necessary due to the Public Safety implications of any development in these circumstances.

Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

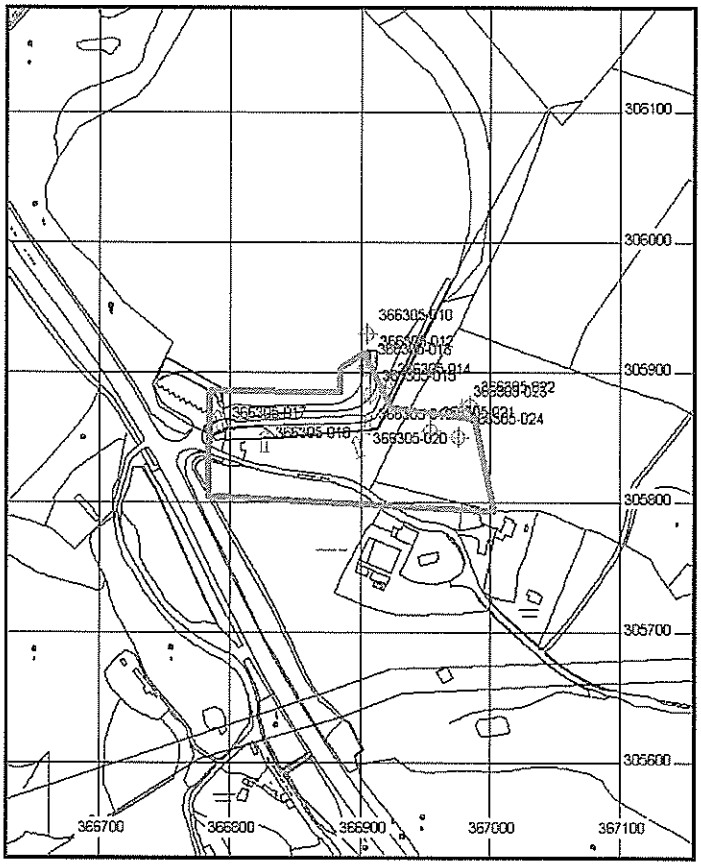
Location map

Approximate position of property



Enquiry boundary

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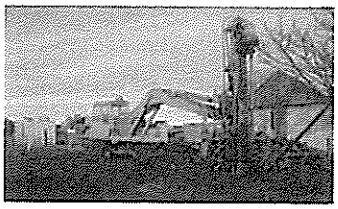
Key

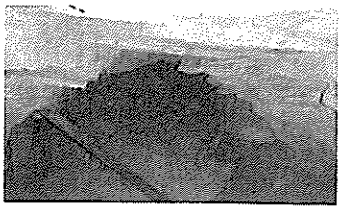
Approximate position of enquiry boundary shown

Disused Adit or Mineshaft

Mapping sourced from Ordnance Survey

The COAL AUTHORITY





CLOSURE SUMMARY FORM – PERMIT 3699

PERMISSION TO ENTER OR DISTURB OF COAL AUTHORITY MINING INTERESTS

Applicant:	Site Location:
Bourneville Village Trust Bourneville Village Developments Courtside House Telford Square	Stoney Hill Telford

Within 90 days of site operations finishing, this form must be completed and returned to the Coal Authority **together with a completion/validation report** detailing the work which was carried out to our property.

The attached completion report should include: *number of boreholes; grout takes, treatments and stabilisation works carried out in relation to mine workings or mine entries (including engineering drawings); a scaled site layout plan (correlated to O.S National Grid) showing the relevant mine entry positions, voids and broken ground proved by the works, et al.*

On what date did operations commence?	
On what date did operations finish?	

Risk Factor	Factors	Comments					
Mine Gas Monitoring	What gases were found during the works? (Include maximum readings / flow rates/ barometric pressure)	Carbon Monoxide (CO)	Methane (CH4)	Carbon Dioxide (CO2)	Oxygen (O2)	Other gases (Please specify)	None
	Where were the gases found?	Drill Rig	On-site Buildings	Off-site buildings	Monitoring Points	Other locations (please specify)	

Risk Factor	Factors	Yes	No	Comments
Spontaneous Combustion	Was spontaneous combustion found or created during the works?			If yes, provide the circumstance details together with any relevant treatment information.
Mine Water	Was mine water encountered during the works?			
Collapse of shallow mine workings or mine entries	Did any mine workings or mine entries collapse during the work activities?			

Signed..... Date .....

Print Name ..... Position .....

E-mail ..... Tel No .....

In order for this file to be closed please send this closure form together with the completion report to:

The Coal Authority, Licensing & Permits Office, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG
or e-mail it to permissions@coal.gov.uk

APPENDIX F

Exploratory Hole Logs

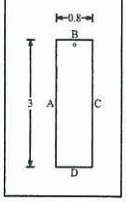
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A2a**
Date: 11-08-2008	**Co-ordinates:** E 366820.8 N 305843.9	**Ground Level:** 174.08 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.50)	Soft-very soft, brown, very sandy CLAY with occasional angular cobbles of sandstone. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			173.58	0.50			
				(0.40)	Firm - stiff, grey-brown, slightly sandy, gravelly CLAY with occasional cobbles of mudstone. Gravel is fine - medium, subangular - subrounded of mixed lithologies. Cobbles are angular of grey mudstone with thin (< 1mm) laminations of plant remains. (CAPPING LAYER)		
			173.18	0.90			
				(0.40)	Medium dense brown, slightly clayey SAND with frequent thin coal and clay laminae. (OPENCAST FILL)		
			172.78	1.30			
				(4.20)	Loose grey-brown, slightly clayey, gravelly SAND with many cobbles. Gravel is fine - coarse, subangular - angular, of sandstone and coal. Cobbles are angular of grey mudstone. (OPENCAST FILL)		
					Becoming medium dense to dense, gravelly and very clayey from 4m.		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Large collapse in upslope (northern) face from 1.3m

Shoring: None

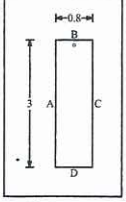
Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

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TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A2a**
Date: 11-08-2008	**Co-ordinates:** E 366820.8 N 305843.9	**Ground Level:** 174.08 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
					Loose grey-brown, slightly clayey, gravelly SAND with many cobbles. Gravel is fine - coarse, subangular - angular, of sandstone and coal. Cobbles are angular of grey mudstone. (OPENCAST FILL) *(continued)*		
			168.58	5.50			
					End of Trial Pit		

Groundwater Observations		Orientation	Method, Equipment and Remarks	Stability / Shoring
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Stability:** Large collapse in upslope (northern) face from 1.3m **Shoring:** None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

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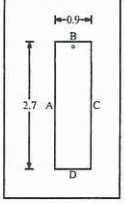
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A2b**
Date: 11-08-2008	**Co-ordinates:** E 366820.4 N 305835.9	**Ground Level:** 172.34 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			171.84	(0.50) 0.50	Loose, brown gravelly, very clayey SAND. Gravel is subangular of mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
0.50	D A2b B A2b 1/2 B A2b 2/2		171.24	(0.60) 1.10	Soft - firm, grey-brown, sandy, gravelly CLAY. Gravel is fine - coarse, angular - subrounded of sandstone, slag, coal, ceramic and mixed lithologies. (CAPPING LAYER)		
			170.64	(0.60) 1.70	Loose, dark brown - black, slightly clayey, very gravelly SAND with occasional metal. Gravel is fine - coarse, subangular of sandstone, brick, ceramic and mixed lithologies. (OPENCAST FILL)		
			170.14	(0.50) 2.20	Soft - very soft, mottled grey-brown, slightly gravelly, very sandy CLAY. Gravel is fine - medium, subangular of sandstone. (OPENCAST FILL)		
			169.74	(0.40) 2.60	Soft - firm, dark brown - grey, sandy gravelly CLAY. Gravel is fine - medium, subangular of sandstone and coal. (OPENCAST FILL)		
			168.44	(1.30) 3.90	Loose brown clayey, very gravelly SAND with angular - subangular gravel of coal, clay lens' and occasional cobbles. Gravel is fine - medium, angular - subangular of sandstone. Cobbles are subangular of sandstone. (OPENCAST FILL)		
				(2.00)	Loose, brown, slightly sandy, clayey GRAVEL. Gravel is medium - coarse grained, angular - subrounded of sandstone, coal, mudstone and mixed lithologies. (OPENCAST FILL)		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

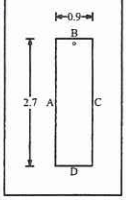
Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

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TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A2b**
Date: 11-08-2008	**Co-ordinates:** E 366820.4 N 305835.9	**Ground Level:** 172.34 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
					Loose, brown, slightly sandy, clayey GRAVEL. Gravel is medium - coarse grained, angular - subrounded of sandstone, coal, mudstone and mixed lithologies. (OPENCAST FILL) *(continued)*		
			166.44	5.90			
					End of Trial Pit		

Groundwater Observations		Orientation	Method, Equipment and Remarks	
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Stability:** Good **Shoring:** None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:24

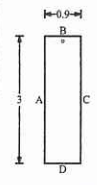
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A3a**
Date: 12-08-2008	**Co-ordinates:** E 366837.0 N 305843.5	**Ground Level:** 173.57 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.60)	Soft, brown, slightly gravelly, very sandy CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			172.97	0.60			
				(2.30)	Firm, grey, slightly gravelly, very sandy CLAY with occasional angular cobbles of coal, bricks and wood. Localised coal rich horizons from 1.3m and sandy bands from 2m. Gravel is fine - medium, angular - subangular of sandstone and mixed lithologies. (OPENCAST FILL) Localised coal rich horizons from 1.3m Thin laminations of sand from 2m		
			170.67	2.90			
				(2.00)	Loose, grey, slightly clayey, very gravelly SAND. Locally firm, grey clay lens'. Gravel is fine - medium, subangular - subrounded of sandstone and mudstone. (OPENCAST FILL)		
			168.67	4.90			

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

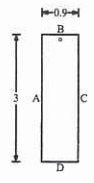
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TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A3a**
Date: 12-08-2008	**Co-ordinates:** E 366837.0 N 305843.5	**Ground Level:** 173.57 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			168.47	(0.20) 5.10	Moderately weak, grey MUDSTONE with iron-rich nodules and thin (< 1mm) laminations of plant remains, recovered as angular boulders and cobbles of mudstone. (LOWER COAL MEASURES) *(continued)*		
				(0.60)	Weak, hard, black COAL. (LOWER COAL MEASURES)		
			167.87	5.70	End of Trial Pit		

Groundwater Observations		Orientation	Method, Equipment and Remarks	
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Stability:** Good **Shoring:** None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_Z_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:29

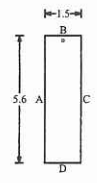
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A3b**
Date: 13-08-2008	**Co-ordinates:** E 366836.4 N 305834.5	**Ground Level:** 172.51 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			172.31	(0.20) 0.20	Soft, brown, slightly gravelly, sandy CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and quartz. Rootlets and grass at upper limit of horizon. (TOPSOIL)		
			171.01	(1.30) 1.50	Firm, grey-brown, slightly sandy, gravelly CLAY with localised lens' of fine - medium angular gravel of coal, mottled brown sandy lenses and occasional cobbles and rare boulders. Gravel is is fine - medium, subangular - subrounded of sandstone, mudstone, coal and mixed lithologies. Cobbles and boulders are subangular of sandstone. (OPENCAST FILL)		
			170.51	(0.50) 2.00	Loose, brown, slightly clayey, gravelly SAND with subangular cobbles of sandstone. Gravel is fine - coarse, angular - subrounded fo sandstone, mudstone, coal and mixed lithologies. (OPENCAST FILL)		
			169.51	(1.00) 3.00	Loose, black, fine grained, very clayey SAND with much fine - medium angular gravel of coal. Sand is coal. (OPENCAST FILL)		
				(2.20)	Loose, grey-brown, slightly clayey SAND AND GRAVEL with some subangular cobbles of mudstone and occasional soft - firm clay lens'. Gravel is fine - coarse, angular - subangular of mudstone. Cobbles are of mudstone. (OPENCAST FILL)		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:35

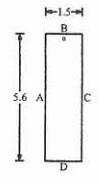
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A3b**
Date: 13-08-2008	**Co-ordinates:** E 366836.4 N 305834.5	**Ground Level:** 172.51 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			167.31	5.20			
				(0.40)	Moderately strong, pale brown, medium grained SANDSTONE, recovered as angular boulders and cobbles. (LOWER COAL MEASURES)		
			166.91	5.60			
					End of Trial Pit		

Groundwater Observations	
Depth	Flow

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:35

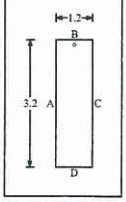
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A4a**
Date: 13-08-2008	**Co-ordinates:** E 366844.8 N 305843.3	**Ground Level:** 174.08 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			173.88	(0.20) 0.20	Soft, brown, slightly gravelly, sandy CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and quartz. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
				(5.40)	Firm, grey, slightly sandy, gravelly CLAY with lenses of fine - medium, angular gravel of coal, occasional wood and metal. Gravel is fine - coarse, subangular - angular of sandstone, mudstone, coal, ceramic and glass. (OPENCAST FILL)		
					Becoming soft and very gravelly from 4.2m		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

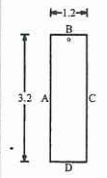
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TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A4a**
Date: 13-08-2008	**Co-ordinates:** E 366844.8 N 305843.3	**Ground Level:** 174.08 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
					Firm, grey, slightly sandy, gravelly CLAY with lenses of fine - medium, angular gravel of coal, occasional wood and metal. Gravel is fine - coarse, subangular - angular of sandstone, mudstone, coal, ceramic and glass. (OPENCAST FILL*(continued)*		
			168.48	5.60			
			168.28	(0.20) 5.80	Soft, mottled grey-brown sandy, gravelly CLAY with frequent subangular cobbles of grey mudstone. Gravel is fine - coarse, subangular of mudstone. (OPENCAST FILL)		
					End of Trial Pit		

Groundwater Observations		Orientation	Method, Equipment and Remarks	
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Stability:** Good **Shoring:** None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:40

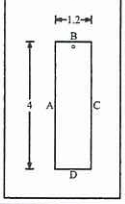
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A5a**
Date: 12-08-2008	**Co-ordinates:** E 366858.2 N 305840.9	**Ground Level:** 173.64 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.70)	Soft, brown, slightly gravelly, sandy CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and quartz. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			172.94	0.70			
				(5.50)	Soft - stiff, grey, sandy, very gravelly CLAY with occasional subangular cobbles and small boulders, wood, brick and tiles. Gravel is fine - coarse, angular - subrounded of sandstone, mudstone, coal, ceramic and mixed lithologies. Cobbles and boulders are of brown, medium grained sandstone. (OPENCAST FILL)		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

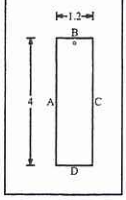
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AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:43

TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A5a**
Date: 12-08-2008	**Co-ordinates:** E 366858.2 N 305840.9	**Ground Level:** 173.64 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
					Soft - stiff, grey, sandy, very gravelly CLAY with occasional subangular cobbles and small boulders, wood, brick and tiles. Gravel is fine - coarse, angular - subrounded of sandstone, mudstone, coal, ceramic and mixed lithologies. Cobbles and boulders are of brown, medium grained sandstone. (OPENCAST FILL) *(continued)*		
			167.44	6.20			
					End of Trial Pit		

Groundwater Observations		Orientation	Method, Equipment and Remarks	Stability: Good
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Shoring:** None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:43

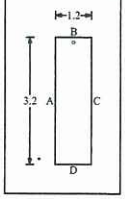
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A5b**
Date: 14-08-2008	**Co-ordinates:** E 366854.8 N 305829.4	**Ground Level:** 172.75 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			172.25	(0.50) 0.50	Soft, brown, slightly sandy, gravelly CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and quartz. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			170.15	(2.10) 2.60	Soft - firm, grey, slightly sandy, gravelly CLAY with occasional cobbles of sandstone and rare boulders of concrete. Gravel is fine - coarse, angular - subrounded of sandstone, coal, mudstone, ceramic and mixed lithologies. (OPENCAST FILL)		
			168.95	(1.20) 3.80	Loose, grey-brown, clayey, gravelly SAND, with locally mottled grey-brown sandy clay lens'. Gravel is fine - coarse, subangular - subrounded of sandstone and coal. (OPENCAST FILL)		
			168.55	(0.40) 4.20	Weak, black COAL. (LOWER COAL MEASURES)		
			167.95	(0.60) 4.80	Weak, grey MUDSTONE with thin (< 1mm) laminations of plant remains, recovered as subangular cobbles and boulders. (LOWER COAL MEASURES)		
			167.85	4.90	Moderately weak, brown, medium grained SANDSTONE interbedded with weak, mottled grey-brown MUDSTONE. Recovered as clayey cobbles and boulders. (LOWER COAL MEASURES)		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

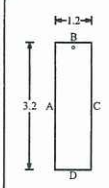
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AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:47

TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A5b**
Date: 14-08-2008	**Co-ordinates:** E 366854.8 N 305829.4	**Ground Level:** 172.75 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
					End of Trial Pit		

Groundwater Observations		Orientation	Method, Equipment and Remarks	
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Stability:** Good **Shoring:** None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:47

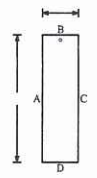
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A6a**
Date: 12-08-2008	**Co-ordinates:** E 366874.6 N 305840.4	**Ground Level:** 174.09 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.50)	Soft, brown, slightly gravelly, sandy CLAY. Gravel is fine - medium, subangular - subrounded of sandstone. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			173.59	0.50			
				(5.00)	Soft - firm, grey, slightly sandy - sandy, gravelly CLAY with occasional cobbles and boulders from 4.8m. Gravel is fine - coarse, subangular of sandstone, mudstone, coal, wood, ceramic and mixed lithologies. Boulders and cobbles are subangular of grey mudstone with thin (<1mm) laminations of plant remains. (OPENCAST FILL)		
					Occasional cobbles and boulders of MUDSTONE from 4.8m		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

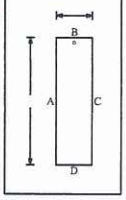
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AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:50

TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A6a**
Date: 12-08-2008	**Co-ordinates:** E 366874.6 N 305840.4	**Ground Level:** 174.09 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill / Instrument
			168.59	5.50	Soft - firm, grey, slightly sandy - sandy, gravelly CLAY with occasional cobbles and boulders from 4.8m. Gravel is fine - coarse, subangular of sandstone, mudstone, coal, wood, ceramic and mixed lithologies. Boulders and cobbles are subangular of grey mudstone with thin (<1mm) laminations of plant remains. (OPENCAST FILL) *(continued)*		
			168.09	(0.50) 6.00	Weak, mottled grey-brown MUDSTONE, interbedded with mottled grey-brown, sandy CLAY. Recovered as clayey, angular cobbles and boulders. (LOWER COAL MEASURES)		
					End of Trial Pit		

Groundwater Observations		Orientation	Method, Equipment and Remarks	
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Stability:** Good **Shoring:** None

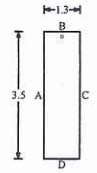
Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:51

TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A6b**
Date: 12-08-2008	**Co-ordinates:** E 366870.9 N 305832.3	**Ground Level:** 172.32 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			171.82	(0.50) 0.50	Soft, brown, sandy, gravelly CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			171.32	(0.50) 1.00	Soft - firm, grey-brown, sandy, gravelly CLAY. Gravel is medium, subangular of sandstone, quartz, coal and mixed lithologies. (OPENCAST FILL)		
			170.72	(0.60) 1.60	Loose, grey-brown, clayey, very gravelly SAND with some cobbles and boulders and occasional metal, wood and ceramic pieces. Gravel is fine - medium, angular - subrounded of sandstone, mudstone, quartz, coal and mixed lithologies. Cobbles and boulders are subangular of grey mudstone. (OPENCAST FILL)		
			168.32	(2.40) 4.00	Soft, grey, slightly sandy, gravelly CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and coal. (OPENCAST FILL)		
				(1.40)	Very weak, grey MUDSTONE with thin (<1mm) laminations of plant remains and thin laminations of coal. (LOWER COAL MEASURES)		

Groundwater Observations		Orientation	Method, Equipment and Remarks	Stability: Good
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Shoring:** None
0.00	No groundwater observed			

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL GP J | AGS3_NEW.GDT | 17/09/2008 | 12:17:54

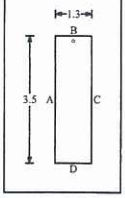
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A6b**
Date: 12-08-2008	**Co-ordinates:** E 366870.9 N 305832.3	**Ground Level:** 172.32 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill / Instrument
					Very weak, grey MUDSTONE with thin (<1mm) laminations of plant remains and thin laminations of coal. (LOWER COAL MEASURES) *(continued)*		
			166.92	5.40			
				(0.40)	Soft, black, very gravelly CLAY. Gravel is angular and coarse of weak coal. (LOWER COAL MEASURES)		
			166.52	5.80			
					End of Trial Pit		

Groundwater Observations	
Depth	Flow

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

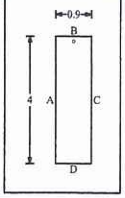
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AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:55

TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A7b**
Date: 12-08-2008	**Co-ordinates:** E 366910.5 N 305840.0	**Ground Level:** 175.28 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.40)	Loose, brown, slightly gravelly, clayey SAND . Gravel is fine - medium, subangular of sandstone and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			174.88	0.40			
				(2.40)	Soft - firm, grey, slightly sandy, gravelly CLAY with occasional subangular cobbles, boulders and wood. Gravel is fine - medium, angular - subrounded of sandstone, mudstone, coal, ceramic and mixed lithologies. Locally loose and very gravelly. (OPENCAST FILL)		
			172.48	2.80			
				(0.50)	Soft, black, slightly gravelly, sandy CLAY. Gravel is fine - coarse, angular of coal. Sand is fine coal. (OPENCAST FILL)		
			171.98	3.30			
				(0.60)	Soft - stiff, pale grey, slightly sandy CLAY with occasional subangular boulders and localised brown, medium grained sandy lens'. Boulders are of grey mudstone with thin (<1mm) laminations of coal. (OPENCAST FILL)		
			171.38	3.90			
				(1.30)	Soft, brown - grey, gravelly, very sandy CLAY with occasional boulders. Gravel is fine - medium, angular - subangular of sandstone, mudstone and mixed lithologies. Boulders are angular - subangular of sandstone and mudstone. (OPENCAST FILL)		

Groundwater Observations		Orientation	Method, Equipment and Remarks	Stability: Good
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Shoring:** None
0.00	No groundwater observed			

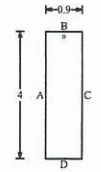
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AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:58

TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A7b**
Date: 12-08-2008	**Co-ordinates:** E 366910.5 N 305840.0	**Ground Level:** 175.28 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill / Instrument
			170.08	5.20	End of Trial Pit		

Groundwater Observations		Orientation	Method, Equipment and Remarks	Stability / Shoring
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Stability:** Good **Shoring:** None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:17:59

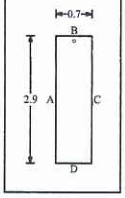
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A7c**
Date: 31-07-2008	**Co-ordinates:** E 366927.5 N 305833.4	**Ground Level:** 175.09 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.90)	Soft, brown, slightly gravelly, very sandy CLAY. Gravel is fine - medium, subangular - rounded of sandstone, quartz and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			174.19	0.90			
				(3.10)	Soft - firm, grey-brown, slightly sandy, gravelly CLAY with occasional cobbles and rare boulders. Gravel is subangular - subrounded of sandstone, coal and mixed lithologies. Cobbles and boulders are angular - subangular of sandstone. (OPENCAST FILL) Becoming more gravelly and coal-rich from 1.7m		
			171.09	4.00			
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:18:02

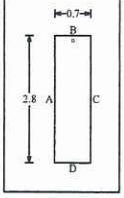
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A7d**
Date: 31-07-2008	**Co-ordinates:** E 366938.8 N 305824.5	**Ground Level:** 174.82 (m)	
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		Sheet: 1 of 1

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill / Instrument
				(0.56)	Soft - firm, brown, slightly gravelly, very sandy CLAY. Gravel is fine - medium, subangular - rounded of sandstone, quartz, coal and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			174.26	0.56			
				(3.54)	Firm - stiff, grey-brown slightly sandy, very gravelly CLAY with occasional cobbles. Gravel is fine - coarse, subangular - rounded of sandstone, coal and mixed lithologies. Cobbles are subangular - subrounded of sandstone. (OPENCAST FILL)		
			170.72	4.10			
			170.62	4.20	Soft - firm, light brown slightly gravelly CLAY with cobbles and boulders. Gravel is medium - coarse, angular - subangular of sandstone. Cobbles and boulders are angular - subangular of light brown, moderately weak, medium grained sandstone. (OPENCAST FILL)		
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:18:05

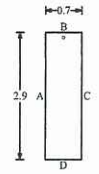
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A7e**
Date: 31-07-2008	**Co-ordinates:** E 366957.5 N 305823.6	**Ground Level:** 174.36 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.40)	Soft - firm, brown, slightly gravelly sandy CLAY. Gravel is fine - medium, angular - subrounded of mudstone, sandstone, coal and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			173.96	0.40			
0.50	D A7e B A7e 1/2 B A7e 2/2				Soft - stiff, grey-brown slightly sandy, gravelly CLAY with occasional cobbles and wood. Gravel is fine - coarse, subangular - subrounded of sandstone, coal, ceramics and mixed lithologies. Cobbles are angular subangular of sandstone. (OPENCAST FILL)		
					Locally very gravelly from 1.5m		
				(4.20)			
			169.76	4.60			
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:18:08

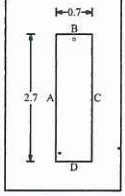
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A9a**
Date: 31-07-2008	**Co-ordinates:** E 366975.2 N 305832.6	**Ground Level:** 175.53 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			174.93	(0.60) 0.60	Soft - firm, brown, slightly gravelly, very sandy CLAY. Gravel is fine - medium, subangular - rounded of sandstone, quartz and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			171.03	(3.90) 4.50	Firm - stiff, grey, slightly sandy, gravelly CLAY with occasional cobbles, boulders, bricks and wood. Gravel is fine - coarse, subangular - subrounded of sandstone, coal, ceramics and mixed lithologies. Cobbles and boulders are angular - subangular of sandstone. (OPENCAST FILL)		
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:18:11

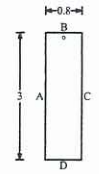
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **A9b**
Date: 31-07-2008	**Co-ordinates:** E 366977.0 N 305825.1	**Ground Level:** 175.18 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.60)	Soft - firm, brown, slightly gravelly, very sandy CLAY. Gravel is fine - coarse, subangular - subrounded of sandstone, quartz and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			174.58	0.60			
				(4.10)	Firm - stiff, grey, slightly sandy, gravelly CLAY with occasional cobbles, boulders, bricks and wood. Gravel is fine - medium, subangular - subrounded of sandstone, coal, concrete and mixed lithologies. Cobbles are angular of sandstone and concrete, boulders are angular - subangular of sandstone. (OPENCAST FILL)		
			170.48	4.70			
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:18:14

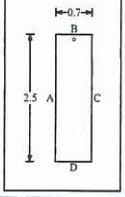
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **BV1**
Date: 01-08-2008	**Co-ordinates:** E 366817.5 N 305815.0	**Ground Level:** 174.34 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			174.01	(0.33) 0.33	Loose, brown, slightly clayey, gravelly SAND. Gravel is fine - medium, sub angular - rounded of quartz and sandstone. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			173.44	(0.57) 0.90	Moderately weak - moderately strong, grey-brown, medium grained SANDSTONE. Closely spaced, low persistence discontinuities with rare - some orange staining on discontinuity surfaces. (LOWER COAL MEASURES)		
			172.84	(0.60) 1.50	Weak - moderately weak, orange-brown, medium grained SANDSTONE with soft - firm grey-brown sandy CLAY interbeds. (LOWER COAL MEASURES)		
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:21:04

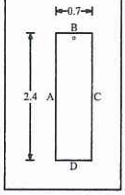
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **BV2**
Date: 01-08-2008	**Co-ordinates:** E 366825.0 N 305815.6	**Ground Level:** 174.08 (m)	
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	Sheet: 1 of 1

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			173.58	(0.50) 0.50	Loose. brown, clayey, gravelly SAND. Gravel is fine - medium, subangular - rounded of sandstone and quartz. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
0.50	D BV2 B BV2 1/2 B BV2 2/2		173.18	(0.40) 0.90	Soft, orange-brown, slightly gravelly, very sandy CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and quartz. (SUPERFICIAL DEPOSITS)		
			172.28	(0.90) 1.80	Weak - strong, orange-brown, fine - medium grained SANDSTONE with medium spaced, low persistence discontinuities. Occasional fine - medium, rounded gravel of quartz. (LOWER COAL MEASURES)		
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:22:46

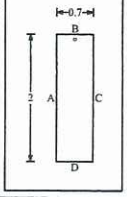
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **BV3**
Date: 01-08-2008	**Co-ordinates:** E 366858.4 N 305800.7	**Ground Level:** 173.97 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			173.71	(0.26) 0.26	Loose, brown, slightly clayey, very gravelly SAND. Gravel is fine - medium, subangular - rounded fo sandstone, quartz and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			173.01	(0.70) 0.96	Loose, brown, slightly clayey, very gravelly SAND with lens' of pale grey, soft sandy, gravelly clay and occasional cobbles. Gravel is fine - coarse, subangular - subrounded, of quartz, sandstone and mixed lithologies. Cobbles are angular - subangular of sandstone. (SUPERFICIAL DEPOSITS)		
			171.67	(1.34) 2.30	Very loose - loose, brown slightly clayey, very gravelly SAND with occasional cobbles and clay lens'. Gravel is fine - coarse, subangular - subrounded of sandstone and mixed lithologies. Cobbles are angular subangular of sandstone. (SUPERFICIAL DEPOSITS)		
			171.37	(0.30) 2.60	Moderately weak - moderately strong, fine - coarse grained, pale brown SANDSTONE with some black coal staining and some soft, pale brown clay interbeds. (LOWER COAL MEASURES)		
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:23:06

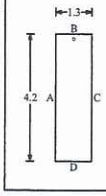
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **BV5**
Date: 14-08-2008	**Co-ordinates:** E 366900.1 N 305839.7	**Ground Level:** 174.64 (m)	Sheet: 1 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			174.14	(0.50) 0.50	Soft, brown, slightly gravelly, sandy CLAY. Gravel is fine - medium , subangular - subrounded of sandstone and quartz. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			172.24	(1.90) 2.40	Firm, grey, slightly sandy, gravelly CLAY with occasional wood, glass, rubber, boulders and frequent cobbles. Gravel is fine - coarse, angular - subrounded of sandstone, mudstone, coal, ceramic and mixed lithologies. Cobbles and boulders are angular - subangular of sandstone. (OPENCAST FILL)		
			170.64	(1.60) 4.00	Loose, grey-brown, clayey, gravelly SAND with occasional subangular cobbles of sandstone. Gravel is fine - coarse, angular - subrounded of sandstone, mudstone, coal, brick and ceramic. (OPENCAST FILL)		
				(1.80)	Soft - very soft, black, sandy, gravelly CLAY. Gravel and sand are fine, angular of coal. (OPENCAST FILL)		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 360 Tracked Excavator

Stability: Good

Shoring: None

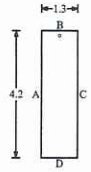
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AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTHOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:23:10

TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **BV5**
Date: 14-08-2008	**Co-ordinates:** E 366900.1 N 305839.7	**Ground Level:** 174.64 (m)	Sheet: 2 of 2
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			168.84	5.80	Soft - very soft, black, sandy, gravelly CLAY. Gravel and sand are fine, angular of coal. (OPENCAST FILL *(continued)*		
			167.84	(1.00) 6.80	Weak - very weak, grey MUDSTONE with thin (<1mm) laminations of plant remains, recovered as angular cobbles and gravel. Locally soft, mottled grey-brown sandy clay lenses or interbeds. (LOWER COAL MEASURES)		
			167.54	(0.30) 7.10	Weak, black COAL recovered as angular gravel and cobbles. (LOWER COAL MEASURES)		
					End of Trial Pit		

Groundwater Observations		Orientation	Method, Equipment and Remarks	Stability: Good
Depth	Flow		**Method / Equipment:** 360 Tracked Excavator	**Shoring:** None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:23:10

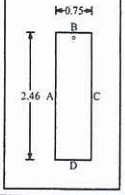
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **BV6**
Date: 30-07-2008	**Co-ordinates:** E 366942.4 N 305816.1	**Ground Level:** 173.99 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
			173.63	(0.36) 0.36	Loose, brown, clayey, gravelly SAND. Gravel is fine - coarse, angular - subrounded of sandstone, coal, quartz and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			171.89	(1.74) 2.10	Soft - firm, grey and brown, slightly gravelly, sandy CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and coal. (OPENCAST FILL)		
			169.79	(2.10) 4.20	Loose, dark grey, gravelly, very clayey SAND with occasional cobbles. Gravel is fine - coarse, angular - subrounded of coal, sandstone and granular material. Cobbles are subangular of sandstone. (OPENCAST FILL)		
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:23:21

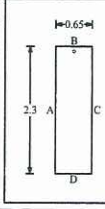
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **BV7**
Date: 30-07-2008	**Co-ordinates:** E 366964.9 N 305807.8	**Ground Level:** 173.36 (m)	
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	Sheet: 1 of 1

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.46)	Soft - firm, brown, slightly gravelly, sandy CLAY. Gravel is fine - coarse subangular - subrounded of sandstone and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			172.90	0.46			
				(3.29)	Firm - stiff, grey - brown, slightly sandy, gravelly CLAY with occasional wood pieces. Gravel is fine - coarse, subangular - subrounded of sandstone, coal and mixed lithologies. (OPENCAST FILL)		
					Becoming coal-rich with rare cobbles of sandstone, metal and much wood from 2.95m		
			169.61	3.75			
			169.51	3.85	Soft, grey-brown, slightly gravelly - gravelly, very sandy CLAY with occasional rootlets. Gravel is fine - coarse, angular - subrounded of sandstone, coal and mixed lithologies. (OPENCAST FILL)		
					End of Trial Pit		

Groundwater Observations	
Depth	Flow
2.95	2.95m Moist

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:23:26

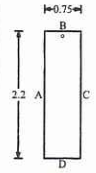
TRIAL PIT LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Trial Pit No. **BV8**
Date: 30-07-2008	**Co-ordinates:** E 366990.4 N 305808.3	**Ground Level:** 172.87 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests			Strata				
Depth	Type No	Test Result	Reduced Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
				(0.42)	Soft - firm, brown, gravelly, very sandy CLAY. Gravel is fine - medium subangular - subrounded of mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
			172.45	0.42			
				(2.93)	Soft - firm, grey, slightly sandy, gravelly CLAY with sand lens'. Gravel is fine - medium, subangular of sandstone, coal and mixed lithologies. (OPENCAST FILL) Becoming coal rich from 2.44m		
			169.52	3.35			
				(0.54)	Soft - firm, grey-brown, slightly gravelly, sandy CLAY. Gravel is fine - coarse, subangular - subrounded of sandstone, coal and mixed lithologies. (OPENCAST FILL)		
			168.98	3.89	End of Trial Pit		

Groundwater Observations	
Depth	Flow
0.00	No groundwater observed

Orientation



Method, Equipment and Remarks

Method / Equipment: 3CX Type Wheeled Excavator

Stability: Good

Shoring: None

Scale: 1:25 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

A053_NEW.GLB | SW TP LOG | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:23:29

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH1**
Date: 07-08-2008	**Co-ordinates:** E 366802.0 N 305843.3	**Ground Level:** 173.71 (m)	Sheet: 1 of 5
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
						168.71	(5.00) 5.00	Brown sandy gravel. (MADE GROUND)		
						166.71	(2.00) 7.00	Pale brown sandstone, becoming brown at depth. (LOWER COAL MEASURES)		
						166.21	(0.50) 7.50	Coal. (LOWER COAL MEASURES)		
						165.21	(1.00) 8.50	Broken ground, lost flush		
						163.91	(1.30) 9.80	Hard drilling, no arisings (LOWER COAL MEASURES)		
								Broken, no arisings		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks
0.00				No groundwater observed

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RIC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:27

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH1** Sheet: 2 of 5
Date: 07-08-2008	**Co-ordinates:** E 366802.0 N 305843.3	**Ground Level:** 173.71 (m)	
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
								Broken, no arisings *(continued)*		
							(8.00)			
						155.91	17.80			
								Hard drilling, no arisings (LYDEBROOK SANDSTONE)		
							(1.20)			
						154.71	19.00			
								Broken, no arisings		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:28

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH1**
Date: 07-08-2008	**Co-ordinates:** E 366802.0 N 305843.3	**Ground Level:** 173.71 (m)	Sheet: 3 of 5
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
							(5.80)	Broken, no arisings *(continued)*		
						148.91	24.80	Hard drilling, no arisings (WENLOCK SHALE)		

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:28

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH1**
Date: 07-08-2008	**Co-ordinates:** E 366802.0 N 305843.3	**Ground Level:** 173.71 (m)	Sheet: 4 of 5
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
								Hard drilling, no arisings (WENLOCK SHALE) *(continued)*		
							(16.20)			

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:28

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH1**
Date: 07-08-2008	**Co-ordinates:** E 366802.0 N 305843.3	**Ground Level:** 173.71 (m)	Sheet: 5 of 5
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
								Hard drilling, no arisings (WENLOCK SHALE) *(continued)*		
						132.71	41.00			
								End of Borehole		

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINTV08.08:19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:28

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH+1 (A7e)**
Date: 30-07-2008	**Co-ordinates:** E N	**Ground Level:** (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
							(0.55) 0.55	Loose, brown, clayey, gravelly SAND. Gravel is fine - medium subangular - subrounded of sandstone, coal and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
							(3.55) 4.10	Firm - stiff, dark grey-brown slightly sandy, slightly gravelly and locally very gravelly CLAY. Gravel is fine - medium, subangular - subrounded of sandstone and coal. (OPENCAST FILL)		
							(0.50) 4.60	Very weak - weak, pale grey, fine - medium SANDSTONE with coal rich laminations up to 25mm thick. (LOWER COAL MEASURES)		
							4.87	Very weak, thinly laminated, dark brown/black COAL. (LOWER COAL MEASURES)		
								End of Borehole		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks
3.10				3.1 - 3.5m Moist

Method, Equipment and Remarks

Sonic Core
Method: RC
Equipment: Sonic SDC550-18

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL / CHF	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:23

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH2**
Date: 08-08-2008	**Co-ordinates:** E 366848.2 N 305836.9	**Ground Level:** 173.36 (m)	Sheet: 1 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
						170.36	(3.00) 3.00	Brown sandy gravel. (MADE GROUND)		
						168.16	(2.20) 5.20	Coal with mudstone. (MADE GROUND or LOWER COAL MEASURES?)		
						166.96	(1.20) 6.40	Yellow-brown clay. (MADE GROUND or LOWER COAL MEASURES?)		
						166.66	6.70	Coal. (LOWER COAL MEASURES)		
						165.36	(1.30) 8.00	Hard drilling, lost flush (LOWER COAL MEASURES)		
						163.86	(1.50) 9.50	Pale brown sandstone. (LOWER COAL MEASURES)		
						163.36	(0.50) 10.00	Brown sandstone. (LOWER COAL MEASURES)		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks
0.00				No groundwater observed

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:35

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH2**
Date: 08-08-2008	**Co-ordinates:** E 366848.2 N 305836.9	**Ground Level:** 173.36 (m)	Sheet: 2 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
							(2.00)	Broken sandstone, lost flush		
						161.36	12.00			
							(9.10)	Broken in places, no arisings (LYDEBROOK SANDSTONE?)		

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:36

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH2**
Date: 08-08-2008	**Co-ordinates:** E 366848.2 N 305836.9	**Ground Level:** 173.36 (m)	Sheet: 3 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
						152.26	21.10	Broken in places, no arisings (LYDEBROOK SANDSTONE?) *(continued)*		
						151.46	(0.80) 21.90	Firm drilling (LYDEBROOK SANDSTONE?)		
						149.46	(2.00) 23.90	Broken, no arisings		
							(11.90)	Hard drilling, no arisings (WENLOCK SHALE)		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:36

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH2**
Date: 08-08-2008	**Co-ordinates:** E 366848.2 N 305836.9	**Ground Level:** 173.36 (m)	Sheet: 4 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
								Hard drilling, no arisings (WENLOCK SHALE) *(continued)*		
						137.56	35.80			
								Weak, no returns (WENLOCK SHALE)		
							(3.40)			
						134.16	39.20			
								Hard drilling, no arisings (WENLOCK SHALE)		
							(0.80)			
						133.36	40.00			
								End of Borehole		

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08 08:19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:36

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH3**
Date: 06-08-2008	**Co-ordinates:** E 366975.4 N 305811.1	**Ground Level:** 173.67 (m)	Sheet: 1 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
							(7.80)	Brown sandy gravel with coal fragments. (MADE GROUND)		
						165.87	7.80			
						165.67	8.00	Coal. (LOWER COAL MEASURES)		
								Grey-brown, soft sand with coal fragments. (LOWER COAL MEASURES)		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks
0.00				No groundwater observed

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (EP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08 08:19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:41

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH3**
Date: 06-08-2008	**Co-ordinates:** E 366975.4 N 305811.1	**Ground Level:** 173.67 (m)	Sheet: 2 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
								Grey-brown, soft sand with coal fragments. (LOWER COAL MEASURES) *(continued)*		
							(10.20)			
						155.47	18.20			
								Yellow-brown sandstone. (LYDEBROOK SANDSTONE?)		
							(0.60)			
						154.87	18.80			
								Grey-brown sandstone. (LYDEBROOK SANDSTONE)		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:42

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH3**
Date: 06-08-2008	**Co-ordinates:** E 366975.4 N 305811.1	**Ground Level:** 173.67 (m)	Sheet: 3 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
							(2.50)	Grey-brown sandstone. (LYDEBROOK SANDSTONE) *(continued)*		
						152.37	21.30	Grey, sandy mudstone. (WENLOCK SHALES)		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:42

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH3**
Date: 06-08-2008	**Co-ordinates:** E 366975.4 N 305811.1	**Ground Level:** 173.67 (m)	Sheet: 4 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
							(18.70)	Grey, sandy mudstone. (WENLOCK SHALES) *(continued)*		
						133.67	40.00	End of Borehole		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:42

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH4**
Date: 30-07-2008/07-08-2008	**Co-ordinates:** E 366948.7 N 305832.1	**Ground Level:** 175.40 (m)	Sheet: 1 of 5
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
						174.75	(0.65) 0.65	Soft - firm, brown, slightly gravelly, sandy - very sandy CLAY. Gravel is fine - medium, subangular - subrounded of sandstone, coal and mixed lithologies. Grass and rootlets at upper limit of horizon. (TOPSOIL)		
						172.56	(2.19) 2.84	Firm, dark brown, slightly sandy, gravelly CLAY with thinly laminated coal and sand bands at 2.7 - 2.84, and occasional plant material. Gravel is fine - coarse, subangular - subrounded of sandstone, coal, brick and mixed lithologies. (CAPPING LAYER or OPENCAST FILL?)		
						171.06	(1.50) 4.34	Soft - firm, grey - brown, slightly sandy - sandy, gravelly CLAY with occasional rootlets. Gravel is fine - coarse, subangular - subrounded of sandstone and coal. (OPENCAST FILL)		
						168.16	(2.90) 7.24	No recovery		
8.00-8.80			91 91 83				(4.36)	Moderately weak - moderately stong, thinly laminated, dark grey-brown, fine - medium grained SANDSTONE. Occasional medium grained gravel lens' and some dark grey clay laminae. Slightly weathered, orange-brown brown surface staining from 10.2m. Medium - widely spaced rough discontinuities with very low persistence. Slightly weathered. (LOWER COAL MEASURES)		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks
0.00				No groundwater observed

Method, Equipment and Remarks

Method: RC
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:47

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH4**
Date: 30-07-2008/07-08-2008	**Co-ordinates:** E 366948.7 N 305832.1	**Ground Level:** 175.40 (m)	Sheet: 2 of 5
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
8.80-11.60			97 93 89					Moderately weak - moderately stong, thinly laminated, dark grey-brown, fine - medium grained SANDSTONE. Occasional medium grained gravel lens and some dark grey clay laminae. Slightly weathered, orange-brown brown surface staining from 10.2m. Medium - widely spaced rough discontinuities with very low persistence. Slightly weathered. (LOWER COAL MEASURES)*(continued)*		
						163.80	11.60			
11.60-14.60			87 71 67					Very weak - moderately strong, pale brown-grey, medium - coarse grained, thickly bedded and locally thinly laminated SANDSTONE with occasional fine - medium gravel of quartz. Occasional thin clay bands. Fresh. (LYDEBROOK SANDSTONE?) 13.64 - 13.96 Poorly cemented from 13.64 - 13.96.		
							(6.00)			
14.60-17.60			100 86 84			157.80	17.60			
							(1.50)	No recovery		
17.60-20.60			84 45 30			156.30	19.10			
							(1.25)	Very weak - moderately strong, pale brown-grey, medium - coarse grained, thickly bedded and locally thinly laminated SANDSTONE with occasional fine - medium gravel of quartz. Occasional thin clay bands. Fresh. (LYDEBROOK SANDSTONE)		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RC
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:48

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH4**
Date: 30-07-2008/07-08-2008	**Co-ordinates:** E 366948.7 N 305832.1	**Ground Level:** 175.40 (m)	Sheet: 3 of 5
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
						155.05	20.35			
						154.80	20.60	Poorly cemented, pale brown, medium grained SANDSTONE recovered as loose, gravelly SAND. Gravel is subrounded of quartz. Slightly weathered - fresh. (LYDEBROOK SANDSTONE?)		
							(1.00)	No recovery		
						153.80	21.60			
						153.68	21.72	Poorly cemented, brown SANDSTONE recovered as gravelly, clayey SAND. Gravel is coarse, subrounded - rounded of quartz. Slightly weathered - fresh. (LYDEBROOK SANDSTONE)		
20.60-23.60			60 46 42			153.49	21.91			
							(0.89)	Weak, grey-brown MUDSTONE with occasional medium, rounded - subrounded gravel of quartz. Distinctly weathered. (LYDEBROOK SANDSTONE)		
						152.60	22.80	Moderately strong - strong, light brown, medium grained SANDSTONE with occasional gravel of quartz. Slightly weathered - fresh. (LYDEBROOK SANDSTONE)		
							(0.80)	Moderately weak - very weak, brown CONGLOMERATE of medium grained sands and medium - coarse grained, rounded gravels of quartz. Partially weathered. (LYDEBROOK SANDSTONE)		
						151.80	23.60	23.10 - 23.60 Poorly cemented from 23.1		
						151.60	23.80	No recovery		
23.60-24.60			87 58 58			151.19	(0.41) 24.21	Moderately weak - moderately strong, grey MUDSTONE with occasional gravel of quartz. Some localised thin laminations. Fresh. (LYDEBROOK SANDSTONE?)		
						150.87	24.53	Moderately strong, pale brown, medium SANDSTONE with occasional medium grained gravel of quartz. Fresh - slightly weathered. (LYDEBROOK SANDSTONE)		
24.60-26.30			90 82 81					Moderately weak - moderately strong, thinly laminated, grey MUDSTONE. Fresh. (WENLOCK SHALES)		
26.30-29.30			100 100 94							

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RC
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:48

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH4**
Date: 30-07-2008/07-08-2008	**Co-ordinates:** E 366948.7 N 305832.1	**Ground Level:** 175.40 (m)	Sheet: 4 of 5
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
								Moderately weak - moderately strong, thinly laminated, grey MUDSTONE. Fresh. (WENLOCK SHALES) *(continued)*		
29.30-32.30			100 100 92				(15.57)			
32.30-35.30			90 86 86							
35.30-38.30			100 94 91							
38.30-40.10			100 100 83							

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RC
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:48

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH4**
Date: 30-07-2008/07-08-2008	**Co-ordinates:** E 366948.7 N 305832.1	**Ground Level:** 175.40 (m)	Sheet: 5 of 5
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
						135.30	40.10	End of Borehole		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RC
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (EP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:48

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH5**
Date: 06-08-2008/07-08-2008	**Co-ordinates:** E 366880.2 N 305803.8	**Ground Level:** 173.23 (m)	Sheet: 1 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
						173.23	(4.00)	Soft, grey brown sand. (SUPERFICIAL DEPOSITS)		
						169.23	4.00			
							(1.20)	Yellow-brown clay. (SUPERFICIAL DEPOSITS)		
						168.03	5.20			
							(1.30)	Yellow-brown sandstone. (LOWER COAL MEASURES?)		
						166.73	6.50			
							(3.60)	Broken in places, lost flush. (LYDEBROOK SANDSTONE?)		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks
0.00				No groundwater observed

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:59

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH5**
Date: 06-08-2008/07-08-2008	**Co-ordinates:** E 366880.2 N 305803.8	**Ground Level:** 173.23 (m)	Sheet: 2 of 4
Contractor: M & J Drilling Services Ltd		**Engineer:** Scott Wilson Ltd	

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
						163.13	10.10	Hard drilling. (LYDEBROOK SANDSTONE?)		
							(3.90)			
						159.23	14.00			
							(0.50)	Grey sandy mudstones. (LYDEBROOK SANDSTONE?)		
						158.73	14.50			
							(1.20)	Grey mudstone. (LYDEBROOK SANDSTONE?)		
						157.53	15.70			
							(0.50)	Pink-grey mudstone laminations. (LYDEBROOK SANDSTONE?)		
						157.03	16.20			
								Grey sandy mudstones. (WENLOCK SHALES)		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:15:59

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH5**
Date: 06-08-2008/07-08-2008	**Co-ordinates:** E 366880.2 N 305803.8	**Ground Level:** 173.23 (m)	Sheet: 3 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
								Grey sandy mudstones. (WENLOCK SHALES) *(continued)*		
							(23.80)			

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:16:00

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH5**
Date: 06-08-2008/07-08-2008	**Co-ordinates:** E 366880.2 N 305803.8	**Ground Level:** 173.23 (m)	Sheet: 4 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
								Grey sandy mudstones. (WENLOCK SHALES) *(continued)*		
						133.23	40.00	End of Borehole		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:16:00

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH6**
Date: 08-08-2008/12-08-2008	**Co-ordinates:** E 366791.6 N 305822.7	**Ground Level:** 171.60 (m)	Sheet: 1 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
							(5.40)	Red brown sandy clay. (OPENCAST FILL)		
						166.20	5.40			
						166.00	5.60	Black COAL. (LOWER COAL MEASURES?)		
							(1.00)	Poorly cemented yellow-brown SANDSTONE. (LOWER COAL MEASURES)		
						165.00	6.60			
6.60-8.30			100 86 81				(3.20)	Weak - moderately strong, light brown, thinly laminated, medium grained, SANDSTONE. Some thin clayey laminae, moderately weathered. Widely spaced, low persistence discontinuities. (LOWER COAL MEASURES)		
8.30-11.30			56 41 41			161.80	9.80	No recovery		

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks
0.00				No groundwater observed

Method, Equipment and Remarks

Method: RC
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:16:09

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH6**
Date: 08-08-2008/12-08-2008	**Co-ordinates:** E 366791.6 N 305822.7	**Ground Level:** 171.60 (m)	Sheet: 2 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
							(1.50)	No recovery *(continued)*		
						160.30	11.30			
						160.08	11.52	Moderately strong, light brown, medium grained SANDSTONE. Slightly weathered. (LOWER COAL MEASURES)		
							(0.85)	Very weak - weak, grey MUDSTONE with localised thin dark grey laminations and occasional thin sand lamiae and lens'. Unweathered. (LOWER COAL MEASURES?)		
						159.23	12.37			
11.30-14.30			68 54 49				(1.63)	Moderately strong, light brown, very thickly bedded, medium grained SANDSTONE with some gravel of quartz. Locally weakly cemented with clay rich laminae. (LYDEBROOK SANDSTONE)		
						157.60	14.00			
							(0.60)	Weak - moderately weak, brown CONGLOMERATE of fine-coarse, rounded gravel of quartz and medium grained sand. Unweathered. (LYDEBROOK SANDSTONE)		
						157.00	14.60	14.30 - 14.60 Becoming less gravelly and more sandy from 14.3		
14.30-17.30			93 84 84				(5.30)	Moderately weak - moderately strong, thinly laminated, mottled grey/green - red/brown MUDSTONE. Widely spaced discontinuities with low persistence. Unweathered. (WENLOCK SHALES)		
17.30-20.30			100 91 91			151.70	19.90			

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RC
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTHOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:16:09

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH6**
Date: 08-08-2008/12-08-2008	**Co-ordinates:** E 366791.6 N 305822.7	**Ground Level:** 171.60 (m)	Sheet: 3 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
20.30-23.60			93 83 81					Moderately weak - moderately strong, grey - dark grey, thinly laminated MUDSTONE with occasional clay lens'. Widely spaced disconinuities with low persistence. Unweathered. (WENLOCK SHALE) *(continued)*		
23.60-26.60			100 91 84							
26.60-29.30			100 89 77				(20.10)			

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RC
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.09_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:16:10

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **BH6**
Date: 08-08-2008/12-08-2008	**Co-ordinates:** E 366791.6 N 305822.7	**Ground Level:** 171.60 (m)	Sheet: 4 of 4
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				Backfill/ Instrument
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	
29.30-32.20			88 78 74					Moderately weak - moderately strong, grey - dark grey, thinly laminated MUDSTONE with occasional clay lens'. Widely spaced disconinuities with low persistence. Unweathered. (WENLOCK SHALE) *(continued)*		
32.20-35.20			100 100 93							
35.20-37.70			84 78 78							
37.70-40.00			100 92 86							
						131.60	40.00	End of Borehole		

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks

Method, Equipment and Remarks

Method: RC
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:16:10

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **GM01**
Date: 13-08-2008	**Co-ordinates:** E 366826.8 N 305834.4	**Ground Level:** 172.35 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
							(6.00)	Yellow brown-grey clay with coal fragments. (MADE GROUND)		
						166.35	6.00			
						166.15	6.20	Grey clay. (MADE GROUND)		
						166.05	6.30	Grey-black sandstone. (LOWER COAL MEASURES)		
								End of Borehole		

Water Strikes				
Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks
0.00				No groundwater observed

Method, Equipment and Remarks

Gas Monitoring Standpipe
Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4	**Client:** Bournville Village Developments	**Logged By:** CL	**Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006-2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:13:44

BOREHOLE LOG

Project: Stoney Hill Ground Investigation		**Job No:** D111050	Borehole No. **GM02**
Date: 13-08-2008	**Co-ordinates:** E 366866.4 N 305837.0	**Ground Level:** 173.64 (m)	Sheet: 1 of 1
Contractor: M & J Drilling Services Ltd	**Engineer:** Scott Wilson Ltd		

Samples & Tests					Water/ (Flush Return)	Strata				
Depth	Type No	Test Results	TCR SCR RQD	If (mm)		O.D. Level	Depth (Thickness)	Description	Legend	Backfill/ Instrument
							(6.30)	Red-brown and grey clay with coal fragments. (MADE GROUND)		
						167.34	6.30			
							(1.00)	Grey clay. (MADE GROUND)		
						166.34	7.30			
						166.14	7.50	Yellow-brown sandstone. (LOWER COAL MEASURES)		
								End of Borehole		

Water Strikes

Strike Depth	Casing Depth	Post Mins	Post Depth	Flow Remarks
0.00				No groundwater observed

Method, Equipment and Remarks

Gas Monitoring Standpipe
Method: RO
Equipment: Klemm 802

Scale: 1:50 @ A4 | **Client:** Bournville Village Developments | **Logged By:** CL | **Data Checked By:** CHF

AGS3_NEW.GLB | SW BH LOG (CP/RC) | K:\2006_2007\D111050 - LIGHTMOOR VILLAGE\02_0 PROJECT INFO\02_3 GEOTECH CALCS & DATA\02_03_2_GINT\08.08.19_STONEY HILL.GPJ | AGS3_NEW.GDT | 17/09/2008 | 12:14:22

APPENDIX G

Soil Testing Results

Your Ref :
Our Ref : LG/ALS/PC083583
Date : 4th September 2008

Chloe French
Scott Wilson
3 Pemberton House
Stafford Court
Stafford Park
Telford
TF3 3AP

Dear Madam

Re : Stoney Hill

We have pleasure in enclosing the results of laboratory tests on the soil samples recently received at our office on the 20th August 2008 in connection with the above contract and trust that they provide the information which you require.

We would ask you to note that if opinions and interpretations are expressed, they are outside the scope of our UKAS Accreditation.

In the interests of clarity the enclosed test summaries do not include all data required by the documented test procedure. If information beyond that submitted is required the laboratory will be pleased to supply this within a period of up to six years. If no further requests for information are received, then the laboratory assumes your acceptance of the summarised report.

Unless otherwise instructed, all samples will be disposed of 1 month from the date of this letter, without reference back to you.

We look forward to having the opportunity to work for you again in the future.

Yours faithfully

L Griffin
Laboratory Manager
for GEOTECHNICS LIMITED - Head Office
Direct Line : 024 7647 6681
email: lgriffin@geotechnics.co.uk

Enc

LABORATORY REPORT FOR THE SITE AT

STONEY HILL

PROJECT NO : PC083583

LIST OF CONTENTS

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1.0	Laboratory Results	Pages 2 to 5
Appendix 1	Data Sheet and UKAS Accreditation Certificate and Schedule.	6 No. Pages

LABORATORY RESULTS - *Classification and Strength*

Project STONEY HILL GROUND INVESTIGATION P.O.N-TL/442 **Project No:** PC083583

Sample					Classification					Strength					
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Symbol	I_p (>425) %	w_L %	w_p %	w (p_d) %	Test	γ_b (γ_d) Mg/m^3	σ_3 kN/m^2	$\sigma_1-\sigma_3$ kN/m^2	c_u kN/m^2	c_{Avg} kN/m^2
TPA2B	0.50 (0.50)	B	C12541	Brown and grey gravelly fine SAND/SILT.*	CL	14 (31%)	32	18	25						
TPA2B	0.50 (0.50)	D	C13328	Grey gravelly fine SAND/SILT.*					19						
TPA7E	0.50 (0.50)	B	C12538	Grey slightly gravelly sandy SILT/CLAY.*	CI	20 (20%)	41	21	26						
TPA7E	0.50 (0.50)	D	C13330	Grey slightly gravelly sandy SILT/CLAY.*					23						
TPBV2	0.50 (0.50)	B	C12536	Brown slightly silty sandy GRAVEL.*		(34%)	35	NP	20						
TPBV2	0.50 (0.50)	D	C13329	Brown slightly silty sandy GRAVEL.*					21						

Remarks AGS Tests performed in accordance with BS 1377: 1990

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LABORATORY RESULTS - Particle Size Distribution

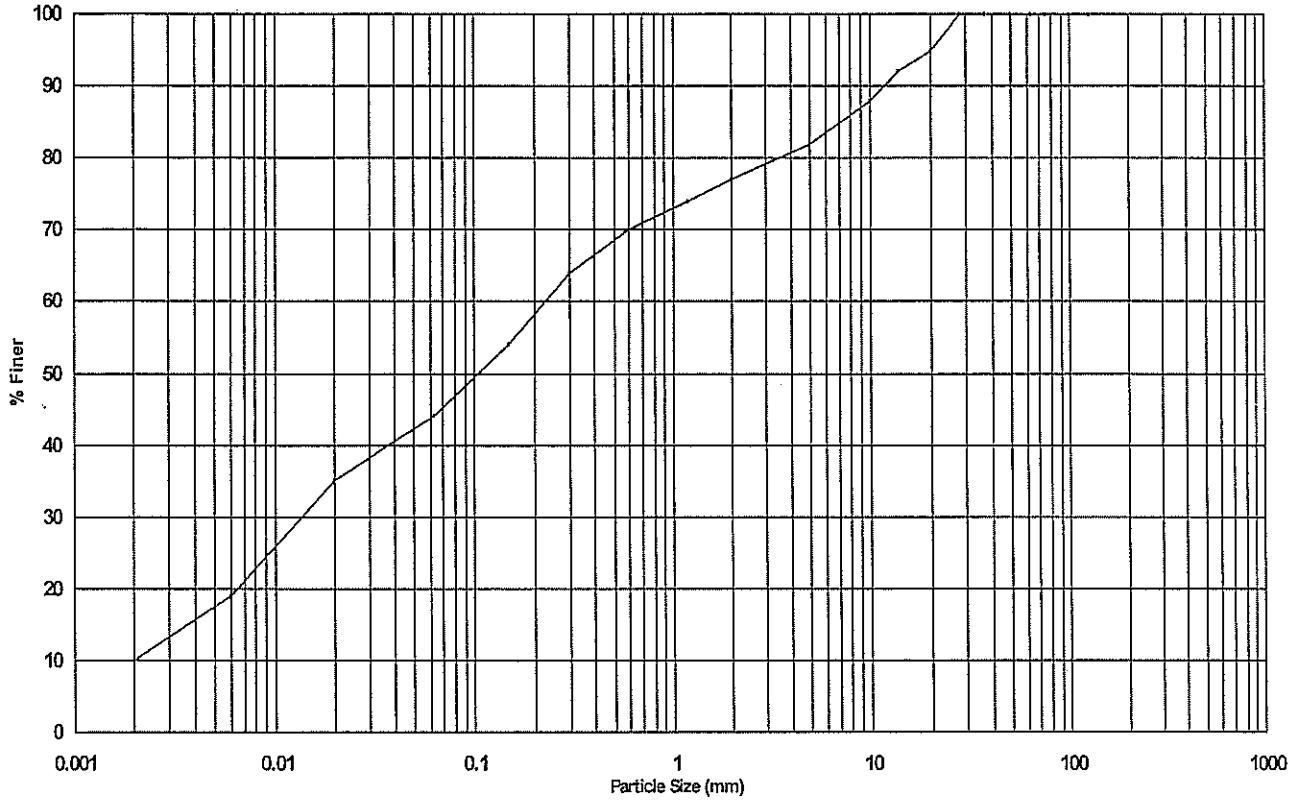
Project: STONEY HILL GROUND INVESTIGATION P.O.N-TL/442

Project No: PC083583

Hole	TPA2B
Sample Depth	0.50m
Sample Type	B
Sample Ref	C12540

Sample Description

Brown and grey gravelly fine SAND/SILT. **



Classification		Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
	CLAY	SILT			SAND			Gravel				

Classification	% of each
CLAY	10
SILT	34
SAND	33
GRAVEL	23
COBBLES	0
BOULDERS	0

Size	Percentage Finer
125mm	100
100mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
28mm	100
20mm	95
14mm	92
10mm	88
6.3mm	-
5mm	82
3.35mm	-

Size	Percentage Finer
2mm	77
1.18mm	74
600μm	70
425μm	-
300μm	64
212μm	-
150μm	54
75μm	-
63μm	44
20μm	35
6μm	19
2μm	10

Uniformity Coefficient	
87.34	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	Pipette
Pre-treated with	Hydrogen Peroxide
% loss on Pre-treatment	1.01
Particle Density	2.65 (Assumed)

Remarks Test performed in accordance with BS 1377: Part 2: 1990

29/08/2008

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LABORATORY RESULTS - Particle Size Distribution

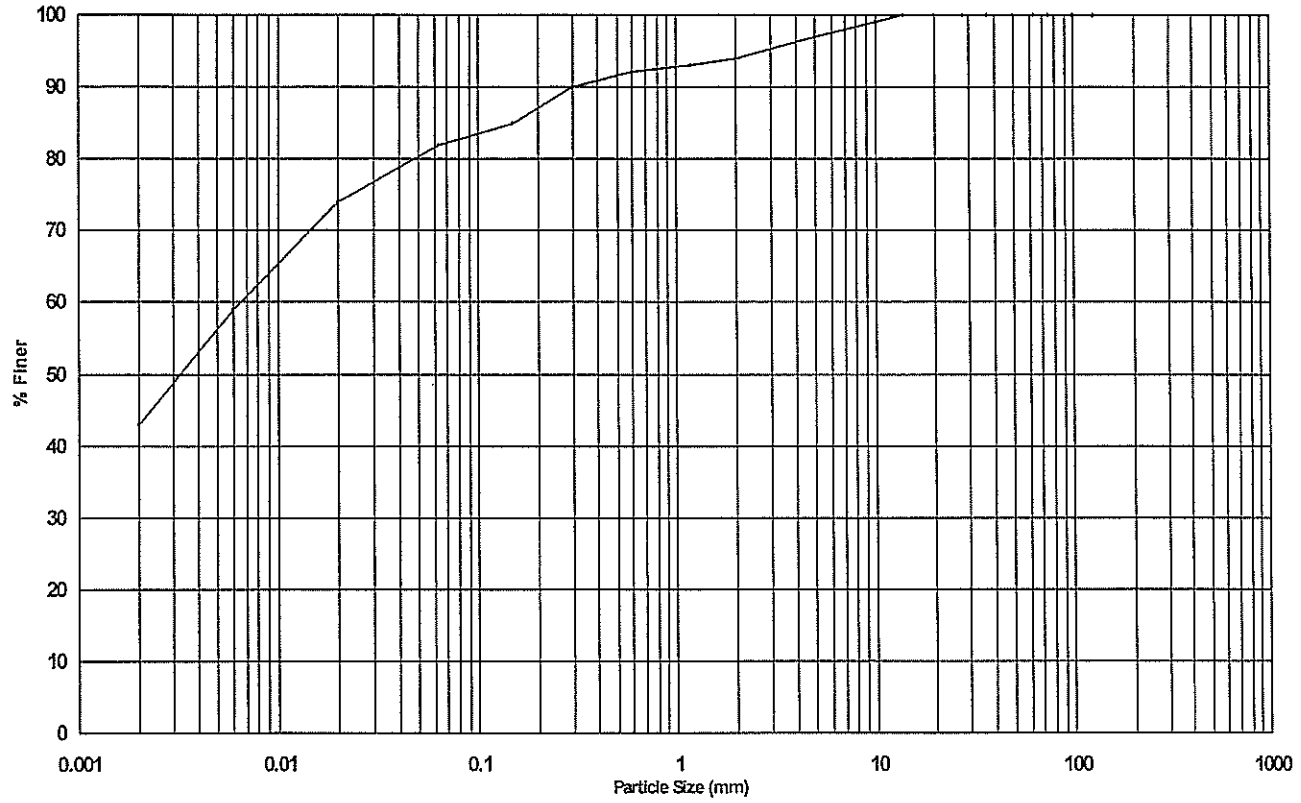
Project: STONEY HILL GROUND INVESTIGATION P.O.N-TL/442

Project No: PC083583

Hole	TPA7E
Sample Depth	0.50m
Sample Type	B
Sample Ref	C12539

Sample Description

Grey slightly gravelly sandy SILT/CLAY. **



Classification	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
		SILT			SAND			Gravel				

Classification	% of each
CLAY	43
SILT	39
SAND	12
GRAVEL	6
COBBLES	0
BOULDERS	0

Size	Percentage Finer
125mm	100
100mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
28mm	100
20mm	100
14mm	100
10mm	99
6.3mm	-
5mm	97
3.35mm	-

Size	Percentage Finer
2mm	94
1.18mm	93
600μm	92
425μm	-
300μm	90
212μm	-
150μm	85
75μm	-
63μm	82
20μm	74
6μm	59
2μm	43

Uniformity Coefficient	
Not Available	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	Pipette
Pre-treated with	Hydrogen Peroxide
% loss on Pre-treatment	1.11
Particle Density	2.65 (Assumed)

Remarks Test performed in accordance with BS 1377: Part 2: 1990

29/08/2008

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LABORATORY RESULTS - Particle Size Distribution

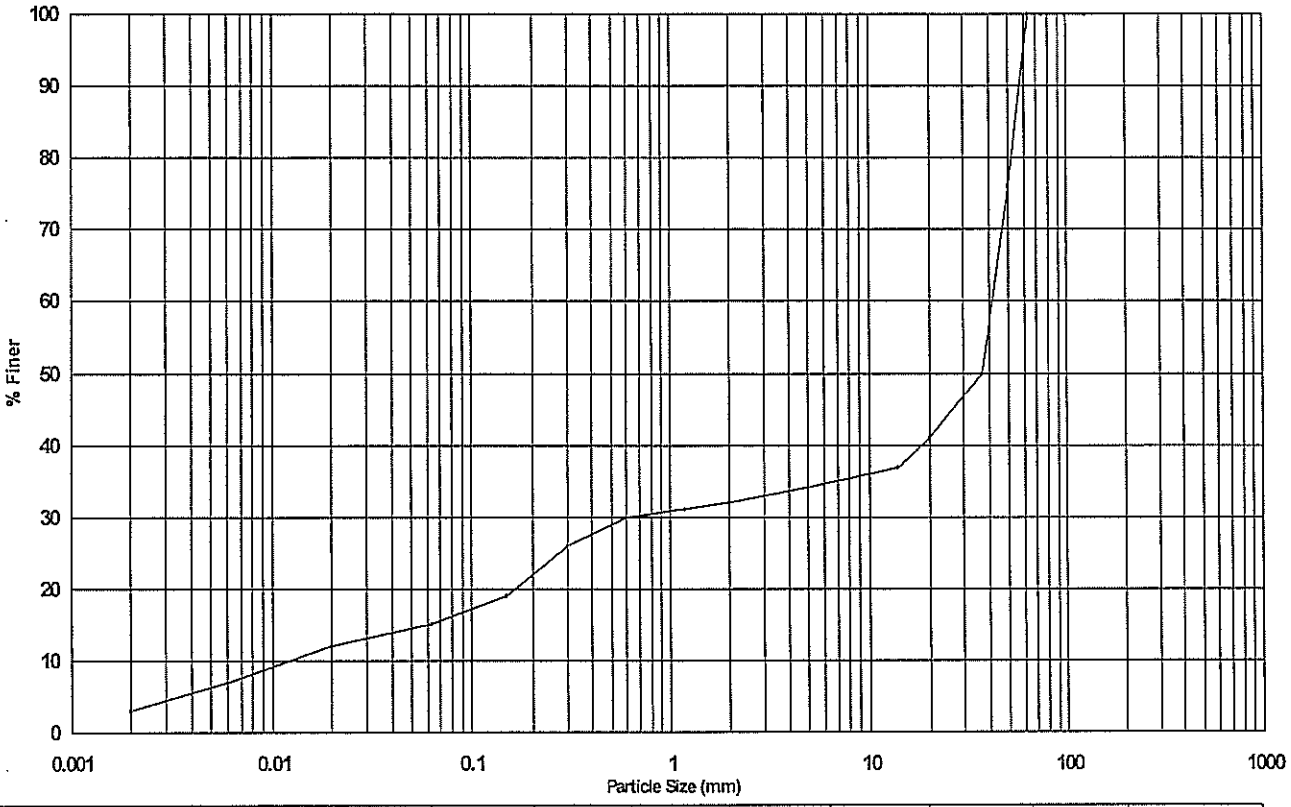
Project: STONEY HILL GROUND INVESTIGATION P.O.N-TL/442

Project No: PC083583

Hole	TPBV2
Sample Depth	0.50m
Sample Type	B
Sample Ref	C12537

Sample Description

Brown slightly silty sandy GRAVEL. **



Classification		Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
	CLAY	SILT			SAND			Gravel				

Classification	% of each
CLAY	3
SILT	12
SAND	17
GRAVEL	68
COBBLES	0
BOULDERS	0

Size	Percentage Finer
125mm	100
100mm	100
75mm	100
63mm	100
50mm	76
37.5mm	50
28mm	-
20mm	41
14mm	37
10mm	36
6.3mm	-
5mm	34
3.35mm	-

Size	Percentage Finer
2mm	32
1.18mm	31
600μm	30
425μm	-
300μm	26
212μm	-
150μm	19
75μm	-
63μm	15
20μm	12
6μm	7
2μm	3

Uniformity Coefficient	
3331.98	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	Pipette
Pre-treated with	Hydrogen Peroxide
% loss on Pre-treatment	0.19
Particle Density	2.65 (Assumed)

Remarks Test performed in accordance with BS 1377: Part 2: 1990

29/08/2008

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United Kingdom Accreditation Service

ACCREDITATION CERTIFICATE

UKAS
UNITED KINGDOM ACCREDITATION SERVICE

TESTING LABORATORY
No. 1365

Geotechnics Limited

is accredited in accordance with the recognised International Standard ISO/IEC 17025:2005
General Requirements for the competence of testing and calibration laboratories.

This accreditation demonstrates technical competence for a defined scope as detailed in and at the locations specified in the schedule to this certificate, and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated 18 June 2005).

The schedule to this certificate is an essential accreditation document and from time to time may be revised and reissued by the United Kingdom Accreditation Service. The most recent issue of the schedule of accreditation, which bears the same accreditation number as this certificate, is available from the UKAS website www.ukas.org.

This accreditation is subject to continuing conformity with United Kingdom Accreditation Service requirements. The absence of a schedule on the UKAS website indicates that the accreditation is no longer in force.

Accreditation Manager, United Kingdom Accreditation Service

Initial Accreditation date
01 September 1993

This certificate issued on
25 May 2007

The Department of Trade and Industry (DTI) has entered into a memorandum of understanding with the United Kingdom Accreditation Service (UKAS) through which UKAS is recognised as the national body responsible for assessing and accrediting the competence of organisations in the fields of calibration, testing, inspection and certification of systems, products and persons

DATA SHEET - Laboratory Test Symbols

Classification and Strength

Symbol	C - Clay M - Silt (O - containing organic matter) Plasticity L - Low I - Intermediate H - High V - Very High E - Extremely High
Ip	Plasticity Index
%	% Retained on 425 μm sieve (shown over Ip value)
w_L	Liquid Limit
w_P	Plastic Limit
NP	Non-Plastic
w	Moisture Content
Test	Quick undrained triaxial tests SS Single stage - 102mm diameter. S3 Single stage - set of 3 38mm diameter. MS Multistage - 102mm diameter. D Drained Test
	HV Hand Vane
	PP Pocket Penetrometer
	UT Unsuitable for Test
γ_b	Bulk Density
σ_3	Triaxial Cell Pressure
$\sigma_1 - \sigma_3$	Deviator Stress
##	Excessive Strain
c_u	Undrained Cohesion
c	Cohesion Intercept
ϕ	Angle of Shearing Resistance

Chemical Analysis

Acid Soluble	Total sulphate in specimen (expressed as SO_3%)
Water Soluble	Soluble Sulphate in 2:1 water : soil extract (expressed as SO_3 g/L)
In Water	Sulphate content of groundwater (expressed as SO_3 g/L)
pH	pH value
Organic Content	Organic content expressed as a percentage of dry weight.
Chloride Content	Chloride Ion Content expressed as a percentage of dry weight.

Consolidation

Size	Size of specimen in mm (d = diameter, h = height)
w	Moisture Content
γ_b	Bulk Density
γ_d	Dry Density
ρ_s	Particle Density (A = Assumed, M = Measured)
S_r	Initial Degree of Saturation
p	Applied Pressure
e	Voids Ratio
m_v	Coefficient of Volume Compressibility
c_{v50}	Coefficient of Consolidation - Log t
c_{v90}	Coefficient of Consolidation - $\sqrt{t}$

MCV, Compaction, CBR

MCV	Moisture Condition Value at natural moisture content
MCC	Moisture Condition Calibration
CCV	Chalk Crushing Value
Compaction	
Type	2.5 = BS 2.5 kg Rammer 4.5 = BS 4.5 kg Rammer V = BS Vibrating Hammer
γ_b	Bulk Density
γ_d	Dry Density
CBR California Bearing Ratio	
Type	2.5 = Test on Specimen Recompacted using BS 2.5 kg Rammer 4.5 = As above but using BS 4.5 kg Rammer V = As above but using BS Vibrating Hammer M = Test on open drive mould specimen cut in field S = Soaked Specimen
Top	CBR at top of mould
Bottom	CBR at bottom of mould
ND	None Detected

All tests performed in accordance with BS 1377 : Parts 1-9 : 1990 incorporating amendments where appropriate.

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Schedule of Accreditation

issued by

United Kingdom Accreditation Service

21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

1365

Accredited to ISO/IEC 17025:2005

Geotechnics Limited

Issue No: 010 Issue date: 25 May 2007

The Geotechnical Centre
203 Torrington Avenue
Tile Hill
Coventry
CV4 9AP

Contact: Mrs Lynn Griffin
Tel: +44 (0)24 7669 4664
Fax: +44 (0)24 7669 4642
E-Mail: lgriffin@geotechnics.co.uk
Website: www.geotechnics.co.uk

Testing performed at the above address only

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
AGGREGATES	Particle size distribution - washing and sieving	BS 812:Part 103 Section 103.1:1985
	Particle size distribution - dry sieving	BS 812:Part 103: Section 103.1:1985
	Moisture content - oven drying method	BS 812:Part 109:1990
ROCK	Point load strength and anisotropy indices *(loads from 0 to 50kN)*	ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985
	Water content – method 1	International Society for Rock Mechanics – suggested methods 1, 2 and 3, p 83, 1981
SOILS for civil engineering purposes	Organic matter content	BS 1377:Part 3:1990
	Mass loss on ignition	BS 1377:Part 3:1990
	Sulphate content of soil and ground water gravimetric method	BS 1377:Part 3:1990
	Water-soluble chloride content	BS 1377:Part 3:1990
	Acid-soluble chloride content	BS 1377:Part 3:1990
	pH value	BS 1377:Part 3:1990
	California Bearing Ratio (CBR) *(loads from 0 to 50kN)*	BS 1377:Part 4:1990

1365 Accredited to ISO/IEC 17025:2005	Schedule of Accreditation issued by United Kingdom Accreditation Service 21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK Geotechnics Limited Issue No: 010 Issue date: 25 May 2007

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
SOILS for civil engineering purposes	Unconfined compressive strength - load frame method *(loads from 0 to 50kN)*	BS 1377:Part 7:1990
	Undrained shear strength - triaxial compression without measurement of pore pressure *(loads from 0 to 50kN)*	BS 1377:Part 7:1990
	Undrained shear strength - triaxial compression with multistage loading and without measurement of pore pressure *(loads from 0 to 50kN)*	BS 1377:Part 7:1990
	Moisture content - oven drying method	BS 1377:Part 2:1990
	Saturation moisture content of chalk	BS 1377:Part 2:1990
	Liquid limit - cone penetrometer	BS 1377:Part 2:1990
	Liquid limit - cone penetrometer - one point	BS 1377:Part 2:1990
	Plastic limit	BS 1377:Part 2:1990
	Plasticity index and liquidity index	BS 1377:Part 2:1990
	Linear shrinkage	BS 1377:Part 2:1990
	Density - linear measurement	BS 1377:Part 2:1990
	Particle density - gas jar	BS 1377:Part 2:1990
	Particle density - small pyknometer	BS 1377:Part 2:1990
	Particle density - large pyknometer	BS 1377:Part 2:1990
	Particle size distribution - wet sieving	BS 1377:Part 2:1990

1365 Accredited to ISO/IEC 17025:2005	Schedule of Accreditation issued by United Kingdom Accreditation Service 21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK Geotechnics Limited Issue No: 010 Issue date: 25 May 2007

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
SOILS for civil engineering purposes	Particle size distribution - dry sieving	BS 1377:Part 2:1990
	Particle size distribution - sedimentation - pipette method	BS 1377:Part 2:1990
	Dry density/moisture content relationship (2.5 kg rammer)	BS 1377:Part 4:1990
	Dry density/moisture content relationship (4.5 kg rammer)	BS 1377:Part 4:1990
	Dry density/moisture content relationship (vibrating hammer)	BS 1377:Part 4:1990
	Maximum and minimum dry densities for granular soils	BS 1377:Part 4:1990
	Moisture condition value (MCV)	BS 1377:Part 4:1990
	MCV/moisture content relation	BS 1377:Part 4:1990
	MCV - rapid assessment	BS 1377:Part 4:1990
	Chalk crushing value	BS 1377:Part 4:1990
	One-dimensional consolidation properties	BS 1377:Part 5:1990
	Shear strength - small shear box *(loads from 0.05 to 50 kN)*	BS1377: Part 7:1990
	Residual strength - small ring shear apparatus *(loads from 0.05 to 10 kN)*	BS1377: Part 7:1990
STABILIZED MATERIALS for civil engineering purposes - cement-stabilized and lime-stabilized materials	Initial consumption of lime	BS 1924:Part 2:1990
	California Bearing Ratio (CBR) *(loads from 0 to 50kN)*	BS 1924:Part 2:1990
	Moisture content - oven drying method (definitive)	BS 1924:Part 2:1990
	Plastic limit	BS 1924:Part 2:1990

1365 Accredited to ISO/IEC 17025:2005	Schedule of Accreditation issued by United Kingdom Accreditation Service 21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK Geotechnics Limited Issue No: 010 Issue date: 25 May 2007

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
STABILIZED MATERIALS for civil engineering purposes - cement-stabilized and lime-stabilized materials (cont'd)	Liquid limit	BS 1924:Part 2:1990
	Plasticity index	BS 1924:Part 2:1990
	Degree of pulverization	BS 1924:Part 2:1990
	Dry density/moisture content relationship (2.5 kg rammer)	BS 1924:Part 2:1990
	Dry density/moisture content relationship (4.5 kg rammer)	BS 1924:Part 2:1990
	Dry density/moisture content relationship (vibrating hammer - subsidiary method)	BS 1924:Part 2:1990
	Moisture condition value (MCV)	BS 1924:Part 2:1990
	MCV/moisture content relation	BS 1924:Part 2:1990
END		

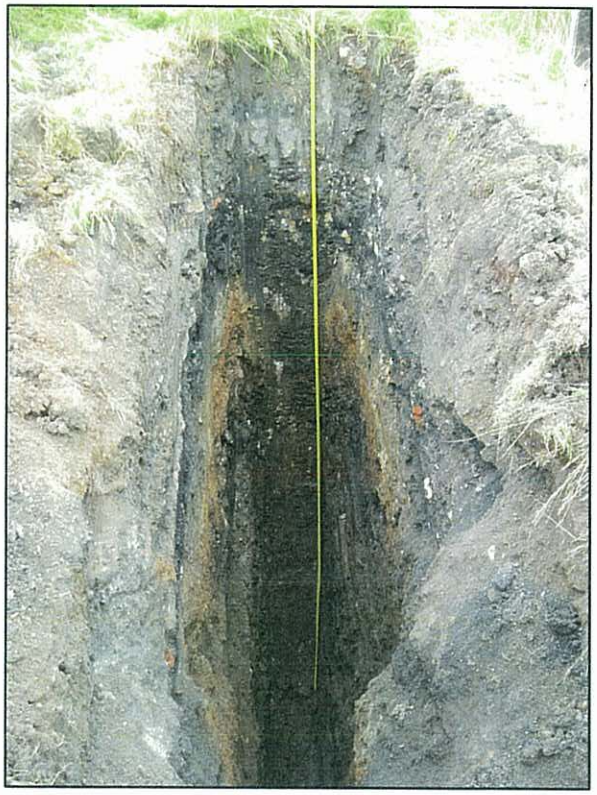
APPENDIX H

Photographic Record of Exploratory Holes



Plate 1 A2a Full Depth

Plate 2 A2b Full Depth



Stoney Hill Mining Investigation **Photographic Plates 1 and 2** **Trial Pits A2a and A2b**	**D111050/GTR/P/001**		
	Scale @ A4 – NTS		
	Drn . CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 3 A3a Full Depth

Plate 4 A3b Full Depth



Stoney Hill Mining Investigation	**D111050/GTR/P/002**		
Photographic Plates 3 and 4	Scale @ A4 – NTS		
Trial Pits A3a and A3b	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 5 A4a Upper pit walls

Plate 6 A4a Lower Pit Walls



Stoney Hill Mining Investigation **Photographic Plates 5 and 6** **Trial Pits A4a**	**D111050/GTR/P/003**		
	Scale @ A4 – NTS		
	Drn: CL	Appd:	Revised:
	Chk: CHF	Date: 29.10.08	Date:

Scott Wilson



Plate 7 A5a Lower pit walls

Plate 8 A5a Upper Pit Walls



Stoney Hill Mining Investigation	**D111050/GTR/P/004**		
Photographic Plates 7 and 8	Scale @ A4 – NTS		
Trial Pits A5a	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 9 A5b Lower pit walls

Plate 10 A5b Upper Pit Walls



Stoney Hill Mining Investigation

Photographic Plates 9 and 10

Trial Pits A5b

D111050/GTR/P/005

Scale @ A4 – NTS

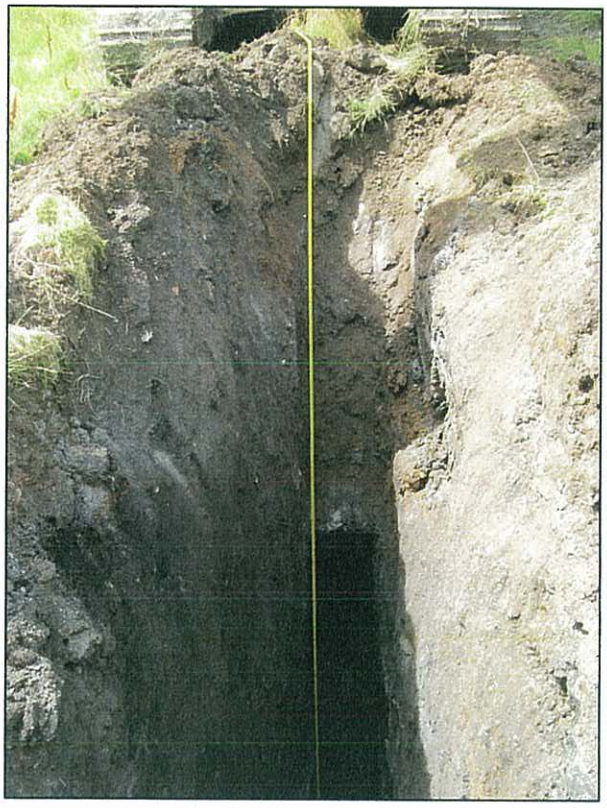
Drn	Appd	Revised
CL		
Chk	Date	Date
CHF	29.10.08	

Scott Wilson



Plate 11 A6a Full Depth

Plate 12 A6b Upper Pit Walls



Stoney Hill Mining Investigation **Photographic Plates 11 and 12** **Trial Pits A6a and A6b**	**D111050/GTR/P/006**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised . .
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 13 A7b Upper Pit Walls

Plate 14 A7b Lower Pit Walls



Stoney Hill Mining Investigation **Photographic Plates 13 and 14** **Trial Pits A7b**	**D111050/GTR/P/007**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 15 A7c Lower Pit Walls

Plate 16 A7c Upper Pit Walls



Stoney Hill Mining Investigation **Photographic Plates 15 and 16** **Trial Pit: A7c**	**D111050/GTR/P/008**		
	Scale @ A4 – NTS		
	Drn CL	Appd .	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 17 A7d Lower Pit Walls

Plate 18 A7d Upper Pit Walls



Stoney Hill Mining Investigation **Photographic Plates 17 and 18** **Trial Pit: A7d**	**D111050/GTR/P/009**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 19 A7e Lower pit walls

Plate 20 A7e Upper pit walls



Stoney Hill Mining Investigation	**D111050/GTR/P/010**		
Photographic Plates 19 and 20	Scale @ A4 – NTS		
Trial Pit: A7e	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 21 A9a Lower pit walls

Plate 22 A9a Upper pit walls



Stoney Hill Mining Investigation

Photographic Plates 21 and 22

Trial Pit: A9a

D111050/GTR/P/011

Scale @ A4 – NTS

Drn	Appd	Revised
CL		
Chk	Date	Date
CHF	29.10.08	

Scott Wilson



Plate 23 A9b Lower Pit Walls

Plate 24 A9b Upper Pit Walls



Stoney Hill Mining Investigation	**D111050/GTR/P/012**		
Photographic Plates 23 and 24	Scale @ A4 – NTS		
Trial Pit: A9b	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 25 BV1 Full Depth

Stoney Hill Mining Investigation	**D111050/GTR/P/013**		
Photographic Plate 25	Scale @ A4 – NTS		
Trial Pit: BV1	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 26 BV2 Full Depth

Stoney Hill Mining Investigation	**D111050/GTR/P/014**		
Photographic Plate 26	Scale @ A4 – NTS		
Trial Pit: BV2	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 27 BV3 Full Depth

Stoney Hill Mining Investigation	**D111050/GTR/P/015**		
Photographic Plate 27	Scale @ A4 – NTS		
Trial Pit: BV3	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 28 BV5 Upper Pit Walls

Plate 29 BV5 Lower Pit Walls



Stoney Hill Mining Investigation **Photographic Plates 28 and 29** **Trial Pits BV5**	**D111050/GTR/P/016**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 30 BV6 Upper Pit Walls

Plate 31 BV6 Lower Pit Walls



Stoney Hill Ground Investigation	**D111050/GEO/P/017**		
Photographic Plates 30 and 31	Scale @ A4 – NTS		
Trial Pit: BV6	Drn RJE	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 32 BV7 Lower Pit Walls

Plate 33 BV7 Upper Pit Walls



Stoney Hill Ground Investigation **Photographic Plates 32 and 33** **Trial Pit: BV7**	**D111050/GEO/P/018**		
	Scale @ A4 – NTS		
	Drn RJE	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 34 BV8 Lower Pit Walls

Plate 35 BV8 Upper Pit Walls



Stoney Hill Ground Investigation	**D111050/GEO/P/019**		
Photographic Plates 34 and 35	Scale @ A4 – NTS		
Trial Pit: BV8	Drn RJE	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 36 – BH4 8.00 – 8.80m



Plate 37 – BH4 8.80 – 11.60m

Stoney Hill Mining Investigation **Photographic Plates 36 and 37** **Rotary Cored Borehole 4**	**D111050/GTR/P/020**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 38 – BH4 11.6 – 14.6m



Plate 39 – BH4 14.6 – 17.6m

Stoney Hill Mining Investigation **Photographic Plates 38 and 39** **Rotary Cored Borehole 4**	**D111050/GTR/P/021**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 40 – BH4 17.6 – 20.6m



Plate 41 – BH4 20.6 – 23.6m

Stoney Hill Mining Investigation **Photographic Plates 40 and 41** **Rotary Cored Borehole 4**	**D111050/GTR/P/022**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

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Plate 42 – BH4 23.6 – 24.6m



Plate 43 – BH4 24.6 – 26.3m

Stoney Hill Mining Investigation	**D111050/GTR/P/023**		
Photographic Plates 42 and 43	Scale @ A4 – NTS		
Rotary Cored Borehole 4	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

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Plate 44 – BH4 26.3 – 29.3m



Plate 45 – BH4 29.3 – 32.3m

Stoney Hill Mining Investigation **Photographic Plates 44 and 45** **Rotary Cored Borehole 4**	**D111050/GTR/P/024**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

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Plate 46 – BH4 32.3 – 35.3m



Plate 47 – BH4 35.3 – 38.3m

Stoney Hill Mining Investigation **Photographic Plates 46 and 47** **Rotary Cored Borehole 4**	**D111050/GTR/P/025**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

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Plate 48 – BH4 38.3 – 40.1m

Stoney Hill Mining Investigation	**D111050/GTR/P/026**		
Photographic Plate 48	Scale @ A4 – NTS		
Rotary Cored Borehole 4	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date



Plate 49 – BH6 6.6 – 8.3m



Plate 50 – BH6 8.3 - 11.3m

Stoney Hill Mining Investigation	**D111050/GTR/P/027**		
Photographic Plates 49 and 50	Scale @ A4 – NTS		
Rotary Cored Borehole 6	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

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Plate 51 – BH6 11.3 – 14.3m



Plate 52 – BH6 14.3 - 17.3m

Stoney Hill Mining Investigation **Photographic Plates 51 and 52** **Rotary Cored Borehole 6**	**D111050/GTR/P/028**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

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Plate 53 – BH6 17.3 – 20.3m



Plate 54 – BH6 20.3 - 23.3m

Stoney Hill Mining Investigation **Photographic Plates 53 and 54** **Rotary Cored Borehole 6**	**D111050/GTR/P/029**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

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Plate 55 – BH6 23.3 – 26.3m



Plate 56 – BH6 26.3 - 29.3m

Stoney Hill Mining Investigation **Photographic Plates 55 and 56** **Rotary Cored Borehole 6**	**D111050/GTR/P/030**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 57 – BH6 29.3 – 32.2m



Plate 58 – BH6 32.2 – 35.2m

Stoney Hill Mining Investigation **Photographic Plates 57 and 58** **Rotary Cored Borehole 6**	**D111050/GTR/P/031**		
	Scale @ A4 – NTS		
	Drn CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson



Plate 59 – BH6 35.2 – 37.7m



Plate 60 – BH6 37.7 – 40.00m

Stoney Hill Mining Investigation **Photographic Plates 59 and 60** **Rotary Cored Borehole 6**	**D111050/GTR/P/032**		
	Scale @ A4 – NTS		
	Dm CL	Appd	Revised
	Chk CHF	Date 29.10.08	Date

Scott Wilson

APPENDIX I

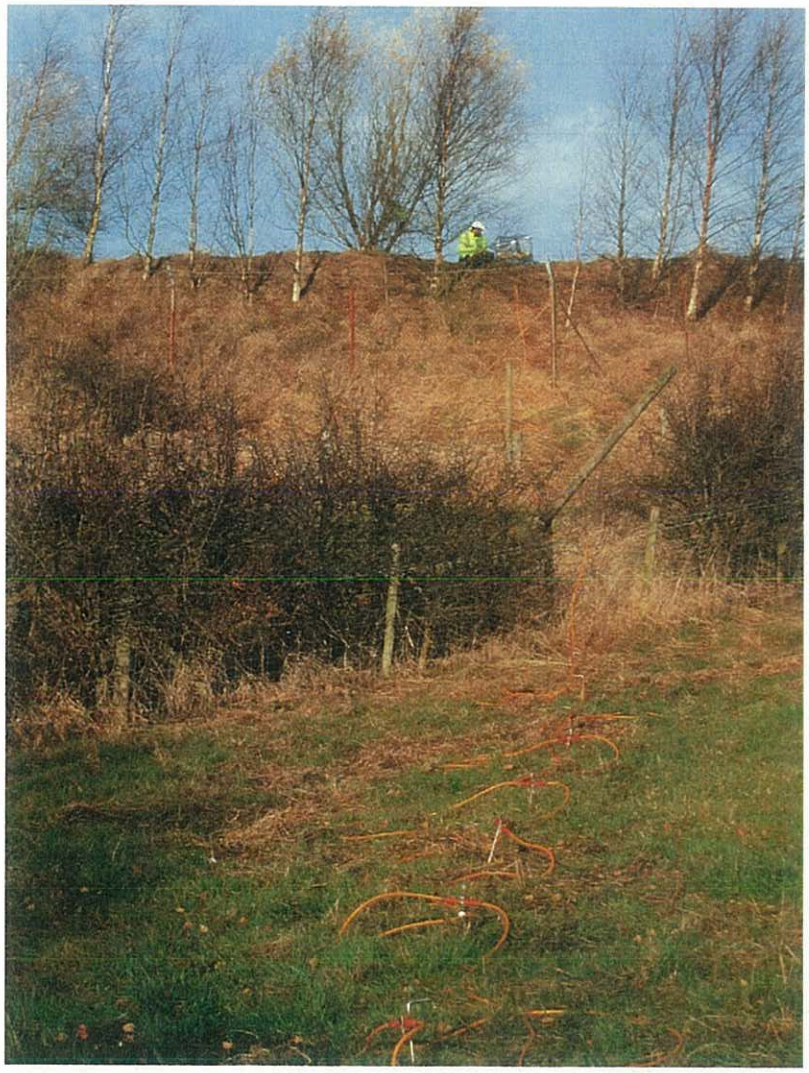
Geophysical Report

Stoney Hill Geophysical Survey

Stoney Hill, Lightmoor Urban Village, Telford

SW Document Number: D118518

February 2008



Web Site : www.swpe.co.uk E-mail : enquiry@swpe.co.uk

Job Name:	Stoney Hill Geophysical Survey
Job Location:	Stoney Hill, Lightmoor Urban Village, Telford
Job Type:	Resistivity Survey
Job Number (Document No):	D118518
Report for:	Scott Wilson 3 Pemberton House Stafford Park Telford Shropshire TF3 3AP
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Issue Number:	2

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Figures and Images

Drawing No. D118518_01

Includes:

- Figure 1: Plan of Worksite
- Figures 2–10: Resistivity Profiles

Photo No. D118518_01

Resistivity Survey in operation

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1 INTRODUCTION

1.1 Summary of Information

1.1.1 The survey is on the site of a former open cast coal mine. Two stages of open cast mining are believed to have been undertaken (from coal authority records and local anecdotal evidence), the boundaries of which are shown on Drawing D118518_01 Figure 1. The site was then used as a landfill, and is now abandoned, though some reclaimed areas are farmed at present. Plans of the limits of the workings exist, but the information is not clear, and on occasion appears contradictory. A new village is being built adjacent to the site, and an access road is planned which crosses the line of the old workings.

1.1.2 The open cast mine workings are believed to have extended to a depth of approximately 10m to the locally worked Randle Seam. As such resistivity profiling was chosen as the optimum method of assessing the limits of the workings.

1.1.3 This report documents a non-destructive investigation using Resistivity profiling in the area of the proposed road to assess the limits of the workings and locate a number of possible adits which could cross the line of the planned road. In total nine profiles were completed for this survey.

1.2 Terms of Reference

1.2.1 The investigative technique used was Resistivity. The findings given in this report are based on indirect measurements and the interpretation of electrical signals. The findings represent the best professional opinions of the authors, based on their experience and observations on site, and plans where provided.

1.2.2 This is the final report of this investigation. It therefore supersedes any previous reports whether written or oral, and completes all work currently ordered under this contract.

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2 FIELDWORK

2.1 The Survey

2.1.1 The survey was conducted from the 4 to the 5 of December 2007. The Resistivity survey consisted of a series of targeted profiles, with each made up of an array of 64 electrodes placed at 2m centres.

2.1.2 In total 9 profiles were collected, including lines running along the line of and perpendicular to the edge of the suspected mine workings.

3 FINDINGS

3.1 Overview

3.1.1 The results of the survey are presented on Drawing D118518_01. This includes a location plan showing the limits of the mine workings from Coal Authority records, the locations of the resistivity profiles, and the major boundaries within subsurface as found from the resistivity survey. Also included are nine annotated resistivity profiles, showing variations in electrical resistance due to changes within the subsurface materials.

3.1.2 Within the red line delimiting the limits of mine workings from Coal Authority records, the thickness of fill materials gradually increases to what appear to be two steps in the bedrock, one just outside the landfill bunding, and a further just inside (red blocked and crosshatched lines). The outer (blocked) line appears to tie in with the brown hatched area, and it is likely that this is the high wall of the mine. The second step may suggest that a greater depth of open cast mining was undertaken than was initially believed. These steps can be most clearly seen on Figures 5, 6 and 7 (Drawing D118518_01).

3.1.3 The Coal Authority records show a series of known and possible adits in this area, which the Resistivity confirms (Figure 2). None of the possible adits appear to continue down to the line of the proposed road, as they are not present in profile in Figure 3. It appears that one of the known adits may cross this line (Drawing D118518_01 Figure 1 - pink hatching). The fact that these are visible, suggests that fill material between the red blocked and red hatched areas may in fact at least partially be drift deposits, rather than coal spoil, as the adits would have been mined out if the workings had extended to this point.

3.1.4 The blue line (Drawing D118518_01 Figure 1) represents a further change in geology, where bedrock appears to end, and further fill or drift materials begin. This corresponds with the line of a buried valley, visible beyond the limits of our site. This valley may be filled naturally by alluvium in this area, or could have been filled by spoil from the workings.

3.1.5 The area believed to be mined in the second stage of workings shows the bedrock to be almost horizontal across the site, overlain by fill material. There is no visible high wall in this area, suggesting that it was all mined down to one level, with fill material replaced on completion of work. The limits of the workings do not therefore appear to correlate with the red boundary line in this area, but appear to reach the edge of the buried valley.

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4 CONCLUSIONS

4.1.1 The limits of the workings as found by the resistivity profiles, correspond well with the limits from Coal Authority records for the site of the initial workings. The limits for the second stage of the workings do not appear to correspond to the researched plans.

4.1.2 The mining methods for the two areas appear different.

- The original area (Area 1) shows two large steps (approx 7m) in the bedrock level, suggesting two high walls, and may mean that mining extended to a greater depth than was initially thought. A further shallow (approx. 5m) layer of fill materials covers the bedrock outside this area to the limits of the workings, though it is not clear whether this is drift or spoil from the workings, or a combination of the two. Where the proposed road crosses the boundary shown by Coal Authority records, there does not appear to have been any significant mining, with only this shallow fill layer present.

- The later area of mining (Area 2) shows no obvious step suggesting an end to the workings, with bedrock appearing level at a depth of 7-8m and no high wall visible in the data.

4.1.3 The limits of the mine workings according to coal authority plans appears to correlate with the edges of the open cast mines, with the levels of excavation stepped, so other workings such as adits can still be present beneath these locations. Adits shown on the Coal Authority plans do appear to be present in the data, suggesting incomplete mining on the peripheries of the workings. These do not appear to extend beyond the known working limits as shown on the Coal Authority plans, and do not typically cross the line of the proposed road.

4.1.4 A further change in the subsurface beyond the limits of the workings has been noted, where the bedrock seems to end. Beyond the limits of the site a valley is visible, which has been buried beneath fill material as it nears our site. The valley appears to run approximately in line with this change in bedrock (Drawing D118518_1 Figure 1), suggesting that this feature is the edge of the buried valley. Anecdotal evidence suggests that there was a pond on the site. As such the infilling of the valley does not appear to be a recent occurrence. Significant areas of the proposed road will cross this fill material, and as it was on the edge of our survey its depth was not established.

4.1.5 Further intrusive investigation would be suggested to provide confirmation of a number of features, though exact locations would depend upon the design requirements for the road:

A. Bedrock level and type
B. Steps in mine workings.
C. Depth and type of shallow fill levels.
D. Materials properties and thickness in the filled in valley.

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FIGURE 1: LOCATION PLAN
SCALE: 1:1000

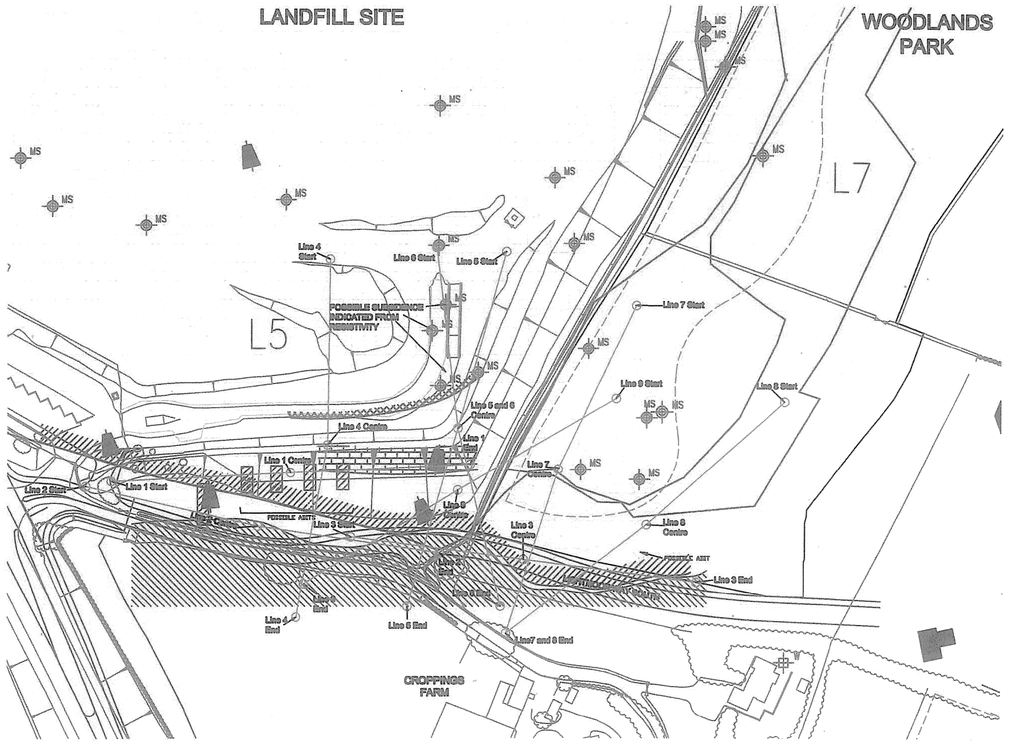


FIGURE 2: RESISTIVITY PROFILE 1
SCALE: 1:500

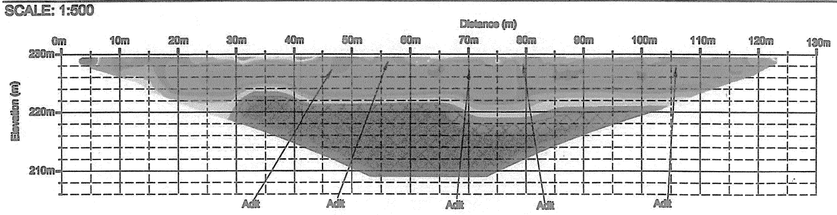


FIGURE 3: RESISTIVITY PROFILE 2
SCALE: 1:500

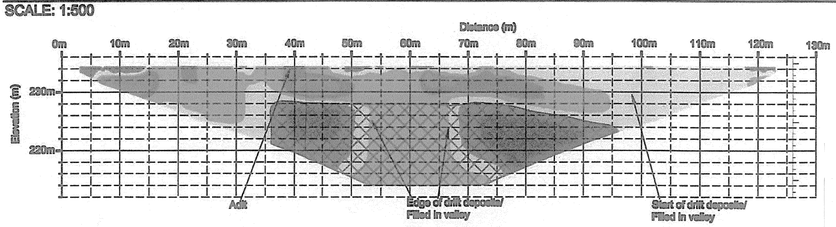


FIGURE 4: RESISTIVITY PROFILE 3
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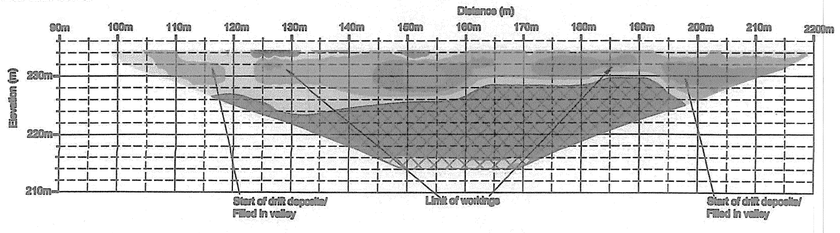


FIGURE 5: RESISTIVITY PROFILE 4
SCALE: 1:500

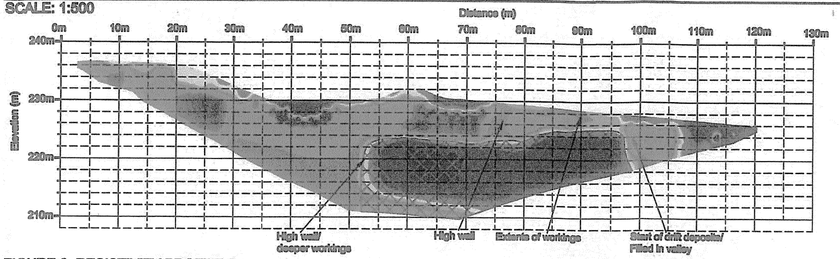


FIGURE 6: RESISTIVITY PROFILE 5
SCALE: 1:500

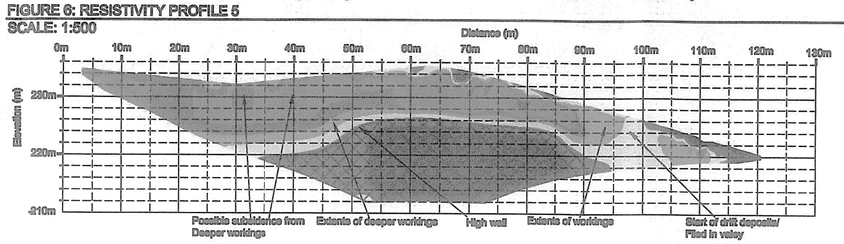


FIGURE 7: RESISTIVITY PROFILE 6
SCALE: 1:500

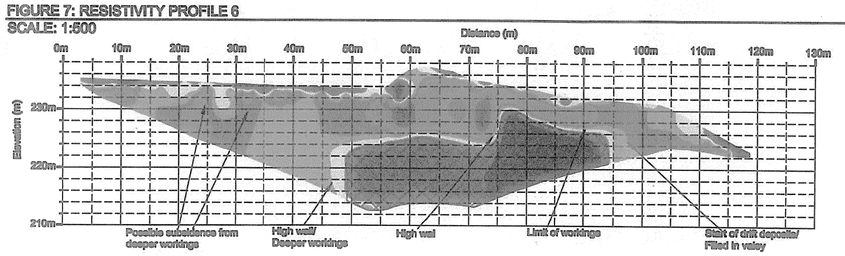


FIGURE 8: RESISTIVITY PROFILE 7
SCALE: 1:500

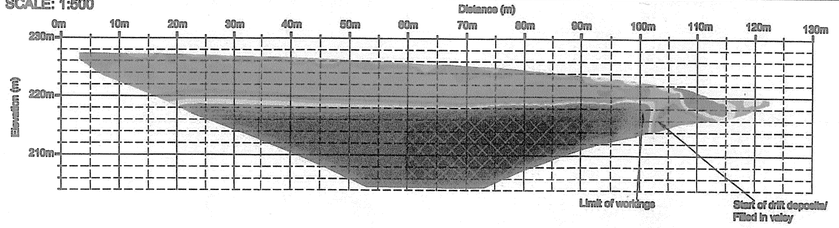


FIGURE 9: RESISTIVITY PROFILE 8
SCALE: 1:500

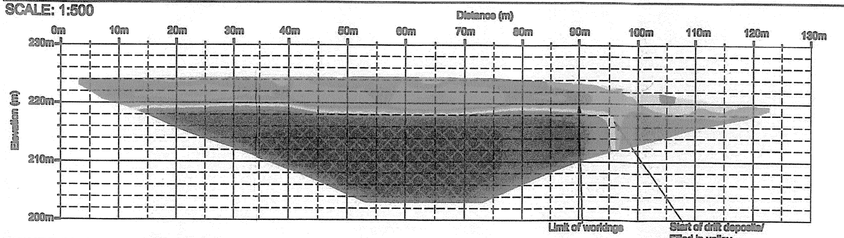
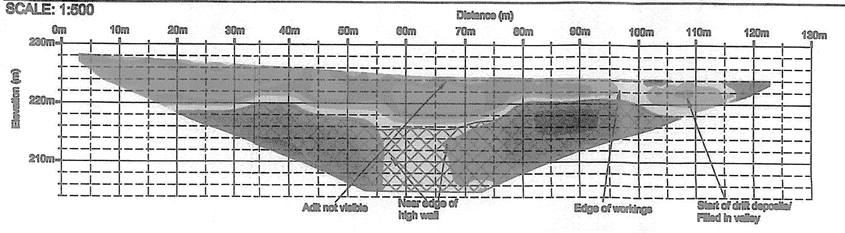


FIGURE 10: RESISTIVITY PROFILE 9
SCALE: 1:500



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

LIGHTMOOR TELFORD

KEY FOR FIGURE 1

- RESISTIVITY PROFILE LINE
- VALLEY INFILL
- EXTENT OF OPEN CAST WORKS
- EXTENT OF DEEP WORKS
- ADITS (INDICATED BY RESISTIVITY)
- HIGH WALL FEATURE
- RANDLE COAL SEAM
- EXTENT OF OPENCAST WORKS (FROM COAL AUTHORITY)
- MS — SHAFTS (POSITION FROM COAL AUTHORITY)
- ADITS (FROM COAL AUTHORITY)

KEY FOR FIGURES 2 TO 10

0.0	4.0 / 7.9	15.9 / 31.6	63.7 / 126.0	251.4 / 501.7

MODELED RESISTIVITY IN OHM. METRES

Bedrock

Revision	Details	By	Check	Date	Suffix
SECOND ISSUE	Revisions may now highlighted in purple Diamond title	JRW/DOS		22.11.07	01

Drawing Status: FINAL

Job Title: STONEY HILL GEOPHYSICAL SURVEY

Drawing Title: MINING GEOHAZRDS ADJACENT TO PROPOSED LINK ROAD

Scale at A1: See figure

Drawn	Approved		
Rose Mansbip	Oliver Chirp		
Stage 1 check	Stage 2 check	Originated	Date

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Drawing Number: D118518 Rev: -03

Plot Date: PLOT_DAT CLOCK
AutoCAD File Name: DWGNAME

REPORT FOR LANDFILL GAS PUMPING TRIAL AT STONEY HILL LANDFILL SITE

UNDERTAKEN FOR TELFORD & WREKIN COUNCIL

AUGUST - SEPTEMBER 2008



Prepared by: Paul Baker, Aftercare Supervisor, Biogas Technology Ltd
Checked by: Rafal Lewicki, Technical Director, Biogas Technology Ltd

TELFORD AND
WREKIN COUNCIL
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1. Executive summary

The pumping trial at Stoney Hill Landfill Site was undertaken over the six weeks as prescribed by Environment Agency Guidance, with the site elevated flare performing satisfactorily throughout the period.

The area used for the trial was selected as it comprised of two discrete waste deposition cells, representing the deepest on site. Three new Gas Extraction Wells (GEWs) were drilled into each cell.

Wells 1 and 5, one from each cell, were fitted with pneumatic pumps to draw down the high leachate level. Leachate pumping during the gas pumping trial did not significantly lower its levels across the site. Leachate management is crucial for the gas control on site. Should the leachate on site be pumped, the gas flow and the migration control parameters may change. Future assessment needs to take place to agree the best leachate management strategy on site.

With respects to landfill gas, the trial results show that the new wells quickly exhausted the reservoir of gas, indicating that the gas production in the first cell (GEWs 1, 2 and 3) is extremely low. Towards the end of the trial it was seen that only GEW 6 provided a stable gas flow of high quality gas. The cause of this low flow may be attributed to a combination of: high leachate levels, old post-methanogenic waste; inert wastes in the mix and the presence of void spaces or poorly compacted wastes as suggested by the mobility of the leachate and gas.

Indication of the capacity of the flare based on the pumping trial results: 150m^3/h. This would suit the site as it stands, with the high leachate levels and using the existing Line 1, Line 2 and 6 installed trial wells.

The existing elevated flare was, prior to the trial running at very low flows, in the order of 50 to 100m^3/hr, and not continuously. In accordance to the EA guidance-elevated flares are permitted on sites only for testing or emergency purposes for period of time no longer than 6 months.

The overall level of trace constituents was at the low end, indicating relatively clean emissions from any replacement combustion plant. At this stage there is no justification for gas treatment.

2. Introduction

Biogas Technology Ltd was asked by Telford & Wrekin Council to undertake a gas pumping trial using a set of six newly drilled gas extraction wells with the facility to install leachate pumps. Three wells were drilled into two Cells, with one pump in one well per cell. The ultimate objectives of this trial were:

- to assist in the estimation of the size of a permanent ground flare for environmental protection purposes

- to conclude about the efficiency of the leachate pumping during the trial.

3. Site description

Site plans are available in Appendix B.

The site is situated south of the town of Horsehay, between the A5523 and A4169 Queensway. New housing developments to the East of the site are currently under construction.

Waste disposal commenced in 1985 into the void space left by open cast mining. Multiple waste types were taken, but accurate records have not been made available from the client. Waste tipping ceased in 1991.

The site has been subject to several forms of gas management, including venting since migration was detected in 1992. Flaring commenced in 1993. In 2007 Biogas Technology Ltd replaced the existing gas extraction well heads on both gas lines as the previous well heads were unsuitable for gas balancing. The quality of landfill gas and the time that the flare actually burned improved considerably.

The information below is taken from Telford and Wrekins original tender background documentation:

"History

The site was licensed to take all types waste including the following:-
Domestic & Commercial
Non-hazardous Industrial (potentially combustible)
Non-hazardous Industrial (inert and non-flammable)

Construction Waste
Old cars, vehicles and trailers
Sewage Sludge
Medical, Surgical and Veterinary Wastes
Difficult Wastes (specified and infrequent non-specified)
D90 91 92+95 96 10
J10 20 40 50 60
L20 30 40 50
M60
N10
P10 20
Q10 20 30 40
R20 50 70 80
T10 T20

Since Closure the site has been monitored by the Waste Disposal Authority (WDA) who were part of Shropshire County Council. In November 1992 they became aware that gas was migrating outside the site boundary. As a consequence gas control measures were incorporated into the site in the form of passive gas venting which was later upgraded to active gas venting and a flare stack in 1993 or 1994.

Problems
92 it was noticed that gas was migrating outside the boundary
passive gas venting system incorporated later upgraded to active gas venting system and a flare stack (1993).
Condensate in gas line - flare cutting out
Bund may be incomplete and liner may have been used to increase depth of capping.
Second clay bund should have been installed by Coal Authority as extra precaution; no evidence of this.
Leachate pumped to tank - emptied by contractor as required - 3-4 times a week.
Site continues to be monitored on a twice weekly basis
On and Off Site monitoring
-gas; methane CO2, O2, pressure
-leachate levels
quarterly chemical analysis
leachate levels in wells; On & Off Site"

4. Theoretical gas model results

To enable the creation of a theoretical gas model many variables including waste inputs, age, depth and composition are required. Biogas has received no such data from Telford & Wrekin, as historical records appear to be unavailable.

Therefore the presented model is based exclusively on the geometry of the site and several assumptions. Hence it is to be considered only as an illustration rather than the true representation of the gas generation on site.

For the same reason, i.e. lack of reliable data, this report will be based upon the gas composition and flows as measured from the trial wells and at the flare throughout the trial period.

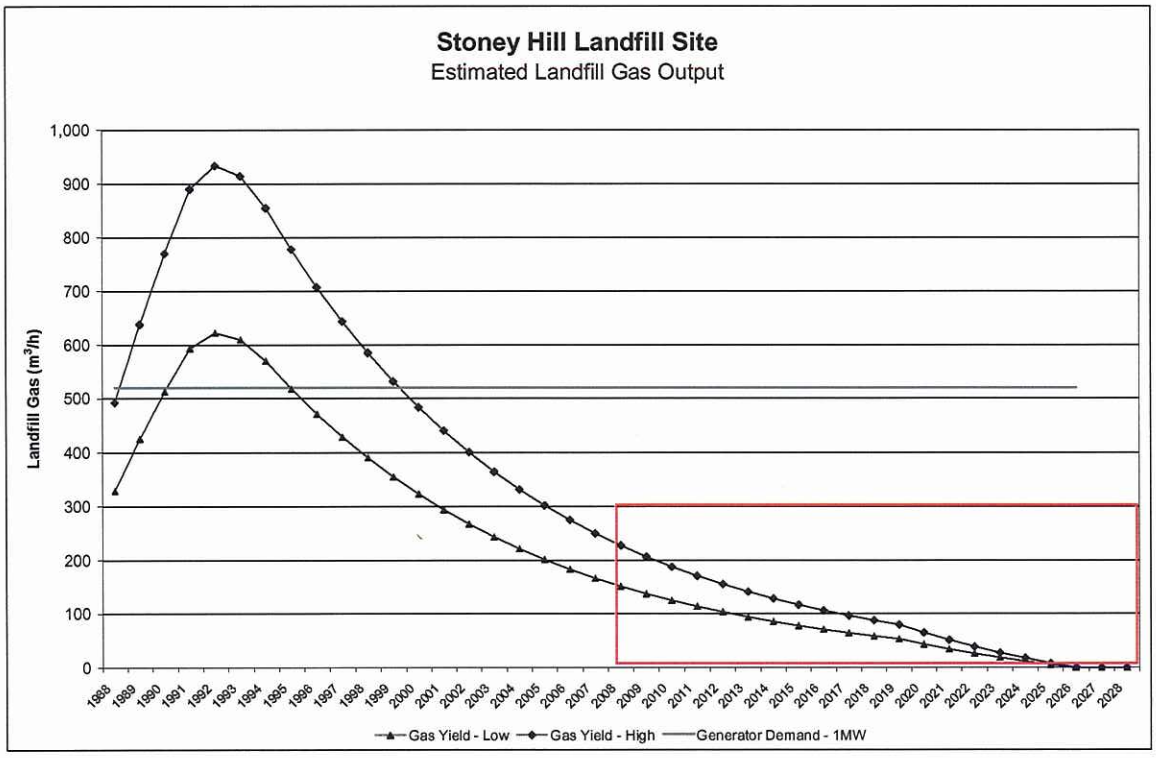
It is also important to note that the high leachate levels encountered will also impair any estimations of gas generation on site.

Any flare sizing exercise undertaken using these results must be done bearing in mind the high leachate levels found on site.

Assumptions used for the theoretical model, reflecting the worst (environmentally) case scenario:

waste tipping start	year	1985
waste tipping end	year	1991
area	ha	6.5
depth	m	15
waste volume	m3	975,000
waste density	t/m3	0.70
waste mass	t	682,500
organic content	%	60%
collection efficiency	%	85%

yearly input	year	t/yr
	1985	97,500
	1986	97,500
	1987	97,500
	1988	97,500
	1989	97,500
	1990	97,500
	1991	97,500



5. Infrastructure construction details

a. New wells

Six new wells were drilled for the purpose of the gas pumping trial, with the intention of using them later as a permanent part of the existing gas collection system. As such they represent the deepest and potentially most effective wells on the site. The placing of these wells was chosen to cover the two deepest waste disposal cells. Three wells were drilled in each, and numbered 1 to 6, with 1, 2 and 3 in one cell and 4, 5 and six in the other. Drilling logs of these new wells may be found in Appendix I, along with details of leachate levels.

The drilling works proceeded well, except for GEW 2 which had to be re-positioned slightly as the drill auger struck an impenetrable object buried in the waste.

Following installation, the new wells were monitored for gas and leachate levels. The leachate levels were found to be high enough to impair the zone of influence of individual wells. A decision was made to install leachate pumping well heads in all six wells and install pumps in two of them, to enable the transfer of pumps from well to well, if required. The pumps were installed in the two deepest Wells 1 and 5 - and remained in place throughout the trial period.

b. Existing wells

The site has been extensively drilled in the past for gas venting and/or extraction. Prior to the trial these wells were capped to prevent venting. Several existing wells within the vicinity of the six trial wells were selected to monitor the zone of influence. Sample points were installed to enable sampling gas composition and pressure from these boreholes.

c. Modifications

As described above. During the trial only minor alterations were made to improve falls or seal very small leaks.

d. Pipework

No new mainline pipework was required as the six trial wells were saddled into the existing Line 1. The link lines from Line 1 to the trial wells was 63mm MDPE laid to falls, either towards the mainline or to the well head. A section of 90mm line at the well head was inserted to assist in the de-watering process.

Each of the new 63mm link lines was fitted with a saddle and threaded riser for use as a sample point for a vane anemometer; a sample point for taking gas temperatures; and a hosetail sample point for taking gas composition and relative pressures.

e. Flare

The existing landfill gas flare was used during the trial. Throughout the trial landfill gas was extracted not only from the new wells but also at very low flows from Line 2. The gas flow through this line was below of limit of detection using vane anemometer. It was proven that this volume of gas couldn't sustain operation of the flare on its own. Hence this gas flow has not been considered in the conclusions. This line of wells covers the Eastern flank of the site which is known to exhibit signs of landfill gas migration. It was therefore not possible to shut this line off.

The Gas flare was serviced prior to the commencement of the trial and ran satisfactorily throughout.

6. Pumping Trial Methodology

a. Gas Balancing & Monitoring

At the start of each site visit the landfill gas flare is attended. The flare is checked for any maintenance issues and gas readings taken. Should the flare be found un-lit, the reasons for failure are established.

The purpose of gas balancing is to ensure that a steady, sustainable flow of landfill gas is drawn from individual gas wells through the gas collection system to the flare. This is achieved by taking, with a portable gas analyser, concentration measurements of the Methane, Carbon Dioxide, Oxygen and remaining gas content (known as the balance) and the relative pressure in millibars from a sample point attached between the well head and control valve.

A 'static' reading is taken with the control valve shut, the gas well at rest (i.e. the gas is not actively being extracted) and the flare off. The reading taken should be assessed bearing in mind the amount of time that the well has not been drawn upon. This reading (although arbitrary) reflects gas generation rate, potential of gas reservoir and state of containment, in the direct vicinity of the gas well.

After the static reading is taken, the flare is switched on, the gas control valve is opened and suction is applied to the well. The suction, measured in negative pressure (in relation to barometric pressure) is increased, up to the point when a notable change in the gas quality occurs, i.e. a drop in methane content or the appearance of oxygen or 'balance of other gases' in the gas mix. This is because these gases are not produced by anaerobic methanogenic decomposition. The appearance of gases other than Methane and Carbon Dioxide indicate either that the waste is too young or too old and is not within its stable methanogenic phase of decomposition or atmospheric air is being drawn into the well due to too high suction applied and/or poor containment of the waste.

The accidental introduction of atmospheric air into the decomposing waste has two major disadvantages. Firstly, it increases the risk of underground fire. Secondly, it adversely affects the anaerobic decomposition of waste which will reduce or stop the production of methane and will impair the stabilisation of the decomposing waste.

The purpose of balancing is to ensure that the flare is run at its optimum (measured by flame temperature and hours run) at maximum methane content

and maximum flow rate at the same time minimising potential for gas migration. It is a case of matching the amount of gas drawn to that being produced within the area of influence of the wells.

Landfill gas monitoring involves taking gas pressure and readings of bulk gases (CH_4, CO_2, and O_2) concentrations with a portable gas analyser - a Geotechnical Instruments GA2000.

b. Peak Flow Testing

This test involves the regular and frequent monitoring of an individual gas well whilst opening the gas control valve at a set amount. In this case the valve was opened 1/16th of a turn following the recording of the gas quality and flow every 15 minutes. The valve is opened until the gas quality begins to deteriorate. The valve is then slowly turned back down at the same rate as it was opened at.

This test indicates the maximum flow and/or suction that can be applied to a well and the gas recovery rate in the vicinity of the tested well.

Unlike balancing it does not indicate sustainable gas flow or take into account the relationship between the wells on the entire gas field. However, it is considered an important part of the pumping trial that enables further interpretation of results.

c. Gas Bag Sampling

This is undertaken to capture a larger sample of gas for detailed laboratory analysis for trace constituents that cannot be measured on site with portable instrumentation and for bulk constituents to check against the portable analyser. It involves drawing a gas sample into a 'Tedlar Bag' and the swift delivery of the sample to a laboratory.

d. Radius of influence

This is undertaken to assess the radius of influence of gas wells when suction is applied. Additional observation boreholes need to be installed and pressures measured in them during the static and dynamic tests, as per the EA guidance. The radius of influence depends on the waste nature and compaction, state of the containment, leachate presence and levels and operational parameters of the gas collection system.

e. Leachate levels

Leachate levels are giving indication to the need for leachate control on site, design well depths and overall efficiency of gas collection and operation of the system.

7. Pumping Trial Diary

The details below are required to compare to the gas balancing data as found in Appendix E. Any anomalies or changes to the gas entering the collection system may have been due to physical changes to the system outlined below, particularly due to improvements to the falls and condensate removal issues.

18th August 2008

Overcast and breezy weather with wet ground.

The compressor and flare turned off to enable static gas and leachate readings to be taken. Sealing small leaks and snagging undertaken on trial wells. At 1.20pm the two new pumps were started in GEWs 1 and 5.

19th August 2008

Overcast and breezy weather with showers.

A further round of static gas readings were taken with leachate measurements. Following these readings, the flare was started at 9.55am and all new wells GEW's were cracked open. The remaining wells on Line 1 were left closed. An initial flow of 525 m^3/hour soon fell to 490m^3/hour at the flare. It must be remembered that Line 2 gas, albeit at very low flows, was included in this total flow. By 12.45pm the flow was 400m^3/hr, and 2.30pm 380m^3/hr. By this time individual gas wells were being turned down whilst balancing.

20th August 2008

Weather - overcast with light showers.

The flare was running, but with highly variable flow. This was caused by a condensate blockage in Line 2, which was soon repaired and the line re-laid to prevent a re-occurrence. The leachate tank was full, just before Patrick's (Liquid disposal tanker) arrived, so the pumps had stopped for a short while. Tedlar gas bags samples were also taken and transported to the laboratory. The flare was left running with 250 m^3/hr.

21st August 2008

Mild, showery weather.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

22nd August 2008

Mild, dry and clear.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

26th August 2008

Mild, dry, overcast.

The flare was found to be off and the leachate pumps in need of service. The site pumps were serviced and the flare re-lit.

27th August 2008

Mild, windy, overcast, dry.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

28th August 2008

Warm, dry, overcast.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

29th August 2008

Flare checks and Trial Area gas system maintenance.

1st September 2008

Mild, dry and clear am, rain pm.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

2nd September 2008

Mild, dry, clear am with showers pm.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

3rd September 2008

Mild, dry am with wet weather later.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

4th September 2008

Mild, dry, clear am with showers pm.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

5th September 2008

Very wet weather.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

8th September 2008

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

9th September 2008

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

10th September 2008

Mild, dry, overcast.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

11th September 2008

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

12th September 2008

The gas extraction wells along Line 1 were opened as migration was detected along the Western edge boreholes of the site.

15th September 2008

Mild, dry, overcast.

The flare found running (100 m^3/hr), but the compressor was off due to a full leachate tank, as Patricks were unable to attend until later today. Line 1 wells and trial wells balanced.

16th September 2008

Overcast, cool, dry with damp ground.

Pumps found off, as compressor off, due to full leachate tank. Patrick's on site later in day. All sample points, saddles and fittings tested and tightened.

17th September 2008

Mild, dry, overcast.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

18th September 2008

Fine, dry, warm.

Again, pumps off, despite tanks being emptied daily. Peak flows taken from GEW6

19th September 2008

Sunny spells, mild, dry.

Again, pumps off despite Patricks attending every day this week, including later today. Peak flow testing of trial well 1. Leachate pump kept working on this well.

22nd September 2008

Mild, dry, overcast.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping. All site pumps serviced.

23rd September 2008

Mild, dry, overcast.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

24th September 2008

Mild, dry, overcast.

Balancing of trial wells, monitoring of zone of influence boreholes and leachate dipping.

25th September 2008

Mild, dry, clear

Peak flow testing of trial well 5.

26th September 2008

Cool, dry, misty, overcast later.

Final day of trial with regular monitoring and balancing.

8. Discussion of the results

a. Static readings

Please refer to Appendix D.

As previously discussed, static readings are taken prior to active gas extraction. The readings give an indication of the quality and flow of gas that may be expected during the initial stages of extraction. It must be noted that they are indicative only and wells may react unexpectedly under extraction.

Static readings indicate stable methanogenesis in locations covered by the gas wells.

All six trial wells contained high quality gas, albeit in a mixture indicative of gas affected by the presence of leachate. Undiluted landfill gas produced through methanogenesis has a gas composition with a typical ratio of 60% Methane and 40% Carbon Dioxide. These gases have different solubility in water. Carbon Dioxide is much more soluble in water than methane. For example, a gas produced by decomposition may be 'stripped' from 60% CH_4 and 40% Carbon Dioxide to 70% CH_4 and 30% Carbon Dioxide. These distorted ratios are evident in some of the static readings.

Relative pressures found at this stage of monitoring at the wells and boreholes and within the zone of influence are increasing towards GEW 6. This can be indicative of gas production intensity and therefore assist in the further balancing regime and interpretation of the results.

Signs of surface emission of gas were not detected (odours, gas sipping through the ground) during the trial, and no strong odours were recorded either adjacent to or away from any wells. The thickness and integrity of the cap is known to be highly variable, as can be seen in the GEW dips colour diagram within Appendix I.

b. Gas bag samples - table, discussion

The trace gas bag analysis results may be seen in the laboratory certificates provided in Appendix G .

Gas bag samples were taken as per Environment Agency guidance at the start of the trial, to assess any potential risks caused by constituents within the gas, and once a more stable flow has been achieved.

The initial results show that the landfill gas has constituents were in line with expectations on waste composition.

Low levels of Carbon Monoxide are not raising concerns, all being less than the detection limit of 20 ppmv. Usually levels above 25 pmm indicate presence of landfill fires. The level of Hydrogen Sulphide (H_2S) found in the gas was low (below the 1 mg/m^3 detection limit) throughout the trial period.

Levels of halogenated hydrocarbons and organic silicon do not raise issues for concern.

c. Well balancing, Peak Flows & performance

For the first four weeks of the trial the flare burned gas from the six GEWs and the low flow/high quality gas from Line 2. Following the detection of landfill gas migration in wells not normally found to have elevated levels, along the Western edge of the site, the existing wells along Line 1 were also opened. These provided a relatively small proportion of the gas supplied to the flare.

The balancing of all the gas wells was undertaken with care not to draw atmospheric gases into the waste, for reasons previously described. This caution was taken from the start to the end of the trial as it was soon recognised that not all the wells were installed in zones of gas production, and that part of the containment was not ideal.

The majority of the wells were soon found to be challenging to draw upon, as the quality of gas very quickly fell when extraction commenced. The amount of suction applied to the wells was therefore limited due to the nature of the capping and the leachate levels on site, limiting the exposed part of well liner perforations able to collect the gas.

Gas Extraction Well N°1

This well contained the pneumatic leachate pump for this first cell. As the trial progressed the gas quality/flow did not improve as the leachate was drawn down. This may be due to the relative thick layer of clay capping material that surrounds this well, as shown in the colour diagram, Appendix I. It may also relate to the high recharge rate of leachate into this well, as demonstrated by the fact that the pump ran nearly continuously for the trial period, without notable effect on the leachate levels in surrounding wells, resulting in the leachate continuing to impair flow.

The well was drawn upon with moderately high suctions to draw down any reservoir of gas that may have accumulated in the vicinity of the well. It was soon found that only low suctions were required before gas quality dropped away. Gas quality did recover fairly quickly following periods of high suction, suggesting that a pocket of gas generation did exist within the zone of influence of the well.

A peak flow test was undertaken which showed that the well could withstand relatively high suctions only for a limited time, with the gradual diminishing of gas quality. As the oxygen component of the gas reached 1.6% the well was backed down to assess recovery. However, the gas quality struggled to reach pre-test levels, suggesting that the pocket of gas was exhausted by the test.

The sudden influxes of oxygen into the well, on 22nd September, for example indicate that the gas field in the vicinity of the well had failed to recover following the peak flow test. The well demonstrates that the gas pockets are at a distance from the well and that increased suctions are required to extract the gas. There may also be areas of containment failure, resulting in the oxygen influxes. The sudden increase of methane volume at the end of the trial occurred when the leachate pump failed, allowing the well to flood and the gas to become 'stripped', as described above.

Gas Extraction Well N°2

This well was initially drawn upon to reduce any build up within the well, and high flows exceeding 30m³/hr were possible. However, once this reservoir of gas was extracted, very low flows occurred, followed by a drop in gas quality, which never recovered, despite the well being closed completely. The well, whilst closed, exhibit some signs of interference suction, which may have been from the Well 1. All the results indicate that what reservoir of gas was in the vicinity of this well was soon drawn away and that any gas generation was not great enough to re-fill the well and may have been drawn away towards Well 1.

It may be that the gas in this cell, as covered by GEWs 1, 2 and 3, is of a very dispersed nature, occurring in pockets. It may be that the a pocket of gas did exist between these wells and that it was extracted via GEW 1, therefore denying any gas to GEW2.

Due to the poverty of gas flows and quality found early on, no peak test was carried out on this well. A small test was undertaken to assess the suitability of the well for peak flow testing, but any increased suctions resulted in poor gas flow/quality. Whilst opening the well plug for leachate dipping no pressurised gas or odours were detected. Any alterations in gas quality detected at this well are likely to have been caused by alterations to GEWs 1 and 3. It may also

be that gas flows may have been affected by mobile leachate. The leachate level graph for this well shows that the level did rise following the start of pumping at GEW1, indicating that the start of the pumping regime initiated some mobility in the leachate, i.e. an amount of leachate was drawn through the vicinity of the well.

Gas Extraction Well N°3

Even with the gas control valve cracked open, very high suctions appeared in the well. This immediately suggests a limited head of gas, possibly due to a blockage (e.g. saturated waste) or limited gas production in the vicinity of the well. It is difficult to draw upon any pockets of gas from saturated waste with low suctions, but elevated suctions increase the risk of completely depleting any pockets of gas remote from the well which may be of limited extent.

Following the depletion of the reservoir, an attempt was made to carry out a peak flow test, but to no avail as the gas quality was unstable. The gas quality improved with some suction, but fell away when the control valve was closed. It could indicate pocket(s) of gas interspersed with void space within this cell, as previously mooted for GEW2.

Gas Extraction Well N°4

Gas Well 4 demonstrated static pressures in excess of those found in the first cell. However, the gas was very quickly drawn away and only slightly recovered. Following an initial 'burst' of gas flow at high quality, gas flows soon fell, suggesting that the reservoir was very much depleted. As such, no peak flow tests were attempted.

The well exhibited signs of interference suction with the adjacent GEW, N°5. This suggests, along with the failure to recover any gas flow/quality, that the well may exist in an area of little or no gas production and/or with a pocket(s) of gas between it and GEW5. Any increases in gas quality at GEW4 are associated with either backing down GEW5 or occasional difficulties with the leachate pump in GEW5.

Gas Extraction Well N°5

This well contained a pneumatic leachate pump.

Static readings indicated that gas production was taking place within the zone of influence of this well, as the relative pressure readings approached positive 5mb and gas quality was >60% methane.

The reservoir was extracted in a short time and, following this, only very modest suctions could be applied before gas quality was reduced. The oxygen level increase encountered on 22nd August represents a leak on a well head fitting - soon repaired. Similar to GEW4, gas flows remained nominal throughout, although suctions were continuously applied to this well, whereas GEW4 was closed for considerable periods - i.e. any available gas in this area was extracted via GEW 5, not GEW 4, as there was not enough available to supply both.

A peak flow test was undertaken, as the well was found to provide at least some flow of generated gas. The well was very carefully opened and the peak flow reached 36.17m³/hr, which is similar to the flow rate taken from the well whilst the reservoir was being drawn down. The gas quality quickly recovered and moderate suctions were again applied, but with flows below the detection limit of the instrument used. Again, it appears that low suctions are unable to extract the pockets of gas, but higher suctions quickly deplete any available gas.

It is of note that the on the 10th September gas quality dropped away as the leachate level in the well rose due to a pump failure. This would indicate that mobile leachate blocked the path of the gas from the pocket of generation to the well.

The colour diagram in the leachate levels appendix show that this well was installed through a layer of clay material notably thinner than elsewhere. The well does appear to be situated in a hollow as can observed whilst walking towards the well. It may be that containment in the vicinity of this well is not as sound as elsewhere.

Gas Extraction Well N°6

This well exhibited the highest values with respects to static tests. Leachate dipping was difficult due to strong odour of gas escaping under pressure from the sampling point.

Initially a small leak was found on the well head. This was repaired and the gas quality greatly improved. Suction on this relatively shallow well had to be higher in comparison to the other ones, most likely due to the local low permeability of waste, with suction issues as previously described.

At the beginning of the trial the well was only moderately drawn upon as it was assumed that the well would act in a similar way to the other five wells, and caution was applied due to the relative shallowness of the well. This assumption was found to be incorrect as increased suctions resulted in increasing flows with no diminishing of gas quality. The associated ZOIBHs had, good quality gas which was found to be drawn away under the influence of this well.

The peak flow test came out in line to the static test results and proved best gas generation in comparison to the rest of the trial area. Increases in suctions resulted in increased flow without significant detriment in gas quality. Following the peak flow test the well was left providing ~30 m^3/hr.

The leachate levels in the well did peak on two occasions, with no obvious effect on gas flow/quality. Again, these peaks may have been due to the mobilisation of leachate via the pneumatic pump in GEW5.

It may be that this well demonstrates a different gas regime due to its positioning through a pocket of gas generation, rather than being remote from such a pocket.

Gas Flare, Lines 1 and 2

The Gas Flare ran satisfactorily throughout the period of the trial, as demonstrated by the flare hours graph in Appendix E. As previously mentioned, the flare was run for the first four weeks of the trial with the six trial wells and the wells on Line 2 only. The final two weeks some of the wells on Line 1 were opened for anti-migration purposes.

Following an initial flow of 490 m^3/h, representing the reservoir of gas primarily from the six trial wells, this rapidly declined to ~200 m^3/h flow. The flare was backed down to attempt assess the recovery of the gas from the site as a whole, but opened up again when it was realised that GEW6 and some Line 1 wells required extra suction. For the remaining two weeks of the trial, the flare received flows in the region of 85 m^3/h. Of this, ~40 m^3/h came from the open trial wells, ~15 m^3/h from Line 1 wells and ~30 m^3/h from Line 2 wells.

The table and graph for Line 1 shows a highly variable trend for all parameters. This sample point represents the combined gas quality/flow from the trial area and, at a later stage, the older wells along Line 1. This line has a separate control valve which was altered on several occasions to moderate the total suction applied to Line 1. Line 1 was not unduly affected by condensate during the trial period.

Line 2 was monitored throughout the trial as part of our scheduled routine, but also as the gas from this line mixes with that of line 1 to give a total combined gas mix at the flare. As can be seen the gas quality and flow (as assumed from relative pressure) remained stable throughout the trial. The high suctions at this sample point are matched with similar suctions at the well heads, indication limited flows.

d. Radius of influence

The site has historically been drilled with at various times with various types of well. Many of these were found to be left as 90mm vents. All were capped by Biogas prior to the trial and a selection, interspersed with the trial wells. They were numbered as per the map in Appendix A and fitted with a sample point, as shown by the photograph in Appendix C.

All of these boreholes, used to assess the zone of influence, exhibited negative relative pressure when the active extraction phase of the trial was in operation. This demonstrates that the trial wells were all capable of exerting a zone of influence to variable distances. Interference suction was also observed between trial wells.

In summary,

	Trial Wells				Zone of Influence Boreholes										
Trial Well	GEW 2	GEW 3	GEW 5	GEW 6	47	48	57	58	60	61	70	71	81	90	91	92
GEW1	46	40					10.6	14.3								
GEW2		30			8.7	9			38.5							
GEW3								8.7			25.4					
GEW4			29							12.6		9.5				
GEW5				36.4								12.6	21.9			
GEW6													15	13	13	14

Distance between the wells and boreholes in meters.

These results show that despite variable cap depths and leachate levels the trial wells were all able to draw upon gas throughout the trial area. This may indicate that the upper areas of the waste mass may contain highly permeable zones, in saturated waste and possibly preferential channels for fluid flow. The fact that the wells, bar GEW 6, were capable of collecting very poor quality gas would also suggest voids within the waste mass.

The data from the Zone of Influence Boreholes been graphed to compare the static readings and the readings taken during active extraction. These graphs and tables are in Appendix H. These graphs and tables demonstrate that the suction exerted on trial wells affected the observation boreholes, causing changes in pressure and gas composition. Effectively, the atmospheric air was drawn into the landfill body through the boreholes

The radius of influence was observed at maximum 30 - 40 m.

e. Leachate levels

The leachate levels within the waste mass are high, as indicated in the dips colour diagram, which is based upon drilling log data and initial dips.

Despite 6 wells of continuous pumping from wells 1 and 5, which successfully reduced the leachate levels in these two wells, little difference was seen in the remaining four trial wells. The amounts of liquid taken throughout the trial period were considerable, certainly when compared to previous the previous period, when the two trial pumps were not installed. A separate assessment needs to be carried out for the leachate volumes, composition and proposed management, following scrutinising the data obtained during the trial.

Summary dips table: (mbgl = metres below well head).

Well	Sample dip to liquid from beginning of trial (mbgl)	Sample dip to liquid from end of trial (mbgl)
GEW 1 (pumped)	10.90	14.20
GEW 2	10.02	10.41
GEW 3	12.21	12.51
GEW 4	8.37	8.92
GEW 5 (pumped)	8.30	10.46
GEW 6	10.05	9.02

Control of leachate levels is critical to enable efficient gas management on site.

9. Results interpolation

The results of the pumping trial are considered for initial sizing of the gas collection system and the flare.

The site area considered was 6.5 hectares.
The average depth of the site was considered as 15m

These figures give volume of 975,000 m^3 and some 680,000 t of waste in simplified calculations, based exclusively on the approximate geometry of the site.

The pumping trial results indicated range of gas flow rates [in m^3/h]:

GEW1	<1 - 15
GEW2	<1
GEW3	<1 - 10
GEW4	<1 - 20
GEW5	<1 - 25
GEW6	10 - 35

Using average figures for wells performance would not give the true reflection of the situation on site, as the recovery rates and peak flows demonstrated wide spatial and temporal variations. The Gas Flare has stabilised by the end of the trial with gas flow in the region of 85 m^3/h, including flow from the anti-migration wells on Lines 1 and 2.

Radius of influence (ROI) has been observed in the monitoring boreholes at distances of 30 - 40 m from the trial wells. The ROI is highly variable which is not uncommon for pockets of gas and mixed layers of saturated and loosely compacted waste. The conservative approach with consideration of preventing breach of the site containment by excessive suction should adopt 20 - 25 m ROI. This would result in approximately 20 -30 wells on site. Considering that the perimeter of the site has already some infrastructure, the middle of the site should be addressed and the first stage of the improvement of gas collection system should include installation of at least 10 new wells. Then, if necessary, new perimeter wells should replace the older shallow ones.

The existing gas extraction points and boreholes that have been proven out of use and not crucial for migration control should be filled back to prevent air ingress during active gas extraction phase.

The effective perforation of the gas well liner open to collect the gas is blocked by the leachate and the capping varying in thickness between 0.5 to 3 m. These facts are limiting collection efficiency of the gas from site and are influencing the interpolation of the trial results.

10. Conclusions - site potential

The expected maximum gas flow, based on the pumping trial results would be in the range of 90 - 120 m^3/h. These figures roughly match the theoretical illustration model.

Considering the above figures, falling gas curve, leachate levels in measures wells and boreholes, the age and the size of the site a landfill gas flare at 150 Nm^3/h capacity with minimum turn down ratio 5:1, compliant with the current Environment Agency guidelines, should be sufficient to control the gas on site.

Containment of the waste and control of leachate levels are crucial in order to achieve the predicted gas yield.

For the purpose of design of the environmental gas collection system the system should always have margin of safety in respect of expected gas flows to cope with surplus gas.

No power generation on site can be considered due to the unstable and relatively low flow gas supply.

It is recommended to review further leachate levels on site in order to understand its influence on the gas control system and to make correct decisions about leachate management that is crucial for successful operation of gas management scheme.

11. Caveats & acknowledgements

As a leading expert Biogas Technology Ltd have carried out static and dynamic gas tests to estimate the current gas yield for the above site.

While all efforts have been made to ensure that the information supplied within this report is accurate. Biogas Technology Ltd does not accept any responsibility for failure of the site to produce the gas yield predicted within this report.

The pumping trial was limited by:

- the leachate levels encountered on site
- containment issues (observation boreholes) affecting the suction applied to the wells
- lack of reliable data for the theoretical model.

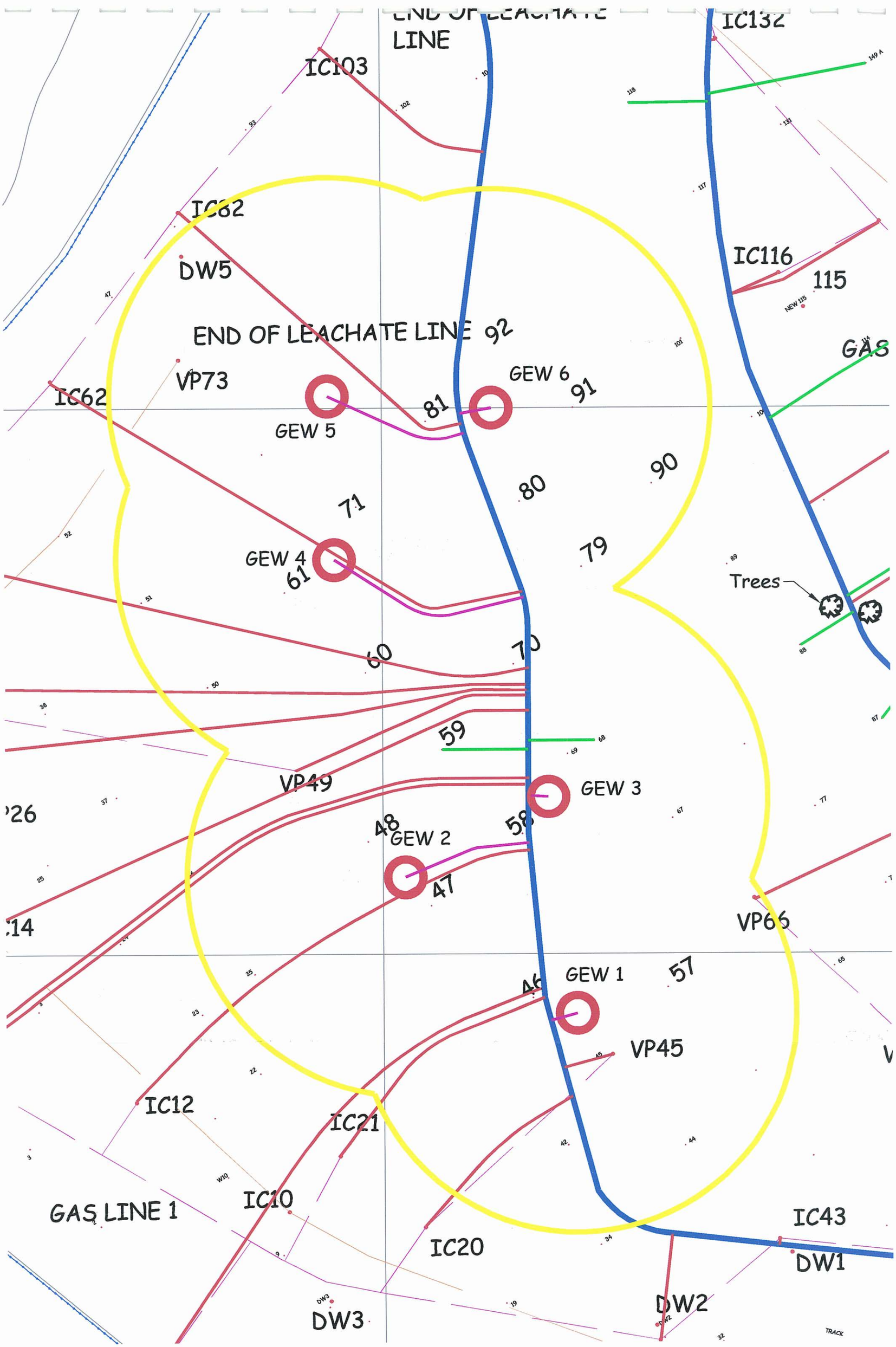
Biogas Technology Ltd would like to acknowledge and extend its thanks to the personnel at StoneyHill landfill site for all their assistance during the course of the trial.

12. Appendices

Appendix A. Site data - Data Gathering Form

Not available due to lack of historical records

Appendix B. Site maps


LINE
IC103
IC132
IC82
DW5
IC116
115
END OF LEACHATE LINE
92
GAS
VP73
IC62
GEW 6
91
GEW 5
81
90
80
71
GEW 4
79
61
Trees
60
70
59
VP49
GEW 3
48
GEW 2
58
47
VP66
GEW 1
57
46
VP45
IC12
IC21
GAS LINE 1
IC10
IC20
IC43
DW1
DW2
DW3
TRACK

Appendix C. Site pictures


81
81

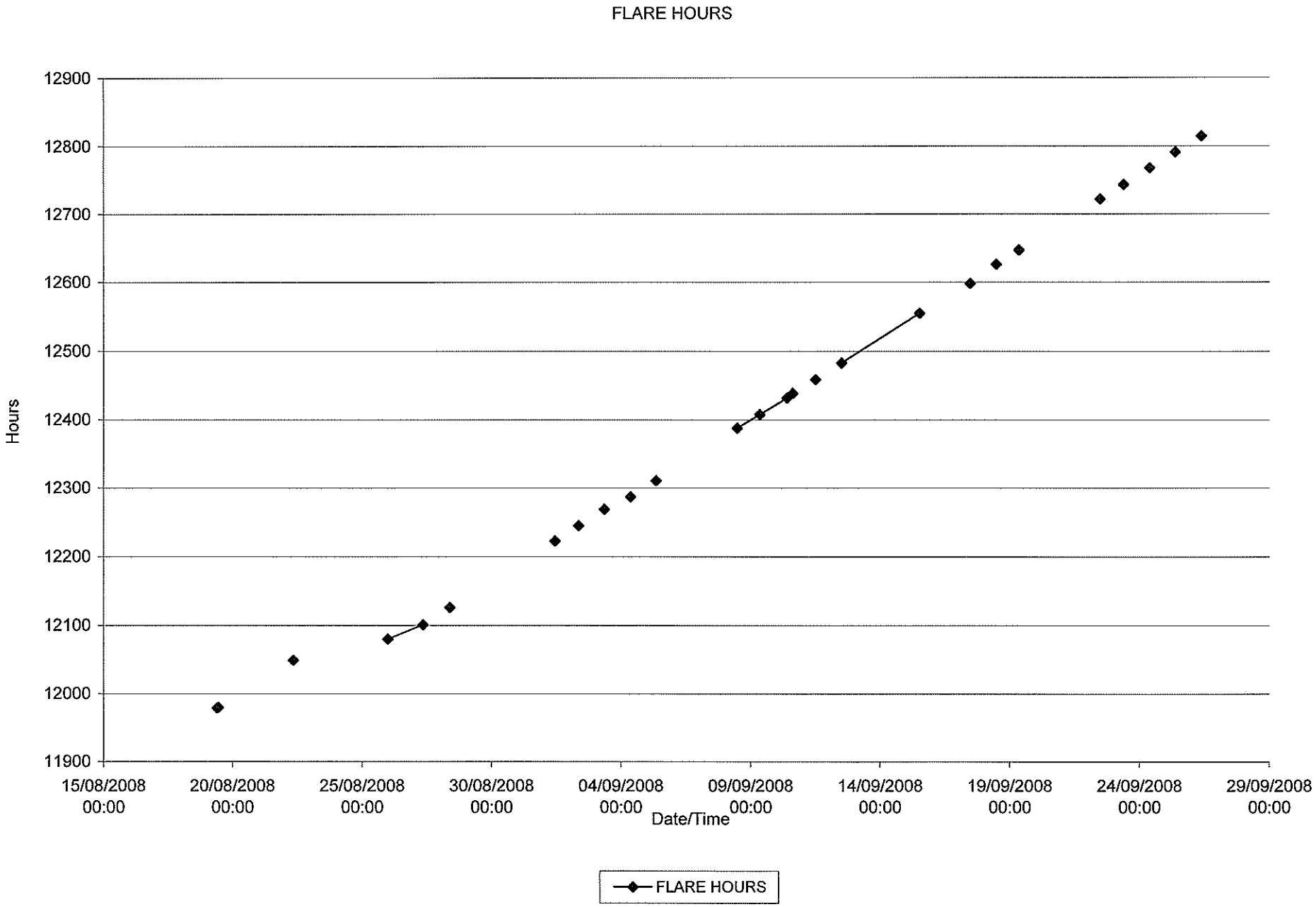

Danger
High voltage
DANGER NO SMOKING
Flammable gas
WARNING!
BARBED WIRE
DANGER NO SMOKING

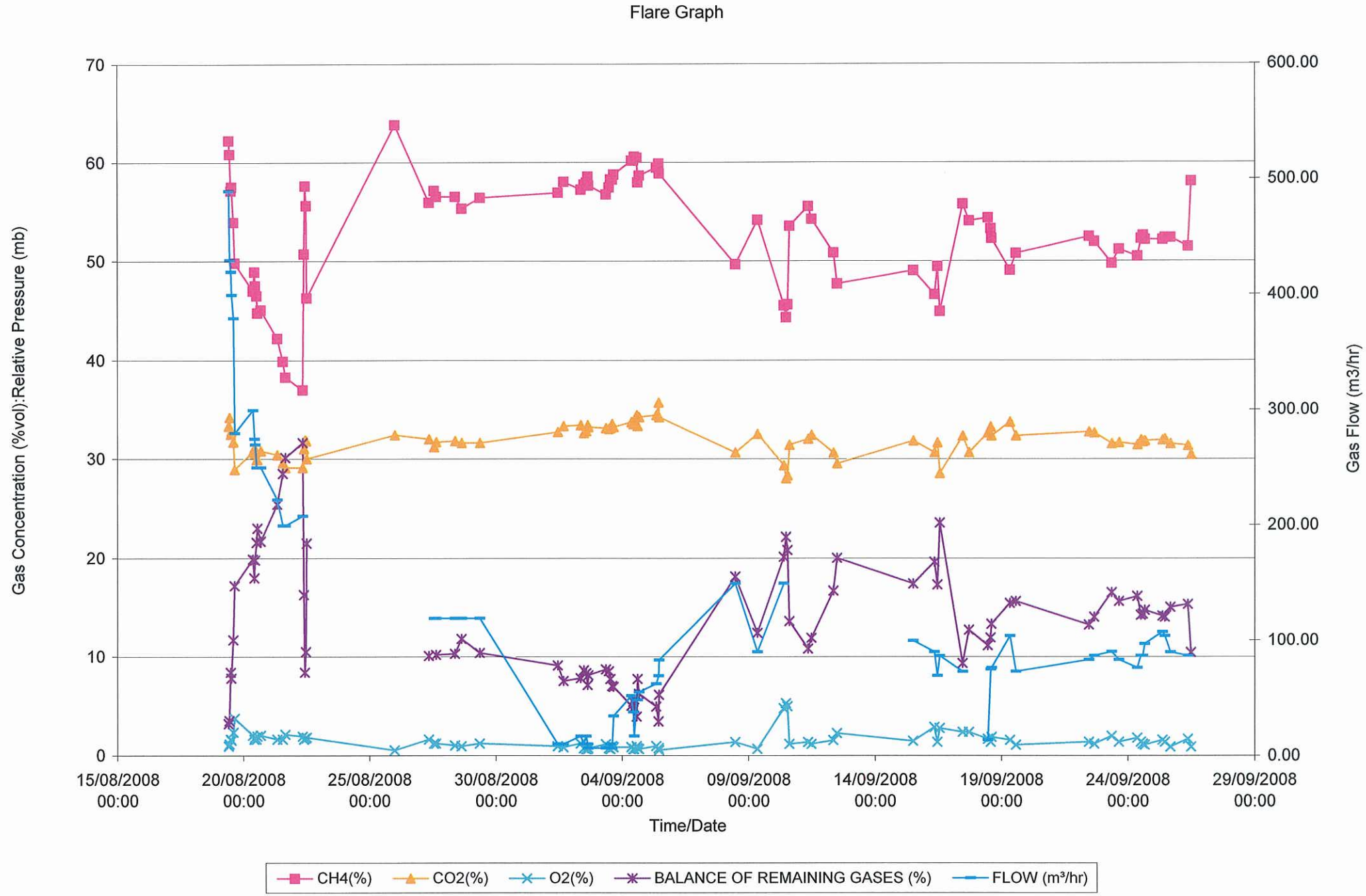
Appendix D. Static readings

BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL							3298
SAMPLE POINT	DATE	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE (mb)	COMMENTS
GEW 1	18/08/2008 10:54	57.2	30.3	1.8	10.7	975	2.27	Static reading
GEW 1	19/08/2008 08:27	57.1	30.3	1.5	11.1	974	2.52	Static reading
GEW 2	19/08/2008 08:42	63.7	34.6	0.1	1.6	974	2.3	Static reading
GEW 2	18/08/2008 11:20	62.5	37	0.2	0.3	975	2.37	Static reading
GEW 3	18/08/2008 11:39	65.9	35.1	0	0	974	2.65	Static reading
GEW 3	19/08/2008 08:43	66.5	34.8	0	0	974	3.6	Static reading
GEW 4	19/08/2008 08:49	64.1	36.9	0.1	0	973	3.3	Static reading
GEW 4	18/08/2008 12:26	65.8	36.6	0.3	0	974	3.34	Static reading
GEW 5	19/08/2008 09:26	65.2	35.9	0	0	974	4.75	Static reading
GEW 5	18/08/2008 12:28	65	36.2	0.1	0	974	4.98	Static reading
GEW 6	18/08/2008 12:01	64.3	36.6	0	0	974	6.92	Static reading
GEW 6	19/08/2008 09:00	64.6	36.5	0	0	974	8.08	Static reading
ZOIBH 45	19/08/2008 08:29	67.5	27.2	0.5	4.8	974	-0.12	Static reading
ZOIBH 47	18/08/2008 11:33	39.1	14.7	1.9	44.3	974	0	Static reading
ZOIBH 47	19/08/2008 09:36	32.4	12.4	3.1	52.1	974	0.21	Static reading
ZOIBH 48	18/08/2008 11:24	60.6	34.7	0	4.7	974	0.8	Static reading
ZOIBH 48	19/08/2008 09:32	60.8	35	0	4.2	974	0.82	Static reading
ZOIBH 49	19/08/2008 09:30	47.9	32.4	0.6	19.1	974	2.53	Static reading
ZOIBH 57	19/08/2008 08:33	52.1	12.9	3	32	974	-0.07	Static reading
ZOIBH 57	18/08/2008 11:12	65	15.7	0.3	19	975	0	Static reading
ZOIBH 58	19/08/2008 08:41	69.8	9.2	0.3	20.7	974	1.21	Static reading
ZOIBH 58	18/08/2008 11:22	68.7	9.2	0	22.1	975	1.26	Static reading
ZOIBH 60	19/08/2008 09:28	65.2	35.8	0	0	974	0.62	Static reading
ZOIBH 61	19/08/2008 09:23	64.2	36.6	0.3	0	974	2.51	Static reading
ZOIBH 61	18/08/2008 12:22	64.5	36.5	0	0	974	3.08	Static reading
ZOIBH 70	18/08/2008 11:47	7.7	9	3.2	80.1	974	0.12	Static reading
ZOIBH 70	19/08/2008 08:48	11.6	9.9	1.5	77	973	1.05	Static reading
ZOIBH 71	19/08/2008 09:18	68.8	33.2	0	0	974	3.55	Static reading
ZOIBH 71	18/08/2008 12:20	72.6	26.6	0.1	0.7	974	3.62	Static reading
ZOIBH 80	18/08/2008 12:30	69.4	25.1	0	5.5	973	5.19	Static reading
ZOIBH 81	18/08/2008 12:04	65.8	35.4	0	0	974	6.34	Static reading
ZOIBH 81	19/08/2008 09:06	65.3	36.5	0.2	0	974	6.57	Static reading
ZOIBH 90	19/08/2008 08:52	0.1	10.7	3.7	85.5	973	0.04	Static reading
ZOIBH 90	18/08/2008 11:49	0.1	12	1.9	86	974	0.22	Static reading
ZOIBH 91	18/08/2008 11:51	65.3	34.7	0	0	974	0.15	Static reading
ZOIBH 91	19/08/2008 08:54	66.1	35	0.3	0	974	0.51	Static reading
ZOIBH 92	18/08/2008 12:02	77.9	19.7	0	2.4	974	7.23	Static reading
ZOIBH 92	19/08/2008 09:04	62.9	32.7	1	3.4	974	7.62	Static reading

Appendix E. Gas balancing data

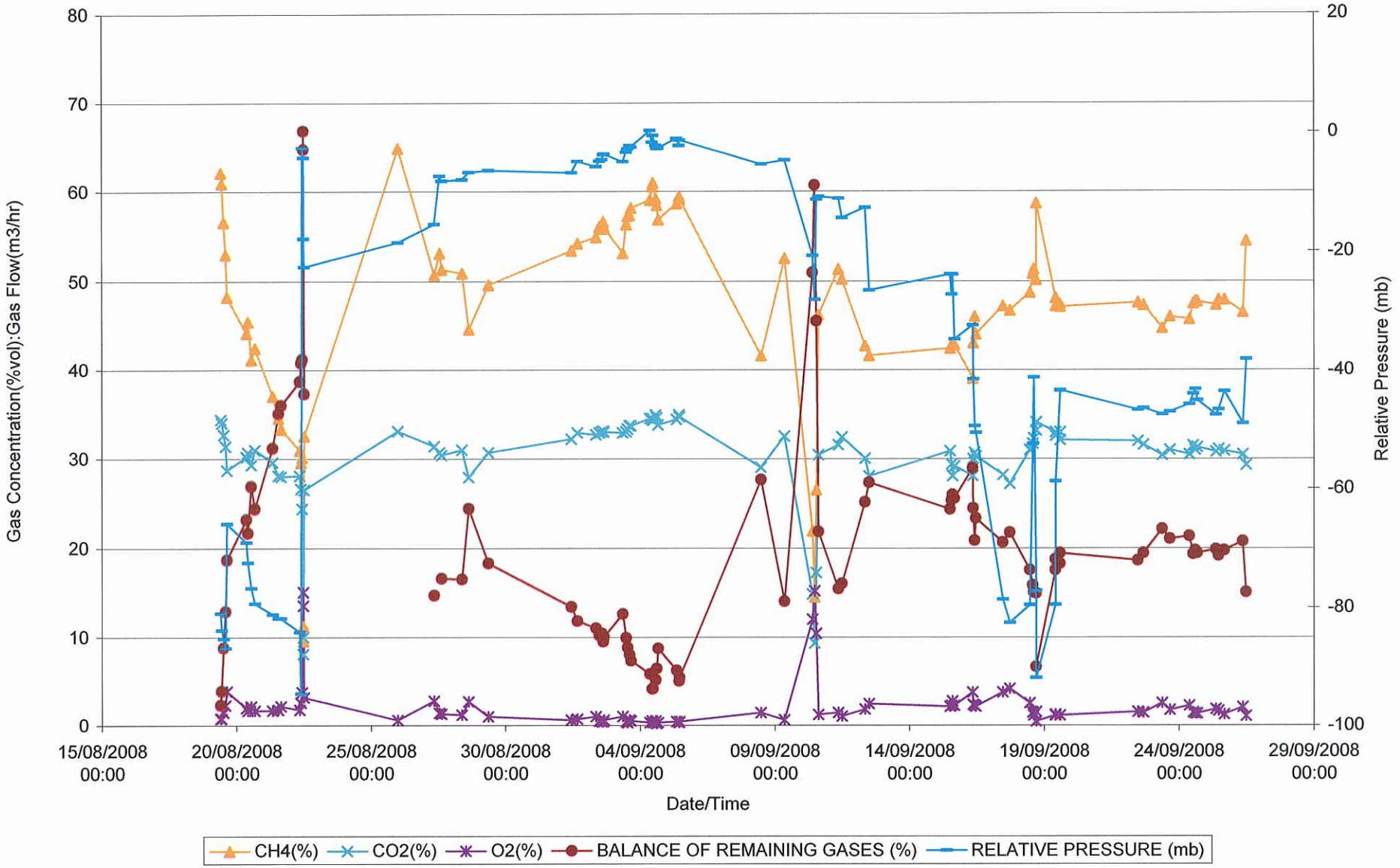
BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL											3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH4(%)	CO2(%)	O2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m³/hr)	FLARE HOURS	COMMENTS
Flare	19/08/2008 09:59	975	62.3	33.4	1	3.3	4.59			490.00	11979	Flare Started using Lines 1 (GEW 1 to 6 only and Line 2)
Flare	19/08/2008 10:54	977	60.9	34.3	1.2	3.6	3.94	341		430.00	11980	The flame temperature is low as the flame is physically escaping the stack
Flare	19/08/2008 12:04	978	57.2	32.6	1.7	8.5	3.08			420.00		
Flare	19/08/2008 12:43	977	57.6	32.9	1.6	7.9	3.55			400.00		
Flare	19/08/2008 14:27	978	54	31.8	2.4	11.8	3.09			380.00		Following this reading the flare was backed to 300 flow
Flare	19/08/2008 15:42	978	49.9	29	3.8	17.3	2			280.00		
Flare	20/08/2008 08:57	986	47.1	30.8	2.1	20	1.9	329		300.00		
Flare	20/08/2008 10:21	984	49	31.2	1.7	18.1	1.55	420		275.00		
Flare	20/08/2008 11:07	987	47.6	30.6	1.9	19.9	1.69	356		270.00		
Flare	20/08/2008 12:34	985	46.6	30	1.7	21.7	1.41	476		250.00		Taken with gas bag samples
Flare	20/08/2008 13:20	987	44.9	30	2	23.1	1.23	369		250.00		
Flare	20/08/2008 16:31	987	45.2	30.9	2.1	21.8	1.48	355		250.00		
Flare	21/08/2008 08:18	989	42.3	30.5	1.7	25.5	1.17	347	6.4	222.15		
Flare	21/08/2008 13:31	990	40	29.7	1.7	28.6	0.6			200.00		
Flare	21/08/2008 15:51	990	38.4	29.2	2.2	30.2	0.82			200.00		
Flare	22/08/2008 08:28	993	37.1	29.2	2	31.7	1.36	345	6	208.27	12049	
Flare	22/08/2008 09:38	992	50.8	31.1	1.7	16.4	-0.08					
Flare	22/08/2008 10:35	991	57.7	32	1.8	8.5	0.5					
Flare	22/08/2008 11:37	991	55.7	31.9	1.8	10.6	-0.28					
Flare	22/08/2008 12:15	993	46.4	30.1	1.9	21.6	-0.55					
Flare	26/08/2008 00:00		63.9	32.5	0.6		0.16	548			12080	FLARE RESTARTED
Flare	27/08/2008 08:28	997	56	32.1	1.7	10.2	0	667			12101	
Flare	27/08/2008 13:20	997	57.2	31.3	1.3		0.07			120.00		
Flare	27/08/2008 15:13	998	56.6	31.8	1.3	10.3	-0.03	624		120.00		
Flare	28/08/2008 09:17	997	56.6	31.9	1.1	10.4	0.43	633		120.00	12126	Flare on
Flare	28/08/2008 15:28	998	55.4	31.7	1	11.9	-0.18			120.00		
Flare	29/08/2008 08:50	999	56.5	31.7	1.3	10.5	-0.38			120.00		
Flare	01/09/2008 10:49	987	57	32.8	1	9.2	0.1	640	0.3	10.41	12223	Line 1 backed down to check recovery
Flare	01/09/2008 16:16	984	58.1	33.4	0.9	7.6	0.55		0.3	10.41		
Flare	02/09/2008 08:41	979	57.3	33.5	1.3	7.9	0.62	602	0.5	17.36	12245	
Flare	02/09/2008 11:42	978	57.8	32.7	0.8	8.7	-0.17		0.3	10.41		
Flare	02/09/2008 13:50	977	58	32.9	0.7	8.4	-1.22		0.5	17.36		
Flare	02/09/2008 15:10	976	58.6	33.5	0.7	7.2	-0.18		0.3	10.41		
Flare	02/09/2008 15:45	974	57.7	33.3	0.8	8.2	0.02		0.2	6.94		
Flare	03/09/2008 08:31	976	56.8	33.2	1.2	8.8	0.86	610	0.2	6.94	12269	
Flare	03/09/2008 11:27	975	57.5	33.1	0.8	8.6	-0.14	695	0.2	6.94		
Flare	03/09/2008 12:51	974	58.3	33.2	0.7	7.8	-0.32	658	0.3	10.41		
Flare	03/09/2008 14:29	972	58.3	33.6	1	7.1	0.73	647	0.2	6.94		
Flare	03/09/2008 15:46	971	58.8	33.3	0.9	7	0.21		1	34.71		
Flare	04/09/2008 08:44	974	60.2	33.8	0.9	5.1	0.73	349	1.5	52.07	12287	flare off
Flare	04/09/2008 10:39	972	60.2	33.6	0.7	5.5	1.64	568	1.1	38.18		
Flare	04/09/2008 11:22	972	60.6	33.8	0.7	4.9	0.46	580	0.5	17.36		
Flare	04/09/2008 13:54	973	60.5	34.5	1	4	0.99	582	1.4	48.60		
Flare	04/09/2008 14:42	972	58	33.4	0.8	7.8	1		1.4	48.60		
Flare	04/09/2008 15:58	973	58.7	34.3	0.7	6.3	0.46	582	1.6	55.54		
Flare	05/09/2008 08:22	970	59.5	34.5	1	5	0.65	560	1.8	62.45	12311	
Flare	05/09/2008 10:30	967	59.9	35.8	0.8	3.5	0.67	566	2	69.42		
Flare	05/09/2008 11:01	967	58.9	34.3	0.6	6.2	0.68	577	2.4	83.31		
Flare	08/09/2008 11:30	989	49.7	30.7	1.4	18.2	-0.14	616		150.00	12388	
Flare	09/09/2008 08:30	985	54.2	32.6	0.7	12.5	0.86	607	2.6	90.25	12408	
Flare	10/09/2008 09:34	986	45.6	29.4	4.8	20.2	0.68	535		150.00	12432	
Flare	10/09/2008 11:29	985	44.4	28.1	5.3	22.2	0.28	559				
Flare	10/09/2008 12:55	984	45.7	28.4	5	20.9	-0.16	671				
Flare	10/09/2008 14:50	984	53.6	31.5	1.2	13.7	-0.56	672			12438.87	
Flare	11/09/2008 08:36	976	55.6	32.1	1.4	10.9	-0.21	668				
Flare	11/09/2008 11:50	977	54.3	32.5	1.2	12	0.41	682			12459.03	
Flare	12/09/2008 08:30	988	50.9	30.7	1.6	16.8	0.16					
Flare	12/09/2008 12:04	989	47.8	29.6	2.3	20.1	0.45	648			12483.21	
Flare	15/09/2008 12:13	1002	49.1	31.9	1.5	17.5	0.21	620		100.00	12555	
Flare	16/09/2008 08:22	1001	46.7	30.7	2.9	19.7	1.21		2.6	90.25		
Flare	16/09/2008 11:05	1000	43.5	31.7	1.4	17.4	0.13		2	69.42		
Flare	16/09/2008 13:21	999	45	28.6	2.8	23.6	0.05		2.5	86.78		
Flare	17/09/2008 11:04	999	55.8	32.4	2.4	9.4	0.58	671	2.1	72.89	12598	
Flare	17/09/2008 17:14	1001	54.1	30.7	2.4	12.8	-0.31		2.1			
Flare	18/09/2008 11:05	1001	54.4	32.7	1.7	11.2	0	640	0.4	13.88	12626	
Flare	18/09/2008 13:41	1000	53.3	33.3	1.4	12	0.35			75.00		
Flare	18/09/2008 14:32	1001	52.3	32.4	1.9	13.4	0.3		2.2	76.37		
Flare	19/09/2008 08:04	1004	49.1	33.8	1.6	15.5	0.38	576	3	104.13	12647	
Flare	19/09/2008 13:48	1005	50.8	32.4	1.1	15.7	0.11		2.1	72.89		Estimate - 1.0m3/hr GEW5, 34.0m3/hr GEW6, 25m3/hr Line 2, 5m3/hr Line 1 others
Flare	22/09/2008 11:02	1004	52.5	32.8	1.4	13.3	0.56	629	2.4	83.31	12722	
Flare	22/09/2008 16:07	1003	52	32.7	1.2	14.1	0.13		2.5	86.78		
Flare	23/09/2008 08:42	1005	49.8	31.6	2	16.6	0.19	600	2.6	90.25	12743	
Flare	23/09/2008 15:35	1005	51.2	31.7	1.4	15.7	0.05		2.4	83.31		
Flare	24/09/2008 08:53	1005	50.5	31.5	1.8	16.2	0.38	610	2.2	76.37	12768	
Flare	24/09/2008 12:15	1004	52.3	32	1.4	14.3	0.7		2.5	86.78		
Flare	24/09/2008 14:14	1004	52.6	31.8	1.2	14.4	0.07		2.5	86.78		
Flare	24/09/2008 15:57	1004	52.2	31.9	1.1	14.8	-0.09		2.8	97.19		
Flare	25/09/2008 08:41	1010	52.2	32	1.6	14.2	0.17	621	3.1	107.61	12791	
Flare	25/09/2008 10:59	1010	52.4	32.1	1.4	14.1	0.27		3	104.13		
Flare	25/09/2008 16:11	1010	52.4	31.6	0.9	15.1	0.16			90.00		
Flare	26/09/2008 08:42	1013	51.5	31.4	1.7	15.4	0.11	580	2.5	86.78	12815	estimate - similar to 19th.
Flare	26/09/2008 11:38	1011	58.1	30.5	0.9	10.5	0.64					


FLARE HOURS
12900
12800
12700
12600
12500
12400
12300
12200
12100
12000
11900
Hours
15/08/2008 00:00
20/08/2008 00:00
25/08/2008 00:00
30/08/2008 00:00
04/09/2008 00:00
09/09/2008 00:00
14/09/2008 00:00
19/09/2008 00:00
24/09/2008 00:00
29/09/2008 00:00
Date/Time
FLARE HOURS


Flare Graph
Gas Concentration (%vol):Relative Pressure (mb)
Gas Flow (m3/hr)
70
60
50
40
30
20
10
0
600.00
500.00
400.00
300.00
200.00
100.00
0.00
15/08/2008 00:00
20/08/2008 00:00
25/08/2008 00:00
30/08/2008 00:00
04/09/2008 00:00
09/09/2008 00:00
14/09/2008 00:00
19/09/2008 00:00
24/09/2008 00:00
29/09/2008 00:00
Time/Date
CH4(%)
CO2(%)
O2(%)
BALANCE OF REMAINING GASES (%)
FLOW (m³/hr)

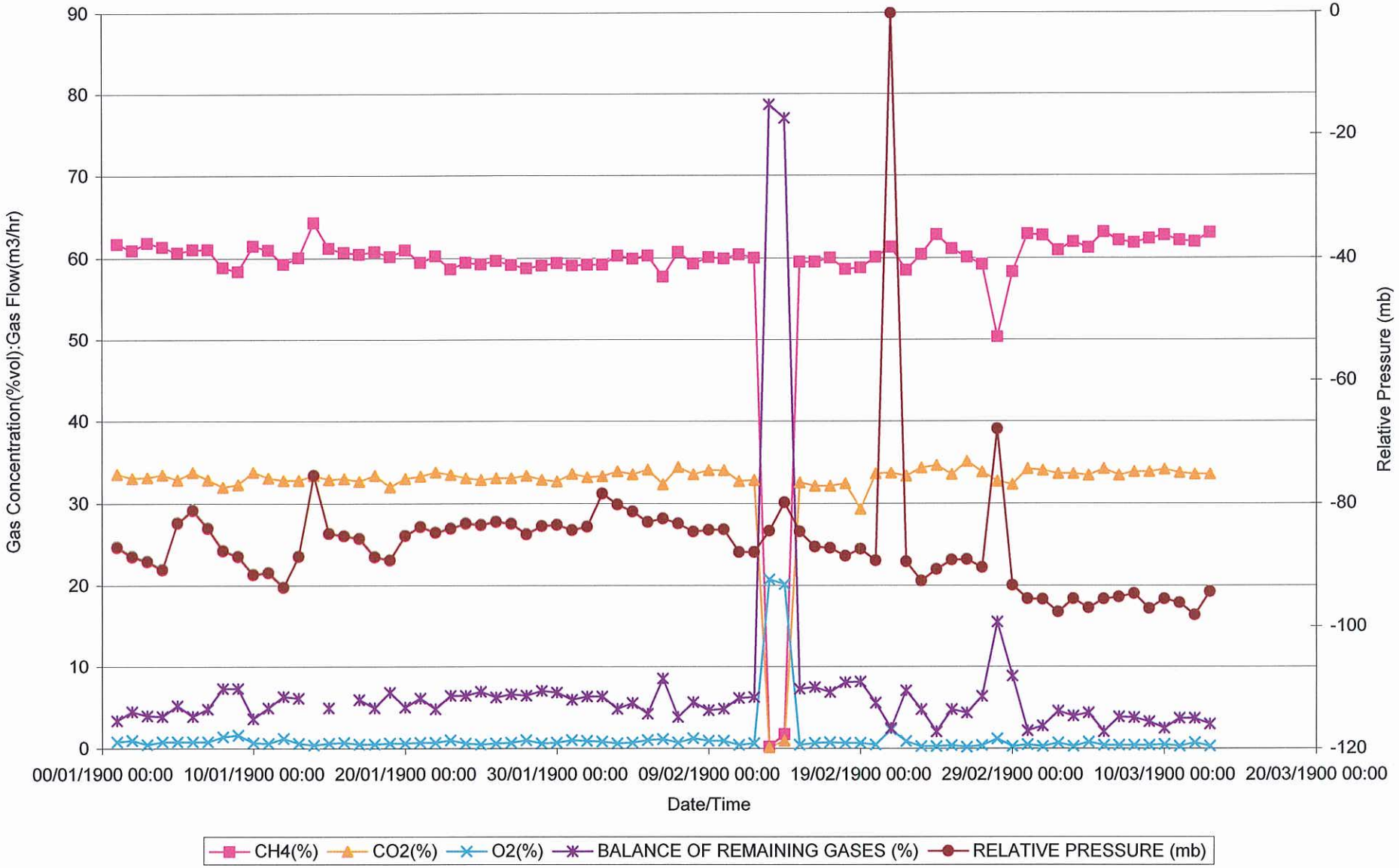
BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL								3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH4(%)	CO2(%)	O2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	ADJUSTED PRESSURE (mb)	COMMENTS
Line 1	19/08/2008 10:04	976	62.2	34.5	0.9	2.4	-80.84		
Line 1	19/08/2008 10:55	977	61	34.1	0.9	4	-83.7		
Line 1	19/08/2008 12:44	977	56.7	32.8	1.6	8.9	-85.12		
Line 1	19/08/2008 14:29	978	53.1	31.5	2.4	13	-86.72		
Line 1	19/08/2008 15:43	978	48.4	28.8	4	18.8	-65.78		
Line 1	20/08/2008 08:58	986	44.3	30.3	2.1	23.3	-68.9		
Line 1	20/08/2008 10:23	984	45.6	30.8	1.8	21.8	-72.29		
Line 1	20/08/2008 13:23	987	41.3	29.4	2.3	27	-76.58		
Line 1	20/08/2008 16:34	987	42.6	31.1	1.8	24.5	-79.18		
Line 1	21/08/2008 08:22	988	37.2	29.7	1.8	31.3	-81		
Line 1	21/08/2008 13:33	990	34.7	28.2	1.9	35.2	-81.63		
Line 1	21/08/2008 15:53	990	33.5	28.1	2.3	36.1	-81.7		
Line 1	22/08/2008 08:31	992	31.1	28.2	1.9	38.8	-84		
Line 1	22/08/2008 09:40	992	29.7	26.7	2.7	40.9	-94.46		
Line 1	22/08/2008 10:38	992	30.3	24.5	3.9	41.3	-2.56	-9.89	INCREASED LINE 2 VALVE
Line 1	22/08/2008 11:39	992	11.4	10.1	13.7	64.8	-4.19		
Line 1	22/08/2008 11:42	992	9.7	8.2	15.2	66.9	-17.76		
Line 1	22/08/2008 12:17	993	32.7	26.6	3.3	37.4	-22.46		
Line 1	26/08/2008 00:00		64.9	33.2	0.7		-18.42		cloudy mild dry
Line 1	27/08/2008 08:29	997	50.8	31.5	2.9	14.8	-15.4		
Line 1	27/08/2008 13:23		53.2	30.8	1.5		-7.36		
Line 1	27/08/2008 15:15	998	51.4	30.5	1.4	16.7	-8.14		
Line 1	28/08/2008 09:18	997	51	31.1	1.3	16.6	-7.94		
Line 1	28/08/2008 15:29	998	44.7	28	2.8	24.5	-6.68		
Line 1	29/08/2008 08:53	998	49.7	30.8	1.1	18.4	-6.38		
Line 1	01/09/2008 10:53	987	53.5	32.3	0.7	13.5	-6.76		
Line 1	01/09/2008 16:18	984	54.3	33	0.8	11.9	-4.87		
Line 1	02/09/2008 08:44	978	55	32.8	1.1	11.1	-5.76		
Line 1	02/09/2008 11:44	978	56.1	33	0.6	10.3	-4.82		
Line 1	02/09/2008 13:53	977	55.9	33.1	0.5	10.5	-4.54		
Line 1	02/09/2008 15:12	975	56.7	33.2	0.5	9.6	-3.79		
Line 1	02/09/2008 15:47	975	56.1	33.1	0.7	10.1	-3.67		
Line 1	03/09/2008 08:34	976	53.2	33	1.1	12.7	-4.92		
Line 1	03/09/2008 11:30	976	56.4	33.1	0.5	10	-3.35		
Line 1	03/09/2008 12:54	975	57.3	33.4	0.4	8.9	-2.82		
Line 1	03/09/2008 14:32	973	57.4	33.8	0.7	8.1	-2.24		
Line 1	03/09/2008 15:49	972	58.2	33.8	0.6	7.4	-2.5		
Line 1	04/09/2008 08:48	974	59.1	34.6	0.4	5.9	0.37		
Line 1	04/09/2008 10:42	973	60.6	34.6	0.6	4.2	-1.66		
Line 1	04/09/2008 11:24	973	61	34.4	0.4	4.2	-0.51	-2.01	increased
Line 1	04/09/2008 13:57	973	59.2	35	0.6	5.2	-2.22		
Line 1	04/09/2008 14:48	974	58.5	34.7	0.3	6.5	-2.71		
Line 1	04/09/2008 16:01	974	56.9	33.9	0.4	8.8	-2.63		
Line 1	05/09/2008 08:25	970	58.7	34.5	0.5	6.3	-1.02		
Line 1	05/09/2008 10:33	968	59.5	35	0.4	5.1	-2.25		
Line 1	05/09/2008 11:04	967	59.2	34.8	0.5	5.5	-1.29		
Line 1	08/09/2008 11:33	989	41.7	29.1	1.5	27.7	-5.4		
Line 1	09/09/2008 08:35	985	52.6	32.6	0.7	14.1	-4.72	-16.72	
Line 1	10/09/2008 09:37	986	22	14.9	12.1	51	-20.66		
Line 1	10/09/2008 11:32	985	14.6	9.4	15.3	60.7	-28.02	-15.01	
Line 1	10/09/2008 12:58	985	26.6	17.3	10.5	45.6	-11.35		
Line 1	10/09/2008 14:52	984	46.3	30.5	1.3	21.9	-10.89		
Line 1	11/09/2008 08:38	976	51.4	31.6	1.5	15.5	-11.21		
Line 1	11/09/2008 11:52	977	50.3	32.5	1.1	16.1	-14.42		
Line 1	12/09/2008 08:32	988	42.8	30.1	1.9	25.2	-12.75		
Line 1	12/09/2008 12:06	989	41.7	28.1	2.5	27.4	-26.47		
Line 1	15/09/2008 12:15	1001	42.5	30.9	2.2	24.4	-23.85		
Line 1	15/09/2008 13:26	1001	42.9	29.4	2.3	25.4	-27.19		
Line 1	15/09/2008 14:26	1000	43.1	28.1	2.8	26	-23.88		
Line 1	15/09/2008 16:03	1001	42.9	29.2	2.3	25.6	-34.78		
Line 1	16/09/2008 08:24	1001	39.1	28.1	3.8	29	-32.38		
Line 1	16/09/2008 08:49	1001	43.1	30	2.4	24.5	-41.6		
Line 1	16/09/2008 10:01	999	46.1	30.7	2.3	20.9	-49.42		
Line 1	16/09/2008 11:02	1000	44.1	30.3	2.2	23.4	-50.59		
Line 1	17/09/2008 11:08	999	47.3	28.2	3.8	20.7	-78.62		
Line 1	17/09/2008 17:16	999	46.6	27.2	4.2	21.8	-82.55		
Line 1	18/09/2008 11:07	1001	48.8	31	2.6	17.6	-79.55		
Line 1	18/09/2008 13:38	1000	50.9	31.7	1.5	15.9	-52.53		
Line 1	18/09/2008 14:35	1001	51.4	32.3	1.2	15.1	-41.31		
Line 1	18/09/2008 16:38	1000	50.2	33.2	1.6	15	-77.09		
Line 1	18/09/2008 16:40	1000	58.7	34.1	0.5	6.7	-91.9		
Line 1	19/09/2008 09:42	1004	48.2	33	1.2	17.6	-79.5		Backed down slightly
Line 1	19/09/2008 09:51	1004	47.3	32.6	1.3	18.8	-58.81		
Line 1	19/09/2008 13:51	1005	47.5	33	1.2	18.3	-43.49		
Line 1	19/09/2008 13:53	1005	47.2	32.1	1.2	19.5	-43.42		
Line 1	22/09/2008 11:07	1004	47.7	32	1.6	18.7	-46.73		
Line 1	22/09/2008 16:09	1003	47.4	31.6	1.5	19.5	-46.45		
Line 1	23/09/2008 08:45	1005	44.8	30.4	2.6	22.2	-47.49		
Line 1	23/09/2008 15:38	1004	46.1	31	1.8	21.1	-47.05		
Line 1	24/09/2008 08:56	1004	45.8	30.5	2.3	21.4	-45.78		
Line 1	24/09/2008 12:17	1003	47.6	31.5	1.5	19.4	-44.01		
Line 1	24/09/2008 14:16	1004	47.8	31	1.4	19.8	-43.23		
Line 1	24/09/2008 15:59	1004	47.8	31.3	1.4	19.5	-45.11		
Line 1	25/09/2008 08:43	1010	47.4	30.8	1.9	19.9	-47.59		
Line 1	25/09/2008 11:03	1010	48	31.1	1.7	19.2	-46.68		
Line 1	25/09/2008 16:14	1010	48	30.9	1.3	19.8	-43.61		
Line 1	26/09/2008 08:45	1013	46.6	30.5	2.1	20.8	-49.05		
Line 1	26/09/2008 11:41	1012	54.5	29.3	1.1	15.1	-38.16		

Line 1 Graph


Gas Concentration(%vol):Gas Flow(m3/hr)
Relative Pressure (mb)
80
70
60
50
40
30
20
10
0
20
0
-20
-40
-60
-80
-100
15/08/2008 00:00
20/08/2008 00:00
25/08/2008 00:00
30/08/2008 00:00
04/09/2008 00:00
09/09/2008 00:00
14/09/2008 00:00
19/09/2008 00:00
24/09/2008 00:00
29/09/2008 00:00
Date/Time
CH4(%)
CO2(%)
O2(%)
BALANCE OF REMAINING GASES (%)
RELATIVE PRESSURE (mb)

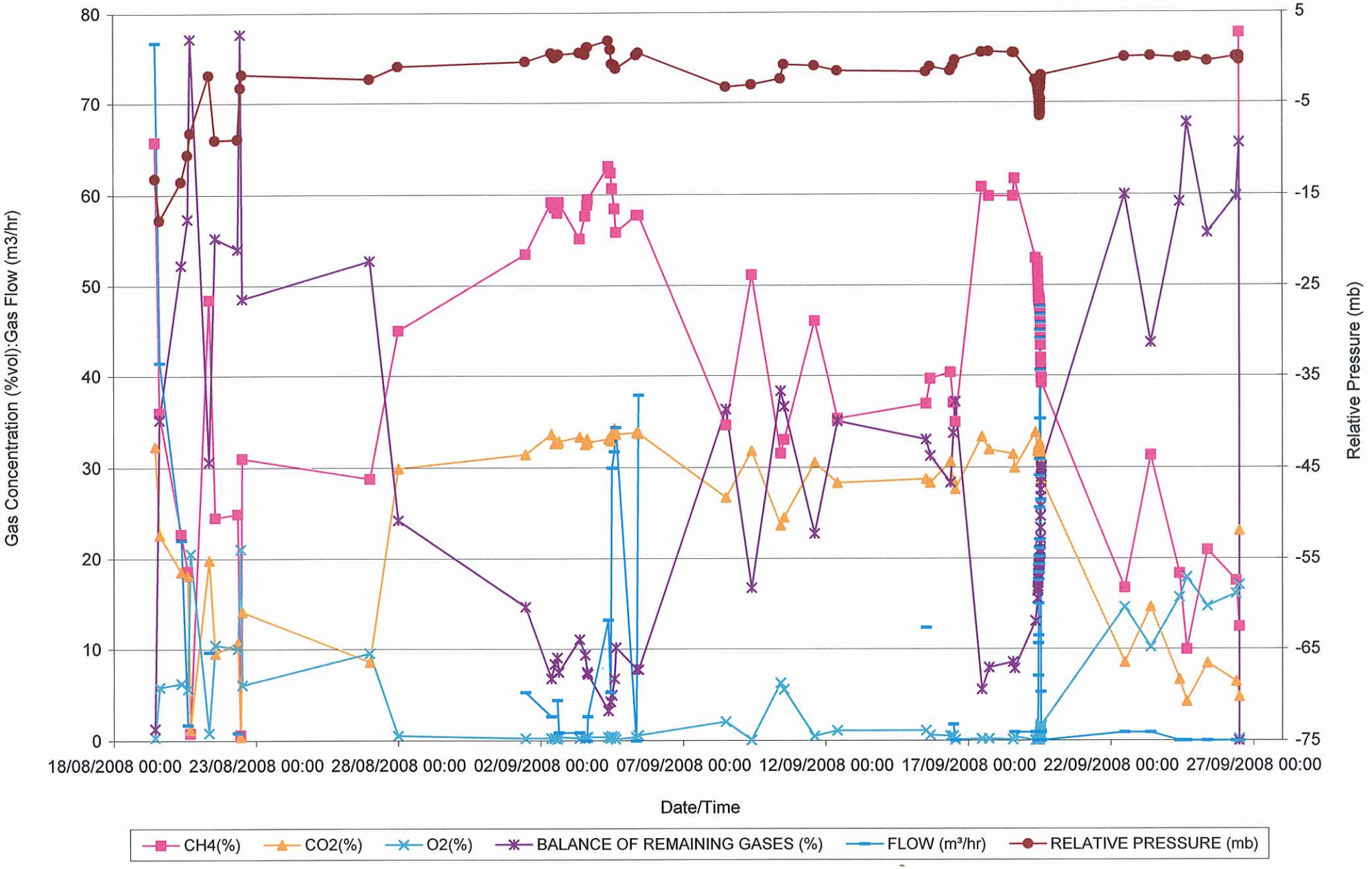
BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL								3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH4(%)	CO2(%)	O2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	ADJUSTED PRESSURE (mb)	COMMENTS
Line 2	19/08/2008 10:06	976	61.9	33.7	0.9	3.5	-86.96		
Line 2	19/08/2008 10:56	977	61.1	33.2	1.1	4.6	-88.5		
Line 2	19/08/2008 12:45	977	62	33.3	0.6	4.1	-89.28		
Line 2	19/08/2008 14:30	978	61.5	33.6	0.9	4	-90.6		
Line 2	19/08/2008 15:45	978	60.8	33	0.9	5.3	-83.02		
Line 2	20/08/2008 09:00	986	61.2	33.9	0.9	4	-80.99		
Line 2	20/08/2008 10:24	984	61.2	33	0.9	4.9	-83.89		
Line 2	20/08/2008 13:25	987	59	32.1	1.5	7.4	-87.55		
Line 2	20/08/2008 16:38	986	58.5	32.4	1.7	7.4	-88.5		
Line 2	21/08/2008 08:24	988	61.6	33.9	0.8	3.7	-91.43		
Line 2	21/08/2008 13:36	990	61.1	33.2	0.7	5	-91.12		
Line 2	22/08/2008 08:34	992	59.4	32.9	1.3	6.4	-93.52		
Line 2	22/08/2008 12:20	993	60.2	32.9	0.7	6.2	-88.5		
Line 2	26/08/2008 00:00		64.4	33.5	0.5		-75.36		
Line 2	27/08/2008 08:30	997	61.3	33	0.7	5	-84.76		
Line 2	27/08/2008 13:25	997	60.8	33.1	0.8		-85.17		
Line 2	27/08/2008 15:16	998	60.6	32.8	0.6	6	-85.6		
Line 2	28/08/2008 09:19	997	60.9	33.5	0.6	5	-88.58		
Line 2	28/08/2008 15:30	998	60.3	32.1	0.7	6.9	-89.08		
Line 2	29/08/2008 08:54	998	61.1	33.1	0.7	5.1	-85.12		
Line 2	01/09/2008 10:56	987	59.6	33.4	0.8	6.2	-83.65		
Line 2	01/09/2008 16:20	984	60.4	33.9	0.8	4.9	-84.61		
Line 2	02/09/2008 08:46	978	58.8	33.6	1.1	6.5	-83.95		
Line 2	02/09/2008 11:47	978	59.6	33.2	0.7	6.5	-83.11		
Line 2	02/09/2008 13:55	977	59.4	33	0.6	7	-83.34		
Line 2	02/09/2008 15:15	976	59.8	33.2	0.7	6.3	-82.86		
Line 2	02/09/2008 15:49	975	59.3	33.2	0.8	6.7	-83.15		
Line 2	03/09/2008 08:37	976	58.9	33.5	1.1	6.5	-84.88		
Line 2	03/09/2008 11:32	976	59.2	33	0.7	7.1	-83.54		
Line 2	03/09/2008 12:57	975	59.5	32.8	0.8	6.9	-83.34		
Line 2	03/09/2008 14:35	973	59.2	33.7	1.1	6	-84.2		
Line 2	03/09/2008 15:51	972	59.3	33.3	1	6.4	-83.67		
Line 2	04/09/2008 08:51	974	59.3	33.4	0.9	6.4	-78.33		
Line 2	04/09/2008 10:45	973	60.4	34	0.7	4.9	-80.1		
Line 2	04/09/2008 11:27	973	60	33.6	0.8	5.6	-81.25		
Line 2	04/09/2008 14:01	973	60.4	34.2	1.1	4.3	-82.92		
Line 2	04/09/2008 14:53	974	57.8	32.4	1.2	8.6	-82.36		
Line 2	04/09/2008 16:04	974	60.8	34.5	0.8	3.9	-83.16		
Line 2	05/09/2008 08:28	970	59.4	33.6	1.3	5.7	-84.49		
Line 2	05/09/2008 10:35	968	60.2	34.1	1	4.7	-84.21		
Line 2	05/09/2008 11:06	967	60	34.1	1	4.9	-84.15		
Line 2	08/09/2008 11:37	989	60.5	32.8	0.5	6.2	-87.84		
Line 2	09/09/2008 08:40	985	60.1	32.9	0.7	6.3	-87.84		
Line 2	10/09/2008 11:35	985	0.3	0.2	20.8	78.7	-84.36		
Line 2	10/09/2008 13:00	985	1.8	1	20.2	77	-79.78		
Line 2	10/09/2008 14:56	984	59.6	32.6	0.5	7.3	-84.5		
Line 2	11/09/2008 08:40	976	59.6	32.2	0.7	7.5	-86.98		
Line 2	11/09/2008 11:56	977	60.1	32.2	0.8	6.9	-87.17		
Line 2	12/09/2008 08:36	988	58.7	32.5	0.7	8.1	-88.44		
Line 2	12/09/2008 12:10	989	58.9	29.4	0.7	8.2	-87.33		
Line 2	15/09/2008 12:17	1002	60.2	33.7	0.5	5.6	-89.22		
Line 2	15/09/2008 12:19	1002	61.4	33.8	2.3	2.5	-0.11		
Line 2	16/09/2008 08:25	1001	58.6	33.4	0.9	7.1	-89.36		
Line 2	16/09/2008 11:03	1000	60.5	34.4	0.3	4.8	-92.5		
Line 2	17/09/2008 11:11	999	62.9	34.7	0.3	2.1	-90.62		
Line 2	17/09/2008 17:19	999	61.2	33.6	0.4	4.8	-89.08		
Line 2	18/09/2008 11:08	1001	60.2	35.2	0.2	4.4	-89.01		
Line 2	18/09/2008 14:36	1001	59.3	33.9	0.4	6.4	-90.32		
Line 2	18/09/2008 14:39	1001	50.4	32.8	1.2	15.6	-67.82		
Line 2	19/09/2008 13:54	1005	58.4	32.4	0.3	8.9	-93.23		
Line 2	22/09/2008 11:10	1004	63	34.3	0.5	2.2	-95.4		
Line 2	22/09/2008 16:12	1002	62.8	34.1	0.3	2.8	-95.49		
Line 2	23/09/2008 08:48	1004	61	33.7	0.7	4.6	-97.56		
Line 2	23/09/2008 15:41	1003	62	33.7	0.3	4	-95.42		
Line 2	24/09/2008 09:00	1004	61.3	33.5	0.8	4.4	-96.92		
Line 2	24/09/2008 12:21	1004	63.2	34.3	0.4	2.1	-95.45		
Line 2	24/09/2008 14:19	1004	62.2	33.5	0.4	3.9	-95.15		
Line 2	24/09/2008 16:02	1004	61.9	33.9	0.4	3.8	-94.6		
Line 2	25/09/2008 08:46	1010	62.4	33.9	0.4	3.3	-97.02		
Line 2	25/09/2008 11:06	1010	62.8	34.2	0.5	2.5	-95.45		
Line 2	25/09/2008 16:16	1010	62.2	33.8	0.3	3.7	-96.07		
Line 2	26/09/2008 08:47	1013	62	33.6	0.7	3.7	-98.1		
Line 2	26/09/2008 11:44	1012	63.1	33.6	0.3	3	-94.27		

Line 2 Graph


Gas Concentration(%vol):Gas Flow(m3/hr)
Relative Pressure (mb)
90
80
70
60
50
40
30
20
10
0
0
-20
-40
-60
-80
-100
-120
00/01/1900 00:00
10/01/1900 00:00
20/01/1900 00:00
30/01/1900 00:00
09/02/1900 00:00
19/02/1900 00:00
29/02/1900 00:00
10/03/1900 00:00
20/03/1900 00:00
Date/Time
CH4(%)
CO2(%)
O2(%)
BALANCE OF REMAINING GASES (%)
RELATIVE PRESSURE (mb)

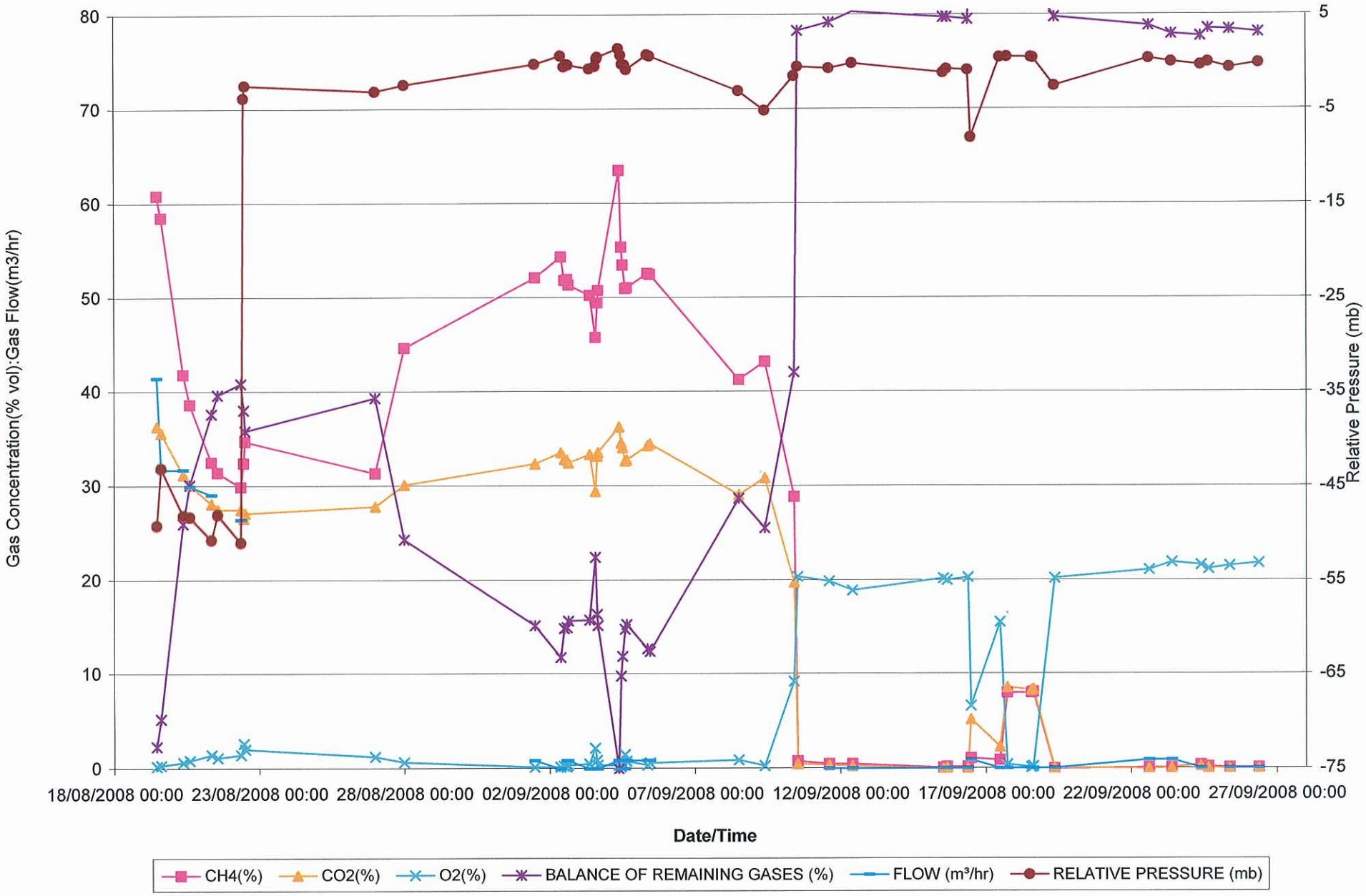
BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL											3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m³/hr)	ADJUSTED PRESSURE (mb)	COMMENTS
GEW 1	19/08/2008 11:04	976	65.8	32.4	0.4	1.4	-13.18	16	8.7	76.75		
GEW 1	19/08/2008 14:42	978	36.1	22.7	5.9	35.3	-17.74		4.7	41.46	-16.1	
GEW 1	20/08/2008 09:08	986	22.8	18.6	6.3	52.3	-13.52		2.5	22.05	-12.8	
GEW 1	20/08/2008 14:33	987	18.7	18.2	5.7	57.4	-10.6		0.2	1.76	-8.2	
GEW 1	20/08/2008 16:50	986	0.9	1.3	20.6	77.2	-8.23					
GEW 1	21/08/2008 08:36	988	48.5	19.9	0.9	30.7	-1.86		1.1	9.70		
GEW 1	21/08/2008 13:43	990	24.6	9.6	10.5	55.3	-9	14.7				
GEW 1	22/08/2008 08:46	991	25	10.8	10.1	54.1	-8.91	14.6	0.1	0.88	-5	
GEW 1	22/08/2008 11:09	992	0.7	0.5	21.1	77.7	-3.26				off	
GEW 1	22/08/2008 12:24	993	31.1	14.2	6.1	48.6	-1.78					
GEW 1	27/08/2008 00:00	997	28.9	8.7	9.6	52.8	-2.3				-1	
GEW 1	28/08/2008 00:00	998	45.1	30	0.6	24.3	-0.9					
GEW 1	01/09/2008 11:16	986	53.5	31.5	0.3	14.7	-0.38	25.5	0.6	5.29		
GEW 1	02/09/2008 08:59	977	59.2	33.7	0.3	6.8	0.54	17.5	0.3	2.65		
GEW 1	02/09/2008 11:55	978	58.6	32.7	0.3	8.4	0.03					
GEW 1	02/09/2008 14:03	977	58	32.7	0.2	9.1	0.25		0.5	4.41	0.18	Increased 1/4 turn
GEW 1	02/09/2008 15:20	976	59.2	32.9	0.4	7.5	0.4		0.1	0.88		
GEW 1	03/09/2008 08:49	976	55.2	33.4	0.3	11.1	0.58	13.7	0.1	0.88		
GEW 1	03/09/2008 13:26	973	57.7	32.6	0.3	9.4	0.39					Increased
GEW 1	03/09/2008 15:08	971	58.9	33.2	0.4	7.5	1.18		0	0.00		
GEW 1	03/09/2008 15:41	971	59.5	32.8	0.4	7.3	1.21		0.3	2.65		
GEW 1	04/09/2008 09:01	973	63.1	33.2	0.4	3.3	1.93	14.8	1.5	13.23		
GEW 1	04/09/2008 10:56	973	62.4	33	0.3	4.3	0.94		0.6	5.29		
GEW 1	04/09/2008 12:04	973	60.7	33.8	0.5	5	-0.66		3.4	29.99		
GEW 1	04/09/2008 14:09	973	58.5	34.3	0.4	6.8	-0.77		3.6	31.76		
GEW 1	04/09/2008 15:23	973	55.9	33.7	0.2	10.2	-1.19		3.9	34.40		
GEW 1	05/09/2008 08:36	970	57.8	33.9	0.4	7.9	0.35	12.9	0	0.00		
GEW 1	05/09/2008 10:20	968	57.8	33.8	0.6	7.8	0.58		4.3	37.93		
GEW 1	08/09/2008 11:58	989	34.7	26.8	2.1	36.4	-3.22				-2.44	
GEW 1	09/09/2008 09:35	985	51.2	31.9	0.1	16.8	-2.99					
GEW 1	10/09/2008 09:49	986	31.6	23.7	6.3	38.4	-2.35				-2.2	
GEW 1	10/09/2008 12:51	984	33.1	24.6	5.6	36.7	-0.75					
GEW 1	11/09/2008 14:36	984	46.1	30.6	0.5	22.8	-0.88					
GEW 1	12/09/2008 09:44	988	35.4	28.4	1.1	35.1	-1.47					
GEW 1	15/09/2008 12:25	1000	37	28.8	1.1	33.1	-1.58		1.4	12.35	-1.49	
GEW 1	15/09/2008 15:49	1000	39.7	28.4	0.6	31.3	-1.01					
GEW 1	16/09/2008 08:56	1000	40.4	30.7	0.5	28.4	-1.5				-1.1	
GEW 1	16/09/2008 11:13	1000	37.1	28.6	0.5	33.8	-0.94		0.2	1.76	-0.7	
GEW 1	16/09/2008 12:57	999	35	27.7	0.1	37.2	-0.3		0	0.00		
GEW 1	17/09/2008 11:17	999	60.8	33.4	0.2	5.6	0.57					
GEW 1	17/09/2008 17:25	999	59.8	32	0.2	8	0.62					
GEW 1	18/09/2008 13:34	1000	59.8	31.5	0.1	8.6	0.51					
GEW 1	18/09/2008 14:51	1001	61.7	30	0.4	7.9	0.49		0.1	0.88		Left low flow pre peak test
GEW 1	19/09/2008 08:23	1004	53	33.9	0	13.1	-2.5		0.1	0.88		
GEW 1	19/09/2008 10:12	1003	52.6	31.8	0	15.6	-2.91	26.2	0	0.00		Peak Flow Test
GEW 1	19/09/2008 10:17	1003	51.7	31.9	0	16.4	-3.05	25.3	0	0.00		Peak Flow Test
GEW 1	19/09/2008 10:22	1003	51.5	31.9	0	16.6	-2.94	25.4	0	0.00		Peak Flow Test
GEW 1	19/09/2008 10:27	1003	50.9	32.2	0	16.9	-3.08	27.7	0	0.00		Peak Flow Test
GEW 1	19/09/2008 10:32	1003	50.6	32.1	0	17.3	-3.25	31	0.8	7.06		Peak Flow Test
GEW 1	19/09/2008 10:37	1003	50.4	31.9	0	17.7	-3.22	31.4	0.8	7.06		Peak Flow Test
GEW 1	19/09/2008 10:42	1003	49.8	32.2	0	18	-3.14	27.7	0.8	7.06		Peak Flow Test
GEW 1	19/09/2008 10:47	1003	49.3	32	0	18.7	-3.22	23.8	0.8	7.06		Peak Flow Test
GEW 1	19/09/2008 10:52	1003	49.2	32.5	0	18.3	-3.35	22.3	1.2	10.59		Peak Flow Test
GEW 1	19/09/2008 10:57	1003	49	32.2	0	18.8	-3.41	21	1.3	11.47		Peak Flow Test
GEW 1	19/09/2008 11:02	1003	48.7	32	0	19.3	-3.68	20.2	1.7	15.00		Peak Flow Test
GEW 1	19/09/2008 11:07	1004	48.5	32.2	0	19.3	-3.71	19.9	2	17.64		Peak Flow Test
GEW 1	19/09/2008 11:12	1003	48.3	32	0	19.7	-3.94	21.4	2.1	18.53		Peak Flow Test
GEW 1	19/09/2008 11:17	1003	48.2	32	0	19.8	-4.09	24.7	2.2	19.41		Peak Flow Test
GEW 1	19/09/2008 11:22	1004	48.6	32.5	0	18.9	-3.87	27.1	2.3	20.29		Peak Flow Test
GEW 1	19/09/2008 11:27	1003	48.6	32.5	0	18.9	-4.02	28.7	2.3	20.29		Peak Flow Test
GEW 1	19/09/2008 11:32	1003	48.2	32.3	0	19.5	-3.94	28.6	2.4	21.17		Peak Flow Test
GEW 1	19/09/2008 11:37	1004	48.1	32.2	0	19.7	-3.96	28.6	2.5	22.05		Peak Flow Test
GEW 1	19/09/2008 11:42	1003	48.3	32.4	0	19.3	-4.11	28.5	2.9	25.58		Peak Flow Test
GEW 1	19/09/2008 11:47	1003	48	32.3	0.2	19.5	-4.52	29.2	3.3	29.11		Peak Flow Test
GEW 1	19/09/2008 11:52	1004	48.2	32.7	0.2	18.9	-4.57	29.7	3.5	30.88		Peak Flow Test
GEW 1	19/09/2008 11:57	1004	47.9	32.1	0.2	19.8	-5.16	28	4	35.29		Peak Flow Test
GEW 1	19/09/2008 12:02	1004	47.7	32.1	0.3	19.9	-5.58	27.8	4.6	40.58		Peak Flow Test
GEW 1	19/09/2008 12:07	1004	47.4	31.5	0.4	20.7	-6.11	28.3	5.1	44.99		Peak Flow Test
GEW 1	19/09/2008 12:12	1004	47	31.7	0.5	20.8	-6.13	28.4	5	44.11		Peak Flow Test
GEW 1	19/09/2008 12:17	1004	46.7	31.6	0.7	21	-6.49	26	5.4	47.64		Peak Flow Test
GEW 1	19/09/2008 12:22	1004	46.8	31.8	0.8	20.6	-6.34	26.9	5.4	47.64		Peak Flow Test
GEW 1	19/09/2008 12:27	1004	45.8	31.6	0.9	21.7	-6.31	27.8	5.3	46.75		Peak Flow Test
GEW 1	19/09/2008 12:32	1004	45.4	31.3	1.1	22.2	-6.18	28.8	5.2	45.87		Peak Flow Test
GEW 1	19/09/2008 12:37	1004	44.2	31.1	1.3	23.4	-5.8	29.3	4.6	40.58		Peak Flow Test
GEW 1	19/09/2008 12:42	1004	43.4	30.5	1.4	24.7	-5.27	29.3	4	35.29		Peak Flow Test
GEW 1	19/09/2008 12:47	1004	42	30.7	1.5	25.8	-4.66	30.8	3	26.46		Peak Flow Test
GEW 1	19/09/2008 12:52	1004	41.6	30.1	1.5	26.8	-3.46	31.8	0.6	5.29		Peak Flow Test
GEW 1	19/09/2008 12:57	1004	40.7	30.1	1.6	27.6	-2.96	31.8	0.1	0.88		Peak Flow Test
GEW 1	19/09/2008 13:02	1004	40.4	29.6	1.6	28.4	-2.74	31.8	0.1	0.88		Peak Flow Test
GEW 1	19/09/2008 13:07	1004	39.8	29.6	1.6	29	-2.41	30.5	0.1	0.88		Peak Flow Test
GEW 1	19/09/2008 13:12	1004	39.7	28.7	1.7	29.9	-2.24	28.2	0.1	0.88		Peak Test - closed for recovery
GEW 1	19/09/2008 13:17	1005	39.4	28.9	1.7	30	-2.16	26.1	0	0.00		Cracked open - very low flow
GEW 1	19/09/2008 13:22	1004	39.7	29	1.7	29.6	-2.03	25.4	0	0.00		Cracked open - very low flow
GEW 1	19/09/2008 13:27	1005	39.3	28.8	1.7	30.2	-1.99	25.2	0	0.00		Cracked open - very low flow
GEW 1	22/09/2008 11:26	1004	16.8	8.6	14.6	60	0.06	19.9	0.1	0.88		Cracked open - very low flow
GEW 1	23/09/2008 09:11	1003	31.4	14.7	10.2	43.7	0.14	9.6	0.1	0.88		Cracked open - very low flow
GEW 1	24/09/2008 09:20	1004	18.4	6.7	15.7	59.2	-0.06	13.1	0	0.00		Cracked open - very low flow
GEW 1	24/09/2008 15:27	1003	10	4.3	17.9	67.8	0.04		0	0.00		Cracked open - very low flow
GEW 1	25/09/2008 08:54	1009	21	8.5	14.7	55.8	-0.4	15	0	0.00		Cracked open - very low flow
GEW 1	26/09/2008 08:56	1013	17.6	6.5	16.1	59.8	0.08	10.1	0	0.00		Cracked open - very low flow
GEW 1	26/09/2008 11:31	1011	12.5	4.8	17.1	65.6	0.12		0	0.00		Cracked open - very low flow
GEW 1	26/09/2008 11:33	1011	77.7	23.1	0.2	0	-0.32		0	0.00		Pump failure - gas stripped

GEW 1 Gas Graph

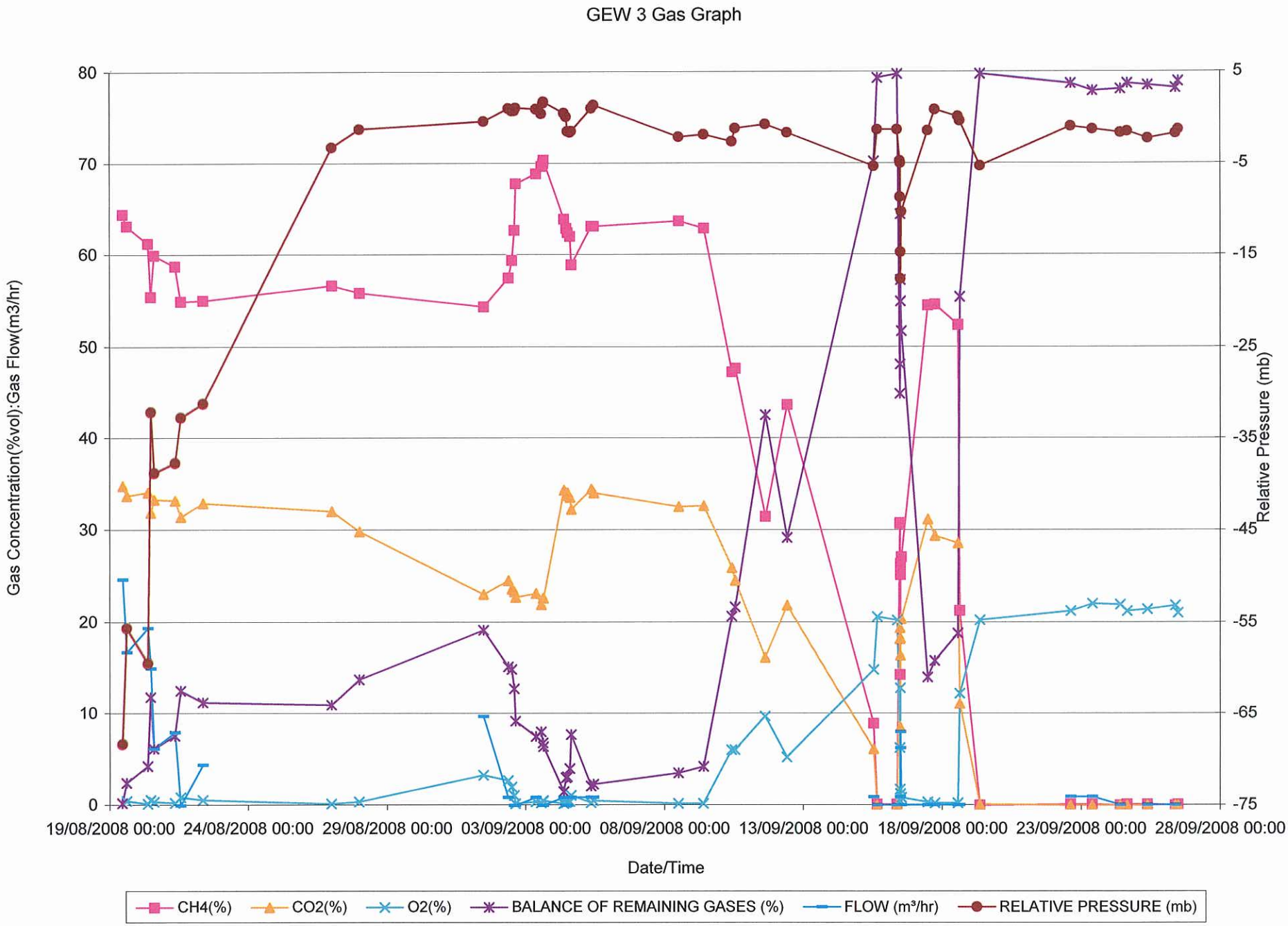


BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL											3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m^3/hr)	ADJUSTED PRESSURE (mb)	COMMENTS
GEW 2	19/08/2008 11:15	976	60.9	36.4	0.3	2.4	-49.14	16.2	4.7	41.46		
GEW 2	19/08/2008 14:58	977	58.6	35.7	0.4	5.3	-43.1		3.6	31.76		
GEW 2	20/08/2008 09:17	986	41.9	31.3	0.7	26.1	-48.1		3.6	31.76	-46	
GEW 2	20/08/2008 14:38	986	38.7	30.2	0.9	30.2	-48.24		3.4	29.99		
GEW 2	21/08/2008 08:41	988	32.6	28.2	1.5	37.7	-50.64		3.3	29.11	-48.2	
GEW 2	21/08/2008 13:48	989	31.5	27.6	1.2	39.7	-47.99	14.9				
GEW 2	22/08/2008 08:52	991	30	27.6	1.5	40.9	-50.93	16.5	3	26.46	-5	
GEW 2	22/08/2008 11:13	992	32.5	26.7	2.7	38.1	-3.81					
GEW 2	22/08/2008 12:27	991	34.8	27.2	2.1	35.9	-2.47					
GEW 2	27/08/2008 00:00	997	31.4	27.9	1.3	39.4	-3.1				-1.4	
GEW 2	28/08/2008 00:00	998	44.7	30.2	0.7	24.4	-2.4					
GEW 2	01/09/2008 11:46	986	52.2	32.4	0.2	15.2	-0.21	21.5	0.1	0.88		
GEW 2	02/09/2008 09:05	977	54.4	33.6	0.2	11.8	0.68	15.4	0	0.00		
GEW 2	02/09/2008 11:59	976	51.9	32.9	0.3	14.9	-0.51					
GEW 2	02/09/2008 14:07	975	52	32.8	0.2	15	-0.25		0.1	0.88	-0.44	increased 1/4 turn
GEW 2	02/09/2008 15:24	974	51.4	32.5	0.4	15.7	-0.31		0.1	0.88		
GEW 2	03/09/2008 08:53	975	50.3	33.4	0.5	15.8	-0.72	12.9	0	0.00		
GEW 2	03/09/2008 13:30	973	45.8	29.5	2.2	22.5	-0.47					
GEW 2	03/09/2008 15:11	971	49.5	33.2	0.9	16.4	0.36		0	0.00		
GEW 2	03/09/2008 15:38	971	50.8	33.6	0.4	15.2	0.52		0	0.00		
GEW 2	04/09/2008 09:06	972	63.5	36.3	0.4	0	1.43	15.7	0.1	0.88		
GEW 2	04/09/2008 11:00	972	55.4	34.6	0.2	9.8	0.71		0	0.00		
GEW 2	04/09/2008 12:07	972	53.5	34.1	0.5	11.9	-0.23		0	0.00		
GEW 2	04/09/2008 14:13	972	51	32.7	1.5	14.8	-0.32		0	0.00		
GEW 2	04/09/2008 15:28	973	51.1	32.8	0.8	15.3	-0.82		0.1	0.88		
GEW 2	05/09/2008 08:41	969	52.6	34.3	0.4	12.7	0.73	12.4	0.1	0.88		
GEW 2	05/09/2008 10:41	968	52.5	34.5	0.6	12.4	0.61		0.1	0.88		
GEW 2	08/09/2008 12:05	989	41.3	29.1	0.9	28.7	-3.11					
GEW 2	09/09/2008 09:39	985	43.2	30.9	0.3	25.6	-5.19					
GEW 2	10/09/2008 09:53	984	28.9	19.8	9.2	42.1	-1.53				-1.4	
GEW 2	10/09/2008 12:47	983	0.8	0.5	20.4	78.3	-0.53					
GEW 2	11/09/2008 14:49	984	0.5	0.4	19.9	79.2	-0.69		0	0.00		closed
GEW 2	12/09/2008 09:49	988	0.5	0.3	18.9	80.3	-0.15		0	0.00		closed
GEW 2	15/09/2008 12:40	1000	0.1	0	20.2	79.7	-1.19		0	0.00		closed
GEW 2	15/09/2008 15:50	999	0.2	0.1	20	79.7	-0.8		0	0.00		closed
GEW 2	16/09/2008 09:01	1000	0.2	0	20.3	79.5	-0.88		0	0.00		closed
GEW 2	16/09/2008 11:20	1000	1.1	5.2	6.6	87.1	-8.07		0.1	0.88		opened, then closed
GEW 2	17/09/2008 11:20	998	0.9	2.3	15.5	81.3	0.46		0	0.00		closed
GEW 2	17/09/2008 17:27	998	8	8.6	0.4	83	0.5		0	0.00		closed
GEW 2	18/09/2008 13:32	1000	8	8.3	0.1	83.6	0.45		0	0.00		closed
GEW 2	18/09/2008 14:55	1001	8.1	8.4	0.2	83.3	0.39		0	0.00		closed
GEW 2	19/09/2008 08:26	1004	0	0.1	20.2	79.7	-2.58		0	0.00		closed
GEW 2	22/09/2008 14:38	1002	0.1	0	21.1	78.8	0.34	15.6	0.1	0.88		closed
GEW 2	23/09/2008 09:16	1003	0.1	0.1	21.9	77.9	-0.04	10	0.1	0.88		closed
GEW 2	24/09/2008 09:25	1003	0.4	0.3	21.6	77.7	-0.38	11.1	0	0.00		closed
GEW 2	24/09/2008 15:30	1004	0.2	0.1	21.2	78.5	-0.06					closed
GEW 2	25/09/2008 09:00	1009	0.1	0	21.5	78.4	-0.64	14.4	0	0.00		closed
GEW 2	26/09/2008 09:00	1012	0.1	0	21.8	78.1	-0.17	9.7	0	0.00		closed

GEW 2 Gas Graph

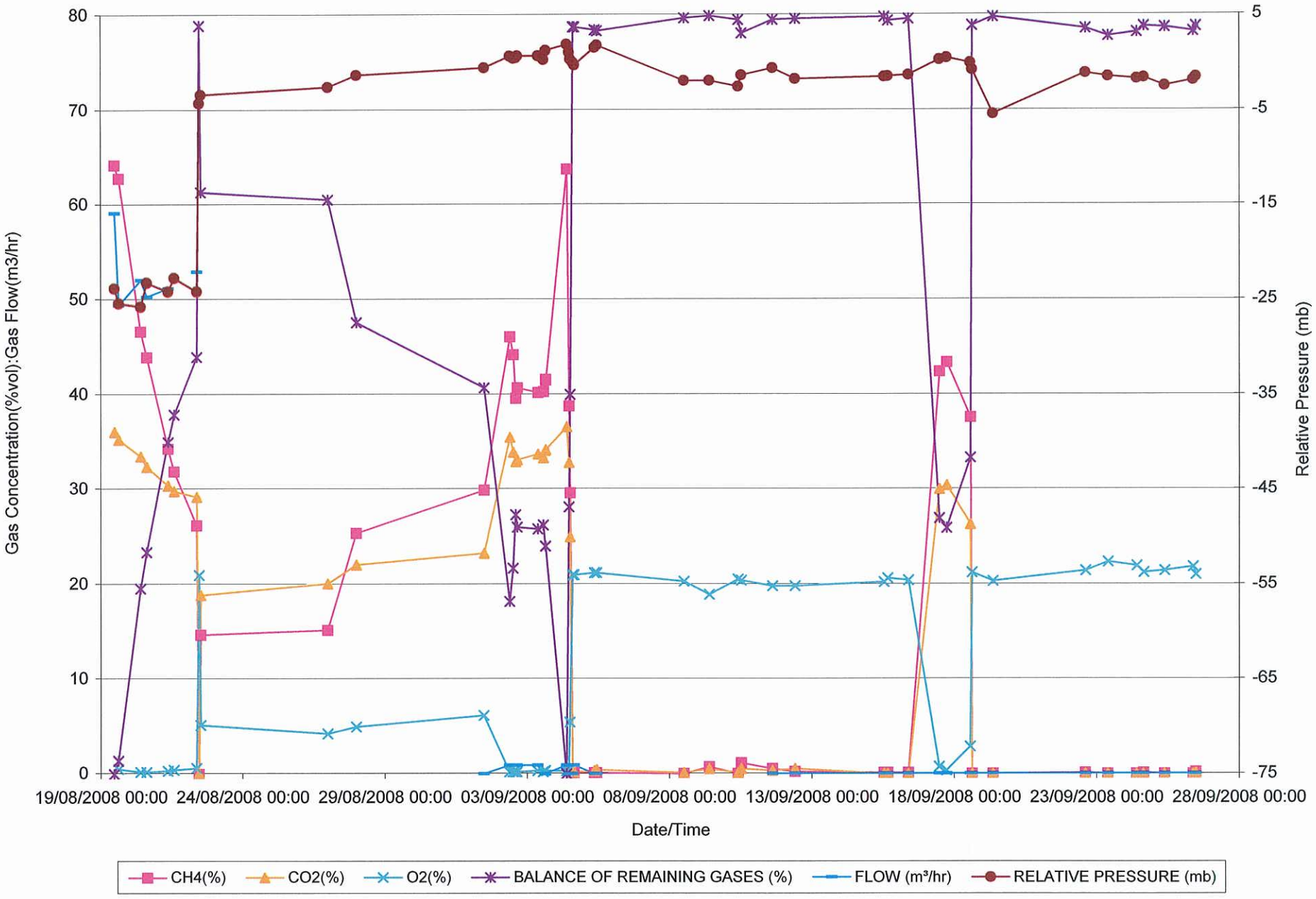


	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL											3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m^3/hr)	ADJUSTED PRESSURE (mb)	COMMENTS
GEW 3	19/08/2008 11:21	975	64.5	34.9	0.3	0.3	-68.35	14.9	2.8	24.70		
GEW 3	19/08/2008 14:54	977	63.2	33.8	0.5	2.5	-55.59		1.9	16.76		
GEW 3	20/08/2008 09:21	986	61.3	34.2	0.2	4.3	-59.44		2.2	19.41		
GEW 3	20/08/2008 11:51	987	55.5	32	0.6	11.9	-32.08		1.7	15.00		Taken with gas bag samples
GEW 3	20/08/2008 14:42	986	60	33.4	0.4	6.2	-38.74		0.7	6.18		
GEW 3	21/08/2008 08:47	988	58.8	33.3	0.3	7.6	-37.67		0.9	7.94		
GEW 3	21/08/2008 13:51	989	55	31.5	0.9	12.6	+32.68	14.7		0.00		
GEW 3	22/08/2008 08:58	991	55.1	33	0.6	11.3	+31.15	16.8	0.5	4.41	-5	
GEW 3	27/08/2008 00:00	997	56.7	32.1	0.2	11	-3.2					
GEW 3	28/08/2008 00:00	998	55.9	29.9	0.4	13.8	-1.2					
GEW 3	01/09/2008 11:42	986	54.4	23.1	3.3	19.2	-0.35	20.7	1.1	9.70		
GEW 3	02/09/2008 09:11	977	57.5	24.6	2.7	15.2	1.05	14.3	0.1	0.88		
GEW 3	02/09/2008 12:07	976	59.4	23.7	2	14.9	0.8					
GEW 3	02/09/2008 14:12	975	62.7	23.4	1.1	12.8	0.81		0	0.00		
GEW 3	02/09/2008 15:26	974	67.8	22.8	0.2	9.2	1.11		0	0.00		
GEW 3	03/09/2008 08:57	975	68.9	23.2	0.4	7.5	0.98	11.5	0.1	0.88	0.21	increased
GEW 3	03/09/2008 13:33	973	69.7	22	0.3	8	0.48					increased
GEW 3	03/09/2008 15:14	971	70	22.7	0.5	6.8	1.61		0	0.00	-0.9	
GEW 3	03/09/2008 15:35	971	70.4	22.7	0.5	6.4	1.76		0	0.00		
GEW 3	04/09/2008 09:11	972	63.9	34.4	0.2	1.5	0.52	14.1	0.1	0.88		
GEW 3	04/09/2008 11:04	972	62.9	33.8	0.3	3	0.14		0	0.00		
GEW 3	04/09/2008 12:10	972	62.4	34.1	0.4	3.1	-1.45		0	0.00		
GEW 3	04/09/2008 14:18	972	62	33.6	0.4	4	-1.57		0.1	0.88		
GEW 3	04/09/2008 15:31	973	58.9	32.3	1.1	7.7	-1.44		0.1	0.88		
GEW 3	05/09/2008 08:45	968	63.1	34.5	0.3	2.1	1.05	12.7	0.1	0.88		
GEW 3	05/09/2008 10:41	966	63.1	34.1	0.5	2.3	1.39		0.1	0.88		
GEW 3	08/09/2008 12:07	989	63.7	32.6	0.2	3.5	-2.09					
GEW 3	09/09/2008 09:41	985	62.9	32.7	0.2	4.2	-1.83					
GEW 3	10/09/2008 09:57	984	47.3	26	6	20.7	-2.6					
GEW 3	10/09/2008 12:44	984	47.7	24.6	6	21.7	-1.15					
GEW 3	11/09/2008 14:51	984	31.5	16.2	9.7	42.6	-0.71					
GEW 3	12/09/2008 09:52	988	41.7	21.9	5.2	29.2	+1.62					
GEW 3	15/09/2008 12:44	1000	8.9	6.1	14.8	70.2	-5.36		0.1	0.88		cracked open, then closed
GEW 3	15/09/2008 15:52	999	0.1	0	20.6	79.3	-1.32		0	0.00		closed
GEW 3	16/09/2008 09:04	1000	0.1	0	20.2	79.7	-1.32		0	0.00		closed
GEW 3	16/09/2008 11:26	1000	30.7	18.2	6.2	44.9	-4.76		0	0.00		cracked open
GEW 3	16/09/2008 11:28	1000	30.8	19.4	1.7	48.1	-8.74		0	0.00		opened gently
GEW 3	16/09/2008 11:47	999	14.3	8.5	12.8	64.4	-5.02		0.1	0.88		opened gently
GEW 3	16/09/2008 11:51	999	25.2	16.4	1.2	57.2	-14.78		0.9	7.94		left open
GEW 3	16/09/2008 11:58	999	26.4	18.3	0.4	54.9	-17.67		0.7	6.18		left open
GEW 3	16/09/2008 12:43	999	27.1	20.4	0.8	51.7	+10.35		0	0.00		remains cracked open
GEW 3	17/09/2008 11:23	998	54.5	31.2	0.3	14	-1.43		0	0.00		remains cracked open
GEW 3	17/09/2008 17:30	998	54.6	29.4	0.2	15.8	0.86		0	0.00		remains cracked open
GEW 3	18/09/2008 13:31	1000	52.4	28.6	0.2	18.8	0.11		0	0.00		remains cracked open
GEW 3	18/09/2008 14:57	1001	21.3	11.1	12.2	55.4	-0.35		0	0.00		closed
GEW 3	19/09/2008 08:28	1004	0	0.1	20.2	79.7	-5.32					closed IS
GEW 3	22/09/2008 14:35	1002	0.1	0	21.2	78.7	-0.96	15.1	0.1	0.88		closed IS
GEW 3	23/09/2008 09:21	1003	0.1	0	22	77.9	-1.26	10.4	0.1	0.88		closed IS
GEW 3	24/09/2008 09:31	1002	0	0	21.9	78.1	-1.66	10.4	0	0.00		closed IS
GEW 3	24/09/2008 15:33	1003	0.1	0	21.2	78.7	-1.5					closed IS
GEW 3	25/09/2008 09:06	1008	0.1	0	21.4	78.5	-2.29	13.7	0	0.00		closed IS
GEW 3	26/09/2008 09:06	1011	0	0	21.8	78.2	-1.72	10.7	0	0.00		closed IS
GEW 3	26/09/2008 11:24	1010	0.1	0	21	78.9	-1.29					closed IS


GEW 3 Gas Graph
Gas Concentration(%vol):Gas Flow(m3/hr)
Relative Pressure (mb)
80
70
60
50
40
30
20
10
0
5
-5
-15
-25
-35
-45
-55
-65
-75
19/08/2008 00:00
24/08/2008 00:00
29/08/2008 00:00
03/09/2008 00:00
08/09/2008 00:00
13/09/2008 00:00
18/09/2008 00:00
23/09/2008 00:00
28/09/2008 00:00
Date/Time
CH4(%)
CO2(%)
O2(%)
BALANCE OF REMAINING GASES (%)
FLOW (m³/hr)
RELATIVE PRESSURE (mb)

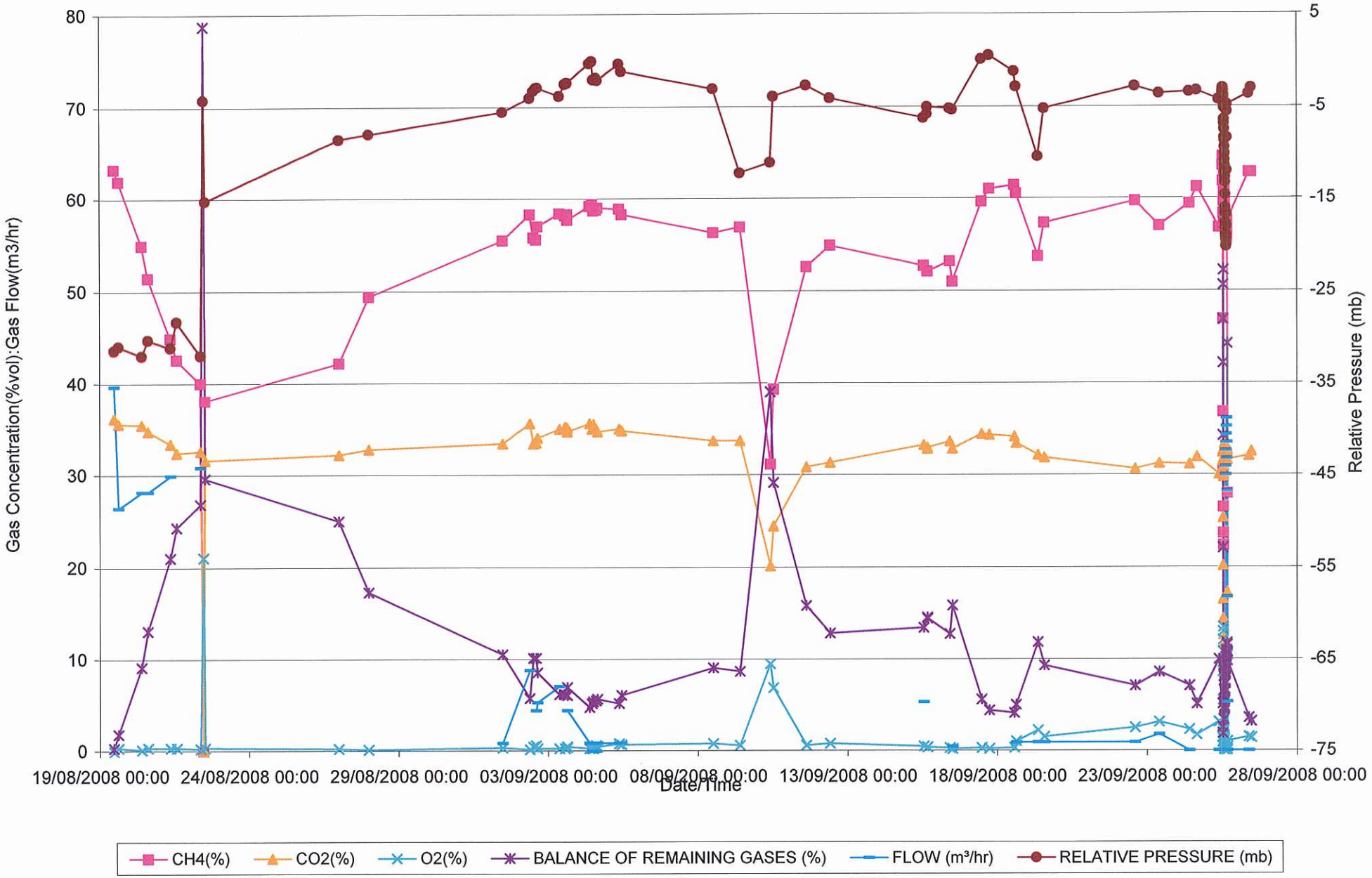
	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL											3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m³/hr)	ADJUSTED PRESSURE (mb)	COMMENTS
GEW 4	19/08/2008 11:30	975	64.2	36.1	0	0	-23.82	15.4	6.7	59.10		
GEW 4	19/08/2008 15:09	977	62.8	35.3	0.5	1.4	-25.38		5.6	49.40		
GEW 4	20/08/2008 09:38	985	46.7	33.5	0.2	19.6	-25.75		5.9	52.05	-25	
GEW 4	20/08/2008 14:47	986	44	32.4	0.2	23.4	-23.23		5.7	50.28		
GEW 4	21/08/2008 08:52	987	34.3	30.4	0.3	35	-24.17		5.8	51.17		
GEW 4	21/08/2008 13:55	989	31.9	29.8	0.4	37.9	-22.72	14.6				
GEW 4	22/08/2008 09:04	991	26.2	29.2	0.6	44	-24.15	16.7	6	52.93	-5	
GEW 4	22/08/2008 11:19	991	0	0.1	21	78.9	-4.24					
GEW 4	22/08/2008 12:32	991	14.7	18.9	5.1	61.3	-3.36				-2	
GEW 4	27/08/2008 00:00	997	15.2	20.1	4.2	60.5	-2.57				-1.4	
GEW 4	28/08/2008 00:00	998	25.4	22.1	4.9	47.6	-1.3					
GEW 4	01/09/2008 11:37	986	29.9	23.3	6.1	40.7	-0.53	21.7	0	0.00		
GEW 4	02/09/2008 09:19	977	46.1	35.5	0.2	18.2	0.66	16.6	0.1	0.88		
GEW 4	02/09/2008 12:12	976	44.2	33.9	0.2	21.7	0.45				0.4	increased 1/4 turn
GEW 4	02/09/2008 14:15	975	39.6	32.9	0.2	27.3	0.49		0.1	0.88		
GEW 4	02/09/2008 15:30	974	40.7	33.1	0.2	26	0.69		0.1	0.88		
GEW 4	03/09/2008 09:05	975	40.2	33.7	0.3	25.8	0.68	13	0.1	0.88		
GEW 4	03/09/2008 13:37	973	40.3	33.3	0.2	26.2	0.31					
GEW 4	03/09/2008 15:17	971	41.6	34.1	0.3	24	1.21		0	0.00		
GEW 4	03/09/2008 15:29	971	41.5	34.2	0.3	24	1.27		0	0.00		
GEW 4	04/09/2008 09:15	972	63.7	36.6	0.3	0	1.88	15.7	0.1	0.88		
GEW 4	04/09/2008 11:07	972	38.8	32.8	0.3	28.1	1.04		0	0.00		
GEW 4	04/09/2008 12:13	972	29.6	25	5.4	40	0.32		0	0.00		
GEW 4	04/09/2008 14:22	972	0.1	0.2	21	78.7	0		0	0.00		
GEW 4	04/09/2008 15:35	973	0.1	0.2	21	78.7	-0.28		0.1	0.88		closed
GEW 4	05/09/2008 08:50	968	0.1	0.3	21.2	78.4	1.54	12.3	0	0.00		
GEW 4	05/09/2008 10:46	966	0.1	0.4	21.2	78.3	1.8		0	0.00		
GEW 4	08/09/2008 12:15	989	0	0.1	20.3	79.6	-1.96					
GEW 4	09/09/2008 09:43	985	0.7	0.5	18.9	79.8	-1.95					
GEW 4	10/09/2008 10:00	984	0	0.1	20.5	79.4	-2.57					
GEW 4	10/09/2008 12:42	984	1.1	0.5	20.4	78	-1.37					
GEW 4	11/09/2008 14:56	984	0.5	0.3	19.8	79.4	-0.64		0	0.00		closed
GEW 4	12/09/2008 09:55	988	0.2	0.5	19.8	79.5	-1.79		0	0.00		closed
GEW 4	15/09/2008 12:56	1000	0.1	0	20.2	79.7	-1.53		0	0.00		closed - IS
GEW 4	15/09/2008 15:53	999	0.1	0	20.6	79.3	-1.49		0	0.00		closed
GEW 4	16/09/2008 09:22	1000	0.1	0	20.4	79.5	-1.35		0	0.00		closed
GEW 4	17/09/2008 11:26	998	42.4	30	0.7	26.9	0.25		0	0.00		closed
GEW 4	17/09/2008 17:33	998	43.4	30.4	0.3	25.9	0.45		0	0.00		closed
GEW 4	18/09/2008 13:22	1000	37.6	26.3	2.8	33.3	-0.08		0	0.00		closed
GEW 4	18/09/2008 15:00	1001	0	0	21.2	78.8	-0.8		0	0.00		closed
GEW 4	19/09/2008 08:30	1002	0	0	20.3	79.7	-5.48		0	0.00		closed
GEW 4	22/09/2008 14:30	1002	0.1	0	21.4	78.5	-1.16	14.3	0	0.00		closed
GEW 4	23/09/2008 09:27	1003	0	0	22.3	77.7	-1.52	9.8	0	0.00		closed
GEW 4	24/09/2008 09:36	1002	0	0	21.9	78.1	-1.76	10.9	0	0.00		closed
GEW 4	24/09/2008 15:35	1003	0.1	0	21.2	78.7	-1.63		0	0.00		closed
GEW 4	25/09/2008 09:11	1008	0	0	21.4	78.6	-2.51	13.8	0	0.00		closed
GEW 4	26/09/2008 09:10	1011	0	0	21.8	78.2	-1.89	10	0	0.00		closed
GEW 4	26/09/2008 11:21	1011	0.2	0.1	21	78.7	-1.56		0	0.00		closed

GEW 4 Gas Graph



	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL											3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m³/hr)	ADJUSTED PRESSURE (mb)	COMMENTS
GEW 5	19/08/2008 11:36	975	63.3	36.3	0	0.4	-31.34	17.2	4.5	39.70		
GEW 5	19/08/2008 15:11	977	62	35.7	0.4	1.9	-30.9		3	26.46		
GEW 5	20/08/2008 09:49	985	55	35.6	0.2	9.2	-31.93		3.2	28.23		
GEW 5	20/08/2008 14:51	986	51.5	34.9	0.4	13.2	-30.18		3.2	28.23		
GEW 5	21/08/2008 08:58	987	45	33.5	0.4	21.1	-31.04		3.4	29.99		
GEW 5	21/08/2008 13:59	988	42.7	32.5	0.4	24.4	-28.21	14.7				
GEW 5	22/08/2008 09:09	991	40.1	32.7	0.3	26.9	-31.89	17.2	3.5	30.88	-5	
GEW 5	22/08/2008 11:23	991	0	0.1	21.1	78.8	-4.17				closed for a short time re leak	
GEW 5	22/08/2008 12:34	991	38.2	31.7	0.4	29.7	-15.24				-8.9	
GEW 5	27/08/2008 00:00	997	42.3	32.3	0.3	25.1	-8.5					
GEW 5	28/08/2008 00:00	998	49.5	32.9	0.2	17.4	-7.9					
GEW 5	01/09/2008 11:30	986	55.5	33.5	0.4	10.6	-5.5	18.1	0.1	0.88		
GEW 5	02/09/2008 09:24	977	58.3	35.7	0.2	5.8	-3.99	18.7	1	8.82		
GEW 5	02/09/2008 12:17	976	55.8	33.5	0.5	10.2	-3.24					
GEW 5	02/09/2008 14:19	975	55.6	33.6	0.6	10.2	-2.91		0.5	4.41		
GEW 5	02/09/2008 15:32	974	57	34.1	0.3	8.6	-2.88		0.6	5.29		
GEW 5	03/09/2008 09:10	974	58.4	35.1	0.3	6.2	-3.78	13.5	0.8	7.06	-3.71	increased
GEW 5	03/09/2008 13:40	973	58.2	35.3	0.3	6.2	-2.47					
GEW 5	03/09/2008 15:20	971	58.3	35.2	0.4	6.1	-2.38		0.5	4.41		
GEW 5	03/09/2008 15:26	971	57.7	34.8	0.5	7	-2.34		0.5	4.41		
GEW 5	04/09/2008 09:20	972	59.2	35.7	0.3	4.8	-0.25	15.6	0.1	0.88		
GEW 5	04/09/2008 11:11	972	59.4	35.1	0.3	5.2	0		0	0.00		
GEW 5	04/09/2008 12:15	972	58.7	35.6	0.3	5.4	-2.01		0	0.00		
GEW 5	04/09/2008 14:26	972	58.8	35.1	0.6	5.5	-1.82		0	0.00		
GEW 5	04/09/2008 15:39	973	59	34.8	0.5	5.7	-2.09		0.1	0.88		
GEW 5	05/09/2008 08:55	968	58.9	35.1	0.8	5.2	-0.3	12.5	0.1	0.88		
GEW 5	05/09/2008 10:49	966	58.3	34.9	0.7	6.1	-1.12		0.1	0.88		
GEW 5	08/09/2008 12:22	989	56.3	33.8	0.8	9.1	-3.01					
GEW 5	09/09/2008 09:45	985	56.9	33.8	0.6	8.7	-12.22					
GEW 5	10/09/2008 10:03	984	31.2	20.2	9.5	39.1	-11.07				-8.45	
GEW 5	10/09/2008 12:40	984	39.4	24.5	6.9	29.2	-3.84					
GEW 5	11/09/2008 14:58	984	52.6	30.9	0.6	15.9	-2.66					
GEW 5	12/09/2008 09:58	988	54.9	31.4	0.8	12.9	-4.05					
GEW 5	15/09/2008 12:58	1000	52.7	33.3	0.5	13.5	-6.21		0.6	5.29		
GEW 5	15/09/2008 15:55	999	52.1	32.9	0.4	14.6	-5.79				-5	
GEW 5	15/09/2008 15:56	999	52.1	33	0.4	14.5	-5.01					
GEW 5	16/09/2008 09:47	999	53.2	33.7	0.3	12.8	-5.2					
GEW 5	16/09/2008 12:04	999	51	32.9	0.2	15.9	-5.34		0.05	0.44	-5.51	
GEW 5	17/09/2008 11:29	998	59.6	34.5	0.3	5.6	0.14					
GEW 5	17/09/2008 17:35	998	61	34.4	0.2	4.4	0.52					
GEW 5	18/09/2008 13:29	1000	61.4	34.2	0.3	4.1	-1.19					
GEW 5	18/09/2008 15:03	1001	60.5	33.5	1	5	-2.85		0.1	0.88		
GEW 5	19/09/2008 08:32	1002	53.7	32.2	2.2	11.9	-10.48		0.1	0.88		
GEW 5	19/09/2008 13:32	1004	57.3	31.9	1.5	9.3	-5.21		0.1	0.88		
GEW 5	22/09/2008 14:19	1002	59.7	30.7	2.5	7.1	-2.79	14.6	0.1	0.88		
GEW 5	23/09/2008 09:33	1002	57	31.3	3.1	8.6	-3.58	10.2	0.2	1.76		
GEW 5	24/09/2008 09:42	1002	59.4	31.2	2.3	7.1	-3.41	12.1	0	0.00		
GEW 5	24/09/2008 15:38	1002	61.2	32	1.7	5.1	-3.28					
GEW 5	25/09/2008 09:18	1008	56.8	30.1	3.1	10	-4.25	14.1	0	0.00		
GEW 5	25/09/2008 12:13	1009	63.5	32.5	1.4	2.6	-3.86		0	0.00		Peak Flow Test
GEW 5	25/09/2008 12:18	1010	61.8	31.6	1.5	5.1	-3.51		0	0.00		Peak Flow Test
GEW 5	25/09/2008 12:23	1009	64.5	32.7	0.9	1.9	-3.34		0	0.00		Peak Flow Test
GEW 5	25/09/2008 12:28	1009	47	25.4	5.5	22.1	-3.08		0	0.00		Peak Flow Test
GEW 5	25/09/2008 12:33	1010	36.9	20.2	8.6	34.3	-3.22		0	0.00		Peak Flow Test
GEW 5	25/09/2008 12:38	1010	30.4	16.6	10.8	42.2	-3.14		0	0.00		Peak Flow Test
GEW 5	25/09/2008 12:43	1010	26.5	14.5	12.1	46.9	-3.13		0	0.00		Peak Flow Test
GEW 5	25/09/2008 12:48	1010	23.7	12.7	13	50.6	-3.01		0	0.00		Peak Flow Test
GEW 5	25/09/2008 12:53	1009	22.4	11.9	13.5	52.2	-3.04		0	0.00		Peak Flow Test
GEW 5	25/09/2008 12:58	1010	58.3	29.8	2.6	9.3	-3.21		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:03	1010	63.6	31.9	1.1	3.4	-3.32		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:08	1010	59.6	30.1	2.2	8.1	-3.66		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:13	1010	60.8	31	1.6	6.6	-3.8		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:18	1010	61.7	31.7	1.4	5.2	-3.99		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:23	1009	61.9	31.5	1.3	5.3	-4.43		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:28	1010	62.4	32	1.1	4.5	-4.64		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:33	1010	62.2	32.6	0.7	4.5	-5.17		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:38	1010	62	33.2	0.1	4.7	-6.46		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:43	1010	61.7	33.3	0.2	4.8	-6.88		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:48	1009	61.3	33.2	0	5.5	-7.51		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:53	1009	60.8	33.5	0	5.7	-8.45		0	0.00		Peak Flow Test
GEW 5	25/09/2008 13:58	1010	60.1	33.2	0	6.7	-8.73		0	0.00		Peak Flow Test
GEW 5	25/09/2008 14:03	1009	60.2	33.3	0.1	6.4	-9.5		0	0.00		Peak Flow Test
GEW 5	25/09/2008 14:08	1010	59.2	33.2	0.1	7.5	-10.2		0	0.00		Peak Flow Test
GEW 5	25/09/2008 14:13	1010	59.6	33.1	0	7.3	-10.91		0	0.00		Peak Flow Test
GEW 5	25/09/2008 14:18	1009	58.7	32.8	0	8.5	-11.56		0	0.00		Peak Flow Test
GEW 5	25/09/2008 14:23	1010	58.6	33.1	0	8.3	-12.09		0	0.00		Peak Flow Test
GEW 5	25/09/2008 14:28	1010	58.3	32.9	0	8.8	-12.76		0	0.00		Peak Flow Test
GEW 5	25/09/2008 14:33	1010	58.1	32.9	0	9	-13.35		0	0.00		Peak Flow Test
GEW 5	25/09/2008 14:38	1009	57.8	32.8	0	9.4	-14.69		0	0.00		Peak Flow Test
GEW 5	25/09/2008 14:43	1009	57.3	32.8	0	9.9	-16.14		3.4	29.99		Peak Flow Test
GEW 5	25/09/2008 14:48	1009	57.1	32.7	0	10.2	-16.73		3.5	30.88		Peak Flow Test
GEW 5	25/09/2008 14:53	1010	57	33.2	0	9.8	-17.72		3.7	32.64		Peak Flow Test
GEW 5	25/09/2008 14:58	1009	56.5	32.8	0.1	10.6	-18.35		3.8	33.52		Peak Flow Test
GEW 5	25/09/2008 15:03	1010	56.5	33	0	10.5	-19.07		3.9	34.40		Peak Flow Test
GEW 5	25/09/2008 15:08	1010	56.6	33.2	0	10.2	-19.32		3.9	34.40		Peak Flow Test
GEW 5	25/09/2008 15:13	1009	56.3	32.9	0.1	10.7	-19.59		4	35.29		Peak Flow Test
GEW 5	25/09/2008 15:18	1009	55.9	33.1	0	11	-20.26		4.1	36.17		Peak Flow Test
GEW 5	25/09/2008 15:23	1010	56.3	33.1	0	10.6	-20.15		4.1	36.17		Peak Flow Test
GEW 5	25/09/2008 15:28	1009	56.2	33	0	10.8	-19.43		3.8	33.52		Peak Flow Test
GEW 5	25/09/2008 15:33	1010	55.6	32.6	0	11.8	-19.05		3.8	33.52		Peak Flow Test
GEW 5	25/09/2008 15:38	1010	55.6	32.8	0	11.6	-18.11		3.6	31.76		Peak Flow Test
GEW 5	25/09/2008 15:43	1010	55.7	32.7	0	11.6	-16.78		3.2	28.23		Peak Flow Test
GEW 5	25/09/2008 15:48	1009	56.4	32.8	0.1	10.7	-12.05		1.9	16.76		Peak Flow Test
GEW 5	25/09/2008 15:53	1008	56.1	32.7	0.4	10.8	-8.43		0.6	5.29		Peak Flow Test
GEW 5	25/09/2008 15:58	1008	28	17.3	10.4	44.3	-5.56		0	0.00		Peak Flow Test
GEW 5	25/09/2008 16:03	1009	57.5	31.7	1	9.8	-4.8		0	0.00		Peak Flow Test
GEW 5	26/09/2008 09:15	1011	62.8	32.1	1.5	3.6	-3.65	10.5	0	0.00		
GEW 5	26/09/2008 11:17	1011	62.8	32.6	1.4	3.2	-3.01					

GEW 5 Gas Graph

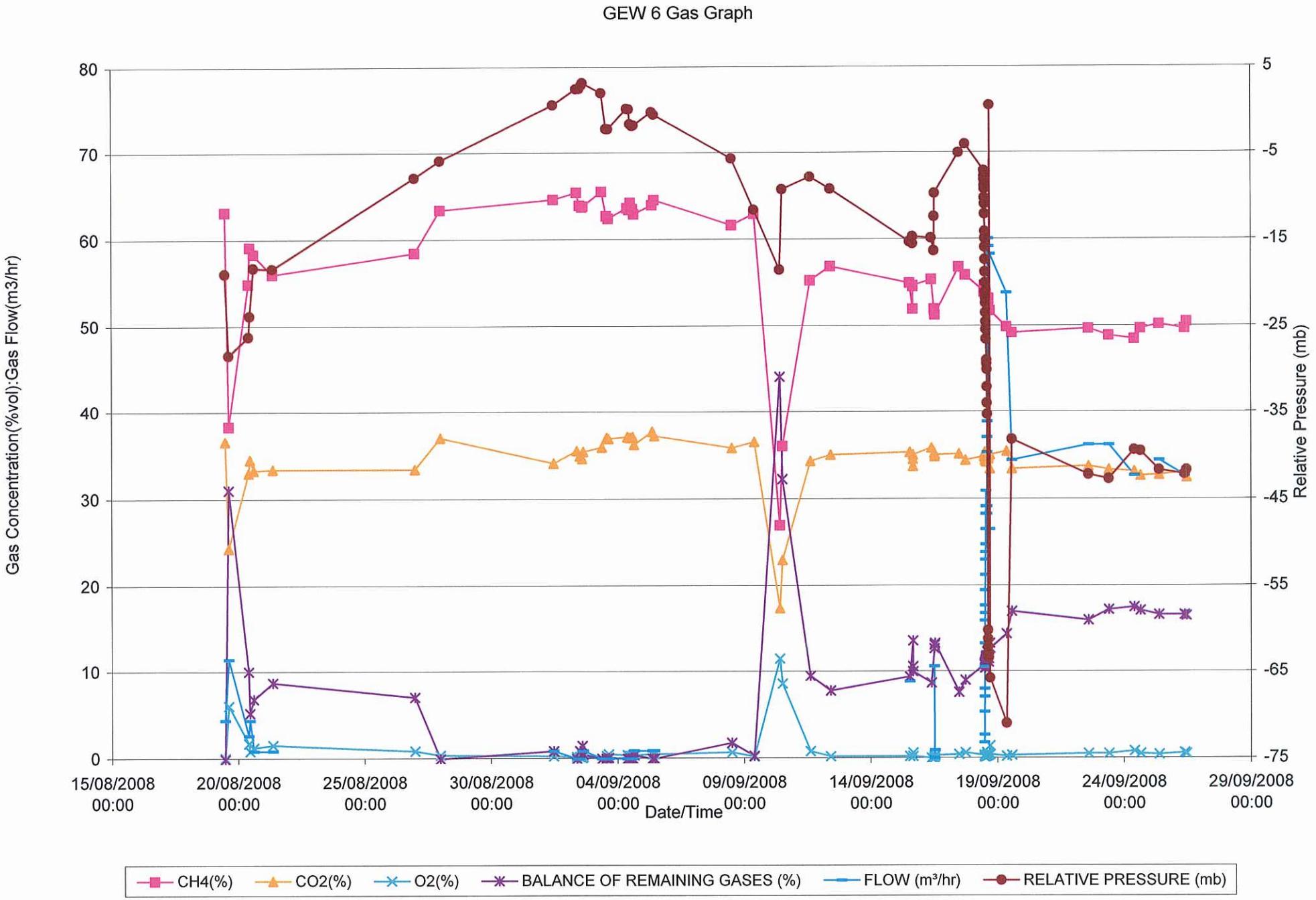


BIOGAS

STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL

3298

SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m³/hr)	ADJUSTED PRESSURE (mb)	COMMENTS
GEW 6	19/08/2008 13:45	975	63.2	36.7	0.1	0	-18.85	17.2	0.5	4.41	-23.19	
GEW 6	19/08/2008 15:14	977	38.4	24.4	6.1	31.1	-28.34		1.3	11.47	-27.57	
GEW 6	20/08/2008 10:05	984	55	33.1	1.8	10.1	-26.17		0.3	2.65		
GEW 6	20/08/2008 11:27	987	59.2	34.6	0.9	5.3	-23.72		0.5	4.41		Taken with gas bag samples
GEW 6	20/08/2008 14:55	986	58.4	33.4	1.3	6.9	-18.2		0.1	0.88		
GEW 6	21/08/2008 09:02	987	56.1	33.5	1.6	8.8	-18.32		0.1	0.88		
GEW 6	27/08/2008 00:00	997	58.5	33.5	0.9	7.1	-7.9					
GEW 6	28/08/2008 00:00	998	63.4	37.1	0.4	0	-5.9					
GEW 6	01/09/2008 11:25	986	64.6	34.2	0.3	0.9	0.61	18.2	0.1	0.88		
GEW 6	02/09/2008 09:29	977	65.4	35.6	0.2	0	2.47	16.9	0	0.00		
GEW 6	02/09/2008 12:21	976	63.9	35	0.2	0.9	2.49			0.00	2.31	Increased
GEW 6	02/09/2008 14:24	975	63.7	34.7	0.1	1.5	2.91		0.1	0.88	0	reduced
GEW 6	02/09/2008 15:35	974	63.8	35.5	0.2	0.5	3.18		0.1	0.88		
GEW 6	03/09/2008 09:15	974	65.5	36	0	0	1.99	15.1	0	0.00	-0.6	Increased
GEW 6	03/09/2008 13:43	973	62.7	37.1	0.3	0	-2.21			0.00		
GEW 6	03/09/2008 15:23	971	62.4	37	0.5	0.1	-2.23		0	0.00		
GEW 6	04/09/2008 09:25	972	63.6	37.2	0.4	0	0.13	14.6	0	0.00		
GEW 6	04/09/2008 11:13	972	63.4	37.1	0.3	0	0.09		0	0.00		
GEW 6	04/09/2008 12:18	972	64.2	37.1	0.3	0	-1.65		0	0.00		
GEW 6	04/09/2008 14:30	972	63.5	37.2	0.4	0	-1.87		0	0.00		
GEW 6	04/09/2008 15:42	973	62.9	36.3	0.4	0.4	-1.8		0.1	0.88		
GEW 6	05/09/2008 08:58	968	63.9	37.8	0.5	0	-0.26	12.6	0.1	0.88		
GEW 6	05/09/2008 10:51	966	64.5	37.3	0.5	0	-0.57		0.1	0.88		
GEW 6	08/09/2008 12:30	989	61.6	35.9	0.7	1.8	-5.71					
GEW 6	09/09/2008 09:47	985	62.9	36.6	0.2	0.3	-11.67					
GEW 6	10/09/2008 10:06	984	27	17.4	11.5	44.1	-18.48				-17.96	
GEW 6	10/09/2008 12:31	984	36.1	23	8.6	32.3	-9.31					
GEW 6	11/09/2008 15:01	984	55.3	34.4	0.8	9.5	-7.85					
GEW 6	12/09/2008 10:02	988	56.9	35.1	0.2	7.8	-9.26					
GEW 6	15/09/2008 13:02	1000	55	35.4	0.2	9.4	-15.31		1	8.82		
GEW 6	15/09/2008 15:56	999	52	33.8	0.6	13.6	-15.53					
GEW 6	15/09/2008 15:57	999	54.6	34.6	0.2	10.6	-15.54				-14.7	
GEW 6	15/09/2008 15:58	999	54.7	35.1	0.2	10	-14.74					
GEW 6	16/09/2008 09:29	999	55.4	35.9	0	8.7	-14.88					
GEW 6	16/09/2008 12:09	999	52	35.3	0	12.7	-16.36		1.2	10.58	-14.4	Backed down to check recovery
GEW 6	16/09/2008 12:16	999	51.8	34.9	0.2	13.1	-12.46		0	0.00		
GEW 6	16/09/2008 12:38	999	51.3	35.1	0.3	13.3	-9.77		0.1	0.88		
GEW 6	17/09/2008 11:32	998	56.8	35.2	0.4	7.6	-5.05					
GEW 6	17/09/2008 17:38	997	55.9	34.5	0.6	9	-4.07					
GEW 6	18/09/2008 11:29	1000	54	34.9	0.3	10.8	-7.13	21.7	0.2	1.76		Peak Flow Test
GEW 6	18/09/2008 11:34	1001	54	35.1	0.1	10.8	-7.84	21.4	0.3	2.65		Peak Flow Test
GEW 6	18/09/2008 11:39	1001	53.9	35	0.1	11	-8.23	19.7	0.6	5.29		Peak Flow Test
GEW 6	18/09/2008 11:44	1000	54	35.1	0.1	10.8	-8.92	18.6	0.8	7.06		Peak Flow Test
GEW 6	18/09/2008 11:49	1001	54.7	34.8	0.1	10.4	-9.3	18	0.9	7.94		Peak Flow Test
GEW 6	18/09/2008 11:54	1000	54	34.9	0.1	11	-10.31	19.3	1.2	10.59		Peak Flow Test
GEW 6	18/09/2008 11:59	1000	54.1	35.4	0.1	10.4	-11.05	21.1	1.5	13.23		Peak Flow Test
GEW 6	18/09/2008 12:04	1000	54.2	34.9	0.1	10.8	-12.19	20.3	1.8	15.88		Peak Flow Test
GEW 6	18/09/2008 12:09	1000	54.2	34.5	0.1	11.2	-14.16	21.3	1.9	16.76		Peak Flow Test
GEW 6	18/09/2008 12:14	1000	54.1	34.6	0.1	11.2	-14.96	21.4	2	17.64		Peak Flow Test
GEW 6	18/09/2008 12:19	1000	54.1	34.6	0.1	11.2	-15.95	21	2.2	19.41		Peak Flow Test
GEW 6	18/09/2008 12:24	1000	54	34.5	0.2	11.3	-17.36	20.9	2.4	21.17		Peak Flow Test
GEW 6	18/09/2008 12:29	1000	54.3	35	0.2	10.5	-18.79	21	2.6	22.94		Peak Flow Test
GEW 6	18/09/2008 12:34	1000	54	34.5	0.2	11.3	-20.04	21	2.7	23.82		Peak Flow Test
GEW 6	18/09/2008 12:39	1000	54.4	34.7	0.1	10.8	-21.13	21	2.7	23.82		Peak Flow Test
GEW 6	18/09/2008 12:44	1000	53.9	34.7	0.2	11.2	-21.77	20.6	2.8	24.70		Peak Flow Test
GEW 6	18/09/2008 12:49	1000	54.2	34.7	0.2	10.9	-22.36	21	3	26.46		Peak Flow Test
GEW 6	18/09/2008 12:54	1000	53.7	34.4	0.2	11.7	-23.49	21.1	3.2	28.23		Peak Flow Test
GEW 6	18/09/2008 12:59	1000	53.8	34.5	0.2	11.5	-24.54	20.8	3.3	29.11		Peak Flow Test
GEW 6	18/09/2008 13:04	1000	53.7	34.7	0.2	11.4	-25.43	21	3.5	30.88		Peak Flow Test
GEW 6	18/09/2008 13:09	1000	53.7	34.3	0.2	11.8	-26.56	20.8	3.3	29.11		Peak Flow Test
GEW 6	18/09/2008 13:47	1000	52.9	35.1	0.6	11.4	-29	21.9	3.2	28.23		Peak Flow Test
GEW 6	18/09/2008 13:52	1000	53.1	34.8	0.3	11.8	-29.42	21.8	3.3	29.11		Peak Flow Test
GEW 6	18/09/2008 13:57	1000	52.8	34.6	0.3	12.3	-30.09	22	3.3	29.11		Peak Flow Test
GEW 6	18/09/2008 14:02	1000	52.9	34.6	0.2	12.3	-32.11	20.2	4	35.29		Peak Flow Test
GEW 6	18/09/2008 14:07	1001	53.1	35.1	0.2	11.6	-34	19.5	4.2	37.05		Peak Flow Test
GEW 6	18/09/2008 14:12	1000	53.2	35	0.2	11.6	-35.3	20.4	4.4	38.82		Peak Flow Test
GEW 6	18/09/2008 15:07	1001	52.5	34.6	0.4	12.5	-60.17		6.8	59.99		Suction up as flare opened up
GEW 6	18/09/2008 15:10	999	52.6	34.7	0.3	12.4	-61.19		6.8	59.99		Peak Flow Test
GEW 6	18/09/2008 15:20	1000	52.9	34.8	0.4	11.9	-62.11		6.8	59.99		Peak Flow Test
GEW 6	18/09/2008 15:30	1000	53.2	35.3	0.4	11.1	-62.95		6.7	59.10		Peak Flow Test
GEW 6	18/09/2008 15:40	1000	53.1	35.1	0.3	11.5	-63.38		6.7	59.10		Peak Flow Test
GEW 6	18/09/2008 16:36	1002	51.8	33.5	1.4	13.3	0.48		3	26.46		Peak Flow Test
GEW 6	18/09/2008 16:50	999	51.8	35.1	0.4	12.7	-65.77		6.6	58.22		Peak Flow Test
GEW 6	19/09/2008 08:35	1002	49.9	35.5	0.2	14.4	-70.97		6.1	53.81		Peak Flow Test
GEW 6	19/09/2008 13:34	1004	49.2	33.5	0.3	17	-38.15		3.9	34.40		
GEW 6	22/09/2008 14:15	1002	49.7	33.8	0.5	16	-42.2	14.3	4.1	36.17		
GEW 6	23/09/2008 09:37	1002	48.9	33.4	0.5	17.2	-42.69		4.1	36.17		
GEW 6	24/09/2008 09:49	1003	48.5	33.2	0.8	17.5	-39.36	13.6	3.7	32.64		
GEW 6	24/09/2008 15:40	1003	49.7	32.7	0.5	17.1	-39.5					
GEW 6	25/09/2008 09:23	1008	50.2	32.8	0.4	16.6	-41.69	14.1	3.9	34.40		
GEW 6	26/09/2008 09:22	1011	49.7	33.1	0.6	16.6	-42.16	13.1	3.7	32.64		
GEW 6	26/09/2008 11:14	1010	50.5	32.5	0.5	16.5	-41.69					

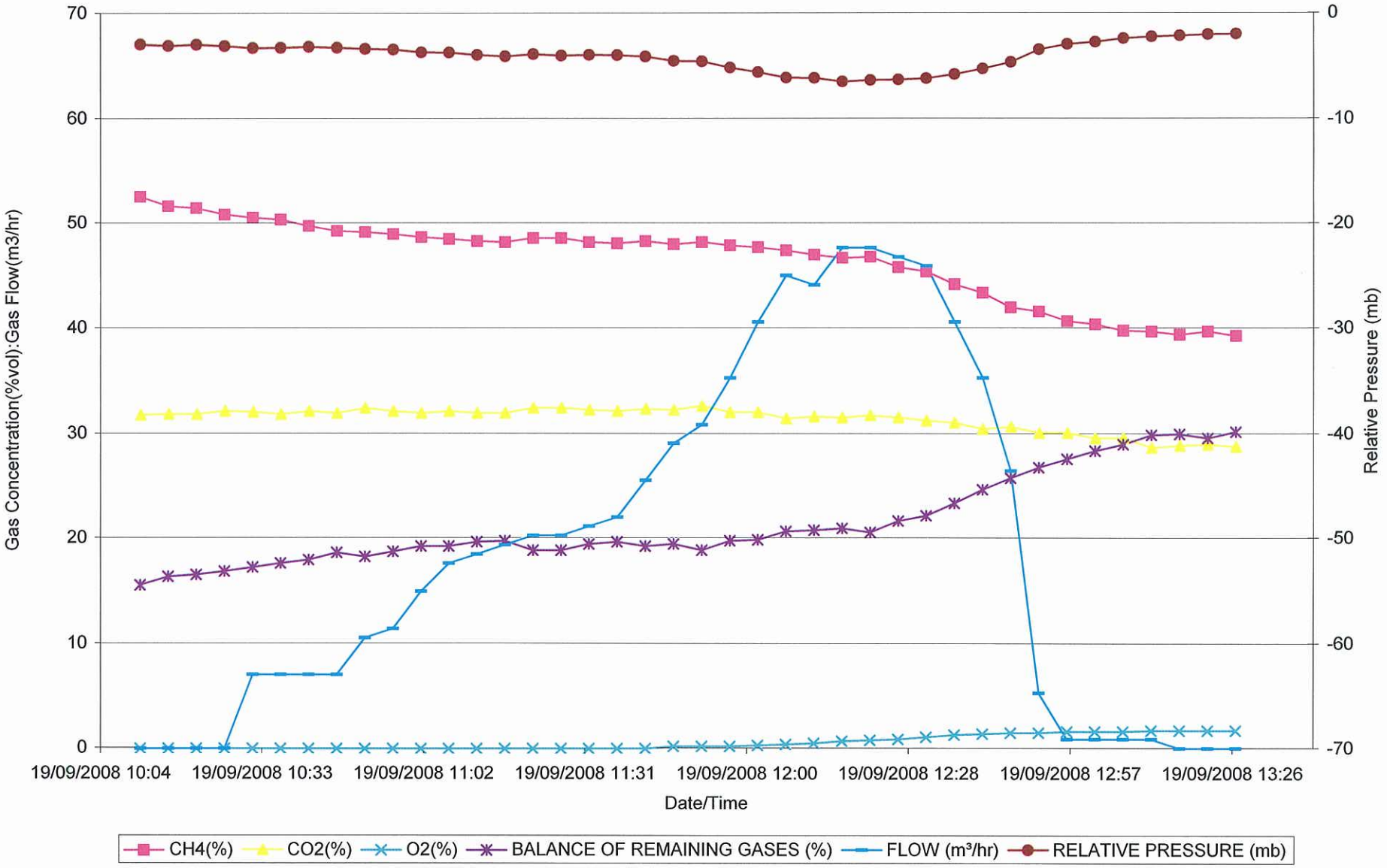

GEW 6 Gas Graph
Gas Concentration(%vol):Gas Flow(m3/hr)
Relative Pressure (mb)
80
70
60
50
40
30
20
10
0
5
-5
-15
-25
-35
-45
-55
-65
-75
15/08/2008 00:00
20/08/2008 00:00
25/08/2008 00:00
30/08/2008 00:00
04/09/2008 00:00
09/09/2008 00:00
14/09/2008 00:00
19/09/2008 00:00
24/09/2008 00:00
29/09/2008 00:00
Date/Time
CH4(%)
CO2(%)
O2(%)
BALANCE OF REMAINING GASES (%)
FLOW (m³/hr)
RELATIVE PRESSURE (mb)

Appendix F. Gas Peak Flows

GEW 1 Peaks

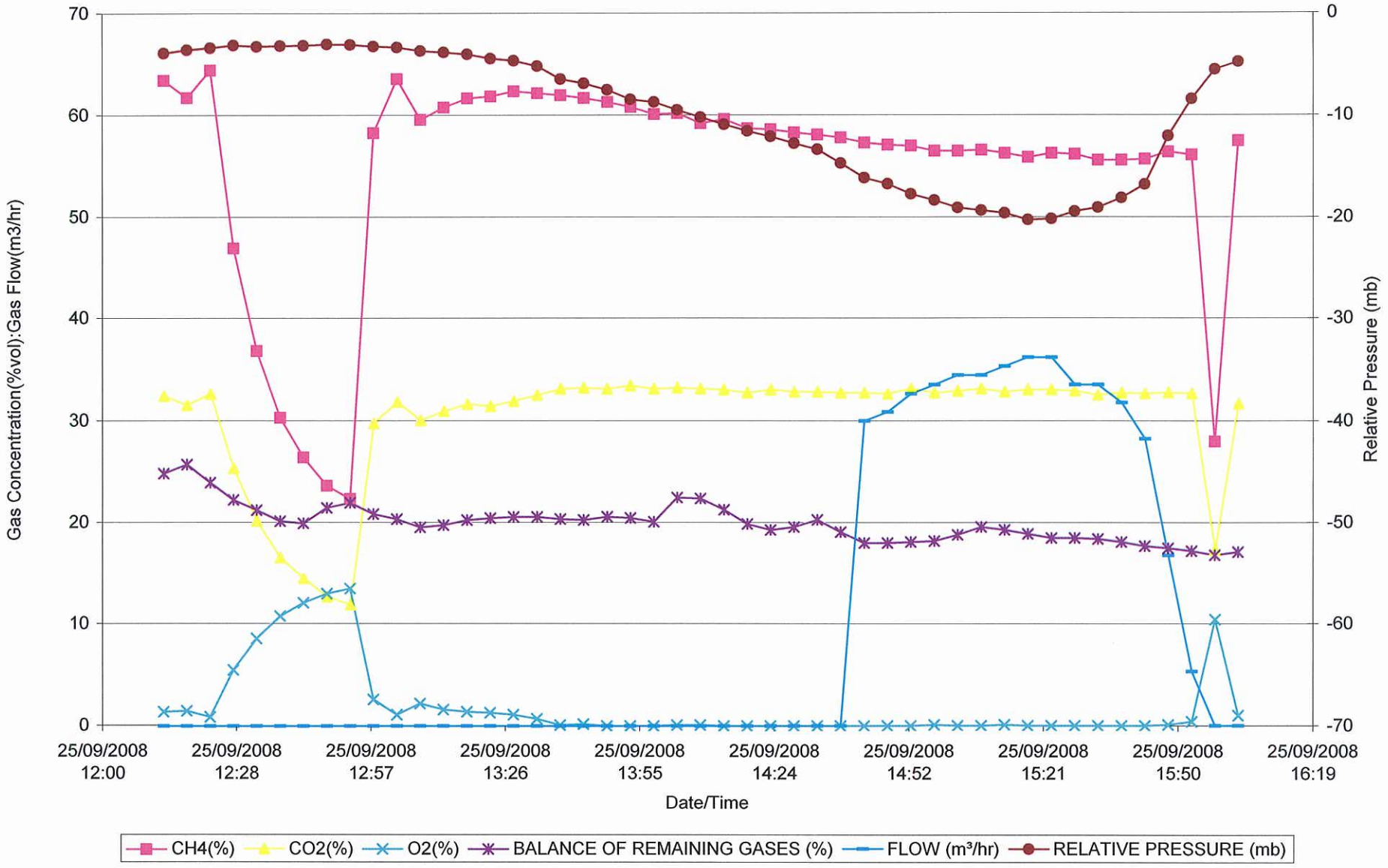
BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL									3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m^3/hr)
GEW 1	19/09/2008 10:12	1003	52.6	31.8	0	15.6	-2.91	26.2	0	0.00
GEW 1	19/09/2008 10:17	1003	51.7	31.9	0	16.4	-3.05	25.3	0	0.00
GEW 1	19/09/2008 10:22	1003	51.5	31.9	0	16.6	-2.94	25.4	0	0.00
GEW 1	19/09/2008 10:27	1003	50.9	32.2	0	16.9	-3.08	27.7	0	0.00
GEW 1	19/09/2008 10:32	1003	50.6	32.1	0	17.3	-3.25	31	0.8	7.06
GEW 1	19/09/2008 10:37	1003	50.4	31.9	0	17.7	-3.22	31.4	0.8	7.06
GEW 1	19/09/2008 10:42	1003	49.8	32.2	0	18	-3.14	27.7	0.8	7.06
GEW 1	19/09/2008 10:47	1003	49.3	32	0	18.7	-3.22	23.8	0.8	7.06
GEW 1	19/09/2008 10:52	1003	49.2	32.5	0	18.3	-3.35	22.3	1.2	10.59
GEW 1	19/09/2008 10:57	1003	49	32.2	0	18.8	-3.41	21	1.3	11.47
GEW 1	19/09/2008 11:02	1003	48.7	32	0	19.3	-3.68	20.2	1.7	15.00
GEW 1	19/09/2008 11:07	1004	48.5	32.2	0	19.3	-3.71	19.9	2	17.64
GEW 1	19/09/2008 11:12	1003	48.3	32	0	19.7	-3.94	21.4	2.1	18.53
GEW 1	19/09/2008 11:17	1003	48.2	32	0	19.8	-4.09	24.7	2.2	19.41
GEW 1	19/09/2008 11:22	1004	48.6	32.5	0	18.9	-3.87	27.1	2.3	20.29
GEW 1	19/09/2008 11:27	1003	48.6	32.5	0	18.9	-4.02	28.7	2.3	20.29
GEW 1	19/09/2008 11:32	1003	48.2	32.3	0	19.5	-3.94	28.6	2.4	21.17
GEW 1	19/09/2008 11:37	1004	48.1	32.2	0	19.7	-3.96	28.6	2.5	22.05
GEW 1	19/09/2008 11:42	1003	48.3	32.4	0	19.3	-4.11	28.5	2.9	25.58
GEW 1	19/09/2008 11:47	1003	48	32.3	0.2	19.5	-4.52	29.2	3.3	29.11
GEW 1	19/09/2008 11:52	1004	48.2	32.7	0.2	18.9	-4.57	29.7	3.5	30.88
GEW 1	19/09/2008 11:57	1004	47.9	32.1	0.2	19.8	-5.16	28	4	35.29
GEW 1	19/09/2008 12:02	1004	47.7	32.1	0.3	19.9	-5.58	27.8	4.6	40.58
GEW 1	19/09/2008 12:07	1004	47.4	31.5	0.4	20.7	-6.11	28.3	5.1	44.99
GEW 1	19/09/2008 12:12	1004	47	31.7	0.5	20.8	-6.13	28.4	5	44.11
GEW 1	19/09/2008 12:17	1004	46.7	31.6	0.7	21	-6.49	26	5.4	47.64
GEW 1	19/09/2008 12:22	1004	46.8	31.8	0.8	20.6	-6.34	26.9	5.4	47.64
GEW 1	19/09/2008 12:27	1004	45.8	31.6	0.9	21.7	-6.31	27.8	5.3	46.75
GEW 1	19/09/2008 12:32	1004	45.4	31.3	1.1	22.2	-6.18	28.8	5.2	45.87
GEW 1	19/09/2008 12:37	1004	44.2	31.1	1.3	23.4	-5.8	29.3	4.6	40.58
GEW 1	19/09/2008 12:42	1004	43.4	30.5	1.4	24.7	-5.27	29.3	4	35.29
GEW 1	19/09/2008 12:47	1004	42	30.7	1.5	25.8	-4.66	30.8	3	26.46
GEW 1	19/09/2008 12:52	1004	41.6	30.1	1.5	26.8	-3.46	31.8	0.6	5.29
GEW 1	19/09/2008 12:57	1004	40.7	30.1	1.6	27.6	-2.96	31.8	0.1	0.88
GEW 1	19/09/2008 13:02	1004	40.4	29.6	1.6	28.4	-2.74	31.8	0.1	0.88
GEW 1	19/09/2008 13:07	1004	39.8	29.6	1.6	29	-2.41	30.5	0.1	0.88
GEW 1	19/09/2008 13:12	1004	39.7	28.7	1.7	29.9	-2.24	28.2	0.1	0.88
GEW 1	19/09/2008 13:17	1005	39.4	28.9	1.7	30	-2.16	26.1	0	0.00
GEW 1	19/09/2008 13:22	1004	39.7	29	1.7	29.6	-2.03	25.4	0	0.00
GEW 1	19/09/2008 13:27	1005	39.3	28.8	1.7	30.2	-1.99	25.2	0	0.00

GEW 1 Peak Flow Graph



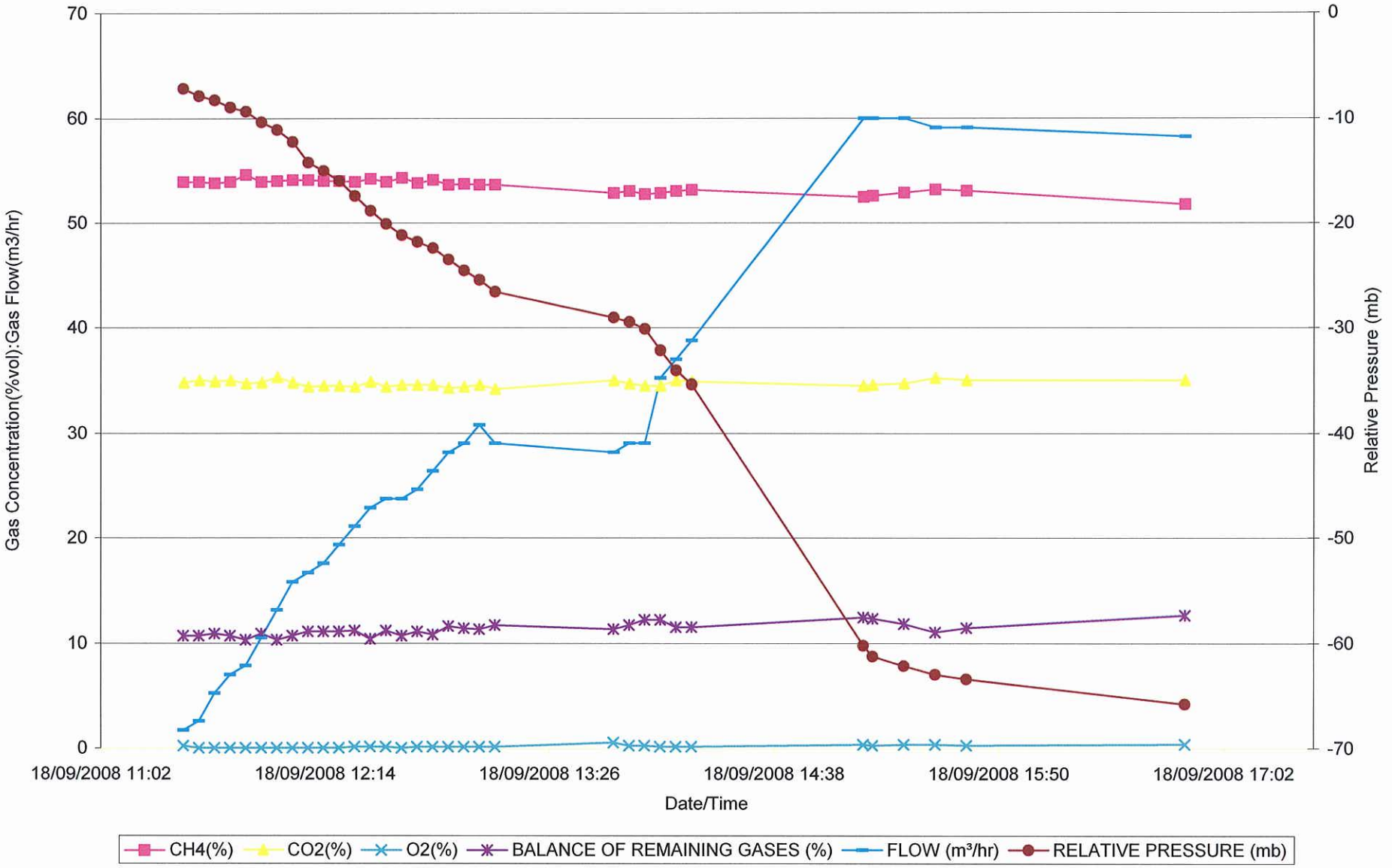
BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL									3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m^3/hr)
GEW 5	25/09/2008 12:13	1009	63.5	32.5	1.4	24.9	-3.86		0	0.00
GEW 5	25/09/2008 12:18	1010	61.8	31.6	1.5	25.8	-3.51		0	0.00
GEW 5	25/09/2008 12:23	1009	64.5	32.7	0.9	24	-3.34		0	0.00
GEW 5	25/09/2008 12:28	1009	47	25.4	5.5	22.3	-3.08		0	0.00
GEW 5	25/09/2008 12:33	1010	36.9	20.2	8.6	21.3	-3.22		0	0.00
GEW 5	25/09/2008 12:38	1010	30.4	16.6	10.8	20.2	-3.14		0	0.00
GEW 5	25/09/2008 12:43	1010	26.5	14.5	12.1	20	-3.13		0	0.00
GEW 5	25/09/2008 12:48	1010	23.7	12.7	13	21.5	-3.01		0	0.00
GEW 5	25/09/2008 12:53	1009	22.4	11.9	13.5	22	-3.04		0	0.00
GEW 5	25/09/2008 12:58	1010	58.3	29.8	2.6	20.9	-3.21		0	0.00
GEW 5	25/09/2008 13:03	1010	63.6	31.9	1.1	20.4	-3.32		0	0.00
GEW 5	25/09/2008 13:08	1010	59.6	30.1	2.2	19.6	-3.66		0	0.00
GEW 5	25/09/2008 13:13	1010	60.8	31	1.6	19.8	-3.8		0	0.00
GEW 5	25/09/2008 13:18	1010	61.7	31.7	1.4	20.3	-3.99		0	0.00
GEW 5	25/09/2008 13:23	1009	61.9	31.5	1.3	20.5	-4.43		0	0.00
GEW 5	25/09/2008 13:28	1010	62.4	32	1.1	20.6	-4.64		0	0.00
GEW 5	25/09/2008 13:33	1010	62.2	32.6	0.7	20.6	-5.17		0	0.00
GEW 5	25/09/2008 13:38	1010	62	33.2	0.1	20.4	-6.46		0	0.00
GEW 5	25/09/2008 13:43	1010	61.7	33.3	0.2	20.3	-6.88		0	0.00
GEW 5	25/09/2008 13:48	1009	61.3	33.2	0	20.6	-7.51		0	0.00
GEW 5	25/09/2008 13:53	1009	60.8	33.5	0	20.5	-8.45		0	0.00
GEW 5	25/09/2008 13:58	1010	60.1	33.2	0	20.1	-8.73		0	0.00
GEW 5	25/09/2008 14:03	1009	60.2	33.3	0.1	22.5	-9.5		0	0.00
GEW 5	25/09/2008 14:08	1010	59.2	33.2	0.1	22.4	-10.2		0	0.00
GEW 5	25/09/2008 14:13	1010	59.6	33.1	0	21.3	-10.91		0	0.00
GEW 5	25/09/2008 14:18	1009	58.7	32.8	0	19.9	-11.56		0	0.00
GEW 5	25/09/2008 14:23	1010	58.6	33.1	0	19.3	-12.09		0	0.00
GEW 5	25/09/2008 14:28	1010	58.3	32.9	0	19.6	-12.76		0	0.00
GEW 5	25/09/2008 14:33	1010	58.1	32.9	0	20.3	-13.35		0	0.00
GEW 5	25/09/2008 14:38	1009	57.8	32.8	0	19.1	-14.69		0	0.00
GEW 5	25/09/2008 14:43	1009	57.3	32.8	0	18	-16.14		3.4	29.99
GEW 5	25/09/2008 14:48	1009	57.1	32.7	0	18	-16.73		3.5	30.88
GEW 5	25/09/2008 14:53	1010	57	33.2	0	18.1	-17.72		3.7	32.64
GEW 5	25/09/2008 14:58	1009	56.5	32.8	0.1	18.2	-18.35		3.8	33.52
GEW 5	25/09/2008 15:03	1010	56.5	33	0	18.8	-19.07		3.9	34.40
GEW 5	25/09/2008 15:08	1010	56.6	33.2	0	19.6	-19.32		3.9	34.40
GEW 5	25/09/2008 15:13	1009	56.3	32.9	0.1	19.3	-19.59		4	35.29
GEW 5	25/09/2008 15:18	1009	55.9	33.1	0	18.9	-20.26		4.1	36.17
GEW 5	25/09/2008 15:23	1010	56.3	33.1	0	18.5	-20.15		4.1	36.17
GEW 5	25/09/2008 15:28	1009	56.2	33	0	18.5	-19.43		3.8	33.52
GEW 5	25/09/2008 15:33	1010	55.6	32.6	0	18.4	-19.05		3.8	33.52
GEW 5	25/09/2008 15:38	1010	55.6	32.8	0	18.1	-18.11		3.6	31.76
GEW 5	25/09/2008 15:43	1010	55.7	32.7	0	17.7	-16.78		3.2	28.23
GEW 5	25/09/2008 15:48	1009	56.4	32.8	0.1	17.5	-12.05		1.9	16.76
GEW 5	25/09/2008 15:53	1008	56.1	32.7	0.4	17.2	-8.43		0.6	5.29
GEW 5	25/09/2008 15:58	1008	28	17.3	10.4	16.8	-5.56		0	0.00
GEW 5	25/09/2008 16:03	1009	57.5	31.7	1	17.1	-4.8		0	0.00

GEW 5 Peak Flow Graph



BIOGAS TECHNOLOGY LIMITED	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL									3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)	TEMPERATURE (°C)	FLOW (m/s)	FLOW (m³/hr)
GEW 6	18/09/2008 11:29	1000	54	34.9	0.3	10.8	-7.13	21.7	0.2	1.76
GEW 6	18/09/2008 11:34	1001	54	35.1	0.1	10.8	-7.84	21.4	0.3	2.65
GEW 6	18/09/2008 11:39	1001	53.9	35	0.1	11	-8.23	19.7	0.6	5.29
GEW 6	18/09/2008 11:44	1000	54	35.1	0.1	10.8	-8.92	18.8	0.8	7.06
GEW 6	18/09/2008 11:49	1001	54.7	34.8	0.1	10.4	-9.3	18	0.9	7.94
GEW 6	18/09/2008 11:54	1000	54	34.9	0.1	11	-10.31	19.3	1.2	10.59
GEW 6	18/09/2008 11:59	1000	54.1	35.4	0.1	10.4	-11.05	21.1	1.5	13.23
GEW 6	18/09/2008 12:04	1000	54.2	34.9	0.1	10.8	-12.19	20.3	1.8	15.88
GEW 6	18/09/2008 12:09	1000	54.2	34.5	0.1	11.2	-14.16	21.3	1.9	16.76
GEW 6	18/09/2008 12:14	1000	54.1	34.6	0.1	11.2	-14.96	21.4	2	17.64
GEW 6	18/09/2008 12:19	1000	54.1	34.6	0.1	11.2	-15.95	21	2.2	19.41
GEW 6	18/09/2008 12:24	1000	54	34.5	0.2	11.3	-17.36	20.9	2.4	21.17
GEW 6	18/09/2008 12:29	1000	54.3	35	0.2	10.5	-18.79	21	2.6	22.94
GEW 6	18/09/2008 12:34	1000	54	34.5	0.2	11.3	-20.04	21	2.7	23.82
GEW 6	18/09/2008 12:39	1000	54.4	34.7	0.1	10.8	-21.13	21	2.7	23.82
GEW 6	18/09/2008 12:44	1000	53.9	34.7	0.2	11.2	-21.77	20.6	2.8	24.70
GEW 6	18/09/2008 12:49	1000	54.2	34.7	0.2	10.9	-22.36	21	3	26.46
GEW 6	18/09/2008 12:54	1000	53.7	34.4	0.2	11.7	-23.49	21.1	3.2	28.23
GEW 6	18/09/2008 12:59	1000	53.8	34.5	0.2	11.5	-24.54	20.8	3.3	29.11
GEW 6	18/09/2008 13:04	1000	53.7	34.7	0.2	11.4	-25.43	21	3.5	30.88
GEW 6	18/09/2008 13:09	1000	53.7	34.3	0.2	11.8	-26.56	20.8	3.3	29.11
GEW 6	18/09/2008 13:47	1000	52.9	35.1	0.6	11.4	-29	21.9	3.2	28.23
GEW 6	18/09/2008 13:52	1000	53.1	34.8	0.3	11.8	-29.42	21.8	3.3	29.11
GEW 6	18/09/2008 13:57	1000	52.8	34.6	0.3	12.3	-30.09	22	3.3	29.11
GEW 6	18/09/2008 14:02	1000	52.9	34.6	0.2	12.3	-32.11	20.2	4	35.29
GEW 6	18/09/2008 14:07	1001	53.1	35.1	0.2	11.6	-34	19.5	4.2	37.05
GEW 6	18/09/2008 14:12	1000	53.2	35	0.2	11.6	-35.3	20.4	4.4	38.82
GEW 6	18/09/2008 15:07	1001	52.5	34.6	0.4	12.5	-60.17		6.8	59.99
GEW 6	18/09/2008 15:10	999	52.6	34.7	0.3	12.4	-61.19		6.8	59.99
GEW 6	18/09/2008 15:20	1000	52.9	34.8	0.4	11.9	-62.11		6.8	59.99
GEW 6	18/09/2008 15:30	1000	53.2	35.3	0.4	11.1	-62.95		6.7	59.10
GEW 6	18/09/2008 15:40	1000	53.1	35.1	0.3	11.5	-63.38		6.7	59.10
GEW 6	18/09/2008 16:50	999	51.8	35.1	0.4	12.7	-65.77		6.6	58.22

GEW 6 Peak Flow Graph



Appendix G. Gas Analysis Results

Summary Table

Sample point	Lab Sample No	Date	CH_4	CO_2	O_2	N_2	CO	Org.F	Org.Cl	Org. Si	Total S	H_2S
		dd/mm/yy	% vv	% vv	% vv	% vv	ppmv	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3
Flare	14899	20/08/08	46.5	27.9	2.5	21.8	<20	<1	<1	<1	<1	<1
GEW 3	14897	20/08/08	59.8	30.9	0.8	6.6	<20	28	26	<1	<1	<1
GEW 6	14898	20/08/08	58.5	31.7	1.5	6.5	<20	9	14	<1	<1	<1
Flare	15297	08/10/08	54.3	30.2	1.7	13.1	<20	8	8	3	<1	<1

Certificate of Analysis

Lab Sample No: **15297**

Company: Biogas Technology

Address: 6 Brookside Ind. Est., Glatton Road, Sawtry, Cambs, PE28 5SB

Site: Stoneley Hill

Contact: Paul Baker

Location: Flare

Date Sampled: 08/10/2008

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Test		Level	Units	Method	Accreditation
Oxygen		1.7	%v/v	sma11a	
Nitrogen		13.1	%v/v	sma11a	
Methane		54.3	%v/v	sma11a	
Carbon Dioxide		30.2	%v/v	sma11a	
Carbon Monoxide	<	20	ppmv	sma13a	
Organic Fluorine		8	mg/m3	sma11f	
Organic Chlorine		8	mg/m3	sma11f	
Organic Silicon		3	mg/m3	sma11f	

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Registered in England and WalesNo. 988844

Date Reported: 09/10/2008

Signature:

Authorised Signatory: J Shearer (Laboratory Supervisor)

report_5b.fsl 26/02/08
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Summary of Trace Components

Lab Sample No: **15297** Location: Flare

Company: Biogas Technology Date Sampled: 08/10/2008

Address: 6 Brookside Ind. Est., Glatton Road, Sawtry, Cambs, Site: Stoneley Hill

Test		Conc	Units	ukas
Toluene		16	mg/m3	
Freon 12	<	1	mg/m3	
Freon 22		15	mg/m3	
Freon 114		4	mg/m3	
Freon 21	<	1	mg/m3	
Freon 11	<	1	mg/m3	
1:2 Dichloro 1:1:2 Trifluoroethane	<	1	mg/m3	
Freon 113	<	1	mg/m3	
Vinyl Chloride	<	1	mg/m3	
Chloroethane	<	1	mg/m3	
1:1 Dichloroethene	<	1	mg/m3	
Dichloromethane	<	1	mg/m3	
1:1 Dichloroethane	<	1	mg/m3	
cis 1:2 Dichloroethene	<	1	mg/m3	
1:1:1 Trichloroethane	<	1	mg/m3	
1:2 Dichloroethane	<	1	mg/m3	
Trichloroethene	<	1	mg/m3	
Tetrachloroethene	<	1	mg/m3	
Chlorobenzene	<	1	mg/m3	
Hexamethyldisiloxane	<	1	mg/m3	
Hexamethylcyclotrisiloxane	<	1	mg/m3	
Octamethylcyclotetrasiloxane		3	mg/m3	
Decamethylcyclopentasiloxane		5	mg/m3	
Dodecamethylcyclohexasiloxane	<	1	mg/m3	
Methanethiol	<	1	mg/m3	
Ethanethiol	<	1	mg/m3	
Dimethylsulphide	<	1	mg/m3	
Carbondisulphide	<	1	mg/m3	
1-Propanethiol	<	1	mg/m3	
Methylethylsulphide	<	1	mg/m3	
Thiophen	<	1	mg/m3	
Diethylsulphide	<	1	mg/m3	
1-Butanethiol	<	1	mg/m3	
Dimethyldisulphide	<	1	mg/m3	
Diethyldisulphide	<	1	mg/m3	
Hydrogen sulphide	<	1	mg/m3	
Fluorine Cpds		19	mg/m3	
Chlorine Cpds	<	1	mg/m3	
Silicon Cpds		8	mg/m3	
Sulphur Cpds	<	1	mg/m3	
Organic Fluorine		8	mg/m3	
Organic Chlorine		8	mg/m3	
Organic Silicon		3	mg/m3	
Total Sulphur	<	1	mg/m3	

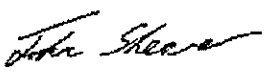
Test		Conc	Units	ukas
Acetaldehyde	<	1	mg/m3	*
Benzene		1	mg/m3	*
Benzyl chloride	<	1	mg/m3	*
1,3-Butadiene	<	1	mg/m3	*
1-Butene	<	1	mg/m3	*
2-Butene	<	1	mg/m3	*
Carbon tetrachloride	<	1	mg/m3	*
Chloroform	<	1	mg/m3	*
p-Dichlorobenzene	<	1	mg/m3	*
m+p-Ethyltoluene	<	1	mg/m3	*
o-Ethyltoluene	<	1	mg/m3	*
Methyl chloride	<	1	mg/m3	*
isoPentane	<	1	mg/m3	*
Pentane	<	1	mg/m3	*
1-Pentene	<	1	mg/m3	*
2-Pentene	<	1	mg/m3	*
Phenol	<	1	mg/m3	*
1,1,2,2-Tetrachloroethane	<	1	mg/m3	*
1,2,3-Trichlorobenzene	<	1	mg/m3	*
1,2,4-Trichlorobenzene	<	1	mg/m3	*
1,3,5-Trichlorobenzene	<	1	mg/m3	*
1,3,5-Trimethylbenzene	<	1	mg/m3	*
1,2,4-Trimethylbenzene	<	1	mg/m3	*
1,2,3-Trimethylbenzene	<	1	mg/m3	*
m+p-Xylene		14	mg/m3	*
o-Xylene	<	1	mg/m3	*
Ethylbenzene		6	mg/m3	*
Nonane	<	1	mg/m3	*
Ethylbutyrate	<	1	mg/m3	*
Furan	<	1	mg/m3	*
2-Butoxyethanol	<	1	mg/m3	*
alpha-Pinene		14	mg/m3	*
Limonene	<	1	mg/m3	*
para-Cymene	<	1	mg/m3	*

The components in the left hand column have been analysed by the laboratory method sma11f and, if present, those in the right hand column by method sma11k (a provisional method based on the principles of sma11f)

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Signature: 

Authorised Signatory: J Shearer (Laboratory Supervisor)

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Registered in England and WalesNo. 988844

* denotes not UKAS accredited test

NB All samples are analysed as received unless otherwise stated and the results relate only to the items tested. The client should be aware that some components of landfill gas may decay between the time of sampling and analysis.

Certificate of Analysis

Lab Sample No: **14897**

Company: Biogas Technology

Address: 6 Brookside Ind. Est., Glatton Road, Sawtry, Cambs, PE28 5SB

Site: Stoney Hill

Contact Paul Baker

Location: 2 (GEW3)

Date Sampled: 20/08/2008

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Test		Level	Units	Method	Accreditation
Oxygen		0.8	%v/v	sma11a	
Nitrogen		6.6	%v/v	sma11a	
Methane		59.8	%v/v	sma11a	
Carbon Dioxide		30.9	%v/v	sma11a	
Carbon Monoxide	<	20	ppmv	sma13a	
Organic Fluorine		28	mg/m3	sma11f	
Organic Chlorine		26	mg/m3	sma11f	
Organic Silicon	<	1	mg/m3	sma11f	

Additional information

denotes not UKAS accredited test

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egistered in England and WalesNo. 988844

Date Reported: 26/08/2008

Signature:

Authorised Signatory: J Shearer (Laboratory Supervisor)

eport_5b.fsl 26/02/08

Summary of Trace Components

Lab Sample No: **14897** Location: 2 (GEW3)

Company: Biogas Technology Date Sampled: 20/08/2008

Address: 6 Brookside Ind. Est., Glatton Road, Sawtry, Cambs, Site: Stoney Hill

Test		Conc	Units	ukas
Toluene		7	mg/m3	
Freon 12	<	1	mg/m3	
Freon 22		64	mg/m3	
Freon 114	<	1	mg/m3	
Freon 21	<	1	mg/m3	
Freon 11	<	1	mg/m3	
1:2 Dichloro 1:1:2 Trifluoroethane	<	1	mg/m3	
Freon 113	<	1	mg/m3	
Vinyl Chloride	<	1	mg/m3	
Chloroethane	<	1	mg/m3	
1:1 Dichloroethene	<	1	mg/m3	
Dichloromethane	<	1	mg/m3	
1:1 Dichloroethane	<	1	mg/m3	
cis 1:2 Dichloroethene	<	1	mg/m3	
1:1:1 Trichloroethane	<	1	mg/m3	
1:2 Dichloroethane	<	1	mg/m3	
Trichloroethene	<	1	mg/m3	
Tetrachloroethene	<	1	mg/m3	
Chlorobenzene	<	1	mg/m3	
Hexamethyldisiloxane	<	1	mg/m3	
Hexamethylcyclotrisiloxane	<	1	mg/m3	
Octamethylcyclotetrasiloxane		1	mg/m3	
Decamethylcyclopentasiloxane	<	1	mg/m3	
Dodecamethylcyclohexasiloxane	<	1	mg/m3	
Methanethiol	<	1	mg/m3	
Ethanethiol	<	1	mg/m3	
Dimethylsulphide	<	1	mg/m3	
Carbondisulphide	<	1	mg/m3	
1-Propanethiol	<	1	mg/m3	
Methylethylsulphide	<	1	mg/m3	
Thiophen	<	1	mg/m3	
Diethylsulphide	<	1	mg/m3	
1-Butanethiol	<	1	mg/m3	
Dimethyldisulphide	<	1	mg/m3	
Diethyldisulphide	<	1	mg/m3	
Hydrogen sulphide	<	1	mg/m3	
Fluorine Cpds		64	mg/m3	
Chlorine Cpds	<	1	mg/m3	
Silicon Cpds		1	mg/m3	
Sulphur Cpds	<	1	mg/m3	
Organic Fluorine		28	mg/m3	
Organic Chlorine		26	mg/m3	
Organic Silicon	<	1	mg/m3	
Total Sulphur	<	1	mg/m3	

Test		Conc	Units	ukas
Acetaldehyde	<	1	mg/m3	*
Benzene	<	1	mg/m3	*
Benzyl chloride	<	1	mg/m3	*
1,3-Butadiene	<	1	mg/m3	*
1-Butene	<	1	mg/m3	*
2-Butene	<	1	mg/m3	*
Carbon tetrachloride	<	1	mg/m3	*
Chloroform	<	1	mg/m3	*
p-Dichlorobenzene	<	1	mg/m3	*
m+p-Ethyltoluene	<	1	mg/m3	*
o-Ethyltoluene	<	1	mg/m3	*
Methyl chloride	<	1	mg/m3	*
isoPentane	<	1	mg/m3	*
Pentane	<	1	mg/m3	*
1-Pentene	<	1	mg/m3	*
2-Pentene	<	1	mg/m3	*
Phenol	<	1	mg/m3	*
1,1,2,2-Tetrachloroethane	<	1	mg/m3	*
1,2,3-Trichlorobenzene	<	1	mg/m3	*
1,2,4-Trichlorobenzene	<	1	mg/m3	*
1,3,5-Trichlorobenzene	<	1	mg/m3	*
1,3,5-Trimethylbenzene	<	1	mg/m3	*
1,2,4-Trimethylbenzene	<	1	mg/m3	*
1,2,3-Trimethylbenzene	<	1	mg/m3	*
m+p-Xylene		9	mg/m3	*
o-Xylene	<	1	mg/m3	*
Ethylbenzene	<	1	mg/m3	*
Nonane	<	1	mg/m3	*
Ethylbutyrate	<	1	mg/m3	*
Furan	<	1	mg/m3	*
2-Butoxyethanol	<	1	mg/m3	*
alpha-Pinene		6	mg/m3	*
Limonene	<	1	mg/m3	*
para-Cymene	<	1	mg/m3	*

The components in the left hand column have been analysed by the laboratory method sma11f and, if present, those in the right hand column by method sma11k (a provisional method based on the principles of sma11f)

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Registered in England and WalesNo. 988844

Date Reported: 26/08/2008

Signature:

Authorised Signatory: J Shearer (Laboratory Supervisor)

* denotes not UKAS accredited test

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Certificate of Analysis

Lab Sample No: **14898**

Company: Biogas Technology

Address: 6 Brookside Ind. Est., Glatton Road, Sawtry, Cambs, PE28 5SB

Site: Stoney Hill

Contact: Paul Baker

Location: 6 (GEW6)

Date Sampled: 20/08/2008

A UKAS Accredited Testing Laboratory No 2125

Test		Level	Units	Method	Accreditation
Oxygen		1.5	%v/v	sma11a	
Nitrogen		6.5	%v/v	sma11a	
Methane		58.5	%v/v	sma11a	
Carbon Dioxide		31.7	%v/v	sma11a	
Carbon Monoxide	<	20	ppmv	sma13a	
Organic Fluorine		9	mg/m3	sma11f	
Organic Chlorine		14	mg/m3	sma11f	
Organic Silicon	<	1	mg/m3	sma11f	

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Date Reported: 26/08/2008

Signature:

Authorised Signatory: J Shearer (Laboratory Supervisor)

report_5b.fsl 26/02/08

Summary of Trace Components

Lab Sample No: **14898** Location: 6 (GEW6)

Company: Biogas Technology Date Sampled: 20/08/2008

Address: 6 Brookside Ind. Est., Glatton Road, Sawtry, Cambs, Site: Stoney Hill

Test		Conc	Units	ukas
Toluene		8	mg/m3	
Freon 12		20	mg/m3	
Freon 22	<	1	mg/m3	
Freon 114		5	mg/m3	
Freon 21	<	1	mg/m3	
Freon 11	<	1	mg/m3	
1:2 Dichloro 1:1:2 Trifluoroethane	<	1	mg/m3	
Freon 113	<	1	mg/m3	
Vinyl Chloride	<	1	mg/m3	
Chloroethane	<	1	mg/m3	
1:1 Dichloroethene	<	1	mg/m3	
Dichloromethane	<	1	mg/m3	
1:1 Dichloroethane	<	1	mg/m3	
cis 1:2 Dichloroethene	<	1	mg/m3	
1:1:1 Trichloroethane	<	1	mg/m3	
1:2 Dichloroethane	<	1	mg/m3	
Trichloroethene	<	1	mg/m3	
Tetrachloroethene	<	1	mg/m3	
Chlorobenzene	<	1	mg/m3	
Hexamethyldisiloxane	<	1	mg/m3	
Hexamethylcyclotrisiloxane	<	1	mg/m3	
Octamethylcyclotetrasiloxane	<	1	mg/m3	
Decamethylcyclopentasiloxane	<	1	mg/m3	
Dodecamethylcyclohexasiloxane	<	1	mg/m3	
Methanethiol	<	1	mg/m3	
Ethanethiol	<	1	mg/m3	
Dimethylsulphide	<	1	mg/m3	
Carbondisulphide	<	1	mg/m3	
1-Propanethiol	<	1	mg/m3	
Methylethylsulphide	<	1	mg/m3	
Thiophen	<	1	mg/m3	
Diethylsulphide	<	1	mg/m3	
1-Butanethiol	<	1	mg/m3	
Dimethyldisulphide	<	1	mg/m3	
Diethyldisulphide	<	1	mg/m3	
Hydrogen sulphide	<	1	mg/m3	
Fluorine Cpds		26	mg/m3	
Chlorine Cpds	<	1	mg/m3	
Silicon Cpds	<	1	mg/m3	
Sulphur Cpds	<	1	mg/m3	
Organic Fluorine		9	mg/m3	
Organic Chlorine		14	mg/m3	
Organic Silicon	<	1	mg/m3	
Total Sulphur	<	1	mg/m3	

Test		Conc	Units	ukas
Acetaldehyde	<	1	mg/m3	*
Benzene	<	1	mg/m3	*
Benzyl chloride	<	1	mg/m3	*
1,3-Butadiene	<	1	mg/m3	*
1-Butene	<	1	mg/m3	*
2-Butene	<	1	mg/m3	*
Carbon tetrachloride	<	1	mg/m3	*
Chloroform	<	1	mg/m3	*
p-Dichlorobenzene	<	1	mg/m3	*
m+p-Ethyltoluene	<	1	mg/m3	*
o-Ethyltoluene	<	1	mg/m3	*
Methyl chloride	<	1	mg/m3	*
isoPentane	<	1	mg/m3	*
Pentane	<	1	mg/m3	*
1-Pentene	<	1	mg/m3	*
2-Pentene	<	1	mg/m3	*
Phenol	<	1	mg/m3	*
1,1,2,2-Tetrachloroethane	<	1	mg/m3	*
1,2,3-Trichlorobenzene	<	1	mg/m3	*
1,2,4-Trichlorobenzene	<	1	mg/m3	*
1,3,5-Trichlorobenzene	<	1	mg/m3	*
1,3,5-Trimethylbenzene	<	1	mg/m3	*
1,2,4-Trimethylbenzene	<	1	mg/m3	*
1,2,3-Trimethylbenzene	<	1	mg/m3	*
m+p-Xylene	<	1	mg/m3	*
o-Xylene	<	1	mg/m3	*
Ethylbenzene	<	1	mg/m3	*
Nonane	<	1	mg/m3	*
Ethylbutyrate	<	1	mg/m3	*
Furan	<	1	mg/m3	*
2-Butoxyethanol	<	1	mg/m3	*
alpha-Pinene		3	mg/m3	*
Limonene	<	1	mg/m3	*
para-Cymene	<	1	mg/m3	*

The components in the left hand column have been analysed by the laboratory method sma11f and, if present, those in the right hand column by method sma11k (a provisional method based on the principles of sma11f)

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Date Reported: 26/08/2008

Signature: John Shearer

Authorised Signatory: J Shearer (Laboratory Supervisor)

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Certificate of Analysis

Lab Sample No: **14899**

Company: Biogas Technology

Address: 6 Brookside Ind. Est., Glatton Road, Sawtry, Cambs, PE28 5SB

Site: Stoney Hill

Contact: Paul Baker

A UKAS Accredited Testing Laboratory No 2125

Location: Flare (GAS FLARE)

Date Sampled: 20/08/2008

Test		Level	Units	Method	Accreditation
Oxygen		2.5	%v/v	sma11a	
Nitrogen		21.8	%v/v	sma11a	
Methane		46.5	%v/v	sma11a	
Carbon Dioxide		27.9	%v/v	sma11a	
Carbon Monoxide	<	20	ppmv	sma13a	
Organic Fluorine	<	1	mg/m3	sma11f	
Organic Chlorine	<	1	mg/m3	sma11f	
Organic Silicon	<	1	mg/m3	sma11f	

Additional information

* denotes not UKAS accredited test

NB All samples are "analysed as received" unless otherwise stated and the results relate to the items tested. Any opinions and interpretations expressed in this report are a personal view of the analyst and are not accredited under the laboratory's UKAS quality system. The client should be aware that some components of landfill gas may decay between the time of sampling and analysis.

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Wolseley Business Park, Kempston
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Registered Office
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Doncaster
DN4 5NU
Registered in England and WalesNo. 988844

Date Reported: 26/08/2008

Signature:

Authorised Signatory: J Shearer (Laboratory Supervisor)

report_5b.fsl 26/02/08

Summary of Trace Components

Lab Sample No: **14899** Location: Flare (GAS FLARE)

Company: Biogas Technology Date Sampled: 20/08/2008

Address: 6 Brookside Ind. Est., Glatton Road, Sawtry, Cambs, Site: Stoney Hill

Test		Conc	Units	ukas
Toluene		6	mg/m3	
Freon 12	<	1	mg/m3	
Freon 22	<	1	mg/m3	
Freon 114	<	1	mg/m3	
Freon 21	<	1	mg/m3	
Freon 11	<	1	mg/m3	
1:2 Dichloro 1:1:2 Trifluoroethane	<	1	mg/m3	
Freon 113	<	1	mg/m3	
Vinyl Chloride	<	1	mg/m3	
Chloroethane	<	1	mg/m3	
1:1 Dichloroethene	<	1	mg/m3	
Dichloromethane	<	1	mg/m3	
1:1 Dichloroethane	<	1	mg/m3	
cis 1:2 Dichloroethene	<	1	mg/m3	
1:1:1 Trichloroethane	<	1	mg/m3	
1:2 Dichloroethane	<	1	mg/m3	
Trichloroethene	<	1	mg/m3	
Tetrachloroethene	<	1	mg/m3	
Chlorobenzene	<	1	mg/m3	
Hexamethyldisiloxane	<	1	mg/m3	
Hexamethylcyclotrisiloxane	<	1	mg/m3	
Octamethylcyclotetrasiloxane		1	mg/m3	
Decamethylcyclopentasiloxane	<	1	mg/m3	
Dodecamethylcyclohexasiloxane	<	1	mg/m3	
Methanethiol	<	1	mg/m3	
Ethanethiol	<	1	mg/m3	
Dimethylsulphide	<	1	mg/m3	
Carbondisulphide	<	1	mg/m3	
1-Propanethiol	<	1	mg/m3	
Methylethylsulphide	<	1	mg/m3	
Thiophen	<	1	mg/m3	
Diethylsulphide	<	1	mg/m3	
1-Butanethiol	<	1	mg/m3	
Dimethyldisulphide	<	1	mg/m3	
Diethyldisulphide	<	1	mg/m3	
Hydrogen sulphide	<	1	mg/m3	
Fluorine Cpds	<	1	mg/m3	
Chlorine Cpds	<	1	mg/m3	
Silicon Cpds		1	mg/m3	
Sulphur Cpds	<	1	mg/m3	
Organic Fluorine	<	1	mg/m3	
Organic Chlorine	<	1	mg/m3	
Organic Silicon	<	1	mg/m3	
Total Sulphur	<	1	mg/m3	

Test		Conc	Units	ukas
Acetaldehyde	<	1	mg/m3	*
Benzene	<	1	mg/m3	*
Benzyl chloride	<	1	mg/m3	*
1,3-Butadiene	<	1	mg/m3	*
1-Butene	<	1	mg/m3	*
2-Butene	<	1	mg/m3	*
Carbon tetrachloride	<	1	mg/m3	*
Chloroform	<	1	mg/m3	*
p-Dichlorobenzene	<	1	mg/m3	*
m+p-Ethyltoluene	<	1	mg/m3	*
o-Ethyltoluene	<	1	mg/m3	*
Methyl chloride	<	1	mg/m3	*
isoPentane	<	1	mg/m3	*
Pentane	<	1	mg/m3	*
1-Pentene	<	1	mg/m3	*
2-Pentene	<	1	mg/m3	*
Phenol	<	1	mg/m3	*
1,1,2,2-Tetrachloroethane	<	1	mg/m3	*
1,2,3-Trichlorobenzene	<	1	mg/m3	*
1,2,4-Trichlorobenzene	<	1	mg/m3	*
1,3,5-Trichlorobenzene	<	1	mg/m3	*
1,3,5-Trimethylbenzene	<	1	mg/m3	*
1,2,4-Trimethylbenzene	<	1	mg/m3	*
1,2,3-Trimethylbenzene	<	1	mg/m3	*
m+p-Xylene		10	mg/m3	*
o-Xylene	<	1	mg/m3	*
Ethylbenzene	<	1	mg/m3	*
Nonane	<	1	mg/m3	*
Ethylbutyrate	<	1	mg/m3	*
Furan	<	1	mg/m3	*
2-Butoxyethanol	<	1	mg/m3	*
alpha-Pinene		7	mg/m3	*
Limonene	<	1	mg/m3	*
para-Cymene	<	1	mg/m3	*

The components in the left hand column have been analysed by the laboratory method sma11f and, if present, those in the right hand column by method sma11k (a provisional method based on the principles of sma11f)

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Telephone 01234 841480
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Date Reported: 26/08/2008

Signature: John Shearer

Authorised Signatory: J Shearer (Laboratory Supervisor)

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Appendix H. Zone of Influence Boreholes

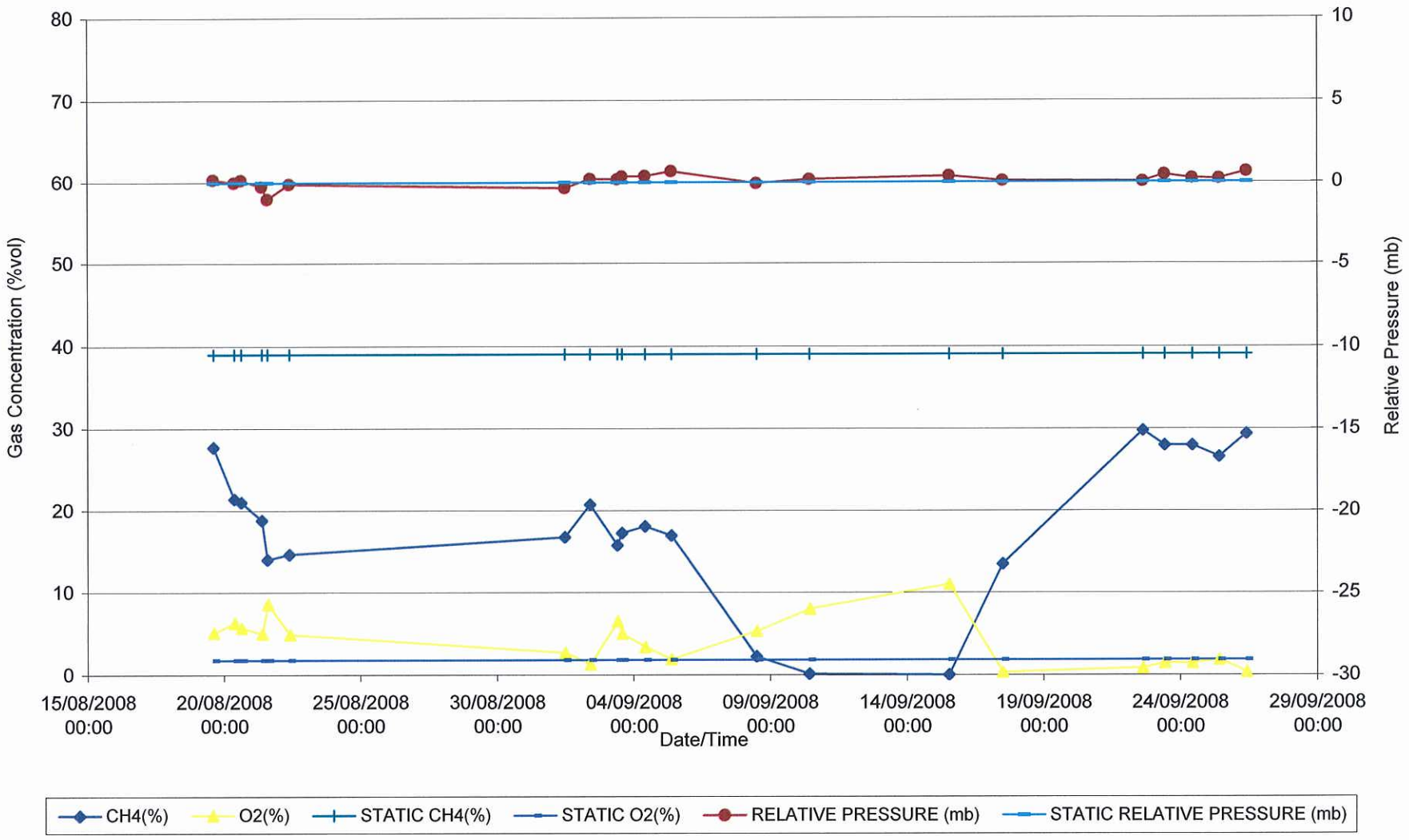
BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL						3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 45	19/08/2008 14:50	977	0.1	0	20.4	79.5	0.05
ZOIBH 45	20/08/2008 09:07	986	0.1	0	20.4	79.5	-0.25
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 46	20/08/2008 09:14	986	47.1	14.8	3.8	34.3	-12.78
ZOIBH 46	20/08/2008 15:33	986	45.1	14.2	4.5	36.2	-8.16
ZOIBH 46	21/08/2008 09:43	988	45	14.2	4.1	36.7	-7.89
ZOIBH 46	21/08/2008 14:37	989	43.3	13.2	4.4	39.1	-7.58
ZOIBH 46	22/08/2008 09:51	991	45.4	14.9	3.4	36.3	-7.22
ZOIBH 46	28/08/2008 10:25		42.2	15.5	2.5	39.8	-0.65
ZOIBH 46	01/09/2008 11:56	986	39.6	15.1	1.6	43.7	-0.44
ZOIBH 46	02/09/2008 10:09	977	40.6	16.1	1.2	42.1	0.42
ZOIBH 46	02/09/2008 13:06	975	40.3	15.9	1	42.8	0.18
ZOIBH 46	03/09/2008 09:27	974	41	16.4	0.7	41.9	0.47
ZOIBH 46	03/09/2008 14:21	972	40.9	16.5	0.6	42	0.47
ZOIBH 46	04/09/2008 10:28	972	41.8	16.9	0.6	40.7	1.06
ZOIBH 46	05/09/2008 09:35	968	42.2	17	0.4	40.4	1.39
ZOIBH 46	08/09/2008 12:01	989	42.5	16.7	0.1	40.7	-1.86
ZOIBH 46	10/09/2008 10:43	984	30.3	12	7.4	50.3	-0.25
ZOIBH 46	15/09/2008 12:29	1000	42.4	16.8	0.1	40.7	-0.48
ZOIBH 46	15/09/2008 13:22	999	42.2	16.3	0.3	41.2	-1.59
ZOIBH 46	17/09/2008 12:14	998	44.4	16.6	0.2	38.8	0.28
ZOIBH 46	22/09/2008 15:13	1001	46.3	16.7	0.3	36.7	0.17
ZOIBH 46	23/09/2008 10:21	1002	46.8	16.8	0.1	36.3	0.51
ZOIBH 46	24/09/2008 10:33	1002	46.8	16.6	0.1	36.5	0.46
ZOIBH 46	25/09/2008 10:07	1009	47.3	16.7	0.2	35.8	0.3
ZOIBH 46	26/09/2008 10:05	1011	47.1	16.7	0.1	36.1	0.47
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 47	19/08/2008 15:01	977	27.8	10.4	5.2	56.6	0.2
ZOIBH 47	20/08/2008 09:27	984	21.5	10.6	6.4	61.5	0.01
ZOIBH 47	20/08/2008 15:30	986	21.1	11.7	5.8	61.4	0.16
ZOIBH 47	21/08/2008 09:40	988	18.9	12.3	5.1	63.7	-0.22
ZOIBH 47	21/08/2008 14:34	989	14.1	9.1	8.7	68.1	-1.01
ZOIBH 47	22/08/2008 09:54	991	14.7	12.3	5	68	-0.08
ZOIBH 47	01/09/2008 11:59	986	16.8	12.9	2.8	67.5	-0.33
ZOIBH 47	02/09/2008 10:15	977	20.8	14.8	1.4	63	0.22
ZOIBH 47	03/09/2008 10:07	974	15.8	11.8	6.6	65.8	0.2
ZOIBH 47	03/09/2008 14:18	972	17.3	13.5	5.1	64.1	0.37
ZOIBH 47	04/09/2008 10:25	972	18.1	14.7	3.5	63.7	0.39
ZOIBH 47	05/09/2008 09:32	968	17	15	2	66	0.69
ZOIBH 47	08/09/2008 12:11	989	2.3	9.3	5.4	83	-0.05
ZOIBH 47	10/09/2008 10:40	984	0.2	7.9	8.1	83.8	0.19
ZOIBH 47	15/09/2008 13:20	999	0.07	4.6	11.1	84.23	0.4
ZOIBH 47	17/09/2008 12:11	999	13.5	11.5	0.4	74.6	0.1
ZOIBH 47	22/09/2008 15:10	1001	29.8	13.8	0.9	55.5	0.06
ZOIBH 47	23/09/2008 10:18	1003	28	13.9	1.5	56.6	0.48
ZOIBH 47	24/09/2008 10:30	1002	28	14.2	1.5	56.3	0.24
ZOIBH 47	25/09/2008 10:04	1008	26.6	14.1	1.9	57.4	0.22
ZOIBH 47	26/09/2008 10:03	1011	29.4	14.7	0.4	55.5	0.66
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 48	19/08/2008 15:03	977	0.2	0	20.5	79.3	-5.05
ZOIBH 48	20/08/2008 09:29	984	0	0	20.4	79.6	-5.43
ZOIBH 48	20/08/2008 15:28	986	0	0	21.8	78.2	-4.93
ZOIBH 48	21/08/2008 09:37	988	0	0.1	21.4	78.5	-4.48
ZOIBH 48	21/08/2008 14:32	989	0	0	21.4	78.6	-4.71
ZOIBH 48	22/08/2008 09:57	991	0	0.1	21.4	78.5	-3.36
ZOIBH 48	28/08/2008 10:34		0.2	0.2	20.6	79	-0.18
ZOIBH 48	01/09/2008 12:01	986	0	0.1	21.7	78.2	-0.37
ZOIBH 48	02/09/2008 10:12	977	19.7	23.4	0.2	56.7	0.28
ZOIBH 48	03/09/2008 10:04	974	5.1	14	2.2	78.7	0.4
ZOIBH 48	03/09/2008 14:15	972	20.6	23.7	0.3	55.4	0.58
ZOIBH 48	04/09/2008 10:21	972	22.6	24.9	0.2	52.3	0.65
ZOIBH 48	05/09/2008 09:29	968	8	15.4	2.2	74.4	0.85
ZOIBH 48	08/09/2008 12:13	989	0.3	0.2	19.4	80.1	-0.66
ZOIBH 48	10/09/2008 10:37	984	0	0	20.6	79.4	-0.38
ZOIBH 48	15/09/2008 13:19	999	0.1	0	20.3	79.6	-0.42
ZOIBH 48	16/09/2008 09:55	999	0.1	0	20.4	79.5	-0.42
ZOIBH 48	16/09/2008 09:56	999	8.4	11.5	0.5	79.6	0.12
ZOIBH 48	17/09/2008 12:08	998	0.3	4.9	4.8	90	0.41
ZOIBH 48	22/09/2008 15:08	1002	0.1	0	21	78.9	0.14
ZOIBH 48	23/09/2008 10:14	1003	0.1	0	21.2	78.7	0.12
ZOIBH 48	24/09/2008 10:27	1002	0.1	0	21.1	78.8	-0.23
ZOIBH 48	25/09/2008 10:01	1008	0.1	0	21.2	78.7	-0.43
ZOIBH 48	26/09/2008 10:00	1011	0.1	0	21.5	78.4	0.28
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 49	19/08/2008 15:31	977	47.1	30.8	1.1	21	-12.81
ZOIBH 49	20/08/2008 09:34	985	47.7	31.3	0.7	20.3	-12.07

BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL						3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 57	19/08/2008 14:48	978	27.3	6.4	11.2	55.1	-2.54
ZOIBH 57	20/08/2008 09:13	986	9.8	3.4	16.2	70.6	-7.32
ZOIBH 57	20/08/2008 15:35	986	8.2	2.7	18	71.1	-2.14
ZOIBH 57	21/08/2008 09:46	988	6.9	2.6	17.5	73	-4.34
ZOIBH 57	21/08/2008 14:40	990	6.6	2.3	18	73.1	-2.43
ZOIBH 57	22/08/2008 09:49	991	7.4	3	17.3	72.3	-3.16
ZOIBH 57	28/08/2008 10:23		53.6	12.9	2.9	30.6	0.03
ZOIBH 57	01/09/2008 11:52	986	61.4	13.9	1	23.7	2.64
ZOIBH 57	02/09/2008 10:19	977	64.4	14.5	0.7	20.4	0.71
ZOIBH 57	02/09/2008 13:09	975	63.8	14.3	0.6	21.3	0.36
ZOIBH 57	03/09/2008 09:31	974	65.2	14.9	0.4	19.5	4.4
ZOIBH 57	03/09/2008 14:24	972	64.8	15	0.4	19.8	7.98
ZOIBH 57	04/09/2008 10:31	972	65.5	15	0.3	19.2	0.95
ZOIBH 57	05/09/2008 09:37	968	68.4	15.3	0.2	16.1	2.46
ZOIBH 57	08/09/2008 11:58	989	70.4	15.6	0.4	13.6	-0.1
ZOIBH 57	10/09/2008 10:45	984	36.9	8.1	10.5	44.5	0.08
ZOIBH 57	15/09/2008 12:33	1000	33.7	9.5	7.3	49.5	0.23
ZOIBH 57	16/09/2008 08:59	1000	25.5	7.5	10.3	56.7	-0.25
ZOIBH 57	17/09/2008 12:18	998	28.4	7.8	9.7	54.1	0.18
ZOIBH 57	22/09/2008 15:16	1001	32.6	9.9	7.5	50	0.34
ZOIBH 57	23/09/2008 10:24	1003	32.7	10.2	7.5	49.6	0.46
ZOIBH 57	24/09/2008 10:36	1002	32.9	10.2	7.2	49.7	0.54
ZOIBH 57	25/09/2008 10:11	1008	29.5	9.1	8.5	52.9	0.26
ZOIBH 57	26/09/2008 10:10	1011	28.4	9	9.1	53.5	0.33
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 58	19/08/2008 14:53	41.3	5.7	7.8	45.2	977	-13.54
ZOIBH 58	20/08/2008 09:24	986	33.3	5.2	9.9	51.6	-1.22
ZOIBH 58	20/08/2008 15:25	986	32.2	5.1	11.2	51.5	-4.42
ZOIBH 58	21/08/2008 09:34	987	32.2	5.3	10.7	51.8	-2.03
ZOIBH 58	21/08/2008 14:29	989	31.3	4.9	10.7	53.1	-3.89
ZOIBH 58	22/08/2008 10:00	991	32.8	5.8	10.1	51.3	-1.83
ZOIBH 58	28/08/2008 10:30		23.9	5.8	10.2	60.1	2.8
ZOIBH 58	01/09/2008 12:04	986	26.7	5.9	10.9	56.5	1.15
ZOIBH 58	02/09/2008 10:05	977	30	6.8	9.9	53.3	1.35
ZOIBH 58	02/09/2008 13:03	975	30.1	6.5	10	53.4	-0.1
ZOIBH 58	03/09/2008 09:34	974	32.8	7.2	8.7	51.3	1.42
ZOIBH 58	03/09/2008 14:12	972	32.5	7.2	9.2	51.1	0.97
ZOIBH 58	04/09/2008 10:19	972	34.2	7.5	8.6	49.7	1.89
ZOIBH 58	05/09/2008 09:27	967	35.7	8.1	7.9	48.3	2.32
ZOIBH 58	08/09/2008 12:03	989	37.8	8.6	5.7	47.9	1.49
ZOIBH 58	10/09/2008 10:34	984	17	3.8	14.3	64.9	2.25
ZOIBH 58	15/09/2008 12:47	1000	34.2	8	6.3	51.5	0.78
ZOIBH 58	16/09/2008 09:03	1000	33.4	8.4	6.5	51.7	0.11
ZOIBH 58	16/09/2008 11:53	999	32.8	8.1	6	53.1	-3.95
ZOIBH 58	17/09/2008 12:05	998	35.8	8.3	6.1	49.8	1.24
ZOIBH 58	22/09/2008 14:42	1001	36.7	9.3	4.6	49.4	0.21
ZOIBH 58	23/09/2008 10:12	1003	37.8	9.4	4.1	48.7	1.45
ZOIBH 58	24/09/2008 10:24	1002	38.3	9.5	3.7	48.5	2.24
ZOIBH 58	25/09/2008 09:58	1008	38.3	9.3	3.8	48.6	-0.12
ZOIBH 58	26/09/2008 09:57	1010	37.7	9.5	3.9	48.9	0.27
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 60	19/08/2008 15:05	977	48	25.9	4.6	21.5	-18.55
ZOIBH 60	20/08/2008 09:32	985	0	0	20.5	79.5	-15.46
ZOIBH 60	20/08/2008 15:19	986	0	0	21.8	78.2	-13.5
ZOIBH 60	21/08/2008 09:28	988	0	0.1	21.5	78.4	-14.04
ZOIBH 60	21/08/2008 14:24	989	0	0	21.3	78.7	-13.43
ZOIBH 60	22/08/2008 10:05	991	0	0.1	21.3	78.6	-8.17
ZOIBH 60	28/08/2008 10:40		33.7	24.9	2.1	39.3	0.15
ZOIBH 60	01/09/2008 12:11	986	32.8	25.3	1.6	40.3	-0.23
ZOIBH 60	02/09/2008 09:59	977	29.6	23.6	3.1	43.7	0.34
ZOIBH 60	02/09/2008 12:57	976	24.2	18.6	6.3	50.9	-0.14
ZOIBH 60	03/09/2008 10:00	974	26.8	21.9	3.8	47.5	0.4
ZOIBH 60	03/09/2008 14:08	972	22.1	18	7.6	52.3	0.42
ZOIBH 60	04/09/2008 10:12	972	26.5	20.8	3.6	49.1	0.48
ZOIBH 60	05/09/2008 09:22	968	26.3	18.8	3.6	51.3	0.51
ZOIBH 60	08/09/2008 12:19	989	30.4	12.9	1.3	55.4	-3.01
ZOIBH 60	10/09/2008 10:29	984	23	9.2	6.6	61.2	-1.25
ZOIBH 60	15/09/2008 13:17	999	0.4	2.3	19	78.3	-1.13
ZOIBH 60	17/09/2008 11:59	998	0.3	5.7	16.8	77.2	0.1
ZOIBH 60	18/09/2008 13:19	1000	0.2	7	14.1	78.7	0.04
ZOIBH 60	22/09/2008 15:05	1001	0.1	6.1	18	75.8	0.29
ZOIBH 60	23/09/2008 10:06	1002	0.1	6.2	18.3	75.4	0.61
ZOIBH 60	24/09/2008 10:18	1002	0.1	6.6	17.5	75.8	0.49
ZOIBH 60	25/09/2008 09:52	1008	0.2	1.3	20.6	77.9	-0.52
ZOIBH 60	26/09/2008 09:51	1010	0.1	0.2	21.6	78.1	0.51
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 61	19/08/2008 15:29	977	0	0	20.6	79.4	-18.02
ZOIBH 61	20/08/2008 10:15	984	0.2	0	20.2	79.6	-17.01
ZOIBH 61	20/08/2008 15:16	986	0.1	0.1	21.8	78	-15.15
ZOIBH 61	21/08/2008 09:25	988	0	0.1	21.3	78.6	-15.48
ZOIBH 61	21/08/2008 14:22	989	0	0	21.3	78.7	-14.72
ZOIBH 61	22/08/2008 10:08	991	0	0.1	21.4	78.5	-7.95
ZOIBH 61	28/08/2008 10:41		7.2	4.8	14.4	73.6	-0.38
ZOIBH 61	01/09/2008 12:14	986	19.3	14.1	8.5	58.1	-0.56
ZOIBH 61	02/09/2008 09:56	977	33.3	28.7	0.5	37.5	0.58
ZOIBH 61	02/09/2008 12:54	976	29.2	24.7	3	43.1	0.4
ZOIBH 61	03/09/2008 09:57	974	19.8	16.3	8.8	55.1	0.56
ZOIBH 61	03/09/2008 14:05	972	21.2	17.6	8.3	52.9	0.88
ZOIBH 61	04/09/2008 10:09	972	29.7	25.8	2.8	41.7	1.31
ZOIBH 61	05/09/2008 09:19	968	20.1	16.3	8.9	54.7	1.5
ZOIBH 61	08/09/2008 12:21	989	9.8	7.5	11.9	70.8	-1.8
ZOIBH 61	10/09/2008 10:26	985	4.9	4.3	17.3	73.5	-1.96
ZOIBH 61	15/09/2008 13:15	999	19.5	14.8	9	56.7	-1.15
ZOIBH 61	16/09/2008 09:51	999	22.8	19.3	7	50.9	-1.25
ZOIBH 61	17/09/2008 11:56	998	39.9	30.1	0.2	29.8	0.27
ZOIBH 61	18/09/2008 13:18	1000	40.1	30.5	0.2	29.2	0.06
ZOIBH 61	22/09/2008 15:03	1001	8.2	5.7	16.1	70	-0.75
ZOIBH 61	23/09/2008 10:03	1003	7.7	6.7	16.2	69.4	-0.95
ZOIBH 61	24/09/2008 10:15	1002	12.2	9.9	13.6	64.3	-1.05
ZOIBH 61	25/09/2008 09:49	1008	27.3	20	7.3	45.4	-1.91
ZOIBH 61	26/09/2008 09:48	1010	15.9	13.1	11.7	59.3	-1.16

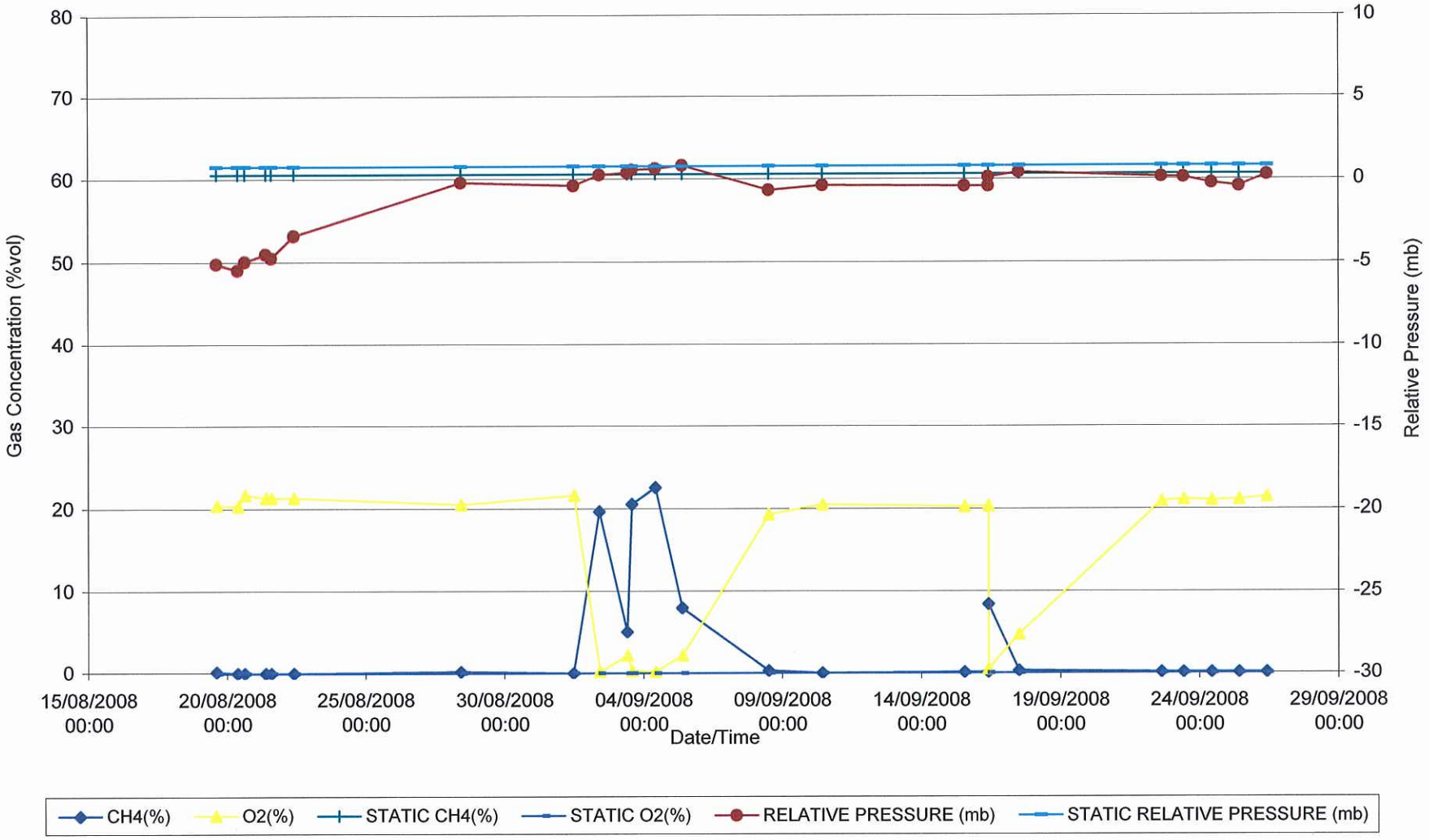
BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL						3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 70	19/08/2008 15:07	977	0.2	0	20.4	79.4	-0.52
ZOIBH 70	20/08/2008 09:36	985	0.2	0	20.2	79.6	-3.64
ZOIBH 70	20/08/2008 15:22	986	0	0	21.9	78.1	-5.13
ZOIBH 70	21/08/2008 09:31	987	0	0.1	21.5	78.4	-1.16
ZOIBH 70	21/08/2008 14:27	989	0	0	21.4	78.6	-1.8
ZOIBH 70	22/08/2008 10:02	991	0	0.1	21.3	78.6	-0.89
ZOIBH 70	28/08/2008 10:36		0.1	0.5	20.5	78.9	0.05
ZOIBH 70	01/09/2008 12:08	986	0.4	1.8	19.2	78.6	-0.3
ZOIBH 70	02/09/2008 10:02	976	2	4	15.5	78.5	0.49
ZOIBH 70	02/09/2008 13:00	975	1.3	2.7	17.7	78.3	-0.11
ZOIBH 70	03/09/2008 09:37	974	5.3	5.7	11.5	77.5	0.31
ZOIBH 70	03/09/2008 14:10	972	5.5	5.6	12.4	76.5	0.55
ZOIBH 70	04/09/2008 10:16	972	12.8	7.9	6.4	72.9	1.25
ZOIBH 70	05/09/2008 09:24	968	15.1	7.8	6.1	71	1.8
ZOIBH 70	08/09/2008 12:15	989	0.1	0.1	20.1	79.7	-0.37
ZOIBH 70	10/09/2008 10:32	984	0.1	0.1	20.4	79.4	-1.28
ZOIBH 70	15/09/2008 12:49	1000	0.2	0	20	79.8	-0.18
ZOIBH 70	16/09/2008 09:21	1000	0.2	0	20.2	79.6	-0.02
ZOIBH 70	17/09/2008 12:02	998	0.3	0.7	20	79	0.15
ZOIBH 70	18/09/2008 13:21	1000	1.5	2.3	17.4	78.8	-0.02
ZOIBH 70	18/09/2008 17:00	998	0.3	0.3	20.8	78.6	-0.07
ZOIBH 70	22/09/2008 14:44	1001	0.2	0	21.1	78.7	0.06
ZOIBH 70	23/09/2008 10:09	1002	0.1	0.1	21.5	78.3	0.15
ZOIBH 70	24/09/2008 10:21	1002	0.1	0	21.1	78.8	0.07
ZOIBH 70	25/09/2008 09:55	1008	0.1	0	21.2	78.7	0.09
ZOIBH 70	26/09/2008 09:54	1010	0	0.1	21.6	78.3	0.08
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 71	19/08/2008 15:27	977	0	0	20.7	79.3	-20.15
ZOIBH 71	20/08/2008 10:13	984	55.3	28.9	2.2	13.6	-19.7
ZOIBH 71	20/08/2008 15:13	986	53.9	27.7	2.9	15.5	-17.51
ZOIBH 71	21/08/2008 09:23	988	48.8	25	4	22.2	-18.14
ZOIBH 71	21/08/2008 14:20	989	41.4	21.4	6.4	30.8	-17.13
ZOIBH 71	22/08/2008 10:10	991	60	27.1	2.4	10.5	-8.44
ZOIBH 71	28/08/2008 10:42		56.9	19.5	2.6	21	-0.36
ZOIBH 71	01/09/2008 12:17	986	67.7	25.5	0.6	6.2	-0.39
ZOIBH 71	02/09/2008 09:53	977	63.6	24.1	1.7	10.6	0.58
ZOIBH 71	02/09/2008 12:51	976	62.6	26.6	1.4	9.4	0.78
ZOIBH 71	03/09/2008 09:55	975	66.9	27.7	0.5	4.9	0.61
ZOIBH 71	03/09/2008 14:02	972	63.1	27.4	1.6	7.9	1.03
ZOIBH 71	04/09/2008 10:06	972	67.2	27.3	0.7	4.8	1.5
ZOIBH 71	05/09/2008 09:17	968	65.4	29.8	0.9	3.9	1.64
ZOIBH 71	08/09/2008 12:23	989	71.9	23.4	1.2	3.5	-1.92
ZOIBH 71	10/09/2008 10:23	985	44.6	19.7	7.4	28.3	-2.58
ZOIBH 71	15/09/2008 13:13	999	77.5	18	0	4.5	-1.36
ZOIBH 71	16/09/2008 09:50	999	78.8	17.6	0	3.6	-1.48
ZOIBH 71	17/09/2008 11:52	998	80	16	0	4	0.63
ZOIBH 71	18/09/2008 13:17	1000	72.4	20	0.4	7.2	0
ZOIBH 71	22/09/2008 15:00	1002	73	15.1	1.6	10.3	-1.46
ZOIBH 71	23/09/2008 09:59	1002	76.1	15.5	0.8	7.6	-1.77
ZOIBH 71	24/09/2008 10:11	1002	60.4	25.4	2.7	11.5	-1.9
ZOIBH 71	25/09/2008 09:46	1008	66.2	28	1.2	4.6	-2.61
ZOIBH 71	26/09/2008 09:46	1011	66.7	28.1	1	4.2	-1.89
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 80	19/08/2008 15:18	977	23	8.9	12.4	55.7	-18.79
ZOIBH 80	20/08/2008 09:55	984	6.7	7.4	13.2	72.7	-14.48
ZOIBH 80	20/08/2008 15:00	986	3.5	6	15.9	74.6	-5.02
ZOIBH 80	21/08/2008 09:07	988	0.6	5.1	14.6	79.7	-15.7
ZOIBH 80	21/08/2008 14:07	989	0.2	1.3	19.5	79	-11.17
ZOIBH 80	22/08/2008 10:25	991	3.7	6.9	11	78.4	-7.17
ZOIBH 80	28/08/2008 10:52		19.1	16.4	5.8	58.7	-0.09
ZOIBH 80	01/09/2008 12:30	986	27.2	20	0.4	52.4	-0.15
ZOIBH 80	02/09/2008 09:37	977	30.7	21.6	0.8	46.9	1.39
ZOIBH 80	02/09/2008 12:33	976	27.4	18.4	3.3	50.9	1.73
ZOIBH 80	03/09/2008 09:40	974	41.9	24.7	1	32.4	0.18
ZOIBH 80	03/09/2008 13:47	973	37.2	21.9	3.2	37.7	-0.39
ZOIBH 80	04/09/2008 10:00	972	38.8	23.1	2	36.1	0.69
ZOIBH 80	05/09/2008 09:12	968	38.5	20.8	2	38.7	1.34
ZOIBH 80	08/09/2008 12:33	989	35.1	12.5	2.4	50	-0.76
ZOIBH 80	10/09/2008 10:18	984	20.1	7.1	10.8	62	-2.66
ZOIBH 80	15/09/2008 13:08	999	37.3	14.3	0.4	48	-9.97
ZOIBH 80	16/09/2008 09:27	999	37.6	15.1	0.3	47	-8.09
ZOIBH 80	17/09/2008 11:36	998	38.4	14.3	0.8	46.5	-0.96
ZOIBH 80	18/09/2008 13:27	1000	34.4	13.4	1.4	50.8	-10.64
ZOIBH 80	18/09/2008 16:57	998	35.4	13.7	1	49.9	-24.32
ZOIBH 80	22/09/2008 14:47	1001	0.1	2.4	19.4	78.1	-10.66
ZOIBH 80	23/09/2008 09:42	1002	0.2	2.2	20.3	77.3	-8.82
ZOIBH 80	24/09/2008 09:55	1002	0.2	2	20.2	77.6	-10.64
ZOIBH 80	25/09/2008 09:29	1008	0.1	1.7	20.3	77.9	-4.39
ZOIBH 80	26/09/2008 09:27	1011	0.2	1.9	20.6	77.3	-3.81
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 81	19/08/2008 15:25	977	4.5	3.2	19.1	73.2	-19.22
ZOIBH 81	20/08/2008 10:10	984	8.9	5.7	17	68.4	-21.07
ZOIBH 81	20/08/2008 15:10	986	6.6	4.7	19.1	69.6	-17.81
ZOIBH 81	21/08/2008 09:20	988	54.7	32.1	2.4	10.8	-18.77
ZOIBH 81	21/08/2008 14:17	989	36.3	21.3	8.3	34.1	-17.36
ZOIBH 81	22/08/2008 10:13	991	46.3	27.7	4.8	21.2	-9.96
ZOIBH 81	28/08/2008 10:44		61.6	32.5	0.6	5.3	0.05
ZOIBH 81	01/09/2008 12:19	986	64	33.9	0.3	1.8	0.36
ZOIBH 81	02/09/2008 09:50	977	62.2	34.5	0.8	2.5	2.03
ZOIBH 81	02/09/2008 12:45	976	55.3	31.2	2.4	11.1	2.13
ZOIBH 81	03/09/2008 09:52	975	63	34.8	0.5	1.7	1.39
ZOIBH 81	03/09/2008 14:00	972	58.9	33.8	1.6	5.7	1.62
ZOIBH 81	04/09/2008 10:03	972	63.5	35.6	0.4	0.5	2.29
ZOIBH 81	05/09/2008 09:14	968	63	36.1	0.6	0.3	2.84
ZOIBH 81	08/09/2008 12:25	989	63.1	34.2	0.3	2.4	-1.88
ZOIBH 81	10/09/2008 10:20	984	37.1	21.7	8.9	32.3	-4.51
ZOIBH 81	15/09/2008 13:12	999	66.3	35	0.3	0	-3.34
ZOIBH 81	16/09/2008 09:49	999	67.3	36	0	0	-3.15
ZOIBH 81	17/09/2008 11:49	998	67.2	35.4	0.2	0	0.95
ZOIBH 81	18/09/2008 13:15	1000	64.5	34	0.3	1.2	-1.97
ZOIBH 81	18/09/2008 16:56	998	61.4	34	0.7	3.9	-10.13
ZOIBH 81	22/09/2008 14:57	1002	58.9	32.3	2.6	6.2	-6.74
ZOIBH 81	23/09/2008 09:56	1002	51.7	29.2	4.3	14.8	-7.36
ZOIBH 81	24/09/2008 10:08	1002	53.7	30.1	3.7	12.5	-6.84
ZOIBH 81	25/09/2008 09:43	1008	57.5	30.9	2.6	9	-7.95
ZOIBH 81	26/09/2008 09:43	1011	35.3	20.4	9.6	34.7	-6.62

BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL						3298
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 90	19/08/2008 15:20	977	0.1	2.8	16.8	80.3	0.16
ZOIBH 90	20/08/2008 09:57	984	0.1	9	7	83.9	0.13
ZOIBH 90	20/08/2008 15:02	986	0	9.6	6.8	83.6	0.13
ZOIBH 90	21/08/2008 09:10	987	0	9.5	7.4	83.1	-0.27
ZOIBH 90	21/08/2008 14:10	989	0	5.8	12.2	82	-0.77
ZOIBH 90	22/08/2008 10:21	991	0	10.1	6.4	83.5	0.05
ZOIBH 90	01/09/2008 12:28	986	58	25.1	0.3	16.6	-0.24
ZOIBH 90	02/09/2008 09:40	977	65.9	30.5	0.2	3.4	0.34
ZOIBH 90	02/09/2008 12:36	976	57.3	28	2.1	12.6	-0.31
ZOIBH 90	03/09/2008 09:43	974	65.3	30.8	0.2	3.7	0.35
ZOIBH 90	03/09/2008 13:50	973	60.8	29.8	1.1	8.3	0.26
ZOIBH 90	04/09/2008 09:57	972	66.4	31.7	0.2	1.7	0.38
ZOIBH 90	05/09/2008 09:09	968	67.7	30.3	0.5	1.5	0.7
ZOIBH 90	10/09/2008 10:15	984	52.4	11.7	4.7	31.2	0.17
ZOIBH 90	15/09/2008 13:10	999	20.1	12.5	0	67.4	0.08
ZOIBH 90	16/09/2008 09:24	1000	22.1	14.4	0.2	63.3	0.01
ZOIBH 90	17/09/2008 11:39	998	69	30.9	0.2	0	0.12
ZOIBH 90	18/09/2008 13:24	1000	65.5	31.7	0.2	2.6	0.09
ZOIBH 90	18/09/2008 16:58	998	64.6	31.3	0.2	3.9	0.02
ZOIBH 90	22/09/2008 14:49	1002	59.7	24.2	0.4	15.7	0.3
ZOIBH 90	23/09/2008 09:46	1002	57.2	24.7	0.3	17.8	0.32
ZOIBH 90	24/09/2008 09:58	1002	32.5	16.7	0.3	50.5	0.57
ZOIBH 90	25/09/2008 09:33	1008	20.7	14.3	0.6	64.4	0.04
ZOIBH 90	26/09/2008 09:33	1011	12.7	13.4	0.7	73.2	0.41
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 91	19/08/2008 15:21	977	0.1	0.1	20.5	79.3	-0.3
ZOIBH 91	20/08/2008 09:59	984	0	0.6	20	79.4	-0.38
ZOIBH 91	20/08/2008 15:05	986	0	0.7	21.3	78	-0.14
ZOIBH 91	21/08/2008 09:14	988	0	0.5	21	78.5	-0.41
ZOIBH 91	21/08/2008 14:12	989	0	0.4	21	78.6	-1.2
ZOIBH 91	22/08/2008 10:19	991	0	0.4	21.3	78.3	-0.41
ZOIBH 91	28/08/2008 10:48		7.2	8.4	10.8	73.6	-0.05
ZOIBH 91	01/09/2008 12:25	986	65	33	0.2	1.8	-0.17
ZOIBH 91	02/09/2008 09:43	976	65.4	34.1	0.1	0.4	0.31
ZOIBH 91	02/09/2008 12:39	976	64.5	34.3	0.2	1	-0.34
ZOIBH 91	03/09/2008 09:46	974	62.1	33.5	0.6	3.8	0.35
ZOIBH 91	03/09/2008 13:53	972	40.5	26.7	4.6	28.2	0.38
ZOIBH 91	04/09/2008 09:54	972	23.3	20	5.8	50.9	0.49
ZOIBH 91	05/09/2008 09:06	969	0.6	4.7	17.5	77.2	0.99
ZOIBH 91	08/09/2008 12:30	989	1.2	2.4	15.9	80.5	0.62
ZOIBH 91	10/09/2008 10:12	984	0	0.4	20	79.6	0.05
ZOIBH 91	15/09/2008 13:07	999	0.2	0.9	19.4	79.5	0
ZOIBH 91	16/09/2008 09:25	1000	0.1	0.9	19.5	79.5	0
ZOIBH 91	17/09/2008 11:43	997	0.2	1.5	19.5	78.8	0.1
ZOIBH 91	18/09/2008 13:26	1000	0	1.1	20	78.9	-0.2
ZOIBH 91	22/09/2008 14:52	1002	0.2	0.4	20.5	78.9	-0.57
ZOIBH 91	23/09/2008 09:49	1002	0.2	0.4	21.4	78	-0.51
ZOIBH 91	24/09/2008 10:02	1002	0.1	0.3	21.2	78.4	-0.36
ZOIBH 91	25/09/2008 09:36	1008	0	0.3	21.2	78.5	-0.39
ZOIBH 91	26/09/2008 09:37	1010	0.1	0.3	21.6	78	-0.29
SAMPLE POINT	DATE	BAROMETRIC PRESSURE (mb)	CH_4(%)	CO_2(%)	O_2(%)	BALANCE OF REMAINING GASES (%)	RELATIVE PRESSURE (mb)
ZOIBH 92	19/08/2008 15:23	977	0.1	0	20.6	79.3	-22.62
ZOIBH 92	20/08/2008 10:01	984	38.8	23.5	7.5	30.2	-22.93
ZOIBH 92	20/08/2008 15:08	986	8.4	4.9	19	67.7	-18.38
ZOIBH 92	21/08/2008 09:17	987	50.1	25.5	4.3	20.1	-18.65
ZOIBH 92	21/08/2008 14:15	989	43.6	21.3	6.4	28.7	-16.92
ZOIBH 92	22/08/2008 10:16	991	46	19.8	6.1	28.1	-11.34
ZOIBH 92	28/08/2008 10:46		48.5	22.7	3.7	25.1	0.04
ZOIBH 92	01/09/2008 12:22	986	57.5	22.2	1.5	18.8	0.54
ZOIBH 92	02/09/2008 09:47	977	61.5	24.1	0.8	13.6	2.69
ZOIBH 92	02/09/2008 12:42	976	61.2	23.5	0.7	14.6	2.85
ZOIBH 92	03/09/2008 09:49	975	65.9	25.7	0.3	8.1	0.68
ZOIBH 92	03/09/2008 13:57	973	66.1	26	0.4	7.5	0.89
ZOIBH 92	04/09/2008 09:51	973	68	24.3	0.3	7.4	2.38
ZOIBH 92	05/09/2008 09:03	968	70.5	23.1	0.2	6.2	2.44
ZOIBH 92	08/09/2008 12:28	989	72.6	17.8	0.4	9.2	-3.06
ZOIBH 92	10/09/2008 10:09	985	26.3	7.9	13	52.8	-9.13
ZOIBH 92	15/09/2008 13:05	999	54.2	15.1	2.4	28.3	-7.13
ZOIBH 92	16/09/2008 09:38	999	54.7	15.7	1.8	27.8	-6.58
ZOIBH 92	17/09/2008 11:46	998	57.5	15.2	1.5	25.8	-0.53
ZOIBH 92	18/09/2008 13:14	1000	57.6	15	1	26.4	-8.22
ZOIBH 92	18/09/2008 16:54	998	50	13.2	2.9	33.9	-26.58
ZOIBH 92	22/09/2008 14:55	1002	38.8	18.1	7.5	35.6	-17.42
ZOIBH 92	23/09/2008 09:52	1003	41.6	20.9	6.7	30.8	-18.33
ZOIBH 92	24/09/2008 10:05	1002	29.7	14.9	11	44.4	-16.96
ZOIBH 92	25/09/2008 09:40	1008	35.6	18.9	9	36.5	-18.62
ZOIBH 92	26/09/2008 09:40	1011	48.2	26	5	20.8	-18.08

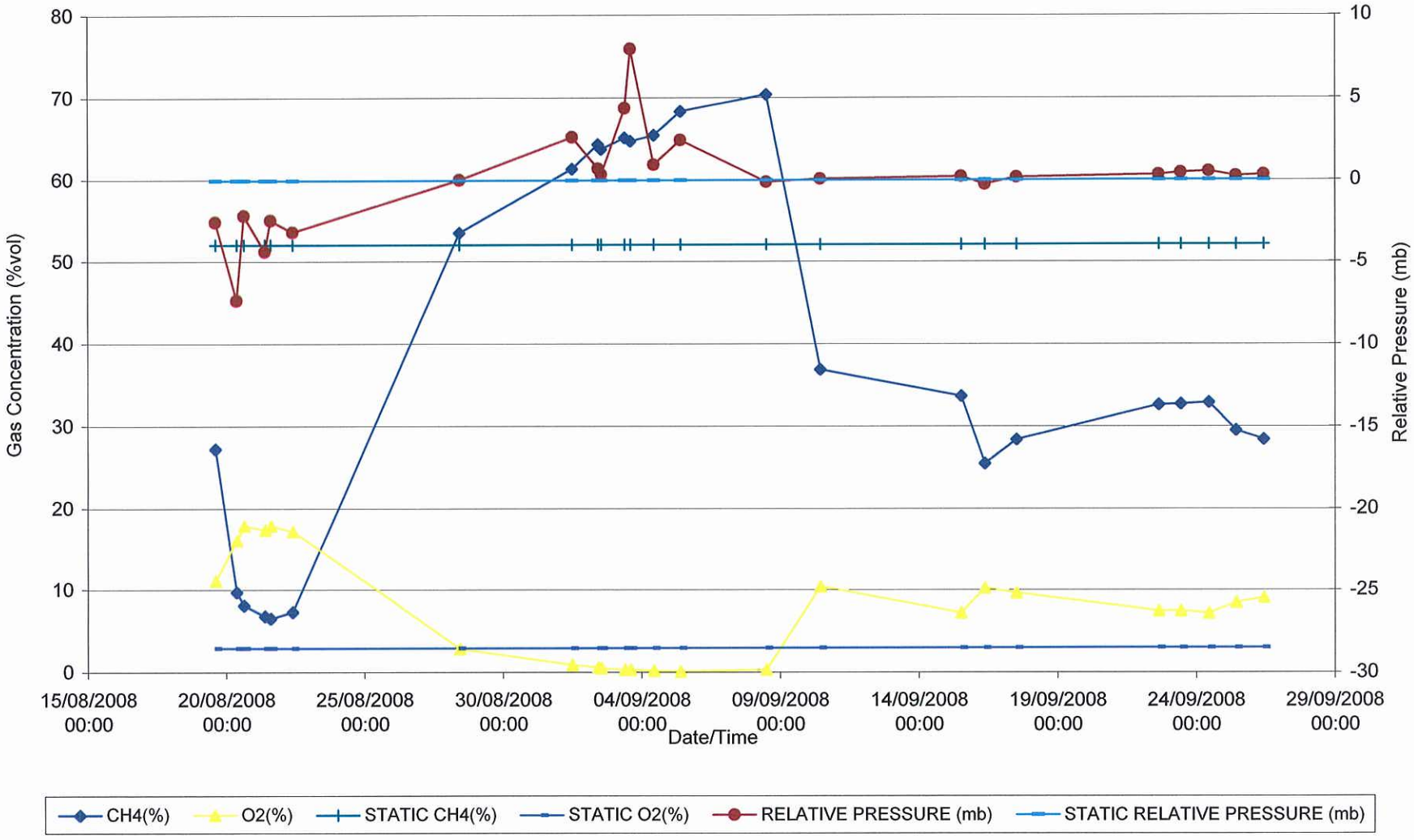
ZOIBH 47 Graph



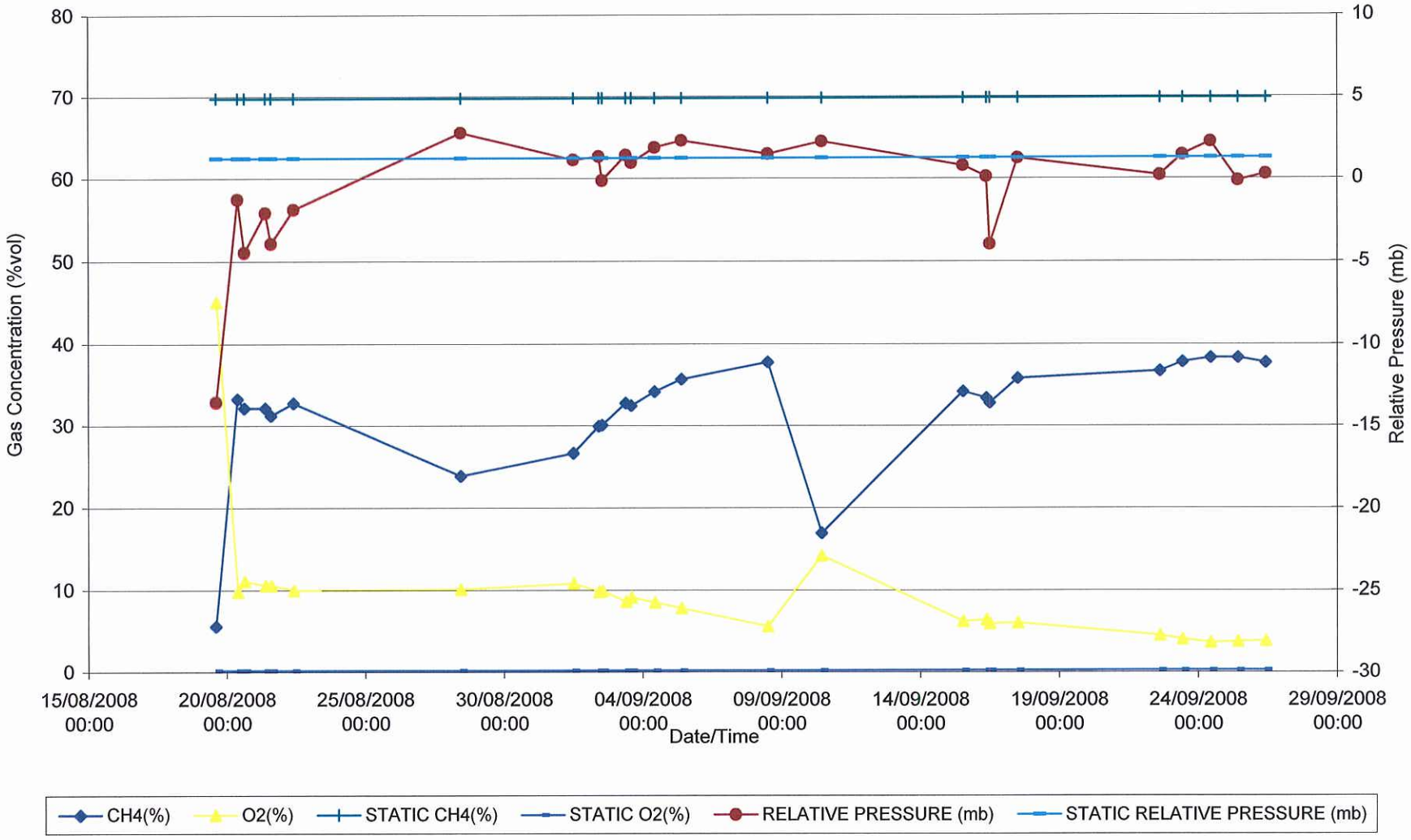
ZOIBH 48 Graph



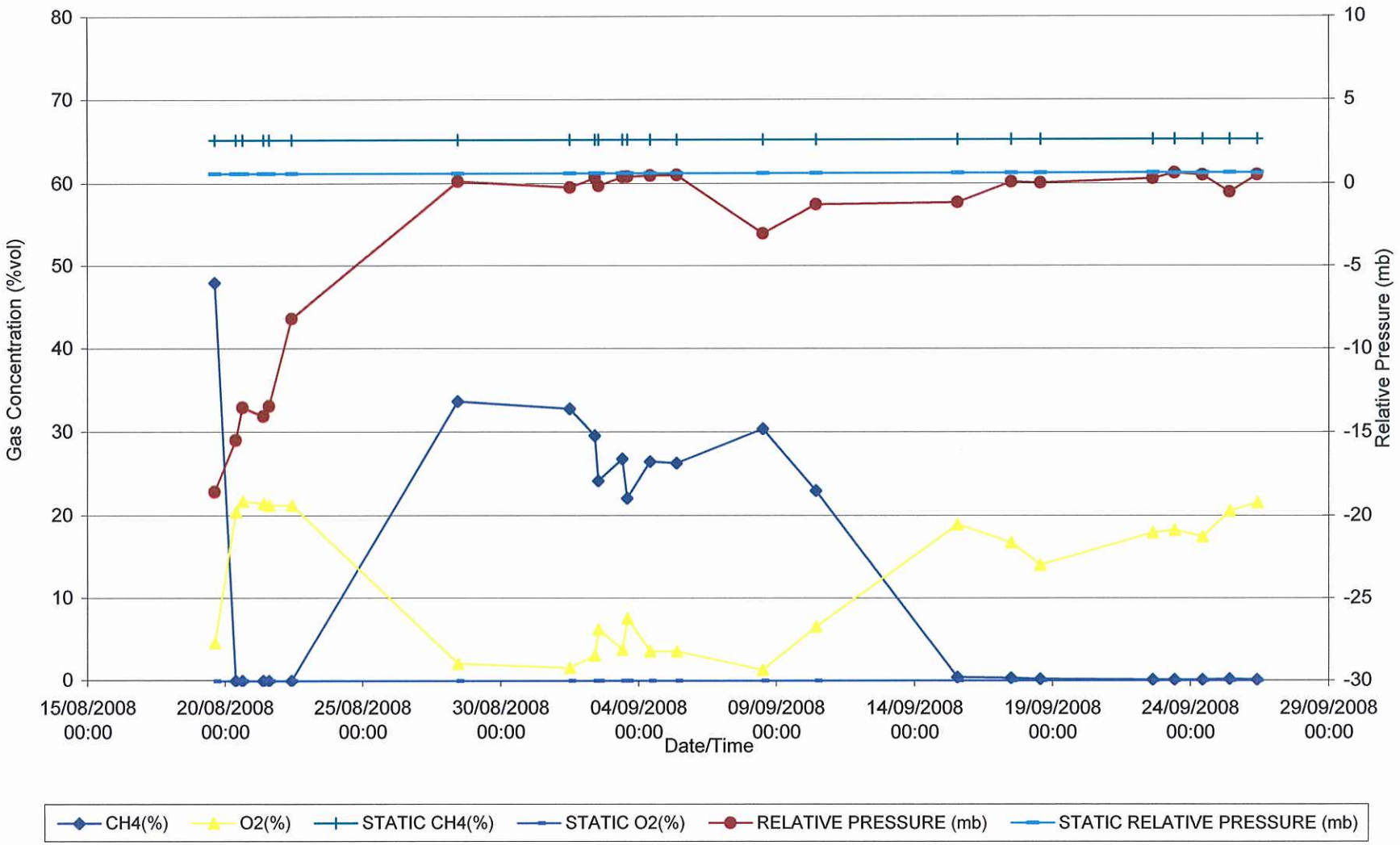
ZOIBH 57 Graph



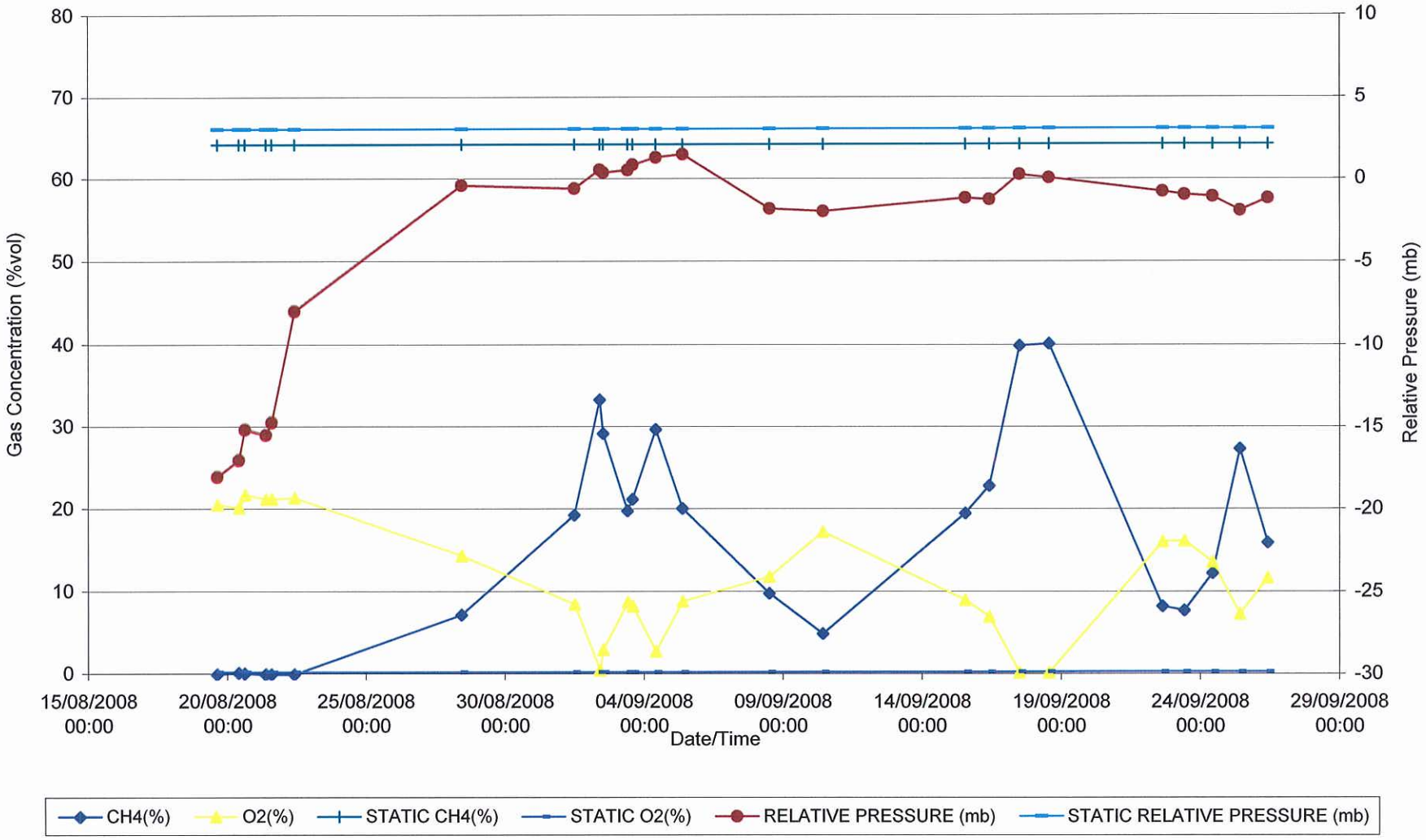
ZOIBH 58 Graph



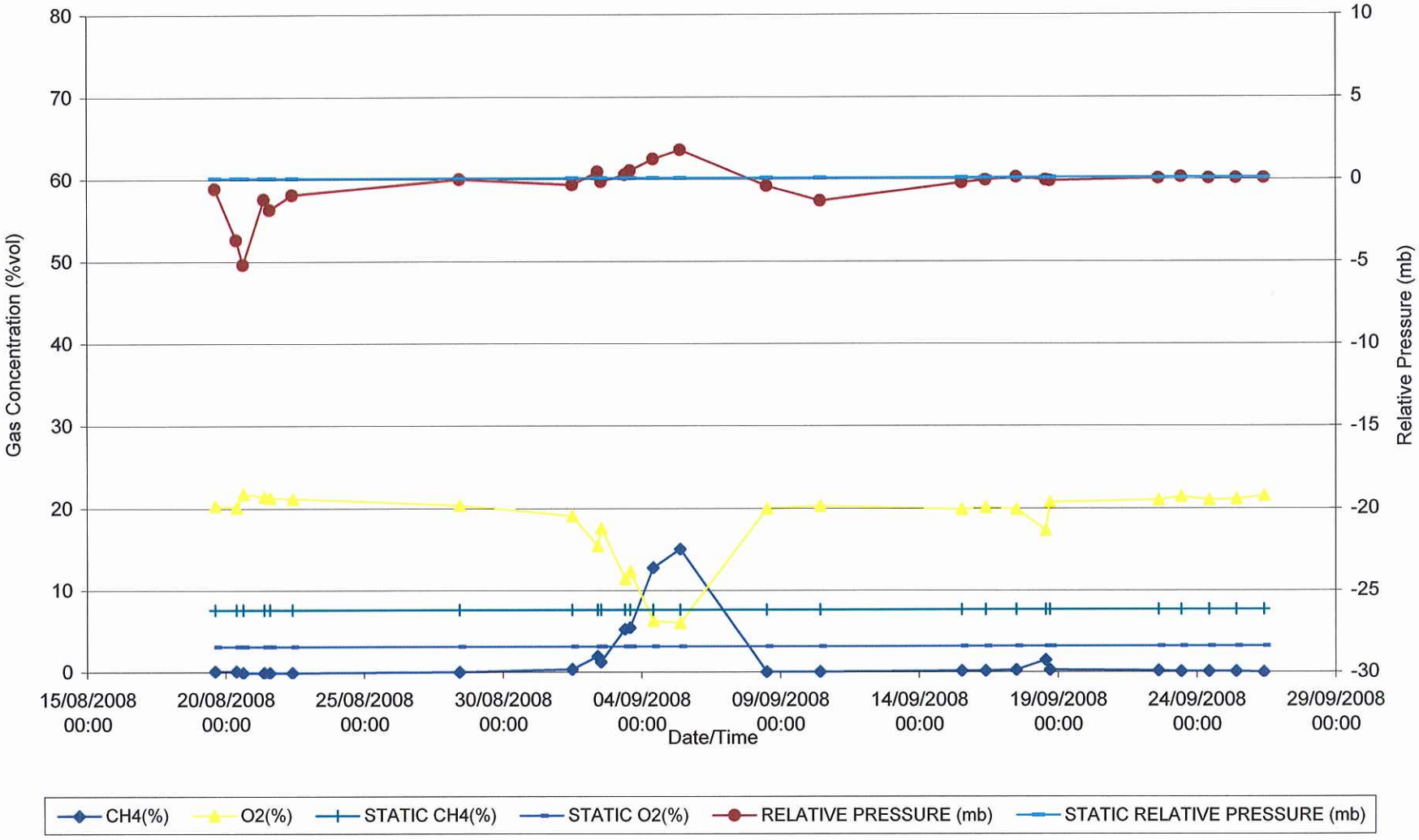
ZOIBH 60 Graph



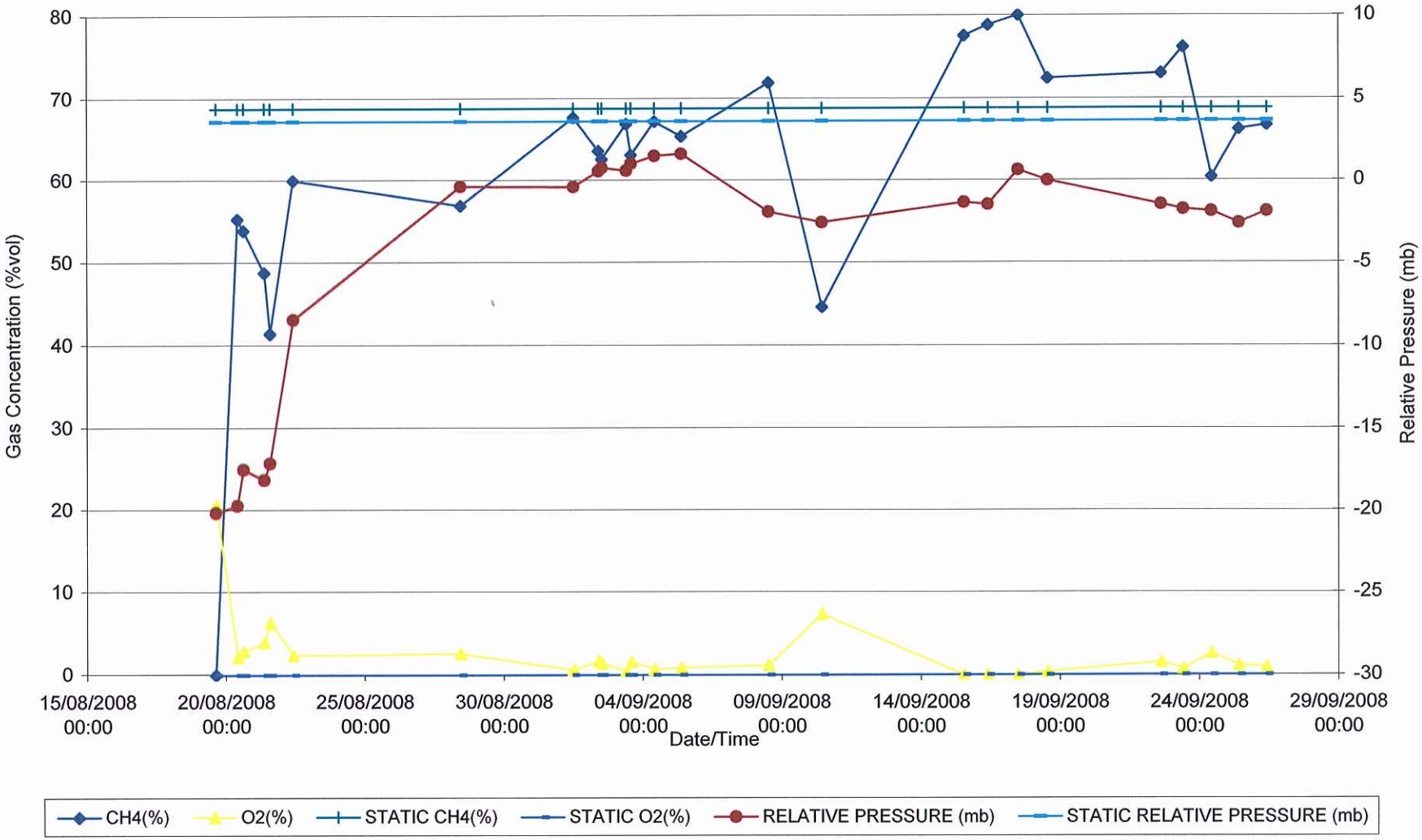
ZOIBH 61 Graph



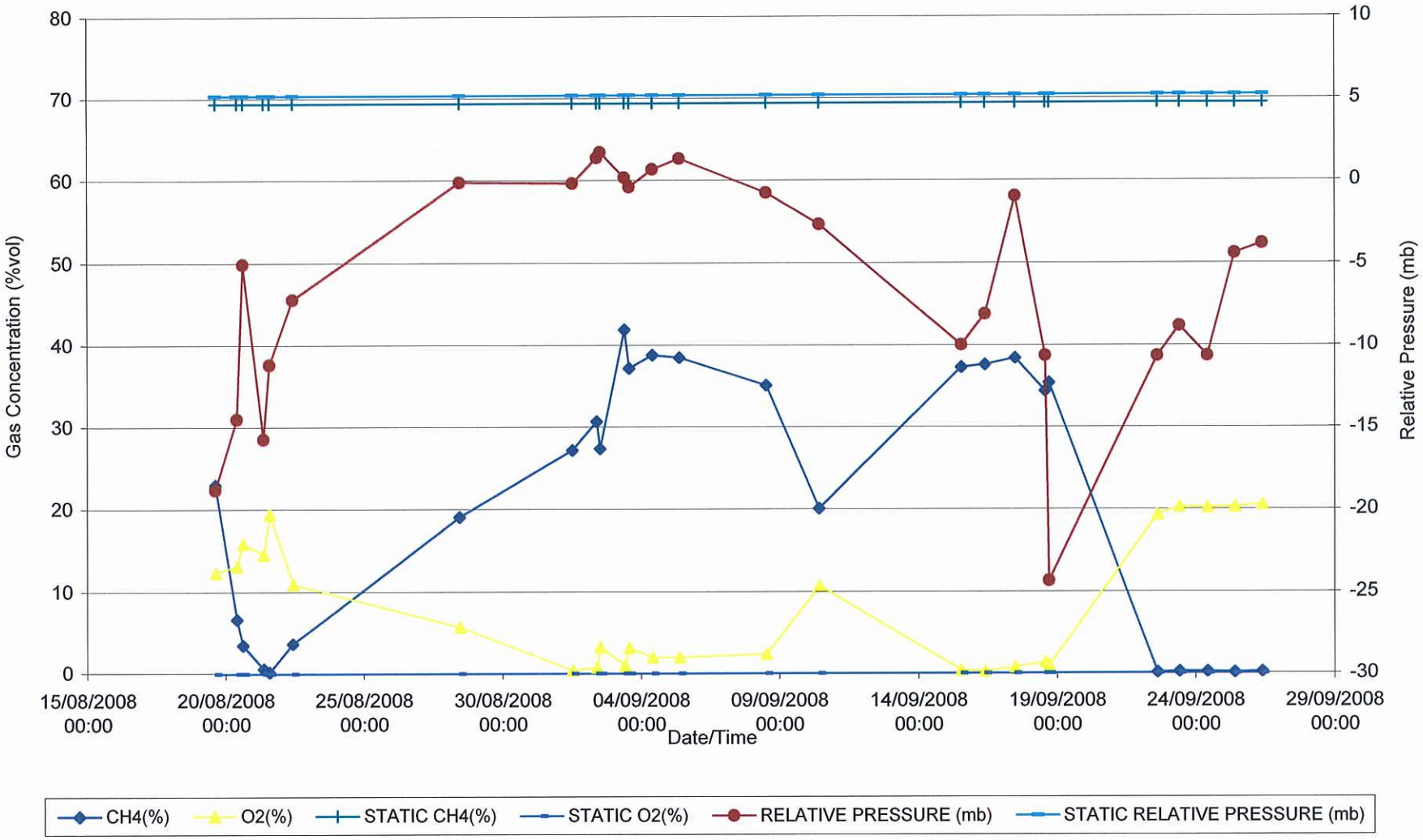
ZOIBH 70 Graph



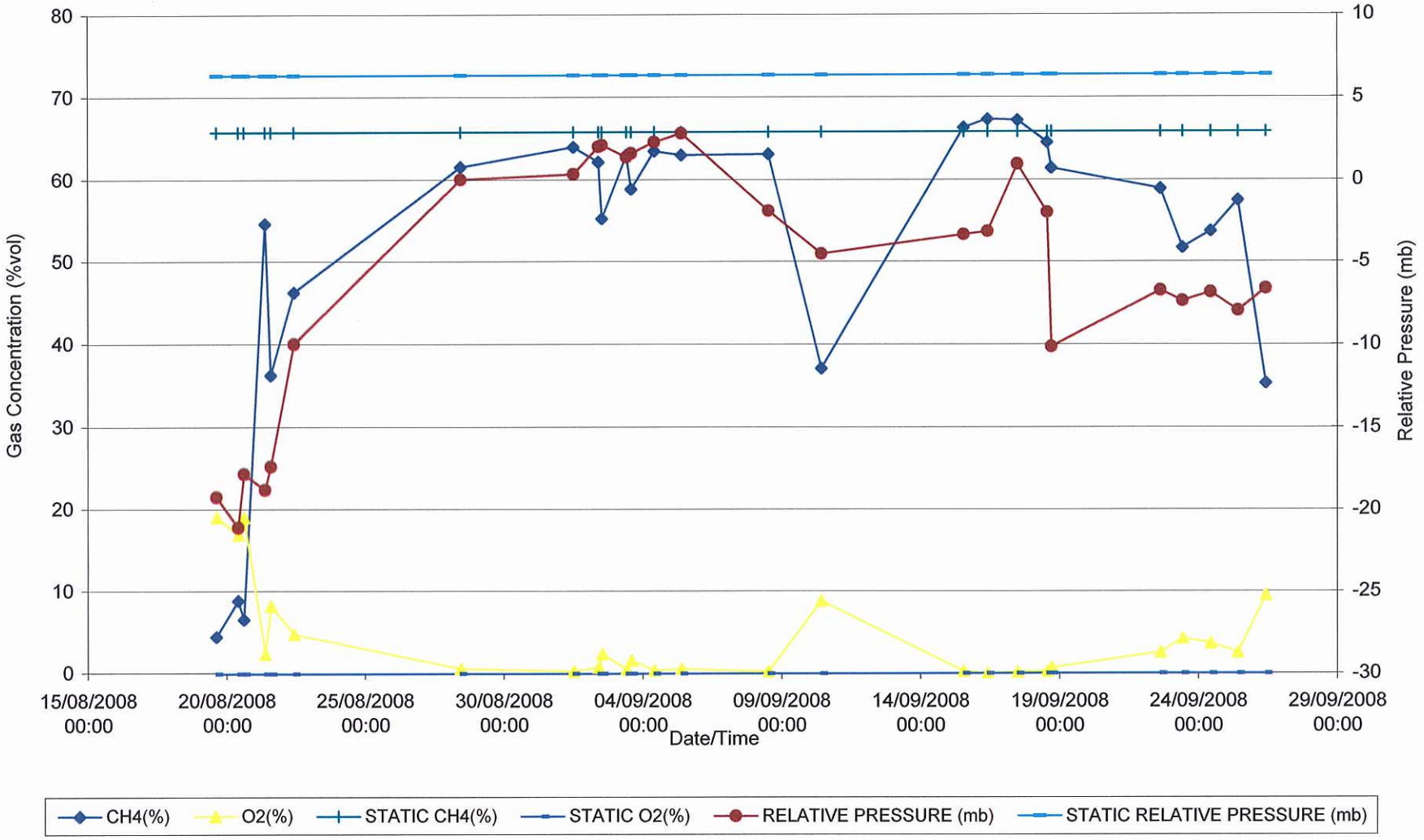
ZOIBH 71 Graph



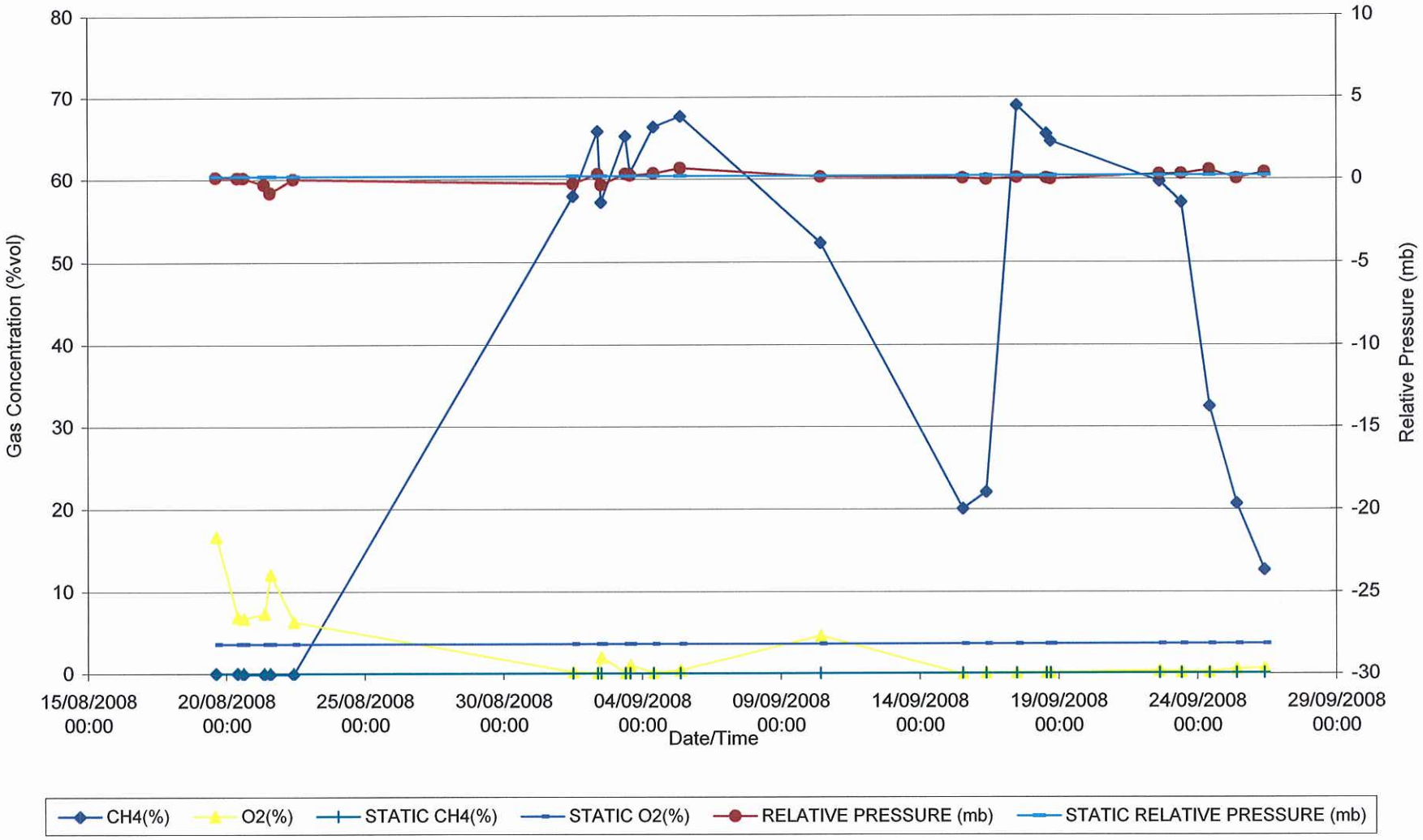
ZOIBH 80 Graph



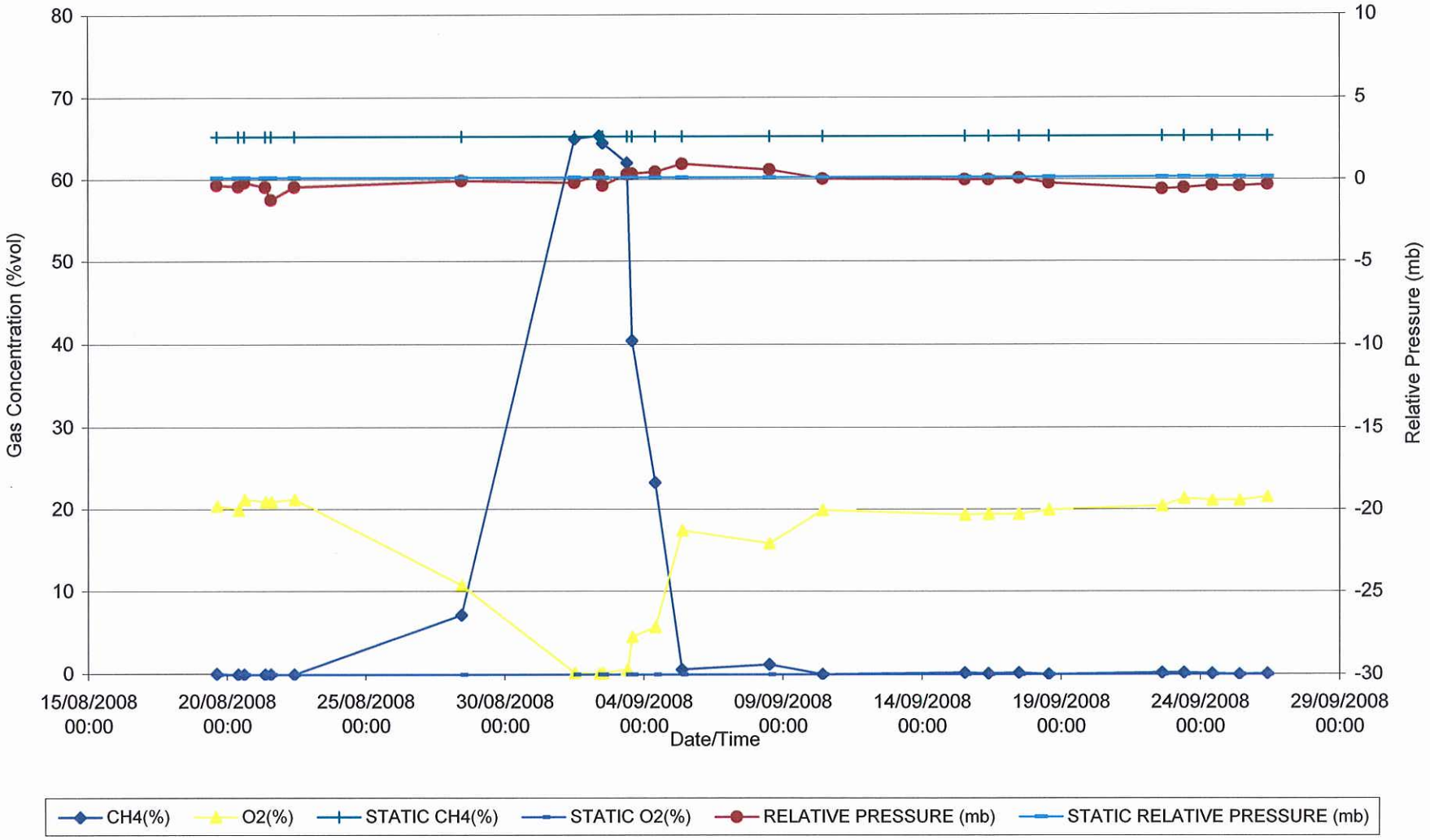
ZOIBH 81 Graph



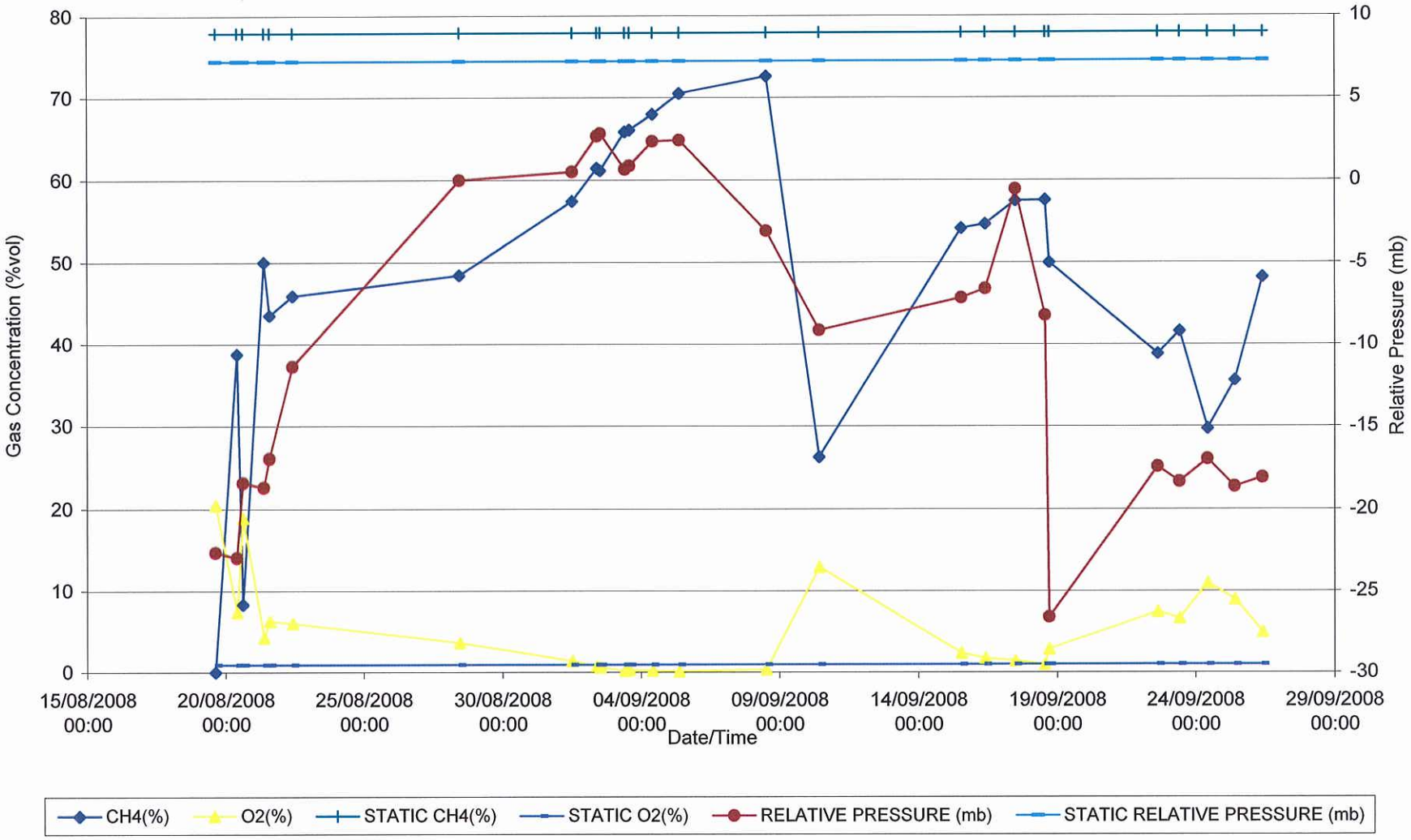
ZOIBH 90 Graph



ZOIBH 91 Graph



ZOIBH 92 Graph



Appendix I. Leachate Levels

Stoney Hill Trial Dips ZOIBH

SAMPLE POINT	DATE	DIP TO LIQUID (metres below well head)
69	18/08/2008 00:00	13.74
69	19/08/2008 08:45	12.7
69	20/08/2008 15:49	10.8
69	21/08/2008 10:07	9.84
69	21/08/2008 14:56	9.93
69	22/08/2008 10:51	8.06
69	26/08/2008 00:00	13.05
69	27/08/2008 09:43	13.1
69	29/08/2008 10:30	13.4
69	01/09/2008 12:48	8.24
69	02/09/2008 10:41	8.24
69	03/09/2008 10:22	7.1
69	04/09/2008 00:00	8.55
69	05/09/2008 00:00	8.88
69	10/09/2008 10:59	8.03
69	17/09/2008 12:36	8.15
69	22/09/2008 15:59	13.6
69	23/09/2008 11:14	13.58
69	24/09/2008 11:28	12.43
69	25/09/2008 10:50	13.58
ZOIBH 46	18/08/2008 15:05	4.66
ZOIBH 47	18/08/2008 00:00	9.31
ZOIBH 47	19/08/2008 09:41	8.66
ZOIBH 47	20/08/2008 16:22	8.81
ZOIBH 47	21/08/2008 09:56	8.75
ZOIBH 47	21/08/2008 14:48	8.5
ZOIBH 47	22/08/2008 10:47	8.27
ZOIBH 47	26/08/2008 00:00	9.4
ZOIBH 47	27/08/2008 09:35	dry
ZOIBH 47	29/08/2008 10:24	9.5
ZOIBH 47	01/09/2008 12:39	9.93
ZOIBH 47	02/09/2008 10:30	9.92
ZOIBH 47	03/09/2008 10:13	9.8
ZOIBH 47	04/09/2008 00:00	9.35
ZOIBH 47	05/09/2008 00:00	8.55
ZOIBH 47	10/09/2008 10:50	7.95
ZOIBH 47	17/09/2008 12:26	9.69
ZOIBH 47	22/09/2008 15:29	10.08
ZOIBH 47	23/09/2008 10:35	10.06
ZOIBH 47	24/09/2008 10:51	10.04
ZOIBH 47	25/09/2008 10:20	10.06
ZOIBH 48	18/08/2008 00:00	9.35
ZOIBH 48	19/08/2008 09:39	9.33
ZOIBH 48	20/08/2008 16:19	9.33
ZOIBH 48	21/08/2008 10:01	9.33
ZOIBH 48	21/08/2008 14:52	9.33
ZOIBH 48	22/08/2008 10:49	9.33
ZOIBH 48	26/08/2008 00:00	9.1
ZOIBH 48	27/08/2008 09:48	dry
ZOIBH 48	29/08/2008 10:22	8.8
ZOIBH 48	01/09/2008 12:43	9.35
ZOIBH 48	02/09/2008 10:35	dry
ZOIBH 48	03/09/2008 10:18	9.74
ZOIBH 48	04/09/2008 00:00	9.35
ZOIBH 48	05/09/2008 00:00	9.37
ZOIBH 48	10/09/2008 10:55	9.34
ZOIBH 48	17/09/2008 12:32	9.5
ZOIBH 48	22/09/2008 15:35	9.32
ZOIBH 48	23/09/2008 10:40	9.3
ZOIBH 48	24/09/2008 10:56	9.31
ZOIBH 48	25/09/2008 10:25	9.3
ZOIBH 57	18/08/2008 15:00	5.57
	27/08/2008 09	dry
ZOIBH 58	19/08/2008 09:40	2.37
ZOIBH 58	26/08/2008 00:00	2.5
ZOIBH 61	18/08/2008 00:00	8.17
ZOIBH 61	18/08/2008 13:46	8.17
ZOIBH 61	18/08/2008 14:38	7.45
ZOIBH 61	18/08/2008 15:16	8.29
ZOIBH 61	20/08/2008 16:13	8.27
ZOIBH 61	21/08/2008 10:34	7.7
ZOIBH 61	21/08/2008 15:16	8.2
ZOIBH 61	22/08/2008 11:03	8.2
ZOIBH 61	29/08/2008 10:06	8.6
ZOIBH 61	01/09/2008 13:09	7.43
ZOIBH 61	02/09/2008 11:06	6.21
ZOIBH 61	03/09/2008 10:47	7.33
ZOIBH 61	04/09/2008 00:00	6.59
ZOIBH 61	05/09/2008 00:00	7.22
ZOIBH 61	10/09/2008 11:17	8.19
ZOIBH 61	17/09/2008 12:56	8.16
ZOIBH 61	22/09/2008 15:39	8.16
ZOIBH 61	23/09/2008 10:44	8.51
ZOIBH 61	24/09/2008 11:02	3.01
ZOIBH 61	25/09/2008 10:31	8.23

SAMPLE POINT	DATE	DIP TO LIQUID (metres below well head)
ZOIBH 70	01/09/2008 12:50	5.68
ZOIBH 70	02/09/2008 10:43	5.54
ZOIBH 70	03/09/2008 10:25	5.87
ZOIBH 70	04/09/2008 00:00	5.75
ZOIBH 70	05/09/2008 00:00	6.1
ZOIBH 70	10/09/2008 11:01	5.76
ZOIBH 70	17/09/2008 12:38	5.64
ZOIBH 70	22/09/2008 15:56	10.5
ZOIBH 70	23/09/2008 11:12	6.58
ZOIBH 70	24/09/2008 11:26	5.6
ZOIBH 70	25/09/2008 10:47	5.15
ZOIBH 90	01/09/2008 12:53	4.58
ZOIBH 90	02/09/2008 10:45	4
ZOIBH 90	03/09/2008 10:27	3.99
ZOIBH 90	04/09/2008 00:00	4
ZOIBH 90	05/09/2008 00:00	5.3
ZOIBH 90	10/09/2008 11:03	4.04
ZOIBH 90	17/09/2008 12:40	4.17
ZOIBH 90	22/09/2008 15:51	7.48
ZOIBH 90	23/09/2008 11:07	5.32
ZOIBH 90	24/09/2008 11:21	4.02
ZOIBH 90	25/09/2008 10:42	4.17
ZOIBH 80	01/09/2008 12:55	7.31
ZOIBH 80	02/09/2008 10:48	7.29
ZOIBH 80	03/09/2008 10:30	7.3
ZOIBH 80	04/09/2008 00:00	7.26
ZOIBH 80	05/09/2008 00:00	5.48
ZOIBH 80	10/09/2008 11:05	7.5
ZOIBH 80	17/09/2008 12:42	7.36
ZOIBH 80	22/09/2008 15:53	7.9
ZOIBH 80	23/09/2008 11:19	7.89
ZOIBH 80	24/09/2008 11:23	7.31
ZOIBH 80	25/09/2008 10:45	7.37
ZOIBH 81	01/09/2008 12:59	4.98
ZOIBH 81	02/09/2008 10:53	4.98
ZOIBH 81	03/09/2008 10:34	4.98
ZOIBH 81	04/09/2008 00:00	5
ZOIBH 81	05/09/2008 00:00	4.29
ZOIBH 81	10/09/2008 11:09	6.23
ZOIBH 81	17/09/2008 12:46	5.33
ZOIBH 81	22/09/2008 15:46	7.59
ZOIBH 81	23/09/2008 11:03	7.04
ZOIBH 81	24/09/2008 11:16	4.97
ZOIBH 81	25/09/2008 10:37	2.84
ZOIBH 71	01/09/2008 13:05	6.99
ZOIBH 71	02/09/2008 11:01	6.99
ZOIBH 71	03/09/2008 10:43	6.99
ZOIBH 71	04/09/2008 00:00	6.93
ZOIBH 71	05/09/2008 00:00	7
ZOIBH 71	10/09/2008 11:13	6.99
ZOIBH 71	17/09/2008 12:52	7.02
ZOIBH 71	22/09/2008 16:00	7.03
ZOIBH 71	23/09/2008 10:49	6.99
ZOIBH 71	24/09/2008 11:07	6.76
ZOIBH 71	25/09/2008 10:35	6.98
ZOIBH 60	01/09/2008 13:11	2.94
ZOIBH 60	02/09/2008 11:08	2.7
ZOIBH 60	03/09/2008 10:49	2.8
ZOIBH 60	04/09/2008 00:00	2.8
ZOIBH 60	05/09/2008 00:00	2.83
ZOIBH 60	10/09/2008 11:18	2.68
ZOIBH 60	17/09/2008 12:58	2.88
ZOIBH 60	22/09/2008 15:37	2.97
ZOIBH 60	23/09/2008 00:00	2.68
ZOIBH 60	24/09/2008 10:59	2.69
ZOIBH 60	25/09/2008 10:27	2.71

BIOGAS ENGINEERING LIMITED

STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL

SAMPLE POINT	DATE	DIP TO LIQUID (metres below well head)	DIP TO LIQUID (metres below ground level)	APPROXIMATE DATUM (m)	LEACHATE LEVEL (mAOD)		PUMP COUNTER READING	COMMENTS
GEW 1	25/02/2008 00:00	n/a	10.90	191.50	180.6			
GEW 1	26/02/2008 00:00	n/a	11.50	191.50	180			
GEW 1	29/02/2008 00:00	n/a	10.66	191.50	180.84			
GEW 1	03/03/2008 00:00	n/a	9.00	191.50	182.5			
GEW 1	05/03/2008 00:00	n/a	10.72	191.50	180.78			
GEW 1	07/03/2008 00:00	n/a	10.65	191.50	180.85			
GEW 1	11/03/2008 00:00	n/a	10.68	191.50	180.82			
GEW 1	25/03/2008 00:00	n/a	10.73	191.50	180.77			
GEW 1	30/06/2008 00:00	n/a	11.00	191.50	180.5			
GEW 1	18/08/2008 00:00	12	11.1	191.50	180.4			Pump started at 1.32pm
GEW 1	18/08/2008 10:54	12.08	11.18	191.50	180.32		66	Static gas and leachate readings. Tested Pump, but counter failed
GEW 1	18/08/2008 14:53	12.53	11.63	191.50	179.87			Turned off due to repairs to leachate line. Back on at 2.50pm
GEW 1	18/08/2008 15:13	13	12.1	191.50	179.4			
GEW 1	18/08/2008 15:25	13.08	12.18	191.50	179.32			
GEW 1	19/08/2008 08:30	14.31	13.41	191.50	178.09			
GEW 1	19/08/2008 11:55	13.12	12.22	191.50	179.28			
GEW 1	20/08/2008 15:43	11.59	10.69	191.50	180.81			
GEW 1	21/08/2008 09:51	15.05	14.15	191.50	177.35			
GEW 1	21/08/2008 14:45	15.25	14.35	191.50	177.15			
GEW 1	22/08/2008 11:50	14.87	13.97	191.50	177.53			
GEW 1	26/08/2008 00:00	14.55	13.65	191.50	177.85		145	
GEW 1	27/08/2008 09:30	14.3	13.4	191.50	178.1			
GEW 1	28/08/2008 10:31	14.6	13.7	191.50	177.8			
GEW 1	01/09/2008 13:15	13.24	12.34	191.50	179.16		599182	
GEW 1	02/09/2008 10:26	14.78	13.88	191.50	177.62		610249	
GEW 1	03/09/2008 10:52	15	14.1	191.50	177.4		622762	
GEW 1	04/09/2008 00:00	15.02	14.12	191.50	177.38		636027	
GEW 1	05/09/2008 00:00	14	13.1	191.50	178.4		647732	
GEW 1	10/09/2008 11:20	14.03	13.13	191.50	178.37		654950	
GEW 1	15/09/2008 00:00	14.87	13.97	191.50	177.53			
GEW 1	17/09/2008 13:01	13.42	12.52	191.50	178.98		676187	
GEW 1	22/09/2008 16:04	13.76	12.86	191.50	178.64		710652	
GEW 1	23/09/2008 11:22	13.91	13.01	191.50	178.49		710655	
GEW 1	24/09/2008 10:46	13.4	12.5	191.50	179		711205	
GEW 1	25/09/2008 10:55	14.27	13.37	191.50	178.13		712471	
GEW 1	26/09/2008 10:32	15.1	14.2	191.50	177.3		716128	

BIOGAS TECHNOLOGY LIMITED

STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL

SAMPLE POINT	DATE	DIP TO LIQUID (metres below well head)	DIP TO LIQUID (metres below ground level)	APPROXIMATE DATUM (m)	LEACHATE LEVEL (mAOD)		PUMP COUNTER READING	COMMENTS
GEW 2	25/02/2008 00:00	n/a	10.02	191.50	181.48			
GEW 2	26/02/2008 00:00	n/a	10.02	191.50	181.48			
GEW 2	29/02/2008 00:00	n/a	10.06	191.50	181.44			
GEW 2	03/03/2008 00:00	n/a	10.00	191.50	181.5			
GEW 2	05/03/2008 00:00	n/a	10.02	191.50	181.48			
GEW 2	07/03/2008 00:00	n/a	10.10	191.50	181.4			
GEW 2	11/03/2008 00:00	n/a	10.00	191.50	181.5			
GEW 2	25/03/2008 00:00	n/a	9.88	191.50	181.62			
GEW 2	30/06/2008 00:00	n/a	10.59	191.50	180.91			
GEW 2	18/08/2008 11:20	11.69	10.54	191.50	180.96			
GEW 2	18/08/2008 13:48	11.68	10.53	191.50	180.97			
GEW 2	18/08/2008 15:19	11.65	10.5	191.50	181			
GEW 2	18/08/2008 15:29	11.66	10.51	191.50	180.99			
GEW 2	19/08/2008 09:33	11.38	10.23	191.50	181.27			
GEW 2	19/08/2008 11:58	11.11	9.96	191.50	181.54			
GEW 2	20/08/2008 16:20	10.95	9.8	191.50	181.7			
GEW 2	21/08/2008 09:58	10.9	9.75	191.50	181.75			
GEW 2	21/08/2008 14:49	10.87	9.72	191.50	181.78			
GEW 2	22/08/2008 12:10	11.03	9.88	191.50	181.62			
GEW 2	26/08/2008 00:00	9.5	8.35	191.50	183.15			
GEW 2	27/08/2008 09:35	10.25	9.1	191.50	182.4			
GEW 2	28/08/2008 10:18	10.6	9.45	191.50	182.05			
GEW 2	01/09/2008 12:41	11.09	9.94	191.50	181.56			
GEW 2	02/09/2008 10:33	11.07	9.92	191.50	181.58			
GEW 2	03/09/2008 10:16	11.08	9.93	191.50	181.57			
GEW 2	04/09/2008 00:00	11.1	9.95	191.50	181.55			
GEW 2	05/09/2008 00:00	11.06	9.91	191.50	181.59			
GEW 2	10/09/2008 10:53	10.81	9.66	191.50	181.84			
GEW 2	15/09/2008 00:00	11.02	9.87	191.50	181.63			
GEW 2	17/09/2008 12:29	11.06	9.91	191.50	181.59			
GEW 2	22/09/2008 15:33	11.19	10.04	191.50	181.46			
GEW 2	23/09/2008 10:37	11.23	10.08	191.50	181.42			
GEW 2	24/09/2008 10:54	11.39	10.24	191.50	181.26			
GEW 2	25/09/2008 10:23	11.46	10.31	191.50	181.19			
GEW 2	26/09/2008 10:37	11.56	10.41	191.50	181.09			

BIOGAS	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL							
SAMPLE POINT	DATE	DIP TO LIQUID (metres below well head)	DIP TO LIQUID (metres below ground level)	APPROXIMATE DATUM (m)	LEACHATE LEVEL (mAOD)		PUMP COUNTER READING	COMMENTS
GEW 3	25/02/2008 00:00	n/a	12.21	193.10	180.89			
GEW 3	26/02/2008 00:00	n/a	12.10	193.10	181			
GEW 3	29/02/2008 00:00	n/a	12.24	193.10	180.86			
GEW 3	03/03/2008 00:00	n/a	12.80	193.10	180.3			
GEW 3	05/03/2008 00:00	n/a	11.57	193.10	181.53			
GEW 3	07/03/2008 00:00	n/a	12.27	193.10	180.83			
GEW 3	11/03/2008 00:00	n/a	11.70	193.10	181.4			
GEW 3	25/03/2008 00:00	n/a	12.35	193.10	180.75			
GEW 3	30/06/2008 00:00	n/a	12.14	193.10	180.96			
GEW 3	18/08/2008 00:00	12.85	11.9	193.10	181.2			
GEW 3	18/08/2008 13:37	12.85	11.9	193.10	181.2			
GEW 3	18/08/2008 15:17	12.85	11.9	193.10	181.2			
GEW 3	18/08/2008 15:27	12.85	11.9	193.10	181.2			
GEW 3	19/08/2008 08:35	12.84	11.89	193.10	181.21			
GEW 3	19/08/2008 12:01	12.16	11.21	193.10	181.89			
GEW 3	20/08/2008 15:47	12.75	11.8	193.10	181.3			
GEW 3	21/08/2008 10:05	12.67	11.72	193.10	181.38			
GEW 3	21/08/2008 14:54	12.71	11.76	193.10	181.34			
GEW 3	22/08/2008 11:52	12.94	11.99	193.10	181.11			
GEW 3	26/08/2008 00:00	12.2	11.25	193.10	181.85			
GEW 3	27/08/2008 09:40	12.2	11.25	193.10	181.85			
GEW 3	28/08/2008 10:10	12.3	11.35	193.10	181.75			
GEW 3	01/09/2008 12:45	13.3	12.35	193.10	180.75			
GEW 3	02/09/2008 10:39	13.09	12.14	193.10	180.96			
GEW 3	03/09/2008 00:00	13.04	12.09	193.10	181.01			
GEW 3	04/09/2008 00:00	13	12.05	193.10	181.05			
GEW 3	05/09/2008 00:00	12.97	12.02	193.10	181.08			
GEW 3	10/09/2008 10:57	12.95	12	193.10	181.1			
GEW 3	15/09/2008 00:00	13.2	12.25	193.10	180.85			
GEW 3	17/09/2008 12:34	13.15	12.2	193.10	180.9			
GEW 3	22/09/2008 16:02	13.32	12.37	193.10	180.73			
GEW 3	23/09/2008 11:17	13.32	12.37	193.10	180.73			
GEW 3	24/09/2008 11:31	12.87	11.92	193.10	181.18			
GEW 3	25/09/2008 10:52	13.37	12.42	193.10	180.68			
GEW 3	26/09/2008 11:08	13.46	12.51	193.10	180.59			

BIOGAS TECHNOLOGY LIMITED	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL							
SAMPLE POINT	DATE	DIP TO LIQUID (metres below well head)	DIP TO LIQUID (metres below ground level)	APPROXIMATE DATUM (m)	LEACHATE LEVEL (mAOD)		PUMP COUNTER READING	COMMENTS
GEW 4	25/02/2008 00:00	n/a	8.37	192.00	183.63			
GEW 4	26/02/2008 00:00	n/a	8.54	192.00	183.46			
GEW 4	29/02/2008 00:00	n/a	8.45	192.00	183.55			
GEW 4	03/03/2008 00:00	n/a	8.70	192.00	183.3			
GEW 4	05/03/2008 00:00	n/a	8.77	192.00	183.23			
GEW 4	07/03/2008 00:00	n/a	8.70	192.00	183.3			
GEW 4	11/03/2008 00:00	n/a	8.39	192.00	183.61			
GEW 4	25/03/2008 00:00	n/a	8.00	192.00	184			
GEW 4	30/06/2008 00:00	n/a	9.16	192.00	182.84			
GEW 4	18/08/2008 13:44	10	8.9	192.00	183.1			
GEW 4	18/08/2008 14:11	9.98	8.88	192.00	183.12			
GEW 4	19/08/2008 09:21	9.99	8.89	192.00	183.11			
GEW 4	19/08/2008 12:05	9.97	8.87	192.00	183.13			
GEW 4	20/08/2008 16:11	9.71	8.61	192.00	183.39			
GEW 4	21/08/2008 10:31	9.72	8.62	192.00	183.38			
GEW 4	21/08/2008 15:13	9.8	8.7	192.00	183.3			
GEW 4	22/08/2008 12:01	9.76	8.66	192.00	183.34			
GEW 4	26/08/2008 00:00	8.9	7.8	192.00	184.2			
GEW 4	28/08/2008 09:58	9.2	8.1	192.00	183.9			
GEW 4	01/09/2008 13:08	10.05	8.95	192.00	183.05			
GEW 4	02/09/2008 11:03	10.05	8.95	192.00	183.05			
GEW 4	03/09/2008 10:45	9.61	8.51	192.00	183.49			
GEW 4	04/09/2008 00:00	10.07	8.97	192.00	183.03			
GEW 4	05/09/2008 00:00	10.07	8.97	192.00	183.03			
GEW 4	10/09/2008 11:15	10.05	8.95	192.00	183.05			
GEW 4	15/09/2008 00:00	10.05	8.95	192.00	183.05			
GEW 4	17/09/2008 12:54	10.03	8.93	192.00	183.07			
GEW 4	15/09/2008 00:00	10.05	8.95	192.00	183.05			
GEW 4	15/09/2008 00:00	10.05	8.95	192.00	183.05			
GEW 4	22/09/2008 15:40	10.2	9.1	192.00	182.9			
GEW 4	23/09/2008 10:47	10.02	8.92	192.00	183.08			
GEW 4	24/09/2008 11:05	10	8.9	192.00	183.1			
GEW 4	25/09/2008 10:33	10	8.9	192.00	183.1			
GEW 4	26/09/2008 10:45	10.02	8.92	192.00	183.08			

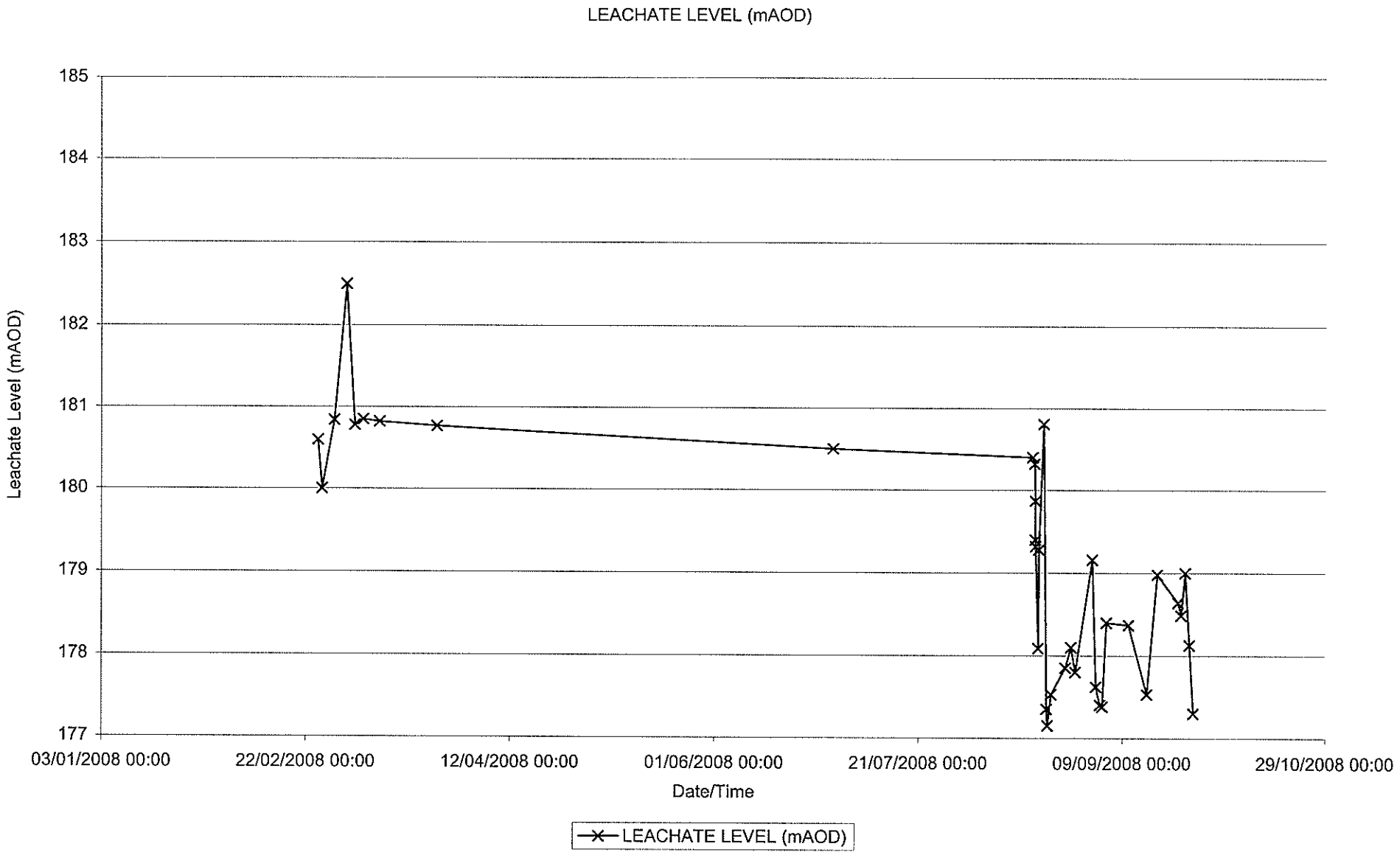
BIOGAS TECHNOLOGY LIMITED

STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL

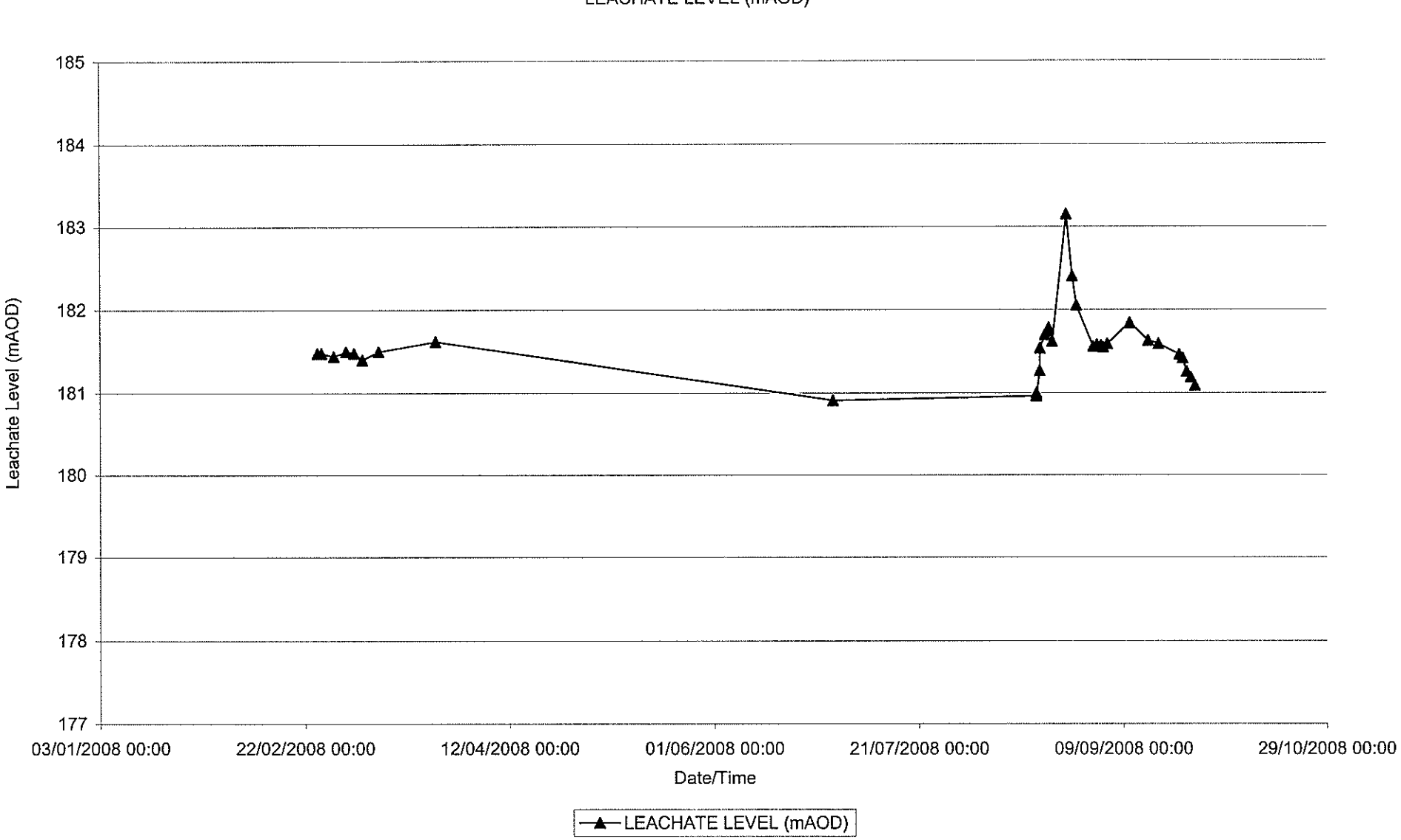
SAMPLE POINT	DATE	DIP TO LIQUID (metres below well head)	DIP TO LIQUID (metres below ground level)	APPROXIMATE DATUM (m)	LEACHATE LEVEL (mAOD)		PUMP COUNTER READING	COMMENTS
GEW 5	25/02/2008 00:00	n/a	8.30	191.30	183			
GEW 5	26/02/2008 00:00	n/a	8.40	191.30	182.9			
GEW 5	29/02/2008 00:00	n/a	8.39	191.30	182.91			
GEW 5	03/03/2008 00:00	n/a	8.60	191.30	182.7			
GEW 5	05/03/2008 00:00	n/a	8.45	191.30	182.85			
GEW 5	07/03/2008 00:00	n/a	8.40	191.30	182.9			
GEW 5	11/03/2008 00:00	n/a	8.26	191.30	183.04			
GEW 5	25/03/2008 00:00	n/a	8.22	191.30	183.08			
GEW 5	30/06/2008 00:00	n/a	7.97	191.30	183.33			
GEW 5	18/08/2008 14:09	9.56	8.46	191.30	182.84			
GEW 5	18/08/2008 00:00	9	7.9	191.30	183.4			Pump started at 1.23pm
GEW 5	18/08/2008 13:42	9.39	8.29	191.30	183.01		590	Pump cycling OK
GEW 5	19/08/2008 09:10	9.6	8.5	191.30	182.8		4883	Cycling
GEW 5	19/08/2008 12:08	8.31	7.21	191.30	184.09		5425	
GEW 5	20/08/2008 16:07	9.38	8.28	191.30	183.02			
GEW 5	21/08/2008 10:23	9.55	8.45	191.30	182.85			
GEW 5	21/08/2008 15:09	10.44	9.34	191.30	181.96			
GEW 5	22/08/2008 11:58	9.51	8.41	191.30	182.89			
GEW 5	26/08/2008 00:00	8.8	7.7	191.30	183.6		11796	
GEW 5	28/08/2008 09:55	9.1	8	191.30	183.3			
GEW 5	01/09/2008 13:03	9.69	8.59	191.30	182.71		15921	
GEW 5	02/09/2008 10:56	9.62	8.52	191.30	182.78		16830	
GEW 5	03/09/2008 10:38	9.61	8.51	191.30	182.79		17819	
GEW 5	04/09/2008 00:00	9.62	8.52	191.30	182.78		18929	
GEW 5	05/09/2008 00:00	9.6	8.5	191.30	182.8		19905	
GEW 5	10/09/2008 11:11	9.45	8.35	192.30	183.95		23567	
GEW 5	15/09/2008 00:00	9.65	8.55	191.30	182.75			
GEW 5	17/09/2008 12:49	9.61	8.51	191.30	182.79		25919	
GEW 5	15/09/2008 00:00	9.65	8.55	191.30	182.75			
GEW 5	15/09/2008 00:00	9.65	8.55	191.30	182.75			
GEW 5	22/09/2008 15:43	11.52	10.42	191.30	180.88		31940	
GEW 5	23/09/2008 10:57	10.4	9.3	191.30	182		35506	
GEW 5	24/09/2008 11:10	11.56	10.46	191.30	180.84		39964	
GEW 5	26/09/2008 10:50	10.02	8.92	191.30	182.38		44760	

BIOGAS TECHNOLOGY LIMITED	STONEY HILL CLOSED LANDFILL SITE, FOR TELFORD & WREKIN COUNCIL							
SAMPLE POINT	DATE	DIP TO LIQUID (metres below well head)	DIP TO LIQUID (metres below ground level)	APPROXIMATE DATUM (m)	LEACHATE LEVEL (mAOD)		PUMP COUNTER READING	COMMENTS
GEW 6	25/02/2008 00:00	n/a	10.05	191.90	181.85			
GEW 6	26/02/2008 00:00	n/a	10.46	191.90	181.44			
GEW 6	29/02/2008 00:00	n/a	8.95	191.90	182.95			
GEW 6	03/03/2008 00:00	n/a	10.60	191.90	181.3			
GEW 6	05/03/2008 00:00	n/a	9.80	191.90	182.1			
GEW 6	07/03/2008 00:00	n/a	9.70	191.90	182.2			
GEW 6	11/03/2008 00:00	n/a	9.50	191.90	182.4			
GEW 6	25/03/2008 00:00	n/a	9.41	191.90	182.49			
GEW 6	30/06/2008 00:00	n/a	9.34	191.90	182.56			
GEW 6	18/08/2008 00:00	10.3	9.2	191.90	182.7			
GEW 6	18/08/2008 13:40	10.31	9.21	191.90	182.69			
GEW 6	18/08/2008 14:15	10.3	9.2	191.90	182.7			
GEW 6	19/08/2008 09:00	10.32	9.22	191.90	182.68			
GEW 6	19/08/2008 12:11	10.29	9.19	191.90	182.71			
GEW 6	20/08/2008 16:01	10.21	9.11	191.90	182.79			
GEW 6	21/08/2008 10:19	10.26	9.16	191.90	182.74			
GEW 6	21/08/2008 15:04	10.09	8.99	191.90	182.91			
GEW 6	22/08/2008 11:55	10.33	9.23	191.90	182.67			
GEW 6	26/08/2008 00:00	9.6	8.5	191.90	183.4			
GEW 6	28/08/2008 09:50	9.6	8.5	191.90	183.4			
GEW 6	01/09/2008 12:57	10.37	9.27	191.90	182.63			
GEW 6	02/09/2008 10:51	10.34	9.24	191.90	182.66			
GEW 6	03/09/2008 10:32	10.22	9.12	191.90	182.78			
GEW 6	04/09/2008 00:00	10.28	9.18	191.90	182.72			
GEW 6	05/09/2008 00:00	10.25	9.15	191.90	182.75			
GEW 6	10/09/2008 11:07	10.25	9.15	191.90	182.75			
GEW 6	15/09/2008 00:00	10.33	9.23	191.90	182.67			
GEW 6	17/09/2008 12:44	10.34	9.24	191.90	182.66			
GEW 6	15/09/2008 00:00	10.33	9.23	191.90	182.67			
GEW 6	15/09/2008 00:00	10.33	9.23	191.90	182.67			
GEW 6	15/09/2008 00:00	10.33	9.23	191.90	182.67			
GEW 6	15/09/2008 00:00	10.33	9.23	191.90	182.67			
GEW 6	22/09/2008 15:49	10.15	9.05	191.90	182.85			
GEW 6	23/09/2008 11:05	10.13	9.03	191.90	182.87			
GEW 6	24/09/2008 11:18	10.25	9.15	191.90	182.75			
GEW 6	25/09/2008 10:39	8.67	7.57	191.90	184.33			
GEW 6	26/09/2008 10:55	10.12	9.02	191.90	182.88			

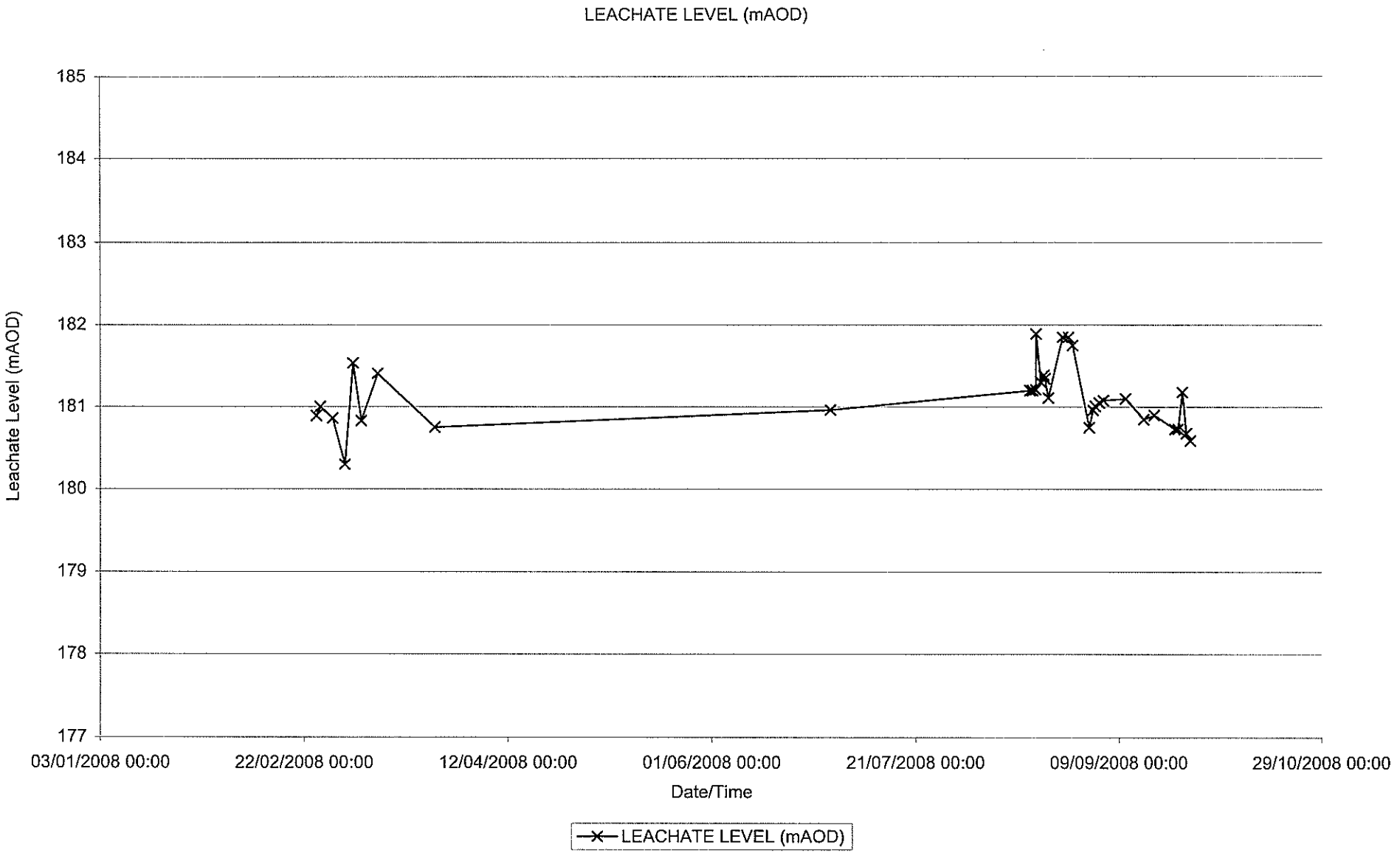
GEW 1 Levels Graph



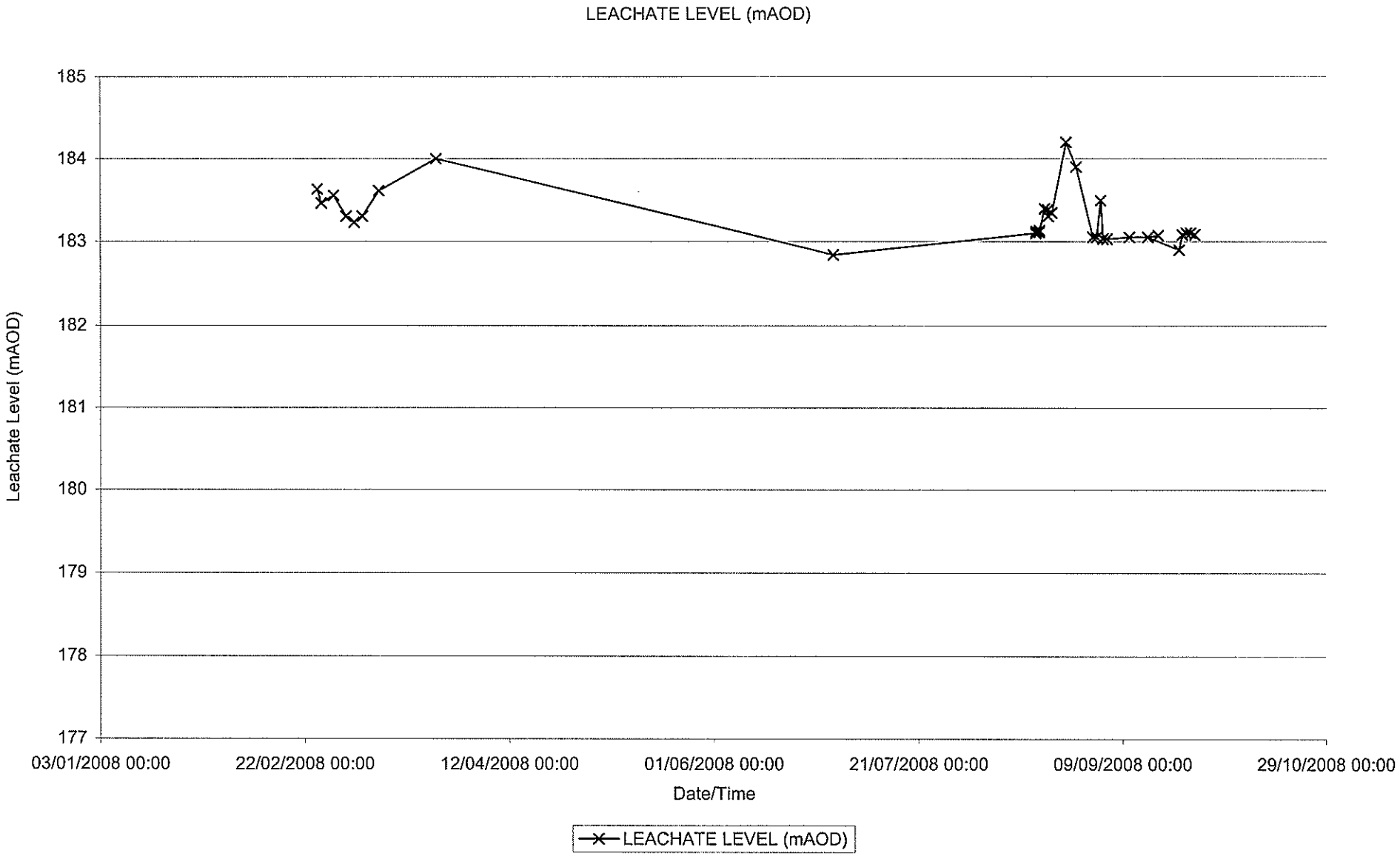
GEW 2 Levels Graph



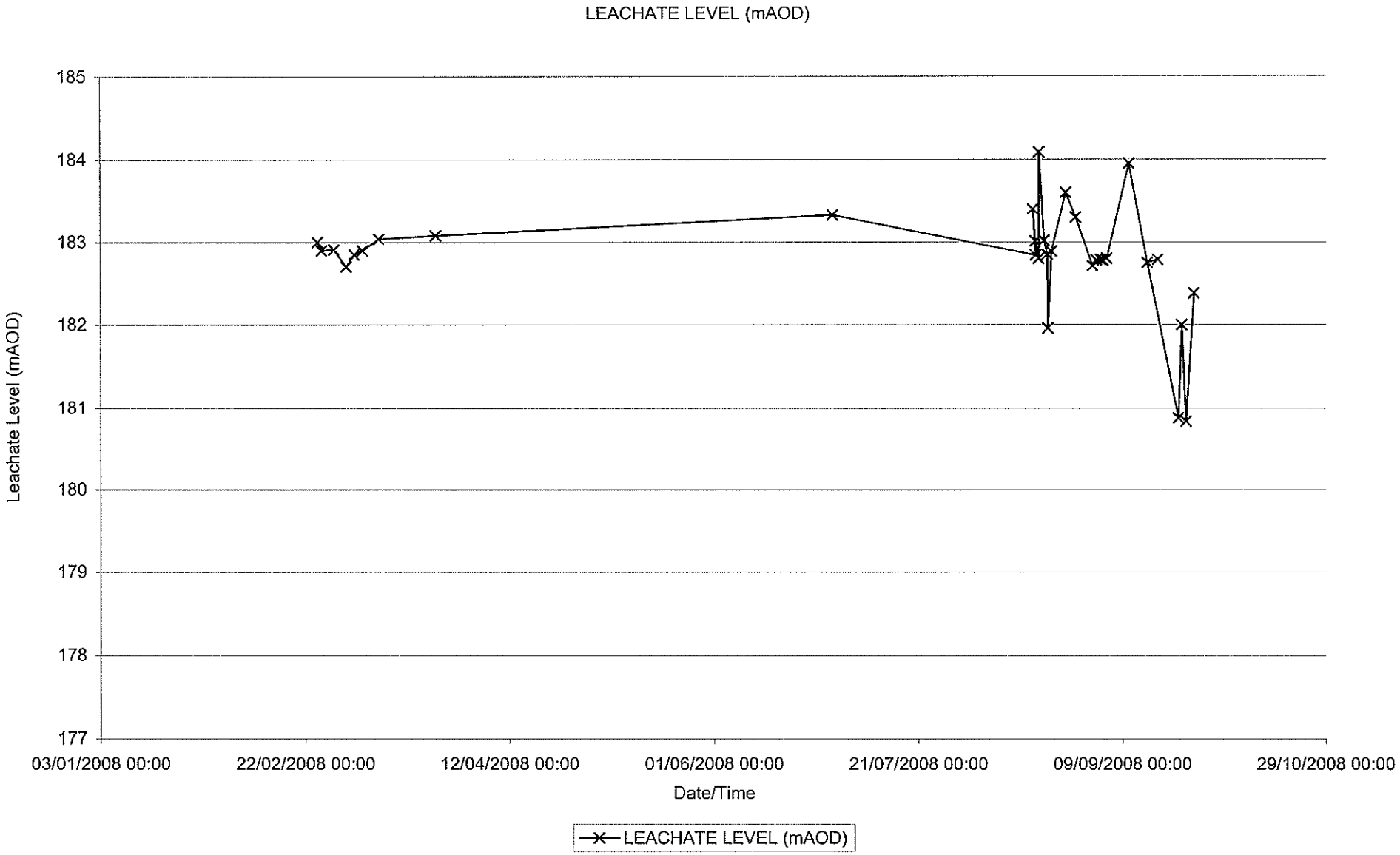
GEW 3 Levels Graph



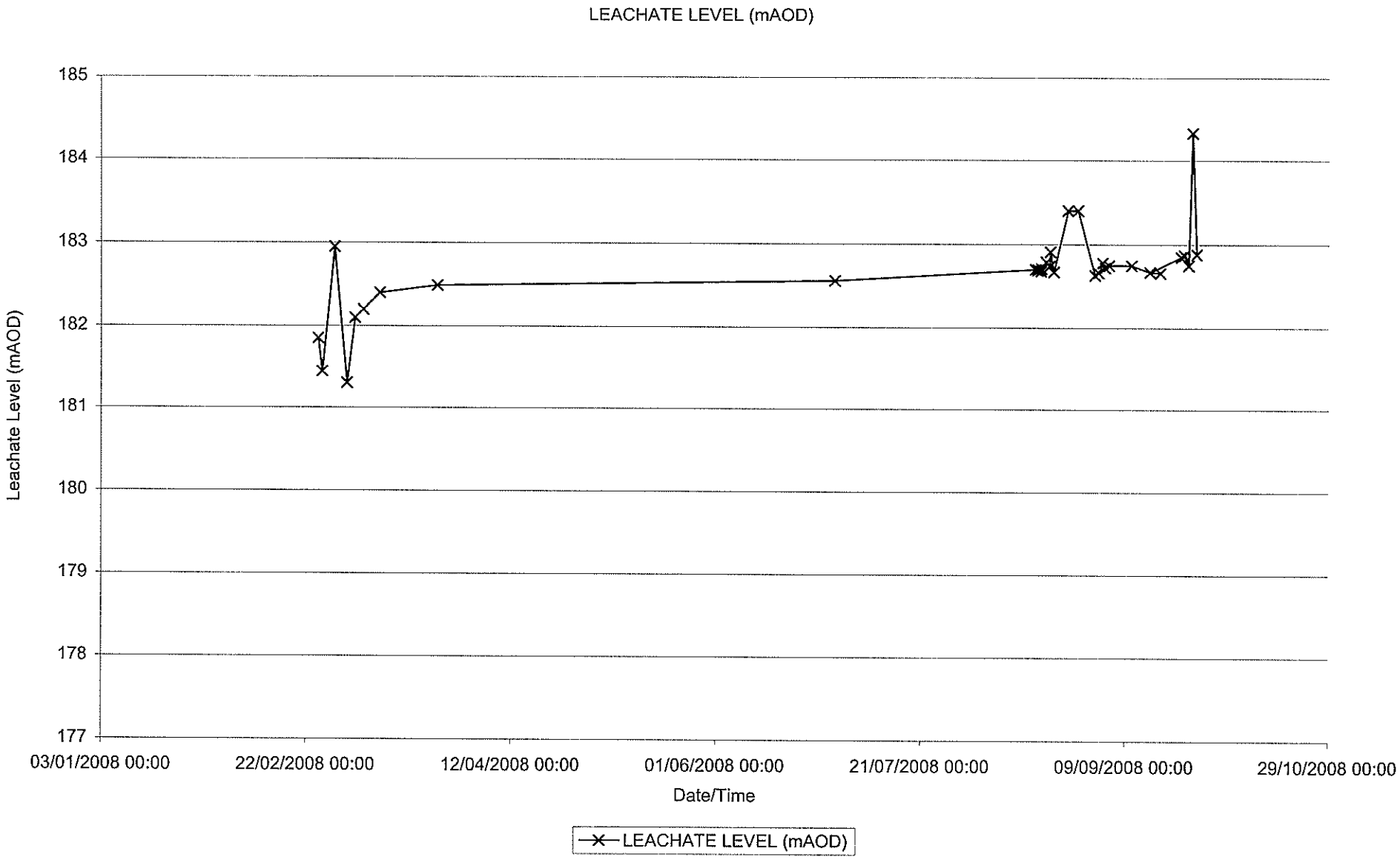
GEW 4 Levels Graph



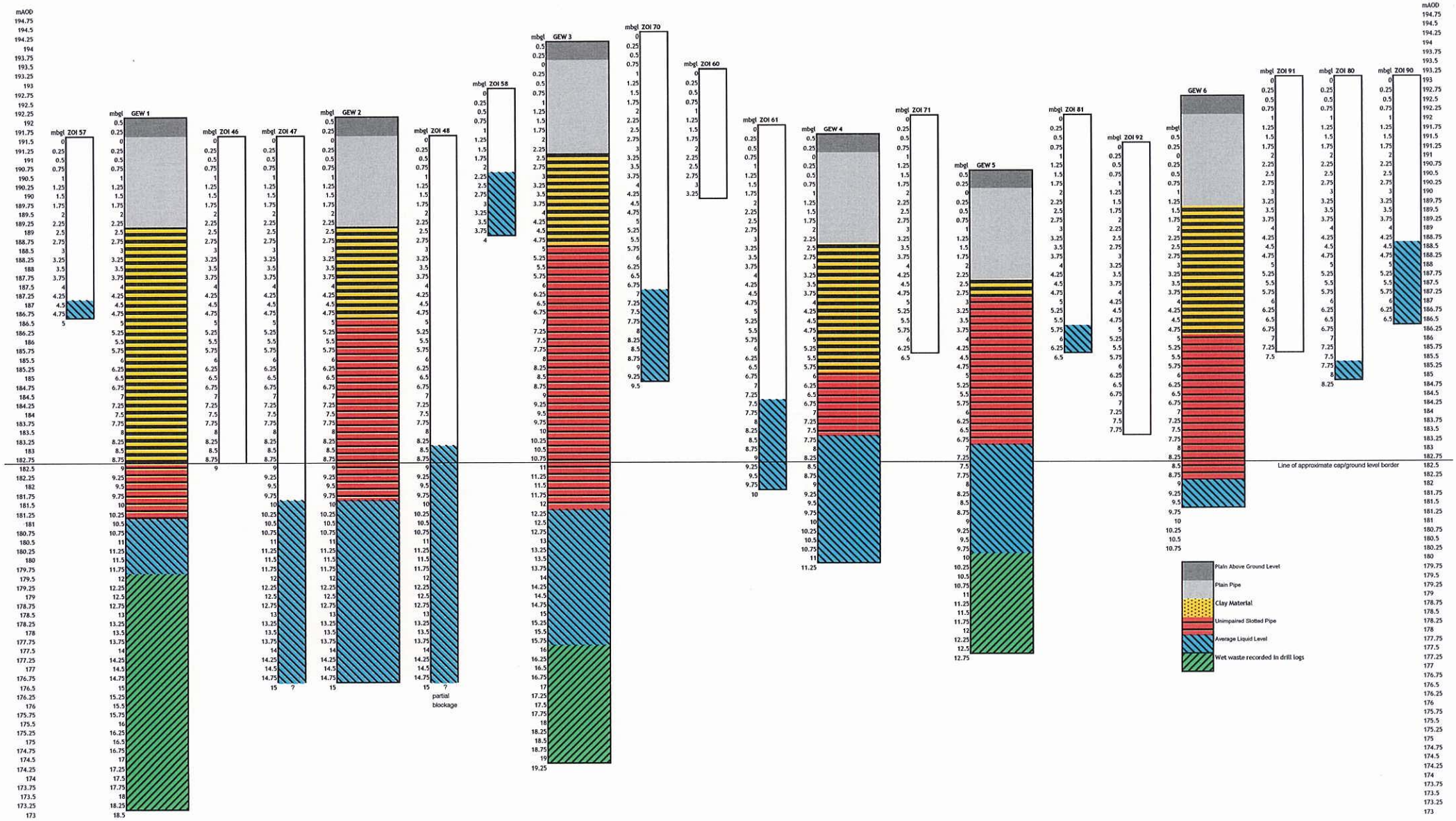
GEW 5 Levels Graph



GEW 6 Levels Graph



GEW Dips Diagram colour



Appendix J. Calibration certificates

Geotechnical Instruments

Landfill and Environmental Equipment - subsidiary of LANDTEC

CERTIFICATE OF CALIBRATION

Certificate number:	GA07780_1/2203
Date of check:	17 March 2008
Product:	GA2000Plus
Serial number:	GA07780
Calibration checked at:	20.4°C to 29.5°C

Primary Gas Channels

Methane (CH4)		Carbon Dioxide (CO2)	
Certified Gas (%)	**Reading (%)**	**Certified Gas (%)**	**Reading (%)**
49.67	50.0	50.33	48.0
15.29	15.0	15.19	14.6
5.06	4.9	5.06	4.7

Oxygen (O2)	
Certified Gas (%)	**Reading (%)**
20.95	21.0

Additional Gas Cells		
Gas	Certified Gas (ppm)	**Reading (ppm)**
H2	999.0	LOW
CO	512.0	512.0
H2S	47.6	47.0

Barometer	
Certified (mb)	**Reading (mb)**
1010	1010

Approved by: P. Handy **(Name)**

P Handy **(Signature)**

All gases are traceable to certified National Standards

This unit must be serviced at regular 6 monthly intervals by a Geotechnical Instruments (UK) Ltd approved service facility.

ANNUAL REPORT FOR MONITORING AT STONEY HILL CLOSED LANDFILL SITE

UNDERTAKEN FOR TELFORD AND WREKIN COUNCIL

May 2007 to April 2008

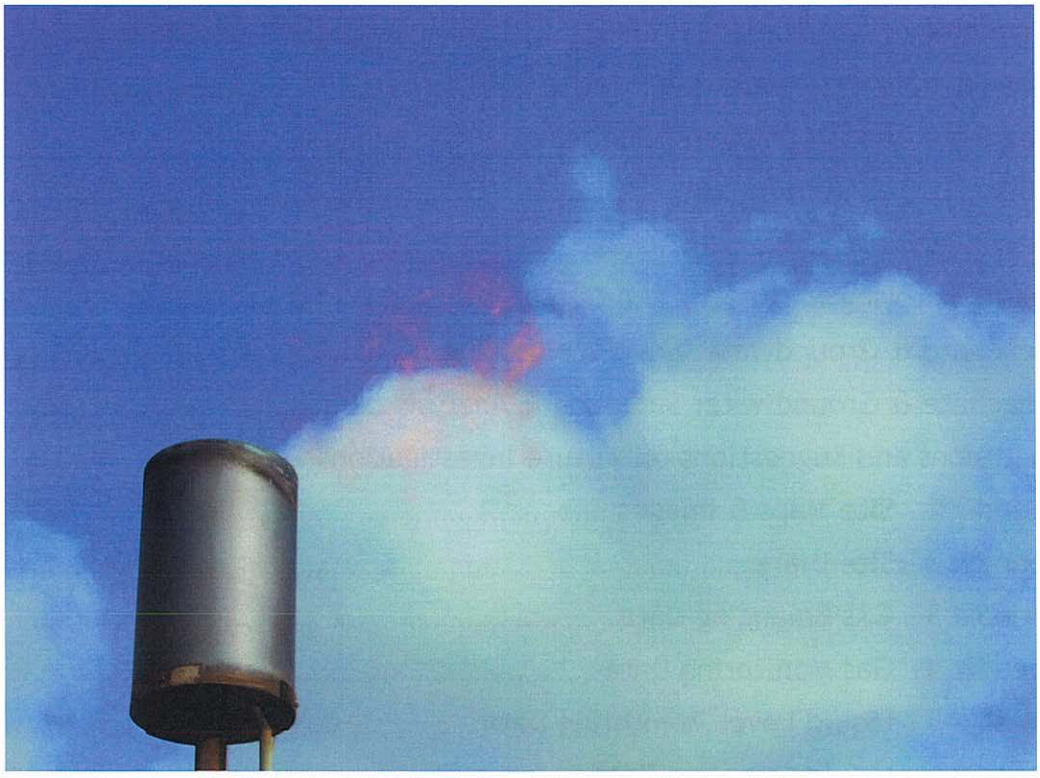


Author: Paul Baker, Aftercare Supervisor

ANNUAL REPORT FOR MONITORING AT STONEY HILL CLOSED LANDFILL SITE

UNDERTAKEN FOR TELFORD AND WREKIN COUNCIL

May 2007 to April 2008



Author: Paul Baker, Aftercare Supervisor

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Introduction

Requirements

Biogas Technology Ltd is required, on behalf of Telford & Wrekin Borough Council to:

- Take perimeter borehole gas samples using a portable gas analyser on a weekly basis in order to assess the migration of any landfill-derived gases from the closed site
- Balance the gas collection system wells on the two gas main lines in order to reduce the migration of landfill gases from the site, again, on a weekly basis.
- On a quarterly basis, take leachate level dips and samples.
- On a quarterly basis, take groundwater level dips and samples.
- Maintain the leachate collection system, from the pumps and associated pipe work to ensuring that the collection tanks are emptied at an appropriate frequency
- Maintain the gas collection system, from the gas wells to and including the flare.
- Report any relevant data and analysis to the client on a regular basis.

Site Details

The site is located between Coalbrookdale and Horsehay, Telford, covering an area of approximately 0.62km^2. The site level rises to a maximum of elevation of 190m.

Historically, the site exists on area extensively mined for coal. Landfill operations commenced in January 1985 by Shropshire County Council until March 1991. The site was licensed to receive a very wide range of wastes including:

- domestic
- commercial
- combustible, inert and non-combustible industrial
- construction
- vehicle
- sewage sludge
- clinical
- difficult

Following the detection of migrating gas a passive vent system was installed in 1993. In 1994 an elevated flare was installed to burn off the collected gas. A series of gas lines and wells has been installed, but more recently replaced, as discussed below.

The site has had, and continues to exhibit, difficulties with leachate levels. A series of pneumatic pumps were emplaced in various wells around the perimeter of the site to counteract leachate migration and take away excess condensate from the gas lines. The liquid passes to a couple of leachate tanks which have historically been emptied and the liquid taken away by tanker 3 to 4 times per week. This scenario happens to this day.

Works commenced in 2007 and continue to date on a housing development to the east of the site, which will encroach to within a short distance to the eastern boundary of the site.

The following report details the on-going monitoring of landfill gas and leachate by Biogas Technology Ltd, the improvements made to the system within the reporting period and recommendations for the future.

Diary of Events within the Reporting Period

Please refer to Appendix 1.

Biogas Technology Ltd commenced its aftercare regime at Stoney Hill in May 2007, with three visits per week to attend to the gas and leachate systems and monitor for migration on gas and leachate from the site.

It was soon recognised that the gas collection system was not fit for purpose. Gas Main - Line Two, extending from the flare compound northwards, picking up the gas extraction wells along the eastern side of the waste mass, was found to provide excessive and unsafe levels of atmospheric air. This provided the oxygen to create a potentially explosive atmosphere within the gas main. The poor quality of the gas from this line contributed to the frequent shutting down of the flare due to flame loss.

The flare also struggled to stay lit due to mobile condensate within both gas lines. The electric pump in the compound condensate knock out pot was found to be adequate to remove condensate to the leachate system, but surging condensate in the gas lines intermittently blocked gas flow to the flare, causing the flame loss.

The gas extraction well wellheads were also soon found to be unusable. The design of these well heads exhibited two major flaws:

- The 63mm elbow to the 63mm link line to the gas main was inflexible and in the event of even a small amount of movement this link was found to spilt apart - resulting in air ingress to the gas main, loss of extraction and emission to atmosphere of landfill gas.

- The integrated spindle type graduated gas control valve was found to be ineffectual. The internal seal between it, the well line and the exit port to the main was inadequate. This means that it was impossible, in many of the wells, to close the well to the gas collection system, resulting in over-extraction and further air ingress to the gas main.

A proposal was made by Biogas to replace the well heads and gas mains for both lines 1 and 2. Line 2, the more troublesome, was replaced first, works being completed in the first week of September 2007. The new system was designed to enable the site technician to disconnect non-productive wells, re-seal, and transfer the line to a more suitable well. These works continue where required. Please see images a) and b) in Appendix 1 for comparison of new and old well heads.

A similar system was installed to replace the main line and well heads on Line 1 completed in December 2007.

As a result of these works the quality of gas received at the flare improved and the amount of condensate reduced to greatly assist in the goal of achieving continual running of the flare.

Several other minor works have also assisted with respects to the smooth running of the flare, including:

- Re-routing the condensate line from the compound pumped pot direct to the leachate tank, in order to lessen the workload of the pot pump.
- Continual checking and servicing of the existing site pumps. Although it is a requirement for Biogas to move these pumps around to optimise leachate extraction, it was found that few of the wells were suitable for pumping, either due to shallowness and/or deformation of the well liner.
- Improved landfill gas balancing regime due to the new well heads and valves.

In 2008, following an approach by Telford & Wrekin, a formal landfill gas pumping trial was proposed. For this purpose, six new gas extraction wells were drilled and connected to Line 1 in February 2008. To date, due to the discovery of excessive leachate levels, the pumping trial has not commenced and these wells remain untapped. Testing undertaken during installation suggested these new wells capable of providing landfill gas of high quality and flow. Further details on the trail wells will be available in a separate report dedicated to this trial.

The leachate extraction system pumps have been under continual assessment. Some difficulties were experienced with the leachate discharge line adjacent to well 28, resulting in the removal and replacement of a blocked section of line.

The adverse weather conditions experienced in June and July 2007 resulted in a certain amount of overload for these pumps. The rainfall in these 'Summer' months was, in some cases, extreme. Local flooding occurred in the Telford & Wrekin area and the small trenches needed to be dug to help drain the flare compound.

The leachate tank alarm and cut off system has worked throughout the reporting period. No sampling or dipping of either tank has been possible due to the unsafe access to the top of these tanks.

Methodology

Gas Balancing & Monitoring

At the start of each site visit the landfill gas flare is attended. The flare is checked for any maintenance issues and gas readings taken. Should the flare be found un-lit, an assessment is made as to why. The flare at Stoney Hill is an elevated unit, which has historically suffered from flame failures due to problems with the gas collection system (air ingress and condensate), rather than mechanical failures. To date, this remains the case. The flare, at past and current flow rates, and due to its construction, is not capable of achieving the desired temperature of 1000°C. This is the temperature at which the majority of trace gases have been consumed.

The purpose of gas balancing is to ensure that a steady, sustainable flow of landfill gas is drawn through the gas collection system and then through the flare from individual gas wells. This is achieved by taking a measurement, via a portable gas analyser, of the Methane, Carbon Dioxide, Oxygen and remaining gas content (known as the balance) and the relative pressure in millibars from a sample point attached between the well head and control valve.

A 'static' reading is taken with the control valve shut. The reading taken should be assessed bearing in mind the amount of time that the well has not been drawn upon. This reading (although arbitrary) reflects gas generation rate, potential of gas reservoir and state of containment, in the direct vicinity of the gas well.

After the static reading is taken, the gas control valve is opened and suction is applied to the well. The suction, measured in negative pressure (in relation to atmospheric barometric pressure) is increased, up to the point when a notable change in the gas quality occurs, i.e. a drop in methane content or the appearance of oxygen or 'balance of other gases' in the gas mix. This is because these gases are not produced by anaerobic methanogenic decomposition. The appearance of gases other than Methane and Carbon Dioxide indicate either that the waste is too young or old and is not within its methanogenic phase of decomposition or atmospheric air is being drawn into the well due to too high suctions and/or poor seals around the waste.

The accidental introduction of atmospheric air into the decomposing waste has two major disadvantages. Firstly, it increases the risk of waste fire. Secondly, it adversely affects the anaerobic decomposition process which will reduce the production of methane and impair the holistic decomposition of the waste.

The purpose of balancing is to ensure that the flare is run at its optimum (fundamentally measured by flame temperature and hours run) at maximum methane content and maximum flow rate at the same time minimising potential for gas migration. It is a case of matching the amount of gas drawn to that being produced within the area of influence of the wells.

Landfill gas monitoring involves the use of the same equipment, a Geotechnical Instruments GA2000, to take pressure and bulk gas readings.

Leachate and Groundwater Sampling

Leachate and groundwater samples are taken contemporaneously in order to assess whether the local strata are being infiltrated by liquid from the waste mass. The perimeter boreholes were drilled to two depths, either into the shallower topsoil and colliery spoils or into the deeper sandstone bedrock. The boreholes are marked with an S or D to denote which strata they probe into.

Sampling involves the use of either pre-emplaced 'Waterra' foot-valve tubing or portable borehole bailers. The Boreholes are purged of standing liquid before liquid is taken and passed directly into a selection of bottles. Each bottle is then sealed, dated and numbered. The bottles are then carefully packed and sent for analysis as quickly as possible. Laboratory analysis is undertaken by a UKAS accredited laboratory, and results supplied in a formal laboratory analysis certificate.

The boreholes are dipped, using a portable electronic dip tape, and should no liquid be available, as happens infrequently, a note made and no sample taken.

Surface water samples are taken in a similar fashion. Only the ponds have been sampled during the reporting period as the sample points for the streams and brook were never formally identified.

Results

Please refer to Appendix 1 for site maps

Please refer to Appendix 2 for site diary

Please refer to Appendix 3 for gas balancing results

Please refer to Appendix 4 for gas monitoring results

Please refer to Appendix 5 for liquid level monitoring results

Please refer to Appendix 6 for liquid sampling results

Gas Balancing

The gas balancing results can easily be summarised by assessing the operation of the flare throughout the monitoring period, and to compare this operation with the perimeter gas migration monitoring, as discussed below.

The methane graph shows that the percentage by volume of methane being accepted at the flare has stabilised over time. The high values from the early recordings represent times when the flare had been off for some time and the gas had been allowed to accumulate within the gas mains. This graph compares well with the following flare oxygen graph which shows a similar diminishing of oxygen received by the flare. The oxygen accepted at the flare in the early readings was unacceptably high, creating a potentially explosive atmosphere within the gas main.

The following graphs for lines 1 and 2 demonstrate the source of this oxygen as primarily line 2. The replacement of this line, then the replacement of line 1 had a great and positive effect upon the gas mix taken at the flare. Since November 2007 the oxygen at the flare has consistently been below 4%.

The flare hours graph also demonstrates the positive effect of the gas main and well head replacement works. The period in the summer of 2007 where the flare struggled to remain lit, coincides with a period of intense rainfall which overwhelmed the site de-watering system. This problem was, to a large extent, dealt with by the installation of new lines 1 and 2.

Gas Monitoring

The perimeter borehole gas monitoring results have been summarised as two simple maps and by colour coding of the tables. These show that in a significant number of boreholes basic Environment Agency trigger levels for Methane (1.0% v/v) and Carbon Dioxide (1.5% v/v) have been exceeded. The problem is particularly acute along the Eastern boundary of the site.

The results for individual boreholes do fluctuate considerably over time, so average concentrations have been included in the results tables. The table below summarises the borehole data by areas around the perimeter (Field being around the South and Eastern boundary; Wood being around the Western boundary and Pond the Northern.).

Perimeter Borehole	Average Methane Concentration (% v/v)	Area
1D	2.55	Field
1S	2.49	Field
2D	1.08	Field
2S	1.27	Field
3D	25.75	Field
3S	6.48	Field
4D	15.18	Field
4S	0.85	Field
5D	20.66	Field
5S	8.62	Field
21D	36	Field
21S	1.85	Field
22D	26.25	Field
22S	12.3	Field
23D	21.68	Field
23S	34.37	Field
24D	29.95	Field
24S	0.12	Field
25D	52.23	Field
25S	3.94	Field
26D	38.34	Field
26S	0.19	Field
27D	0.08	Field
27S	2.61	Field
28D	0.04	Field
28S	0.19	Field

29D	3.08	Field
29S	6.08	Field
30D	4.31	Field
PZ1	0.23	Field
PZ2	0.06	Field
PZ3	6.91	Field
PZ4	0.08	Field
37WD	8.68	Field
38WD	3.79	Field
Average	10.81	Field
6S	3.61	Pond
7D	0.04	Pond
7S	0.03	Pond
8W	0.03	Pond
10W	0.11	Pond
11W	1.36	Pond
32D	2.61	Pond
34S	0.05	Pond
35S	0.05	Pond
36S	0.06	Pond
6WD	6.66	Pond
9WD	0.27	Pond
9WS	6.86	Pond
PZ5	0.89	Pond
PZ6	0.12	Pond
32WD	1.06	Pond
33WD	0.05	Pond
34WD	0.05	Pond
Average	1.33	Pond
12W	0.05	Wood
13W	0.56	Wood
14D	0.04	Wood
14S	0.04	Wood
15S	0.04	Wood
16W	0.04	Wood
17W	0.04	Wood
18D	0.04	Wood
19W	0.06	Wood
20D	0.09	Wood
20S	1.34	Wood
15WD	0.04	Wood
31WD	0.04	Wood
Average	0.19	Pond

It can be seen that, as described in previous quarterly reports, that the 'Field' area is considerably more affected by sub soil landfill gas migration.

Biogas does not have any background data, i.e. data taken prior to tipping, with which to compare recent monitoring data.

Over the reporting period no discernible trends can be seen, despite the upgraded gas lines and wells. Over time, an improvement may be observed.

Leachate & Groundwater Level Monitoring

All leachate and groundwater levels were taken using an electronic portable dip meter, and results given as metres below ground level, where datums available.

Throughout the reporting period it has been unsafe to attempt sampling from the leachate collection tanks. This is because the gantry which was attached has been damaged and therefore unusable. Throughout the reporting period, these tanks have been emptied on average three times per week by the 'Patricks' of Hereford. This regime has not altered since the 2006/2007.

A simplified map of liquid levels and the results shown are provided in Appendix 5.

The graph shows that individual boreholes show little variation throughout the year. It is the comparison between the perimeter borehole levels and the internal leachate monitoring points which is of interest. Basically, the leachate level within the waste mass exceeds the level exterior to the waste by several meters. The internal leachate levels have been recorded between 177 and 187 metres above datum, in comparison to 163 to 179 metres above datum found in the perimeter boreholes.

Leachate & Groundwater Sampling & Analysis

The maps and tables in appendix 6 demonstrate the levels of contamination emitted from the site via leachate. The tables do include infrequent missing results, these are caused by insufficient amounts of water for sampling purposes.

The hydreogeological ground water flow is known to flow in a South-Westerly direction, within the lower sandstone strata. Groundwater flows in a North Westerly direction through the upper colliery spoils which overlay the sandstones in the northern part of the site.

As per previous reports, one borehole, 9WD & WS, consistently exhibits elevated contaminant levels. The deeper of the two boreholes, penetrating into the south westerly groundwater flow, had an average ammonia level of 340mg/l over the reporting period. The shallower borehole had an average ammonia level of 50.5mg/l. This suggests that the deeper sample is not being contaminated by the waste mass, but from a source to the north of the site, possibly colliery-waste generated. The shallower contamination does indicate leachate migration from the site. It is of note that other boreholes along this boundary have had high sulphate contamination levels - namely 32, 33 and 34, which may be sourced from outside the waste mass. In fact, the leachate samples taken from within the waste have sulphate levels between 0.494mg/l and 307mg/l, whereas some of the perimeter boreholes contain higher levels, 15WD, for example, consistently has sulphate ~ 330mg/l. 8W consistently had concentrations in excess of 700mg/l. The Drinking Water Quality Standard Regulations 2000 indicate a maximum permissible value of 250mg/l SO_4.

The contamination found in these boreholes must be compared to the elevated liquid levels within the landfill compared to in the perimeter, suggesting that the potential for leachate break out along the boundary of the waste is high. The site has been lined with a reasonable clay barrier, but the cap is known to be highly variable.

Conclusions and Suggestions for Future Investigations

One of the fundamental problems encountered when Biogas Technology Ltd first attended site - the very poor quality gas and irregular operation of the gas flare - has been successfully dealt within the reporting period. The new system has been designed with a degree of flexibility whereby non-gassing wells may be disconnected and gassing wells attached, thereby targeting the areas of the site where gas generation is highest.

A major concern does still exist, however. The new lines and well heads may have dramatically improved the operation of the flare, but the effect on gas migration appears to have been negligible to date. This may because:

a) The existing wells, particularly towards the boundary of the of the site, are likely to be very shallow and therefore the zone of influence upon the gas field limited

b) And/or the boreholes in question are drilled into a waste mass.

It may be very worthwhile connecting the adjacent boreholes which consistently exhibit high gas quality directly into the existing gas collection system - i.e. creating perimeter gas extraction wells. The operation to do this would be simple and demonstrate that the gas migration problem is being tackled.

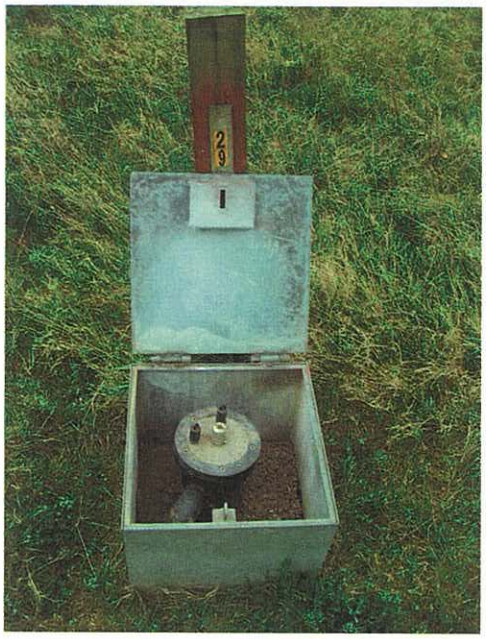
Before undertaking the above works, it may be worthwhile replacing some of the existing perimeter borehole sample points to unable Biogas to take accurate flow measurements. Some of these sample points will require replacement during the next reporting period regardless.

The existing gas collection system is to be augmented shortly following the completion of a gas pumping trial, using six newly emplaced wells within the deeper parts of the waste. This gas pumping trial will be reported upon separately from the regular monitoring visits.

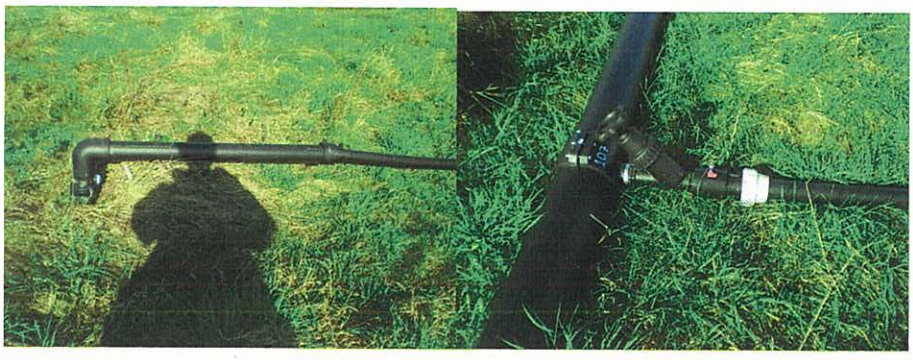
The gas flare itself is, although operating reasonably well, an older model and no longer recognised as fit for purpose by legislation. This is primarily due to its elevated stack which does not contain the combustion process completely and does not guarantee a combustion temperature exceeding 1000°C. It is therefore not capable of completely breaking down the bulk and trace component gases found within the landfill gas. Replacement of this unit is now essential.

The second major environmental issue regards the leachate levels and potential for leachate migration into the upper strata around the site. Currently, there are eight pneumatic pumps spread around lower in-waste wells. The pumps are regularly serviced and continue to provide enough leachate for three tanker loads per week. They do not, however, appear to be achieving the primary goal of lowering the leachate levels and keeping them down. This is primarily due to the number of pumps and the depth of the wells in which they are emplaced. A review of the system, including the disposal regime, is certainly required.

Appendix 1 - Site Maps & Images

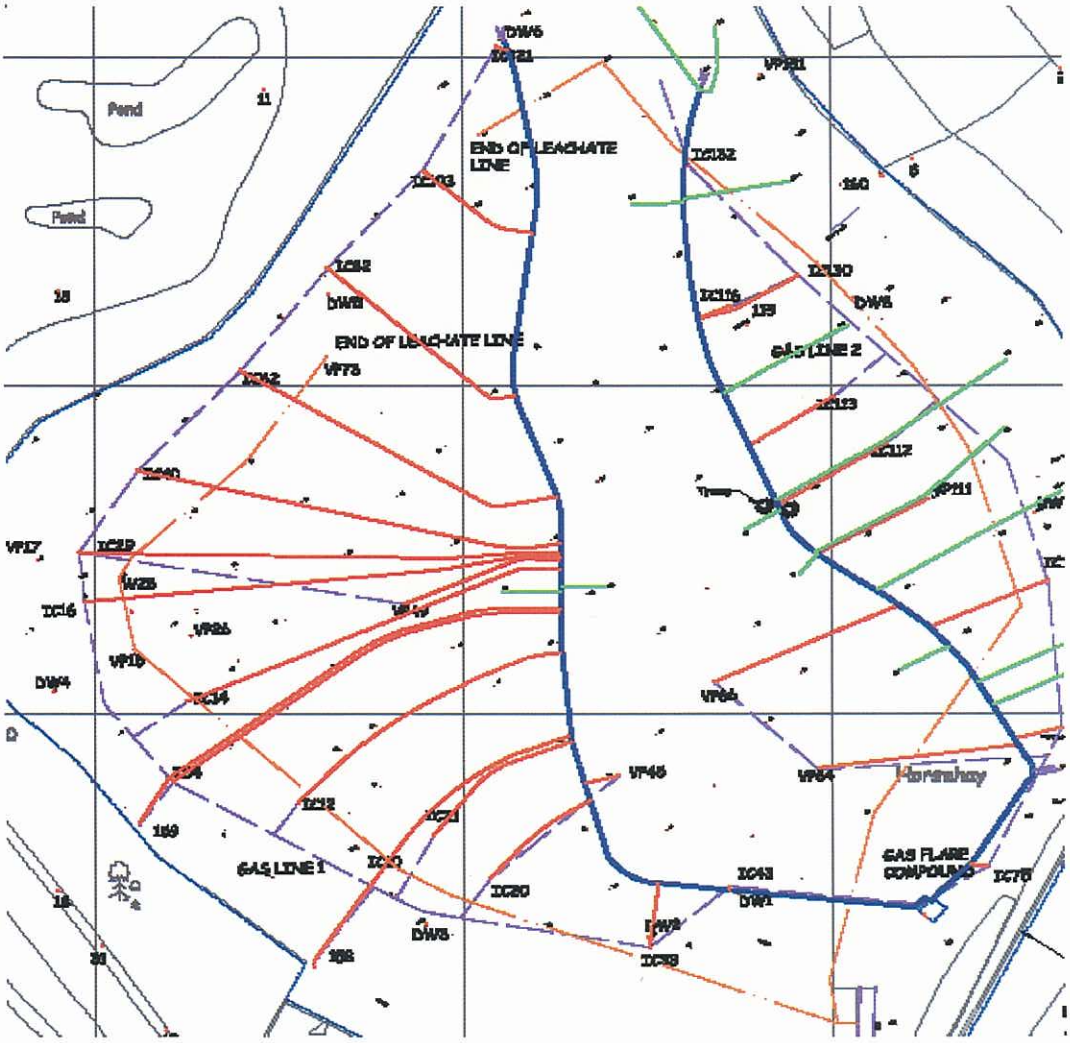


a) Image of previous well head unit



b) Image of replacement gas extraction well head, control valve and mainline


228 m
© 2008 Infoterra Ltd & Bluesky
© 2008 Tele Atlas
©2007 Google
Pointer 52°39'04.71" N 2°29'32.47" W elev 186 m
Streaming 100%
Eye alt 878 m



c) Plan of current landfill gas collection system

Appendix 2 - Site Diary

Please see associated excel file

Appendix 2 - Site Diary

Please see associated excel file

Date	Weather	Flare status on arrival	Compressor Hours	Compressor status	Tank status	Site Works	Comment
30-Apr-07	Clear, dry, warm		10731				
02-May-07	Clear, dry, warm						
02-May-07			10760				New sample point required
04-May-07	Mild, dry, overcast		10776				
08-May-07	Mild, showers, overcast		10791				
09-May-07	Mild, showers, overcast		10805				
11-May-07	Mild, showers, overcast		10833				
16-May-07	Mild, showers, overcast						
18-May-07	Mild, showers, overcast						
21-May-07	Mild, dry, overcast						The gas readings taken represent alterations made at the flare to improve suction/flow/temperature. Migration BH's not sampled this week to allow time for additional balancing and gas system audit/maintenance.
23-May-07	Mild, dry, overcast						
29-May-07	Mild, dry, showers later		10924				
30-May-07			10925				
04-Jun-07	Clear, dry, warm		10937				
06-Jun-07	Dry		10940				
08-Jun-07	Mild, dry, overcast		10943				
13-Jun-07	Overcast, mild, breezy						Flare running on arrival.
18-Jun-07	Mild, dry, overcast		10963				Flare off, restarted ok.
20-Jun-07	Mild, dry		10963				Compressor reset, flare won't light, water in line.
22-Jun-07	Mild, dry		10968				Compressor off, reset. Flare off lines flooded.
27-Jun-07	Mild,showers		10968				Flare off
29-Jun-07	Very Heavy Rain, Mild		10977				Flare off both lines flooded. Compound flooded, switched off electricity and dug drainage trench to try to clear water out.
02-Jul-07	Showers, with sodden ground over all site						Flare off as both gas lines full of water. Any draw on these lines fill plant KOP with water. Compressor not working, but repaired (float in tank stuck)
03-Jul-07	Showers, with sodden ground over all site						Flare off still. Could not re-light flare due to flooded lines.
09-Jul-07	Heavy showers, warm, wet		10991				Flare off, lines flooded.
11-Jul-07	Mild, dry, overcast		10995				Flare off, lines flooded, leachate system and compressor ok
16-Jul-07							Dug up to repair leak between well head and gas main at 63mm flexiseal. Requires spare parts - work to be completed next visit. Also undertook further site survey to assess improvements.
16-Jul-07	Sunshine & showers						Unable to light flare as all plant KOP's flooded. Repaired pump and removed excess water, but water in gas lines still prohibits the establishment of a stable flame.
07-Aug-07	Sunny spells, damp ground		11048				Flare off on arrival
07-Aug-07							Flare had shut down whilst venting.
07-Aug-07							Cannot control air ingress through Line 2. Flare turned off as risk of explosive mix in gas lines.
15-Aug-07	Mild, showers, overcast		11094				

22-Aug-07	Fine, dry, breezy						Flare off on arrival. Several attempts made to re-light.
03-Sep-07	Mild, dry mixed cloud						Leak from DW7 connectors compressor off flare off
05-Sep-07	Mild, dry, overcast						Line 2 balance first time since replacement (works completed 4th September)
07-Sep-07	Mild, dry clear						Flare on, compressor off, repaired lines for air on DW7 well, non return valves broken, replaced with connectors.
10-Sep-07	Mild, dry, sunny						Line pressures increased at flare, perimeter wells done.
13-Sep-07	Overcast, mild, dry						Strimmed perimeter boreholes and overgrown gas wells. No gas available from 146 to moved well head to 128.
14-Sep-07	Cool, overcast, dry						
17-Sep-07	Mild, dry, some cloud						
19-Sep-07	Overcast, damp						Made alterations to end de-waterleg as pulled out by contraction of main line. New regulators fitted to VP15 and DW7a.
21-Sep-07	Mild, dry, overcast						Pump checks and dips
25-Sep-07	Mild, dry, fine						Flare off on arrival. Air ingress through KOP occurred if pumped dry. U-bend put into leachate line solved problem and flare re-lit. Gas well 118 disconnected, capped and line moved to 117 as no gas available at 118.
26-Sep-07	Sunshine & showers, with cold wind						Monthly sip leachate wells numbered and marked up. Pumped wells checked. Pump in DW7a is too tall and requires>1.5m of head to start - so attempted to move to adjacent well. Did not work as alterative well bent., Pump returned to DW7.
28-Sep-07	Cool, breezy, overcast						
01-Oct-07	Cool, damp, overcast		11128				Flare off, air ingress problem, relit ok but only stayed lit 6 hours after left site. Gas levels taken for Perimeter wells
03-Oct-07	Cool, damp, overcast		11135				Flare off, air ingress problem, relit again, seems to be ok, balanced line 2, sampled line 1, pumps checked and dipped.
05-Oct-07	Warm, dry, clear	Off	11143	ON			
08-Oct-07	Mild, dry, overcast	Off	11168	ON		QUARTERLY PERIMETER LIQUID SAMPLES.	
09-Oct-07	Mild, showers, overcast	Off	11178	ON		QUARTERLY LEACHATE SAMPLES	
12-Oct-07	Damp, overcast	Off		ON	EMPTY		Flare off on arrival. Added non-return valve and water u-bend to plant KOP leachate discharge line. Leachte tank empty.
15-Oct-07	Cool, damp, overcast	On	11026	ON	15%		Leachate tank very slowly filling. Flare OK. Installed home-made rain guage. Babties on site to install 6 new groundwater boreholes.
17-Oct-07	Fine, following overnight rain	Off	11216	ON	35%	SITE MEETING.	Flare relit in arrival. Spent time assessing why by running flare on each line independently. Met Kate on site and discussed Flare flow, migration, replacing Line 1, putting a tap/level guage on the leachate tank, the new boreholes, the rain guage, plant
22-Oct-07	Cool, dry, clear	Off	11243	ON	40%	WEEKLY PERIMETER GAS READINGS.	
24-Oct-07	Misty then cool, dry, clear	Off	11253	OFF	50%	WEEKLY DIPS & BALANCE.	Flare ran for only 2 hours since LAST VISIT, poor gas in line 2 due to Well 143 detached from pipeline unable to reattach so sealed the hole repair.
29-Oct-07	Mild, dry, overcast	On	11253	OFF	75%	PIPEWORK ADJUSTMENTS.	Flare serviced last week. Disconnected 143 and moved to 77. No gas found so moved onto 97. 138 disconnected and moved to 127.
01-Nov-07	Cool, dry, overcast	On	11253	OFF	50%		
02-Nov-07	Cool, dry	On	11253	ON	40%		
05-Nov-07	Cool, dry, overcast	On	11312	ON	60%	WEEKLY PERIMETER GAS READINGS.	PATRICKS DUE.
07-Nov-07	Cool, dry	On	11333	ON	55%	WEEKLY BALANCE.	
09-Nov-07	Cold, dry	On	11335	ON	57%	COMPOUND CHECKS.	
12-Nov-07	Cold, dry	On	11338.67	ON	60%		
14-Nov-07	Cold, dry	On	11340	ON	80%		
16-Nov-07	Cold, dry	On	11353	OFF	FULL.		
19-Nov-07	Cold, dry	On	11353	RESET	50%	QUARTERLY LIQUID SAMPLES. (RETAKES) PERIMETER GAS READINGS.	

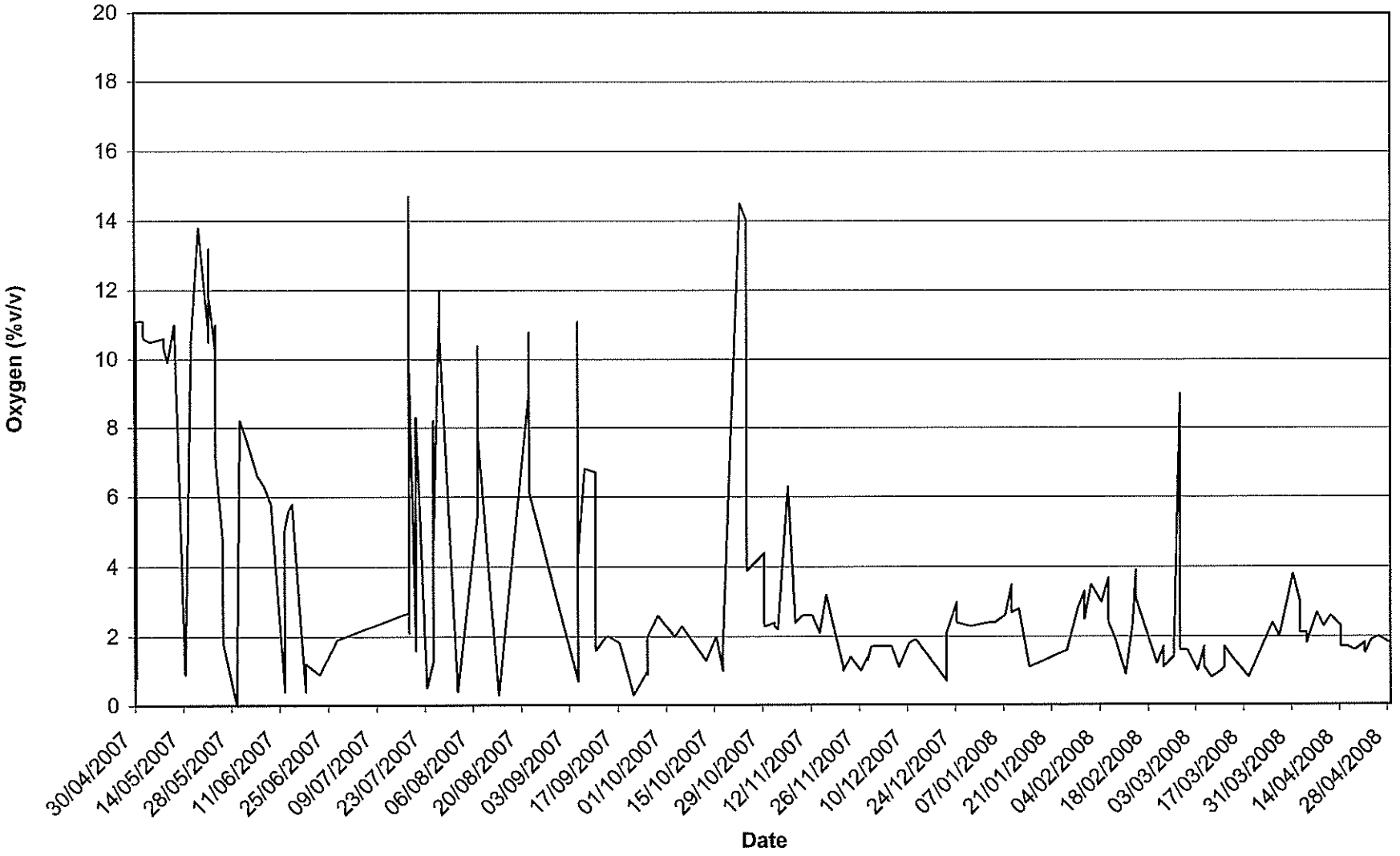
21-Nov-07	Cold, dry, overcast	On	11375	OFF	FULL	QUARTERLY LIQUID SAMPLES. (RETAKES) WEEKLY BALANCE.	Patricks dueThursday 22nd.
23-Nov-07	Cold, dry, clear	On	11375	RESET	50%	QUARTERLY LIQUID SAMPLES. (RETAKES)	
26-Nov-07	Cold, dry, overcast	On	11412	ON	EMPTY	WEEKLY PERIMETER GAS READINGS.	Perimeter monitoring wells sampled, Leachate system operational.
28-Nov-07	Cold, dry, overcast	On	11432	ON	50%	WEEKLY BALANCE.	Patricks called to empty Thursday 29th.
29-Nov-07	Cold, dry, overcast	On	11439	ON	EMPTY	WEEKLY DIPS & COMPOUND CHECKS.	
05-Dec-07	Cool, dry, clear	On	11457	ON	50%	WEEKLY PERIMETER GAS READINGS.	
06-Dec-07	Mild, dry, overcast	On	11459	ON	50%	WEEKLY BALANCE.	
07-Dec-07	Cool, dry, overcast	On	11467	ON	50%	WEEKLY DIPS & COMPOUND CHECKS.	
10-Dec-07	Cold, dry, clear	On	11480	ON			
12-Dec-07	Cold, dry, clear	Off	11488	ON		MONTHLY LEACHATE DIPS. WEEKLY DIPS.	Flare off due to line 1 replacement installation.
17-Dec-07	Cold, dry, overcast	Off	11488	OFF	FULL	FLARE COMPOUND CHECKS.	Patricks contacted.
21-Dec-07	Cold, dry, overcast	Off	11488	ON	50%	LINE 1 BALANCE.	Line 1 works completed 20-12-07. Initial alterations to valves made to open up to flare.
24-Dec-07	Cool, damp, overcast	On	?	ON	50%	LINE 1 BALANCE.	
28-Dec-07	Mild, dry, overcast	On	11542	ON	50%	COMPOUND CHECKS.	
02-Jan-08	Cold, dry, clear	On	11543	OFF	FULL	WEEKLY PERIMETER GAS READINGS.	
04-Jan-08	Dry	On	11557	ON	50%	WEEKLY DIPS & COMPOUND CHECKS.	
07-Jan-08	Cool with rain, dry later	On	11585	RESET	EMPTY	WEEKLY PERIMETER GAS READINGS.	Flare on, compressor reset, tank emptied am. Perimeter monitoring.
09-Jan-08	Cool with rain, dry later	On	11592	RESET	50%	WEEKLY BALANCE.	Fitting of 3 missing sample points to line 1 wells. Balance successful, reduced oxygen increased methane and carbon dioxide. Compressor off, not due to tank over level alarm, not sure why, reset, seems to be working ok.
11-Jan-08	Cold, rain, overcast	On	11598	OFF	FULL	WEEKLY DIPS.	Patricks called out for Monday.
14-Jan-08	Cold, rain, overcast	Off	11598	ON	50%	WEEKLY PERIMETER GAS READINGS.	Heavy rain has occurred, ground saturated, flare won't stay lit, Perimeter readings taken.
16-Jan-08	Cool, dry, clear	Off	11605	OFF	FULL	MONTHLY LEACHATE DIPS.	Monthly leachate dips. Flare off, suspect water in lines due to pumps also being off.
18-Jan-08	Mild, showers, overcast	Off	11605	ON	50%	INVESTIGATIVE DIPPING.	Wells 91, 92, 81, 71, 61, 58, 48, 47, 46, 69 dipped.
21-Jan-08	Cool, showers, overcast	Off	11611	OFF	FULL	QUARTERLY LIQUID SAMPLES.	Quarterly samples from 29D, 8, 38D, 9D, 9S, 15D & 31D.
22-Jan-08	Cool, dry	Off	11616	RESET	50%	QUARTERLY LIQUID SAMPLES.	Quarterly samples from 37D, 6D, 34,33D, 32D, LONG POND, HIGH POND & SMALL POND. 7435hrs. Patricks to come 23rd and 25th January to empty tanks completely.
25-Jan-08	Sunshine & showers, windy	Off		RESET	50%	WEEKLY DIPS & COMPOUND CHECKS.	Flare off on arrival due to full tank - Patricks had been earlier. Flare lit and plant KOP pumped well.
28-Jan-08	Cool, dry, overcast	On	11634	RESET	50%	QUARTERLY LEACHATE SAMPLES MAPPING FOR 6 NEW LEACHATE PUMP	Patricks will come 3 times this week.
30-Jan-08	Cool, dry, overcast	On	11642	RESET	50%	WEEKLY BALANCE.	
01-Feb-08	Cool, dry, overcast	On	11649	OFF	50%	COMPOUND CHECKS.	
04-Feb-08	Cool, dry, overcast	On	11649	RESET	15%	WEEKLY PERIMETER GAS READINGS.	Patricks due 3 times this week.
06-Feb-08	Cold, dry, clear	On	11663	RESET	20%	WEEKLY BALANCE.	
08-Feb-08	Fine, dry, mild	On		RESET		COMPOUND CHECKS.	Meeting on Site re GASCLAM.
11-Feb-08	Cool, dry, clear	Off	11743	OFF	10%	COMPRESSOR REPAIRS & FLARE MAINTENANCE	Line flooded out due to airline becoming detached from compressor, refitted together. Pumps restarted, drained lineand started flare.
13-Feb-08	Mild, clear, dry	Off	11765	RESET	50%	COMPOUND CHECKS.	DW7 pump is not working, taken away for service. Line flooded

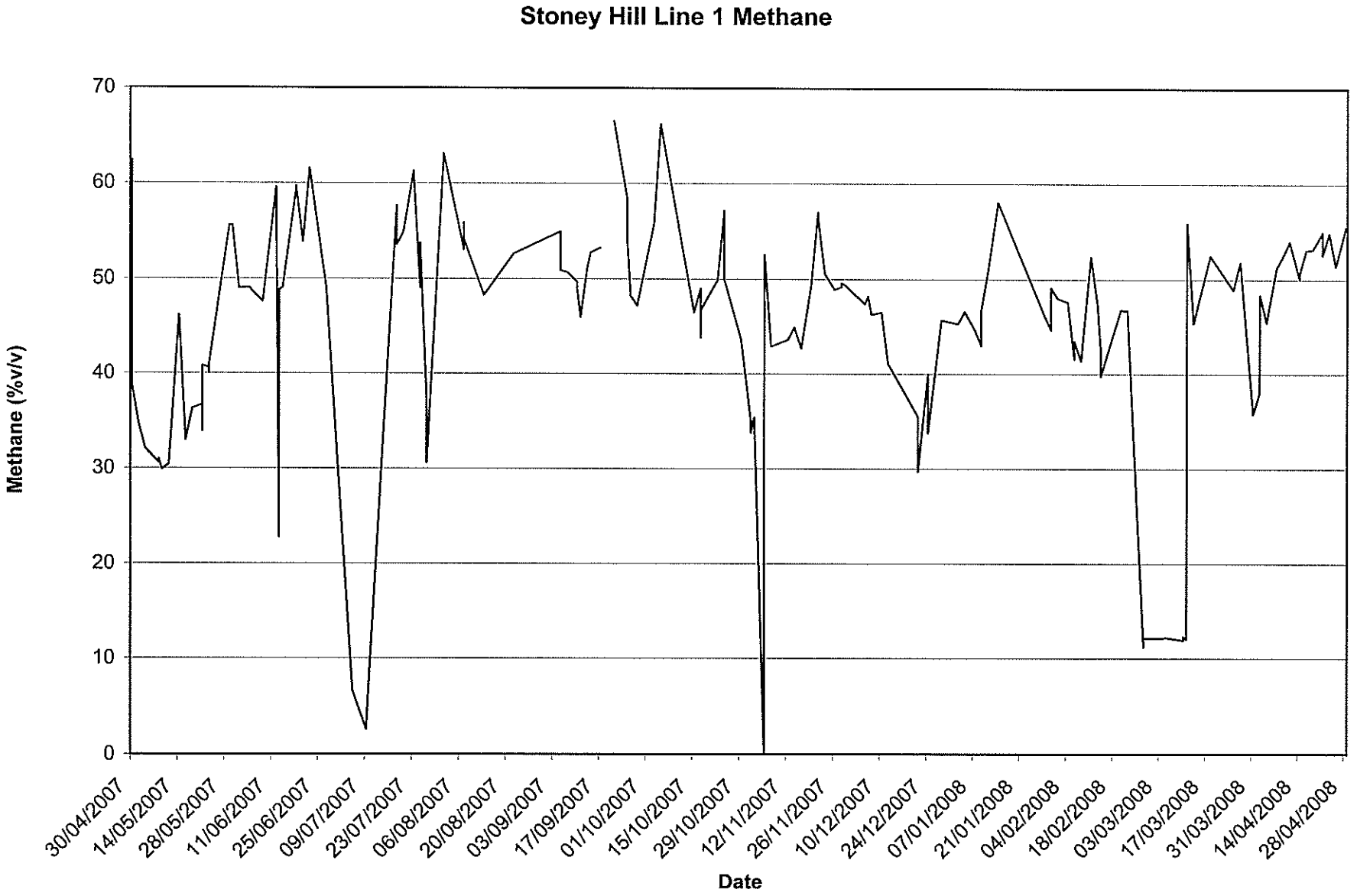
14-Feb-08	Cold, dry, overcast	On	11771	OFF	FULL	WEEKLY BALANCE.	
18-Feb-08	Fine, dry, after frost				Empty	WEEKLY PERIMETER GAS READINGS.	Drillers on site . Line 1 closed re drilling, as multiple lines disconnected. Perflow on plant repaired. Flare tested to see if runs well on L2 alone. DW7 air and condensate lines frozen solid - repaired, pump itself taken to yard for major overhaul.
20-Feb-08	Cold, dry, overcast	Off	11790	ON	30%	COMPOUND CHECKS.	Drillers on site
22-Feb-08	Mild, dry, overcast	On	11811	ON		WEEKLY BALANCE.	Materials delivery at 8am, Balance line 2.
25-Feb-08	Overcast, dry, cold wind.	Off	11818	RESET	50%	WEEKLY PERIMETER GAS READINGS.	Installing pumping trial wells and lines. DW7 replaced and working well. Flare off and re-started after DW7 replaced. Flare ran for 3 hours only, left overnight to restore Line 2 gas. Pump in VP73 requires servicing.
26-Feb-08	Sunny, dry, breezy.	Off			0%	SYSTEM CHECK WHILST PUMPING TRIAL WORKS ONGOING	Flare lit on L2 only at 8.30am. Compressor air line broken at olive elbow joint - repaired. Flare running when left site. Codensate line from main to DW7 moved to adjacent vent as interferes with pump.
27-Feb-08	Sunny, dry	On		ON	0%	WEEKLY BALANCE.	Completion of pumping trial well head works. Dipping new wells continues. New padlock installed on first gate. Remaining pumps checked and VP73 removed for full service at Biogas. Flare has run overnight on Line 2 only with approx 50 to 75 flow.
29-Feb-08	Cold, dry, overcast	On	11850	RESET	0%	WEEKLY DIPS & COMPOUND CHECKS.	New wells dipped.
03-Mar-08	Cold, dry, clear	Off	11865	RESET	50%	WEEKLY PERIMETER GAS READINGS.	Reinstalled pump to DW7, New wells dipped, all pumps dipped and checked.
05-Mar-08	Mild Dry Clear	On	11874	OFF	50%	BALANCE LINE 2	Balanced line 2 only, Dip to ground level pumped wells and new pump trial wells, Line 1 closed.
07-Mar-08	Sunny spells, dry,damp ground	On		On	Both Full	COMPOUND CHECKS.	Patricks tanker broke down - to come twice on Monday. Flare running on L2 only re pumping trial.
10-Mar-08	Cool Windy Overcast Showers	Off	11883	Off	Empty	PERIMETER BOREHOLES	Patricks attended with Two tankers AM
11-Mar-08	Overcast Showers Sunny Spells	On	11883	On	Empty	BALANCE LINE 1 AND 2	Dipped Pump Trial Wells, Started pumps, Patricks attended AM. High flow into tank.
13-Mar-08	Dry overcast breezy	On		off	Full	Site Meeting plus Compound Checks	Patricks Attended 12.03.08 and attending Friday 14.03.08
17-Mar-08		On			Patricks on site	PERIMETER BOREHOLES	
18-Mar-08	Dry overcast breezy	Off		OK	Patricks on site	See Comment	Replaced aquapipe plant KOP condensate line to tank. New 63mm line installed, part buried in compound. Difficulty in lighting flare due to condensate from L1 - but left running.
25-Mar-08	Cold Overcast Sleet Showers	On	11942	RESET	Main Full Secondary Empty	PERIMETER BOREHOLES	
27-Mar-08	Mild Dry Clear with Light Wind	On	11947	Off	Both Full	Monthly Weekly and New Boreholes	New Caps on two wells
28-Mar-08						Balance Lines	
31-Mar-08	Dry Bright Showers	On	11955	Off	50%	PERIMETER BOREHOLES	
02-Apr-08	Mild dry overcast	On	12002	off	10%	Balance Line 1	Air pipe detached at compressor, reattached and restarted pumps.
04-Apr-08	Overcast	On	12008	reset	50%	**Balance line 2 Weekly Dips 6 New wells**	
07-Apr-08	Cold dry overcast damp ground	On	12016	off	65%	Quarterly Leachate Samples and Dips	
09-Apr-08	Mild dry overcast	On	12033	reset	50%	Quarterly Water Samples and Dips	
11-Apr-08	Rain cold	On	12041	reset	50%	Quarterly Water Samples and Dips	
14-Apr-08	Mild dry clear dry ground	On	12055	reset	50%	Weekly Gas Balance	
16-Apr-08	Cold dry overcast	Off	12063	reset	50%	Weekly Perimeter gas readings	
18-Apr-08		On	12069	reset		**Weekly dips and new 6 wells finish weekly** perimeter gas readings	
21-Apr-08	Mild dry overcast clearing	On	12083	reset	100%	weekly balance.	
23-Apr-08	Mild dry clear damp ground	On	12091	reset		perimeter boreholes.	
25-Apr-08	Showers then dry	On	12107	reset	50%	leachate dips.	
28-Apr-08	Showers dry	On	12115	reset	50%	leachate temperatures and dips taken balance line 2.	leachate temperatures 1: 59 degrees C. 2: 29, 3: 35, 4: 22, 5: 25, 6: 24 degrees.
30-Apr-08	Mild, showers, overcast	On	12132	OFF	100%	perimeter boreholes.	FLARE RELIT ON ARRIVAL Leachate tanks full, not yet emptied by Patricks.

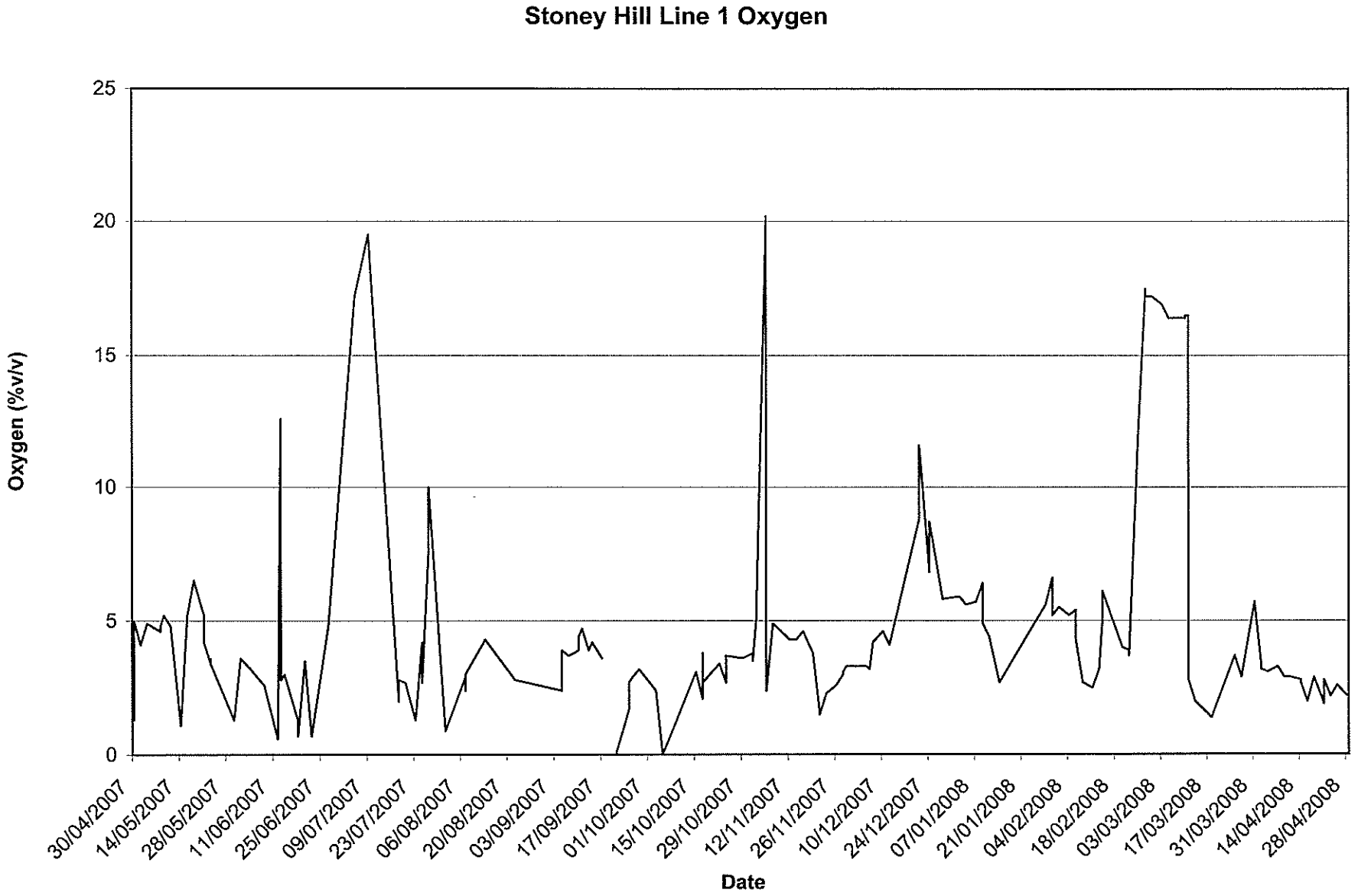
Appendix 3 - Gas Balancing Data

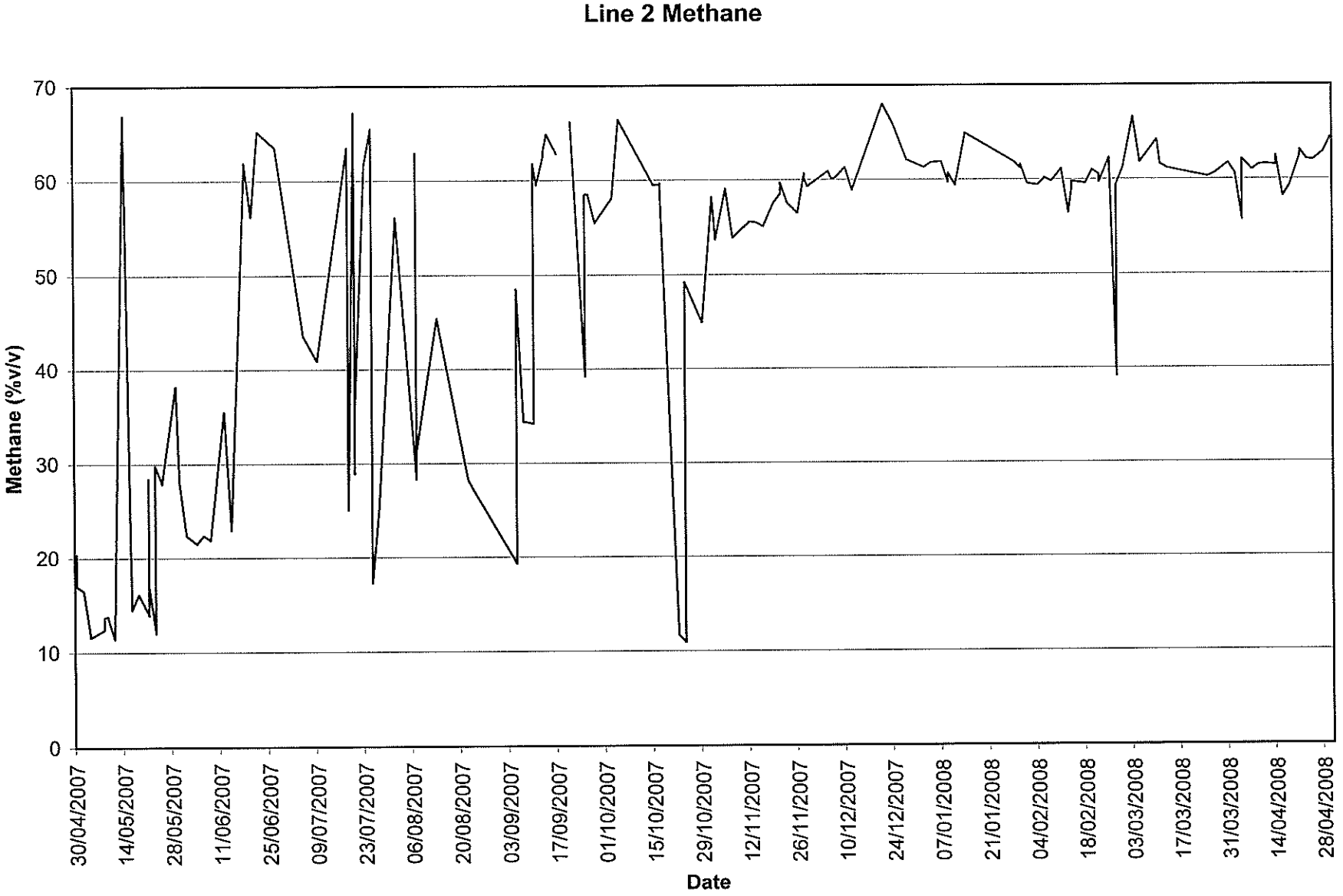
Please see attached excel files

Stoney Hill Flare - Oxygen

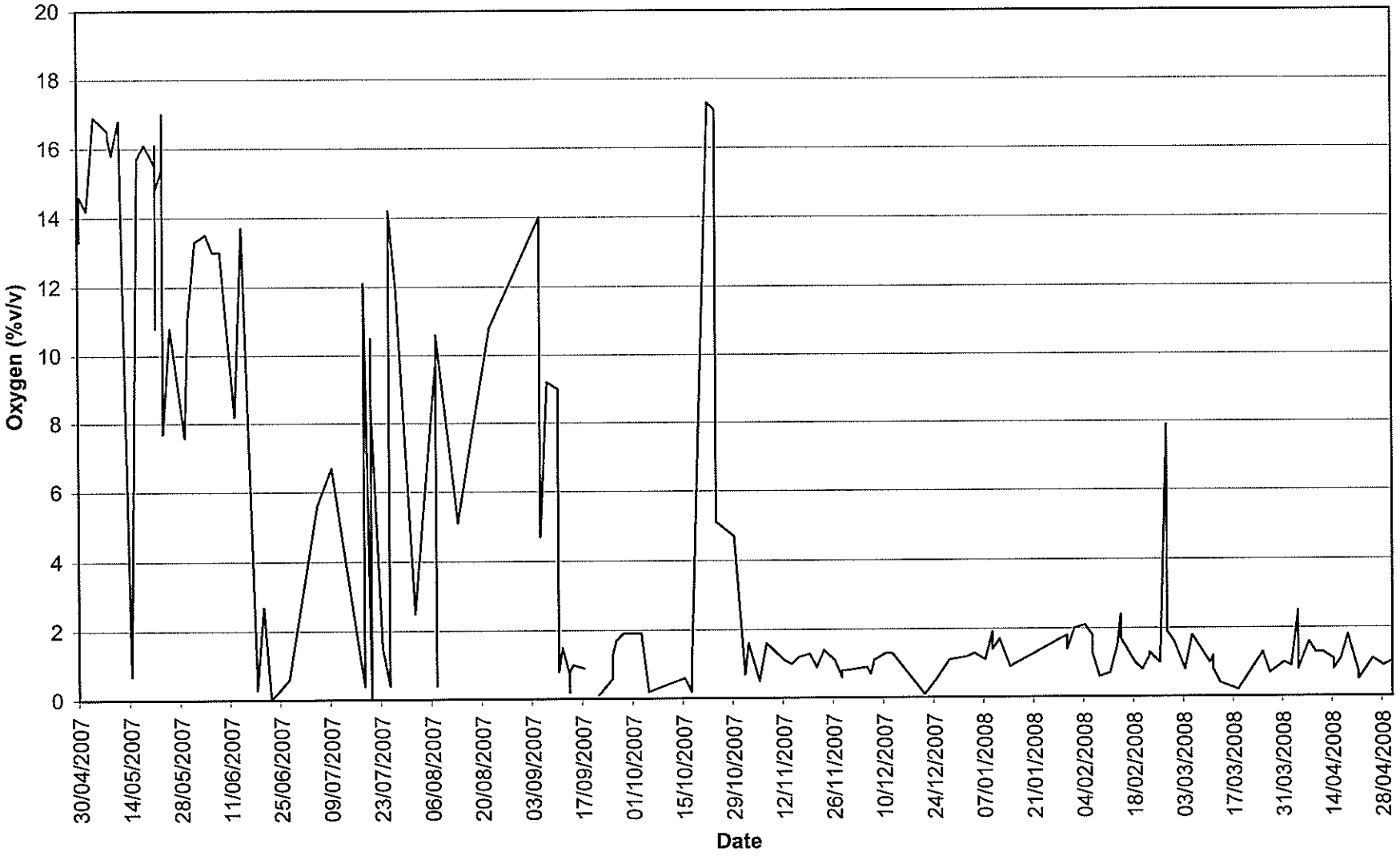



Stoney Hill Line 1 Methane
Methane (%v/v)
70
60
50
40
30
20
10
0
30/04/2007
14/05/2007
28/05/2007
11/06/2007
25/06/2007
09/07/2007
23/07/2007
06/08/2007
20/08/2007
03/09/2007
17/09/2007
01/10/2007
15/10/2007
29/10/2007
12/11/2007
26/11/2007
10/12/2007
24/12/2007
07/01/2008
21/01/2008
04/02/2008
18/02/2008
03/03/2008
17/03/2008
31/03/2008
14/04/2008
28/04/2008
Date

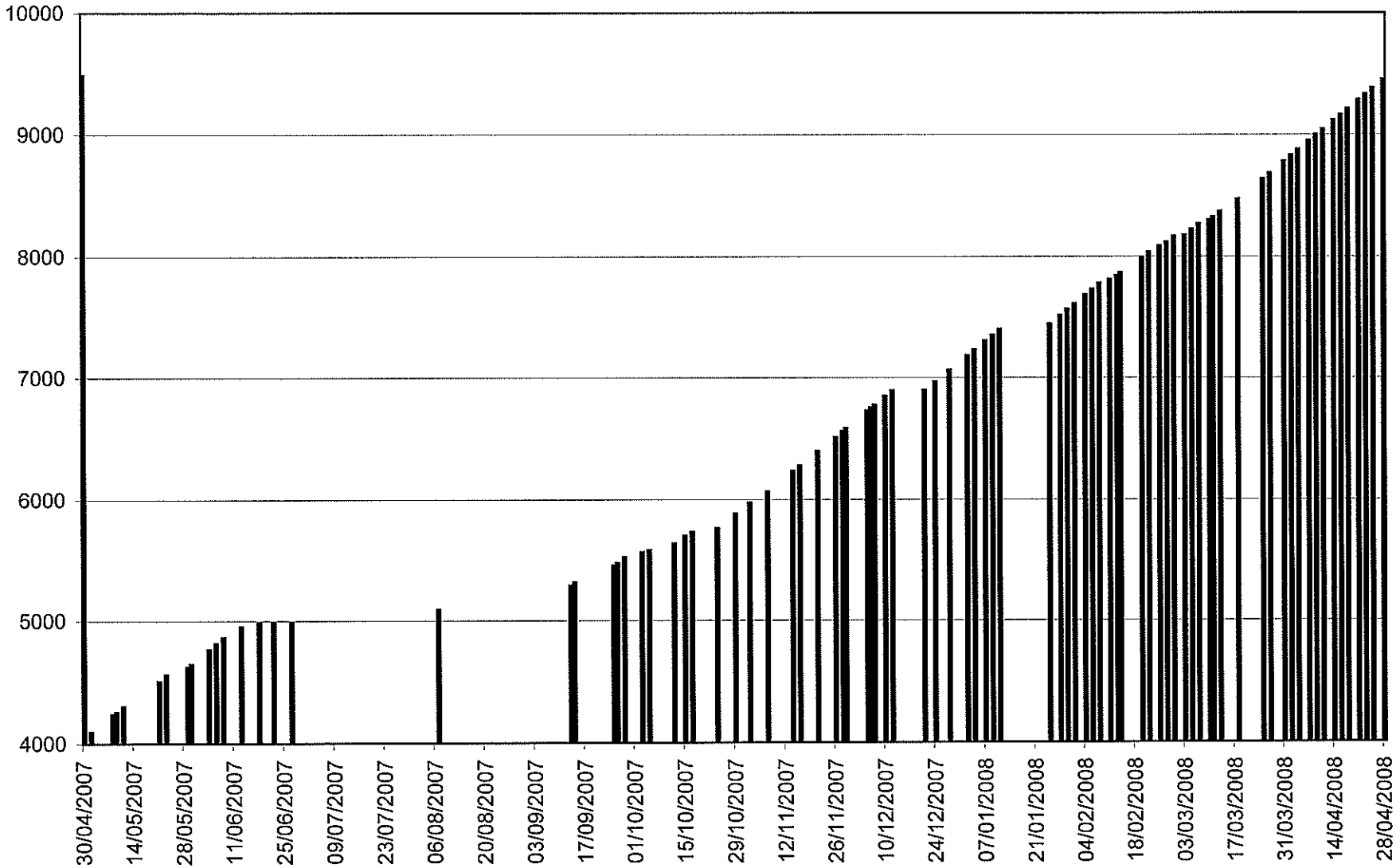

Stoney Hill Line 1 Oxygen
Oxygen (%v/v)
25
20
15
10
5
0
30/04/2007
14/05/2007
28/05/2007
11/06/2007
25/06/2007
09/07/2007
23/07/2007
06/08/2007
20/08/2007
03/09/2007
17/09/2007
01/10/2007
15/10/2007
29/10/2007
12/11/2007
26/11/2007
10/12/2007
24/12/2007
07/01/2008
21/01/2008
04/02/2008
18/02/2008
03/03/2008
17/03/2008
31/03/2008
14/04/2008
28/04/2008
Date


Line 2 Methane
Methane (%v/v)
70
60
50
40
30
20
10
0
30/04/2007
14/05/2007
28/05/2007
11/06/2007
25/06/2007
09/07/2007
23/07/2007
06/08/2007
20/08/2007
03/09/2007
17/09/2007
01/10/2007
15/10/2007
29/10/2007
12/11/2007
26/11/2007
10/12/2007
24/12/2007
07/01/2008
21/01/2008
04/02/2008
18/02/2008
03/03/2008
17/03/2008
31/03/2008
14/04/2008
28/04/2008
Date

Line 2 - Oxygen



FLARE HOURS


10000
9000
8000
7000
6000
5000
4000
30/04/2007
14/05/2007
28/05/2007
11/06/2007
25/06/2007
09/07/2007
23/07/2007
06/08/2007
20/08/2007
03/09/2007
17/09/2007
01/10/2007
15/10/2007
29/10/2007
12/11/2007
26/11/2007
10/12/2007
24/12/2007
07/01/2008
21/01/2008
04/02/2008
18/02/2008
03/03/2008
17/03/2008
31/03/2008
14/04/2008
28/04/2008

Gas Balancing Flare

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)	FLARE HOURS	FLARE TEMPERATURE (T°C)	UNADJUSTED FLARE FLOW (m3/hr) perflow=red
StoFlare	30 April 2007	27.5	15.5	9.9	994	4.28	4044	711	
StoFlare	30 April 2007	25.4	13.7	11.1	993	3.21			
StoFlare	02 May 2007	22.8	14.2	11.1	993	4.53	4087	706	
StoFlare	02 May 2007	22.8	14.6	10.6	993	4.46			
StoFlare	04 May 2007	22.2	15.5	10.5	993	2.29			
StoFlare	08 May 2007	22	14.2	10.6	982	1.56	4231	733	
StoFlare	08 May 2007	21.4	15.6	10.3	982	1.64			
StoFlare	09 May 2007	24.2	14.8	9.9	989	2.08	4252	454	
StoFlare	11 May 2007	21.4	12.8	11	978	2.11	4298	663	
StoFlare	14 May 2007	48.3	27.8	0.9	984	0.25			
StoFlare	16 May 2007	23.3	16.3	10.6	989	0.87			
StoFlare	18 May 2007	21.8	11	13.8	978	0.54			
StoFlare	21 May 2007	25.2	15.6	10.7	998	0.93	4500	355	
StoFlare	21 May 2007	27.9	16.5	10.7	997	3.46			
StoFlare	21 May 2007	25.5	15.5	10.9	997	3.22		390	
StoFlare	21 May 2007	25.6	14.4	10.5	996	3.43		427	
StoFlare	21 May 2007	23.4	13	11.9	997	3.9		430	
StoFlare	21 May 2007	22.8	12.9	11.8	997	1.68		483	
StoFlare	23 May 2007	24	14.9	10.2	1001	1.61		509	
StoFlare	23 May 2007	24.1	14.2	11	1000	1.37			
StoFlare	23 May 2007	32.5	19.3	7.3	1000	0.87	4550	570	
StoFlare	23 May 2007	34.1	19.8	7	1000	0.7		660	
StoFlare	25 May 2007	45.1	26.4	4.6	988	0.37			
StoFlare	25 May 2007	51	28.6	1.8	988	-92.85			
StoFlare	29 May 2007	63.4	33.6	0	987	-0.09	4615	409	
StoFlare	30 May 2007	36.6	21	8.2	982	-0.37	4636	409	
StoFlare	01 June 2007	37.6	20.6	7.6	996	0.05			
StoFlare	04 June 2007	40.5	21.9	6.6	1004	1.31	4758	568	
StoFlare	06 June 2007	40.2	22.7	6.3	1001	0.64	4806	484	
StoFlare	08 June 2007	40.8	23.6	5.8	998	0.77	4854	483	
StoFlare	12 June 2007	60.9	32.4	0.4	990	0.88			
StoFlare	13 June 2007	41.4	23.8	5.6	986	0.2	4942	663	
StoFlare	14 June 2007	41.4	24.2	5.8	979	1.67			
StoFlare	18 June 2007	62.1	32.9	0.4	984	-0.74	4975	424	
StoFlare	22 June 2007	62.2	34.2	0.9	984	0.11	4978		
StoFlare	27 June 2007	59.8	31.4	1.9	984	0.61	4978		
StoFlare	18 July 2007	57.5	32.1	2.7	992	-0.09			
StoFlare	18 July 2007	57.5	30.7	2.1	992	0.2			
StoFlare	18 July 2007	25.5	14.4	11.9	994	1.93			
StoFlare	18 July 2007	17.2	9.1	14.7	994	0			
StoFlare	18 July 2007	27.7	14.3	11.2	994	0.01			
StoFlare	18 July 2007	31.1	16.8	9.6	994	-0.69			
StoFlare	20 July 2007	60.8	32.5	1.6	992	0			
StoFlare	20 July 2007	35.8	21.7	8.3	991	0.42			
StoFlare	20 July 2007	38.4	23	7.5	991	0.45			
StoFlare	20 July 2007	36.1	22.2	8.3	991	0.07			
StoFlare	23 July 2007	64.9	34.7	0.5	979	0.34			
StoFlare	25 July 2007	34.9	21.1	8.2	985	0.79			
StoFlare	25 July 2007	46.9	27	4.8	984	0.25			
StoFlare	27 July 2007	25.6	14.7	12	985	1.23			
StoFlare	27 July 2007	29.4	16.8	10.5	986	-0.08			
StoFlare	07 August 2007	44.8	25.2	5.6	995	0.57	5085	0	
StoFlare	07 August 2007	43.4	23.6	6.3	994	0.6			
StoFlare	07 August 2007	32.5	17.8	9.4	995	2.91	5085	432	
StoFlare	07 August 2007	30.1	16.4	10.1	995	2.62		477	
StoFlare	07 August 2007	27.6	15.9	10.4	995	2.22			
StoFlare	07 August 2007	27.8	16.1	10.4	995	1			
StoFlare	07 August 2007	37.8	20.7	7.7	995	0.51			
StoFlare	13 August 2007	66.6	32.9	0.3	985				
StoFlare	22 August 2007	16.8	10	9.1	997	4.06			
StoFlare	22 August 2007	31.6	17.5	9.8	997	2.94			
StoFlare	22 August 2007	29.5	16.1	10.7	997	3.27			

StoFlare	22 August 2007	28.8	15.4	10.8	997	0.3			
StoFlare	22 August 2007	30.4	16.4	10.3	997	-0.16			
StoFlare	22 August 2007	43.6	22.7	6.1	997	0			
StoFlare	05 September 2007	62.6	32.8	0.7	1009				
StoFlare	05 September 2007	29.6	15.9	11.1	1008				
StoFlare	05 September 2007	50.4	26.7	4.4	1008				
StoFlare	07 September 2007	41.2	22.6	6.8	1011	0.26			
StoFlare	10 September 2007	41.2	22.8	6.7	999	0.2			
StoFlare	10 September 2007	59.2	31.6	1.6	998	0.52			
StoFlare	13 September 2007	58.4	30.8	2	1002	0.04	5280	572	
StoFlare	14 September 2007	60.7	29.2	2	993	0.02	5307	514	
StoFlare	17 September 2007	60.1	30.5	1.8	985	0.23			
StoFlare	21 September 2007	67.4	33	0.3	986	3.3			
StoFlare	25 September 2007	61.2	33.6	1	989	1.04			
StoFlare	25 September 2007	32.6	15	1	989	0.77			
StoFlare	25 September 2007	60.3	31.8	0.9	988	0.99			
StoFlare	25 September 2007	61.2	31.7	0.9	988	-0.18	5442	645	
StoFlare	25 September 2007	58	31.7	1.5	989	0.21			
StoFlare	25 September 2007	55.8	31.3	2	991	0.86	5445.7	696	
StoFlare	26 September 2007	53.6	31.9	2.2	1000	0.36	5467	651	
StoFlare	28 September 2007	51.4	30.4	2.6	994	0.2	5515.89	550	
StoFlare	03 October 2007	57.7	30.4	2	991	1.25	5556	474	
StoFlare	05 October 2007	57.4	30.4	2.3	999	1.95	5571		
StoFlare	12 October 2007	58.1	31.2	1.3		0.84	5625	426	
StoFlare	15 October 2007	52.8	31.6	2	989	0.63	5693	600	
StoFlare	17 October 2007	55.4	32.6	1	997	1.21	5723	540	
StoFlare	17 October 2007	55	31.5	1.4	998	0.75	5725	646	170
StoFlare	17 October 2007	52.5	29.8	1.8	998	0.91			121
StoFlare	22 October 2007	19.3	10.8	14.5	995	4.19			
StoFlare	24 October 2007	19.7	10.5	14	1002	4.32	5753	452	
StoFlare	29 October 2007	44.1	27.5	4.4	991	0.63	5873	540	
StoFlare	29 October 2007	50.3	30.4	2.3	991	0.63		575	
StoFlare	01 November 2007	45	29.7	2.4	1008	0.63			
StoFlare	01 November 2007	43.6	28.4	2.4	1008	0.58		579	122
StoFlare	01 November 2007	47.1	28.7	2.3	1008	0.11		622	110
StoFlare	02 November 2007	47.3	29.2	2.2	1000	0.17	5967	615	
StoFlare	05 November 2007	42.2	20.9	6.3	1000	0.41			
StoFlare	07 November 2007	51.2	30	2.4	1000	0.42	6058	634	
StoFlare	09 November 2007	55.4	26.2	2.6	1000	0.21			
StoFlare	12 November 2007	51.4	29.7	2.6	1001	0.2			
StoFlare	14 November 2007	51.4	30	2.1	1000	0.51	6226	619	
StoFlare	16 November 2007	50.2	29.3	3.2	1000	0.61	6271	556	
StoFlare	19 November 2007	55.9	31.1	1.9	972	-0.2			
StoFlare	21 November 2007	60.4	31.1	1.1	971	0.41	6392	574	
StoFlare	21 November 2007	60.5	31.8	1	970	0.59		615	
StoFlare	23 November 2007	56	30.1	1.4	999	-0.13			
StoFlare	26 November 2007	56.3	29.2	1	1005	0.82	6502		
StoFlare	28 November 2007	56.3	31.2	1.4	988	0.36	6550	574	
StoFlare	29 November 2007	56	30.3	1.7	981	0.09	6574	630	
StoFlare	05 December 2007	56.8	30.5	1.7	974	0.2	6719	657	
StoFlare	06 December 2007	57.4	30	1.4	977	-0.03	6743	642	
StoFlare	07 December 2007	58	31.9	1.1	973	0.56	6766	646	
StoFlare	10 December 2007	58.9	30.5	1.8	988	-0.56	6838	673	
StoFlare	12 December 2007	53.6	29.6	1.9	1009	0.38	6886	560	
StoFlare	21 December 2007	66.2	35.2	0.7	1002	0.83	6889.75	425	
StoFlare	21 December 2007	60.2	31.9	2.1	1001	0.82		470	
StoFlare	24 December 2007	54	30.9	3	995	0.17	6957	577	
StoFlare	24 December 2007	56.4	31	2.4	995	0.13		600	
StoFlare	28 December 2007	58.6	29.1	2.3	987	-0.41	7055	614	
StoFlare	02 January 2008	57.4	28.9	2.4	989	0.1	7175	598	
StoFlare	04 January 2008	58.4	30.4	2.4	973	0.58	7223	591	
StoFlare	07 January 2008	57.6	29.5	2.6	981	0.66	7297	610	
StoFlare	09 January 2008	54.9	28.8	3.5	981	0.26	7345	660	
StoFlare	09 January 2008	55.3	30	2.7	980	0.55			
StoFlare	11 January 2008	57.3	31	2.8	968	0.42	7391	612	

StoFlare	25 January 2008	61.8	35.6	1.6		0.28	7436	555	
StoFlare	28 January 2008	54.8	29.2	2.8	1009	0.03	7509	563	
StoFlare	30 January 2008	55.1	29.8	3.3	1003	0.57	7557	657	
StoFlare	01 February 2008	55.1	30.3	3.5	973	1.11	7604	659	
StoFlare	04 February 2008	53.5	30.1	3	971	0.12	7677	604	
StoFlare	06 February 2008	51.5	27.9	3.7	1000	0.3	7725	640	
StoFlare	08 February 2008	49.8	32.3	1.9	1004	0.39	7775	570	71
StoFlare	11 February 2008	59.9	31.4	0.9	1009	0.62	7806	409	135
StoFlare	13 February 2008	55.4	28.4	2.4	1011	0.71	7838	550	146
StoFlare	14 February 2008	51	28	3.9	1014	0.17	7859	497	101
StoFlare	20 February 2008	62.6	32	1.2	994	0.5	7985	480	150
StoFlare	22 February 2008	60	32	1.7	993	0.18	8031	689	100
StoFlare	25 February 2008	63.3	32.1	1.4	992	-0.09	8083	559	113
StoFlare	27 February 2008	36	20	9	993	0.38	8113	609	50-75
StoFlare	27 February 2008	39.2	21.9	7.8	994	0			
StoFlare	29 February 2008	62.5	33.7	1.6	986	0.57	8160	689	75
StoFlare	03 March 2008	66.6	33	1	986	0.49	8171	529	
StoFlare	05 March 2008	63.4	32.7	1.7	1008	-0.08	8219	669	50-75
StoFlare	07 March 2008	60.8	36.3	0.8		0	8266	650	50
StoFlare	10 March 2008	65.1	34.1	1	935	0.55	8295	660	150
StoFlare	11 March 2008	61.1	33.8	1.1	958	-0.08	8319	663	50
StoFlare	13 March 2008	52.3	34	1.4	988	0.03	8367	565	100
StoFlare	18 March 2008	58.2	35.6	0.8	1000	0.64	8466	490	150
StoFlare	25 March 2008	55.3	30.8	2.4	984	0.11	8632	626	100
StoFlare	25 March 2008	57.2	31.7	2.4	984	-0.11			
StoFlare	27 March 2008	56.3	31.6	2	977	0.33	8680	563	100
StoFlare	31 March 2008	46	27.8	3.8	988	0.39	8776	635	150
StoFlare	02 April 2008	47.6	28.5	3	1001	0.46	8823	657	150
StoFlare	02 April 2008	54.8	30.5	2.1	1001	0.51			
StoFlare	04 April 2008	53.6	30.2	2.1	1003	0.76	8871	682	
StoFlare	04 April 2008	54.9	30.9	1.8	1003	0.22			
StoFlare	07 April 2008	56	31.1	2.7	978	-0.07	8944	643	
StoFlare	09 April 2008	57.8	31.9	2.3	974	0.11	8991	578	110
StoFlare	11 April 2008	57.1	31.6	2.6	969	-0.13	9038	578	100
StoFlare	14 April 2008	55.5	30.8	2.3	994	0.6	9112	660	120
StoFlare	14 April 2008	56.2	30.6	1.7	994	-0.3		650	
StoFlare	21 May 2007	21.6	12	13.2	996	-81.04			
StoFlare	12 June 2007	43.1	24.5	5.1	990	1.66			
StoFlare	18 June 2007	57.8	29.9	1.2	982	0.45			
StoFlare	25 July 2007	60.9	33.2	1.3	986	0.3			
StoFlare	24 October 2007	50.6	26.4	3.9	1001	0.67			
StoFlare	28 November 2007	56.9	31.1	1.3	984	0.83			
StoFlare	30 January 2008	56.8	29.2	2.5	1002	0.85			
StoFlare	06 February 2008	51.4	29.8	2.4	1001	0.59			
StoFlare	14 February 2008	51.1	28.3	3.1	1013	0.31			
StoFlare	22 February 2008	60.2	31.7	1.1	993	-0.21			
StoFlare	27 February 2008	60.4	31.7	1.6	993	0.09			
StoFlare	05 March 2008	63.1	32.1	1.1	1006	-0.07	8220	673	
StoFlare	11 March 2008	58.8	31.5	1.7	957	-0.1			
StoFlare	30 April 2007	63.6	33.1	0.8	964	0.62	9479	OFF	150
StoFlare	01 August 2007	66.4	32.9	0.4	991				
StoFlare	14 January 2008	65.6	33.1	1.1	965	1.1			
StoFlare	16 April 2008	57.8	31.4	1.7	997	0.55	9155	422	150
StoFlare	18 April 2008	58	31.6	1.6	976	0.48	9205	692	140
StoFlare	21 April 2008	59.1	32.1	1.8	983	-0.05			
StoFlare	21 April 2008	59.4	31.8	1.5	983	-0.05	9276	608	125
StoFlare	21 April 2008	58.7	31.7	1.5	984	0.09			
StoFlare	23 April 2008	58	31.5	1.9	991	-0.35	9324	679	120
StoFlare	25 April 2008	57.1	31	2	1002	0.1	9372	668	120
StoFlare	28 April 2008	58.9	31.9	1.8	977	0.69	9444	690	100

Gas Balancing Flare

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
StoLine1	30 April 2007	39.8	21.9	4.7	993	-72.1
StoLine1	30 April 2007	62.4	32.6	1.3	965	-42.24
StoLine1	30 April 2007	38.7	21.4	5	994	-70.04
StoLine1	02 May 2007	34.7	22.5	4.1	994	-69.33
StoLine1	04 May 2007	32.1	22.7	4.9	993	-72.74
StoLine1	08 May 2007	30.6	22	4.6	983	-77.6
StoLine1	08 May 2007	31	21.7	4.8	983	-73.13
StoLine1	09 May 2007	29.9	20.7	5.2	988	-73
StoLine1	11 May 2007	30.4	21.1	4.8	978	-72.17
StoLine1	14 May 2007	46.2	26.9	1.1	984	-90.21
StoLine1	16 May 2007	33	23.7	5.2	989	-72.85
StoLine1	18 May 2007	36.3	20.6	6.5	978	-86.9
StoLine1	21 May 2007	36.7	23.2	5.2	998	-70.08
StoLine1	21 May 2007	36.8	22.6	5.1	997	-63.18
StoLine1	21 May 2007	33.9	22.6	5.2	996	-94.55
StoLine1	21 May 2007	40.8	23.9	4.2	997	-98.15
StoLine1	23 May 2007	40.6	25.4	3.4	1000	-99.96
StoLine1	23 May 2007	40	24.3	3.6	1000	-97.73
StoLine1	23 May 2007	41	25.1	3.4	1000	-90.03
StoLine1	29 May 2007	55.6	30.5	1.6	988	-90.34
StoLine1	30 May 2007	55.6	31.1	1.3	982	-92.92
StoLine1	01 June 2007	49	26.2	3.6	996	-91.64
StoLine1	04 June 2007	49.1	26.5	3.2	1004	-92.51
StoLine1	06 June 2007	48.3	27.1	2.9	1001	-87.48
StoLine1	08 June 2007	47.6	27.6	2.6	998	-84.56
StoLine1	12 June 2007	59.6	31.4	0.6	990	-85.82
StoLine1	13 June 2007	22.8	13.1	12.6	985	-2.69
StoLine1	13 June 2007	48.8	27.4	2.8	985	-89.29
StoLine1	14 June 2007	49.1	28.8	3	979	-90.26
StoLine1	18 June 2007	59.4	30.5	1.3	984	-92.8
StoLine1	18 June 2007	59.7	31.2	0.7	983	-84.97
StoLine1	20 June 2007	53.9	28	3.5	986	-47.23
StoLine1	22 June 2007	61.6	33.2	0.7	984	-97.91
StoLine1	27 June 2007	49.2	26.4	4.8	983	-92.29
StoLine1	05 July 2007	6.6	7.5	17.2	988	-65.1
StoLine1	09 July 2007	2.6	4.7	19.5	989	-5.8
StoLine1	18 July 2007	57.7	30.3	2	992	-89.72
StoLine1	18 July 2007	53.6	28	2.8	994	-98.64
StoLine1	20 July 2007	54.9	29.3	2.7	992	-90.16
StoLine1	23 July 2007	61.3	33.6	1.3	979	-95.12
StoLine1	25 July 2007	49.1	27.6	4.2	985	-86.58
StoLine1	25 July 2007	53.8	29	2.7	985	-97.98
StoLine1	27 July 2007	37.1	20.7	7.6	985	-96.07
StoLine1	27 July 2007	30.6	16.7	10	986	-93.71
StoLine1	01 August 2007	63.1	32.3	0.9	991	
StoLine1	07 August 2007	53.1	29.1	2.9	995	-97.24
StoLine1	07 August 2007	55.9	29.6	2.4	994	-92.81
StoLine1	07 August 2007	54.2	29.1	3	995	-95.86
StoLine1	13 August 2007	48.3	28.2	4.3	984	
StoLine1	22 August 2007	52.7	27.7	2.8	997	-96.82
StoLine1	05 September 2007	55	30.4	2.4	1008	
StoLine1	05 September 2007	51.2	26.5	3.6	1008	

StoLine1	05 September 2007	50.9	26.6	3.9	1008	
StoLine1	07 September 2007	50.7	26.7	3.7	1011	-25.64
StoLine1	10 September 2007	49.7	26.8	3.9	999	-25.82
StoLine1	10 September 2007	48.9	26	4.4	998	-23.79
StoLine1	11 September 2007	46	23.4	4.7	1000	-35.71
StoLine1	13 September 2007	51.1	27	3.9	1002	-23.49
StoLine1	14 September 2007	52.8	24.8	4.2	993	-27.73
StoLine1	17 September 2007	53.3	26.8	3.6	985	-27.83
StoLine1	19 September 2007					
StoLine1	21 September 2007	66.5	33.3	0	986	6.51
StoLine1	25 September 2007	58.4	31.4	1.7	989	-97.54
StoLine1	25 September 2007	54.2	29.8	2.7	989	-95.79
StoLine1	26 September 2007	48.2	29.2	2.9	999	-97.91
StoLine1	28 September 2007	47.2	28.9	3.2	994	-98.33
StoLine1	03 October 2007	55.8	29.9	2.4	991	-98.01
StoLine1	05 October 2007	66.2	34	0	999	6.75
StoLine1	15 October 2007	46.5	29.1	3.1	989	-97.03
StoLine1	17 October 2007	49	29.8	2.1	998	-99
StoLine1	17 October 2007	48.3	29.6	2.3	997	-98.85
StoLine1	17 October 2007	43.8	27	3.8	997	-3.81
StoLine1	17 October 2007	47	28.8	2.7	998	-97.82
StoLine1	17 October 2007	46.7	28.1	2.7	998	-89.41
StoLine1	22 October 2007	49.9	28	3.4	995	-88.84
StoLine1	24 October 2007	57.2	25.6	2.7	1003	-88.85
StoLine1	24 October 2007	50	24.2	3.7	1001	-89.91
StoLine1	29 October 2007	43.7	27.8	3.6	991	-99.07
StoLine1	01 November 2007	34.9	25.7	3.8	1008	-99.92
StoLine1	01 November 2007	34.5	25.4	3.5	1008	-99.25
StoLine1	01 November 2007	33.8	25	3.6	1008	-31.99
StoLine1	02 November 2007	35.4	24.3	5	1000	-32.11
StoLine1	05 November 2007	0.1	2.9	20.2	999	-20.18
StoLine1	05 November 2007	52.6	28.7	2.4	999	-32.81
StoLine1	07 November 2007	42.9	25.9	4.9	1000	-34.21
StoLine1	12 November 2007	43.6	26.1	4.3	1001	-35.63
StoLine1	14 November 2007	44.9	26.4	4.3	1000	-35.4
StoLine1	16 November 2007	42.7	25.6	4.6	1000	-37.36
StoLine1	19 November 2007	49.4	26.5	3.8	972	-38.34
StoLine1	21 November 2007	57	30.8	1.6	971	-40.72
StoLine1	21 November 2007	56.5	30.4	1.5	971	-40.61
StoLine1	23 November 2007	50.6	27.8	2.3	999	-45.15
StoLine1	26 November 2007	48.9	27.4	2.6	1005	-40.41
StoLine1	28 November 2007	49.2	27.8	3	987	-37.46
StoLine1	28 November 2007	49.6	27.1	3.1	984	-34.54
StoLine1	29 November 2007	49.4	27.2	3.3	981	-37.59
StoLine1	05 December 2007	47.4	27.3	3.3	974	-37.71
StoLine1	06 December 2007	48.2	27.1	3.2	977	-36.38
StoLine1	07 December 2007	46.3	26.6	4.2	973	-82.13
StoLine1	10 December 2007	46.5	26.7	4.6	988	-75.98
StoLine1	12 December 2007	41.1	25.4	4.1	1008	-51.25
StoLine1	21 December 2007	35.5	21	8.8	1002	-100.88
StoLine1	21 December 2007	29.7	15.6	11.6	1002	-101.43
StoLine1	24 December 2007	40	22.9	6.8	995	-64.4
StoLine1	24 December 2007	33.8	19.7	8.7	995	-69.57
StoLine1	28 December 2007	45.7	23.2	5.8	986	-71.99
StoLine1	02 January 2008	45.3	23.5	5.9	989	-72.52

StoLine1	04 January 2008	46.6	25.8	5.6	973	-72.38
StoLine1	07 January 2008	44.7	23.9	5.7	980	-73.86
StoLine1	09 January 2008	43	23.9	6.4	981	-73.19
StoLine1	09 January 2008	46.8	25.3	4.9	980	-57.94
StoLine1	11 January 2008	50.8	28.1	4.4	968	-62.87
StoLine1	14 January 2008	58.1	30.6	2.7	965	-57.53
StoLine1	28 January 2008	46.2	24.6	5.6	1009	-94.93
StoLine1	30 January 2008	44.7	22.9	6.6	1003	-94.75
StoLine1	30 January 2008	49.1	25	5.2	1002	-93.68
StoLine1	01 February 2008	48	26.2	5.5	973	-92.54
StoLine1	04 February 2008	47.6	26.1	5.2	971	-92.75
StoLine1	06 February 2008	41.6	24.4	5.4	999	-94.43
StoLine1	06 February 2008	43.5	26.3	4.3	1001	-94.01
StoLine1	08 February 2008	41.4	29.6	2.7	1004	-93.9
StoLine1	11 February 2008	52.4	27.5	2.5	1009	-94.04
StoLine1	13 February 2008	47.4	25.8	3.2	1011	-97.06
StoLine1	14 February 2008	42.4	24.9	5	1014	-97.68
StoLine1	14 February 2008	39.8	23.2	6.1	1013	-99.05
StoLine1	20 February 2008	46.8	26.6	4	993	-0.1
StoLine1	22 February 2008	46.7	26.4	3.9	993	-0.21
StoLine1	22 February 2008	46.7	26.1	3.7	993	-0.06
StoLine1	25 February 2008	25.6	13.4	12.4	992	-0.35
StoLine1	25 February 2008	25.7	13.5	12.4	992	-0.27
StoLine1	27 February 2008	11.2	6.3	17.5	993	-43.95
StoLine1	27 February 2008	12.1	6.7	17.2	993	1.13
StoLine1	29 February 2008	12.1	7.1	17.2	985	0.79
StoLine1	03 March 2008	12.1	7.3	16.9	986	-2.32
StoLine1	05 March 2008	12.2	7.5	16.4	1008	1.93
StoLine1	10 March 2008	11.9	8.1	16.4	935	1.37
StoLine1	10 March 2008	12.3	8.1	16.5	935	0.05
StoLine1	11 March 2008	12	8.1	16.5	958	0.07
StoLine1	11 March 2008	32.3	15.3	10.1	958	-63.88
StoLine1	11 March 2008	55.9	29.7	2.8	956	-85.81
StoLine1	13 March 2008	45.4	32.9	2	987	-72.7
StoLine1	18 March 2008	52.5	33.7	1.4	1000	-33.2
StoLine1	25 March 2008	48.9	28.3	3.7	984	-48.71
StoLine1	27 March 2008	51.8	29.8	2.9	977	-48.43
StoLine1	31 March 2008	35.8	24	5.7	988	-17.1
StoLine1	02 April 2008	38.1	25.6	3.4	1000	-15.57
StoLine1	02 April 2008	48.4	28.2	3.2	1001	-51.95
StoLine1	04 April 2008	45.5	27.8	3.1	1003	-48.48
StoLine1	07 April 2008	51.2	29.1	3.3	979	-49.28
StoLine1	09 April 2008	52.5	30	2.9	973	-49.67
StoLine1	11 April 2008	54	30.9	2.9	968	-49.81
StoLine1	14 April 2008	50.1	29	2.8	994	-50.33
StoLine1	14 April 2008	50.6	29.1	2.7	995	-44.73
StoLine1	16 April 2008	53.1	29.7	2	997	-46.41
StoLine1	18 April 2008	53.2	29.7	2.9	977	-43.14
StoLine1	21 April 2008	55	30.4	1.9	983	-45.12
StoLine1	21 April 2008	52.6	29.1	2.8	984	-44.42
StoLine1	23 April 2008	54.9	30.2	2.2	991	-43.8
StoLine1	25 April 2008	51.4	29.5	2.6	1001	-44.05
StoLine1	28 April 2008	55.5	30.5	2.2	977	-42.34

Gas Balancing Flare

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
StoLine2	30 April 2007	20.4	10.6	13.3	993	-49.38
StoLine2	30 April 2007	17	10.5	14.6	994	-53.96
StoLine2	02 May 2007	16.5	9.3	14.2	994	-49.45
StoLine2	04 May 2007	11.6	7.1	16.9	993	-18.86
StoLine2	08 May 2007	12.4	7.7	16.5	983	-20.22
StoLine2	08 May 2007	13.7	6.9	16.3	983	-26.23
StoLine2	09 May 2007	13.8	7.4	15.8	988	-20.22
StoLine2	11 May 2007	11.4	5.9	16.8	978	-20.36
StoLine2	14 May 2007	66.9	29.9	0.7	984	-91.03
StoLine2	16 May 2007	14.5	9	15.7	989	-23.03
StoLine2	18 May 2007	16.1	8.4	16.1	977	-14.97
StoLine2	21 May 2007	14	7.8	15.5	998	-21.83
StoLine2	21 May 2007	13.9	7.7	16.1	998	-10.84
StoLine2	21 May 2007	28.4	16.2	10.8	998	-77.53
StoLine2	21 May 2007	21.7	12.1	13	997	-80.82
StoLine2	21 May 2007	16.9	8.6	14.8	997	-83.36
StoLine2	23 May 2007	12.3	6.6	15.4	1000	-32.79
StoLine2	23 May 2007	12	6	17	1000	-32.09
StoLine2	23 May 2007	29.8	18.2	7.7	1000	1.02
StoLine2	25 May 2007	27.9	17.4	10.8	988	-3.91
StoLine2	29 May 2007	38.2	22.6	7.6	987	-5.26
StoLine2	30 May 2007	28.1	16.3	11.1	982	-6.49
StoLine2	01 June 2007	22.4	12.4	13.3	996	-6.59
StoLine2	04 June 2007	21.5	12	13.5	1004	-5.1
StoLine2	06 June 2007	22.4	12.6	13	1001	-4.44
StoLine2	08 June 2007	21.9	12.7	13	998	-4.05
StoLine2	12 June 2007	35.5	22.2	8.2	991	-2.55
StoLine2	14 June 2007	23	13.3	13.7	979	-2.59
StoLine2	18 June 2007	61.5	34.4	0.6	983	-90.98
StoLine2	18 June 2007	61.9	36	0.3	983	-85.29
StoLine2	20 June 2007	56.2	29.6	2.7	985	-18.39
StoLine2	22 June 2007	65.2	34.3	0	984	-88.39
StoLine2	27 June 2007	63.5	33.7	0.6	983	-85.52
StoLine2	05 July 2007	43.6	27	5.6	988	28.43
StoLine2	09 July 2007	40.9	24.8	6.7	989	-35.62
StoLine2	18 July 2007	63.5	34	0.4	992	-91.5
StoLine2	18 July 2007	25.1	13.8	12.1	993	-96.84
StoLine2	20 July 2007	67.2	35.8	0	992	-0.07
StoLine2	20 July 2007	63.8	33.7	0.5	992	-6.15
StoLine2	20 July 2007	32.2	19.7	9.5	991	-17.03
StoLine2	20 July 2007	28.9	17.4	10.5	991	-6.4
StoLine2	20 July 2007	35.6	21.9	8.4	991	-6.99
StoLine2	23 July 2007	61.6	32.1	1.5	978	-93.47
StoLine2	25 July 2007	65.5	35.4	0.4	985	-89.2
StoLine2	25 July 2007	28.8	16.7	10.3	984	-35.5
StoLine2	25 July 2007	17.3	9.6	14.2	984	-9.72
StoLine2	27 July 2007	25.1	14.2	11.9	986	0.64
StoLine2	01 August 2007	56.1	30.2	2.5	991	
StoLine2	07 August 2007	28.3	17.6	9.8	994	-5.23
StoLine2	07 August 2007	62.9	33.8	0.4	995	-1.65
StoLine2	07 August 2007	31.2	17.4	10.6	995	-96.8

StoLine2	13 August 2007	45.4	26.8	5.1	985	
StoLine2	22 August 2007	28.2	15.7	10.8	997	-97.41
StoLine2	05 September 2007	19.3	11.1	14	1008	
StoLine2	05 September 2007	22.5	11.9	13.5	1008	
StoLine2	05 September 2007	48.5	26.2	4.7	1008	
StoLine2	07 September 2007	34.4	19.1	9.2	1011	-5.27
StoLine2	10 September 2007	34.2	19.5	9	999	-5.34
StoLine2	10 September 2007	61.8	34	0.8	998	-51.43
StoLine2	11 September 2007	59.5	28.9	1.5	1000	-98.23
StoLine2	13 September 2007	62.5	32.9	0.7	1002	-68.37
StoLine2	13 September 2007	62.5	33.1	0.2	1002	-87.87
StoLine2	13 September 2007	63	33.3	0.8	1002	-87.67
StoLine2	14 September 2007	64.9	30	1	993	-92.22
StoLine2	17 September 2007	62.8	31.7	0.9	985	-91.07
StoLine2	19 September 2007					
StoLine2	21 September 2007	66.2	32.7	0.1	985	9
StoLine2	25 September 2007	39.2	17.6	0.6	988	-97.07
StoLine2	25 September 2007	58.5	32.7	1.3	989	-95.72
StoLine2	26 September 2007	58.5	32.6	1.7	1000	-98.27
StoLine2	28 September 2007	55.5	31.7	1.9	994	-98.16
StoLine2	03 October 2007	58.1	31.3	1.9	991	-98.14
StoLine2	05 October 2007	66.4	33.8	0.2	999	7.39
StoLine2	15 October 2007	59.5	33.4	0.6	989	-97.31
StoLine2	17 October 2007	59.5	33.6	0.2	997	-99.05
StoLine2	17 October 2007	58.9	33	0.2	997	-97.82
StoLine2	17 October 2007	59.7	33.1	0.4	998	-98.38
StoLine2	17 October 2007	58.6	31.6	0.8	998	-91.36
StoLine2	22 October 2007	11.7	6.3	17.3	996	-27.61
StoLine2	24 October 2007	10.9	6.6	17.1	1003	-25.96
StoLine2	24 October 2007	49.2	23.6	5.1	1002	-88.81
StoLine2	29 October 2007	44.9	26.7	4.7	991	-98.9
StoLine2	01 November 2007	58.2	31.1	0.7	1008	-100.79
StoLine2	02 November 2007	53.7	31.2	1.6	1000	-99.15
StoLine2	05 November 2007	59.1	32.4	0.5	998	-68.89
StoLine2	07 November 2007	53.9	32.1	1.6	1000	-97.53
StoLine2	12 November 2007	55.6	32	1.1	1002	-98.29
StoLine2	14 November 2007	55.5	32.4	1	1000	-96.89
StoLine2	16 November 2007	55.1	31.5	1.2	1000	-99.3
StoLine2	19 November 2007	57.6	31.3	1.3	973	-96.39
StoLine2	21 November 2007	58.5	32	0.9	971	-94.33
StoLine2	21 November 2007	59.7	31.1	0.9	971	-94.54
StoLine2	23 November 2007	57.6	30.5	1.4	998	-98.86
StoLine2	26 November 2007	56.5	29.2	1.1	1005	-102.23
StoLine2	28 November 2007	60.7	32.1	0.6	987	-96.48
StoLine2	28 November 2007	60.1	31.5	0.8	984	-95.84
StoLine2	29 November 2007	59.3	32.1	0.8	981	-96.32
StoLine2	05 December 2007	60.9	31.5	0.9	974	-95.57
StoLine2	06 December 2007	60.1	32	0.7	977	-94.69
StoLine2	07 December 2007	60.2	32.3	1.1	972	-93.64
StoLine2	10 December 2007	61.3	32.1	1.3	988	-95.89
StoLine2	12 December 2007	58.9	31.1	1.3	1008	-100.12
StoLine2	21 December 2007	68	35.7	0.1	1002	-100.76
StoLine2	24 December 2007	65.9	34.8	0.5	995	-96.54
StoLine2	28 December 2007	62.1	31.6	1.1	987	-95.65

StoLine2	02 January 2008	61.3	30.9	1.2	988	-96.11
StoLine2	04 January 2008	61.8	31.7	1.3	973	-94.48
StoLine2	07 January 2008	61.9	32	1.1	980	-95.09
StoLine2	09 January 2008	59.7	32.2	1.9	980	-94.76
StoLine2	09 January 2008	60.7	32.9	1.4	980	-95.2
StoLine2	11 January 2008	59.4	32.8	1.7	968	-94.09
StoLine2	14 January 2008	64.9	33.4	0.9	965	-94.41
StoLine2	28 January 2008	61.9	31.2	1.7	1009	-96.64
StoLine2	30 January 2008	61.2	31.2	1.8	1003	-96.06
StoLine2	30 January 2008	61.6	31.1	1.4	1002	-96.71
StoLine2	01 February 2008	59.6	32.3	2	973	-95.2
StoLine2	04 February 2008	59.4	31.8	2.1	971	-95.71
StoLine2	06 February 2008	60.1	31.6	1.8	1000	-96.87
StoLine2	06 February 2008	60.2	31.5	1.3	1001	-97.56
StoLine2	08 February 2008	59.8	34.8	0.6	1004	-97.71
StoLine2	11 February 2008	61.1	31.3	0.7	1009	-97.25
StoLine2	13 February 2008	56.5	29.5	1.5	1011	-100.75
StoLine2	14 February 2008	59.1	30.5	2.4	1014	-101.91
StoLine2	14 February 2008	59.8	30.9	1.7	1014	-100.38
StoLine2	18 February 2008	59.6	31.7	1	1006	-93.18
StoLine2	20 February 2008	61	32	0.8	993	-99.8
StoLine2	22 February 2008	60.5	32.1	1.2	992	-90.21
StoLine2	22 February 2008	59.7	31.8	1.3	993	-92.8
StoLine2	25 February 2008	62.3	32.8	1	992	-91.67
StoLine2	27 February 2008	39.1	21.5	7.9	993	-96.7
StoLine2	27 February 2008	59.4	32	1.9	993	-93.75
StoLine2	29 February 2008	61.2	32.8	1.6	985	-91.95
StoLine2	03 March 2008	66.6	33.5	0.8	986	-98.8
StoLine2	05 March 2008	61.8	31.8	1.8	1008	-93.19
StoLine2	10 March 2008	64.2	34.3	1	936	-92.95
StoLine2	11 March 2008	61.6	34.4	1.2	957	-90.05
StoLine2	11 March 2008	61.6	34.2	0.8	958	-91.71
StoLine2	13 March 2008	61.2	36.2	0.4	987	-97.36
StoLine2	18 March 2008	60.8	37.5	0.2	1000	-97.9
StoLine2	25 March 2008	60.3	32.6	1.3	984	-96.14
StoLine2	27 March 2008	60.6	33.5	0.7	977	-92.99
StoLine2	31 March 2008	61.7	32.9	1	989	-96.3
StoLine2	02 April 2008	60.6	32.4	0.9	1000	-96.58
StoLine2	04 April 2008	55.7	30.2	2.5	1003	-93.89
StoLine2	04 April 2008	62.1	33.1	0.8	1003	-94.71
StoLine2	07 April 2008	61	33.5	1.6	978	-94.54
StoLine2	09 April 2008	61.5	33.5	1.3	973	-93.22
StoLine2	11 April 2008	61.6	33.6	1.3	968	-94.86
StoLine2	14 April 2008	61.5	32.7	1.1	994	-95.1
StoLine2	14 April 2008	62.5	32.6	0.8	995	-69.93
StoLine2	16 April 2008	58.2	31.5	1.1	997	-100.3
StoLine2	18 April 2008	59.3	31.4	1.8	975	-93.03
StoLine2	21 April 2008	62.5	33.4	0.7	983	-93.22
StoLine2	21 April 2008	63.1	33.3	0.5	984	-92.77
StoLine2	23 April 2008	62.1	32.6	0.8	991	-92.54
StoLine2	25 April 2008	62	32.3	1.1	1001	-95.63
StoLine2	28 April 2008	62.9	33.4	0.9	977	-90.32
StoLine2	30 April 2008	64.4	33.8	1	965	-96.82

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00004	30 April 2007	18.2	10.9	3.7	994	-44.24
Sto00004	08 May 2007	3.5	6	16.4	982	-51.17
Sto00004	14 May 2007	43.4	22.8	4.2	982	0
Sto00004	21 May 2007	20.5	13	12	996	-34.11
Sto00004	30 May 2007	42.7	24.6	5	980	-0.15
Sto00004	04 June 2007	25.2	14	11.5	1004	0.47
Sto00004	12 June 2007	24.6	11.3	8.2	989	-50.55
Sto00004	18 June 2007	42.3	21	3.7	983	-16.16
Sto00004	02 July 2007	73	20.5	0.2	977	3.11
Sto00004	09 July 2007	75.8	21.3	0.3	989	2.49
Sto00004	07 August 2007	42.1	22.8	6.8	995	-0.02
Sto00004	13 August 2007	64.7	22.6	1.4	984	
Sto00004	20 August 2007	69.7	26.6	0.1	982	
Sto00004	25 September 2007	10.4	14.7	9.1	989	-92
Sto00004	03 October 2007	17.4	15.3	7.6	990	-87.12
Sto00004	24 October 2007	7	14.9	3.9	1001	-85.6
Sto00004	01 November 2007	1.4	7	14.2	1007	-91.85
Sto00004	07 November 2007	5.9	12.1	10.3	1000	-32.54
Sto00004	21 November 2007	36.2	21.4	6.9	970	-39.38
Sto00004	28 November 2007	19.1	12.5	13.1	984	-30.39
Sto00004	06 December 2007	44.5	24.8	2.4	976	-32.55
Sto00004	24 December 2007	71.5	35.5	0.1	994	-0.64
Sto00004	09 January 2008	66.8	32.8	1.2	979	-20.41
Sto00004	30 January 2008	65.5	31.7	1.4	1002	-22.81
Sto00004	06 February 2008	65.5	33.1	1	999	-64.34
Sto00004	14 February 2008	62.7	32.3	0.9	1013	-88.23
Sto00004	11 March 2008	66.5	32.7	0.9	956	-78.88
Sto00004	02 April 2008	59.8	32.5	0.5	999	-40.36
Sto00004	14 April 2008	57.2	33	0.5	993	-43.74
Sto00004	21 April 2008	62.4	34.4	0.4	982	-42.46
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00010	24 December 2007	66.7	32.6	0.3	994	-32.02
Sto00010	09 January 2008	60.6	32.3	1.1	980	-53.13
Sto00010	30 January 2008	65.8	32.3	1.1	1002	-59.23
Sto00010	06 February 2008	48.6	30	1	999	-64.21
Sto00010	14 February 2008	0.2	1.2	20.4	1013	-69.86
Sto00010	11 March 2008	68.2	30.4	0.7	956	-56.54
Sto00010	02 April 2008	66.6	30.6	0.5	1000	-9.25
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00012	30 April 2007	62.2	32.5	0.4	993	-64.07
Sto00012	08 May 2007	55.3	33	0.3	982	-75.4
Sto00012	14 May 2007	56	33.2	0	983	0.36
Sto00012	21 May 2007	54.7	33.1	0.2	996	-49.96
Sto00012	30 May 2007	61.5	34.4	0.1	979	-3.41
Sto00012	04 June 2007	58.6	33.7	0.5	1004	-39.01
Sto00012	12 June 2007	61.5	34.3	0.1	990	-70.88
Sto00012	18 June 2007	61.3	34.5	0.2	983	-11.65
Sto00012	02 July 2007	62.5	31.7	0.3	977	3.25
Sto00012	09 July 2007	66.4	31.9	1	989	2.44
Sto00012	27 July 2007	63.5	37.8	0.1	985	0.54
Sto00012	07 August 2007	60.3	39	0.3	996	0.31
Sto00012	13 August 2007	63.1	35.6	0.1	984	
Sto00012	20 August 2007	64.6	33.9	0.1	982	
Sto00012	25 September 2007	63.4	38.2	0.4	989	-95.98
Sto00012	03 October 2007	64.7	36.4	0.2	990	-96.7
Sto00012	24 October 2007	66.3	35.4	0.2	1002	-89.14
Sto00012	01 November 2007	64.7	36.5	0	1008	-99.29
Sto00012	07 November 2007	62.9	36.6	1.9	1000	-32.77
Sto00012	14 November 2007	61	36.7	1.7	1000	-35.06
Sto00012	21 November 2007	64.4	35.7	0.3	970	-40.26
Sto00012	28 November 2007	66.1	36.1	0.1	984	-35.16

Sto00012	06 December 2007	64.6	35.7	0.3	975	-35.81
Sto00012	09 January 2008	52.7	29.2	4.8	979	-4.2
Sto00012	30 January 2008	46.3	24	6.5	1002	3.32
Sto00012	06 February 2008	64.3	35	1.2	999	-91.87
Sto00012	14 February 2008	62.5	34	2.6	1013	-96.8
Sto00012	11 March 2008	62.7	35.1	0.6	956	-81.64
Sto00012	02 April 2008	64.5	34.8	0.6	999	-42.32
Sto00012	14 April 2008	60.4	34.1	0.9	993	-45.59
Sto00012	21 April 2008	64.1	35.7	0.4	982	-43.57
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00014	30 April 2007	46.3	25.1	1.4	994	-44.24
Sto00014	08 May 2007	23.5	22.7	1.9	982	-0.39
Sto00014	14 May 2007	53.1	26.6	0.2	982	-0.12
Sto00014	21 May 2007	29	19.2	6.1	997	-26.78
Sto00014	30 May 2007	61.6	32.9	0	979	0.26
Sto00014	04 June 2007	53.6	25.5	0.8	1003	-14.53
Sto00014	12 June 2007	35.4	20.9	7.1	990	-7
Sto00014	18 June 2007	61.5	33.1	0.5	982	-9.56
Sto00014	02 July 2007	66.8	29	0.4	977	3.3
Sto00014	09 July 2007	69.7	30.1	0.4	988	1.44
Sto00014	07 August 2007	57.4	37.1	0.8	995	-0.62
Sto00014	13 August 2007	60.2	38.6	0.1	983	
Sto00014	20 August 2007	60.2	38.9	0.2	981	
Sto00014	10 September 2007	57.3	35.5	1.2	997	-14.86
Sto00014	25 September 2007	48.6	29.4	4.5	989	-46.98
Sto00014	03 October 2007	48	27.9	4.6	990	-44.13
Sto00014	24 October 2007	61.1	33.2	1.7	1001	-42.94
Sto00014	01 November 2007	52.1	33.8	1.2	1008	-47.68
Sto00014	07 November 2007	58.7	34.1	1.5	1000	-18.88
Sto00014	14 November 2007	57.8	34.3	2.4	1000	-19.43
Sto00014	21 November 2007	61.1	33	1.7	969	-20.76
Sto00014	28 November 2007	62.6	33.8	1.1	985	-17.44
Sto00014	28 November 2007	60.8	34.9	1.3	985	-16.86
Sto00014	28 November 2007	60.9	34.9	1.3	985	-17.39
Sto00014	06 December 2007	64	34.2	0.7	975	-18.46
Sto00014	24 December 2007	58.8	32.8	0.2	994	-9.56
Sto00014	09 January 2008	62.7	31.7	1	980	-7.42
Sto00014	30 January 2008	64.8	30.9	0.8	1001	-26.76
Sto00014	06 February 2008	59.8	30.5	1.1	999	-52.11
Sto00014	14 February 2008	53.4	29.2	1.5	1012	-57.46
Sto00014	11 March 2008	60.9	33.1	0.4	955	-78.83
Sto00014	02 April 2008	56.6	31.2	0.6	999	-42.92
Sto00014	14 April 2008	0.1	0.1	20.8	993	0.3
Sto00014	21 April 2008	0.2	0.1	20.7	983	-0.11
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00016	30 April 2007	13.1	7.2	14.3	994	-46.78
Sto00016	08 May 2007	5	6.2	14.4	982	-46.89
Sto00016	14 May 2007	26	8.6	5.4	982	0.9
Sto00016	21 May 2007	8.8	4	18.1	997	-37.45
Sto00016	30 May 2007	26.8	16.4	9.3	980	-0.41
Sto00016	04 June 2007	5.2	2.8	19.5	1004	-27.15
Sto00016	12 June 2007	8.6	7.2	16	989	-40.93
Sto00016	18 June 2007	57.3	21.3	3.4	982	2.47
Sto00016	02 July 2007	63.5	34.3	0.3	977	3.6
Sto00016	09 July 2007	76.2	18.1	0.2	989	4.77
Sto00016	13 August 2007	80.8	17.2	0	984	
Sto00016	20 August 2007	73.5	26.2	0	982	
Sto00016	10 September 2007	62.6	35.2	0	998	1.26
Sto00016	25 September 2007	72.9	27.6	0.3	989	0.56
Sto00016	03 October 2007	59.5	31.3	2.1	990	1.35
Sto00016	24 October 2007	55.3	30.7	0.7	1001	-2.54
Sto00016	01 November 2007	72.7	29.6	0	1007	0.05
Sto00016	07 November 2007	62.3	35.3	1.2	1000	0.56
Sto00016	14 November 2007	66.5	32.3	1.3	1000	0.45

Sto00016	21 November 2007	69.6	26.5	0.5	970	2.22
Sto00016	28 November 2007	72.8	27.7	0.1	984	4.12
Sto00016	06 December 2007	69	31.2	0.2	976	2.46
Sto00016	09 January 2008	3.2	2.1	19.7	979	-68.32
Sto00016	30 January 2008	0.8	0.9	19.7	1000	21.87
Sto00016	06 February 2008	0.3	0.9	20.6	999	0.11
Sto00016	14 February 2008	0.4	0.9	20.7	1012	4.14
Sto00016	11 March 2008	34.9	7.6	11	955	-80.72
Sto00016	02 April 2008	52.4	7.7	7.2	999	16.42
Sto00016	14 April 2008	40.6	5.9	10	993	29.53
Sto00016	21 April 2008	46.5	6.8	8.8	982	10.88
GAS WELL	**DATE**	**CH4(%)**	**CO2(%)**	**O2(%)**	**BAROMETRIC PRESSURE (mb)**	**RELATIVE PRESSURE(mb)**
Sto00020	30 April 2007	57.6	27.3	0.3	993	-58.72
Sto00020	08 May 2007	40.3	26.4	0.1	982	-60.35
Sto00020	14 May 2007	48.4	27.9	0	982	0.24
Sto00020	21 May 2007	50.1	27.8	0.1	996	-46.84
Sto00020	30 May 2007	63.8	32	0	979	-2.85
Sto00020	04 June 2007	59.6	28.4	0.4	1003	-35.26
Sto00020	12 June 2007	59.6	29.2	0	989	-55.09
Sto00020	18 June 2007	64.6	30	0.1	982	-9.43
Sto00020	02 July 2007	66	30.2	0.2	977	2.98
Sto00020	09 July 2007	69.8	31.5	0.2	989	2.77
Sto00020	27 July 2007	67.7	32.4	0.1	985	0.93
Sto00020	07 August 2007	56.5	29.8	2.4	994	0.96
Sto00020	13 August 2007	67.4	34.5	0	984	
Sto00020	20 August 2007	67.5	32.1	0.1	982	
Sto00020	25 September 2007	67.3	33.9	0.2	989	-76.5
Sto00020	03 October 2007	66.2	32.7	0.1	990	-75.14
Sto00020	24 October 2007	69.7	30.2	0.2	1001	-70.72
Sto00020	01 November 2007	41	30.4	0.1	1007	-77.36
Sto00020	07 November 2007	54.3	31.4	0.5	1000	-28.33
Sto00020	14 November 2007	57.7	31.2	1.4	1000	-31.1
Sto00020	21 November 2007	64	31.2	0.5	971	-35.15
Sto00020	28 November 2007	61.8	30.3	0.3	983	-30.44
Sto00020	06 December 2007	60.6	30.8	0.2	975	-31.69
Sto00020	09 January 2008	0.9	1.2	20.8	980	-1.9
Sto00020	30 January 2008	53	25.1	4.6	1002	-2.45
Sto00020	06 February 2008	53	24.3	4.9	999	-8.84
Sto00020	14 February 2008	49.9	22.1	6.5	1014	-3.85
Sto00020	11 March 2008	66.9	33.2	0.5	956	0.84
Sto00020	02 April 2008	68.2	32	0.5	1000	-1.64
Sto00020	14 April 2008	61.3	29.4	2.3	993	-0.36
Sto00020	21 April 2008	67.9	31.2	0.4	983	-1.37
GAS WELL	**DATE**	**CH4(%)**	**CO2(%)**	**O2(%)**	**BAROMETRIC PRESSURE (mb)**	**RELATIVE PRESSURE(mb)**
Sto00021	30 April 2007	29.1	22	0.4	993	-35.07
Sto00021	08 May 2007	15.6	22	0.1	983	-69.54
Sto00021	14 May 2007	40.3	25.2	0.1	983	1.54
Sto00021	21 May 2007	32.5	24.7	0.1	996	-44.59
Sto00021	30 May 2007	51.5	27.1	0	979	1.66
Sto00021	04 June 2007	50.9	27.3	0.5	1004	-23.67
Sto00021	12 June 2007	36.8	27.2	0.1	989	-39.52
Sto00021	18 June 2007	53.3	29.6	0.4	983	-8.09
Sto00021	02 July 2007	62.8	27.8	0.4	977	2.5
Sto00021	09 July 2007	68.3	28.8	0.3	989	2.64
Sto00021	07 August 2007	65.8	29.6	0.7	994	0.51
Sto00021	13 August 2007	68.7	29.6	0.1	984	
Sto00021	20 August 2007	68.8	30.1	0.2	982	
Sto00021	25 September 2007	65.9	34.1	0.2	989	-55.48
Sto00021	03 October 2007	59.6	32.3	0.1	990	-38.29
Sto00021	24 October 2007	51.4	29.6	0.2	1001	-37.36
Sto00021	01 November 2007	31.3	29.9	0.1	1007	-42.87
Sto00021	07 November 2007	48.7	36.5	1.1	1000	-7.97
Sto00021	14 November 2007	56.7	32.5	1.3	1000	-9.24
Sto00021	21 November 2007	63.3	31.1	0.8	970	-11.67

Sto00021	28 November 2007	59	30.4	0.6	984	-7.11
Sto00021	06 December 2007	53.3	31.2	0.2	975	-8.62
Sto00021	09 January 2008	12	5.7	16.8	980	0.63
Sto00021	30 January 2008	14.3	7.1	15.1	1002	0.7
Sto00021	06 February 2008	16	7.4	15	999	0.46
Sto00021	14 February 2008	17.9	7.7	14.7	1013	-0.01
Sto00021	11 March 2008	17.8	9.6	14.7	956	-80.68
Sto00021	02 April 2008	18.5	9.6	14	1000	0.09
Sto00021	14 April 2008	64	31.8	0.5	993	-14.91
Sto00021	21 April 2008	64.4	32.4	0.3	983	-35.58
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00029	30 April 2007	15.5	8.4	14.2	993	-48.37
Sto00029	08 May 2007	6.3	8.2	15.9	982	-44.81
Sto00029	14 May 2007	14.8	6.4	10.7	982	-0.17
Sto00029	21 May 2007	12.2	7.2	15.4	997	-34.97
Sto00029	30 May 2007	0.7	1.9	18.8	980	0.07
Sto00029	04 June 2007	10.2	5.5	17.2	1003	-28.56
Sto00029	12 June 2007	17.6	13.2	12.4	989	-39.24
Sto00029	18 June 2007	60.7	29.1	0.8	983	2.76
Sto00029	02 July 2007	0.1	4.6	8.2	977	0
Sto00029	09 July 2007	0.4	6.4	9.3	989	-0.26
Sto00029	07 August 2007	62.9	35.4	0.1	994	0.68
Sto00029	07 August 2007	74.9	19.2	0	994	0.93
Sto00029	13 August 2007	66.3	34.4	0	984	
Sto00029	20 August 2007	65.1	36.1	0	982	
Sto00029	10 September 2007	62.6	36.5	0.5	998	1.31
Sto00029	25 September 2007	59.9	35.8	1.4	989	0.53
Sto00029	03 October 2007	51.3	30.4	3.7	990	1.29
Sto00029	24 October 2007	6.8	8.9	15.9	1001	-2.35
Sto00029	01 November 2007	36.2	29.6	3.6	1007	0.24
Sto00029	07 November 2007	59.5	33.4	1.5	1000	-0.08
Sto00029	14 November 2007	63.6	36.2	0.8	1000	0.17
Sto00029	21 November 2007	41.3	13.1	1.7	970	0.31
Sto00029	28 November 2007	40.5	17.9	0.9	984	0.08
Sto00029	06 December 2007	10.4	9.9	3.9	975	0.1
Sto00029	09 January 2008	9.1	6.6	15.6	979	1.73
Sto00029	30 January 2008	7.8	5.7	14.7	1002	3.91
Sto00029	06 February 2008	8.2	6.8	14.2	998	9.84
Sto00029	14 February 2008	8.3	6.3	15.1	1012	4.26
Sto00029	11 March 2008	23.1	12.4	13.3	956	-80.52
Sto00029	02 April 2008	20	9.9	14.8	999	0
Sto00029	14 April 2008	13.5	8.8	14	993	8.71
Sto00029	21 April 2008	6.3	6.2	15.1	982	0.98
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00033	30 April 2007	54.4	26.4	2.2	993	-72.87
Sto00033	08 May 2007	58.7	28.8	1.1	982	-73.62
Sto00033	14 May 2007	66.4	31.3	0	983	0.36
Sto00033	21 May 2007	41.4	23.9	4.5	996	-55.45
Sto00033	30 May 2007	61.5	32	0.6	979	-2.97
Sto00033	04 June 2007	50.6	26.3	3	1004	-42.22
Sto00033	12 June 2007	55.3	28.9	1.7	990	-69.2
Sto00033	18 June 2007	13.2	6.4	15.9	983	-9.64
Sto00033	02 July 2007	68.2	28.4	0.3	977	3.12
Sto00033	09 July 2007	71.1	30	0	988	2.47
Sto00033	27 July 2007	69	29.3	0.5	985	1.13
Sto00033	07 August 2007	61.8	28.5	2	994	0.82
Sto00033	07 August 2007	66.1	27.7	0.8	995	-52.94
Sto00033	13 August 2007	68.8	29.6	0.1	984	
Sto00033	20 August 2007	70.4	30	0.1	982	
Sto00033	25 September 2007	69.6	29.9	0.3	988	-95.44
Sto00033	03 October 2007	70.8	31	0	990	-96.87
Sto00033	24 October 2007	72.5	28.1	0.3	1001	-89.8
Sto00033	01 November 2007	67.4	33.9	0.1	1007	-99.64
Sto00033	07 November 2007	48.4	26.2	3.4	1000	-32.33

Sto00033	14 November 2007	66.5	32.5	1.6	1000	-35.36
Sto00033	21 November 2007	70.1	30.6	0.6	970	-40.62
Sto00033	28 November 2007	70.7	31.7	0.1	983	-34.99
Sto00033	06 December 2007	70.2	30.4	0.2	975	-36.17
Sto00033	09 January 2008	22.2	9.3	15.7	980	-25.33
Sto00033	30 January 2008	70.5	27.8	0.6	1002	1.21
Sto00033	06 February 2008	73.3	28.1	1	1000	0.95
Sto00033	14 February 2008	39	15.8	9.8	1014	-2.49
Sto00033	22 February 2008	70.2	29.5	0.9	992	1.01
Sto00033	11 March 2008	46.7	22.2	6.1	956	-85.73
Sto00033	02 April 2008	68.9	32.3	0.7	1000	58.51
Sto00033	14 April 2008	50.9	22.2	5.3	994	-51.05
Sto00033	21 April 2008	68.1	30.4	0.7	983	50.34
Sto00033	21 April 2008	66.4	31.6	0.7	983	52.12
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00040	30 April 2007	0.1	2.4	20.2	993	-47.86
Sto00040	30 April 2007	61.7	30.1	0.4	993	-42.9
Sto00040	08 May 2007	38	29.2	0.2	982	-53.24
Sto00040	14 May 2007	57.5	30.9	0.1	982	0.8
Sto00040	21 May 2007	0	0	21.6	997	-33.29
Sto00040	30 May 2007	62.5	34.3	0	980	0.45
Sto00040	04 June 2007	62.1	33.2	0.3	1003	-23.58
Sto00040	12 June 2007	0.1	0	20.7	989	-38.29
Sto00040	18 June 2007	64.1	32.7	0.2	983	2.75
Sto00040	02 July 2007	64.2	33.5	0.4	977	5.28
Sto00040	09 July 2007	66.2	34	0.2	989	5.27
Sto00040	07 August 2007	61.8	37.7	0.1	994	0.87
Sto00040	13 August 2007	60.5	38.3	0	984	
Sto00040	20 August 2007	61.4	37.9	0	982	
Sto00040	10 September 2007	61.3	38.3	0.2	998	1.3
Sto00040	25 September 2007	62.3	37.9	0.1	989	0.74
Sto00040	03 October 2007	64.8	38	0	990	1.36
Sto00040	24 October 2007	60.2	33.8	1.5	1001	-3.02
Sto00040	01 November 2007	64.9	37.2	0.1	1007	0.05
Sto00040	07 November 2007	61.6	36.2	1.2	1000	0.58
Sto00040	14 November 2007	62.9	36.7	0.7	1000	0.67
Sto00040	21 November 2007	64.9	36.8	0.2	970	2.47
Sto00040	28 November 2007	65.6	38.3	0	984	2.81
Sto00040	06 December 2007	65.4	36.3	0.1	975	2.78
Sto00040	09 January 2008	54.3	31.4	3.7	979	3.66
Sto00040	30 January 2008	55.2	30.6	3.4	1001	4.07
Sto00040	06 February 2008	51.5	27.9	4.8	999	-0.5
Sto00040	14 February 2008	57	29.4	4.3	1012	2.66
Sto00040	11 March 2008	62.1	37.1	0.8	956	-78.2
Sto00040	02 April 2008	66.3	34.4	0.8	1000	-36.72
Sto00040	14 April 2008	67	33.7	0.6	993	-22.31
Sto00040	21 April 2008	66	33.7	0.3	983	-20.28
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00043	30 April 2007	65.6	26.4	0.3	993	-70.84
Sto00043	08 May 2007	65.9	29.5	0.1	982	-72.73
Sto00043	14 May 2007	53.5	25.5	0	983	0.52
Sto00043	21 May 2007	63.1	29.7	1.2	997	-52.72
Sto00043	30 May 2007	64.1	28.1	0	979	-2.99
Sto00043	04 June 2007	65.1	31.4	0.5	1004	-37.3
Sto00043	12 June 2007	65.5	29.5	0.8	989	-71.37
Sto00043	18 June 2007	66.8	30.4	0.3	983	-10.61
Sto00043	09 July 2007	75.5	23.6	0.2	989	2.55
Sto00043	13 August 2007	72.5	26	0.3	984	
Sto00043	20 August 2007	73.2	26.5	0	982	
Sto00043	25 September 2007	66.7	30	0.8	989	-95.63
Sto00043	03 October 2007	64.3	29.9	0.2	990	-96.22
Sto00043	24 October 2007	66.2	25.6	0.3	1001	-90.18
Sto00043	01 November 2007	13.8	15.3	7.2	1007	-99.51
Sto00043	07 November 2007	38.6	21.3	3.7	1000	-32.7

Sto00043	21 November 2007	60.3	27.5	0.4	970	-39.73
Sto00043	28 November 2007	60.6	26	0.3	984	-34.13
Sto00043	06 December 2007	55	26	0.2	975	-35.66
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00045	30 April 2007	62.2	24.4	0.5	993	-71.53
Sto00045	08 May 2007	62.1	25.8	0.3	981	-73.83
Sto00045	14 May 2007	70.5	26.4	0	981	0.77
Sto00045	21 May 2007	67.4	26.9	0.2	996	-55.54
Sto00045	30 May 2007	70.7	28.3	0	980	-1.4
Sto00045	04 June 2007	70.6	26.8	0.3	1003	-38.84
Sto00045	12 June 2007	69.4	28.2	0.3	989	-69.41
Sto00045	18 June 2007	70.2	27.9	0.3	982	-20.93
Sto00045	09 July 2007	83.4	16.4	0.1	988	4.58
Sto00045	07 August 2007	68.7	30	0.1	993	-48.24
Sto00045	13 August 2007	70.5	30	0.1	983	
Sto00045	20 August 2007	71.1	30.3	0.1	981	
Sto00045	01 November 2007	53.5	31.8	0	1007	-99.28
Sto00045	07 November 2007	57.3	30.1	0.9	1000	-32.73
Sto00045	14 November 2007	62.1	30.9	1.3	1000	-35.24
Sto00045	24 December 2007	13.4	7.1	14.4	994	-40.6
Sto00045	09 January 2008	0.2	1	20.6	980	0.59
Sto00045	30 January 2008	0.2	1.2	19.9	1001	0.74
Sto00045	06 February 2008	0.2	1.1	20.5	999	0.09
Sto00045	14 February 2008	0.1	0.5	21	1013	0.06
Sto00045	22 February 2008	68.6	26.7	0.9	991	0.13
Sto00045	11 March 2008	9.5	4.2	18.1	955	-81.71
Sto00045	02 April 2008	0.1	0	20.6	1000	11.49
Sto00045	14 April 2008	0.1	0	20.9	994	0.1
Sto00045	21 April 2008	56.7	24.7	3.4	982	-0.38
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00049	30 April 2007	63.1	30.1	0.3	994	-19.05
Sto00049	08 May 2007	48.1	32.1	0.1	982	-28.02
Sto00049	14 May 2007	68.5	29.2	0	983	0.28
Sto00049	23 May 2007	53.4	31.3	0.3	1000	-23.74
Sto00049	30 May 2007	64.9	34.2	0	979	0.86
Sto00049	04 June 2007	60.6	31.1	0.4	1004	-16.61
Sto00049	12 June 2007	64.3	32.3	0.2	989	-31.6
Sto00049	18 June 2007	67	30.8	0.2	983	2.76
Sto00049	09 July 2007	71.2	29.3	0	989	2.7
Sto00049	07 August 2007	68.3	31.3	0.1	993	1.23
Sto00049	13 August 2007	69.3	31.1	0.1	984	
Sto00049	20 August 2007	70	30.4	0.1	982	
Sto00049	25 September 2007	63.4	31.7	1.4	989	0.89
Sto00049	24 October 2007	70.5	30.6	0.3	1001	-1.77
Sto00049	01 November 2007	60.4	35.2	1.2	1007	0.01
Sto00049	21 November 2007	73.6	28.3	0.2	971	0.75
Sto00049	06 December 2007	70.6	23.1	1.3	975	1.85
Sto00049	24 December 2007	66.7	34.5	0.6	994	1.09
Sto00049	09 January 2008	61.7	30.1	2.6	979	1.28
Sto00049	30 January 2008	64.6	35.3	0.8	1001	-3.81
Sto00049	06 February 2008	56.2	34.3	0.7	999	-31.17
Sto00049	14 February 2008	51.8	31.4	1.5	1013	-75.61
Sto00049	11 March 2008	63.1	35.4	0.6	955	-78.63
Sto00049	02 April 2008	51.1	33.5	0.5	999	-43.13
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00059	14 April 2008	61	33.2	0.5	993	-42.09
Sto00059	21 April 2008	62	32.9	0.5	983	-40.34
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00062	30 April 2007	62.7	31.9	0.3	994	-46.56
Sto00062	08 May 2007	60.5	32.1	0.1	982	-49.49

Sto00062	14 May 2007	58.1	30.1	0.1	982	0.68
Sto00062	21 May 2007	63.6	33	0.5	996	-37.83
Sto00062	30 May 2007	64.6	34.7	0	980	-0.17
Sto00062	04 June 2007	64.2	34.7	0.4	1004	-26.58
Sto00062	12 June 2007	64.7	34.2	0.1	989	-42.78
Sto00062	18 June 2007	63.8	34.7	0.2	983	2.47
Sto00062	02 July 2007	62.4	34.2	0.3	977	5.34
Sto00062	09 July 2007	67	35.6	0.1	989	4.66
Sto00062	07 August 2007	64	35.7	0	994	0.77
Sto00062	13 August 2007	65.3	36.3	0	984	
Sto00062	20 August 2007	64.4	36.8	0.1	982	
Sto00062	25 September 2007	64.8	37.6	0.3	989	0.84
Sto00062	03 October 2007	65.8	36.8	0.1	990	1.6
Sto00062	24 October 2007	68	34	0.1	1002	-2.87
Sto00062	01 November 2007	65.9	36.6	0.1	1007	0.39
Sto00062	07 November 2007	62.4	35.8	1.1	1000	0.85
Sto00062	14 November 2007	63.8	36.8	0.6	1000	1.09
Sto00062	21 November 2007	67	36.6	0	970	2.27
Sto00062	28 November 2007	67.5	35.8	0.1	985	4.05
Sto00062	06 December 2007	65.7	34.8	0.1	976	2.7
Sto00062	09 January 2008	65.6	34.9	1	979	0.82
Sto00062	30 January 2008	67.5	32.7	0.9	1001	0.58
Sto00062	06 February 2008	0.8	1.5	20.5	998	-2.2
Sto00062	14 February 2008	21.9	11.1	14.6	1013	-0.24
Sto00062	11 March 2008	18.7	10	14.9	956	-68.1
Sto00062	02 April 2008	67.6	32	0.6	1000	0.24
Sto00062	21 April 2008	68.1	32.8	0.3	982	0.11
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00064	30 April 2007	64.1	32.2	0.4	994	-46.7
Sto00064	08 May 2007	63.3	33.6	0.1	982	-18.78
Sto00064	14 May 2007	66.7	34.6	0	981	0.29
Sto00064	21 May 2007	61.6	33	0.4	996	-75.44
Sto00064	21 May 2007	62.8	33.5	0.2	996	-74.64
Sto00064	30 May 2007	63.8	35.9	0	981	-5.37
Sto00064	04 June 2007	65.1	34.9	0.1	1003	-4.59
Sto00064	12 June 2007	63.7	35.1	0	989	-1.88
Sto00064	18 June 2007	63.7	35.2	0	983	2.43
Sto00064	09 July 2007	66.2	35.2	0.2	989	3.9
Sto00064	07 August 2007	65.9	34	0.2	994	-1.76
Sto00064	07 August 2007	64.4	35.2	0.1	993	-1.68
Sto00064	13 August 2007	66.4	34.9	0.2	984	
Sto00064	20 August 2007	65.9	35.9	0.2	982	
Sto00064	05 September 2007	64.8	34.6	0	1008	
Sto00064	05 September 2007	64.1	35.7	0.3	1007	
Sto00064	10 September 2007	64	36	0	998	-5.21
Sto00064	25 September 2007	64.8	35.1	0.3	989	-92.07
Sto00064	03 October 2007	65.3	34.7	0	991	-96.98
Sto00064	24 October 2007	68	33	0.1	1002	-23.99
Sto00064	29 October 2007	56.6	33.9	0	991	-98.75
Sto00064	07 November 2007	51.2	32	1	1000	-97.06
Sto00064	14 November 2007	51.6	32.1	0.8	1000	-97.29
Sto00064	21 November 2007	54.7	31.2	0.7	970	-94.22
Sto00064	28 November 2007	53.5	31	0.4	986	-96.46
Sto00064	06 December 2007	54.4	31.4	0.5	976	-94.34
Sto00064	09 January 2008	57.1	33	0.9	980	-95.12
Sto00064	30 January 2008	59.7	32.6	0.8	1001	-95.92
Sto00064	06 February 2008	58.6	33.2	1.1	1001	-97.13
Sto00064	14 February 2008	55.5	30.8	2.1	1012	-100.4
Sto00064	22 February 2008	56.4	32	0.9	993	-81.6
Sto00064	27 February 2008	58.7	32.9	0.8	992	-93.67
Sto00064	05 March 2008	56.1	30.8	2	1007	-92.11
Sto00064	11 March 2008	61.1	35	0.6	957	-94.27
Sto00064	04 April 2008	55.6	31.5	0.8	1002	-95.07
Sto00064	14 April 2008	59.7	31.6	0.5	994	-73.22
Sto00064	21 April 2008	60.9	32.7	0.4	983	-92.89
Sto00064	28 April 2008	61.7	32.9	0.7	976	-75.46

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00066	30 April 2007	61.6	30	0.9	994	-45.64
Sto00066	08 May 2007	67	32	0	982	-18.01
Sto00066	14 May 2007	67.1	33.1	0	981	0.49
Sto00066	21 May 2007	60.7	30.8	1.3	996	-72.11
Sto00066	30 May 2007	65.4	34.1	0	980	-5.65
Sto00066	04 June 2007	65.9	33	0	1003	-4.89
Sto00066	12 June 2007	66.2	33.7	0	989	-2.07
Sto00066	18 June 2007	65.4	33.6	0.1	982	2.39
Sto00066	09 July 2007	68.3	34.2	0.1	988	4.04
Sto00066	13 August 2007	67.5	33.2	0.1	983	
Sto00066	20 August 2007	67.4	34.2	0.1	981	
Sto00066	05 September 2007	65.5	33	0.1	1007	
Sto00066	05 September 2007	66	32.3	0.1	1007	
Sto00066	10 September 2007	65.9	33.2	0.1	998	-14.41
Sto00066	25 September 2007	61.9	31.5	0.6	989	-64.27
Sto00066	03 October 2007	61.3	30.5	1.1	990	-61.36
Sto00066	24 October 2007	66.9	29.8	0.1	1001	-17.25
Sto00066	29 October 2007	57.6	29.5	1.8	990	-73.89
Sto00066	07 November 2007	49	25.9	3.7	1000	-71.33
Sto00066	14 November 2007	58.3	30.1	1.1	1000	-58.01
Sto00066	21 November 2007	64.9	30	0.5	970	-60.15
Sto00066	28 November 2007	64	30.1	0.4	985	-56
Sto00066	06 December 2007	62.9	29.8	0.2	975	-57.59
Sto00066	09 January 2008	62.2	31.1	0.8	980	-60.55
Sto00066	30 January 2008	63.8	30.3	0.9	1001	-61.01
Sto00066	06 February 2008	62.6	29.7	1.1	1000	-74.05
Sto00066	14 February 2008	60.4	29	1.6	1012	-73.36
Sto00066	22 February 2008	52.3	27.6	3.4	992	-59.61
Sto00066	27 February 2008	52.8	27.1	3.2	991	-68.6
Sto00066	05 March 2008	64	30.8	1	1005	-45.89
Sto00066	11 March 2008	62.4	32.7	0.5	957	-56.94
Sto00066	04 April 2008	47.2	26.2	3.3	1002	-72.15
Sto00066	14 April 2008	62.4	30.3	1.2	993	-16.17
Sto00066	21 April 2008	65.6	31.9	0.3	982	-17.82
Sto00066	28 April 2008	63.5	31.4	0.8	976	-11.51
Sto00068	02 April 2008	28.5	15.2	9.4	999	0.79
Sto00068	14 April 2008	42.6	10.4	5.1	993	6.24
Sto00068	21 April 2008	53.5	8.2	3.3	982	4.19

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00075	30 April 2007	62.7	29.9	1.2	995	-49.7
Sto00075	08 May 2007	64.7	32.9	0.3	982	-19.94
Sto00075	14 May 2007	66.6	34.8	0	982	-5.11
Sto00075	21 May 2007	62.9	34.6	0.3	996	-78.93
Sto00075	21 May 2007	61.7	33.7	0.6	996	-79.36
Sto00075	30 May 2007	63.9	35.2	0.1	982	-5.96
Sto00075	04 June 2007	64.5	34.4	0.1	1004	-4.93
Sto00075	12 June 2007	64.6	35.7	0	990	-2.19
Sto00075	18 June 2007	61.9	35.8	0.2	983	-84.58
Sto00075	02 July 2007	64.2	35.3	0.4	977	27.37
Sto00075	09 July 2007	64.5	34.3	0.7	989	2.81
Sto00075	07 August 2007	36.6	20.3	7.8	994	-1.44
Sto00075	13 August 2007	65.6	34.7	0	984	
Sto00075	20 August 2007	65.5	36.3	0.4	982	
Sto00075	22 August 2007	62.4	36.1	0.2	997	-92.32
Sto00075	05 September 2007	63.5	34.2	0.3	1008	
Sto00075	05 September 2007	49.3	26.6	4.4	1008	
Sto00075	10 September 2007	26.9	16	11.2	999	-4.99
Sto00075	13 September 2007	65.2	34.3	0.2	1002	2.23
Sto00075	25 September 2007	64.4	35.1	0.1	989	0.2
Sto00075	03 October 2007	66	35.5	0	991	0.24
Sto00075	24 October 2007	71.1	30.3	0.6	1003	-0.07
Sto00075	29 October 2007	66.3	36.8	0.2	991	0
Sto00075	07 November 2007	63.4	35.6	0.5	1000	17

Sto00075	14 November 2007	63.5	35.9	1.2	1000	0.02
Sto00075	21 November 2007	66.5	35.4	0.1	971	0.1
Sto00075	28 November 2007	67.3	34.5	0.2	987	0.2
Sto00075	06 December 2007	66.9	34.5	0.3	977	0.5
Sto00075	09 January 2008	66.7	35.6	0.7	980	1.02
Sto00075	30 January 2008	66.9	33.2	0.5	1002	0.49
Sto00075	06 February 2008	67.1	32.7	0.3	1001	0.41
Sto00075	14 February 2008	65.6	32.2	1.3	1013	0.26
Sto00075	22 February 2008	66.6	34.8	0.6	993	0.07
Sto00075	27 February 2008	65.3	34.2	1	992	0.51
Sto00075	05 March 2008	66.8	34.2	0.4	1007	0.02
Sto00075	11 March 2008	64.9	36.5	0.9	958	0.16
Sto00075	04 April 2008	67	33.5	1	1002	0.47
Sto00075	14 April 2008	66.9	33.7	0.4	994	0.28
Sto00075	21 April 2008	66.5	34.5	0.6	983	0.21
Sto00075	28 April 2008	66	34.9	1	976	0.22
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00082	30 April 2007	43.4	20.3	6.9	993	-49.23
Sto00082	08 May 2007	34	17.2	9.9	982	-52.21
Sto00082	14 May 2007	73.5	27.3	0	982	4.45
Sto00082	21 May 2007	28.2	15.4	11.4	997	-34.11
Sto00082	30 May 2007	64.2	35.6	0	979	-1.49
Sto00082	04 June 2007	45.1	25.6	5.9	1004	-28.13
Sto00082	12 June 2007	60.7	32.1	1.3	989	-43.49
Sto00082	18 June 2007	63.8	34.4	0.3	982	2.6
Sto00082	02 July 2007	65.9	33.1	0.2	977	5.26
Sto00082	09 July 2007	0.6	0.3	20.8	989	-37.27
Sto00082	09 July 2007	68.3	33.2	0.3	989	4.63
Sto00082	27 July 2007	68.3	33.8	0	984	4.06
Sto00082	07 August 2007	65.4	33.6	0.1	994	0.47
Sto00082	13 August 2007	67	33.6	0	984	
Sto00082	20 August 2007	67	34.4	0.1	982	
Sto00082	25 September 2007	66.7	34.3	0.3	989	0.89
Sto00082	03 October 2007	68.2	34.2	0	991	1.26
Sto00082	24 October 2007	69.7	32.4	0.1	1001	-3.1
Sto00082	01 November 2007	67.9	33.9	0	1007	0.26
Sto00082	07 November 2007	64.3	34.1	1	1000	0.71
Sto00082	14 November 2007	65.7	34.4	0.8	1000	0.54
Sto00082	21 November 2007	67	35.1	0.2	970	2.29
Sto00082	28 November 2007	67.2	35.6	0.1	985	4.4
Sto00082	06 December 2007	67	35.2	0	976	3.1
Sto00082	09 January 2008	71	29.6	0.7	979	<<<
Sto00082	30 January 2008	69	28.6	1.1	1001	9.2
Sto00082	06 February 2008	47.4	14.4	7.1	999	-93.39
Sto00082	14 February 2008	81.3	18.6	2.6	1012	127.98
Sto00082	22 February 2008	73.8	27.2	0.7	992	121.52
Sto00082	11 March 2008	70.2	30.7	0.5	956	135.09
Sto00082	02 April 2008	70.5	29.1	0.4	1000	113.95
Sto00082	14 April 2008	72	28.4	0.6	994	127.87
Sto00082	21 April 2008	76.2	25.5	0.5	982	150.8
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00085	05 September 2007	64.6	34.7	0.1	1007	
Sto00085	05 September 2007	28.1	22.2	6.1	1008	
Sto00085	10 September 2007	64	34.2	0	997	0.63
Sto00085	25 September 2007	64.8	34.8	0.2	988	0.23
Sto00085	03 October 2007	67.3	34.8	0.1	990	0.49
Sto00085	24 October 2007	69.3	33.3	0.2	1001	0
Sto00085	29 October 2007	64.3	33.8	0.1	990	0.37
Sto00085	07 November 2007	1.1	1.4	20.3	1000	-4.07
Sto00085	14 November 2007	0.1	0.1	20.5	1000	-0.17
Sto00085	21 November 2007	3.7	2.1	20	970	-0.17
Sto00085	28 November 2007	41	21.6	5.6	985	0.54
Sto00085	06 December 2007	16	6.7	14.7	976	0.14
Sto00085	09 January 2008	21.6	10.5	13	980	0.57

Sto00085	30 January 2008	21.4	10.6	13.3	1001	0.36
Sto00085	06 February 2008	0.2	1.3	20.5	1000	0.02
Sto00085	14 February 2008	65.6	32.7	1.1	1012	0.27
Sto00085	22 February 2008	65.9	32.3	0.9	992	0.52
Sto00085	27 February 2008	61	33.4	1.3	992	1.01
Sto00085	05 March 2008	62.6	32.1	1.4	1006	0.36
Sto00085	11 March 2008	62.5	34.7	1.3	957	0.89
Sto00085	04 April 2008	69.5	31.4	0.9	1002	0.65
Sto00085	14 April 2008	37.1	18.5	8.6	994	0.05
Sto00085	21 April 2008	49.8	25.3	4.6	982	0.01
Sto00085	28 April 2008	55.2	27.9	3.4	976	0.01
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00087	05 September 2007	48.7	24.1	4.7	1007	
Sto00087	05 September 2007	15.6	7.1	16.1	1007	
Sto00087	10 September 2007	40.7	15.6	5.9	997	-0.03
Sto00087	25 September 2007	44.1	13.5	4	988	-0.35
Sto00087	03 October 2007	63	16.2	0.5	990	0.27
Sto00087	24 October 2007	76.9	15.8	0.2	1001	-0.24
Sto00087	29 October 2007	76.1	16.4	0.1	989	-0.66
Sto00087	07 November 2007	73.6	16.4	0.6	1000	2.19
Sto00087	14 November 2007	0.6	0.3	19.6	1000	-0.06
Sto00087	21 November 2007	73.8	15.6	0.8	970	0.31
Sto00087	28 November 2007	60.9	13.7	2.8	985	0.56
Sto00087	06 December 2007	35.1	12.3	1.9	975	0.48
Sto00087	09 January 2008	11.4	8.7	5.2	979	1.08
Sto00087	30 January 2008	4	7.7	4.3	1001	1.72
Sto00087	06 February 2008	3	4.4	12	1000	-8.41
Sto00087	14 February 2008	5	7.6	5.5	1013	0.03
Sto00087	22 February 2008	34.3	13.8	1.1	992	38.28
Sto00087	27 February 2008	58.1	14.9	0.1	992	17.61
Sto00087	05 March 2008	26.6	6.2	12.4	1006	-10.32
Sto00087	11 March 2008	30.3	7.2	8.1	956	0.82
Sto00087	04 April 2008	4.3	6	7	1002	0.78
Sto00087	14 April 2008	2.5	6.1	8.1	993	-4.23
Sto00087	21 April 2008	3.3	8.9	1.4	982	5.7
Sto00087	28 April 2008	3.2	9	2.1	976	1.7
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00088	05 September 2007	64.8	31.8	0.5	1007	
Sto00088	05 September 2007	66.2	32.3	0.2	1007	
Sto00088	10 September 2007	65.6	33.2	0	997	-24.43
Sto00088	25 September 2007	66.5	33.5	0.2	988	-85.62
Sto00088	03 October 2007	67.9	33	0.3	990	-96.78
Sto00088	24 October 2007	72.2	29.5	0.4	1002	-23.15
Sto00088	29 October 2007	67	32.7	0.3	991	-97.99
Sto00088	07 November 2007	64.5	31.8	0.5	1000	-96.17
Sto00088	14 November 2007	64.4	32.8	0.8	1000	-97.03
Sto00088	21 November 2007	65.1	32.2	0.7	970	-94.52
Sto00088	28 November 2007	67.8	31	0.6	984	-95.73
Sto00088	06 December 2007	66.5	31.7	0.6	975	-94.06
Sto00088	09 January 2008	65.4	33.3	1.3	980	-94.67
Sto00088	30 January 2008	66	31.9	1.2	1001	-95.85
Sto00088	06 February 2008	65	32.7	1.1	1000	-96.7
Sto00088	14 February 2008	66.6	31.6	1.8	1013	-100.11
Sto00088	22 February 2008	65.5	33.3	0.8	992	-81.21
Sto00088	27 February 2008	66.3	34	0.7	992	-91.14
Sto00088	05 March 2008	66.7	33.2	0.7	1005	-91.83
Sto00088	11 March 2008	62.9	33.8	0.9	957	-95.66
Sto00088	04 April 2008	65.8	32.9	0.7	1002	-94.5
Sto00088	14 April 2008	64.8	33.5	0.5	993	-73.78
Sto00088	21 April 2008	64	33.1	0.4	982	-92.04
Sto00088	28 April 2008	65	33.2	0.8	976	-74.27
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)

Sto00089	09 January 2008	81.4	11.7	1.2	980	3.6
Sto00089	30 January 2008	87.9	5.7	1	1001	3.95
Sto00089	06 February 2008	23.3	11.1	11.2	999	-91.21
Sto00089	14 February 2008	11.4	4.4	16.5	1012	-1.09
Sto00089	22 February 2008	28.6	5	9.6	991	6.47
Sto00089	11 March 2008	75	23.9	1	956	-80.76
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00094	30 April 2007	63.7	33.3	0.4	994	-46.81
Sto00094	08 May 2007	65.7	34.3	0.2	982	-19.28
Sto00094	14 May 2007	67	34.1	0	982	31.01
Sto00094	23 May 2007	64.4	35	0	1000	-31.43
Sto00094	30 May 2007	64	35.5	0.1	981	-5.92
Sto00094	04 June 2007	64.4	34.6	0.1	1004	-4.28
Sto00094	12 June 2007	64.3	35.2	0	990	-1.93
Sto00094	18 June 2007	64.1	35.1	0.2	983	14.89
Sto00094	02 July 2007	64	34.5	0.3	977	53.66
Sto00094	09 July 2007	65.7	34.5	0.2	989	3.26
Sto00094	07 August 2007	64.7	35.4	0	994	-1.65
Sto00094	13 August 2007	65.8	35.2	0.1	984	
Sto00094	20 August 2007	65.6	35.5	0.2	982	
Sto00094	05 September 2007	63.4	35.7	0	1008	
Sto00094	05 September 2007	63.5	34.9	0.1	1008	
Sto00094	10 September 2007	64.1	36.1	0	998	-16.45
Sto00094	25 September 2007	63.9	36.3	0.1	989	-94.36
Sto00094	03 October 2007	66.6	35	0.2	990	-95.55
Sto00094	24 October 2007	68.7	32.9	0.2	1002	-23.89
Sto00094	29 October 2007	64.1	35.4	0.4	990	-97.73
Sto00094	07 November 2007	59.6	34	1.3	1000	-96.4
Sto00094	14 November 2007	59.6	34.6	1	1000	-96.53
Sto00094	21 November 2007	63	32.6	0.8	970	-93.32
Sto00094	28 November 2007	65.9	33.8	0.2	987	-96.07
Sto00094	06 December 2007	63.5	34.3	0.6	976	-94.32
Sto00094	09 January 2008	64.6	35.3	0.8	980	-95.04
Sto00094	30 January 2008	63.9	35.4	0.8	1002	-95.43
Sto00094	06 February 2008	60.4	33.3	1.8	1001	-97.27
Sto00094	14 February 2008	60.6	33	1.9	1013	-100.56
Sto00094	22 February 2008	63.2	35.7	0.9	993	-81.4
Sto00094	27 February 2008	62	35.5	0.8	992	-92.93
Sto00094	05 March 2008	64.8	35.9	0.6	1007	-92.21
Sto00094	11 March 2008	62.9	37.3	0.4	957	-94.79
Sto00094	04 April 2008	64.8	35.3	0.7	1002	-95.46
Sto00094	14 April 2008	63.8	36.4	0.5	994	-73.45
Sto00094	21 April 2008	65.1	36.8	0.5	983	-92.92
Sto00094	28 April 2008	63.9	36	0.7	976	-75.7
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00097	29 October 2007	63.1	28.3	2.3	989	-46.93
Sto00097	29 October 2007	69.2	31.4	0.1	989	30.76
Sto00097	07 November 2007	68.4	31	0.8	1000	55.77
Sto00097	14 November 2007	44.6	23.4	6.9	1000	57.58
Sto00097	21 November 2007	71.1	30.5	0.1	970	<<<
Sto00097	28 November 2007	69.9	31.2	0.6	985	-91.59
Sto00097	06 December 2007	68	32	0.5	976	-88.62
Sto00097	09 January 2008	66.6	32.5	1.2	979	-95.07
Sto00097	30 January 2008	58.1	27.9	3.3	1000	-95.62
Sto00097	06 February 2008	63.7	30.1	2	1000	-97.15
Sto00097	14 February 2008	67	31.3	1.4	1012	-100.2
Sto00097	22 February 2008	62	31.2	2.2	992	-81.56
Sto00097	27 February 2008	65.9	31.7	1	992	-91.21
Sto00097	05 March 2008	68	32.9	0.7	1006	-92.01
Sto00097	11 March 2008	63.3	31.1	1.7	956	-95.34
Sto00097	04 April 2008	66.2	31	1.6	1002	-94.75
Sto00097	14 April 2008	67.1	32.9	0.6	993	-74.22
Sto00097	21 April 2008	64.4	31.2	0.9	981	-92.69
Sto00097	28 April 2008	66.8	32.3	0.7	976	-74.37

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00103	30 April 2007	29.9	16.8	10.6	993	-46.58
Sto00103	08 May 2007	21.2	10.7	14.3	981	-53.65
Sto00103	14 May 2007	76.1	23.3	0	983	4.61
Sto00103	21 May 2007	34.2	20	8.7	996	-33.5
Sto00103	30 May 2007	64.2	36.2	0	980	0.44
Sto00103	04 June 2007	31.6	18.1	10	1003	-24.54
Sto00103	12 June 2007	31.5	22.1	8.6	989	-39.01
Sto00103	18 June 2007	68.1	29	0.1	983	1.36
Sto00103	02 July 2007	63.7	36	0.1	977	5.39
Sto00103	09 July 2007	65.3	36	0.3	989	4.72
Sto00103	27 July 2007	64.8	31.9	0.1	984	4.26
Sto00103	07 August 2007	62.5	36.6	0.2	994	0.45
Sto00103	13 August 2007	63.3	36.6	0	984	
Sto00103	20 August 2007	64.1	37.4	0.1	982	
Sto00103	10 September 2007	62.6	36.1	0.1	998	1.46
Sto00103	25 September 2007	63.9	38	0.2	989	0.74
Sto00103	03 October 2007	65.3	36.9	0.1	991	1.28
Sto00103	24 October 2007	51.2	31.4	3.1	1001	-3.94
Sto00103	01 November 2007	65.2	37.4	0.2	1007	0.08
Sto00103	07 November 2007	62.9	36.5	0.7	1000	0.83
Sto00103	14 November 2007	62.2	36.5	0.6	1000	0.44
Sto00103	21 November 2007	69.9	31	0	970	2.36
Sto00103	28 November 2007	67.8	35.2	0.2	984	3.72
Sto00103	06 December 2007	68.3	33.9	0.2	975	3.11
Sto00103	09 January 2008	64.2	36	0.9	980	-5.26
Sto00103	30 January 2008	43	24.1	6.7	1001	-91.83
Sto00103	06 February 2008	41.8	23.6	7.1	999	4.21
Sto00103	14 February 2008	57.6	30.4	3.3	1013	9.12
Sto00103	22 February 2008	63.1	34.7	0.9	991	15.79
Sto00103	11 March 2008	63.7	36.7	0.8	957	-48.57
Sto00103	02 April 2008	64.9	35	0.6	1000	8.57
Sto00103	14 April 2008	64.7	34.9	0.5	993	8.27
Sto00103	21 April 2008	65.4	35.2	0.5	983	11.94
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00107	05 September 2007	65	34.8	0	1008	
Sto00107	05 September 2007	65.1	34.4	0.1	1008	
Sto00107	10 September 2007	64	35.2	0	998	-22.28
Sto00107	25 September 2007	64.3	35.3	0.2	989	-88.49
Sto00107	03 October 2007	64.4	34.7	0.2	991	-90.99
Sto00107	24 October 2007	68.2	33.1	0.1	1002	-23.52
Sto00107	29 October 2007	57.7	35.9	0	991	-97.38
Sto00107	07 November 2007	44.3	28.3	4	1000	-95.8
Sto00107	14 November 2007	52.8	34.1	0.7	1000	-96.49
Sto00107	21 November 2007	58.1	33	0.7	970	-93.42
Sto00107	28 November 2007	60.5	32.3	0.4	986	-96.18
Sto00107	06 December 2007	59.9	34.2	0.5	975	-94.07
Sto00107	09 January 2008	65.2	34.6	1.2	980	-94.68
Sto00107	30 January 2008	64.6	34.2	1	1001	-95.37
Sto00107	06 February 2008	65	33.5	1.2	1001	-96.95
Sto00107	14 February 2008	64.6	32.9	1.4	1012	-99.82
Sto00107	22 February 2008	63.8	34.3	1.3	992	-80.8
Sto00107	27 February 2008	63.9	35	0.7	992	-92.27
Sto00107	05 March 2008	65.1	34.9	0.7	1006	-92.08
Sto00107	11 March 2008	63.3	36.1	0.5	957	-94.5
Sto00107	04 April 2008	62.4	32.9	1.4	1002	-94.61
Sto00107	14 April 2008	61.6	34.1	1	994	-73.54
Sto00107	21 April 2008	65.1	35.1	0.3	983	-92.53
Sto00107	28 April 2008	65	35	0.9	977	-75.81
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00108	05 September 2007	69.3	30.7	0	1008	
Sto00108	05 September 2007	67.4	31.8	0.2	1008	

Sto00108	10 September 2007	64.1	34.3	0	997	-23.72
Sto00108	25 September 2007	58.6	33.7	1	988	-94.85
Sto00108	03 October 2007	60.4	33.3	0.3	991	-95.98
Sto00108	24 October 2007	65.8	30.9	0.3	1002	-23.99
Sto00108	29 October 2007	34.2	26.3	3.9	990	-98.05
Sto00108	07 November 2007	30.2	22.5	6.4	1000	-96.62
Sto00108	14 November 2007	33	24.5	4.4	1000	-96.9
Sto00108	21 November 2007	47	29.1	1.1	970	-93.83
Sto00108	28 November 2007	47.7	31.1	0.6	986	-96.1
Sto00108	06 December 2007	50.4	30.2	0.9	976	-93.93
Sto00108	09 January 2008	63.3	32.5	1.9	980	-94.72
Sto00108	30 January 2008	62	31.3	1.8	1001	-95.64
Sto00108	06 February 2008	64.6	31.8	1.9	1001	-96.93
Sto00108	14 February 2008	64.4	32.5	1.9	1013	-100.46
Sto00108	22 February 2008	52.6	29.2	4	992	-81.28
Sto00108	27 February 2008	59.2	31.8	1.8	992	-91.77
Sto00108	05 March 2008	63.1	33.2	1.7	1006	-92.37
Sto00108	11 March 2008	62.7	34.8	0.9	956	-95.35
Sto00108	04 April 2008	63.4	32.6	1.4	1002	-94.71
Sto00108	14 April 2008	63.6	32.9	1.4	994	-74.03
Sto00108	21 April 2008	62.9	32.8	0.8	982	-92.49
Sto00108	28 April 2008	63.9	33.4	0.9	976	-75.33

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00109	30 April 2007	63.8	28.8	1.2	993	-50.55
Sto00109	08 May 2007	66.2	32.2	0.5	982	-20.2
Sto00109	14 May 2007	68.5	33	0	981	8.53
Sto00109	23 May 2007	64.4	33.1	0.2	1000	-32.16
Sto00109	30 May 2007	65.9	34.8	0	980	-6.22
Sto00109	04 June 2007	66.1	32.8	0.2	1003	-4.91
Sto00109	12 June 2007	65	33.6	0	990	-2.42
Sto00109	18 June 2007	65.7	33	0.1	982	14.89
Sto00109	02 July 2007	66.9	33.4	0.3	977	24.32
Sto00109	09 July 2007	68.1	32.6	0.1	988	4.7
Sto00109	07 August 2007	66.6	32.5	0.1	994	-2.16
Sto00109	13 August 2007	67.9	33.6	0.2	983	
Sto00109	20 August 2007	67.7	33.2	0.3	981	
Sto00109	05 September 2007	63.8	31.6	0.3	1007	
Sto00109	05 September 2007	56.6	28.8	2.7	1007	
Sto00109	10 September 2007	66.7	32.8	0	998	6.71
Sto00109	25 September 2007	7	4.8	17.6	988	-95.01
Sto00109	03 October 2007	4.9	2.2	19.3	991	1.06
Sto00109	24 October 2007	6	4	18.5	1002	0.4
Sto00109	29 October 2007	0.1	0.2	20.6	990	-14.67
Sto00109	07 November 2007	0.7	0.4	20.2	1000	-16.18
Sto00109	14 November 2007	0.3	0.3	20.2	1000	-24.24
Sto00109	21 November 2007	0.3	2.3	20.8	971	-18.53
Sto00109	28 November 2007	0.4	2	20.9	986	-22.63
Sto00109	06 December 2007	0.3	1.6	20.6	975	-21.74
Sto00109	09 January 2008	0.2	1.1	20.1	979	-23.76
Sto00109	30 January 2008	0.2	1.1	20.2	1001	-3.08
Sto00109	06 February 2008	0	0.6	20.9	1001	-8.69
Sto00109	14 February 2008	0.4	1.6	19.4	1012	-5.89
Sto00109	22 February 2008	0.1	0.1	20.8	991	-0.12
Sto00109	27 February 2008	0.1	0.1	20.4	992	0.1
Sto00109	05 March 2008	0.1	0.1	20.7	1006	-1.21
Sto00109	11 March 2008	0.4	0.2	20.3	956	6.43
Sto00109	04 April 2008	0.3	0.2	19.5	1002	2.43
Sto00109	14 April 2008	3.1	2	18.7	994	-1.72
Sto00109	21 April 2008	10.1	6.1	12.9	982	6.96
Sto00109	28 April 2008	5	2.9	17.1	976	-4.75

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00112	30 April 2007	66.2	30.3	0.4	993	-46.8
Sto00112	08 May 2007	68	32.1	0.1	982	-20.15
Sto00112	14 May 2007	70.2	31	0	982	8.66

Sto00112	23 May 2007	66.5	33.3	0	1000	-16.47
Sto00112	30 May 2007	65.7	33.3	0.3	981	-6.22
Sto00112	04 June 2007	66.8	32.5	0.2	1003	-5
Sto00112	12 June 2007	66.9	33.2	0	989	-2.32
Sto00112	18 June 2007	66.7	32.2	0.1	983	14.93
Sto00112	02 July 2007	66.3	32.8	0.2	976	24.75
Sto00112	09 July 2007	68.4	33.3	0.1	989	4.99
Sto00112	07 August 2007	65.5	33.9	0	994	-2.13
Sto00112	13 August 2007	67.1	33.9	0.1	984	
Sto00112	20 August 2007	67.4	34.5	0.1	981	
Sto00112	05 September 2007	60.7	30	1.4	1006	
Sto00112	05 September 2007	66.3	33.4	0.2	1007	
Sto00112	10 September 2007	65.2	34	0	997	-25.2
Sto00112	25 September 2007	64.2	35.2	0.3	988	-95.26
Sto00112	03 October 2007	66	34.9	0	990	-97.17
Sto00112	24 October 2007	70.8	30.6	0.2	1001	-23.48
Sto00112	29 October 2007	57.6	35.8	0.1	989	-98.08
Sto00112	07 November 2007	44.3	25.9	4.3	1000	-96.2
Sto00112	14 November 2007	55.4	33.1	1.4	1000	-97.31
Sto00112	21 November 2007	57	30.1	2.9	970	-94.66
Sto00112	28 November 2007	62.4	32.6	0.4	984	-95.76
Sto00112	06 December 2007	61.3	33	0.9	975	-93.99
Sto00112	09 January 2008	54.1	30.3	3.8	979	-94.79
Sto00112	30 January 2008	60.9	30.9	2.3	1001	-95.63
Sto00112	06 February 2008	53.9	27	4.8	1000	-71.86
Sto00112	14 February 2008	55.9	30.6	1.9	1012	-99.79
Sto00112	22 February 2008	59.4	32.5	1.1	992	-81.74
Sto00112	27 February 2008	61.3	32.3	1.5	992	-91.28
Sto00112	05 March 2008	64.5	33.4	1.4	1005	-92.03
Sto00112	11 March 2008	61	34.5	1.3	956	-95.74
Sto00112	04 April 2008	64.1	31.9	0.9	1002	-94.98
Sto00112	14 April 2008	57.6	29.8	2.5	993	-73.72
Sto00112	21 April 2008	63.4	33.5	0.4	982	-92.2
Sto00112	28 April 2008	65.6	33.8	0.7	976	-74.37
GAS WELL	**DATE**	**CH4(%)**	**CO2(%)**	**O2(%)**	**BAROMETRIC PRESSURE (mb)**	**RELATIVE PRESSURE(mb)**
Sto00113	30 April 2007	63.8	31.7	0.4	993	-37.25
Sto00113	08 May 2007	65.8	33.1	0	981	-11.92
Sto00113	14 May 2007	67.8	33.1	0	982	8.4
Sto00113	23 May 2007	65.6	34.2	0.2	999	8.34
Sto00113	30 May 2007	65.1	35.5	0	980	11.1
Sto00113	04 June 2007	65.3	33.5	0.2	1003	9.09
Sto00113	12 June 2007	65.1	34.2	0	989	7.96
Sto00113	18 June 2007	65.1	33.9	0.1	983	14.79
Sto00113	02 July 2007	65.1	34.3	0.1	976	24.73
Sto00113	09 July 2007	67.8	33.8	0.1	989	11.84
Sto00113	07 August 2007	65.7	34.4	0.1	993	0.3
Sto00113	07 August 2007	65.1	34.8	0	993	-0.03
Sto00113	13 August 2007	66.7	34	0	983	
Sto00113	20 August 2007	66.8	34.5	0	981	
Sto00113	05 September 2007	65.5	33.9	0.1	1007	
Sto00113	05 September 2007	65.5	33.7	0.2	1007	
Sto00113	10 September 2007	65.2	34.9	0	997	-17.21
Sto00113	25 September 2007	63	34.1	0.2	988	-77.96
Sto00113	03 October 2007	63.9	34	0	990	-80.51
Sto00113	24 October 2007	66.4	29.6	0.2	1001	-19.89
Sto00113	29 October 2007	62.6	34.4	0.1	989	-93.82
Sto00113	07 November 2007	60.4	33.5	0.9	1000	-92.06
Sto00113	14 November 2007	60.9	33.9	0.9	1000	-92.7
Sto00113	21 November 2007	64.4	32.2	0.9	970	-90.86
Sto00113	28 November 2007	66.4	32.1	0.5	985	-91.85
Sto00113	06 December 2007	65.1	31.7	0.6	975	-91.06
Sto00113	09 January 2008	64.1	34	1.2	979	-91.84
Sto00113	30 January 2008	65.4	31.9	1.3	1001	-93.53
Sto00113	06 February 2008	60.7	31.8	2.1	1000	-95.42
Sto00113	14 February 2008	65.1	32.6	1.7	1012	-96.9
Sto00113	22 February 2008	61.2	32.8	1.2	992	-79.32

Sto00113	27 February 2008	64.1	33.4	0.9	992	-89.1
Sto00113	05 March 2008	66.3	33.8	0.9	1007	-89.7
Sto00113	11 March 2008	62.6	34.7	0.9	956	-92.32
Sto00113	04 April 2008	63.1	33.2	0.7	1002	-91.08
Sto00113	14 April 2008	66	33.8	0.8	993	-71.86
Sto00113	21 April 2008	60.1	31.9	1.8	983	-89.47
Sto00113	28 April 2008	65.2	34	0.9	976	-72.3
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00116	30 April 2007	62.1	32.4	0.8	993	-37.12
Sto00116	08 May 2007	54.9	32	2.4	981	-12.01
Sto00116	14 May 2007	65.7	35.9	0	982	1.7
Sto00116	23 May 2007	64.2	35.6	0	1000	1.38
Sto00116	30 May 2007	64.3	36.7	0	980	4.69
Sto00116	04 June 2007	64.9	34.9	0.1	1003	2.09
Sto00116	12 June 2007	64.7	35.6	0	989	4.35
Sto00116	18 June 2007	63.5	35.7	0.1	983	10.61
Sto00116	02 July 2007	61.2	35.9	0	977	6.62
Sto00116	09 July 2007	66.5	36.9	0.2	989	4.62
Sto00116	13 August 2007	64.1	36.3	0	983	
Sto00116	20 August 2007	65.8	37.4	0.1	981	
Sto00116	05 September 2007	62.2	33.7	0.3	1007	
Sto00116	05 September 2007	49.9	27.6	4	1007	
Sto00116	10 September 2007	65.7	32.6	0	997	9.39
Sto00116	13 September 2007	64	31.3	0.4	1002	-17.6
Sto00116	13 September 2007	63.7	36.6	0.3	1002	-79.17
Sto00116	25 September 2007	64.4	36.6	0	988	-69.59
Sto00116	25 September 2007	64.8	36.7	0.1	988	-94.39
Sto00116	03 October 2007	65.4	36.5	0.2	991	-93.46
Sto00116	24 October 2007	69.1	35	0.2	1001	-22.07
Sto00116	29 October 2007	64.6	38.6	0.3	989	-95.08
Sto00116	07 November 2007	61.6	36.8	1.1	1000	-92.76
Sto00116	14 November 2007	62.8	37	0.7	1000	-92.49
Sto00116	21 November 2007	64.3	32.9	0.9	970	-92.57
Sto00116	28 November 2007	66.7	34.8	0.5	985	-94.81
Sto00116	06 December 2007	64.3	35	0.6	976	-93.19
Sto00116	09 January 2008	63.5	35.7	1	979	-94.58
Sto00116	30 January 2008	64.8	33.9	1.2	1001	-94.75
Sto00116	06 February 2008	64.9	33.5	1.6	1000	-95.96
Sto00116	14 February 2008	64.6	34.3	1.6	1012	-99.37
Sto00116	22 February 2008	63.3	35.8	0.9	992	-81.24
Sto00116	27 February 2008	64.1	36.6	0.8	992	-58.88
Sto00116	05 March 2008	65.9	36	0.7	1006	-91.47
Sto00116	11 March 2008	63.2	36.5	0.5	956	-94.7
Sto00116	04 April 2008	64.1	35.6	0.8	1002	-93.55
Sto00116	14 April 2008	63.7	35.5	0.7	994	-73.52
Sto00116	21 April 2008	63.7	36	0.4	982	-92.28
Sto00116	28 April 2008	64.2	36.1	0.5	976	-73.66
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00117	03 October 2007	21.6	11.2	14.1	991	0.27
Sto00117	07 November 2007	37.6	14.3	9.2	1000	-0.08
Sto00117	14 November 2007	36.8	13.9	9.1	1000	0.2
Sto00117	21 November 2007	45.8	16.7	7.2	970	0.14
Sto00117	28 November 2007	25.7	10.2	13.5	984	0.33
Sto00117	06 December 2007	21.3	7.7	14.4	976	-0.05
Sto00117	09 January 2008	8.2	2.3	18.1	980	0.61
Sto00117	30 January 2008	4	2	17.5	1002	0.47
Sto00117	06 February 2008	2.8	1.7	18.2	1000	0.43
Sto00117	14 February 2008	3.3	2.8	15.9	1013	0.08
Sto00117	22 February 2008	1.8	2.3	16.8	992	0.22
Sto00117	27 February 2008	1.2	2.1	17.3	992	-0.19
Sto00117	05 March 2008	0.7	1.4	18.5	1008	0.03
Sto00117	11 March 2008	0.6	1.2	18.5	956	-0.21
Sto00117	04 April 2008	0.2	1.3	18.9	1002	-0.03
Sto00117	14 April 2008	0.1	1.4	19.5	994	-0.12

Sto00117	21 April 2008	0.1	1.1	19.2	983	-0.35
Sto00117	28 April 2008	0.1	1.7	18.7	976	-0.07
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00118	05 September 2007	3.1	1.6	19.9	1008	
Sto00118	05 September 2007	4.9	2.6	19.7	1008	
Sto00118	10 September 2007	2	1.1	20.4	998	-8.8
Sto00118	13 September 2007	3	1.7	19.6	1002	75.6
Sto00118	13 September 2007	8	1.7	19.6	1002	-0.4
Sto00118	25 September 2007	29.7	18.3	3.8	988	4.99
Sto00118	25 September 2007	13	7.1	16.6	988	0.1
Sto00118	24 October 2007	41.3	14.4	8.5	1001	-0.35
Sto00118	29 October 2007	42.3	17.6	7.3	989	-0.18
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00121	30 April 2007	1.5	3.7	19.9	993	-41.23
Sto00121	08 May 2007	0.3	2	20.5	982	-39.14
Sto00121	14 May 2007	0.9	4	19.6	982	5.12
Sto00121	21 May 2007	0.1	0.2	20.6	996	-29.73
Sto00121	23 May 2007	0.1	0.3	20.8	999	-27.87
Sto00121	30 May 2007	4.3	4.7	3.6	980	12.36
Sto00121	04 June 2007	1.6	1.5	18.9	1004	-1.25
Sto00121	12 June 2007	10.4	10.4	8.9	990	-0.63
Sto00121	18 June 2007	28.1	6.1	1.2	982	<<<
Sto00121	02 July 2007	61.3	6.2	0.5	977	47.21
Sto00121	09 July 2007	75.8	8.3	0.2	989	5.62
Sto00121	07 August 2007	64.1	36.4	0	994	0.12
Sto00121	13 August 2007	64.4	35.3	0	984	
Sto00121	20 August 2007	66.6	34.8	0.2	981	
Sto00121	01 November 2007	64	39.1	0.3	1007	0.03
Sto00121	07 November 2007	61.8	36.3	0.8	1000	0.26
Sto00121	14 November 2007	61.4	39.1	0.8	1000	0.64
Sto00121	21 November 2007	44.6	6.2	0.3	971	-3.3
Sto00121	06 December 2007	34.1	8.1	0.3	975	2.88
Sto00121	09 January 2008	22.4	3.3	13.5	980	0.55
Sto00121	30 January 2008	47.8	6.1	5.5	1001	0.73
Sto00121	06 February 2008	16.7	2.5	15.9	1000	0.42
Sto00121	14 February 2008	57.9	6.7	3.2	1013	0.25
Sto00121	22 February 2008	35	20.9	3.8	991	0.01
Sto00121	11 March 2008	0.1	0.1	20.7	957	-46
Sto00121	02 April 2008	28.7	6.7	11.2	1000	0.07
Sto00121	14 April 2008	29.4	8.4	9.9	994	0.02
Sto00121	21 April 2008	46.7	9.3	6.1	983	-0.01
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00127	29 October 2007	48	23.5	5.6	989	-96.84
Sto00127	07 November 2007	7.6	4.4	17.2	1000	-96.55
Sto00127	14 November 2007	6.7	4.5	18	1000	1.78
Sto00127	21 November 2007	51	27	4.4	970	-27.75
Sto00127	28 November 2007	23.8	12.8	13.8	984	3.32
Sto00127	06 December 2007	41.7	21.7	7.5	975	1.12
Sto00127	09 January 2008	60.2	32.7	2.2	979	5.1
Sto00127	30 January 2008	12.7	6.9	16.7	1001	2
Sto00127	06 February 2008	8.7	4.9	18.2	1000	-0.15
Sto00127	14 February 2008	19.7	10.9	14.2	1012	-15.83
Sto00127	22 February 2008	22.7	12.5	13.6	992	7.46
Sto00127	27 February 2008	23.4	12.3	13.2	992	2.26
Sto00127	05 March 2008	23.3	12.2	13.3	1006	9.35
Sto00127	11 March 2008	23.4	12.3	13.1	956	6.35
Sto00127	04 April 2008	25.2	11.8	12.7	1002	8.97
Sto00127	14 April 2008	27.6	12.7	12.6	993	1.13
Sto00127	21 April 2008	28.4	13.1	11.9	982	3.59
Sto00127	28 April 2008	31.7	14	11	976	5.91

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00128	25 September 2007	36.2	19.8	8.3	988	-5.18
Sto00128	03 October 2007	0.2	0.1	21	989	-4.69
Sto00128	07 November 2007	0.7	0.4	20.5	1000	-39.35
Sto00128	14 November 2007	0.6	0.4	20	1000	-41.46
Sto00128	21 November 2007	0.4	4.5	20	970	-28.81
Sto00128	28 November 2007	0.3	1.7	21.1	985	-31.33
Sto00128	06 December 2007	0.3	1.6	20.7	975	-33.34
Sto00128	09 January 2008	0.2	1.5	20.1	979	-32.57
Sto00128	30 January 2008	0.2	1.4	20.2	1001	-34.98
Sto00128	06 February 2008	0.2	1.4	20.6	1000	-41.08
Sto00128	14 February 2008	0.3	1.4	19.9	1012	-33.04
Sto00128	22 February 2008	0	0.1	21	992	-10.37
Sto00128	27 February 2008	0.1	0.1	20.6	991	-14.35
Sto00128	05 March 2008	0	0.1	20.9	1006	-25.25
Sto00128	11 March 2008	9.6	5.1	17.5	956	-5.76
Sto00128	04 April 2008	0	0	20.4	1001	-9.71
Sto00128	14 April 2008	0	0	21.1	993	-5.38
Sto00128	21 April 2008	0.1	0	20.8	982	1.92
Sto00128	28 April 2008	0.2	0.1	20.2	976	3.43
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00129	05 September 2007	63.8	34.9	0.1	1007	
Sto00129	05 September 2007	63.7	34.8	0.2	1007	
Sto00129	10 September 2007	62.2	35.9	0.1	997	-23.11
Sto00129	25 September 2007	62.6	35.9	0.2	988	-94.14
Sto00129	03 October 2007	63.5	34.1	0.1	990	-95.98
Sto00129	24 October 2007	68.2	30.5	0.3	1001	-17.52
Sto00129	29 October 2007	33.1	28.9	1.4	989	-95.78
Sto00129	07 November 2007	34.2	27.2	1.6	1000	-94.37
Sto00129	14 November 2007	30.5	25.1	2.8	1000	-94.28
Sto00129	21 November 2007	46.6	25.2	5.1	970	-90.09
Sto00129	28 November 2007	31.6	19.8	8.9	984	-96.26
Sto00129	06 December 2007	17.8	21.4	1	975	-92.98
Sto00129	09 January 2008	31.1	16.7	11.2	979	-89.82
Sto00129	30 January 2008	16	7.8	16.1	1001	-38.08
Sto00129	06 February 2008	18.3	8.2	15.8	1000	-53.92
Sto00129	14 February 2008	20.1	9.8	14.7	1012	-39.76
Sto00129	22 February 2008	25.1	12.3	12.9	992	-32.07
Sto00129	27 February 2008	15.1	7.4	16.2	991	-32.14
Sto00129	05 March 2008	5.6	2.8	19.3	1006	-46.53
Sto00129	11 March 2008	13.5	6.4	16.3	956	-28.51
Sto00129	04 April 2008	9.1	4	17.6	1002	-33.6
Sto00129	14 April 2008	6.4	3.1	18.9	993	-36.35
Sto00129	21 April 2008	4.7	2.2	19.3	983	-27.86
Sto00129	28 April 2008	1.8	0.9	20.3	976	-28.93
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00130	05 September 2007	13.9	8.1	16.3	1007	
Sto00130	05 September 2007	50.2	28	4.2	1007	
Sto00130	10 September 2007	65.6	34	0	997	9.12
Sto00130	13 September 2007	0.2	0.1	20.4	1002	-17.6
Sto00130	13 September 2007	0.2	0.2	20.3	1002	-32.25
Sto00130	25 September 2007	60.7	32.7	0.3	988	5.27
Sto00130	03 October 2007	6.7	5.6	15	990	1.81
Sto00130	24 October 2007	19.9	8.7	10.5	1001	2.22
Sto00130	29 October 2007	0.1	0.1	20.8	989	-24.5
Sto00130	07 November 2007	0.4	0.2	20.2	1000	-20.91
Sto00130	14 November 2007	0.5	0.4	19.4	1000	-27
Sto00130	21 November 2007	0.2	2.1	20.9	970	-9.66
Sto00130	28 November 2007	0.3	1.7	21.1	985	-5.13
Sto00130	06 December 2007	0.2	1.5	20.6	975	-8.24
Sto00130	09 January 2008	0.3	1.4	19.9	980	0
Sto00130	30 January 2008	52.1	18.3	5.7	1001	0.93

Sto00130	06 February 2008	23.9	6.6	14	1000	-4.19
Sto00130	14 February 2008	31.2	7.2	11.7	1013	0.29
Sto00130	22 February 2008	46.1	8.1	6.8	991	4.56
Sto00130	27 February 2008	54.6	8.4	5	992	0.18
Sto00130	05 March 2008	38	7.4	10	1007	-4.57
Sto00130	11 March 2008	70.4	27.3	0.7	956	3.79
Sto00130	04 April 2008	14	2.5	16.6	1002	-0.79
Sto00130	14 April 2008	34.2	5.5	10.4	994	0.96
Sto00130	21 April 2008	54.4	8.1	4.7	983	4.66
Sto00130	28 April 2008	56.7	7.7	4.6	976	0.28
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00132	30 April 2007	68.3	30.4	0.3	993	-34.86
Sto00132	08 May 2007	68.2	31.8	0.1	982	-11.35
Sto00132	14 May 2007	68.6	32.5	0	982	1.33
Sto00132	23 May 2007	66.8	32.4	0	999	1.48
Sto00132	30 May 2007	66.4	33.2	0	980	4.84
Sto00132	04 June 2007	66.4	30.9	0.2	1004	2.03
Sto00132	12 June 2007	66.4	32.4	0	989	4.59
Sto00132	18 June 2007	65.9	32.4	0.1	982	10.08
Sto00132	02 July 2007	66.4	32.5	0.2	976	6.72
Sto00132	09 July 2007	68.9	32.4	0.3	989	4.71
Sto00132	16 July 2007					
Sto00132	27 July 2007	68.8	31.9	0	984	-52.54
Sto00132	13 August 2007	67.4	31.5	0	983	
Sto00132	20 August 2007	67.9	32.7	0.1	981	
Sto00132	05 September 2007	66.9	31.9	0.2	1008	
Sto00132	07 November 2007	65.7	32.9	1.9	1000	0.27
Sto00132	14 November 2007	66.7	33.1	0.7	1000	-0.27
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00138	05 September 2007	0.1	0	20.7	1007	
Sto00138	05 September 2007	0.7	0.4	21.1	1007	
Sto00138	10 September 2007	10.5	4.2	17.6	998	0.21
Sto00138	25 September 2007	65.1	32.7	0.1	988	0.21
Sto00138	03 October 2007	2.7	1.8	19.8	991	-13.25
Sto00138	24 October 2007	3.3	3.5	19.2	1001	0.02
Sto00138	29 October 2007	3.5	2.5	19.1	991	0.12
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00143	05 September 2007	50.1	29.3	3.4	1007	
Sto00143	05 September 2007	41.6	24.7	6.5	1008	
Sto00143	10 September 2007	31.2	18.7	8.8	998	-43.6
Sto00143	13 September 2007	28.7	16.4	9.9	1002	6.1
Sto00143	25 September 2007	67.4	34	0.2	988	11.72
Sto00143	03 October 2007	68.8	34	0	990	1.99
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00144	05 September 2007	41.7	18.6	7.8	1007	
Sto00144	05 September 2007	47.3	19.9	6.3	1008	
Sto00144	10 September 2007	67.5	26.2	1	997	113.72
Sto00144	25 September 2007	71.3	28.8	0	988	81.66
Sto00144	03 October 2007	74.6	28.1	0.1	991	93.04
Sto00144	24 October 2007	72.1	31.2	0.1	1002	49.41
Sto00144	29 October 2007	68.2	34.6	0.1	990	-98.05
Sto00144	07 November 2007	64.3	33	1.1	1000	-96.98
Sto00144	14 November 2007	65.4	33.7	1	1000	-97.08
Sto00144	21 November 2007	67.6	30.6	1	970	-94.33
Sto00144	28 November 2007	69.2	32.5	0.5	985	-96.3
Sto00144	06 December 2007	66.9	32.4	0.6	976	-94.13
Sto00144	09 January 2008	66.7	32.8	1.6	979	-94.82
Sto00144	30 January 2008	65.6	33.1	1	1001	-95.27
Sto00144	06 February 2008	64	32	1.2	1000	-97.4
Sto00144	14 February 2008	65.2	33.4	1.3	1012	-100.18

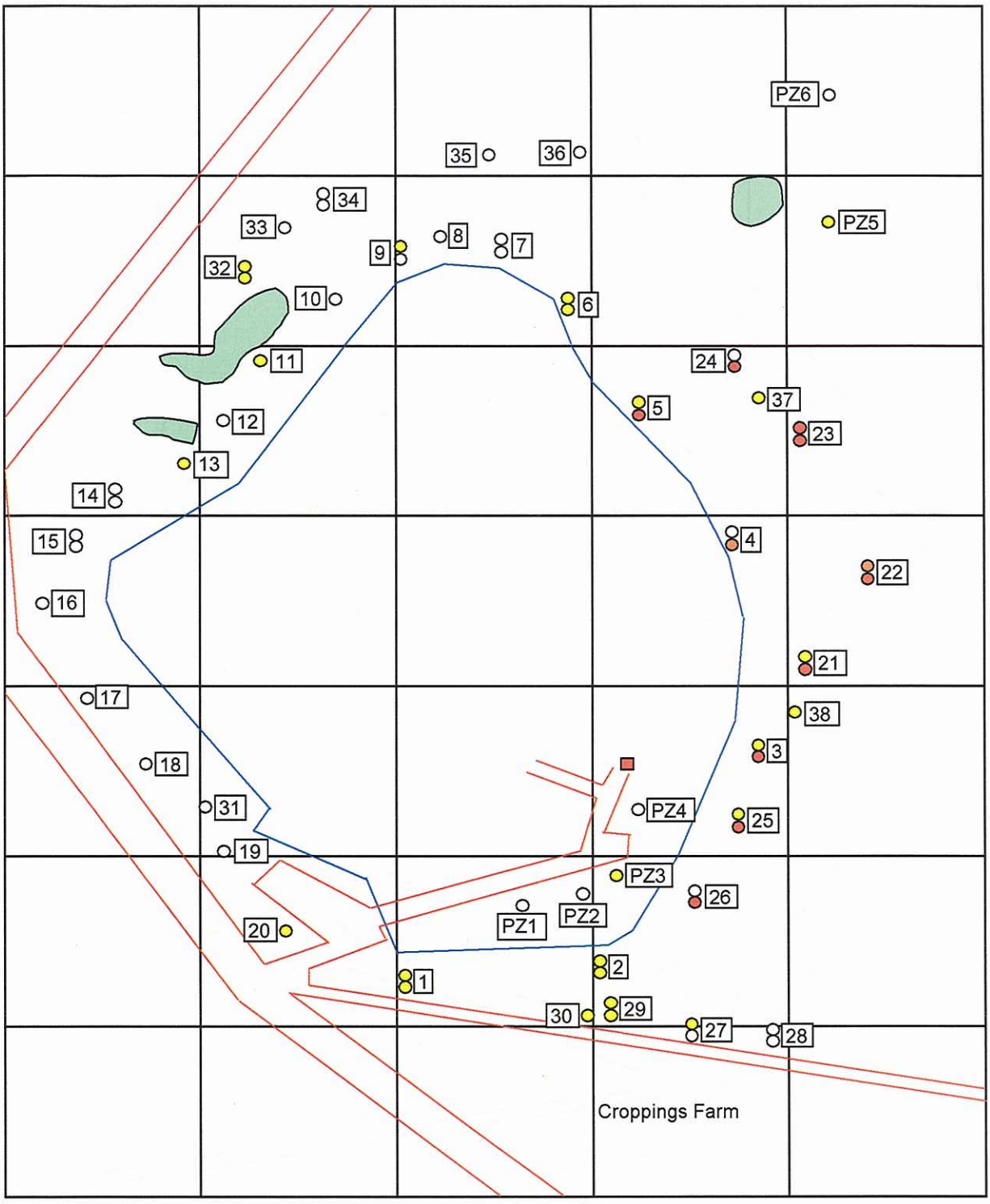
Sto00144	22 February 2008	65.2	34.5	0.6	992	-81.34
Sto00144	27 February 2008	64	34.2	1.1	992	-91.55
Sto00144	05 March 2008	65.9	34.4	0.6	1006	-92.29
Sto00144	11 March 2008	65.1	35.4	0.8	957	-95.72
Sto00144	04 April 2008	66.6	34.4	0.9	1002	-94.57
Sto00144	14 April 2008	64.8	34.1	0.5	994	-73.62
Sto00144	21 April 2008	64.3	33.8	0.6	982	-92.43
Sto00144	28 April 2008	65.4	34.5	0.8	976	-74.56
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00146	05 September 2007	0	0	20.9	1007	
Sto00146	10 September 2007	0.1	0.1	20.8	997	-2.15
Sto00146	24 October 2007	3.2	3.9	19.4	1001	1.52
Sto00146	29 October 2007	0.2	0.2	20.4	989	-44.58
Sto00149	05 September 2007	25.4	16.1	11.7	1008	
Sto00149	05 September 2007	11.7	6.8	17.2	1008	
Sto00149	10 September 2007	35.1	22.8	8.2	997	-24.57
Sto00149	13 September 2007	61.4	37.4	0.3	1002	4.25
Sto00149	13 September 2007	38.8	25.2	6.9	1002	-53.35
Sto00149	25 September 2007	56.2	37	1.6	988	0.32
Sto00149	03 October 2007	63.3	39	0.1	990	2.19
Sto00149	24 October 2007	5	5	18.8	1001	-22.42
Sto00149	29 October 2007	62.3	39.5	0.2	989	1.53
Sto00149	07 November 2007	61.7	38.3	0.4	1000	1.34
Sto00149	14 November 2007	60.4	39.2	0.6	1000	2.13
Sto00149	21 November 2007	64	38.1	0.3	970	1.07
Sto00149	28 November 2007	66.8	37.1	0.3	984	1.78
Sto00149	06 December 2007	60.7	34.8	1	975	0.33
Sto00149	09 January 2008	51.8	23	5.3	980	0.6
Sto00149	30 January 2008	41.3	14.7	8.1	1002	0.5
Sto00149	06 February 2008	27	8.7	13.5	999	0.29
Sto00149	14 February 2008	44	14.2	8.6	1013	0.13
Sto00149	22 February 2008	64.3	25.2	2.1	991	0.15
Sto00149	27 February 2008	30.1	14.3	11.3	992	-0.32
Sto00149	05 March 2008	38.3	19.7	8.7	1007	0.2
Sto00149	11 March 2008	45.6	24.4	5.9	957	-0.32
Sto00149	04 April 2008	51.1	23.9	4.6	1002	-0.32
Sto00149	14 April 2008	19	8.6	15	993	-0.52
Sto00149	21 April 2008	59	27.1	2.5	982	0.48
Sto00149	28 April 2008	38.8	20.1	8.6	976	-0.27
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00152	05 September 2007	3.7	9	14.5	1008	
Sto00152	05 September 2007	1.7	3.3	18.7	1008	
Sto00152	10 September 2007	0	0	21.4	998	-1.05
Sto00152	13 September 2007	3.6	3.1	18.4	1002	0.52
Sto00152	25 September 2007	40.5	23	6.8	988	0.03
Sto00152	03 October 2007	60.3	32.1	1.7	990	0.14
Sto00152	24 October 2007	66.2	32.9	0.6	1001	0.2
Sto00152	07 November 2007	62.9	35.1	0.9	1000	-0.04
Sto00152	14 November 2007	64.2	35.1	0.6	1000	0.81
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00157	14 May 2007	0	1.8	20.5	982	-0.18
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00158	30 April 2007	35.8	21	5.9	994	-46.27
Sto00158	08 May 2007	34.1	21.4	7.4	982	-27.89
Sto00158	14 May 2007	58.7	28.4	1	983	0.36
Sto00158	23 May 2007	41.4	23.7	5.6	999	-25.57
Sto00158	30 May 2007	54.3	29.3	1.4	979	0.06
Sto00158	04 June 2007	33.5	18.1	9	1004	-9.81
Sto00158	12 June 2007	43.5	24.7	4.6	990	-12.49
Sto00158	18 June 2007	47.7	25.1	3.8	983	-8.71

Sto00158	09 July 2007	69.2	30.3	0.3	989	2.03
Sto00158	13 August 2007	64.3	34.1	0.1	984	
Sto00158	20 August 2007	62.3	37.2	0.1	982	
Sto00158	25 September 2007	38.2	27	5	989	-13
Sto00158	03 October 2007	39.8	25.7	4.6	990	-11.23
Sto00158	24 October 2007	41.1	23.2	4.6	1001	-10.38
Sto00158	01 November 2007	35.5	20.4	7.6	1007	-10.75
Sto00158	21 November 2007	35.5	20	8.1	969	-6.99
Sto00158	28 November 2007	39.1	21.8	6.8	984	-3.18
Sto00158	06 December 2007	36.1	20.5	7.1	975	-4.87
Sto00158	14 April 2008	20.4	9.9	13.5	993	-0.01
Sto00158	21 April 2008	22.5	10.1	13.3	983	0.01
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00159	30 April 2007	47.2	26.2	2.3	993	-28.35
Sto00159	08 May 2007	40.2	25.3	3	983	-31.32
Sto00159	14 May 2007	48.6	26.3	1.3	983	-0.18
Sto00159	21 May 2007	44	26.3	2.5	997	-24.94
Sto00159	30 May 2007	60.2	32.4	0	980	3.6
Sto00159	04 June 2007	51.1	27.1	2.2	1004	-17.7
Sto00159	12 June 2007	54.5	29.3	1.3	989	-32.56
Sto00159	18 June 2007	64.4	33	0.3	983	-8.68
Sto00159	09 July 2007	69.7	31.1	0.2	989	2.35
Sto00159	13 August 2007	68.1	31.8	0	984	
Sto00159	20 August 2007	69.2	31.4	0.1	982	
Sto00159	25 September 2007	62	32	1.1	989	-53.64
Sto00159	03 October 2007	58.5	30.5	1.2	990	-51.38
Sto00159	24 October 2007	54.5	26.4	1.8	1001	-43.61
Sto00159	01 November 2007	37.8	27	3	1007	-52.13
Sto00159	21 November 2007	53.7	28.8	0.6	970	-23.31
Sto00159	28 November 2007	50.4	29.4	0.4	984	-18.39
Sto00159	06 December 2007	50.4	30	0.2	976	-18.68
Sto00159	24 December 2007	0.1	0.3	19.9	994	-0.05
Sto00159	09 January 2008	0.3	4.5	18.4	980	0.37
Sto00159	30 January 2008	0.6	4.2	18.4	1001	0.71
Sto00159	06 February 2008	0.4	3.7	17.8	998	1.15
Sto00159	14 February 2008	3.1	4.3	17.6	1012	0.05
Sto00159	11 March 2008	0.1	0.1	20.9	956	-79.79
Sto00159	02 April 2008	0.1	0.1	20.6	999	0.01
Sto00159	14 April 2008	49.2	31	0.8	993	-44
Sto00159	21 April 2008	51.5	31.6	0.3	982	-42.62
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00160	30 April 2007	61.4	29.4	1.5	993	-37.17
Sto00160	08 May 2007	1.6	2.4	20.2	982	-12.04
Sto00160	14 May 2007	57.8	30.3	2.1	982	1.63
Sto00160	23 May 2007	60.4	32.9	1.2	999	1.27
Sto00160	30 May 2007	63.1	36.3	0	980	4.74
Sto00160	04 June 2007	64.3	34.9	0.1	1003	2.12
Sto00160	12 June 2007	64.9	35.4	0	989	4.48
Sto00160	18 June 2007	64.1	34.7	0.2	983	10.53
Sto00160	09 July 2007	66.2	35.3	0.1	989	4.48
Sto00160	07 August 2007	62.5	32.8	0.9	994	-0.31
Sto00160	07 August 2007	65.8	32	0	994	-0.22
Sto00160	13 August 2007	68.5	33.1	0	983	
Sto00160	20 August 2007	67.8	33.2	0.1	981	

Appendix 4 - Gas Monitoring Data

Please see attached excel files

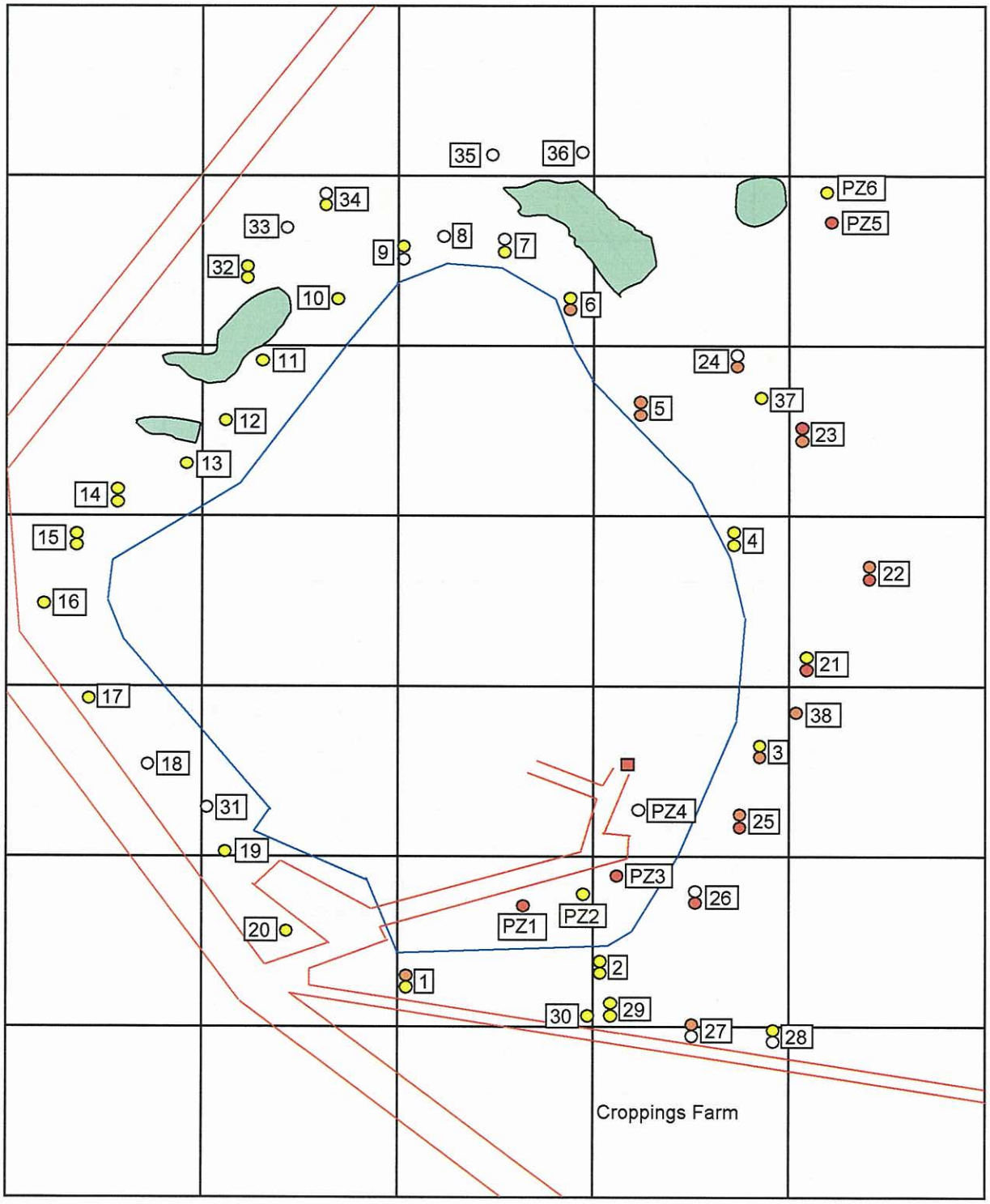
Methane Map



Gas Flare
Approximate Edge of Landfill
Roadways
Ponds
X Perimeter Borehole (upper/lower circles indicate shallow/deep readings)
0 to 0.9 % Methane
1.0 to 9.9 % Methane (1.0% Environment Agency guidance trigger level)
10.0 to 19.9 % Methane
> 20.0% Methane

NOT TO SCALE

Carbon Dioxide Map



- Gas Flare
- Approximate Edge of Landfill
- Roadways
- Ponds
- X — Perimeter Borehole (upper/lower circles indicate shallow/deep readings)
- 0 to 1.4 % Carbon Dioxide
- 1.5 to 9.9 % Carbon Dioxide (1.5% Envoironment Agency Trigger level)
- 10.0 to 19.9 % Carbon Dioxide
- >20 Carbon Dioxide

NOT TO SCALE

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0001D	23 April 2008	0.00	0.00	20.30	993	-0.75
Sto0001D	30 April 2008	0.10	14.90	2.90	965	1.31
Sto0001D	02 May 2007	0.00	11.70	14.50	995	-0.43
Sto0001D	09 May 2007	0.00	9.00	15.60	989	-0.89
Sto0001D	16 May 2007	0.00	0.20	21.00	989	-0.71
Sto0001D	29 May 2007	0.00	14.50	13.20	988	7.31
Sto0001D	06 June 2007	0.00	14.20	12.70	1001	-0.72
Sto0001D	13 June 2007	18.40	27.70	0.20	986	0.45
Sto0001D	20 June 2007	0.00	15.50	11.40	986	3.47
Sto0001D	27 June 2007	0.00	16.60	10.70	983	15.49
Sto0001D	03 July 2007	0.00	18.00	10.60	976	15.9
Sto0001D	11 July 2007	0.00	0.10	21.30	991	0.11
Sto0001D	01 August 2007	0.10	16.50	9.20	991	
Sto0001D	15 August 2007	0.00	16.80	8.70	972	
Sto0001D	15 August 2007	0.00	17.20	8.90	972	
Sto0001D	30 August 2007	0.00	0.30	18.80	1001	
Sto0001D	03 September 2007	0.00	1.30	19.90	1000	
Sto0001D	17 September 2007	0.00	2.40	19.70	986	-2.16
Sto0001D	01 October 2007	0.00	0.10	21.70	999	0
Sto0001D	15 October 2007	22.60	30.00	0.10	990	0.31
Sto0001D	22 October 2007	1.40	1.40	20.00	997	-0.14
Sto0001D	05 November 2007	20.50	28.50	0.20	998	0.58
Sto0001D	19 November 2007	0.10	2.40	20.80	973	-1.02
Sto0001D	26 November 2007	0.10	1.90	20.60	1006	0.13
Sto0001D	05 December 2007	0.20	1.30	20.90	974	0.03
Sto0001D	10 December 2007	0.20	0.90	21.20	988	-3.24
Sto0001D	17 December 2007	0.20	0.50	21.30	1012	0
Sto0001D	02 January 2008	0.10	0.80	21.50	987	0.24
Sto0001D	07 January 2008	0.20	0.80	21.40	979	0.39
Sto0001D	14 January 2008	0.20	1.10	20.80	964	0.25
Sto0001D	04 February 2008	0.00	0.70	20.40	971	-0.72
Sto0001D	18 February 2008	0.00	15.00	2.20	1009	0.69
Sto0001D	25 February 2008	11.60	23.10	7.00	991	1.26
Sto0001D	10 March 2008	18.30	28.80	1.00	935	3.55
Sto0001D	25 March 2008	0.00	0.10	21.20	985	0.19
Sto0001D	31 March 2008	0.00	0.00	20.60	989	0.19
Sto0001D	16 April 2008	0.00	0.10	21.40	998	0.24
Averages		2.55	9.04	14.70		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0001S	23 April 2008	0.00	12.90	4.70	993	-0.63
Sto0001S	30 April 2008	0.00	0.10	20.10	965	0.03
Sto0001S	02 May 2007	0.00	2.50	19.40	995	-0.19
Sto0001S	09 May 2007	5.90	6.00	15.00	990	0.51
Sto0001S	16 May 2007	0.00	10.70	16.00	989	-0.86
Sto0001S	29 May 2007	0.00	0.10	21.20	988	0.26
Sto0001S	06 June 2007	0.00	0.00	20.90	1002	0.01
Sto0001S	13 June 2007	0.00	16.30	11.40	986	8.29
Sto0001S	20 June 2007	4.10	4.30	16.60	986	0.2
Sto0001S	27 June 2007	16.30	27.50	1.20	984	0.77
Sto0001S	03 July 2007	21.40	28.40	0.20	976	0.21
Sto0001S	11 July 2007	0.00	17.50	10.90	991	2.4
Sto0001S	01 August 2007	15.00	11.00	8.70	993	
Sto0001S	15 August 2007	0.00	0.10	20.80	972	
Sto0001S	30 August 2007	0.00	16.60	9.80	1000	
Sto0001S	03 September 2007	0.00	0.00	20.60	1000	
Sto0001S	17 September 2007	0.00	1.30	20.90	986	-0.38
Sto0001S	01 October 2007	0.10	0.20	21.30	998	-2.07
Sto0001S	15 October 2007	0.00	1.20	19.60	990	-0.25
Sto0001S	22 October 2007	0.10	0.40	20.70	996	-2.77
Sto0001S	05 November 2007	0.30	6.20	15.60	1000	0.07
Sto0001S	12 November 2007	0.50	18.00	2.30	1003	-7.22
Sto0001S	19 November 2007	1.30	15.90	0.40	973	1.11
Sto0001S	26 November 2007	1.30	10.90	7.40	1006	-3.55
Sto0001S	05 December 2007	2.40	17.50	0.50	975	2.3
Sto0001S	10 December 2007	0.40	2.30	18.90	988	-9
Sto0001S	17 December 2007	2.50	16.50	0.50	1012	0.28
Sto0001S	02 January 2008	0.10	1.90	20.00	989	0.08
Sto0001S	07 January 2008	0.10	10.00	10.80	980	-0.23
Sto0001S	14 January 2008	0.10	17.20	2.90	965	1.64
Sto0001S	04 February 2008	0.00	13.00	5.50	972	-0.52
Sto0001S	18 February 2008	20.30	26.10	1.30	1009	0.78
Sto0001S	25 February 2008	0.00	16.10	0.90	993	2.49
Sto0001S	10 March 2008	0.00	15.80	0.80	935	18.18
Sto0001S	25 March 2008	0.00	14.80	2.40	985	0.15
Sto0001S	31 March 2008	0.00	6.50	12.80	989	-2.95
Sto0001S	16 April 2008	0.00	7.20	12.00	998	-2.2
Averages		2.49	10.08	11.22		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0002D	23 April 2008	0.00	0.00	20.40	993	-0.02
Sto0002D	30 April 2008	0.30	0.30	20.20	966	-0.07
Sto0002D	02 May 2007	0.00	0.60	21.00	995	0.17
Sto0002D	09 May 2007	0.00	0.70	20.60	991	-0.75
Sto0002D	16 May 2007	0.00	0.10	21.20	990	0.04
Sto0002D	16 May 2007	0.00	1.10	20.80	989	0.26
Sto0002D	29 May 2007	0.00	0.30	21.20	988	0
Sto0002D	06 June 2007	0.00	0.00	21.10	1002	0.11
Sto0002D	20 June 2007	0.00	0.00	20.40	987	0.27
Sto0002D	27 June 2007	1.90	2.90	17.80	984	0.14
Sto0002D	11 July 2007	0.00	0.10	20.80	991	0.19
Sto0002D	01 August 2007	0.20	0.60	20.00	993	
Sto0002D	15 August 2007	0.10	0.20	20.90	971	
Sto0002D	30 August 2007	0.80	1.60	19.10	1000	
Sto0002D	03 September 2007	0.00	0.20	20.80	1000	
Sto0002D	17 September 2007	0.00	1.20	20.70	986	0.04
Sto0002D	01 October 2007	0.00	0.10	21.20	998	0.01
Sto0002D	22 October 2007	0.30	0.50	20.70	997	-0.24
Sto0002D	05 November 2007	0.20	0.40	20.70	999	-0.29
Sto0002D	12 November 2007	0.00	0.20	19.90	1003	0.31
Sto0002D	19 November 2007	0.10	0.70	21.30	973	-0.24
Sto0002D	26 November 2007	0.10	0.50	21.20	1006	-0.08
Sto0002D	05 December 2007	0.70	2.00	19.10	974	-0.13
Sto0002D	10 December 2007	0.10	0.60	21.20	989	-0.26
Sto0002D	17 December 2007	0.10	0.40	22.00	1011	0.28
Sto0002D	02 January 2008	2.30	4.10	15.70	988	0.31
Sto0002D	07 January 2008	0.20	0.40	21.60	980	0.6
Sto0002D	14 January 2008	1.20	1.60	20.30	965	0.3
Sto0002D	04 February 2008	0.00	0.80	20.60	972	0.12
Sto0002D	18 February 2008	0.00	1.60	17.60	1009	0.59
Sto0002D	25 February 2008	1.60	6.50	12.50	991	-0.04
Sto0002D	10 March 2008	27.50	32.00	1.50	936	0.12
Sto0002D	25 March 2008	0.00	0.10	21.20	985	0.23
Sto0002D	31 March 2008	0.00	0.00	20.80	990	-1.25
Sto0002D	16 April 2008	0.00	0.20	21.50	997	0
Averages		1.08	1.79	19.65		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0002S	23 April 2008	0.00	0.00	20.20	992	-0.01
Sto0002S	30 April 2008	1.60	2.10	19.00	965	-0.09
Sto0002S	02 May 2007	0.00	0.40	20.70	997	1.92
Sto0002S	09 May 2007	0.00	0.50	20.80	990	-0.78
Sto0002S	16 May 2007	0.00	0.10	21.00	989	0.08
Sto0002S	29 May 2007	0.00	0.10	21.40	988	-0.15
Sto0002S	06 June 2007	0.00	0.90	19.10	1001	0.2
Sto0002S	20 June 2007	2.00	2.30	18.40	986	0.35
Sto0002S	27 June 2007	6.20	10.50	8.20	983	0.17
Sto0002S	11 July 2007	0.00	0.30	20.90	991	0.12
Sto0002S	01 August 2007	1.00	2.20	17.70	992	
Sto0002S	15 August 2007	2.30	2.20	19.40	971	
Sto0002S	30 August 2007	0.10	0.40	19.50	1000	
Sto0002S	03 September 2007	0.00	0.00	20.90	999	
Sto0002S	17 September 2007	0.00	0.60	20.80	986	-0.27
Sto0002S	01 October 2007	0.10	0.10	21.00	997	0.21
Sto0002S	22 October 2007	0.10	0.10	21.20	996	-0.19
Sto0002S	05 November 2007	1.40	6.00	10.30	998	0.08
Sto0002S	12 November 2007	0.00	1.20	19.50	1003	0.27
Sto0002S	19 November 2007	0.10	0.40	21.30	973	-0.37
Sto0002S	26 November 2007	0.10	0.30	21.40	1005	0.07
Sto0002S	05 December 2007	1.00	2.00	18.10	975	0.28
Sto0002S	10 December 2007	0.10	0.50	21.40	988	-0.01
Sto0002S	17 December 2007	0.10	0.30	22.10	1010	0.19
Sto0002S	02 January 2008	2.10	5.90	8.80	988	0.43
Sto0002S	07 January 2008	0.20	0.40	21.70	980	0.48
Sto0002S	14 January 2008	4.40	3.60	18.70	965	0.18
Sto0002S	04 February 2008	0.00	0.40	20.80	972	0.13
Sto0002S	18 February 2008	0.00	1.00	19.90	1008	0.36
Sto0002S	25 February 2008	0.50	2.30	18.70	991	0.15
Sto0002S	10 March 2008	19.70	24.30	6.80	935	0.27
Sto0002S	25 March 2008	0.00	0.10	21.20	985	0.08
Sto0002S	31 March 2008	0.00	0.10	20.80	989	0.43
Sto0002S	16 April 2008	0.00	0.10	21.50	997	0.13
Averages		1.27	2.11	18.92		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0003D	23 April 2008	0.10	0.00	20.80	993	-0.66
Sto0003D	30 April 2008	53.70	30.30	3.20	965	0.93
Sto0003D	02 May 2007	1.60	2.00	19.70	996	-0.14
Sto0003D	09 May 2007	65.60	32.40	0.40	989	-0.73
Sto0003D	16 May 2007	0.70	0.70	20.50	989	0.05
Sto0003D	16 May 2007	1.90	1.60	20.10	990	0.08
Sto0003D	29 May 2007	63.00	34.00	0.20	987	0.71
Sto0003D	06 June 2007	2.90	1.70	20.20	1000	0.25
Sto0003D	13 June 2007	56.50	31.00	2.00	985	0.7
Sto0003D	20 June 2007	59.90	33.70	1.20	985	1.34
Sto0003D	27 June 2007	63.90	34.90	0.00	983	1.74
Sto0003D	11 July 2007	54.90	29.80	3.10	990	0.17
Sto0003D	11 July 2007	7.00	7.50	15.60	990	0.13
Sto0003D	01 August 2007	63.70	33.60	0.20	992	
Sto0003D	15 August 2007	63.00	35.00	0.10	970	
Sto0003D	30 August 2007	8.90	4.80	17.40	999	
Sto0003D	03 September 2007	8.00	4.30	18.50	999	
Sto0003D	17 September 2007	0.10	3.80	20.10	985	-0.58
Sto0003D	01 October 2007	3.00	1.80	20.00	997	0.24
Sto0003D	22 October 2007	59.30	30.70	1.50	996	0.22
Sto0003D	05 November 2007	50.20	28.20	3.70	998	0.2
Sto0003D	12 November 2007	0.10	0.30	20.10	1002	-0.43
Sto0003D	19 November 2007	0.10	2.50	20.80	973	-0.28
Sto0003D	26 November 2007	0.10	0.80	21.20	1005	0.2
Sto0003D	05 December 2007	13.20	10.30	15.00	973	-0.06
Sto0003D	10 December 2007	0.10	0.50	21.20	988	-0.29
Sto0003D	17 December 2007	51.70	27.30	0.60	1009	0.94
Sto0003D	02 January 2008	49.80	26.30	5.30	986	1.26
Sto0003D	07 January 2008	0.20	0.70	21.50	979	0.16
Sto0003D	14 January 2008	54.90	31.70	3.10	964	1.06
Sto0003D	04 February 2008	0.10	0.80	20.60	972	-0.23
Sto0003D	18 February 2008	0.10	0.90	20.30	1008	0.51
Sto0003D	25 February 2008	58.80	32.10	2.10	990	2.52
Sto0003D	10 March 2008	60.80	36.90	0.50	934	4.75
Sto0003D	25 March 2008	0.60	0.60	20.80	984	0.39
Sto0003D	31 March 2008	0.00	0.00	20.40	989	-0.97
Sto0003D	31 March 2008	0.00	0.00	20.80	989	-0.5
Sto0003D	16 April 2008	0.00	0.10	21.50	996	0.67
Averages		25.75	14.57	12.22		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0003S	23 April 2008	0.00	0.40	20.60	993	-0.13
Sto0003S	30 April 2008	0.40	0.90	19.60	965	0.06
Sto0003S	02 May 2007	0.10	3.10	17.20	996	1.77
Sto0003S	09 May 2007	0.70	4.90	16.70	989	0.2
Sto0003S	16 May 2007	0.20	3.10	18.10	989	0.06
Sto0003S	29 May 2007	6.40	6.70	15.80	987	0
Sto0003S	06 June 2007	0.60	4.10	17.20	1000	0.33
Sto0003S	13 June 2007	0.50	5.30	15.80	985	0.15
Sto0003S	20 June 2007	51.60	30.90	1.90	985	0.39
Sto0003S	27 June 2007	40.40	25.30	5.30	983	0.31
Sto0003S	03 July 2007	31.70	21.80	7.30	975	0.02
Sto0003S	01 August 2007	19.00	13.50	10.40	992	
Sto0003S	15 August 2007	20.60	14.90	10.00	970	
Sto0003S	30 August 2007	9.60	9.40	14.30	999	
Sto0003S	03 September 2007	7.80	8.00	15.10	999	
Sto0003S	17 September 2007	0.00	1.10	20.50	986	-0.29
Sto0003S	01 October 2007	0.40	0.60	20.90	997	0.57
Sto0003S	22 October 2007	4.60	2.60	19.40	996	-0.29
Sto0003S	05 November 2007	5.20	3.40	18.90	998	0.15
Sto0003S	12 November 2007	0.00	0.20	20.90	1002	0.36
Sto0003S	19 November 2007	0.60	1.80	20.30	972	-0.18
Sto0003S	26 November 2007	0.10	0.60	20.80	1005	0.07
Sto0003S	05 December 2007	3.90	5.10	17.50	973	0.01
Sto0003S	10 December 2007	0.10	0.50	21.00	988	-0.26
Sto0003S	17 December 2007	3.50	2.70	20.50	1009	0.13
Sto0003S	02 January 2008	1.90	2.40	20.70	986	0.66
Sto0003S	07 January 2008	0.20	0.60	21.40	980	0.51
Sto0003S	14 January 2008	2.30	2.20	19.60	964	0.49
Sto0003S	04 February 2008	0.00	0.50	20.70	971	0
Sto0003S	18 February 2008	0.00	0.50	20.60	1008	0.22
Sto0003S	25 February 2008	4.50	2.80	19.30	990	-0.04
Sto0003S	10 March 2008	10.00	6.40	16.80	934	0.11
Sto0003S	25 March 2008	0.00	0.40	20.80	983	0.16
Sto0003S	31 March 2008	0.00	0.40	20.20	989	0.26
Sto0003S	16 April 2008	0.00	0.60	21.20	996	0.05
Averages		6.48	5.36	17.35		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0004D	23 April 2008	0.40	0.30	21.30	994	-0.22
Sto0004D	30 April 2008	9.10	7.80	16.10	965	-0.12
Sto0004D	02 May 2007	41.90	19.80	6.70	996	0.76
Sto0004D	09 May 2007	59.70	28.90	2.50	990	0.43
Sto0004D	29 May 2007	40.00	20.40	7.50	987	0.39
Sto0004D	06 June 2007	34.40	15.90	9.40	1001	0.53
Sto0004D	13 June 2007	55.60	29.40	2.50	985	0.44
Sto0004D	20 June 2007	32.90	17.10	9.00	986	0.34
Sto0004D	27 June 2007	3.80	1.70	19.40	983	0.31
Sto0004D	01 August 2007	10.90	8.70	14.30	992	
Sto0004D	15 August 2007	0.80	0.50	20.60	971	
Sto0004D	03 September 2007	0.00	0.00	21.10	999	
Sto0004D	17 September 2007	0.30	1.30	21.10	986	-0.23
Sto0004D	01 October 2007	1.50	1.00	20.50	997	-0.08
Sto0004D	22 October 2007	12.00	5.90	17.40	996	-0.04
Sto0004D	05 November 2007	13.20	6.20	17.00	998	0.25
Sto0004D	12 November 2007	0.10	0.10	20.90	1002	0.3
Sto0004D	19 November 2007	0.20	2.50	20.80	973	-0.17
Sto0004D	26 November 2007	0.20	0.70	21.10	1005	0.07
Sto0004D	05 December 2007	35.00	17.80	9.60	974	-0.17
Sto0004D	10 December 2007	0.20	0.50	21.30	988	0
Sto0004D	17 December 2007	0.20	1.30	21.80	1009	0.54
Sto0004D	02 January 2008	39.10	18.50	9.10	986	0.94
Sto0004D	07 January 2008	0.20	0.60	21.70	980	0.46
Sto0004D	14 January 2008	2.40	3.10	19.10	964	0.33
Sto0004D	04 February 2008	0.50	0.70	20.80	972	0.01
Averages		15.18	8.10	15.87		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0004S	23 April 2008	0.00	0.70	20.70	993	0.02
Sto0004S	30 April 2008	0.10	1.80	19.20	965	0.11
Sto0004S	02 May 2007	2.30	5.30	17.00	996	1.65
Sto0004S	09 May 2007	5.70	8.20	16.10	989	-0.67
Sto0004S	29 May 2007	1.10	0.90	21.00	987	0.6
Sto0004S	06 June 2007	1.20	2.30	19.80	1000	0.78
Sto0004S	13 June 2007	5.00	2.90	18.70	985	0.76
Sto0004S	20 June 2007	2.40	2.70	18.60	986	1.04
Sto0004S	27 June 2007	0.50	2.20	19.00	982	0.72
Sto0004S	11 July 2007	0.00	1.80	20.50	991	0.9
Sto0004S	01 August 2007	0.30	3.80	18.30	992	
Sto0004S	15 August 2007	0.00	0.10	20.90	971	
Sto0004S	03 September 2007	0.00	1.50	20.60	999	
Sto0004S	17 September 2007	0.00	0.80	21.30	985	0.31
Sto0004S	01 October 2007	0.10	1.30	20.80	997	0.47
Sto0004S	22 October 2007	0.60	1.20	20.90	995	0.63
Sto0004S	05 November 2007	1.30	2.20	20.20	998	0.85
Sto0004S	12 November 2007	0.00	0.10	21.20	1003	0.14
Sto0004S	19 November 2007	0.50	4.90	18.90	972	-0.26
Sto0004S	26 November 2007	0.10	0.50	21.30	1005	0.34
Sto0004S	05 December 2007	3.00	6.10	17.40	973	-0.09
Sto0004S	10 December 2007	0.10	0.40	21.10	988	-0.21
Sto0004S	17 December 2007	0.10	0.60	22.00	1009	0.25
Sto0004S	02 January 2008	0.40	1.80	21.40	987	1.44
Sto0004S	07 January 2008	0.20	0.40	21.80	979	0.98
Sto0004S	14 January 2008	0.10	1.30	20.10	964	0.79
Sto0004S	04 February 2008	0.00	0.60	21.00	972	0.65
Sto0004S	18 February 2008	0.10	1.70	19.80	1008	0.41
Sto0004S	25 February 2008	0.10	0.10	21.30	990	-0.09
Sto0004S	10 March 2008	0.30	11.90	13.40	934	0.84
Averages		0.85	2.34	19.81		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0021D	23 April 2008	35.60	22.50	9.10	994	-0.61
Sto0021D	30 April 2008	62.40	36.10	0.40	965	0.57
Sto0021D	02 May 2007	64.30	32.30	0.60	996	-0.16
Sto0021D	09 May 2007	64.00	34.10	0.30	990	1.72
Sto0021D	16 May 2007	5.10	3.10	18.70	990	0.1
Sto0021D	29 May 2007	61.80	34.50	0.30	987	0.8
Sto0021D	06 June 2007	23.30	11.90	12.60	1001	0.57
Sto0021D	13 June 2007	62.70	34.90	0.30	985	0.22
Sto0021D	20 June 2007	63.00	34.90	0.20	986	0.45
Sto0021D	27 June 2007	61.00	35.10	0.10	983	0.73
Sto0021D	03 July 2007	63.90	36.80	0.00	975	0.65
Sto0021D	11 July 2007	57.20	31.60	1.70	991	0.13
Sto0021D	01 August 2007	57.30	31.80	0.60	992	
Sto0021D	15 August 2007	62.60	34.10	0.30	971	
Sto0021D	30 August 2007	61.10	32.60	2.20	999	
Sto0021D	03 September 2007	25.30	14.70	13.80	999	
Sto0021D	17 September 2007	58.90	20.40	4.00	986	-0.24
Sto0021D	01 October 2007	17.60	12.50	14.00	997	0.17
Sto0021D	22 October 2007	50.90	33.60	0.20	995	0.27
Sto0021D	05 November 2007	22.60	18.50	7.80	998	0.19
Sto0021D	12 November 2007	0.20	0.20	21.10	1003	0.24
Sto0021D	19 November 2007	14.00	7.40	14.40	973	-0.49
Sto0021D	26 November 2007	0.10	0.30	21.10	1005	-0.06
Sto0021D	05 December 2007	20.90	23.50	0.70	973	0.08
Sto0021D	10 December 2007	0.20	0.30	21.40	988	-2.77
Sto0021D	17 December 2007	0.20	1.20	21.80	1009	0.77
Sto0021D	02 January 2008	28.40	27.30	0.30	987	1.23
Sto0021D	07 January 2008	0.20	0.40	21.50	980	0.18
Sto0021D	14 January 2008	46.60	32.00	0.60	965	0.66
Sto0021D	04 February 2008	9.00	2.30	19.60	972	-0.2
Sto0021D	18 February 2008	48.50	27.90	1.80	1008	0.9
Sto0021D	25 February 2008	59.90	34.70	0.50	990	1.59
Sto0021D	10 March 2008	61.50	37.50	0.50	934	3.29
Sto0021D	25 March 2008	25.50	14.90	13.50	984	0.3
Sto0021D	31 March 2008	0.00	0.10	20.50	989	-0.93
Sto0021D	16 April 2008	0.10	0.40	21.40	996	0.47
Averages		36.00	21.01	8.00		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0021S	23 April 2008	0.00	0.00	21.10	993	-0.25
Sto0021S	30 April 2008	0.00	0.20	19.50	965	-0.01
Sto0021S	02 May 2007	5.10	5.00	18.60	996	-0.44
Sto0021S	09 May 2007	8.50	9.40	16.30	990	2.22
Sto0021S	16 May 2007	0.10	0.20	20.80	990	0.07
Sto0021S	29 May 2007	0.10	0.10	21.30	987	-0.01
Sto0021S	06 June 2007	0.10	0.10	21.30	1001	0.33
Sto0021S	13 June 2007	0.80	0.60	20.10	985	0.07
Sto0021S	20 June 2007	0.00	0.10	20.60	985	0.42
Sto0021S	27 June 2007	0.00	0.10	20.40	983	0.35
Sto0021S	03 July 2007	0.00	0.40	19.50	975	-0.13
Sto0021S	11 July 2007	0.30	0.30	20.90	991	0.06
Sto0021S	01 August 2007	0.30	0.20	20.40	992	
Sto0021S	15 August 2007	5.60	3.00	18.40	971	
Sto0021S	30 August 2007	6.40	3.70	17.70	999	
Sto0021S	03 September 2007	0.00	0.00	21.30	999	
Sto0021S	17 September 2007	0.10	4.60	20.00	985	-0.2
Sto0021S	01 October 2007	1.10	2.70	19.50	997	-0.05
Sto0021S	22 October 2007	20.20	17.30	9.10	996	-0.1
Sto0021S	05 November 2007	0.50	12.20	8.70	998	0.12
Sto0021S	12 November 2007	0.00	0.10	21.10	1002	0.19
Sto0021S	19 November 2007	0.70	3.90	19.10	972	0.6
Sto0021S	26 November 2007	0.30	0.40	20.50	1005	0.2
Sto0021S	05 December 2007	0.20	1.40	20.50	974	0.1
Sto0021S	10 December 2007	0.10	0.20	21.30	989	-0.14
Sto0021S	17 December 2007	0.10	0.60	22.10	1009	0.3
Sto0021S	02 January 2008	0.20	1.40	21.60	986	0.57
Sto0021S	07 January 2008	0.10	0.30	21.60	980	0.5
Sto0021S	14 January 2008	0.20	1.20	20.10	964	0.29
Sto0021S	04 February 2008	0.00	0.50	21.00	972	0.75
Sto0021S	18 February 2008	7.20	4.30	18.20	1008	0.4
Sto0021S	25 February 2008	8.20	4.50	18.40	990	0.09
Sto0021S	10 March 2008	0.10	0.30	20.20	934	0.07
Sto0021S	25 March 2008	0.00	0.10	21.10	984	-0.06
Sto0021S	31 March 2008	0.00	0.00	20.50	989	0.04
Sto0021S	16 April 2008	0.00	0.10	21.40	996	0.16
Averages		1.85	2.21	19.56		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0024D	23 April 2008	30.80	11.00	5.90	994	-1
Sto0024D	30 April 2008	38.50	12.00	2.20	966	0.38
Sto0024D	02 May 2007	31.30	11.80	6.30	996	-0.9
Sto0024D	09 May 2007	33.20	13.50	6.20	989	0.04
Sto0024D	16 May 2007	15.80	8.70	13.90	990	0.03
Sto0024D	29 May 2007	33.70	17.40	5.90	988	0.44
Sto0024D	06 June 2007	18.20	8.90	11.60	1001	0.8
Sto0024D	13 June 2007	41.40	19.20	2.00	985	0.13
Sto0024D	20 June 2007	37.30	20.00	5.00	986	0.23
Sto0024D	27 June 2007	50.20	24.30	0.40	983	0.81
Sto0024D	11 July 2007	24.40	12.10	10.10	991	0.07
Sto0024D	01 August 2007	25.00	9.80	9.10	992	
Sto0024D	15 August 2007	47.70	22.50	1.80	971	
Sto0024D	30 August 2007	22.70	10.10	10.30	999	
Sto0024D	03 September 2007	33.50	14.20	6.30	999	
Sto0024D	17 September 2007	50.20	16.70	3.60	985	-0.23
Sto0024D	01 October 2007	32.30	13.00	8.20	997	0.37
Sto0024D	22 October 2007	35.40	12.60	6.40	996	-0.07
Sto0024D	05 November 2007	35.90	13.20	6.40	998	0.28
Sto0024D	12 November 2007	29.90	10.80	10.50	1002	0.32
Sto0024D	19 November 2007	48.60	13.40	4.50	973	-0.41
Sto0024D	26 November 2007	19.40	5.70	14.30	1005	0.16
Sto0024D	05 December 2007	27.90	10.80	10.30	974	0.13
Sto0024D	10 December 2007	1.00	0.80	21.00	988	-2.94
Sto0024D	17 December 2007	14.50	6.70	13.10	1009	0.91
Sto0024D	02 January 2008	28.10	10.90	6.70	986	1.69
Sto0024D	07 January 2008	34.30	12.50	7.00	980	0.28
Sto0024D	14 January 2008	44.90	16.80	2.50	965	0.58
Sto0024D	04 February 2008	30.70	12.20	8.10	972	-0.4
Sto0024D	18 February 2008	12.70	5.80	11.70	1008	1
Sto0024D	25 February 2008	27.70	11.30	6.70	990	1.94
Sto0024D	10 March 2008	42.10	32.30	0.60	934	3.54
Sto0024D	25 March 2008	18.90	10.00	12.70	984	0.46
Sto0024D	31 March 2008	14.40	5.80	14.90	990	-1.32
Sto0024D	16 April 2008	15.60	5.60	13.90	996	0.51
Averages		29.95	12.64	8.00		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0024S	23 April 2008	0.00	0.00	21.30	994	-0.13
Sto0024S	30 April 2008	0.10	0.10	20.40	966	-0.04
Sto0024S	02 May 2007	0.10	4.60	19.60	996	-0.68
Sto0024S	09 May 2007	0.00	3.00	19.90	990	-0.02
Sto0024S	16 May 2007	0.00	0.10	21.00	990	0.16
Sto0024S	29 May 2007	0.00	0.10	22.10	987	0.19
Sto0024S	06 June 2007	0.00	0.00	21.60	1001	0.48
Sto0024S	13 June 2007	0.10	0.20	20.70	985	0.05
Sto0024S	20 June 2007	0.00	0.00	20.50	986	0.55
Sto0024S	27 June 2007	0.00	0.10	20.40	983	0.26
Sto0024S	11 July 2007	0.10	0.10	21.40	991	0.34
Sto0024S	01 August 2007	0.10	0.00	20.90	993	
Sto0024S	15 August 2007	0.10	0.10	20.90	972	
Sto0024S	30 August 2007	0.50	0.30	19.20	1000	
Sto0024S	03 September 2007	0.00	0.00	21.10	999	
Sto0024S	17 September 2007	0.00	4.00	20.50	985	0.18
Sto0024S	01 October 2007	0.10	0.10	21.00	997	0.53
Sto0024S	22 October 2007	0.10	0.10	21.20	996	0.33
Sto0024S	05 November 2007	0.30	0.20	21.00	998	0.86
Sto0024S	12 November 2007	0.30	0.20	20.10	1002	1.32
Sto0024S	19 November 2007	0.20	2.10	20.90	972	0.04
Sto0024S	26 November 2007	0.20	1.20	21.10	1004	0.17
Sto0024S	05 December 2007	0.30	1.30	20.70	974	0.21
Sto0024S	10 December 2007	0.10	0.50	21.20	989	-0.15
Sto0024S	17 December 2007	0.20	1.40	21.90	1009	-0.49
Sto0024S	02 January 2008	0.20	1.70	21.40	987	1.32
Sto0024S	07 January 2008	0.30	1.30	21.30	980	0.81
Sto0024S	14 January 2008	0.30	1.40	20.30	965	0.49
Sto0024S	04 February 2008	0.20	1.30	20.60	972	0.37
Sto0024S	18 February 2008	0.10	2.50	19.40	1008	0.43
Sto0024S	25 February 2008	0.00	0.50	21.10	990	0.85
Sto0024S	10 March 2008	0.10	0.20	21.00	934	0.25
Sto0024S	25 March 2008	0.00	0.10	21.60	984	0.15
Sto0024S	31 March 2008	0.00	0.00	20.50	990	0.27
Sto0024S	16 April 2008	0.10	0.20	21.40	996	0.91
Averages		0.12	0.83	20.83		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0025D	23 April 2008	58.40	34.70	1.30	993	-0.68
Sto0025D	30 April 2008	60.80	35.90	0.90	965	0.97
Sto0025D	02 May 2007	56.60	32.10	2.20	996	0.3
Sto0025D	09 May 2007	60.80	31.80	1.20	989	0.67
Sto0025D	16 May 2007	55.40	34.40	2.30	989	0.64
Sto0025D	29 May 2007	62.10	35.00	0.30	987	0.98
Sto0025D	06 June 2007	57.80	33.40	1.00	1000	1.08
Sto0025D	13 June 2007	62.60	34.40	0.30	985	1.02
Sto0025D	20 June 2007	62.10	35.30	0.40	986	-0.65
Sto0025D	27 June 2007	63.70	35.70	0.10	982	0.4
Sto0025D	03 July 2007	62.30	37.80	0.20	975	1.34
Sto0025D	11 July 2007	62.80	35.60	0.60	991	0.82
Sto0025D	01 August 2007	60.60	34.80	0.40	992	
Sto0025D	15 August 2007	62.80	35.50	0.20	970	
Sto0025D	30 August 2007	60.40	34.70	1.20	999	
Sto0025D	03 September 2007	61.80	34.40	0.50	999	
Sto0025D	17 September 2007	66.10	27.90	1.50	986	-0.54
Sto0025D	01 October 2007	47.80	28.10	4.30	997	0.22
Sto0025D	22 October 2007	60.70	34.20	0.70	996	0.28
Sto0025D	05 November 2007	35.10	23.50	6.80	998	0.9
Sto0025D	12 November 2007	37.60	29.80	5.40	1002	0.32
Sto0025D	19 November 2007	37.80	24.00	4.40	972	-0.88
Sto0025D	26 November 2007	14.20	8.20	14.60	1005	-0.01
Sto0025D	05 December 2007	29.60	25.10	4.10	973	0.12
Sto0025D	10 December 2007	14.10	10.10	14.60	988	-2.91
Sto0025D	17 December 2007	19.60	12.70	12.10	1010	1.36
Sto0025D	02 January 2008	44.00	24.60	5.20	987	1.32
Sto0025D	07 January 2008	55.00	30.00	3.20	980	0.15
Sto0025D	14 January 2008	53.60	32.00	3.10	964	1.36
Sto0025D	04 February 2008	60.30	34.90	1.90	972	-0.51
Sto0025D	18 February 2008	65.50	34.20	1.20	1008	1.24
Sto0025D	25 February 2008	62.00	36.00	1.50	990	2.11
Sto0025D	10 March 2008	63.30	37.50	0.80	934	4.46
Sto0025D	25 March 2008	48.70	30.00	4.90	984	0.57
Sto0025D	31 March 2008	45.20	27.70	6.70	989	-1.17
Sto0025D	16 April 2008	49.20	28.40	4.50	996	-0.56
Averages		52.23	30.40	3.18		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0025S	23 April 2008	0.10	5.90	9.60	993	-2.65
Sto0025S	30 April 2008	0.00	12.10	0.80	965	3.39
Sto0025S	02 May 2007	0.20	14.80	5.90	995	0.31
Sto0025S	09 May 2007	0.10	15.40	5.10	988	-0.54
Sto0025S	16 May 2007	0.00	19.90	3.40	989	-0.16
Sto0025S	29 May 2007	0.00	22.40	0.20	987	4.13
Sto0025S	06 June 2007	0.00	18.60	3.30	1000	0.71
Sto0025S	13 June 2007	0.20	23.10	1.30	985	0.7
Sto0025S	20 June 2007	0.00	22.90	1.00	986	0.26
Sto0025S	27 June 2007	0.00	24.10	1.00	982	0.63
Sto0025S	03 July 2007	0.00	25.60	1.10	974	1.26
Sto0025S	11 July 2007	0.30	18.20	5.10	990	-12.28
Sto0025S	01 August 2007	0.10	19.30	3.90	992	
Sto0025S	15 August 2007	0.20	27.40	0.20	970	
Sto0025S	30 August 2007	0.40	25.40	3.00	999	
Sto0025S	03 September 2007	0.10	23.10	4.90	999	
Sto0025S	17 September 2007	0.10	20.80	3.60	985	-0.18
Sto0025S	01 October 2007	2.10	25.10	3.30	997	0
Sto0025S	22 October 2007	22.60	35.40	1.80	995	-0.13
Sto0025S	05 November 2007	9.80	29.10	2.90	998	-0.04
Sto0025S	12 November 2007	13.90	30.60	5.30	1002	0.42
Sto0025S	19 November 2007	25.20	38.10	1.30	972	5.54
Sto0025S	26 November 2007	9.40	2.50	16.30	1004	-9.65
Sto0025S	05 December 2007	27.70	5.00	0.30	973	3.56
Sto0025S	10 December 2007	0.60	1.10	20.80	987	-5.56
Sto0025S	17 December 2007	5.50	1.60	16.80	1010	-60.91
Sto0025S	02 January 2008	7.80	3.60	5.10	986	1.96
Sto0025S	07 January 2008	2.90	2.10	16.20	979	-1.16
Sto0025S	14 January 2008	6.30	3.70	4.30	965	5.55
Sto0025S	04 February 2008	3.40	6.50	1.00	971	2.52
Sto0025S	18 February 2008	0.90	4.20	8.90	1008	0.81
Sto0025S	25 February 2008	1.00	7.20	4.20	989	3.16
Sto0025S	10 March 2008	0.90	10.10	0.60	934	11.92
Sto0025S	25 March 2008	0.00	0.60	19.60	983	-4.05
Sto0025S	31 March 2008	0.00	9.30	1.00	990	-0.83
Sto0025S	16 April 2008	0.00	5.70	9.80	996	-0.8
Averages		3.94	15.57	5.36		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0022D	23 April 2008	17.40	17.10	9.60	993	-0.67
Sto0022D	30 April 2008	22.50	22.20	6.00	965	0.31
Sto0022D	02 May 2007	18.50	14.10	10.60	996	-0.27
Sto0022D	09 May 2007	20.90	15.20	10.20	989	-0.16
Sto0022D	16 May 2007	18.10	16.90	10.90	990	-0.02
Sto0022D	29 May 2007	26.40	21.60	6.80	987	0.2
Sto0022D	06 June 2007	23.90	19.60	8.10	1000	0.57
Sto0022D	13 June 2007	26.80	23.40	6.10	985	0.42
Sto0022D	20 June 2007	29.90	26.50	4.90	986	0.41
Sto0022D	27 June 2007	35.20	27.50	3.00	983	0.62
Sto0022D	03 July 2007	34.00	28.90	3.60	975	0.36
Sto0022D	01 August 2007	27.00	20.40	7.50	992	
Sto0022D	15 August 2007	34.90	27.10	4.00	971	
Sto0022D	30 August 2007	28.00	21.70	8.00	1000	
Sto0022D	03 September 2007	26.10	20.70	8.80	999	
Sto0022D	17 September 2007	31.30	17.30	8.00	986	-0.11
Sto0022D	01 October 2007	21.00	17.10	11.10	997	0.01
Sto0022D	22 October 2007	25.70	19.40	8.20	995	-0.1
Sto0022D	05 November 2007	31.20	23.40	5.30	998	0.04
Sto0022D	12 November 2007	27.60	21.10	8.30	1003	0.21
Sto0022D	19 November 2007	35.50	24.20	3.50	973	-0.56
Sto0022D	26 November 2007	37.50	27.10	1.50	1004	0.12
Sto0022D	05 December 2007	36.40	29.00	0.30	974	0.11
Sto0022D	10 December 2007	20.70	12.90	11.60	989	-1.56
Sto0022D	17 December 2007	28.00	23.50	5.00	1009	0.58
Sto0022D	02 January 2008	34.20	29.50	1.10	987	1.15
Sto0022D	07 January 2008	34.20	29.30	0.80	980	0.32
Sto0022D	14 January 2008	32.50	30.40	1.00	965	0.52
Sto0022D	04 February 2008	28.10	23.70	6.20	971	0.05
Sto0022D	18 February 2008	16.20	12.90	11.90	1009	0.81
Sto0022D	25 February 2008	20.40	19.10	8.70	990	1.24
Sto0022D	10 March 2008	26.70	26.50	4.20	934	2.65
Sto0022D	25 March 2008	17.10	15.50	11.70	983	0.03
Sto0022D	31 March 2008	12.60	12.20	13.20	989	-0.88
Sto0022D	16 April 2008	12.40	12.10	13.60	996	0.58
Averages		26.25	21.40	6.95		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0022S	23 April 2008	0.00	0.00	21.00	994	-0.74
Sto0022S	30 April 2008	32.00	26.40	5.80	965	8.66
Sto0022S	02 May 2007	22.10	16.60	9.60	996	-0.22
Sto0022S	09 May 2007	25.50	24.60	6.10	990	-0.2
Sto0022S	16 May 2007	0.00	0.70	19.80	990	0.01
Sto0022S	29 May 2007	10.60	17.40	7.20	987	0.07
Sto0022S	06 June 2007	2.90	12.80	6.70	1001	0.46
Sto0022S	13 June 2007	29.80	27.00	6.00	985	0.24
Sto0022S	20 June 2007	26.20	22.70	8.10	986	0.49
Sto0022S	27 June 2007	27.10	31.70	0.50	983	0.7
Sto0022S	03 July 2007	36.70	37.70	0.00	975	0.4
Sto0022S	11 July 2007	3.40	3.00	19.20	991	-0.07
Sto0022S	01 August 2007	13.10	15.70	6.90	993	
Sto0022S	15 August 2007	16.90	15.00	14.30	971	
Sto0022S	30 August 2007	0.80	0.70	18.70	999	
Sto0022S	03 September 2007	0.00	0.00	21.20	999	
Sto0022S	17 September 2007	0.00	4.00	20.50	986	-0.23
Sto0022S	01 October 2007	0.10	0.50	20.90	996	0
Sto0022S	22 October 2007	13.00	23.60	2.70	996	0.19
Sto0022S	05 November 2007	20.50	27.60	4.70	998	0.17
Sto0022S	12 November 2007	0.00	0.10	21.20	1003	0.09
Sto0022S	19 November 2007	32.40	32.00	0.50	972	-0.55
Sto0022S	26 November 2007	0.20	1.60	20.80	1005	-0.08
Sto0022S	05 December 2007	12.60	17.60	5.40	974	0.24
Sto0022S	10 December 2007	0.20	1.10	21.00	988	-1.59
Sto0022S	17 December 2007	2.20	16.60	0.50	1009	0.8
Sto0022S	02 January 2008	14.70	19.40	5.70	986	1.27
Sto0022S	07 January 2008	0.30	1.20	21.30	980	0.31
Sto0022S	14 January 2008	34.80	29.70	4.50	965	0.47
Sto0022S	04 February 2008	0.10	1.10	20.60	972	-0.27
Sto0022S	18 February 2008	1.90	10.80	5.60	1008	0.66
Sto0022S	25 February 2008	21.90	22.90	4.80	990	1.22
Sto0022S	10 March 2008	40.90	34.60	3.70	935	1.96
Sto0022S	25 March 2008	0.00	3.20	19.50	984	0.18
Sto0022S	31 March 2008	0.00	0.00	20.40	990	-0.52
Sto0022S	16 April 2008	0.00	4.90	16.30	996	0.44
Averages		12.30	14.01	11.44		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0026D	23 April 2008	0.00	0.30	20.70	993	-0.77
Sto0026D	30 April 2008	60.40	37.00	0.60	966	0.28
Sto0026D	02 May 2007	63.40	33.50	0.60	996	0.18
Sto0026D	09 May 2007	64.30	33.30	0.50	990	1.32
Sto0026D	16 May 2007	0.00	0.60	20.80	990	0.21
Sto0026D	29 May 2007	60.60	33.80	0.10	987	0.47
Sto0026D	06 June 2007	58.30	33.40	0.20	1001	0.68
Sto0026D	13 June 2007	61.80	35.70	0.80	985	0.66
Sto0026D	20 June 2007	60.30	34.90	0.30	986	0.88
Sto0026D	27 June 2007	63.20	35.70	0.00	983	1.23
Sto0026D	03 July 2007	63.30	36.60	0.00	975	0.91
Sto0026D	01 August 2007	61.40	34.40	0.30	992	
Sto0026D	15 August 2007	62.10	35.30	0.30	971	
Sto0026D	30 August 2007	64.80	34.90	0.70	1000	
Sto0026D	03 September 2007	0.00	0.10	21.10	1000	
Sto0026D	17 September 2007	0.00	0.50	20.70	986	-0.37
Sto0026D	01 October 2007	57.50	33.50	1.50	997	0.14
Sto0026D	22 October 2007	64.00	34.90	0.20	997	-0.2
Sto0026D	05 November 2007	60.20	34.20	0.20	998	0.66
Sto0026D	12 November 2007	0.00	0.10	20.60	1002	-0.01
Sto0026D	19 November 2007	0.10	0.40	21.30	972	-0.88
Sto0026D	26 November 2007	0.10	0.30	21.30	1006	-0.48
Sto0026D	05 December 2007	43.90	30.10	0.20	974	0
Sto0026D	10 December 2007	0.20	0.80	21.00	988	-2.92
Sto0026D	17 December 2007	3.50	1.10	20.60	1010	0.8
Sto0026D	02 January 2008	47.00	31.60	0.40	988	0.99
Sto0026D	07 January 2008	0.20	0.40	21.70	980	0.44
Sto0026D	14 January 2008	56.00	34.70	1.10	965	0.88
Sto0026D	04 February 2008	0.30	0.50	20.90	973	-0.34
Sto0026D	18 February 2008	58.80	32.50	1.10	1008	0.84
Sto0026D	25 February 2008	62.10	35.80	1.10	991	2.05
Sto0026D	10 March 2008	61.00	38.40	0.60	935	3.71
Sto0026D	25 March 2008	0.00	0.10	21.20	984	0.57
Sto0026D	16 April 2008	44.90	31.50	1.00	997	0.56
Averages		38.34	22.38	7.76		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0026S	23 April 2008	0.00	0.10	20.80	993	0.1
Sto0026S	30 April 2008	0.10	0.20	19.80	964	1.16
Sto0026S	09 May 2007	0.10	2.40	19.90	989	-0.14
Sto0026S	16 May 2007	0.00	0.20	20.80	990	0.48
Sto0026S	29 May 2007	0.00	0.30	21.30	987	-0.03
Sto0026S	06 June 2007	0.10	0.20	21.00	1000	0.24
Sto0026S	13 June 2007	0.30	0.40	18.60	985	0.21
Sto0026S	20 June 2007	0.20	0.40	19.90	986	0.3
Sto0026S	03 July 2007	0.30	0.60	16.60	975	0.07
Sto0026S	11 July 2007	0.50	0.50	20.50	990	0.56
Sto0026S	01 August 2007	0.20	0.30	20.30	992	
Sto0026S	15 August 2007	0.30	0.20	20.60	971	
Sto0026S	30 August 2007	1.10	0.70	19.90	999	
Sto0026S	03 September 2007	0.00	0.10	21.00	999	
Sto0026S	17 September 2007	0.00	0.40	20.70	986	-0.17
Sto0026S	01 October 2007	0.10	0.20	21.10	997	0.53
Sto0026S	22 October 2007	0.10	2.10	19.60	995	-0.14
Sto0026S	05 November 2007	0.20	2.70	19.40	998	-0.04
Sto0026S	12 November 2007	0.00	2.00	20.40	1003	0.06
Sto0026S	19 November 2007	0.10	1.30	20.20	972	-0.63
Sto0026S	26 November 2007	0.10	0.80	21.00	1005	0.24
Sto0026S	05 December 2007	0.40	2.20	20.60	974	0.49
Sto0026S	10 December 2007	0.20	0.60	21.10	988	0.25
Sto0026S	17 December 2007	0.10	0.60	22.10	1010	-3.49
Sto0026S	02 January 2008	0.40	2.20	21.20	987	1.73
Sto0026S	07 January 2008	0.20	0.40	21.50	979	2.73
Sto0026S	14 January 2008	0.40	2.20	20.20	964	6.44
Sto0026S	04 February 2008	0.00	0.40	20.90	972	4.52
Sto0026S	18 February 2008	0.20	1.60	20.30	1008	0.93
Sto0026S	25 February 2008	0.10	0.10	21.20	991	-1.47
Sto0026S	10 March 2008	0.20	0.20	20.70	934	0.37
Sto0026S	25 March 2008	0.10	0.10	21.30	984	0.63
Sto0026S	16 April 2008	0.10	0.20	21.30	996	0.11
Averages		0.19	0.82	20.48		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0027D	23 April 2008	0.00	0.40	20.50	993	0.01
Sto0027D	30 April 2008	0.00	0.70	19.90	966	0.94
Sto0027D	09 May 2007	0.00	2.00	20.30	990	-0.51
Sto0027D	29 May 2007	0.00	0.60	21.00	988	-0.88
Sto0027D	06 June 2007	0.00	0.30	20.80	1002	0.17
Sto0027D	13 June 2007	1.20	1.80	19.50	986	-0.05
Sto0027D	20 June 2007	0.00	0.60	20.00	986	6.88
Sto0027D	27 June 2007	0.00	0.50	20.10	983	-0.8
Sto0027D	11 July 2007	0.00	0.70	20.60	991	0.17
Sto0027D	01 August 2007	0.00	0.20	20.50	993	
Sto0027D	15 August 2007	0.00	0.40	20.70	971	
Sto0027D	30 August 2007	0.10	0.60	18.00	1000	
Sto0027D	03 September 2007	0.00	0.20	20.80	1000	
Sto0027D	17 September 2007	0.00	4.10	20.20	986	0.15
Sto0027D	01 October 2007	0.10	0.90	21.10	997	0.32
Sto0027D	15 October 2007	0.00	1.10	19.40	990	0.17
Sto0027D	22 October 2007	0.10	1.30	20.60	996	0.11
Sto0027D	05 November 2007	0.10	0.70	20.80	999	0.19
Sto0027D	12 November 2007	0.00	1.30	19.20	1003	-6.64
Sto0027D	19 November 2007	0.10	3.20	20.70	973	2.1
Sto0027D	26 November 2007	0.10	2.60	20.60	1006	-0.25
Sto0027D	05 December 2007	0.20	2.40	20.30	974	1.61
Sto0027D	10 December 2007	0.10	2.00	20.80	988	-9.53
Sto0027D	17 December 2007	0.10	1.60	21.60	1011	0.1
Sto0027D	02 January 2008	0.10	1.80	21.50	988	0.93
Sto0027D	07 January 2008	0.10	1.80	21.20	980	0.58
Sto0027D	14 January 2008	0.10	2.00	20.60	966	3.63
Sto0027D	04 February 2008	0.00	1.60	20.10	972	-8.53
Sto0027D	18 February 2008	0.00	1.40	20.40	1009	0.36
Sto0027D	25 February 2008	0.10	0.30	21.30	991	0.12
Sto0027D	10 March 2008	0.20	0.50	20.80	936	0.25
Sto0027D	25 March 2008	0.00	0.30	20.80	985	0.35
Sto0027D	31 March 2008	0.00	0.60	20.30	990	0.03
Sto0027D	16 April 2008	0.00	0.70	21.30	998	0.52
Averages		0.08	1.21	20.48		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0027S	23 April 2008	1.30	13.00	4.10	993	-0.33
Sto0027S	30 April 2008	2.50	16.10	0.90	966	13.44
Sto0027S	02 May 2007	0.00	15.50	2.00	996	-0.18
Sto0027S	09 May 2007	0.60	15.70	2.30	991	1.03
Sto0027S	29 May 2007	4.30	19.30	0.20	988	0.02
Sto0027S	06 June 2007	1.40	19.00	0.30	1002	0.18
Sto0027S	13 June 2007	13.50	17.10	6.80	986	0.12
Sto0027S	20 June 2007	3.10	15.20	0.20	986	0.85
Sto0027S	27 June 2007	0.00	0.20	19.90	983	-35.95
Sto0027S	11 July 2007	0.00	6.00	5.90	991	-0.14
Sto0027S	01 August 2007	0.00	4.60	7.40	993	
Sto0027S	15 August 2007	6.40	15.60	0.60	971	
Sto0027S	30 August 2007	3.60	16.30	8.50	1001	
Sto0027S	03 September 2007	4.10	19.90	1.70	999	
Sto0027S	17 September 2007	1.20	15.00	3.00	986	-0.08
Sto0027S	01 October 2007	3.20	21.40	3.00	998	0.3
Sto0027S	15 October 2007	0.90	22.80	2.50	989	0.01
Sto0027S	22 October 2007	1.00	21.60	2.40	997	-0.14
Sto0027S	22 October 2007	1.00	21.90	2.30	997	-17.32
Sto0027S	05 November 2007	0.10	18.80	4.60	999	0.01
Sto0027S	12 November 2007	0.00	19.90	5.70	1003	0.18
Sto0027S	19 November 2007	3.00	20.90	2.40	973	-0.38
Sto0027S	26 November 2007	7.60	21.90	1.90	1006	-0.33
Sto0027S	05 December 2007	4.90	18.50	0.90	974	0.33
Sto0027S	10 December 2007	5.40	16.90	0.80	989	-7.49
Sto0027S	17 December 2007	4.40	12.90	3.30	1011	-0.05
Sto0027S	02 January 2008	1.80	10.00	7.10	987	-5.9
Sto0027S	07 January 2008	2.70	14.10	1.50	981	0.36
Sto0027S	14 January 2008	3.20	14.50	1.00	966	17.41
Sto0027S	04 February 2008	1.00	11.80	2.80	972	-0.47
Sto0027S	18 February 2008	0.80	11.70	4.90	1008	0.47
Sto0027S	25 February 2008	0.40	15.30	4.00	992	0.2
Sto0027S	10 March 2008	3.00	17.10	3.30	935	1.31
Sto0027S	25 March 2008	2.10	13.50	5.60	985	0.07
Sto0027S	31 March 2008	3.00	17.10	1.50	990	0.02
Sto0027S	16 April 2008	2.30	16.10	1.00	997	5.46
Averages		2.61	15.76	3.51		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0028D	23 April 2008	0.00	0.00	20.90	994	-0.19
Sto0028D	30 April 2008	0.00	0.00	20.30	966	-0.15
Sto0028D	02 May 2007	0.00	4.30	17.10	995	-0.21
Sto0028D	09 May 2007	0.00	2.00	16.20	991	-0.67
Sto0028D	29 May 2007	0.00	0.00	21.30	988	-0.1
Sto0028D	06 June 2007	0.00	0.50	20.70	1001	0.07
Sto0028D	20 June 2007	0.00	0.00	20.40	987	0.27
Sto0028D	27 June 2007	0.00	0.00	20.30	983	-0.74
Sto0028D	11 July 2007	0.00	0.10	21.00	991	0.72
Sto0028D	01 August 2007	0.00	0.00	20.80	993	
Sto0028D	15 August 2007	0.00	1.50	19.10	971	
Sto0028D	30 August 2007	0.00	0.20	20.10	1001	
Sto0028D	03 September 2007	0.00	4.70	14.00	1000	
Sto0028D	17 September 2007	0.00	2.90	15.30	986	-0.21
Sto0028D	01 October 2007	0.10	5.20	15.60	997	0.33
Sto0028D	15 October 2007	0.00	9.10	10.20	989	0.07
Sto0028D	22 October 2007	0.10	4.90	16.20	996	-0.19
Sto0028D	05 November 2007	0.10	4.40	16.60	999	0.2
Sto0028D	12 November 2007	0.00	3.10	19.20	1003	1.12
Sto0028D	19 November 2007	0.10	2.80	17.60	973	0.33
Sto0028D	26 November 2007	0.10	4.30	13.10	1006	5.43
Sto0028D	05 December 2007	0.10	0.80	21.00	975	0.11
Sto0028D	10 December 2007	0.20	0.40	21.20	989	-0.04
Sto0028D	17 December 2007	0.10	0.50	22.00	1012	0.1
Sto0028D	02 January 2008	0.10	0.60	21.70	988	0.27
Sto0028D	07 January 2008	0.10	0.60	21.50	980	0.49
Sto0028D	14 January 2008	0.10	0.60	21.00	966	0.46
Sto0028D	04 February 2008	0.00	0.50	20.70	973	-0.02
Sto0028D	18 February 2008	0.10	0.70	20.70	1009	0.72
Sto0028D	25 February 2008	0.00	0.00	21.60	991	-0.16
Sto0028D	10 March 2008	0.00	0.10	20.80	936	0.08
Sto0028D	25 March 2008	0.00	0.10	21.20	985	0.28
Sto0028D	31 March 2008	0.00	0.00	20.80	990	0.21
Sto0028D	16 April 2008	0.00	0.00	21.60	997	2.25
Averages		0.04	1.61	19.17		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0028S	23 April 2008	0.00	0.00	20.90	994	-4.6
Sto0028S	30 April 2008	0.20	12.70	1.00	966	6.35
Sto0028S	02 May 2007	0.00	1.00	20.40	995	-1.67
Sto0028S	09 May 2007	0.00	1.00	20.60	990	-1.28
Sto0028S	29 May 2007	0.00	0.20	21.30	988	-1.19
Sto0028S	06 June 2007	0.00	1.50	16.40	1002	0.57
Sto0028S	20 June 2007	0.00	2.60	15.90	986	0.34
Sto0028S	27 June 2007	0.10	9.10	6.60	983	-0.67
Sto0028S	11 July 2007	0.40	11.90	2.50	991	4.83
Sto0028S	01 August 2007	0.00	0.80	19.80	993	
Sto0028S	15 August 2007	0.30	12.70	0.90	972	
Sto0028S	30 August 2007	0.00	0.20	20.30	1000	
Sto0028S	03 September 2007	0.00	0.10	20.80	1000	
Sto0028S	17 September 2007	0.10	2.30	16.20	986	-2
Sto0028S	01 October 2007	0.10	0.10	21.20	998	-0.55
Sto0028S	15 October 2007	0.30	11.60	3.60	989	1.3
Sto0028S	22 October 2007	0.30	11.40	3.80	997	-0.1
Sto0028S	05 November 2007	0.10	4.70	13.60	999	0.78
Sto0028S	12 November 2007	0.00	1.00	18.00	1003	-0.74
Sto0028S	19 November 2007	0.10	1.10	21.20	973	-2.28
Sto0028S	26 November 2007	0.10	1.00	21.00	1006	-0.64
Sto0028S	05 December 2007	0.90	12.40	0.40	974	0.69
Sto0028S	10 December 2007	0.20	0.30	21.30	989	-8.07
Sto0028S	17 December 2007	0.10	0.40	22.10	1010	0.87
Sto0028S	02 January 2008	0.80	12.40	0.40	987	2.95
Sto0028S	07 January 2008	0.20	0.50	21.50	981	-3.51
Sto0028S	14 January 2008	0.90	12.60	1.10	966	3.47
Sto0028S	04 February 2008	0.70	11.80	1.70	972	4.38
Sto0028S	18 February 2008	0.10	11.20	1.40	1009	4.18
Sto0028S	25 February 2008	0.00	1.00	20.40	991	3.49
Sto0028S	10 March 2008	0.40	13.40	0.90	935	21.09
Sto0028S	25 March 2008	0.00	0.10	21.10	985	-2.56
Sto0028S	31 March 2008	0.00	1.40	18.50	990	-10.14
Sto0028S	16 April 2008	0.00	0.10	21.60	997	0.32
Averages		0.19	4.84	13.48		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0029D	23 April 2008	0.00	0.90	19.90	993	-0.05
Sto0029D	30 April 2008	18.30	24.60	2.60	966	0.25
Sto0029D	02 May 2007	0.00	0.60	19.90	995	-0.25
Sto0029D	09 May 2007	0.00	0.90	20.50	990	-0.47
Sto0029D	16 May 2007	0.00	4.40	16.40	990	0.02
Sto0029D	29 May 2007	0.00	4.60	15.50	988	-0.17
Sto0029D	06 June 2007	8.40	13.30	0.50	1002	0.07
Sto0029D	13 June 2007	29.50	26.90	0.70	986	0.04
Sto0029D	20 June 2007	0.00	4.70	11.00	986	0.25
Sto0029D	27 June 2007	0.30	8.90	7.20	984	0.18
Sto0029D	03 July 2007	0.00	9.40	9.30	976	-0.01
Sto0029D	11 July 2007	0.00	8.80	13.40	991	0.36
Sto0029D	01 August 2007	8.60	14.80	2.00	993	
Sto0029D	15 August 2007	0.00	3.70	18.10	972	
Sto0029D	30 August 2007	0.10	1.50	19.80	1000	
Sto0029D	03 September 2007	0.00	1.00	20.10	1000	
Sto0029D	17 September 2007	0.00	1.10	20.30	986	-0.1
Sto0029D	01 October 2007	0.00	2.30	19.90	998	0.15
Sto0029D	15 October 2007	0.80	4.80	13.90	989	0.04
Sto0029D	22 October 2007	0.10	3.00	16.20	997	-0.07
Sto0029D	05 November 2007	0.20	1.10	19.80	1000	-0.06
Sto0029D	12 November 2007	0.00	1.70	18.00	1003	0.2
Sto0029D	19 November 2007	0.10	4.10	17.80	973	-0.42
Sto0029D	26 November 2007	0.10	0.90	20.60	1006	0.26
Sto0029D	05 December 2007	15.90	17.80	4.30	975	-0.05
Sto0029D	10 December 2007	0.10	1.10	20.60	988	0.09
Sto0029D	17 December 2007	0.10	2.00	20.40	1011	-0.18
Sto0029D	02 January 2008	0.20	2.90	18.70	988	0.44
Sto0029D	07 January 2008	0.20	0.80	21.30	981	0.43
Sto0029D	14 January 2008	4.20	8.60	9.20	966	0.42
Sto0029D	04 February 2008	0.10	2.20	18.00	972	0.05
Sto0029D	18 February 2008	0.00	5.50	12.60	1009	0.49
Sto0029D	25 February 2008	0.90	6.70	14.00	992	-0.02
Sto0029D	10 March 2008	25.20	27.10	2.00	936	-0.07
Sto0029D	25 March 2008	0.10	1.10	20.70	985	0.2
Sto0029D	31 March 2008	0.00	1.00	19.70	989	0.24
Sto0029D	16 April 2008	0.30	5.00	13.60	997	0.18
Averages		3.08	6.21	14.55		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0029S	23 April 2008	0.00	0.00	20.70	993	-0.11
Sto0029S	30 April 2008	19.80	23.90	3.50	965	-0.14
Sto0029S	02 May 2007	0.00	0.50	19.80	995	-0.17
Sto0029S	09 May 2007	0.00	0.80	20.70	990	-0.43
Sto0029S	16 May 2007	1.50	5.70	14.50	990	0.04
Sto0029S	29 May 2007	0.00	6.40	12.70	988	0.07
Sto0029S	06 June 2007	11.50	12.70	0.50	1002	0.12
Sto0029S	13 June 2007	28.00	25.80	0.80	986	0.07
Sto0029S	20 June 2007	0.00	0.90	17.80	987	0.38
Sto0029S	27 June 2007	0.00	3.20	14.90	984	0.18
Sto0029S	03 July 2007	20.50	25.20	5.00	975	0.01
Sto0029S	11 July 2007	0.00	9.20	12.50	991	0.34
Sto0029S	01 August 2007	3.00	13.80	3.40	993	
Sto0029S	15 August 2007	11.10	16.00	5.70	972	
Sto0029S	30 August 2007	0.30	0.70	19.90	1000	
Sto0029S	03 September 2007	0.00	1.10	20.10	1000	
Sto0029S	17 September 2007	0.00	2.60	19.30	986	-0.19
Sto0029S	01 October 2007	0.00	0.70	20.80	998	0.13
Sto0029S	15 October 2007	14.90	18.90	3.40	989	-0.02
Sto0029S	22 October 2007	10.00	11.60	12.80	997	-0.06
Sto0029S	05 November 2007	16.90	15.90	3.90	999	-0.07
Sto0029S	19 November 2007	0.10	1.50	20.90	973	-0.49
Sto0029S	26 November 2007	0.10	0.50	21.30	1006	0.29
Sto0029S	05 December 2007	20.50	20.70	1.70	974	-0.01
Sto0029S	10 December 2007	0.10	0.50	21.30	989	-0.12
Sto0029S	17 December 2007	0.10	3.00	19.70	1011	0.14
Sto0029S	02 January 2008	6.70	10.10	8.30	988	0.46
Sto0029S	07 January 2008	0.10	0.40	21.70	981	0.45
Sto0029S	14 January 2008	5.80	6.50	13.60	966	0.36
Sto0029S	04 February 2008	0.90	2.80	17.30	973	0.08
Sto0029S	18 February 2008	0.00	3.90	14.70	1009	0.4
Sto0029S	25 February 2008	19.60	22.00	1.90	992	0.17
Sto0029S	10 March 2008	27.20	30.40	0.50	936	0.1
Sto0029S	25 March 2008	0.00	0.10	21.20	985	0.3
Sto0029S	31 March 2008	0.00	0.00	20.90	990	0.18
Sto0029S	16 April 2008	0.30	4.60	14.10	997	0.12
Averages		6.08	8.41	13.11		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0030D	23 April 2008	0.00	2.80	17.40	993	-0.91
Sto0030D	30 April 2008	0.30	7.00	11.90	965	0.04
Sto0030D	02 May 2007	0.00	0.90	19.80	995	-0.1
Sto0030D	09 May 2007	0.10	3.40	16.50	990	0.01
Sto0030D	16 May 2007	0.00	0.10	21.10	990	0
Sto0030D	29 May 2007	0.30	5.40	13.40	988	0.05
Sto0030D	06 June 2007	0.50	8.60	8.80	1002	0.18
Sto0030D	13 June 2007	18.70	24.10	0.30	986	0.3
Sto0030D	20 June 2007	0.00	0.00	20.40	986	0.27
Sto0030D	27 June 2007	12.40	12.70	7.50	984	0.27
Sto0030D	11 July 2007	0.00	0.20	21.20	991	0.15
Sto0030D	01 August 2007	22.50	20.10	0.20	993	
Sto0030D	15 August 2007	0.00	0.00	20.90	972	
Sto0030D	30 August 2007	0.00	0.30	19.50	1001	
Sto0030D	03 September 2007	0.00	0.00	20.80	1000	
Sto0030D	17 September 2007	0.00	0.80	21.10	986	-0.07
Sto0030D	01 October 2007	0.10	0.10	21.60	997	-0.07
Sto0030D	15 October 2007	23.30	26.80	0.00	990	0.42
Sto0030D	22 October 2007	0.10	0.10	20.90	997	-0.08
Sto0030D	05 November 2007	10.20	18.40	0.80	999	0.47
Sto0030D	12 November 2007	0.00	0.10	20.60	1004	0.32
Sto0030D	19 November 2007	0.10	1.90	21.00	973	-0.72
Sto0030D	26 November 2007	0.10	1.20	20.90	1006	-0.15
Sto0030D	05 December 2007	8.80	18.00	0.50	974	0.37
Sto0030D	10 December 2007	0.10	0.80	21.20	989	-1.34
Sto0030D	17 December 2007	0.10	2.30	19.40	1011	0.36
Sto0030D	02 January 2008	8.60	18.20	0.40	988	1.15
Sto0030D	07 January 2008	0.20	0.80	21.70	981	0.21
Sto0030D	14 January 2008	15.20	23.40	1.10	966	0.73
Sto0030D	04 February 2008	0.00	0.80	20.30	972	-0.44
Sto0030D	18 February 2008	4.00	12.40	4.50	1009	0.69
Sto0030D	25 February 2008	8.80	18.90	1.40	992	0.91
Sto0030D	10 March 2008	20.70	28.50	0.60	936	2.97
Sto0030D	25 March 2008	0.00	0.10	21.10	985	0.39
Sto0030D	31 March 2008	0.00	0.00	20.80	990	-1.17
Sto0030D	16 April 2008	0.00	1.90	19.60	998	0.41
Averages		4.31	7.25	13.87		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00PZ1	23 April 2008	0.40	35.30	0.70	991	-0.97
Sto00PZ1	30 April 2008	0.40	35.60	0.60	964	-0.53
Sto00PZ1	04 May 2007	0.00	8.30	16.30	993	0.02
Sto00PZ1	09 May 2007	0.00	14.00	10.30	988	-0.22
Sto00PZ1	29 May 2007	0.00	29.00	2.30	987	0.12
Sto00PZ1	06 June 2007	0.00	27.40	2.60	1000	0.09
Sto00PZ1	14 June 2007	0.10	31.00	1.70	979	13.83
Sto00PZ1	20 June 2007	0.00	30.20	1.20	986	1.04
Sto00PZ1	27 June 2007	0.00	32.00	0.70	983	3.36
Sto00PZ1	11 July 2007	0.00	31.80	0.80	992	4.89
Sto00PZ1	01 August 2007	0.00	6.40	9.30	992	
Sto00PZ1	15 August 2007	0.00	33.50	0.10	971	
Sto00PZ1	30 August 2007	0.00	0.40	17.50	1000	
Sto00PZ1	03 September 2007	0.00	30.90	2.00	999	
Sto00PZ1	17 September 2007	0.10	30.10	0.40	985	-0.48
Sto00PZ1	01 October 2007	0.10	33.50	0.70	997	9.69
Sto00PZ1	05 November 2007	0.20	34.10	0.60	999	7.54
Sto00PZ1	12 November 2007	0.00	34.10	1.30	1003	7.08
Sto00PZ1	19 November 2007	0.20	32.10	0.50	972	5.29
Sto00PZ1	26 November 2007	0.20	33.80	0.50	1006	3.95
Sto00PZ1	05 December 2007	0.30	34.30	0.30	974	8.11
Sto00PZ1	10 December 2007	0.60	36.00	0.30	988	0.23
Sto00PZ1	02 January 2008	0.50	34.90	0.40	987	4.89
Sto00PZ1	07 January 2008	0.60	35.50	0.20	980	6.53
Sto00PZ1	14 January 2008	0.60	35.10	0.70	965	2.8
Sto00PZ1	04 February 2008	0.50	34.60	1.00	971	4.39
Sto00PZ1	11 February 2008	0.40	33.50	0.80	1009	-0.15
Sto00PZ1	18 February 2008	0.50	32.90	1.30	1008	1.06
Sto00PZ1	25 February 2008	0.40	34.10	0.70	991	1.8
Sto00PZ1	10 March 2008	0.50	35.50	0.70	935	4.43
Sto00PZ1	27 March 2008	0.50	35.00	0.90	977	-0.28
Sto00PZ1	16 April 2008	0.40	35.40	0.60	997	-0.14
Averages		0.23	30.01	2.44		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0023D	23 April 2008	19.30	19.10	10.00	993	-1.12
Sto0023D	30 April 2008	25.80	27.40	5.70	965	0.1
Sto0023D	02 May 2007	21.00	16.90	10.10	996	-0.26
Sto0023D	09 May 2007	25.10	20.50	8.50	989	-0.14
Sto0023D	16 May 2007	9.20	7.90	16.60	990	-0.02
Sto0023D	29 May 2007	20.60	20.50	10.20	987	0.21
Sto0023D	06 June 2007	13.00	11.80	14.40	1000	0.67
Sto0023D	13 June 2007	27.90	26.90	6.20	985	0.34
Sto0023D	13 June 2007	40.60	37.10	0.20	985	2.72
Sto0023D	20 June 2007	28.20	27.10	6.30	985	0.2
Sto0023D	27 June 2007	25.30	25.50	7.70	983	0.57
Sto0023D	03 July 2007	33.90	35.10	3.10	975	0.55
Sto0023D	11 July 2007	15.30	13.60	13.70	991	-0.31
Sto0023D	01 August 2007	15.30	12.30	13.30	992	
Sto0023D	15 August 2007	35.50	33.50	3.00	971	
Sto0023D	30 August 2007	15.50	12.10	14.10	999	
Sto0023D	03 September 2007	22.40	19.80	10.00	999	
Sto0023D	17 September 2007	37.20	24.70	5.20	985	-0.36
Sto0023D	01 October 2007	20.50	17.20	11.30	997	0.18
Sto0023D	22 October 2007	19.20	16.00	12.00	996	-0.12
Sto0023D	05 November 2007	21.90	17.80	10.40	998	0.41
Sto0023D	12 November 2007	29.60	25.00	7.70	1002	0.08
Sto0023D	19 November 2007	39.30	30.00	3.00	972	-0.59
Sto0023D	26 November 2007	42.80	37.10	0.20	1004	-0.52
Sto0023D	05 December 2007	18.10	14.10	12.80	973	0.21
Sto0023D	10 December 2007	0.40	0.50	21.20	988	-3.29
Sto0023D	17 December 2007	9.10	5.10	18.40	1009	0.77
Sto0023D	02 January 2008	16.20	12.70	14.00	986	1.52
Sto0023D	07 January 2008	15.80	10.80	15.70	980	0.47
Sto0023D	14 January 2008	31.30	29.70	5.30	965	0.54
Sto0023D	04 February 2008	22.70	20.30	11.00	971	-0.54
Sto0023D	18 February 2008	6.80	4.00	17.70	1008	0.83
Sto0023D	25 February 2008	18.60	17.80	11.20	989	1.74
Sto0023D	10 March 2008	35.70	39.40	1.00	934	3.38
Sto0023D	25 March 2008	12.90	13.50	14.60	983	0.56
Sto0023D	31 March 2008	4.50	4.10	18.50	990	-1.41
Sto0023D	16 April 2008	5.70	5.20	18.60	996	0.79
Averages		21.68	19.25	10.35		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0023S	23 April 2008	33.30	34.70	1.10	994	-2.81
Sto0023S	30 April 2008	35.20	36.50	0.60	965	0.73
Sto0023S	02 May 2007	37.90	23.40	2.40	997	-1.23
Sto0023S	09 May 2007	37.30	28.60	1.10	990	0.43
Sto0023S	16 May 2007	35.10	35.80	0.80	990	-0.07
Sto0023S	29 May 2007	38.00	33.80	1.50	988	1
Sto0023S	06 June 2007	39.80	33.10	0.50	1001	1.94
Sto0023S	20 June 2007	39.10	37.70	0.30	986	0.61
Sto0023S	27 June 2007	38.50	37.40	0.30	983	3.36
Sto0023S	03 July 2007	37.60	39.30	0.30	975	0.92
Sto0023S	11 July 2007	33.40	32.50	3.30	991	-0.23
Sto0023S	01 August 2007	37.70	37.80	0.30	993	
Sto0023S	15 August 2007	38.70	40.30	0.30	972	
Sto0023S	30 August 2007	38.00	39.20	2.40	1000	
Sto0023S	03 September 2007	38.60	38.60	0.90	999	
Sto0023S	17 September 2007	39.90	35.10	1.20	985	-0.1
Sto0023S	01 October 2007	21.60	32.10	2.70	997	-0.09
Sto0023S	22 October 2007	38.80	38.30	0.80	996	0.02
Sto0023S	05 November 2007	33.10	37.30	0.40	998	0.23
Sto0023S	12 November 2007	31.00	37.80	1.80	1002	0.16
Sto0023S	19 November 2007	0.20	2.50	21.00	972	-2.21
Sto0023S	26 November 2007	42.80	38.40	0.20	1005	-0.2
Sto0023S	05 December 2007	38.90	36.60	0.90	973	1.29
Sto0023S	10 December 2007	30.80	27.00	7.40	988	-11.82
Sto0023S	17 December 2007	41.50	39.00	0.40	1009	1.8
Sto0023S	02 January 2008	37.90	37.70	0.40	987	3.58
Sto0023S	07 January 2008	35.80	36.60	1.70	979	-2.7
Sto0023S	14 January 2008	36.20	37.80	1.10	965	2
Sto0023S	04 February 2008	34.90	36.60	2.10	972	-2.56
Sto0023S	18 February 2008	32.90	33.70	2.20	1008	2.44
Sto0023S	25 February 2008	32.50	33.90	2.30	990	4.35
Sto0023S	10 March 2008	34.80	37.90	0.60	934	15.08
Sto0023S	25 March 2008	27.00	28.50	6.70	984	-0.72
Sto0023S	31 March 2008	23.30	22.80	8.70	990	-5.6
Sto0023S	16 April 2008	30.80	33.50	2.20	996	1.06
Averages		34.37	34.05	2.31		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0005D	23 April 2008	1.30	0.90	20.70	994	-0.19
Sto0005D	30 April 2008	55.60	36.00	0.50	966	-0.16
Sto0005D	02 May 2007	31.40	24.10	7.30	996	-0.89
Sto0005D	09 May 2007	30.70	22.10	8.30	989	-0.76
Sto0005D	29 May 2007	13.70	12.70	14.70	987	0.12
Sto0005D	06 June 2007	7.10	5.40	17.10	1001	0.44
Sto0005D	13 June 2007	33.60	38.70	1.90	985	-0.06
Sto0005D	20 June 2007	21.60	21.60	9.60	986	0.4
Sto0005D	27 June 2007	13.90	12.50	13.80	983	0.33
Sto0005D	03 July 2007	37.40	39.50	2.90	974	-0.17
Sto0005D	11 July 2007	15.40	15.30	13.50	991	0.16
Sto0005D	01 August 2007	14.70	12.40	12.80	992	
Sto0005D	15 August 2007	35.70	37.10	3.80	972	
Sto0005D	03 September 2007	9.80	9.70	15.20	999	
Sto0005D	17 September 2007	29.30	25.80	6.90	985	-0.36
Sto0005D	01 October 2007	9.70	9.60	15.80	997	0.34
Sto0005D	22 October 2007	13.60	15.20	11.80	995	-0.17
Sto0005D	05 November 2007	11.70	13.80	12.30	999	0.14
Sto0005D	12 November 2007	7.00	8.20	16.30	1002	0.3
Sto0005D	19 November 2007	17.90	18.20	11.90	972	-0.11
Sto0005D	26 November 2007	0.90	1.00	20.40	1005	-0.02
Sto0005D	05 December 2007	11.50	7.20	15.70	974	-0.1
Sto0005D	10 December 2007	0.10	0.50	21.20	988	0
Sto0005D	17 December 2007	10.10	6.70	16.70	1009	0.36
Sto0005D	02 January 2008	55.90	34.00	0.50	987	0.65
Sto0005D	07 January 2008	2.60	1.90	20.50	980	0.66
Sto0005D	14 January 2008	55.70	35.00	1.10	965	0.1
Sto0005D	04 February 2008	20.30	12.80	14.00	972	0
Sto0005D	18 February 2008	48.40	29.90	1.30	1008	0.07
Sto0005D	25 February 2008	27.40	18.50	10.30	990	0.09
Sto0005D	10 March 2008	56.80	38.40	0.80	934	0.27
Sto0005D	25 March 2008	1.20	1.20	21.00	984	0.08
Sto0005D	31 March 2008	0.00	0.30	20.40	990	0.11
Sto0005D	16 April 2008	0.30	0.70	20.60	996	0.27
Averages		20.66	16.67	11.81		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0005S	23 April 2008	1.70	13.70	10.10	993	-0.26
Sto0005S	30 April 2008	2.20	23.50	3.60	965	0.25
Sto0005S	02 May 2007	0.00	11.50	11.60	996	2.48
Sto0005S	09 May 2007	0.00	10.70	11.80	989	-0.69
Sto0005S	16 May 2007	0.00	12.40	12.10	990	0.08
Sto0005S	29 May 2007	0.00	11.40	12.70	987	0.1
Sto0005S	06 June 2007	0.00	10.40	12.70	1000	0.21
Sto0005S	13 June 2007	0.10	11.30	11.20	985	-0.02
Sto0005S	20 June 2007	0.00	10.40	12.10	985	0.31
Sto0005S	27 June 2007	0.00	10.90	12.10	983	0.38
Sto0005S	03 July 2007	0.00	22.10	4.80	974	0.2
Sto0005S	11 July 2007	0.00	21.40	4.80	990	0.2
Sto0005S	01 August 2007	0.00	14.70	9.10	992	
Sto0005S	15 August 2007	0.20	14.40	9.30	971	
Sto0005S	03 September 2007	0.00	12.30	11.50	999	
Sto0005S	17 September 2007	0.00	12.10	11.30	985	0.07
Sto0005S	01 October 2007	2.80	14.30	9.70	997	0.25
Sto0005S	22 October 2007	0.10	14.50	9.90	995	-0.08
Sto0005S	05 November 2007	0.10	13.70	10.60	998	-0.09
Sto0005S	12 November 2007	0.00	12.10	13.40	1002	0.3
Sto0005S	19 November 2007	20.10	21.40	7.20	972	0
Sto0005S	26 November 2007	0.10	1.10	20.80	1004	-0.04
Sto0005S	05 December 2007	57.90	35.00	0.80	973	0.14
Sto0005S	10 December 2007	18.30	15.90	11.90	988	-0.18
Sto0005S	17 December 2007	0.30	3.90	19.90	1008	0.54
Sto0005S	02 January 2008	10.00	10.10	15.30	986	0.9
Sto0005S	07 January 2008	20.00	17.20	10.40	979	0.91
Sto0005S	14 January 2008	21.30	20.00	7.60	965	0.26
Sto0005S	04 February 2008	31.10	24.60	6.70	971	0
Sto0005S	18 February 2008	11.30	16.60	8.70	1007	0.44
Sto0005S	25 February 2008	6.60	15.50	9.50	989	0
Sto0005S	10 March 2008	52.20	34.90	2.50	934	-0.02
Sto0005S	25 March 2008	26.60	23.00	7.90	983	0.36
Sto0005S	31 March 2008	13.90	16.10	10.40	990	0.28
Sto0005S	16 April 2008	4.90	15.20	9.70	996	0.18
Averages		8.62	15.67	10.11		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00PZ2	23 April 2008	0.00	4.80	9.40	992	0.22
Sto00PZ2	30 April 2008	0.00	5.00	8.90	965	1.65
Sto00PZ2	04 May 2007	0.00	4.00	12.30	994	-0.01
Sto00PZ2	09 May 2007	0.00	5.80	11.10	989	-0.68
Sto00PZ2	29 May 2007	0.00	4.80	9.10	987	0.19
Sto00PZ2	06 June 2007	0.00	5.20	8.50	1001	1.13
Sto00PZ2	14 June 2007	0.10	5.90	9.10	979	11.85
Sto00PZ2	20 June 2007	0.00	4.90	7.70	986	2.76
Sto00PZ2	27 June 2007	0.00	4.50	7.60	983	1.85
Sto00PZ2	11 July 2007	0.00	6.80	8.90	991	10.98
Sto00PZ2	11 July 2007	0.00	6.90	9.00	991	-32.88
Sto00PZ2	01 August 2007	0.00	30.00	1.60	992	
Sto00PZ2	15 August 2007	0.00	7.00	8.50	971	
Sto00PZ2	30 August 2007	0.00	6.10	10.30	1000	
Sto00PZ2	03 September 2007	0.00	6.80	9.60	999	
Sto00PZ2	17 September 2007	0.00	8.70	9.90	985	-0.03
Sto00PZ2	01 October 2007	0.10	7.90	11.10	997	3.98
Sto00PZ2	05 November 2007	0.10	8.00	10.70	999	0.33
Sto00PZ2	19 November 2007	0.20	8.40	11.00	972	0.02
Sto00PZ2	26 November 2007	0.20	7.10	10.60	1005	0.8
Sto00PZ2	05 December 2007	0.20	7.30	8.90	973	0.35
Sto00PZ2	10 December 2007	0.20	7.50	8.20	988	0.71
Sto00PZ2	02 January 2008	0.20	6.10	8.00	988	0.03
Sto00PZ2	07 January 2008	0.20	6.60	7.70	980	0.62
Sto00PZ2	14 January 2008	0.10	5.60	7.70	965	4.1
Sto00PZ2	04 February 2008	0.00	4.90	13.40	972	0.44
Sto00PZ2	11 February 2008	0.20	4.80	12.90	1009	0.54
Sto00PZ2	18 February 2008	0.00	4.70	12.90	1007	0.39
Sto00PZ2	25 February 2008	0.00	4.50	12.90	991	-0.03
Sto00PZ2	10 March 2008	0.00	4.90	12.10	935	-0.22
Sto00PZ2	27 March 2008	0.00	4.10	11.30	977	0
Sto00PZ2	16 April 2008	0.00	4.50	10.80	997	2.63
Averages		0.06	6.69	9.74		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00PZ3	23 April 2008	7.30	28.60	1.70	991	-0.81
Sto00PZ3	30 April 2008	7.60	29.80	1.70	964	-0.27
Sto00PZ3	04 May 2007	0.00	0.60	21.00	993	-0.09
Sto00PZ3	09 May 2007	0.00	4.60	11.60	988	-0.41
Sto00PZ3	29 May 2007	2.10	21.90	0.70	987	-0.58
Sto00PZ3	06 June 2007	2.50	21.60	0.80	1001	0
Sto00PZ3	11 July 2007	3.50	25.80	1.90	991	-0.35
Sto00PZ3	01 August 2007	3.40	25.60	2.10	992	
Sto00PZ3	15 August 2007	3.10	26.40	4.90	970	
Sto00PZ3	30 August 2007	3.60	27.80	6.50	1000	
Sto00PZ3	03 September 2007	4.00	29.40	2.10	999	
Sto00PZ3	17 September 2007	3.80	13.00	7.50	986	-0.2
Sto00PZ3	01 October 2007	5.70	30.60	2.10	998	-0.24
Sto00PZ3	05 November 2007	8.80	32.40	1.40	999	0.08
Sto00PZ3	19 November 2007	10.50	31.30	2.20	972	-0.5
Sto00PZ3	26 November 2007	11.10	31.10	2.70	1006	-0.19
Sto00PZ3	05 December 2007	11.80	32.10	2.30	974	-0.84
Sto00PZ3	10 December 2007	11.60	33.30	2.80	988	-1.82
Sto00PZ3	02 January 2008	12.20	33.00	2.10	988	0.4
Sto00PZ3	07 January 2008	12.30	33.80	3.00	981	-0.26
Sto00PZ3	14 January 2008	12.00	34.30	2.40	964	-1.27
Sto00PZ3	04 February 2008	10.70	32.80	3.20	972	-0.57
Sto00PZ3	11 February 2008	10.90	30.30	2.70	1009	-0.05
Sto00PZ3	18 February 2008	11.40	29.80	3.20	1007	0.95
Sto00PZ3	25 February 2008	11.20	32.40	2.40	991	0.72
Sto00PZ3	10 March 2008	0.40	18.90	3.30	935	1.94
Sto00PZ3	27 March 2008	5.40	24.90	2.60	977	-0.25
Sto00PZ3	16 April 2008	6.70	26.30	2.90	997	0.66
Averages		6.91	26.51	3.71		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00PZ4	06 June 2007	0.00	0.00	20.70	1001	0.03
Sto00PZ4	20 June 2007	0.00	0.00	20.20	986	-2.04
Sto00PZ4	27 June 2007	0.00	0.00	20.10	983	0.05
Sto00PZ4	11 July 2007	0.00	0.20	21.10	991	-1.79
Sto00PZ4	01 August 2007	0.00	0.10	20.10	991	
Sto00PZ4	15 August 2007	0.00	0.10	20.70	970	
Sto00PZ4	03 September 2007	0.00	0.00	21.30	1000	
Sto00PZ4	17 September 2007	0.00	3.60	19.80	985	-0.19
Sto00PZ4	01 October 2007	0.10	0.10	21.10	997	-0.06
Sto00PZ4	05 November 2007	0.10	0.20	20.80	998	0
Sto00PZ4	19 November 2007	0.40	3.90	20.50	972	0.21
Sto00PZ4	26 November 2007	0.30	1.70	20.60	1005	-0.02
Sto00PZ4	05 December 2007	0.30	1.40	20.90	973	0.21
Sto00PZ4	10 December 2007	0.10	1.50	21.10	988	-0.18
Sto00PZ4	02 January 2008	0.10	1.20	21.40	987	-0.72
Sto00PZ4	07 January 2008	0.20	1.40	21.10	980	1.88
Sto00PZ4	14 January 2008	0.10	1.20	20.90	965	0.6
Sto00PZ4	04 February 2008	0.10	1.30	20.00	971	0.44
Sto00PZ4	11 February 2008	0.10	1.30	20.00	1009	0.09
Sto00PZ4	18 February 2008	0.10	1.40	20.60	1007	0.28
Sto00PZ4	25 February 2008	0.00	0.10	21.40	991	0.06
Sto00PZ4	10 March 2008	0.00	0.10	20.70	935	-0.88
Sto00PZ4	27 March 2008	0.00	0.00	20.20	977	0.17
Sto00PZ4	16 April 2008	0.00	0.10	21.30	997	0.7
Sto00PZ4	23 April 2008	0.00	0.00	19.80	991	0.95
Sto00PZ4	30 April 2008	0.10	0.10	20.00	964	-0.46
Averages		0.08	0.81	20.63		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto037WD	23 April 2008	0.00	0.00	21.30	994	-0.25
Sto037WD	30 April 2008	9.00	6.80	15.40	966	-0.16
Sto037WD	02 May 2007	0.00	1.70	20.40	996	0.69
Sto037WD	09 May 2007	0.00	1.70	20.50	990	-0.68
Sto037WD	16 May 2007	0.00	0.20	21.00	990	0.2
Sto037WD	29 May 2007	0.30	1.10	20.50	987	0.12
Sto037WD	06 June 2007	0.90	2.80	16.60	1001	0.43
Sto037WD	13 June 2007	34.10	29.00	2.90	985	0.23
Sto037WD	20 June 2007	9.50	5.60	15.60	986	0.28
Sto037WD	27 June 2007	21.80	18.80	6.00	983	0.24
Sto037WD	03 July 2007	32.50	29.20	1.50	974	-0.04
Sto037WD	11 July 2007	0.10	0.20	21.30	991	0.03
Sto037WD	01 August 2007	30.90	10.10	0.30	993	
Sto037WD	15 August 2007	0.50	0.40	20.70	971	
Sto037WD	30 August 2007	3.90	2.90	17.50	1000	
Sto037WD	03 September 2007	0.00	0.00	21.30	999	
Sto037WD	17 September 2007	0.20	5.30	20.10	985	-0.12
Sto037WD	01 October 2007	0.00	0.10	21.00	998	-0.03
Sto037WD	22 October 2007	23.40	17.80	7.30	996	-0.24
Sto037WD	05 November 2007	16.80	13.60	7.00	998	-0.03
Sto037WD	12 November 2007	0.10	0.40	20.70	1002	0.19
Sto037WD	19 November 2007	0.20	1.00	21.40	972	-0.47
Sto037WD	26 November 2007	0.20	1.70	20.80	1004	-0.04
Sto037WD	05 December 2007	19.10	16.10	8.10	974	0.25
Sto037WD	10 December 2007	0.20	1.30	21.00	988	-0.24
Sto037WD	17 December 2007	0.20	1.80	21.40	1009	0.59
Sto037WD	02 January 2008	23.10	17.20	6.70	986	0.82
Sto037WD	07 January 2008	0.20	1.40	21.30	980	0.54
Sto037WD	14 January 2008	22.70	19.10	7.70	965	0.3
Sto037WD	04 February 2008	0.20	1.40	20.50	972	0.25
Sto037WD	18 February 2008	11.70	10.70	8.20	1008	0.34
Sto037WD	25 February 2008	13.30	11.40	9.40	990	0.12
Sto037WD	10 March 2008	37.20	36.60	1.10	935	0.2
Sto037WD	25 March 2008	0.00	0.10	21.60	984	0.19
Sto037WD	31 March 2008	0.00	0.00	20.30	990	0.21
Sto037WD	16 April 2008	0.00	0.30	21.20	996	0.3
Averages		8.68	7.44	15.27		

Perimeter Boreholes - Field

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto038WD	23 April 2008	0.10	0.00	21.10	993	-0.85
Sto038WD	30 April 2008	3.00	21.30	0.50	965	0.28
Sto038WD	02 May 2007	0.00	0.80	20.40	996	2.01
Sto038WD	09 May 2007	10.10	20.10	1.80	990	-0.86
Sto038WD	16 May 2007	0.00	0.10	21.00	990	0.05
Sto038WD	29 May 2007	10.60	22.30	1.70	986	0.41
Sto038WD	06 June 2007	10.00	22.40	2.10	1000	0.46
Sto038WD	13 June 2007	8.80	23.30	0.40	985	0.05
Sto038WD	20 June 2007	0.00	0.00	20.50	986	0.31
Sto038WD	27 June 2007	11.60	23.60	0.40	982	0.44
Sto038WD	03 July 2007	10.10	25.40	0.40	975	0.12
Sto038WD	11 July 2007	0.10	0.10	21.10	991	-0.05
Sto038WD	01 August 2007	15.90	23.40	0.40	992	
Sto038WD	15 August 2007	0.30	0.40	20.10	970	
Sto038WD	30 August 2007	0.20	0.30	20.20	998	
Sto038WD	03 September 2007	0.00	0.00	21.20	999	
Sto038WD	17 September 2007	0.00	0.60	21.00	985	-0.17
Sto038WD	01 October 2007	0.10	0.10	21.00	997	0.42
Sto038WD	22 October 2007	11.00	22.80	1.10	996	-0.15
Sto038WD	05 November 2007	11.30	23.60	0.30	997	-0.04
Sto038WD	12 November 2007	0.00	0.10	21.00	1002	0.21
Sto038WD	19 November 2007	0.10	0.80	21.30	972	-0.46
Sto038WD	26 November 2007	0.10	0.40	21.30	1004	-0.17
Sto038WD	05 December 2007	0.40	1.20	20.80	973	0.17
Sto038WD	10 December 2007	0.10	0.30	21.10	988	-0.25
Sto038WD	17 December 2007	1.40	14.60	8.80	1010	0.62
Sto038WD	02 January 2008	6.10	21.60	0.80	986	1.3
Sto038WD	07 January 2008	0.20	0.40	21.70	979	0.23
Sto038WD	14 January 2008	6.10	21.30	1.20	964	0.27
Sto038WD	04 February 2008	0.00	0.40	21.10	971	-0.24
Sto038WD	18 February 2008	4.30	18.40	3.50	1008	0.48
Sto038WD	25 February 2008	4.90	21.50	1.20	990	1.1
Sto038WD	10 March 2008	5.20	22.00	0.70	934	3.15
Sto038WD	25 March 2008	2.20	17.00	5.50	983	0.19
Sto038WD	31 March 2008	0.00	0.00	20.60	989	-1.06
Sto038WD	16 April 2008	2.30	16.80	6.10	996	0.46
Averages		3.79	10.76	11.48		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0006S	02 May 2007	3.10	4.80	19.10	996	1.68
Sto0006S	09 May 2007	1.50	3.50	19.80	988	1.1
Sto0006S	16 May 2007	0.00	0.20	20.90	989	0.07
Sto0006S	29 May 2007	0.00	0.20	21.50	987	0.06
Sto0006S	06 June 2007	0.00	0.10	21.70	1000	0.48
Sto0006S	13 June 2007	0.20	0.20	21.00	985	-0.06
Sto0006S	20 June 2007	0.10	0.10	20.40	986	0.54
Sto0006S	27 June 2007	0.00	0.10	20.30	982	0.38
Sto0006S	03 July 2007	0.10	0.20	20.10	974	-0.22
Sto0006S	01 August 2007	0.60	0.40	20.90	992	
Sto0006S	01 August 2007	0.60	0.40	21.10	992	
Sto0006S	15 August 2007	0.20	0.20	20.50	972	
Sto0006S	30 August 2007	3.00	3.80	17.30	999	
Sto0006S	03 September 2007	0.00	0.10	21.40	999	
Sto0006S	17 September 2007	0.30	2.30	20.20	985	-0.2
Sto0006S	01 October 2007	0.30	0.30	21.10	997	0.33
Sto0006S	22 October 2007	5.60	8.00	18.90	994	-0.21
Sto0006S	05 November 2007	7.00	10.80	17.50	998	0
Sto0006S	12 November 2007	1.20	5.00	19.00	1003	0.31
Sto0006S	19 November 2007	2.60	3.90	20.30	972	0.54
Sto0006S	26 November 2007	4.10	4.50	19.50	1004	0.14
Sto0006S	05 December 2007	0.80	1.90	20.80	974	0.43
Sto0006S	10 December 2007	3.10	4.90	19.90	989	-0.06
Sto0006S	17 December 2007	4.40	5.90	20.40	1008	1.26
Sto0006S	02 January 2008	2.20	4.00	20.70	986	0.92
Sto0006S	07 January 2008	1.50	2.80	20.80	979	1.35
Sto0006S	14 January 2008	2.10	3.30	19.90	965	0.29
Sto0006S	04 February 2008	9.10	15.30	16.50	972	-0.01
Sto0006S	18 February 2008	15.80	24.70	12.90	1007	0.33
Sto0006S	25 February 2008	9.70	17.20	16.00	989	0.05
Sto0006S	10 March 2008	6.50	10.50	17.90	934	0.22
Sto0006S	25 March 2008	13.40	19.90	15.30	983	0.66
Sto0006S	31 March 2008	10.30	15.90	15.60	990	0.07
Sto0006S	16 April 2008	10.70	15.30	16.40	996	0.28
Sto0006S	23 April 2008	4.80	5.90	18.90	995	-0.25
Sto0006S	30 April 2008	5.20	6.50	18.20	967	-0.3
Averages		3.61	5.64	19.24		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0007D	02 May 2007	0.00	1.40	20.40	996	-1.76
Sto0007D	09 May 2007	0.00	1.70	20.30	989	-0.4
Sto0007D	29 May 2007	0.00	1.90	20.90	987	0.23
Sto0007D	06 June 2007	0.00	2.90	17.80	1000	0.86
Sto0007D	13 June 2007	0.00	7.90	4.80	985	0.78
Sto0007D	20 June 2007	0.00	9.00	3.50	986	0.78
Sto0007D	27 June 2007	0.00	13.70	0.20	982	3.7
Sto0007D	03 July 2007	0.00	17.20	0.40	974	1.86
Sto0007D	11 July 2007	0.00	0.10	21.70	991	-0.28
Sto0007D	01 August 2007	0.00	3.90	16.60	992	
Sto0007D	15 August 2007	0.00	14.20	0.90	971	
Sto0007D	30 August 2007	0.10	0.30	19.70	999	
Sto0007D	03 September 2007	0.00	0.00	21.50	999	
Sto0007D	17 September 2007	0.00	0.90	20.80	986	-0.8
Sto0007D	01 October 2007	0.00	0.10	21.30	997	-0.38
Sto0007D	22 October 2007	0.00	5.80	12.80	995	0.03
Sto0007D	05 November 2007	0.10	5.60	12.60	997	1.21
Sto0007D	12 November 2007	0.00	0.10	21.00	1002	-0.23
Sto0007D	19 November 2007	0.10	1.20	21.20	972	-0.86
Sto0007D	26 November 2007	0.10	1.00	21.10	1004	-0.07
Sto0007D	05 December 2007	0.10	5.50	13.00	974	0.46
Sto0007D	10 December 2007	0.10	0.90	21.20	989	-9.44
Sto0007D	17 December 2007	0.20	2.20	20.40	1008	1.8
Sto0007D	02 January 2008	0.10	7.80	8.40	985	3.94
Sto0007D	07 January 2008	0.10	0.80	21.50	980	-0.38
Sto0007D	14 January 2008	0.10	12.70	2.80	965	3.12
Sto0007D	04 February 2008	0.00	1.10	20.40	971	-0.45
Sto0007D	18 February 2008	0.10	4.00	15.80	1007	1.88
Sto0007D	25 February 2008	0.00	4.50	15.70	989	1.15
Sto0007D	10 March 2008	0.10	15.10	1.10	934	2.97
Sto0007D	25 March 2008	0.00	0.10	21.40	984	0.31
Sto0007D	31 March 2008	0.00	0.00	20.90	989	-1.19
Sto0007D	16 April 2008	0.00	1.50	20.20	996	0.51
Sto0007D	23 April 2008	0.00	0.00	21.30	994	-1.59
Sto0007D	30 April 2008	0.10	10.70	1.50	966	0.75
Averages		0.04	4.45	15.00		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0007S	02 May 2007	0.00	0.50	20.80	996	0.94
Sto0007S	09 May 2007	0.00	0.80	20.80	989	-0.63
Sto0007S	29 May 2007	0.00	0.00	21.60	987	0.06
Sto0007S	06 June 2007	0.00	0.00	21.80	1000	0.35
Sto0007S	20 June 2007	0.00	0.20	20.10	986	0.31
Sto0007S	27 June 2007	0.00	2.10	17.40	982	0.35
Sto0007S	11 July 2007	0.00	0.10	21.50	991	0.02
Sto0007S	01 August 2007	0.00	1.20	19.60	992	
Sto0007S	15 August 2007	0.00	0.10	20.70	971	
Sto0007S	30 August 2007	0.00	0.20	20.60	999	
Sto0007S	03 September 2007	0.00	0.00	21.50	999	
Sto0007S	17 September 2007	0.00	0.60	20.90	985	-0.2
Sto0007S	01 October 2007	0.00	0.10	21.20	996	0.49
Sto0007S	22 October 2007	0.10	0.30	21.00	995	-0.08
Sto0007S	05 November 2007	0.10	0.70	20.00	997	0.22
Sto0007S	12 November 2007	0.00	0.10	20.80	1002	0.14
Sto0007S	19 November 2007	0.10	0.80	21.50	972	-0.01
Sto0007S	26 November 2007	0.10	1.50	21.00	1004	-300.88
Sto0007S	05 December 2007	0.10	1.30	20.40	973	0.07
Sto0007S	10 December 2007	0.10	0.50	21.20	989	-0.23
Sto0007S	17 December 2007	0.10	0.70	21.80	1008	0.48
Sto0007S	02 January 2008	0.10	1.10	21.30	986	1
Sto0007S	07 January 2008	0.20	0.50	21.50	979	0.75
Sto0007S	14 January 2008	0.00	1.60	19.30	965	0.29
Sto0007S	04 February 2008	0.00	0.60	20.80	972	0.04
Sto0007S	18 February 2008	0.00	1.00	20.70	1007	0.48
Sto0007S	25 February 2008	0.00	0.80	20.10	989	0.18
Sto0007S	10 March 2008	0.00	5.50	13.60	934	0.31
Sto0007S	25 March 2008	0.00	0.10	21.50	983	0.03
Sto0007S	31 March 2008	0.00	0.00	20.80	990	0.23
Sto0007S	18 April 2008	0.00	0.10	21.10	976	0.04
Sto0007S	23 April 2008	0.00	0.00	21.30	994	-0.29
Sto0007S	30 April 2008	0.00	0.30	20.20	966	-0.32
Averages		0.03	0.71	20.56		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0008W	02 May 2007	0.00	0.40	21.00	996	-1.52
Sto0008W	09 May 2007	0.00	0.40	21.00	988	-0.71
Sto0008W	16 May 2007	0.00	0.10	21.00	989	0.1
Sto0008W	29 May 2007	0.00	0.00	21.70	987	0.04
Sto0008W	06 June 2007	0.00	0.00	21.70	1000	0.38
Sto0008W	20 June 2007	0.00	0.00	20.60	986	0.31
Sto0008W	27 June 2007	0.00	0.00	20.40	982	0.14
Sto0008W	11 July 2007	0.00	0.10	21.60	991	0.08
Sto0008W	01 August 2007	0.00	0.00	21.40	992	
Sto0008W	15 August 2007	0.00	0.00	21.00	971	
Sto0008W	30 August 2007	0.00	0.10	20.60	1000	
Sto0008W	03 September 2007	0.00	0.00	21.50	999	
Sto0008W	17 September 2007	0.00	0.40	21.20	986	-0.3
Sto0008W	01 October 2007	0.00	0.10	21.10	997	0.09
Sto0008W	22 October 2007	0.00	0.10	21.40	995	0.03
Sto0008W	05 November 2007	0.10	0.10	21.50	997	0.24
Sto0008W	12 November 2007	0.00	0.00	21.10	1002	0.16
Sto0008W	19 November 2007	0.10	0.80	21.40	972	-0.06
Sto0008W	26 November 2007	0.10	0.50	21.10	1005	0
Sto0008W	05 December 2007	0.10	0.60	21.40	973	-0.03
Sto0008W	10 December 2007	0.20	0.40	21.40	990	-0.07
Sto0008W	17 December 2007	0.10	0.50	21.80	1008	0.73
Sto0008W	02 January 2008	0.10	0.60	21.80	986	0.81
Sto0008W	07 January 2008	0.10	0.40	21.70	979	0.84
Sto0008W	14 January 2008	0.10	0.60	21.00	965	0.45
Sto0008W	04 February 2008	0.00	0.40	20.90	972	0
Sto0008W	18 February 2008	0.00	0.50	21.10	1007	0.28
Sto0008W	25 February 2008	0.10	0.00	21.20	989	0.03
Sto0008W	10 March 2008	0.00	0.10	21.00	934	0.09
Sto0008W	25 March 2008	0.00	0.10	21.50	983	0.17
Sto0008W	31 March 2008	0.00	0.00	20.80	990	0.11
Sto0008W	16 April 2008	0.00	0.00	21.50	996	0.23
Sto0008W	23 April 2008	0.00	0.00	21.30	994	-0.34
Sto0008W	30 April 2008	0.00	0.00	21.10	966	-0.25
Averages		0.03	0.21	21.23		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0010W	02 May 2007	0.00	1.40	19.10	996	-1.83
Sto0010W	09 May 2007	0.10	0.90	20.90	989	1.71
Sto0010W	16 May 2007	0.00	0.10	21.00	989	0.09
Sto0010W	29 May 2007	0.00	0.40	20.50	987	0.05
Sto0010W	06 June 2007	0.00	0.80	18.70	1000	0.43
Sto0010W	13 June 2007	0.00	0.80	18.40	985	0.01
Sto0010W	20 June 2007	0.00	1.90	13.60	986	0.89
Sto0010W	27 June 2007	0.00	1.20	17.40	982	0.64
Sto0010W	11 July 2007	0.00	1.80	17.20	991	-0.01
Sto0010W	01 August 2007	0.00	2.40	7.50	992	
Sto0010W	01 August 2007	0.00	2.40	7.40	992	
Sto0010W	15 August 2007	0.00	3.90	5.50	972	
Sto0010W	30 August 2007	0.00	3.80	11.30	999	
Sto0010W	03 September 2007	0.00	3.90	9.40	999	
Sto0010W	17 September 2007	0.00	3.00	6.20	986	-0.08
Sto0010W	01 October 2007	0.50	6.40	5.50	996	0.23
Sto0010W	22 October 2007	0.10	3.00	17.20	995	-0.13
Sto0010W	05 November 2007	0.20	4.40	13.80	997	0.2
Sto0010W	12 November 2007	0.00	5.20	13.50	1002	0.32
Sto0010W	19 November 2007	0.10	3.30	10.80	972	6.19
Sto0010W	26 November 2007	0.10	2.70	10.20	1004	3.43
Sto0010W	05 December 2007	0.40	1.00	19.30	974	-0.26
Sto0010W	10 December 2007	1.80	1.00	18.50	989	0.16
Sto0010W	17 December 2007	0.20	0.80	21.60	1008	0.97
Sto0010W	02 January 2008	0.20	1.10	21.30	985	0.97
Sto0010W	07 January 2008	0.20	0.30	21.40	979	0.37
Sto0010W	14 January 2008	0.00	0.20	21.20	965	0.22
Sto0010W	04 February 2008	0.00	0.30	20.50	972	-0.04
Sto0010W	18 February 2008	0.10	1.10	20.10	1007	0.31
Sto0010W	25 February 2008	0.00	0.20	21.10	989	1.08
Sto0010W	10 March 2008	0.00	0.10	21.00	934	0.31
Sto0010W	25 March 2008	0.00	0.10	21.20	983	0.17
Sto0010W	31 March 2008	0.00	0.10	20.80	990	0.02
Sto0010W	16 April 2008	0.00	0.20	21.00	995	0.08
Sto0010W	23 April 2008	0.00	0.20	21.10	995	-0.43
Sto0010W	30 April 2008	0.00	0.10	20.80	967	-0.45
Averages		0.11	1.68	16.56		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0011W	02 May 2007	0.00	0.50	21.00	996	-1.66
Sto0011W	09 May 2007	0.00	3.10	18.70	989	0.87
Sto0011W	16 May 2007	0.00	0.50	20.60	989	0.09
Sto0011W	29 May 2007	0.00	0.00	21.60	987	0.07
Sto0011W	06 June 2007	0.00	3.80	15.40	1001	0.36
Sto0011W	13 June 2007	0.00	13.60	4.20	985	0.09
Sto0011W	20 June 2007	0.90	14.80	0.80	986	0.52
Sto0011W	27 June 2007	8.40	19.60	0.50	983	0.47
Sto0011W	03 July 2007	12.00	22.20	0.30	975	-0.22
Sto0011W	11 July 2007	0.00	0.00	21.40	992	-0.03
Sto0011W	01 August 2007	0.00	3.40	14.50	992	
Sto0011W	15 August 2007	0.00	0.00	21.00	972	
Sto0011W	03 September 2007	0.00	0.00	21.80	999	
Sto0011W	17 September 2007	0.00	0.60	20.70	986	-0.21
Sto0011W	01 October 2007	0.40	0.10	21.10	997	0.2
Sto0011W	22 October 2007	0.00	10.90	8.90	994	-0.03
Sto0011W	05 November 2007	0.10	12.20	6.90	997	-0.07
Sto0011W	12 November 2007	0.00	0.00	21.10	1003	0.34
Sto0011W	19 November 2007	0.10	0.50	21.40	973	0.01
Sto0011W	26 November 2007	0.10	0.30	21.20	1004	0.16
Sto0011W	05 December 2007	0.10	7.00	13.40	974	0.01
Sto0011W	10 December 2007	0.10	0.30	21.30	990	-0.63
Sto0011W	17 December 2007	0.10	1.90	18.60	1008	0.83
Sto0011W	02 January 2008	0.20	13.70	5.20	985	1.08
Sto0011W	07 January 2008	0.20	0.30	21.70	980	0.6
Sto0011W	14 January 2008	11.70	21.10	1.30	965	0.19
Sto0011W	04 February 2008	0.00	0.20	21.00	973	0.07
Sto0011W	18 February 2008	0.00	4.60	14.50	1007	0.53
Sto0011W	25 February 2008	0.00	7.10	14.50	989	0.22
Sto0011W	10 March 2008	9.50	25.50	1.00	934	0.9
Sto0011W	25 March 2008	0.00	0.00	21.30	983	0.3
Sto0011W	31 March 2008	0.00	0.00	21.00	991	-0.04
Sto0011W	18 April 2008	0.00	13.00	7.30	976	0.29
Sto0011W	23 April 2008	0.00	0.00	21.50	995	-0.41
Sto0011W	30 April 2008	3.80	17.60	0.80	967	-0.35
Averages		1.36	6.24	14.50		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0032D	09 May 2007	8.80	16.10	9.00	989	1.76
Sto0032D	29 May 2007	0.00	0.00	21.60	986	0.2
Sto0032D	06 June 2007	0.80	1.00	20.90	1001	0.35
Sto0032D	13 June 2007	30.20	40.50	1.90	985	-0.12
Sto0032D	20 June 2007	0.00	0.00	20.80	986	0.53
Sto0032D	27 June 2007	0.20	0.60	20.10	982	0.79
Sto0032D	11 July 2007	0.00	0.10	21.40	991	-0.02
Sto0032D	01 August 2007	4.00	5.30	18.20	992	
Sto0032D	15 August 2007	0.00	0.00	20.80	972	
Sto0032D	30 August 2007	0.20	0.40	17.90	999	
Sto0032D	03 September 2007	0.00	0.10	21.60	999	
Sto0032D	17 September 2007	0.00	2.60	19.10	986	-0.19
Sto0032D	01 October 2007	0.40	0.10	21.00	997	0.32
Sto0032D	22 October 2007	0.70	1.00	20.50	995	-0.08
Sto0032D	05 November 2007	2.10	3.90	17.70	996	0.07
Sto0032D	12 November 2007	0.00	0.10	21.00	1002	0.4
Sto0032D	19 November 2007	0.20	1.00	21.30	972	0.07
Sto0032D	26 November 2007	0.30	0.80	20.30	1004	0.02
Sto0032D	05 December 2007	0.20	0.50	20.80	973	-0.14
Sto0032D	10 December 2007	0.10	0.40	21.30	989	-0.45
Sto0032D	17 December 2007	0.10	0.70	21.10	1007	0.99
Sto0032D	02 January 2008	2.60	1.00	20.40	985	0.85
Sto0032D	07 January 2008	5.10	0.80	18.80	980	1.13
Sto0032D	14 January 2008	0.00	0.20	21.10	965	0.18
Sto0032D	04 February 2008	0.00	0.20	20.80	971	-0.01
Sto0032D	18 February 2008	2.00	4.50	15.50	1007	0.18
Sto0032D	25 February 2008	20.00	19.20	1.80	988	0.11
Sto0032D	10 March 2008	0.20	0.20	18.90	934	0.12
Sto0032D	25 March 2008	0.00	0.50	20.80	983	0.14
Sto0032D	31 March 2008	0.00	0.00	21.00	991	0.06
Averages		2.61	4.08	17.69		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0032S	23 April 2008	0.10	0.00	21.40	995	-0.36
Sto0032S	30 April 2008	0.00	0.10	21.10	967	-0.3
Sto0034S	02 May 2007	0.00	1.00	20.50	997	2.06
Sto0034S	09 May 2007	0.00	0.50	21.30	989	3.54
Sto0034S	16 May 2007	0.00	0.10	21.00	989	2.48
Sto0034S	29 May 2007	0.00	0.30	21.10	987	0.13
Sto0034S	06 June 2007	0.00	0.00	21.70	1001	1.02
Sto0034S	13 June 2007	0.00	6.70	14.00	985	0.06
Sto0034S	20 June 2007	0.00	0.00	20.60	986	0.4
Sto0034S	27 June 2007	0.00	0.00	20.50	983	0.16
Sto0034S	03 July 2007	0.00	0.00	20.30	974	-0.27
Sto0034S	11 July 2007	0.00	0.10	21.40	992	0.1
Sto0034S	01 August 2007	0.00	5.20	13.80	992	
Sto0034S	15 August 2007	0.00	0.10	20.90	972	
Sto0034S	30 August 2007	0.00	0.40	17.90	999	
Sto0034S	03 September 2007	0.00	0.00	21.60	999	
Sto0034S	17 September 2007	0.00	1.10	21.10	986	-0.11
Sto0034S	01 October 2007	0.60	0.10	21.20	997	0.34
Sto0034S	22 October 2007	0.00	0.10	21.20	995	-0.05
Sto0034S	05 November 2007	0.10	0.10	21.10	998	0.18
Sto0034S	05 November 2007	0.10	0.10	21.20	998	-14.9
Sto0034S	12 November 2007	0.00	0.10	20.10	1003	0.51
Sto0034S	19 November 2007	0.10	0.60	21.30	972	-0.33
Sto0034S	26 November 2007	0.10	0.50	21.20	1004	-0.04
Sto0034S	05 December 2007	0.10	0.50	21.10	974	0.28
Sto0034S	10 December 2007	0.10	0.40	21.50	990	-0.03
Sto0034S	17 December 2007	0.10	0.60	21.80	1008	0.72
Sto0034S	02 January 2008	0.10	0.70	21.50	985	0.7
Sto0034S	07 January 2008	0.20	0.90	21.50	980	0.65
Sto0034S	07 January 2008	0.20	0.50	21.60	980	0.69
Sto0034S	14 January 2008	0.00	0.40	21.40	966	0.62
Sto0034S	04 February 2008	0.00	0.50	20.80	972	0.15
Sto0034S	18 February 2008	0.00	0.70	21.10	1007	0.24
Sto0034S	25 February 2008	0.00	0.00	21.20	989	0.1
Sto0034S	10 March 2008	0.00	0.00	21.00	935	0.18
Sto0034S	25 March 2008	0.10	0.10	21.50	984	0.25
Sto0034S	31 March 2008	0.00	0.00	20.80	991	1.37
Sto0034S	18 April 2008	0.00	0.30	21.20	977	0.29
Sto0034S	23 April 2008	0.00	0.00	21.40	995	-0.32
Sto0034S	30 April 2008	0.00	0.00	21.10	967	-0.31
Averages		0.05	0.57	20.70		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0035S	09 May 2007	0.00	1.20	18.80	989	-0.82
Sto0035S	29 May 2007	0.00	0.00	21.60	987	0.22
Sto0035S	06 June 2007	0.00	2.70	17.30	1000	0.34
Sto0035S	13 June 2007	0.00	3.00	17.10	986	-0.02
Sto0035S	20 June 2007	0.00	0.00	20.60	986	0.38
Sto0035S	27 June 2007	0.00	0.00	20.40	983	0.39
Sto0035S	03 July 2007	0.00	0.00	20.30	975	-0.19
Sto0035S	11 July 2007	0.00	0.00	21.40	991	0
Sto0035S	01 August 2007	0.00	0.00	21.40	992	
Sto0035S	15 August 2007	0.00	5.20	14.10	972	
Sto0035S	03 September 2007	0.00	5.30	15.40	999	
Sto0035S	17 September 2007	0.00	2.30	15.70	986	-0.42
Sto0035S	01 October 2007	0.60	5.30	15.20	997	0.11
Sto0035S	22 October 2007	0.10	1.70	20.00	995	-0.14
Sto0035S	05 November 2007	0.10	1.80	19.60	997	0.11
Sto0035S	12 November 2007	0.00	0.00	21.10	1003	0.27
Sto0035S	19 November 2007	0.10	0.40	21.70	972	-0.12
Sto0035S	26 November 2007	0.10	0.40	21.10	1005	0.06
Sto0035S	05 December 2007	0.20	0.50	21.30	974	0.16
Sto0035S	10 December 2007	0.10	0.30	21.50	990	-0.24
Sto0035S	17 December 2007	0.10	0.40	21.90	1008	0.52
Sto0035S	02 January 2008	0.10	0.50	21.90	986	1.19
Sto0035S	07 January 2008	0.20	0.30	21.50	979	0.7
Sto0035S	14 January 2008	0.10	0.40	21.20	965	0.37
Sto0035S	04 February 2008	0.00	0.30	21.10	973	0.33
Sto0035S	18 February 2008	0.00	0.70	20.50	1007	0.2
Sto0035S	25 February 2008	0.00	0.00	21.30	989	0.19
Sto0035S	10 March 2008	0.00	0.00	21.10	934	-0.01
Sto0035S	25 March 2008	0.00	0.00	21.60	984	0.35
Sto0035S	31 March 2008	0.00	0.00	20.90	990	0.08
Sto0035S	18 April 2008	0.00	0.00	21.60	977	0.28
Sto0035S	23 April 2008	0.00	0.00	21.30	994	-0.42
Sto0035S	23 April 2008	0.00	0.00	21.30	994	-0.33
Sto0035S	30 April 2008	0.00	0.00	21.20	966	-0.32
Averages		0.05	0.96	20.12		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0036S	09 May 2007	0.00	0.50	21.00	989	-0.66
Sto0036S	29 May 2007	0.00	0.00	21.40	987	0.24
Sto0036S	06 June 2007	0.00	0.00	21.70	1001	0.34
Sto0036S	13 June 2007	0.00	0.00	21.10	985	-0.05
Sto0036S	20 June 2007	0.00	0.00	20.60	986	0.34
Sto0036S	27 June 2007	0.00	0.00	20.60	983	0.41
Sto0036S	03 July 2007	0.00	0.00	20.30	975	-0.16
Sto0036S	11 July 2007	0.00	0.00	21.50	991	0
Sto0036S	01 August 2007	0.00	0.00	21.50	993	
Sto0036S	15 August 2007	0.00	0.00	21.00	972	
Sto0036S	03 September 2007	0.00	0.00	21.70	1000	
Sto0036S	17 September 2007	0.00	1.30	21.00	986	0.03
Sto0036S	01 October 2007	0.60	0.30	21.00	997	0.18
Sto0036S	22 October 2007	0.10	0.10	21.40	995	-0.15
Sto0036S	05 November 2007	0.10	0.30	20.90	998	0.14
Sto0036S	12 November 2007	0.00	0.00	21.20	1002	0.17
Sto0036S	19 November 2007	0.10	0.40	21.70	973	-0.22
Sto0036S	26 November 2007	0.10	0.30	21.30	1004	-0.12
Sto0036S	05 December 2007	0.10	0.40	21.30	975	-0.02
Sto0036S	10 December 2007	0.10	0.30	21.50	990	-0.2
Sto0036S	17 December 2007	0.10	0.30	21.90	1008	0.75
Sto0036S	02 January 2008	0.10	0.40	21.90	986	0.66
Sto0036S	07 January 2008	0.20	0.30	21.70	980	0.69
Sto0036S	14 January 2008	0.10	0.30	21.30	965	0.17
Sto0036S	04 February 2008	0.00	0.40	21.00	972	-0.05
Sto0036S	18 February 2008	0.10	0.40	21.20	1008	0.3
Sto0036S	25 February 2008	0.00	0.00	21.50	989	0.27
Sto0036S	10 March 2008	0.00	0.00	21.00	934	0
Sto0036S	25 March 2008	0.00	0.00	21.70	984	0.09
Sto0036S	31 March 2008	0.00	0.00	20.90	991	0.02
Sto0036S	18 April 2008	0.00	0.00	21.40	976	0.04
Sto0036S	23 April 2008	0.10	0.00	21.30	995	-0.29
Sto0036S	30 April 2008	0.00	0.00	21.20	967	-0.34
Averages		0.06	0.18	21.26		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto006WD	09 May 2007	17.90	28.00	10.70	989	1.2
Sto006WD	16 May 2007	14.50	32.60	10.50	989	0.09
Sto006WD	29 May 2007	11.80	29.00	10.10	988	0.06
Sto006WD	06 June 2007	8.30	21.40	12.40	1001	0.41
Sto006WD	20 June 2007	7.50	22.60	10.70	987	0.46
Sto006WD	27 June 2007	6.50	22.50	10.60	983	0.14
Sto006WD	03 July 2007	5.00	21.10	11.00	974	0.07
Sto006WD	11 July 2007	3.00	15.40	13.60	991	-0.01
Sto006WD	01 August 2007	3.40	18.90	11.20	993	
Sto006WD	15 August 2007	3.40	22.30	9.50	972	
Sto006WD	30 August 2007	1.60	12.80	16.80	999	
Sto006WD	03 September 2007	1.90	16.90	12.30	999	
Sto006WD	17 September 2007	1.60	11.00	13.90	986	-0.29
Sto006WD	01 October 2007	1.20	13.90	14.40	998	0.15
Sto006WD	22 October 2007	0.50	3.50	20.00	996	-0.23
Sto006WD	05 November 2007	0.60	2.50	20.00	998	0.08
Sto006WD	12 November 2007	6.50	10.20	17.70	1002	0.24
Sto006WD	19 November 2007	5.30	12.50	16.80	973	-0.4
Sto006WD	26 November 2007	2.30	5.70	19.10	1005	0.08
Sto006WD	05 December 2007	8.00	18.90	14.50	975	-0.04
Sto006WD	10 December 2007	5.70	11.30	17.50	990	-0.14
Sto006WD	17 December 2007	6.00	12.20	18.00	1010	0.86
Sto006WD	02 January 2008	7.20	12.90	17.80	987	0.93
Sto006WD	07 January 2008	10.60	20.70	15.10	980	0.72
Sto006WD	14 January 2008	16.80	32.00	10.60	966	0.38
Sto006WD	04 February 2008	14.00	24.10	12.70	973	0.37
Sto006WD	18 February 2008	8.20	14.10	15.70	1008	0.33
Sto006WD	25 February 2008	5.60	9.70	18.00	990	0.26
Sto006WD	10 March 2008	18.30	31.90	10.30	934	0.13
Sto006WD	25 March 2008	1.90	4.40	20.00	983	0.23
Sto006WD	31 March 2008	2.20	5.30	18.70	990	0.14
Sto006WD	16 April 2008	1.60	3.90	20.30	996	0.07
Sto006WD	23 April 2008	7.80	18.40	13.60	994	-0.32
Sto006WD	30 April 2008	9.60	25.00	10.20	966	-0.24
Averages		6.66	16.69	14.54		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto009WD	09 May 2007	0.40	0.30	21.00	989	-0.62
Sto009WD	16 May 2007	0.00	0.20	20.90	989	0.15
Sto009WD	29 May 2007	0.00	0.00	21.60	987	0.12
Sto009WD	29 May 2007	0.00	0.00	21.50	987	0.22
Sto009WD	06 June 2007	0.00	0.00	21.80	1000	0.37
Sto009WD	13 June 2007	0.30	0.10	21.10	985	-0.04
Sto009WD	20 June 2007	0.00	0.00	20.70	986	0.4
Sto009WD	27 June 2007	0.00	0.00	20.30	983	0.31
Sto009WD	11 July 2007	0.00	0.00	21.70	991	-0.04
Sto009WD	01 August 2007	0.70	0.20	21.30	992	
Sto009WD	15 August 2007	0.00	0.00	20.90	972	
Sto009WD	03 September 2007	0.00	0.00	21.70	999	
Sto009WD	17 September 2007	0.00	0.50	20.90	986	-0.09
Sto009WD	01 October 2007	0.80	0.30	20.90	997	0.24
Sto009WD	22 October 2007	2.00	1.20	20.60	995	-0.07
Sto009WD	05 November 2007	0.30	0.30	20.80	997	0.01
Sto009WD	12 November 2007	0.00	0.00	21.20	1002	0.34
Sto009WD	19 November 2007	0.20	1.30	21.40	972	0.03
Sto009WD	26 November 2007	0.10	0.30	21.10	1004	0.24
Sto009WD	05 December 2007	0.20	1.20	20.90	974	0.3
Sto009WD	10 December 2007	0.30	0.80	21.20	990	-0.12
Sto009WD	17 December 2007	0.20	0.40	21.90	1008	0.58
Sto009WD	02 January 2008	1.20	0.70	21.30	986	1.2
Sto009WD	07 January 2008	0.20	0.30	21.80	980	0.61
Sto009WD	14 January 2008	0.00	0.20	21.30	965	0.18
Sto009WD	04 February 2008	0.00	0.30	21.00	971	0.02
Sto009WD	18 February 2008	1.90	0.70	20.70	1007	0.38
Sto009WD	25 February 2008	0.40	0.20	21.30	989	0.25
Sto009WD	10 March 2008	0.00	0.10	21.10	934	0.31
Sto009WD	25 March 2008	0.00	0.00	21.50	983	0.24
Sto009WD	31 March 2008	0.00	0.00	21.00	990	0.04
Sto009WD	16 April 2008	0.00	0.00	21.50	996	0.73
Sto009WD	23 April 2008	0.10	0.00	21.40	995	0.03
Sto009WD	30 April 2008	0.00	0.00	21.10	967	-0.22
Averages		0.27	0.28	21.19		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto009WS	09 May 2007	14.30	5.00	15.80	989	-0.28
Sto009WS	16 May 2007	0.00	0.10	21.00	989	0.06
Sto009WS	29 May 2007	0.00	0.00	21.60	987	0.2
Sto009WS	06 June 2007	0.00	1.30	18.80	1000	0.47
Sto009WS	13 June 2007	12.70	5.50	16.40	985	0.12
Sto009WS	20 June 2007	0.00	0.00	20.50	986	0.32
Sto009WS	27 June 2007	0.00	0.00	20.40	982	0.43
Sto009WS	11 July 2007	0.00	0.10	21.40	991	0.06
Sto009WS	01 August 2007	52.60	23.60	4.00	992	
Sto009WS	15 August 2007	0.00	0.00	21.00	972	
Sto009WS	03 September 2007	0.00	0.00	21.80	999	
Sto009WS	17 September 2007	0.00	0.40	20.70	986	-0.12
Sto009WS	01 October 2007	12.60	6.80	16.80	996	0.08
Sto009WS	22 October 2007	24.90	13.80	12.50	995	-0.15
Sto009WS	05 November 2007	15.10	10.00	14.40	997	0.15
Sto009WS	12 November 2007	0.00	0.00	21.10	1002	0.27
Sto009WS	19 November 2007	0.10	0.70	21.40	973	-0.23
Sto009WS	26 November 2007	0.10	0.20	21.30	1004	0.12
Sto009WS	05 December 2007	11.80	2.50	17.80	974	0.24
Sto009WS	10 December 2007	0.10	0.30	21.30	989	0.08
Sto009WS	17 December 2007	10.00	5.80	13.50	1008	0.75
Sto009WS	02 January 2008	29.80	15.60	9.00	985	1.38
Sto009WS	07 January 2008	0.20	0.30	21.70	980	0.75
Sto009WS	14 January 2008	0.10	0.20	21.40	965	0.11
Sto009WS	04 February 2008	0.00	0.20	20.90	972	-0.17
Sto009WS	18 February 2008	19.30	7.10	15.10	1007	0.18
Sto009WS	25 February 2008	29.50	14.40	11.90	988	0.13
Sto009WS	10 March 2008	0.10	0.10	21.10	934	-0.07
Sto009WS	25 March 2008	0.00	0.10	21.40	983	0.13
Sto009WS	31 March 2008	0.00	0.00	21.10	990	0.1
Sto009WS	16 April 2008	0.00	0.00	21.40	996	0.29
Sto009WS	23 April 2008	0.00	0.00	21.30	994	-32
Sto009WS	23 April 2008	0.00	0.00	21.40	994	-0.32
Sto009WS	30 April 2008	0.00	0.00	21.10	967	-0.34
Averages		6.86	3.36	18.60		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00PZ5	09 May 2007	0.10	11.70	8.00	990	0.92
Sto00PZ5	29 May 2007	0.00	19.80	2.90	987	2.52
Sto00PZ5	06 June 2007	0.10	22.00	2.30	1000	-6.46
Sto00PZ5	13 June 2007	0.50	25.10	1.60	985	0.05
Sto00PZ5	20 June 2007	0.40	25.40	2.00	986	1.8
Sto00PZ5	27 June 2007	0.40	22.50	4.60	983	12.79
Sto00PZ5	11 July 2007	0.40	17.80	7.10	991	0
Sto00PZ5	01 August 2007	0.00	2.20	19.20	992	
Sto00PZ5	15 August 2007	0.20	8.60	14.50	971	
Sto00PZ5	17 September 2007	0.20	13.40	9.30	984	-0.03
Sto00PZ5	01 October 2007	0.10	20.60	3.90	997	0.29
Sto00PZ5	22 October 2007	0.40	28.40	0.10	994	0.14
Sto00PZ5	05 November 2007	0.70	29.50	0.10	997	0.64
Sto00PZ5	12 November 2007	0.80	29.50	2.80	1003	0.38
Sto00PZ5	19 November 2007	1.20	29.10	0.70	972	-0.41
Sto00PZ5	26 November 2007	1.40	29.10	0.40	1004	0.01
Sto00PZ5	05 December 2007	1.50	30.00	0.40	974	-0.03
Sto00PZ5	10 December 2007	1.60	30.80	1.00	988	-0.16
Sto00PZ5	17 December 2007	1.60	29.60	1.50	1008	0.96
Sto00PZ5	02 January 2008	1.70	30.00	1.00	986	6.02
Sto00PZ5	07 January 2008	1.70	31.00	0.40	979	0.57
Sto00PZ5	14 January 2008	1.80	31.40	1.20	964	1.26
Sto00PZ5	04 February 2008	1.40	26.30	2.90	971	0.06
Sto00PZ5	25 February 2008	1.50	27.30	2.10	989	-0.88
Sto00PZ5	16 April 2008	1.50	25.00	1.80	996	-1.62
Sto00PZ5	23 April 2008	1.60	25.40	1.10	994	-2.08
Sto00PZ5	30 April 2008	1.30	19.70	5.40	967	-0.22
Averages		0.89	23.75	3.64		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto00PZ6	09 May 2007	0.00	3.00	15.80	990	-42.31
Sto00PZ6	29 May 2007	0.00	0.50	16.10	988	-39.38
Sto00PZ6	06 June 2007	0.00	0.60	15.60	1001	-119.59
Sto00PZ6	20 June 2007	0.00	0.30	16.40	987	-0.65
Sto00PZ6	27 June 2007	0.00	0.30	16.70	983	0.27
Sto00PZ6	11 July 2007	0.10	0.70	17.30	992	-9.42
Sto00PZ6	01 August 2007	0.00	0.10	19.90	993	
Sto00PZ6	15 August 2007	0.00	0.40	17.80	972	
Sto00PZ6	17 September 2007	0.00	4.60	19.30	986	-0.1
Sto00PZ6	01 October 2007	0.10	0.50	18.10	998	1.06
Sto00PZ6	22 October 2007	0.20	0.60	19.80	996	0.35
Sto00PZ6	05 November 2007	0.20	0.70	19.60	999	0.89
Sto00PZ6	12 November 2007	0.20	1.90	12.70	1003	-203.47
Sto00PZ6	19 November 2007	0.20	5.30	18.90	973	1.09
Sto00PZ6	26 November 2007	0.20	5.30	18.30	1006	1.15
Sto00PZ6	05 December 2007	0.30	4.60	18.70	975	-0.21
Sto00PZ6	10 December 2007	0.20	4.70	18.80	989	0.66
Sto00PZ6	17 December 2007	0.10	5.00	20.50	1009	1.31
Sto00PZ6	02 January 2008	0.20	5.60	20.00	987	1.95
Sto00PZ6	07 January 2008	0.30	5.90	19.50	980	1.8
Sto00PZ6	14 January 2008	0.40	5.70	19.50	966	1.37
Sto00PZ6	04 February 2008	0.20	5.70	19.20	973	-1.69
Sto00PZ6	25 February 2008	0.10	0.50	20.00	990	1.31
Sto00PZ6	16 April 2008	0.10	0.30	19.20	997	3.44
Sto00PZ6	23 April 2008	0.00	0.20	20.90	995	0.29
Sto00PZ6	30 April 2008	0.10	0.20	20.50	967	0.24
Averages		0.12	2.43	18.43		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto032WD	09 May 2007	1.00	5.20	17.00	989	-0.57
Sto032WD	16 May 2007	0.00	0.10	21.00	989	0.56
Sto032WD	29 May 2007	0.00	0.00	21.50	987	0.22
Sto032WD	06 June 2007	0.00	0.00	21.70	1001	0.42
Sto032WD	13 June 2007	18.50	24.00	9.90	985	0.04
Sto032WD	20 June 2007	0.00	0.00	20.70	986	0.38
Sto032WD	27 June 2007	1.30	1.50	19.40	983	0.4
Sto032WD	11 July 2007	0.20	0.50	20.90	991	-0.09
Sto032WD	01 August 2007	1.20	5.00	17.50	992	
Sto032WD	15 August 2007	2.10	3.10	19.50	972	
Sto032WD	30 August 2007	1.00	2.10	19.80	1000	
Sto032WD	03 September 2007	0.30	0.70	21.40	1000	
Sto032WD	17 September 2007	0.20	1.40	20.20	986	-0.3
Sto032WD	01 October 2007	0.40	0.50	21.10	997	0.26
Sto032WD	22 October 2007	0.10	0.20	21.40	995	0.22
Sto032WD	05 November 2007	0.20	0.30	20.70	997	-0.1
Sto032WD	12 November 2007	0.00	0.10	21.20	1001	0.7
Sto032WD	19 November 2007	0.10	0.80	21.40	972	-0.27
Sto032WD	26 November 2007	0.10	0.50	21.30	1004	0.39
Sto032WD	05 December 2007	0.20	0.50	21.10	974	0.17
Sto032WD	10 December 2007	0.10	0.40	21.50	990	-0.13
Sto032WD	17 December 2007	0.10	0.40	21.90	1008	0.86
Sto032WD	02 January 2008	0.20	0.50	21.60	986	0.87
Sto032WD	07 January 2008	0.20	0.30	21.60	980	0.86
Sto032WD	14 January 2008	0.00	0.20	21.40	966	0.36
Sto032WD	04 February 2008	0.00	0.20	20.80	972	0.26
Sto032WD	18 February 2008	0.30	1.00	20.60	1008	0.25
Sto032WD	25 February 2008	0.20	0.30	21.10	989	0.35
Sto032WD	10 March 2008	0.90	0.80	20.70	934	0.23
Sto032WD	25 March 2008	0.00	0.10	21.30	983	0.13
Sto032WD	31 March 2008	0.00	0.00	21.10	990	-0.01
Sto032WD	18 April 2008	4.40	3.70	15.20	976	0.29
Sto032WD	23 April 2008	0.00	0.00	21.50	995	-0.39
Sto032WD	30 April 2008	2.60	2.20	19.10	967	-0.31
Averages		1.06	1.66	20.24		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto033WD	09 May 2007	0.00	0.30	21.30	990	0.32
Sto033WD	16 May 2007	0.00	0.10	21.00	989	0.14
Sto033WD	29 May 2007	0.00	0.00	21.50	987	0.58
Sto033WD	06 June 2007	0.00	0.00	21.70	1000	0.77
Sto033WD	13 June 2007	0.00	0.00	21.20	985	0
Sto033WD	20 June 2007	0.00	0.00	20.50	986	0.9
Sto033WD	27 June 2007	0.00	0.00	20.40	982	0.78
Sto033WD	11 July 2007	0.00	0.10	21.30	991	-0.05
Sto033WD	01 August 2007	0.00	0.00	21.30	992	
Sto033WD	15 August 2007	0.00	0.00	21.00	972	
Sto033WD	03 September 2007	0.00	0.00	21.80	1000	
Sto033WD	17 September 2007	0.00	0.70	21.10	986	0.27
Sto033WD	01 October 2007	0.50	0.10	21.20	997	1.08
Sto033WD	22 October 2007	0.00	0.10	21.50	995	0.34
Sto033WD	05 November 2007	0.10	0.10	20.90	997	0.74
Sto033WD	12 November 2007	0.00	0.00	21.10	1002	2.52
Sto033WD	19 November 2007	0.10	0.50	21.50	972	-0.05
Sto033WD	26 November 2007	0.10	0.40	21.30	1004	0.21
Sto033WD	05 December 2007	0.10	0.50	21.10	974	0.04
Sto033WD	10 December 2007	0.10	0.40	21.50	990	-0.06
Sto033WD	17 December 2007	0.10	0.40	21.90	1008	0.7
Sto033WD	02 January 2008	0.20	0.40	21.90	986	0.94
Sto033WD	07 January 2008	0.20	0.40	21.80	980	0.56
Sto033WD	14 January 2008	0.00	0.30	21.40	965	0.16
Sto033WD	04 February 2008	0.00	0.40	20.90	973	-0.05
Sto033WD	18 February 2008	0.00	0.50	21.10	1007	0.34
Sto033WD	25 February 2008	0.00	0.00	21.40	989	0.33
Sto033WD	10 March 2008	0.00	0.00	21.10	934	0.14
Sto033WD	25 March 2008	0.00	0.00	21.60	984	0.09
Sto033WD	31 March 2008	0.00	0.00	20.90	991	0
Sto033WD	18 April 2008	0.00	0.80	21.20	976	0.18
Sto033WD	23 April 2008	0.00	0.00	21.30	995	0.13
Sto033WD	30 April 2008	0.00	0.00	21.10	967	-0.3
Averages		0.05	0.20	21.27		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto034WD	09 May 2007	0.00	0.50	20.00	989	1.24
Sto034WD	16 May 2007	0.00	0.10	21.00	989	0
Sto034WD	29 May 2007	0.00	0.00	21.50	987	1.56
Sto034WD	06 June 2007	0.00	6.40	11.60	1001	0.41
Sto034WD	13 June 2007	0.00	0.00	21.10	985	0.1
Sto034WD	20 June 2007	0.00	0.30	20.10	986	0.38
Sto034WD	27 June 2007	0.00	0.00	20.50	983	1.58
Sto034WD	03 July 2007	0.00	0.00	20.40	975	-0.03
Sto034WD	11 July 2007	0.00	4.30	15.00	991	0
Sto034WD	01 August 2007	0.00	0.00	21.50	993	
Sto034WD	15 August 2007	0.00	6.80	14.70	972	
Sto034WD	30 August 2007	0.00	3.70	18.60	1000	
Sto034WD	03 September 2007	0.00	7.00	15.20	1000	
Sto034WD	17 September 2007	0.00	2.10	18.20	986	-0.21
Sto034WD	01 October 2007	0.60	3.90	18.10	997	0.41
Sto034WD	22 October 2007	0.10	3.30	17.30	996	0.12
Sto034WD	05 November 2007	0.10	4.20	16.30	998	-0.14
Sto034WD	12 November 2007	0.00	2.10	19.10	1003	0.41
Sto034WD	19 November 2007	0.10	2.00	14.20	973	-0.23
Sto034WD	26 November 2007	0.10	1.20	17.20	1005	0.01
Sto034WD	05 December 2007	0.10	0.80	19.50	974	0.18
Sto034WD	10 December 2007	0.10	0.80	19.50	989	-0.24
Sto034WD	17 December 2007	0.10	2.80	16.70	1008	0.99
Sto034WD	02 January 2008	0.10	3.50	15.30	986	1.08
Sto034WD	07 January 2008	0.10	1.70	18.80	980	1.91
Sto034WD	14 January 2008	0.10	1.10	19.10	966	0.1
Sto034WD	04 February 2008	0.00	1.50	18.40	972	0.14
Sto034WD	18 February 2008	0.00	2.20	18.10	1008	0.35
Sto034WD	25 February 2008	0.10	3.00	18.60	990	0.28
Sto034WD	10 March 2008	0.20	1.10	19.90	934	0.29
Sto034WD	25 March 2008	0.00	2.70	19.10	985	0.18
Sto034WD	31 March 2008	0.00	1.10	19.80	991	0.07
Sto034WD	18 April 2008	0.00	3.60	18.60	976	0.29
Sto034WD	23 April 2008	0.00	2.60	19.10	995	-0.26
Sto034WD	30 April 2008	0.00	0.40	20.60	967	-0.3
Averages		0.05	2.19	18.36		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0012W	18 April 2008	0.00	2.30	13.40	977	0.52
Sto0012W	23 April 2008	0.10	1.80	14.70	996	-0.46
Sto0012W	30 April 2008	0.00	1.80	14.20	967	2.58
Sto0012W	02 May 2007	0.00	0.40	20.50	997	-2.34
Sto0012W	09 May 2007	0.00	1.20	19.60	989	1.36
Sto0012W	29 May 2007	0.00	0.50	20.30	988	0
Sto0012W	06 June 2007	0.00	0.70	18.70	1001	0.44
Sto0012W	13 June 2007	0.00	0.90	17.20	986	-0.01
Sto0012W	20 June 2007	0.00	0.60	18.70	986	0.5
Sto0012W	27 June 2007	0.00	0.70	18.40	983	0.28
Sto0012W	03 July 2007	0.00	0.90	17.80	975	0.23
Sto0012W	11 July 2007	0.00	0.30	21.10	992	0
Sto0012W	01 August 2007	0.00	0.30	21.00	992	
Sto0012W	15 August 2007	0.00	0.60	19.40	973	
Sto0012W	03 September 2007	0.00	2.80	18.10	1000	
Sto0012W	17 September 2007	0.00	1.40	13.40	986	-0.56
Sto0012W	01 October 2007	0.40	4.50	11.80	997	0.31
Sto0012W	22 October 2007	0.10	4.70	8.00	995	0.42
Sto0012W	05 November 2007	0.10	4.60	5.80	997	0.71
Sto0012W	12 November 2007	0.00	4.50	9.70	1003	0.59
Sto0012W	19 November 2007	0.10	2.70	5.60	972	3.57
Sto0012W	26 November 2007	0.10	1.20	15.70	1004	0.51
Sto0012W	05 December 2007	0.10	2.20	15.50	974	0.79
Sto0012W	10 December 2007	0.20	1.00	17.90	990	1.13
Sto0012W	17 December 2007	0.10	2.00	16.70	1008	1.32
Sto0012W	02 January 2008	0.10	3.00	16.60	985	1.37
Sto0012W	07 January 2008	0.20	1.20	17.10	981	0.94
Sto0012W	14 January 2008	0.10	2.40	16.40	966	0.44
Sto0012W	04 February 2008	0.00	0.60	18.30	973	-0.2
Sto0012W	18 February 2008	0.00	1.90	18.10	1008	0.77
Sto0012W	25 February 2008	0.00	2.60	16.90	989	1.35
Sto0012W	10 March 2008	0.00	2.90	8.30	935	-0.15
Sto0012W	25 March 2008	0.00	2.70	11.90	984	0.6
Sto0012W	31 March 2008	0.00	2.40	11.50	991	0.25
Averages		0.05	1.89	15.54		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0013W	18 April 2008	0.00	11.10	14.50	977	6.31
Sto0013W	23 April 2008	0.00	0.70	20.20	996	-4.61
Sto0013W	30 April 2008	0.10	16.10	3.70	968	3.35
Sto0013W	02 May 2007	0.00	0.30	20.80	997	-2.23
Sto0013W	09 May 2007	0.00	0.50	21.70	990	0.3
Sto0013W	16 May 2007	0.00	0.10	21.00	989	-0.16
Sto0013W	29 May 2007	0.00	0.10	21.20	988	0.03
Sto0013W	06 June 2007	0.00	1.70	21.00	1001	1.17
Sto0013W	13 June 2007	0.00	12.60	4.50	986	1.64
Sto0013W	20 June 2007	0.20	18.90	1.00	986	2.06
Sto0013W	27 June 2007	0.60	25.00	0.50	983	4.78
Sto0013W	03 July 2007	2.60	30.80	0.20	975	6.57
Sto0013W	11 July 2007	0.00	0.10	21.40	992	-2.45
Sto0013W	01 August 2007	0.00	3.10	20.30	993	
Sto0013W	15 August 2007	2.10	24.70	0.50	973	
Sto0013W	03 September 2007	0.00	1.20	20.60	1000	
Sto0013W	17 September 2007	0.00	3.50	16.10	987	-1.36
Sto0013W	01 October 2007	0.30	3.80	17.60	998	-0.22
Sto0013W	22 October 2007	0.00	12.00	12.10	995	0.35
Sto0013W	05 November 2007	0.10	11.40	11.20	997	0.95
Sto0013W	12 November 2007	0.00	6.00	16.70	1003	-0.1
Sto0013W	19 November 2007	0.10	1.10	20.60	973	-2.57
Sto0013W	26 November 2007	0.10	0.40	21.40	1005	-3.16
Sto0013W	05 December 2007	0.10	7.10	17.70	974	2.23
Sto0013W	10 December 2007	0.10	0.40	21.10	990	-16.63
Sto0013W	17 December 2007	0.10	2.00	20.90	1008	2.33
Sto0013W	02 January 2008	0.10	14.00	10.10	985	5.85
Sto0013W	07 January 2008	0.20	0.60	21.20	981	-4.12
Sto0013W	14 January 2008	2.40	25.60	1.30	966	4.92
Sto0013W	04 February 2008	3.80	21.70	3.90	973	-0.65
Sto0013W	18 February 2008	0.00	2.20	20.10	1008	3.28
Sto0013W	25 February 2008	0.00	3.70	16.80	989	3.98
Sto0013W	10 March 2008	6.70	33.10	0.70	935	22.97
Sto0013W	25 March 2008	0.00	0.20	20.70	984	-1.37
Sto0013W	31 March 2008	0.00	0.80	20.00	992	-8.88
Averages		0.56	8.47	14.38		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0014D	18 April 2008	0.00	1.00	20.80	977	2.21
Sto0014D	23 April 2008	0.00	1.20	20.70	995	-0.34
Sto0014D	30 April 2008	0.00	1.50	20.70	968	-0.38
Sto0014D	02 May 2007	0.00	0.90	20.50	997	-1.19
Sto0014D	09 May 2007	0.00	0.60	21.50	989	0.88
Sto0014D	29 May 2007	0.00	0.70	21.30	987	0.11
Sto0014D	06 June 2007	0.00	1.70	21.20	1001	0.35
Sto0014D	20 June 2007	0.00	0.80	20.40	986	0.49
Sto0014D	27 June 2007	0.00	3.30	19.20	983	-0.84
Sto0014D	03 July 2007	0.00	4.10	17.70	974	-0.2
Sto0014D	11 July 2007	0.00	2.40	20.60	992	-0.29
Sto0014D	01 August 2007	0.00	2.30	20.40	992	
Sto0014D	15 August 2007	0.00	3.10	19.80	973	
Sto0014D	03 September 2007	0.00	3.00	20.50	1000	
Sto0014D	17 September 2007	0.00	2.40	20.10	987	-0.2
Sto0014D	01 October 2007	0.30	2.20	20.40	997	0.15
Sto0014D	22 October 2007	0.10	2.50	20.30	995	0.29
Sto0014D	05 November 2007	0.10	2.10	20.10	998	0.16
Sto0014D	12 November 2007	0.00	2.10	20.60	1003	0.15
Sto0014D	19 November 2007	0.10	1.80	20.90	973	-0.06
Sto0014D	26 November 2007	0.10	0.90	21.20	1004	0.16
Sto0014D	05 December 2007	0.10	2.10	20.70	974	0.12
Sto0014D	10 December 2007	0.10	2.00	20.80	990	0
Sto0014D	17 December 2007	0.10	3.00	21.10	1008	0.81
Sto0014D	02 January 2008	0.20	3.30	20.60	986	0.95
Sto0014D	07 January 2008	0.20	2.10	21.20	981	0.86
Sto0014D	14 January 2008	0.00	2.10	20.40	966	0.22
Sto0014D	04 February 2008	0.00	2.30	20.10	973	1.36
Sto0014D	18 February 2008	0.00	3.00	20.30	1007	0.39
Sto0014D	25 February 2008	0.00	3.40	20.50	988	0.31
Sto0014D	10 March 2008	0.00	1.50	20.50	935	0.19
Sto0014D	25 March 2008	0.00	1.40	20.50	983	0.22
Sto0014D	31 March 2008	0.00	2.40	20.40	991	0.17
Averages		0.04	2.10	20.48		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0014S	18 April 2008	0.00	3.00	20.30	977	0.3
Sto0014S	23 April 2008	0.10	2.30	20.40	995	-0.4
Sto0014S	30 April 2008	0.00	2.00	20.80	967	-0.37
Sto0014S	02 May 2007	0.00	0.70	21.00	998	-1.18
Sto0014S	09 May 2007	0.00	0.90	21.20	989	-0.14
Sto0014S	29 May 2007	0.00	1.70	21.00	987	0.14
Sto0014S	06 June 2007	0.00	0.60	21.70	1001	0.41
Sto0014S	20 June 2007	0.00	1.70	20.10	986	0.35
Sto0014S	27 June 2007	0.00	0.80	20.10	984	0.36
Sto0014S	03 July 2007	0.00	5.10	17.60	975	-0.03
Sto0014S	11 July 2007	0.00	0.80	21.20	992	0
Sto0014S	01 August 2007	0.00	0.80	21.10	992	
Sto0014S	15 August 2007	0.00	1.10	20.60	973	
Sto0014S	03 September 2007	0.00	0.70	21.40	1000	
Sto0014S	17 September 2007	0.00	1.30	20.70	987	-0.36
Sto0014S	01 October 2007	0.20	0.70	20.90	998	0.11
Sto0014S	22 October 2007	0.10	1.10	21.00	995	0.15
Sto0014S	05 November 2007	0.10	0.90	20.60	998	-0.06
Sto0014S	12 November 2007	0.00	1.30	20.70	1002	0.16
Sto0014S	19 November 2007	0.10	1.20	21.10	972	-0.15
Sto0014S	26 November 2007	0.10	0.60	21.20	1004	0.23
Sto0014S	05 December 2007	0.10	0.90	21.00	974	0.04
Sto0014S	10 December 2007	0.10	1.30	20.90	990	0.05
Sto0014S	17 December 2007	0.10	1.80	21.20	1008	0.75
Sto0014S	02 January 2008	0.10	1.70	21.20	986	0.86
Sto0014S	07 January 2008	0.10	1.20	21.40	981	0.85
Sto0014S	14 January 2008	0.00	2.60	20.50	966	0.48
Sto0014S	04 February 2008	0.00	3.10	19.90	973	0.31
Sto0014S	18 February 2008	0.00	1.80	20.60	1008	0.26
Sto0014S	25 February 2008	0.00	1.50	21.20	989	0.33
Sto0014S	10 March 2008	0.10	3.30	20.10	935	0.26
Sto0014S	25 March 2008	0.00	2.60	20.20	983	0.27
Sto0014S	31 March 2008	0.00	2.10	20.50	991	0.1
Averages		0.04	1.61	20.71		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0015S	18 April 2008	0.00	0.30	21.00	976	0.34
Sto0015S	23 April 2008	0.10	3.40	19.90	995	-0.35
Sto0015S	30 April 2008	0.00	0.00	21.60	967	-0.4
Sto0015S	02 May 2007	0.00	0.30	20.70	997	-0.95
Sto0015S	09 May 2007	0.00	0.40	21.50	989	3.62
Sto0015S	16 May 2007	0.00	1.10	20.50	989	0.09
Sto0015S	29 May 2007	0.00	0.50	21.30	988	0.12
Sto0015S	06 June 2007	0.00	0.20	21.60	1001	0.36
Sto0015S	13 June 2007	0.00	0.50	20.40	985	-0.1
Sto0015S	20 June 2007	0.00	0.90	20.20	987	0.39
Sto0015S	27 June 2007	0.00	4.00	17.80	984	0.46
Sto0015S	11 July 2007	0.00	3.30	19.40	992	-0.07
Sto0015S	01 August 2007	0.00	4.40	18.40	992	
Sto0015S	15 August 2007	0.00	3.50	19.40	973	
Sto0015S	03 September 2007	0.00	0.00	21.60	1000	
Sto0015S	17 September 2007	0.00	0.50	20.90	987	-0.32
Sto0015S	01 October 2007	0.20	0.10	21.10	998	0.36
Sto0015S	22 October 2007	0.10	0.60	21.00	995	-0.14
Sto0015S	05 November 2007	0.10	6.70	17.40	998	0.12
Sto0015S	12 November 2007	0.00	0.80	21.00	1002	0.35
Sto0015S	19 November 2007	0.10	0.40	21.50	972	-0.06
Sto0015S	26 November 2007	0.10	0.30	21.50	1005	-11.6
Sto0015S	05 December 2007	0.10	1.40	20.50	974	0.21
Sto0015S	10 December 2007	0.10	0.40	21.20	991	-0.23
Sto0015S	17 December 2007	0.10	1.00	21.40	1008	0.82
Sto0015S	02 January 2008	0.10	2.50	20.70	986	0.82
Sto0015S	07 January 2008	0.20	3.20	20.30	981	1.03
Sto0015S	14 January 2008	0.00	2.70	19.80	966	0.37
Sto0015S	04 February 2008	0.00	3.80	19.30	973	0.12
Sto0015S	18 February 2008	0.10	1.70	20.20	1008	0.29
Sto0015S	25 February 2008	0.00	7.40	18.20	989	0.26
Sto0015S	10 March 2008	0.00	0.40	21.10	935	0.21
Sto0015S	25 March 2008	0.00	1.90	20.00	983	0.4
Sto0015S	31 March 2008	0.00	0.00	21.20	991	-0.05
Averages		0.04	1.72	20.40		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0016W	18 April 2008	0.00	12.60	15.90	977	0.26
Sto0016W	23 April 2008	0.00	5.60	18.70	995	-0.39
Sto0016W	30 April 2008	0.10	14.10	15.60	968	-0.35
Sto0016W	02 May 2007	0.00	2.70	19.10	997	-0.79
Sto0016W	09 May 2007	0.00	3.40	19.60	990	-0.47
Sto0016W	16 May 2007	0.00	4.40	13.30	989	0.07
Sto0016W	29 May 2007	0.00	3.70	19.90	988	0.13
Sto0016W	06 June 2007	0.00	4.10	19.90	1001	0.43
Sto0016W	20 June 2007	0.00	5.10	18.40	986	0.3
Sto0016W	27 June 2007	0.00	7.40	17.40	984	0.05
Sto0016W	11 July 2007	0.00	7.10	18.50	992	-0.51
Sto0016W	01 August 2007	0.00	11.70	16.70	992	
Sto0016W	15 August 2007	0.00	4.90	18.90	973	
Sto0016W	03 September 2007	0.00	5.30	19.20	1000	
Sto0016W	17 September 2007	0.00	3.00	19.20	987	-0.2
Sto0016W	01 October 2007	0.10	9.30	17.50	998	0.25
Sto0016W	22 October 2007	0.00	11.40	16.60	995	0
Sto0016W	05 November 2007	0.10	8.60	17.50	997	0.01
Sto0016W	12 November 2007	0.00	9.90	18.40	1003	0.4
Sto0016W	19 November 2007	0.10	8.20	17.70	973	-0.1
Sto0016W	26 November 2007	0.10	4.60	19.20	1005	-0.09
Sto0016W	05 December 2007	0.10	4.20	19.50	974	0.31
Sto0016W	10 December 2007	0.10	2.20	20.30	991	-0.14
Sto0016W	17 December 2007	0.10	11.90	16.90	1008	0.95
Sto0016W	02 January 2008	0.10	13.00	16.40	986	1.03
Sto0016W	07 January 2008	0.20	1.80	20.90	982	0.65
Sto0016W	14 January 2008	0.00	10.40	16.80	966	0.2
Sto0016W	04 February 2008	0.00	2.50	19.70	972	-0.07
Sto0016W	18 February 2008	0.00	11.00	16.30	1008	0.34
Sto0016W	25 February 2008	0.00	8.60	17.80	989	1.87
Sto0016W	10 March 2008	0.10	11.10	16.70	935	0.18
Sto0016W	25 March 2008	0.00	6.30	18.00	983	0.07
Sto0016W	31 March 2008	0.00	3.50	19.60	991	0.09
Averages		0.04	7.08	18.06		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0017W	18 April 2008	0.00	3.70	15.50	976	0.21
Sto0017W	23 April 2008	0.10	0.10	21.10	996	-0.47
Sto0017W	30 April 2008	0.00	5.00	13.50	968	-0.42
Sto0017W	02 May 2007	0.00	1.10	19.70	997	-0.77
Sto0017W	09 May 2007	0.00	1.00	21.20	989	-0.38
Sto0017W	29 May 2007	0.00	4.20	13.10	988	0.11
Sto0017W	06 June 2007	0.00	2.30	17.70	1001	0.54
Sto0017W	20 June 2007	0.00	6.60	9.20	987	0.35
Sto0017W	27 June 2007	0.00	4.30	13.80	984	0.27
Sto0017W	03 July 2007	0.00	5.80	12.10	976	0
Sto0017W	11 July 2007	0.00	3.70	16.00	992	-0.18
Sto0017W	01 August 2007	0.00	4.80	13.80	992	
Sto0017W	15 August 2007	0.00	4.90	13.60	973	
Sto0017W	03 September 2007	0.00	0.80	20.10	1000	
Sto0017W	17 September 2007	0.00	2.30	18.90	987	-0.06
Sto0017W	01 October 2007	0.10	1.30	19.30	998	0.27
Sto0017W	22 October 2007	0.10	5.30	14.10	995	0.04
Sto0017W	05 November 2007	0.10	4.50	15.00	998	0.07
Sto0017W	12 November 2007	0.00	0.60	20.60	1002	0.36
Sto0017W	19 November 2007	0.10	1.70	19.90	973	0.05
Sto0017W	26 November 2007	0.10	0.90	21.10	1004	-1.16
Sto0017W	05 December 2007	0.10	1.90	19.30	975	0.04
Sto0017W	10 December 2007	0.10	0.60	21.20	991	-0.44
Sto0017W	17 December 2007	0.10	3.70	16.90	1008	0.6
Sto0017W	02 January 2008	0.10	5.00	14.60	986	0.95
Sto0017W	07 January 2008	0.10	0.60	21.40	981	0.57
Sto0017W	14 January 2008	0.00	4.50	14.00	966	0.19
Sto0017W	04 February 2008	0.00	1.40	18.90	973	0.03
Sto0017W	18 February 2008	0.10	2.30	18.40	1008	0.19
Sto0017W	25 February 2008	0.00	2.50	18.30	988	0.27
Sto0017W	10 March 2008	0.10	9.00	5.90	935	0.25
Sto0017W	25 March 2008	0.00	0.70	19.90	984	0.17
Sto0017W	31 March 2008	0.00	0.00	21.30	991	-0.08
Averages		0.04	2.94	16.95		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0018D	18 April 2008	0.00	0.30	20.50	977	0.2
Sto0018D	23 April 2008	0.10	0.20	21.10	996	-0.41
Sto0018D	30 April 2008	0.00	0.20	21.10	968	-0.37
Sto0018D	02 May 2007	0.00	0.60	20.20	997	-0.66
Sto0018D	09 May 2007	0.00	0.50	21.70	989	-0.41
Sto0018D	16 May 2007	0.00	0.20	20.60	989	0.03
Sto0018D	29 May 2007	0.00	0.70	19.00	988	-0.13
Sto0018D	06 June 2007	0.00	0.10	21.50	1001	0.47
Sto0018D	20 June 2007	0.00	1.10	15.10	987	-0.01
Sto0018D	27 June 2007	0.00	2.60	13.30	984	0.43
Sto0018D	03 July 2007	0.00	3.80	11.50	976	0.18
Sto0018D	11 July 2007	0.00	0.90	19.20	992	-0.18
Sto0018D	01 August 2007	0.00	0.90	19.80	992	
Sto0018D	15 August 2007	0.00	0.70	19.50	973	
Sto0018D	03 September 2007	0.00	0.50	20.10	1000	
Sto0018D	17 September 2007	0.00	1.00	20.20	987	1.67
Sto0018D	01 October 2007	0.20	0.30	20.80	998	0.26
Sto0018D	22 October 2007	0.00	1.00	18.50	995	0.02
Sto0018D	05 November 2007	0.10	0.20	20.70	997	2.2
Sto0018D	12 November 2007	0.00	0.50	20.20	1002	0.56
Sto0018D	19 November 2007	0.10	1.40	16.80	973	-0.07
Sto0018D	26 November 2007	0.10	0.60	21.00	1004	-0.65
Sto0018D	05 December 2007	0.10	0.90	20.20	975	0.24
Sto0018D	10 December 2007	0.10	0.90	19.60	991	-0.14
Sto0018D	17 December 2007	0.10	1.20	18.90	1008	0.73
Sto0018D	02 January 2008	0.10	1.60	18.90	986	0.69
Sto0018D	07 January 2008	0.20	0.90	20.20	982	1.05
Sto0018D	14 January 2008	0.10	2.20	15.30	966	0.45
Sto0018D	04 February 2008	0.00	1.00	18.70	973	0.05
Sto0018D	18 February 2008	0.00	0.80	20.80	1008	0.38
Sto0018D	25 February 2008	0.00	1.00	17.60	989	0.32
Sto0018D	10 March 2008	0.00	6.00	6.30	935	0.22
Sto0018D	25 March 2008	0.00	0.40	20.50	984	0.34
Sto0018D	31 March 2008	0.00	0.30	20.70	991	-0.09
Averages		0.04	1.04	18.83		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0019W	18 April 2008	0.00	2.20	10.90	976	0.09
Sto0019W	23 April 2008	0.00	0.00	21.50	995	-0.39
Sto0019W	30 April 2008	0.00	1.60	13.30	968	-0.47
Sto0019W	02 May 2007	0.00	0.40	20.20	997	-0.87
Sto0019W	09 May 2007	0.00	0.40	21.30	989	-0.53
Sto0019W	16 May 2007	0.00	0.10	21.00	989	0.04
Sto0019W	29 May 2007	0.00	0.80	18.20	988	0.16
Sto0019W	06 June 2007	0.00	0.20	21.00	1001	0.38
Sto0019W	20 June 2007	0.00	2.80	9.50	987	0.4
Sto0019W	27 June 2007	0.00	2.30	15.20	984	0.17
Sto0019W	03 July 2007	0.30	9.80	0.80	975	-0.05
Sto0019W	11 July 2007	0.00	0.20	21.10	992	-0.16
Sto0019W	01 August 2007	0.00	5.60	7.80	992	
Sto0019W	15 August 2007	0.00	0.40	21.10	973	
Sto0019W	03 September 2007	0.00	0.00	21.60	1000	
Sto0019W	17 September 2007	0.00	0.50	21.00	987	-0.3
Sto0019W	01 October 2007	0.10	0.20	21.00	997	0.12
Sto0019W	22 October 2007	0.10	3.00	13.60	995	0
Sto0019W	05 November 2007	0.10	2.00	15.90	997	0.18
Sto0019W	19 November 2007	0.10	0.60	21.40	973	0.18
Sto0019W	26 November 2007	0.10	0.30	21.30	1005	-1.62
Sto0019W	05 December 2007	0.10	0.40	21.40	975	0.2
Sto0019W	10 December 2007	0.10	0.40	21.30	991	-0.32
Sto0019W	17 December 2007	0.10	1.60	16.70	1009	0.73
Sto0019W	02 January 2008	0.10	3.60	9.70	985	0.68
Sto0019W	07 January 2008	0.10	0.40	21.60	981	0.99
Sto0019W	14 January 2008	0.00	1.60	19.30	966	0.58
Sto0019W	04 February 2008	0.00	0.40	21.00	974	0.19
Sto0019W	18 February 2008	0.00	0.70	19.70	1008	0.25
Sto0019W	25 February 2008	0.00	2.90	9.70	988	-0.39
Sto0019W	10 March 2008	0.60	7.80	2.80	935	0.16
Sto0019W	25 March 2008	0.00	0.10	21.00	983	0.22
Sto0019W	31 March 2008	0.00	0.00	21.30	991	0.16
Averages		0.06	1.62	17.10		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0020D	18 April 2008	0.00	0.20	20.30	976	0.09
Sto0020D	18 April 2008	0.00	3.40	9.70	977	0.13
Sto0020D	23 April 2008	0.10	0.00	21.60	996	-0.4
Sto0020D	30 April 2008	0.00	0.10	21.70	968	-0.38
Sto0020D	02 May 2007	0.00	0.20	20.20	997	-0.72
Sto0020D	09 May 2007	0.00	0.30	21.80	989	0.24
Sto0020D	16 May 2007	0.00	0.10	21.00	989	0.06
Sto0020D	29 May 2007	0.00	0.10	21.10	988	0.2
Sto0020D	06 June 2007	0.00	0.00	21.70	1001	0.37
Sto0020D	20 June 2007	0.00	0.20	19.70	987	0.28
Sto0020D	27 June 2007	0.00	0.20	19.90	984	0.44
Sto0020D	03 July 2007	0.30	0.90	17.30	975	0.93
Sto0020D	11 July 2007	0.00	0.20	21.10	992	-0.1
Sto0020D	01 August 2007	1.00	0.80	18.40	992	
Sto0020D	15 August 2007	0.00	0.10	21.30	973	
Sto0020D	03 September 2007	0.00	0.00	21.40	1000	
Sto0020D	17 September 2007	0.00	0.40	21.00	987	-0.33
Sto0020D	01 October 2007	0.10	0.10	21.00	997	0.4
Sto0020D	22 October 2007	0.10	0.10	20.90	995	0.15
Sto0020D	05 November 2007	0.10	0.10	20.90	998	0.17
Sto0020D	19 November 2007	0.10	0.40	21.30	973	0.09
Sto0020D	26 November 2007	0.10	0.30	21.20	1004	-2.18
Sto0020D	05 December 2007	0.10	0.40	21.40	975	0.24
Sto0020D	10 December 2007	0.10	0.30	21.20	991	0.19
Sto0020D	17 December 2007	0.10	0.60	21.50	1008	1.15
Sto0020D	02 January 2008	0.20	0.70	21.30	986	0.93
Sto0020D	07 January 2008	0.10	0.30	21.50	982	1.14
Sto0020D	14 January 2008	0.00	0.60	20.90	966	0.28
Sto0020D	04 February 2008	0.00	0.30	20.90	973	0.02
Sto0020D	18 February 2008	0.00	0.40	21.00	1008	0.22
Sto0020D	25 February 2008	0.00	0.30	20.00	988	0
Sto0020D	10 March 2008	0.40	1.40	16.80	935	0.17
Sto0020D	25 March 2008	0.00	0.10	21.10	984	-0.02
Sto0020D	31 March 2008	0.00	0.00	21.30	992	0.14
Averages		0.09	0.40	20.39		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto0020S	23 April 2008	0.00	0.00	21.60	996	-0.5
Sto0020S	30 April 2008	0.10	1.50	15.60	968	-0.34
Sto0020S	02 May 2007	0.00	0.10	20.30	998	-0.83
Sto0020S	09 May 2007	0.00	0.20	21.60	990	-0.44
Sto0020S	16 May 2007	0.00	0.00	21.00	989	0.02
Sto0020S	29 May 2007	0.00	1.90	9.40	988	0.1
Sto0020S	06 June 2007	0.00	0.00	21.90	1001	0.4
Sto0020S	20 June 2007	0.00	2.90	6.50	987	0.41
Sto0020S	27 June 2007	0.40	4.30	5.10	984	0.39
Sto0020S	03 July 2007	3.10	6.20	0.30	975	-0.04
Sto0020S	11 July 2007	0.10	1.80	15.50	992	-0.09
Sto0020S	01 August 2007	7.60	6.50	0.70	992	
Sto0020S	15 August 2007	13.90	7.30	2.50	973	
Sto0020S	03 September 2007	9.30	7.20	3.10	1000	
Sto0020S	17 September 2007	4.30	4.10	6.90	987	-0.33
Sto0020S	01 October 2007	0.20	2.40	15.10	997	0.4
Sto0020S	22 October 2007	0.90	6.60	7.70	995	-0.08
Sto0020S	05 November 2007	0.10	4.40	12.30	998	0.04
Sto0020S	19 November 2007	0.10	0.40	20.70	973	0.08
Sto0020S	26 November 2007	0.10	0.70	18.70	1004	-2.11
Sto0020S	05 December 2007	0.10	0.70	20.60	975	0.22
Sto0020S	10 December 2007	0.10	2.60	15.40	990	-0.31
Sto0020S	17 December 2007	0.10	3.00	15.40	1008	0.69
Sto0020S	02 January 2008	0.20	1.80	15.60	985	1
Sto0020S	07 January 2008	0.10	1.60	16.80	982	0.93
Sto0020S	14 January 2008	0.20	3.10	13.50	966	0.4
Sto0020S	04 February 2008	0.00	0.30	21.10	973	-0.01
Sto0020S	18 February 2008	0.10	0.80	19.40	1008	0.38
Sto0020S	25 February 2008	0.00	5.90	4.40	988	0.33
Sto0020S	10 March 2008	1.80	8.40	0.90	935	0.17
Sto0020S	25 March 2008	0.00	0.10	21.00	984	-0.03
Sto0020S	31 March 2008	0.00	0.00	21.40	991	0.14
Averages		1.34	2.71	13.50		

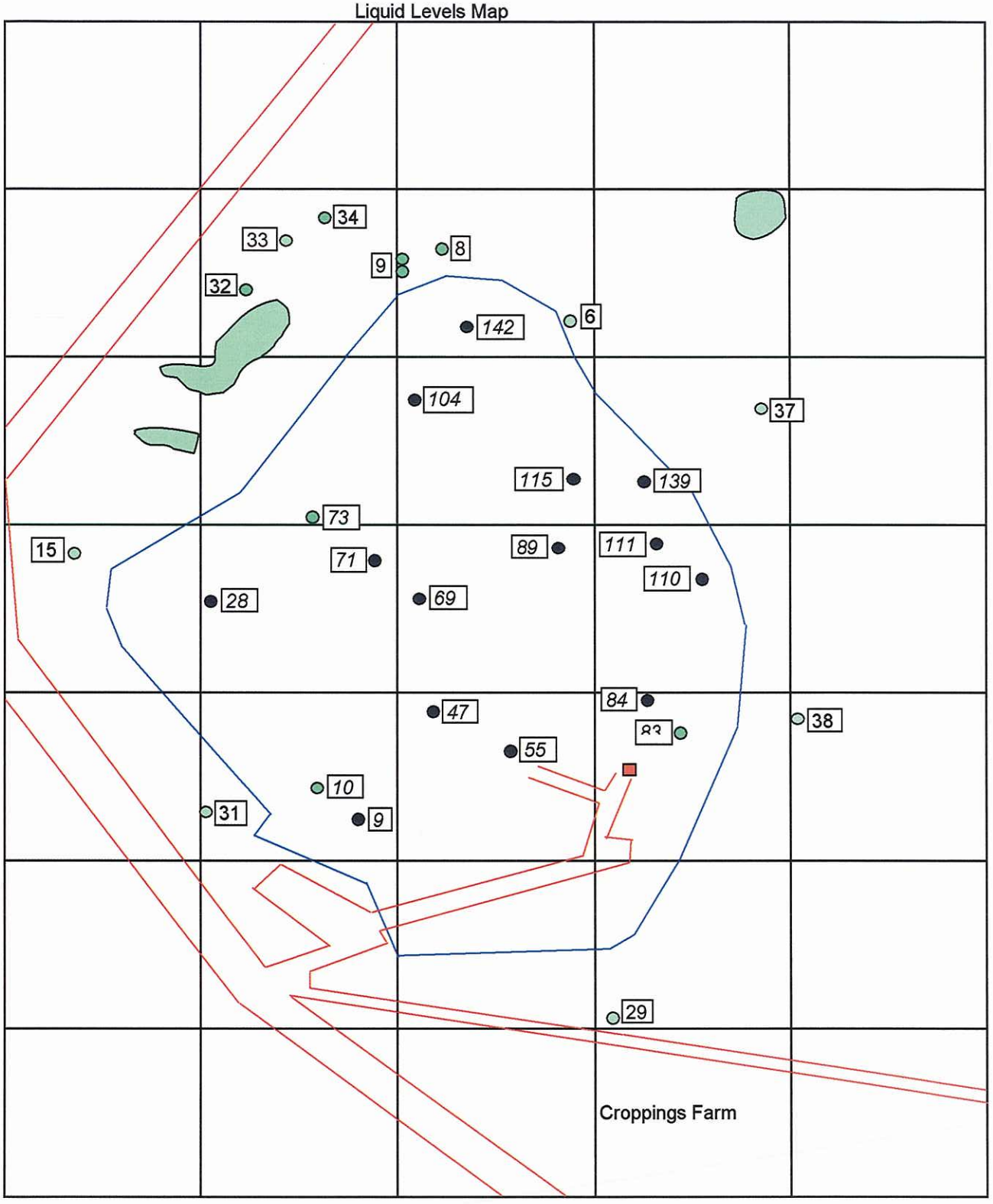
GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto015WD	18 April 2008	0.00	0.30	21.00	976	0.19
Sto015WD	23 April 2008	0.00	1.40	20.50	996	-0.42
Sto015WD	30 April 2008	0.10	0.50	21.20	968	-0.44
Sto015WD	02 May 2007	0.00	0.50	20.50	998	-0.84
Sto015WD	09 May 2007	0.00	0.60	21.40	989	-0.4
Sto015WD	16 May 2007	0.00	0.70	20.50	989	0.09
Sto015WD	29 May 2007	0.00	1.20	20.70	988	0.14
Sto015WD	06 June 2007	0.00	0.30	21.50	1001	0.47
Sto015WD	13 June 2007	0.00	0.90	20.10	986	0.06
Sto015WD	20 June 2007	0.00	1.00	20.00	986	0.37
Sto015WD	27 June 2007	0.00	5.40	17.30	984	0.32
Sto015WD	11 July 2007	0.00	5.00	17.50	992	-0.16
Sto015WD	01 August 2007	0.00	6.80	17.80	992	
Sto015WD	15 August 2007	0.00	5.80	18.60	973	
Sto015WD	03 September 2007	0.00	0.20	21.60	1000	
Sto015WD	17 September 2007	0.00	0.80	20.80	987	-0.2
Sto015WD	01 October 2007	0.20	0.50	20.90	997	0.11
Sto015WD	22 October 2007	0.00	1.20	20.50	995	0.15
Sto015WD	05 November 2007	0.10	3.60	18.80	998	0.22
Sto015WD	12 November 2007	0.00	0.60	20.90	1003	0.39
Sto015WD	19 November 2007	0.10	0.70	21.30	973	0.12
Sto015WD	26 November 2007	0.10	0.50	21.20	1004	-4.27
Sto015WD	05 December 2007	0.10	2.30	19.80	974	0.28
Sto015WD	10 December 2007	0.10	0.60	21.10	991	-0.15
Sto015WD	17 December 2007	0.10	1.70	20.90	1008	0.79
Sto015WD	02 January 2008	0.10	2.00	20.70	985	0.87
Sto015WD	07 January 2008	0.10	3.70	20.00	981	0.93
Sto015WD	14 January 2008	0.10	2.20	20.00	966	0.2
Sto015WD	04 February 2008	0.00	5.10	18.90	972	0.14
Sto015WD	18 February 2008	0.00	1.90	20.10	1008	0.17
Sto015WD	25 February 2008	0.00	3.20	19.90	989	0.19
Sto015WD	10 March 2008	0.00	1.00	20.60	935	0
Sto015WD	25 March 2008	0.00	1.30	20.20	983	0.09
Sto015WD	31 March 2008	0.00	0.20	21.00	991	0.03
Averages		0.04	1.87	20.23		

GAS WELL	DATE	CH4(%)	CO2(%)	O2(%)	BAROMETRIC PRESSURE (mb)	RELATIVE PRESSURE(mb)
Sto031WD	18 April 2008	0.00	0.10	20.70	976	0.17
Sto031WD	23 April 2008	0.10	0.00	21.40	996	-0.46
Sto031WD	02 May 2007	0.00	0.50	20.20	997	-0.87
Sto031WD	09 May 2007	0.00	0.40	21.70	990	-0.44
Sto031WD	29 May 2007	0.00	0.00	21.80	987	0.05
Sto031WD	06 June 2007	0.00	0.80	20.80	1001	-10.55
Sto031WD	20 June 2007	0.00	0.00	20.60	987	0.44
Sto031WD	27 June 2007	0.00	0.00	20.50	984	0.29
Sto031WD	11 July 2007	0.00	0.10	21.40	992	-0.25
Sto031WD	01 August 2007	0.00	0.00	21.50	992	
Sto031WD	15 August 2007	0.00	0.10	21.10	973	
Sto031WD	03 September 2007	0.00	0.10	21.50	1000	
Sto031WD	17 September 2007	0.00	0.60	21.00	987	0
Sto031WD	01 October 2007	0.10	0.50	20.70	997	0.18
Sto031WD	22 October 2007	0.20	3.90	17.20	995	-0.28
Sto031WD	05 November 2007	0.10	0.10	21.10	998	-0.09
Sto031WD	12 November 2007	0.00	0.10	20.50	1002	0.37
Sto031WD	19 November 2007	0.10	0.70	21.20	972	0.01
Sto031WD	26 November 2007	0.10	0.40	21.50	1005	-6.53
Sto031WD	05 December 2007	0.10	0.60	21.30	975	0.38
Sto031WD	10 December 2007	0.10	0.40	21.30	991	-0.12
Sto031WD	17 December 2007	0.10	0.60	21.40	1008	1.05
Sto031WD	02 January 2008	0.10	0.80	21.00	986	0.72
Sto031WD	07 January 2008	0.20	0.40	21.60	981	0.86
Sto031WD	04 February 2008	0.00	0.40	20.90	973	0.07
Sto031WD	18 February 2008	0.00	0.50	21.00	1008	-0.13
Sto031WD	25 February 2008	0.00	2.90	9.90	988	0.05
Sto031WD	25 March 2008	0.00	0.10	20.90	984	0.04
Sto031WD	31 March 2008	0.00	0.10	20.90	992	-0.09
Averages		0.04	0.52	20.57		

Appendix 5 - Liquid Level Monitoring Data

Please see attached excel files

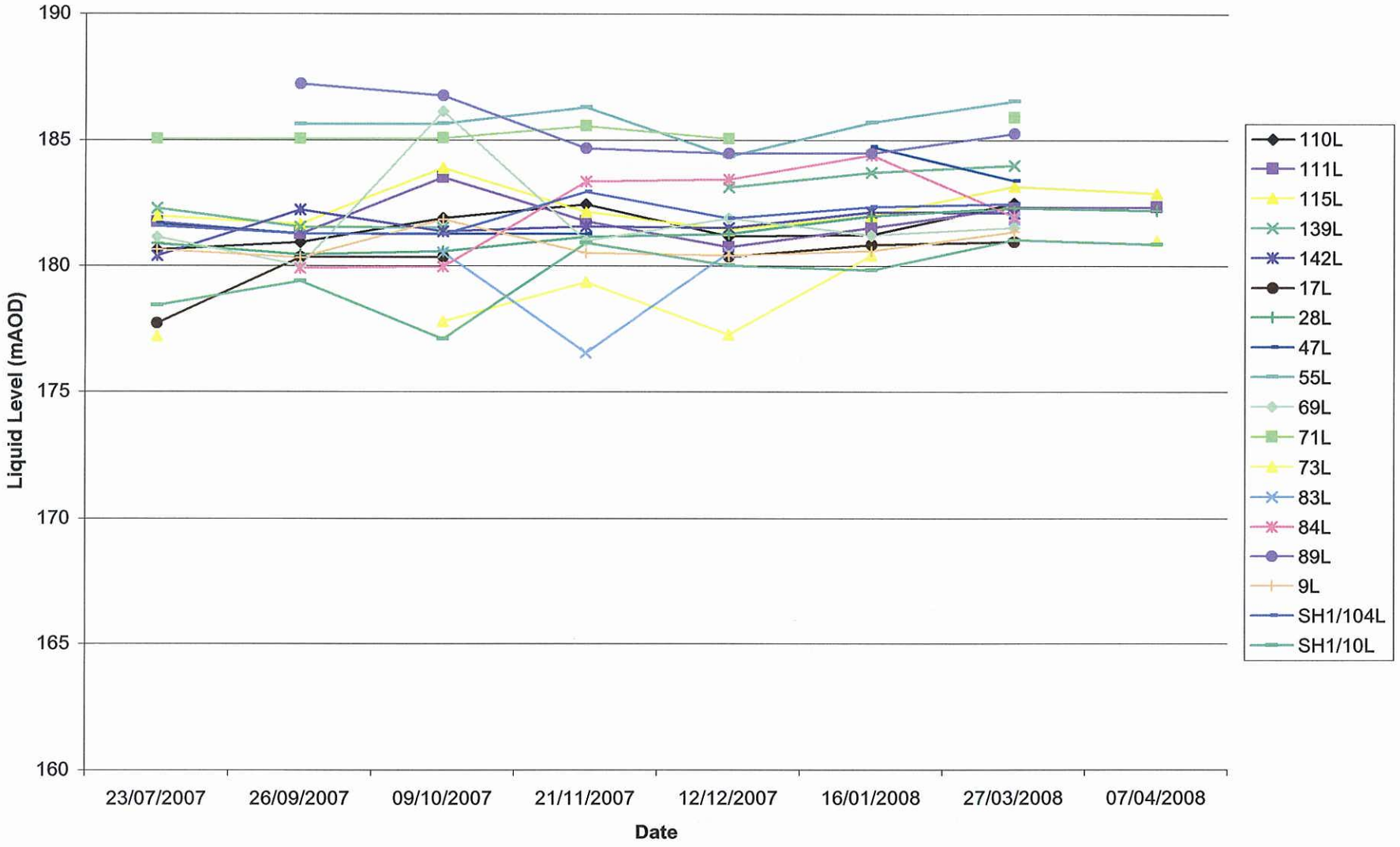
Liquid Levels Map



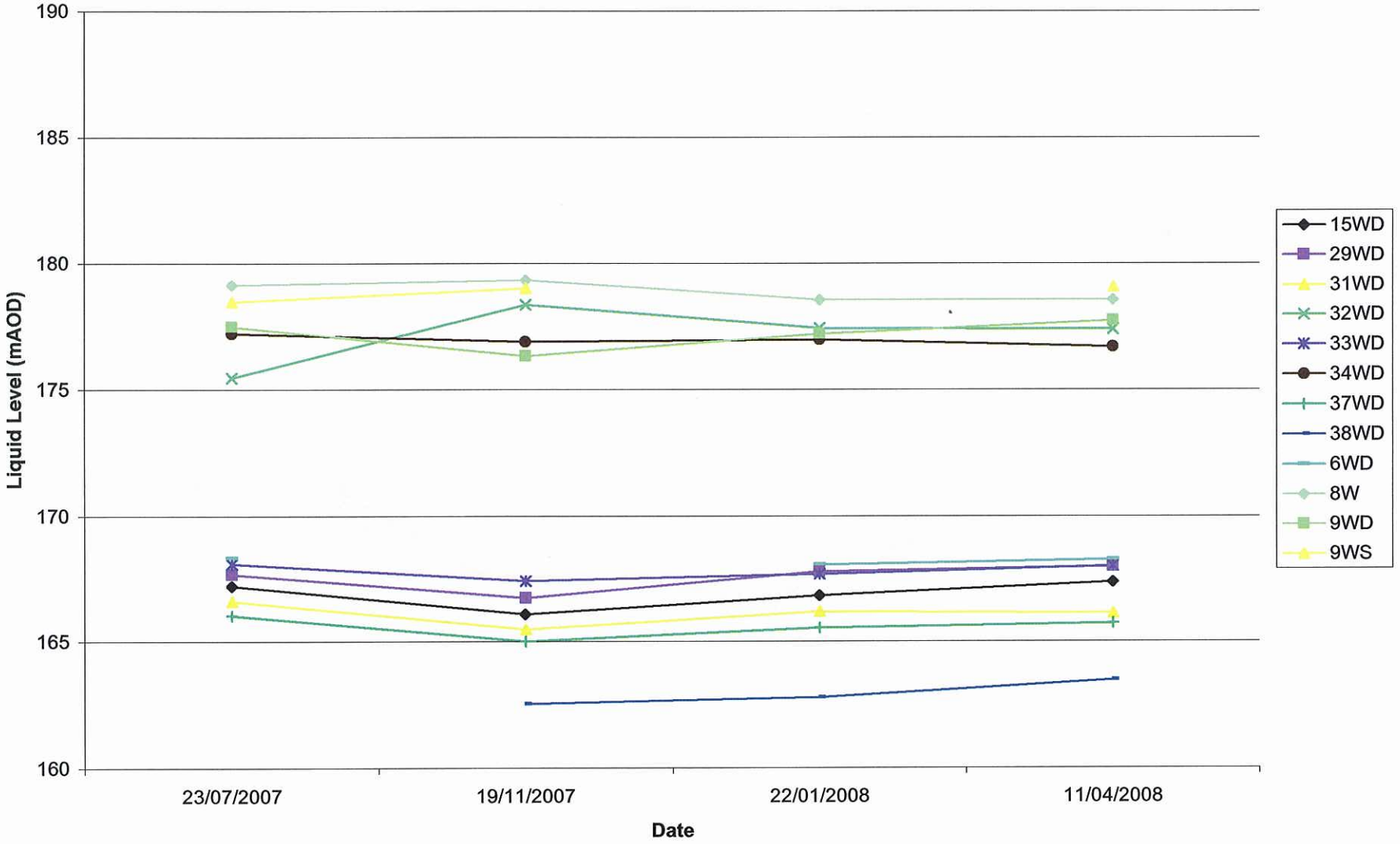
Gas Flare
Approximate Edge of Landfill
Roadways
Ponds
Perimeter Borehole (upper/lower circles indicate shallow/deep readings)
160 to 169 mAOD
170 to 179 mAOD
180 to 189 mAOD

NOT TO SCALE

Stoney Hill - Leachate Levels



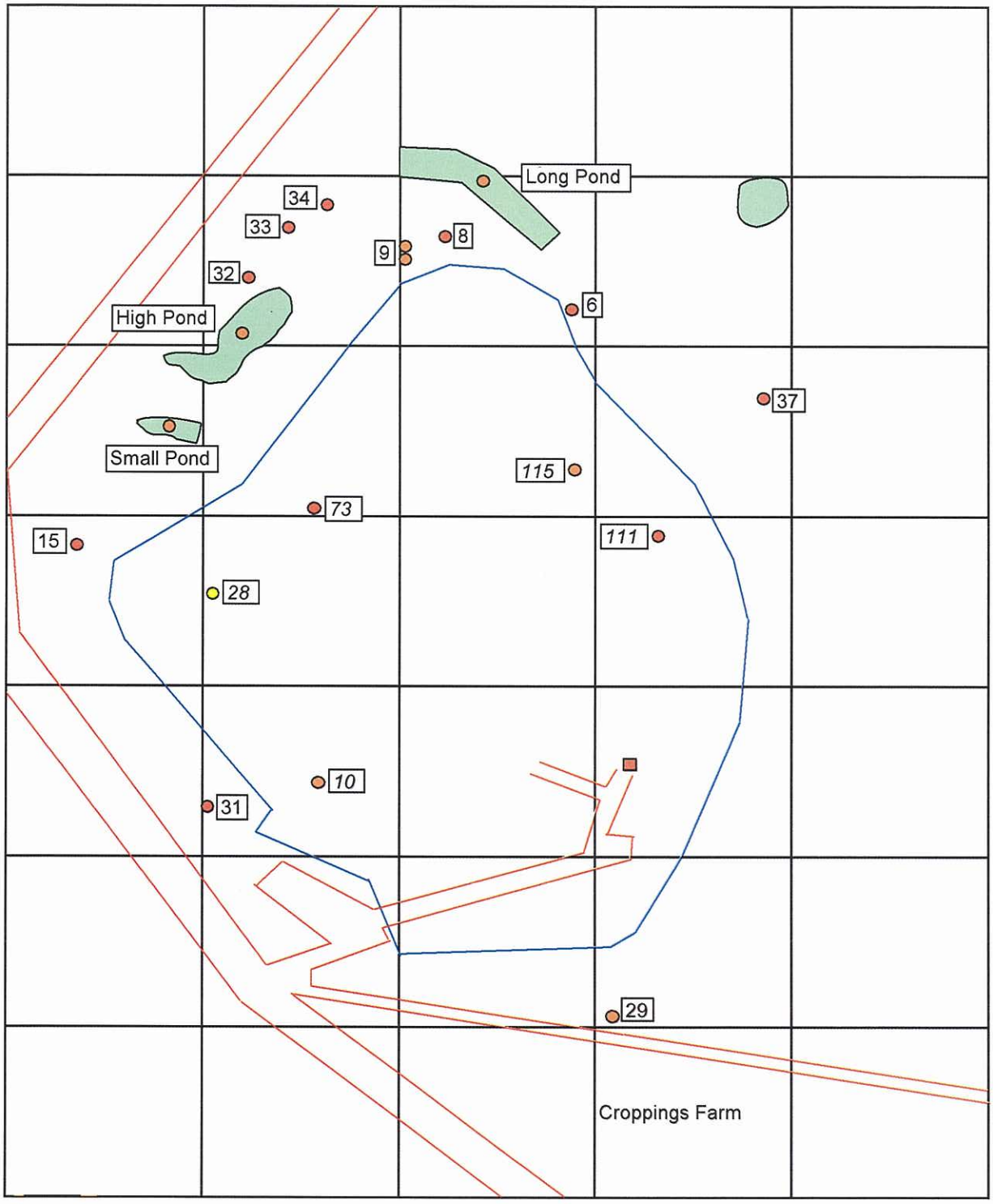
Stoney Hill - Groundwater Levels



Appendix 6 - Liquid Sampling Data

Please see attached excel files

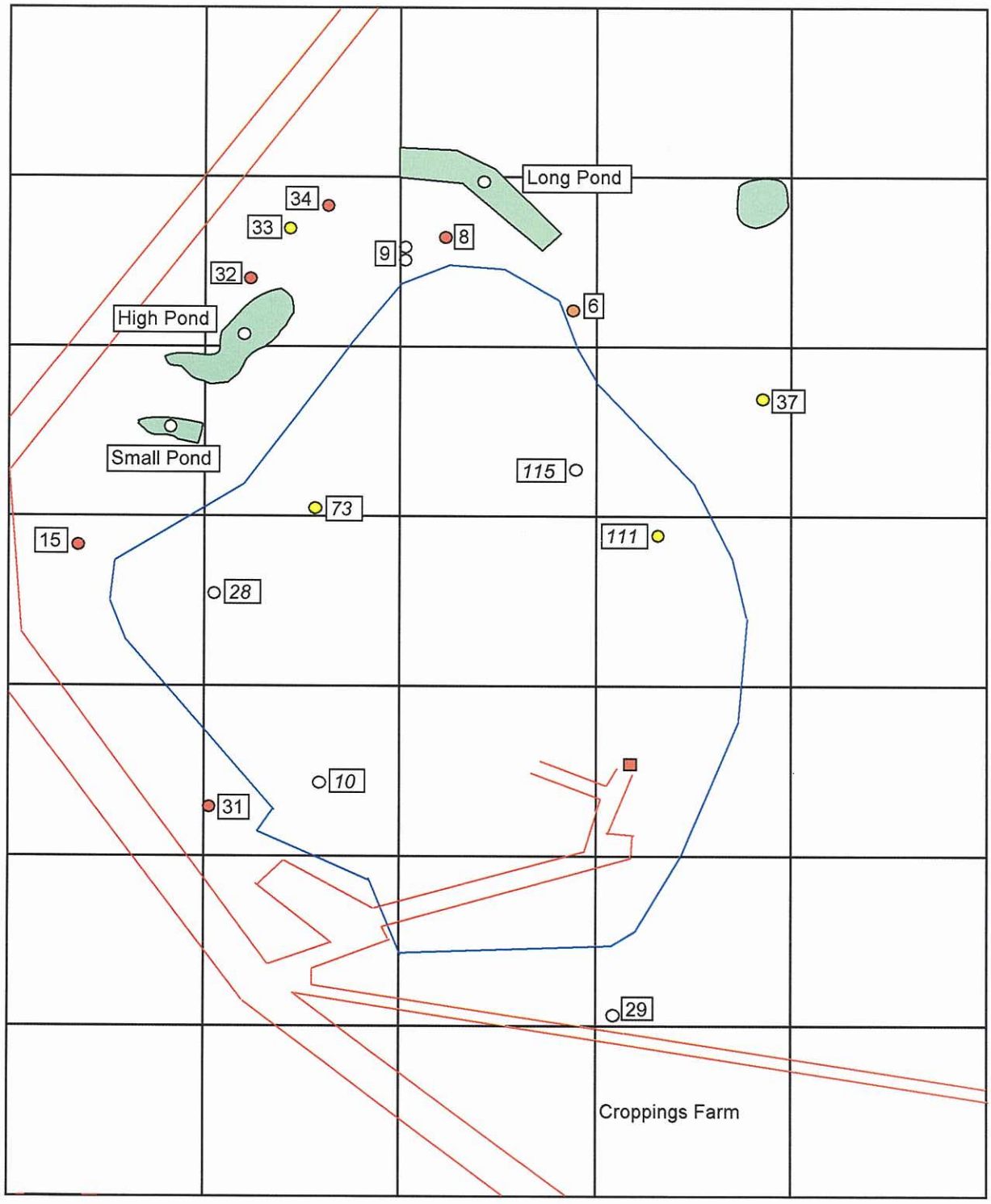
TOC Map



Gas Flare
Approximate Edge of Landfill
Roadways
Ponds
X Perimeter Borehole (upper/lower circles indicate shallow/deep readings)
0 to 4.9 mg/l TOC
5.0 to 49 mg/l TOC
50 to 99 mg/l TOC
>100 mg/l TOC

NOT TO SCALE

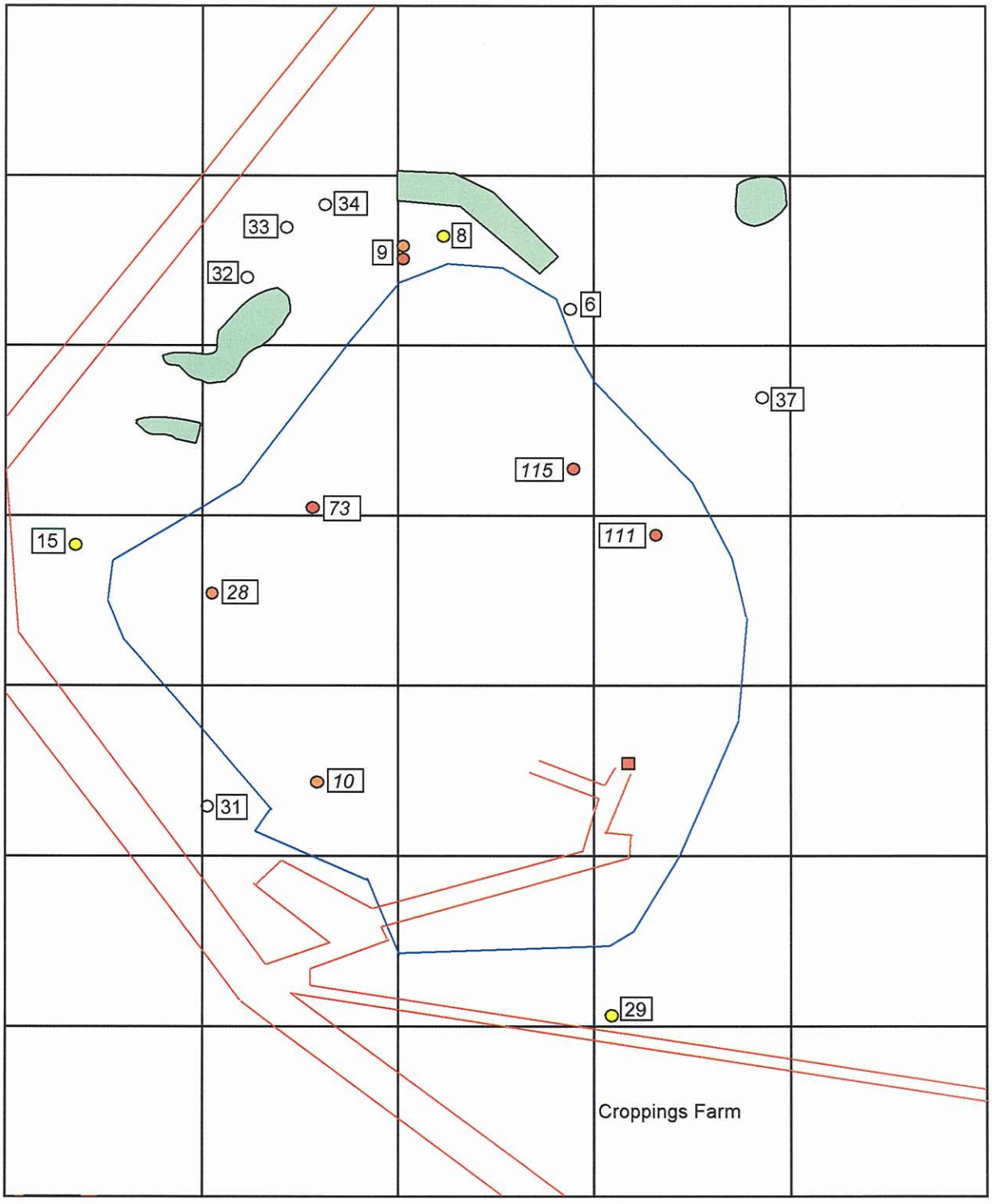
Sulphate Map



Gas Flare
Approximate Edge of Landfill
Roadways
Ponds
X Perimeter Borehole (upper/lower circles indicate shallow/deep readings)
0 to 99 mg/l Sulphate
100 to 199 mg/l Sulphate
200 to 299 mg/l Sulphate
>300 mg/l Sulphate

NOT TO SCALE

Ammonia Map



Gas Flare
Approximate Edge of Landfill
Roadways
Ponds
8 X Perimeter Borehole (upper/lower circles indicate shallow/deep readings)
0 to 0.99 mg/l Ammonia
1.0 to 9.99 mg/l Ammonia
10.0 to 99.9 mg/l Ammonia
>100 mg/l Ammonia

NOT TO SCALE

SAMPLE POINT	TYPE	DATE	pH	Electical Conductivity	Ammonia	Chloride	Sulphate	Total Organic Carbon	Sodium	Potassium	Calcium	Magnesium	Iron	Manganese	Total Oxidised Nitrogen	Chemical Oxygen Demand	Total suspended solids	Total dissolved solids
			units	(µS/cm)	(NH4 mg/l)	(Cl mg/l)	(SO4 mg/l)	(mg/l)	(Na mg/l)	(K mg/l)	(Ca mg/l)	(Mg mg/l)	(Fe mg/l)	(Mn mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
15WD	Groundwaters	JULY	3.55	818	1.09	0.02	339	2.62	33	7.58	66.5	32.4	101	12.6	0.5	20.7	121	630
15WD	Groundwaters	OCTOBER	3.99		0.977		328	1.21			80.6	34.4	18.6	7.23	0.3	30.1	300	
15WD	Groundwaters	JANUARY	5.72	0.938	1.18	57.9	336	3	32.2	6.24					0.3	40.5	116	394
15WD	Groundwaters	APRIL	5.12	0.832	1.15	54.7	324	7.59	68.5	26	87.7	36.1	65.9	7.21	0.3	78.6	533	427
		AVERAGES	4.60	273.26	1.10	37.54	331.75	3.61	44.57	13.27	78.27	34.30	61.83	9.01	0.35	42.48	267.50	483.67
29WD	Groundwaters	JULY	6.69	302	3.3	0.02	11.6	21.6	7.57	4.44	40	8.79	9.68	3.44	0.5	177	120	225
29WD	Groundwaters	JANUARY	6.31	0.388	0.85	10.3	86.3	24.2	10.2	13.5					0.3	107	80	183
29WD	Groundwaters	APRIL	6.11	0.613	1.59	10.8	144	9.6	12.6	4.31	77.5	22	17.2	10.7	0.3	40.9	55	295
		AVERAGES	6.37	101.00	1.91	7.04	80.63	18.47	10.12	7.42	58.75	15.40	13.44	7.07	0.37	108.30	85.00	234.33
31WD	Groundwaters	JULY	6.55	772	0.64	0.02	287	3.27	55.4	14.8	70.9	31.7	447	31.7	0.5	600	3870	607
31WD	Groundwaters	OCTOBER	3.25		1.52		456	1.61			91.1	45.6	144	12.4	0.3	103	1000	
31WD	Groundwaters	JANUARY	5.71	0.839	0.3	68.5	287	5.47	42.1	7.78					0.3	205	86	380
31WD	Groundwaters	APRIL	6.78	0.723	0.454	49.8	221	6.33	40.5	10.2	99.8	21.5	104	4.02	0.384	213	1010	365
		AVERAGES	5.57	257.85	0.73	39.44	312.75	4.17	46.00	10.93	87.27	32.93	231.67	16.04	0.37	280.25	1491.50	450.67
32WD	Groundwaters	JULY	5.73	750	0.813	0.02	370	5.78	14.8	8.27	82.5	31.6	55	22.2	0.5	93.8	184	648
32WD	Groundwaters	OCTOBER	3.93		0.759		374	3.01							1.46	39	100	
32WD	Groundwaters	JANUARY	4.14	0.588	0.3	14.1	239		4.87	2.58					0.3	21.9	61	265
32WD	Groundwaters	APRIL	5.52	0.666	1.16	20.4	274	7.18	14.6	8.69	78.9	28	49.9	10.1	0.35	52.7	254	345
		AVERAGES	4.83	250.42	0.76	11.51	314.25	5.32	11.42	6.51	80.70	29.80	52.45	16.15	0.65	51.85	149.75	419.33
33WD	Groundwaters	JULY	6.48	399	0.64	0.02	76	2.05	21.7	12.2	43.8	24.5	688	16.4	0.5	512	9440	242
33WD	Groundwaters	OCTOBER	7.5		0.54		143	2.89							0.416	11.4	44	
33WD	Groundwaters	JANUARY	6.68	0.516	0.526	37.6	95.5	3.9	428	262					0.3	12.6	115	236
33WD	Groundwaters	APRIL	6.3	0.514	0.854	34.6	98.2	3	45.3	5.92	60.7	18.1	40.6	3.31	0.3	16.3	116	267
		AVERAGES	6.74	133.34	0.64	24.07	103.18	2.96	165.00	93.37	52.25	21.30	364.30	9.86	0.38	138.08	2428.75	248.33
34WD	Groundwaters	JULY	5.29	931	1.09	0.02	542	2.31	27.8	25.9	75.7	53.6	447	37.5	0.5	357	6790	928
34WD	Groundwaters	OCTOBER	7.42		1.7		391	4.35			123	45.4	12.1	13.6	0.3	38.3	104	
34WD	Groundwaters	JANUARY	5.3	0.589	0.361	14.3	240	3.14	18.4	6.14	58.5	25.2	1.09	7.33	0.3	21.7	21	271
34WD	Groundwaters	APRIL	5.43	0.452	0.3	14.1	182	3	11.6	4.92	41	17.9	2.08	4.51	0.353	14.8	105	227
		AVERAGES	5.86	310.68	0.86	9.47	338.75	3.20	19.27	12.32	74.55	35.53	115.57	15.74	0.36	107.95	1755.00	475.33
37WD	Groundwaters	JULY	5.84	465	0.64	0.02	111	5.6	13.6	5.21	56.9	14.4	48.8	2.35	0.5	178	1380	319
37WD	Groundwaters	OCTOBER	7.34		0.3		254	3.17			128	33.5	115	3.02	0.3	366	3550	
37WD	Groundwaters	JANUARY	6.34	0.681	0.514	38.6	187	3.98	18.1	2.98	105	22.8	43.9	2.43	0.3	74	838	308
37WD	Groundwaters	APRIL	6	0.786	0.522	42.3	233	3.36	18.8	2.79	120	27.4	51.1	2.56	0.3	34.5	654	405
		AVERAGES	6.38	155.49	0.49	26.97	196.25	4.03	16.83	3.66	102.48	24.53	64.70	2.59	0.35	163.13	1605.50	344.00
8W	Groundwaters	OCTOBER	6		1.2		762	1.75							0.3	38	116	
8W	Groundwaters	JANUARY	6.45	2.07	1.28	49	700	6.97	9.5	4.24					0.3	155	306	730
8W	Groundwaters	APRIL	5.05	1.4	0.851	36	743	3	38.2	15.5	161	83.2	42.6	15.2	0.3	25.5	151	708
		AVERAGES	5.83	1.74	1.11	42.50	735.00	3.91	23.85	9.87	161.00	83.20	42.60	15.20	0.30	72.83	191.00	719.00
9WD	Groundwaters	JULY	6.79	497	29.2	0.02	53.8	25.5	34.9	79.3	75.6	48.5	380	4.73	0.5	1220	16000	251
9WD	Groundwaters	OCTOBER	8.27		163		78.6	36.3			110	54.8	23.2	3.08	0.3	178	550	
9WD	Groundwaters	JANUARY	6.87	5.48	561	521	118	102	49.7	15					0.3	393	920	2000
9WD	Groundwaters	APRIL	6.94	8.24	609	824	69	123	881	688	214	180	90.8	4.88	0.3	517	7970	4580
		AVERAGES	7.22	170.24	340.55	448.34	79.85	71.70	321.87	260.77	133.20	94.43	164.67	4.23	0.35	577.00	6360.00	2277.00
9WS	Groundwaters	JULY	6.73	478	33.1	0.02	53.9	13.8	25.3	119	110	136	713	24	1.56	14200	164000	262
9WS	Groundwaters	OCTOBER	8.3		91.4		109	27.2							0.823	749	8210	
9WS	Groundwaters	APRIL	6.86	0.669	27	35.8	131	15.7	29.1	39.1	364	307	1240	31.1	0.3	11200	137000	341
		AVERAGES	7.30	239.33	50.50	17.91	97.97	18.90	27.20	79.05	237.00	221.50	976.50	27.55	0.89	8716.33	103070.00	301.50
SH1/06WD	Groundwaters	JANUARY	5.88	0.919	0.702	101	247	3.82	56.6	3.59					0.3	43.1	1700	408
SH1/06WD	Groundwaters	APRIL	5.71	0.929	0.634	97.1	256	4.6	46.8	2.87	78	33	49.5	7.79	0.3	228	657	457
SH1/06WD	Groundwaters	JULY	5.88	910	0.976	0.02	300	3.95	65.3	7.09	63.9	31.5	110	13.9	0.5	271	1070	738
		AVERAGES	5.82	303.95	0.77	66.04	267.67	4.12	56.23	4.52	70.95	32.25	79.75	10.85	0.37	180.70	1142.33	534.33

Leachate Sampling Data

SAMPLE POINT	TYPE	DATE	pH	Electical Conductivity	Ammonia	Chloride	Sulphate	Total Organic Carbon	Sodium	Potassium	Calcium	Magnesium	Iron	Manganese	Total Oxidised Nitrogen	Chemical Oxygen Demand	Total suspended solids	Total dissolved solids
			units	(µS/cm)	(NH4 mg/l)	(Cl mg/l)	(SO4 mg/l)	(mg/l)	(Na mg/l)	(K mg/l)	(Ca mg/l)	(Mg mg/l)	(Fe mg/l)	(Mn mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
111L	Leachate Chamber	JULY	7	5920	383	0.02	49.5	130	483	236	225	94.6	26.6	2.93	0.5	580	209	870
111L	Leachate Chamber	OCTOBER	7	5920	383	0.02	49.5	130	483	236	225	94.6	26.6	2.93	0.5	580	209	870
111L	Leachate Chamber	OCTOBER	7.84		539		36.7	147			217	98.7	1.39	0.814	0.3	524	93	870
111L	Leachate Chamber	JANUARY	8.37	6.87	507		74	78	706	268	232	99.6	4.14	0.6	2.27	493	38	3130
111L	Leachate Chamber	APRIL	7.36	6.83	419	740	7.3	133	54.3	22.8	219	93.1	3.4	0.748	0.3	455	73	3420
		AVERAGES	7.51	2963.43	446.20	246.68	43.40	123.60	431.58	190.70	223.60	96.12	12.43	1.60	0.77	526.40	124.40	1832.00
115L	Leachate Chamber	JULY	6.84	2720	117	0.02	0.494	94	190	121	311	73.8	144	8.65	0.5	610	661	109
115L	Leachate Chamber	OCTOBER	6.84	2720	117	0.02	0.494	94	190	121	311	73.8	144	8.65	0.5	610	661	109
115L	Leachate Chamber	OCTOBER	7.66		231		25.5	91.2			311	73.8	144	8.65	0.3	345	616	109
115L	Leachate Chamber	JANUARY	8.2	2.43	75.2		28.3	108	196	98.5	212	6.02	37.3	2.74	0.2	253	25	906
115L	Leachate Chamber	APRIL	7.23	2.24	84.9	189	14.3	87.9	264	68.8	164	46.3	4.19	0.577	0.3	245	58	1030
		AVERAGES	7.35	1361.17	125.02	63.01	13.82	95.02	210.00	102.33	261.80	54.74	94.70	5.85	0.36	412.60	404.20	452.60
28L	Leachate Chamber	JULY	6.86	3260	181	0.02	40.6	69.6	225	169	202	48.1	78.3	4.06	0.5	500	359	56.5
28L	Leachate Chamber	OCTOBER	6.86	3260	181	0.02	40.6	69.6	225	169	202	48.1	78.3	4.06	0.5	500	359	56.5
28L	Leachate Chamber	OCTOBER	7.73		29.2		36.4	24.2			255	45	40.4	2.84	0.3	71.5	196	56.5
28L	Leachate Chamber	JANUARY	8.04	1.77	10.9		307	15.6	29.6	22.2	312	60.3	48.3	11.9	0.3	49.1	96.1	610
28L	Leachate Chamber	APRIL	6.78	1.65	22.6	36.1	126	12.5	38.4	35.1	279	47.9	56.9	6.85	0.3	46.9	158	680
		AVERAGES	7.25	1630.86	84.94	12.05	110.12	38.30	129.50	98.83	250.00	49.88	60.44	5.94	0.38	233.50	233.62	291.90
73L	Leachate Chamber	JULY	6.82	4320	161	0.02	11.6	147	305	236	294	77.6	43.3	4.2	0.5	458	98.8	915
73L	Leachate Chamber	OCTOBER	6.82	4320	161	0.02	11.6	147	305	236	294	77.6	43.3	4.2	0.5	458	98.8	915
73L	Leachate Chamber	OCTOBER	7.08		135		121	45.4			120	28.4	3.13	0.114	0.3	143	16	915
73L	Leachate Chamber	JANUARY	8.34	8.01	750		1.97	213	666	564	126	94.7	15.4	0.226	2.07	640	66	4920
73L	Leachate Chamber	APRIL	7.46	7.88	620	783	14.6	159	890	717	135	88.8	14.4	0.251	0.3	572	99	3640
		AVERAGES	7.30	2163.97	365.40	261.01	32.15	142.28	541.50	438.25	193.80	73.42	23.91	1.80	0.73	454.20	75.72	2261.00
SH1/10L	Leachate Chamber	JULY	6.36	919	1.3	0.02	26	11.2	36.2	6.42	251	15.9	6.63	2.45	0.5	555	37.1	133
SH1/10L	Leachate Chamber	OCTOBER	6.36	919	1.3	0.02	26	11.2	36.2	6.42	251	15.9	6.63	2.45	0.5	555	37.1	133
SH1/10L	Leachate Chamber	OCTOBER	7.96		1.92		159	12.6			251	15.9	6.63	2.45	0.3	30.2	22	133
SH1/10L	Leachate Chamber	JANUARY	8.02	3.92	154		158	114	417	243	344	82.4	11.4	1.95	<0.200	303	121	1430
SH1/10L	Leachate Chamber	APRIL	7.27	6.11	208	781	248	189	830	444	439	145	10.4	2.25	0.3	506	154	2820
		AVERAGES	7.19	462.01	73.30	260.35	123.40	67.60	329.85	174.96	307.20	55.02	8.34	2.31	0.40	389.84	74.24	929.80

SAMPLE POINT	TYPE	DATE	pH	Electical Conductivity	Ammonia	Chloride	Sulphate	Total Organic Carbon	Sodium	Potassium	Calcium	Magnesium	Iron	Manganese	Total Oxidised Nitrogen	Chemical Oxygen Demand	Total suspended solids	Total dissolved solids
			units	(µS/cm)	(NH4 mg/l)	(Cl mg/l)	(SO4 mg/l)	(mg/l)	(Na mg/l)	(K mg/l)	(Ca mg/l)	(Mg mg/l)	(Fe mg/l)	(Mn mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
High Pond	Surface Waters	JULY	7.31	176	0.64	0.02	51.3	7.18	3.76	2.54	20.4	6.76	0.364	0.458	0.5	23.8	17.1	81.3
High Pond	Surface Waters	OCTOBER	8.22		0.3		55.1	11.1			41.7	10.8	0.252	0.969	0.3	34	28	
High Pond	Surface Waters	JANUARY	7.56	0.258	0.3	6.9	78.2	5.21	22.1	2.58					0.3	24.5	25	127
High Pond	Surface Waters	APRIL	7.15	0.297	0.3	8.9	126	6.05	4.63	2.01	35.3	12.6	0.1	0.445	0.3	18.1	8	153
		AVERAGES	7.56	58.85	0.39	5.27	77.65	7.39	10.16	2.38	32.47	10.05	0.24	0.62	0.35	25.10	19.53	120.43
Long Pond	Surface Waters	JULY	6.1	301	0.64	0.02	18.4	9.23	5.65	3.95	55.4	7.45	0.231	0.05	0.5	29.5	2	196
Long Pond	Surface Waters	OCTOBER	8.02		0.3		86.4	8.99							0.44	25.6	6	
Long Pond	Surface Waters	JANUARY	8.32	0.482	0.3	10.7	73.4	10.2	399	52.1					0.3	20.3	6	218
Long Pond	Surface Waters	APRIL	8.02	0.434	0.3	13.4	98.5	10.9	7.81	3.95	68.4	13.5	0.1	0.05	0.3	30.7	6	223
		AVERAGES	7.62	100.64	0.39	8.04	69.18	9.83	137.49	20.00	61.90	10.48	0.17	0.05	0.39	26.53	5.00	212.33
Small Pond	Surface Waters	JULY	6.65	182	0.64	0.02	18.8	10.8	3.91	2.74	29.5	6.35	0.483	0.312	0.5	27.9	10.6	99.2
Small Pond	Surface Waters	OCTOBER	7.98		0.3		21.9	6.9			21.9	6.39	0.1	0.0806	0.975	17.7	6	
Small Pond	Surface Waters	JANUARY	7.81	0.359	0.3	9.4	101	7.17	7.48	2.87					0.3	19	6	168
Small Pond	Surface Waters	APRIL	7.13	0.446	0.3	14.3	141	7.88	10.9	3.64	61.3	17.1	0.1	0.528	0.3	21.6	6	230
		AVERAGES	7.39	60.94	0.39	7.91	70.68	8.19	7.43	3.08	37.57	9.95	0.23	0.31	0.52	21.55	7.15	165.73

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Borough of Telford and Wrekin

DSEAR Assessment (Final Report)

Stoneyhill Landfill

February 2008

Document No. B0578400/DSEAR/R01

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1 Introduction

1.1 Status of Document

The Borough of Telford and Wrekin Council (BTW) has commissioned Jacobs to undertake an assessment at the Stoneyhill landfill site and gas flare compound in accordance with the Dangerous Substances and Explosive Atmosphere Regulations 2002 (DSEAR). This document outlines the methodology used and applies zones of classification to specific areas of the closed landfill site.

During our initial visit to site in March 2007 it was not possible to complete the site reconnaissance of the whole site area because of Health & Safety concerns. Therefore, as agreed with BTW, an initial draft report was progressed incorporating the assessment of the site excluding the gas flare compound area. A further site visit was then undertaken in November 2007 to assess this excluded area, so that information from the gas flare compound could be incorporated into the findings of our initial assessment.

This document represents the final report of the assessment of the site. It outlines the methodology used and application of zones of classification to specific areas of the closed landfill site and gas flare compound area. In the Draft Report of May 2007, two equally valid scenarios were considered, one where the flare was running and one where the flare was shut down, for each of the site features. Improvements to the management of the landfill gas flare and repair to the extraction infrastructure have now invalidated this second scenario and calculations and zoning appertaining to it have been removed from this report to reflect site conditions as of November 2007.

1.2 Site Location

Stoneyhill landfill is a closed landfill and is situated to the south of Telford, just north of the Ironbridge by-pass between Horsehay and Coalbrookdale at National Grid Reference SJ 668 0604. The location of Stoneyhill landfill is shown Drawing Number B0578400/DSEAR/01. The site covers an area of approximately 81.6 hectares.

1.3 Legislation and Guidance

The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) are concerned with protection against risks from fire and explosion

arising from dangerous substances used or present in the workplace. DSEAR place duties on an employer to provide:

- Risk assessments (Regulation 5), i.e. establish source, pathways, receptors and accidents and consequences including likelihood and severity;
- Elimination or reduction of risk (Regulation 6), the elimination or reduction of the flammable substances is not a realistic proposition at landfill, but removal of the sources of ignition and regular maintenance are an appropriate method of compliance with this regulation;
- Area classification (Regulation 7), this requires the employer to identify locations where potentially explosive atmospheres do or could occur and to record this information on suitable drawings. Regulation 7 also covers the selection and assessment of electrical equipment and the marking of zones;
- Arrangements to deal with accidents, incidents and emergencies (Regulation 8) to be in place;
- Training of employees and dissemination of information (Regulation 9); a
- Identification of containers and pipes (Regulation 10); and
- Co-ordination of the implementation of measures taken under DSEAR (Regulation 11) to protect employees and others at the workplace from risks from explosive atmospheres.

The Environmental Services Association (ESA) in consultation with the Health and Safety Executive (HSE) have produced a comprehensive and detailed Industry Code of Practice (ICoP) and methodology for the Area Classification for Landfill Gas Extraction, Utilisation and Combustion.

2 Methodology

2.1 Basis of Methodology

The ESA has produced a total of five ICoP for DSEAR implementation for the waste management industry:

- ICoP 1 DSEAR for the Waste Management Industry (November 2005);
- ICoP 2 Area Classification for Landfill Gas Extraction, Gas Utilisation and Combustion (July 2006);
- ICoP 3 Area Classification for Leachate Extraction, Treatment and Disposal (May 2006);
- ICoP 4 Drilling Operations (DRAFT); and
- ICoP 5 Landfill Operations (DRAFT).

The five ICoP documents deal specifically with landfill gas and other substances, common to the waste industry, capable of creating an explosive atmosphere. The methodology outlined in ICoP2 - Area Classification for Landfill Gas Extraction, Gas Utilisation and Combustion (July 2006) has been used as a basis for this DSEAR assessment.

2.2 Site Visit

Two site visits were conducted by Jacobs' Angela Price and Costa Athanatos. The initial visit took place on 28th March 2007 in order to establish the areas of the site which require zone classification. The following areas were inspected;

- gas field, passive vents and active extraction wells;
- dewatering points;
- leachate extraction points; and
- leachate storage tanks.

At this time health and safety concerns prevented the inspection of the gas flare compound and knock-out pots. A further site visit was therefore undertaken on 28th November 2007 to examine the compound and flare, once health and safety issues were resolved. This report represents a final report from these two site visits.

2.3 Data Collection

As identified in ICoP2 - Area Classification for Landfill Gas Extraction, Utilisation and Combustion (July 2006) the following information was compiled for each point of assessment:

(a) Plant item

The type of item assessed such as a gas extraction well, leachate tank, knock-out pot or compressor, was identified and recorded.

(b) Location

The physical location of each item was recorded e.g. the precise location of each item within the gas flare compound, these are shown on the accompanying plans B0578400/DSEAR/02 Principal Site Features and B0578400/DSEAR/03 Gas Flare Compound Area Classification Plan contained in Appendix A

(c) Grade of release

ICoP 2 defines the grades of release to be assigned to potential releases of flammable materials. Table 1 reproduces the definitions of the grades of release as shown in ICoP 2.

Table 1: Grades of Release

Grade of release	Definition
Continuous	a release which is continuous or is expected to occur frequently or for long periods (typically >1000 hours/year)
Primary	a release which can be expected to occur periodically or occasionally during normal operation (typically between 10 and 1000 hours/year)
Secondary	a release which is not expected to occur during normal operation and, if it does occur, is likely to do so only infrequently and for short periods (typically less than 10 hours/year and for short periods only)

(d) Operating temperature and pressure

The operating temperature was taken from the ICoP 2 as 10°C. Pressures are based on historical monitoring data and readings taken on site.

(e) Ventilation type

Ventilation type is natural, artificial or both.

(f) Ventilation degree

Ventilation degree is high, medium or low.

(g) Ventilation availability

Ventilation availability is 'good', 'fair' or 'poor'.

(h) Additional information

Other information such as gas quality within wells was also collected to add to the background data supplied.

2.4 Risk Assessment

Risk assessment has been carried out qualitatively according to the methodology outlined in LFGT03 Guidance on the Management of Landfill Gas, Environment Agency (2004), which provides a simple structured methodology for assessing the magnitude of risks.

Stage one involves assessment of the likelihood of an incident occurring using Table 2.5 of LFTGN03 below.

Table 2: Reproduction of Table 2.5 Assessment of Likelihood from LFTGN03

Category		Range
1	Extremely unlikely	Incident occurs less than once in a 1,000,000 years.
2	Very unlikely	Incident occurs between once per 1,000,000 years and once per 10,000 years.
3	Unlikely	Incident occurs between once per 10,000 years and once per 100 years.
4	Somewhat unlikely	Incident occurs between once per 100 years and once per 10 years.
5	Fairly probable	Incident occurs between once per 10 years and once per year.
6	Probable	Incident occurs at least once per year.

Stage two involves assessment of the potential severity of the consequences of an incident using Table 2.6 from LFTGN03.

Table 3: Reproduction of Table 2.6 Assessment of Severity from LFTGN03

Category	Range
1 Minor	Nuisance on site only No outside complaint
2 Noticeable	Noticeable Nuisance off site Minor breach of emission limits no environmental harm One or two complaints from the public
3 Significant	Severe and sustained nuisance Major breach of emission limits. possibility of prosecution Numerous public complaints
4 Severe	Hospital treatment required Off site emergency plan / public warning invoked
5 Major	Evacuation of local populace Temporary disablement and hospitalisation Serious toxic effect on beneficial or protected species Widespread but not persistent damage to land
6 Catastrophic	Major airborne release with serious off site side effects Site shut down

Stage three involves assessment of the severity likelihood of an incident using Table 2.7 from LFTGN03.

Table 4: Reproduction of Table 2.7 – Likelihood/Severity Matrix from LFTGN03

	Severity of Consequences					
Likelihood	**Minor**	**Noticeable**	**Significant**	**Severe**	**Major**	**Catastrophic**
Extremely unlikely	1	2	3	4	5	6
Very unlikely	2	4	6	8	10	12
Unlikely	3	6	9	12	15	18
Somewhat unlikely	4	8	12	16	20	24
Fairly probable	5	10	15	20	25	30
Probable	6	12	18	24	30	36

The final stage of assessment is to evaluate the magnitude of risk using Table 2.8.

Table 5: Reproduction of Table 2.8 – Evaluation of Risk from LFTGN03

Magnitude of Risk	Score
Insignificant	6 or less
Acceptable	8 to 12
Unacceptable	15 or more

An unmitigated magnitude of risk over 15 is unacceptable and suitable procedural or engineered mitigation measures will be required to lower the magnitude of risk.

2.5 Zone Classification

Zone classification was done in accordance with ICoP 2, the definition of a gas/vapour zone being dependant on the grade of release is identified in Table 6.

Table 6: Relation of grade of release to zone

Grade of release	Corresponding gas/vapour zone
Continuous grade release	zone 0
Primary grade release	zone 1
Secondary grade release	zone 2

Calculation of the extent of each zone has been carried out in accordance with ICoP 2.

3 DSEAR Risk Assessment and Mitigation

3.1 Risk Assessment

The risk assessment requirements of DSEAR should already have been largely met by compliance with the Management of Health & Safety at Work (MHSW) Regulations 1999. Consequently, this DSEAR requirement applies to existing workplaces with immediate effect.

At the Stoneyhill landfill it is only landfill gas that is relevant to the DSEAR Assessment as there are no other flammable substances present at the site which is a closed landfill. DSEAR regulation 5 requires risk assessments that identify:

- the types of flammable substances on site;
- work processes;
- the amount of the substance involved;
- the likelihood that an explosive atmosphere will occur and its persistence;
- the likelihood that ignition sources will be present and become active and effective;
- the scale of the anticipated effects of a fire or an explosion;
- the effect of measures which have been or will be taken pursuant to the Regulations;
- the arrangements for the safe handling, storage and transport of dangerous substances and of waste containing dangerous substances;

DSEAR regulation 6 requires employers to reduce risk as far as reasonably possible, the two key elements of this being the reduction of the quantity of flammable material and the elimination of ignition sources.

Significant findings of risk assessments should always be communicated to employees. Risk assessments should also be reviewed and updated if the nature of any activity changes.

3.2 Landfill Gas - Hazardous Properties and Safety Information

Landfill gas is a mixture of gases produced by the biological degradation of wastes. In the steady state methanogensis stage the gases are produced in a known and predictable ratio of 3:2 (methane (CH_4) to carbon dioxide (CO_2)). The

landfill gas monitoring data for Stoneyhill Landfill indicates that the landfill gas produced by the site is currently within this ratio and therefore the standard values for properties of landfill gas given within both LFTGN03 and ICoP2 can be used.

Table 7: Properties of landfill gas

Property	Value	Comments
Constituents	CH_4 60% v/v CO_2 40% v/v 35.3% CH_4 by mass	Proportions may vary but these values will be used for calculation purposes. CO_2 is not flammable.
Molecular mass (M)	27.2 kg/kmol @ 60% CH_4	CH_4 has a molecular mass of 16 CO_2 has a molecular mass of 44 Therefore, landfill gas containing 60% methane will have a molecular mass as follows: M = [(60 x 16) + (40 x 44)]/100
Explosive limits	4.4 – 16.5% v/v	Assumed as for pure methane in air (BS EN 61779-1:2000)
Relative density (air = 1)	0.94	Air has an average molecular mass of 29 kg/kmol
Minimum temperature of landfill gas (for calculation purposes)	10°C	From LFTGN 03
Auto-ignition temperature	537°C	As for pure methane

From the properties of landfill gas the Apparatus Group and Temperature Class to be considered for any equipment to be used or installed within the zoned areas can be established; the Apparatus Group is IIA and the Temperature Class T1 in both as for pure methane.

However, it should be noted that landfill gas production at the site is in decline and the gas quality may change over time. The DSEAR assessment should be reviewed where changes in gas composition are noted.

3.3 Assessment of Activities

Stoneyhill Landfill is a closed landfill and many of the activities that would normally be associated with landfill can therefore be excluded from this assessment. The principle activities/ items of concern subject to risk assessment and mitigation are:

- passive venting of landfill gas;
- extraction of landfill gas;
- failure of the bentonite seals;.
- extraction of leachate and removal of condensate;
- transfer of pumps between wells and dewatering points;
- storage of leachate;
- transfer of leachate to road tanker;
- monitoring of gas extraction, leachate and condensate points; and
- flaring of landfill gas.

The identification of containers and pipes is separately required under DSEAR Regulation 10. Therefore in proposing mitigation measures, the use of signage and marking of pipes and containers are detailed in Section 7.

3.3.1 Passive venting of landfill gas

The site has both capped and uncapped passive landfill gas vents. The uncapped vents comprise of: 125mm or 160mm diameter open pipe wells drilled directly into the waste mass providing an uninterrupted flow of landfill gas from waste mass to atmosphere. The risk assessment for the passive vents is summarised in Table 8.

Passive vents are typically installed in areas of landfill sites with low flows. ICoP2 accounts for this, stating that the flow rate is unlikely to exceed $5m^3/hr$ of landfill gas and calculating a Zone 0 radius of 1.3m (given that this is a continuous release). This estimation of volume of gas likely to be evolved from a passive vent is in line with the predictions of landfill gas generation and the prevalence of uncapped wells at the site. During normal operations uncapped passive landfill gas vents are subject to a very slight negative pressure created by the extraction of gas from nearby wells. The risk presented is that of air ingress to the landfill

body. This can potentially lead to a fire and is therefore a potential source of ignition.

For the capped passive landfill gas vents, the risk of air ingress during flare operation is very limited unless damage is sustained to the seal; this is a rare but foreseeable condition.

With regard to this issue, the HSE has recently added content to their web site which advises landfill operators to avoid or reduce ingress of air into the landfill body as this creates the risk of either fires or explosive mixtures.

DSEAR Regulation 6 gives requirements for both reducing the quantity of flammable material and eliminating ignition sources. The recommended mitigation for this is therefore to:

- cap the passive wells with either electrofused or flexseal caps with sample valves fitted;
- maintaining the gas field and flare in good operational condition;
- reduce extraction pressures;
- periodically check the integrity of the mechanical seals.
- use` certified monitoring equipment, and
- prohibit smoking on site.

Prior to maintenance or repair works and especially those that include hot work, contractors should provide a full risk assessment and method statement for any work to be undertaken.

3.3.2 Extraction of landfill gas

The landfill gas extraction wells are identified on Drawing Number B0578400/DSEAR/02 and all have well heads which appear to be of a single size of 125mm diameter. The risk assessed from the gas extraction wells is summarised in Table 8.

During normal operation where the gas extraction wells are subject to a negative pressure, created by the flare booster, and applied though the gas extraction system. The risk presented is that of air ingress to the landfill body through leaking sample valves, dip points and other mechanical seals. This can potentially lead to a fire and is therefore a potential source of ignition. The design of the installed gas extraction well headworks reduces the risk of the escape of gas via leaking adjustment valves.

Instances of excessive extraction pressures have been recorded at Stoneyhill and the extraction pressures across the site have averaged over -30 mbarg. These elevated pressures can exacerbate the risks by placing unnecessary strain on the gas extraction infrastructure increasing the risk of air ingress through this route. Electrofused seals very rarely develop faults unless subject to excessive mechanical stress from settlement or damage from machinery.

HSE guidance advises landfill operators to avoid or reduce ingress of air into the landfill body as this creates the risk of either fires or explosive mixtures and DSEAR Regulation 6 gives requirements for both reducing the quantity of flammable material and eliminating ignition sources. The recommended mitigation for this is therefore to:

- maintain the gas field and flare in good operational condition;
- reduce extraction pressures;
- periodically check the integrity of the mechanical seals.
- use certified monitoring equipment, and maintain interconnecting pipework in a good condition;
- prohibit smoking on site.

Prior to maintenance or repair works and especially those that include hot work, contractors should provide a full risk assessment and method statement for any work to be undertaken.

3.3.3 Extraction of leachate and removal of condensate

The site has a number of uncapped leachate extraction and dewatering wells, which are identified on Drawing Number B0578400/DSEAR/02. These comprise 160mm diameter open pipe wells drilled directly into the waste mass providing an uninterrupted pathway for the flow of landfill gas from waste mass to atmosphere. This is exacerbated by the action of lowering the water level and extending the zone from which gas can freely vent. The risk assessed from the leachate extraction and dewatering wells is summarised in Table 8.

The risk assessment for the leachate extraction and dewatering wells is very similar to that for the uncapped vents. However, the leachate extraction and dewatering wells have two additional issues:

- the extended dewatered zone permits a greater volume of landfill gas to escape; and

- the extraction and dewatering wells contain a pneumatic submersible pump.

In mitigation, the pneumatic pump type generally used at Stoneyhill landfill is generally intrinsically safe and is often submerged below the water level. Therefore not exposed to the explosive atmosphere, should one occur.

During normal operations where the leachate extraction and dewatering wells are subject to a very slight negative pressure, created by the extraction of gas from nearby wells. The risk presented is that of air ingress to the landfill body. This can potentially lead to a fire and is therefore a potential source of ignition. In addition, the ingress of air to the well may create an explosive atmosphere around the pump.

HSE guidance advises landfill operators to avoid or reduce ingress of air into the landfill body as this creates the risk of either fires or explosive mixtures. DSEAR Regulation 6 gives requirements for both reducing the quantity of flammable material and eliminating ignition sources. The recommended mitigation is therefore to:

- limit the flow of gas from the well by capping wells;
- use cable and pipe glands to provide air tight seal around pump pipes and/or cables;
- use certified pumping equipment;
- periodically check the condition of the pump to avoid air leaks and maintain intrinsic safety;
- periodically check the integrity of the mechanical seals; and
- prohibit smoking on site.

Prior to maintenance or repair works and especially those that include hot work, contractors should provide a full risk assessment and method statement for any work to be undertaken.

3.3.4 Failure of the bentonite Seals

As no construction details have been provided for the 146 wells installed at Stoneyhill landfill, it has been assumed that each of the wells has been installed with a bentonite seal and this section deals with the failure of the seal.

ICoP 2 indicates that under normal circumstances, two independent faults are not considered for area classification. Consequently, as failure of the seal and a

positive pressure condition are not considered to be possible at the same time in normal operation at any landfill site, this scenario is not considered a particular risk.

3.3.5 Transfer of pumps between wells and dewatering points

The transfer of pumps between wells and dewatering points is a maintenance activity for which contractors should provide a risk assessment. The transfer of pumps between wells requires the wells to be opened, thus allowing the free venting of landfill gas. The risk assessed from the transfer of pumps between wells is summarised in Table 8. Appropriate mitigation measures would be:

- use certified tools;
- where tools are not certified, work must be undertaken outside re-zoned areas, where this is not practical the well must be temporarily sealed to eliminate the possibility of an explosive atmosphere;
- vehicles and generators should be parked away from the zoned area;
- prohibit smoking on site; and
- the provision of a full risk assessment and method statement from contractor prior to works commencing.

3.3.6 Storage of leachate

Leachate is stored in two separate tanks prior to collection for off site disposal:

- the main leachate storage tank, of 36,500L capacity fitted with one 600mm x 600mm "access hatch" and a ~125mm diameter separate vent; and
- a smaller overflow tank of ~15,000L capacity, with a single vent ~300mm x 150mm

The risk assessed from the storage of leachate is summarised in Table 8.

The risks presented therefore are of an explosive atmosphere that will be periodically or occasionally present during normal operations around the vents and hatches and continuously present above the liquid within the tank.

DSEAR Regulation 6 gives requirements for both reducing the quantity of flammable material and eliminating ignition sources. Reduction of the flammable material is probably impractical in this situation as even active ventilation will not achieve a non hazardous area at the vent areas. Given the lack of plant in the

vicinity of the tanks the most appropriate mitigation measure to eliminate sources of ignition is to prohibit smoking.

Prior to maintenance or repair works and especially those that include hot work, contractors should provide a full risk assessment and method statement for any work to be undertaken.

3.3.7 Transfer of leachate to road tanker

Leachate disposal is by means of road tanker, the risk assessed from the storage of leachate is summarised in Table 8.

ICoP 3 provides a zoning diagram for the loading of leachate into a road tanker. The radius of the zone around the tanker's air/vapour release vent is indicated as 1.0m, giving ample clearance between the vent and any potential sources of ignition and also presenting minimal risk.

DSEAR Regulation 6 gives requirements for both reducing the quantity of flammable material and eliminating ignition sources. As the releases of flammable gases are minimal and unavoidable,these cannot be reduced. As most sources of ignition are located outside the hazardous zone, there are no further mitigation measures that can be put in place other than an overall prohibition of smoking at the site

3.3.8 Monitoring of gas extraction wells, leachate extraction wells and condensate removal points

The monitoring of gas extraction wells, leachate extraction wells and condensate removal points at the site is a routine activity occurring on a weekly basis. Monitoring involves either taking gas samples for analysis with a portable gas analyser or taking depth readings with a dip meter. The risk assessed from monitoring activities is summarised in Table 8.

Gas sampling is normally performed by opening the sample point (a 3 mm diameter hole) and attaching a flexible tube that allows a small volume of gas to be drawn through a hand-held gas analyser. The flammable gas is then vented to atmosphere. The system of gas monitoring at Stoneyhill involves utilisation of self-sealing, quick-release connections. This minimises the risk of either gas release or air ingress.

DSEAR Regulation 6 gives requirements for both reducing the quantity of flammable material and eliminating ignition sources. The installations at Stoneyhill already adequately reduce the release of flammable materials. Elimination of ignition sources would be achieved by:

- the use of certified monitoring equipment, and
- the prohibition of smoking on site.

The other activity involved in monitoring is measurement of water levels, particularly in leachate wells. During the measurement of leachate levels the dip point, typically 25mm diameter, is opened to allow the use of a dipping tape to establish depth to liquid measurements. Where the well is under positive pressure, gas will be released and a hazardous zone may occur around the well head.

To comply with DSEAR Regulation 6, the following mitigation measures should be implemented:

- the use of certified depth monitoring equipment, and
- the prohibition of smoking on site.

Monitoring is undertaken by contractors and they should provide a full risk assessment and method statement for any work to be undertaken.

3.3.9 Monitoring of flare inlet and outlet

The monitoring of flare inlet and outlet is a routine activity occurring on a weekly basis. Monitoring involves taking gas samples for analysis with a portable gas analyser. The risk assessed from monitoring activities is summarised in Table 8.

Gas sampling is normally performed by opening the sample point (a 3 mm diameter hole) and attaching a flexible tube that allows a small volume of gas to be drawn through a hand-held gas analyser. The flammable gas is then vented to atmosphere.

DSEAR Regulation 6 gives requirements for both reducing the quantity of flammable material and eliminating ignition sources. The installations at Stoneyhill already adequately reduce the release of flammable materials. Elimination of ignition sources would be achieved by:

- the use of certified monitoring equipment, and
- the prohibition of smoking on site.

To comply with DSEAR Regulation 6, these should be implemented as mitigation measures.

Monitoring is undertaken by contractors and they should provide a full risk assessment and method statement for any work to be undertaken.

3.3.10 Maintenance of Knock-out pot pumps

Maintenance of Knock-out pot pumps is an activity for which contractors should provide a risk assessment for any work to be undertaken. The activity requires knock-out pots to be opened and thus allow the free venting of landfill gas. The risk assessed from the maintenance of pumps is summarised in Table 8. Appropriate mitigation measures would be:

- to use certified tools and equipment;
- where tools are not certified, work must be undertaken outside re-zoned areas, where this is not practical the well must be temporarily sealed to eliminate the possibility of an explosive atmosphere;
- vehicles and generators should be parked away from the zoned area;
- to prohibit smoking on site; and
- the provision of a full risk assessment and method statement from contractor prior to works commencing.

3.3.11 Maintenance of the Flare

Maintenance of the flare is an activity for which contractors should provide a risk assessment for any work to be undertaken. The activity may require removal of flare components leading to the free venting of landfill gas. The risk assessed from the maintenance of the flare is summarised in Table 8. Appropriate mitigation measures would be:

- to prohibit smoking on site;
- to use certified tools and plant;
- where tools are not certified, work must be undertaken outside re-zoned areas, where this is not practical the well must be temporarily sealed to eliminate the possibility of an explosive atmosphere;
- vehicles and generators should be parked away from the zoned area; and
- the provision of a full risk assessment and method statement from contractor before works commence.

Table 8: Assessment of work activities, accidents, consequences and recommended mitigation

Plant Item	Activity	Risk Description	Likelihood	Score	Severity	Score	Magnitude of Risk	Score	Preventative Measures
Uncapped passive vent	Air ingress through open pipe during normal flare operation where the wells are subject to a very slight negative pressure created by the extraction of gas from nearby wells	Air ingress to the landfill body potentially leading to a fire and therefore providing a potential source of ignition	Probable	6	Significant	3	Unacceptable	18	Cap all passive vents to prevent air ingress
Capped passive vent	Air ingress through leaking mechanical seals during normal flare operation where negative pressure exist	Air ingress to the landfill body potentially leading to a fire and therefore providing a potential source of ignition	Unlikely	3	Significant	3	Acceptable	9	Check integrity of seals on a periodic basis – not less than annually.
Gas Extraction Wells	Air ingress through leaking mechanical seals during normal flare operation where negative pressure may be in excess of -30mbarg	Air ingress to the landfill body potentially leading to a fire and therefore providing a potential source of ignition	Unlikely	3	Significant	3	Acceptable	9	Reduce extraction pressures at flare; Check integrity of seals on a periodic basis – not less than annually.
Uncapped leachate and dewatering points	Air ingress through open pipe during normal flare operation where the wells are subject to a very slight negative pressure created by the extraction of gas from nearby wells	Air ingress to the landfill body potentially leading to a fire and therefore providing a potential source of ignition	Probable	6	Significant	3	Unacceptable	18	Cap all Leachate wells and dewatering points to prevent air ingress.
Capped leachate and dewatering points	Air ingress through leaking mechanical seals during normal flare operation where negative pressure exist	Air ingress to the landfill body potentially leading to a fire and therefore providing a potential source of ignition	Unlikely	3	Significant	3	Acceptable	9	Use cable and pipe glands to provide air tight seal around pump pipes and/or cables; Periodically check the integrity of the mechanical seals- not less than annually.
Capped leachate and dewatering points	Pumping leachate	Spark or hot surface of non certified pump providing a potential source of ignition	Somewhat unlikely	4	Severe	4	Unacceptable	16	Use certified pumping equipment; Periodically check the condition of the pump to maintain intrinsic safety - not less than monthly.
Capped leachate and dewatering points	Escape of air from leaking supply pipework	Air ingress to the landfill body potentially leading to a fire and therefore providing a potential source of ignition	Unlikely	3	Significant	3	Acceptable	9	Periodically check the condition of the pump to avoid air leaks and maintain intrinsic safety- not less than monthly
Temporarily uncapped leachate and dewatering points	Escape of landfill gas during pump maintenance.	Ignition of the freely venting gases leading to fire or explosion.	Unlikely	3	Severe	4	Acceptable	12	Use certified tools; Where tools are not certified, work must be undertaken outside re-zoned areas, where this is not practical the well must be temporarily sealed to eliminate the possibility of an explosive atmosphere; Vehicles and generators should be parked away from the zoned area; Prohibit smoking on site; Full risk assessment and method statement from contractor before works commence.
Leachate storage tanks	Passive venting of gas from stored leachate	Ignition of the liberated gases leading to fire or explosion.	Unlikely	3	Significant	3	Acceptable	9	Prohibit smoking on site
Road Tanker	Venting of landfill gas and air from the tanker during transfer of leachate	Ignition of the liberated gases leading to fire or explosion	Very unlikely	2	Significant	3	Acceptable	6	Prohibit smoking on site
Gas Extraction well	Escape of very small quantities of landfill gas during sampling wells under positive pressure generate in flare shut down conditions	Ignition of the liberated gases leading to fire or explosion	Very unlikely	2	Significant	3	Acceptable	6	Prohibit smoking on site; Use intrinsically safe gas monitoring equipment.

Plant Item	Activity	Risk Description	Likelihood	Score	Severity	Score	Magnitude of Risk	Score	Preventative Measures
Interconnecting pipework	Damage of pipelines results in escape of gas/ingress of air	Air ingress/ignition of the liberated gases leading to fire or explosion	Unlikely	3	Significant	3	Acceptable	9	Inspect pipelines integrity (joint connections etc) periodically.
Capped leachate and dewatering points	Escape of small quantities of landfill gas during sampling wells under positive pressure generate in flare shut down conditions	Ignition of the liberated gases leading to fire or explosion	Unlikely	3	Significant	3	Acceptable	9	Prohibit smoking on site Use intrinsically safe depth monitoring equipment
Flare monitoring	Venting of landfill gas from monitoring equipment during	Ignition of the escaping gases leading to fire or explosion.	Unlikely	3	Severe	4	Acceptable	12	Prohibit smoking on site Use certified monitoring equipment
Maintenance of knock-out pots pumps	Escape of landfill gas during pump maintenance.	Ignition of the freely venting gases leading to fire or explosion.	Unlikely	3	Severe	4	Acceptable	12	Prohibit smoking on site; Use certified tools and plant; Where tools are not certified, work must be undertaken outside re-zoned areas, where this is not practical the well must be temporarily sealed to eliminate the possibility of an explosive atmosphere. Vehicles and generators should be parked away from the zoned area; Full risk assessment and method statement from contractor before works commence.
Maintenance of flare	Escape of landfill gas during flare maintenance.	Ignition of the freely venting gases leading to fire or explosion.	Unlikely	3	Severe	4	Acceptable	12	Prohibit smoking on site; Use certified tools and plant; Where tools are not certified, work must be undertaken outside re-zoned areas, where this is not practical the well must be temporarily sealed to eliminate the possibility of an explosive atmosphere. Vehicles and generators should be parked away from the zoned area; Full risk assessment and method statement from contractor before works commence.

4 Zone Classification

4.1 Zone Classification

Zone Classification has been undertaken on the following equipment, installations and areas:

- passive vents;
- the gas extraction wells;
- leachate extraction points and dewatering points
- bentonite seals;
- leachate storage tanks;
- condensate knock-out pots; and
- gas flare compound.

The following standard parameters have been used within the calculations:

- The operating temperature of 10°C identified in ICoP2 has been used ;
- In all cases for Stoneyhill, the flammable material is landfill gas comprising 60% methane and 40% carbon dioxide;
- Ventilation type can be natural, artificial or a combination of the two, in all cases for Stoneyhill the ventilation type is considered to be natural; and
- Ventilation degree can be high, medium or low. Outdoors at Stoneyhill, ventilation is considered to be medium.

4.2 Area Classification

4.2.1 Passive wells

There are a large number (~110) of passive vents on site which have flexseal caps or screw on caps and others which are open to atmosphere. The passive vents are of two sizes:

- 125mm diameter passive vent, capped with flexseal cap;
- 125mm diameter passive vent, no cap;
- 160mm diameter well, capped with flexseal cap or screw fitting cap; and
- 160mm diameter well, no cap.

The area classification for passive vents is shown in Table 9.

Table 9: Area Classification – Passive Vents

Plant Item		125mm no cap	125mm capped	160mm no cap	160mm capped
Location		Gas Field	Gas Field	Gas Field	Gas Field
Grade of Release	4.2.1(a)	Primary	Secondary	Primary	Secondary
Operating temperature °C	4.1	10°C	10°C	10°C	10°C
Operating Pressure mbar	4.2.1(b)	11.1	11.1	11.1	11.1
Flammable material	4.1	Landfill gas	Landfill gas	Landfill gas	Landfill gas
Ventilation Type	4.1	Natural	Natural	Natural	Natural
Ventilation Degree	4.1	Medium	Medium	Medium	Medium
Ventilation Availability	4.2.1(c)	Good	Good	Good	Good
Hazardous Area Zone Number	4.2.1(d)	1	2	1	2
Vertical Zone extent	4.2.1(e)	Height of pipe + 1.3m	Height of pipe + 0.1m	Height of pipe + 1.3m	Height of pipe + 0.1m
Horizontal Zone Radius	4.2.1(e)	1.3m	0.1m	1.3m	0.1m
Calculation reference		125/160mm uncapped Table 10	125/160mm capped Table 10	125/160mm capped Table 10	125/160mm capped Table 10

(a) Grade of release

For uncapped passive vents the grade of release is primary due to strong extraction pressures at the site. Capped passive vents should not leak unless damage is sustained and the release should be infrequent, therefore the grade of release is considered to be secondary.

(b) Pressures

The data from the Stoneyhill landfill provides mean maximum positive pressure of 11.1 mbarg. This value will be used for all calculations.

(c) Ventilation availability

Ventilation availability can be good, fair or poor. Outdoors at Stoneyhill, ventilation availability is considered to be good.

(d) Zone number

Uncapped passive wells have a continuous release and therefore the zone has been designated as zone 1.

The capped wells have a secondary release and therefore the zone has been designated as zone 2.

(e) Zone extent

The size of the zone is calculated in Table 10 below.

Table 10: Calculation of Zone Extent– Passive Vents

Parameter	Symbol	Units	Passive Vent 125/160mm uncapped	Passive Vent 125/160mm capped
Leak diameter	D	mm	125	N/A
CSA of leak path	A_{leak}	mm^2	12273.4	0.25
CSA of leak path	A	m^2	1.23E-02	2.50E-07
Gauge pressure	P	barg	0.011	0.011
Molecular mass of landfill gas	M_{LG}	kg/kmol	27.2	27.2
Upstream temperature	T	K	283	283
LEL	$E_{\%}$	% v/v	4.4	4.4
Safety factor on LEL	k	-	0.25	0.5
Coefficient of discharge	Cd	-	0.8	0.8
Mass flow rate = 1500CdA(MP/T)0.5	g	kg/s	0.478889	0.0000098
Vol. flow rate of LG = 0.0821gT/MCH4	Q_{LG}	m^3/s	0.0014	0.0000083
Proportion methane in landfill gas	-	v/v	0.6	0.6
Volume flow rate of CH4	Q_{CH4}	m^3/s	0.00083	0.00000
Zone extent = (1840Q/kE%)0.55	x	m	**1.3**	**0.1**

4.2.2 Gas extraction wells

There are currently 28 gas extraction wells across the site which are shown on Drawing Number B0578400/02. All gas extraction wells have well heads and appear to be of a single size of 125mm diameter. The design of the wells is such

that the number of mechanical joints is limited and therefore reduces the potential for leaks. The area classification for gas extraction wells is shown in Table 11.

Table 11: Area Classification - Gas Extraction Wells

Plant Item		125mm Gas extraction
Location		Gas Field
Grade of Release	4.2.1(a)	Secondary
Operating temperature °C	4.1	10°C
Operating Pressure mbar	4.2.1(b)	11.1
Flammable material	4.1	Landfill gas
Ventilation Type	4.1	Natural
Ventilation Degree	4.1	Medium
Ventilation Availability	4.2.1(c)	Good
Hazardous Area Zone Number	4.2.1(d)	2
Vertical Zone extent	4.2.1(e)	H + 0.1
Horizontal Zone Radius	4.2.1(e)	0.1
Calculation reference		125/160mm uncapped Table 12

(a) Grade of release

Gas extraction wells should not leak unless damage is sustained and the release should be infrequent, therefore the grade of release is considered to be secondary.

(b) Pressures

The data from the Stoneyhill landfill provides mean maximum positive pressure of 11.1 mbarg. This value will be used for all calculations.

(c) Ventilation availability

Ventilation availability can be good, fair or poor. Outdoors at Stoneyhill, ventilation availability is considered to be good.

(d) Zone number

The gas extraction wells have a secondary release and therefore the zone has been designated as zone 2.

(e) Zone extent

The size of the zone is calculated in Table 12 below.

Table 12: Calculation of Zone Extent- Gas Extraction Wells

Parameter	Symbol	Units	125mm Gas extraction
Leak diameter	D	mm	N/A
CSA of leak path	A_{leak}	mm^2	0.25
CSA of leak path	A	m^2	2.50E-07
Gauge pressure	P	barg	0.011
Molecular mass of landfill gas	M_{LG}	kg/kmol	27.2
Upstream temperature	T	K	283
LEL	$E_{\%}$	% v/v	4.4
Safety factor on LEL	k	-	0.5
Coefficient of discharge	Cd	-	0.8
Mass flow rate = 1500CdA(MP/T)0.5	g	kg/s	0.0000098
Vol. flow rate of LG = 0.0821gT/MCH4	Q_{LG}	m^3/s	0.0000083
Proportion methane in landfill gas	-	v/v	0.6
Volume flow rate of CH4	Q_{CH4}	m^3/s	0.00000
Zone extent = (1840Q/kE%)0.55	x	m	**0.1**

4.2.3 Leachate extraction

The wells dipped for leachate (or water level) DW7, DW7A, DW8, DW6, VP73, W28, VP15 and DW3 appear to correspond with those that have pumps installed, none of these have well heads and appear to be of a single size of 160mm diameter. As it is strongly recommended that the leachate extraction points are capped, the area classification for capped leachate extraction wells has been included in Table 13.

Table 13: Area Classification – Leachate Extraction

Plant Item		160mm Leachate Extraction well no cap	160mm Leachate Extraction well capped
Location		Gas Field	Gas Field
Grade of Release	4.2.1(a)	Continuous	Secondary
Operating temperature °C	4.1	10°C	10°C
Operating Pressure mbar	4.2.1(b)	11.1	11.1
Flammable material	4.1	Landfill gas	Landfill gas
Ventilation Type	4.1	Natural	Natural
Ventilation Degree	4.1	Medium	Medium
Ventilation Availability	4.2.1(c)	Good	Good
Hazardous Area Zone Number	4.2.1(d)	0	2
Vertical Zone extent	4.2.1(e)	Height of pipe + 1.3m	Height of pipe + 0.1m
Horizontal Zone Radius	4.2.1(e)	1.3m	0.1m
Calculation reference		Table 14	Table 14

(a) Grade of release

For uncapped leachate extraction wells the grade of release is considered to be continuous. Capped leachate extraction wells should not leak unless damage is sustained and the release should be infrequent, therefore the grade of release is secondary.

(b) Pressures

The data from the Stoneyhill landfill provides mean maximum positive pressure of 11.1 mbarg. This value will be used for all calculations

(c) Ventilation availability

Ventilation availability can be good, fair or poor. Outdoors at Stoneyhill, ventilation availability is considered to be good.

(d) Zone number

Uncapped leachate extraction wells have a continuous release and therefore the zone has been designated as zone 0. The capped leachate extraction wells have a secondary release and therefore the zone has been designated as zone 2.

(e) Zone extent

The size of the zone is calculated in table 14 below.

Table 14: Calculation of Zone Extent– Leachate Extraction

Parameter	Symbol	Units	160mm Leachate Extraction well no cap	160mm Leachate Extraction well capped
Leak diameter	D	mm	125	N/A
CSA of leak path	A_{leak}	mm^2	12273.4	0.25
CSA of leak path	A	m^2	1.23E-02	2.50E-07
Gauge pressure	P	barg	0.011	0.011
Molecular mass of landfill gas	M_{LG}	kg/kmol	27.2	27.2
Upstream temperature	T	K	283	283
LEL	$E_{\%}$	% v/v	4.4	4.4
Safety factor on LEL	k	-	0.25	0.5
Coefficient of discharge	Cd	-	0.8	0.8
Mass flow rate = 1500CdA(MP/T)0.5	g	kg/s	0.478889	0.0000098
Vol. flow rate of LG = 0.0821gT/MCH4	Q_{LG}	m^3/s	0.0014	0.0000083
Proportion methane in landfill gas	-	v/v	0.6	0.6
Volume flow rate of CH4	Q_{CH4}	m^3/s	0.00083	0.00000
Zone extent = (1840Q/kE%)0.55	x	m	**1.3**	**0.1**

4.2.4 Bentonite seals

As no construction details have been provided for any of the wells installed, it has been assumed that each of the wells has been installed with a bentonite seal and this section deals with the releases resulting from failure of the seal.

ICoP 2 indicates that under normal circumstances, two independent faults are not considered for area classification. Consequently, as failure of the seal and positive pressure condition are no longer both possible in normal operation at any landfill site, this scenario is not considered a particular risk and zone extents have not been calculated.

4.2.5 Transfer of pumps between wells and dewatering points

The transfer of pumps between wells requires the wells to be opened, which allows the free venting of landfill gas. This activity presents less risk than the permanent installation of pumps in uncapped wells as the activity is much less frequent than the continuous venting of gas. The area classification for transfer of pumps between wells is shown in Table 15.

Table 15: Area Classification – Transfer of Pumps

Plant Item		160mm Leachate Extraction well, no cap during maintenance
Location		Gas Field
Grade of Release	4.2.1(a)	Primary
Operating temperature °C	4.1	10°C
Operating Pressure mbar	4.2.1(b)	11.1
Flammable material	4.1	Landfill gas
Ventilation Type	4.1	Natural
Ventilation Degree	4.1	Medium
Ventilation Availability	4.2.1(c)	Good
Hazardous Area Zone Number	4.2.1(d)	1
Vertical Zone extent	4.2.1(e)	Height of pipe + 1.3m
Horizontal Zone Radius	4.2.1(e)	1.3m
Calculation reference		Table 16

(a) Grade of release

For open leachate extraction wells the grade of release is considered to be primary.

(b) Pressures

The data from the Stoneyhill landfill provides mean maximum positive pressure of 11.1 mbarg. This value will be used for all calculations

(c) Ventilation availability

Ventilation availability can be good, fair or poor. Outdoors at Stoneyhill, ventilation availability is considered to be good.

(d) Zone number

Uncapped leachate extraction wells have a primary release and therefore the zone has been designated as zone 1.

(e) Zone extent

The size of the zone is calculated as table 16 below.

Table 16: Calculation of Zone Extent– Transfer of Pumps

Parameter	Symbol	Units	160mm Leachate Extraction well, no cap during maintenance
Leak diameter	D	mm	125
CSA of leak path	A_{leak}	mm^2	12273.4
CSA of leak path	A	m^2	1.23E-02
Gauge pressure	P	barg	0.011
Molecular mass of landfill gas	M_{LG}	kg/kmol	27.2
Upstream temperature	T	K	283
LEL	$E_{\%}$	% v/v	4.4
Safety factor on LEL	k	-	0.25
Coefficient of discharge	Cd	-	0.8
Mass flow rate = 1500CdA(MP/T)0.5	g	kg/s	0.478889
Vol. flow rate of LG = 0.0821gT/MCH4	Q_{LG}	m^3/s	0.0014
Proportion methane in landfill gas	-	v/v	0.6
Volume flow rate of CH4	Q_{CH4}	m^3/s	0.00083
Zone extent = (1840Q/kE%)0.55	x	m	**1.3**

4.2.6 Leachate storage tanks

Leachate is stored prior to disposal in two separate tanks:

- the main leachate storage tank, of 36,500L capacity fitted with one 600mm x 600mm "access hatch" and a ~125mm separate vent; and
- a smaller overflow tank ~15,000L capacity, with a single vent ~300mm x 150mm

There is no active ventilation of the tanks nor is any pre-treatment undertaken. Disposal is by transfer to road tanker. The area classification for leachate storage areas is shown in Table 17.

Table 17: Area Classification – Leachate Storage

Plant Item		Headspace over liquid	Around vents and hatches	Around tanker hatch
Location		Near site entrance	Near site entrance	Near site entrance
Grade of Release	4.2.1(a)	Continuous	Primary	Secondary
Operating temperature °C	4.1	10°C	10°C	10°C
Operating Pressure mbar	4.2.1(b)	NA	NA	NA
Flammable material	4.1	Landfill gas	Landfill gas	Landfill gas
Ventilation Type	4.1	Natural	Natural	Natural
Ventilation Degree	4.1	Low	Medium	Low
Ventilation Availability	4.2.1(c)	Poor	Good	Poor
Hazardous Area Zone Number	4.2.1(d)	0	1	2
Vertical Zone extent	4.2.1(e)	Entire headspace	3.0	1.0
Horizontal Zone Radius	4.2.1(e)	Entire headspace	3.0	1.0
Calculation reference	4.2.1(e)	ICoP 03	ICoP 03	ICoP 03

(a) Grade of release

Methane is release from leachate is considered to be continuous.

(b) Pressures

The leachate tanks are not subject to pressure, therefore pressures are not applicable for release of methane from leachate.

(c) Ventilation availability

Ventilation availability can be good, fair or poor. Within the leachate tank the availability of ventilation is considered to be poor, outdoors i.e. at the hatches, ventilation availability is considered to be good.

(d) Zone number

Methane release from leachate is continuous; therefore the zone above the liquid within the tank has been designated as zone 0.

ICoP3 recommends the zone around the leachate storage tank hatches and around the tanker is classified as zone 1.

(e) Zone extent

The size of the zone is calculated in ICoP3 gives a 3m radius zone 1 around vents or unsealed hatches and a 1m radius zone 2 around tanker hatch.

4.2.7 Monitoring of gas extraction wells, leachate extraction wells and condensate removal points

The monitoring of gas extraction wells, leachate extraction wells and condensate removal points at the site is a routine activity occurring on a weekly basis. Monitoring involves either taking gas samples for analysis with a portable gas analyser or taking depth readings with a dip meter.

The system of gas monitoring at Stoneyhill involves self-sealing, quick-release connections for attaching a flexible tube that allows a small volume of gas to be drawn through a hand-held gas analyser. The flammable gas is then vented to atmosphere. ICoP 2 states that this will produce a zone 1 but of negligible extent.

The other activity involved in monitoring is measurement of liquid levels particularly in leachate wells. During the measurement of leachate levels the dip point, typically 25mm diameter (17mm ID) is opened to allow the use of a dipping tape to establish depth to liquid measurements. Where the well is under positive pressure gas will be released and a hazardous zone may occur around the well head. The area classification for gas extraction wells, leachate extraction wells and condensate monitoring points is shown in Table 18.

Table 18: Area Classification – Gas Extraction Wells, Leachate Extraction Wells and Condensate Monitoring Points

Plant Item		Bentonite Seals
Location		Gas Field
Grade of Release	4.2.1(a)	Secondary
Operating temperature °C	4.1	10°C
Operating Pressure mbar	4.2.1(b)	11.1
Flammable material	4.1	Landfill gas
Ventilation Type	4.1	Natural
Ventilation Degree	4.1	Medium
Ventilation Availability	4.2.1(c)	Good
Hazardous Area Zone Number	4.2.1(d)	0
Vertical Zone extent	4.2.1(e)	H + 2.1
Horizontal Zone Radius	4.2.1(e)	2.1
Calculation reference	4.2.1(e)	Table 19

(a) Grade of release

This is, although a frequent activity, of very short duration therefore the grade of release is considered to be secondary.

(b) Pressures

The data from the Stoneyhill landfill gives positive pressures recorded in flare shut down situations in the range 0 to 46.4 mbarg, statistical analysis of the data provides mean maximum positive pressure of 11.1 mbarg. This value will be used for all calculations.

(c) Ventilation availability

Ventilation availability can be good, fair or poor. Outdoors at Stoneyhill, ventilation availability is considered to be good.

(d) Zone number

The dipping points have a have a secondary release and therefore the zone is designated as zone 2.

(e) Zone extent

The size of the zone is calculated as table 19 below.

Table 19: Calculation of Zone Extent - Gas Extraction Wells, Leachate Extraction Wells and Condensate Monitoring Points

Parameter	Symbol	Units	Dipping points, 17mm ID
Leak diameter	D	mm	17
CSA of leak path	A_{leak}	mm^2	227.0
CSA of leak path	A	m^2	2.27E-04
Gauge pressure	P	barg	0.011
Molecular mass of landfill gas	M_{LG}	kg/kmol	27.2
Upstream temperature	T	K	283
LEL	$E_{\%}$	% v/v	4.4
Safety factor on LEL	k	-	0.5
Coefficient of discharge	Cd	-	0.8
Mass flow rate = 1500CdA(MP/T)0.5	g	kg/s	0.0089
Vol. flow rate of LG = 0.0821gT/MCH4	Q_{LG}	m^3/s	0.0076
Proportion methane in landfill gas	-	v/v	0.6
Volume flow rate of CH4	Q_{CH4}	m^3/s	0.00454
Zone extent = (1840Q/kE%)0.55	x	m	2.1

4.2.8 Flare and Line 1 & 2 Monitoring Points

The monitoring of gas at the flare is a routine activity occurring on a weekly basis.

(a) Grade of release

Monitoring involves taking gas samples for analysis with a portable gas analyser. The system of gas monitoring on the flare at Stoneyhill uses individual valve sample points for attaching a flexible tube that allows a small volume of gas to be drawn through a hand-held gas analyser. The flammable gas is then vented to atmosphere. This is expected to occur periodically and predictably so should be considered a primary release.

(b) Pressures

The data from the Stoneyhill landfill gives positive pressures recorded in flare shut down situations in the range 0 to 46.4 mbarg, statistical analysis of the data provides mean maximum positive pressure of 11.1 mbarg. This value will be used for all calculations.

(c) Ventilation availability

Ventilation availability can be good, fair or poor. Outdoors at Stoneyhill, ventilation availability is considered to be good.

(d) Zone number

ICoP 2 states that this will produce a zone 1.

(e) Zone extent

ICoP 2 states that this will produce a zone 1 but of negligible extent and zoning therefore need not be considered.

4.2.9 Flanges, screwed fittings, joints and valve glands

(a) Grade of release

These feature are not expected to leak releases and would therefore be secondary.

(b) Pressures

The data from the Stoneyhill landfill provides mean maximum positive pressure of 11.1 mbarg. This value will be used for all calculations.

(c) Ventilation availability

Ventilation availability can be good, fair or poor. Outdoors at Stoneyhill, ventilation availability is considered to be good.

(d) Zone number

As this is a secondary release this will be a Zone 2.

(e) Zone extent

ICoP 2 uses a maximum 80mbarg for landfill gas pressure and a leak aperture of 0.25 mm^2 (standard value from IGE/SR/25) to give a standard rounded up Zone 2 radii of 0.1m from all of these items.

4.2.10 Condensate Knock-out Pots

ICoP 2 provides a detailed diagrammatic illustration of the zoning around a typical pumped Condensate Knock-out Pot (KOP) and states that the Zone 2 around the "blanking plate is negligible". However if consideration is given to the age of the installation the KOP top or blanking plates could be considered as flanged joints and a standard rounded up Zone 2 radii of 0.1m (as above) would provide a conservative value.

4.2.11 Flexible or expansion joints

There two of these expansion joints indicated as present within the Booster acoustic housing; one of these connects the booster to the gas field side and the other the stack side, ICoP2 addresses these in section 6.4 and gives Zone 2 radius of 1.0m. However, following ICoP2 guidance as the booster is housed within an acoustic enclosure, the interior of the acoustic housing should be considered as Zone 2.

4.2.12 Gas Booster

The point at which the gas booster drive shaft passes into the fan housing is identified as a potential source of release. No data is available on the diameter of the shaft to allow calculation of the zone; the ICoP gives a range of pre-calculated zone extent values based on drive shaft diameter. For shafts up 50 mm, a 1.0 m zone is calculated. The shaft given the size of booster is not thought to be greater than 50mm. in addition the Zone would be confined by the acoustic enclosure. For leaks from the booster drive shaft the interior of the acoustic housing should be considered as Zone 2.

4.3 Area Classification Plan

The Gas Flare Compound Area Classification Plan is shown on Drawing B0578400/DSEAR/03.

4.4 Equipment Assessment

No electrical/mechanical equipment within the compound is located within any area classified Zone 1.

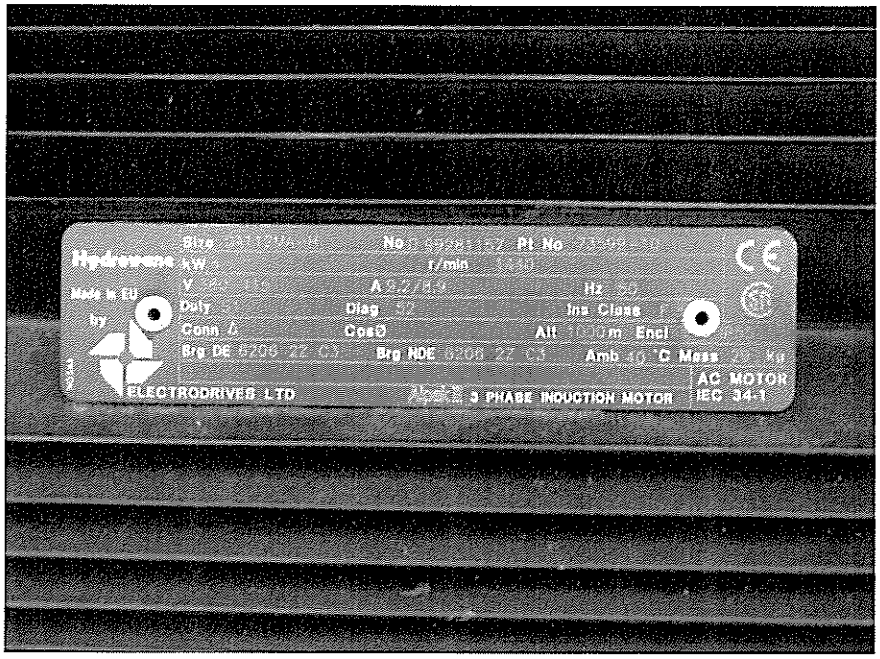
The Gas Booster motor is located within Zone 2. Equipment located within Zone 2 should have either the Pre-ATEX protection "non-incendive, Ex N or Ex n" or ATEX Category 3G, (classified II for surface or non mining use).

The ICoP 1 states that there is no necessity to replace existing electrical equipment with ATEX marked equivalents provided a risk assessment shows that the equipment is suitable for its location. The suitability of the equipment cannot be assessed due to lack of data. The Figure 1 below shows the manufacturers "data plate" for the booster motor. Figure 2 shows a typical data plate.

Figure 1 - Booster motor data plate



Figure 2 - Typical data plate



The details of this motor and its likely ATEX protection level should be available from the manufacturer of the flare or from the booster/motor manufacturer, however given the age of the machine it is unlikely that the appropriate level of detail would be available.

5 Accident and Incident Management

DSEAR Regulation 8 requires arrangements to be in place to deal with accidents, incidents and emergencies. The ICoP guidance indicates the following points should be addressed:

- occupied buildings should have a fire alarm system that is tested regularly;
- evacuation and assembly points should be designated and clearly marked;
- emergency exits should be marked and housekeeping standards such that exits are unobstructed;
- fire drills should be held at suitable intervals;
- visitors should be alerted to escape routes and muster points; and
- notice boards in every workplace should detail the local emergency arrangements.

Stoneyhill Landfill is closed and is subject only to periodic maintenance and monitoring visits by contractors and site inspection by BTW staff and contractors. To satisfy regulation 8, prior to allowing any contractor to operate on site BTW should provide information comprising of:

- zone classification and extent information;
- the impact on the selection of ATEX certified equipment;
- requirements for contractors to provide a method statement for approval prior to conducting routine works;
- requirements for contractors to provide a method statement for approval prior to conducting non standard works; and
- contact numbers in the event of emergency.

The contact numbers should include the numbers of BTW staff responsible for the site and their deputies.

6 Recommendations for Training

DSEAR Regulation 9 requires information on the hazardous properties of substances to be made available. The hazardous properties of all flammable mixtures should be identified and made available at the workplace where this is practical. Specifically, employees should be made aware of the potentially explosive nature of landfill gas and measures taken to reduce the risk of ignition.

DSEAR Regulation 11 requires the employer responsible for the workplace to co-ordinate the implementation of measures taken under DSEAR to protect employees and others at the workplace from risks from explosive atmospheres.

In many cases on landfill sites, employees from external contractors and visitors may be unaware of their responsibilities under DSEAR.

Induction training is required to cover such areas as:

- no-smoking policy in or near hazardous areas;
- prohibition of the use of uncertified electrical equipment in hazardous areas, such as test equipment, mobile phones, pagers, personal audio equipment, etc; and
- correct use of intrinsically safe test equipment, e.g. oxygen analysers and dip meters.

It is recommended that contractors attend a hazardous area awareness course or are requested to provide evidence that staff employed to work at the site are suitably trained or qualified.

Where access to zoned areas is part of the work of external contractors, then contractors must be required to provide risk assessments and method statements which contain that only suitably-qualified persons will be used for such work.

7 Recommendations for Marking of Pipes and Containers

DSEAR Regulation 10 requires identification of pipes and containers, particularly those that are visible to alert employees and others to the presence of a dangerous substance so that they can take the necessary precautions.

The following recommendations are made in order to satisfy the regulations:

- All containers and pipework containing hazardous materials should be marked according to the appropriate regulations (i.e. Health and Safety (Safety Signs and Signals) Regulations 1996 (S.I. 1996/341)).
- Additional generalised signage should be placed within the site to notify of the risks as indicated in the Area Classification Plan (see Drawing No. B0578400/DSEAR/03)
- The leachate storage tank and flare compound should be individually marked with EX warning signs to alert personnel of the risk
- A warning sign should be placed at the site entrance in line with the example given in the ICoP(Figure 3)

Figure 3: Suggested Site Entrance Signage

Key information regarding explosion risks

Landfilled waste generates methane!

Where you see this sign:



it indicates areas where landfill gas may be present.

There is an explosion risk if ignited.

Follow the instructions on the sign.

No smoking anywhere on the site.

7.1 Assessing the risks

The fact that a dangerous substance is present at the workplace does not necessarily mean that areas where it is used, transferred or stored need to be classified as hazardous. Where the risk of a release is extremely unlikely or the quantity that could be released is small, it may not be necessary to classify the area as hazardous. For example, if a dangerous substance is being transferred through a seamless pipe that has been properly installed and maintained, it is not expected that the substance will be released; therefore an explosive atmosphere would not be expected to occur and the area surrounding the pipe would be safe.

However, if equipment (i.e. pipeworks, tanks or containers etc) is not adequately maintained or properly installed then this can lead to leaks and spills, the risks of which need to be assessed. Steps need to be taken to prevent incidents of this nature.

All equipment within the site (i.e. pipeworks, tanks, containers etc) should be maintained in efficient working order and in good repair, and therefore the following recommendations are made:

- A maintenance programme (which should include pipework, tanks etc) should be in place to ensure the integrity of the plant and equipment on site; maintenance includes examination, servicing, cleaning, repairing and testing.
- Records should be kept of the activities undertaken to examination and maintain all equipment.
- General precautions should be implemented even in areas considered non-hazardous. At a minimum, the no-smoking policy and procedures for prompt clean-up and safe disposal of the substances should be place.

The Approved Code of Practice 'Safe Maintenance, Repair and Cleaning', provides practical advice on identifying and implementing appropriate control measures and systems of work during maintenance and other similar non-routine activities.

8 Summary of Actions

The Assessment of the site has raised a number of actions required to bring the site into compliance with the Dangerous Substance and Explosive Atmospheres Regulations 2002 (DSEAR). Consequently, requirements apply to the existing site with immediate effect and implementation should be continued by the newly appointed landfill gas management contractor Biogas Limited.

The recommended actions are indicated below;

- prohibit smoking on site;
- cap all passive vents to prevent air ingress;
- cap all leachate wells and dewatering points to prevent air ingress;
- reduce extraction pressures at flare;
- maintain the gas field and flare in good operational condition;
- vehicles and generators should be parked away from the zoned area;
- use intrinsically safe gas monitoring equipment;
- use of certified pumping equipment and certified tools;
- where tools are not certified, work must be carried out in an un-zoned area, where this is not practical the well must be temporarily sealed to eliminate the possibility of an explosive atmosphere and a full risk assessment and method statement provided from the contractor before works commence; and
- consideration should be given to HSE advice with regard to storage of propane gas cylinders.
- Implement a maintenance programme for equipment, such as pipes and tanks, and retain appropriate records.
- Supply of a contractors information pack comprising of:
  - zone classification and extent information;
  - the impact on the selection of ATEX certified equipment;
  - requirements for contractors to provide a full risk assessment and method statement for approval prior to conducting routine works;

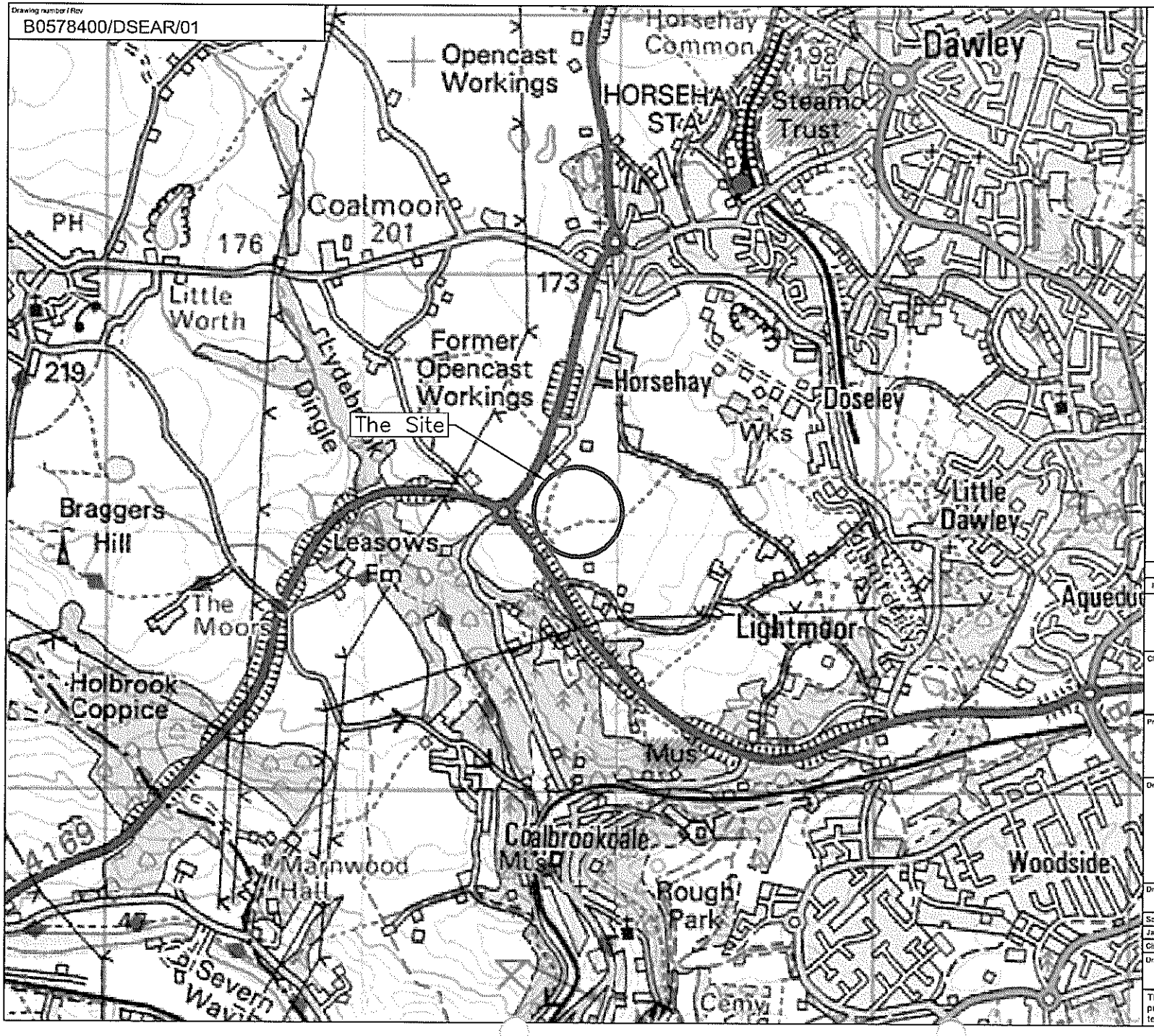
- requirements for contractors to provide a full risk assessment and method statement for approval prior to conducting non standard works; and
- contact numbers in the event of emergency.

- Induction training is required to cover such areas as:
  - no-smoking policy in or near hazardous areas;
  - prohibition of the use of uncertified electrical equipment in hazardous areas, such as test equipment, mobile phones, pagers, personal audio equipment, etc;
  - correct use of intrinsically safe test equipment, e.g. oxygen analysers and dip meters; and
  - improved signage in accordance with the regulations as described in Section 7.
- Communication methods should be developed and regularly engaged so that significant findings of risk assessments, or other associated issues to protect employees, can be relayed.
- DSEAR Risk Assessments should be reviewed and updated if the nature of any activity changes.

Appendix A Drawings

Drawing Number	Revision	Drawing Title
B0578400/DSEAR/01	0	Site Location Plan
B0578400/DSEAR/02	0	Principal Site Features
B0578400/DSEAR/03	0	Gas Flare Compound Area Classification Plan

Drawing number / Rev
B0578400/DSEAR/01



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Rev	Rev. Date	Purpose of revision	Drawn	Checked	Approved
0	21.05.07	DRAWING CREATED	CA	CA	SM

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Project
STONEYHILL LANDFILL SITE HORSEHAY
DSEAR ASSESSMENT

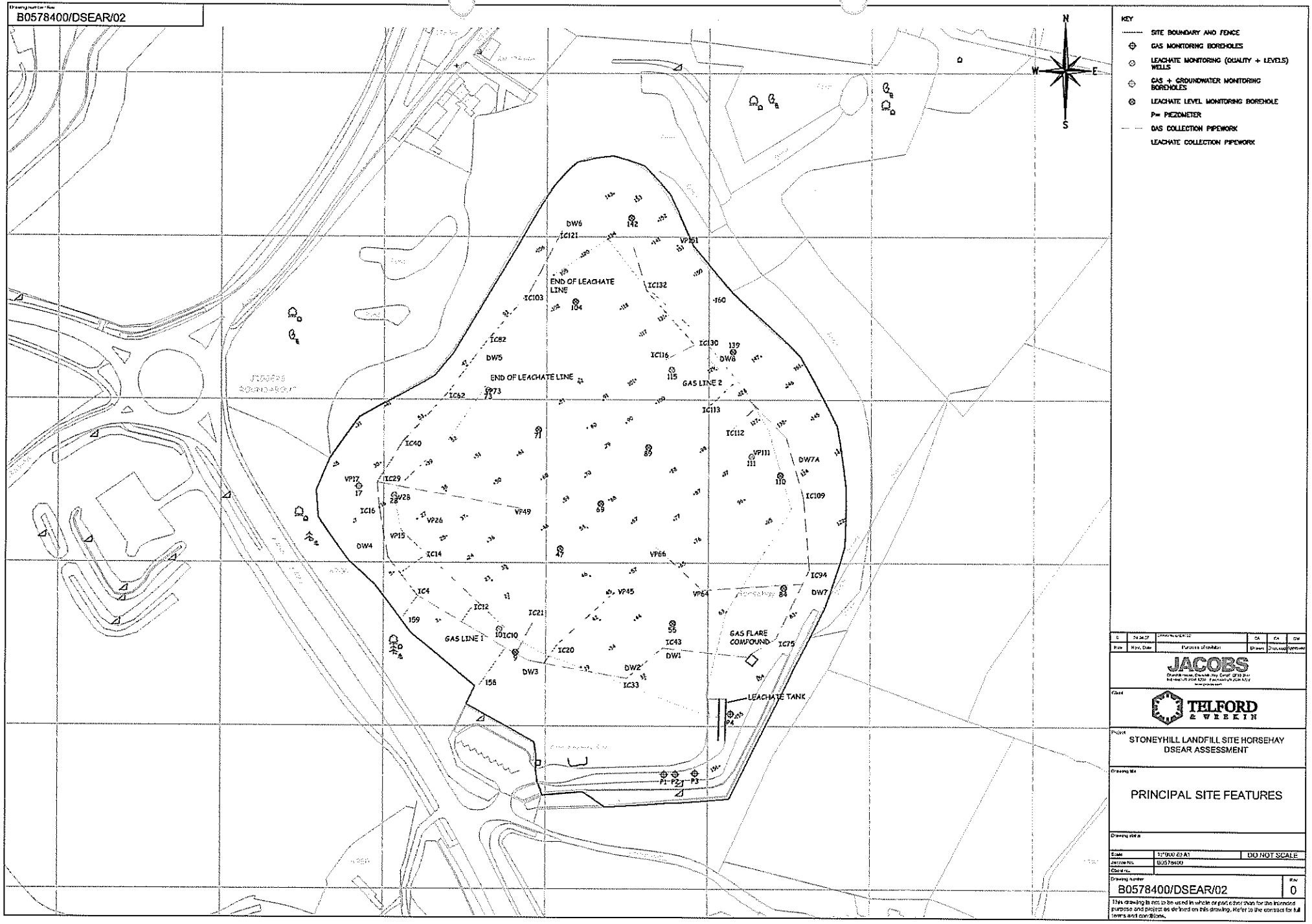
Drawing title
SITE LOCATION PLAN

Drawing status

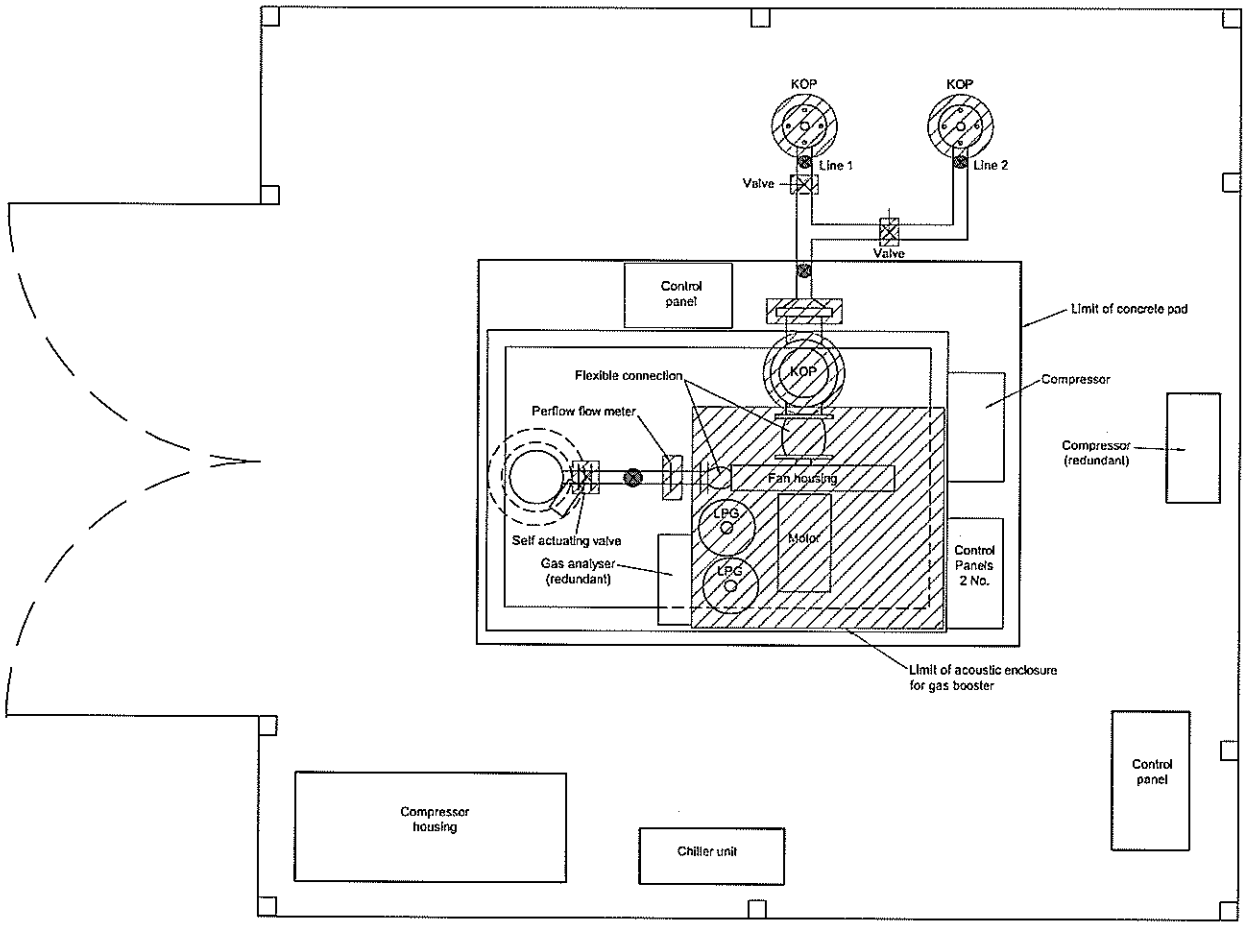
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B0578400/DSEAR/02
N
S
E
W
KEY
SITE BOUNDARY AND FENCE
GAS MONITORING BOREHOLES
LEACHATE MONITORING (QUALITY + LEVELS) WELLS
GAS + GROUNDWATER MONITORING BOREHOLES
LEACHATE LEVEL MONITORING BOREHOLE
P= PIEZOMETER
GAS COLLECTION PIPEWORK
LEACHATE COLLECTION PIPEWORK
END OF LEACHATE LINE
END OF LEACHATE LINE
GAS LINE 1
GAS LINE 2
GAS FLARE COMPOUND
LEACHATE TANK
DW1
DW2
DW3
DW4
DW5
DW6
DW7
DW7A
DW8
P1
P2
P3
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STONEYHILL LANDFILL SITE HORSEHAY
DSEAR ASSESSMENT
PRINCIPAL SITE FEATURES
DO NOT SCALE
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Drawing number / Rev
B0578400/DSEAR/03



NOTES

LEGEND

- Zone 1
- Zone 2
- Gas sampling point (Zone 1 of negligible extent)

KOP - Knock-out pot

Rev	Rev. Date	Purpose of revision	Drawn	Checked	Approved
0	14.07.08	Issued for comment	MC		

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Client: TELFORD & WREKIN

Project: STONEYHILL LANDFILL SITE DSEAR ASSESSMENT

Drawing title: GAS FLARE COMPOUND AREA CLASSIFICATION PLAN

Drawing status: DRAFT FOR COMMENT

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Telford and Wrekin Council

Stoneyhill Closed Landfill Site

Updated Conceptual Site Model

Date: February 2008

Document No: B0578400/CSM/R01

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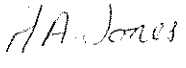
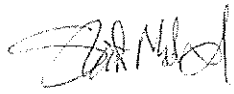
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Document Control Sheet

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Title:	Updated Conceptual Site Model		

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Appendices

Appendix 1	Borehole Logs
Appendix 2	Summary of Historic Groundwater, Surface Water and Leachate Data
Appendix 3	Historic Perimeter Landfill Gas Monitoring Data
Appendix 4	ALcontrol Data Sheets

Drawings

Drawing Number	Revision	Drawing Tilte
B0578400/CSM/01	0	Site Location Plan
B0578400/CSM/02	0	Current Conceptual Model
B0578400/CSM/03	0	Locations for Monitoring of Leachate, Groundwater, Surface water
B0578400/CSM/04	0	Zone Map indicating areas of contamination
B0578400/CSM/05	0	Geological cross-sections
B0578400/CSM/06	0	Receptor Plan
B0578400/CSM/07	0	Schematic representation of Updated Conceptual Model

1 Introduction

1.1 Overview and objectives

Jacobs has been commissioned by Telford and Wrekin Council (TWC) to update the conceptual model produced by GeoWater Environmental Geology in order to assist TWC in reviewing the site in the context of Part IIA of the Environmental Protection Act (EPA) 1990.

A formal proposal for the works required to progress the site were presented to TWC in September 2006 (Ref B0245700/SJM/HJ/02). Following issue of this proposal TWC were awarded Department of Environment, Food and Rural Affairs (DEFRA) funding to progress investigation works at the site via the DEFRA Contaminated Land Capital Projects Programme (CLCPP).

An initial Gap Assessment and Scoping Report was produced by Jacobs in May 2007 as the first stage of the proposal and presented a review of the current conceptual understanding of the site. The conceptual model was soley based on a report produced by GeoWater Environmental Geology (hereafter referred to as GeoWater) on the 'Assessment of Contaminant Risks Posed by Stoneyhill Landfill Site, Volume 1: Main Report, May 2004'.

The Jacobs assessment identified gaps within the data sets currently held by TWC in relation to the site. It was concluded that filling these gaps was critical in understanding and assessing the significance of Potential Pollutant Linkages (PPLs) associated with the site as identified in the GeoWater report and in reviewing the Council's liabilities in relation to these identified linkages. PPLs between the site, controlled waters and human health have previously been identified. To progress the assessment of these PPLs, and therefore the development of the Conceptual Site Model (CSM), a number of tasks were identified. Works included the following tasks which have acted to inform this revised and updated CSM:

- Further sampling in order to further characterise the landfill leachate;
- Further investigation of the shallow groundwater regime within the colliery spoil by installing additional boreholes;
- Monitoring the groundwater quality in the sandstone aquifer; and
- Monitoring the surface waters in close proximity of the site.

This formed the second stage of the proposal and the basis for this report.

The information gathered from the above works has been used to update and develop the CSM and has been used to refine the assessment of risk associated with the site. The end goal of this risk assessment process will be to determine if any of the PPLs are likely to be considered 'significant' linkages in the context of EPA Part IIA 1990, thus potentially resulting in 'determination' of the site as Contaminated Land by the Local Authority.

1.2 Limitations and Exceptions

This report is for the sole use of TWC and shall not be relied upon by, or transferred to, any other parties without the express written consent of Jacobs and TWC. If an unauthorised third party comes into possession of this report, they rely on the contents at their own risk and Jacobs owes them no duty of care or skill.

The findings and opinions contained within this report are based on information obtained from a variety of sources which are believed to be reliable. Nevertheless, the authenticity or reliability of the information cannot be guaranteed. It is noted that a substantial amount of previous work has been completed at the site. For the purpose of this study, this information will be taken at 'face value'. Interrogation and validation of the assumptions and findings of these various studies will not be undertaken as part of the study. Should, during the preparation of the study conflicts within the findings / assumptions of the various reports and documents be noted, then these will be reported and identified for future assessment.

It is possible that the research carried out, whilst appropriate to comply with the agreed brief, has not indicated the full extent of conditions across the site and the existence of other relevant information sources. If such sources actually exist, their information could not reasonably have been considered in the formulation of the findings and opinions presented in this report.

Jacobs believes that providing information about the exact scope of works undertaken is essential to help TWC to identify and therefore manage its risks. These risks can be mitigated, but not entirely eliminated, through additional investigation, assessment and subsequent remedial works.

Jacobs can provide advice upon the likelihood of designation of a site as contaminated land but are unable to designate as this is the sole responsibility of the Local Authority. The information obtained within this report is intended to provide TWC with an informed understanding of the Site in its environmental and legislative context only.

2 Contaminated Land Regime

2.1 Part IIA Environmental Protection Act (1990)

The regime for 'Contaminated Land', as defined under Part IIA of the Environmental Protection Act 1990 and the Contaminated Land (England) 2000 Regulations contains a statutory obligation on UK Local Authorities to prepare, adopt and publish a written strategy for the identification and remediation of such land. Contaminated Land is defined within the Regulations as any land, 'which appears to the Local Authority in whose area it is situated, to be in such a condition, by reason of the substances in, on or under the land, that:

a) Significant harm is being caused, or there is significant possibility of such harm being caused, or

(b) Significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused.'

2.2 Local Authority Notified Pollutant Linkages

For land to be determined as 'Contaminated' by a Local Authority, it must satisfy two principal criteria. In the first instance, a pollutant linkage, or source-pathway-receptor relationship, must be established. Secondly, the Local Authority must also be satisfied that the identified pollutant linkage is causing, or has the potential to cause 'significant harm' and therefore constitutes a significant pollutant linkage'. Significant harm in the Regulations in terms of its effects on statutorily designated receptors can be summarised as follows:

Humans:	Chronic, or acute toxic effect, serious injury or death;
Ecosystems:	Irreversible, or other adverse change in statutorily protected wildlife sites;
Infrastructure:	Substantial damage too, or failure of buildings;
Livestock/crops:	Disease, physical damage or death such that a substantial loss in value is incurred;
Controlled waters:	Pollution of major groundwater aquifers or surface waters.

2.3 Inspecting Land Under Part IIA

As noted above, it is the responsibility of the Local Authority to prepare, adopt and publish a written strategy for the identification and remediation of contaminated land. It is this report's objective to assess the contaminated land risks at Stoneyhill Landfill based on information provided to Jacobs by TWC and on additional investigations conducted by Jacobs.

2.4 Legislative Requirement

TWC has been awarded monies in the form of a direct grant under section 31 of the Local Government Act 2003 as part of the DEFRA CLCPP. The CLCPP is intended to support local authority work arising under the regime set out in Part IIA of the EPA 1990 and the Contaminated Land (England) 2000 Regulations.

Part IIA introduced a new regulatory regime for the identification and remediation of contaminated land. Part IIA requires a strategic approach to the inspection and determination of contaminated land that, in accordance with paragraph B.20, may include one or all of the following stages:

- Desk Study – Collation and assessment of documentary information, or information from other bodies.
- Study area visit – For the purposes of visual inspection (and in some cases limited sampling), and
- Intrusive Investigation.

This approach ensures that the Local Authority is satisfied that there is a reasonable possibility that a pollutant linkage exists within the study area, before moving onto the next stage. For example, by way of an initial desk study to collate and assess documentary information, the Local Authority is satisfied that there is a reasonable possibility that a pollutant linkage exists before:

- A visit / inspection of the study area is undertaken.
- And then, that the local authority is satisfied that the contamination is actually present and that the receptor is actually present or likely to be present, before;
- An invasive investigation is carried out using statutory powers.

The strategic approach prevents further unnecessary investigation of a pollutant linkage if at any stage there is no longer a reasonable possibility that the particular pollutant linkage exists.

In accordance with the Part IIA guidance on the definition of contaminated land set out in Chapter A, there are four possible grounds for determination, namely that:

- Significant harm is being caused, in line with paragraph B.44.
- There is significant possibility that significant harm is being caused, in line with paragraph B.45 to B.49.
- Pollution of controlled waters is being caused, in line with paragraph B.50.
- Pollution of controlled waters is likely to be caused, in line with paragraph B.51.

Pollutant linkage or linkages should be identified as the basis for the determination and all three elements (i.e. source-pathway-receptor) should be identified. A linkage that forms the basis for determination that land is contaminated is then a 'significant pollutant linkage' as defined in section 2.2 above.

3 Background Information

3.1 Site Description and Historical Development

Site Location

Stoneyhill landfill is situated to the south of Telford, just north of the Ironbridge by-pass between Horsehay and Coalbrookdale at National Grid Reference SJ 6685 0605. The location of the site is shown on Drawing Number B0578400/CSM/01.

The site is situated to the east of the Jiggers roundabout and is bound to the north-west by Wellington Road (A5223) and south west by the A4169. Residential properties are also situated within 50 to100 metres to the north, south (Croppings farm) and 200 metres north-east (Woodlands House) of the site as shown on the location map.

The site covers an area of 8.2 hectares and lies at the end of a spur of high ground projecting south-eastwards towards the Ironbridge Gorge about 2km to the south, containing the River Severn at an elevation of about 35m AOD. The site boundary lies at approximately 185m AOD and the landfill forms a mound with a summit elevation of 194m AOD.

Geology

The site of the Stoneyhill landfill was subject to extensive underground coal mining, probably from the eighteenth century or earlier. A National Coal Board report of 1984 (provided in the GeoWater report) refers to the last date of working being the early 1900's. The site was subsequently subjected to opencast coal mining in the mid twentieth century and is thought to have ceased in 1963. Opencast workings are understood to have extended to the Little Flint seam which lies well beyond the eastern landfill boundary.

Previous assessments of the site indicate that the geological strata prior to mining were Lower Coal Measures underlain by Sandstones and Mudstones of Lower Coal Measures age.

British Geological Survey Sheet SJ60NE (1:10,560 series, Solid and Drift Edition) indicates the site to be underlain by made ground comprising 'worked out opencast coal area' of the Stoneyhill opencast. The 'solid' geology at the site comprises the Lower Coal Measures Strata of the Carboniferous Period with no overlying superficial soils shown. The Little Flint Coal Seam and Lancashire Ladies Coal Seam are conjectured to outcrop around the approximate boundary of the current landfill. The SW-NW trending Stoneyhill Fault is conjectured to the north west of the site and downthrows to the north-west.

It is reported in the GeoWater report that the approximate elevation of the Little Flint Coal is of the order of 168 mAOD (+/- 1m) across most of the northern half of the site. The elevation is recorded to be consistent despite recorded dip and

faulting. External monitoring boreholes around the north of the site recorded colliery spoil to this elevation or slightly higher.

It is reported in the GeoWater report that beneath the base of the Stoneyhill opencast void, about 40 metres of Lower Coal Measures and Dinantian (Lower Carboniferous) strata are anticipated, consisting primarily of iron-rich sandstones with subordinate mudstones.

Hydrogeology

The hydrogeology of the site has been described in the GeoWater report and as such, is summarised below.

Prior to mining disturbance, natural hydrogeology would have consisted of limited recharge of Lower Coal Measures strata on the upper slopes of Stoneyhill and discharge via more permeable strata at the outcrop in the surrounding valleys. The site lies on a watershed, therefore groundwater flow and discharge would have been both to the south-west, into the Lyde Brook valley and to the east into the springs.

The natural groundwater system in the natural sandstones is likely to be capable of significant groundwater transmission through fissures. However, it has been assumed in the GeoWater report that any minor flow systems in the near-surface will have been disrupted by mining, creating large volumes of reworked material in the opencast voids.

In 1984, prior to the construction of the site, five boreholes were installed on the site, at depths of 7 to 9.5 metres through the opencast backfill. The boreholes encountered clay fill with coal and some silt and sandstone fragments. Eight samples were tested for permeability with ranges of between 10^{-6} and 10^{-9} m/s recorded. The higher permeability values were associated with samples containing higher sandstone or siltstone content. It was assumed in the GeoWater report that the permeability tests were carried out on undisturbed samples and the results were an indication of the permeability of the in-situ colliery waste outside the present landfill liner. The results suggested that whilst the fill is of predominantly low permeability, pockets of more permeable material exist.

A second groundwater system was then created with the construction of the landfill and its compacted liner. This is described in the GeoWater report as consisting of a bowl-like structure within which landfill leachate has collected to levels significantly higher than groundwater levels outside the bowl.

As part of the investigations carried out by GeoWater in 2004, additional boreholes were installed (see section 4.1 and appendix 1). These additional boreholes (in addition to average historic groundwater levels for the period 2002-2004) identified the presence of two groundwater systems:

A deep groundwater system exists within the natural sandstone strata underlying the site and a second, separate body of water shallow exists within the colliery spoil groundwater system. Conjectural deep sandstone groundwater contours



presented in the GeoWater conceptual report showed the potential for groundwater flow beneath the site in all directions from south-west through to the south and north-east. From this interpretation, GeoWater has assumed that Boreholes 31 and possibly BH15 and BH37 are downgradient monitoring points and BH33 as upgradient monitoring points.

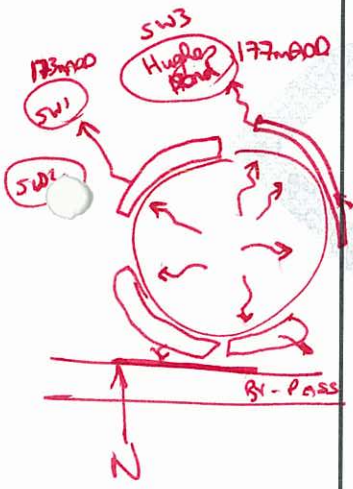
Groundwater levels in the colliery spoil were less consistent, indicating disconnected groundwater bodies in heterogeneous, often low permeability fill. At the north end of the site there appears to be a north-west flowing shallow groundwater system in the colliery spoil. It is reported in the GeoWater report that this system appears to flow contrary to deep groundwater flow and may be supported in part by the egress of leachate from within the site.

Comparison of historic and recent groundwater levels with leachate levels provided in section 3 shows that leachate levels are consistently higher than groundwater levels, thus any flow through the landfill liner system would be outwards. Ground levels around much of the site fall below leachate levels within the site therefore leachate seepage to the surface is possible. The GeoWater report states that there has been some visual evidence of leachate outbreaks along the north and west boundaries of the site. Jacobs has not been able to confirm that this has re-occurred recently.

Hydrology

The Hydrology of the site has been described in the GeoWater report and is summarised below.

The site lies at the end of a spur of high ground projecting south-eastwards towards the Ironbridge Gorge about 2km to the south, containing the River Servern at an elevation of about 35m AOD. The site boundary lies at approximately 185m AOD and the landfill forms a mound with a summit elevation of 194m AOD.



Drainage is therefore in every direction off the landfill itself. An interceptor ditch outside the north-eastern boundary carries run-off northwards to an artificial pond known as Hughes Pond (labelled as SW3 on Drawing Number B0578400/CSM/03) close to the northern end of the site, at an elevation of about 177m AOD.

The north-western boundary drains to the two ponds (labelled as SW1 and SW2 on Drawing Number B0578400/CSM/03) at an elevation of approximately 173m AOD. The ponds appear to be internally draining and are assumed to be in at least partial continuity with shallow groundwater.

The south-western boundary drains to ditches constructed in connection with the Ironbridge bypass, while run-off from the southern sector of the landfill drains into the depression formed by the access road. The latter is bounded by a French drain conducting water back to the road drainage system. A small proportion of run-off from the south-eastern part of the site may proceed as overland flow.

The site lies on a watershed which runs approximately north-north-west to south-

south-east across the centre of the site. To the east drainage is towards Lightmoor and then back southwards towards Coalbrookdale, while to the west drainage is towards the Lyde / Loamhole Brook system.

Ecology

An Ecological Appraisal was carried out by Shropshire Wildlife Trust in June 1992. Information provided by TWC on this appraisal indicated that the site was designated in 1984 as a Prime Site for Nature Conservation due to high conservation value wildlife. Two existing ponds (ponds SW1 and SW2) were left undeveloped outside the north-west boundary of the landfill and as a result were saved as part of the conservation area.

During the later stages of waste infilling, land immediately east of the sites was subjected to opencast coal workings in 1990 as the Croppings Farm opencast site. This was subsequently restored and a new pool was constructed (Hughes Pond).

A fourth pool is also present, located to the east of Hughes pond. No information is available regarding this fourth pool.

A summary of the main findings of the Appraisal are outlined below:

- Frogs, toads and great crested newts (protected under the 1981 Wildlife and Countryside Act) had previously been recorded.
- Further survey work in 1992 failed to find evidence of these species.
- The larger of the two ponds east of the landfill (Hughes Pond) was species poor.
- The smaller of the ponds west of the site (SW1) had more diverse vegetation.
- It was reported that much silt was washed into large pond from steep landfill banks.
- Hughes pond contained a small variety of vegetation and juvenile smooth newt.
- A serious decline in water quality of two ponds was noted.
- Samples analysed in 1990 detected significant increases in excess of a hundredfold in levels of Cr, Cu, Zn and Cd to those recorded in 1989.
- A dramatic drop in pH of water was recorded between 1983 and 1989 from values of between 7.0 and 7.5 to 3.5 and 3.9 leading to a decline of newts.
- A decline in certain habitats was also noted.

No information on the current state of ecology of the site has been made available to Jacobs.

Summary of Site Construction and Waste Infilling

The site was subjected to opencast coal mining in the middle of the twentieth century, though exact dates and extent of workings have not been ascertained.

Tipping 1985 → 1992.

The opencast backfill, consisting of clay with broken mudstone, sandstone and coal, was reworked, commencing in late 1984, to form the landfill void. Tipping commenced in 1985 and was completed in late 1992. During later stages of infilling, land immediately east of the site was subjected to opencast coal working as the Croppings Farm opencast site.

Detailed environmental monitoring of the landfill site began in1990 when 20 gas monitoring boreholes were installed around the perimeter of the site. Further monitoring points were installed in 1992 to the east of the site, to address concerns regarding potential gas migration eastwards into the Croppings Farm area. The gas control system was also initiated at this time along with limited groundwater and surface water monitoring.

As specified in the Waste Disposal Resolution, the landfill was developed in five phases. Base elevations were generally in the range of 175 -178 mAOD except for Phase 4/5 which has a base sloping down to 168 mAOD at its lowest point. Records show that Phase 1 was divided by a double bund across the middle, creating three cells designated 'toxic waste cells'. Phase 2 also appeared to have partial internal divisions, including an area designated for asbestos disposal.

The Resolution also required that the base and sides of the cells were lined with a cohesive argillaceous material not less than 2 metres thick after compaction and with a permeability which was less than 10^{-9} m/s.

Permeability testing of the liner was also required. It is reported that although the majority of the test results were accepted, there were, at times, difficulties in achieving the required degree of compaction and permeability.

The GeoWater report states that the site was capped with clay in 1992 to a specified permeability of 10^{-9} m/s. A substantial thickness of between 1 and 3 metres of soil cover was then placed over the clay cap. This information cannot be validated by Jacobs.

Reference should be made to the Gap Assessment and Scoping Document for further details of the site's construction and waste infilling details. Table 3.1 below summarises the salient points.

Gas and Leachate Extraction Systems

It is understood from the Waste Resolution that leachate levels in each cell were not permitted to rise above 177mAOD. No leachate drainage system was installed in the base of the cells. Leachate monitoring and extraction wells were first installed in 1992 and a pumped leachate extraction system installed in the mid 1990's and upgraded in 2000. It is believed that no basal drainage was included in the landfill cell design and no detail of the type of extraction infrastructure is available for this review.

Approximately fifty 110mm diameter HDPE lined wells were installed as passive gas vents in 1992. The GeoWater report states that these were installed as close to the base of the landfill as possible. No further information in the form of borehole logs has been made available for this review. To complement and upgrade this system, and in response to elevated gas readings in external gas monitoring points along the eastern perimeter of the site, a small active gas extraction system was installed in 1993. However, gas migration was not contained and as a result a permanent gas extraction system with two buried gas extraction lines and a flare unit was installed. Passive gas vents were capped.

Table 3.1: Summary of historical development and waste infilling of site.

Event	Date	Comments
Waste Disposal Resolution (WDR) passed allowing the deposit of controlled waste.	1984	The opencast backfill (clay with broken mudstone, sandstone and coal) was reworked to form the landfill void.
Landfill was to be constructed in five phases.		Phase 1 divided by a double bund across the middle creating three cells designated as 'toxic waste cells'. Phase 2 also appears to have inter-cell bunds, including an area designated for asbestos disposal.
Base and sides of the containment areas should have been lined with a structurally sound layer of approved cohesive argillaceous material.		Material to be no less than two metres thick after compaction and free of voids and fissures and with a permeability of 10^{-9} m/s or better. Permeability testing of the laid liner also required.
Records of liner testing for Phases 1 and 2 indicate that on several occasions the required degree of compaction and permeability was not achieved, particularly in the internal bund walls.		No results available for the testing of other phases, however, according to GeoWater report 2004, anecdotal evidence from the Environment Agency suggests that evidence of former underground coal workings was found, probably in Phase 4 or 5, the deepest part of the site.
Infilling and completion of waste.	1985-1991	Wastes from Monsanto plc were deposited at the landfill between Feb 1985 and Jan 1988.
Final capping	1992	WDR stated waste was to be capped with a layer of argillaceous material no less than one meter thick after compaction and a permeability of no more than 10^{-9} m/s.
The bulk of waste types permitted by WDR consisted of household, commercial, industrial and construction wastes known as Schedule A General waste. Some difficult waste (Schedule B), now known as Hazardous Waste was also accepted.		807 tonnes of Schedule A was permitted to be accepted daily whilst only 519 tonnes of Schedule B was permitted to be accepted daily. No evidence to indicate actual quantities and waste types accepted.
Wastes listed comprise mainly solid distillation residues, waste cleaning materials and sweepings together with interceptor sludge from a dewatering area and bagged clay dust from a synthetic rubber plant.		The landfill is also known to have accepted approximately 1000 carcasses of cattle affected by BSE. No further information or details has been made available to Jacobs at this time.
Information provided suggests no leachate drainage system present in the base of the cells. Leachate monitoring / extraction wells first installed.	1992	Pumped leachate extraction system installed in the mid 1990s and upgraded in 2000. Highest extraction rates reported to be achieved from the western part of site (Phase 5).
Fifty 110mm diameter HDPE passive gas vents installed	1992	Permanent extraction system installed in 1993 due to migrating gas.

3.2 GeoWater Environmental Conceptual Model

The following sections summarise the conceptual model as presented by GeoWater Environmental Geology in their assessment of the contaminant risks posed by Stoneyhill in May 2004 and is illustrated on Drawing Number B0578400/CSM/02. Table 3.3 is a summary of the GeoWater report conceptual model.

The GeoWater conceptual model described the landfill site as a bowl set in a substantial thickness of low to moderately permeable colliery spoil, lined with compacted colliery spoil, containing actively biodegrading waste. Leachate levels were recorded as being high, with up to 7 metres of leachate recorded above base. Leachate was described as strongly polluting, though not significantly contaminated with Listed I or II Substances.

3.3 Sources

The assessment undertaken by GeoWater identified the waste within the landfill site along with the landfill leachate and gas as the primary sources of potential contamination at the site.

Waste

The waste types permitted to be deposited at the site was defined under two categories.

Schedule A: General Waste. This consisted of domestic, commercial, non-hazardous industrial and construction wastes.

Schedule B: Difficult Waste. This consisted of a variety of wastes in liquid, sludge or solid form including but not limited to:

- List I and II substances, including metals
- Hydrocarbon compounds
- Asbestos
- Aldehydes and Ketones
- Industrial effluent treatment sludges
- Tar, bitumen and asphalt

In addition, wastes from Monsanto plc were deposited at the landfill between 1985 and 1988. The GeoWater report states that the wastes listed comprised mainly solid distillation residues, waste cleaning materials and sweepings together with interceptor sludge from a dewatering area and bagged clay dust from a synthetic rubber plant. It also mentions a number of contaminants present in small quantities, including a compound called Paranitrochlorobenzene (PNCB) which is reported to be flammable and capable of emitting hydrochloric acid or nitrous gases and the solvent xylene. The landfill is also known to have accepted about 1000 carcasses of cattle affected by BSE.

Leachate

Leachate was tested in 2000 / 2001 for a range of EC Groundwater Directive List I and II substances. It is reported that results showed that leachate at this site

was generally low in hazardous substances tested. No herbicides, pesticides or organotin compounds were detected nor were toxic metals in excess quantities. Some volatile organic compounds were present at low concentrations, including some chlorinated organics, and BTEX (Benzene, Toluene, Ethyl benzene and Xylene) compounds. Boron concentrations were elevated and PAH (Polycyclic Aromatic Hydrocarbons) compounds, other aromatics, and nitrogen-sulphur containing organics were also detected, together with significant concentrations of C_{10} to C_{30} hydrocarbons.

Monitoring data indicated that leachate levels were often in breach of the permitted level as stated in the site Waste Disposal Resolution which was issued in 1984. The permitted level is 2m below the lowest lip of the site and should not exceed 177m AOD. On the assumption therefore that the lowest lip point within the landfill is 179m AOD, results of leachate level monitoring indicate leachate should be over topping.

Landfill Gas

The GeoWater report stated that when extracted under reduced pressure the gas produced at the site had a composition of approximately 30 - 45% methane, with the remainder consisting of carbon dioxide. Small percentages of oxygen (<5%) have also been recorded in the extraction system. This is consistent with findings from an assessment undertaken by Jacobs on behalf of TWC of the landfill gas flaring and extraction system in February 2007[1].

The above Jacobs report also concluded that from the landfill gas monitoring data for Stoneyhill, the site is in a steady state methanogensis stage.

It is reported in the GeoWater report that routine monitoring has for many years indicated gas migration over short to moderate distances (50 to 100 metres) from the site, particularly along the eastern margin.

Recent monitoring data has also indicated gas migration to the east as well as occasional migration to the north and north-west. This is discussed further in the perimeter landfill gas monitoring section of this report.

[1] Assessment of Landfill Gas Flaring and Extraction Arrangements, Draft – February 2007.

Table 3.3: A summary of the GeoWater report conceptual model.

Source	Pathway	Receptor
Leachate	Direct contact and/ or ingestion	Site staff, unauthorised personnel
	Vertical migration down through the basal liner and colliery spoil into the underlying sandstone aquifer	Sandstone Groundwater strata
	Migration laterally through the liner into colliery spoil, forming zones of contaminated perched groundwater. This may eventually emerge to the surface or recharge groundwater in the sandstones below	Sandstone and colliery spoil groundwater strata
	Migration through liner and groundwater or overland flow to surface water	Surface water features and wildlife
Landfill Gas	Gas migration laterally through the liner and colliery spoil, potentially travelling through permeable strata or workings and emerging beneath sensitive receptors such as nearby properties.	Residential properties Underground Services
	Gas migration on and off site	Site staff, unauthorised personnel, local residence and general public outside site perimeter

Drawing Number B0578400/CSM/02 illustrates the conceptual model schematically.

4 Ground Investigations

4.1 Previous Investigations

There have been several investigations throughout the history of the site aimed at addressing concerns with migrating gas. Jacobs is aware of the following investigations carried out in relation to this issue:

- 1990: Twenty gas monitoring boreholes were installed around the perimeter of the site.
- 1992: Further monitoring points were installed to the east of the site to address concerns about potential gas migration eastwards into Croppings Farm area.
- 2002: Ten new monitoring boreholes were installed by Charles Ruxton Environmental Geologist to allow further measurements of groundwater and landfill gas.

The ten boreholes installed by Charles Ruxton, BH 29 to 38 are shown on Drawing Number B0578400/CSM/03 and the borehole logs presented in Appendix 1.

4.2 Jacobs Ground Investigations

In response to Jacobs' proposal B0578400/CR/04 dated 14th September 2007, a further ground investigation was conducted to better characterise the surrounding geology. Ground Investigation and Piling Limited (GIP) were commissioned by TWC to install six additional boreholes (BH 1 to 6) into the reworked coal shale around the periphery of the site. The full ground investigation report provided by GIP is attached as Appendix 1. Drawing Number B0578400/CSM/03 illustrates the position of the new boreholes. BH4 was terminated at the request of our Engineer due to an impenetrable layer of tarmac and hardcore.

The investigation indicated that the materials surrounding the site were cohesive and are dominated by clay, and not granular coal shale, as was suggested in previous reports. Furthermore no noticeable groundwater strikes or any visual or sensory evidence of contamination was observed. Table 4.2 summarise the geological strata encountered.

Table 4.2: A summary of the depths of material encountered.

Strata	Description of Strata	Depth (m bgl)
MADE GROUND	Clayey gravely SAND	Ground Level – 0.75
MADE GROUND	sandy gravely CLAY	0.50 – 9.50
MADE GROUND	Friable CLAY	0.50 – 12.00

4.3 Monitoring of Groundwater, Surface water and Leachate

Shallow and Deep Groundwater

Detailed environmental monitoring of the landfill site began in1990 with gas, groundwater, surface water and leachate monitoring undertaken. Records provided to Jacobs by TWC shows that Charles Ruxton Environmental Geologist has been undertaking environmental monitoring at the site since 1998. This detailed information and data has been made available by TWC and should be reviewed in conjunction with this updated report.

Groundwater and leachate monitoring was undertaken at the site by Jacobs between the 3rd and 6th December 2007. During the works, leachate and groundwater levels were monitored and groundwater and leachate samples retrieved.

In total, 6 No. groundwater boreholes were sampled, 5 No. targeting the deep sandstone strata and 1 No. targeting the shallow colliery shale strata. Following initial purging of the boreholes some were found to be dry or had significantly slow recharge. These boreholes were revisited the next day, however, insufficient water to allow a second purge was available therefore these were abandoned. This suggests that the material surrounding the boreholes is of a low permeability and corresponds with the findings of the recent boreholes installed. Table 4.3a and 4.3b summarise the deep and shallow boreholes sampled.

Table 4.3a: Summary of Deep Boreholes Sampled and Dipped.

Borehole Id No	Date sampled	Sample Taken	GW to GL (mbgl)
BH31	3/12/07	YES	9.30
BH15	4/12/07	YES	8.92
BH9	4/12/07	YES	8.34
BH33	4/12/07	YES	11.87
BH10	4/12/07	NO	1.68
BH38	5/12/07	NO	18.22
BH37	5/12/07	YES	13.34
BH3- Old	5/12/07	NO	10.83
BH30	6/12/07	NO	11.83
BH2-Old	6/12/07	NO	8.41
Notes: GL-Ground Level, GW-Groundwater, mbgl- metres below ground level			

Table 4.3b: Summary of Shallow Boreholes Sampled and Dipped.

Borehole Id No	Date sampled	Sample Taken	GW to GL (mbgl)
BH6	3/12/07	NO	6.96
BH9	4/12/07	NO	1.57
BH15	4/12/07	NO	N/A
BH32	4/12/07	NO	1.20
BH34	4/12/07	NO	1.85
BH3- New	5/12/07	YES	2.58
BH29	5/12/07	NO	6.06
BH3- Old	5/12/07	NO	5.83
BH1-New	5/12/07	NO	10.24
BH2- New	5/12/07	NO	10.20
BH2-Old	6/12/07	NO	8.92
Notes: BH 29 is designated as being Deep in Enitial's annual monitoring report for the year ending July 07 and in a schedule provided by TWC. However, the factual completion report for 10 new boreholes installed by Charles Ruxton in 2002 designates the borehole as Shallow as do Jacobs' site records.			

Surface Water Monitoring

Surface water was recovered from a total of 4 No. sample locations during the December 2007 monitoring exercise, one from each of the four ponds surrounding the site. It was not possible to take representative samples from the drainage ditches due to overgrown vegetation and very low and slow flow conditions. The locations of the surface water monitoring locations are illustrated on Drawing Number B0578400/CSM/03.

Characterisation of landfill leachate

Five leachate samples were taken from five separate boreholes, one from each cell. Table 4.3c summarises the boreholes sampled whilst Table 4.3d summarises average leachate levels for the period August 2005 and July 2006.

Table 4.3c: Summary of Leachate Monitoring Boreholes for Cells 1 to Cell 5.

Borehole Id No	Date sampled	Leachate to TOS (mbgl)	Leachate to GL (mbgl)
BH28	6/12/07	3.60	2.60
BH115	6/12/07	7.80	6.84
BH10	6/12/07	9.50	8.50
BH73	6/12/07	10.90	9.90
BH111	6/12/07	8.90	7.96

Table 4.3d: Historic Average Leachate Levels Between August 2005 and July 2006 for Cells 1 to Cell 5 (provided by TWC).

Borehole Id No	Maximum mAOD	Minimum mAOD	Difference metres	Average mAOD
BH28	178.41	177.39	1.02	177.71
BH115	181.64	181.32	0.32	181.47
BH10	178.66	178.06	0.60	178.25
BH73	180.45	176.28	4.17	177.41
BH111	181.76	180.55	1.21	181.26

4.4 Laboratory Analysis

Samples of leachate, groundwater and surface water were sent for chemical and physical analysis to ALcontrol, a UKAS Accredited laboratory. A comprehensive schedule of testing has been designed in line with the analysis proposed in Table 1 of the Jacobs 'Gap Assessment and Scoping Report' (Document No: B0578400/R01), dated 22 May 2007. A summary of the testing schedule is provided in Table 4.4 below.

Table 4.4: Summary of schedule testing regime.

Body Monitored	Schedule of Chemical Analysis
Leachate and Groundwater	pH, Temperature, conductivity (EC), dissolved oxygen (DO), ammoniacal nitrogen (NH_4–N), chloride (Cl), sulphate (SO_4) , total alkalinity as $CaCO_3$, total organic carbon (TOC), total oxidised nitrogen (TON), metal (inc. Na, K, Ca, Mg, Fe, Mn, Cd, Cr, Cu, Ni, Pb, and Zn) and List I & II substances.
Surface Waters	pH ,Temperature, EC, DO, (NH_4–N), Cl, Chemical Oxygen Demand, metals, List I & II substances

4.5 Preliminary Findings

All data was compared against relevant Environmental Quality Standards (EQS) for Freshwater based on the Environment Agency Landfill Guidance Note 1 (LFGN01): Hydrogeological Risk Assessments for Landfills and the Derivation of Groundwater Control and Trigger Levels. Where freshwater standards are absent, EQS Drinking water limits were used. The ALcontrol data sheets with the complete data set are presented in Appendix 4. Table 4.5a below is a summary of the number of boreholes sampled for each medium and the number of elevated contaminants for each borehole. Tables 4.5b to 4.5e illustrate the elevated contaminants in each borehole. Drawing Number B0578400/CSM/04 is a zone map illustrating the areas where elevated concentrations of determinants have been recorded.

Leachate

Initial examination of the results indicates the presence of List 1 substances in the leachate, mainly BTEX compounds (Benzene, Toluene, Ethylbenzene and Xylene) and Aromatics and Aliphatics. These compounds appear to be occurring in one particular leachate borehole, BH73L.

Borehole BH73L, on the north-western side of the landfill, experienced the highest levels for the majority of determinants tested, with the exception of boron, Malathion, 1,2,4 Trimethylbenzene, Mecoprorp and Dibutyl tin. Ammoniacal nitrogen was recorded at 710mg/l in comparison to 210mg/l in BH 28L. Boron levels were highest in BH28L east of the site with a reading of 5300µg/l, more than double the next highest reading. Malathion was only elevated in BH111L and BH115L north-east of the site. BH115L also had the highest levels of 1,2,4-Trimethylbenzene and Mecoprop. The highest level of Dibutyl Tin was in BH10L. The pH readings for the leachate were relatively similar and in the range 8.14 to 8.99.

Groundwater

In addition, there is evidence of BTEX and Aromatic and Aliphatic compounds also being present within the groundwater, along with high concentrations of List I metals.

The results for Borehole 9WD in the north of the site consistently experienced the highest levels of determinants tested with the exception of Antimony, Nickel, Zinc, Copper and Dibutyl Tin. Total Aliphatics (C5-C35) were recorded at 3400 µg/l, whilst Total Aromatics were recorded at 1100µg/l and TPH (aliphatics and aromatics C5-C35) at 4400µg/l. Ammoniacal nitrogen and ammonia in BH9WD were recorded at 460mg/l and 470mg/l respectively.

The only elevated level of Antimony occurred in borehole 3WS (installed by Jacobs) in the north western perimeter of the site, at a level of 9µg/l. Borehole 31WD south west of the site experienced the highest levels of Nickel, Zinc and Copper at 290µg/l, 4800µg/l and 76µg/l respectively whilst the only reading for Dibutyl Tin occurred at BH37WD at 0.05µg/l north-east of the site. In the groundwater boreholes the pH ranged from 3.50 in borehole 31WD up to 8.83 in borehole 9WD.

The surface water results show that samples taken from pond SW1 west of the site, recorded the highest levels of Ammoniacal Nitrogen and Titanium. The only elevated level of Malathion was recorded in pond SW3 north-east of the site. The range of recorded pH values was from 7.67 in SW3 to 8.26 in SW4.

Drawing Number B0578400/CSM/04 highlights the areas where low pH values were recorded. The pH results indicate fluctuations, with both acidic and alkali groundwater being detected, indicating the presence of external sources other than the landfill acting upon the groundwater. Acidic pH values were detected in BHs 15WD west of the site and BH33WD north-west of the site which both target the deep sandstone groundwater, and in BH32WS north-west of the site which targets shallow colliery spoil groundwater. Acidic water was also detected north and east of the site in BH8WS and BH6WD respectively and BH37WD and

BH29S north-east and south of the site. The low pH values indicate the potential for acid mine water to be present in the vicinity and influencing the groundwater chemistry. High pH values were also reported in two of the four surface water ponds sampled and in the leachate. A summary of the elevated contaminants is provided in tables 4.5b to 4.5d below.

Table 4.5a: Number of boreholes experiencing elevated levels

Source	Number of boreholes sampled	Antimony	Ammoniacal Nitrogen as N	Ammonia	Nickel	Zinc	Copper	Selenium	Boron	Naphthalene	1,2,4- Trimethylbenzene	Mecoprorp	GRO	m & p Xylene	Aliphatics >C5-6	Aliphatics >C6-8	Aliphatics >C10-12	Aliphatics >C12-16	Aliphatics >C16-21	Aliphatics >C21-35	Total Aliphatics C5-C35	Aromatics >EC8-EC10	Aromatics >EC10-EC12	Aromatics >EC12-EC16	Aromatics >EC16-EC21	Aromatics >EC21-EC35	Total Aromatics C6-C35	TPH(aliphatics and aromatics (C5-C35)	Malathion	Dibutyl Tin	Titanium
Groundwater	6	1	6	5	2	2	1											2	1	2	1			1	1	1	1	1	3	1	
Leachate	5		5	5		1		1	1	1	3	3	1	1	1	1	1				1	1	1				1	1		5	
Surfacewater	4		4																										1		1

Table 4.5b: Summary of elevated contaminants from recent groundwater analysis.

BH No.	Antimony µg/l	Ammoniacal Nitrogen mg/l as N	Ammonia mg/l	Nickel µg/l	Zinc µg/l	Copper µg/l	pH	Aliphatics >C12-16 µg/l	Aliphatics >C16-21 µg/l	Aliphatics >C21-35 µg/l	Total Aliphatics C5-C35 µg/l	Aromatics >EC12-EC16 µg/l	Aromatics >EC16-EC21 µg/l	Aromatics >EC21-EC35 µg/l	Total Aromatics C6-C35 µg/l	TPH(aliphatics and aromatics C5-C35) µg/l	Malathion ng/l	Dibutyl Tin µg/l
9WD		460	470				8.83	1500	1300	580	3400	200	420	450	1100	4400	<200*	
3WS	9	2.7	1				8.08											
15WD		1	7	200	1400		3.38											
31WD		1.2	5	290	4800	76	3.50										<20*	
33WD		0.6					7.99	1.46		3.61							<20*	
37WD		2.6	2				7.75											0.05

*Note: Below the reporting value

Table 4.5c: Summary of elevated contaminants from recent leachate analysis.

BH No.	Ammon. Nitrogen mg/l as N	Ammonia mg/l	Selenium	Zinc µg/l	Boron µg/l	pH	GRO (C4-C12)	M & p Xylene µg/l	Aliphatics >C5-C6 µg/l	Aliphatics >C6-C8 µg/l	Aliphatics >C10-C12 µg/l	Total Aliphatics C5-C35 µg/l	Aromatics >EC8-EC10 µg/l	Aromatics >EC10-EC12 µg/l	Total Aromatics C6-C35 µg/l	TPH (C5-C35) µg/l
BH10L	2.1	3				8.14										
BH28L	210	190			5300	8.83										
BH73L	710	530	12	1400	2500	8.97	130	34	13	10	27	50	42	41	83	130
BH111L	400	380				8.99										
BH115L	72	100				8.61										

Table 4.5c: Summary of elevated contaminants from recent leachate analysis (continued).

BH No.	Malathion ng/l	Naphthalene µg/l	1,2,4-Trimethyl benzene µg/l	Mecoprorp µg/l	Dibutyl Tin µg/l
BH10L					0.40
BH28L				12	0.33
BH73L		30	10	190	0.09
BH111L	<100*		6	220	0.07
BH115L	<100*		3		0.21
*Note: Below the reporting value					

Table 4.5d: Summary of elevated contaminants from recent surface water analysis.

BH No.	Ammoniacal Nitrogen mg/l as N	Titanium µg/l	pH	Malathion ng/l
SW1	0.3	1200	8.00	
SW2	<0.2		7.72	
SW3	0.2		7.67	<20*
SW4	0.2		8.26	
*Note: Below the reporting value				

4.6 Historic Groundwater, Surface water and Leachate Data

Appendix 2 contains average historic data analysed for groundwater, surface water and leachate. The data has been provided by TWC from historic Enitial quarterly and annual monitoring reports. Data from the period up to 2005 has been used. There have been some inconsistencies identified in the data and these have not been used when assessing the data or drawing any conclusions. These have been highlighted in the spreadsheets presented in Appendix 2 and are summarised in Tables 4.6a to 4.6d.

The historic data display trends similar to the recent chemical analysis undertaken. Levels of ammoniacal nitrogen, chloride, potassium, sodium and magnesium were all elevated at levels in BH9WD and BH9WS similar to those recorded in leachate. Ammoniacal nitrogen recorded an average of 955.13mg/l and 451mg/l in both boreholes respectively whilst average levels in leachate boreholes ranged from 163.06mg/l to 703.17mg/l.

Drawing number B0578400/CSM/04 shows the zones of contamination based on both historic and recent monitoring data.

Table 4.6a: Summary of average elevated groundwater contaminants from historic data.

Sandstone Strata	Sulphate mg/l SO4	Chloride mg/l	Ammoniacal Nitrogen mg/l as N	Potassium mg/l	Sodium mg/l	Electrical Conductivity Us/cm	pH	Iron mg/l	Magnesium mg/l	Manganese mg/l
6WD			1.88				5.59	19.56		8.19
9WD		955.13	397.38	423.52	600.73	8028	7.48		178.56	5.41
15WD	437.88		2.68				3.35	18.99	72.33	7.79
31WD	489.38		3.02				4.76	27.06		8.74
33WD			0.68				6.91	1.46		3.61
37WD			1.94				6.71	5.78		2.94

Table 4.6b: Summary of average elevated groundwater contaminants from historic data.

Colliery Spoil	Sulphate mg/l SO4	Chloride mg/l	Ammoniacal Nitrogen mg/l as N	Potassium mg/l	Sodium mg/l	pH	Calcium mg/l	Iron mg/l	Magnesium mg/l	Manganese mg/l
8WS	905.25		6.83	18.81		7.10	321.69	9.91	84.09	22.63
9WS		451.00	216.70	296.89	302.92	7.50		1.00	81.88	1.12
29WS			0.45			6.10				2.60
32WS	553.00		4.74			5.59		15.30		14.90
34WS	411.75		3.04			5.86		6.08		10.42

Table 4.6c: Summary of average elevated leachate contaminants from historic data.

Leachate	Chloride mg/l	Ammoniacal Nitrogen mg/l	Potassium mg/l	Sodium mg/l	Electrical Conductivity Us/cm	pH	Iron mg/l	Magnesium mg/l	mg/l Manganese
10L	612.75	236.43	357.88	478.27	4986.13	7.6		88.22	0.79
111L	755.75	501.42	340.05	607.45	7327.88	7.73	1.61	106.70	1.12
115L		163.06	88.19		2730.50	7.6	2.39	57.69	3.88
28L	517.63	306.28	273.21	409.99	5711.75	7.7	1.57	75.37	1.34
73L	733.88	703.17	498.17	504.15	7872.63	7.8		97.79	0.07

Table 4.6d: Summary of average elevated surface water contaminants from historic data.

Surface water	Ammoniacal Nitrogen mg/l	Manganese mg/l
SW1	0.42	1.63
SW2	0.22	1.94
SW3	0.21	1.29
SW4	0.2	
LYDW	1.1	1.29
SPRW	0.20	0.40
STRW	0.15	0.50

4.7 Perimeter Landfill Gas Monitoring

Landfill gas is monitored on behalf of TWC by Enitial on a weekly basis. Quarterly and annual reports summarising the data are produced. Trigger levels of 1% by volume for methane and 1.5% by volume for Carbon Dioxide are applied to all perimeter gas monitoring results. This is in line with Environment Agency guidance detailed within Waste Management Paper 27.

Appendix 3 contains graphical representations of average landfill gas concentrations for the year August 2005 / July 2006 as presented in Enitial's annual report for the year ending 31/7/06 provided by TWC. This is the most recent data available to Jacobs.

Based on the above Enitial report gas monitoring data has been categorised and discussed according to the location of the monitoring points around the site boundary, i.e. North, East, South and West (Table 4.7). Drawing Number B0578400/CSM/03 indicates the locations of the gas monitoring boreholes.

Table 4.7: Perimeter gas boreholes and location

Site Boundary	Monitoring Boreholes
North	BH6, BH7, BH8, BH9, BH10, BH32, BH33, BH34, BH35, BH36
East	BH3, BH4, BH5, BH21, BH22, BH23, BH24, BH25, BH26, BH37, BH38, PZ5, PZ6
South	BH1, BH2, BH20, BH26, BH27, BH28, BH29, BH30, PZ1, PZ2, PZ3, PZ4
West	BH9, BH10, BH11, BH12, BH13, BH14, BH15, BH16, BH17, BH18, BH19

Northern Boundary

During this reporting period boreholes BH6D, BH6S, BH9WD and BH9WS recorded methane concentrations in excess of the 1% trigger level applied to this site. The highest recorded methane concentration of 44.8% was recorded at BH9WD. The highest average methane concentration was recorded at BH6S (9.3%). BH7D, BH7S and BH35S have all shown fluctuating carbon dioxide concentrations that on occasion have breached the trigger level of 1.5%. The highest carbon dioxide concentration of 45.7% was recorded at BH6S, while the highest average concentration of 14.0% was also recorded at BH6S.

Eastern Boundary

On at least one occasion every monitoring point on the eastern boundary breached Methane and Carbon Dioxide threshold levels of 1.0%v/v and 1.5%v/v respectively except for Boreholes PZ5 and PZ6.

It was reported that in total 19 monitoring points have routinely recorded landfill gas concentrations in excess of agreed trigger levels throughout the reporting period, these are; BH3D, BH3S, BH4D, BH4S, BH5D, BH5S, BH21D, BH21S, BH22D, BH22S, BH23D, BH23S, BH24D, BH24S, BH25D, BH25S, BH26D, BH37WD and BH38WD. The highest recorded methane concentration of 66.1%v/v was recorded within BH3D. BH25D recorded the highest average methane concentration of 41.4%v/v. A peak carbon dioxide concentration of 50.1% was recorded at BH3D, while the highest average concentration of 25.2% was recorded at BH23S.

It is reported that a significant factor that may be responsible for the observed fluctuations in methane and carbon dioxide concentration was the intermittent operation of the gas extraction system. The frequent faults experienced in the past with the flare have resulted in periods of up to forty-eight hours without gas abstraction. This issue has now been addressed.

Southern Boundary

Gas migration in excess of 1.0%v/v methane was detected along the southern boundary during the reporting period within 14 monitoring points including; PZ1, PZ2, PZ3, PZ4, BH1D, BH1S, BH2D, BH2S, BH26D, BH27S, BH28D, BH29D, BH29S and BH30D. The highest recorded value was of 62.6%v/v in BH26D, with the peak average being 29.8%v/v found in BH29D.

Methane was not the dominant migratory gas along the southern border, Carbon Dioxide migration in this region was far more frequent. On at least one occasion every monitoring point along this boundary breached the 1.5%v/v Carbon Dioxide trigger level. With a Carbon dioxide peak at 44.6%v/v in PZ3, a peak average of Carbon Dioxide of 25.3%v/v was recorded.

Western Boundary

As highlighted with the southern boundary, migration along the western boundary was characterised by elevated carbon dioxide concentrations with only limited methane migration detected. Elevated carbon dioxide levels were recorded at all monitoring points across the western Boundary.

Methane concentrations exceeding the trigger level for this site were recorded at 9WD, 9WS, 11W and 13W during this review period, with a peak at 44.8%v/v in 9WD, and a high average of 3.9%v/v in 9WS.

In comparison, all monitoring points exceeded the Carbon Dioxide threshold of 1.5%v/v on more than one occasion throughout the review period. With a peak reading of 28.5%v/v in 9WS and a peak average of 10.3%v/v in 13W.

Concern has been raised by Enitial in previous reviews regarding the incidence of gas migration along the south-western boundary of the site within the vicinity

of Croppings Farm. It was mentioned in previous reports that methane concentrations within BH29D, BH29S and BH30 had been recorded up to 44.9%. During this reporting period maximum methane concentrations recorded within BH29D, BH29S and BH30 reached 30.1%, 29.3 and 30.6% respectively.

This data is consistent with routine monitoring reported in the GeoWater report which states that gas migration has been recorded over short to moderate distances (50 to 100 metres) from the site, particularly along the eastern margin.

It is understood that since the issue of the Enitial report, remedial works have been undertaken to improve the landfill gas extraction system pipework at the site. These works may have had a positive impact on gas migration potential, but as this has not been substantiated through monitoring, an assumed risk of transfer must be adopted.

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5 Qualitative Risk Assessment

5.1 Site Conceptual Model

The assessment of risks associated with potential contamination is based on the source-pathway-receptor analysis as described under Part IIA EPA 1990 and the Contaminated Land (England) 2000 Regulations. The main principle of this approach is that a risk can only exist if there is a pathway through which a sensitive receptor may be exposed to an identified hazard (or source).

The conceptual model plays a pivotal role throughout the investigation of sites being inspected under Part IIA EPA 1990. It forms a planning tool which allows strategic investigation of identified potential pollutant linkages.

The previous conceptual site model was based on data provided by GeoWater. This data was assumed by Jacobs to be correct; however, recent ground investigations have indicated that the colliery backfill surrounding the site is of a cohesive nature rather than granular or mixed. The GeoWater conceptual site model was therefore considered to have misrepresented the actual site condition. An updated model of the site has been developed and is summarised below. Drawing Number B0578400/CSM/05 illustrates geological cross-sections depicting Jacobs' understanding of the site. Drawing Number B0578400/CSM/06 is a map showing identified receptors and B0578400/CSM/07 is a schematic representation of the updated conceptual model.

Below is a comparison of the conceptual model of the Stoneyhill Landfill Site as depicted in the GeoWater Report with the conceptual model as understood by Jacobs based on all the additional information gathered. The two tables are compared below.

The first conceptual model is that of GeoWater and is summarised below.

Source

A bowl set in a substantial thickness of low to moderately permeable colliery spoil, lined with compacted colliery spoil, containing actively biodegrading and gassing waste.

Pathways

- Direct contact and/ or ingestion
- Vertical migration down through the basal liner and colliery spoil into the underlying sandstone aquifer
- Migration laterally through the liner into colliery spoil

Receptors

- Colliery spoil and sandstone groundwater strata
- Residential properties

The second conceptual model is that of Jacobs.

Source

Actively gassing and degrading site confined by a substantial thickness of low permeable colliery spoil, lined with compacted low permeability colliery spoil and surrounded by made ground consisting of predominantly clay material. The landfill is set within the topography at a sloping angle and thus has been formed by a combination of cut and fill.

Pathways

- Limited potential for direct contact and/ or ingestion
- Limited potential for vertical migration down through the basal liner and colliery spoil into the underlying sandstone aquifer
- Migration potential laterally through the liner into colliery spoil groundwater
- Limited potential for above ground migration of gas should the gas extraction system fail
- Limited over ground migration of leachate should the leachate extraction system fail via surface water ditches

Receptors

- Colliery spoil and sandstone groundwater strata
- Residential properties
- Site workers and local residents
- Four ponds

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5.2 Comparison

The Jacobs conceptual model has identified the landfill site as being set within the topography at a sloping angle and thus has been formed by a combination of cut and fill in contrast with the bowl as previously described by GeoWater. The site is also enclosed by a compacted engineered liner and capped with a clay liner and substantial thickness of soils. This will lend a certain degree of containment to the site.

As a result of the setting of the site, landfill gas migration is dictated by the topography of the surrounding area encouraging potential lateral migration.

Above ground receptors have been identified in the Jacobs conceptual model which require to be considered further in the qualitative risk assessment in terms of pollution linkages being present. This is discussed further below.

Based on the chemistry of the groundwater and leachate samples, the Jacobs conceptual model has identified that potential off site pollution sources are also influencing the surrounding environs of the landfill due to lower pH values in groundwater than in leachate and higher contaminant concentrations than has been detected in the leachate.

5.3 Qualitative Risk Assessment

As identified above, the site review has identified a number of issues that are considered significant in terms of potential contamination of the site's surroundings. Table 5.2 summarises the identified potential source-pathway-receptor relationships (potential pollutant linkages, PL) for the elevated contaminants that exist for the site but also identifies elevated contaminants which do not have a pollution linkage (NL).

Table 5.2: Source-Pathway-Receptor Relationships

Linkage No	Contaminant	Migration & Exposure Pathway	Receptor	Comments	Uncertainty/ Gaps/ Options	Status
			Humans			
1	Ammoniacal Nitrogen	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
2	Metals	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent and historic analytical sample results have shown indication of leachate contamination. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
3	Xylene	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical sample results have shown xylene present in leachate but not groundwater. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
4	Sulphate	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Historic analytical sample results have shown elevated concentrations but not in leachate samples indicating other external sources may be contributing. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
5	Aliphatics	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical samples have shown elevated levels in leachate. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
6	Aromatics	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical samples have shown elevated levels in leachate. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
7	Gas Range Organics	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical samples have shown elevated levels in leachate. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
8	TPH	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical samples have shown elevated levels in leachate. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
9	Malathion	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical samples have shown elevated levels in leachate. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
10	1,2,4 Trimethylbenzene	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical samples have shown elevated levels in leachate. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
11	Naphthalene	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical samples have shown elevated levels in leachate. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
12	Dibutyltin	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical samples have shown elevated levels in leachate. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
13	Mecoprop	Ingestion of leachate Direct contact with leachate	Human (site visitors)	Recent analytical samples have shown elevated levels in leachate. Engineered clay cap and restoration soils of between 1 and 3 metres placed		NL (public unable to access discharge location)
14	Landfill Gas	Inhalation of gas, asphyxiation, explosion	Human (site visitors)	Recent monitoring data have shown elevated levels around the perimeter of the site. Engineered clay cap and restoration soils of between 1 and 3 metres placed		PL

Table 5.2: Source-Pathway-Receptor Relationships (continued)

Linkage No	Contaminant	Migration & Exposure Pathway	Receptor	Comments	Uncertainty/ Gaps/ Options	Status
			Controlled Waters			
1	Ammoniacal Nitrogen	Lateral and vertical migration via groundwater	Groundwater (Sandstone)	Recent and historic analytical sample results have shown indication of leachate contamination		PL
2	Ammoniacal Nitrogen	Lateral and vertical migration via groundwater	Groundwater (Colliery spoil)	Recent and historic analytical sample results have shown indication of leachate contamination		PL
3	Ammoniacal Nitrogen	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent and historic chemical analysis has shown slightly elevated levels but not at concentrations found in leachate. Other external sources may be contributing	Not certain if the ponds are in hydraulic continuity with the groundwater.	NL
4	Ammoniacal Nitrogen	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Historic chemical analysis has shown slightly elevated levels but not at concentrations found in leachate. Geowater report states that monitoring data at the spring in Lydebrook dingle indicated higher chloride concentrations and elevated chemical oxygen demand, taken to be due to decaying organic matter at the sampling point	No samples taken recently by Jacobs to establish presence or absence of contamination. Considered to be too far away to be impacted by any potential contamination	NL
5	List II Metals	Lateral and vertical migration via groundwater	Groundwater (Sandstone)	Recent and historic analytical sample results have shown indication of leachate contamination.		PL
6	List II Metals	Lateral and vertical migration via groundwater	Groundwater (Colliery spoil)	Recent and historic analytical sample results have shown indication of leachate contamination	Shallow groundwater not as well understood. Data for shallow groundwater not as extensive as deep groundwater	PL
7	List II Metals	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Little is known about surface water runoff from the site. Insufficient water present in ditches to allow samples to be taken. May indicate absence of pathway. Recent and historic chemical analysis has shown little or no indication of leachate contamination. Other external sources may be contributing	Concentrations of manganese appear elevated in all surface water points, however, not enough data to be certain. Data from 19 January 2007 erroneous	NL
8	Metals	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Little is known about surface water runoff from the site. Insufficient water present in ditches to allow samples to be taken. May indicate absence of pathway. Recent and historic chemical analysis has shown little or no indication of leachate contamination. Other external sources may be contributing	Concentrations of manganese appear elevated in all surface water points, however, not enough data to be certain. Data from 19 January 2007 erroneous. No further information available to substantiate erroneous results	NL
9	Sulphate	Lateral and vertical migration via groundwater	Groundwater (Sandstone)	Historic analytical sample results have shown elevated concentrations but not in leachate samples indicating other external sources may be contributing	Recent analysis by Jacobs has not tested for Sulphate	NL
10	Sulphate	Lateral and vertical migration via groundwater	Groundwater (Colliery spoil)	Historic analytical sample results have shown elevated concentrations but not in leachate samples indicating other external sources may be contributing	Recent analysis by Jacobs has not tested for Sulphate	NL
11	Sulphate	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Historic analytical sample results have shown no elevated concentrations	Recent analysis by Jacobs has not tested for Sulphate	NL
12	Sulphate	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Historic analytical sample results have shown no elevated concentrations	Recent analysis by Jacobs has not tested for Sulphate	NL
13	Xylene	Lateral and vertical migration via groundwater	Groundwater (Sandstone)	Recent analytical sample results have shown elevated levels in leachate but not groundwater	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
14	Xylene	Lateral and vertical migration via groundwater	Groundwater (Colliery spoil)	Recent analytical sample results have shown elevated levels in leachate but not groundwater	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
15	Xylene	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
16	Xylene	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL

Table 5.2: Source-Pathway-Receptor Relationships (continued)

Linkage No	Contaminant	Migration & Exposure Pathway	Receptor	Comments	Uncertainty/ Gaps/ Options	Status
17	Aliphatics	Lateral and vertical migration via groundwater	Groundwater (Sandstone)	Recent analytical samples have shown elevated levels in deep groundwater only but in greater concentrations than in leachate. Other external sources may be contributing	Insufficient historic data to establish source. Possible off site source	PL
18	Aliphatics	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
19	Aliphatics	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
20	Aromatics	Lateral and vertical migration via groundwater	Groundwater (Sandstone)	Recent analytical samples have shown elevated levels in groundwater but in greater concentrations than in leachate. Other external sources may be contributing	Insufficient historic data to establish source. Possible off site source	PL
21	Aromatics	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
22	Aromatics	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
23	Gas Range Organics	Lateral and vertical migration via groundwater	Groundwater (Sandstone and Colliery Shale)	Recent analytical samples have shown elevated levels in leachate but not in groundwater		NL
24	Gas Range Organics	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
25	Gas Range Organics	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
26	TPH	Lateral and vertical migration via groundwater	Groundwater (Sandstone)	Recent analytical samples have shown elevated levels in leachate but not in groundwater	Insufficient historic data to establish source	NL
27	TPH	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
28	TPH	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
29	Malathion	Lateral and vertical migration via groundwater	Groundwater (Sandstone)	Recent analytical samples have shown elevated levels in groundwater but in greater concentrations than in leachate. Other external sources may be contributing	Insufficient historic data to establish source. Laboratory results indicate <200 ng/l in groundwater. Not a representative indication of level. Possible off site source	PL
30	Malathion	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
31	Malathion	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
32	1,2,4 Trimethylbenzene	Lateral and vertical migration via groundwater	Groundwater (Sandstone and Colliery Shale)	Recent analytical samples have shown elevated levels in leachate but not in groundwater		NL
33	1,2,4 Trimethylbenzene	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL

Table 5.2: Source-Pathway-Receptor Relationships (continued)

Linkage No	Contaminant	Migration & Exposure Pathway	Receptor	Comments	Uncertainty/ Gaps/ Options	Status
34	1,2,4 Trimethylbenzene	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
35	Naphthalene	Lateral and vertical migration via groundwater	Groundwater (Sandstone and Colliery Shale)	Recent analytical samples have shown elevated levels in leachate but not in groundwater		NL
36	Naphthalene	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
37	Naphthalene	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Recent analytical sample results have shown no elevated concentrations	Insufficient historic and recent samples taken to confirm presence in groundwater	NL
38	Dibutyltin	Lateral and vertical migration via groundwater	Groundwater (Sandstone)	Recent analytical sample results have shown elevated concentrations in one deep groundwater borehole and in leachate	Insufficient historic and recent samples taken to confirm presence in groundwater	PL
39	Mecoprop	Lateral and vertical migration via groundwater	Groundwater (Sandstone and Colliery Shale)	Recent analytical samples have shown elevated levels in leachate but not in groundwater		NL
40	Mecoprop	Lateral and vertical migration via groundwater	Surface water (Ponds SW1 to SW3)	Recent analytical sample results have shown no elevated concentrations		NL
41	Mecoprop	Lateral and vertical migration via groundwater	Surface water (Lydebrook, stream and spring)	Recent analytical sample results have shown no elevated concentrations		NL
42	Ammoniacal Nitrogen	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Little is known about surface water runoff from the site. Insufficient water present in ditches to allow samples to be taken. May indicate absence of pathway. Recent and historic chemical analysis has shown slightly elevated levels but not at concentrations found in leachate. Other external sources may be contributing	No chemical data sets are available to establish presence or absence of contamination in ditches	NL
43	List II Metals	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Little is known about surface water runoff from the site. Insufficient water present in ditches to allow samples to be taken. May indicate absence of pathway. Recent and historic chemical analysis has shown little or no indication of leachate contamination. Other external sources may be contributing	Concentrations of manganese appear elevated in all surface water points, however, not enough data to be certain. Data from 19 January 2007 erroneous	NL
44	Sulphate	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Historic analytical sample results have shown no elevated concentrations in surface waters	Recent analysis by Jacobs has not tested for Sulphate	NL
45	Xylene	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Recent analytical sample results have shown no elevated concentrations in surface water	No chemical data sets are available to establish presence or absence of contamination in ditches	NL
46	Aliphatics	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Recent analytical sample results have shown no elevated concentrations in surface water	No chemical data sets are available to establish presence or absence of contamination in ditches	NL
47	Aromatics	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Recent analytical sample results have shown no elevated concentrations in surface water	No chemical data sets are available to establish presence or absence of contamination in ditches	NL
48	Mecoprop	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)			NL

Table 5.2: Source-Pathway-Receptor relationships (continued)

Linkage No	Contaminant	Migration & Exposure Pathway	Receptor	Comments	Uncertainty/ Gaps/ Options	Status
49	Gasoline Range Organics	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Recent analytical sample results have shown no elevated concentrations in surface water	No chemical data sets are available to establish presence or absence of contamination in ditches	NL
50	TPH	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Recent analytical sample results have shown no elevated concentrations in surface water	No chemical data sets are available to establish presence or absence of contamination in ditches	NL
51	Malathion	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Recent analytical sample results have shown no elevated concentrations in surface water	No chemical data sets are available to establish presence or absence of contamination in ditches	NL
52	1,2,4 Trimethylbenzene	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Recent analytical sample results have shown no elevated concentrations in surface water	No chemical data sets are available to establish presence or absence of contamination in ditches	NL
53	Naphthalene	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)	Recent analytical sample results have shown no elevated concentrations in surface water	No chemical data sets are available to establish presence or absence of contamination in ditches	NL
54	Mecoprop	Migration via surface water ditches	Surface water (Ponds SW1 to SW4)			NL
55			Property			
56	Landfill Gas	Explosion	Residential property and infrastructure		No information on gas monitoring within properties or services and infrastructure to determine levels	NL

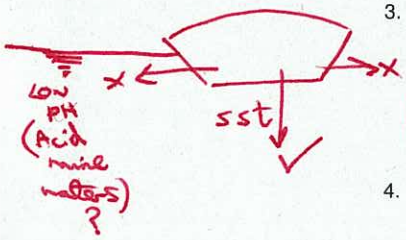
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6 Conclusions and Recommendations

The previous conceptual model for the site was derived by GeoWater to facilitate TWC's understanding of the site in relation to contaminated land legislation. Following additional investigation works, revision and update of the CSM is necessary and the following conclusions can be derived:

1. Additional boreholes installed by Jacobs have found the landfill to be confined laterally by clay materials. This confirms the intended design criteria for the site.

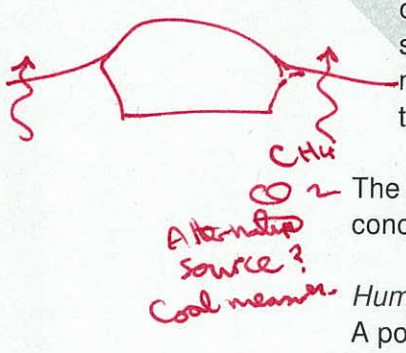
2. Groundwater dips for boreholes installed in the colliery spoil suggest limited evidence of water in the reworked clay soils.



3. A reasonable degree of containment of the landfill leachate has been assumed given the observed difference in head levels inside and outside of the landfill. A hydraulic gradient between the landfill and the sandstone exists but little evidence of lateral contaminant transfer is being observed.

4. Groundwater in the vicinity of the site exhibits low pH conditions in the acid range. This suggests influence by acid mine waters. The situation is not mirrored in the leachate which further suggests that containment and therefore physical and hydraulic separation is present.

5. Groundwater chemistry to the north of the landfill and to some degree within the sandstone suggests the influence of an off site or secondary contaminant source (ammoniacal nitrogen, aromatics and aliphatics to the north and malathion (pesticide) and sulphates in the Sandstone) as levels observed in the receptors are significantly elevated when compared against results observed in the leachate.



6. Given the contained nature of the site, high leachate head, gas extraction system and site situation in relation to topography, lateral gas transfer potential is considered to be low to moderate. However, as significant levels of methane and carbon dioxide are being observed at multiple locations surrounding the site it is considered that an alternative source to the landfill may be present e.g. coal measures. This should be reviewed in more detail to determine whether a significant PPL is present.

The qualitative risk assessment has therefore determined the following conclusions:

Human Health

A pollution linkage has been determined for landfill gas. There is a landfill gas source which is present in boreholes along the entire perimeter of the landfill boundaries in levels that are a risk to human health (i.e. a significant pollution linkage). However, much of the above ground migrating gas has been attributed

to an inefficient and temperamental gas flare. An assessment at the Stoneyhill landfill site and gas flare compound carried out by Jacobs on behalf of TWC in 2007 in accordance with the Dangerous Substances and Explosive Atmosphere Regulations 2002 (DSEAR). The assessment recommended the gas flare compound and associated infrastructure be improved. This has increased the efficiency of the gas extraction system and is considered that due to natural dispersion the risk to properties and the public will be significantly reduced.

In addition, evidence suggests that other external sources may be contributing to the gas in the area of the landfill therefore it is recommended that further assessment of this risk is undertaken.

Controlled Waters

The data reviewed has indicated that there is a source of contamination present within the landfill waste mass, which is evidenced by the landfill leachate. Monitoring data collected over the past years has indicated a number of elevated contaminats, mainly Ammoniacal Nitrogen, Chloride, Potassium, Sodium, Calcium, Iron, Magnesium, Manganese, BTEX, EC List I and II substances and Aromatics and Aliphatics in the leachate.

There is evidence of Organotin compounds in the groundwater at levels similar to that found in the leachate but these are at very low concentrations. There is evidence of groundwater contamination from leachate, especially in Borehole 9, mainly with List I and II substances north of the site. Levels of aromatics and aliphatics have been detected in groundwater at concentrations greater than those detected in leachate samples, thus indicating additional external factors influencing the groundwater. The pH results indicate fluctuations to the extremes with both acidic and alkali groundwater being detected, indicating the presence of external sources other than the landfill acting upon the groundwater. The low pH values indicate the potential for acid mine water to be present in the vicinity and influencing the groundwater chemistry. Although this linkage may be considered as a pollution linkage it cannot be entirely attributed to the landfill thus requiring further assessment.

External Aromatic source?

With regards to the surface waters, although levels of ammoniacal nitrogen and manganese were elevated in the ponds, these are not high enough to indicate leachate contamination and may be from other sources.

ponds

Ecosystems

The conceptual model and QRA has not assessed the potential harm to ecological receptors that may be present. However, there may not be any significant receptors such as protected wildlife sites. This requires further assessment.

Property and Infrastructure

There has not been any data provided to suggest risk to property and underground services therefore any potential harm has not been assessed. This requires further assessment.

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Further Works

Further works are recommended to enable the identified pollution linkages to be substantiated and for the external sources to be identified and quantified. Such works are to include:

1. Phase 1 Desk Study to include a 1km area surrounding the Stoneyhill site;
2. Additional monitoring for further leachate and groundwater chemical characterisation;
3. Trace gas analysis for anthropogenic compounds (Landfill or coal) to establish the source of the gas; and
4. Gas monitoring programme to establish degree of risk (to include pressure and flow in gas wells) and derive an appropriate action plan if deemed necessary.

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Appendices

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Appendix 1- Borehole Logs

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Appendix 2- Summary of Historic Groundwater, Surface water and Leachate

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From Jacobs report.

Appendix 2- Summary of Historic Monitoring Data Sets

EAST: Combine these.

Stoneyhill 2005-2007 - Groundwater Quality - Summary Data

Borehole	mg/l SO4		mg/l		mg/l	mg/l	mg/l as N		mg/l		mg/l		mg/l	mg/l	mg/l	Us/cm	mg/l	mg/l as CaCO	mg/l		mg/l		mg/l		mg/l	
6WD	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	342	400	133	250	20	<1.0	2.10	0.015	5.96		50.89	170	472	115	2.2	943	5.50	10	80.02	250	23.78	1	32.46	50	8.25	50ugl
1.07.05	304	400	97	250	111	<1.0	1.50	0.015	3.7		50.57	170	465	390	74.2	930	7.20		66.49	250	<0.03	1	30.7	50	7.46	50ugl
28.10.05	420	400	104	250	173	<1.0	1.60	0.015	3.74	12	56.04	170	533	1165	8.2	1065	4.70	16	77.1	250	23.16	1	32.38	50	9.42	50ugl
25.01.06	261	400	103	250	43	<1.0	0.80	0.015	3.37	12	47.34	170	463	914	5.4	926	5.50	26	63.55	250	18.15	1	26.7	50	5.97	50ugl
28.04.06	341	400	98	250	98	<1.0	1.20	0.015	4.17	12	53.11	170	462	611	7.2	923	5.00	17	76.91	250	21.32	1	32.27	50	8.34	50ugl
14.07.06	344	400	105	250	130	<1.0	4.20	0.015	4.66	12	51.92	170	481	521	81.4	962	5.80	48	70.4	250	30.93	1	30.7	50	8.12	50ugl
17.10.06	337	400	94	250	156	<1.0	1.10	0.015	5.29	12	56.14	170	486	1309	<1.0	972	5.60	22	77.72	250	0.025	1	33.4	50	9.74	50ugl
19.01.07	268	400	110	250	128	<1.0	2.50	0.015	3.64		55.06	170	468	241	12.3	936	5.40	36	70.4	250	<8.0	1	29.42	50	6593.00	50ugl
Average	327.13		105.50		107.38	<1.0	1.88		4.32		52.63		478.75	658.25	27.27	957.13	5.59	25.00	72.82		19.56		31.00		8.19	

NORTH

8WS	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	859	400	51	250	41	<1.0	5.80	0.015	22.80		51.17	170	994	153	4.9	1988	6.8	410	328.17	250	19.58	1	79.84	50	23.42	50ugl
1.07.05	758	400	68	250	77	<1.0	7.20	0.015	16.59		52.79	170	937	87	20.2	1874	7.7	410	325.74	250	10.07	1	79.78	50	21.88	50ugl
28.10.05	944	400	50	250	78	<1.0	6.30	0.015	16.02	12	57.2	170	1103	167	3.8	2206	7.1	556	315.80	250	17.86	1	78.30	50	21.76	50ugl
25.01.06	991	400	51	250	70	<1.0	10.90	0.015	20.40	12	57.82	170	1122	22460	13.6	2243	6.3	465	293.68	250	8.08	1	82.30	50	23.74	50ugl
28.04.06	990	400	54	250	104	<1.0	8.70	0.015	23.05	12	64.67	170	1139	284	8.6	2278	6.9	457	354.71	250	0.67	1	88.43	50	29.72	50ugl
14.07.06	995	400	46	250	222	<1.0	7.70	0.015	17.46	12	53.56	170	1056	1992	3.3	2112	7.9	476	305.40	250	3.19	1	89.26	50	25.36	50ugl
17.10.06	882	400	41	250	263	<1.0	7.00	0.015	19.18	12	55.9	170	1060	6824	3.4	2120	7.1	438	338.80	250	<0.008	1	93.24	50	12.50	50ugl
19.01.07	823	400	51		612	<1.0	1.00	0.015	14.98		47.78	170	1064	32019	5.8	2128	7	430	311.20	250	<8.0	1	81.60	50	24240.00	50ugl
Average	905.25		51.50		183.38	<1.0	6.83		18.81		55.11		1059.38	7998.25	7.95	2118.63	7.10	455.25	321.69		9.91		84.09		22.63	

NORTH.

9WD	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	28	400	1016	250	296	1.8	405.60	0.015	446.80		575.51	170	3825	433	85.8	7649	7.3	3340	237.57	250	0.23	1	177.20	50	6.32	50ugl
1.07.05	46	400	925	250	377	<1.0	293.80	0.015	430.68		666.05	170	3669	536	107.2	7337	7.6	2280	225.14	250	<0.03	1	188.56	50	5.64	50ugl
28.10.05	56	400	1103	250	484	4.5	452.40	0.015	351.32	12	674.40	170	4261	545	43.5	8521	7.4	3105	203.6	250	0.19	1	173.72	50	5.62	50ugl
25.01.06	78	400	924	250	268	5.9	368.40	0.015	460.41	12	580.57	170	4053	711	115.5	8105	6.8	2940	186.32	250	0.29	1	175.10	50	5.78	50ugl
28.04.06	67	400	963	250	638	2.2	396.20	0.015	439.34	12	579.94	170	4062	322	100.2	8124	7.2	3060	190.99	250	0.04	1	173.33	50	5.92	50ugl
14.07.06	57	400	940	250	544	2.9	418.00	0.015	397.20	12	574.80	170	3999	524	95.5	7997	7.7	3160	59.48	250	0.07	1	176.00	50	3.20	50ugl
17.10.06	68	400	927	250	434	<1.0	467.20	0.015	487.40	12	594.40	170	4370	452	92.8	8739	7.4	3350	37.04	250	0.03	1	186.00	50	5.40	50ugl
19.01.07	100	400	843	250	444	16.5	314.80	0.015	375.00		560.20	170	3876	240	69.3	7752	7.1	2870	32.74	250	60.40	1	161.20	50	5295.00	50ugl
5.12.07					690		460.00	0.015									8.83									
Average	62.50		955.13		463.89	5.63	397.38		423.52		600.73		4014.38	470.38	88.73	8028	7.48	3013.13	146.61		0.14		178.56		5.41	

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9WS	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	112		29	250	1016	<1.0	0.5	0.015	37.5	12	21.99	170	303	225232	30.7	606	6.8	336	32.44		1.39	1	10.27	50	1.15	50ugl
1.07.05	85		873	250	968	<1.0	432.9	0.015	556.28	12	583.85	170	4005	9727	152.7	8009	8.2	3460	166.46		0.6	1	153.48	50	1.08	50ugl
Average	98.50		451.00		992.00		216.70		296.89		302.92		2154.00	117479.50	91.70	4307.50	7.50	1898.00	99.45		1.00		81.88		1.12	

WEST

15WD	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	487	400	72	250	<20	<1.0	1.2	0.015	9.78		32.49	170	557	78	8.1	1114	3.1	<4	76.6	250	1.25	1	35.62	50	7.95	50ugl
1.07.05	432	400	66	250	60	<1.0	4.4	0.015	6.25		29.91	170	598	530	16.4	1195	2.9	<4	65.65	250	32.64	1	336.8	50	7.08	50ugl
28.10.05	469	400	75	250	84	<1.0	2.2	0.015	6.03	12	32.22	170	571	418	3.9	1141	3.2	<4	70.86	250	2.37	1	32.22	50	7.69	50ugl
25.01.06	455	400	71	250	33	<1.0	5.4	0.015	7.24	12	30.44	170	505	2930	6.2	1009	4.9	<4	66.81	250	43.49	1	33.76	50	7.39	50ugl
28.04.06	428	400	71	250	366	<1.0	1.8	0.015	8.16	12	35.65	170	552	1229	7.5	1103	3.3	<4	75.09	250	37.96	1	35.93	50	8.39	50ugl
14.07.06	442	400	70	250	52	<1.0	5.3	0.015	8.38	12	35.5	170	583	523	3.1	1166	3.1	<4	72.2	250	2.36	1	34.42	50	7	50ugl
17.10.06	410	400	67	250	50	<1.0	1.3	0.015	6.7	12	30.96	170	548	336	<1.0	1098	3.1	<4	70.06	250	12.85	1	34.34	50	9.04	50ugl
19.01.07	380	400	77	250	73	<1.0	1.5	0.015	6.84		32.56	170	572	162	8.9	1144	3.2	<4	69.9	250	3096	1	35.56	50	7538	50ugl
5.12.07					19		1	0.015									3.38									
Average	437.88		71.13		92.13	<1.0	2.68		7.42		32.47		560.75	775.75	7.73	1121.25	3.35	#DIV/0!	70.90		18.99		72.33		7.79	

Stop treating site.

Note: Values for Manganese and Iron on 19.01.07 have not been included in the averages as they appear to be erroneous

EQS Freshwater used. Where no value is available, UK Drinking Water Standard used.

Denotes average values which have exceeded relevant EQS Values

P18

South.

Stoneyhill 2005-2007 - Groundwater Quality - Summary Data

29WS	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	134	400	10	250	<20	<1.0	0.4	0.015	3.52	12	24.77	170	292	488	7.9	584	6.8	164	74.2	250	<0.03	1	21.12	50	1.61	50ugl
1.07.05		400		250				0.015		12		170								250		1		50		50ugl
25.01.06	250	400	18	250	<20	<1.0	0.5	0.015	1.7	12	10.47	170	319	40	8.6	638	5.7	42	63.65	250	0.03	1	25.26	50	1.76	50ugl
28.04.06	280	400	20	250	123	<1.0	0.2	0.015	1.86	12	12.64	170	334	163	7	667	5.7	58	78.55	250	0.82	1	31.91	50	4.44	50ugl
19.01.07	186	400	17	250	189	<1.0	0.7	0.015	2.1	12	16	170	314	115	20.1	628	6.2	122	70.98	250	10810	1	21.86	50	3073	50ugl
Average	212.50		16.25		156.00	<1.0	0.45		2.30		15.97		314.75	201.50	10.90	629.25	6.10	96.50	71.85		0.43		25.04		2.60	

SW

31WD	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.4.05	463	400	116	250	50	<1.0	3.3	0.015	15	12	74.99	170	614	736	11.4	1228	5.9	18	106.65	250	48.04	1	43.78	50	8.01	50ugl
1.07.05	438	400	108	250	217	<1.0	2.4	0.015	9.55	12	60.53	170	570	2356	2.6	1140	4	<4	83.51	250	5.97	1	41.02	50	7.28	50ugl
28.10.05	678	400	109	250	595	<1.0	6	0.015	9.1	12	76.7	170	637	4152	4.3	1274	4.7	56	90.64	250	38.62	1	40.7	50	8.97	50ugl
25.01.06	463	400	104	250	376	<1.0	9.6	0.015	11.57	12	81.22	170	686	19222	6.9	1371	6	122	89.11	250	24.91	1	40.4	50	7.88	50ugl
28.04.06	412	400	82	250	80	<1.0	1.3	0.015	11.6	12	70.79	170	537	10501	11.9	1074	5.6	30	96.01	250	0.82	1	35.71	50	6.13	50ugl
14.07.06	677	400	88	250	386	<1.0	1.4	0.015	10.5	12	45.48	170	651	5345	8.7	1301	3.5	<4	98.8	250	41.25	1	46.54	50	11.06	50ugl
17.10.06	499	400	<1.0	250	232	<1.0	1.3	0.015	9.88	12	41.48	170	566	3346	3.7	1132	3.5	<4	82.18	250	29.78	1	39.88	50	11.86	50ugl
19.01.07	285	400	67	250	294	<1.0	0.7	0.015	9.25	12	44.86	170	436	3730	16.8	871	6.1	44	78.46	250	2274	1	22.98	50	3380	50ugl
5.12.07		400			790		1.2	0.015									3.5									
Average	489.38		96.29		335.56	<1.0	3.02		10.81		62.01		587.13	6173.50	8.29	1173.88	4.76	54.00	90.67		27.06		38.88		8.74	

N-W

32WS	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	453	400	21	250	<20	<1.0	1.2	0.015	10.02	12	16.54	170	425	171	3.3	850	5.6	6	100.32	250	<0.03	1	33.62	50	12.75	50ugl
1.07.05	436	400	20	250	54	<1.0	2	0.015	5.26	12	13	170	432	139	23.2	863	7.7	18	89.01	250	<0.03	1	31.78	50	9.97	50ugl
28.10.05	523	400	25	250	62	<1.0	2.1	0.015	5.03	12	15.07	170	483	69	2.8	966	5.3	21	99.14	250	<0.03	1	32.72	50	11.92	50ugl
25.01.06	372	400	19	250	35	<1.0	4	0.015	6.84	12	10.4	170	381	237	1.9	761	5.2	6	72.59	250	0.06	1	27.88	50	8.37	50ugl
28.04.06	724	400	35	250	99	<1.0	5	0.015	9.7	12	22.09	170	626	204	12.4	1251	5.2	16	150.89	250	18.58	1	53.33	50	22.3	50ugl
14.07.06	685	400	33	250	108	<1.0	11.3	0.015	9.18	12	19.76	170	578	219	6.7	1156	7	12	125.38	250	31.76	1	47.5	50	17.63	50ugl
17.10.06	648	400	22	250	88	<1.0	7.6	0.015	8.94	12	15.8	170	583	1072	5	1165	3.7	<4	117.24	250	10.8	1	42	50	21.34	50ugl
19.01.07	583	400	28	250	117	<1.0	4.7	0.015	8.43	12	18.04	170	580	579	8.2	1159	5	16	140	250	<8.0	1	53	50	19138	50ugl
Average	553.00		25.38		80.43	<1.0	4.74		7.93		16.34		511.00	336.25	7.94	1021.38	5.59	13.57	111.82		15.30		40.23		14.90	

N-W

33WS	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	192	400	61	250	30	<1.0	0.8	0.015	5.2	12	39.73	170	367	265	3.8	734	6.6	98	76.72	250	<0.03	1	22.22	50	3.64	50ugl
1.7.05	177	400	57	250	55	<1.0	0.6	0.015	2.88	12	35.05	170	355	<5	20.6	710	8.4	98	60.41	250	<0.03	1	19.54	50	2.82	50ugl
28.10.05	182	400	63	250	37	<1.0	0.1	0.015	2.49	12	36.54	170	372	76	7.2	744	6.7	88	63.84	250	<0.03	1	20.04	50	0.8	50ugl
25.01.06	172	400	57	250	<20	<1.0	0.2	0.015	3.45	12	37.08	170	384	923	2.4	768	6.1	126	67.97	250	<0.03	1	23.3	50	3.93	50ugl
28.04.06	187	400	60	250	49	<1.0	1.2	0.015	3.77	12	39.71	170	366	6992	13.2	732	6.2	102	73.79	250	2.92	1	25.03	50	4.74	50ugl
14.07.06	183	400	57	250	92	<1.0	0.7	0.015	4.23	12	34.8	170	355	4380	2.2	709	7.8	115	67.5	250	<0.03	1	22.3	50	4.32	50ugl
17.10.06	210	400	<1	250	184	<1.0	1.4	0.015	4.24	12	33.28	170	370	11180	1.8	739	6.2	100	73.78	250	0.004	1	25.22	50	5.04	50ugl
19.01.07	244	400	24	250	134	<1.0	0.5	0.015	3.84	12	16.73	170	310	759	14.1	620	6.2	30	65.98	250	<8.0	1	19.66	50	2016	50ugl
5.12.07					59		0.6	0.015									7.99									
Average	193.38		54.14		80.00	<1.0	0.68		3.76		34.12		359.88	3510.71	8.16	719.50	6.91	94.63	68.75		1.46		22.16		3.61	

34WS	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	230		12	250	<20	<1.0	0.8	0.015	8.71	12	12.26	170	262	7355	5.3	524	6.6	40	54.92	250	<0.03	1	18.41	50	7.28	50ugl
1.07.05	228		13	250	52	<1.0	1.4	0.015	6.66	12	12	170	264	46	5.2	527	6.6	<4	41.55	250	<0.03	1	18.31	50	5.09	50ugl
28.10.05	132	400	10	250	300	<1.0	0.3	0.015	3.66	12	7.48	170	171	5857	3.8	342	5.6	14	24.82	250	<0.03	1	10.03	50	2.49	50ugl
25.01.06	294	400	25	250	26	<1.0	1	0.015	8.01	12	16.04	170	358	7090	2.8	716	5.8	41	62.69	250	0.3	1	27.6	50	7.98	50ugl
28.04.06	668	400	28	250	86	<1.0	3.5	0.015	13.49	12	29.47	170	583	10952	7.3	1165	5.4	16	122.25	250	1.27	1	52.27	50	18.58	50ugl
14.07.06	852	400	52	250	291	<1.0	9.5	0.015	14.01	12	35.84	170	691	42375	6.8	1381	6.4	96	152.72	250	22.72	1	73.68	50	23.35	50ugl
17.10.06	272	400	<1	250	140	<1.0	1.3	0.015	25.78	12	14.09	170	309	4301	1.8	617	5.9	26	56.28	250	0.029	1	25.78	50	8.16	50ugl
19.01.07	618		30	250	1156	<1.0	6.5	0.015	10.82	12	24.36	170	604	30817	6.8	1207	4.6	<4	130.4	250	19.4	1	55.2	50	21730	50ugl
Average	411.75		24.29		293.00	<1.0	3.04		11.39		18.94		405.25	13599.13	4.98	809.88	5.86	38.83	80.70		6.08		35.16		10.42	

Note: Values for Manganese and Iron on 19.01.07 have not been included in the averages as they appear to be erroneous

EQS Freshwater used. Where no value is available, UK Drinking Water Standard used.

Denotes average values which have exceeded relevant EQS Values

NE

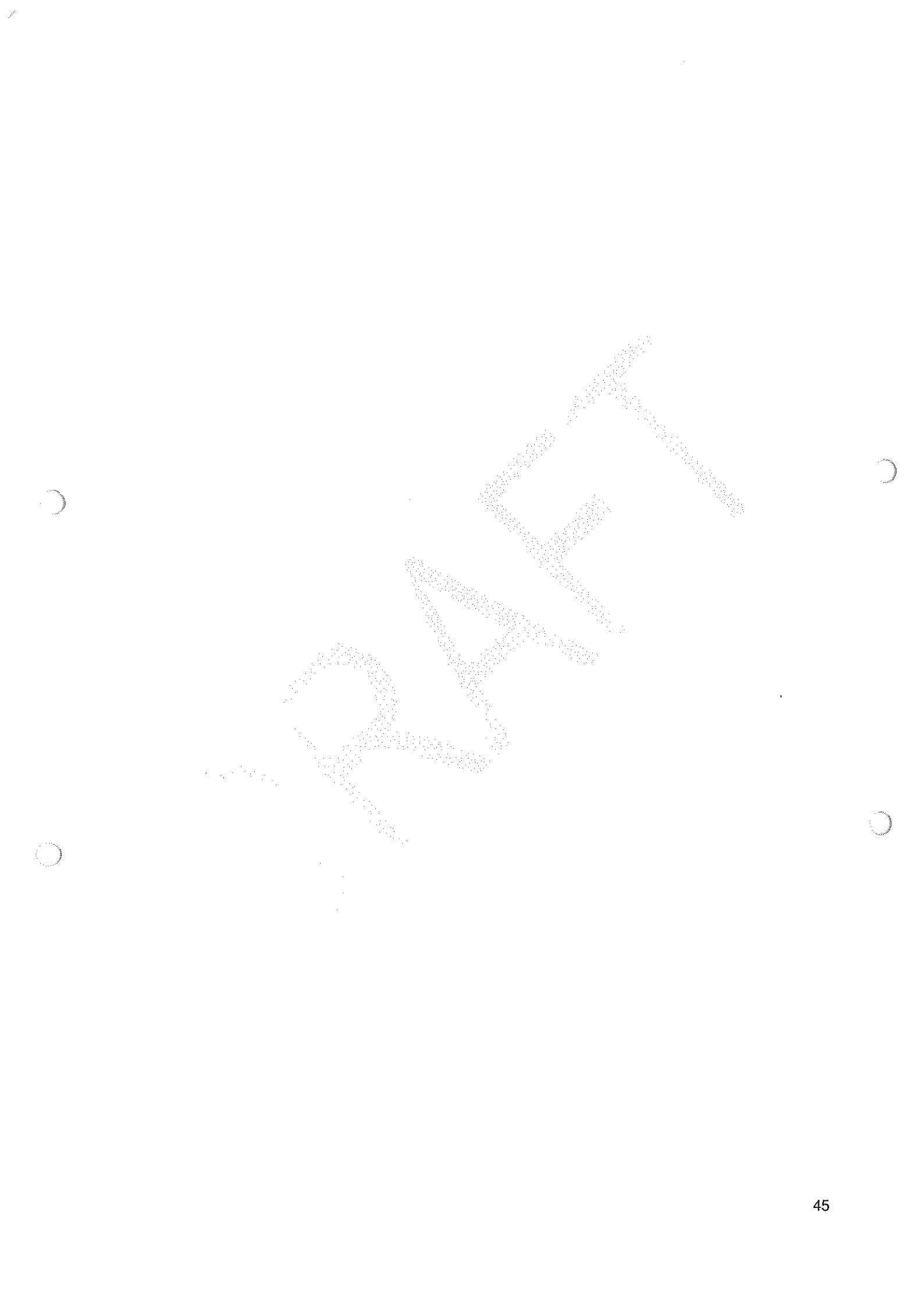
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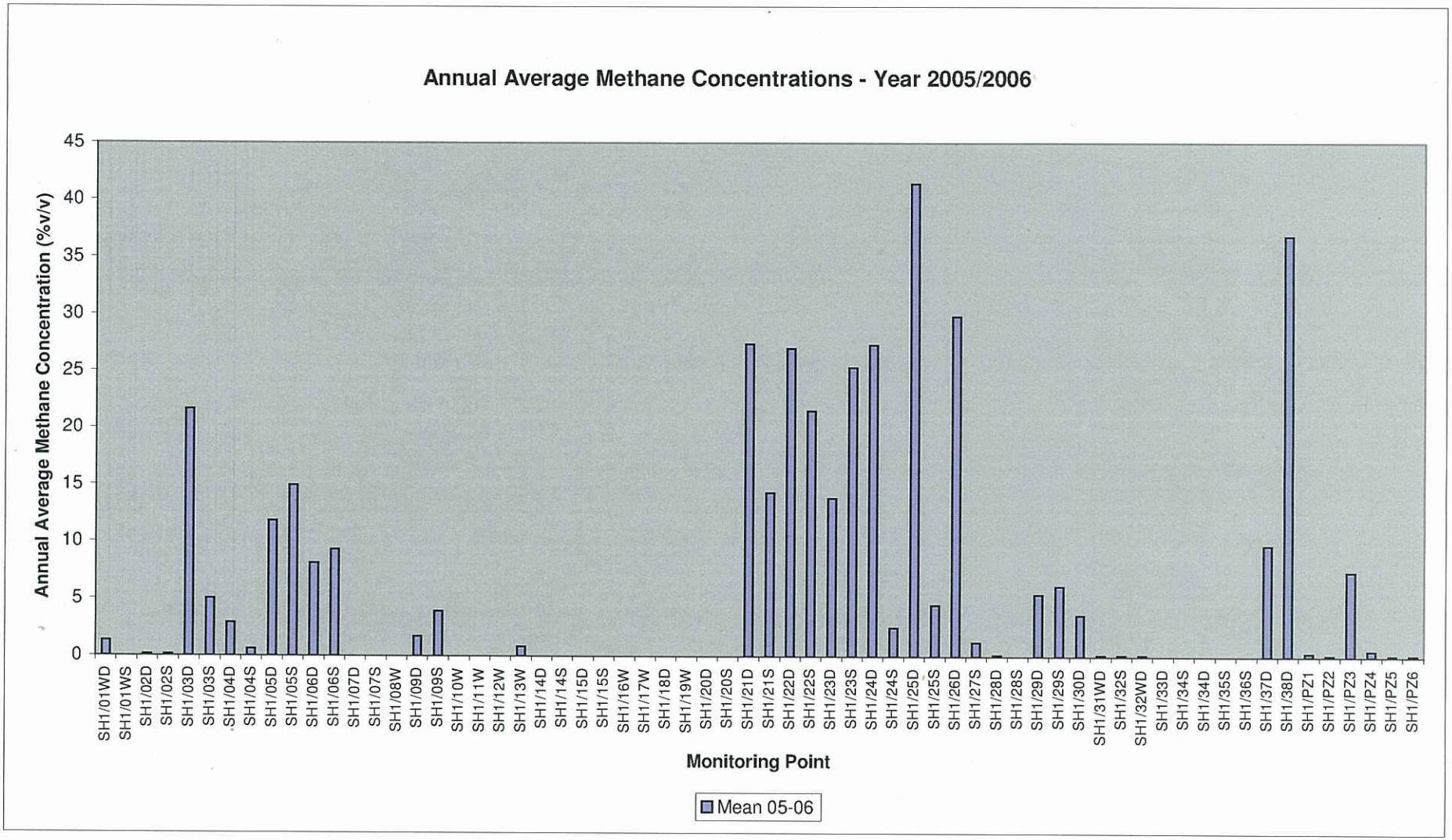
37WD	Sulphate	EQS	Chloride	EQS	COD	TON	Ammoniacal Nitrogen	EQS	Potassium	EQS	Sodium	EQS	Dissolved Solids	Suspended Solids	TOC	Electrical Conductivity	pH	Alkalinity	Calcium	EQS	Iron	EQS	Magnesium	EQS	Manganese	EQS
19.04.05	135		13	250	<20	<1.0	0.5	0.015	3.1	12	10.09	170	193	815	10.1	386	6.1	39	46.26	250	0.53	1	13.36	50	2.14	50ugl
1.07.05	225		36	250	93	<1.0	2.7	0.015	3.53	12	17.71	170	349	3070	19.9	697	8.3	70	83.55	250	12.45	1	22.24	50	2.08	50ugl
28.10.05	202	400	38	250	185	<1.0	0.2	0.015	2.08	12	13.17	170	331	1142	15.4	661	6.2	88	76.24	250	0.3	1	17.1	50	1.42	50ugl
25.01.06	187	400	22	250	51	<1.0	1.5	0.015	2.69	12	11.41	170	294	1141	4.8	587	5.6	60	57.77	250	4.4	1	18.22	50	4.6	50ugl
28.04.06	221	400	29	250	190	<1.0	3.3	0.015	3.12	12	16.94	170	363	3343	110.2	726	6	145	75.43	250	13	1	22.57	50	6.42	50ugl
14.07.06	312	400	54	250	147	<1.0	4.1	0.015	4.67	12	22.2	170	426	850	3.1	852	7.8	114	109.72	250	9.76	1	25.72	50	2	50ugl
17.10.06	219	400	<1	250	63	<1.0	2	0.015	3.49	12	17.01	170	364	1235	1	728	6.2	94	87.58	250	0.001	1	22.34	50	1.94	50ugl
19.01.07	262		45	250	57	<1.0	0.6	0.015	3.26	12	21.86	170	400	140	4.7	800	6.4	100	96.78	250	<8.0	1	23.98	50	2240	50ugl
5.12.07					1600		2.6	0.015									7.75									
Average	**220.38**		**33.86**		**298.25**	**<1.0**	**1.94**		**3.24**		**16.30**		**340.00**	**1467.00**	**21.15**	**679.63**	**6.71**	**88.75**	**79.17**		**5.78**		**20.69**		**2.94**	

Note: Values for Manganese and Iron on 19.01.07 have not been included in the averages as they appear to be erroneous

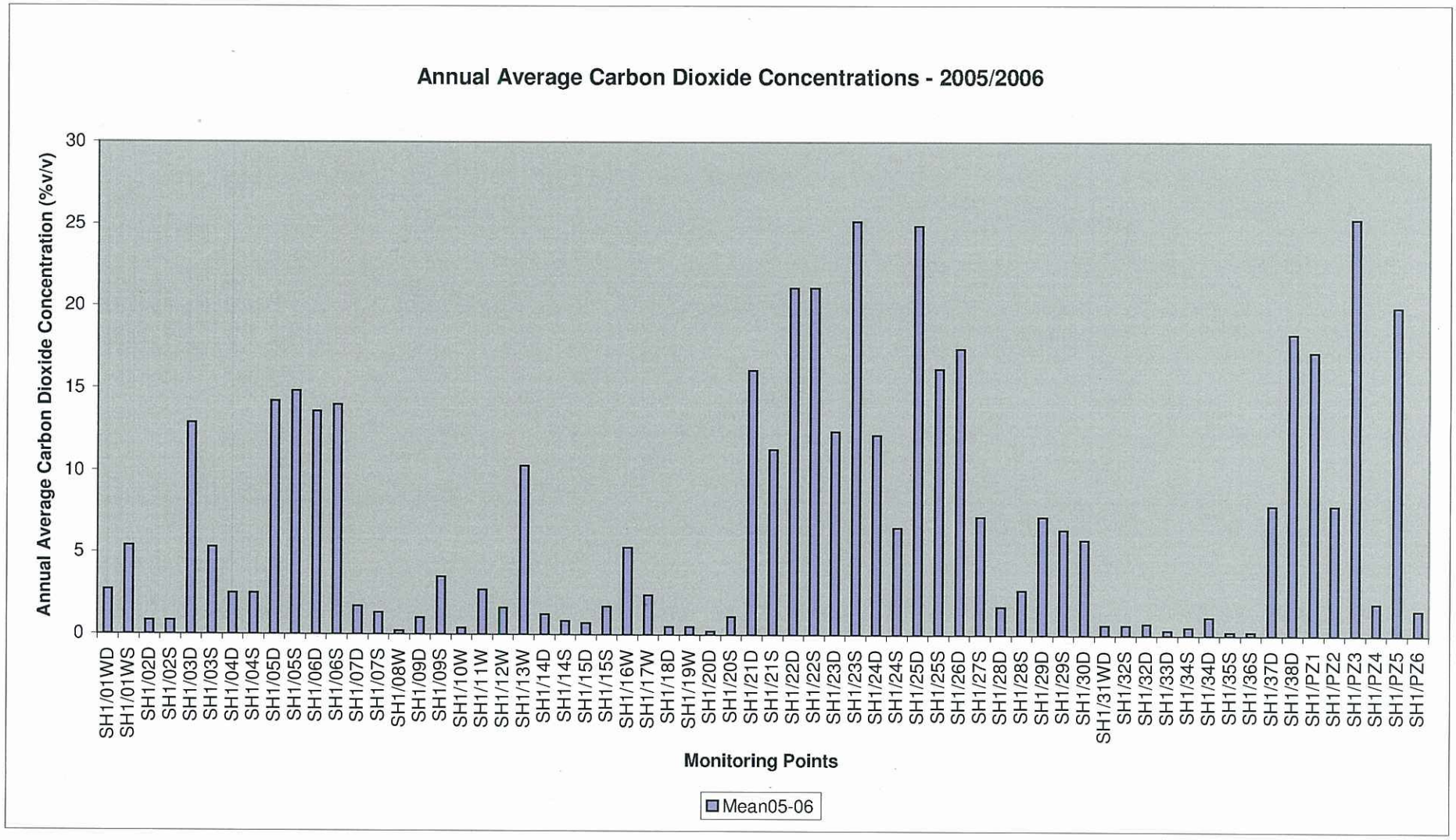
EQS Freshwater used. Where no value is available, UK Drinking Water Standard used.

Denotes average values which have exceeded relevant EQS Values





Appendix 3- Historic Average Annual Methane Concentrations



Appendix 3- Historic Annual Average Carbon Dioxide Concentrations



Part of Jacobs Appendix 4 Excel Spreadsheets complete + acid herb + organotins.pdf

ALcontrol Laboratories - Table Of Results

Job Number: 07/21616/02/01
Client: Jacobs Ltd
Client Ref: B0578400
Matrix: LIQUID

Sample Identity				BH 3	BH9 - D	BH10-L	BH15 - D	BH28-L	BH 31	BH 33	BH37	BH73-L	BH111-L	BH115-L	SW 2	SW 3	SW 4	SW - SMALL
Depth				-	-		-		-	-					-	-	-	-
Sample Type				LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Sample Received Date				06/12/2007	06/12/2007	07/12/2007	06/12/2007	07/12/2007	06/12/2007	06/12/2007	07/12/2007	07/12/2007	07/12/2007	07/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007
Sampled Date				05/12/2007	04/12/2007	06/12/2007	04/12/2007	06/12/2007	03/12/2007	05/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007	04/12/2007	04/12/2007	04/12/2007	03/12/2007
Batch				1	1	2	1	2	1	1	2	2	2	2	1	1	1	1
Sample Number(s)				1-2,4-17	18-34	154-170	35-51	171-187	52-68	69-85	188-204	205-221	222-238	239-255	86-102	103-119	120-136	137-153
	Method	**Units**	**Method Detection Limit**															
Antimony Dissolved (ICP-MS)	TM152	ug/l	<5	9	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Arsenic Dissolved (ICP-MS)	TM152	ug/l	<1	2	<1	<1	<1	7	3	<1	<1	8	8	4	<1	<1	<1	<1
Barium Dissolved (ICP-MS)	TM152	ug/l	<1	34	<1	140	39	370	36	110	66	250	590	590	5	12	29	37
Beryllium Dissolved (ICP-MS)	TM152	ug/l	<1	<1	<1	<1	<1	<1	4	<1	<1	<1	<1	<1	<1	<1	<1	<1
Boron Dissolved (ICP-MS)	TM152	ug/l	<10	100	<10	<10	230	5300	340	120	160	2500	2000	520	<10	<10	<10	<10
Cadmium Dissolved (ICP-MS)	TM152	ug/l	<0.4	0.9	<0.4	<0.4	1.7	<0.4	20	0.8	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.6
Chromium Dissolved (ICP-MS)	TM152	ug/l	<1	1	<1	2	<1	26	<1	<1	<1	23	7	3	<1	<1	7	180
Cobalt Dissolved (ICP-MS)	TM152	ug/l	<1	50	<1	<1	170	5	240	50	86	11	10	3	<1	<1	<1	31
Copper Dissolved (ICP-MS)	TM152	ug/l	<1	3	5	5	6	<1	76	<1	2	13	1	17	<1	1	2	65
Lead Dissolved (ICP-MS)	TM152	ug/l	<1	4	<1	<1	11	<1	210	<1	<1	<1	<1	<1	<1	1	<1	3
Molybdenum Dissolved (ICP-MS)	TM152	ug/l	<1	<1	<1	<1	<1	2	<1	<1	<1	1	<1	1	<1	<1	<1	<1
Nickel Dissolved (ICP-MS)	TM152	ug/l	<1	66	<1	2	200	35	290	56	110	80	24	17	3	7	8	17
Phosphorus Dissolved (ICP-MS)	TM152	ug/l	<10	45	<10	24	<10	110	<10	<10	<10	150	160	<10	<10	<10	<10	120
Selenium Dissolved (ICP-MS)	TM152	ug/l	<1	3	1	<1	2	8	3	1	<1	12	13	5	<1	<1	<1	1
Silver Dissolved (ICP-MS)	TM152	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tellurium Dissolved (ICP-MS)	TM152	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium Dissolved (ICP-MS)	TM152	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tin Dissolved (ICP-MS)	TM152	ug/l	<1	<1	<1	<1	<1	2	<1	<1	<1	6	5	2	<1	<1	<1	<1
Titanium Dissolved (ICP-MS)	TM152	ug/l	<1	1	<1	<1	<1	3	<1	<1	<1	8	6	1	<1	<1	<1	1200
Uranium Dissolved (ICP-MS)	TM152	ug/l	<1	1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium Dissolved (ICP-MS)	TM152	ug/l	<1	3	<1	<1	<1	2	<1	<1	<1	4	3	<1	<1	<1	<1	<1
Zinc Dissolved (ICP-MS)	TM152	ug/l	<3	91	<3	<3	1400	<3	4800	240	310	<3	<3	<3	<3	16	12	210
Mercury Dissolved (CVAF)	TM183	ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silicon Dissolved	TM129	mg/l	<0.05	4.1	3.8	4.8	7.0	19	9.6	5.9	5.9	15	13	6.3	0.61	1.1	3.2	1.9
BOD	TM045	mg/l	<1	2	17	7	3	5	<1	2	4	76	10	2	2	2	2	3
COD	TM107	mg/l	<5	210	690	80	19	530	790	59	1600	800	520	220	17	24	33	29
Nitrite as NO2	TM103	mg/l	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoride	TM104	mg/l	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	1.3	<0.5	<0.5	0.6	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
Phosphate (Ortho as PO4)	TM100	mg/l	<0.08	<0.08	0.14	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.11	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Ammoniacal Nitrogen as N	TM099	mg/l	<0.2	2.7	460	2.1	1.0	210	1.2	0.6	2.6	710	400	72	<0.2	0.2	0.2	0.3
Ammonia Free as NH3	TM082	mg/l	<1	1	470	3	7	190	5	<1	2	530	380	100	<1	<1	<1	<1
Total Cyanide	TM153	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Free Cyanide Low	PENDING	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
pH Value	TM133	pH Units	<1.00	8.08	8.83	8.14	3.38	8.83	3.50	7.99	7.75	8.97	8.99	8.61	7.72	7.67	8.26	8.00
GRO (C4-C12)	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	130	<10	<10	<10	<10	<10	<10
MTBE	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Benzene	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Toluene	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ethyl benzene	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
m & p Xylene	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	34	<10	<10	<10	<10	<10	<10
o Xylene	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

			Sample Identity	BH 3	BH9 - D	BH10-L	BH15 - D	BH28-L	BH 31	BH 33	BH37	BH73-L	BH111-L	BH115-L	SW 2	SW 3	SW 4	SW - SMALL
			Depth	-	-		-		-	-					-	-	-	-
			Sample Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
			Sample Received Date	06/12/2007	06/12/2007	07/12/2007	06/12/2007	07/12/2007	06/12/2007	06/12/2007	07/12/2007	07/12/2007	07/12/2007	07/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007
			Sampled Date	05/12/2007	04/12/2007	06/12/2007	04/12/2007	06/12/2007	03/12/2007	05/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007	04/12/2007	04/12/2007	04/12/2007	03/12/2007
			Batch	1	1	2	1	2	1	1	2	2	2	2	1	1	1	1
			Sample Number(s)	1-2,4-17	18-34	154-170	35-51	171-187	52-68	69-85	188-204	205-221	222-238	239-255	86-102	103-119	120-136	137-153
	Method	**Units**	**Method Detection Limit**															
Aliphatics C5-C6	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	13	<10	<10	<10	<10	<10	<10
Aliphatics >C6-C8	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	<10	<10	<10	<10	<10	<10
Aliphatics >C8-C10	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aliphatics >C10-C12	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	27	<10	<10	<10	<10	<10	<10
Aliphatics >C12-C16 Aqueous	TM174	ug/l	<10	<10	1500	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aliphatics >C16-C21 Aqueous	TM174	ug/l	<10	<10	1300	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aliphatics >C21-C35 Aqueous	TM174	ug/l	<10	<10	580	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Aliphatics C5-C35 Aqueous	TM61/89	ug/l	<10	<10	3400	<10	<10	<10	<10	<10	<10	50	<10	<10	<10	<10	<10	<10
Aromatics C6-C7	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aromatics >C7-C8	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	42	<10	<10	<10	<10	<10	<10
Aromatics >EC10-EC12	TM089	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	41	<10	<10	<10	<10	<10	<10
Aromatics >EC12-EC16 Aqueous	TM174	ug/l	<10	<10	200	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aromatics >EC16-EC21 Aqueous	TM174	ug/l	<10	<10	420	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aromatics >EC21-EC35 Aqueous	TM174	ug/l	<10	<10	450	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Aromatics C6-C35 Aqueous	TM61/89	ug/l	<10	<10	1100	<10	<10	<10	<10	<10	<10	83	<10	<10	<10	<10	<10	<10
TPH (Aliphatics and Aromatics C5-C35)	TM61/89	ug/l	<10	<10	4400	<10	<10	<10	<10	<10	<10	130	<10	<10	<10	<10	<10	<10
Mineral Oil Aqueous	TM172	ug/l	<10	<10	620	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB 7 Congeners																		
PCB congener 28	TM070	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 52	TM070	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 101	TM070	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 118	TM070	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 153	TM070	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 138	TM070	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 180	TM070	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total of 7 Congener PCBs	TM070	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB WHO 12 Congeners																		
PCB congener 77	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 81	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 105	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 114	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 118	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 123	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 126	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 156	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 157	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 167	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 169	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PCB congener 189	TM130	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tributyl Tin*		ug/l				<0.02		<0.02				<0.02	<0.02	<0.02				
Triphenyl Tin*		ug/l				<0.02		<0.02				<0.02	<0.02	<0.02				
Dibutyl Tin*		ug/l				0.40		0.33				0.09	0.07	0.21				
Acid Herbicides																		
2,3,6-TBA*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
2,4,5-T*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				

			Sample Identity	BH 3	BH9 - D	BH10-L	BH15 - D	BH28-L	BH 31	BH 33	BH37	BH73-L	BH111-L	BH115-L	SW 2	SW 3	SW 4	SW - SMALL
			Depth	-	-		-		-	-					-	-	-	-
			Sample Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
			Sample Received Date	06/12/2007	06/12/2007	07/12/2007	06/12/2007	07/12/2007	06/12/2007	06/12/2007	07/12/2007	07/12/2007	07/12/2007	07/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007
			Sampled Date	05/12/2007	04/12/2007	06/12/2007	04/12/2007	06/12/2007	03/12/2007	05/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007	04/12/2007	04/12/2007	04/12/2007	03/12/2007
			Batch	1	1	2	1	2	1	1	2	2	2	2	1	1	1	1
			Sample Number(s)	1-2,4-17	18-34	154-170	35-51	171-187	52-68	69-85	188-204	205-221	222-238	239-255	86-102	103-119	120-136	137-153
	Method	**Units**	**Method Detection Limit**															
2,4-D*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
2,4-DB*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
4-CPA*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Benazolin*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Bentazone*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Bromoxynil*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Dicamba*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Dichloroprop*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Diclofop*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Fenoprop*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Flamprop*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Flamprop-isopropyl*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Ioxynil*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
MCPA*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
MCPB*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Mecoprop*		ug/l				<1.00		12				190	220	<10.00				
Pentachlorophenol*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Triclopyr*		ug/l				<1.00		<1.00				<10.00	<10.00	<10.00				
Pesticides																		
Dichlorvos	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Mevinphos	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tecnazene	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Trifluralin	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
alpha-BHC (Lindane)	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Hexachlorobenzene	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Dimethoate	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
beta-BHC (Lindane)	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Propetamphos	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
gamma-BHC (Lindane)	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Quintozene (PCNB)	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Diazinon	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Etrimphos	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Triallate	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chlorothalonil	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Methyl parathion	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chlorpyriphos methyl	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Heptachlor	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Pirimiphos-methyl	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Fenitrothion	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Malathion	TM163	ng/l	<10	<10	<200	<10	<10	<10	<20	<20	<10	<10	<100	<10	<10	<20	<10	<10
Fenthion	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chlorpyriphos	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aldrin	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Parathion	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Triadimefon	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chlorfenvinphos	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Pendimethalin	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

			Sample Identity	BH 3	BH9 - D	BH10-L	BH15 - D	BH28-L	BH 31	BH 33	BH37	BH73-L	BH111-L	BH115-L	SW 2	SW 3	SW 4	SW - SMALL
			Depth	-	-		-		-	-					-	-	-	-
			Sample Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
			Sample Received Date	06/12/2007	06/12/2007	07/12/2007	06/12/2007	07/12/2007	06/12/2007	06/12/2007	07/12/2007	07/12/2007	07/12/2007	07/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007
			Sampled Date	05/12/2007	04/12/2007	06/12/2007	04/12/2007	06/12/2007	03/12/2007	05/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007	04/12/2007	04/12/2007	04/12/2007	03/12/2007
			Batch	1	1	2	1	2	1	1	2	2	2	2	1	1	1	1
			Sample Number(s)	1-2,4-17	18-34	154-170	35-51	171-187	52-68	69-85	188-204	205-221	222-238	239-255	86-102	103-119	120-136	137-153
	Method	**Units**	**Method Detection Limit**															
Heptachlor Epoxide	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
o,p'-DDE	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Endosulphan I	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
p,p'-DDE	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Dieldrin	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
p,p'-TDE(DDD)	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Endrin	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Endosulphan II	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
o,p'-TDE(DDD)	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ethion	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
o,p'-DDT	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Triazophos	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Carbophenothion	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
p,p'-DDT	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Endosulphan sulphate	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
o,p'-Methoxychlor	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
p,p'-Methoxychlor	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Phosalone	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Azinphos-methyl	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Azinphos-ethyl	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Permethrin I	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Permethrin II	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Disulphoton	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Telodrin	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Isodrin	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
cis-Chlordane	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
trans-Chlordane	TM163	ng/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
SVOC by GCMS																		
Phenols																		
SVOC Derivatised	TM143			see attached	see attached	see attached	see attached	see attached	see attached	see attached	see attached	see attached	see attached	see attached	see attached	see attached	see attached	see attached
2-Chlorophenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2-Methylphenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2-Nitrophenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2,4-Dichlorophenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2,4-Dimethylphenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2,4,5-Trichlorophenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2,4,6-Trichlorophenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
4-Chloro-3-methylphenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
4-Methylphenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
4-Nitrophenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Pentachlorophenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Phenol	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
PAHs																		
2-Chloronaphthalene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2-Methylnaphthalene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Acenaphthene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Acenaphthylene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1

			Sample Identity	BH 3	BH9 - D	BH10-L	BH15 - D	BH28-L	BH 31	BH 33	BH37	BH73-L	BH111-L	BH115-L	SW 2	SW 3	SW 4	SW - SMALL
			Depth	-	-		-		-	-					-	-	-	-
			Sample Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
			Sample Received Date	06/12/2007	06/12/2007	07/12/2007	06/12/2007	07/12/2007	06/12/2007	06/12/2007	07/12/2007	07/12/2007	07/12/2007	07/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007
			Sampled Date	05/12/2007	04/12/2007	06/12/2007	04/12/2007	06/12/2007	03/12/2007	05/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007	04/12/2007	04/12/2007	04/12/2007	03/12/2007
			Batch	1	1	2	1	2	1	1	2	2	2	2	1	1	1	1
			Sample Number(s)	1-2,4-17	18-34	154-170	35-51	171-187	52-68	69-85	188-204	205-221	222-238	239-255	86-102	103-119	120-136	137-153
	Method	Units	Method Detection Limit															
Anthracene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Benzo(a)anthracene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Benzo(a)pyrene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Benzo(b)fluoranthene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Benzo(ghi)perylene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Benzo(k)fluoranthene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Chrysene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Fluoranthene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Fluorene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Indeno(1,2,3-cd)pyrene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Naphthalene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Phenanthrene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Pyrene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Phthalates																		
Bis(2-ethylhexyl) phthalate	TM176	ug/l	<2	<2	<2	<2	<2	<2	<2	<2	<2			<2	<2	<2	<2	<2
Butylbenzyl phthalate	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Di-n-butyl phthalate	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Di-n-Octyl phthalate	TM176	ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5			<5	<5	<5	<5	<5
Diethyl phthalate	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Dimethyl phthalate	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Other Semi-volatiles																		
1,2-Dichlorobenzene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
1,2,4-Trichlorobenzene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
1,3-Dichlorobenzene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
1,4-Dichlorobenzene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2-Nitroaniline	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2,4-Dinitrotoluene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
2,6-Dinitrotoluene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
3-Nitroaniline	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
4-Bromophenylphenylether	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
4-Chloroaniline	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
4-Chlorophenylphenylether	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
4-Nitroaniline	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Azobenzene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Bis(2-chloroethoxy)methane	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Bis(2-chloroethyl)ether	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Carbazole	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Dibenzofuran	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Hexachlorobenzene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Hexachlorobutadiene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Hexachlorocyclopentadiene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Hexachloroethane	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Isophorone	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
N-nitrosodi-n-propylamine	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1
Nitrobenzene	TM176	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1

			Sample Identity	BH 3	BH9 - D	BH10-L	BH15 - D	BH28-L	BH 31	BH 33	BH37	BH73-L	BH111-L	BH115-L	SW 2	SW 3	SW 4	SW - SMALL
			Depth	-	-		-		-	-					-	-	-	-
			Sample Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
			Sample Received Date	06/12/2007	06/12/2007	07/12/2007	06/12/2007	07/12/2007	06/12/2007	06/12/2007	07/12/2007	07/12/2007	07/12/2007	07/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007
			Sampled Date	05/12/2007	04/12/2007	06/12/2007	04/12/2007	06/12/2007	03/12/2007	05/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007	04/12/2007	04/12/2007	04/12/2007	03/12/2007
			Batch	1	1	2	1	2	1	1	2	2	2	2	1	1	1	1
			Sample Number(s)	1-2,4-17	18-34	154-170	35-51	171-187	52-68	69-85	188-204	205-221	222-238	239-255	86-102	103-119	120-136	137-153
	Method	**Units**	**Method Detection Limit**															
SVOC TICs																		
Mecoprop	TM143	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Triazine Herbicides by GCMS																		
Atrazine	PENDING	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Simazine	PENDING	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Volatile Organic Compounds																		
Dichlorodifluoromethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloromethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vinyl Chloride	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bromomethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Trichlorofluoromethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-1-2-Dichloroethene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dichloromethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbon Disulphide	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1-Dichloroethene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1-Dichloroethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Methyl Tertiary Butyl Ether	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-1-2-Dichloroethene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bromochloromethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.2-Dichloropropane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dichloroethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1.1-Trichloroethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1-Dichloropropene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	9	3	<1	<1	<1	<1	<1
Carbontetrachloride	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibromomethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dichloropropane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bromodichloromethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Trichloroethene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-1-3-Dichloropropene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-1-3-Dichloropropene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1.2-Trichloroethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	8	<1	<1	<1	<1	<1	<1
1.3-Dichloropropane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibromochloromethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dibromoethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tetrachloroethene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1.1.2-Tetrachloroethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlorobenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	12	2	<1	<1	<1	<1	<1
p/m-Xylene	TM116	ug/l	<1	<1	<1	<1	<1	2	<1	<1	<1	30	5	2	<1	<1	<1	<1
Bromoform	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Styrene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1.2.2-Tetrachloroethane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
o-Xylene	TM116	ug/l	<1	<1	<1	<1	<1	1	<1	<1	<1	9	2	2	<1	<1	<1	<1

			Sample Identity	BH 3	BH9 - D	BH10-L	BH15 - D	BH28-L	BH 31	BH 33	BH37	BH73-L	BH111-L	BH115-L	SW 2	SW 3	SW 4	SW - SMALL
			Depth	-	-		-		-	-					-	-	-	-
			Sample Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
			Sample Received Date	06/12/2007	06/12/2007	07/12/2007	06/12/2007	07/12/2007	06/12/2007	06/12/2007	07/12/2007	07/12/2007	07/12/2007	07/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007
			Sampled Date	05/12/2007	04/12/2007	06/12/2007	04/12/2007	06/12/2007	03/12/2007	05/12/2007	06/12/2007	06/12/2007	06/12/2007	06/12/2007	04/12/2007	04/12/2007	04/12/2007	03/12/2007
			Batch	1	1	2	1	2	1	1	2	2	2	2	1	1	1	1
			Sample Number(s)	1-2,4-17	18-34	154-170	35-51	171-187	52-68	69-85	188-204	205-221	222-238	239-255	86-102	103-119	120-136	137-153
	Method	Units	Method Detection Limit															
1.2.3-Trichloropropane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Isopropylbenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1
Bromobenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2-Chlorotoluene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Propylbenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
4-Chlorotoluene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2.4-Trimethylbenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	10	6	3	<1	<1	<1	<1
4-Isopropyltoluene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	10	<1	<1	<1	<1	<1	<1
1.3.5-Trimethylbenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	3	<1	<1	<1	<1	<1	<1
1.2-Dichlorobenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.4-Dichlorobenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
sec-Butylbenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
tert-Butylbenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.3-Dichlorobenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
n-Butylbenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dibromo-3-chloropropane	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2.4-Trichlorobenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	30	<1	<1	<1	<1	<1	<1
1.2.3-Trichlorobenzene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene	TM116	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	243-BH115-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	226-BH111-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	209-BH73-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	192-BH37
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	175-BH28-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	158-BH10-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	23-BH9-D
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	57-BH31
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	74-BH33
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	91-SW2
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	108-SW3
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	125-SW4
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Derivatised Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	142-SW SMALL POND
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	04/01/2008
Date Reported	-	07/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	-

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	158-BH10-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	175-BH28-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
unknown	6.742	13.22
Benzenamine, dimethyl-	9.238	483.54
Hexanoic acid, trimethyl-	9.833	103.55
Hexanone	10.413	26.01
Heptanoic acid, propyl-, methyl ester	11.136	31.11
Hexanoic acid, ethyl-, methyl ester	11.205	15.03
Phenol, (dimethylethyl)-	11.375	21.47
Benzothiazolone	14.61	22.2
Hexadecenoic acid	16.438	14.13
Lycopodan-one, hydroxy-methyl-,	16.833	32

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	192-BH37
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	209-BH73-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	09/01/2008
Date Reported	-	10/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
Hexanoic acid, trimethyl-	-	195
Chloroaniline	10.872	78.89
unknown	11.389	45.33
Neodecanoic acid	11.513	71.98
Acetamide, cyclohexyl-	11.778	64.97
Benzothiazolone	15.158	590.63
Imidazole, amino-ethoxycarbonyl-	16.361	129.2
Butyl-hydroxyphenylpropionic acid	17.229	69.19
Phenol,(methylethylidene)bis-	18.462	69.09

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	226-BH111-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	09/01/2008
Date Reported	-	10/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
Dimethylheptanoic acid	10.157	84.96
Cyclopentanediol, methyl-	10.781	48.6
unknown	11.117	28.42
unknown	11.37	44.09
unknown	11.505	81.88
Butanoic acid, ethyl-trimethyl-	11.582	47.18
unknown	11.626	28.56
unknown	11.67	41.47
Phenol, butyl-	11.733	40.97
Butyl-hydroxyphenylpropionic acid	17.217	60.3

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	243-BH115-L
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
Hexanoic acid, trimethyl-	9.746	24.16
Phenol, (dimethylethyl)-	11.368	15.22
Hexadecanolide	16.438	33.92

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	5-BH 3
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Laboratories

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	23-BH9-D
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
C_{10}-C_{32} Hydrocarbons, 80% aliphatic	-	450

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	40-BH15-D
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	57-BH 31
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	74-BH 33
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	91-SW 2
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	108-SW 3
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	125-SW 4
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

SVOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	142-SW-SMALL POND
Sample Type [Units]	-	Water - µg/l
Date Acquired	-	07/01/2008
Date Reported	-	08/01/2008

Tentative Compound Identification	Retention Time min	Concentration µg/l
No compounds detected	-	<10

MAY INCLUDE PREVIOUSLY QUANTIFIED COMPOUNDS

Alcontrol Geochem

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs
Sample Identity	-	016 - BH3
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	17/12/2007
Date Reported	-	20/12/2007

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Geochem

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs
Sample Identity	-	033 - BH9-D
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	17/12/2007
Date Reported	-	20/12/2007

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Geochem

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs
Sample Identity	-	050 - BH15-D
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	17/12/2007
Date Reported	-	20/12/2007

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Geochem

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs
Sample Identity	-	067 - BH31
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	17/12/2007
Date Reported	-	20/12/2007

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Geochem

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs
Sample Identity	-	084 - BH33
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	17/12/2007
Date Reported	-	20/12/2007

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Geochem

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs
Sample Identity	-	101 - SW2
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	17/12/2007
Date Reported	-	20/12/2007

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Geochem

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs
Sample Identity	-	118 - SW3
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	17/12/2007
Date Reported	-	20/12/2007

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Geochem

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs
Sample Identity	-	135 - SW4
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	17/12/2007
Date Reported	-	20/12/2007

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Geochem

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs
Sample Identity	-	152 - SW- small pond
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	17/12/2007
Date Reported	-	20/12/2007

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	169 - BH10-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	186 - BH28-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	203 - BH37
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	220 - BH73-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	237 - BH111-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	254 - BH115-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	169 - BH10-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	186 - BH28-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	203 - BH37
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	220 - BH73-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

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VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	237 - BH111-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

Alcontrol Laboratories

VOC Tentatively Identified Compounds

Job Number	-	200721616
Client	-	Jacobs Ltd
Sample Identity	-	254 - BH115-L
Sample Type [Units]	-	Liquid µg/l
Date Acquired	-	19/12/2007
Date Reported	-	02/01/2008

Tentative Compound Identification	RetentionTime min	Concentration Liquid µg/l
No compounds detected	-	ND

please note: the identification and semi-quantification of these tentatively identified compounds is outside the scope of the UKAS accreditation for this method

ISO 17025 Form	FORM NO:SQS 105
ALCONTROL LABORATORIES	SHEET 1 OF 1
	ISSUE NO: 2
	WRITTEN BY: DOH
Title of Form	ISSUE DATE: 27/01/05
Notification of NDP's (No determination possible).	APPROVED BY: DP

Job Number : 21616
Client : Jacobs
Sample Type : Water

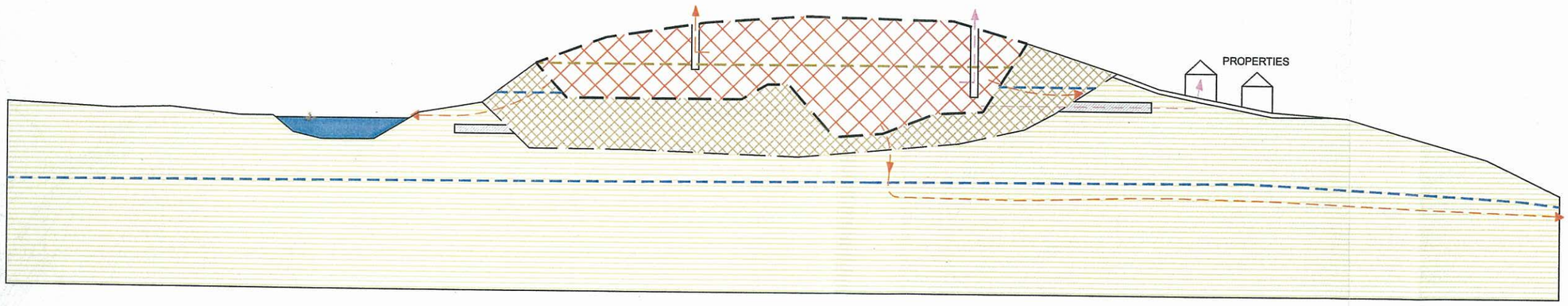
Job No.	Sample No.	Sample ID.	Analyte(s)	Reason
21616	1, 2, 18, 19, 35, 36, 52, 53, 69, 70, 86, 87, 103, 104, 102, 121, 137, 138		ACID HERBS (SUB) ORGANO TIN (SUB)	Technical error. Sample not sent out for sub-contracted analysis

Drawings

Drawing Number	Revision	Drawing Tilte
B0578400/CSM/01	0	Site Location Plan
B0578400/CSM/02	0	Current Conceptual Model
B0578400/CSM/03	0	Locations for Monitoring of Leachate, Groundwater, Surface water
B0578400/CSM/04	0	Zone map indicating areas of contamiantion
B0578400/CSM/05	0	Geological cross-sections
B0578400/CSM/06	0	Receptor Plan
B0578400/CSM/07	0	Schematic representation of Updated Conceptual Model



Drawing number / Rev
B0578400/CSM/02



NOTE

Drawing reproduced from - GeoWater Assessment Of Contaminant Risks Posed By Stoneyhill Landfill Site Volume 1: Main Report Figure 12 16.06.04 161/R30

LEGEND

- Waste
- Carboniferous sandst and mudstones
- Madeground- Rework colliery spoil
- Surface water
- Mine workings
- Leachate level
- Groundwater
- Potential leachate migration route
- Gas migration route

Rev	Rev. Date	Purpose of revision	Drawn	Che
0	14.02.08	DRAWING CREATED	CA	

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Churchill House, Churchill Way, Cardiff, CF10 2HH
Tel:+44(0)29 2035 3200 Fax:+44(0)29 2035 3222
www.jacobs.com

Client: TELFORD & WREKIN

Project: STONEYHILL LANDFILL SITE

Drawing title: CURRENT CONCEPTUAL MOI

Drawing status: FINAL

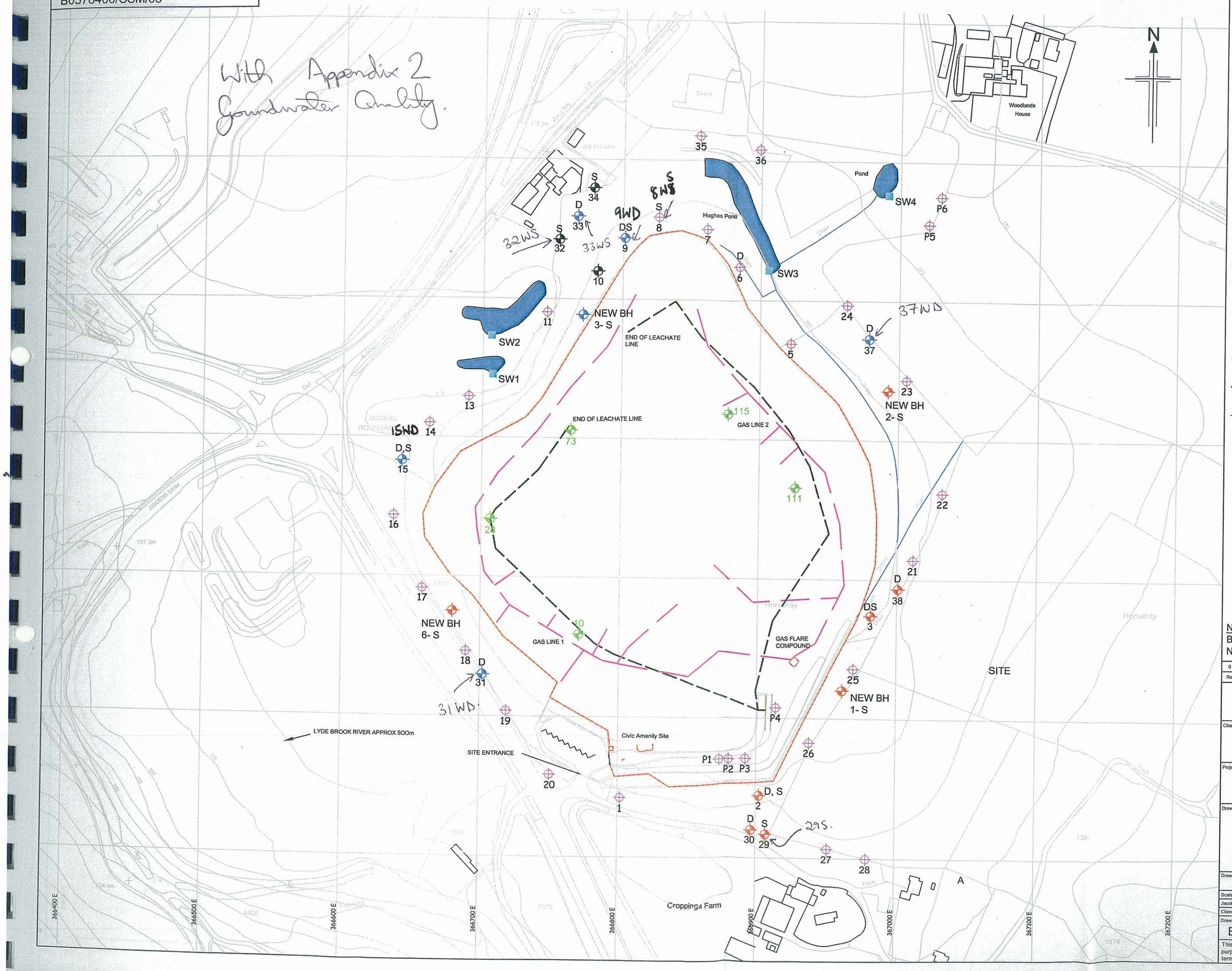
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Jacobs No.	B0578400	
Client no.		

Drawing number: B0578400/CSM/02

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Drawing number / Rev
B0578400/CSM/03

With Appendix 2 Groundwater Quality.



- Site boundary and fence
- Surface water sampling locations
- Boreholes sampled for groundwater, also monitored for gas
- Unable to sample due to no/little water or slow recovery rate, also monitored for gas
- Dipped - No samples taken, also monitored for gas
- Existing leachate well sampled for leachate in cells 1 to cell 5
- Gas monitoring boreholes
- Existing gas line
- Leachate line
- Surface water drains

S= Shallow (colliery spoil)

D= Deep (sandstone)

P= Piezometer

NOTE
BH15 AND BH9 SHALLOW WERE DIPPED.
NO SAMPLES TAKEN.

Rev	Rev. Date	Purpose of revision	Drawn	Checked	Approved
0	04.02.08	DRAWING CREATED	MC	HJ	HMW

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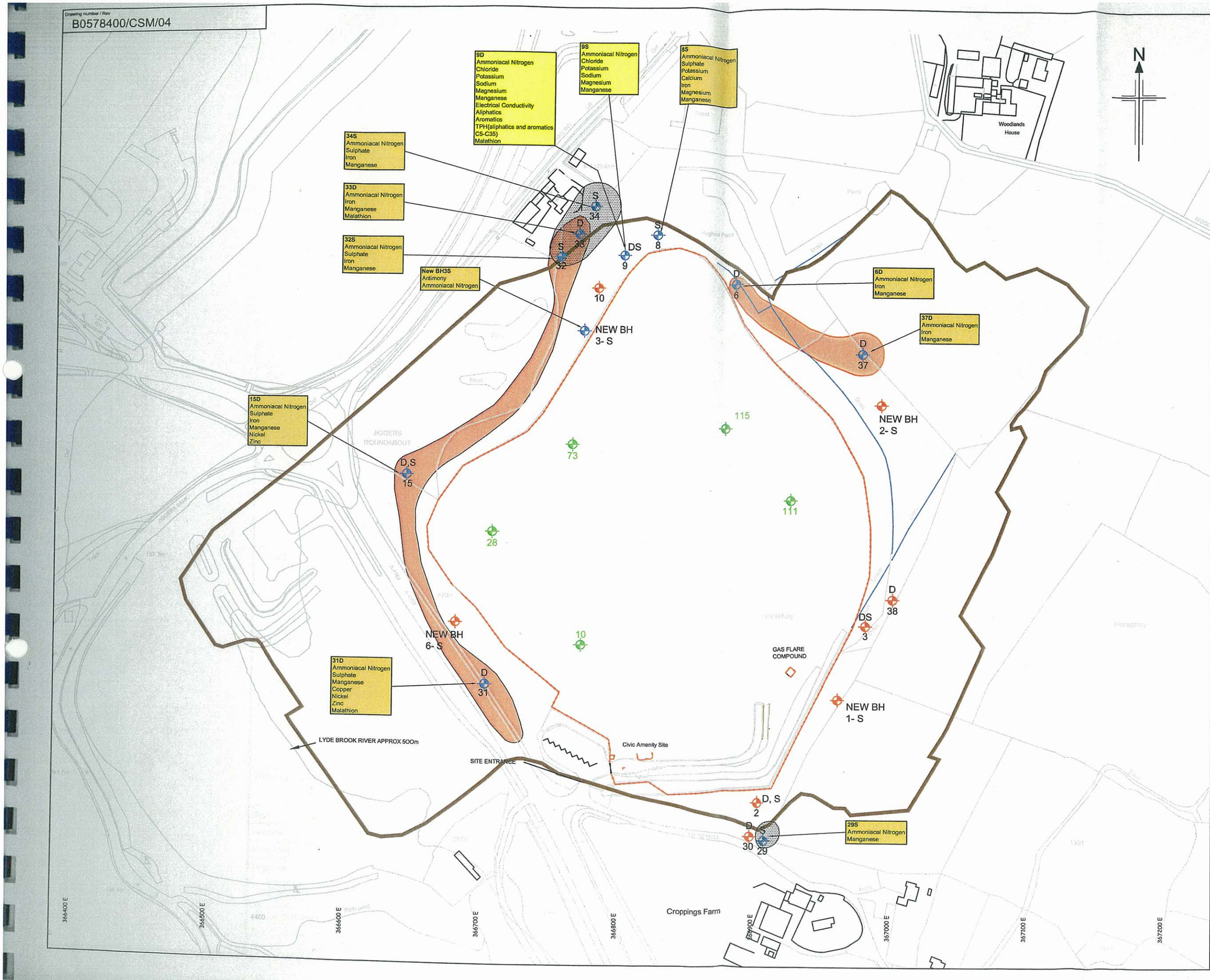
Project: STONEYHILL LANDFILL SITE

Drawing title: LOCATIONS FOR MONITORING OF LEACHATE, GROUNDWATER AND SUFACE WATER

Drawing status	FINAL
Scale	1:2500 @ A3 — DO NOT SCALE
Jacobs No.	B0578400
Client no.	
Drawing number	B0578400/CSM/03
Rev	0

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Drawing number / Rev
B0578400/CSM/04



Site boundary and fence

Extent of opencast boundary

Data relates to analysis over period of 19/4/05 to 5/12/07

Boreholes sampled for groundwater

No groundwater analysis available

Existing leachate well sampled for leachate in cells 1 to cell 5

Surface water ditches

S = shallow (colliery spoil)

D = deep (sandstone)

Groundwater chemical results

Very high levels of contaminants detected

High levels of contaminants detected

Acidic sandstone ground water

Acidic colliery spoil groundwater

Notes

Refer to report text and appendicies 2 and 4 for details of levels and contaminant types

No samples were taken from BH15S and BH9S.

Extent of opencast boundary provided by Telford and Wrekin Council.

Rev	Rev. Date				
0	04.02.08	DRAWING CREATED	MC	HJ	HMW
		Purpose of revision	Drawn	Checked	Approved

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www.jacobs.com

Client: TELFORD & WREKIN

Project: STONEYHILL LANDFILL SITE

Drawing title: ZONE MAP INDICATING AREAS OF CONTAMINATION

Drawing status: FINAL

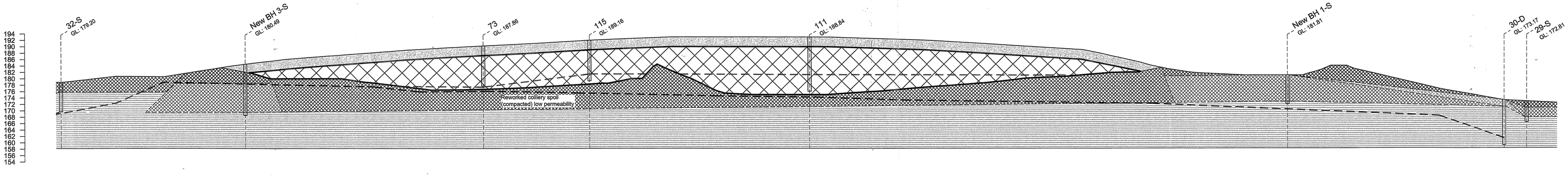
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Client no.		

Drawing number: B0578400/CSM/04 Rev 0

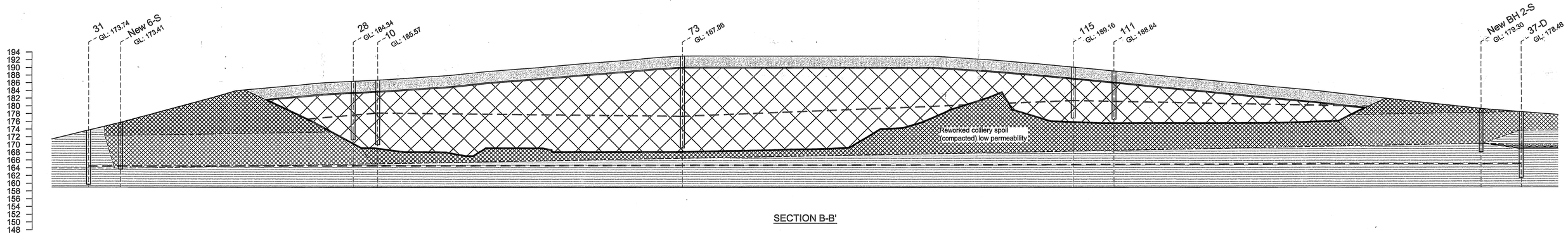
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Drawing number / Rev

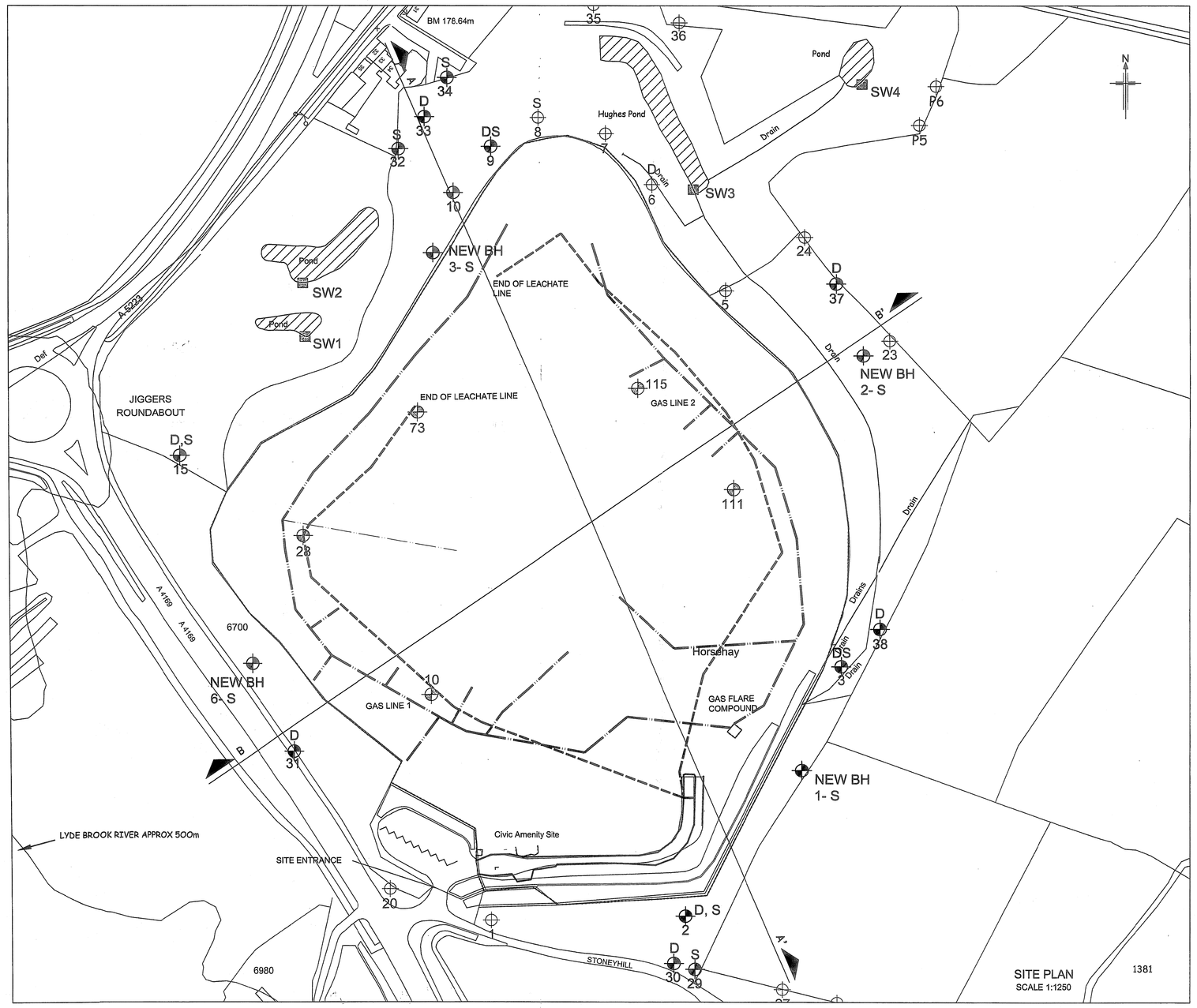
B0578400/CSM/05



SECTION A-A'



SECTION B-B'



NOTE

1. Borehole survey carried out by Jacobs on behalf of Telford and Wrekin Council.
2. Permeability is assumed to be k = 10⁻⁹m/s. Based on information provided by Geowater Environmental Geology report: "Assessment of contaminant risks posed by stoneyhill landfill site Volume 1: Main report May 2004".
3. Bases of leachate boreholes assumed as no information or borehole logs available.
4. All boreholes have been projected along section line.

LEGEND

- Water level - Deep
- Leachate level
- Base of landfill
- Existing ground level
- Waste
- Madeground- Clayey gravely sand
- Madeground - Reworked clay
- Madeground - Reworked colliery spoil
- Carboniferous sandstones and mudstones
- Coal
- 3m engineered clay cap

Rev	Rev. Date	Purpose of revision	Drawn	Checked	Approved
0	13.02.06	DRAWING CREATED	MC	HJ	HMW

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Client: TELFORD & WREKIN

Project: STONEYHILL LANDFILL SITE

Drawing title: GEOLOGICAL CROSS SECTIONS

Drawing status: FINAL

Scale	1:500 @ A0	DO NOT SCALE
Jacobs No.	B0578400	
Client no.		

Drawing number: B0578400/CSM/05 Rev: 0

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LEGEND

- Site boundary and fence
- Receptor 1- Residential properties
- Receptor 2- Surface water
- Receptor 3- Site personnel and sub contractors

Rev	Rev. Date	Purpose of revision	Drawn	Checked	Approved
0	15.02.08	DRAWING CREATED	CA	HJ	HMW

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www.jacobs.com

Client: TELFORD & WREKIN

Project: STONEYHILL LANDFILL SITE

Drawing title: RECEPTOR PLAN

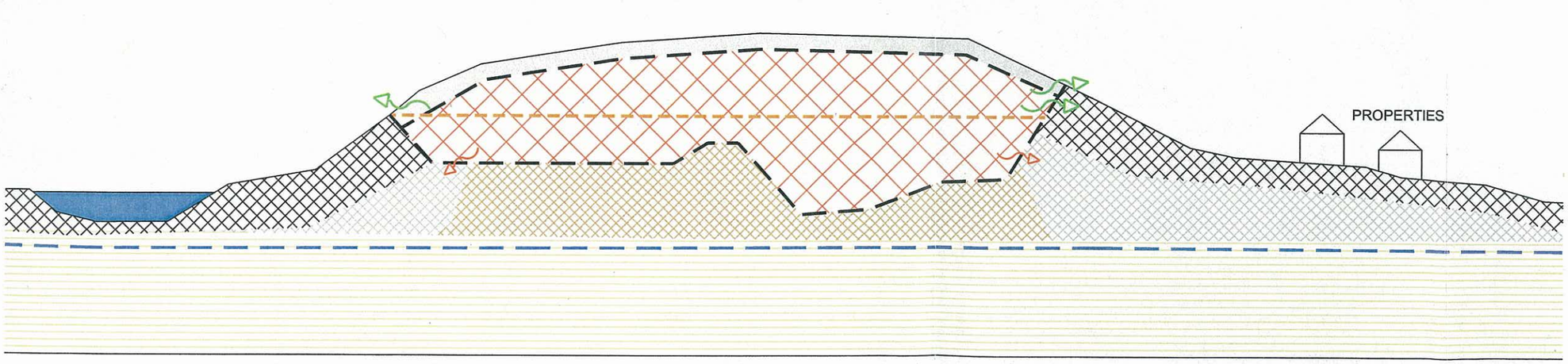
Drawing status: FINAL

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Jacobs No.	B0578400	
Client no.		

Drawing number: B0578400/CSM/06 Rev 0

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Drawing number / Rev
B0578400/CSM/07



SCHEMATIC REPRESENTATION

NOTES

Information provided by Geowater suggests:

1. Engineered clay cap with permeability of 10^{-9} m/s.

2. Soil covers between 1 and 3 metres placed above engineered cap.

3. Base of landfill in phases 1 to 3 would be underlain by reworked colliery spoil of between 7-11 metres, with the remainder of cells underlain by reworked materials.

LEGEND

- Leachate level
- Deep groundwater level
- Waste
- Madeground - Reworked collery spoil
- Madeground - clayey gravely sand
- Madeground - Reworked clay
- Carboniferous sandstones and mudstones
- Engineered clay cap
- Surface water
- Gas migration
- Leachate migration

Rev	Rev. Date	Purpose of revision	Drawn	Checked	Approved
0	13.02.08	DRAWING CREATED	CA	HJ	HMW

JACOBS
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Client
TELFORD & WREKIN

Project
STONEYHILL LANDFILL SITE

Drawing title
SCHEMATIC REPRESENTATION OF UPDATED CONCEPTUAL MODEL

Drawing status
FINAL

Scale	NTS @ A3	DO NOT SCALE
Jacobs No.	B0578400	
Client no.		

Drawing number
B0578400/CSM/07

Rev
0

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Borough of Telford and Wrekin

Stoneyhill Closed Landfill Site

Gap Assessment and Scoping Document

Date: 22 May 2007

Document No: B0578400/R01

Jacobs UK Limited, Churchill House, Churchill Way, CF10 2HH

Tel: 02920 353200 Fax: 02920 353222

Registered Office: 95 Bothwell Street, Glasgow, G2 7HX

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Document Control Sheet

Client:	Borough of Telford and Wrekin	**Job No:**	B0578400
Project:	Stoneyhill Closed Landfill Site	**Report No.**	R01
Title:	Gap Assessment and Scoping Document		

	Prepared by	Reviewed by	Approved by
ORIGINAL	NAME Costa Athanatos	NAME Craig Roberts	NAME Stuart Mollard
DATE 21 May 2007	SIGNATURE	SIGNATURE	SIGNATURE

REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE

REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE

REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE

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Contents

1	Introduction	5
2	Background Information	8
3	Summary of Current Preliminary Conceptual Model	12
4	Gap Assessment	15
5	Investigation Proposals	19
6	Bibliography	22

Drawings

Drawing Number	Revision	Drawing Tilte
B0578400/01	0	Site Location Plan
B0578400/02	0	Site Features and Infrustructure
B0578400/03	0	Current Conceptual Model
B0578400/04	0	Illustration of Current Conceptual Model
B0578400/05	0	Proposed Locations for Monitoring of Leachate, Groundwater, Surface water and Gas

1 Introduction

1.1 Overview

Jacobs has been commissioned by The Borough of Telford and Wrekin (BTW) to assist the council with their duties of assessing whether the site potentially meets the requirements of being classified as 'Contaminated Land' under Part IIA of the Environmental Protection Act (EPA) 1990.

A formal proposal for the works required to progress the site was presented to BTW in September 2006 (Ref B0245700/SJM/HJ/02). Following issue of this proposal BTW were awarded DEFRA funding for progression of investigation at the site as part of the DEFRA Contaminated Land Capital Projects Programme (CLCCP).

1.2 Project Objectives

This report presents Jacobs objectives for the project which are to develop proposals for investigation works of the site to progress the contaminated land assessment in accordance with the requirements of the CLCPP as specified in the guidance document CLAN 1/06: Guide to DEFRA Contaminated Land Capital Projects Programme 2006-07.

In order to achieve this we have reviewed the current conceptual site model, which was produced by GeoWater Environmental Geology in a report entitled 'Assessment of Contaminant Risks Posed by Stoneyhill Landfill Site, May 2004' and completed a gap analysis of the information detailed. This report presents the first phase of that work.

1.3 Legislative Requirement

BTW have been awarded monies in the form of a direct grant under section 31 of the Local Government Act 2003 as part of the DEFRA Contaminated Land Capital Projects Programme (CLCCP). The CLCCP is intended to support local authority work arising under the regime set out in Part IIA of the EPA 1990.

Part IIA introduced a new regulatory regime for the identification and remediation of contaminated land. Part IIA requires a strategic approach to the inspection and determination of contaminated land that, in accordance with paragraph B.20, may include one or all of the following stages:

- Desk Study – Collation and assessment of documentary information, or information from other bodies.
- Study area visit – For the purposes of visual inspection (and in some cases limited sampling), and
- Intrusive Investigation.

This approach ensures that the Local Authority is satisfied that there is a

reasonable possibility that a pollutant linkage exists within the study area, before moving onto the next stage. For example, by way of an initial desk study to collate and assess documentary information, the Local Authority is satisfied that there is a reasonable possibility that a pollutant linkage exists before:

- A visit / inspection of the study area is undertaken.
- And then, that the local authority is satisfied that the contamination is actually present and that the receptor is actually present or likely to be present, before;
- An invasive investigation is carried out using statutory powers.

The strategic approach prevents further unnecessary investigation of a pollutant linkage if at any stage there is no longer a reasonable possibility that the particular pollutant linkage exists.

In accordance with the Part IIA guidance on the definition of contaminated land set out in Chapter A, there are four possible grounds for determination, namely that:

- Significant harm is being caused, in line with paragraph B.44.
- There is significant possibility that significant harm is being caused, in line with paragraph B.45 to B.49.
- Pollution of controlled waters is being caused, in line with paragraph B.50.
- Pollution of controlled waters is likely to be caused, in line with paragraph B.51.

Pollutant linkage or linkages should be identified as the basis for the determination and all three elements (i.e. source-pathway-receptor) should be identified. A linkage that forms the basis for determination that land is contaminated is then a 'significant pollutant linkage'.

Significant harm in the Regulations in terms of its effects on statutorily designated receptors can be summarised as follows:

- Humans
- Ecosystems,
- Infrastructure,
- Livestock/crops, and
- Controlled waters.

1.4 Structure of Report

The report structure is as follows:

Section 2 - Background Information - This section will provide information on the project history and rational.

Section 3 – Summary of Current Preliminary Conceptual Site Model (CSM) – This provides an overview of the current conceptual model for the site as developed by others, outlining the sources, pathways and receptors identified as associated with the site.

Section 4 - Gap Assessment - A gap assessment of current CSM has then been conducted based on the requirements of Part IIA of the EPA 1990 and the Contaminated Land (England and Wales) 2000 Regulations for assessing whether a site is considered as 'Contaminated Land'. This sections details the findings of this gap analysis.

Section 5 - Intrusive Investigation Proposals - Based on the gap assessment recommendations are then made for further works at the site in order to progress with the assessment of the site potential to be defined as contaminated land.

Section 6 – Bibliography – A list of previous ground investigations and assessments are listed which may be used to assist the next phase of the investigation.

1.5 Limitations and Exceptions

This report is for the sole use of BTW and shall not be relied upon by, or transferred to, any other parties without the express written consent of Jacobs and BTW. If an unauthorised third party comes into possession of this report, they rely on the contents at their own risk and Jacobs owes them no duty of care or skill.

The findings and opinions contained within this report are based on information obtained from a variety of sources which are believed to be reliable. Nevertheless, the authenticity or reliability of the information cannot be guaranteed. It is noted that a substantial amount of previous work has been completed at the site. For the purpose of the scoping study, this information will be taken at 'face value'. Interrogation and validation of the assumptions and findings of these various studies will not be undertaken as part of the scoping study. Should, during the preparation of the scoping study conflicts within the findings / assumptions of the various reports and documents be noted, then these will be reported and identified for future assessment.

It is possible that the research carried out, whilst appropriate to comply with the agreed brief, has not indicated the full extent of conditions across the site and the existence of other relevant information sources. If such sources actually exist, their information could not reasonably have been considered in the formulation of the findings and opinions presented in this report.

Jacobs believes that providing information about the exact scope of works undertaken is essential to help BTW to identify and therefore manage its risks. These risks can be mitigated, but not entirely eliminated, through additional investigation, assessment and subsequent remedial works.

Jacobs can provide advice upon the likelihood of designation of a site as contaminated land but are unable to designate as this is the sole responsibility of the Local Authority. The information obtained within this report is intended to provide BTW with an informed understanding of the Site in its environmental and legislative context only.

2 Background Information

2.1 Site Description and Historical Development

Site Location and Geology

Stoneyhill landfill is situated to the south of Telford, just north of the Ironbridge by-pass between Horsehay and Coalbrookdale at National Grid Reference SJ 668 060. The location of Stoneyhill landfill is shown Drawing Number B0578400/01. The site covers an area of approximately 81.6 hectares.

The site of the Stoneyhill landfill was subject to extensive underground coal mining, probably from the eighteenth century or earlier. A National Coal Board report of 1984 (provided in the GeoWater Environmental Geology report Volume 2) refers to the last date of working being the early 1900's. The site was subsequently subjected to opencast coal mining in the mid twentieth century and is thought to have ceased in 1963. Opencast workings are understood to have extended to the Little Flint seam which extends well beyond the eastern landfill boundary.

Previous assessments of the site indicate that the geological strata prior to mining was Lower Coal Measures underlain by sandstones and mudstones of Lower Coal Measures age.

The current landfill boundary and the extent of the opencast boundary are shown on Drawing Number B0578400/02.

Site Construction

A Waste Disposal Resolution was passed in 1984 allowing the deposit of controlled waste.

The opencast backfill, consisting of clay with broken mudstone, sandstone and coal, was reworked, commencing in 1984, to form the landfill void. It is specified in the site Waste Disposal Resolution that the landfill was to be constructed in five phases. Records provided by GeoWater show that Phase 1 was divided by a double bund across the middle creating three cells designated as 'toxic waste cells'. Phase 2 also appears to have inter-cell bunds, including an area designated for asbestos disposal. The site Waste Disposal Resolution states that certain difficult wastes (now known as hazardous waste) should have been deposited in separate areas (known as containment areas) of the landfill reserved for such waste type.

The Resolution also specified that the base and sides of the containment areas should have been lined with a structurally sound layer of approved cohesive argillaceous material not less than two meters thick after compaction and free of voids and fissures with a permeability of no less than 10^{-9} m/s. Permeability testing of the laid liner was also required.

Records provided by GeoWater of liner testing for Phases 1 and 2, indicate that on several occasions the required degree of compaction and permeability was not achieved, particularly in the internal bund walls. No results were available for the testing of other phases, however, anecdotal evidence from the Environment Agency suggests that evidence of former underground coal workings was found, probably in Phase 4 or 5, the deepest part of the site. Concerns were also raised as to whether the haul road into the site was fully lined prior to final waste deposits.

Waste Infilling

The landfill was formerly operated by Shropshire County Council Waste Disposal Authority. Infilling of waste commenced in 1985 and completed in spring 1991. Details of waste inputs are provided in the GeoWater Environmental Geology report 'Assessment of Contaminant Risks posed by Stoneyhill Landfill Site, Volume 1: Main Report' dated May 2004 (report reference 161/R30) and in the Waste Disposal Resolution contained in Volume 2: Appendices of the report.

The bulk of waste types permitted for disposal by the site's Waste Disposal Resolution consisted of household, commercial, industrial and construction wastes known as Schedule A General waste. Some Difficult waste (Schedule B), now known as Hazardous Waste was also accepted. A total of 807 tonnes of Schedule A was permitted to be accepted daily whilst only 519 tonnes of Schedule B was permitted to be accepted daily. However, there is no evidence to indicate what the actual quantities and waste types accepted were.

Wastes from Monsanto plc were deposited at the landfill, apparently during the period between February 1985 and January 1988, by an agreement dated November 1984 and formalised in June 1897. Further details of the Monsanto plc agreement can be found in Volume 2 of the GeoWater report. The wastes listed comprise mainly solid distillation residues and waste cleaning materials and sweepings together with interceptor sludge from a dewatering area and bagged clay dust from a synthetic rubber plant.

The landfill is also known to have accepted carcasses of cattle affected by BSE. No further information or details has been made available to Jacobs at this time.

Site Capping

According to the Waste Disposal Resolution, once the waste reached the maximum levels specified, the waste was to be capped with a layer of argillaceous material no less than one meter thick after compaction and a permeability of no less than 10^{-9} m/s. It is stated by GeoWater that a substantial thickness of between 1-3m of soil cover was placed over the cap, however the source of this statement is not known. Final capping is recorded to be in 1992.

Environmental Monitoring - Gas Control

Detailed environmental monitoring of the Stoneyhill landfill began in 1990 with the construction of 20 gas monitoring boreholes around the perimeter of the site. Further monitoring points were constructed in 1992 to the east of the site to address concerns about potential gas migration eastwards into the Croppings Farm area. The gas control system was initiated at this time and limited

groundwater and surface water monitoring was commenced.

Passive gas vents were installed in 1992 consisting of approximately 150 110mm diameter HDPE lined wells. According to GeoWater, these were installed as close to the base of the waste as possible. In 1993, due to elevated gas readings in external gas monitoring boreholes along the eastern side of the site, a small extraction system was installed. This initially resulted in reduced gas concentrations in these same monitoring boreholes. However, gas concentrations rose again resulting in the installation of a full gas extraction system in the mid 1990s consisting of two buried feeder lines with spurs, and a permanent extraction and flare unit. Unused passive vents were capped.

Dewatering of the gas extraction system is reported to be a constant problem and has been suggested by GeoWater that conventional condensate disposal systems were not installed. Measures have been taken to control the problem, including pumped dewatering but severe weather conditions are reported to still cause shutdown of the extraction system.

Environmental Monitoring - Leachate Control

According to the Waste Disposal Resolution, within each containment area, two suitably designed points for monitoring the nature and extent of any leachate and / or release of any landfill gas generated, will be constructed and installed. Such monitoring points will be extend vertically in advance of the infilling operations to a level not less than one metre above the final finished contours.

Information provided by GepWater states that there is no leachate drainage system in the base of the cells. Leachate monitoring / extraction wells were first installed in 1992 and a pumped leachate extraction system was installed in the mid 1990s and was upgraded in 2000. The highest extraction rates are reported to be achieved from the western part of the site (Phase 5).

Drawing Number B0578400/02 illustrates the location of the site infrastructure identifying the two gas extraction lines, the gas flare, the leachate extraction system and all the monitoring boreholes which Jacobs is aware of.

2.2 Previous Investigations

In addition to the works completed by Jacobs, numerous other assessment and investigations have been completed at the site and adjacent lands. A bibliography of these documents is provided in Section 6.

A key document is the GeoWater Environmental Geology (GeoWater) 2004 Report which BTW commissioned. The document provides an initial assessment of the risks posed by Stoneyhill closed landfill in terms of below - ground contamination in line with Part IIA of the Environmental Protection Act (EPA) 1990 and the Contaminated Land (England and Wales) 2000 Regulations.

The report of that assessment was based on the principal of a conceptual model and structured broadly around the requirements of Part IIA by identifying the sources, pathways and receptors. A qualitative risk assessment then identified significant below-ground potential pollutant linkages and provided recommendations for future monitoring.

The conceptual model and sources, pathways and receptors identified by GeoWater are presented below.

3 Summary of Current Preliminary Conceptual Model

3.1 Conceptual Model

A conceptual model is an illustrative and descriptive representation of the area of potential contamination, the area of above and below ground environment, and the processes acting on substances that are present. It describes and summarises the pollutant linkages that may be present on a site and that will need to be assessed as part of the detailed inspection.

The following sections summarise the current conceptual model as presented by GeoWater. Drawing Number B0578400/03 is a schematic representation of the current conceptual model of the site whilst Drawing Number B0578400/04 is a diagrammatic illustration of the current conceptual.

3.2 Sources

The assessment undertaken by GeoWater identified the waste within the landfill site along with the landfill leachate and gas as the source of contamination.

Waste
The bulk of the waste types permitted at the time consisted of domestic, commercial, non-hazardous and construction wastes. Liquid waste and some 'Difficult' waste (now known as Hazardous waste) was also accepted.

Leachate
Results of routine leachate monitoring are typical of aged leachate from a biodegradable site like Stoneyhill, with high pollution potential due to ammonia and oxygen demand. Leachate was tested in 2000 / 2001 for a range of EC Groundwater Directive List I and II substances. Results show that leachate at this site was generally low in hazardous substances tested. No herbicides, pesticides or organotin compounds have been detected nor were toxic metals in excess quantities. Some volatile organic compounds were present at low concentrations, including some chlorinated organics, and BTEX (Benzene, Toluene, Ethyl benzene and Xylene) compounds. Boron concentrations were elevated and PAH (Polycyclic Aromatic Hydrocarbons) compounds, other aromatics, and nitrogen-sulphur containing organics were also detected, together with significant concentrations of C_{10} to C_{30} hydrocarbons.

Monitoring data indicated that leachate levels were often in breach of the permitted level as stated in the site Waste Disposal Resolution which was issued in 1984. The permitted level is 2m below the lowest lip of the site and should not exceed 177m AOD. On the assumption therefore that the lowest lip point within the landfill is 179m AOD, results of leachate level monitoring indicate leachate will be over topping.

Landfill Gas
Gas produced from the wastes when extracted under suction had a composition of approximately 30 - 45% methane, with the remainder consisting of carbon dioxide. Small percentages of oxygen have been recorded, sometimes rising to greater than 5%. Concentrations of up to 60% methane have been recorded when gas is vented naturally.

3.3 Pathways

The geology is complex. Several faults are present and the area as been affected by extensive deep underground and opencast coal mining. As a result, the pathways for contaminant migration are also complex, with numerous preferential conduits.

The principal pathways for contaminant migration were identified as being:

1. Leachate migration down through the basal liner and colliery spoil into the underlying sandstone aquifer towards groundwater discharge zones.
2. Leachate migration laterally through the liner into colliery spoil, forming zones of contaminated perched groundwater. This may eventually emerge to the surface or recharge groundwater in the sandstones below.
3. Gas migration laterally through the liner and colliery spoil, potentially travelling through permeable strata or workings and emerging beneath sensitive receptors such as nearby properties.

However, additional pathways were identified in the qualitative risk assessment but not considered further due to the scope of the report. These include:

1. Leachate migration through the liner and into groundwater or surface break outs due to high levels of leachate leading to surface water contamination.
2. Above – ground migration of gas emissions. No ambient air or flare emissions monitoring has been conducted.

Drawings Number B0578400/03 is a schematic representation of the pathways.

3.4 Receptors

Surface water monitoring data at the spring in Lydebrook Dingle indicated higher chloride concentrations and elevated chemical oxygen demand which according to GeoWater has been taken to be due to decaying organic matter at the sampling point.

Several receptors had been identified by GeoWater, however, as the scope of the report only covered below-ground contamination, the risk too many of the above ground receptors had not been considered fully.

The receptors which were deemed to be at high risk from landfill gas and leachate due to the presence of a pathway were identified primarily as being:

1. Nearby residential properties, existing and proposed.
2. Roads and associated services.
3. Personnel on site and unauthorised visitors.
4. Groundwater systems in colliery spoil and natural strata (aquifer), and
5. Surface water bodies (ponds near to site).

Receptors which were identified as being highly vulnerable to above – ground landfill gas migration but not considered further in the risk assessment were:

1. Local residents.
2. Staff working on site, and
3. Unauthorised visitors to site.

4 Gap Assessment

4.1 Methodology

The conceptual model plays a pivotal role throughout the investigation of sites being inspected under Part IIA EPA 1990. It forms a planning tool which allows strategic investigation of identified potential pollutant linkages.

Whist the desk study undertaken by GeoWater to assess the risks posed by Stoneyhill closed landfill, goes some way in terms of investigating the potential for pollutant linkages appropriate to Part IIA, it is noted that the Geowater brief only extended to below-ground risks. There is therefore the potential for other above ground pathways and receptors to be present, which to date the significance of has not been assessed.

In light of this we have conducted a gap assessment of the current conceptual model. Any identified data gaps and those Potential Pollution Linkages identified by GeoWater as potential significant Pollution Linkages form the basis of future assessment.

4.2 Data Gaps and Uncertainties

Leachate

The leachate within the site has been identified as one of the main sources of contamination due to the high pollution potential arising from the ammonia and oxygen demand.

It has been stated that the leachate was generally low in the EC Groundwater Directive List I and II substances tested for. However, some parameters were noted by GeoWater as being detected at elevated or significant concentrations whilst other parameters were not detected in excessive quantities. These statements are conflicting.

It is unclear as to how many leachate samples were analysed for the above substances, however there appears to be a limited data set. It is also unclear as to which detection limits were used to determine whether substances were present in significant or excessive quantities.

1. There needs to be a better characterisation of the leachate in terms of its composition. This will give a better indication of the chemical constituents of the leachate and the risks posed to potential receptors should a leachate break out occur.

Landfill Gas

The gassing regime at the site is poorly understood, determining the stage of

waste decomposition at the site will allow the potential for continued landfill gas production and the rate of current gas production to be determined. This will enable us to assess the risk of the landfill as a driver for gas migration beyond the boreholes where gas has been detected and the risks this may pose to identified receptors.

1. There is a requirement for trace gas analysis in order to characterise the gas source and determine its origin i.e. biogenic (landfill gas) or thermogenic, i.e. coal measure gas. Trace gas analysis will also allow an assessment of the potential health risk posed to humans which has not yet been considered.

Based on information provided by BTW, Jacobs has established that the landfill gas extraction system and more specifically the gas flare is not performing efficiently and is considered a risk to human health and a source of landfill gas.

2. An assessment of the potential risk of the gas flare to personnel on site and adjacent to the site is required.

Humans – Residents of Nearby Properties

Data from additional monitoring points installed by GeoWater for the purpose of the investigation indicated significant gas concentrations within the Croppings Farm opencast backfill to the east of the site and to the north-west of the site, as has been detected previously for many years.

1. This occurrence should be investigated as it is in close proximity to existing residential properties. It may be that the presence of mineshafts and abandoned coal measures are acting as potential pathways for gas migration.
2. Trace gas analysis will need to be conducted on this gas. This will help characterise the source of the gas and identify whether it is biogenic i.e. landfill gas or thermogenic, i.e. coal measure gas and will also allow the risks to human health from trace gas components to be determined.

Humans – Site Users and General Public

In addition to residents of nearby properties, there is a requirement to assess the risks posed to on site users such as personnel working on site, and the general public. Risks which need to be assessed are from:

1. Gas migration emanating from the gas flare.
2. Gas migration emanating from within the landfill site. What, if any, are the emissions to air? What is the flow rate and the characteristics of the gas being emitted.

Controlled Waters – Surface Waters

The topography of the site is complex and drainage appears to be in every direction off the landfill. An interceptor ditch outside the north - eastern boundary

of the site carries runoff to an artificial pond close to the northern end of the site. The north - western boundary also drains to two ponds which appear to be internally draining and are assumed to be in at least partial continuity with shallow groundwater. In the event of heavy rainfall and / or leachate levels being unusually high, leachate outbreaks at the surface or perimeter of the landfill may contaminate surface water.

1. The surface water within this drainage ditches should be monitored for potential leachate contamination as these may act as a pathway for potential contaminants.
2. The assumption that the two ponds are in partial continuity should be investigated further. If this is found to be true, then any contamination of the surface waters may contribute to contamination of groundwater. If not, then there may be no significant pollution linkage present.

Based on the evidence supplied by GeoWater on the contaminated groundwater in boreholes 8, 9, 32 and 34, and that the two ponds north - west of the site are thought to be in partial continuity with groundwater, these ponds are considered a potential receptor. These ponds have not been included in GeoWater's conceptual model as a receptor. In addition, a fourth pond located north - east of the site just further along from the artificial pond has also not been considered. It is necessary to establish the sensitivity and importance of the ponds.

3. Are the ponds and the open grassed areas surrounding the ponds easily accessible by the public or perhaps used for recreational purposes such as fishing? This will assist in assessing the potential risks to human health

Controlled Waters - Groundwater

There has been evidence of contaminated groundwater in colliery spoil around the northern end of the site (boreholes 8, 9, 32 and 34). Data provided by GeoWater indicated ammoniacal nitrogen concentrations and chemical oxygen demand were raised, as were electrical conductivity and on occasion chloride concentrations. The contamination was recorded as being severe close to the landfill margin and concentrations appeared to reduce towards the properties on Wellington Road.

1. The detection limits used for assessing the groundwater contaminants are unclear. This needs to be clarified and the level and severity of groundwater contamination put into perspective.
2. It was noted that most of the contaminants may have originated from either the leachate or the colliery spoil. Samples of colliery spoil should be analysed to determine the origin of the contaminants and the likely contribution from colliery spoil?

The qualitative risk assessment in the GeoWater 2004 report identified the groundwater in natural strata as being at moderate to high vulnerability to leachate migration through the liner and colliery spoil into the underlying sandstone. The monitoring results showed possible contamination of the

groundwater but results were not conclusive.

3. Further monitoring of the natural strata groundwater is needed in order to better clarify and characterise the extent of this potential contamination?

It has been noted that shallow groundwater is present within the colliery spoil. With the exception of the north western boundary the chemistry of this shallow water is not well understood, nor is its interaction with surrounding surface waters.

3. Investigation of the shallow ground water regime to allow risk to nearby surface waters with which it is likely to be in continuity with be determined.

Other Receptors

In addition to the above mentioned receptors, there are additional receptors which have not been identified by GeoWater in its report thus not considered in the current conceptual model mainly because above ground receptors were not within the scope of the report. The main receptors omitted are ecological receptors such as fauna and flora and livestock and crops. The presence of these will need to be further investigated along with issues such as the presence of 'Sites of Special Scientific Interest' (SSSI), 'Special Areas of Conservation' (SAC) or 'National Nature Reserves' (NNR).

5 Investigation Proposals

5.1 Recommendations

For a site to be assessed under Part IIA of the EPA 1990, all receptors, below and above ground, as defined in the legislation must be considered along with the risk from contamination. A comprehensive conceptual model and risk assessment is required to illustrate all potential sources, pathways and to assess the significance of these identified linkages.

In order to satisfy all the requirements of the current contaminated land legislation, we recommended that a phased approach to the investigation is conducted. These phases of works initially proposed are as follows:

- Phase I – Data Collection and Assessment
- Phase II – Detailed Site Inspection.

Drawing Number B0578400/05 illustrates the location of the additional ground investigations recommended.

Phase I – Data Collection and Assessment

These works involve a detailed review and interrogation of the monitoring data and previous investigation reports provided to Jacobs by BTW. This will aim to address some of data gaps identified in the gap analysis in section 4 including other receptors not identified or considered. A list of reports provided by BTW and which will be reviewed is provided in the Bibliography in section 6.

Phase II – Detailed Site Inspection

A brief overview of the documents in Section 6 indicated that whilst some information is present in the previous reports completed for the site, there will following their review remain some uncertainties associated with the site. These are likely to include, the following, amongst others:

- A robust leachate characterisation
- Investigation of the shallow groundwater regime within the colliery spoil,
- Assessment of the quality of surface waters surrounding the site, and
- Assessment of the chemistry of the landfill gasses emanating from the site.

To address these and to validate the assumptions and assessment of risk presented with the GeoWater report we propose that additional detailed site inspection works, in accordance with Para B.20c are carried out at the site. The woks proposed are summarised below. Further detail of the works is presented in Table 1 and 2.

Landfill Leachate

1. Better characterisation of the leachate contained within the five separate cells.

2. Confirm whether leachate outbreaks on the north and west boundaries of the site have occurred recently.

Groundwater

1. Investigate the pollution of groundwater within the colliery spoil in the north of the site (BH 8, 9, 32 and 34) and the gross contamination detected by routine monitoring.

2. Investigate the origin of the phthalate detected in BH 9 and other hydrocarbons which could originate from the colliery spoil.

3. Additional boreholes to be installed to better characterise the groundwater regime on the perimeter of the site. Boreholes proposed are as follows:
    a. Two on the western boundary near the two ponds.
    b. One on the south-western boundary to accompany BH 31.
    c. Two on the eastern boundary to accompany BH 37 and 38.

Surface Water

1. Sample the ditches which drain the site boundaries into the ponds on the north – eastern and north – western boundary.

2. Sample the three ponds currently sampled along with the fourth pond not sampled.

3. Investigate the higher chloride concentrations and elevated COD in Lydebrook Dingle which has been assumed to be due to decaying organic matter at the sampling location.

Landfill Gas

1. Trace gas analysis to be performed on gas detected in BH 32, 33, 38 and 37 to determine its origin i.e. landfill gas or coal gas, and to determine the chemical constituents of the gas and the human health effects of these chemicals.

2. Determine at what stage of waste decomposition the site is at, in order to determine the potential for continued landfill gas production and the rate of current gas production. This will enable us to assess the risk of the landfill as a driver for gas migration beyond the boreholes where gas has been detected, in accordance with CIRIA 659: Assessing Risks Posed by Hazardous Ground Gases to Buildings, 2006.

1. Permanent capping of all uncapped and temporary capped passive vents to reduce emissions to air. Conduct flux box monitoring and trace gas analysis at designated areas of the landfill to determine the rate of gas migration and the risk to site workers.

Gas Flare

1. Conduct ambient air monitoring including trace gas analysis at the perimeter of the site to determine the risk to the public from gas migration. This will also allow us to assess the contribution of the flare to gas migration and the risks posed.

A detailed specification for these works detailed above is presented in Table 1 and Table 2 below.

Table 1: Proposed Schedule of Chemical Analysis

Body Monitored	Schedule of Chemical Analysis
Leachate and Groundwater	pH, Temperature, conductively (EC), dissolved oxygen (DO), ammoniacal nitrogen (NH_4–N), chloride (Cl), sulphate (SO_4) , total alkalinity as $CaCO_3$, total organic carbon (TOC), total oxidised nitrogen (TON), metal (inc. Na, K, Ca, Mg, Fe, Mn, Cd, Cr, Cu, Ni, Pb, and Zn) and List I & II substances.
Surface Waters	pH ,temperature, EC, DO, (NH_4–N), Cl, chemical oxygen demand (COD), metals, List I & II substances

Table 2: Proposed Revised Monitoring Schedule

Type of Measurement	Monitoring Measurement	No. of Locations	Current Location ID	Programme
Observational	Flow and sensory evidence of contamination in surface waters. Evidence of leachate outbreaks	Site Specific but should involve a walk over round site perimeter	Site wide	3 rounds on monthly basis
Chemical	Leachate Characterisation	5 (to include samples from visible leachate break out points)	BH104, BH28, BH71, BH47, BH110	3 rounds on monthly basis
	Surface Water Quality	7	Long pond (Hughes pond), small pond, high pond, pond east of Hughes pond, Lyde Brook, Spring and Stream	3 rounds on monthly basis
	Groundwater in Colliery Spoil (shallow)	6	Six additional boreholes to be installed as indicated on Drawing No B0574800/05 BH8, BH9, BH32 and BH34	3 rounds on monthly basis
	Groundwater in Sandstones (deep)	6	BH6, BH30, BH31, BH33, BH37, BH38	3 rounds on monthly basis
	Landfill gas trace analysis	4	BH32, BH33, BH 37, BH38	3 rounds on monthly basis
	Shallow soil testing (including leachate testing)	6	BH8, BH9 (2 samples), BH32 (2 samples), BH34	One round

Table 2: Proposed Revised Monitoring Schedule (continued)

Type of Measurement	Monitoring Measurement	No. of Locations	Current Location ID	Programme
Level Measurements	Leachate level	5	BH104, BH28, BH71, BH47, BH110	3 rounds on monthly basis
	Groundwater in Colliery Spoil (shallow)	6	CM11B, CM1A, CM3A, CM4A WM7A and CM8B	3 rounds on monthly basis
	Groundwater in Sandstone (deep)	5	Six additional boreholes to be installed as indicated on Drawing No B0574800/05	3 rounds on monthly basis
	Ambient air monitoring	Site specific to involve monitoring at site boundary closest to existing residential properties	To be determined	3 rounds on monthly basis

6 Bibliography

6.1 Previous ground investigations

The following table (Table 3) is a list of other assessments and investigations that have been completed at the site and the surrounding land by various companies and which will be reviewed as part of phase 1 of the investigations.

Table 3: Bibliography of Previous Investigations

COMPANY/ AUTHOR	REPORT NAME	REFERENCE NUMBER	DATE
Stoneyhill Waste Disposal	Water monitoring facilities position of proposed gas vents Map	6433/w/1992/1	Aug 1990
Lightmoor Development Sites Telford	Fault Influence Report	67816	July 1997
Stoneyhill	Borehole Information File		1990-1992
Stoneyhill Site	Gas monitoring boreholes details		
Stoneyhill Site	Borehole information file: Well levels and dips, gas vent information, pumping trials		
Stoneyhill Site	Gas Monitoring file		
Stoneyhill Site Waste Disposal	Gas Flare and pumping trials file		
Stoneyhill Site	Stoneyhill main working site plan only copy Map	043 158CT/1/A	
Stoneyhill Site	Gas and Leachate Wells Stonyhill waste disposal site. Telford landfill gas migration control works and Installation of Leachate pumping wells	079/a26/cl0/6b	Dec 1997 Jan 1998

Table 3: Bibliography of Previous Investigations (continued)

COMPANY/ AUTHOR	REPORT NAME	REFERENCE NUMBER	DATE
Charles Ruxton Environmental Geologist	A risk based review of environmental monitoring at Stoneyhill landfill site	148/r1	Feb 1998
Charles Ruxton	Quarterly factual report		Aug, Sept, Oct 1998
Campbell Reith Hill New Bournville Lightmoor Telford	Preliminary Assessment of the potential risk from ground gases	6479	October 1998
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford	161/R2	Feb 1999
WS Atkins Consultants Limited Commissions for the new town	Stoneyhill waste disposal site(TLF012) Final risk assessment	275/A2961/NE11 9/ESH	Nov 1998
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford Feb, March, April 1999	161/R3	May 1999
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford May, June, July 1999	161/R4	Sept 1999
Charles Ruxton Environmental Geologist	Annual report on environmental monitoring at Stoneyhill landfill site, Telford	161/R5	October 1999
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford Aug, Sept, Oct 1999	161/R6	Dec 1999

Table 3: Bibliography of Previous Investigations (continued)

COMPANY/ AUTHOR	REPORT NAME	REFERENCE NUMBER	DATE
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford Nov 1999, Dec, Jan 2000	161/R7	Feb 2000
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford , Feb, March, April 2000	161/R8	May 2000
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford , May, June, July 2000	161/R9	Aug 2000
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford , May, June, July 2000	161/R9	Aug 2000
Charles Ruxton Environmental Geologist	Annual report on environmental monitoring at Stoneyhill landfill site, Telford Year Ended 31/07/00	161/R10	Sept 2000
Charles Ruxton Environmental Geologist	Annual report on environmental monitoring at Stoneyhill landfill site, Telford Year Ended 31/07/01	161/R16	Sept 2000
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford , Aug, Sept, Oct 2000	161/R11	Dec 2000
Golder Associates	Engineering evaluation of Stoneyhill landfill leachate treatment and disposal options	00513443	Dec 2000

Table 3: Bibliography of Previous Investigations (continued)

COMPANY/ AUTHOR	REPORT NAME	REFERENCE NUMBER	DATE
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford Nov, Dec 2000, + Jan 2001	161/R13	Mar 2001
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford , Quarterly report Feb, Mar, April 2001	161/R14	June 2001
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford, June, July 2001	161/R15	Aug 2001
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford, Aug, Sept + Oct 2001	161/R17	Dec 2001
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford, Nov + Dec 2001 + Jan 2002	161/R18	Mar 2002
Campbell Reith Hill/Tibbalds TM2 Arup Environmental	Lightmoor Village Telford Environmental Statement	6479	April 2002
Campbell Reith Hill /Tibbalds TM2 Arup Environmental	Lightmoor Village Telford Environmental Statement Appendix D (part ii)	6479	April 2002
Campbell Reith Hill/Tibbalds TM2 Arup Environment	Lightmoor Village Telford Environmental Statement Appendices E,F,G,H,I,J	6479	April 2002

Table 3: Bibliography of Previous Investigations (continued)

COMPANY/ AUTHOR	REPORT NAME	REFERENCE NUMBER	DATE
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford, Feb, Mar April 2002	161/R19	July 2002
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford, May, June + July 2002	161/R20	Aug 2002
Charles Ruxton Environmental Geologist	Ten new monitoring boreholes for Stoneyhill landfill site; factual completion report	161/RSCA/R1	Aug 2002
Charles Ruxton Environmental Geologist	Annual report on environmental monitoring at Stoneyhill landfill site, Telford Year ended 31/07/02	161/R21	Sept 2002
Charles Ruxton Environmental Geologist	Factual report on environmental monitoring at Stoneyhill landfill site Telford, Aug, Sept and Oct 2002	161/R22	Jan 2003
Geo Water Environmental Geology	Factual report on environmental monitoring at Stoneyhill landfill site Telford, Nov, Dec 2002 and Jan 2003	161/R24	Mar 2003
Geo Water Environmental Geology	Factual report on environmental monitoring at Stoneyhill landfill site Telford, Feb, March and April 2003	161/R25	Jul 2003
Geo Water Environmental Geology	Factual report on environmental monitoring at Stoneyhill landfill site Telford, May, June and July 2003	161/R26	Sept 2003

Table 3: Bibliography of Previous Investigations (continued)

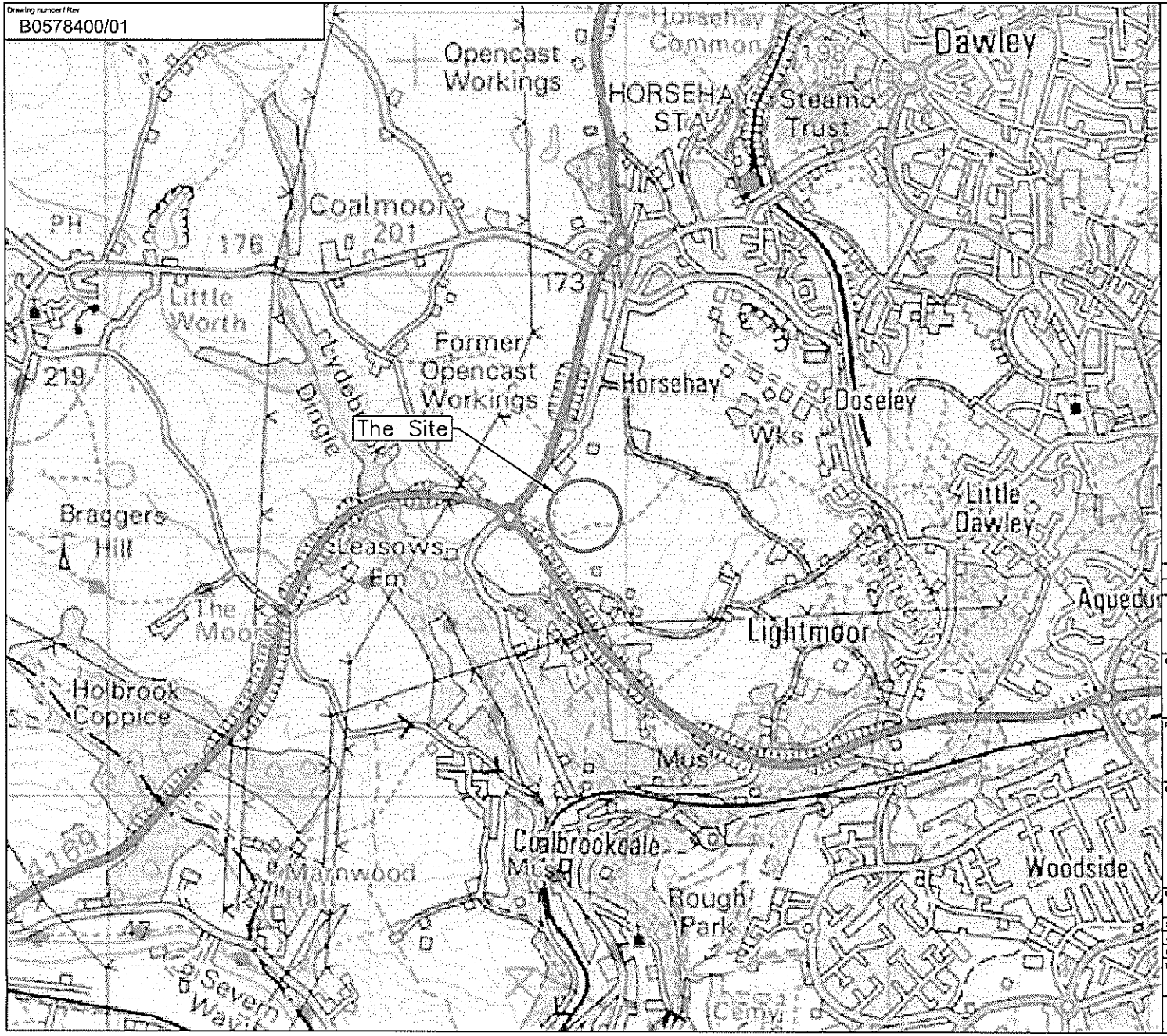
COMPANY/ AUTHOR	REPORT NAME	REFERENCE NUMBER	DATE
Geo Water Environmental Geology	Annual report on environmental monitoring at Stoneyhill landfill site, Telford Year ended 31/07/03	161/R27	Nov 2003
GeoWater Enviromental Geology	Gas Monitoring for proposed dwelling at Wellington Road, Horsehay Telford planning W2003/0980	SJ6606/17 W03/0980	Feb 2004
Geo Water Environmental Geology	Factual report on environmental monitoring at Stoneyhill landfill site Telford, Aug, Sept and Oct 2003	161/R28	Dec 2003
Geo Water Environmental Geology	Factual report on environmental monitoring at Stoneyhill landfill site Telford, Nov,Dec,2003 and Jan 2004	161/R29	Mar 2004
Geo Water Environmental Geology	Assessment of contaminant risks posed by Stoneyhill landfill site. Volume 1: main report	161/R30	May 2004
Geo Water Environmental Geology	Assessment of contaminant risks posed by Stoneyhill landfill site. Volume 2: Appendices	161/R30	May 2004
Stoneyhill Landfill Site	Gas Flare Trial updated		
Stoneyhill Landfill Site	Gas and Leachate Wells	079	Dec 1997-Jan 1998
Geo Water Environmental Geology	Factual report on environmental monitoring at Stoneyhill landfill site Telford, Feb March and April 2004	161/R31	June 2004

Table 3: Bibliography of Previous Investigations (continued)

COMPANY/ AUTHOR	REPORT NAME	REFERENCE NUMBER	DATE
Geo Water Environmental Geology	Factual report on environmental monitoring at Stoneyhill landfill site Telford, May, June July 2004	161/R32	Sept 2004
Geo Water Environmental Geology	Annual report on environmental monitoring at Stoneyhill landfill site, Telford Year ended 31/07/04	161/R33	Nov 2004
Austin Geotech Geo Enviromental Engineering	Wellington Road Horsehay, Telford Persimmon Homes Limited	SJ6606/21	March 2005
	Water Leachate monitoring site record sheets and clayton request forms		
	Stoneyhill Telford, Annual report 04-05 Annual report 05-06	Notes on well and BHs	

Drawings

Drawing number / Rev
B0578400/01



Rev	Rev. Date	Purpose of revision	Drawn	Checked	Approved
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TELFORD & WREKIN

Project
STONEYHILL LANDFILL SITE HORSEHAY

Drawing title
SITE LOCATION PLAN

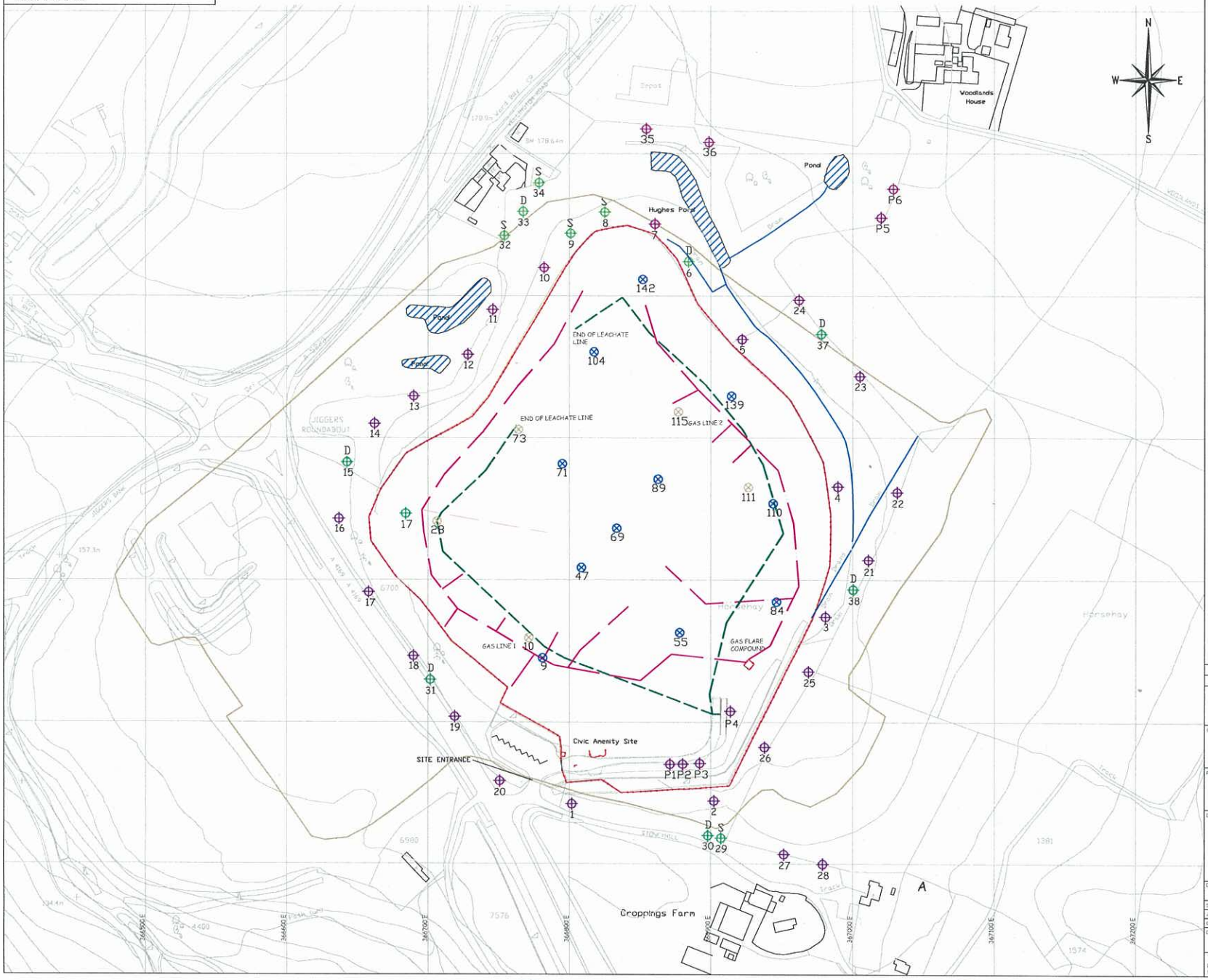
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Drawing number - Rev
B0578400/02



- SITE BOUNDARY AND FENCE
- GAS MONITORING BOREHOLES
- LEACHATE MONITORING (QUALITY + LEVELS) WELLS
- GAS + GROUNDWATER MONITORING BOREHOLES
- LEACHATE LEVEL MONITORING BOREHOLE
- EXTENT OF OPENCAST MINING
- EXISTING GAS LINE
- LEACHATE LINE
- SURFACE WATER DRAINS
- S= SHALLOW (COLLIERY SPOIL)
- D= DEEP (SANDSTONE)
- P= PIEZOMETER

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Drawing title
SITE FEATURES AND INFRASTRUCTURE

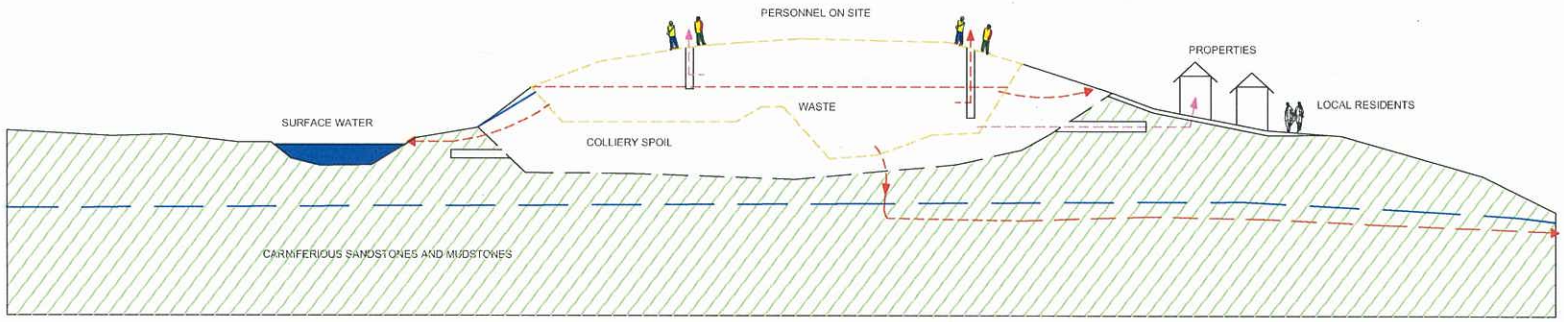
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B0578400/03



Key

- GROUNDWATER/ LEACHATE LEVEL
- LEACHATE MIGRATION ROUTE
- GAS MIGRATION ROUTE

BASED ON GEOWATER REPORT "ASSESSMENT OF CONTAMINANT RISKS POSED BY STONEYHILL LANDFILL SITE, MAY 2004" REPORT REF 161-R30

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Project
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Drawing title
CURRENT CONCEPTUAL MODEL

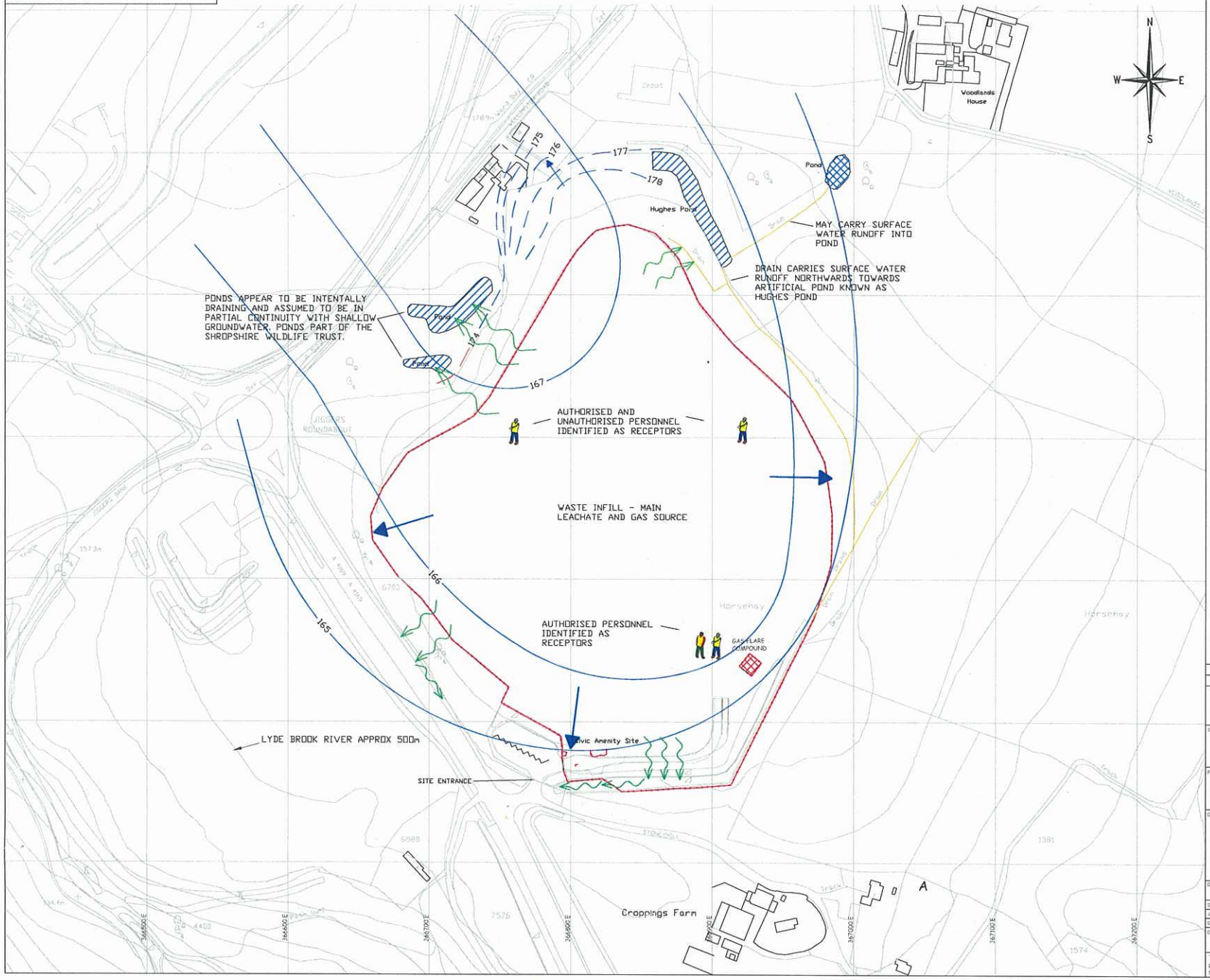
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B0578400/04



- SITE BOUNDARY AND FENCE
- IDENTIFIED SURFACE WATER PATHWAYS – GEOWATER 2004
- POTENTIAL SURFACE WATER PATHWAYS – JACOBS
- IDENTIFIED RECEPTORS – GEOWATER 2004
- POTENTIAL GAS SOURCE – JACOBS
- POTENTIAL RECEPTORS – JACOBS
- 167 POTENTIAL GROUNDWATER PATHWAYS

Rev	Rev. Date	Purpose of revision	Drawn	Checked	Approved
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Project
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Drawing title
ILLUSTRATION OF CONCEPTUAL MODEL

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Borough of Telford and Wrekin

DSEAR Assessment – Methodology and Risk Assessment

Stoneyhill Landfill

March 2007

Jacobs UK Limited, Fairbairn House, Ashton Lane, Sale, Manchester, M33 6WP

Registered Office: 95 Bothwell Street, Glasgow, G2 7HX

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Project: Stoneyhill Landfill Job No:
Title: DSEAR Assessment

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1 Introduction

1.1 Status of Document

The Borough of Telford and Wrekin have commissioned Jacobs to undertaken a DSEAR assessment at the Stoneyhill landfill and flare, this document outlines the methodology to be used.

1.2 Legislation and Guidance

The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) are concerned with protection against risks from fire and explosion arising from dangerous substances used or present in the workplace. DSEAR place duties on and employer to carry out:

- risk assessments (Regulation 5), i.e. establish source, pathways, receptors and accidents and consequences including likelihood and severity;
- elimination or reduction of risk (Regulation 6), the eliminate or reduction of the flammable substances is not a realistic proposition at landfill, but removal of the sources of ignition and regular maintenance are appropriate method of compliance with this regulation;
- area classification, (Regulation 7) this requires the employer to identify locations where potentially explosive atmosphere do or could occur and to record this information on suitable drawings. Regulation 7 also covers the selection and assessment of electrical equipment and the marking of zones;
- Regulation 8 requires arrangements to deal with accidents, incidents and emergencies to be in place;
- Training of employees and dissemination of information (Regulation 9);
- Identification of containers and pipes – Regulation 10

The ESA in consultation with the HSE have produced a comprehensive and detailed Industry code of practice and methodology for the Area Classification for Landfill Gas Extraction, Utilisation and Combustion.

2 Methodology

2.1 Site Visit

A site visit is necessary to establish the areas of the site which require zone classification, all areas of the site where there is a potential for landfill gas to escape will be inspected, these include, but are not limited to;

- The flare stack area;
- The extraction wells;
- The condensate knockout pots and dewatering points and
- The leachate extraction points;

For each point the following information will be required

- Plant item: this means an item, such as a gas extraction well, flange, manifold, etc.
- Location: where the item is physically located, e.g. "gas compound", "various locations on gas field", etc.
- Grade of release, i.e. continuous, primary or secondary
- Operating temperature and pressure: the temperature is likely to be "ambient" and the pressure either a modest over- or under-pressure. The temperature is taken as 10°C.
- Ventilation type: this is natural, artificial or both.
- Ventilation degree: this is high, medium or low.
- Ventilation availability: this can be 'good', 'fair' or 'poor'.

2.2 Reporting

From the information collected on site, the following can be produced in accordance with the ESA ICoP for Area Classification for Landfill Gas Extraction, Utilisation and Combustion

- Zone Classification, the zone number can be ascertained (0, 1 or 2) and the zone extent: the size of the zone;
- The area classification plan, based on the zone number and extent
- The DSEAR Risk Assessment;

- Required risk mitigation measures;
- Accident and incident management/action plans;
- Recommendations for training; and
- Recommendations for marking of pipes and containers.

3 Site Visit Health and Safety

3.1 Site Specific Risks

The Jacobs Report "Assessment of Landfill Gas Flaring and Extraction Arrangements" produced for the Stoneyhill Landfill (February 2007) identified two key site specific risks:

- The flare has been operating outside of the manufacturers recommended operating parameters for 28% of the time over the last two years and for a small proportion of that time the recorded gas quality has been within the explosive range;
- The high negative pressures recorded at the boreholes, a long history of over-extraction and the presence of Carbon Monoxide in the gas analysis are all indicative of a potential underground landfill fire.

These particular issues unmitigated would present an unacceptable health and safety risk.

(a) Flare

The following factors and precautions mitigate the risks from the flare;

- Gas quality within the explosive range is chiefly an issue with flare ignition. Where the gases are within or just slightly more methane rich than the explosive range in the stack at ignition flash-over or flash-back may occur. Therefore under no circumstances will Jacobs's staff re-ignite the flare should the flame fail.
- Flares are designed to fail safe and the very poor gas qualities associated with the explosive range cannot support a flame, therefore the flame fails and the flare shuts down. However following flame failure the flare automatically attempts to reignite the flame, to avoid the risk of staff being in the vicinity of the flare in the event of a shutdown and re-ignition sequence the quality of the gas entering the flare will be checked hourly and where O_2 exceeds 10% and CH_4 is less than 25% staff will withdraw from site and client informed.
- The initial approach to the flare will be carried out with caution. The Senior Engineer will assess the flame condition and should the flame appear weak, smoky or on the verge of failure the visit will be suspended

until the client has called out the flare/gas field contractors to balance the gas field, improve the gas quality so that the flare can be returned to safe operating conditions.

In addition to these measures the only known incidents involving flares and flash over or flash back have been due to experimental designs and poor operator procedures. These mitigation measures are considered adequate to minimise the risks to Jacobs's personnel from any incidents involving the flare

(b) Underground fires

Underground fires are often indicated by:

- Pronounced differential settlement (depressions in the landfill surface) or circular depressions around wells;
- Vegetation stress; or
- Steam or smoke arising from cracks in the surface or well covers,

The following precautions will be taken to mitigate to the risks presented by underground fires

- Areas showing pronounced depressions will be avoided as these indicate deep seated fire
- If any area shows vegetation stress, steam or smoke arising from cracks in the surface or well covers (indicating a near surface fire) the landfill surface inspection will not be undertaken and staff will withdraw from site and client informed.

These actions and assessments are considered adequate to minimise the risks to Jacobs's personnel from any incidents arising from landfill body fires.

3.2 Landfill Specific Risks

Stoneyhill landfill is a closed landfill; therefore all risks arising from landfill operations are absent the residual risks are addressed in the simple risk assessment contained in Appendix A.

Lone working is not an issues as there will be two staff on site at all times.

Appendix A Risk Assessment

Risk Assessment Form

OCCUPATION, JOB OR TASK	DSEAR Assessment at Stoneyhill landfill	DATE OF THIS ASSESSMENT	23 March 2007	Job No. B0245700	Issue: 1

LOCATION Stoneyhill Landfill, Telford

No. OF STAFF AT RISK 2 **HOW OFTEN** Daily **SIGNED** **DESIGNATION**

TASK/ACTIVITY	HAZARD	DEGREE OF RISK (Uncontrolled)			RESIDUAL RISK AND PRIORITY - If further action is required enter details on reverse side					
					Measures to Reduce Risk	Residual risk factor			ACTION REQUIRED	
		L	S	T		L	S	T		
		1-5	1-5	1-25		1-5	1-5	1-25	Yes/ No	Prio rity
Access to site and across site	Site surface may be uneven or muddy. Presenting tripping hazards and possibly slippery surfaces.	4	3	12	Use of safety boots with cleated sole and steel mid-sole to ensure good purchase on surface avoiding slips. Ensure hands are free (not in pockets) when walking across site. When ground conditions are particularly soft a stick should be used to probe ground	2	2	4	no	
Access to site and across site	Site surface is known to be overgrown; risk of scratches and stings from overgrowth	4	2	8	Trousers of heavy material and a long coat or jacket to protect arms and legs from scratches or stings.	1	1	1	no	
Access to site and across site	Landfill surface may still present a hazard from previously emplaced waste such as small metal items protruding from the	3	3	9	Boots with a steel mid-sole should be worn.	1	1	1	no	

	surface.									
Working on a landfill site	Weils disease and other possible human pathogens via hand to mouth contact or cuts or other breakages in skin, (although much of the risk is removed as the site is closed)	2	3	6	Wearing of gloves No eating, drinking or smoking on site Cleaning of hands prior to eating, drinking or smoking (off site) Covering of all cuts with plasters or other water proof dressings.	1	1	1	no	
Working on a landfill site - Accessing manholes and boreholes	Immediate access to boreholes may be more difficult than across the rest of site differential settlement often occurs around wells which can often be flooded entering these flooded area can increase the chances of slipping	4	3	12	Small flooded depressions around wells will not be entered	1	1	1	no	
Working on a landfill site - Accessing manholes and boreholes	Immediate access to boreholes may be more difficult than across the rest of site differential settlement often occurs around wells. However depressions with a radius of greater than 1 metre can sometimes indicate the presence of an underground fire	2	5	10	Depressions around wells of a radius greater than 1m will not be entered	1	1	1	no	

	with could result in the ground giving way under foot									
Working on a landfill site - the potential for the presence of a near surface underground fire	Near surface underground fire may weaken the ground above the fire resulting in the ground giving way underfoot	2	5	10	Underground fires are often indicated by steam or smoke arising from cracks in the surface, vegetation stress or pronounced differential settlement. Areas showing these signs will be avoided on foot.	1	1	1	no	
Working on a landfill site - Accessing manholes and boreholes	Dependant on design injuries associated with lifting or dropping lids	2	3	6	Steel toe-capped boots and heavy weight gloves to protect toes and fingers. Observe 25kg individual lifting limit, items over 25kg to be lifted by two people in the absence of suitable lifting equipment.	1	1	1	no	
Working within the flare compound	Electrical hazards	2	3	6	Electrical control panels not to be accessed by un qualified staff. No electrical controls are to be touched and cables to be avoided.	1	1	1	no	
Working within the flare compound	Landfill gas hazards – explosion - the flare has a history of poor gas quality Build of gas due to flame failure and explosion due to re-ignition.	2	5	10	Flare inlet gases will be checked hourly, where, O2 exceeds 10% and CH4 is less than 25%, staff will withdraw from site and client informed Constant monitoring, in the event of flame failure withdraw immediately and contact client to state emergency. NO LONE WORKING.	1	5	5	no	

Risk Assessment Form

OCCUPATION, JOB OR TASK	DSEAR Assessment at Stoneyhill landfill	DATE OF THIS ASSESSMENT	23 March 2007	Job No. B0245700	Issue: 1

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Stoneyhill Landfill

Assessment of Landfill Gas Flaring and Extraction Arrangements

Borough of Telford and Wrekin

DRAFT

Date - February 2007

Jacobs UK Limited, Fairbairn House, Ashton Lane, Sale, Manchester, M33 6WP

Registered Office: 95 Bothwell Street, Glasgow, G2 7HX

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Document Control Sheet

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Project: Stoneyhill Landfill Job No: B0245700
Title: Assessment of Landfill Gas Flaring and Extraction Arrangements

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DATE	SIGNATURE	SIGNATURE	SIGNATURE

REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE

REVISION	NAME	NAME	NAME
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1 Introduction

1.1 Introduction

Jacobs have been commissioned by the Borough and Wrekin Council to provide advice with regard to the landfill gas management at the Stoneyhill Landfill. The Borough of Telford and Wrekin Council have been made aware of some potentially significant landfill gas issues at the Stoneyhill Landfill site by the Environment Agency; the comments indicate that there are concerns in the following key areas.

- Flare and extraction system infrastructure safety, particularly with regard to air ingress;
- Emissions of trace components; – where?
- Combustion efficiency particularly that combustion often appears incomplete;
- Gas system collection efficiency;
- Gas system controls; and
- Gas generation quantities.

In order to assess the efficiency, suitability and safety of the landfill gas extraction and flaring systems the following methodology has been employed:

- Review the existing correspondence, monitoring data and the specification for the flare;
- Visit the site and inspect the flare and gas extraction system; and
- Report our findings and advice for further actions.

To assist Jacobs in the assessment of the efficiency, suitability and safety of the landfill gas extraction and flaring systems, the Borough of Telford and Wrekin have supplied information comprising:

- A short site report which provides a useful background to the site history, licensing and landfill gas and leachate control infrastructure;
- Raw landfill gas monitoring data;
- Gas analysis;
- Short interpretative reports for some months on 2004 to 2006; and

- The Flare Specification

This information is reviewed and referred to within Section 4.

The Borough of Telford and Wrekin also supplied the full text of Environment Agency comments; the comments relevant to this assessment are contained within Appendix A and are annotated with the findings of this assessment.

1.2 Standards and guidance

Current standards for the management of landfill gas are contained within the following documents:

- LFTGN03, Guidance on the Management of Landfill Gas, Environment Agency, (2004);
- LFTGN04 Guidance for monitoring trace components in landfill gas, Environment Agency, (2004);
- LFTGN05 Guidance for monitoring enclosed landfill gas flares, Environment Agency, (2004);
- LFTGN06 Guidance on gas treatment technologies for landfill gas engines, Environment Agency, (2004);
- LFTGN07 Guidance monitoring landfill gas surface emissions, Environment Agency, (2004); and
- LFTGN08 Guidance monitoring landfill gas engine emissions, Environment Agency, (2004).

In addition to the technical guidance, health and safety legislation such as the Dangerous Substances and Explosive Atmospheres Regulation 2002 must also be considered.

The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR), which implement two European Directives; the safety aspects of the Chemical Agents Directive 98/24/EC (CAD) and the Explosive Atmospheres Directive 99/92/EC (ATEX 137), apply to landfill and non-landfill based environments that could in some circumstances exhibit potentially explosive atmospheres. DSEAR sets out requirements for risk assessment, area classification, use of suitable equipment and provision of PPE as well as provision of information, instruction and training.

1.3 Waste Management Licence Status

We have been advised that no Waste Management Licence is in force for Stoneyhill landfill, nor for the landfill gas flare.

The landfill's waste disposal licence was surrendered in the early 1990's prior to the introduction of the Waste management Licensing Regulations 1994. The landfill and its emissions are therefore under the control of the relevant contaminated land or environmental health authorities.

The operation of the flare to control the landfill gas is a waste management activity, D10 – Incineration on land, as such the flare theoretically requires its own waste management licence. There are no indications given by the Borough of Telford and Wrekin that a separate waste management licence exists for this equipment.

2 Principles of Landfill Gas Extraction

2.1 Terminology

The gas data is discussed with reference to the safe performance of the flare and the gas extraction system. In the discussion the following terms are used;

- Gas Field –landfill and network of gas extraction wells installed at the site;
- Manifold –part of the flare where the two or more lines are connected to the flare itself, this used as a collective term for the gas line sampling points;
- Stack – the vertical part of the flare stack, the term is used to differentiate the gas line monitoring points from the monitoring point for the mixed gas actually entering the stack;
- Elevated Flare - the older type of flare where the flame is elevated above the burner unit or stack. Although the completeness of combustion can be controlled to some degree however the destruction efficiency of trace gases cannot comply with the required current standards. The Stoneyhill unit is of this older elevated type.
- Enclosed Flare - the more modern flare type, where the burners are located at the base of the combustion enclosure and the flame is enclosed within the "stack", this newer design allows more control over the combustion process in terms of time, turbulence and temperature.
- Gas Boosters –fan that provides the extraction pressure for the gas field and delivery pressure to the stack;
- Extraction pressure –negative pressure or vacuum that is applied to the gas field to extract the gas, in an ideal situation all pressures on the gas field side of the gas booster would be negative;
- Delivery pressure –positive pressure provided by the gas booster that delivers the gas to the stack;
- Well head – the gas tight fittings at the top to the extraction well that allow sampling and adjustment of gas flow;
- Over extraction - where excessive vacuum has been applied to the waste mass resulting in a negative pressure (or partial vacuum) within the landfill

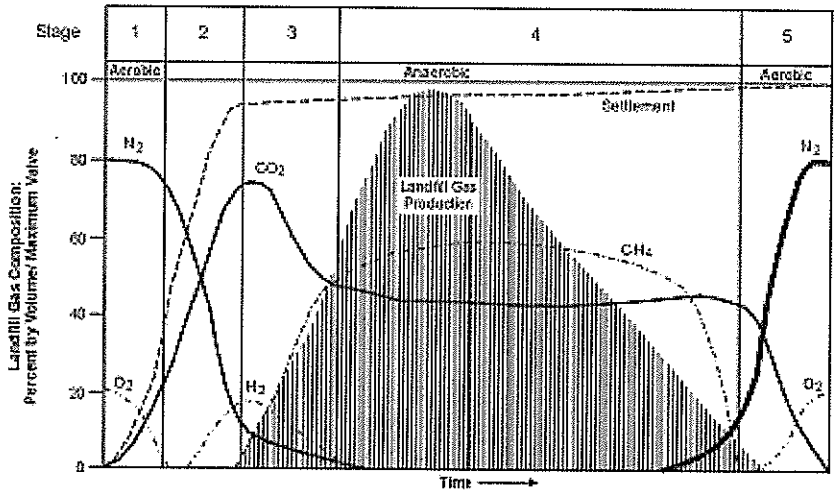
resulting in either air ingress or difficulties in applied sufficient pressure to extract the gas;

- Strong flame, - a strong flame results from proper adjustment of the gas field and flare where the incoming gas is of good quality, ideally around 50% to 60% methane, ~ 40% carbon dioxide and less than 1% oxygen and the air inlet to the flare is adjusted to produce a clear blue flame with a relatively smooth outline. The strong flame represents the most complete combustion and also the safest and most controlled combustion process achievable. With an elevated flare, such as the Stoneyhill flare, the maximum temperature achievable with a strong flame would be around about 800- 850 °C, rather than the currently recommended 1000°C;
- A weak or floppy flame - . a yellow smoky flame, indicates poor gas quality and a badly adjusted flare resulting in incomplete combustion and emissions that may include increased particulate (soot) and partially combusted contaminants, this is neither a safe or acceptable operating condition.
- Vent Mode - When the flare was installed, a facility to operate in "vent" mode was incorporated to allow gas extraction to continue managing gas migration, even when the gas mixture was within the explosive range or when the calorific value of the gas was insufficient to support safe and controlled combustion. This "vent" mode is now considered an unacceptable practice, because of the global warming potential of methane and the uncontrolled releases of both odorous and toxic compounds within the landfill gas.

2.2 Landfill Gas Production

Biodegradable organic material present in landfilled waste undergoes microbial degradation this liberates the gaseous products that make up landfill gas. The idealised evolution of these components from a single body of waste with time (from the moment of deposit) was described by Farquhar and Rovers (1973), and is shown in Figure 1.

Figure 1 Idealised Landfill Gas Production



In Stage 1, oxygen contained within the waste upon deposit is consumed – primarily by aerobic microbial activity, which results in the evolution of mainly carbon dioxide, water and heat. Unless concentrations of oxygen and nitrogen within the fill are replenished by an influx of air, the concentrations of both of these gases will decay during the course of Stage 1. This is due to consumption of oxygen and the purging of nitrogen from the fill due to the liberation of other gases.

Stage 2 is associated with the onset anaerobic conditions within the waste. This is characterised by hydrolysis and acetogenic processes mediated by hydrolytic and cellulolytic bacteria, activity breaks down large chain polymers such as lipids, proteins and carbohydrates present in the waste into short chain organic compounds such as acetic acid, acetates and ethanol and also ammonia, gaseous carbon dioxide, hydrogen, water and heat. The hydrogen and carbon dioxide produced during Stage 2 continue purge to the remaining nitrogen from the landfill atmosphere.

Stage 3 is characterised by a period transitional anaerobic activity during which methanogenesis is initiated and gradually accelerates until a balance with the

rates of hydrolysis and acetogenesis is achieved. Methanogenic bacteria utilise substrates such as the acetates, hydrogen and carbon dioxide produced by hydrolysis and acetogenic bacteria to produce gaseous carbon dioxide and methane.

In Stage 4, the rates of hydrolysis/acetogenesis and methanogenesis are in relative equilibrium. This provides steady state conditions which may last for many years during which methane and carbon dioxide are evolved in the ratio of about 3:2. This period is often termed methanogenesis although other biological processes are taking place at the same time

Stage 5 represents a period during which the organic substrate required for microbial activity becomes limited. At this time, the composition of the interstitial gases within the fill gradually assumes that of atmospheric air.

2.2.1 Principles of Landfill Gas Extraction

The principle that is used to capture and recover gas generated within landfill sites is based upon the fact that gas will travel from areas of high pressure to areas of low pressure to reduce its potential for migration off site. Vacuum relative to atmospheric pressure is applied to the waste through a network of pipes connected to vertical or horizontal wells installed at appropriate centres throughout the waste mass. This creates artificial areas of low pressure to which gas will be encouraged to flow.

Gas flares (of the size installed at Stoneyhill) are generally fitted with gas boosters capable of producing up to -200 mbar of pressure. Depending on the gas booster installed and the flare and manifold configuration, the extraction pressure at the flare manifold and applied to the gas field should lie within the range of pressures between -20 mbar and -150 mbar and the delivery pressure to be within the 20 mbar to 100 mbar range.

The variability of the pressures enables the flare operator to cope with a range of gas yields and gas field pressures and also to ensure that pressure is applied evenly across the entire gas field. It is important to maintain the gas extraction pressures at an even and constant rate to supply the flare with a consistent quality and quantity of gas.

To achieve an even and constant rate of gas extraction, low extraction pressures are used and as a rule of thumb the pressure measured at each well head should be in the region of -2 mbar and should not exceed -10 mbar. High pressures can

result in over extraction and air ingress; air ingress can result in the development of landfill fires at a worse case.

Managing the gas field to provide consistent quality and quantity of gas avoids variability in the flare conditions, enabling the operator to set the flare to obtain . the best possible conditions for the safe and controlled combustion of the gas. Once set up, a well managed and stable gas field should require only periodic monitoring to ensure that conditions remain constant. Adjustment to the well head settings should only be necessary as quality and quantity of gas starts to decline.

3 Site Visit

3.1 Site Visit Findings

A site visit and inspection was undertaken by Lee Walker of Jacobs UK Limited accompanied by Kate Grant of the Borough of Telford and Wrekin in August of 2006. A summary of the findings of the visit are as follows:

- The landfill gas flare is a Biogas 750m^3/hr elevated flare of a type and design produced in the early 1990's, confirming that the manual supplied is that for the equipment present on site. The inspection and manual indicates that the flare was manufactured in around 1994 and can be reasonably expected to be reaching the end of its useful life.
- The flare parts did appear to be securely bolted together and the absence of any odours around the flare indicates that joints are likely to be gas tight. However a number of issues can arise with age; and leakage from some components could be expected to occur, particularly from the gas booster, control vales and sample points. Should even a minor leak be occurring from any of the flare components there may be an issue with the proximity of the electrical control panel to sources of potentially explosive gas mixtures.
- It was noted that some of the manometers and the Per-flow flow meter were not operational. This is likely cause difficulty in adequately managing the flare and to determine any faults that may be occurring, such as blocked flash back arrestors or blocked mesh filters in the integral knock out pot that may be inhibiting the flow of gas through the equipment.
- The flare cubicle was locked and could not be accessed. However it could be determined that the control panel was not hermetically sealed and could allow the entry of potentially explosive gases into the electrical controls.
- The flare compound was adequate to provide security against intruders, although located in a low spot which has implications for the adequate dispersion of the flare emissions
- Security fences, gates and signage, were adequate and maintained to an appropriate standard to deter trespassers.

- The condensate tank was secure and bunded.
- The Condition of well heads and dewatering points could not be ascertained due to the secure manhole type covers requiring a key that was not available;
- It was noted that the sound of water could be heard in the collection pipework, this is indicative of condensate being trapped in a low spot and restricting the gas flow, differential settlement may be the cause of this.
- Inspection of the landfill topography and identification of differential settlement that may be adversely affecting the gas collection was restricted, as a distinct lack of maintenance with regard to landscaping; had left the site very overgrown.

4 Data Interpretation

4.1 Introduction

A review of both the gas extraction well and extraction line data and perimeter gas monitoring boreholes data has been carried out. Due to the large volume of data supplied only the most recent data is discussed as this represents the current situation.

4.2 Gas Extraction System Monitoring

The landfill gas extraction system is monitored on a frequent basis, at least weekly and occasionally more often, with intermediate readings being taken at the flare between weekly monitoring events. From the data supplied, generally the methane and carbon dioxide percentages are as expected from a gassing landfill of this type given age, size and waste types accepted.

4.2.1 Landfill Gas Quality

The data relating to the gas extraction wells indicates the gas quality is indicative of stable methanogensis. Although given the period that active gas extraction has been taking place it is expected that, although gas production is now declining, the landfill is still in the methanogenic phase and the gas available for flaring is still in the appropriate and safe range i.e. ~50-60% Methane and ~30-40% Carbon Dioxide.

An examination of the data from the flare supply lines and the flare monitoring point indicates a number of deviations from the expected gas qualities, these are;

- Low methane percentages (below 25%);
- Elevated oxygen percentages (over 10%); and
- Highly variable relative pressures in both line one and two extraction wells.

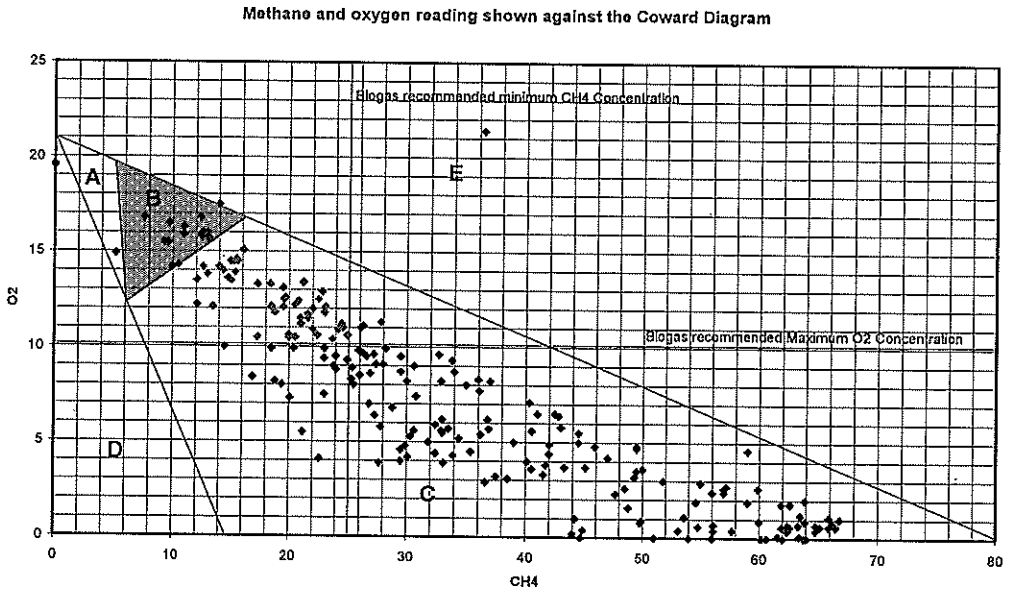
Where there are low percentages of methane coupled with high percentages of oxygen there is a potential for an explosion. The Biogas manual clearly states that if the methane concentration is lower than 25 % and/or the oxygen concentration greater than 10% then an engineer should be consulted. Figure 2 shows Line 1, Line 2 and flare inlet methane/oxygen results for the Stoneyhill landfill between the 6 August 2004 and the end of June 2006. To illustrate the extent of the methane/oxygen issues at the site, the Coward diagram for methane

in air has been overlaid over the plotted data. The coward diagram is divided into five areas;

- A – gas mixtures that may become explosive;
- B – gas mixtures that are explosive;
- C – gas mixtures that may become explosive when diluted by air;
- D - mixtures that cannot be come explosive;
- E - impossible mixtures.

Area B – gas mixtures that are explosive has been highlighted in red. Area C – gas mixtures that may become explosive when diluted by air where the gas quality falls outside of that recommended by biogas for minimum methane and maximum oxygen has been highlighted in yellow.

Figure 2 Methane and oxygen readings against the Coward Diagram*



* Adapted from Coward. HF, Jones GW @limits of flammability of gases and vapours 1952

It can be seen from figure 1 that on a number of occasions (14), the gas quality at either Line 1, Line 2 and flare inlet gas has fallen within the red area (area B) and on 50 occasions in the yellow section of area C. The monitoring therefore indicates that, for approximately 28% of the time, the gas either entering the flare or being combusted by the flare is in the explosive range or near to the explosive range.

In addition to this, on a number of occasions the gas quality recorded at the stack or the manifold is of poorer quality than that recorded in the wells, which suggests

that air is entering the system at some point. As this situation does not occur all the time it suggests that temporary repairs may have been made.

4.2.2 Extraction Pressures

The highly variable relative pressures have been monitored in the flare delivery sample point, the manifold sample points and the extraction wells. The range of pressures recorded at the flare, manifold and wells are highly variable, Table 1 shows the range of pressures recorded at each point (maximum, minimum and average).

Table 1 Relative pressures summary

Location	Point	Max	Min	Ave
Flare	Flare	29.84	-38.18	3.62
Flare	Line 1	80.50	-106.96	-78.02
Flare	Line 2	63.09	-101.25	-55.95
Line 1	75	0.00	-147.71	-67.15
Line 1	94	34.30	-87.69	-42.33
Line 1	64	13.09	-82.27	-49.40
Line 1	66	12.93	-81.86	-43.76
Line 1	109	11.01	-80.55	-51.80
Line 1	112	34.50	-72.19	-35.52
Line 1	113	29.50	-56.00	-26.82
Line 1	116	12.93	-82.07	-39.58
Line 1	160/130	29.10	-60.76	-25.36
Line 1	132	29.00	-63.25	-29.12
Line 2	121	1.46	-50.02	-17.26
Line 2	103	1.48	-59.69	-24.07
Line 2	82	1.41	-60.60	-24.89
Line 2	62	1.01	-58.55	-22.94
Line 2	40	43.66	-42.21	-12.86
Line 2	29	1.51	-50.60	-21.38
Line 2	16	1.40	-62.46	-22.01
Line 2	49	1.82	-38.43	-16.68
Line 2	14	2.14	-40.39	-13.57
Line 2	4	1.59	-62.20	-24.32
Line 2	159	1.30	-37.41	-11.10
Line 2	12	0.61	-73.00	-44.54
Line 2	158	1.63	-73.20	-34.66
Line 2	21	1.13	-58.79	-34.63
Line 2	20	46.40	-52.68	-28.28
Line 2	45	0.80	-74.50	-36.87
Line 2	33	1.61	-74.70	-35.77
Line 2	43	1.41	-75.90	-35.16
Line 2	157	3.99	-82.22	-30.00

Several issues are raised from the review of this data:

- The highest negative pressure recorded at an extraction well (-147 mbar at Well 75) exceeds the highest negative pressure applied to the gas field (-106 mbar);

- There are a number of very high positive pressures recorded at well heads;
- The are a number of very high negative pressures recorded at well heads;
- There are positive pressures recorded at the flare manifold; and
- Negative pressure recorded at the stack.

Additionally, after further examination of the data there appears to be no clear correlation between the pressures at the well head, pressures in the gas line, oxygen content of the gas and whether the flare has been operating or shut down prior to the readings. However there does appear to be a "cycle" occurring with the gas quality, starting with the flare shutting down due to very poor gas quality, often the explosive mixture discussed above, with the next set of readings then showing a much improved mix, possibly a result of repairs to the system that have not been noted, before the gas quality declines again. This cycle has been noted particularly in line two which also sometimes shows that the better gas quality is associated with the higher pressures. This is unexplained as normally the higher the extraction pressure the more likelihood there is of ingress of air into the system.

To attempt to explain these erratic pressure results only general statements can be made, based on our gas field experience. High negative pressures in extraction wells, even when the flare has not been running, are often associated with over extraction and/or landfill body fires which could be a possibility. Carbon monoxide, which could indicate a fire, was present in the gas but at very low levels, however given that the sample was diluted with air the exact carbon monoxide level cannot be ascertained.

The high positive pressures are generally observed when sites have just started to produce gas, however this site has been gassing for over 15 years and the positive pressures noted are in excess of anything previously found in the field under normal conditions. However very high pressures in wells can again sometimes be associated with fires, every fire requires an oxygen source, a fuel source and an exit for the combustion products – a chimney. Fires, at other sites, have been observed to break through at both the surface and also to vent through gas or leachate extraction wells dependant on the depth of the fire and proximity to wells.

There should be no mechanism by which positive pressures could be recorded at the flare manifold if the flare is operating as designed; the anomalous result was

recorded as having occurred when the flare was off and the condensate system full, in which case system gas pressure could account for the reading.

Another set of anomalous results are those from the 12 August 2005, where a negative pressure of –38 mbar was recorded at the stack, -19.1 mbar in line one and -0.28 in line two, the flare is recorded as on when these readings were taken. It is possible, if the gas booster was off, for a flame to create its own "extraction pressure" and draw gas to feed the flame, however this would require a very strong flame which is very unlikely to occur with the gas quality given of 27.8% methane. The results for 12 August 2005 are therefore inexplicable, other than they may have been recorded incorrectly or the measuring equipment was faulty.

4.2.3 Perimeter Gas

The review of the perimeter gas readings indicates that there are a number of wells that consistently show excessive levels of methane and carbon dioxide. The levels of methane have been excess of 60% and carbon dioxide in the 30-40% range, these are certainly indicative of landfill gas. These gas levels also appear to be clustered in three particular groups of wells, Boreholes 1-7, 21 to 27 and 37 to 38, indicative of gas migration from these areas. Further information on the site design, geology and receptors would be required to interpret these results further.

5 Conclusion and Recommendations

5.1 Conclusions

The site visit, data interpretation exercise and the review of the EA comments have revealed a number of serious issues that exist at the Stoneyhill Landfill site. These are:

- Flare Landfill Gas Quality issues;
- DSEAR Issues;
- Extraction Pressures;
- Emissions; and
- Gas Migration off site

There are also two further issues that should be addressed:

- Permit Status
- Site Condition.

5.1.1 Flare Landfill Gas Quality Issues

As discussed in Section 4.2.1, the data interpretation has identified that, although the gas present within the landfill is generally of a good quality for flaring, for a significant proportion of the time (approximately 28%) the gas either entering the flare or being combusted by the flare is in the explosive range or near to the explosive range. This situation presents a high likelihood of an accident related to the gas quality and consequently a serious risk to the health and safety of both employees and contractors of the Borough of Telford and Wrekin.

5.1.2 DSEAR

It is recommended that the Borough of Telford and Wrekin undertake an assessment of the site at Stoneyhill in accordance with DSEAR. Table 2 has been taken from the ESA ICOP for DSEAR Implementation for the Waste Management Industry and clearly summarises the DSEAR requirements and actions. These are mandatory requirements and must be carried out regardless of either the condition of the plant or how long it is likely to remain at site.

Table 2 DSEAR Requirements

Requirement	Action

Requirement	Action
Equipment and protective systems already in use/available at the workplace	Review equipment/protective systems against risk assessment requirements in regulation 5 of DSEAR. Equipment/protective systems at the workplace can continue to be used provided that the assessment indicates it is safe to do so.
Classification and zoning of hazardous areas	Classify places into hazardous and non-hazardous places and zone hazardous places in accordance with regulation 7(1) of DSEAR. However, places may need to be classified before this date if equipment available for the first time after 30 June 2003 is to be used there.
Marking hazardous places	Provide any signs required by regulation 7(3)/Schedule 4 of DSEAR. If the part of the workplace to be marked is modified after 30 June 2003, but before 30 June 2006, regulation 17(3) of DSEAR requires that signs are provided from the date of the modification.
Provision of work clothing	Provide antistatic work clothing as required by regulation 7(5) of DSEAR. However, if the part of the workplace in which it is to be worn is modified before this date it should be provided from the date of the modification.
Co-ordination of explosion protection measures	Co-ordinate any measures required by regulation 11 of DSEAR and, as required by regulation 5(4) of DSEAR, record the aim of the co-ordination in the risk assessment. However, if part of the workplace is modified before 30 June 2006, the co-ordination requirements in respect of that part apply from the date of the modification.

5.1.3 Extraction Pressures

A review of the approach taken to the gas extraction is recommended; the application of excessive extraction pressure to overcome issues associated with condensate, the presence of a vacuum within the landfill or difficulties in balancing the system is inadvisable and likely to exacerbate these issues further.

Environment Agency comments and the Jacobs site visit observations indicate the pipework may be in a poor condition and is likely to have been subjected to

differential settlement that has created condensate traps. The data interpretation also indicates that some of the wells have negative pressure even when not subject to extraction. Given this situation it is suggested that, the Borough of Telford and Wrekin consider;

- Improved gas field management and balancing;
- Replacement of some or all of the pipework;
- Replacement of any leaking headworks or seals;
- Expansion of the extent of the gas collection pipework, and
- Connect some of the unused gas wells that have been installed at site.

It is also recommended that a gas management plan is produced to identify issues such as maintenance and monitoring frequencies are clearly defined and that clear limits for gas qualities and extraction pressures to be applied at extraction wells are also included

5.1.4 Emissions

Review of the Biogas Manual provides no indication of the destruction efficiencies for trace gases or if the flare was constructed to meet TA Luft emission standards, as many elevated flares were in the early 1990's as no other emission standards existed. Accurate modelling of the emissions with any degree of confidence would therefore be difficult. We consider that the configuration of the flare would indicate that the flare cannot comply with the temperature or residence time requirements of the Environment Agency's Technical Guidance on the Flaring of Landfill Gas.

It is recommended that as the unit is reaching the end of its expected life span it should be replaced with a compliant flare and a dispersion modelling exercise undertaken based upon the new equipment.

5.1.5 Gas Migration Off Site

The Perimeter monitoring data indicated that there are levels of methane and carbon dioxide present within the perimeter wells at a level indicative of landfill gas and arranged in clusters suggestive of migration from the landfill through the surrounding strata or through man-made structures such as drains or conduits that may allow the passage of gases.

It is recommended that a desk study is undertaken followed by a Landfill gas risk assessment to determine the level of risk and remedial measures required.

5.1.6 Waste Management Licence Status

Technically, the operation of the Flare without a waste management licence is an offence under section 33(1)(b) of the Environmental Protection Act 1990, this can on summary conviction carry a penalty of imprisonment fore a term not exceeding 6 months or a fine of £20000, on indictment a prison term not exceeding two years and or a fine can be imposed. However there are currently a large number of landfill sites that handed licences back prior to the introduction of the Waste Management Licensing Regulations in 1994 and still operate flares to control landfill gas. The number of these sites is unknown, however to date none have been prosecuted by the Environment Agency for operating a flare without the appropriate Waste Management Licence.

If a waste management licence existed, the Environment Agency could modify the licence to require the operator to upgrade the equipment to the current standard.

It is advised that the Environment Agency be consulted as to their requirements for the licensing of this particular waste management activity. Should the Agency require an application to be made the equipment used would have to meet the standards as specified in their technical guidance.

5.1.7 Site Condition

Although the site and gas collection and flaring infrastructure was judged secure from unwanted intruders or accidental trespass, the overgrowth restricts inspection of the gas wells, dewatering points and landfill surface. Inspection of the gas wells and dewatering points is required to confirm adequate control and maintenance of the collection infrastructure.

Inspection of the landfill surface is of particular importance where fires may be suspected as landfill fires often leave characteristic depressions more pronounced and regular in shape that normal differential settlement at the surface or around wells. As these depressions are an important indicator to confirm the presence of a landfill fire it is important that the overgrowth is removed to allow the landfill surface to be inspected.

5.2 Summary of Recommendations

The assessment has revealed a number of issues at the Stoneyhill landfill, some of which require urgent attention. These are summarised in Table 3 below,

Table 3 Summary of Issues Identified, Consequences and Actions Required

Issue	Potential Consequence	Action Required
Leaking gas extraction pipework, resulting in air ingress and production of explosive gas mixtures	Explosive gas mixtures entering the flare or leaking from pipework can cause fire or explosion resulting in uncontrolled emissions and possible injury to or death of employees, contractors or members of the public	Improved gas field management and balancing Replacement of any leaking headworks or seals Expansion of the gas collection pipework to improve gas quality and collection efficiencies Connection of some of the unused gas wells that have been installed at site
Non-compliance with the Dangerous Substances and Explosive Atmosphere 2002	Prosecution under the Health and Safety at Work Act 1974	Undertaken DSEAR assessments as outlined in Table 3
Pipework has been subjected to differential settlement resulting in condensate collecting in the low spots, blocking the pipework and hampering efficient gas extraction	Increased sub surface migration could possibly cause fire or explosion resulting in uncontrolled emissions and possible injury to or death of employees, contractors or members of the public	Replacement of some or all of the pipework to remove low spots
Inappropriate or lack of understanding of basic principles of gas field management such as appropriate gas mixture and reasonable gas extraction pressures	Inappropriate gas mixtures can cause fire or explosion resulting in uncontrolled emissions and possible injury to or death of employees, contractors or members of the public. Over extraction can allow the introduction of air into landfill body causing fires which could result in uncontrolled emissions and possible injury to or death of employees, contractors or members of the public.	Gas management plan clearly defining operational limits for gas field management, particularly gas qualities and extraction pressures
The flare is reaching the end of its operational life span and there is an increased risk of breakdown or control	A long term breakdown of the flare would result in uncontrolled emissions from the landfill surface and leaks	As a minimum a arrangements should be made to source a replacement unit in the event of a breakdown,

Issue	Potential Consequence	Action Required
system failure that may not be easily replaceable due to the age of the components	in the extraction system. It could also result in Increased sub surface migration could possibly cause fire or explosion resulting in uncontrolled emissions and possible injury to or death of employees, contractors or members of the public	longer term a replacement flare will be required.
Flare is not compliant with current standards	Increased risk to human health and damage to environmental receptors from flare emissions	The flare should be replaced with a flare able to comply with Environment Agency Technical Guidance Risk to human health and damage to environmental receptors should be assessed to demonstrate compliance
Possible sub surface gas migration at the perimeter	Sub surface migration could possibly cause fire or explosion resulting in uncontrolled emissions and possible injury to or death of employees, contractors or members of the public	Desk Study followed by Risk Assessment
Non-compliance with the Waste Management Licensing Regulations 1994	Prosecution under the Environmental Protection act 1990	Discuss licensing requirements with the Environment Agency
Landfill Condition - Landfill surface cannot be inspected and therefore potential issues with differential settlement, well condition or emission or gas and leachate outbreaks cannot be identified	Lack of inspection could allow uncontrolled emissions to go unchecked Employees, contractors and members of the public likely to suffer trips, falls and minor stings or scratches due to overgrowth	Strimming of the site to remove over-growth. Maintain vegetation in a manner that facilitates regular inspection

A programme should be produced that phases the works such that the safety of the site, on site personnel and off-site locations are not compromised.

Appendix A Environment Agency Comments

Environment Agency Comments

The Environment Agency raised a number of points regarding the gas management at Stoneyhill landfill which have prompted The Borough of Telford and Wrekin's concern over the safety and suitability of the gas extraction system. Each of these points is discussed in light of the observations made during the site visit and the data interpretation exercise.

(a) Infrastructure safety

EA Comment, *The gas control infrastructure and flare are potentially dangerous.*

From the site inspection the gas flare in itself is not inherently dangerous, as all joints appear sound and key control elements such as the KOP, gas valves and booster appear to be in adequate condition. The proximity of the control panel to the flare, particularly the gas booster, is however of concern. An assessment in accordance with the Industry Code of Practice for DSEAR Implementation for the Waste Industry should be undertaken to determine the zoning around the flare and determine if relocation of the control panel is necessary.

It should be noted that the flare is between 10 and 15 years of age and is therefore reaching the end of its operational life. Replacement of the flare with a unit compliant with both DSEAR and EA guidance should be considered.

The gas collection/extraction infrastructure has also been installed for a number of years and the data interpretation and site inspection indicates there may be leaks and that the system is being adversely affected by differential settlement. The gas collection infrastructure and well heads probably now require an overhaul and a programme of improvements to ensure that performance of the system is maintained should be developed and implemented.

EA Comment *You have leaking pipework on site - air ingress which could mean explosive atmospheres - remember the explosive range of methane = 5-15%v/v in minimum of 14.3% O2. You do not want oxygen in your system.*

EA Comment *Seals etc on gas collection infrastructure are "shot" from what can be seen.*

Pipework could not be inspected during the site visit but the gas data supplied certainly implies that oxygen is entering the collection system at some point, be it through leaking pipework, seals or even through the cap. The seriousness of oxygen in the system cannot be overstated and as the results indicate that the gas mixture is in the explosive range for 28% of the time the risk of an incident related to the gas mixture is very high indeed.

EA Comment *Flash back arrestors will probably not work if hydrogen is in the LFG in explosive range and Hydrogen production linked to leachate levels and fires*

The production of hydrogen from waste in the landfill environment occurs at an early stage of the decomposition of the waste commencing in the Acidogenic phase and ending in the Acetogenic phase, both of which precede the Methanogenic phase – the main methane producing phase. During the Methanogenic phase (the current phase at Stoneyhill) there is little if any hydrogen produced. Therefore it is unlikely that there will be any issues associated with hydrogen.

(b) Emissions

EA Comment *There is obvious incomplete combustion at the flare (carbon deposits).*

The outcome of the data interpretation indicates a wide variation in the gas quality and gas pressure entering the flare. As the flare cannot automatically adjust to gas quality, on occasion's incomplete combustion will occur. This will also adversely affect the emissions – particularly particulates.

EA Comment *Elevated flares do not control Time, Temperature, Turbulence or O2 content and are only used in "emergency situations" on operational sites where we regulate.*

EA Comment *The landfill gases produced will contain trace components. These components are likely to include carcinogens and will be being nicely "warmed through" in your flare thereby generating other substances that are potentially carcinogenic, mutagenic, or teratogenic. It is unlikely you will get total destruction.*

Elevated flares do allow a degree of control over temperature and oxygen content, but cannot meet the temperature of 1000°C and retention time of 0.3 seconds that EA guidance now requires, whereas enclosed flares can. The design of enclosed flares and the longer retention time does mean a better rate of destruction of the trace components can be achieved, however no manufacturer makes a claim of total destruction and the percentage for destruction of trace components used in the GasSim Model (as recommended by the Environment Agency) is 99%, as the literature supplied with the model states "it is unrealistic that any flare or engine will be 100% efficient".

EA Comment *There is evidence the flare is generating acidic gases as you can see the galvanised parts of the flare have corroded. This could mean HCl or HF (trace compounds can include halogenated substances).*

It has been known for a long time that acidic gases can be formed as a result of the combustion of gases contaminated with halogenated compounds so most flares and engines are designed cope with the acidic gases. The corrosion of the flare therefore would be as much due to these gases as the age of the equipment.

EA Comment *The compound is set in a "bowl" thereby being influenced by terrain effects. This means "down wash", anyone going near the flare needs to be aware that there could potentially be a number of substances accumulating at ground level. I would suggest a thorough health and safety assessment for this.*

EA Comment *There is a human health receptor very close.*

EA Comment *You need to assess your bulk and trace gases to the flare.*

EA Comment *It is pointless trying to measure emissions from this type of flare as the science is incredibly dubious. Look at your trace components and possibly look at the carbon deposits (when the flare is not working) - analyse for Dioxin and Furan.*

A risk assessment including predicted emissions, dispersion of emission and incorporating "terrain effects" should be undertaken prior to the installation of any new equipment.

The trace component analysis in the raw gas provides good site specific data for any modelling exercise. However, without destruction efficiency for trace gases for the flare or even reliable performance from the flare, emissions cannot be predicted with any degree of accuracy.

With regard to analysis of the carbon deposits for dioxin and furans, this would not give any further information on the emissions from the flare as the analysis could not possibly be used to calculate a concentration of dioxin and furans in the combustion gases.

(c) Gas Quantities and system efficiency

EA Comment *When considering a gas generation profile such as one produced in a GasSim model, it is regularly the case that gas is at "peak generation" after 15 years.*

It is our experience that peak generation occurs in the first year after filling of the landfill is complete. Exceptions to this general rule only occur where the filling regime dramatically changes prior to closure, for example where inputs are cut for the last few years of operation, in which case the year of peak generation occurs prior to closure. For peak generation to occur 15 years after closure some inhibitory factor would have to exist preventing gas generation or the waste types would have to be very slow to biodegrade, this is actually very unlikely and not "regularly the case".

EA Comment *You are pumping 350 cubic metres of gas an hour with a gas collection efficiency of probably less than 25%.*

Based (very roughly) on the 1.5 million cubic metres of waste deposited between 1985 and 1991, peak gas of 1600m3/hr would have occurred in 1991. By 2006 the gas generation could be expected to have dropped to ~600 m^3/hr. If the site is removing ~350m^3/hr then the collection efficiency is closer to 50% - 60%. Considering the extent of the gas collection and the coverage of the site this is very reasonable, however further work would be required to properly establish this efficiency.

EA Comment *I do not believe you have any real information on zones of influence on gas extraction or leachate control based on my advice Phil has looked at 40 metre zones on existing wells and there are huge areas where just by going through this exercise you can see lack of control.*

The gas collection system is very limited in its extent and only very few of the installed wells are connected to the system. It is our opinion that the system was installed in this fashion to produce a low pressure zone close to the perimeter to control gas migration only.

(d) Gas System controls

EA Comment *You do not have control on the gas control system for balancing - Many wells are not responsive to balancing.*

EA Comment *You do not have the relevant detail that relates to gas collection pipework falls etc, and indeed there are points in the system where you know condensate collects and stops gas collection.*

Without detailed knowledge of the system design and layout, controlling the gas is a process of trial and error; this is not a satisfactory situation. If it is known that

there are low points in the system then that is where dewatering point should be installed.



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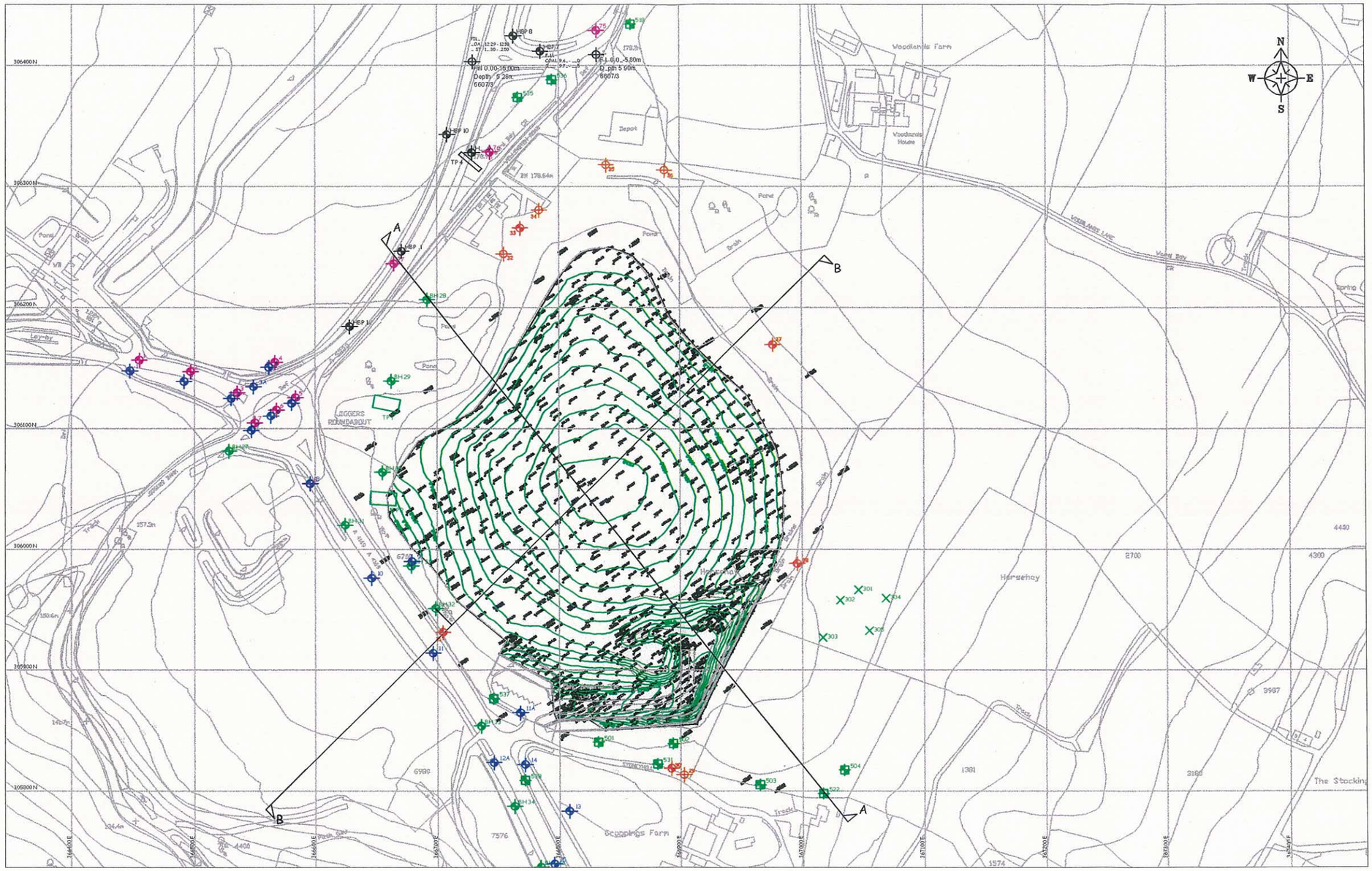
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PROJECT: Stoney Hill Landfill Site, Horsehay – Desk Study

DWG. TITLE: Location Plan – Cells 1 – 5

SCALE	DRAWN	DATE	DWG. NO.
As Shown	IRV	May 2004	E1027/001



PLAN 1:1250

Legend:-

- Borehole - Ironbridge Bypass Investigation, 1983
- Borehole - Horsehay Bypass Investigation, 19..9
- Borehole - Ironbridge Bypass Investigation - Fairclough, 1978
- Borehole - Horsehay Bypass Investigation
- Deep Borehole - Factual Completion Report - C...r es Rydon, 2002
- Shallow Bo....le - Factual Completion Report - C...r es Rydon, 2002
- G...und level survey 20..2
- T...la Pit - Campbell Reith Hill, 2000
- Gas Borehole - Campbell Reith Hill, 200..
- Borehole - ...ronbridge Gorge Instability Study - BT & W Council, 2003

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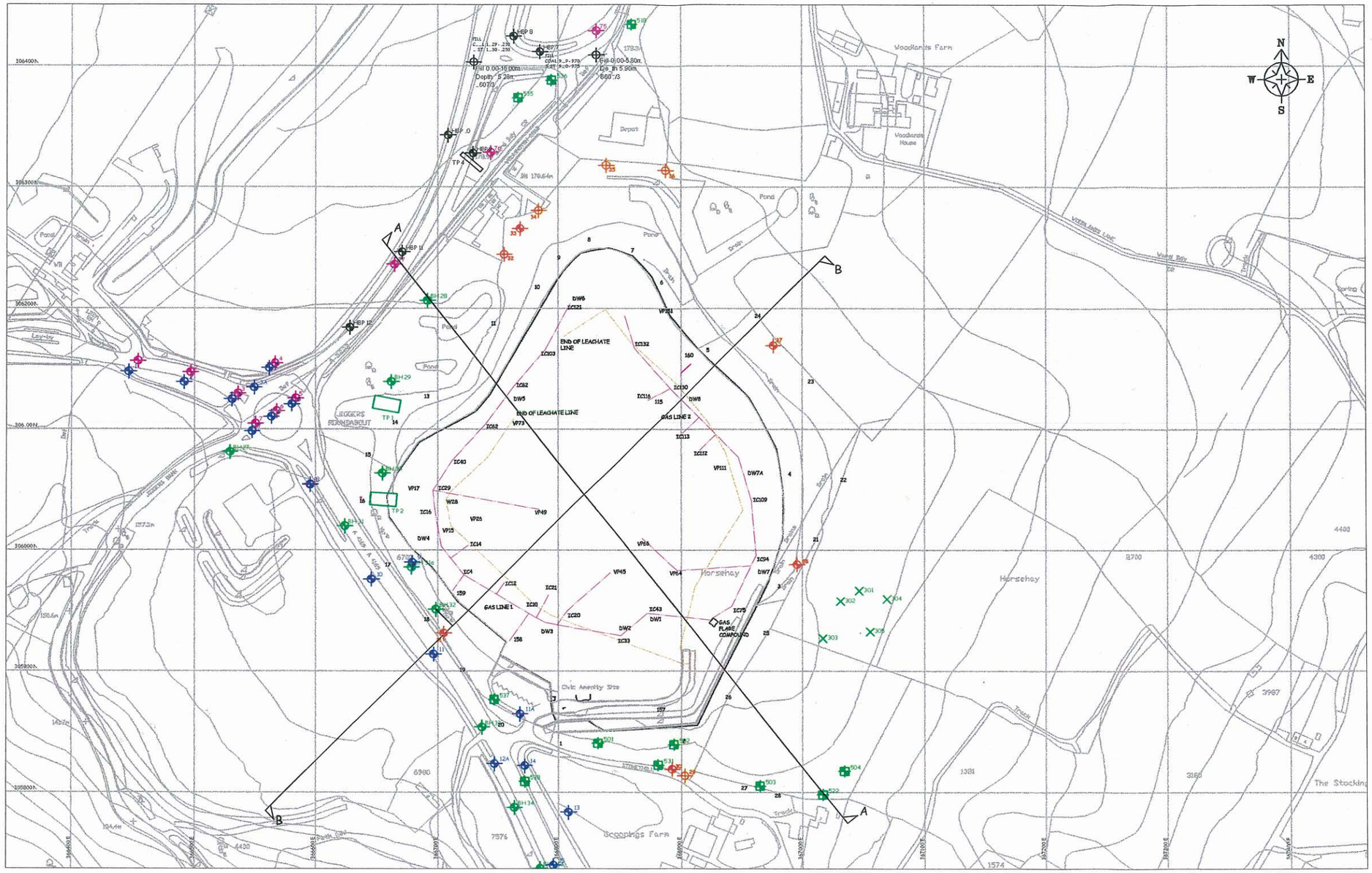
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PROJECT: Stoney Hill Landfill Site, Horsehay — Desk Study

DWG. TITLE: Location Plan — Topographical Survey and G I

SCALE	DRAWN	DATE	DWG. NO.
As Shown	IRV	May 2004	E1027/002


N
W
E
S
A
B
Woodlands Farm
Woodlands House
Depot
Pond
Fill 0.00-15.00m
Depth 5.28m
60m3
Fill 0.00-5.50m
Dp in 5.90m
660m3
BH 179.64m
BH 28
BH 29
BH 30
BH 31
BH 32
BH 33
BH 34
BH 35
BH 36
BH 37
TP 1
TP 2
TP 4
DW6
DW5
DW8
DW7A
DW4
DW2
DW1
DW3
DW7
END OF LEACHATE LINE
GAS LINE 1
GAS LINE 2
GAS FLARE COMPOUND
Horsehay
Civic Amenity Site
Scoonings Farm
JIGGERS ROUNDABOUT
Track
Stream
Ditch
Drain
Spring
4400
3700
4300
3987
1331
3188
The Stocking
7575
1574
6980
6430
1572m
1504m
1502m
1517m
1504m
1506m
1507m
1508m
1509m
1510m
1511m
1512m
1513m
1514m
1515m
1516m
1517m
1518m
1519m
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1523m
1524m
1525m
1526m
1527m
1528m
1529m
1530m
1531m
1532m
1533m
1534m
1535m
1536m
1537m
1538m
1539m
1540m
1541m
1542m
1543m
1544m
1545m

OPENCAST SITE
SEAM THICKNESSES:—
NEW MINE ..... 0·76
UPPER CLUNCH ..... 0·33
LOWER CLUNCH ..... 0·30
TWO FOOT ..... 0·61
BEST AND RANDLE ..... 1·52

STONEYHILL SITE

LITTLE FLINT

PROPOSED POSITION OF LANCASHIRE LADIES

LCM

BEST & RANDLE

2FT

Horsehay

Woodlands Farm

Depot

Civic Amenity Site

Legend:-

- Borehole - Iro...ridge Bypass In..estigation,19..3
- Borehole - Horseha_ Bypa..s Investigation, ...89
- Borehole - Iro..ridge Bypass Investigatio-- Fai..clough, 1978
- Borehole - Horseha_ Bypass Inv..st gation
- Deep ...rehole - ...ctual Comp..tion Repo..t - Charles Rud..n, 200..
- Shallow Borehole - Factua Compl..tion Repo..t - Charles Rud..n, 200..
- Ground leve su..vey, 2..02
- Trial Pit - Campbe l ...th Hill, 2000
- Gas Borehole - Campbe l ...th Hill, 20..0
- ...rehole - Ironbr ..ge Gorg.. Instability Study- BT & W Council, 2003

F.LAN 1:1250

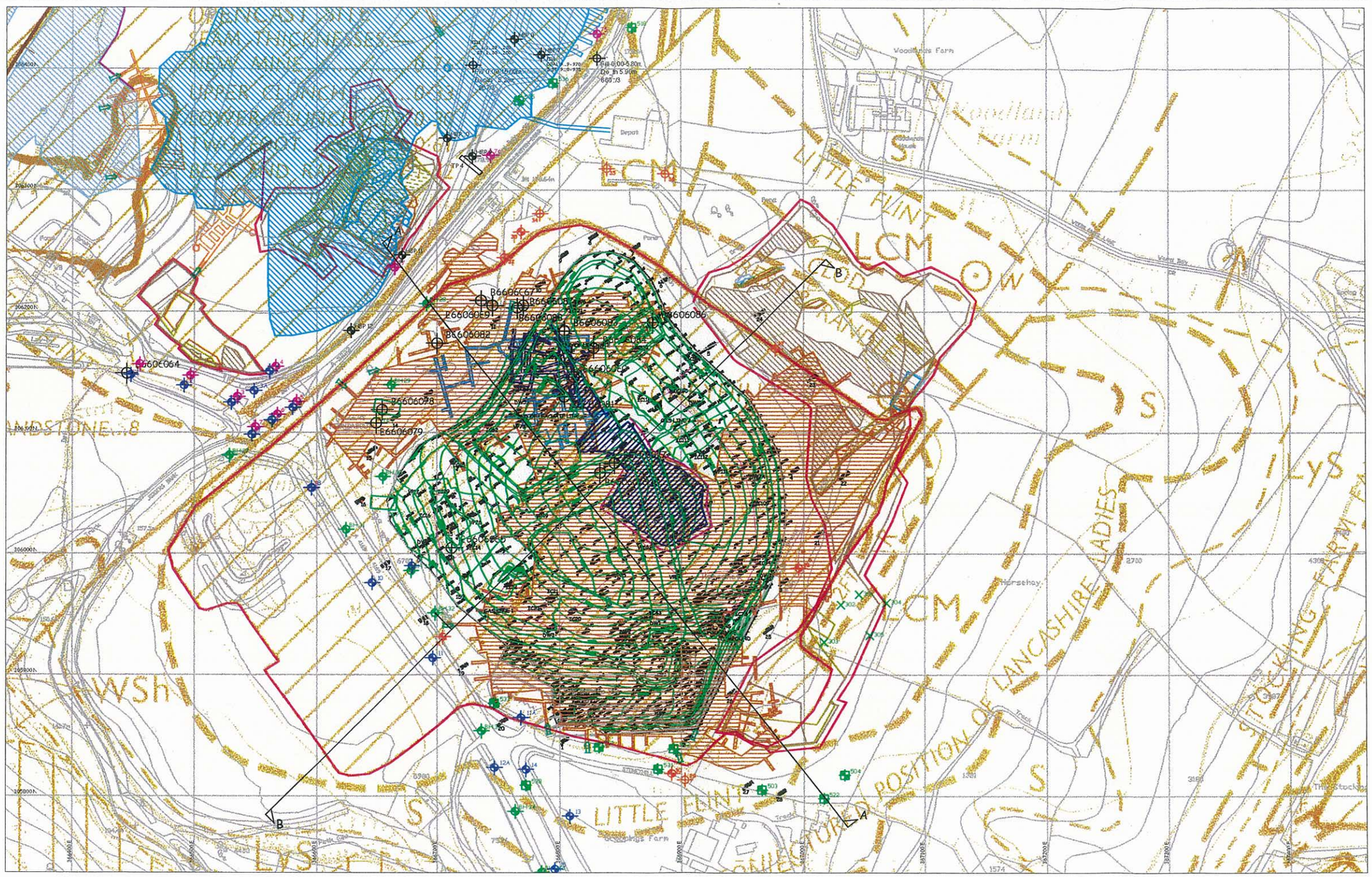
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PROJECT	Stoney Hill Landfill Site, Horsehay — Desk Study
DWG. TITLE	Location Plan — Geology
SCALE	As Shown
DRAWN	IRV
DATE	May 2004
DWG. NO.	EI027/006



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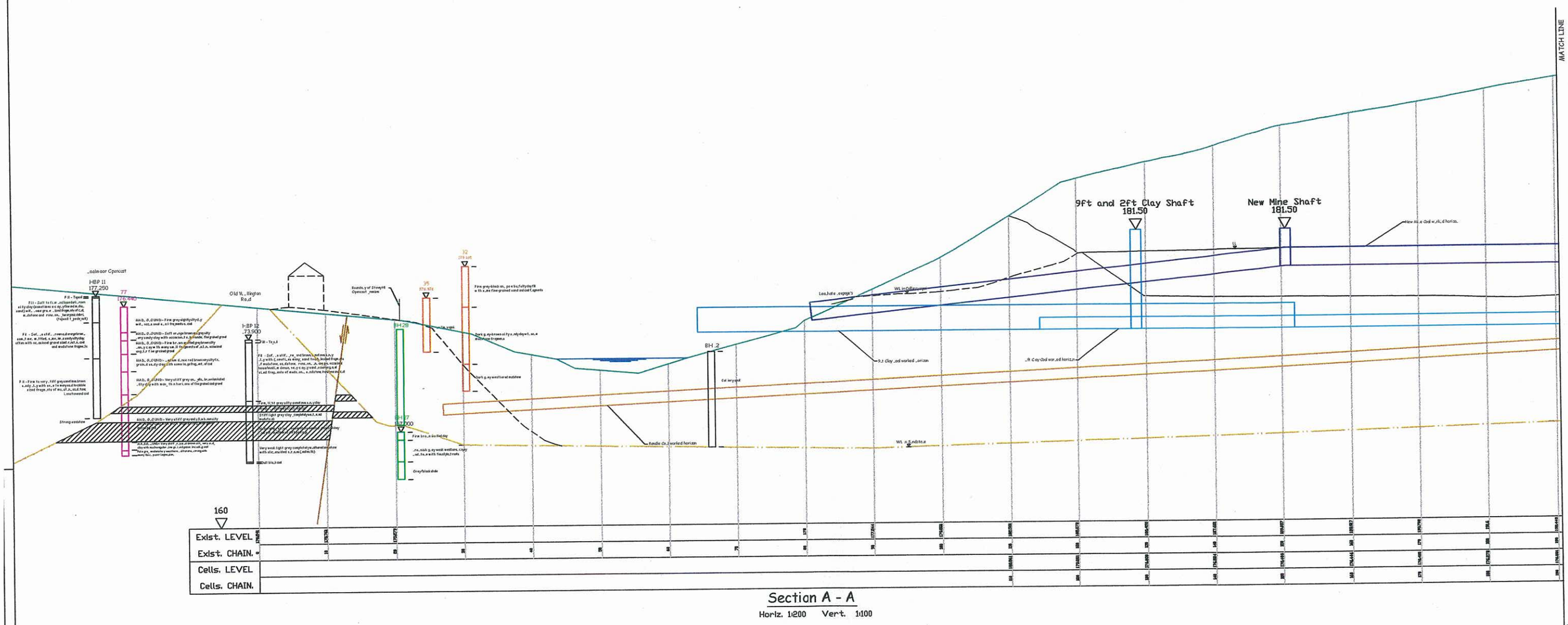
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PROJECT: Stoney Hill Landfill Site, Horsehay — Desk Study

DWG. TITLE: Composite Plan

SCALE	DRAWN	DATE	DWG. NO.
As Shown	IRV	May 2004	E1027/007



Section A - A

Horiz. 1:200 Vert. 1:100

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PROJECT	Stoney Hill Landfill Site, Horsehay – Desk Study
DWG. TITLE	Section A – A (Sheet 1 of 2)
SCALE	1:200
DRAWN	IRV
DATE	07/06/04
DWG. NO.	E1027/008

MATCH LINE

Randle Shaft
183.30

Low Mid Coal Measures horizon

Randle Coal Measures horizon

Cells Profile

160

Section A - A (cont)
Horiz. 1:200 Vert. 1:100

MATCH LINE

Open cast Limestone Flint Clay

Open cast Coal seam

Up to date of abandoned Ironstone Extraction
This open cast site

Cropping. Farm

Number 7
Stoneyhill

Randle Coal Measures horizon

Coal Measures horizon

160

Exist. LEVEL	
Exist. CHAIN.	
Cells. LEVEL	
Cells. CHAIN.	

Section A - A (cont) Horiz. 1:200 Vert. 1:100

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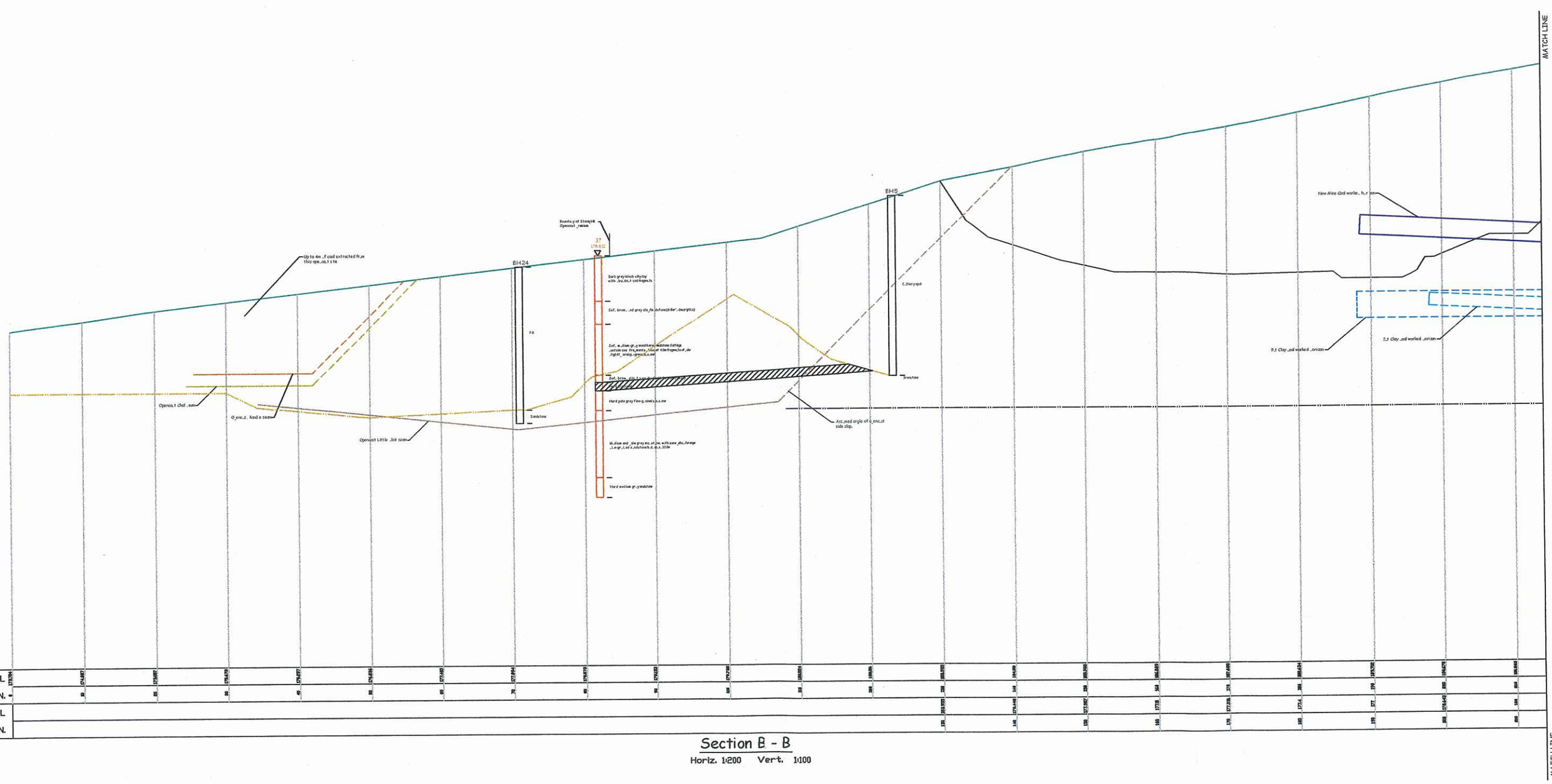
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PROJECT: Stoney Hill Landfill Site, Horsehay – Desk Study

DWG. TITLE: Section A – A (Sheet 2 of 2)

SCALE	DRAWN	DATE	DWG. NO.
1:200	IRV	07/06/04	E1027/009



Section B - B

Horiz. 1:200 Vert. 1:100

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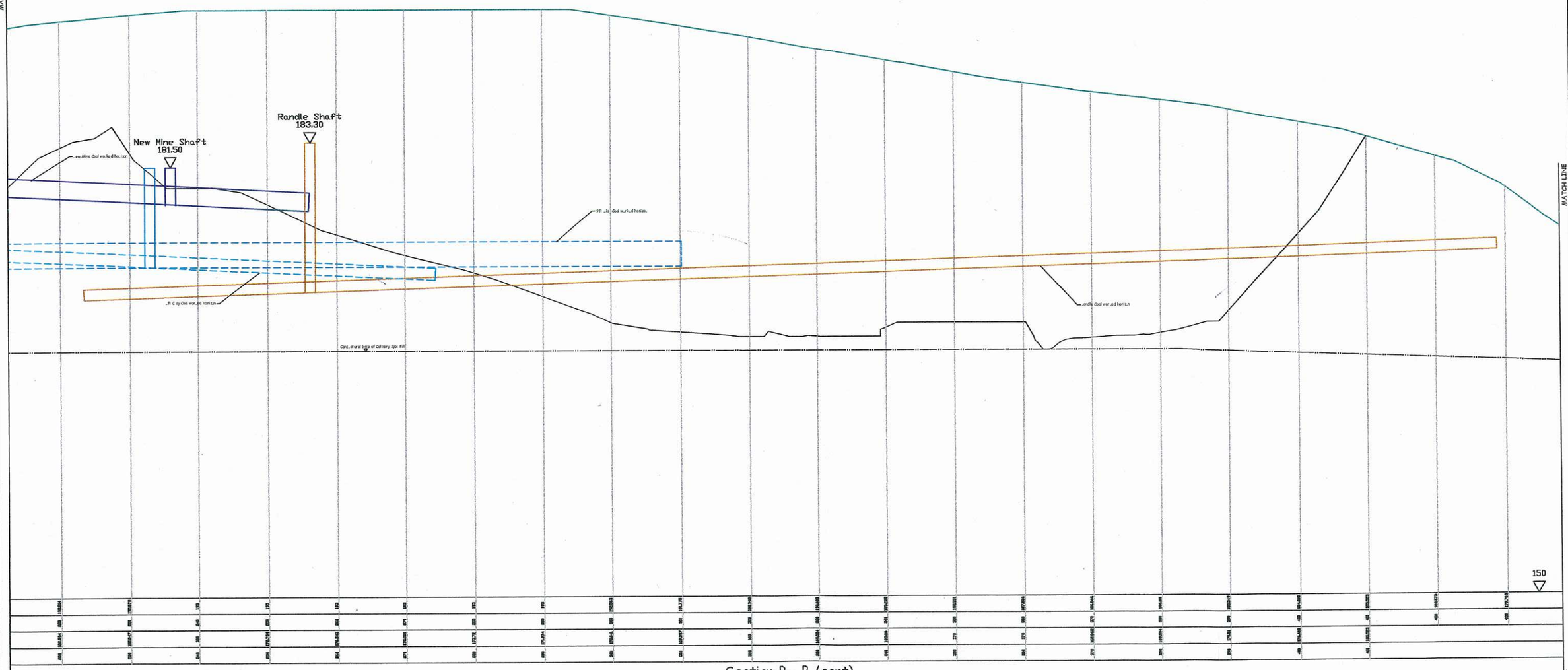
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PROJECT: Stoney Hill Landfill Site, Horsehay — Desk Study

DWG. TITLE: Section B — B (Sheet 1 of 3)

SCALE	DRAWN	DATE	DWG. NO.
1:200	IRV	07/06/04	E1027/010

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Section B - B (cont)

Horiz. 1:200 Vert. 1:100

MATCH LINE

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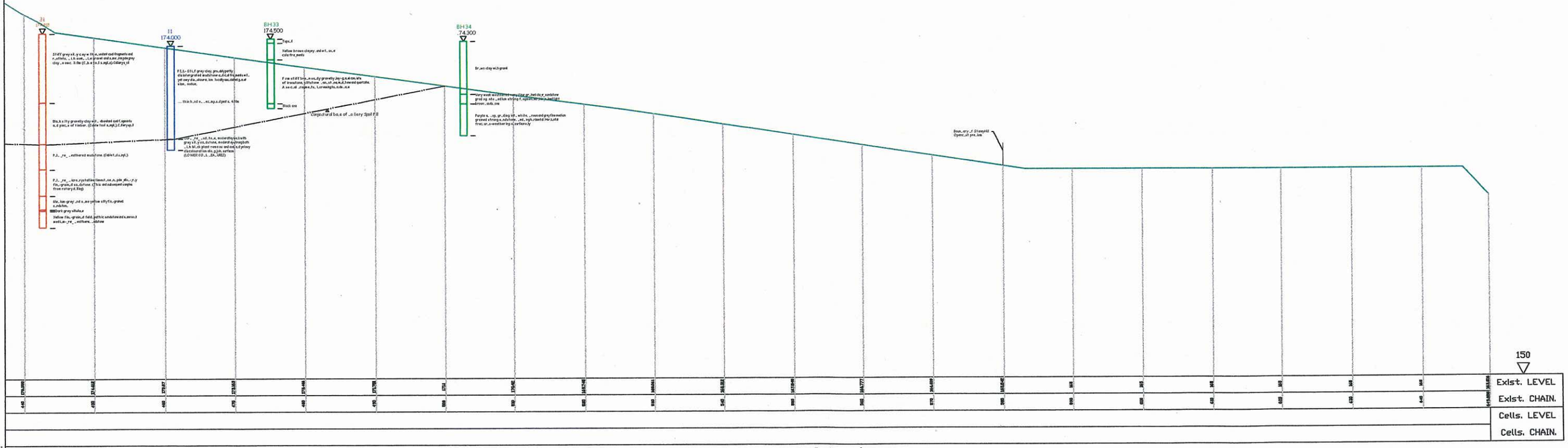
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PROJECT: Stoney Hill Landfill Site, Horsehay – Desk Study

DWG. TITLE: Section B – B (Sheet 2 of 3)

SCALE	DRAWN	DATE	DWG. NO.
1:200	IRV	22/06/04	EI027/011

MATCH LINE



150

Section B - B (cont)

Horiz. 1:200 Vert. 1:100

MATCH LINE

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PROJECT: Stoney Hill Landfill Site, Horsehay — Desk Study

DWG. TITLE: Section B — B (Sheet 3 of 3)

SCALE	DRAWN	DATE	DWG. NO.
1:200	IRV	22/06/04	E1027/012

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Environmental Geology

New Place, Rowley, Nr. Westbury, Shropshire SY5 9RY

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ASSESSMENT OF CONTAMINANT RISKS POSED BY STONEYHILL LANDFILL SITE

VOLUME 1: MAIN REPORT

161/R30 May 04

Telford & Wrekin Council

ASSESSMENT OF CONTAMINANT RISKS POSED BY STONEYHILL LANDFILL SITE

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Site historical development

Site construction

Waste inputs

Leachate and gas quality

Gas and leachate controls

3 PATHWAYS

Topography and drainage

Geology, mining and deposited materials

Hydrogeology

Evidence from monitoring data: groundwater levels

Evidence from monitoring data: water quality

Evidence from monitoring data: landfill gas

4 RECEPTORS

5 QUALITATIVE RISK ASSESSMENT

Summary conceptual model

Risk assessment

6 CONCLUSION

FIGURES

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DRAWINGS (Under separate cover)

ASSESSMENT OF CONTAMINANT RISKS POSED BY STONEYHILL LANDFILL SITE

1 INTRODUCTION

1.1 This report concerns Stoneyhill landfill site, situated at approximate National Grid Reference SJ 6685 0605, near the village of Horsehay, Telford. The landfill was formerly operated by Shropshire County Council Waste Disposal Authority for the disposal of household, commercial and industrial wastes.

1.2 The site is now in the ownership of Telford & Wrekin Council (TWC), who implement monitoring and environmental management of the site. TWC have now commissioned GeoWater to carry out an assessment of below-ground contaminant risks posed by the site, with a view to addressing concerns raised by Contaminated Land legislation. The assessment is based on desk research, historical monitoring data and additional site investigation work commissioned for this purpose.

1.3 This report provides details of data sources and summary data including graphical presentations where appropriate, together with interpretive comment. The information is presented under the categories of 'source', 'pathways' and 'receptors'. The final section is a qualitative assessment of below ground contaminant risks.

2 SOURCE (THE LANDFILL)

Site historical development

2.1 The original configuration of the site is shown in Figure 1 which is an extract from the 1927 1:2500 scale Ordnance Survey map of the area, showing the hamlet of Stoneyhill (which no longer exists) including the former Croppings Farm in the vicinity of the present-day Jiggers Bank roundabout. The Wellington Road from Coalbrookdale (now partially replaced by the Horsehay bypass) runs SW to NE through Horsehay Flat and on towards Horsehay and Wellington. The junction with the lane running south from Horsehay Flat, together with adjacent houses, is virtually the only feature of the site which remains to the present day.

2.2 Also shown on the 1927 map are mine workings to the north-east of Stoneyhill hamlet. The site was subject to underground coal mining, probably from the eighteenth century or earlier, beginning with shallow workings in exposed or near-surface seams (New Mine and Clunch coals – see Section 3.7 below) and extending to deeper seams with time. A National Coal Board report of 1984 (reproduced in Appendix 1) refers to the last date of working being the early 1900's, while a set of mine abandonment plans dated 1954 shows extensive workings in the New Mine and Randle seams and lesser workings in others. The latter appear to have been used as a basis for a plan of shafts and adits in the area, also included in Appendix 1.

2.3 The site was subsequently subjected to opencast coal mining in the middle years of the twentieth century, though exact dates and extent of workings have not been ascertained (opencast abandonment plans have not been made available). Coaling is thought to have ended in 1963. Two plans purporting to show the opencast boundary are attached as Appendix 2 and, although these differ, it is clear that the opencast area extended beyond the current landfill boundary, particularly to the east and north-east and also, probably, to the south-west.

2.4 As part of the opencast operation, the hamlet of Stoneyhill was destroyed and Croppings Farm was relocated to its present position. Opencast workings are understood to have extended to the Little Flint seam, thereby removing the majority of former underground workings within the area of full-depth excavation.

2.5 Further information on mining and geology is provided in Section 3 below.

2.6 The site was acquired by the County Council in the early 1980's, being described in correspondence at the time as being a 'lunar landscape' with numerous water-filled depressions. About the same time, the Ironbridge bypass was constructed, including the Jiggers Bank roundabout at its crossing with the old Coalbrookdale to Wellington road. It is understood that the area to the south of the Jiggers Bank roundabout (i.e. across the Ironbridge bypass from Stoneyhill landfill site) was used for deposit of surplus soils from the bypass construction.

2.7 The opencast backfill, consisting of clay with broken mudstone, sandstone and coal, was reworked, commencing in late 1984, to form the landfill void. A small part of the former 'lunar landscape', containing two ponds, was left undeveloped outside the north-western boundary of the landfill. Aerial photographs held by TWC (refs. SJ 6505/6605 6504/6604 and SJ 6606/6706 6605/6705) show the site at this time (not reproduced due to copyright).

2.8 A Waste Disposal Resolution was passed in November 1984 following consultation in a similar manner to a Licence Application. The consultation response of Severn Trent Water (in its role at the time as regulator for the water environment) is attached as Appendix 3, as is a copy of the Waste Disposal Resolution. Site engineering is described below.

2.9 Tipping commenced in 1985 and details of waste inputs are provided below. During the later stages of infill, land immediately east of the site was subjected to opencast coal working as the Croppings Farm opencast site (winter 1990/91). Waste deposit in the landfill was completed in spring 1991, about the same time as restoration of the Croppings Farm opencast was completed. Capping of the landfill was not completed until late 1992.

2.10 Another development which occurred at about this time was the construction of the Horsehay bypass, replacing the Wellington Road along the north-western boundary of the site. Beyond the Wellington Road, the former Coalmoor Colliery (abandoned as deep mine prior to 1927) was opencast and subsequently developed as a landfill for industrial waste.

2.11 Detailed environmental monitoring of the Stoneyhill landfill began in 1990 with the construction of 20 gas monitoring boreholes around the landfill perimeter. Further monitoring points were constructed in 1992 to the east of the site, to address concerns about potential gas migration eastwards into the Croppings Farm area. The gas control system was also initiated at this time (see 'Gas and leachate controls' below) and limited groundwater and surface water monitoring was commenced.

2.12 In 1998 Telford & Wrekin Council became a Unitary Authority and became responsible for Stoneyhill. TWC have implemented environmental monitoring and management of the site since that time.

2.13 A new urban village is proposed at Lightmoor, including residential development of much of the former Croppings Farm opencast area, close to the eastern margin of the landfill. Construction of access roads commenced in early 2004.

Site construction

2.14 It is specified in the site Resolution that the landfill be developed in five phases. Drawing E1027/001 is a plan showing the phases, including base elevations which are generally in the range 175 – 178 mAOD except for Phase 4/5 which has a base sloping down to 168 mAOD at its lowest point. Records indicate that Phase 1 was divided by a double bund across the middle, creating three cells designated 'toxic waste cells'. Phase 2 also appears to have partial internal divisions, including an area designated for asbestos disposal.

2.15 The Resolution also specifies that:

> "No deposit of permitted wastes other than soil, subsoil and wastes from the construction industry will take place in each phase unless it is to within an area (hereinafter called a containment area) the location and dimension of which have previously been specified.
>
> Furthermore, the base and sides of such areas will be lined with a structurally sound layer of approved cohesive argillaceous material not less than 2 metres thick after compaction and free of voids and fissures and the permeability of which is less than 10^{-9} m/s ..."

Permeability testing of the laid liner is required.

2.16 Some records of liner testing have survived in records and are included as Appendix 4. These all relate to Phases 1 and 2 and show that there were at times difficulties in achieving the required degree of compaction and permeability, particularly in the internal bund walls, though the majority of samples had acceptable permeabilities. Some of the material had a high coal content, making for poor compaction. In the base of Phase 2 a thin (300mm) coal layer was noted, as well as a circular settlement area which may be evidence for a former mineshaft.

2.17 The clay compaction techniques used are believed to have improved with time, so that later cells are likely to be better lined; however no testing data was found in the records searched. Anecdotal evidence from Environment Agency staff suggests that further evidence of former underground coal workings was found, probably in Phase 4 or 5, the deepest part of the site. Interviews also indicated that there were concerns as to whether the haul road into the site (i.e. the eastern end of Phase 5) was fully lined prior to final waste deposits.

2.18 Once filled, the landfill was capped with clay, again specified to a permeability of 10^{-9} m/s. By 1992 (the time of final capping), construction quality assurance of mineral liners was routine in the landfill industry and the cap is likely to have been laid to acceptable standards. Test results for the southern part of the site are attached as Appendix 5.

2.19 A substantial thickness (of the order of 1-3m) of soil cover was placed over the clay cap. An aerial photograph dated 1993 (included in Appendix 5) shows the site at this stage.

Waste inputs

2.20 Waste types permitted by the Resolution are shown in Table 1. The bulk of waste input consists of domestic, commercial, non-hazardous industrial and construction wastes. 'Schedule B' (Difficult) wastes were required to be co-disposed with 'Schedule A' wastes at a ratio (B:A) of at most 1:5. Liquid waste was required to be deposited in trenches. The Resolution also allows for irregular or infrequent deposit of other Difficult Wastes in compliance with regulations at the time.

2.21 Actual waste returns have not been made available.

2.22 Wastes from Monsanto plc were deposited at the landfill, apparently for the period Feb 1985 to Jan 1988, by an agreement dated Nov 1984 and formalised June 1987. Details are provided in Appendix 6. The wastes listed comprise mainly solid distillation residues and waste cleaning materials and sweepings together with interceptor sludge from a dewatering area and bagged clay dust from a synthetic rubber plant. A number of contaminants (present in small quantities) are mentioned, including PNCB (paranitrochlorobenzene) which is flammable and capable of emitting hydrochloric acid or nitrous gases, and the common solvent xylene.

2.23 A letter from the Environment Agency in response to an enquiry regarding Difficult and Special wastes received at the site is also included in Appendix 6.

2.24 The landfill is also known to have accepted the carcasses of cattle affected by BSE.

Leachate and gas quality

2.25 Summary leachate quality data for gross contaminants is given in Table 2 and Figure 2, for the five routine leachate monitoring points within the site. The results are typical for a strong biodegradable leachate, with high pollution potential due to ammonia and oxygen demand. Further detail is provided in routine environmental reports.

TABLE 1: WASTE TYPES PERMITTED BY RESOLUTION A25/30/SL/CC/12

SCHEDULE A: GENERAL WASTE

Waste Type	Permitted daily qty: tonnes
Domestic and Commercial (untreated)	200
Medical Surgical and Veterinary wastes	1
Non-hazardous Industrial (potentially combustible substances)	200
Non-hazardous Industrial (inert and non-flammable substances)	200
Waste from the construction industry	200
Old cars vehicles and trailers	5
Sewage sludge and pail closet contents	1

SCHEDULE B: DIFFICULT WASTES

Waste type	DoE Code	Liquid	Sludge	Solid
Cadmium Compounds	D10			10
Chromium	D90			10
Copper	D91			10
Zinc	D92			10
Nickel	D95			10
Vanadium	D96			10
Asbestos	J10			10
Slag including boiler & flue cleanings	J20			10
Silt & dredgings	J40			10
Contaminated Water	J50	10		
Metal Scrap	J60			10
Hydrocarbons (not included in M)	K10			40
Aldehydes & Ketones	K83			10
Polymeric materials in the finished state	L20			10
Scrap rubber including tyres	L30			10
Latex, latex & rubber solution & suspensions	L40		10	
Synthetic adhesive	L50			10
Fats, waxes & greases	M60		10	10
Pharmaceuticals	N10	1	1	1
Laboratory chemicals (mixed organic compounds)	P10	1	1	1
Laboratory chemicals (mixed inorganic compounds)	P20	1	1	1
Dry battery waste & primary cells	P20			10
Used filter materials	Q10			10
Contaminated rubbish	Q20			20
Empty used containers	Q30			10
Industrial effluent treatment sludge	Q40		40	40
Interceptor pit residues	R20		40	40
Distillation residues (drummed)	R50			40
Tar, pitch bitumen and asphalt	R70			10
Paint waste	R80		10	10
Animal processing waste	T10			10
Food processing waste	T20			10

Table 2: Summary indicator contaminant concentrations in leachate

AVERAGE CONCS. 2003	Mon pt: Units	SH1/10L	SH1/111L	SH1/115L	SH1/28L	SH1/73L
Ammoniacal Nitrogen	mg/l	241.15	990	193.35	452.8	262.3
Chem Oxygen Demand	mg/l	953	1051	609	760.5	851
Chloride	mg/l	1103.75	1258.5	1006.5	930	1076.5
Electrical Conductivity	uS/cm	8717.5	9350	8160	7430	9330
Total Organic Carbon	mg/l	294.75	313	202	255.5	279
pH	pH units	8.45	8.335	8.235	8.035	8.21
Total Oxidised Nitrogen	mg/l	0.625	0.3	0.3	0.3	0.3

2.26 Leachate was tested in 2000/01 for a range of EC Groundwater Directive List I/II substances. Results show that leachate at this site is generally low in the hazardous substances tested for. No herbicides, pesticides or organotin compounds were detected, nor toxic metals in excessive quantities. Boron concentrations were elevated. Some volatile organic compounds were present at low concentrations, including some chlorinated organics, and BTEX compounds. PAH compounds, other aromatics, and nitrogen-sulphur containing organics were also detected, together with significant concentrations of C_{10} to C_{30} hydrocarbons. Maximum concentrations of volatile organic and hydrocarbon compounds are listed in Table 3.

Table 3: Volatile organic compounds and hydrocarbons detected in leachate

Compound	Max concn (µg/l)	Compound	Max concn (µg/l)
Dichlorodifluoromethane	4	1,2,4-Trimethylbenzene	6
Vinyl chloride	6	1,3,5-Trimethylbenzene	23
1,1-Dichloroethane	4	1,4-Dichlorobenzene	9
cis-1,2-Dichloroethene	4	tert-Butylbenzene	82
Benzene	9	1,3-Dichlorobenzene	3
Toluene	40	Naphthalene	29
Ethylbenzene	36	C9-C10 Aromatic isomers	95
p/m-Xylene	76	C9-C11 Aromatic isomers	440
Styrene	2	Indan	15
o-Xylene	22	Cyclohexanone	40
Isopropylbenzene	2	1,1'-Biphenyl	30
Propylbenzene	1	C10 to C40 hydrocarbons	7760

2.27 Gas produced from the wastes (when extracted under suction) has a composition of approximately 30 – 45% methane, with the remainder consisting of carbon dioxide. Small percentages of oxygen are recorded in the extraction system, sometimes rising to significant amounts (>5%) but this is assumed to originate from air drawn into the system. When gas is venting naturally, higher methane concentrations (up to 60% or more) are recorded.

2.28 Analyses for trace gases have not been undertaken. Recent generic guidance for biodegradable landfills indicates the gases listed in Table 4 as priorities in terms of likelihood of occurrence and significance of impact.

Gas and leachate controls

2.29 The Resolution stated that the leachate level in each cell was not permitted to rise above 177m AOD. Recent monitoring data indicates leachate levels in the range 177 to 187 mAOD. Summary data is presented graphically in Figure 3.

2.30 There is no leachate drainage system in the base of the cells. Leachate monitoring/ extraction wells were first installed in 1992 and a pumped leachate extraction system was installed in the mid 1990's and upgraded in spring 2000. Extraction rates up to 20 m^3/ day are achieved though long-term average rates are lower than this. Highest extraction rates are achieved from the western part of the site (Phase 5).

2.31 Passive gas vents were also installed in 1992, consisting of approximately 150 110mm diameter HDPE lined wells installed to as near the base of waste as possible. In 1993, due to elevated gas readings in external gas monitoring points along the eastern side of the site, a small active gas extraction system was installed, which initially resulted in reduced gas concentrations in the external monitoring points. However the effect could not be sustained and over the mid 1990's a full gas extraction system was developed, based on two buried feeder lines with spurs, and a permanent extraction and flare unit, extracting of the order of 250 to 380 m^3/hr. Unused passive vents were capped.

2.32 Dewatering of the gas extraction system has been a perennial problem, as the thickness of capping materials precludes conventional condensate disposal to waste via dewatering lances. Measures have been taken to control the problem, including pumped dewatering, but severe weather conditions can still cause shutdown of the extraction system.

TABLE 4: PRIORITY TRACE COMPONENTS IN LANDFILL GAS

Significant Trace Component	Potential Impact	Category
Chloroethane	Health	Halocarbon
Chloroethene (vinyl chloride)	Health	Halocarbon
Benzene	Health	Aromatic Hydrocarbon
2-butoxy ethanol	Health	Oxygenated hydrocarbon
Arsenic (as As)	Health	Inorganic
1,1-dichloroethane	Health	Halocarbon
Trichloroethene	Health	Halocarbon
Tetrachloromethane	Health	Halocarbon
Methanal (formaldehyde)	Health	Aldehyde
Hydrogen sulphide	Health & Odour	Inorganic
1,I-dichloroethene	Health	Halocarbon
1,2-dichloroethene	Health	Halocarbon
Carbon disulphide	Odour & Health	Organosulphur
Methanethiol	Odour	Organosulphur
Butyric acid	Odour	Organic acid
Ethanal (acetaldehyde)	Odour	Aldehyde
Ethyl butyrate	Odour	Oxygenated hydrocarbon
I-propanethiol	Odour	Organosulphur
Dimethyl disulphide	Odour	Organosulphur
Ethanethiol	Odour	Organosulphur
I-pentene	Odour	Aliphatic hydrocarbon
I-butanethiol	Odour	Organosulphur
Dimethyl sulphide	Odour	Organosulphur
1,3-butadiene	Health	Aliphatic hydrocarbon
Furan	Health	Oxygenated organic
Mercury (as Hg)	Health	Inorganic

Source: Environment Agency 2002

3 PATHWAYS

Topography and drainage

3.1 The site lies at the end of a spur of high ground projecting south-eastwards towards the Ironbridge Gorge about 2km to the south, containing the River Severn at an elevation of about 35m AOD. The site boundary lies at approximately 185m AOD and the landfill forms a mound with a summit elevation of 194m AOD.

3.2 Drainage is therefore in every direction off the landfill itself. An interceptor ditch outside the north- eastern boundary carries runoff northwards to an artificial pond known as Hughes Pond close to the northern end of the site, at an elevation of about 177m AOD.

3.3 The northwestern boundary drains to the two ponds at an elevation of approximately 173m AOD (i.e. the external bund wall extends to some 8 metres below leachate levels in this part of the site). The ponds appear to be internally draining and are assumed to be in at least partial continuity with shallow groundwater.

3.4 The south-western boundary drains to ditches constructed in connection with the Ironbridge bypass, while runoff from the southern sector of the landfill drains into the depression formed by the access road. The latter is bounded by a french drain conducting water back to the road drainage system. A small proportion of runoff from the south-eastern part of the site may proceed as overland flow.

3.5 The site lies on a watershed which runs approximately NNW-SSE across the centre of the site. To the east drainage is towards Lightmoor and thence back southwards towards Coalbrookdale, while to the west drainage is towards the Lyde/ Loamhole Brook system.

Geology, mining and deposited materials

3.6 Geological and mining information is drawn from published geological mapping at 1:10,000 scale and site investigation borehole logs (shown on Drawing E1027/006) together with mine abandonment plans (summarised on Drawings E1027/004 and E1027/005).

3.7 The geological succession prior to mining in the area is summarised in Table 5 (drawn from geological mapping and mine abandonment records).

Table 5: Geological succession at Stoneyhill

Age	Stratum	Thickness
LOWER COAL MEASURES	Pennystone (mudstones)	4m
	New Mine Coal	1.3m
	Nine Foot Clay (fireclay)	3.3m
	Top Sil Coal	0.3m
	Clay	c. 0.4m
	Bottom Sil Coal	0.5m
	Clunch Clay	1.1m
	Two Foot Coal	0.8m
	Clay	2.5m
	Randle Coal (and Best)	0.8m
	Clay	0.6m
	Clod Coal	0.7m
	Clay/ mudstone/ ironstone/ sandstone	4.5m
	Little Flint Coal	0.6m
	sandstone / ironstone/ mudstone	11.3m
	Lancashire Ladies Coal	thin
	sandstone / ironstone/ mudstone	c. 3.0m
DINANTIAN	Lydebrook Sandstone (yellow/ orange-brown sst with some pebbles)	25-31m
WENLOCK SERIES (SILURIAN)	Wenlock Shale (grey mudstones & shales w occasional thin calcareous sst/ lst)	c.200m

Notes: Recorded intervals between coals in the adjacent Croppings Farm opencast are less than these. Total thickness from base of Top Sil to top of Little Flint is 8.9m at Croppings Farm, compared to 11.9m here.

Basalt, intruded into the Lower Coal Measures strata, is present in the sequence to the north of the site, towards Horsehay, but it is not known in the vicinity of the site itself.

Double borders indicate geological unconformities.

3.8 No drift materials are shown on geological maps overlying the solid geology.

3.9 Strata dip gently westwards in the area of the site itself. A significant fault, the Stoneyhill Fault, runs SW-NE approximately along the line of the former Wellington Road to the north-west of the site, downthrown to the north-west. Two minor faults, downthrown on the same side, are shown on the geological map across the centre and east of the site (the eastern one is not proven).

3.10 Progressively lower strata outcrop around the descending flanks of the topographic spur, to the north-east, south-east and south-west of the site. Thus the horizontal distance to the Lydebrook Sandstone outcrop is approximately 300m to the north-east and south-east, but only about 120m to the south on the much steeper slope to the Lyde Brook.

3.11 Strata above approximately the Two Foot Coal were only present beneath the high ground now occupied by the site; consequently all these materials have been removed or disturbed.

3.12 From mine abandonment plans it may be determined that the approximate elevation of the Little Flint Coal is of the order of 168m AOD (+/- 1m) across most of the northern half of the site. The elevation seems relatively consistent despite recorded dip and faulting. The external monitoring boreholes (see below) around the north of the site record colliery spoil to this elevation or slightly higher. From this (and from geological knowledge and verbal evidence from former operatives, but not review of any opencast plans) it is conjectured that opencast mining at Stoneyhill extended to the Little Flint Coal.

3.13 On this basis, the base of the landfill in Phases 1 to 3 (175 – 179m AOD) would be underlain by a substantial thickness (7 to 11m) of reworked colliery spoil. The very deepest part of the landfill (recorded as 168m AOD in cell 4/5) might be expected to have encountered the sandstone beneath the worked-out Little Flint Coal, while the remainder of cells 4 and 5 would be underlain by reworked materials. Although the possibility of the landfill void directly encountering workings cannot be entirely discounted, it would seem equally possible that coal or other 'evidence' of in-situ strata/workings were in fact features of the reworked material.

3.14 Two sections across the site are presented in Drawings E1027/008 – E1027/012. These give estimated positions of the former deep workings, opencast voids and the landfill itself, together with geological information where available. They show the presence of a thickness of colliery spoil beneath the majority of the landfill base.

3.15 An IGS (now BGS) report of 1980 indicates that underground mining would also be unlikely to have progressed below the Little Flint Coal. No evidence for working of the only coal below this, the thin Lancashire Ladies Coal, has been found in shaft or mine abandonment records.

3.16 Workings in the Randle and Little Flint seams certainly extended well beyond the landfill boundary in all directions, particularly to the east (see Drawing E1027/004). Workings in both these seams were encountered by the Croppings Farm opencast – encountered workings are shown on Drawing E1027/005). Thus, although most (if not all) workings will have been removed in the base of the two opencast sites, it is likely that workings remain in strata around the sides of the former Stoneyhill opencast void, as shown on the Sections in Drawings E1027/008 – E1027/012.

3.17 An agreement was made with Clay Colliery Ltd., operators of the Croppings Farm opencast site, to construct a compacted clay barrier along the batter of the western wall (i.e. adjoining Stoneyhill) prior to backfill. No CQA records have been found for this barrier, although interviews with Environment Agency staff indicate that there was some regulatory supervision of its construction.

3.18 An overlay plan of deep and opencast workings is presented in Drawing E1027/013. This shows that at two locations recorded deep workings extend beyond the opencast boundary: to the north-west in the vicinity of the old Wellington Road and to the south-east towards Croppings Farm.

3.19 Beneath the base of the Stoneyhill opencast void, about 40 metres of Lower Coal Measures and Dinantian (Lower Carboniferous) strata are anticipated, consisting primarily of iron-rich sandstones with subordinate mudstones.

Hydrogeology

3.20 Prior to mining disturbance, natural hydrogeology would have consisted of limited recharge of Lower Coal Measures strata on the upper slopes of Stoneyhill and discharge via more permeable strata at outcrop in the surrounding valleys. Because the site lies on a watershed, groundwater flow and discharge would have been both to the south-west (into the Lyde Brook valley) and to the east (e.g. the springs at approximate National Grid Reference SJ 675 062 in the Lydebrook Sandstone).

3.21 The natural system probably prevails at depth in the sandstones, which are likely to be capable of significant groundwater transmission through fissures. However any minor flow systems in the near-surface will have been disrupted by mining, the principal effect being the creation of large volumes of reworked material in the opencast voids.

3.22 In 1984 (prior to landfill construction) five boreholes were drilled on the site to depths of 7 to 9.5m through opencast backfill. The boreholes encountered clay fill with coal and some silt and sandstone fragments. Eight samples were tested for permeability with results in the range 10^{-3} to 10^{-6} mm/sec (i.e. 10^{-6} to 10^{-9} m/sec) with higher permeabilities associated with sandstone or silt content (see Appendix 7). The permeability tests were presumably carried out on undisturbed samples and may be taken as an indication of permeability of the in-situ colliery waste outside the present landfill liner. The results suggest that, while the fill is of predominantly low permeability, pockets of more permeable material exist. Given the nature of backfill operations these features could at times be layered, so that more extensive permeable zones could exist.

3.23 Construction of the landfill with its compacted liner has in effect created yet another groundwater system – a bowl structure within which landfill leachate has collected to levels significantly higher than groundwater levels outside the bowl.

Evidence from monitoring data: groundwater levels

3.24 A plan of monitoring point locations is given in Figure 4.

3.25 Groundwater levels measured in the period 2002 - 2004 are presented in Table 6 and Figure 5. The additional monitoring points installed as part of this investigation have clarified the interpretation of groundwater levels. It is now clear that a groundwater system exists in the sandstones underlying the site with a water level elevation in the range 165 to 169m AOD, with highest groundwater levels at the north end of the site.

Table 6: Average groundwater levels 2002 - 04

Monitoring point	Deep (D) or Shallow (S)	GW level (mAOD)
SH1/06WD	D	167.85
SH1/08W	S	178.40
SH1/09WD	S	176.43
SH1/09WS	S	177.47
SH1/15WD	D	165.91
SH1/30WD	S	161.46
SH1/31WD	D	165.67
SH1/32WD	S	173.47
SH1/33WD	D	167.30
SH1/34WD	S	175.90
SH1/37WD	D	165.45

3.26 Long term records are available for the routine groundwater monitoring boreholes, as summarised in Figure 6. The separate behaviour of the sandstone (boreholes 6 and 15) and colliery spoil groundwater systems can be seen here too.

3.27 Conjectural deep (sandstone) groundwater contours are presented in Figure 7, showing the potential for groundwater flow beneath the site in all directions from south-west through south to north-east. It should be noted that other contour configurations could be fitted to the data, including the possibility of discontinuities in the system[1]. Under this interpretation, boreholes 31 and possibly 15 and 37 are downgradient monitoring points and 33 would be upgradient.

3.28 Groundwater levels in the colliery spoil are less consistent, indicating disconnected groundwater bodies in heterogeneous, often low permeability fill. At the north end of the site there appears to be a north-westward flowing shallow groundwater system in the colliery spoil as shown on Figure 7. This system runs contrary to deep groundwater flow and may be supported in part by leachate egress from the site.

3.29 Comparison of the groundwater levels in Table 6 with the leachate levels in Figure 3 shows that leachate levels are consistently higher than groundwater levels; thus any flow through the landfill liner system would be outwards. Around much of the site, ground levels fall below leachate levels within the site, so that leachate seepage to the surface is possible. There is some visual evidence of this along the north and west boundaries of the site.

[1] Borehole 6 appears to have an anomalously high groundwater level which may indicate that other contours are appropriate, though it is here assumed to indicate piezometric influence from water in the overlying spoil.

Evidence from monitoring data: water quality

3.30 Long term water quality records are available in environmental monitoring reports for the site. Data from the newly installed groundwater monitoring points is now being added to this record and significantly improves the picture. Major ion and indicator contaminant concentrations in both deep and shallow groundwater systems are summarised in Figures 8 and 9. Time series plots for some key indicators are included as Appendix 8.

3.31 The major ion plot for deep groundwaters is consistent with a homogeneous groundwater system with a predominantly calcium sulphate water with subordinate sodium and magnesium chloride. There is some evidence for an increase in sulphate and possibly sodium as water moves down gradient, together with a decrease in bicarbonate.

3.32 There is some evidence of slight rises in electrical conductivity, chemical oxygen demand and ammonia in the downgradient monitoring boreholes.

3.33 More significantly, there is evidence for an area of contaminated groundwater in colliery spoil around the northern end of the site (boreholes 8, 9, 32 and 34). Ammoniacal nitrogen and chemical oxygen demand concentrations are raised, as are electrical conductivities and on occasion chloride concentrations. The contamination is severe close to the landfill margin and appears to extend in dilute form towards the houses on Wellington Road.

3.34 Contaminated water from borehole 9 was sampled and analysed for Listed Substances found in leachate. Detections (apart from routinely monitored parameters) are summarised in Table 7.

Table 7: Summary of Listed Substance detections in Borehole 9

Substance	units	9D	9S
Nickel	mg/l	0.16	0.13
Lead	mg/l	0.08	<0.05
Diesel Range Organics	µg/l	< 10	612
Bis(2-ethylhexyl)phthalate	µg/l	104	<1
C9 -C13 Hydrocarbons	µg/l	1300	ND

The origin of the phthalate contamination is not known as it was not detected in leachate. The other contaminants (particularly the hydrocarbons) may originate from leachate though they may also include a contribution from the colliery spoil materials. In general it may be stated that Listed Substance contamination due to landfill leachate is low with the exception of the gross contamination already detected by routine monitoring.

3.35 In view of the above it is perhaps surprising that the two ponds to the north-west of the site are not affected; there have been occasional slight rises in individual indicator concentrations but no unambiguous indications of contamination in the ponds. The other surface water monitoring points are similarly unaffected, although the spring in Lydebrook Dingle has higher chloride concentrations and elevated chemical oxygen demand (taken to be due to decaying organic matter at the sampling location).

Evidence from monitoring data: landfill gas

3.36 A statistical summary of gas monitoring results for the period Nov 02 (when boreholes were installed for this investigation) and Apr 04 is presented in Figures 10 and 11, while selected time series records are included in Appendix 9.

3.37 Routine monitoring has for many years indicated gas migration over short to moderate distances (50 – 100 metres) from the site, particularly along the eastern margin. This includes detection of significant gas concentrations within the Croppings Farm opencast backfill on the outer (Croppings Farm opencast) side of the clay seal referred in 3.16 above.

3.38 Data from the newly installed monitoring points indicates gas migration to the east (as expected, but proved at greater depths: 9 to 18m below ground level, boreholes 37 and 38) as well as occasional migration to the north/ north-west (boreholes 32 and 33, but not significantly in 34 – 36).

3.39 Migration to the south-east, towards Croppings Farm is also now monitored with greater certainty (boreholes 29 and 30). No significant migration was noted in borehole 31, on the south-west boundary of the site.

3.40 No ambient air/ flare emissions monitoring has been conducted. These issues are outside the scope of this report.

4 RECEPTORS

4.1 Table 8 is a listing of identified receptors with an indication of their vulnerability to the two principal forms of contaminant hazard posed by the landfill.

Table 8: Inventory of receptors

Receptor	Vulnerability* to		
	Leachate	Landfill gas	
		Blw ground	Above grnd+
Staff working on site (monitoring personnel/ contractors)	High	Low/Mod	High
Unauthorised visitors to site	High	Low/Mod	High
Groundwater in colliery spoil	Low/Mod	Low	N/A
Groundwater in natural strata	Mod/High	Low	N/A
Shropshire Wildlife Trust site (established around ponds to NW)	High	Low	N/A
Other surface water features (see Appendix 10)	High	Low	N/A
Springs at SJ 675 062/ other groundwater discharges	High	Low	N/A
Groundwater abstractions (see Appendix 10)	High	Low/Mod	N/A
Surface water abstractions (see Appendix 10)	High	N/A	N/A
Properties# (along Wellington Rd., Woodhouse Farm, Croppings Farm)	Low/Mod	High	Low
Proposed new properties# (Lightmoor Urban Village)	Low/Mod	High	Low
Local residents	Mod	Low	High
General public outside site perimeter	Low	Low	Mod
Roads and associated services	Mod	Mod/High	N/A

* Note: vulnerability refers to the susceptibility of the receptor to harm. High vulnerability does not automatically imply high risk as this depends on the presence of a pathway.

'Properties' refers to buildings only. Residents themselves are considered separately.

+ Above-ground impacts are beyond the scope of this report.

4.2 Where receptor vulnerability is low, potential risk is by definition low. However where receptor vulnerability is moderate or high the presence of a significant pathway could create a risk of concern.

4.3 For leachate, the possibility of risk exists for personnel on site and nearby water features (with possible impacts on local residents or services). For below ground transmission of gas, the principle potential for risk relates to nearby properties (with possible impacts on services or on-site personnel). These are the areas considered further in the risk assessment.

5 QUALITATIVE RISK ASSESSMENT

Summary conceptual model

5.1 The conceptual model of the landfill which emerges from the data collected is of a bowl set in a substantial thickness of low to moderately permeable colliery spoil, lined with compacted colliery spoil, containing actively biodegrading waste including some 'Difficult' industrial wastes. Leachate levels are high (up to 7 metres above base) and leachate is strongly polluting, though not significantly contaminated with Listed Substances. Wastes are actively gassing. The fill is capped with low permeability material.

5.2 Underlying the colliery spoil are sandstones of Lower Coal Measures/ Lower Carboniferous age which are likely to have significant secondary permeability and contain groundwater flowing outwards from the site towards the valleys to the east, south and west. Laterally beyond the colliery spoil the natural strata comprise predominantly mudstones and coals (likely to include significant workings). To the east these strata are intercepted again by the further backfilled opencast void of Croppings Farm, with a compacted clay liner along the margin closest to the landfill.

5.3 Thus the principal below ground pathways for contaminant migration are seen to be:

1. Leachate migration down through the basal liner and colliery spoil into the underlying sandstone aquifer, and thence towards groundwater discharge zones.
2. Leachate migration laterally through the liner into colliery spoil, forming zones of contaminated perched groundwater which may eventually emerge to surface or recharge groundwater in the sandstones below.
3. Gas migration laterally through the liner and colliery spoil, potentially travelling through permeable strata or workings and emerging beneath sensitive receptors such as nearby properties.

5.4 A schematic representation of the conceptual model is given in Figure 12.

Risk assessment

5.5 Table 9 is a qualitative risk assessment of the landfill, based on the conceptual model outlined above and using the information presented under 'Source', 'Pathways' and 'Receptors' above. The table includes an assessment of the extent to which a risk has been realised if monitoring data is available to support this. Also included are recommendations for mitigation or monitoring for significant risks.

Source	Receptor at risk		Possible Pathway		Risk		Recommendations for
Description	Description	Vulnerability	Description	Mitigation	Realised?	Rating	Mitigation/ monitoring
Leachate	Staff and authorised/ unauthorised visitors on site	High	Direct contact with staff operating leachate extraction/ monitoring equipt. Spillage/vandalism to extraction system	Restricted access to site	Occasional splashing reported verbally by staff	High for staff if precautions not taken. Low for visitors (except deliberate damage)	Protection/ working practices for staff. Maintain access restrictions.
Leachate	Groundwater in colliery spoil	Low/Mod	Leakage through liner into colliery spoil	Limited resource, poor quality, not in use or likely to be used.	Detected by monitoring	Low	Continued monitoring (mainly as pathway rather than as receptor).
Leachate	Groundwater in natural strata	Mod/High	Leakage through liner and colliery spoil into underlying sandstone	Longer travel time. Aquifer not currently in use locally for abstraction.	Slight indications in monitoring results – not conclusive	Mod/ Low	Continued monitoring
Leachate	Surface water features/ Wildlife site	High	Migration through liner and groundwater/ overland flow to surface water	Travel time, attenuation in ground	Not detected by monitoring	Low/Mod for 2 ponds nearest site, Low for other features, Possibility of greater surface breakout if leachate levels rise.	Continued monitoring. Maintain extraction system.
Leachate	Properties	Low/Mod	Migration through liner and groundwater/ overland flow	No plausible pathways to properties	No	Low	None
Leachate	Local residents	Mod	Migration through liner and groundwater/ overland flow	No plausible pathways to properties	No	Low	None
Leachate	Roads/ Services	Mod	Migration through liner and groundwater flow	No plausible pathways to roads and services	No	Low	None
Landfill gas (below ground)	Staff and authorised/ unauthorised visitors on site	Low/Mod	Direct inhalation by staff operating leachate/gas extraction/ monitoring equipt. Damage to extraction system. Explosion.	Atmospheric dilution. Restricted site access.	Occasional verbal reports by staff of odour/ dizziness.	Mod for staff if precautions not taken. Low for visitors (except deliberate damage)	Protection/ working practices for staff. Maintain access restrictions.
Landfill gas (below ground)	Groundwater abstractions	Low/Mod	Migration through liner and underground strata/ workings	No boreholes/ wells recorded nearby	No	Low	None
Landfill gas (below ground)	Properties	High	Migration through liner and underground strata/ workings	Travel distance	Significant migration detected (50m) but not detected at properties since extraction system installed	Mod. Could rise to High if extraction system failed.	Continued monitoring. Maintenance of extraction system.
Landfill gas (below ground)	Roads/ Services	Mod/High	Migration through liner and underground strata/ workings. Service runs could themselves become a pathway to properties.	Travel distance. Only enclosed spaces vulnerable.	Significant migration detected (50m) but not detected in enclosed spaces since extraction system installed	Low. Could rise to Mod if extraction system failed.	Continued monitoring. Maintenance of extraction system.

Table 9 : Qualitative risk assessment

5.6 The most significant identified risk relates to offsite migration of landfill gas into surrounding strata, some of which are permeable and may contain coal workings, and consequent impacts on nearby properties (primarily residential). A considerable amount of monitoring data is available to show that existing properties have not been significantly affected since effective gas control measures were installed. Some of this data is also relevant in assessing the risk to proposed new properties.

5.7 Landfill gas risks are to some extent dependent on the satisfactory functioning of the gas control system. The effects of failure are uncertain but are likely to include an increased risk to properties and possibly services.

5.8 Another significant risk is posed to authorised or unauthorised personnel on the site who may come into direct contact with leachate or landfill gas. Persons not handling the gas/leachate extraction equipment are at little risk, but inappropriate handling could lead to a high risk.

5.9 There are also long-term risks of leachate contamination of water bodies (groundwater or surface water). The most immediate is the potential for contaminated groundwater (observed in colliery spoil at the north end of the site) to enter the Large or Small Pond which form part of the wildlife site, though this has not occurred to date. More distant water bodies are less at risk due to the potential for attenuation.

6 CONCLUSION:

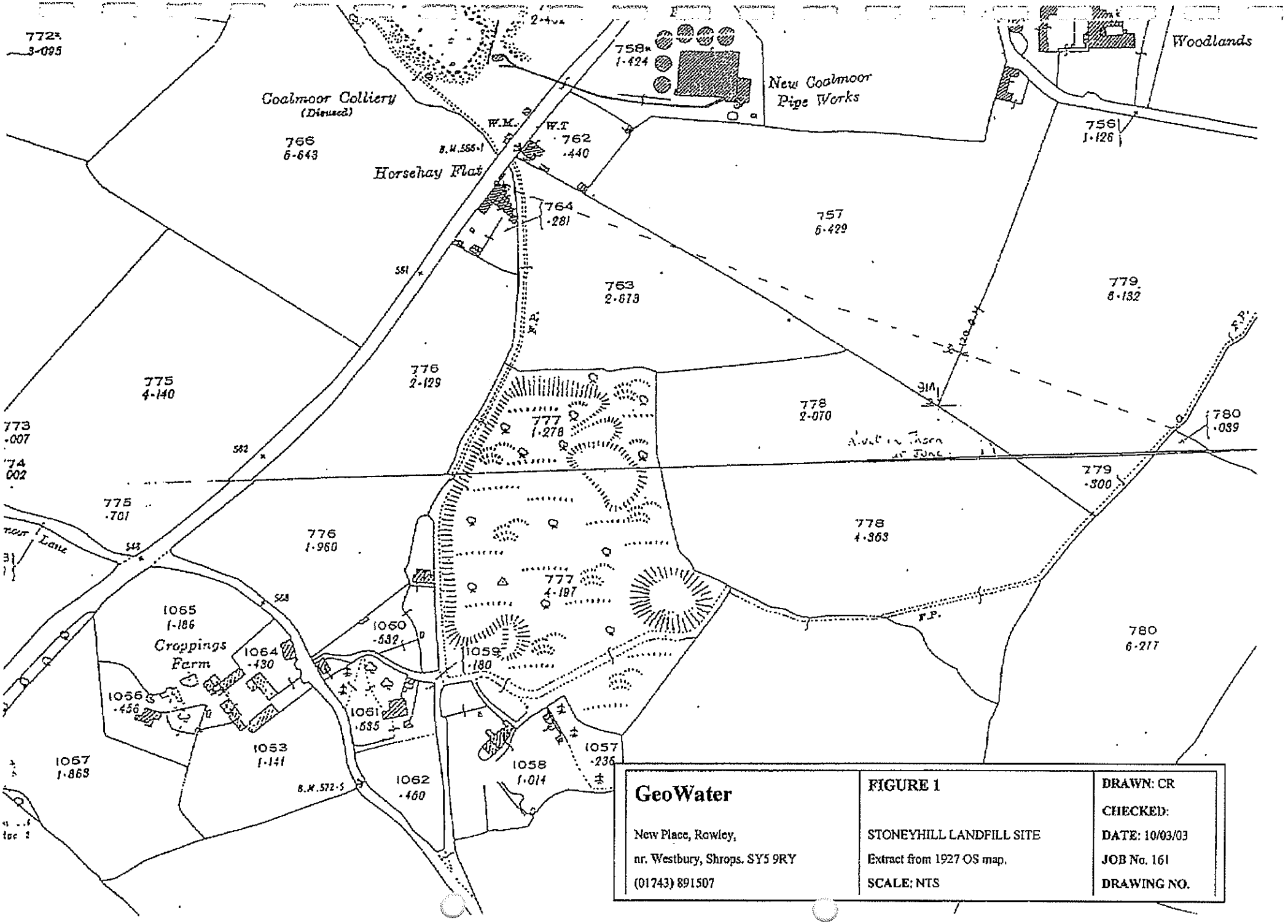
6.1 A qualitative assessment of below-ground contaminant risks posed by Stoneyhill landfill site has been carried out and is summarised in Table 9. Recommendations for risk management include:

- Continued monitoring of leachate, groundwater, surface water and landfill gas inside and outside the site.
- Maintenance of the gas and leachate extractions systems. This includes renewing/ upgrading these as appropriate.
- Adoption of working practices and equipment to protect staff working with leachate/ gas extraction systems.
- Maintain restrictions to site access.

6.2 This report is based in part on information supplied by others and in part on results of site investigation. Both these data sets are incomplete in the sense that further information may come to light which results in a revision of the conceptual model for the site. No liability can be accepted for inaccuracies in information supplied by others.

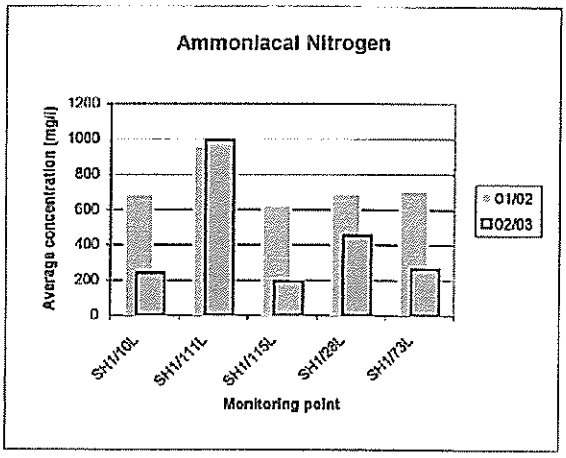
6.3 This report is written for the sole use of Telford & Wrekin Council to assist in addressing concerns raised by Contaminated Land legislation for Stoneyhill landfill site. No liability can be accepted for its use for other purposes or by other parties.

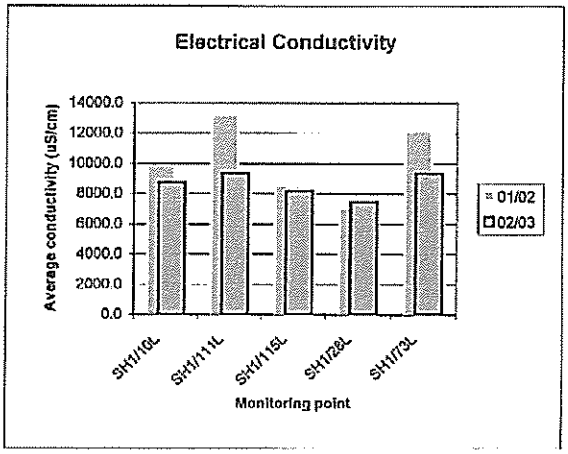
FIGURES

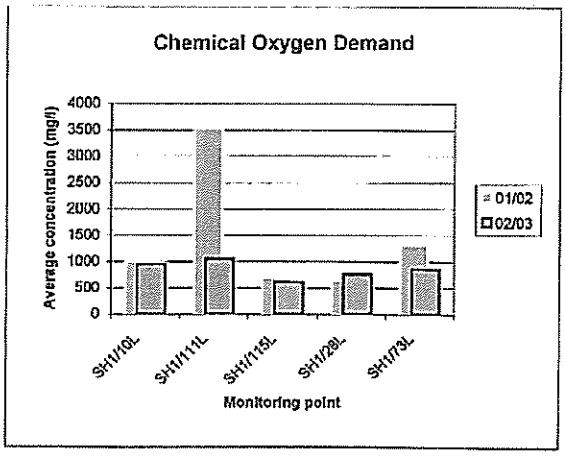


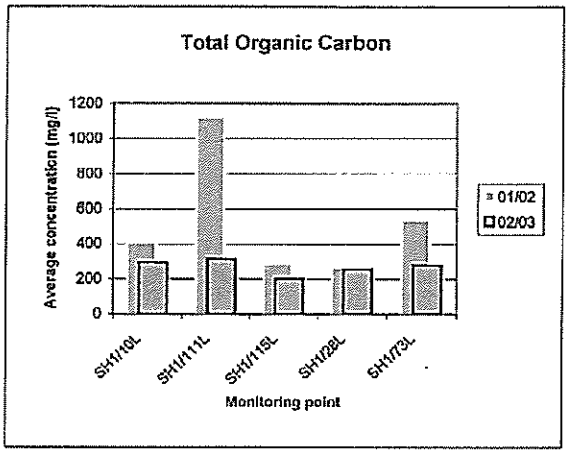
GeoWater	**FIGURE 1**	DRAWN: CR
		CHECKED:
New Place, Rowley,	STONEYHILL LANDFILL SITE	DATE: 10/03/03
nr. Westbury, Shrops. SY5 9RY	Extract from 1927 OS map.	JOB No. 161
(01743) 891507	SCALE: NTS	DRAWING NO.

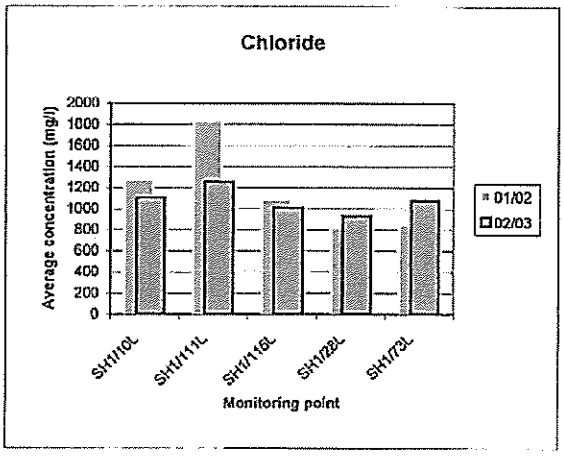
STONEYHILL LANDFILL SITE
LEACHATE QUALITY

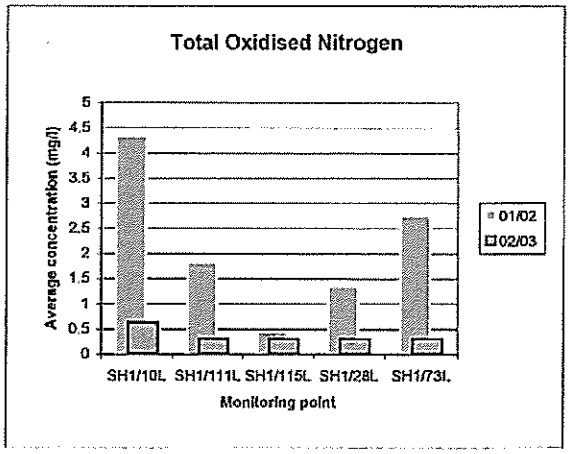






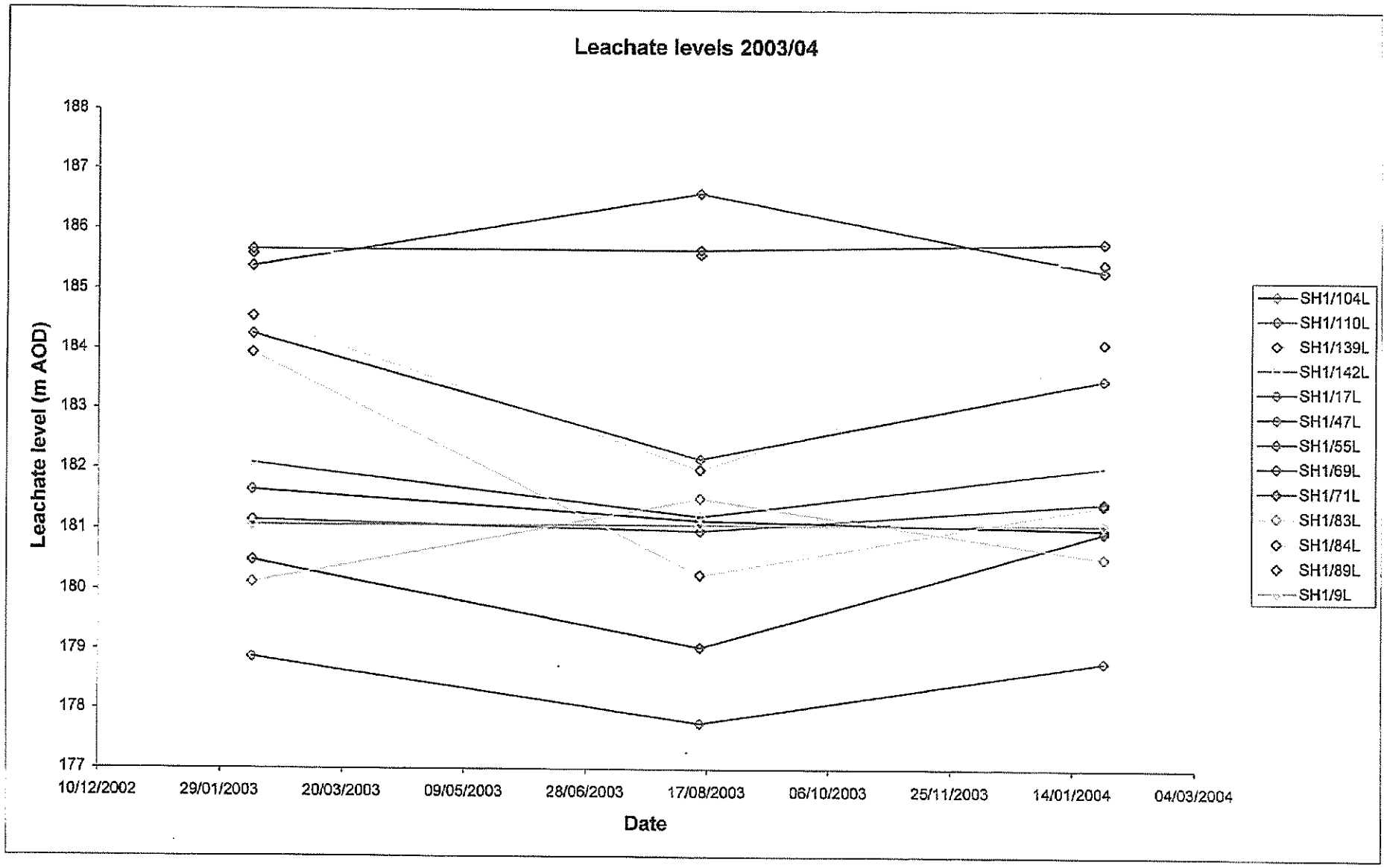






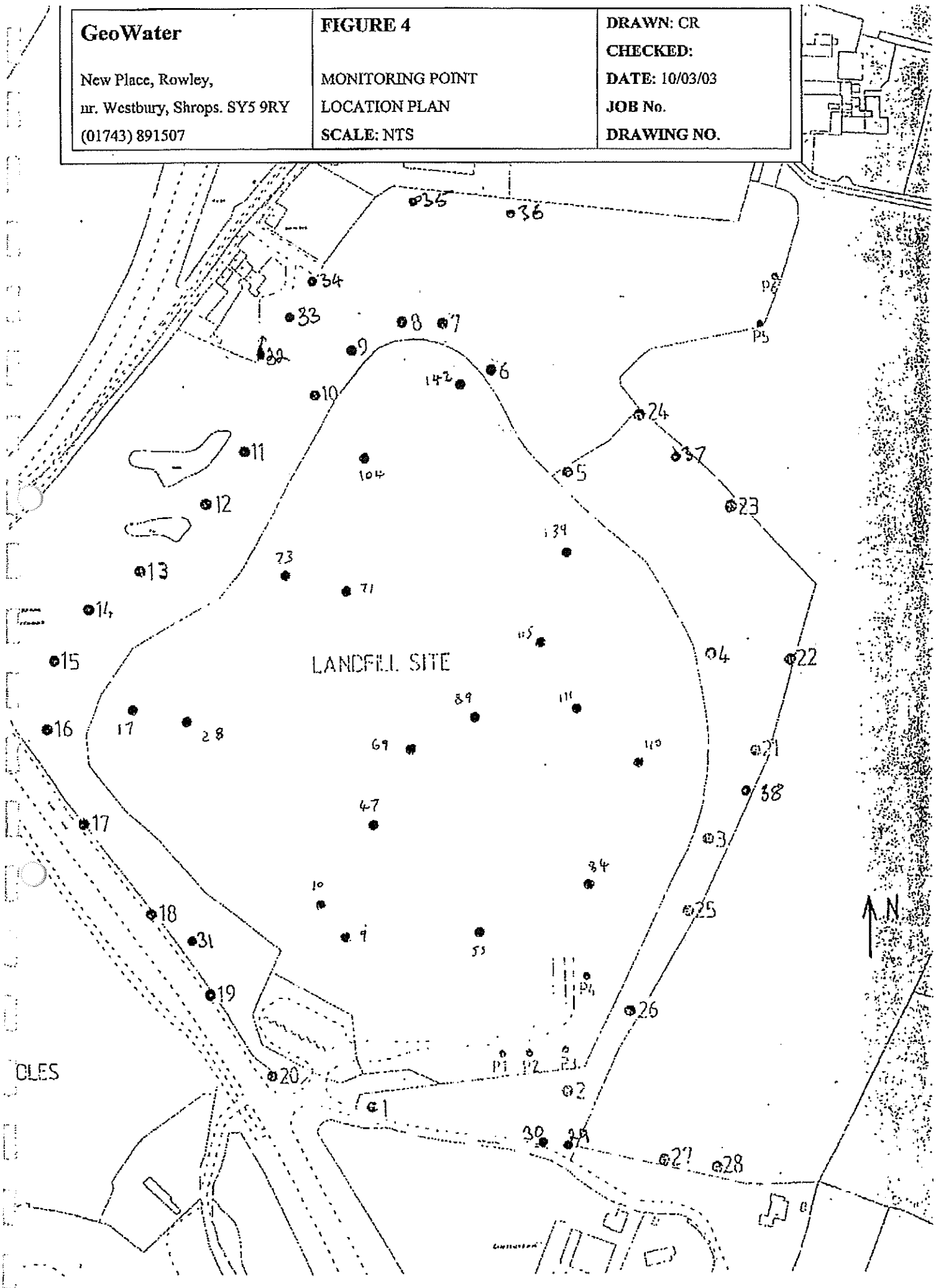
GeoWater

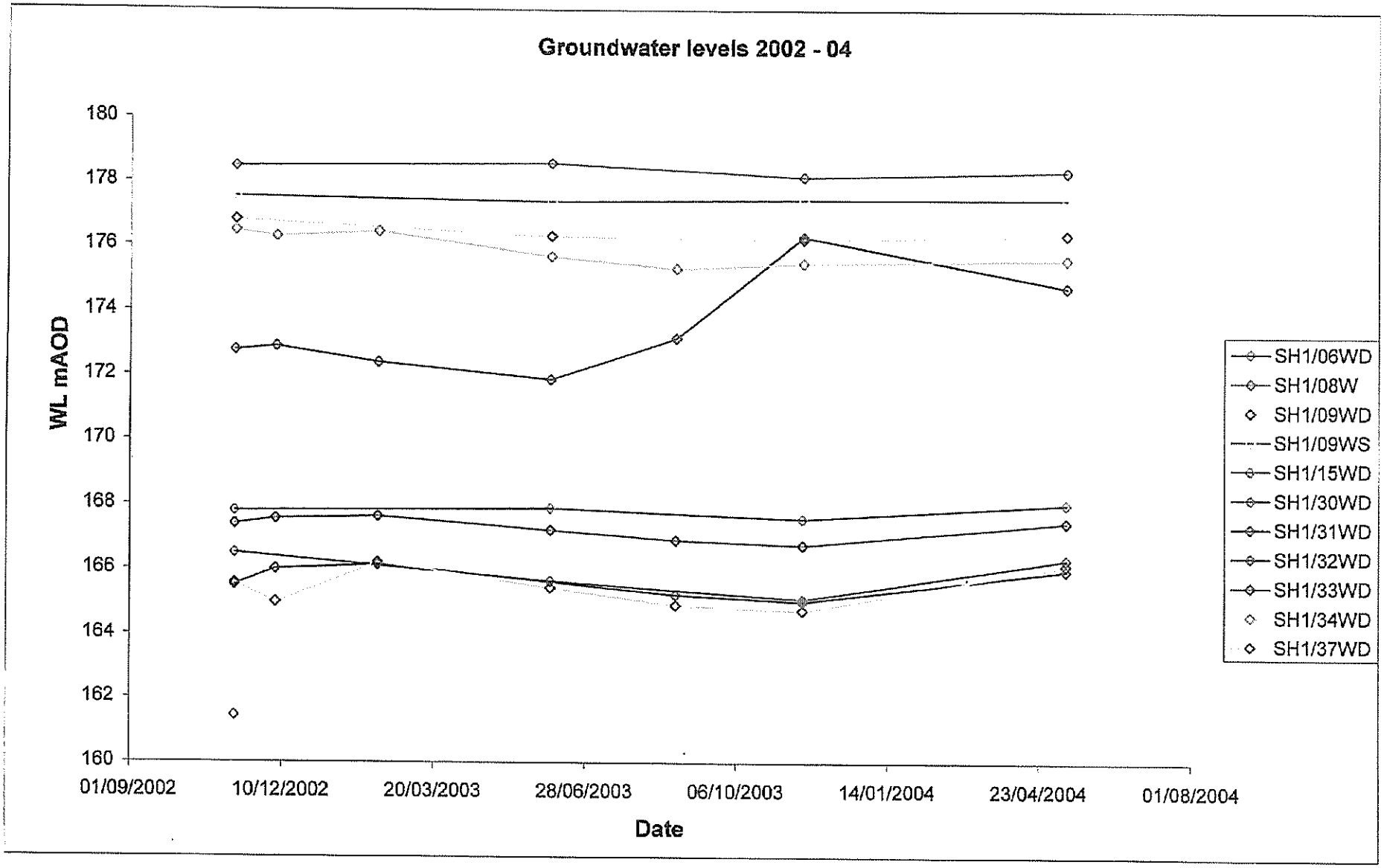
FIGURE 2



GeoWater

FIGURE 3

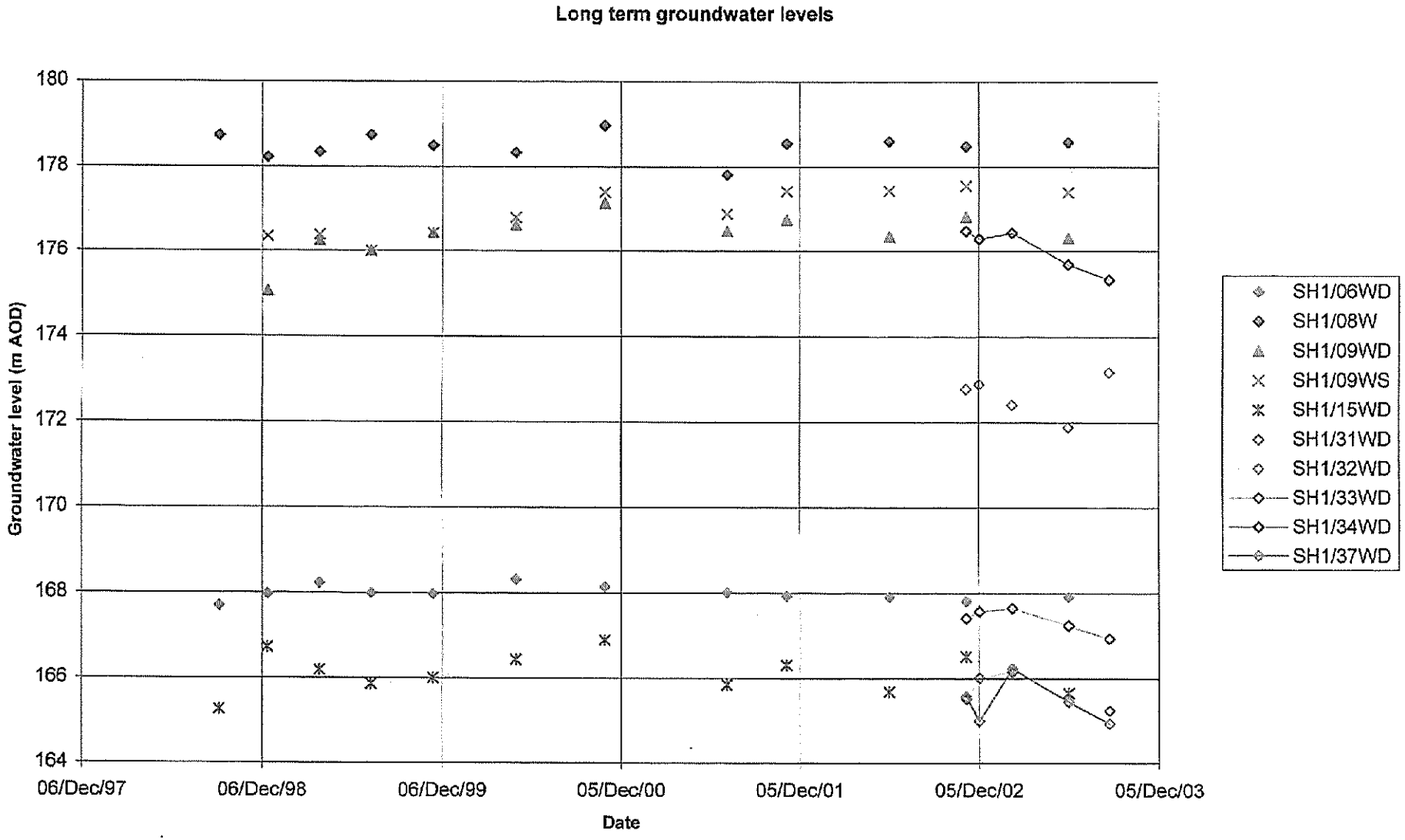

GeoWater
New Place, Rowley,
nr. Westbury, Shrops. SY5 9RY
(01743) 891507
FIGURE 4
MONITORING POINT
LOCATION PLAN
SCALE: NTS
DRAWN: CR
CHECKED:
DATE: 10/03/03
JOB No.
DRAWING NO.
LANDFILL SITE
N
35
36
34
33
8
7
32
9
6
10
142
24
11
104
5
37
12
23
13
73
71
139
14
15
115
4
22
16
17
28
89
111
69
110
21
38
47
3
17
84
10
25
18
31
9
55
19
26
P1
P2
P3
P4
P5
P6
20
2
1
30
29
27
28



GeoWater

FIGURE 5

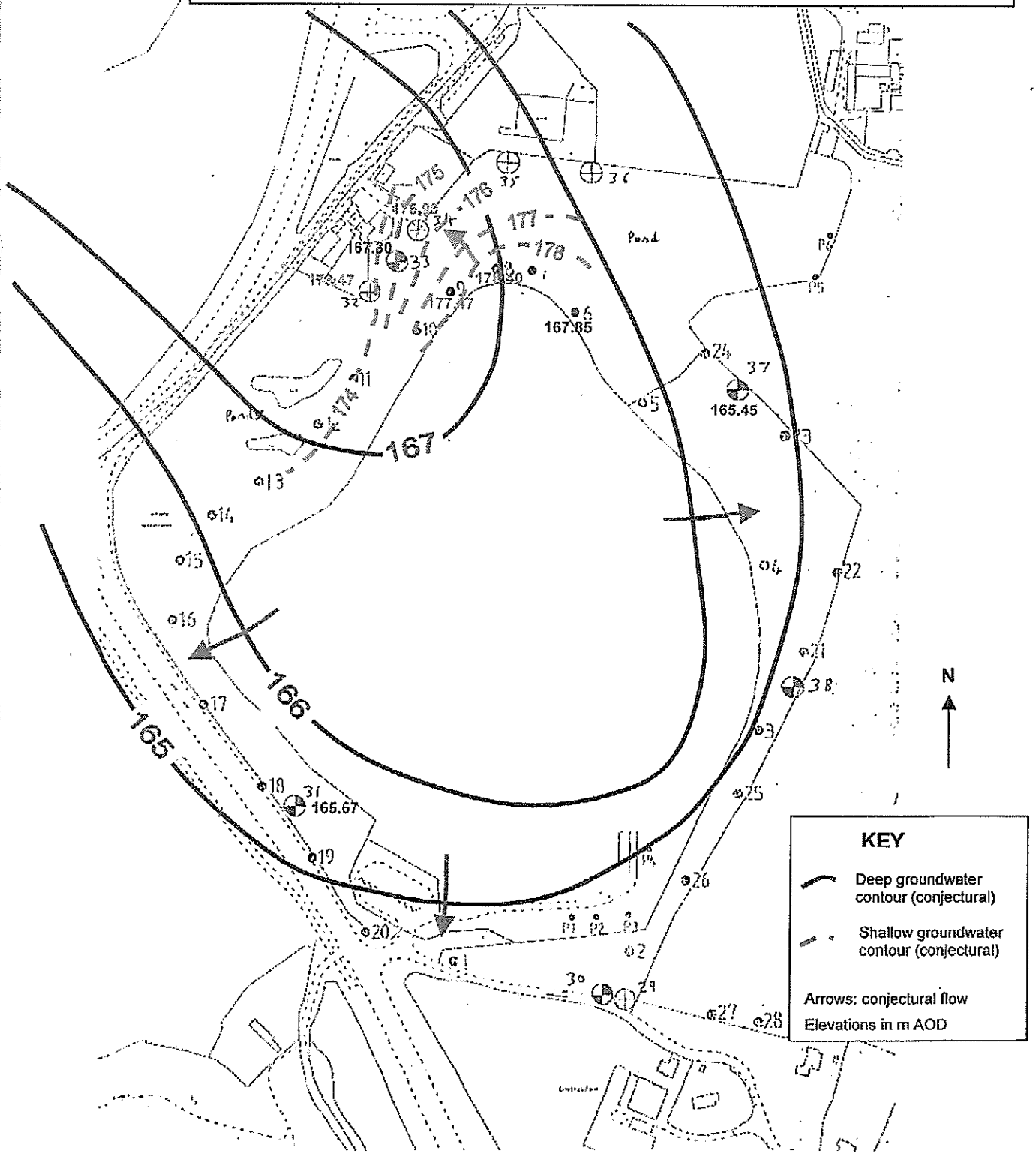
STONEYHILL LANDFILL SITE

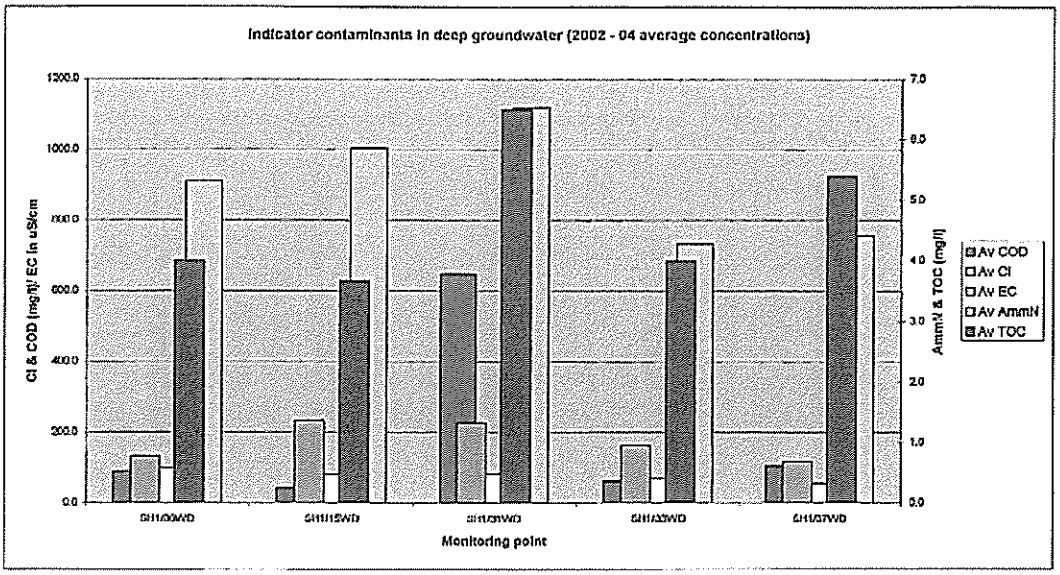


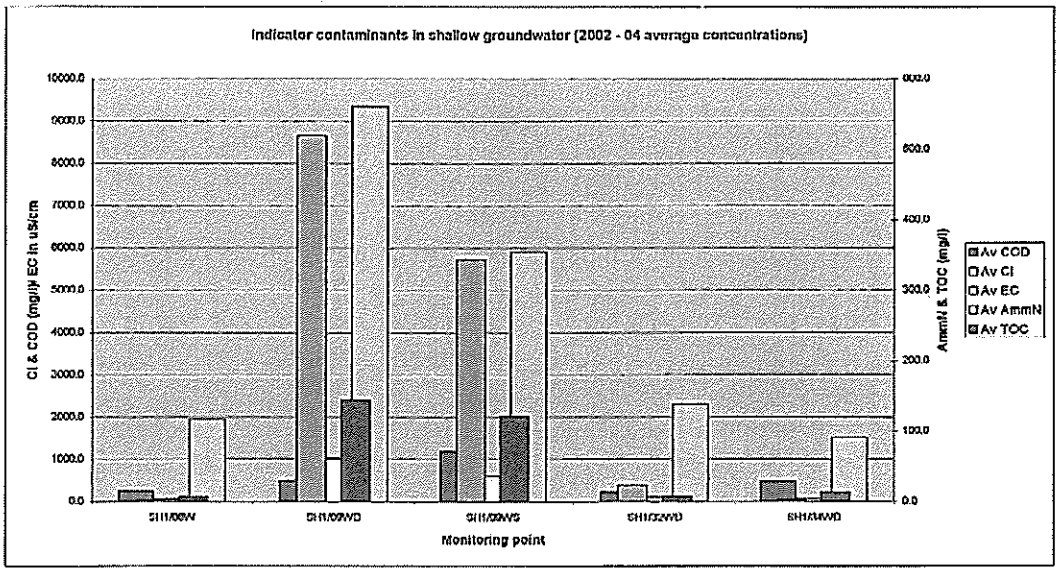
GeoWater

FIGURE 6

GeoWater	FIGURE 7	DRAWN: CR
		CHECKED:
New Place, Rowley,	CONJECTURAL GROUNDWATER	DATE: 10/06/03
nr. Westbury, Shrops. SY5 9RY	CONTOURS	JOB No. 161
(01743) 891507	SCALE: NTS	DRAWING NO.







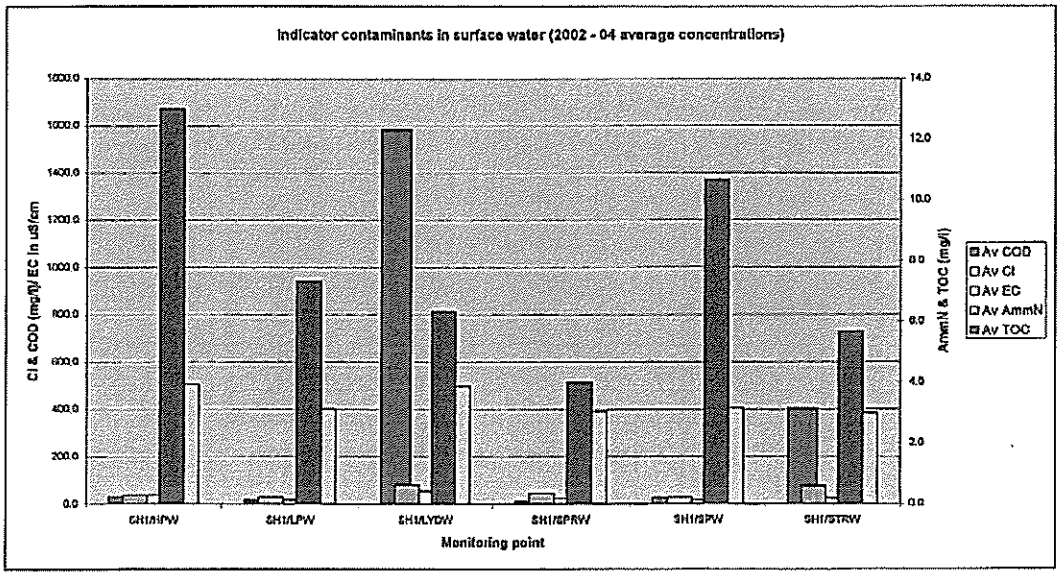
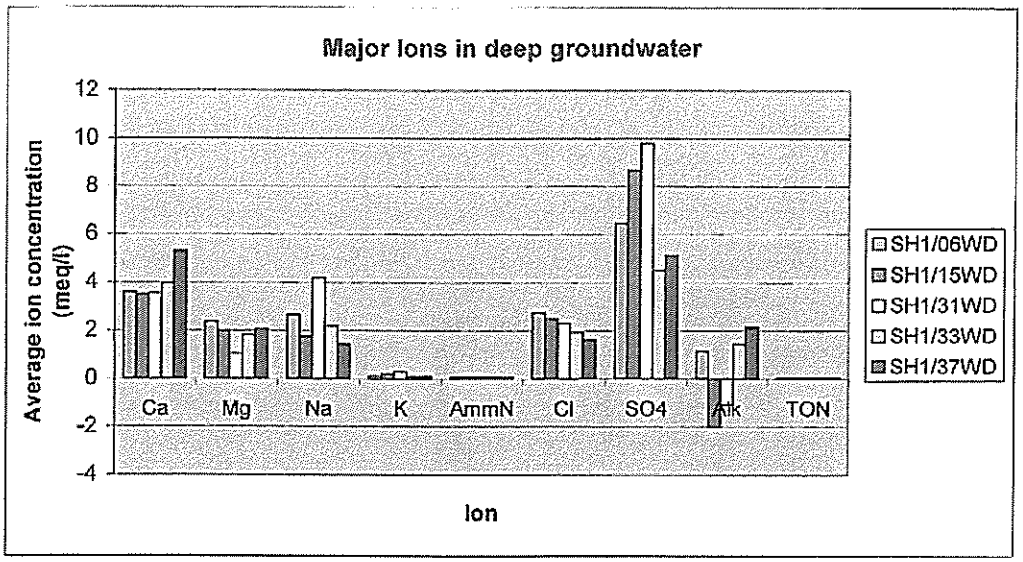
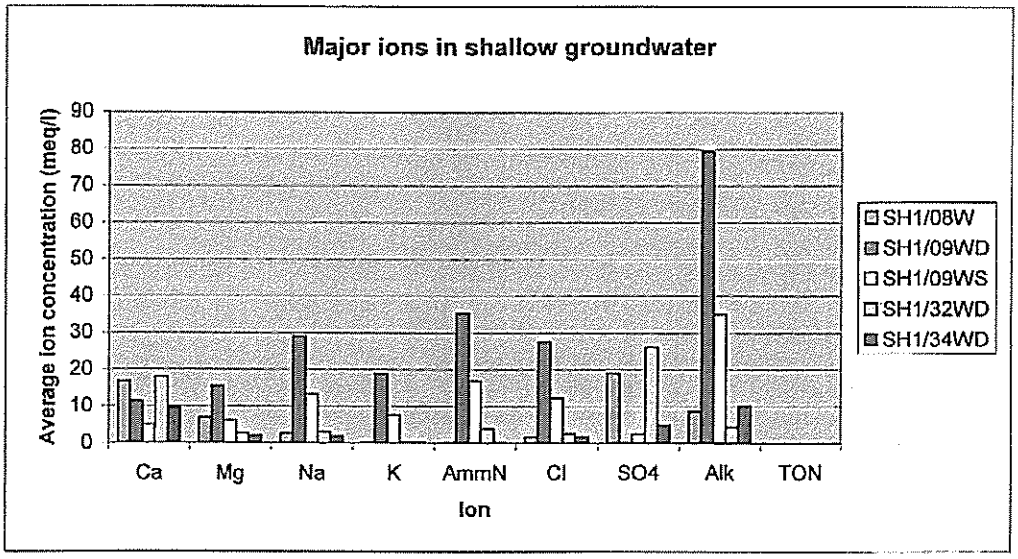


FIGURE 8
CONTAMINANT CONCENTRATIONS IN WATER
(note scales)





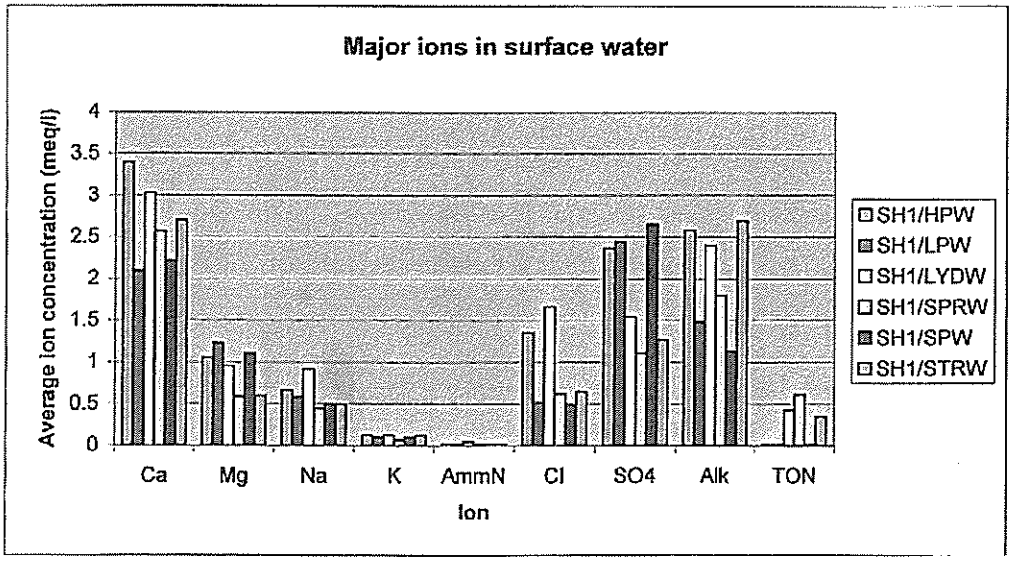
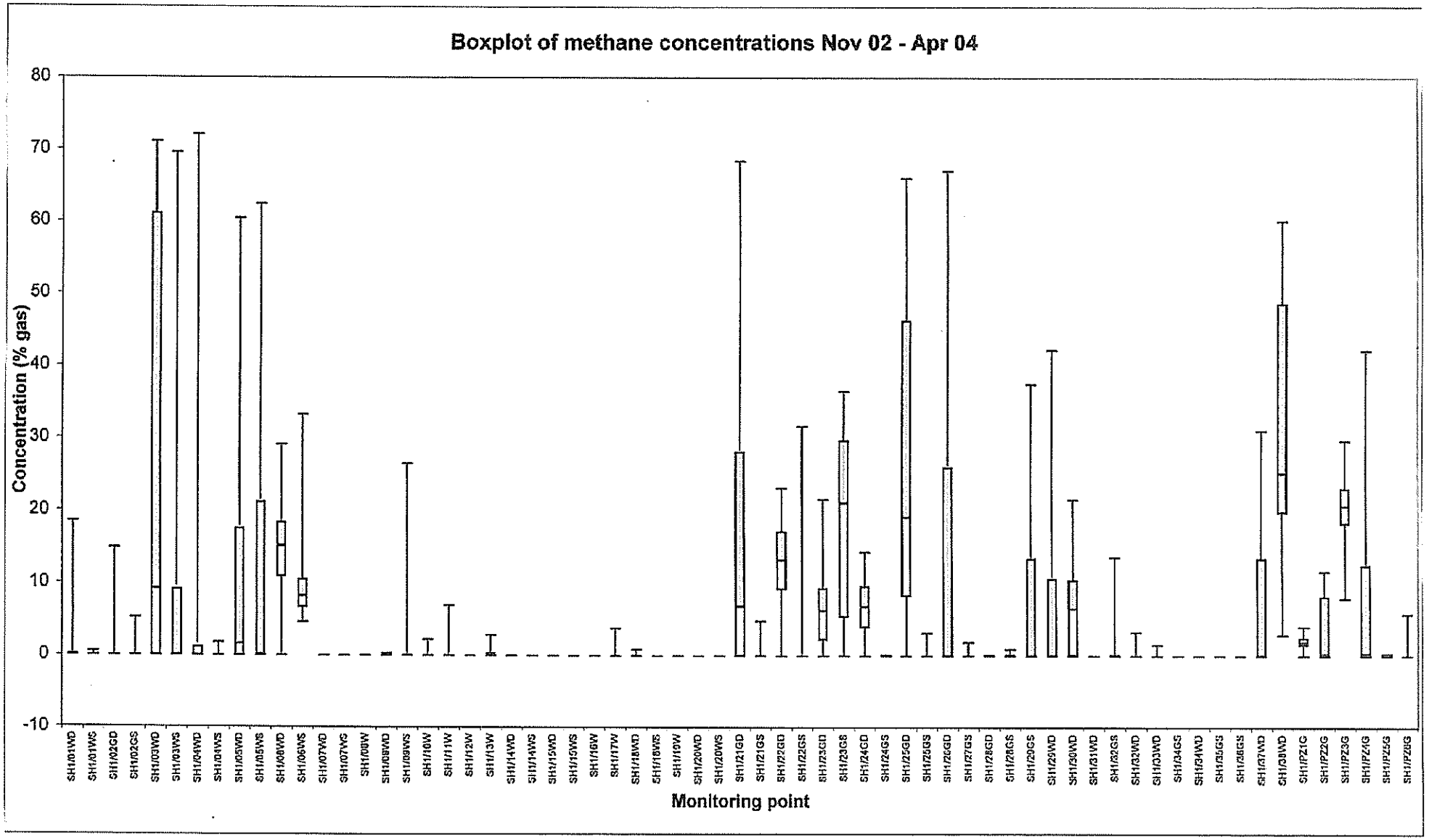


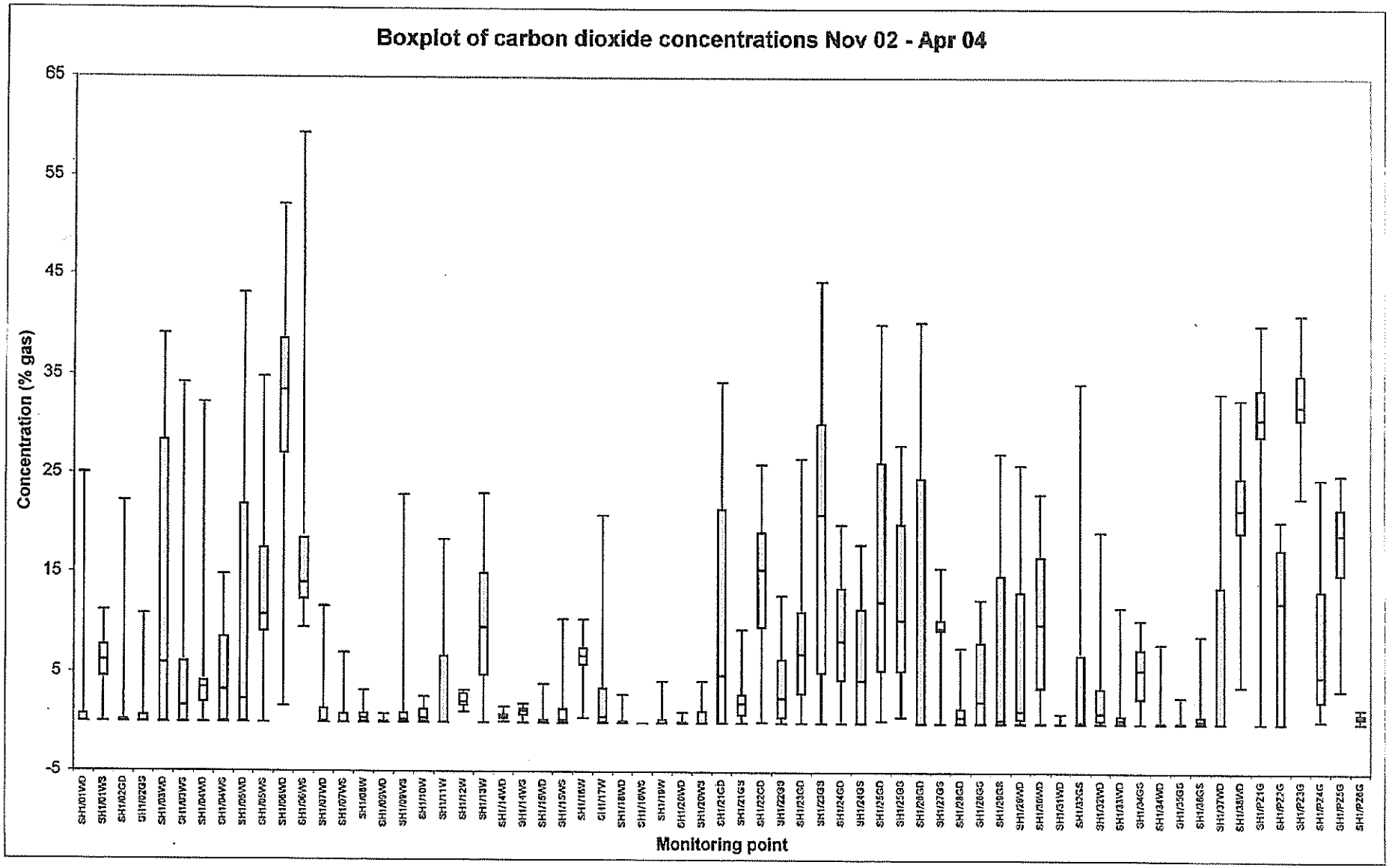
FIGURE 9
MAJOR ION CONCENTRATIONS IN WATER
(note scales)



GeoWater

(Boxplot shows range, median, first and third quartile concentrations)

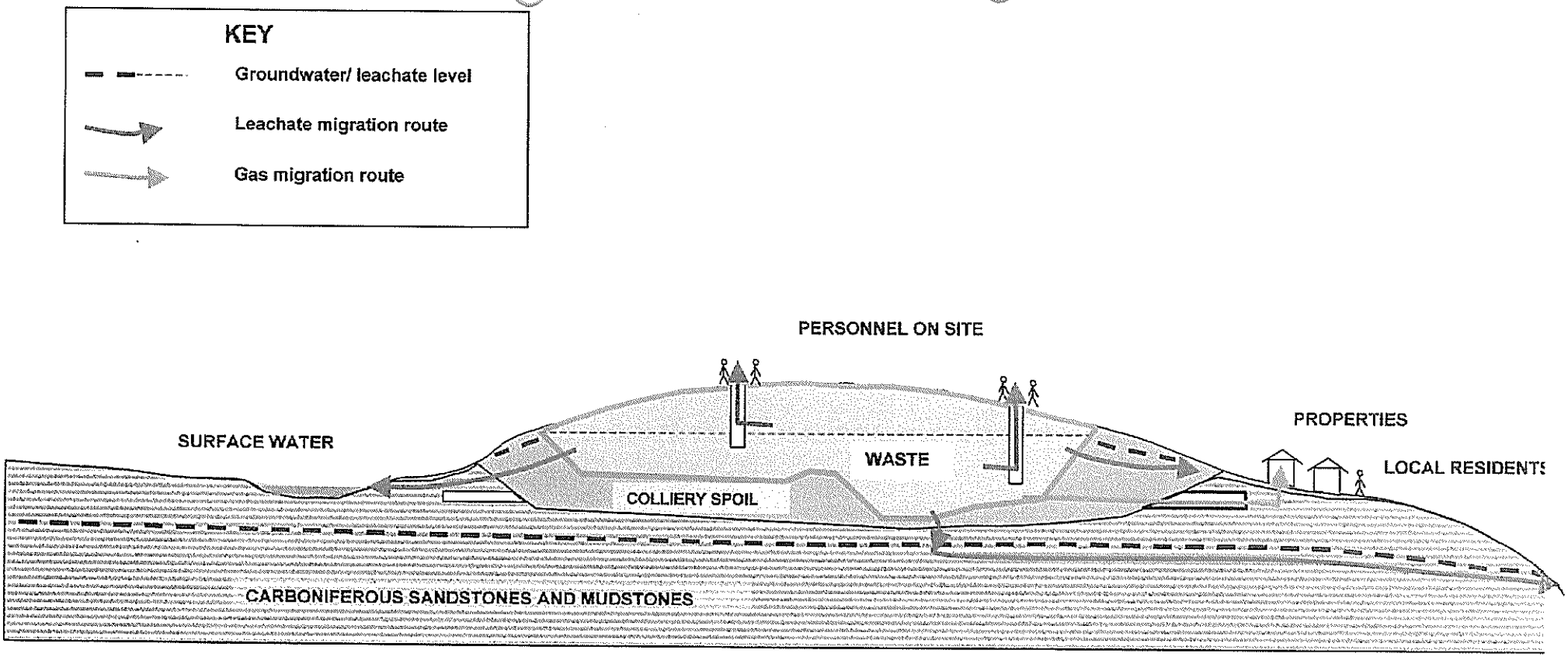
FIGURE 10
METHANE STATISTICS



GeoWater

(Boxplot shows range, median, first and third quartile concentrations)

FIGURE 11
CARBON DIOXIDE STATISTICS



GeoWater New Place, Rowley, nr. Westbury, Shrops. SY5 9RY (01743) 891507	**FIGURE 12** Stoneyhill landfill site Schematic diagram showing conceptual model **SCALE:** NTS	**DRAWN:** CR **CHECKED:** **DATE:** 16/06/04 **JOB No.** 161 **DRAWING NO.**

GeoWater

Environmental Geology

New Place, Rowley, Nr. Westbury, Shropshire SY5 9RY

Tel (01743) 891507 Fax (01743) 891160

ASSESSMENT OF CONTAMINANT RISKS POSED BY STONEYHILL LANDFILL SITE

VOLUME 2: APPENDICES

161/R30 May 04

Telford & Wrekin Council

APPENDIX 1

NATIONAL COAL BOARD REPORT

National Coal Board
Western Area, Staffordshire House
Berry Hill Road, Stoke-on-Trent ST4 2NH
Telephone: 0782 48201
Telex: 882161 (CBHOB G)
'Station Code' WES
This matter is being dealt with by R. Brownsword Esq.
Survey Department

JDB

NCB

Our ref: SR1498733 33/6606/95
Your ref: GKS

County Planning Officer,
Shropshire County Council,
The Shirehall,
Abbey Foregate,
Shrewsbury.
SY2 6ND

County Planning Dept.
25 JUN 1984

Date: 22nd June, 1984

Dear Sir,

Coal Mining Report
Revised Scheme for the Disposal of Household, Industrial & Commercial Waste
Stoneyhill, Telford

I refer to your enquiry dated 12th June, 1984, in connection with the above.

UNDERGROUND COALMINING UNDER AND IN THE VICINITY OF THE PROPERTY

Past Mining

Seams of coal at shallow to very shallow depths have been worked under the site, the last date of working being in the early 1900's.

Present Mining

There are no active workings taking place within influencing distance of the site.

Future Mining

Some coal exists unworked in this locality although the possibility of future working is considered unlikely.

Additional Information

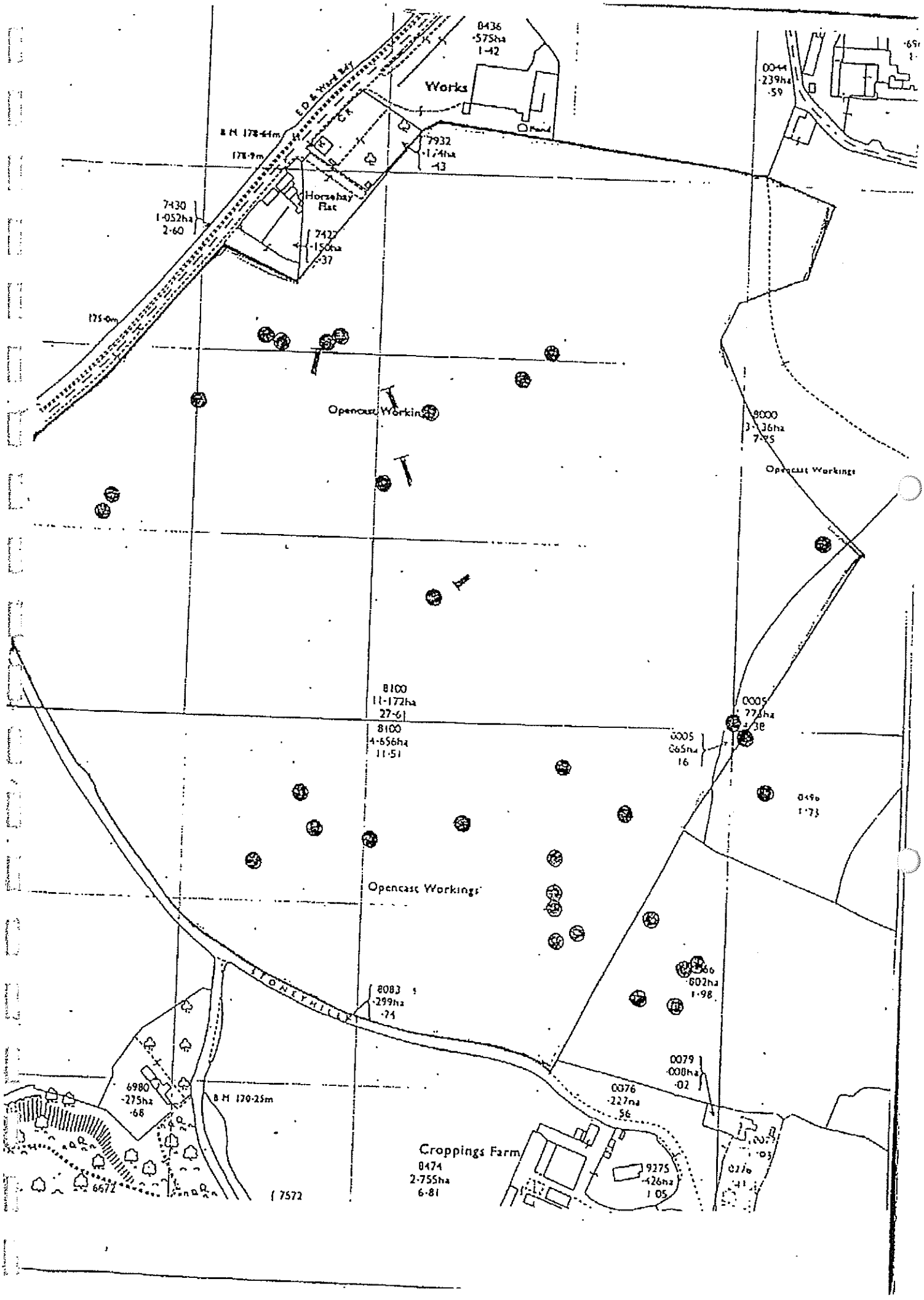
I would point out that our records indicate that 33 disused mineshafts and four adits are situated within and adjacent to the site. The shallow workings, to a depth of 50ft. below rock head, and the disused mineshafts and adits have been ~~made~~ sent to the Telford Development Corporation and it is recommended that you contact them for any information regarding treatment of the disused mineshafts and adits.

OPENCAST MINING IN THE VICINITY OF THE SITE

In addition to underground mining operations, the Board also prospect for and work coal by opencast methods.

../..

EL/5


Works
8436
·575ha
1·42
E.D.& Ward Bdy
C.R.
B.M. 178·44m
178·9m
7932
·174ha
·43
Horsehay Flat
7430
1·052ha
2·60
7422
·150ha
·37
175·0m
Opencast Workings
8000
3·36ha
7·95
Opencast Workings
8100
11·172ha
27·61
8100
4·656ha
11·51
0005
·665ha
16
0005
·77·8ha
·38
0496
1·73
Opencast Workings
8083
·299ha
·74
0066
·602ha
1·98
0079
·008ha
·02
0076
·227ha
·56
6980
·275ha
·68
B.M. 170·25m
6672
7572
Croppings Farm
8474
2·755ha
6·81
9275
·426ha
1·05

STONEYHILL SHAFT DETAILS

1: 2500 33/6606

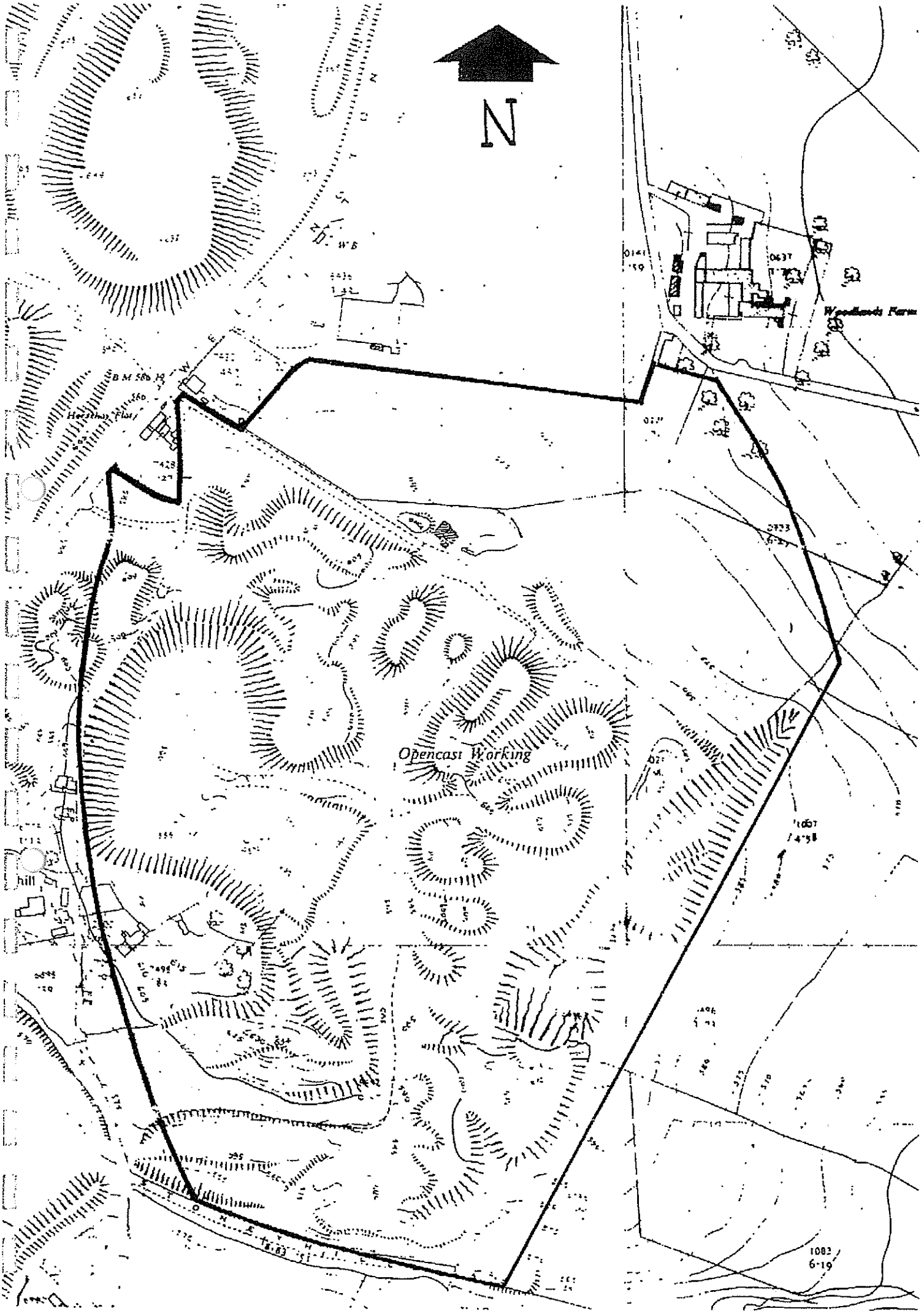
O.S. County Sheet Reference	National and Reference	Depth	Remarks
Shropshire 43/10.80	60		Conveyed to T.D.C 13.6.77
1: 2500 33/6605 O.S County Sheet Reference	National Reference	Depth	Remarks
XL111/10.77	8	apprx. 10m.	Conveyed to T.D.C
" 84	9	"	" " "
" 85	11	"	" " "
" 73	14	"	" " "
" 63	16		" " " 1.7.70
" 89	21		" " " "
" 86	22		" " " "
" 87	23		" " " "
" 88	24		" " " "
1: 2500 33/6705			
O.S County Sheet Reference	National and Reference	Depth	Remarks
XL111/10.82	1	apprx. 10m.	Conveyed to T.D.C 1.7.70

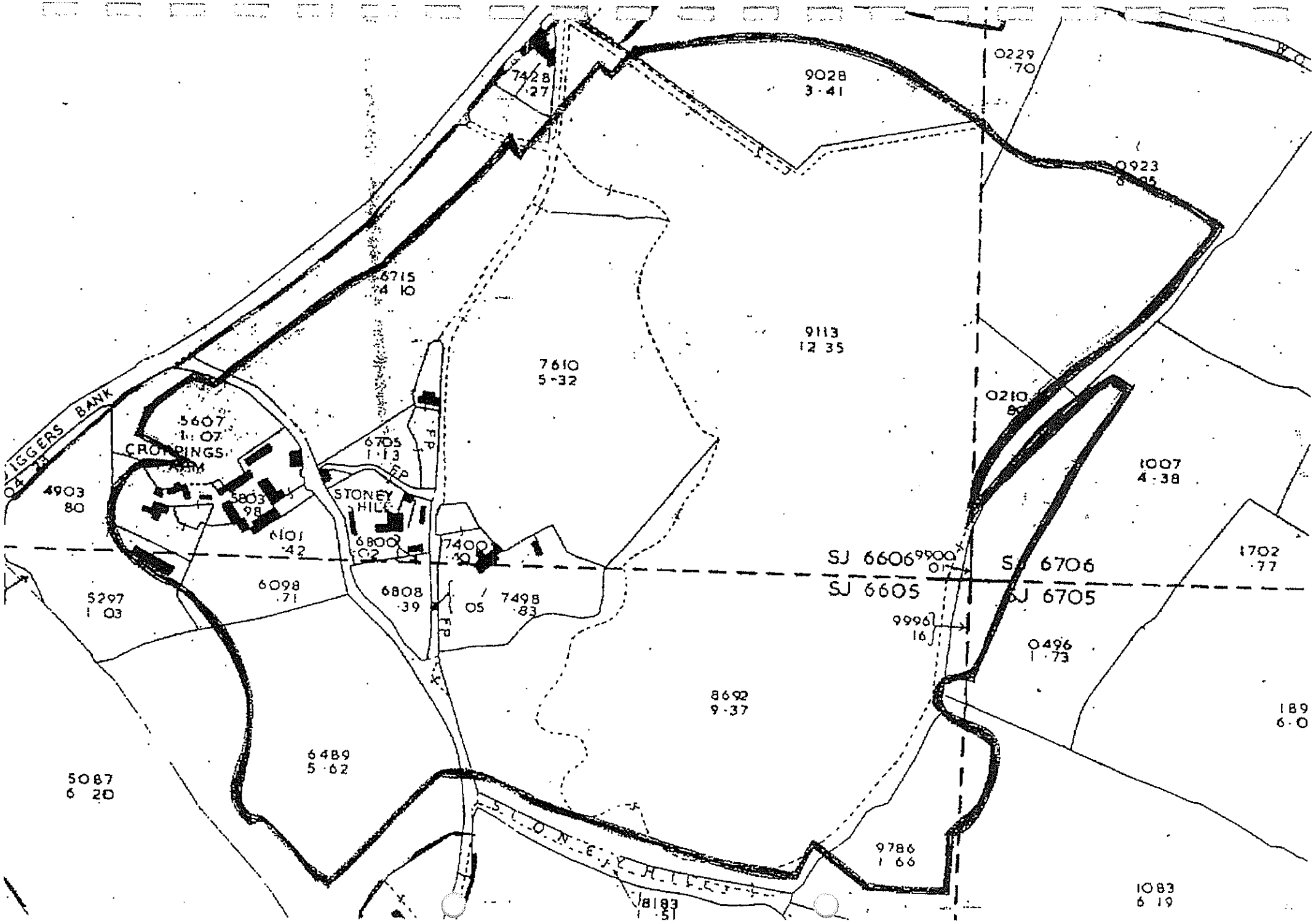
20.11.89

JC/CC

APPENDIX 2

PLANS SHOWING STONEYHILL OPENCAST BOUNDARY


N
Opencast Working


7428
·27
9028
3·41
0229
·70
0923
6715
·4 10
9113
12 35
7610
5·32
0210
5607
1·07
CROPPINGS
6705
1·13
FP
FP
STONEY
HILL
4903
80
5803
·98
6101
·42
6800
·02
7400
·10
1007
4·38
SJ 6606
SJ 6605
SJ 6706
SJ 6705
9996
·01
9996
16
1702
·77
0496
1·73
5297
1·03
6098
·71
6808
·39
05
7498
·83
FP
8692
9·37
189
6·0
6489
5·62
5087
6 20
9786
1 66
8183
1·51
1083
6 19

APPENDIX 3

SEVERN TRENT WATER RESPONSE TO CONSULTATION ON PROPOSED LANDFILL AND COPY OF WASTE DISPOSAL RESOLUTION

SEVERN TRENT WATER

Severn-Trent Water Authority
Abelson House
2297 Coventry Road
Sheldon
Birmingham
B26 3PU.
Telephone: 021-743 4222
Telex: 339333

My Reference: RCH/JEB/S/W/18

Your Reference: A25/3//SL/CC/12
CM/CC

12 November 1984

Dear Sir

Control of Pollution Act 1974 Part 1. Stoneyhill Horsehay Telford

I refer to the above Waste Disposal Site licence consultation and have the following comments on the draft Resolution:-

(i) Condition 17 refers to contaminent areas, the location and dimensions of which have been previously specified. Such specifications should be determined from the results of detailed water balance calculations. The material available on site for lining and capping purposes would appear to be rather variable in suitability. I would request that strict quality control is carried out on the materials to be used. It is assumed that the internal bund walls within each phase will also be constructed of low-permeability material. This is vital in relation to inter-phase boundaries where there should be no transmission of leachate into untipped areas in order that the clean water drainage remains uncontaminated.

(ii) Condition 21. If the surface water drainage system from each phase is to be kept open until the final contaminent area is ready for tipping, it is vital that no tipped material is allowed to enter the system. I would be pleased to receive details of the precautionary measures that you propose to prevent windblown wastes and overspill from entering surface water drains and would request that an additional Condition be added to take account of this.

The disconnection referred to in Condition 21 should be total and not just a superficial covering of connecting pipework, which could become re-activated.

(iii) Condition 34 states that certain difficult wastes will be deposited in specially reserved areas. These areas must be specifically identified on a plan and I should wish to know the precautions proposed to ensure their isolation.

When telephoning or writing please contact

R C Harris Ext 2286

County Surveyor
Shropshire County Council
The Shirehall
Abbey Foregate
SHREWSBURY
SY2 6ND

JEBAAN

(iv) In order to comply with Conditions 36 and 37 it is assumed that the person identified in Condition 10 will have the equipment and ability to check Q40 wastes and interpret the results so obtained. I would be grateful if you would confirm this.

(v) Condition 39 refers to monitoring leachate levels within contaminent areas. This should be carried out weekly and I would request that results are made available to the Authority. At least one monitoring point within each phase should project above the final capping layer to provide a continual check on leachate levels.

(vi) Relating to (v) above, Condition 43 should additionally specify a level above which leachate must not rise. A level at least two metres below the lowest lip of the site would be satisfactory and from study of Drawing No 929/10/2 it would seem that 177m AOD would be a reasonable figure. This should be referred to in Condition 43 and a phrase added to the effect that leachate must be removed for appropriate disposal should this level be reached. This may require some re-wording of Condition 44.

(vii) The capping referred to in Conditions 56 and 57 should be subject to the same specification and checks as have been detailed in Conditions 17, 18 and 19 for the lining. Again the quality control of the capping material is vital and the County Council should ensure that the works are supervised by a qualified and experienced engineer. I would be grateful for your confirmation that this requirement will be met.

(viii) The outlet from the surface water balancing/settlement pool should be fitted with a scumboard/screen to prevent windblown material from entering the sewerage system. The discharge from the site will require the Authority's formal consent. Application should be made to Mr R J Harvey at our Shrewsbury office for the appropriate forms.

(ix) Drainage from the civic amenity area is likely to be contaminated and if connected to the surface water drainage system could well prejudice your ability to discharge all surface waters from the site. You should therefore investigate an alternative means of dealing with the water arising on the relevant area of the civic amenity area.

I look forward to your comments on the points raised above.

Yours faithfully

R. C. Harris

pp R G Sharp
Regional Manager
Resources and Rivers

A25/30/SL/CC/12

SHROPSHIRE COUNTY COUNCIL

Control of Pollution Act, 1974 Waste Disposal Resolution

Stoneyhill Waste Disposal Site, Horsehay, Telford

The Highways Sub-Committee at its meeting on the 14th November, 1984 resolved that pursuant to Section 11 of the Control of Pollution Act 1974 the Council's landfill site known as Stoneyhill, Horsehay, Telford, Shropshire (hereinafter called the 'site') be used by the Council as land on which to deposit controlled waste specified in the Appendix to this Resolution (and) to use plant and equipment for the purpose of disposing of controlled waste or of dealing in a prescribed manner with controlled waste in accordance with the conditions appended hereto.

The reasons for the Council's decision to impose conditions on the use of the site for the operations hereby resolved are:-

to ensure that waste disposal is conducted with no unacceptable risk to the environment and to public health, safety and amenity.

This Resolution does not purport to convey any approval or consent which may be required under any enactment other than Section 11 of the Control of Pollution Act, 1974 (in particular the Health and Safety at Work, etc., Act, 1974, the Radioactive Substances Act, 1960 and planning, water protection and environmental health legislation).

Signed ..... Date 19th November 1984

County Secretary

1. The site will be operated in accordance with the conditions specified herein and drawings numbers 929/01/1, 929/10/2, 929/11/5, 929/13/5 and 929/20/1 unless subsequently modified by the Highways Sub-Committee.

2. Only those types of waste specified in the Schedules of the attached Appendix will be deposited at the site.

3. Notwithstanding the generality of Condition (2) wastes specified on Schedule B of the Appendix attached to this Resolution will only be disposed of in intimate admixture with waste specified on Schedule A of the Appendix in such proportions that in any one calendar month period:-

   (i) The weight ration of Schedule A to Schedule B waste co-deposited will not be less than 5:1.

   (ii) The weight ratio of Schedule A wastes (categories (i) (a) and (iii) (a)) to Schedule B wastes of a liquid or mobile physical state, co-deposited, will not be less than 10:1.

4. Whenever there are reasonable grounds for believing or suspecting that a non-scheduled waste has been delivered to or deposited at the site, all reasonable practicable measures will be taken forthwith to remove the waste from the site.

5. The site will be bounded by fencing and lockable gates, erected to the standard and specification given in B.S. 1722, Part 10 and maintained in a sound condition.

6. A site control office will be provided at the entrance to the site. Toilet and messing facilities will be provided in accordance with the recommendations of the Health and Safety Executive.

7. Suitable arrangements will be made for the storage and maintenance of equipment used at the site.

8. An identification board of durable material and finish will be displayed at the entrance to the site. This board will show:-

   (i) The name of the site.

   (ii) The name, address and telephone number of the Waste Disposal Authority.

   (iii) The hours of operation of the site and those for the receipt of waste.

   (iv) A telephone number to be used in a case of an emergency.

9. The conditions of this Resolution will be made known to the person who is given responsibility for the management or control of the site and a copy of this Resolution and of all documents and plans referred to in this Resolution will be displayed at the site control office.

10. The site will be supervised by a person competent and qualified to secure compliance with the limitations and conditions specified in this Resolution. The site will be inspected at least daily by that person to ensure that the limitations and conditions specified in this Resolution are being observed.

11. The site will be adequately manned and supervised during hours of operation. No deposit will take place unless and until two persons are present on site during operating hours. The hours of operation will not exceed:-

    08.00 - 17.00 hours 7 days a week.

    The operating hours may be varied to suit the requirements of the Waste Disposal Authority.

12. No operations will take place on site during the hours of darkness, as defined by the Science Research Council, unless lighting is provided maintained and used.

13. A suitable drainage system for the collection and off site disposal of surface/ground water will be installed at the site. Suitable measures will be taken to ensure that the integrity and efficiency of this system will not be impaired or impeded.

14. A road will be provided within the site. The road will run from the main site exit/entrance to the site control office and extend thereafter for a distance of 300 metres. The road will not be less than 4 metres wide with passing loops at not more than 150 metre intervals. It will be constructed to a standard commensurate with its use and thereafter maintained as such. Arrangements will also be made for the parking and queueing of vehicles off the highway.

15. Subsidiary site roads will be provided within the site. The roads will not be less than 4 metres wide with passing loops at 100 metre intervals or less and will run from the primary site road to within the phase currently being infilled. Such roads will be constructed of stone, hardcore or similar suitable material to a depth of not less than 300 mm. and underlain with a soil stabilisation fabric. The roads will be maintained to a reasonable standard.

16. Suitable wheel cleaning facilities will be provided at the site. These facilities will be properly maintained and used to prevent mud or other debris being carried onto the highway. Any effluent generated during these operations will be contained within the landfill area. If mud or any other debris is carried onto the highway by vehicles leaving the site, immediate steps will be taken to cleanse the affected area.

17. The site will be infilled in five separate phases each of approximately equal volume. No deposit of permitted wastes other than soil, sub-soil and wastes from the construction industry will take place in each phase unless it is to within an area (hereinafter called a containment area) the location and dimension of which have previously been specified.

Furthermore, the base and sides of such areas will be lined with a structurally sound layer of approved cohesive argillaceous material not less than 2 metres thick after compaction and free of voids and fissures and the permeability of which at any point is less than ten to the minus nine metres per second when measured by any generally accepted or recognised method.

18. Sufficient core samples of the lining referred to in condition 17 will be taken and subjected to any generally accepted or recognised method for the determination of the in situ permeability of the material to ensure that the limitations of condition 17 are complied with.

19. No deposit will take place into a containment area until all holes resulting from the extraction of core samples are filled and grouted with a material having the same permeability as defined in condition number 17.

20. Within each containment area, two suitably designed points for monitoring the nature and extent of any leachate and/or release of any landfill gas generated, will be constructed and installed. Such monitoring points will be extended vertically in advance of the infilling operations to a level not less than one metre above the final finished contours (as shown on drawing No. 929/13/5) and suitably protected.

21. Prior to the deposit of permitted waste into the final containment area of each phase, the drainage sump which will be contained therein will be disconnected from the remainder of the site's drainage system, in such a manner to preclude the egress of leachate into the system.

22. A record will be kept of the type, quantity and origin of wastes delivered to the site.

23. The site will be operated, as far as is reasonably practicable, in such a manner as to minimise adverse effects on the locality, in particular precautions will be taken to prevent nuisance from noise, odour and dust emissions exceeding current legislative standards.

24. Waste other than inert material will not be deposited in water.

25. Solid waste will be compacted and formed into a layer as soon as possible after deposit and not later than the end of the working day on which the waste is received.

26. The depth of a layer of waste will not, after initial compaction, exceed 2.0 metres and the width of the working face will not exceed 25 metres.

27. All articles which are likely to cause large voids will be crushed, broken up or flattened, buried and covered up each day by other wastes.

28. The layer of waste will be formed in one or other of the ways described in condition number 29 below using suitable compaction equipment with a blade or some other appropriate levelling device.

29. Waste will either (a) be deposited on the surface of the site behind the face and partially compacted by a tractor or other compacting machine before being pushed over the face, or it will (b) be deposited on the ground forming the base of the site or on a previous layer in front of the face and will be formed into a compacted layer by being pushed upwards and driven over by a tractor or other compacting machine.

30. Before covering, working faces and flanks will be compacted to form gradients not steeper than 1 in 3.

31. Waste of a finely particulate nature or of a type liable to give rise to an airborne nuisance will be covered immediately with other waste or inert material.

32. Animal carcasses and waste consisting wholly or mainly of animal or fish waste or other obnoxious materials will be deposited in front of the working face and immediately covered with other waste materials so that the obnoxious material is not within 1 metre of the surface and 2 metres of the flanks or face.

33. Samples of wastes specified on Schedule B of the Appendix attached to this resolution will be taken as necessary and subjected to a scale of chemical analysis and/or physical examination to ensure that only scheduled wastes are deposited at the site.

34. Wastes, or the resultant products of such wastes which interact to:-

i) produce toxic or inflammable gases, fumes or vapours.

ii) enhance the solubility of toxic constituents and/or

iii) inhibit biological degradation

will not be co-deposited but will be deposited in separate areas of the landfill reserved for that purpose. Precautions will be taken to ensure continued isolation of such wastes and of any leachate therefrom. A record will be kept of the location of the deposit of such materials.

35. Waste contained in vessels (except category R50) will not be deposited at the site.

36. The pH value of category Q40 waste accepted for disposal at the site will be that value at which the solubility of the chemical heavy metal constituents is a minimum.

37. The concentration of cyanide contained in any category Q40 waste accepted for disposal at the site will not be greater than 10 parts per million.

38. Fibrous asbestos will be disposed of in accordance with the code of practice as laid down in Waste Management Paper No. 18, H.M.S.O. 1979 or any future modification to this code of practice.

39. Such points as referred to in condition number 20 will be monitored weekly and the level of any standing liquid therein recorded.

40. Such points as referred to in condition number 20 will be monitored and the concentration and distribution of gases produced within the landfill recorded.

41. As necessary measures will be taken to promote the safe dispersal from the site of gases generated within the landfill.

42. Waste specified on Schedule B of the Appendix attached to this Resolution, of a liquid or mobile physical state, will only be incorporated in the landfill by discharge into slit trenches, the dimensions of which will not exceed one metre in width or depth and 20 metres in length, and at such a rate that a free board of not less than 0.2 metres is maintained. Such trenches will be constructed not less than 10 metres from the flank or face of the advancing layer and their use discontinued and reinstatement affected when the monitoring records referred in condition number 39 indicate that the absorptive capacity of the landfill in the vicinity of and underlain by such trenches has been reached.

43. In the event that the monitoring records referred to in condition 39 indicate that the level of liquid within any containment area to be at such a level which is:-

a) A potential source of ground water/surface water pollution.

and/or

b) Likely to interfere with the sealing and final restoration of a containment area.

and/or

c) Likely to exceed 177m A.O.D.

Then the deposit of permitted waste shall cease into that containment area forthwith and excess leachate removed from the containment area.

44. In the event of flooding or ponding of a containment area, then the deposit of permitted waste other than soil, sub-soil and waste from the construction industry, will cease immediately and not re-commence until surplus liquid is no longer evident. There will be no pumping of liquid within the site, nor any discharge of liquid from the site, unless the requisite consents have been obtained.

45. No person will be permitted to sort over or disturb any waste delivered to or deposited at the site.

46. Moveable screens or other suitable methods will be used to ensure that paper and other materials are contained within the site. Materials arrested by such screens will be removed and disposed of as necessary to maintain the efficiency of the screens and the tidiness of the site.

47. As necessary, but not less frequently than once a day, all loose waste that is lying within the site will be gathered and disposed of in such a manner as to keep the site tidy. As necessary a scour of adjoining land and hedgerows will be made and any paper or other waste materials collected and disposed of on the site.

48. No waste material will be burned within the boundaries of the site. A fire on the site will be regarded as an emergency and immediate action taken to extinguish it.

49. Precautions will be taken to deal effectively with any vermin and insects at the site. An arrangement will be made with the local authority or a private concern for that purpose.

50. Site roads will, in dry weather, be sprayed with water to suppress dust.

51. Materials used for landfill, other than that which is wholly non-putrescible, will, where appropriate, be covered progressively with suitable non-putrescible material throughout the working period each day, so that by the end of the day all exposed surfaces, including the flanks and face, will have been covered.

52. Each layer of waste and covering material will be laid to a fall to encourage surface water run-off.

53. The final layer deposited will be subjected to the minimum compaction and will, to a depth of not less than one metre, be kept free of materials likely to interfere with final restoration or subsequent cultivation.

54. No deposit of waste specified on Schedule B of the Appendix attached to this Resolution will take place within 2 metres of the final contours of the site, as shown on drawing numbered 929/13/5.

55. The deposit of permitted waste will not exceed a level 1.0 metre below the final contours of the site, as shown on drawing No. 929/13/5.

56. When the level of permitted waste within a containment area reaches the maximum levels specified in condition number 55, then those areas of the containment area will be progressively sealed with a layer of argillaceous material not less than 1.0 m. thick after compaction, such that an area of permitted waste not greater than 1,250 square metres is left unsealed at any time.

57. The sealing layer referred to in condition 56 will have a permeability which is less than ten to the minus nine metres per second and will be keyed into the lining of the containment area.

58. A civic amenity compound will be provided at the site entrance for use by the public for the deposit of bulky household items and garden waste.

59. Until final restoration, completed areas of landfilling will be graded and maintained in a tidy condition and, where necessary, action will be taken to control or destroy weeds.

APPENDIX

Schedule A — General Waste (1)

Type of Waste	Code of Waste	Maximum Daily Quantity Liquid (tonnes)	Sludge (tonnes)	Solid (tonnes)
Domestic and Commercial (untreated)	(i) (a)			200
Medical Surgical and Veterinary wastes	(ii)			1
Non-hazardous Industrial (potentially combustiable substances)	(iii) (a)			200
Non-hazardous Industrial (inert and non-flammable substances)	(iii) (b)			200
Waste from the construction industry	(iv)			200
Old cars vehicles and trailers	(v)			5
Sewage sludge and pail closet contents	(vi)			1

Reference (1) - D.O.E. circular 55/76 Annex A

APPENDIX

Schedule B Difficult Wastes (2)

Type of Waste	Code of Waste	Maximum Daily Quantity Liquid (tonnes)	Sludge (tonnes)	Solid (tonnes)
Cadmium Compounds	D10			10
Chromium "	D90			10
Copper "	D91			10
Zinc "	D92			10
Nickel "	D95			10
Vanadium "	D96			10
Asbestos	J10			10
Slag including boiler & flue cleanings	J20			10
Silt & dredgings	J40			10
Contaminated Water	J50	10		
Metal Scrap	J60			10
Hydrocarbons (not included in M)	K10			40
Aldehydes & Ketones	K83			10
Polymeric materials in the finished state	L20			10
Scrap rubber including tyres	L30			10
Latex, latex & rubber solution & suspensions	L40		10	
Synthetic adhesive	L50			10
Fats, waxes & greases	M60		10	10
Pharmaceuticals	N10	1	1	1
Laboratory chemicals (mixed organic compounds)	P10	1	1	1
Laboratory chemicals (mixed inorganic compounds)	P20	1	1	1
Dry battery waste & primary cells	P20			10
Used filter materials	Q10			10
Contaminated rubbish	Q20			20
Empty used containers	Q30			10
Industrial effluent treatment sludge	Q40		40	40
Interceptor pit residues	R20		40	40
Distillation residues (drummed)	R50			40
Tar, pitch bitument and asphalt	R70			10
Paint waste	R80		10	10
Animal processing waste	T10			10
Food processing waste	T20			10

Irregular small quantities at infrequent periods of other Difficult Wastes (Appendix 4, D.o.E Waste Management Paper No. 4)" in accordance with D.o.E advice and in compliance as necessary with the Control of Pollution (Special Waste) Regulations 1980.

Refer (2) - D.o.E circular 55/76 Annex B.

November, 1985

APPENDIX 4

LINER TESTING RECORDS

SHROPSHIRE COUNTY COUNCIL

HIGHWAYS LABORATORY,
107 Longden Road,
Shrewsbury.
Tel. Shrewsbury 4298

Mr. J. W. Roberts, Division 3
(For the attention of R. Suggett)

Mr. B. Doyle
Waste Disposal Officer
The Old Vicarage
Shirehall

For the attention of C. Moss (AWDO)

22 May 1986

My ref. GAH/JMJ/S342 Your ref.

STONEYHILL WASTE DISPOSAL SITE
COMPACTION & PERMEABILITY OF BUND WALLS TO PHASE TWO

The following test results relate to samples taken on 15 May 1986 from bund walls to the south east and south west of phase two where they have been increased in height using material gained from the base of area phase three :-

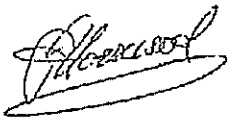
RESULTS

Location	Bulk Density Mg m-3	Dry Density Mg m-3	Moisture Content (%)	Relative Compaction (%)	Coefficient of Permeability (m/s)
S.E. Wall E+10m	1.74	1.44	21.0	91.6*	-
S.E. Wall E+30m	1.92	1.58	21.5	100.2	2.42×10^{-10}
S.E. Wall E+50m	1.94	1.59	22.0	100.8	2.80×10^{-10}
S.E. Wall E+70m	1.89	1.52	23.9	96.8	-
S.E. Wall E+90m	1.83	1.49	22.6	94.6*	-
S.W. Wall S+20	1.84	1.51	21.5	96.2	1.89×10^{-9}
S.W. Wall S+40	1.90	1.56	22.1	99.0	1.50×10^{-9}
S.W. Wall S+60	1.71	1.44	18.1	91.8*	-
Lab. compaction	1.92	1.57	22.0	-	-

* These specimens separated into halves when extracted from the clay cutters. The coal content was significantly higher than that found in all other specimens.

All samples were taken from the top of the bund walls as it was not possible to test the loose material on the batters.

Although some degree of compaction is being achieved (minimum recommended per cent compaction is 95) reliance on the compactive effort of pneumatic tyred earthmovers of varying loads is not sufficient to guarantee consistency in achieving minimum standards as is borne out by the above test results.



Laboratory Engineer

SHROPSHIRE COUNTY COUNCIL

HIGHWAYS LABORATORY,
107 Longden Road,
Shrewsbury.
Tel. Shrewsbury 4298

Mr. J. Roberts
Divisional Surveyor
Division 3

For the attention of R. Suggett (Highways Supt.) 12 May 1986

My ref. GAH/JMJ Your ref.

STONEYHILL WASTE DISPOSAL SITE
COMPACTION OF BUND WALLS TO PHASE TWO

I was requested to look at the method of construction of the raising of the bund walls to south east and south west of phase two of the disposal area.

As far as I could see when I visited the site on the morning of Friday 9 May 1986, the walls were being raised by the addition of clay material to the existing top of the bund walls. This material was collected by box scrapers from the bottom of phase three and unloaded along the top of the walls, the only compaction being that provided by the wheels of the box scrapers. No compaction is evident on the slopes of the bund walls with loose material covering the full area of lift.

The requirement for permeability of these walls will not be achieved without adequate compaction.

These walls are to be tested on Wednesday, 14 May 1986.

I am reliably informed that a vibratory towed roller is to be introduced to the site for compaction of the cover material to phase one. It may be prudent to introduce this earlier to the bund walls to phase two prior to test.

Laboratory Engineer

CC. to C. Moss AWDO

SHROPSHIRE COUNTY COUNCIL

HIGHWAYS LABORATORY,
107 Longden Road,
Shrewsbury.
Tel. Shrewsbury 4298

Mr. B. Doyle,
Waste Disposal Officer,
Waste Disposal Section,
The Old Vicarage,
Shirehall,
Shrewsbury.

1 February 1985

My ref. AHH/JMJ/6300 Your ref.

STONEYHILL WASTE DISPOSAL SITE :
SUITABILITY OF CONTAINMENT AREAS

Further to my visit to the above site on 19 December 1984, I re-visited the toxic waste area on 23 January 1985.

Additional samples were taken for supplementary permeability and compaction tests to be made. The location of these samples is shown on the attached plan and the results of the tests recorded below.

The section of bund wall around sample S10 is showing signs of movement in a westerly direction with tension cracks beginning to appear at the head of the slope. This section also appeared to be poorly compacted in comparison with other areas tested, the test results obtained confirm this observation.

Permeability of the base areas may be taken as satisfactory with k values in the order of 10^{-8} mm/sec being obtained for the natural soil at the time of the original soil survey. This fact has been borne out by the sustained ponding occurring in the containment areas.

RESULTS

Sample No.	Bulk Density kg/m³	Dry Density kg/m³	% Moisture Content	% Relative Compaction	Permeability mm/sec.
S8	1846	1472	25.4	99.2	8.32×10^{-7}
S9	1791	1435	24.8	96.8	3.44×10^{-7}
S10	1722	1356	27.0	91.7*	5.59×10^{-6}
S11	1856	1500	23.7	98.4	1.16×10^{-6}

* The sample recovered from the area of S10 was found to have a high percentage of coal fragments.

A plan of the test locations is attached for reference.

A. Hayward

A. Hayward
Laboratory Engineer

SHROPSHIRE COUNTY COUNCIL

HIGHWAYS LABORATORY,
107 Longden Road,
Shrewsbury.
Tel. Shrewsbury 4298

C M

Mr.B.Doyle,
Waste Disposal Officer.
Waste Disposal Section,
The Old Vicarage,
Shirehall, Shrewsbury. 7-1-'84

My ref. GAH/.S 299 Your ref.

STONEYHILL WASTE DISPOSAL SITE: SUITABILITY OF TOXIC WASTE CELLS.

The above site was visited on 19-12-'84, where Phase One had been divided up into three toxic waste cells.

Samples were taken from the original bund walls and from the newer dividing walls. These samples were tested for compaction and permeability, the results of which are recorded below.

It was observed that cell No.2 (northern most cell) was partially filled with water and that this water was piping through the dividing wall into cell No.1. The level at which the water appeared coincides with the base of the dividing wall. This suggests a lack of bond between the wall and the original ground level and therefore problems with toxic leachate are likely to occur. However, as this dividing wall separates two toxic waste cells, the leachate problem may be acceptable, provided that cell No.1 is utilised first. This method of working will give support to the base of the wall and alleviate any stability problems due to slippage along the base line.

Results.

Sample No.	Bulkdensity kg/m^3	Dry density kg/m^3	% Moisture content	% Relative compaction	Permeability mm/sec
S1	2079	1823	14	107	3.42×10^{-9}
S2	2104	1798	17	106	-
S3	1974	1673	18	98.5	1.11×10^{-9}
S4	1910	1504	27	96.1	2.16×10^{-8}
S5	1958	1579	24	99.7	1.09×10^{-9}
S6	1896	1567	21	95.4	-
S7	1950	1639	19	99.8	1.93×10^{-9}

The minimum recommended per cent relative compaction is 95%

A plan of the tested area is enclosed, with sampling locations plotted to scale.

Laboratory Engineer.

SHROPSHIRE COUNTY COUNCIL

HIGHWAYS LABORATORY,
107 Longden Road,
Shrewsbury.
Tel. Shrewsbury 4298

Mr. B. Doyle
Waste Disposal Officer
Highways & Transport Dept.
The Old Vicarage
Shirehall

F.a.o. Mr. C. Hoss (A.W.D.O.)

1 October 1985

My ref. GAH/JMJ/S317 Your ref.

STONEYHILL WASTE DISPOSAL SITE, TELFORD
COMPACTION & PERMEABILITY TESTING OF REMEDIAL WORK
TO PHASE TWO BUND WALLS

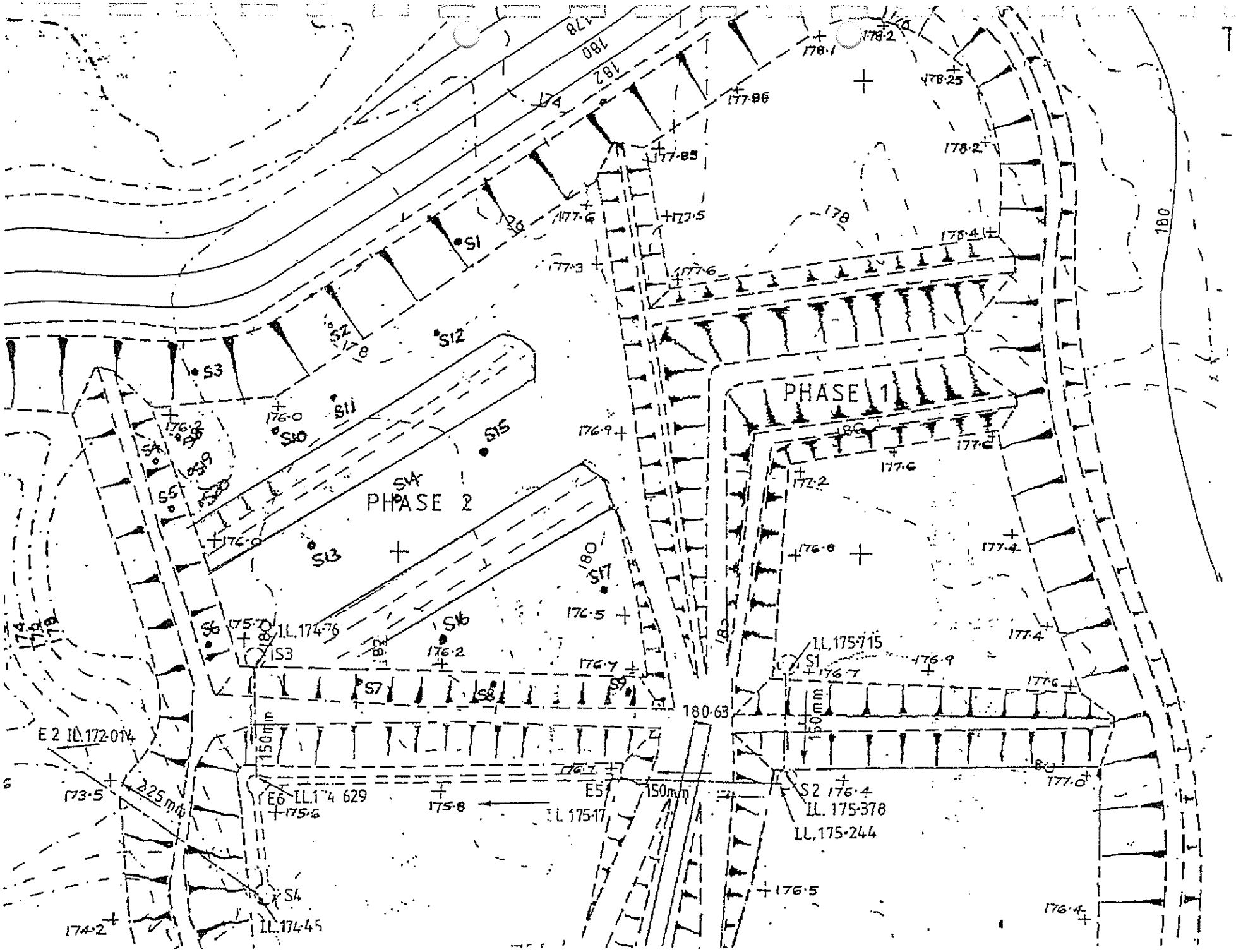
The following samples were taken on 19 September 1985. Remedial work to the bund walls had been carried out in the areas of samples numbered S4, S5 and S9.

It was not possible to test the wall adjacent to S9 as the deposited material had not been compacted. The remedial work adjacent to S4 and S5 was tested; the results are as follows :-

Sample No.	Bulk Density Mg/m³	Dry Density Mg/m³	% Moisture Content	% Relative Compaction	Coefficient of Permeability (m/sec)
S18	1.866	1.576	18.4	95.2	1.23×10^{-9}
S19	1.823	1.518	20.1	91.7	1.43×10^{-9}
S20	1.761	1.491	18.1	90.0	-
Lab.Compaction	1.969	1.656	18.9	-	

The location of the samples is as shown on the attached plan.

Laboratory Engineer


PHASE 1
PHASE 2
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
S13
S15
S16
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S52
S53
S54

SHROPSHIRE COUNTY COUNCIL

HIGHWAYS LABORATORY,
107 Longden Road,
Shrewsbury.
Tel. Shrewsbury 4298

Mr. B. Doyle
Waste Disposal Officer
The Old Vicarage
Shirehall
Shrewsbury
For the attention of C. Moss (AWDO)

4 September 1985

My ref. G.H/JMJ/S314 Your ref.

STONEYHILL WASTE DISPOSAL SITE, PHASE TWO
COMPACTION AND PERMEABILITY TESTING OF BUND WALLS

The following test results were determined on samples taken on 21 August 1985. The base areas were not tested owing to standing water being present; these areas will be tested when the water has been pumped out.

The location of sampling points is as shown on the attached plan.

RESULTS

Sample No.	Bulk Density Mg/m3	Dry Density Mg/m3	% Moisture Content	% Relative Compaction	Coefficient of Permeability M/SEC
S1	1.889	1.563	20.9	95.9	4.22×10^{-10}
S2	1.856	1.458	27.3	89.4	7.36×10^{-10}
S3	1.717	1.458	17.8	89.4	2.28×10^{-8}
S4	1.733	1.382	25.4	84.8	1.81×10^{-6}
S5	2.014	1.727	16.6	92.8	1.03×10^{-8}
S6	1.885	1.583	19.1	97.1	5.3×10^{-9}
S7	1.886	1.517	23.0	93.1	4.65×10^{-8}
S8	1.874	1.502	24.8	92.1	1.26×10^{-7}
S9	1.739	1.345	29.3	82.5	1.58×10^{-5}

Atterberg limits were determined for the material adjacent to sample No. 5 :-

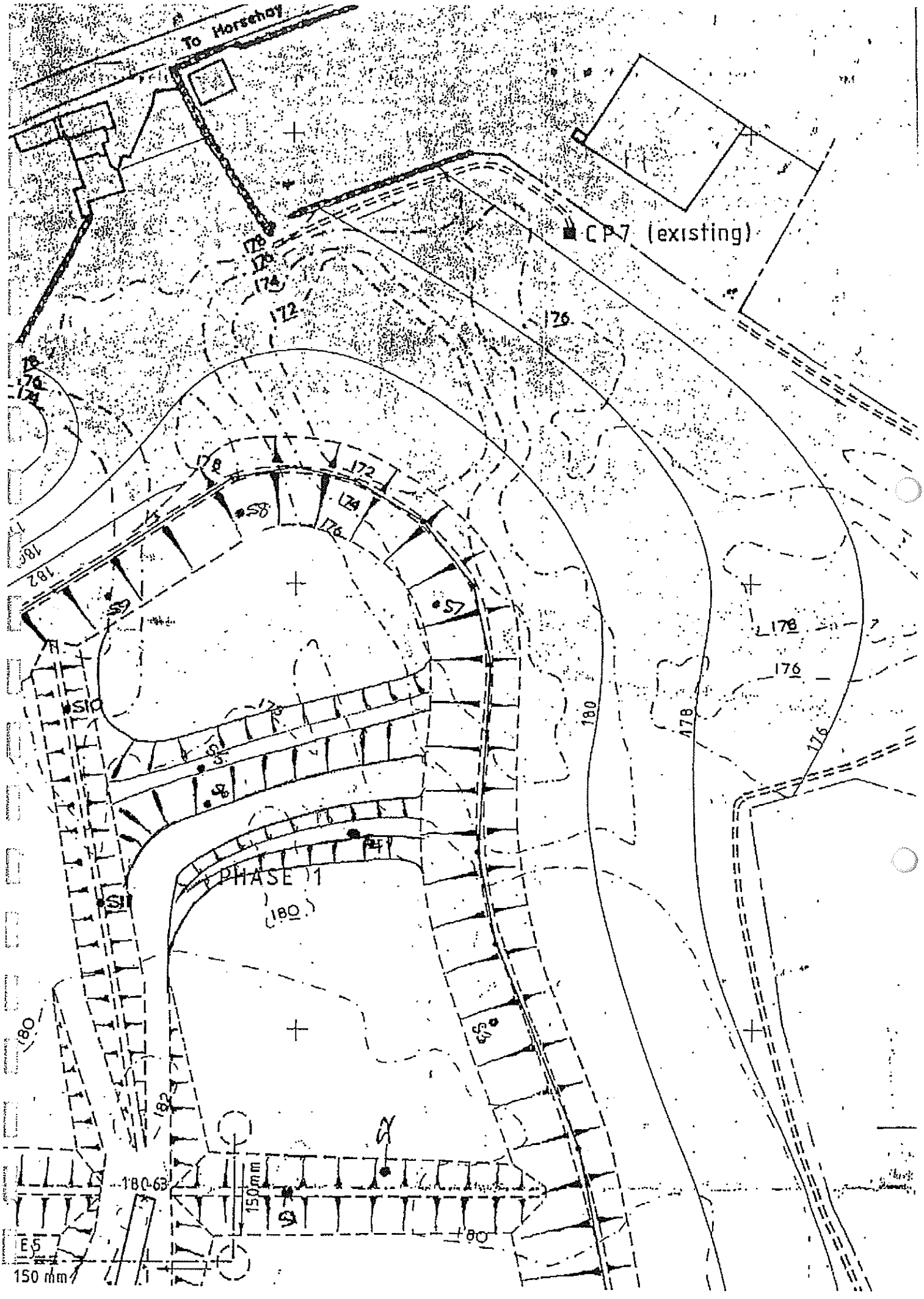
Liquid limit (LL) = 44
Plastic limit (PL) = 22
Plasticity Index (PI) = 22

Classification = CI Clay of intermediate plasticity

The areas of bund wall adjacent to samples S4 and S9 possess a high proportion of coal fragments; this is visually discernible by the black face to the walls.

It was also noticed that cracks had appeared at the head of the perimeter bund wall between marker posts N and O and adjacent to the TBM in that area.

Laboratory Engineer


To Horsehay
CP7 (existing)
PHASE 1
180-63
150mm
150 mm

SHROPSHIRE COUNTY COUNCIL

HIGHWAYS LABORATORY,
107 Longden Road,
Shrewsbury.
Tel. Shrewsbury 4298

Mr. B. Doyle
Waste Disposal Officer
The Old Vicarage
Shirehall
Shrewsbury

[illegible] 6 September 1985

My ref. GAR/JMJ/S315 Your ref.

STONEYHILL WASTE DISPOSAL SITE, TELFORD
PERMEABILITY & COMPACTION TESTING OF PHASE TWO

The following tests were carried out on samples taken from the base area of Phase two on 30 August 1985.

The location of the samples is as shown on the attached plan.

RESULTS

Sample No.	Bulk Density kg/m³	Dry Density kg/m³	% Moisture Content	% Relative Compaction	Coefficient of Permeability (mm/sec)
S10	1700	1386	22.7	81.3	2.77×10^{-6}
S11	2043	1668	22.5	97.8	2.72×10^{-6}
S12	2005	1717	16.8	100.7	1.58×10^{-4}
S13	2041	1708	19.5	100.2	1.52×10^{-7}
S14	2063	1724	19.7	101.1	1.94×10^{-7}
S15	1589	1362	16.7	79.9	1.04×10^{-2}*
S16	1632	1368	19.3	80.2	2.27×10^{-6}
S17	2123	1846	15.0	108.0	1.85×10^{-5}
Lab. Compaction	2038	1705	19.5	-	

Minimum recommended % relative compaction = 95%

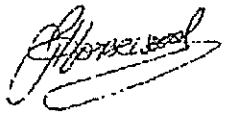
* This sample in particular had a very high coal content of a friable nature.

It was found that a thin layer of coal (approx. 300 mm in depth) existed below the area around sample No. 10, which may account for the lower percentage relative compaction recorded.

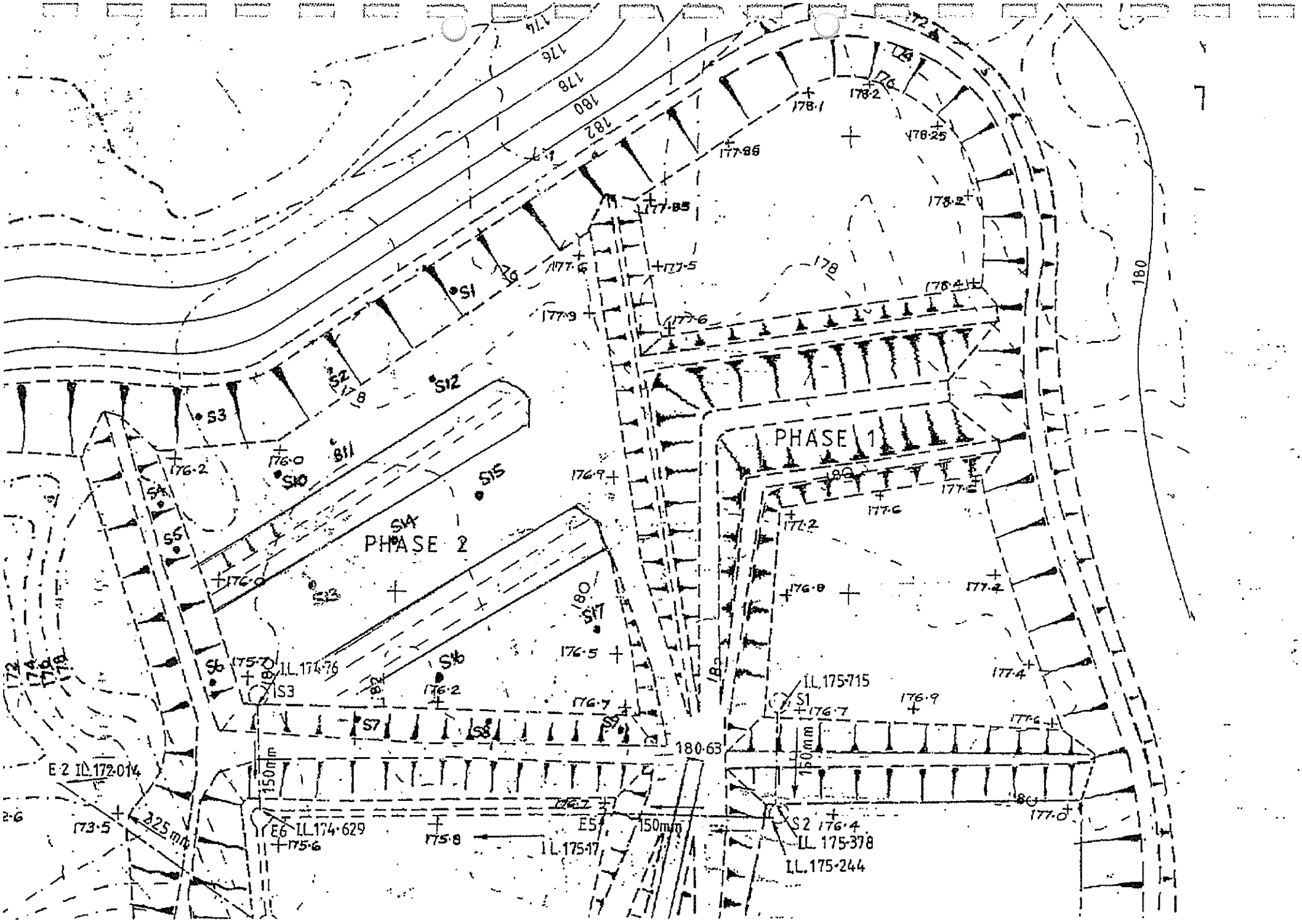
Further compaction may decrease permeability and increase the per cent relative compaction except where areas of high coal concentrations are found.

Removal of these areas may not be practicable without investigation of the quantities involved and therefore an impermeable lining should be considered.

The area adjacent to sample No. 17 (proposed Asbestos disposal area) showed signs of settlement with a circular depression in the ground surface. This may be evidence of a former mineshaft having been inadequately backfilled or insufficiently demolished during the opencast period of mining here.



p Laboratory Engineer


PHASE 1
PHASE 2
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
S13
S14
S15
S16
S17
178·1
178·2
178·25
177·85
177·5
177·6
177·9
178·4
176·9
176·8
177·2
177·4
176·5
176·2
176·0
175·7
176·7
175·8
173·5
180·63
I.L.174·76
I.L.175·715
I.L.175·378
I.L.175·244
I.L.175·17
I.L.174·629
E2 I.L.172·014
E5
E6
150mm
225mm

APPENDIX 5

CAP TESTING RECORDS AND 1993 AERIAL PHOTO

File A25/120

SHROPSHIRE COUNTY COUNCIL

County Surveyor's Department

The Shirehall
Abbey Foregate
Shrewsbury SY2 6ND
Fax: (0743) 253181

MEMORANDUM TO:

B EDWARDS
LICENSING AND REGULATIONS

18 November 1992

My ref	Your ref	Tel: direct (0743)	Please ask for
A25/120/ML/DW ml32381		253078	Mr Lake

STONEYHILL WASTE DISPOSAL SITE
CLAY CAPPING

The final clay capping works were carried out recently at the above site.

Approx 33,000 tonnes of clay was imported from Wrekin Council land at Granville Roundabout, Telford.

Samples were taken out of the stockpile prior to work commencing. These samples were tested and used to obtain natural moisture content, bulk density, dry density and permeability.

All matter was capable of achieving a minimum permeability of 1×10^{-9}.

The clay was imported to site and laid in four layers totalling 1.0m thick and compacted as Table 6/4 of the 'Specification for Highway Works'.

150mm cores were taken on each layer on a 20m grid. Tests were carried out on these cores to determine moisture content and density. Approx 1 in 6 of the samples were tested for permeability.

I enclose for your approval my tabulated results of the laid cap together with plan, and results of the material gained at source.

Chief Engineer
Waste Disposal

K B Madelin MSc CEng
County Surveyor

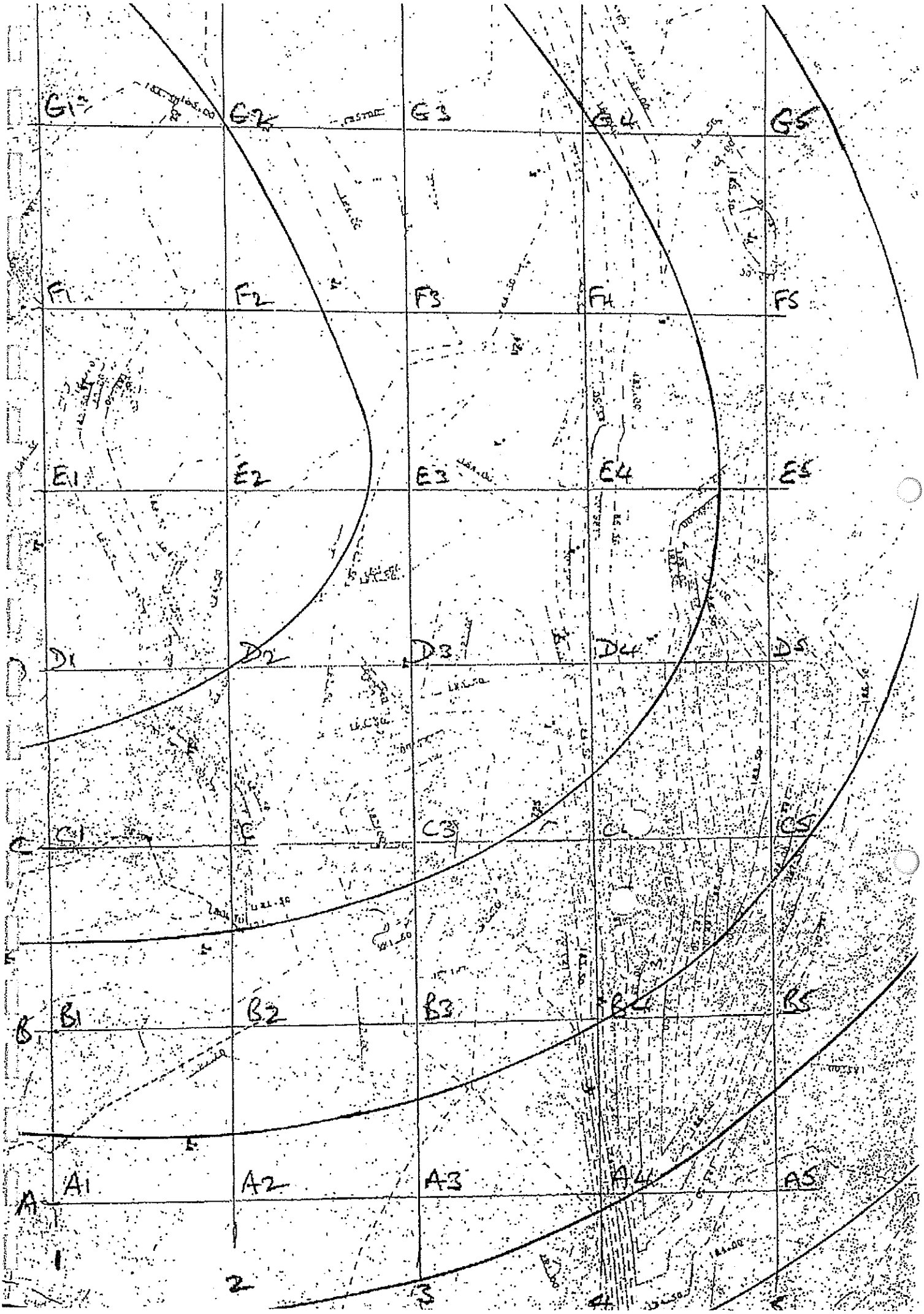
recycled paper

STONEYHILL CL CAP

CORE RESULTS

LOCATION	Layer 1 Moisture Content %	Layer 1 Density %	Layer 1 Permiability m/sec	Layer 2 Moisture Content %	Layer 2 Density %	Layer 2 Permiability m/sec
B4	15	104.0		14	104.6	9.24×10^{-10}
B5	17	99.3		18	97.5	
C1						
C2						
C3						
C4	16	100.4	3.59×10^{-10}	13	107.0	
C5	18	100.5		17	97.5	
D1 A	17	94.8		14	99.0	
B	14	102.7				
D2 A	14	100.0		17	101.00	
B	17	98.9	4.51×10^{-10}			
D3	14	94.8		18	96.7	1.70×10^{-10}
D4	17	102.4	1.79×10^{-9}	16	91.0	
D5	17	106.7		16	98.2	
E1 A	17	94.0		15	99.2	
B	18	95.5				
E2 A	14	101.4		13	104.4	9.96×10^{-10}
B	17	91.3	8.66×10^{-10}			
E3	16	100.5		14	100.2	
E4	17	96.8	8.59×10^{-11}	16	95.5	
E5	18	96.6		15	98.4	
F1 A	17	93.7		19	99.3	
B	18	97.1				
F2 A	18	96.1		19	99.3	4.61×10^{-10}
B	18	95.1				
F3	18	103.7		20	98.8	
F4 A	15	103.7		22	94.5	
B	18	98.8				
F5 A	17	102.5		23	96.5	
B	19	102.1				
G1	15	104.9		15	105.5	8.38×10^{-10}
G2	18	100.2		19	98.0	
G3	19	94.5	8.83×10^{-10}	20	101.2	
G4 A	16	99.7		21	96.7	
B	17	102.2				
G5	16	101.7	8.84×10^{-11}	23	95.5	
	18	102.4				

	Layer 3			Layer 4		
LOCATION	Moisture Content %	Density %	Permiability m/sec	Moisture Content %	Density %	Permiability m/sec
A1				18	88.2	2.17×10^{-9}
A2						
A3				16	95.3	
A4						
A5						
B1				19	100.5	
B2	14	92.8		20	100.8	
B3				17	103.8	
B4	14	103.2		21	100.7	1.17×10^{-10}
B5	19	97.1		16	102.0	
C1	21	100.0		21	97.0	
C2				18	104.9	
C3	14	98.3		19	98.9	
C4	18	101.1		19	101.9	
C5	18	95.1	4.4×10^{-10}	21	95.1	
D1	18	105.4	4.64×10^{-10}	A24	95.4	1.1×10^{-10}
				B14	108.2	
D2	18	104.2		15	110.5	
D3	18	104.2		21	97.6	9.17×10^{-10}
D4	16	107.9		22	94.7	
D5	19	102.0		21	95.6	
E1	15	104.0	4.73×10^{-10}	22	95.3	
E2	17	100.6		21	98.7	
E3	17	99.7		21	100.1	5.85×10^{-10}
E4	16	102.8		20	100.1	
E5	13	100.0		19	98.9	
F1	21	99.3	3.09×10^{-10}	16	100.9	
F2	19	98.1		16	103.3	3.68×10^{-10}
F3	19	100.5		19	92.7	
F4	16	104.2		15	105.7	
F5	20	98.3		14	105.6	6.31×10^{-10}
G1	20	98.7		19	96.0	
G2	19	100.8	7.84×10^{-10}	18	97.9	
G3	18	102.3		17	100.0	
G4	19	99.9		14	104.2	
G5	21	94.5	9.87×10^{-10}	13	106.4	


G1
G2
G3
G4
G5
F1
F2
F3
F4
F5
E1
E2
E3
E4
E5
D1
D2
D3
D4
D5
C1
C2
C3
C4
C5
B1
B2
B3
B4
B5
A1
A2
A3
A4
A5
1
2
3
4

SHROPSHIRE COUNTY COUNCIL

HIGHWAYS LABORATORY,
107 Longden Road,
Shrewsbury.
Tel. Shrewsbury 4298

Mr. J. W. Roberts, Division 3
(For the attention of R. Suggett)

Mr. B. Doyle
Waste Disposal Officer
The Old Vicarage
Shirehall

For the attention of C. Moss (AWDO)

22 May 1986

My ref. GAH/JMJ/S342

Your ref.

STONEYHILL WASTE DISPOSAL SITE
COMPACTION & PERMEABILITY OF BUND WALLS TO PHASE TWO

The following test results relate to samples taken on 15 May 1986 from bund walls to the south east and south west of phase two where they have been increased in height using material gained from the base of area phase three :-

RESULTS

Location	Bulk Density Mg m-3	Dry Density Mg m-3	Moisture Content (%)	Relative Compaction (%)	Coefficient of Permeability (m/s)
S.E. Wall E+10m	1.74	1.44	21.0	91.6*	-
S.E. Wall E+30m	1.92	1.58	21.5	100.2	2.42×10^{-10}
S.E. Wall E+50m	1.94	1.59	22.0	100.8	2.80×10^{-10}
S.E. Wall E+70m	1.89	1.52	23.9	96.8	-
S.E. Wall E+90m	1.83	1.49	22.6	94.6*	-
S.W. Wall S+20	1.84	1.51	21.5	96.2	1.89×10^{-9}
S.W. Wall S+40	1.90	1.56	22.1	99.0	1.50×10^{-9}
S.W. Wall S+60	1.71	1.44	18.1	91.8*	-
Lab. compaction	1.92	1.57	22.0	-	-

* These specimens separated into halves when extracted from the clay cutters. The coal content was significantly higher than that found in all other specimens.

All samples were taken from the top of the bund walls as it was not possible to test the loose material on the batter.


AF/93C/644
ATKINS AMC
TELFORD
SCALE
1:3000
25.3.93

APPENDIX 6

DETAILS OF MONSANTO WASTES

SCHEDULE 'A' TO WASTE DISPOSAL AGREEMENT
REFERENCE WD51188/A DATED 1st NOVEMBER 1984
BETWEEN MONSANTO p.l.c. AND SHROPSHIRE COUNTY COUNCIL

CATEGORY		AS ADDENDUM TO THIS SCHEDULE
GENERAL DESCRIPTION		SOLIDIFIED DISTILLATION RESIDUES, VARIOUS POWDERED CRYSTAL OR GRANULAR AND OTHER NON PUMPABLE SUBSTANCES OR ADMIXTURES; CONTAINED IN STEEL DRUMS, LOOSE (BUT COMPACTED) OR BAGGED – AS DETAILED IN THE ADDENDUM TO THIS SCHEDULE AND SEPARATELY BY FORMAL NOTIFICATION ISSUED BY MONSANTO IN COMPLIANCE WITH STATUTORY REGULATIONS.
MONSANTO POINT OR ORIGIN/LOADING		MONSANTO p.l.c., CORPORATION ROAD, NEWPORT, GWENT, NP9 0XF.
QUANTITIES (MAXIMUM)	1)	DRUMMED WASTE – UP TO 600 x 40 GAL DRUMS P.A.
	2)	COMPACTED WASTE – UP TO 70 x 35 IN YD LOADS P.A.
	3)	BAGGED WASTE – UP TO 30 TIMES P.A.
	4)	OTHER WASTE – AS FORMALLY AGREED FROM TIME TO TIME.
TERM OF AGREEMENT		1ST FEBRUARY 1985 TO 31ST JANUARY 1988 SUBJECT TO A MINIMUM OF 90 DAYS NOTICE IN WRITING.
DELIVERY SCHEDULE	1)	DRUMMED WASTE – 2 x 80 DRUMS PER WEEK APPROX.
	2)	COMPACTED WASTE – 1 OR 2 x 35 CU YD LOADS PER WEEK APPROX.
	3)	BAGGED WASTE – 2 x 40 BAGS PER MONTH APPROX.
		ALL FOLLOWING ISSUE (AS APPROPRIATE) BY MONSANTO p.l.c. OF NOTIFICATIONS IN COMPLIANCE WITH STATUTORY REQUIREMENTS.

* MONSANTO REGISTERED TRADE MARK

METHODS OF DISPOSAL	HAZARDOUS WASTE LANDFILL
CONTRACTOR'S FACILITY	STONEY HILL, TELFORD, SHROPSHIRE, OR ALTERNATIVES APPROVED BY MONSANTO p.l.c. UNDER THE TERMS OF AGREEMENT REF WD51188/A DATED 1ST NOVEMBER 1984.
	1) DRUMMED WASTE – £3.18 40 GALLON DRUM 2) COMPACTED WASTE – £86.10 PER 35 CU YD LOAD INC V.A.T. 3) BAGGED WASTE – £9.55/40 x 25 KG BAGS
PRICE – ALL EFFECTIVE 1/2/89.	
SAFETY/HEALTH AND REGULATORY/TECHNICAL INFORMATION	AS DEFINED UNDER MONSANTO p.l.c. LETTERS DATED 13.8.84 REF PRA/VPE AND 26.11.85 REF. REC/JW AND THEIR ANNEXURES.

ADDRESSES FOR NOTICES

FOR MONSANTO :	FOR CONTRACTOR :
EMERGENCIES	SHROPSHIRE
UTILITIES OR SHIFT SUPERVISOR	SHROPSHIRE COUNTY COUNCIL HIGHWAYS & TRANSPORT DEPT
MONSANTO PLC CORPORATION ROAD NEWPORT GWENT	THE SHIREHALL ABBEY FOREGATE SHREWSBURY ST2 6ND
OTHER NOTICES	
SEE CLAUSE 15 OF AGREEMENT REF WD51188/A 1ST NOVEMBER 1984	

FOR AND ON BEHALF OF MONSANTO PLC

pp .....

FOR AND ON BEHALF OF SHROPSHIRE COUNTY COUNCIL

.....

WD51188R/TXTWD

ADDENDUM TO SCHEDULE 'A' OF WASTE DISPOSAL AGREEMENT REF. WD/51188-LF(SCC)

DRUMMED WASTE

ORIGIN	DESCRIPTION	WASTE CATEGORY
Terphenyl Still	Carbon/Pitch (Solid) consisting of approximately : terphenyls - 0.1% tetra phenyls - 30% Penta Phenyls - 5% higher phenyls and carbonaceous material - remainder	R70
4NDPA (4-Nitrodiphenylamine)	Distillation residues, low solubility solid at ambient temperatures; Flash Point 150 Deg. C MIN and of approximate composition as follows: 4NDPA (4-Nitrodiphenylamine) - 11% 2NDPA (2-Nitrodiphenylamine) - 0.3% 44' ether - 10% (44' di nitro diphenyl ether) 44' ether - 52% (44' dinitro terhenylamine) Unidentified Constituent - 1.3% Potassium Salts - 1% Tars and Carbonaceous Materials - Remainder	R50
Santocure* (N-Cyclohexyl-2-Benzthiazole	Offgrade Santocure* and floor sweepings.	K70
Maleic Anhydride Plant	Spent Vanadium Catalyst mixed vanadium/phosphorous complex.	D96
Terphenyl Still	Solidified Terphenyl Santowax*	K12
Maleic Anhydride Plant	Solidified FumaricAcid with traces of Maleic Acid	K90
F1B40 Plant	Admixture of varying proportions of "Oil-Dri" granulator absorbant and Monsanto's HB40 absorbed (40% Hydrogenated Terphenyl).	K12

"ERED TRADE MARK

COMPACTED OR LOOSE WASTE

ORIGIN	DESCRIPTION	WASTE CATEGORY
HB40 (40% Hydrogenated Terphenyl) Plant	40% hydrogenated terphenyl contaminant plus waste paper, rags and sweepings with chemical contamination approx 5%	Q10 Q20
4NDPA Plant	Contaminated cleaning rags, gloves sweepings, contaminant, approx. 5%)	Q20
Maleic Anhydride Plant	Contaminated packages, paper, clothing and sweepings (Maleic Anhydride Contaminant, approx. 2%	Q20
Santicizer* (Phosphate Esters) (1) Plant	Contaminated rags, paper, sweepings, and used filter aid; approx. 0.5 t/month, contaminated with approx. 200 kg phosphate esters.	Q10
Santocure* Plant	Contaminated packages (N-cyclohexyl-2-benzthiazole sulphenamide approx. 5%)	Q30
Santoflex* (N-Isopropyl-N-Phenyl-P-Phenylenediamine) Plant	Cleaning rags (varying contaminant N-Isopropyl-N-Phenyl-P-Phenylene diamine approx 5% of total arisings)	Q20
Silicon Esters Plant	Contaminated sweepings, rags and broken drums (Ethyl Silicate approx. 1%)	Non-notifiable
Laboratories	Paper, packages, glass and misc. laboratory chemicals and samples approximating 1% of compacted waste, comprising Potassium Carbonate, Santoflex*, Santocure*, Maleic Anhydride and Diphenyl.	Q20
Dequest (Amino Phosphonates) Plant	Contaminated rags, clothing, paper, packaging and floor sweepings. Chemical contaminant = approx 5%.	Q20

(1) Esters 141 - 2-Ethyl Hexyl Diphenyl Phosphate
148 - Iso-decyl Diphenyl Phosphate

℠) REGISTERED TRADE MARK

		WASTE CATEGORY
COMPACTED OR LOOSE WASTE		
Dewatering Area P10	Interceptor Sludge - soil contaminated with mixed organics (approx 5%) essentially Polyphenyls, Hydrogenated Terphenyls, Aniline, Para Nitro Chloro Benzene, Formanilide, Santoflex*, 4NDPA.	R20 (with Trace of H20)
BAGGED WASTE		
Santoprene* (Vulcanised Ethylene Propylene Norbornene Rubber/ Polypropylene mixture.) Plant.	Clay dust and lumps with variable amounts of stannous chloride and zinc oxide in lidded steel drums.	H90
REDUNDANT PROCESS VESSEL		
1) Polyphenyls Plant	Horizontal, cylindrical vessel containing Santowax* (terphenyl and traces of biphenyl) as further described in Monsanto's letter, REC/JW, dated 26.11.85.	K12

FOR AND ON BEHALF OF
MONSANTO p.l.c.

.....

FOR AND ON BEHALF OF
SHROPSHIRE COUNTY COUNCIL

H. J. Brazier
.....
DEPUTY COUNTY SECRETARY.

WD51188G/TXIWD

* MONSANTO REGISTERED TRADE MARK

Our ref: A25/30/SL/12
Date: 28 November 2002

ENVIRONMENT AGENCY

Charles Ruxton,
New House,
Rowley,
Westbury,
Near Shrewsbury,
Shropshire.

Dear Mr Ruxton,

STONEY HILL LANDFILL SITE, DISPOSAL OF MONSANTO WASTE

I have looked through the general files for this site but unfortunately have been unable to find out much about specific difficult and special wastes. I do know that it occasionally accepted small quantities of mixed household chemicals. It also accepted chemicals from Monsanto called "Santocure" Benzthiazyl-N-Cyclohexly Sulphenamide and N-Cyclohexyl-2-Benzothiazolesulphenamide.

Reports about these chemicals can be found on the internet and they are both of low solubility in water and not toxic. Degradation is very slow. I have attached information about these chemicals for you. Photographs of the drums show the waste to be a solid resinous material.

I hope that this is of help.

Yours sincerely,

K A Heede

Kevin Heede
Environment Officer

Environment Agency
Hafren House, Welshpool Road, Shelton, Shrewsbury, SY3 8BB
Tel: 01743 272828 Fax: 01743 272138

APPENDIX 7

RECORD OF TESTING OF COLLIERY SPOIL PRIOR TO LANDFILL

SHROPSHIRE COUNTY COUNCIL

HIGHWAYS LABORATORY,
107 Longden Road,
Shrewsbury.
Tel. Shrewsbury 4298

Mr.C.R.Ayres.
Executive Engineer,
Highways Design Team.
H & T Dept.,
Shire Hall, Shrewsbury.

8th May 1984

My ref. HS 37 Your ref.

Soil Survey for Stoneyhill - Proposed Refuse site.

Over the period 31st January 1984, five boreholes were drilled by cable percussion drilling rig, as set out by your engineer Mr.J.Jennings.

The purpose of this survey was to determine the properties of and classify the soil with relevance to its proposed use.Permeability tests and pH tests were carried out on the Clay material, the results of which are shown on the attached borehole logs.

The site primarily consists of clay material deposited as waste from local coal mine workings and is described on Sheet SJ60 of the Geological survey of Great Britain as Lower Coal Measures.

No evidence of mineshafts was found in any borehole.
No groundwater levels were recorded in any borehole.

The pH tests carried out show the silty CLAY to be highly acidic with the majority of pH values being in the range of 3 to 4; it is therefore fair to say the CLAY will support little in the way of plant life.

Permeability tests indicate that the material is generally impervious with values in the 10^{-5} to 10^{-6} mm/sec range.Values of 10^{-3} mm/sec indicate the presence of sandstone and increased silt content.

The Atterberg limits classify the Clay as CI, a clay of intermediate plasticity, however it should be noted that this material may exhibit properties of a silt with medium to high swelling and shrinkage and medium susceptibility to frost action.

This material may not be classified as suitable for clay sealing owing to the presence of stones, coal fragments and voids.

Laboratory Engineer.

Please address any correspondence to the Laboratory Engineer

SALOP COUNTY COUNCIL – BOREHOLE LOG

Site [illegible] Date 12-3-'84 Borehole No. One

Type of boring [illegible] Natural Surface Level _____ Formation Level _____

Strata description	Depth below surface (m)	Natural moisture content	Type of test and depth taken	Test results	Classification	Further test results and remarks
t brown sandy CLAY aining grey/green with lstone at 1.0m	1.00 1.00 1.20	16 25	pH at 0.5m U100 at 1.0m LL,PL at 1.0m	LL = 42 PL = 25 PI = 17 pH = 4.1	CI	Water added from 0.6m. U100 at 1.0m-35% recovery.
grey silty CLAY with grey siltstone ments and ironstone les. grey silty CLAY with lstone fragments.	1.50 2.00 2.50 3.00	13 22 21	Permeability at 1.5m U100 at 2.0m LL,PL at 2.5m pH at 2.5m Shear Vane at 2.0m U100 at 3.0m	k = 2.38 x 10^{-5} mm/sec LL = 39 PL = 22 PI = 17 S = 52 kN/m^2 pH = 2.70	CI	U100 at 2.0m- 100% recovery. U100 at 3.0m - 100% recovery. Bulk Density = 2.06 Mg/m^3 Dry Density = 1.74 Mg/m^3
grey brown clayey with Sandstone	3.24					
ko stiff dark grey with Sandstone to stiff dark grey with occasional le sized sandstone	3.50 4.00 4.50	21 20 19	U100 at 4.0m LL,PL at 4.0m pH at 4.0m Shear Vane at 4.0m	S = 85 kN/m^2 LL = 43 PL = 24 PI = 19 pH = 3.44	CI	U100 at 4.0m - 70% recovery.

continued on Sheet Two.

211/1

KEY FOR SYMBOLS:– ρ=bulk density (Mg/m^3 ρd=dry density (Mg/m^3) o.m c.=optimum moisture content Spt=standard penetration test N=penetration resistance W=moisture content (%) C.B.R=California Bearing Ratio G_s=Specific Gravity C=cohesion (total stress kN/m^2) Ø=internal friction angle - total stress L.L.=liquid limit P.L.=plastic limit PI=plasticity index NP=Non-plastic S=Vane shear strength (kN/m^2) Tri=undrained triaxial test Va=percentage air voids.

SALOP COUNTY COUNCIL – BOREHOLE LOG

Sheet [illegible] of [illegible]

Site [illegible] Date [illegible] Borehole No. [illegible]

Type of boring [illegible] Natural Surface Level _____ Formation Level _____

Strata description	Depth below surface (m)	Natural moisture content	Type of test and depth taken	Test results	Classification	Further test results and remarks
to stiff [illegible] grey with occasional stone.	3.00 4.50 6.00	22 19 21	U100 at 3.0m Permeability at 3.0m Shear Vane at 3.0m U100 at 6.0m	k = 1.17 x [illegible] mm/sec S = 99 kN/m² Bulk Density = 1.84 Mg/m³ Dry Density = 1.61 Mg/m³	CI	U100 at 3.0m - 70% recovery U100 at 6.0m - 95% recovery
soft grey with brown ing CLAY with ional sandstone.	7.00 8.00	22	Shear Vane at 7.0m LL,PL at 8.0m pH at 8.0m Shear Vane at 8.0m	S = 24 kN/m² LL = 39 PL = 22 pH = 5.78 PI = 17 S at 8m = 65kN/m²	CI	U100 at 7.0m - 65% recovery
e brown very dense y & SAND & Gravel	7.50 8.00	10 25	U100 at 8.0m	Insufficient sample recovered for classification.		U100 at 8.5m - 100% recovery
grey with brown ing CLAY dark grey CLAY with fragments	9.00 9.35 Finished.	21	pH at 9.0m Permeability at 9.0m Shear Vane at 9.0m U100 at 9.0m	S = 60kN/m² pH = 8.30 k = 1.24 x 10^{-6} mm/sec Bulk Density = 1.99 Mg/m³ Dry Density = 1.64 Mg/m³	CI	100mm nominal size fine grain Sandstone at 8.5m U100 at 9.0m - 84% recovery. Break at 9.32m with 40mm band of orange clayey SILT with iron staining.

1/1

KEY FOR SYMBOLS:– ρ=bulk density (Mg/m³) ρ_d=dry density (Mg/m³) o.m.c.=optimum moisture content Spt=standard penetration test N=penetration resistance W=moisture content (%) C.B.R=California Bearing Ratio G_s=Specific Gravity C=cohesion (total stress kN/m²) Ø=internal friction angle - total stress L.L.=liquid limit P.L.=plastic limit PI=plasticity index NP=Non-plastic Vane shear strength (kN/m²) Tri=undrained triaxial test Va=percentage air voids.

SALOP COUNTY COUNCIL – BOREHOLE LOG

Site Stonerhill Refuse Disposal Site Date 9-3-94 Borehole No. Two

Type of boring Cable Percussion Drilling Rig Natural Surface Level _____ Formation Level _____

Strata description	Depth below surface (m)	Natural moisture content	Type of test and depth taken	Test results	Classification	Further test results and remarks
to stiff light grey with coal fragments some evidence of stone	0.30 1.00 1.35	9% 26	LL,PL at 0.3m pH at 0.5m U100 at 1.0m Shear Vane at 1.0m pH at 1.0m	LL= 43 pH = 3.96 PL = 25 PI = 18 S = 94kN/m^2 pH = 3.60	CI	Water added from 0.5m
to stiff light grey brown mottling clayey with coal fragments light grey SILT with lets and horizontal turing at 150mm ing	2.00 2.50 3.00 4.00	14* 23 16* 17*	U100 at 2.0m Shear Vane at 2.0m U100 at 3.0m LL,PL at 3.0m pH at 3.0m U100 at 4.0m	S = 91 kN/m^2 LL = 44 PL = 26 pH = 3.50 PI = 18	CI-MI	* Natural moisture content. U100 at 2.0m - 60% recovery U100 at 3.0m - 100% recovery U100 at 4.0m - 40% recovery.
. to firm light grey y CLAY with coal ments.	5.00	22	Shear Vane at 4.0m Permeability at 4.0m U100 at 5.0m LL,PL at 5.0m pH at 5.0m	S = 41kN/m^2 k = 2.40 x 10^{-3}mm/sec Bulk Density = 1.94 Mg/m^3 Dry Density = 1.66 Mg/m^3 LL = 38 PL = 21 pH = 3.20	CI	U100 at 5.0m - 80% recovery
light grey CLAY with n mottling and brown stone.	6.00 7.00	6.7* Finished	U100 at 6.0m	PI = 17		U100 at 6.0m - 66% recovery

Finished.

11/1

KEY FOR SYMBOLS:— ρ=bulk density (Mg/m^3) ρ_d=dry density (Mg/m^3) o.m.c.=optimum moisture content Spt=standard penetration test N=penetration resistance W=moisture content (%) C.B.R=California Bearing Ratio G_s=Specific Gravity C=cohesion (total stress kN/m^2) ϕ=internal friction angle - total stress L.L.=liquid limit P.L.=plastic limit PI=plasticity index NP=Non-plastic =Vane shear strength (kN/m^2) Tri=undrained triaxial test Va=percentage air voids.

SALOP COUNTY COUNCIL – BOREHOLE LOG

Site Stoneyhill Refuse Disposal Site Date 22 - 2 - 91 Borehole No. Three

Type of boring Cable Percussion Drilling Rig Natural Surface Level Formation Level

Strata description	Depth below surface (m)	Natural moisture content	Type of test and depth taken	Test results	Classification	Further test results and remarks
stiff grey with brown	0.50	11*				Large void at 1.3m approx 75mm
ling SILT/CLAY with	1.00	10*	U100 at 1.0m	S = 112 kN/m^2	CI - MI	diameter.
& siltstone fragments	1.50	14*	Shear Vane at 1.0m	pH = 4.0		U100 at 1.0m - 100% recovery
			pH at 1.0m			U100 at 2.0m - 100% recovery
f grey SILT/CLAY	2.00	20	U100 at 2.0m	k =1.66 x 10^{-6}mm/sec		Bulk Density = 2.06 Mg/m^3
ming light grey.	2.50	16*	Permeability at 2.0m	S = 110 kN/m^2		Dry Density = 1.72 Mg/m^3
			Shear Vane at 2.0m	LL = 46		
	2.95		LL,PL,pH at 2.0m	PL = 26 PI = 20 pH = 3.9		Water added from 0.5m
						*Natural moisture content.
to Firm dark grey	3.00	26	U100 at 3.0m	S = 48 kN/m^2		U100 at 3.0m - 65% recovery
with coal fragments			Shear Vane at 3.0m	LL = 44 PL = 25 PI = 19		
	4.00	24	LL,PL,pH at 3.0m	pH = 3.9	CI	
			U100 at 4.0m			U100 at 4.0 m - 100% recovery
			Shear Vane at 4.0m	S = 43 kN/m^2		
	5.00	21	pH at 4.0m	pH = 3.8		
ble black grey coal/						
mixture	5.40	22				
to firm dark grey CLAY						
coal fragments	6.00		U100 at 6.0m	S = 44 kN/m^2		U100 at 6.0m - 70% recovery
			Shear Vane at 6.0m		CI	
	6.50	20				
	continued.					

11/1

KEY FOR SYMBOLS:– ρ=bulk density (Mg/m^3) ρ_d=dry density (Mg/m^3) o.m.c.=optimum moisture content Spt=standard penetration test N=penetration resistance W=moisture content (%) C.B.R=California Bearing Ratio G_s=Specific Gravity C=cohesion(total stress kN/m^2) Ø=internal friction angle - total stress L.L.=liquid limit P.L.=plastic limit PI=plasticity index NP=Non-plastic =Vane shear strength (kN/m^2) Tri=undrained triaxial test Va=percentage air voids

SALOP COUNTY COUNCIL – BOREHOLE LOG

Site Stoneyhill Refuse Disposal Site Date 23-2-'9[illegible] Borehole No. Three

Type of boring Table Percussion Drilling Rig Natural Surface Level Formation Level

Strata description	Depth below surface (m)	Natural moisture content	Type of test and depth taken	Test results	Classification	Further test results and remarks
to Firm light grey with brown mottling coal fragments.	7.00	.19	U100 at 7.0m Shear Vane at 7.0m pH at 7.0m Permeability at 7.0m	c = 50 kN/m^2 pH = 4.0 k = 2.90 x 10^{-6}mm/sec	CI	
	8.00	.18	U100 at 8.0m Shear Vane at 8.0m LL,PL,pH at 8.0m	c = 43 kN/m^2 LL = 42 PL = 24 pH = 4.2 PI = 18		
	9.00 Finished.					

11/1

KEY FOR SYMBOLS:– ρ=bulk density (Mg/m^3) ρd=dry density (Mg/m^3) o.m.c.=optimum moisture content Spt=standard penetration test N=penetration resistance W=moisture content (%) C.B.R=California Bearing Ratio G_s=Specific Gravity C=cohesion (total stress kN/m^2; ϕ=internal friction angle - total stress L.L.=liquid limit P.L.=plastic limit PI=plasticity index NP=Non-plastic =Vane shear strength (kN/m^2) Tri=undrained triaxial test Va=percentage air voids.

SALOP COUNTY COUNCIL – BOREHOLE LOG

Site Stoneyhill Refuse Disposal Site Date 2-2-'84 Borehole No. Four

Type of boring Cable Percussion Drilling Rig Natural Surface Level _____ Formation Level _____

Strata description	Depth below surface (m)	Natural moisture content	Type of test and depth taken	Test results	Classification	Further test results and remarks
stiff brown/grey y SILT with siltstone coal fragments.	0.50	15	pH at 0.5m	pH = 3.42	MI	U100 at 1.0m – 7% recovery
	1.00	13	U100 at 1.0m LL,PL at 1.0m	LL = 41 PL = 26 PI = 15		
	1.50	12	pH at 1.5m	pH = 3.34		
	2.0	7.2	Spt at 2.0m pH at 2.0m	N = 15 pH = 3.44		Medium Density
m Dense grey ash, tone,coal,shale re	2.30	7.2				Water added at 5.3m
	3.00	12	Spt at 3.0m	N = 14 Medium Density		
	3.50	12	Bulk sample at 3.50		GML	
	4.00	9.6	Spt at 4.0m	N = 24 Medium Density		
	4.50	9.6				
	5.00	13	Spt at 5.0m	N = 21 Medium Density		
	5.50 5.60	31*				
dark grey CLAY e sandstone- – – – –	6.00 6.25	** 21	U100 at 6.0m LL,PL,pH at 6.0m	LL = 42 PL = 24 PI = 18 pH = 3.20 S = 60 kN/m^2	CI	** Natural moisture content Bulk Density = 1.76 Mg/m^3
	6.50	34	Shear Vane at 6.0m Permeability at 6.0m	k = 1.7 x 10^{-6} mm/sec		Dry Density = 1.45 Mg/m^3 U100 at 6.0m – 100% recovery
to stiff dark grey with coal frugments ight grey pockets of	7.00	**19	Vane Shear strength at 7m	S = 82 kN/m^2		U100 at 7.0m – 100% recovery
	7.50	30	pH at 7m pH ay 7.5m	pH = 3.40 pH = 3.38		

continued on sheet Two

1/1

KEY FOR SYMBOLS:– ρ=bulk density (Mg/m^3) ρ_d=dry density (Mg/m^3) o.m.c.=optimum moisture content Spt=standard penetration test N=penetration resistance W=moisture content (%) C.B.R=California Bearing Ratio G_s=Specific Gravity C=cohesion (total stress kN/m^2) ϕ=internal friction angle - total stress L.L.=liquid limit P.L.=plastic limit PI=plasticity index NP=Non-plastic Vane shear strength (kN/m^2) Tri=undrained friaxial test Va=percentage air voids.

SALOP COUNTY COUNCIL — BOREHOLE LOG

Site . Stoneyhill Refuse Disposal Site Date 5-3-'84 Borehole No. Four

Type of boring Cable Percussion Drilling Rig Natural Surface Level Formation Level

Strata description	Depth below surface (m)	Natural moisture content	Type of test and depth taken	Test results	Classification	Further test results and remarks
dark grey CLAY with nominal size coal rsed throughout.	8.00 8.50	21 21	U100 at 8.0m Shear Vane at 8.0m pH at 8.0m LL,PL at 8.5m	C = 90 kN/m² pH = 3.78 LL = 40 PL = 23 PI = 17	CI	*Natural moisture content Organic odour at 8.0m U100 at 8.0m - 100% recovery U100 at 9.0m - 100% recovery
dark grey CLAY with ous coal fragments & s of wood.	8.50 9.50 Finished.	19	U100 at 9.0m Shear Vane at 9.0m	C = 96 kN/m²		

11/1

KEY FOR SYMBOLS:— ρ=bulk density (Mg/m^3: ρ_d=dry density (Mg/m^3) o.m.c.=optimum moisture content Spt=standard penetration test N=penetration resistance W=moisture content (%) C.B.R=California Bearing Ratio G_s=Specific Gravity C=cohesion (total stress kN/m^2) Ø=internal friction angle - total stress L.L.=liquid limit P.L.=plastic limit PI=plasticity index NP=Non-plastic

SALOP COUNTY COUNCIL – BOREHOLE LOG

Site Stoneyhill Refuse Disposal Site Date 5-3-'84 Borehole No. Five

Type of boring Cable Percussion Drilling Rig Natural Surface Level Formation Level

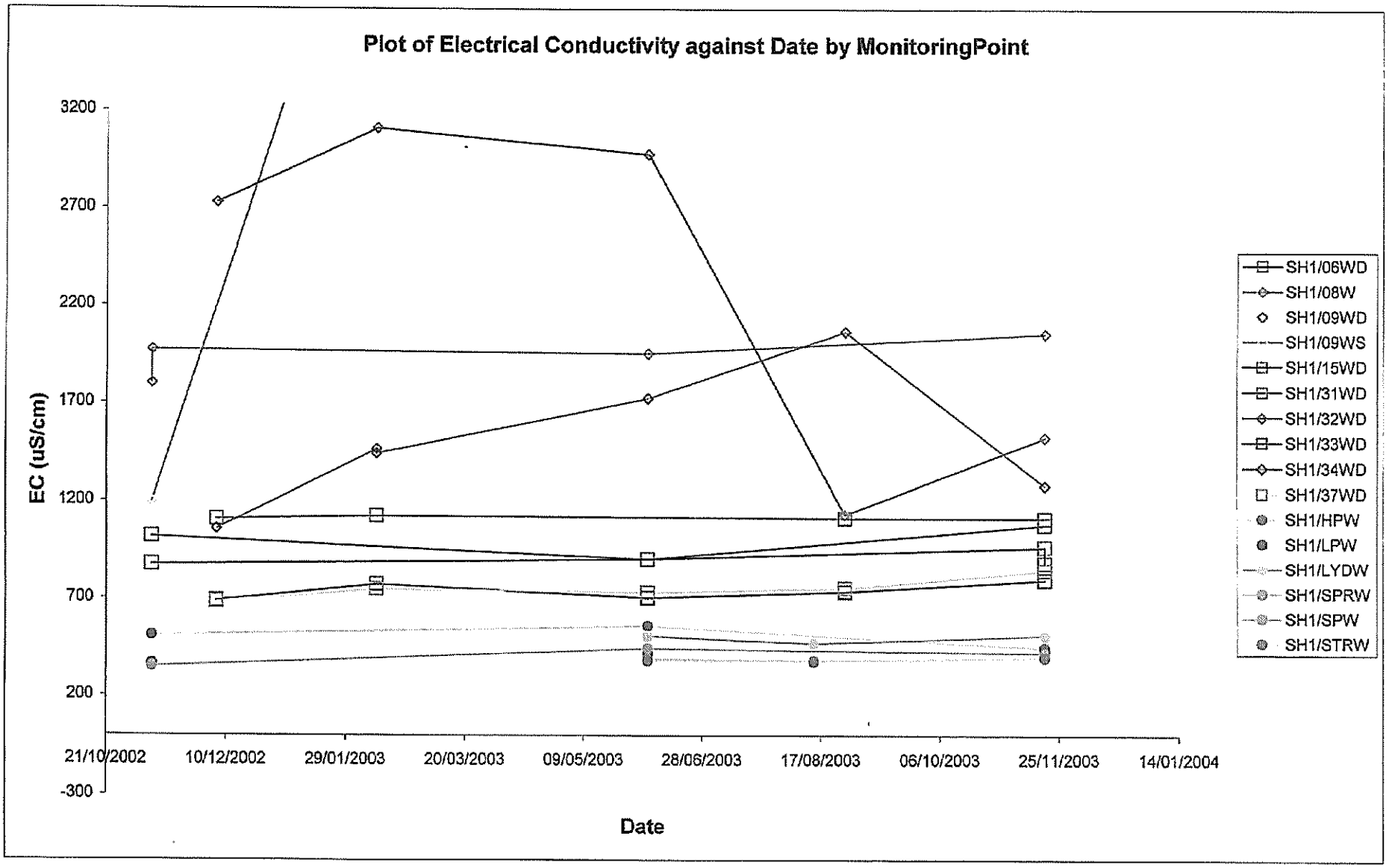
Strata description	Depth below surface (m)	Natural moisture content	Type of test and depth taken	Test results	Classification	Further test results and remarks
grey brown CLAY with fragments	0.5	24				
	1.0	23	U100 at 1.0m	S = 63 kN/m^2		U100 at 1.0m - 78% recovery
	1.5	23	Shear Vane at 1.0m	LL = 41 PL = 24 PI = 17	CI	
	2.0	23	LL,PL,pH at 1.5m	pH = 3.0		Water added from 1.0m
	2.3	25	U100 at 2.3m	S = 40kN/m^2		U100 at 2.3m - 100% recovery
grey silty CLAY with fragments and broken ends	3.0	24	Shear Vane at 2.3m			
			U100 at 3.0m			
			Shear Vane at 3.0m	S = 50kN/m^2		U110 at 3.0m - 95% recovery
			Permeability at 3.0m	k = 2.32 x 10^{-4} mm/sec	CI	
grey silty CLAY with ous coal fragments at	4.0	27	U100 at 4.0m	S = 70 kN/m^2		U100 at 4.0m - 95% recovery
	4.5	24	Shear Vane at 4.0m	LL = 40 PL = 23 PI = 17		
	4.9		LL,PL,pH at 4.0m	pH = 7.40		
le black grey coal/ mixture	5.0	21*	U100 at 5.0m	S = 82 kN/m^2		* Natural moisture content
			Shear Vane at 5.0m	k = 2.04 x 10^{-5} mm/sec		Bulk Density = 1.92 Mg/m^3
			Permeability at 5.0m			Dry Density = 1.59 Mg/m^3
friable coal	6.0		U100 at 6.0m	Sample unsuitable for classification		U100 at 6.0m - 100% recovery
	7.1					
to firm grey one at 8.5m	8.0	15*	U100 at 8.0m	S = 50 kN/m^2		
			Shear Vane at 8.0m	LL = 39 PL = 23 PI = 16	CI	
			LL,PL,pH at 8.0m	pH = 3.6		
	9.0 Finished.	21				

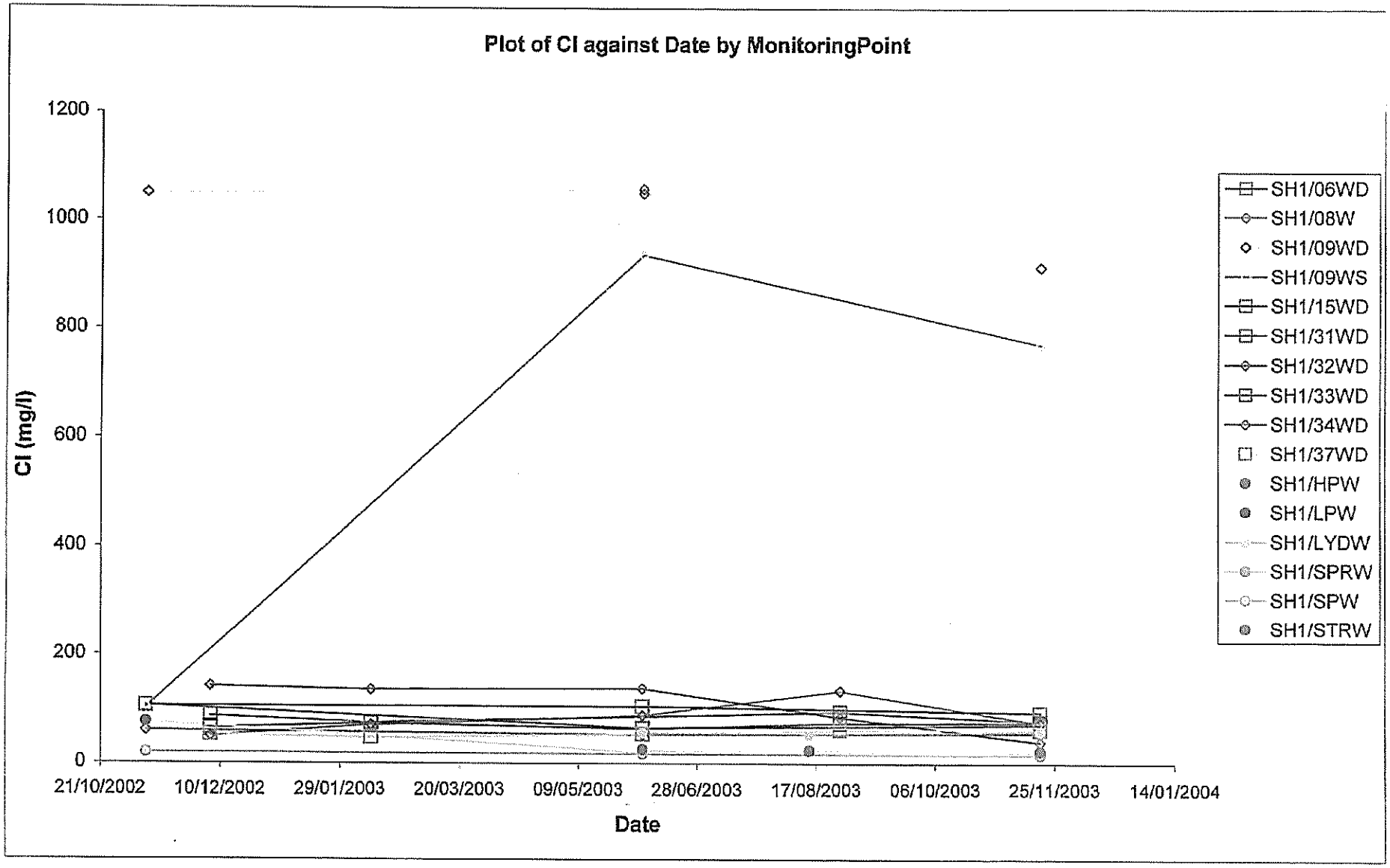
1/1

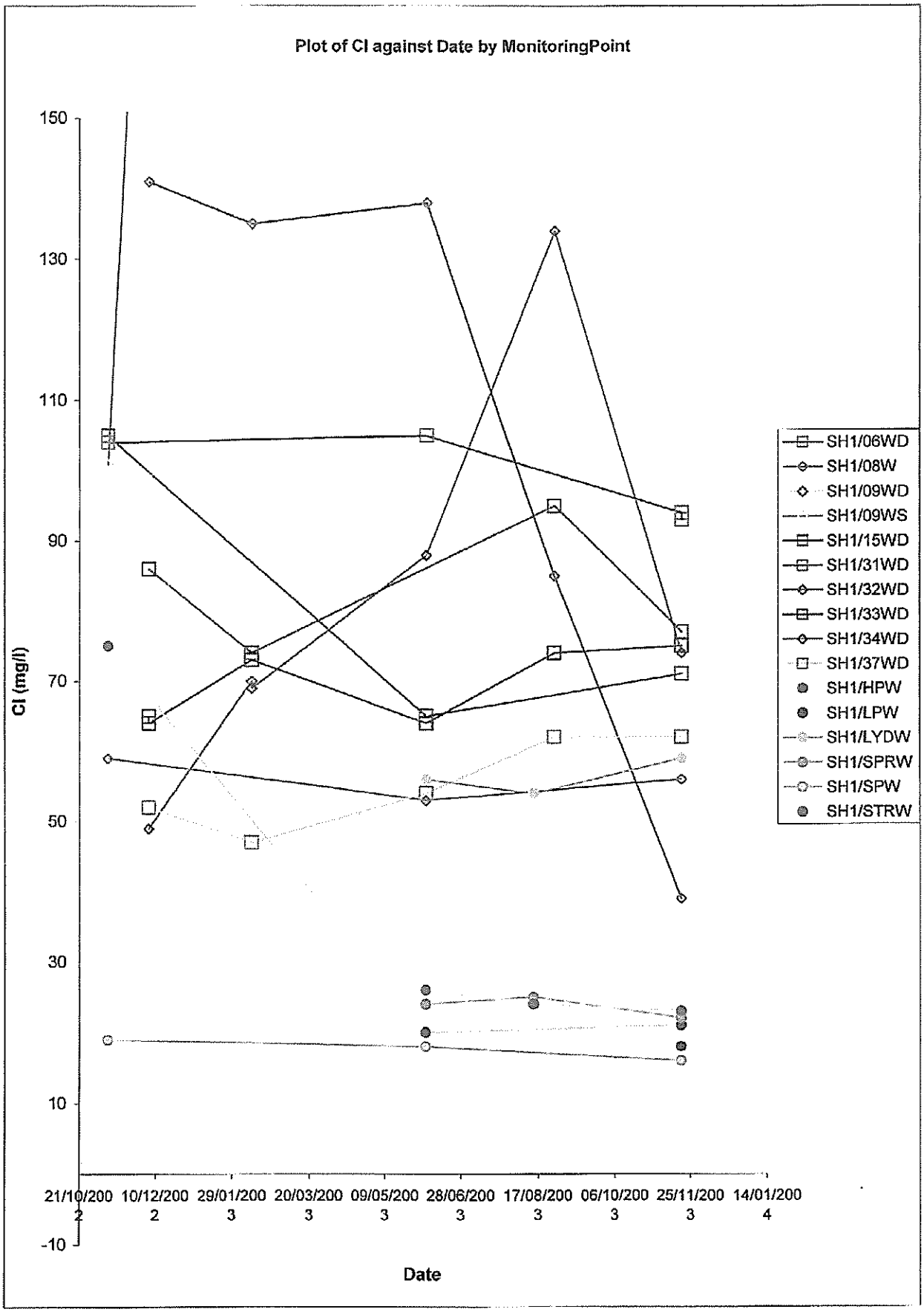
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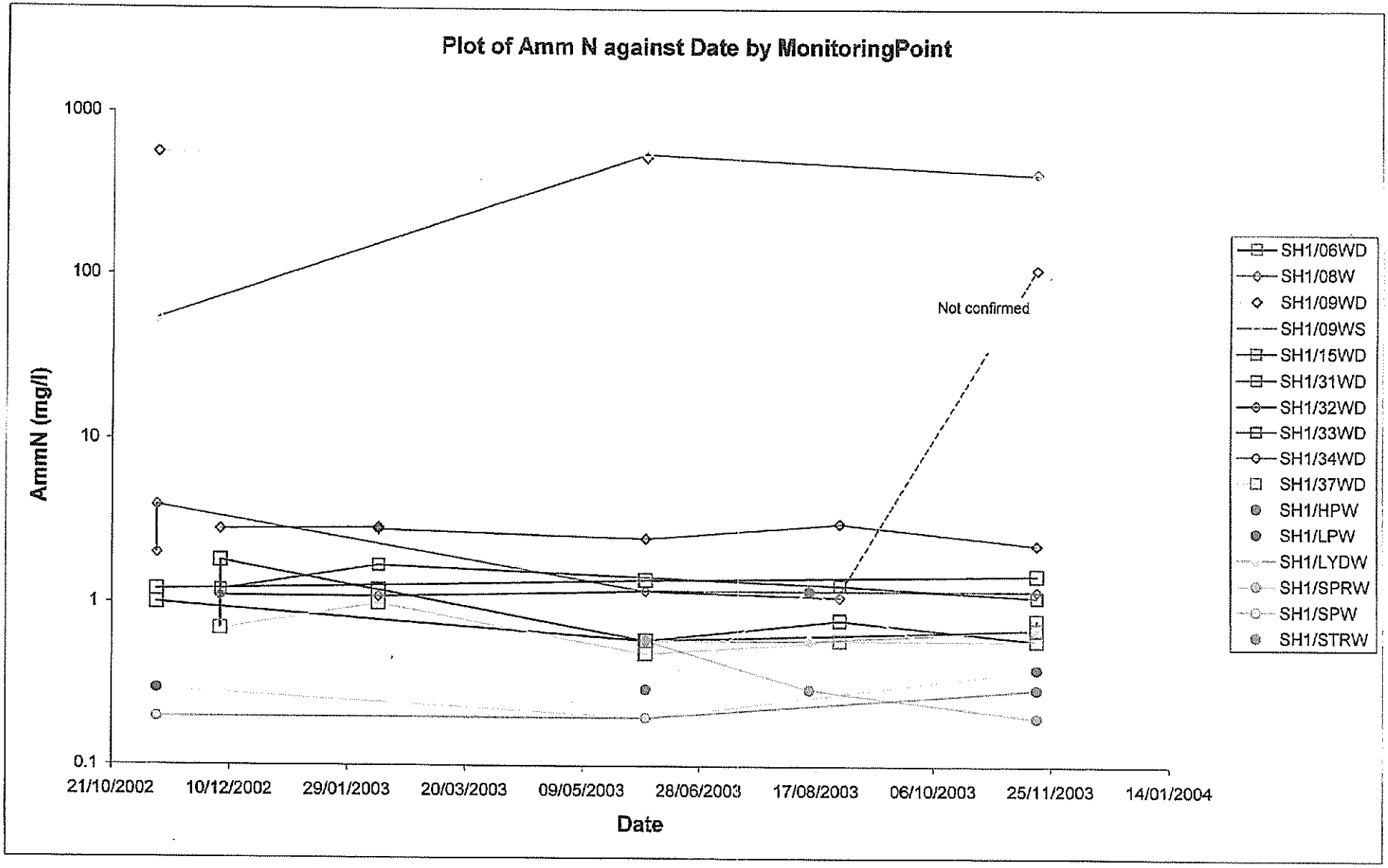
APPENDIX 8

WATER QUALITY
TIME SERIES PLOTS


Plot of Electrical Conductivity against Date by MonitoringPoint
EC (uS/cm)
3200
2700
2200
1700
1200
700
200
-300
21/10/2002
10/12/2002
29/01/2003
20/03/2003
09/05/2003
28/06/2003
17/08/2003
06/10/2003
25/11/2003
14/01/2004
Date
SH1/06WD
SH1/08W
SH1/09WD
SH1/09WS
SH1/15WD
SH1/31WD
SH1/32WD
SH1/33WD
SH1/34WD
SH1/37WD
SH1/HPW
SH1/LPW
SH1/LYDW
SH1/SPRW
SH1/SPW
SH1/STRW

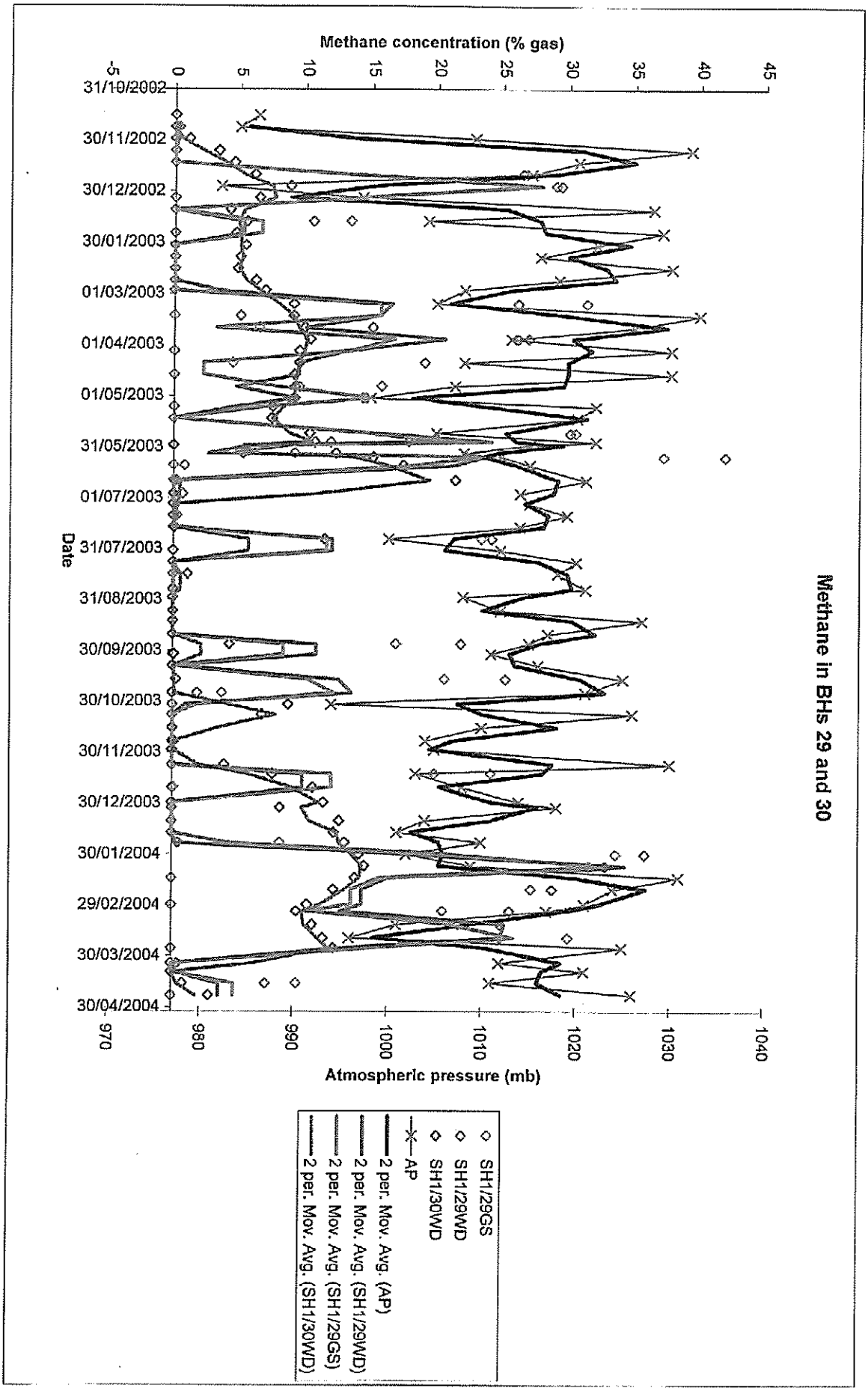

Plot of Cl against Date by MonitoringPoint
Cl (mg/l)
1200
1000
800
600
400
200
0
21/10/2002
10/12/2002
29/01/2003
20/03/2003
09/05/2003
28/06/2003
17/08/2003
06/10/2003
25/11/2003
14/01/2004
Date
SH1/06WD
SH1/08W
SH1/09WD
SH1/09WS
SH1/15WD
SH1/31WD
SH1/32WD
SH1/33WD
SH1/34WD
SH1/37WD
SH1/HPW
SH1/LPW
SH1/LYDW
SH1/SPRW
SH1/SPW
SH1/STRW

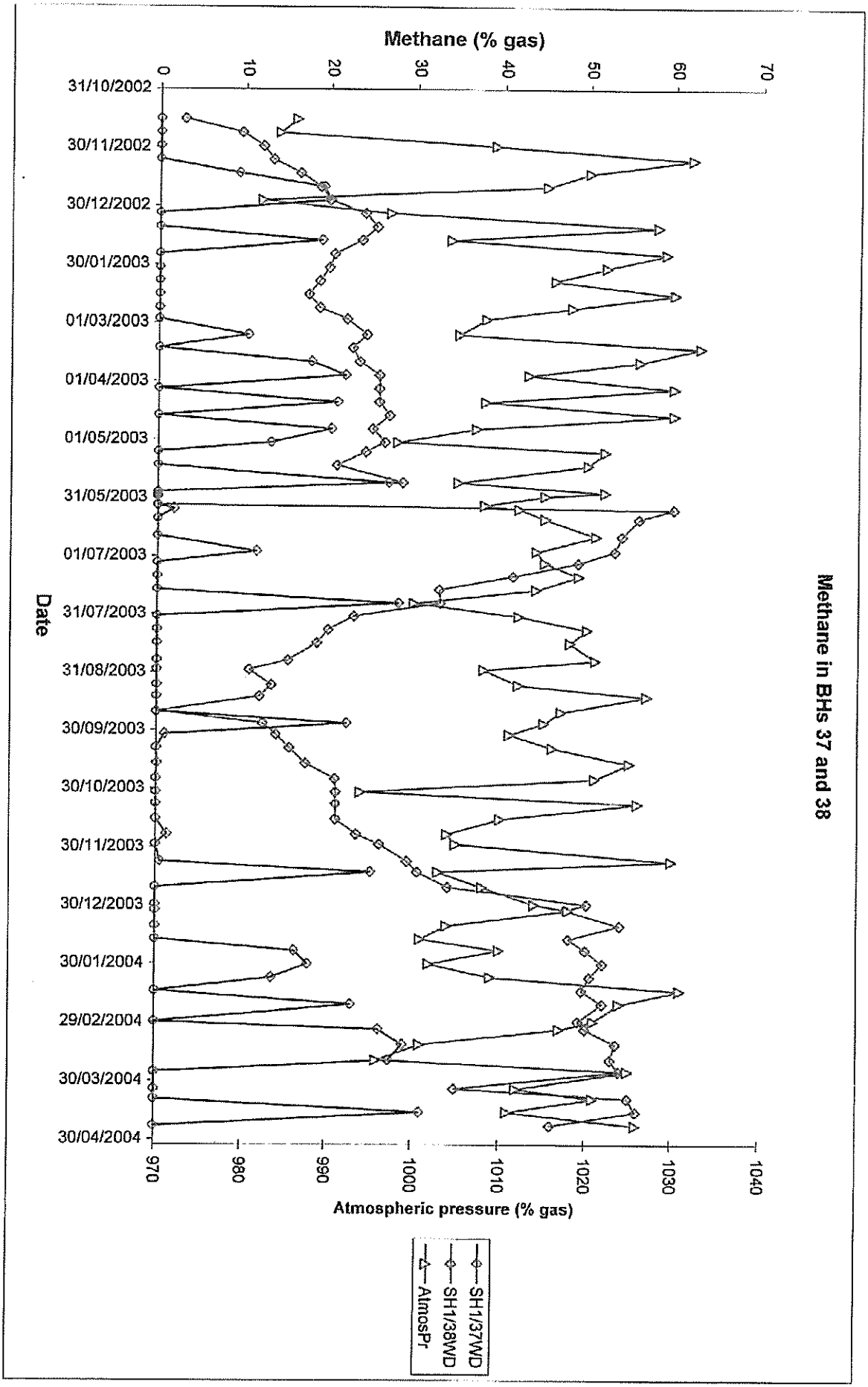

Plot of Cl against Date by MonitoringPoint
Cl (mg/l)
150
130
110
90
70
50
30
10
-10
21/10/200 2
10/12/200 2
29/01/200 3
20/03/200 3
09/05/200 3
28/06/200 3
17/08/200 3
06/10/200 3
25/11/200 3
14/01/200 4
Date
SH1/06WD
SH1/08W
SH1/09WD
SH1/09WS
SH1/15WD
SH1/31WD
SH1/32WD
SH1/33WD
SH1/34WD
SH1/37WD
SH1/HPW
SH1/LPW
SH1/LYDW
SH1/SPRW
SH1/SPW
SH1/STRW

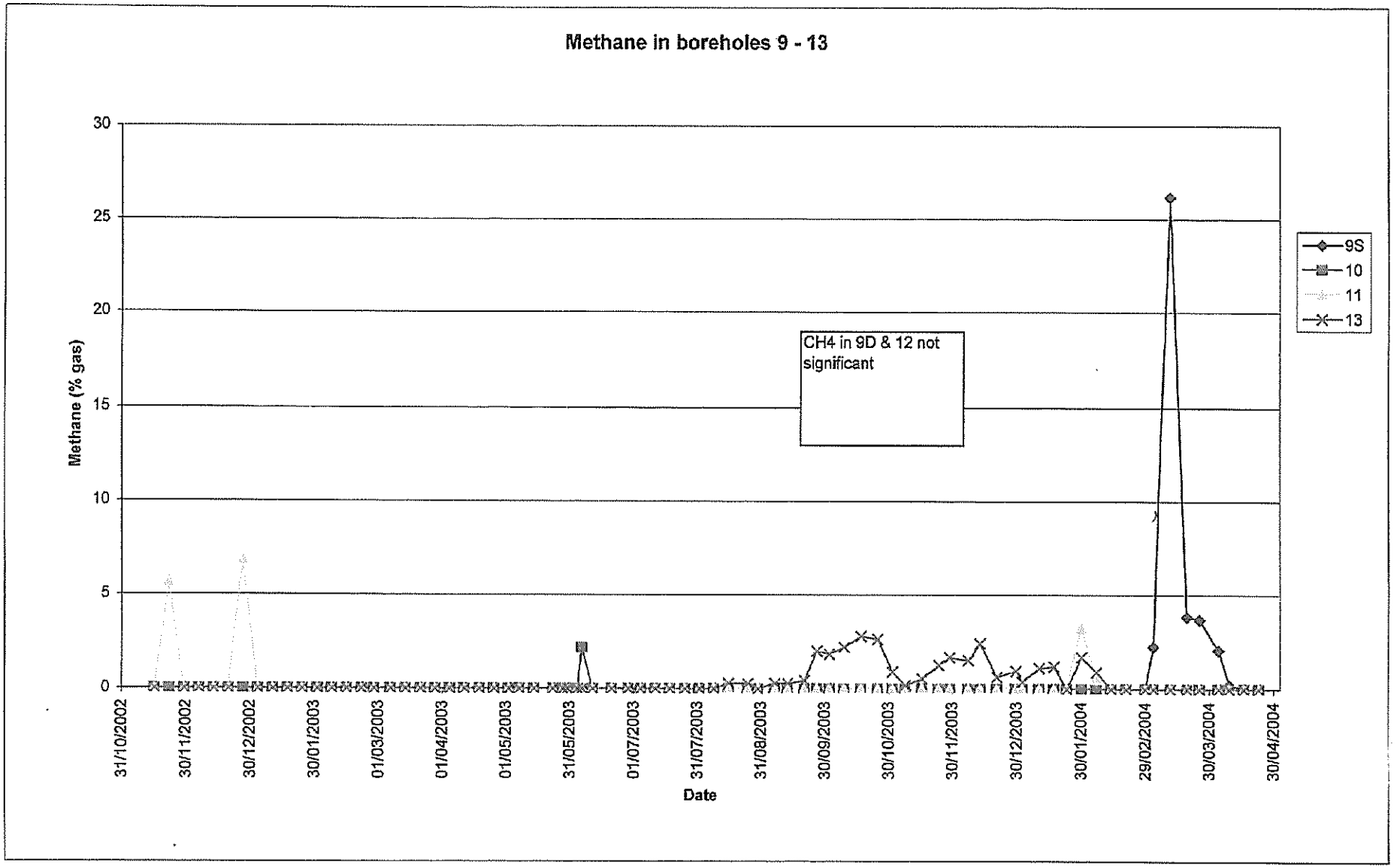

Plot of Amm N against Date by MonitoringPoint
AmmN (mg/l)
1000
100
10
1
0.1
21/10/2002
10/12/2002
29/01/2003
20/03/2003
09/05/2003
28/06/2003
17/08/2003
06/10/2003
25/11/2003
14/01/2004
Date
Not confirmed
SH1/06WD
SH1/08W
SH1/09WD
SH1/09WS
SH1/15WD
SH1/31WD
SH1/32WD
SH1/33WD
SH1/34WD
SH1/37WD
SH1/HPW
SH1/LPW
SH1/LYDW
SH1/SPRW
SH1/SPW
SH1/STRW

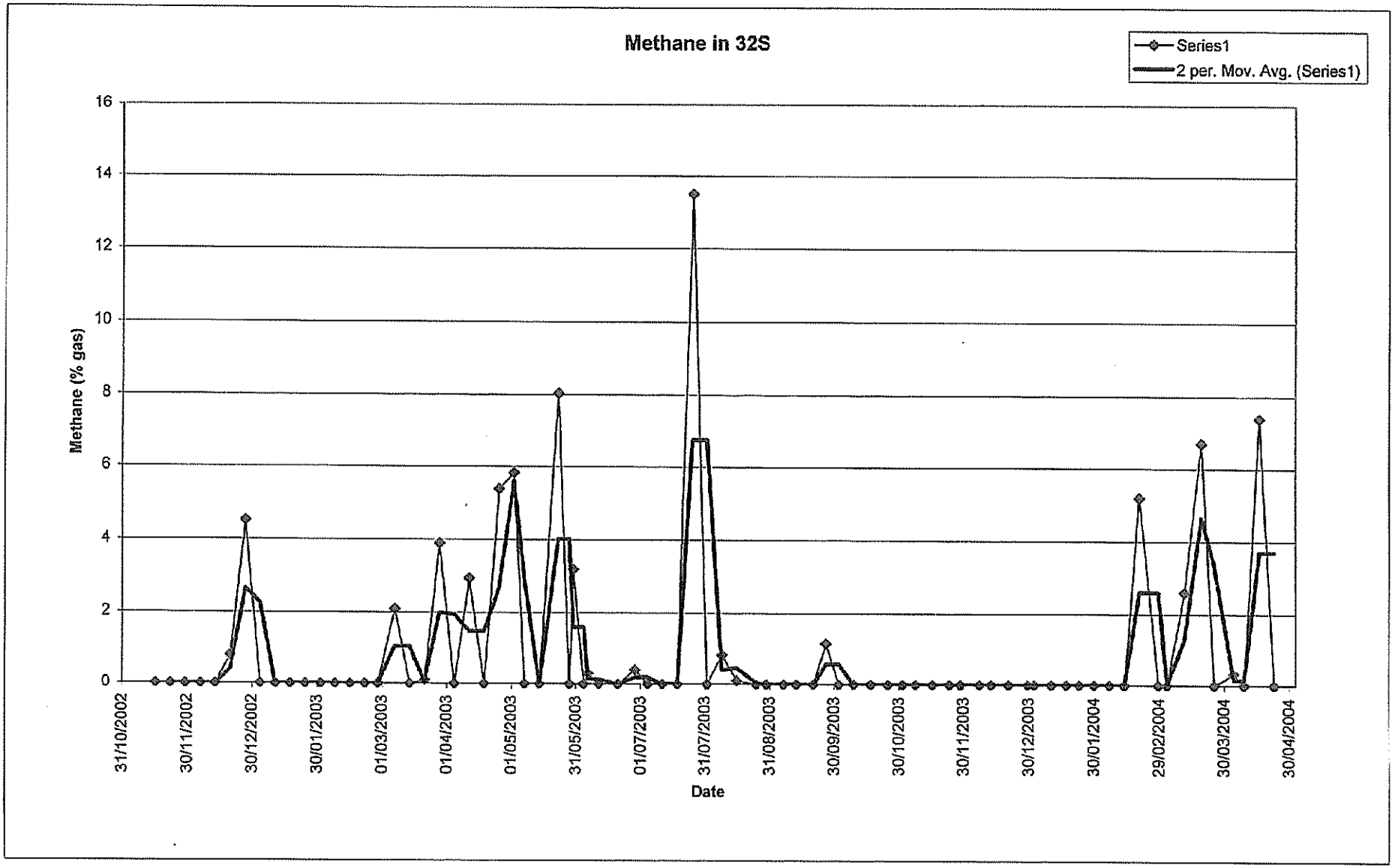
APPENDIX 9

GAS MONITORING
SELECTED TIME SERIES PLOTS


Methane in BHs 29 and 30
Methane concentration (% gas)
-5
0
5
10
15
20
25
30
35
40
45
Date
31/10/2002
30/11/2002
30/12/2002
30/01/2003
01/03/2003
01/04/2003
01/05/2003
31/05/2003
01/07/2003
31/07/2003
31/08/2003
30/09/2003
30/10/2003
30/11/2003
30/12/2003
30/01/2004
29/02/2004
30/03/2004
30/04/2004
970
980
990
1000
1010
1020
1030
1040
Atmospheric pressure (mb)
SH1/29GS
SH1/29WD
SH1/30WD
AP
2 per. Mov. Avg. (AP)
2 per. Mov. Avg. (SH1/29WD)
2 per. Mov. Avg. (SH1/29GS)
2 per. Mov. Avg. (SH1/30WD)


Methane in BHs 37 and 38
Methane (% gas)
0
10
20
30
40
50
60
70
Date
31/10/2002
30/11/2002
30/12/2002
30/01/2003
01/03/2003
01/04/2003
01/05/2003
31/05/2003
01/07/2003
31/07/2003
31/08/2003
30/09/2003
30/10/2003
30/11/2003
30/12/2003
30/01/2004
29/02/2004
30/03/2004
30/04/2004
970
980
990
1000
1010
1020
1030
1040
Atmospheric pressure (% gas)
SH1/37WD
SH1/38WD
AtmosPr


Methane in boreholes 9 - 13
Methane (% gas)
30
25
20
15
10
5
0
CH4 in 9D & 12 not significant
9S
10
11
13
31/10/2002
30/11/2002
30/12/2002
30/01/2003
01/03/2003
01/04/2003
01/05/2003
31/05/2003
01/07/2003
31/07/2003
31/08/2003
30/09/2003
30/10/2003
30/11/2003
30/12/2003
30/01/2004
29/02/2004
30/03/2004
30/04/2004
Date

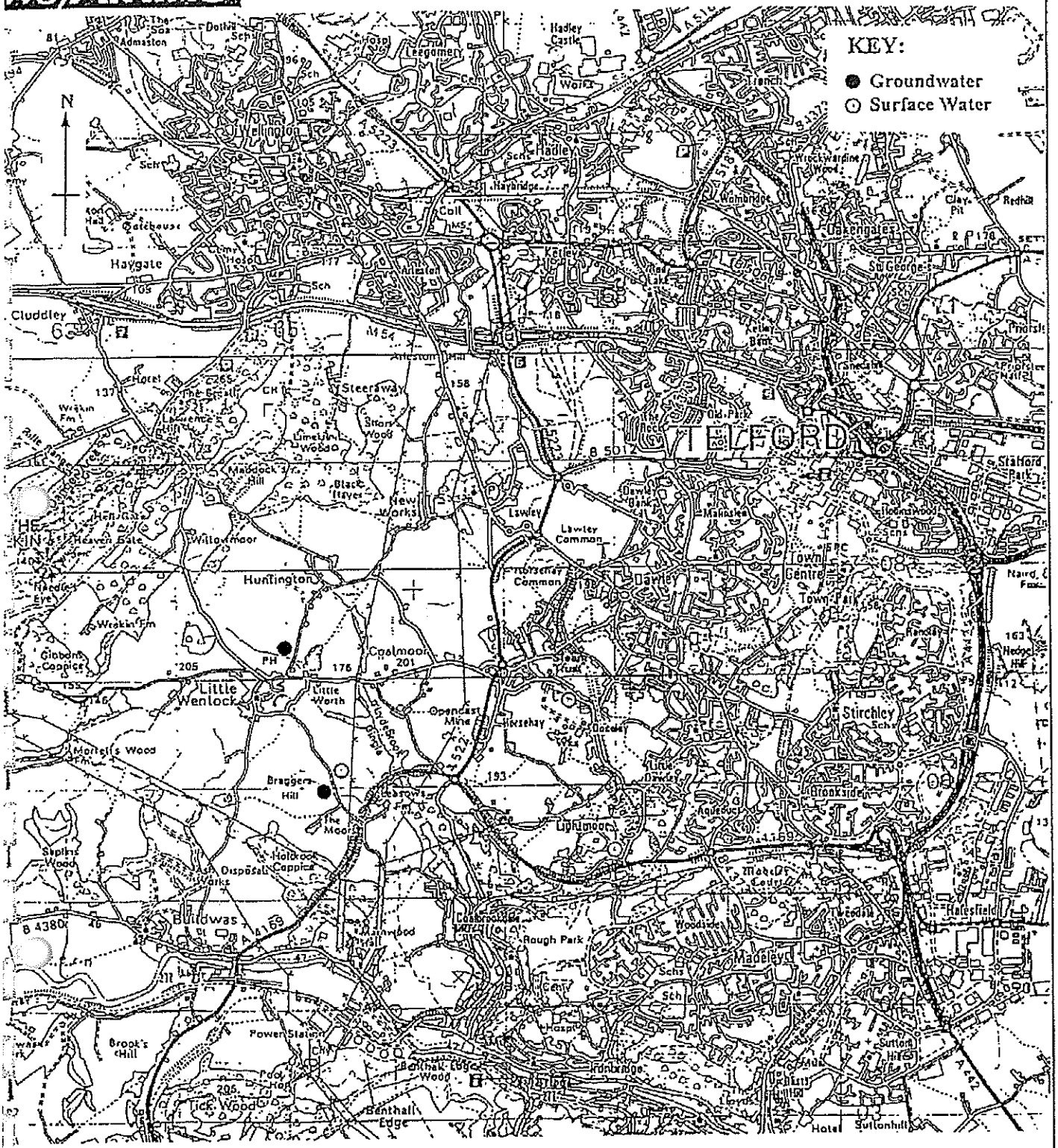

Methane in 32S
Series1
2 per. Mov. Avg. (Series1)
Methane (% gas)
16
14
12
10
8
6
4
2
0
31/10/2002
30/11/2002
30/12/2002
30/01/2003
01/03/2003
01/04/2003
01/05/2003
31/05/2003
01/07/2003
31/07/2003
31/08/2003
30/09/2003
30/10/2003
30/11/2003
30/12/2003
30/01/2004
29/02/2004
30/03/2004
30/04/2004
Date

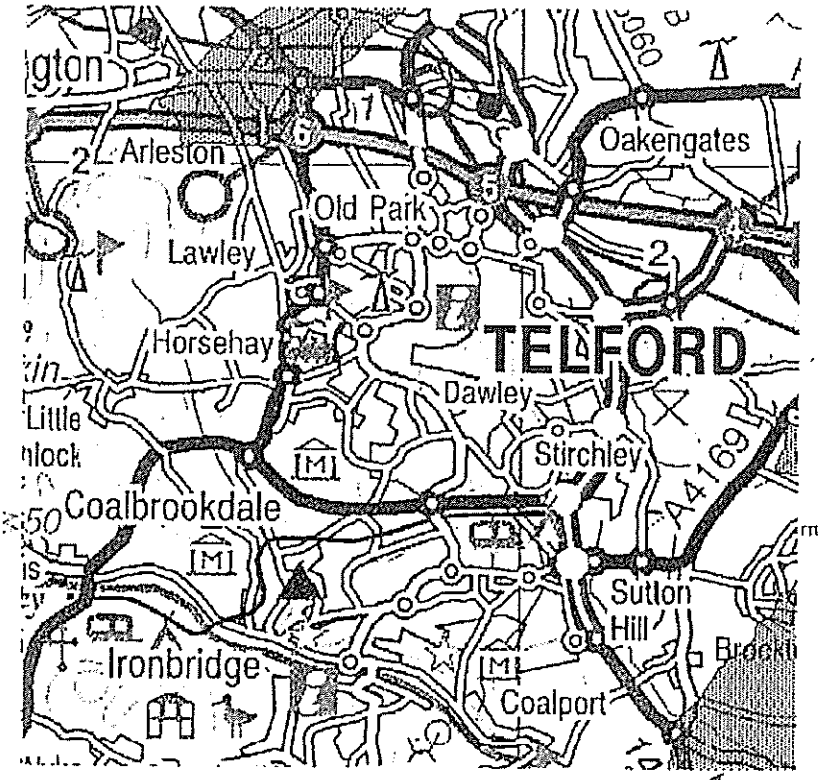
APPENDIX 10

WATER RECEPTOR DATA:

- Extract from WS Atkins report showing licensed water abstractions
- Groundwater Source Protection Zones
- River quality data for Lyde Brook

WS/Atkins


KEY:
Groundwater
Surface Water
N
TELFORD
Wellington
Hadley
Haygate
Cluddley
Huntington
Little Wenlock
Coalmoor
Lawley
Dawley
Stirchley
Madeley
Buildwas
Benthall Edge
Brooks Hill
Town Centre
Lightmoor
Rough Park
Sutton Hill
Hotel
Power Station
Opencast Mine
Steeraway
Wilcotmoor
Heaven Gate
Globe's Coppice
Mortell's Wood
Bragger's Hill
Holdcot Coppice
Disposal Works
Lawley Common
Horsehay Common
Coalbrookdale
Ironbridge
Woodside
Brookside
Aqueduct
Redhill
Oakengates
Stafford Park
Hadley Castle
Admaston
Leegomery
Arleston
Kellet Lake
Old Park
Stirchley Sch
Madeley Sch
Madeley Court
Hospital
Cemy
PH
Sch
Hotel
Town Park
Ind Est
Woodside
Leegomery
Trench
Wrockwardine Wood
Wombridge
Clay Pit
St George
Kellet Bank
Old Park
Dawley Bank
Makeston
Ironwood
Naird Park
Hedge Hill
Little Dawley
Little Worth
Aqueduct
Makeston
Leegomery
Sutton Hill
Hatesfield
Woodside
Ironbridge
Rough Park
Benthall Edge Wood
Tick Wood
Pool Hall
Pool Hay
Limekiln Wood
Stony Wood
Black Haven
New Works
Maidstock Hill
Wrekin Fm
Lawrence Hill
Hall
Ch
Sch
Cemy
Hospl
Ind Est
Aqueduct
Level
Mill
Pool
Wood
Coppice
Works
Fm
Hill
Edge
Common
Park
Centre
Estate
Gate
Heaven
Haven
Lawrence
Stony
Limekiln
Maidstock
Wilcotmoor
Huntington
Coalmoor
Lightmoor
Stirchley
Madeley
Buildwas
Benthall
Brooks
Sutton
Hatesfield
Woodside
Ironbridge
Rough
Aqueduct
Brookside
Redhill
Oakengates
Stafford
Naird
Hedge
Makeston
Ironwood
Dawley
Lawley
Steeraway
Wrekin
Globe's
Mortell's
Bragger's
Holdcot
Disposal
Works
Opencast
Mine
Horsehay
Common
Town
Centre
Park



Groundwater Protection Zones

Data Search

River Quality

River Details:

River Name:	Lyde Brook
Stretch Name:	Coalbrookdale road Bridge to confluence of the River Severn
Upstream Grid Refrence:	X: 366700, Y: 304900
Downstream Grid Refrence:	X: 366600, Y: 303600
Stretch Length:	1.5 km
Year:	2001

Sampling Results:

	Average	Standard Deviation	Percentile 90	Percentile 10	Number of Samples	Grades
Biochemical Oxygen Demand (mg/l)	1.69	0.87	2.79	-	33	B
Ammonia (mgN/l)	0.2	0.21	0.42	-	32	B
Dissolved Oxygen (Percentage Saturation)	103.1	6.84	-	94.33	31	A

LIGHTMOOR VILLAGE, TELFORD

ENVIRONMENTAL STATEMENT

Project N°: 6479

April 2002

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Somerset House
London Road
Redhill
Surrey RH1 1LU

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Fax: 01737 784501

www.campbellreith.com

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2.0 SITE DESCRIPTION

3.0 LEGISLATIVE & POLICY FRAMEWORK

4.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

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6.0 ECOLOGY AND NATURE CONSERVATION

7.0 GEOLOGY

8.0 SOILS AND CONTAMINATION

9.0 HYDROLOGY, DRAINAGE AND HYDROGEOLOGY

10.0 TRAFFIC & TRANSPORTATION

11.0 AIR QUALITY

12.0 NOISE AND VIBRATION

13.0 LAND USE

14.0 LANDSCAPE AND VISUAL IMPACT

15.0 CULTURAL HERITAGE

APPENDICES

1.0 INTRODUCTION

1.1 BACKGROUND

This Environmental Statement is submitted as one of a number of documents in support of an outline planning application for the development of a new urban village at Lightmoor to form part of the development of Telford. The application is being submitted on behalf of Bournville Village Developments (the development vehicle for Bournville Village Trust) and English Partnerships, who have formed a joint venture to promote the development of the new Lightmoor Village.

Established in 1900, Bournville Village Trust carried out the development of the model village alongside George Cadbury's chocolate factory in Bournville, Birmingham. The project initially comprised around 313 houses and 330 acres of land. Since then the Estate has grown to some 8,000 houses with a broad range of tenure, approximately half being freehold or leasehold and half being rented.

The Joint Venture wishes to develop a 'New Bournville' at Lightmoor, Telford. The scheme offers an opportunity to break new ground, and provide an integrated and sustainable environment for the new Millennium in the spirit of George Cadbury's pioneering achievement 100 years ago. Instead of a standard housing development, the Trust wishes to create an 'urban village' which will incorporate:

- a mix and variety of uses and activities;
- a mixture of tenures, both residential and commercial;
- a level of density consistent with sustaining a mixed-use neighbourhood;
- a compactness sufficient to bring a range of facilities within easy access for pedestrians;
- sustainable design, not only of buildings but also of infrastructure; and
- a high quality of urban and landscape design, and architecture.

Lightmoor Village is a unique opportunity to create a flagship example of how urban communities can be developed in the future. It has the potential to act as a 'demonstration' project, providing the region with a benchmark of good urban design and sustainable approaches to urban living.

The proposed development initially received planning consent in 1991, under section 7(1) the New Towns Act. The Application Site is also included in the Telford & Wrekin Local Plan.

1.2 SCOPE OF WORKS

The Joint Venture team has voluntarily submitted this Environmental Impact Assessment (EIA) in order to ensure that environmental considerations are incorporated into the design of the project from the outset. The development seeks to involve state-of-the-art urban design principles to ensure the goals of environmental and social sustainability are met. To this end, the EIA is an integral part of the means to achieve these goals. The legislative and policy framework that encompass this process is detailed in Section 3.0.

Campbell Reith Hill, along with Tibbalds TM2, have been commissioned by Bournville Village Developments and English Partnerships (the Joint Venture) to undertake an EIA in support of the application for outline planning permission.

In order to achieve a full coverage of potential impacts, a voluntary scoping exercise was conducted and the following facets identified for inclusion:

- Socio-economic
- Ecology and Nature Conservation
- Soils and Contamination
- Geology
- Hydrology, Drainage and Hydrogeology
- Traffic and Transportation
- Air Quality
- Noise and Vibration
- Land Use
- Landscape and Visual Impact
- Cultural Heritage

Given the history of this proposal, there exists a well developed body of information relating to the Application Site and its immediate surroundings. Where this information has been deemed appropriately accurate and up-to-date, it has been incorporated into the EIA. Where information was incomplete, superseded, or any doubts existed as to currency and accuracy, further studies were undertaken to remove any deficit.

1.3 REPORT STRUCTURE

The EIA has been prepared in accordance with current best practice, legislation and guidance including:

- The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999/293);
- Preparation of Environmental Statements for Planning Projects that require Environmental Assessments - A Good Practice Guide; DETR 1998; and
- Environmental Impact Assessment, Circular 02/99 DETR 1999.

The report is structured as follows:

- Section 1.0 introduces the project and proposals, and Section 2.0 details the description of the current Application Site;
- Section 3.0 details the legislative and policy framework applicable to the development and Section 4.0 details the proposed development; and
- Section 5.0 through to 15.0 provide detailed assessments of each of the aspects identified during scoping. Impacts are identified and quantified, and where appropriate, mitigation measures presented.

A Non-Technical Summary is provided as a separate document to this Statement.

1.4 PROJECT TEAM

This Statement has been co-ordinated and prepared by Campbell Reith Hill LLP, in conjunction with Tibbalds TM2, along with specialist contributions from Arup, EUS Limited, Fleming & Barron and John Samuels Archaeological Consultants. The specific chapters have been prepared as follows:

• Socio-economic	- Tibbalds TM2
• Ecology and Nature Conservation	- Campbell Reith Hill & Arup
• Geology	- Campbell Reith Hill
• Soils and Contamination	- Campbell Reith Hill
• Hydrology, Drainage & Hydrogeology	- Campbell Reith Hill
• Traffic and Transportation	- Campbell Reith Hill
• Air Quality	- Campbell Reith Hill & EUS Ltd
• Noise and Vibration	- Campbell Reith Hill & Fleming & Barron
• Land Use	- Campbell Reith Hill
• Landscape and Visual Impact	- Tibbalds TM2
• Cultural Heritage	- Tibbalds TM2 & John Samuels Archaeological Consultants

2.0 SITE DESCRIPTION

2.1 LOCATION

The Application Site is situated in the south-western area of Telford in the parish of Dawley Hamlets, approximately 4 km from Telford Town Centre. To the north and east of the Application Site are the communities in Horsehay, Doseley, Little Dawley and the Lightmoor New Community. To the south, across the A4169, is the village of Coalbrookdale and Ironbridge Gorge and its historic Iron Bridge across the River Severn. To the south east, across the A4169, lie the residential estates of Woodside and Madeley. To the west, beyond Wellington Road and the A5223, is open countryside extending to the Wrekin.

The Application Site is 71.8. hectares (177.5 acres) in area. It is bounded by:

- The Stoneyhill waste disposal site, Wellington Road, part of Horsehay village and the boundary of the site occupied by Johnston Pipes to the north
- Land of ecological and landscape value designated as a Wildlife Site to the east and south east
- Agricultural land forming a transition zone between the Application Site and the Wildlife Site to the south with the potential of being incorporated as an extension to the Wildlife Site
- The A4169 Ironbridge by-pass to the west.

The Application Site boundary is detailed in Drawing 6479/ES-2-01.

2.2 SITE DESCRIPTION

The majority of the Application Site is currently in agricultural use, and is primarily used for grazing as it is of low quality (mostly grade 4). There are several private residential properties in the midst of the Application Site and these have been excluded from the planning application. These include properties at the western and eastern ends of Stoneyhill Lane, and at and adjacent to Woodlands Farm, at the northern end of Woodlands Lane. Two properties, Croppings Farm and Stocking Farm, are owned by English Partnerships and leased to their current occupants and are included within the Application Site.

There are a number of public footpaths crossing the Application Site. The principal ones are along historic lanes, flanked by hedgerows, notably Woodlands Lane, Stoneyhill and Holywell Lane. These lanes are used for pedestrian, cycle and vehicular access to the properties along them, and for recreational purposes for walking, cycling and horse riding.

Two sets of overhead power lines on pylons cross the southern part of the Application Site in an east-west direction.

The Application Site has a strongly defined topography of hillslopes and valleys, which has been altered in places by previous mining and waste-disposal activities. The land generally falls to the south-east from approximately 178mAOD in the north to approximately 125mAOD in the south.

The land to the south of the Application Site is the most affected by the legacy of mining, brick and tile manufacture and iron working. This has resulted in a very uneven topography of spoil heaps, mineshafts and pits. Most of this is within the designated Wildlife Site and is outside the Application Site.

Some parts of the Application Site to the south west of Stocking Farm have been subject to open cast mining during World War 2 and have been back-filled to form a smoother, more even topography than elsewhere. In other areas, the Application Site is underlain by shallow and deep mine shafts which would need to be appropriately grouted where needed should development be proposed above them.

The Application Site is adjacent to the former Stoneyhill Waste Disposal site to the east.

The Application Site is underlain by a number of geological faults. These generally run in a south-west to north-east direction, with the grain of the topography. The implications of these, and all the other significant physical constraints on development have been taken into account in the development proposals and are discussed in the relevant chapters of this Statement.

The site lies within the catchment of the Lightmoor Stream and existing run-off is towards the south-east, and the Wildlife Site. Natural drainage feeds a number of large and environmentally sensitive pools (the Burrough's Bank pools) within the Wildlife Site. There are also several natural springs on and adjacent to the Application Site.



N

LEGEND

GENERAL LEGEND:

SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)

BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

notes

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   - S :- SCHEME — Outline/Scheme drawings for proposals, budgets etc.
   - D :- DESIGN DEVELOPMENT — Evolving final design drawings for approvals, tenders, billing etc.
   - C :- CONSTRUCTION — Fully developed drawings issued under instruction for construction.
   - :-

ONLY STATUS C DRAWINGS TO BE USED FOR CONSTRUCTION.

Status/Rev	Description	Date	By
D1	ISSUED FOR INFORMATION	FEB'02	SA

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Job Title: LIGHTMOOR VILLAGE, TELFORD

Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

APPLICATION SITE

drawn	date	scale	CI checked	CAD filename
SA	FEB'02	1:4000	-	ES-2-01-D1

Job No.	Drg No.	Status/Revision
6479	ES-2-01	D1

A2

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3.0 LEGISLATIVE AND POLICY FRAMEWORK

3.1 LEGISLATION

This Environmental Impact Assessment has been undertaken in accordance with the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 - SI 1999/293 (referred to hereinafter as the Regulations). The Regulations implement Council Directive No. 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (the EIA Directive), as amended by Council Directive No. 97/11/EC, in so far as it applies to development under the Town and Country Planning Act 1990.

The EIA Directive came into force in 1988. Directive 97/11/EC, which amends the EIA Directive, came into force on 14 March 1999. It extends the range of development to which the EIA Directive applies and makes a number of small but important changes to environmental impact assessment procedures.

The EIA Directive's main aim is to ensure that the authority giving the primary consent (the Local Authority) for a particular project makes its decision in the knowledge of any likely significant effects on the environment. The EIA Directive, therefore, sets out a procedure that must be followed for certain types of project before they can be given 'development consent'. This procedure - known as Environmental Impact Assessment (EIA) - is a means of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects, and the scope of reducing them, are properly understood by the public and the relevant competent authority before it makes its decision.

The Regulations contain descriptions of different types of development, which are separated into Schedule 1 and Schedule 2 developments. Schedule 1 developments always require EIA. Determination as to whether Schedule 2 developments require EIA is based upon whether the development meets one of the relevant criteria or exceeds one of the relevant thresholds contained within Schedule 2 of the Regulations, or is deemed to be located in a 'sensitive area', as defined in the Regulations.

For all Schedule 2 developments the local planning authority must make its own formal determination of whether or not EIA is required (referred to in the Regulation as a 'screening option').

The Regulations detail examples of a number of infrastructure projects in Schedule 2 which will require EIA if the area of development exceeds 0.5ha. In addition, the supporting document DETR Circular 02/99 'Environmental Impact Assessment' also states:

"Development proposed for sites which have not previously been intensively developed are more likely to require EIA if:

- *The site area of the scheme is more than 5ha; or*

- *It would provide a total of more than 10,000 m² of new commercial floorspace; or*
- *The development would have significant urbanising effects in a previously non-urbanised area (eg a new development of more than 1,000 dwellings)"*

This Environmental Statement is being voluntarily submitted, and therefore no screening opinion from Telford & Wrekin Council was obtained. This was advised to Telford & Wrekin Council in a letter dated 3 December 2001 (see Appendix 1). During these discussions, the scoping of the Statement was also presented informally to the Council, where it was committed to that all potential impact areas would be assessed.

3.2 PLANNING CONTEXT

3.2.1 The Section 7(1) Consent

The Lightmoor area has long been regarded as a component of the long-term development of the new town of Telford, and still remains the last major undeveloped area within the original Telford Master Plan. General proposals for the development of the area were approved by the Secretary of State for the Environment in 1991, under Section 7(1) of the New Towns Act 1981. This permission, granted to the Telford Development Corporation (and subsequently vested in the Commission for New Towns and now English Partnerships), is similar to an outline planning permission under the Planning Acts.

The Section 7(1) permission covered proposals for new vehicular access points into the main Application Site from the north (Wellington Road and the Horsehay by-pass) and from the A4169 Ironbridge by-pass immediately south of the Stoneyhill Waste Disposal Site, as well as development proposals on areas beyond the general location of the Lightmoor Village for which outline planning permission is now being sought.

Within and adjacent to the core development proposals, however, the Section 7(1) permission provided consent for the following uses:

- up to 750 residential units and ancillary development on 30.35 hectares (75 acres);
- manufacturing uses (Use Classes B1 and B2) on 2.83 hectares (7 acres) adjacent to Johnston Pipes;
- office uses (Use Class B1) on 2.02 hectares (5 acres) immediately south of the above manufacturing area;
- retail and community facilities, including a primary school, community centre, doctors surgery, general store and a play area (Use Classes A1, C3, D1 and D2); and
- open space/woodland/public paths.

The approval was subject to two conditions, one of which was relevant to the Lightmoor Village development. This stated that before any development takes

place in the areas of archaeological interest, the developer should secure the implementation of a programme of archaeological work, in accordance with a written scheme of investigation submitted by the developer and approved by the local planning authority.

The above residential and employment uses, together with open space forming a proposed Green Network and the Prime Site for Nature Conservation (now the Wildlife Site) have been incorporated in the Wrekin Local Plan 1995-2006. The principle of development is, therefore, clearly established. The assessment of the current proposals against planning policy is set out later in this statement.

3.2.2 The Evolving Development Concept

In 1997 Bournville Village Trust, supported by the then Commission for New Towns (now English Partnerships), and the Urban Villages Forum (now the Prince's Foundation), and in liaison with Telford & Wrekin Council, appointed various consultants and advisers to investigate the feasibility of developing a New Bournville village at Lightmoor. A core masterplanning team of Tibbalds TM2, (architects, planners and urban designers) and Campbell Reith Hill (consulting engineers) was supplemented by specialists in ecology (Arup) and archaeology (John Samuels Archaeological Consultants), and BVT's advisers in property and valuation (GVA Grimley), legal matters (Wragge & Co), cost consultancy (Francis Graves Ltd), architecture (Bournville Architects) and public relations (Everington Public Relations).

The initial feasibility work undertaken focussed on:

- assessing known constraints on development;
- reviewing the property market to identify realistic levels of potential demand for residential, employment, retail and leisure uses;
- examining options for development;
- clarifying objectives for sustainable development; and
- producing a development concept.

The feasibility work indicated that a development concept which broadly coincided with the Section 7(1) plan and the areas allocated in the Wrekin Local Plan, could be achievable. It identified also, particularly through the consultation process, the need for environmental sensitivity and the protection of ecological and archaeological features. As a result Bournville Village Trust commissioned additional studies of ecology and archaeology and further site investigations which are referred to in the respective Chapters of this Statement.

The results of these additional studies informed a process of identifying and evaluating further development options for Lightmoor Village, and the conclusion that a significantly different disposition of development was preferable to that envisaged at the initial feasibility stage in the 7(1) permission. The revised development concept, on which subsequent detailed masterplanning work leading to this application was based, incorporated the following features:

- the non-development of any land parcels to the south of the Stoneyhill and Holywell Lanes, thereby keeping development well away from the ecologically sensitive Wildlife Site and The Dingle ancient woodland;
- a much more compact form of urban development, with a lower land take requirement and a greater potential to maximise pedestrian connectivity;
- a shorter, more efficient alignment for the principal access road serving the development providing a more effective routing for buses;
- the retention of the existing network of lanes with a requirement for them to be crossed by the access road in only four places;
- the ability to support a mixed-use village centre and primary school at the geographic heart of the development where they would be readily accessible to all;
- a better distribution of employment uses in the north and south of the village as well as in the mixed-use centre;
- an open space network around the built-up area providing for a range of sports, play and recreational facilities close to residents, but still well away from the environmentally sensitive Wildlife Site; and
- a development form which can support a sustainable urban drainage system minimising any potential impact on hydrogeology and the pools within the Wildlife Site.

3.2.3 Consultation

From the outset, the masterplanning process has involved consultation with and involvement of the public, Telford & Wrekin Council, and other agencies and groups. At the feasibility stage of the process, two rounds of public consultation meetings and workshops were run on behalf of BVT by Tibbalds TM2 and the locally based Neighbourhood Initiatives Foundation. There was a significant level of opposition to any form of development at Lightmoor. Most concerns centred on the protection of the landscape and ecology of the area, and fears that the new development would increase crime, drugs, and vandalism problems in the area. However, there was also some support for the concept of an urban village, particularly from some residents of the Lightmoor New Community, who were supportive of the principle of a sustainable settlement, and from Telford Friends of the Earth.

With the exception of the opinion voiced by the Lightmoor Action Group that no built development at all should take place on the Lightmoor site, all other significant concerns have been heeded in the process of preparing the proposals for development. At the strategic level the key decisions that have led to this application can be summarised as:

- relocating development parcels from south of Stoneyhill and providing for a more compact development to the north requiring less development land;
- providing significant extensive open-space buffers between development and the Wildlife Site;
- the undertaking of additional studies of ecology and archaeology;
- retaining and integrating existing landscape, vegetation and historical features sensitively into the development;

- allowing for a sustainable urban drainage system to ensure water regimes in the Wildlife Site and its pools are not affected;
- providing a full Environmental Assessment to accompany the application; and
- pursuing the process of gaining planning consent through the Local Authority under the Town and Country Planning Act 1990, rather than through English Partnerships under Section 7(2) of the New Towns Act 1981.

4.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 DEVELOPMENT CONCEPT

The development concept underpinning the proposal for which outline permission is being sought has evolved in response to thorough investigations of constraints and opportunities, the public and technical consultations undertaken, and the joint ventures aim to create a high quality sustainable development, with a strong sense of place, good urban and landscape design, and a strong commitment to building a genuine community. The following summarises the main objectives:

- Provide Homes for People:

  as many as appropriate, in a range of types and sizes, for a range of tenures, and appropriate for future lifestyles.

- Provide for Social and Community Support and Interaction:

  with access to appropriate schooling, and life long learning, health facilities, recreation and leisure, community facilities, retail and service facilities, with facilities appropriately grouped, and opportunities for community development, and interaction with neighbouring communities.

- Provide for Accessibility and Sustainable Modes of Movement:

  with appropriate access to all facilities, minimising the need for car usage, providing for adequate public transport, encouraging walking and cycling, and providing safe and user-friendly routes and spaces.

- Provide for Job and Occupational Opportunities:

  with access to existing and future jobs nearby; providing for a range of units for new businesses; providing opportunities for working from home; and encouraging training and skills development.

- Provide Appropriate and Sustainable Infrastructure:

  as an integrated network of roads, paths and shared surface routes for access, with utilities and services to meet needs with minimum impact on the environment and natural resources.

- Maximise Environmental Protection and Enhancement:

  minimising impact on the Wildlife Site, retaining and integrating special landscape and historic features, supporting ecological diversity in new and existing habitats, minimising visual impact and creating attractive townscape and landscape.

The key strategic components of the village are:

- a well defined, compact village surrounded by landscape;
- a strong distinction between the recreational open spaces encircling the village, and the more rural space protecting The Dingle and the Wildlife Site to the south-east;
- the High Street providing a strong organising element, connecting together the Village's movement network to create a legible, pedestrian-friendly environment;
- a mixed use centre arranged around the High Street and a village green, located so that it is easily accessible on foot to as many residents as possible;
- higher residential densities clustered around the village centre, with areas of lowest density at the edges of the village where the transitions between urban and rural characters are made;
- retention of the existing lanes as recreational routes for pedestrians, cyclists and horse riders;
- where possible, the retention and integration of existing hedgerows into the village; and
- the incorporation of a variety of other open spaces within the built-up part of the village to provide visual and recreational amenity as well as being part of a sustainable surface water drainage system.

The formal description of the development being applied for and its component elements is set out in the following sub-sections. The approach to design and the subsequent achievement of environmental objectives and design quality is set out in the Lightmoor Village Illustrative Masterplan and Design Guidance document which also accompanies the application.

4.2 APPLICATION FOR OUTLINE PLANNING PERMISSION

This application is for outline planning permission for the development of a mixed-use village for up to 800 residential and live/work units, and employment, retail, leisure, education and community uses, together with open space and associated uses, car parking, infrastructure and services, and landscaping, comprising:

- Residential uses: up to 800 dwellings, of which up to 50 units may be for live/work occupation, and up to 50 units may be for those in need of some care in Use Class C2, with a minimum of 25% of the total being affordable housing.
- Employment uses: up to 4000 m^2 (43,052 sq ft) of employment uses in Use Class B1.
- Education and Community uses: on a site of no less 1.22 hectares (3 acres) and forming part of, or adjacent to the mixed-use village centre, a one-form entry primary school, and approximately 1000 m^2 (10,760 ft^2) of community and indoor recreation facilities in Use Classes D1 and D2, providing for

activities such as community/social meeting, life-long learning, healthcare, multi-faith worship, indoor sports and recreation, cultural and entertainment events, community / estate management, and ancillary facilities and associated car parking.

- Retail and service uses: within the mixed-use village centre, approximately 1000 m^2 (10,760 ft^2) of retail and service uses comprising a maximum of 560 m^2 (6025 ft^2) in a single unit convenience store in Use Class A1, and smaller units of between 50 m^2 (538 ft^2) and 110 m^2 (1184 ft^2) in Use Classes A1, A2, A3 and D1.
- Leisure uses: within the mixed-use village centre, approximately 300 sq m (3229 sq ft) of leisure uses in Use Class A3, providing a facility such as a family pub/restaurant.
- Open space: up to 45.45 hectares (112.5 acres) of open space and landscaped areas around the built-up areas of development, of which no less than 21.9 hectares (54 acres) is to be for areas and facilities for publicly accessible sports, play, recreation and leisure and for amenity and buffer planting.
- Infrastructure: all necessary roads, paths, junctions, utilities and services to service the above development.
- Car Parking and Servicing: sufficient car parking and vehicular servicing facilities to meet the needs of the development, whilst encouraging movement by alternative modes (walking, cycling and public transport).
- Landscape and incidental open space: to include structural landscape, and hard and soft landscaped areas and features forming greens, local amenity and play areas, drainage swales, and other open spaces and landscape elements within the development.

The proposed structure and organisation of the above elements on the Application Site for which outline planning permission is sought are set out on the application drawings prepared by Tibbalds TM2 (Drawing Numbers 1075-OPA-04, 05, 06 and 07), and are described in the following sub-sections.

4.3 DEVELOPMENT FRAMEWORK

The Development Framework Plan (drawing number 1075-OPA-04) sets out the relationship between the proposed built-up areas of the village, and the main areas of open space that enclose it and are proposed within it. It also indicates the locations of the proposed vehicular access points and the general alignment of the new access road serving the development.

The open space associated with the Village, totalling 21.9 hectares (54.1 acres) will accommodate a wide range of open space and landscape types for the benefit of the Village and adjacent communities. Although most of it will be accessible to the general public for various sports, leisure and recreation activities, some areas retained for paddock use or forming parts of the buffer planting proposed may have limited or no general public access.

The area designated as Buffer Zone between the Village and Wildlife Site, totalling 23.55 hectares (58.2 acres) is intended to remain free of development and not form part of the Village and its associated facilities. Existing uses for agricultural and residential purposes would remain, as would the ancient woodland in the Dingle. At present the only development envisaged would be to accommodate any drainage infrastructure required for the development.

The built-up area of the Village totals some 26.33 hectares (65 acres), representing 36% of the Application Site area, and 54% of the total Village area, including its associated open space but excluding the proposed Buffer Zone and the properties in private ownership within the Village area. Details of the components of the built-up area are set out in the following section.

4.4 LAND-USE AND DENSITY

The Land-Use and Density Plan (drawing number 1075-OPA-05) shows the principal components being applied for. These are:

- The mixed-use Village Centre which will accommodate the retail and service uses and community uses applied for (Use Classes A1, A2, A3 and D1) together with residential (Class C3), possibly live-work units, possibly some housing for the elderly (Class C2), and small office units (Class B1) if there is demand for them.
- The northern employment area, immediately adjacent to the proposed Johnston Pipes development site, will accommodate a mix of employment uses within Use Class B1.
- Mixed use areas where primarily residential development may also include live-work units and small B1 business units. The latter would be focussed on Stocking Farm in the south of the Village and across from the proposed employment site in the north.
- The primary school and community facilities area adjacent to the Village Centre, where the potential is greatest to benefit from maximum accessibility from residential areas and the possibility of dual and shared-use of facilities.
- An area designated for sports pitches for formal sports and recreation use, forming part of the main village park, and located near the centre and where joint community/school use of the facilities is most convenient.
- The retention and refurbishment of the Grade II listed squatters cottage, for possible use as an ancillary community, recreational or educational facility (e.g. a field studies centre).
- The retention in current use of buildings associated with Croppings Farm.

The plan also shows the location and extent of the areas proposed for residential development within the Village. It is proposed that residential densities will be highest in the mixed-use Village Centre (over 50 dwellings per hectare) and will decrease progressively outwards towards areas of open space and the rural landscape, where densities would fall below 30 dwellings per hectare. The average density within the built-up area of the village would remain above 30 dwellings per hectare.

While the outer extent of the built development can be set at this outline planning stage, the same does not apply to the notional boundaries between different land-use designations and density zones shown within. Precise boundaries will be defined at the reserved matters stage and may prove to be blurred or different to those shown. It is important that any outline planning permission granted recognises the legitimate need for this flexibility.

4.5 MOVEMENT NETWORK

The Movement Network Plan (drawing number 1075-OPA-06) shows the proposed means of access to the Application Site, the hierarchy and network of principal routes proposed for vehicular traffic, pedestrians and cyclists. It also shows how this relates to the existing network of lanes, paths and other rights of way that currently cross the Application Site.

The main access points are proposed to be from the Horsehay by-pass and Wellington Road and from the A4169 Ironbridge by-pass. The proposals for the means of access to the Application Site are included for determination at this outline planning application stage with all other details reserved for later approval. The access points are joined by the main road spine or loop serving the development. This is referred to as the Village High Street. The plan also indicates the general location and alignment of the proposed principal streets providing access into different parts of the Village. The precise nature and alignment of these will be determined at the reserved matters stage, as will those parts of the movement network serving individual development parcels and properties within the village.

The road network must be capable of accommodating a bus route, and a notional one has been indicated. This is based on technical discussion with Local Authority officers and bus operators, and may prove to be different in due course. So too may the notional locations of the bus stops shown. Any planning permission granted will need to have the flexibility to accommodate appropriate bus provision, with convenient bus stops, irrespective of the precise routing.

The plan shows how the proposed network integrates the existing lanes as routes primarily for walking and cycling, retaining their existing bridleway status. Although currently open to all traffic, it is proposed to restrict vehicular access to only those lengths of the lanes that are necessary to provide access to existing properties.

The plan also shows the main pedestrian and cycle routes proposed through the development. These are notional at this outline stage and show the principal connections that need to be made. The High Street, principal streets and minor roads are all intended to be pedestrian and cycle-friendly to maximise opportunities to walk and cycle between different parts of the Village and beyond. Guidance on how the design of elements of the movement network can be integrated into reserved matters applications is provided in the Lightmoor

Village Illustrative Masterplan and Design Guidance prepared by Tibbalds TM2 as part of this application.

4.6 LANDSCAPE AND OPEN SPACE

The Landscape and Open Space Plan (drawing number 1075-OPA-07) shows the proposed disposition of open space and structural landscape elements associated with the new Lightmoor Village. Formal open space comprises:

- playing fields (the northern part of what can be referred to as Woodlands Park between the built-up area and the former Stoneyhill Waste disposal site);
- parkland with a more formal terraced landscape character (in the area that can be referred to as Stocking Park);
- the route of the old canal to be treated as a linear open space and formally landscaped walk to the south of the Stocking Farm.

Informal open space comprises areas with a more natural and informal landscape character and includes:

- the southern part of Woodlands Park;
- the area between Stoneyhill Lane and the built up part of the village (referred to as Croppings Park);
- an area north of Woodlands Lane up to the site boundary (referred to as Woodlands Valley); and
- open areas to the north and west of Woodlands Farm to be retained as paddocks and providing a rural, informally treated approach to the main part of the Village.

There are two areas of open space which are proposed to be treated as wildflower meadows, to add landscape variety and biodiversity. One is to the north adjacent to Horsehay and acting as a green wedge between residential development land and the employment site. The other is to the south adjacent to Holywell Lane.

New woodland is proposed to add landscape variety, increase biodiversity, provide woodland near the Village as an alternative to that in the environmentally sensitive Wildlife Site and the Dingle, and to provide visual screening. A community orchard is also proposed to the north of Holywell Lane where it would provide a community amenity and reinforce visual screening from the south.

Several areas of open space are indicated as space required as part of the sustainable urban drainage system. Although they have a function to allow for natural recharge of the hydrology and balancing surface water run off, they are also important as usable open space with visual as well as recreational value.

The plan indicates proposals to create new hedgerows and reinforce some of the existing ones in the Buffer Zone south of Stoneyhill Lane. These are useful in assisting visual screening of the development from the south, enriching ecological

habitats and deterring unauthorised walking across agricultural land to the environmentally sensitive areas of the Wildlife Site and The Dingle.

The Plan indicates the general locations of equipped play areas for the children in the Village. A Local Equipped Area for Play (LEAP), for younger children, is proposed in Woodlands Park adjacent to the primary school and close the range of facilities for older children and teenagers that will be provided in the sports field area. Another LEAP is proposed within Stocking Park. Play facilities for both older children (NEAP) and younger ones (LEAP) are proposed in the informal setting of Croppings Farm close to an area of new woodland. These will provide for adventurous play in an appropriate setting accessible not only to residents of the village but also to communities to the east, via Holywell Lane.

Incidental open spaces and Local Areas for Play (LAPs) for the youngest age Groups cannot be located at this outline application stage but will be provided for in reserved matter applications. The strategy for open space, landscape and play and appropriate guidance is set out in the illustrative Open Space Strategy document prepared by Tibbalds TM2 which also accompanies this application. As with the Land Use and Density Plan, the boundaries between the different areas of open space and the location of facilities are notional and will be defined where appropriate at the more detailed design stage in reserved matters applications.

4.7 ALTERNATIVE SITES CONSIDERED

Having created, and still managing 100 years later, the world's first planned and balanced community at Bournville in Birmingham, Bournville Village Trust's desire was the creation of a second Bournville, using the principles of the old, but expressed in a modern context.

The Trust owns considerable land holdings in Worcestershire, all of which are green belt. The potential of using some of this land was originally examined, however its green belt status was not supportive of new development. Discussions were then held with advisers to Consortium Developments and the Trust became a founder member of the Urban Villages Forum. This background helped lead to the creation of the Urban Villages in Bordesley and Bloomsbury, both situated in the inner city of Birmingham.

This award-winning work came to the attention of the Commission for New Towns (now English Partnerships), with whom the Trust already had excellent working arrangements. The Trust was invited to talks with the Commission for New Towns with respect to the Lightmoor site, where advantages relating to the site and the Trust's development objectives were that it had outline planning approval under Section 7(1) of the New Towns Act 1981 (see Section 3.2), the site was within the town boundary of Telford and that it featured in the Local Plan for the area.

The Trust then prepared its own Masterplan, which led to English Partnerships entering into closer co-operation and the eventual signing of a joint venture partnership and the joint decision not to use the existing New Towns Act outline

approval, but to go through the traditional planning system of the Town and Country Planning Act 1990.

4.8 SUSTAINABILITY

From the outset, the Lightmoor Village proposals have been conceived with full consideration of sustainability issues such that it would represent a sustainable settlement. Such an approach has led to the following broad principles being adopted:

- Self-containment to minimise the need for movement;
- Appropriate densities for efficient land-take, movement and infrastructure provision;
- Environmental and ecological preservation and enhancement;
- Effective use of existing renewable resources;
- Minimisation of the need for non-renewable resources;
- Cultural and historic heritage preservation and enhancement; and
- A community for everyone at all stages of life, integrated with existing communities.

A full Sustainability Statement is contained in Chapter 6 of the Planning Statement prepared by Tibbalds TM2.



N

LEGEND

GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BOUNDARY OF WILDLIFE SITE (FROM SHROPSHIRE WILDLIFE TRUST RECORDS)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

notes

1. Do not scale this drawing. Work from figured dimensions only.
2. No deviation from the details shown on this drawing is allowed without Campbell Reith Hill's prior permission in writing.
3. Read this drawing with all Architects, Service Engineers and Campbell Reith Hill's relevant details and drawings.
4. All work is to be in accordance with the relevant specifications issued by Campbell Reith Hill, British Standard Codes of Practice, Statutory requirements and the Contract Documents.
5. DRAWING STATUS
   - S :- SCHEME — Outline/Scheme drawings for proposals, budgets etc.
   - D :- DESIGN DEVELOPMENT — Evolving final design drawings for approvals, tenders, billing etc.
   - C :- CONSTRUCTION — Fully developed drawings issued under instruction for construction.
   - :-

ONLY STATUS C DRAWINGS TO BE USED FOR CONSTRUCTION.

Status/Rev	Description	Date	By
D1	ISSUED FOR INFORMATION	FEB'02	SA

CAMPBELL REITH HILL

Consulting Engineers

Somerset House
London Road • Redhill Surrey • RH1 1LU
Telephone 01737 784500 • Facsimile 01737 784501

Job Title: LIGHTMOOR VILLAGE, TELFORD

Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

APPLICATION SITE & WILDLIFE SITE BOUNDARIES

drawn	date	scale	C1 checked	CAD filename
SA	FEB'02	1:4000	–	ES-NTS-01-D1

Job No.	Drg No.	Status/Revision
6479	ES-NTS-01	D1

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A2



0 100 200 300m

N

DRAWING STATUS:
Outline Planning Application

Lightmoor Village

Bournville Village Trust
& English Partnerships

ISSUED BY:
Tibbalds TM2
Long Lane Studios
142-152 Long Lane
London
SE1 4BS
Tel : 020 7407 8811
Fax : 020 7407 8822

TITLE:
Development Framework

SCALE/SIZE:	CHECKED:	APPROVED:
1 : 2500 @ A1	SR	
CAD FILE:	DESIGN/DRAWN:	DATE:
1075 OPA Disp of Develp 130202	JJP	12/02/02
PROJECT NO:	DRAWING NO:	REV:
1075	1075-OPA-04	B

REV:	DATE:	BY:	DESCRIPTION:	CHK:	APD:
A	21/02/02	JJP	Boundary amended. Hatching removed from road		
B	05/03/02	JJP	Addition of designation boundaries. Hatching removed from lanes		

Application Boundary

Proposed Access Road

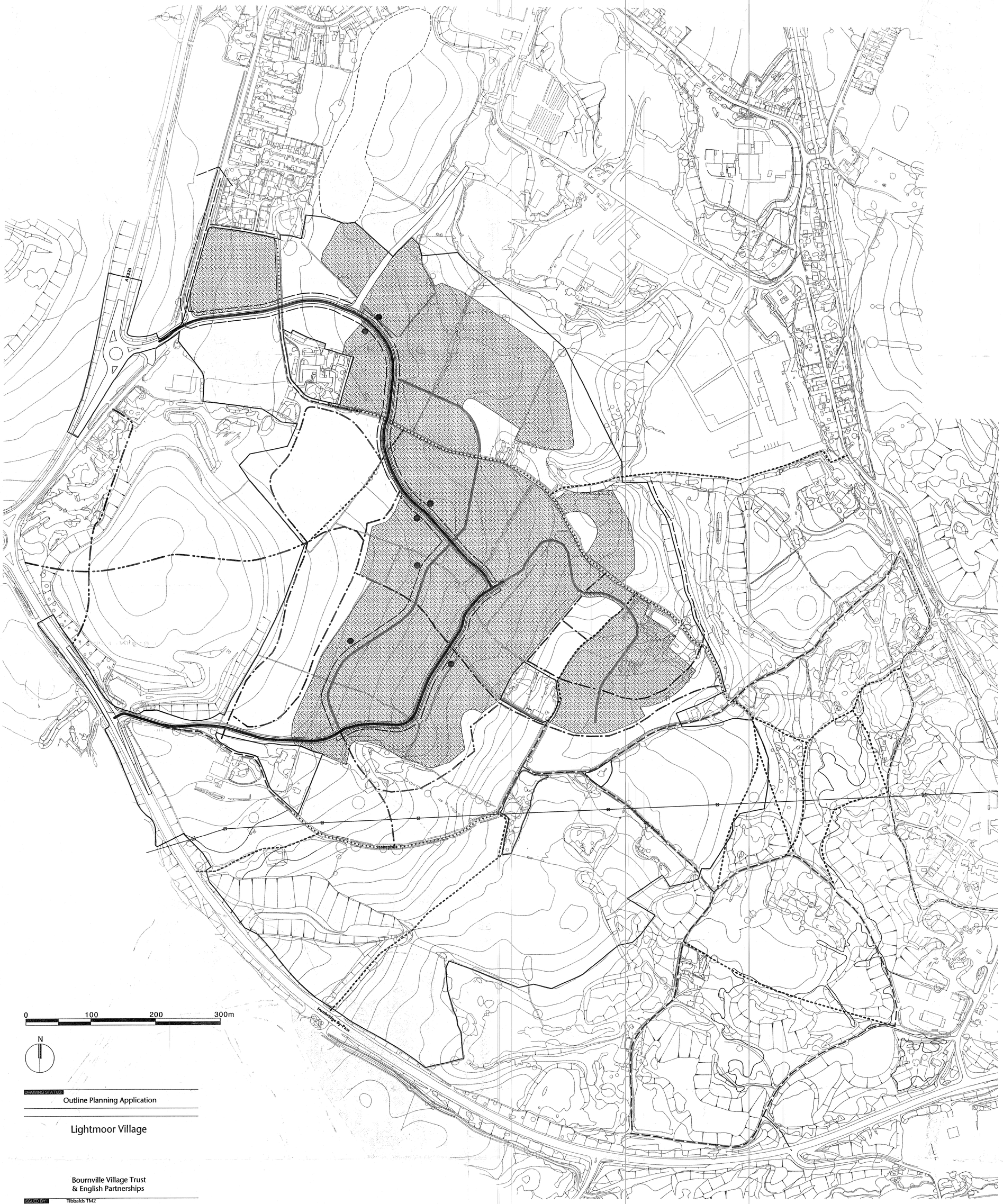
Built Area of Village

Open Space associated with Village

Buffer Zone between village & wildlife site

Boundary of Wildlife Site

Boundary of Ancient Woodland



0 100 200 300m

N

DRAWING STATUS:
Outline Planning Application

Lightmoor Village

Bournville Village Trust
& English Partnerships

ISSUED BY:
Tibbalds TM2
Long Lane Studios
142-152 Long Lane
London
SE1 4BS
Tel : 020 7407 8811
Fax : 020 7407 8822

TITLE:

Movement Network

SCALE/SIZE:	CHECKED:	APPROVED:
1 : 2500 @ A1	SR	
CAD FILE: 1075 OPA Movement 150202	DESIGN/ DRAWN: JJP	DATE: 15/02/02
PROJECT NO: 1075	DRAWING NO: 1075-OPA-06	REV: B

REV:	DATE:	BY:	DESCRIPTION:	CHK:	APD:
A	18/12/01	JJP	Various minor amendments.		
B	15/02/02	JJP	Minor amendments to village envelope. Existing footpaths added.		

Existing movement network

- Application Boundary
- Built area of village
- Location of new roundabout for access
- Location of all movements junction for access
- High Street
- Public rights of way
- Existing Lane: proposed as closed to vehicles
- Existing Lane: proposed as providing vehicular access to existing dwellings
- Permissive Footpath at Canal walk
- Existing Bridleway
- Temporarily extinguished public right of way

Proposed movement network

- Notional Routes for Principal Streets
- Notional Pedestrian / cycle route
- Notional bus route linking village to Town Centre
- Posssible locations of bus stop

5.0 SOCIO-ECONOMIC

5.1 INTRODUCTION

The socio economic impact assessment has been carried out as a desktop exercise in consultation with local authority officers and others.

The methodology for this assessment has been based upon site visits, desktop surveys and consultations with relevant contacts in the local community, in particular with Telford & Wrekin Council officers.

5.2 BASELINE SURVEYS

The baseline assessment includes the following:

- population
- housing
- educational provision
- community facilities
- places of worship
- sport and recreational facilities (including informal recreation and play)
- primary health care
- employment
- retail/leisure

5.2.1 Population

Population in Telford & Wrekin District was identified in the Local Plan (reference 1) as follows:

	1989	2006
Total population	137,271	168,160
No. of households	51,122	67,168

The proposed Lightmoor Village lies within the wards of Dawley Magna and Ironbridge Gorge which have a local population of 11,846 (Telford & Wrekin Population Survey, 1998 - reference 2).

5.2.2 Housing

The Application Site is currently committed in the Local Plan for housing development and has the benefit of a 1991 planning approval from the Secretary of State through Section 7(1) of the New Towns Act 1981. The approval is for up to 750 homes, with employment, leisure and open space development. The aim of the housing mix was towards 50% of the dwellings being for "lower cost' housing. However, the Department of the Environment, in issuing the approval, specifically stated that it would give no commitment to that mix.

The Local Plan identifies the need to accommodate 11,614 dwellings within the District between 1995 and 2006. Of this number, the Local Plan anticipates 7532

dwellings being provided on land that already has permission (including the 750 units at Lightmoor).

The objectives for the location of housing in the District are identified as including:

- to enable the District wide provision of affordable housing, especially social housing
- to follow approved strategic planning guidance specifically by locating the majority of new development in Telford
- to contribute towards sustainable development by locating new housing in areas accessible to employment opportunities, shops and services and with adequate access to public transport and promoting energy efficient design
- The Local Plan encourages higher densities for new housing developments on committed sites (for instance the Application Site) in order to reduce pressure on other greenfield sites in and around Telford
- The Housing Needs in Wrekin 1993-1998 (reference 3) study for Telford & Wrekin Council concluded that 32% of newly forming households in the District could only afford to rent housing. The Local Plan Policy is to pursue, on sites of above 1 ha in area, an overall target of 38 % of dwellings for affordable housing, both social housing and low cost market housing. The 7(1) approval for the Application Site specifically does not guarantee the provision of affordable housing.

5.2.3 Education - Primary and Secondary Schools

Primary and secondary schools are located on Drawing 6479/ES-5-01. Baseline information has been provided by local education authority officers.

Secondary school education in the locality is provided by the Phoenix School in Dawley, and the Abraham Darby School in Woodside, Ironbridge.

There is no existing primary school within walking distance (400m or 5 minutes) of the Application Site of the proposed development. The local education authority have identified a need to provide a new primary school as part of the proposed development.

5.2.4 Community Facilities

Existing social and community facilities are identified on Drawing 6479/ES-5-02.

Facilities at local schools are excluded from the survey as are community rooms linked with Group Dwelling Schemes now owned by Wrekin Housing Trust.

The local education authority has identified an opportunity to provide a Lifelong Learning Centre within the proposed development. This initiative arose from the designation of Telford as an Education Action Zone.

Places of worship are located on Drawing 6479/ES-5-03, which also identifies the denomination of each, where appropriate.

5.2.5 Sports and Recreational Facilities (Including Informal Recreation and Play)

The National Playing Fields Association's (NPFA) minimum requirement (reference 4) for outdoor playing space is 2.4ha per 1000 population. The NPFA also defines three types of unsupervised children's play areas as follows:

- Local Area for Play (LAP) which caters for toddlers and children up to 6 years in age; is within a walking time of 1 minute from home; and does not include play equipment.

- Local Equipped Area for Play (LEAP) which caters for children of 4-8 years of age, is within a walking time of 5 minutes from home and contains at least 5 types of play equipment.

- Neighbourhood Equipped Area for Play (NEAP) which caters predominantly for older children; is within a walking time of 15 minutes from home; and contains at least 8 types of play equipment and a hard surface kickabout area.

The Local Plan sets targets for specific types of open space to be provided per 1000 population:

- 1.6 - 1.8 ha for youths and adults of which 1.21 ha should be sports pitches
- 0.2 - 0.3 ha for outdoor equipped children's play areas (ie LEAPs and NEAPs)
- 0.4 - 0.5 ha for casual play within housing areas (ie LAPs).

Sports facilities

Sports facilities that currently exist within the wider community are located on 6479/ES-05-04, which also identifies those which are indoor and those which outdoor. It also locates specific facilities of the types considered for Lightmoor Urban Village, in particular:

- Sports pitches
- Bowling green
- Tennis courts

The sports facilities are described in more detail in Table 5.1. Facilities at local schools are excluded from the survey. Telford & Wrekin Council officers have indicated that there is unmet demand in the area for a football pitch and that this should be combined with a cricket square to ensure year round usage.

Telford & Wrekin Council officers also note that current trends suggest demand for a hard surfaced, multi-use games area that could incorporate five-a-side football, basketball and tennis.

Table 5.1: Local Sports Facilities

Location	Facility Name	Nature of facilities
1	Phoenix Centre	• Joint school/community use • Indoor and outdoor facilities • Football, tennis, hockey, netball, basketball, rugby • Changing/showers and car parking
2	Horsehay Village Golf Club	• Municipal • Outdoor facilities - Golf • Clubhouse and car parking • 100% usage
3	Doseley Road	• Municipal • Outdoor facilities - Football • Changing/showers and car parking • 100% usage
4	Duncow Bowling Club	• Private • Outdoor facilities - Bowling • Car parking
5	Telford Hornets Rugby Union Football Club	• Private • Outdoor facilities - Rugby • Changing/showers and car parking
6	Madeley Cricket Ground	• Private • Outdoor facilities - Cricket • Club house, changing/showers and car parking • 70% usage
7	Castlefields Playing Fields	• Municipal • Outdoor facilities - Football
8	Dawley Park	• Municipal • Outdoor facilities • Bowling, tennis • Pavilion
9	Deepfield Playing Fields	• Municipal • Outdoor facilities - Football
10	Webb Youth Centre, Dawley	• Municipal • Indoor facilities • 5-a-side football, basketball
11	Madeley Court Leisure Centre	• Municipal • Joint school/community use • Outdoor and indoor facilities • Swimming, skiing, snowboarding, snowblading, tobogganing, football, basketball, rugby, hockey, athletics, bowling, tennis, orienteering, indoor sports hall, crèche

Recreation, Including Play

Provision of parks and play areas in the immediate area of the Application Site is currently poor.

At present the Application Site contains no public open space. However, the landscape of grazed fields is crossed by a number of public footpaths and these are used for informal recreation, particularly dog walking. These footpaths provide informal access to the fields they cross.

5.2.6 Primary Health Care

Medical centres are located in local centres at Dawley and Madeley (two medical centres each) and two dental practices are also located in Dawley. There is also a doctor's surgery in Coalbrookdale.

Consultations have indicated that there is currently sufficient capacity in these facilities to serve the population of the proposed development.

5.2.7 Employment

Telford dominates the local economy of the borough of Telford & Wrekin with employment of 59,000 in 1993 according to the Local Plan.

The Local Plan also identifies the economy as being dominated numerically by the small firm sector with seventy five per cent of local firms employing fewer than 10 people and 86% of firms employing fewer than 20 people. The small firm sector is identified as being an increasingly important element of the economy and one that is particularly dynamic with the rate of new firm start up being 10% above the national average. The Council's assessment of demand for employment land over the Local Plan period (1995-2006) is for a move away from larger sites to a demand for medium, small and very small sites.

In relation to the Application Site, employment is concentrated in the Doseley and Heath Hill Industrial Estate to the north-east of the Application Site and the Halesfield and Tweedale Industrial Estates south-east.

In the immediate area, employment of around 200 to 300 is provided by Johnston Pipes, immediately to the north east of the Application Site.

5.2.8 Retail/ Leisure

The Local Plan defines a retail and service centre hierarchy with three levels:

- Level 1 (district wide and sub-regional role): Telford Town Centre and the Telford Bridge, Telford Forge and Wrekin Retail Parks

  Telford Town Centre is approximately 4.5km from the Application Site.

- Level 2 (more localised and limited shopping role): Newport Town Centre and the District Centres of Wellington, Oakengates, Madeley, Dawley, Hadley and Donnington.

  Of these, Dawley Local Centre is the centre closest to the Application Site at a distance of approximately 2km. Madeley also has a local centre at approximately 3km from the Application Site.

- Level 3 (local convenience shopping needs – groups of at least 4 shops): Other local centres and groups of local shops.

  In the immediate area of the Application Site, the only shopping provision is a post office/ convenience store on Woodhouse Lane. This does not meet the criteria for a local centre in the retail hierarchy.

5.2.9 Response to Baseline Survey

Throughout the design process, Bournville Village Trust has taken a very positive stance in relation to the provision of a range of uses and activities to support the concept of an Urban Village development at Lightmoor. The aim has been to make sure that there is no adverse socio-economic impact and to make sure that any impact is positive both for proposed residents and for the existing residents in the immediate area.

5.3 ANALYSIS OF PREDICTED IMPACTS

5.3.1 Population

The proposed development of 800 residential units is estimated to generate a population of approximately 1900 people. This represents an increase in population of approximately 1.4% relative to the District population in 1989 and an increase of approximately 16% in the local wards of Dawley Magna and Ironbridge Gorge.

The impact of this increase in population at District level is negligible.

The impact upon the ward population is more significant. However, the Application Site is already committed for housing and has the benefit of a longstanding 7(1) approval for housing development of this order of magnitude under the New Towns Act 1981.

The provision of new facilities to serve the proposed development will also benefit existing residents in the immediate area by increasing the range and choice of provision, provided there is no adverse impact upon existing facilities. The reminder of this section demonstrates that the proposals do not have any adverse impact upon existing facilities and opportunities.

5.3.2 Housing

The proposals will provide 800 dwellings, together with employment, primary school and village centre uses on 26.33 ha of land, as opposed to the 750 dwellings, on 30.35ha of land, that are currently committed. The predicted housing impact of the additional 50 live-work dwellings is that they will help to reduce pressure on other greenfield sites. The increase in numbers and higher density development will also contribute to public transport accessibility and the viability of public transport services. The higher densities will also contribute towards energy efficient design. Increased number of dwellings at higher densities contributes towards a more sustainable pattern of development.

The proposed development will provide a minimum of 25% affordable housing - i.e up to 200 units.

The predicted impact of the proposed development on affordable housing is to guarantee the provision of a significant proportion of affordable housing to meet the Local Plan target, as opposed to the 7(1) approval. The proposed development will contribute towards meeting local housing need as identified in the Local Plan.

The Local Plan has a preference for registered social landlords to be used to control the occupancy of affordable properties. By maintaining a significant proportion of affordable accommodation in the management of Bournville Village Trust, this aspiration will be met and the result will be to ensure that there is a long term commitment to maintaining the value and quality of the accommodation and the Village as a whole.

5.3.3 Education

The local education authority has assessed the predicted impact of developing 800 residential units at Lightmoor Urban Village on primary and secondary educational provision and capacity.

They have advised that:

- there is sufficient capacity in the area to take any additional secondary school children generated by the proposed development
- a single form entry primary school will be required, to be provided as part of the proposed development, to take any additional children of primary school age generated by the proposed development

The predicted impact of providing a new primary school at Lightmoor will be:

- to provide a primary school within 5 minutes walk (400m) of the majority of new households in the proposed development

- for some existing households, particularly in parts of Horsehay, to provide a primary school within a closer distance than exists at present, with the existing distribution of primary schools.

- to increase local choice of primary schools

- to provide a high standard of primary provision, with schools well located relative to population.

5.3.4 **Community Facilities**

The proposals include a multi-purpose village hall/learning centre of 1000 sqm as part of village centre.

The predicted impact of the proposed village hall will be to accommodate many social and other activities that contribute to creating a local community and that support the life of a village.

The village hall is proposed as a key element of the village centre. Other village centre uses and activities will include a family Public House/ restaurant, retail and the primary school. Housing in and close to the village centre will be at a high density. The mix of uses and concentration of density will establish the physical characteristics for a centre and the impact will be a concentration of activity in the village centre.

The effect of this concentration of development and activity will be to promote a sense of community and identity for the proposed development.

The local education authority has advised that there is an opportunity to establish a Learning Centre to be accommodated within the proposed development as part of the village centre and the proposed village hall will include accommodation for this use. The Learning Centre is intended to serve the wider community, not just the residents of the proposed development.

The general predicted impact of the proposed Learning Centre will be to support and extend the range of educational opportunities available in this part of Telford. The precise nature of its impact will depend upon its operation and the range of educational opportunities that the centre offers.

It will also contribute towards both:

- integrating the new residents of the urban village into a community

- integrating the new and existing communities in the local area.

The proposed village hall will include accommodation for a multi-faith place of worship. The predicted impact of this will be to accommodate any religious groups with members in the proposed development and immediate neighbourhood. The predicted effect is intended to be that no people of any

religious group should feel that lack of provision for their religious needs excludes them from the proposed urban village.

5.3.5 Sport and Recreational Facilities (Including Informal Recreation and Play)

The NPFA minimum requirement translates to a requirement of 4.56 ha of outdoor playing space for the proposed urban village.

For the proposed 800 dwellings, the Local Plan target leads to:

- 3.04-3.42 ha for youths and adults of which 2.30 ha should be sports pitches
- 0.38-0.57 ha for outdoor equipped children's play areas
- 0.76-0.95 ha for casual play within housing areas

Sports

The proposals include 2.61 ha of sports facilities within one of the proposed parks (Woodlands Park). This area will meet the Telford & Wrekin Local Plan target. The facilities proposed are a football pitch, cricket pitch and a bowling green, which meet the identified needs in the local area. The proposals will provide for the sporting activities of future residents and will improve sports facilities for the wider neighbourhood.

Recreation, Including Play

The proposals include three parks distributed around the urban village:

- Woodlands Park, to contain also the proposed sports pitches and a LEAP
- Croppings Park, a woodland park with a NEAP and a LEAP
- Stocking Park, a formal park area.

These proposals include children's play areas to meet NPFA requirements and Local Plan targets in relation to overall area, walking time and equipment. Three LEAPs and one NEAP are proposed. It will be the responsibility of individual housing developers to provide LAPs within each parcel of housing.

The proposed recreation areas and play facilities will provide a good level of facilities, to the appropriate standards, for proposed residents and they will improve provision in the immediate area for existing residents.

The proposed development includes approximately 21.9 ha of open space (including the parks identified above) that will be accessible to the public as compared to none at present. A variety of landscapes are proposed to include informal and formal open spaces, new woodland, meadows, community orchards and allotments. These will create a variety and level of interest for users that is

not found in the current landscape of the Application Site. The area of open space accessible to members of the public in the immediate neighbourhood will be greatly increased as will be the ability to roam freely over open land.

5.3.6 Primary Health Care

The proposals do not include accommodation specifically identified for primary health care although an element of healthcare provision such as a doctors/dental surgery may take accommodation in the mixed-use village centre. It is believed that existing facilities will serve most of the needs of new residents. The proposed development will support the viability of existing health care provision in the area.

5.3.7 Employment

The proposed development will include 4000sq m of employment floorspace, which is predicted to lead to the creation of between 100 and 250 jobs. The effect of this increase in employment floorspace and jobs within Telford or within the south west sector of Telford is negligible. This will however:

- reduce the need to travel to work, both for residents of the proposed urban village who will have the opportunity to work close to home and for other residents of the immediate area
- increase local employment opportunities.

5.3.8 Retail/Leisure

The proposed development will include 1000sq m of retail floorspace with a maximum of 560 sq m in any single unit. Up to 300sq m of leisure/A3 use is also proposed, for a Public House/ restaurant use.

The predicted impact of this will be to create new local centre for convenience shopping (level 3 in the retail hierarchy). This will provide a range of shops and services in the proposed village centre to meet the daily needs of local residents. There is predicted to be no retail impact upon any other local centre.

At present, Horsehay is served by a single post office/ convenience store. The proposed retail and leisure will provide better local facilities for existing residents of the immediate area. The residents of the proposed development will also contribute to supporting the existing retail at Woodhouse Lane by providing more passing trade.

The proposed retail will not be of sufficient size (either in total or in the size of any unit) to compete with other retail centres in Telford's retail hierarchy, for instance Dawley or Madeley.

5.4 MITIGATION

The socio-economic impact of the proposals has already been mitigated by the inclusion of a range of community facilities as identified above, a mix of uses, including employment and retail, and significant areas of open space, to be accessible to members of the public.

In general terms, the Application Site has permission in principle for 750 dwellings. The impact of the proposed development has been mitigated during the design process by proposing higher density dwellings, so providing more open space than originally proposed.

The permission does not provide any guarantee as to the amount of affordable housing to be provided. Indeed it specifically warns that 50% will not be the rate of provision. Any potential social impact of providing 800 new dwellings has been mitigated by the inclusion of at least 200 affordable units in line with the Local Plan target.

5.5 STATEMENT OF SIGNIFICANCE

The proposals will have one socio-economic impact of significance; they will provide affordable housing of which a large proportion will be social rented housing in line with the need identified in the Local Plan.

Other than in this area, there will be no socio-economic impacts of any significance. The impact of most of the proposals will be to provide a good standard of facilities and opportunities for social and economic activity and to widen choice for existing local residents. Table 5.2 summarises the socio-economic impact appraisal.

Table 5.2: Summary of Socio-economic impacts

Potential Impact	Type of Impact	Nature	Importance	Significance of impact without mitigation	Significance of impact with mitigation
Population increase at District level	No impact predicted	-	-	-	-
Population increase at Ward level	Adverse	Long term Irreversible	Local	Low to Medium	Low
Housing provision (including Affordable Housing)	Beneficial	Long term	Regional	-	-
Provision of new primary school	Beneficial	Long term	Local	-	-
Provision of village hall / learning central	Beneficial	Long term	Local	-	-
Provision of sports and recreational facilities	Beneficial	Long term	Local	-	-
Healthcare provision	No impact predicted	-	-	-	-
Provision of employment floorspace	No impact predicted	-	-	-	-
Provision of retail floorspace	Beneficial	Long term	Local	-	-

REFERENCES AND CONSULTATION

1. Telford & Wrekin Local Plan, February, 2000

2. Telford & Wrekin Population Survey (1998), from Dawley Magna and Ironbridge Gorge Millennium Ward Profiles, Telford & Wrekin Council, 2000.

3. The Housing Needs in Wrekin 1993-1998 (SAUS 1995) Study for Telford & Wrekin Council

4. National Playing Fields Association, The Six Acre Standard: Minimum Standards for Outdoor Playing Space

General:

Innovation and Good Practice: Making Lightmoor a sustainable community; Leather & Revell, University of Birmingham, 2000

Consultation Contacts:

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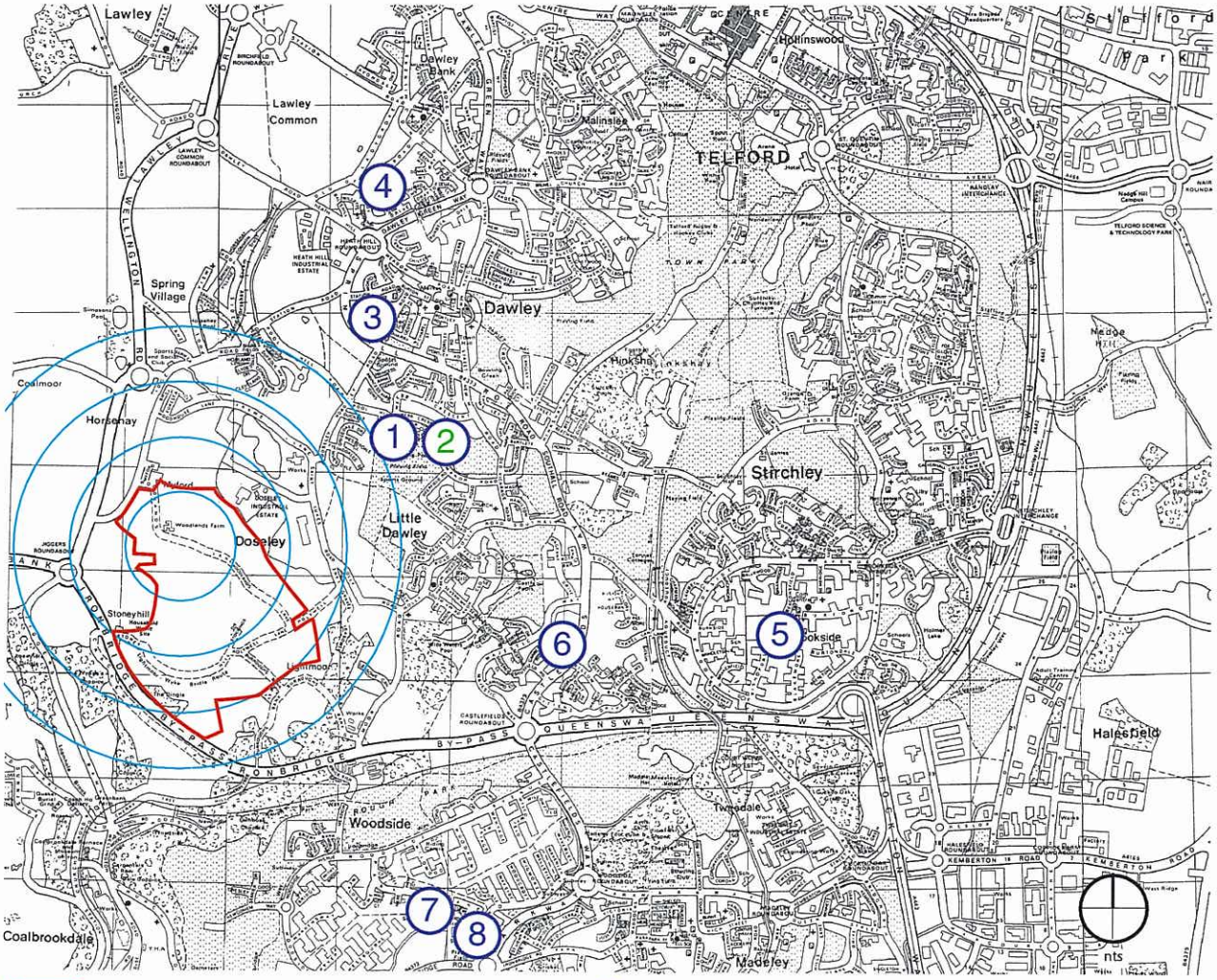
Community facilities
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Philip Semple
Head of Land and Property
tel: 01952 202339.

Pete Jackson
tel: 10952 202238.

Voluntary sector:
Elizabeth Yates
Head of Community Voluntary Service
tel: 10952 291350.

Places of worship:
Revd Brian Nicholls,
West Midlands Baptist Association
tel: 0121 212 4842.



Lightmoor Urban Village

Location of schools (refer to key)

Approximately 5 mins walk (approximately 400 m)

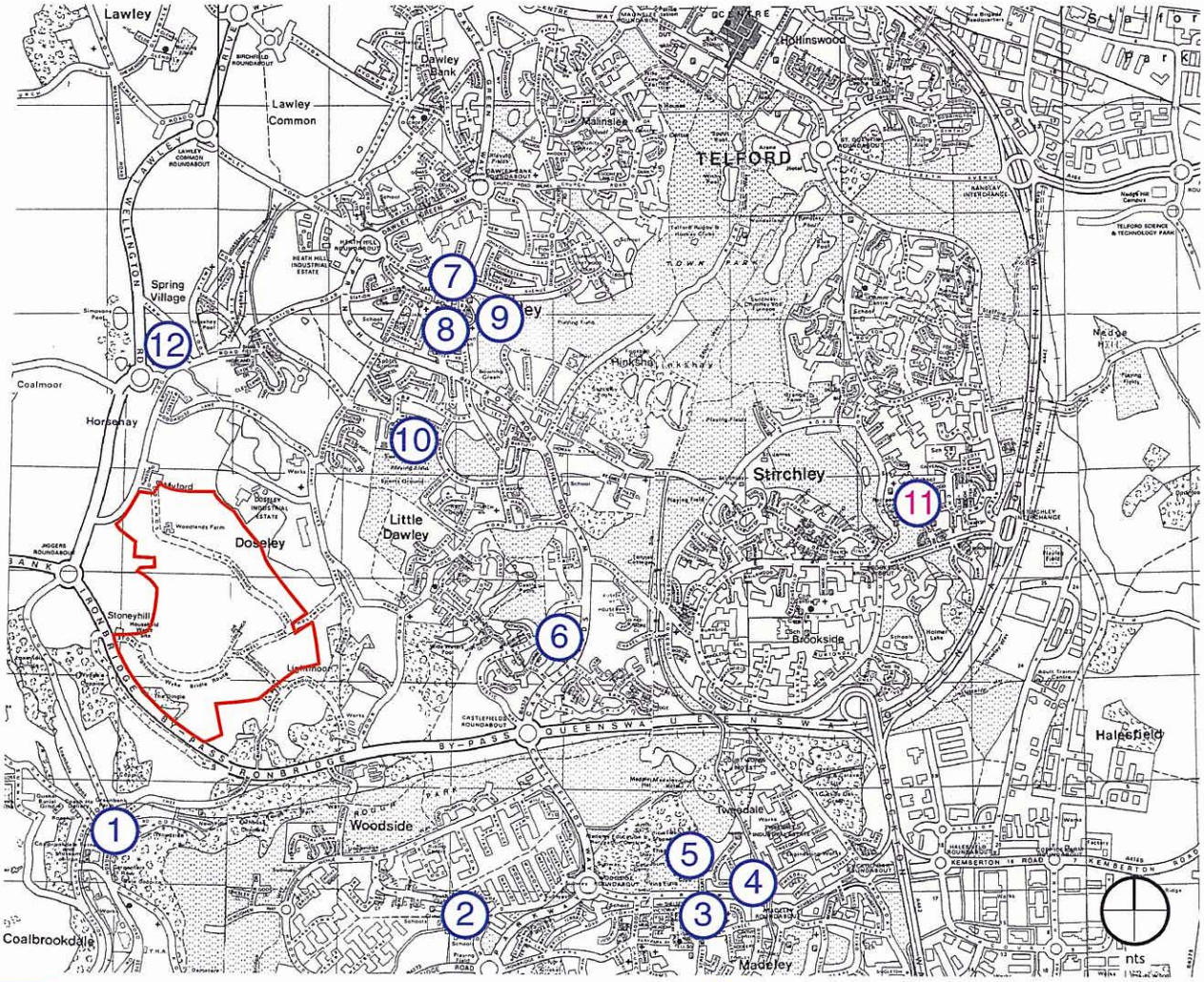
Primary

Secondary

KEY TO SCHOOLS

NO	NAME	TYPE	SIZE
1	Captain Webb School	primary:	65 entry
2	Phoenix School	secondary:	164 entry
3	Dawley CE School	primary:	35 entry
4	Ladygrove School	primary:	40 entry
5	Brindleyford School	primary:	43 entry
6	Aqueduct School	primary:	41 entry
7	Woodside Schools	junior:	70 entry
8	Williams Reynolds	infant:	70 entry

Drawing 6479/ES-5-1: School locations



Lightmoor Urban Village

Location of facilities (refer to key)

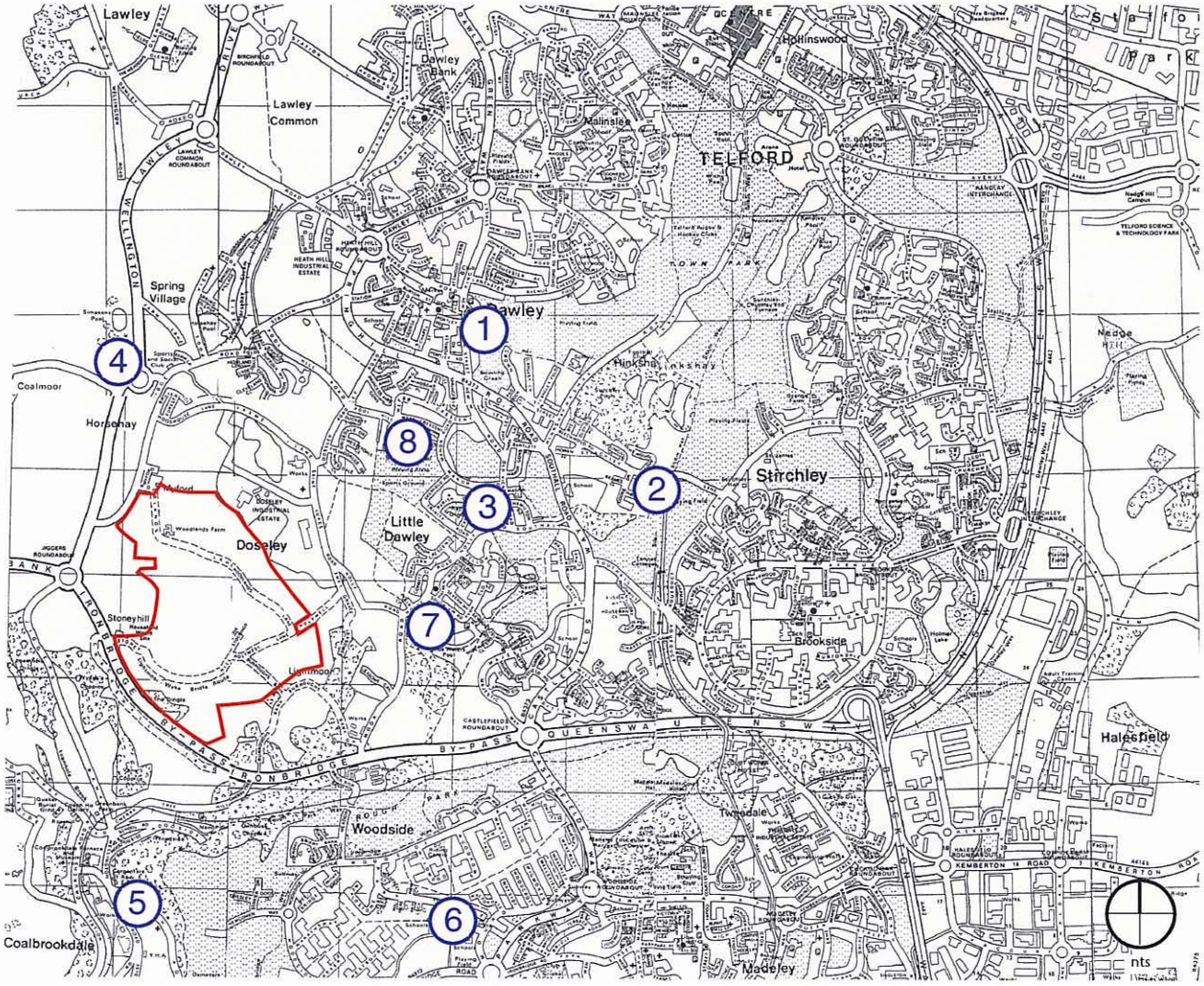
11 Community facilities

11 Community learning centre

KEY

1 Coalbrookdale Community Centre	voluntary/ community managed 350 sq m
2 Woodside Community Centre	public 300 sq m
3 Fletcher Memorial Hall	private (church)
4 Lumley Hall	public
5 Madeley Court Leisure Centre	public
6 Aqueduct Community Centre	public
7 Parish Rest Rooms, Dawley	public
8 Dawley Christian Centre	private (church)
9 Dawley Town Hall	public
10 Phoenix Centre and Webb Youth Centre	public
11 Community Learning Centre, Stirchley	public
12 Horsehay Village Hall	voluntary/ community managed

Drawing 6479/ES-5-2: Social and Community Facilities



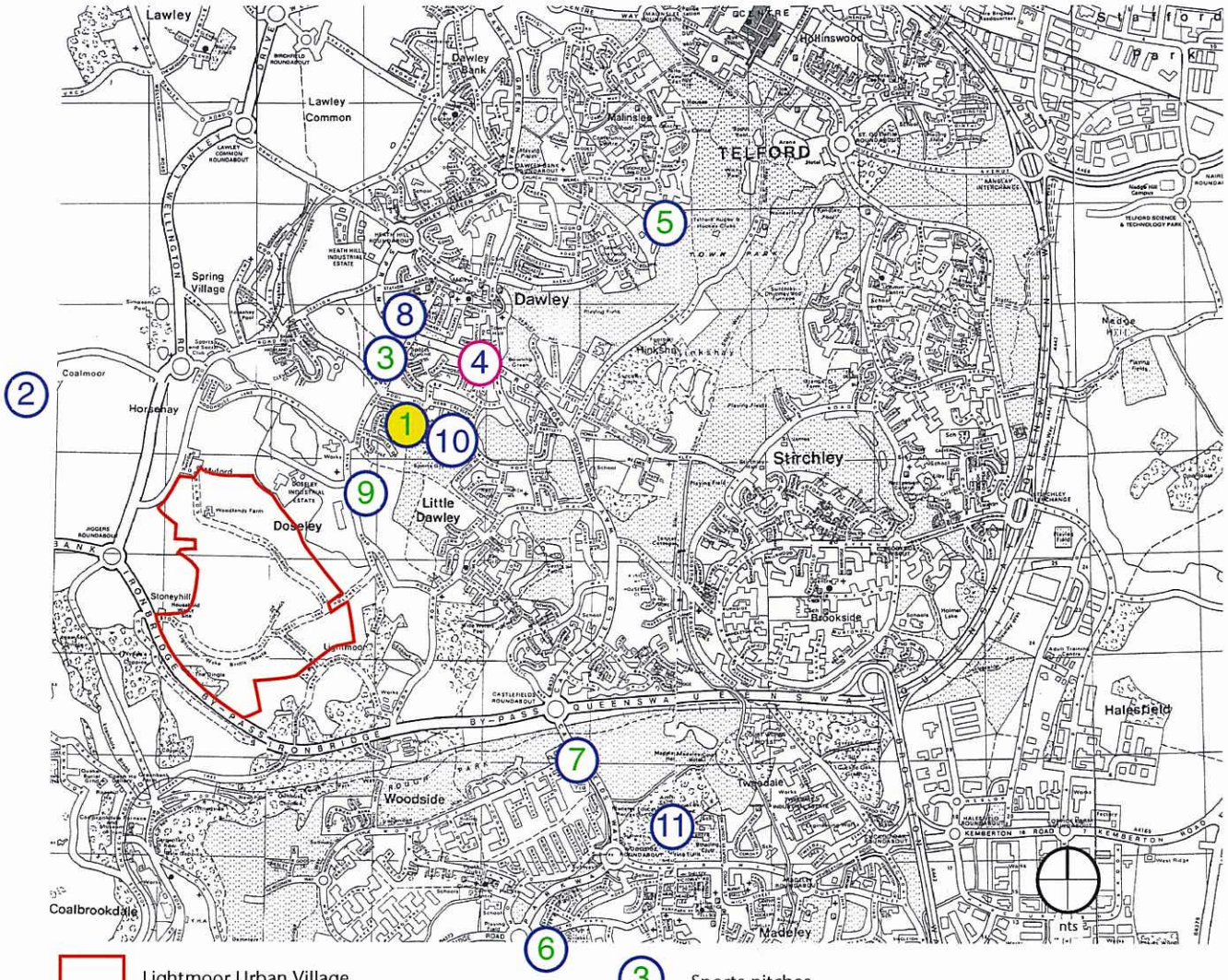
Lightmoor Urban Village

(3) Location of facilities (refer to key)

KEY

1	Dawley Christian Centre, High Street Dawley	Methodist, used ecumenically
2	Stirchley Lane Methodist Church	Methodist
3	Holy Trinity, Old Vicarage Road, Dawley	C of E, Diocese of Lichfield
4	Horsehay Methodist Church	Methodist
5	Holy Trinity, Church Road Coalbrookdale	C of E, Diocese of Hereford
6	Community Centre, Woodside	Anglican group
7	Little Dawley Methodist Church, Lightmoor Road/ Holly Road	Methodist
8	Phoenix School, Manor Road Dawley	Telford Evangelical

Drawing 6479/ES-5-3: Places of Worship



KEY

1 Phoenix Centre	indoor and outdoor
2 Horsehay Village Golf Club	outdoor
3 Doseley Road	outdoor
4 Duncow Bowling Club	outdoor (private)
5 Telford Hornets Rugby Union Football Club	outdoor (private)
6 Madeley Cricket Ground	outdoor (private)
7 Castlefields Playing Fields	outdoor
8 Dawley Park,	outdoor
9 Deepfield Playing Fields	outdoor
10 Webb Youth Centre, Dawley	indoor
11 Madeley Court Leisure Centre	indoor and outdoor

Drawing 5479/ES-5-4: Sports and recreational facilities

6.0 ECOLOGY AND NATURE CONSERVATION

6.1 INTRODUCTION AND POTENTIAL IMPACTS

Ecology is the study of organisms and their relationship with each other and the environment. Nature conservation involves the protection and enhancement of wildlife and their natural and semi-natural habitats, with the objectives of:

- Maintaining the biodiversity and character of the ecosystem; and
- Maintaining viable populations of wildlife species.

Conservation of local ecology cannot be carried out effectively without knowledge of the nature of these habitats, their location, extent and distribution. Conservation of wildlife species and their habitats is important both for human enjoyment and general well-being, as well as to sustain the value of the natural environment for future generations as an asset for recreation, education and direct economic benefit.

Development may have both direct and indirect impacts on the natural environment. Obvious direct effects may include:

- Physical removal of soils and vegetation;
- Obliteration or modification of existing habitats;
- Severance of movement channels for wildlife between habitats; and
- Separation of populations, thus reducing their viability and survival.

Indirect effects of development may include:

- Potential pollution via soil, water or air, which may cause acute or cumulative effects;
- Changes in the micro-climate, such as significant heat, light or radiation emissions, which may be sufficiently great to alter the performance of some species of plants and animals;
- Disruption of groundwater table;
- Affecting natural river flow rates; and
- Putting increased pressure on other habitats, due to the loss or isolation of habitats in areas being developed.

The ecology of the Lightmoor area is both rich and diverse and considerable work has been undertaken to understand the distribution and interrelationship of habitats and species, particularly with respect to the Wildlife Site (formerly known as the Prime Site for Nature Conservation - see Section 6.2.4) to the south and south east. The Application Site and its immediate surroundings are not affected by any statutory designations such as SSSI's, the nearest of which are physically separate and remote from the Application Site. The adjacent Wildlife Site is however locally designated through policies within the Local Plan. Consequently, the ecological status of the Lightmoor area has been taken very seriously and the results from the ecology survey work have been used to inform the masterplan level at a strategic level. The selection of the Application Site, the adoption of a 'Buffer Zone' to the Wildlife Site and specifically the 'built area' have been

considerably influenced by the ecological issues (see Section 6.4.2 - Strategic Mitigation Measures).

6.2 BASELINE SURVEYS

6.2.1 Ecological Surveys and Methodologies

The Lightmoor area and its surroundings have been subject to a series of ecological investigations and appraisals over the recent years as part of the masterplanning process for the proposed development. These baseline surveys can be summarised as follows:

Arup, 1998 to 1999

Arup undertook a series of Phase 1 and 2 ecological surveys over an 18 month period. These comprised an initial Phase 1 Habitat Survey and further detailed surveys for Badgers, Bats, Barn Owls, Great Crested Newts and Birds. The results of these, together with extensive public consultation, were used to inform the original feasibility study and masterplan development.

The Phase 1 Habitat Surveys (detailed in references 1, 2 and 3) involved a desk study appraisal and an extended Phase 1 survey. The desk study involved extensive background data collection and consultations with interested parties. Written consultations were undertaken with:

- English Nature
- Shropshire Wildlife Trust
- Wrekin District Council (now Telford & Wrekin Council)
- Commission for the New Towns (now English Partnerships)
- Shropshire Badger Group
- Environment Agency
- JNCC Invertebrate Site Register
- Botanical Society of the British Isles
- Royal Society for the Protection of Birds (RSPB)
- Shropshire Bat Group
- Lightmoor Action Group and their consultants Nicol, Jones & Lomax

The Phase 1 survey was undertaken in accordance with the Institute of Environmental Assessments document 'Baseline Ecological Assessment' (reference 4) and the JNCC Phase 1 Habitat Survey Methodology (reference 5). As part of the Phase 1 survey, a hedgerow survey of the Lightmoor area was undertaken to assess the value of the hedgerows and their habitats. The assessment of the hedgerows was undertaken in accordance with the Hedgerow Evaluation and Grading System (see reference 6) and with consideration to the Wildlife & Countryside Act 1981 and the Hedgerow Regulations 1997.

The Phase 2 surveys were undertaken in accordance with the following methodologies:

Bats The assessment of the Bats was undertaken using the following methods (reference 7):

- identification of habitats most likely to hold a high diversity of invertebrates and be of value as bat feeding habitat;
- identification of possible roost sites;
- visual assessment of bat activity at dusk;
- use of an ultrasonic detector to identify movement of bats after dark; and
- consultation with the local bat group.

Barn Owls The assessment of Barn Owls was undertaken using the following methods (reference 7):

- identification of habitats likely to support moderate or high densities of small mammals;
- identification of suitable roosting sites/nesting sites;
- visual assessment; and
- consultation with Shropshire Wildlife Trust.

Great Crested Newts The assessment of the presence and status of Great Crested Newts was undertaken using the following methods (reference 7):

- identification and mapping of water bodies and associated terrestrial habitat;
- survey of all water bodies searching for newt larvae or adults; and
- consultation with English Nature and the Shropshire Wildlife Trust.

Birds In assessing usage by breeding birds a point count method was employed and included surveying of the general Lightmoor area including the Wildlife Site (see reference 8). These points were used on four successive occasions, one in April, two in May and one in June 2000. On each occasion these points were visited and records made of all birds seen or heard in the vicinity. The survey points were selected so as to ensure all habitats typical to the area were included, and in particular habitats that would be subject to impact. The aim of the survey was to assess the range of species frequenting the study area, not to gain absolute figures of birds present. The total area of the study was in excess of 100ha, above the size where common birds census methodology is generally applied.

Badgers The assessment of the presence and status of Badgers was undertaken using the following methods (reference 9):

- Badger survey work;
- baitmarking exercise; and
- consultation with the Shropshire Badger Group.

As well as the survey work, this ecological data was utilised to assess the potential ecological impacts from the original Outline Development Plan (see references 10 and 11). This first phase of ecological impact assessment in July 1998 began the on-going process of ecological mitigation through the refinement

of the evolving masterplan. The salient points from these reports are discussed in the relevant sections of this Chapter.

Arup, 1999 to 2000

Following the modifications to the Outline Development Plan as described above, Arup considered the ecological provisions required to mitigate the impact of the revised proposals on the wildlife and habitats, as well as opportunities to improve the ecological value at Lightmoor. Arup's report entitled 'Scoping Report for Lightmoor Sustainable Wildlife Strategy - Ecological Mitigation Measures & Opportunities' (reference 12) details this work, the majority of which has been carried through with the refinement of the masterplan associated with this application, and into the mitigation measures identified at the end of this Chapter.

Arup, October to December 2001

To inform this Environmental Statement and to update the earlier ecological findings, Arup undertook a habitat review (reference 13). This review focused on the habitats and species, particularly those that are statutorily protected, previously identified as being present or potentially being present within the site. This involved recording the main habitat types and reviewing the species lists. Although the habitat review was carried out at a time when the foot and mouth crisis had resulted in restricted access, the review was nonetheless able to update and validate the findings of the 1998 and 1999 ecological surveys. Concurrent with this, Arup also reviewed the findings of the hedgerow survey originally undertaken in 1998.

In general, these surveys demonstrated that the ecological status of the Lightmoor area had not changed significantly between 1998 and 2001. The combined survey findings are used in the next sections to describe the existing baseline conditions, which are also summarised in Drawing 6479/ES-6-01.

The baseline ecological reports (references 1, 2, 7, 8, 12 and 13) prepared by Arup are contained in Appendix B.

6.2.2 Baseline Conditions - Flora

The principal habitats and associated flora within the Application Site are detailed in Drawing 6479/ES-6-01 and can be summarised as follows:

- ***Improved Pasture/Grassland***

  The majority of the Application Site comprises improved pasture fields of low diversity dominated by Perennial Rye Grass, False Oat Grass and Meadow Foxtail. Such grasslands are of limited ecological importance.

- *Arable Grassland*

  Four fields within the central part of the Application Site are of an arable nature. The intensive nature of the management regime employed in arable areas leads to largely single species-dominated fields surrounded by a low diversity of common arable species such as Cow Parsley, False Oat-Grass and Hogweed. These grasslands are also of limited ecological importance.

- *Semi-improved grassland*

  Only limited areas of semi-improved grassland have been identified within the Application Site as detailed in Drawing 6479/ES-6-01. The diversity of these areas is greater than for improved grasslands, which therefore increases their ecological value. Across the Application Site, the diversity varies, with encountered species including common Mouse-ear, Perennial Rye-grass, Meadow Fox-tail, Black Knapweed, Cock's Foot and Dandelion.

- *Secondary woodland*

  Two small areas of secondary woodland are present on the edges the Application Site, to the north east near to Johnston Pipes and to the south west next to The Dingle. Species common within the woodland include Holly, Oak, Ivy, Silver Birch and Honeysuckle. The 2001 survey work has identified some encroachment of the woodland along the tract of the disused canal.

- *Ancient woodland*

  There is one area of ancient woodland on the Application Site to the south west known as The Dingle. This contains good examples of ancient woodland ground flora including Wood Anemone, Yellow Archangel, Bluebell and Wood Melick. Canopy species include Pendunculate Oak, Ash and Elm species.

- *Hedgerows*

  The Application Site contains a number of hedgerows from recently planted single species-dominated hedgerows to mixed species mature hedgerows with ditches, hedgebanks and a diverse ground flora. Many of the hedgerows represent historically and botanically significant features. Under the Hedgerow Evaluation and Grading System (reference 6), hedgerows are classified according to their species diversity and structural and connectivity features as follows:

  Grade 1 Hedgerow - High/very high value
  Grade 2 Hedgerow - Moderate to high value
  Grade 3 Hedgerow - Moderate value
  Grade 4 Hedgerow - Low value

The hedgerow network encompasses examples of mixed species mature hedgerows with deep hedgebanks, ditches and diverse ground flora and of relatively recently planted hedgerows dominated by a single species. Drawing 6479/ES-6-02 details the hedgerow gradings based upon the surveys.

No species listed in Schedules 1, 5 or 8 of the Wildlife & Countryside Act 1981 were recorded in association with the hedgerows during the surveys. Seven of the hedgerows (H11, H40, H43, H54, H55, H57 and H62) include at least seven woody plant species, a feature used in determining whether a hedgerow is considered important under the Hedgerow Regulations 1997. There were no notable species within any of the hedgerows surveyed.

Two Grade 1 hedgerows (H11 and H57) exist north of Woodlands Lane, comprising good diversity of Hazel, Holly, Ash, Field Rose, Ivy, Elder, Rowan, Silver Birch and Hawthorn within the canopy. H11 also bears a number of mature standards of Holly, Ash, Oak and Silver Birch. The majority of the hedgerows are of Grade 2 and Grade 3. Those of particular note are adjacent to Woodlands Lane and Stoneyhill and are dominated by Hazel and Hawthorn, with Holly, Goat Willow, Oak and Elder also present. Only three Grade 4 hedgerows were recorded (H2, H38 and H60), which are located adjacent to the primary vehicular access routes to the site.

Between the 1998 and 2001 surveys, hedgerow changes were evident although only six had changed sufficiently to change grades.

In summary, the majority of the Application Site comprises intensively managed improved pasture or arable land of relatively poor diversity. The areas of improved grassland may provide good foraging areas for resident badger populations (see 6.2.3), however intensively managed arable fields are of little ecological value. Areas of significant ecological value include The Dingle ancient woodland (for its good species assemblages) the mature hedgerows bordering Woodlands Land and Stoneyhill, the hedgerows immediately to the north of Woodlands Lane and 53, 55 and 56 (see Drawing 6479/ES-6-02). There are also some scattered areas of semi-improved grassland which differ in species diversity.

The most ecologically valuable flora habitats within the Lightmoor area are found in the Wildlife Site, which is located to the south and south east of the Application Site. The Wildlife Site and its interrelationship with the Application Site is discussed in Section 6.2.4.

6.2.3 Baseline Conditions - Fauna

The fauna of the Application Site can be summarised as follows:

- *Badgers*

  There is evidence of badgers at the Application Site, and the details on badgers have been compiled into Appendix C for confidentiality reasons. This information should only be made available to bona-fide organisations

with legitimate interests as it contains details of sett locations and foraging areas. This also applies to the Badger Survey report (reference 9) which is also enclosed in Appendix C for confidentiality reasons, along with the relevant extracts from the other Baseline reports.

- *Bats*

During the survey work, no built structures were observed as having ideal conditions for bat roosts due to them being open and draughty, and no trees were observed as having holes exhibiting evidence of use by bats. However, none of the existing residential houses were surveyed in detail. Similarly, no open mine shafts, caves or similar habitats were found within or near to the Application Site. Dusk observations during July and August 1998 recorded activity to the south of the Application Site (around Burroughs Bank Ponds), and only three single bats were observed along the lanes within the Application Site. Ultrasonic detector surveys also only detected infrequent and occasional bats along the lanes. Consultations with the Shropshire Bat Group also confirmed a general absence of bats in the Lightmoor area, although this is probably more reflective of a lack of previous survey data rather than a confirmed absence of bats. The observed presence of bats within the Application Site appears more related to foraging as opposed to roosting.

Based upon the habitats identified in the Phase 1 Habitat Survey (see Drawing 6479/ES-6-01), the following gradings can be applied to the habitats with respect to their value for supporting a wide diversity of invertebrates and therefore their value as bat feeding habitat:

Improved pasture/grassland	Low
Semi-improved pasture/grassland	Low/medium
Arable	Low
Secondary Woodland	Medium/high
Ancient woodland	High
Hedgerows	Medium/high
Existing gardens	Medium

Adjacent off-site habitats such as water bodies, marshy grassland and reed swamps in the Wildlife Site (see Section 6.2.4) also provide medium/high value as bat feeding habitats.

- *Barn Owls*

With the exception of the buildings at Stocking farm, where a single Barn Owl was observed during the winter bird survey, no evidence of roosting sites within the Application Site was encountered. However, the farm buildings of Woodlands Farm and Croppings Farm were identified as potential roost habitats. No trees were observed to present good potential roost or nest sites. During dusk surveys in July and August 1998, no species of owls were observed. In addition, the Shropshire Wildlife Trust have no records of Barn Owls occurring in the survey area. An uncorroborated

comment from a local birdwatcher suggested that Barn Owls had not been seen in the area for about eighteen years. The winter survey individual was not observed during the summer surveys and was clearly not part of a breeding pair. The Application Site and its surroundings, the hedgerow network and habitats in the adjacent Wildlife Site are identified as habitats that would support small mammals that would be hunted by Barn Owls. The survey work concluded that Barn Owls are not currently breeding in the general Lightmoor area and are limited to occasional individuals passing through.

- *Great Crested Newts*

Within the Application Site, only one waterbody has been identified to the south of Croppings Farm (see Drawing 6479/ES-6-01). This pool appears to be relatively modern and receives farm effluent from the cattle barns at Croppings Farm. The water quality is poor and no aquatic vegetation was present. No newts or larvae were caught during a pond sweeping exercise, and it was concluded by Arup that it would probably be toxic to amphibians. No newt breeding habitats therefore exist within the Application Site.

Five pools are to be found beyond the Application Site boundary, three of which are associated with the Wildlife Site. These are also identified in Drawing 6479/ES-6-01. Survey work on these pools has not identified the presence of any adult newts, although evidence of newt larvae, including Great Crested Newts were found in the Pool west of The Finney. These pools are all approximately 100m from the Application Site boundary and between 450m to 500m from the defined built area.

Newts may travel up to 500m from their breeding pond and regularly travel 250m where intervening habitat allows. The pasture/grassland and hedgerows identified on the Application Site represent an appropriate habitat for newt foraging, therefore it is concluded that the southern sector of the Application Site may be a terrestrial habitat for newts in the ponds to the south.

The habitat review in 2001 (reference 13) confirmed the suitability of the five pools as Great Crested Newt breeding habitat and that the southern sector of the application site may be a terrestrial habitat for newts in these ponds. The review also concluded that whilst still in very poor condition the Croppings Farm pond could not be totally ruled out as a habitat.

- *Birds*

The Spring / Summer 2000 bird breeding survey identified 25 species of breeding bird between Stoneyhill/Holywell Lane and Woodlands Lane. This area is mostly put to intensive agriculture and the actual number of species recorded is surprisingly high given the paucity of habitat present. Strongly influential to the number of species present were certain habitats/features within the area, namely the derelict Stocking Farm, occupied cottages with

maintained gardens to the west of Stocking Farm, Croppings Farm and the hedgerows associated with Woodlands Lane and Burroughs Bank. Only three species were observed to be associated with the farmland; Skylark, Lapwing and Red-legged Partridge. Furthermore these occurred at very low densities and none were observed to successfully breed. The presence of Skylark was especially influenced by the presence of the rough grassland covering the former tip site to the west of the study area.

The area north of Woodlands Lane held 33 species of breeding bird, but as above, the distribution of these species was strongly influenced by the habitats present. The great majority of species being associated with the derelict canal and associated scrub and woodland. Again the open farmland supported only three species.

As would be expected, the area to the south of the Application Site containing the Wildlife Site held the greatest recorded diversity of breeding birds with 50 species present. This high diversity reflects the diversity of habitats present, including open water, marsh, mature mixed deciduous woodland, semi-improved grassland, scrub and hedgerows.

The findings of the subsequent 2001 follow up surveys of the application were consistent with the above and confirmed the majority of bird sightings to be associated with the network of hedgerows. Hedgerows provide continuous habitat and link between further areas of prime habitat that is associated with bird breeding and over wintering within and adjacent to the Application Site such as woodland. The following species were recorded in association with the network of hedgerows on site: Blue Tit, Blackbird, Dunnock, Golderest, Goldfinch, House Sparrow, Long-tailed Tit, Magpie, Mistle Thrush, Redwing and Robin.

- *Reptiles*

Desk study information obtained by Arup suggest that three species of reptile occur in the Lightmoor area: Grass snake, Common Lizard and Slow Worm. During the various phases of survey work undertaken, no evidence of these species has been observed.

Grass snakes are commonly associated with aquatic habitats, marshes and wet meadows and therefore it is anticipated that if present, the populations will be associated more with the Wildlife Site. However, grass snakes will travel considerable distances through other habitats on their annual cycle to access hibernation and egg-laying habitats, therefore the use of the Application Site in this context cannot be overlooked.

The Common Lizard in Shropshire is normally associated with acid grassland/heath land communities or other nutrient poor habitats. No evidence of the lizard has been observed during the survey work, and the prime habitat site for this species appears to be the Wildlife Site where the character of the land has been defined by the former mining activities.

Typical Slow Worm habitats overlap with that of the Common Lizard, and the Wildlife Site and connecting habitats to the east and west of this area present prime habitat for the species. No evidence of Slow Worms has been observed during the survey works.

- *Invertebrates*

  Whilst some of the identified habitats within the Application Site are of value to invertebrates such as the hedgerows and the woodland of The Dingle, the principal area of interest relates to the Wildlife Site to the south and east of the Application Site, where two butterfly species (the Dingey Skipper and the Green Hairstreak) and a range of aquatic invertebrate species (including Damselflies and Dragonflies) have been recorded.

In summary, the Application Site has been demonstrated through survey work to not be supporting large or significant numbers of protected or ecologically important species such as Bats, Barn Owls, Great Crested Newts or Badgers, although in the case of the latter the use of the Application Site by limited numbers of badgers is acknowledged and discussed further in Appendix C for confidentiality reasons. The valuable role of the Application Site for foraging and feeding habitats for many of the faunal species discussed is acknowledged, as well as the linkage that the southern part of the Application Site has with the adjacent Wildlife Site (see below).

6.2.4 The Wildlife Site

Designation

The Wildlife Site (formerly known as the Prime Site for Nature Conservation) occurs to the south, south east and east of the Application Site, as detailed in Drawing 6479/ES-6-01. This boundary and designation dates back to the mid 1980s and consequently was based upon Ordnance Survey mapping rather than more precise GIS. The boundary presented is based upon the records held by the Shropshire Wildlife Trust.

The Wildlife Site is of County importance due to the presence of four wetland, thirteen grassland and seven woodland indicator species. The designation is therefore non-statutory but is afforded protection through policies within the Local Plan, which recognises its importance as a reservoir for biodiversity in a county context.

Habitats and Flora

The Wildlife Site exhibits a mosaic of habitats including wetlands, grassland, heathland, woodland and scrub (see Drawing 6479/ES-6-01) and represents the most significant area with respect to ecology and nature conservation in the Lightmoor area. Given this significance, the development proposals, which are the basis of this application, have been amended to accommodate ecological concerns.

The Wildlife Site contains a number of pitmounds that have been naturally regenerated by a variety of flora and have resulted in impeded drainage patterns resulting in a series of wetland areas and pools. The majority of the pitmounds are of acidic waste with typical flora being Birch, Oak, Holly and a ground flora of Honeysuckle, Bramble, Sheep's Sorrell, Wavyhair Grass and Heather. The indicator species for the Wildlife Site are:

- Wetland indicator species - Angelica, Broad-leaved Pondweed, Marsh Marigold, Water Mint.
- Grassland indicator species - Spotted Orchid, Southern Marsh Orchids and hybrids, Adders-tongue Fern, Agrimony, Betony, Yellow-wort, Lady's Smoke, Lesser Knapweed, Common Centaury Oxeye Daisy, Wild Carrot, Heath Bedstraw, Dyer's Greenweed.
- Woodland indicator species - Ramsons, Enchanter's Nightshade, Dog's Mercury, Wood Anemone, Bluebell, Wood Melick, Yellow Archangel.

Survey work undertaken by Arup has largely confirmed the status and species composition of the Wildlife Site habitats.

Fauna

Survey work has also reinforced the ecological significance of the Wildlife Site, where encountered faunal species include:

- Bats - the water bodies associated with the Wildlife Site have been observed to support the feeding habits of bats;
- Badgers - see Appendix C for confidentiality purposes;
- Great Crested Newts - the pools within the Wildlife Site appear to support Great Crested Newt populations, particularly the pool to the west of The Finney;
- Reptiles - the habitats identified across the Wildlife Site appear ideal for supporting Grass snake, Common Lizard and Slow Worms;
- Invertebrates - Two butterfly species (the Dingey Skipper and the Green Hairstreak) and a range of aquatic invertebrate species (including Damselflies and Dragonflies) have been recorded; and

- Birds - the Wildlife Site held the greatest recorded diversity of breeding birds for the surveyed areas, with 50 species present. This diversity reflects the diversity of habitats present.

Linkage with the Application Site

Ecological features are rarely defined by site boundaries, and this is particularly true of the Wildlife Site and the Application Site. Drawing 6479/ES-6-01 details the two 'boundaries' for each site, however the interrelationship between the two sites, particularly the importance of the Application Site to the Wildlife Site, is inevitable and has been confirmed by survey work to be present. Whilst not necessarily supporting populations of faunal species in terms of nesting/roosting sites, the Application Site does provide valuable foraging and feeding habitats for species which are resident within the Wildlife Site.

The most significant of these relates to the presence of Great Crested Newts within the Wildlife Site ponds. The foraging habits of the newts mean that the southern section of the Application Site (notionally south of Stoneyhill and Holywell Lane) is likely utilised by newts as a terrestrial habitat. Similarly, rich habitats such as the hedgerows and The Dingle are also potential feeding grounds for species which may be resident in the Wildlife Site or elsewhere.

The hydrology of the Wildlife Site is largely dictated by the Lightmoor Stream catchment. As detailed in Chapter 9.0, it is important to note that the Application Site itself does not contribute to the hydrological characteristics of this catchment and therefore those of the Wildlife Site.

6.3 ANALYSIS OF PREDICTED IMPACTS

6.3.1 Application Proposals

The application proposals for the new village have been described in Chapter 4.0. These proposals have evolved based upon the input of environmental considerations as part of the masterplan development. Ecological input has formed the principal consideration in this process, and the key features that the development proposals needed to respect are:

- the presence of protected species such as Great Crested Newts and Badgers;
- the network of mature hedgerows alongside lanes and field boundaries and their importance both historically and as ecological habitats;
- the area of ancient woodland, known as The Dingle, in the western part of the site; and
- the Wildlife Site to the south and the need to sustain the pools within as aquatic habitats.

By considering and mitigating for these features at an early stage of the development process, many of the potential impacts have been negated and therefore are not explicitly discussed in this Section, although Section 6.4 provides more details of the Pre-planning strategic mitigation measures and the 'ecological benefits' of such actions.

6.3.2 Flora

By taking each of the key floral habitats identified in the baseline studies, the impacts of the proposed development can be described as follows:

Improved Pasture/grassland

These grasslands are of limited ecological importance and their loss is not considered to represent a significant ecological loss. Nonetheless, through the proposed open space strategy, many areas of this grassland around the built area, especially to the west and south will be retained, thus reducing what is already a negligible impact.

Arable Grassland

Three of the four arable fields will be lost due to the land take of the built area of the village. The limited diversity and consequently low ecological value of these fields is such that this loss is not considered significant and the impact will be negligible.

Semi-improved grassland

The identified areas of semi-improved grassland occupy the fringes of the Application Site, and will therefore be largely untouched by the construction of the village. The main area of semi-improved grassland is located to the south of Burroughs Bank and Stoneyhill and will therefore not be within the identified built area, but will be retained as part of the buffer zone against the Wildlife Site (see Section 6.4.1). Whilst there will be some limited land take of these grasslands, the overall impact is considered to be negligible.

Secondary and Ancient Woodlands

The value of the woodlands within the Application Site has been acknowledged and these will be retained and incorporated into the development proposals. Through the retention of the woodlands as part of the village, the opportunity exists to enhance the woods by good forestry management therefore the development will have a potential net positive impact.

Hedgerows

The historical and ecological value of the hedgerows is such that they have been identified as a particularly sensitive habitat to the proposed development. Loss of the hedgerows would be significant and adverse, both in terms of their ecological diversity and the movement linkages and feeding habitats they provide. For this

reason, the retention of the majority of the hedgerows, along with enhancement through the planting of new native hedgerows, is a fundamental consideration and feature of the current proposals. The development will have an inevitable low adverse impact on the hedgerows, although mitigation measures incorporated at all stages aim to minimise this impact.

6.3.3 Fauna

By taking each of the key faunal species identified in the baseline studies, the impacts of the proposed development can be described as follows:

Badgers

The impact appraisal for badgers is contained in Appendix C for confidentiality reasons. However in general terms the impact is considered to be low due to the planning proposals of buffer zones around the identified setts and the general provision of ecological retention and enhancement through the open space strategy. The latter will ensure species such as Badgers can continue to forage across the Application Site.

Bats

Bats and their roost sites are afforded statutory protection under the Wildlife & Countryside Act 1981 and also under the Conservation (Natural Habitats &c.) Regulations 1994.

No roosting or hibernation sites for Bats have been identified, and therefore the direct impact of the development is considered negligible. The indirect effects can relate to the loss of foraging and feeding grounds. Survey works have demonstrated that the main habitats supporting bats in this respect are the hedgerows and the water bodies in the adjacent Wildlife Site. Both of these are being retained as part of the development, therefore the indirect impact is also considered to be negligible.

Barn Owls

It is illegal to destroy a nest containing eggs or young of any wild bird and to disturb certain species whilst building or on a nest under the Wildlife & Countryside Act 1981.

The ecological surveys concluded that breeding Barn Owls do not occur in the general Lightmoor area and that the proposals will not significantly affect the roosting potential (ie. existing buildings) of the area. On this basis, the impact of the proposed development is considered to be negligible.

Great Crested Newts

Great Crested Newts are afforded statutory protection under the Wildlife & Countryside Act 1981 and also under the Conservation (Natural Habitats &c.) Regulations 1994.

Only one waterbody with the potential to support newts has been identified within the Application Site. However, this potential is limited and in any event the waterbody is not within the proposed built area. The direct impact of the proposals is therefore negligible.

Great Crested Newts are however, known to forage up to 500m from their ponds, and this therefore identifies the southern sector of the Application Site as being potential terrestrial habitat for newts present in the ponds in the Wildlife Site. For this reason, no development will take place within this area, which is to be set-aside as a 'buffer zone' (see Section 6.4.1). Consequently, the indirect impact of the development on newts will be low to negligible.

Birds

It is illegal to destroy a nest containing eggs or young of any wild bird and to disturb certain species whilst building or on a nest under the Wildlife & Countryside Act 1981.

The total number of species found to associate with the Application Site is considered to be unexpectedly high. However, the distribution of these species was strongly associated with the woodland and hedgerows habitats. These areas are to be largely retained as part of the development proposals, such that they would not be expected to reduce the present complement of species. Mitigation proposals including the open space strategy and retention of the hedgerow network will reinforce these habitat types such that the density and diversity of species may be expected to increase.

Conversely the agricultural habitats supported few species at very low densities. The intensive management of the land, combined with the open windswept aspect provides little shelter or food opportunities for typical farmland birds. Landscaping and mitigation proposals will bring retained grassland and hedgerow habitats into more favourable management regimes to encourage a greater presence of farmland birds including Lapwing, Skylark and Grey Partridge. It is probable that with correct management the total number of these species can be increased beyond the present case in association with development proposals.

The proposed development is considered to have a negligible to positive impact on the diversity of bird species present.

Reptiles

Slow Worm, the Common Lizard and Grass Snake are afforded statutory protection under the Wildlife & Countryside Act 1981.

No reptiles have been identified within the Application Site. Furthermore, the prime habitats for such species have been identified as not being within the Application Site but in the adjacent Wildlife Site. Consequently, the impact of the development on reptile species is considered to be negligible.

Invertebrates

As with reptiles, the key habitats for invertebrates exist within the Wildlife Site and not the Application Site. The impact of the development is therefore considered to be negligible.

6.3.4 Inter-relationship between Flora and Fauna Habitats

The development proposals will require a significant landtake within the Application Site. Whilst much of the land to be lost is improved/agricultural grassland, which is of limited ecological significance, it will also include limited losses of some hedgerows and a very limited amount of semi-improved grassland. However, strategic design measures have already been incorporated through the evolution of the masterplan supporting this application in order to minimise this impact. Consequently, this landtake will only lead to a small reduction in the habitat available for fauna including nesting, breeding, feeding and resting sites. Therefore the biodiversity of the Lightmoor area is not likely to be significantly affected by the proposed development.

The development will also lead to a limited loss of wildlife corridors, including the loss of some hedgerows. However, this will be mitigated through the retention of the majority of the hedgerows, along with the planting of new hedges to supplement and enhance the retained network. The development is therefore considered unlikely to significantly affect species' ability to cross and disperse over the Application Site, and prevent them gaining access to feeding and breeding areas. The proposals will also ensure linkage is retained between habitats thus preventing the creation of barriers to movement and hence avoiding fragmentation of species and populations.

6.3.5 The Wildlife Site

The Wildlife Site is the most significant ecological feature of the Lightmoor area and is of county importance. In response to this the Application Site boundary has been delineated to omit this important site. Through the retention of a buffer zone and the hedgerow network (see Section 6.4.1), the linkages and wildlife corridors to the Wildlife Site will be largely preserved. Consequently, the proposed village development is considered to have a negligible impact on the Wildlife Site.

Similarly, the adoption of a Sustainable Urban Drainage System (see Chapter 9.0) will ensure that the Lightmoor catchment, which is responsible for the Wildlife Site's hydrological features will not be subjected to additional flows, and will in fact retain its current approximate flow regime. The Wildlife Site's hydrology will therefore not be impacted upon by the development proposals.

6.3.6 Other Potential Impacts

As well as the potential for habitat and species-specific impacts, the proposed development may also cause impacts that may affect the ecological status of the area as a whole . These potential impacts are discussed below.

Pollution Risk

The new development poses potential risks from contamination both due to the construction of the development and the subsequent operation. During construction, potential pollutants may include the generation of dusts, traffic emissions and spillage or leakage of chemicals and fuels being used. These impacts are largely discussed in Chapters 11.0 and 9.0 respectively, where mitigation measures are proposed in order to minimise these impacts. In view of the measures proposed and the generally short-term nature of the construction activities, construction is considered to pose a negligible impact on ecological receptors of significance with respect to contamination.

The residential nature of the development is such that it is unlikely to create a significant potential for contamination. Measures are also being incorporated into the development, primarily through the drainage systems (see Chapter 9.0) in order to control and attenuate potential contamination, such that the impact on the local ecology from any possible development-related contamination will be negligible.

Disturbance

The development will cause disturbance both during and post construction. This disturbance may be increased noise, dust, visual and increased human activity. These potential impacts are also discussed in the relevant chapters of this Statement. The effect is likely to be more marked during the construction period when the greatest disruption to the area will occur. The impacts local to the built area will be adverse, however they will be short-lived and of a low enough intensity so as not to compromise the habitats affected.

The positioning of the built area away from the Wildlife Site is such that it will not be adversely impacted by construction activities.

Introduction of non-indigenous flora and fauna

The introduction of domestic pets and gardens to the area poses a risk to the ecological receptors through the threat of increased predation, for example by domestic cats, and through the threat of 'garden escapes' dispersing into the natural areas. There is however, one positive impact of the creation of gardens, and that is that they can provide good feeding and breeding opportunities for birds and invertebrates if given some consideration.

6.4 MITIGATION

The mitigation of the potential impacts of the development on the ecological receptors falls into two broad categories, namely those strategic measures that have been adopted as part of the masterplan development, and those that will be adopted as part of the detailed design, construction and longer term management of the development.

6.4.1 Strategic Mitigation Measures

Movement of the Development Northwards

The ecological surveys identified the importance of the Wildlife Site in the context of the Lightmoor area and concluded that development within or close to the Wildlife Site would have significant impacts on the biodiversity and long term integrity of the habitats. Consequently, the entire proposed development was moved northwards to respect the Wildlife Site's sensitivity and therefore to afford it protection. This measure included the delineation of the Application Site boundary so that it did not overlap with the Wildlife Site and more importantly the movement of the built area north of Stoneyhill and Holywell Lane. This measure is seen as the most important to be implemented as part of the application.

Creation of a 'Buffer Zone' with the Wildlife Site

The Application Site boundary sits adjacent to the Wildlife Site boundary, however built development will mainly occur approximately 250m from this boundary, although the proposed south eastern area of the development will be closer. The intervening land is to be retained and managed largely in its present state in order to offer a buffer zone between the built area and the Wildlife Site. This will ensure that impacts on the Wildlife Site are minimised by ensuring continuity and enrichment of the ecological habitats associated with this 'boundary'. In addition, the buffer zone will be managed so as to deter unauthorised access across the retained agricultural land to the environmentally sensitive areas of the Wildlife Site and The Dingle.

The retention of this buffer zone was also in response to the Great Crested Newts that occupy the pools of the Wildlife Site. Newts are known to be able to forage up to 500m from their pool, and this maximum figure has been accounted for in the positioning of the built area, which lies between 450m and 500m away from the pools. This ensures that sufficient terrestrial habitat is retained so that the existing and future newt populations will not be impacted upon by the development.

Retention and Enhancement of the Hedgerows

Retention of the entire hedgerow system will not be possible, particularly at the village centre, however the vast majority of hedges will be retained, particularly the more sensitive sections as defined by the hedgerow surveys. To mitigate against this loss, new sections will be planted and existing sections enhanced and bridged to ensure a continuity for existing movement and feeding corridors. This measure acknowledges the ecological importance of the hedgerows both as habitats in their own right and as feeding, foraging and movement corridors. The opportunity also exists for management of the hedgerows in order to ensure their long term viability is maintained and where possible enhanced.

Open Space Provision

A key aspect of the development proposals is the Open Space Strategy. This not only acknowledges the recreational needs of the new village's community, but also the importance open space will provide in terms of retaining existing ecological communities and creating new ecological habitat opportunities. Approximately 54 acres of open space is being provided around the built area. This includes also for two proposed wildflower meadows which will offer landscape and biodiversity benefits, as well as new woodland north of Holywell Lane.

6.4.2 Mitigation Measures During Detailed Design and Construction

In addition to the above strategic mitigation measures, it is essential that the on-going design and subsequent construction of the development continues to respect the ecological sensitivities of the Lightmoor area. In response to this, the following mitigation measures will be adopted at the respective project stages:

Species-specific mitigation measures - Flora

- Hedgerows and trees - Prior to construction and as part of the detailed design of the individual development plots, each hedgerow and tree to be retained will be entered onto an inventory for recording purposes to ensure all parties are aware of their protected status. All trees and hedges to be retained will be appropriately fenced and secured prior to construction. Ecological watching briefs will be instigated to enable immediate responses to any accidental damage.

Species-specific mitigation measures - Fauna

- Badgers - As part of the detailed design process, a further badger survey will be undertaken (between March and June) in order to review the extent of setts and foraging runs at the time of construction. This work will advise on the proximity of the badger habitats to the proposed development and will determine whether a licence will be required from English Nature in respect of construction and associated activities in the vicinity of the badger populations. Further details are contained in Appendix C for confidentiality reasons;

- Bats - No bat roosts were encountered during the survey work. As a precautionary measure, a watching ecological brief will be maintained during the construction period to ensure no 'hidden' bat roosts are disturbed. This brief will also extend to the pre-construction survey of potentially sensitive areas such as Stocking Farm or any trees which may be directly impacted by the development works, so as to re-establish the absence, or otherwise, of bat species. Such surveys will ideally be done between April and October;

- Great Crested Newts - No Great Crested Newts were encountered during the survey work within the Application Site. As a precautionary measure, a watching ecological brief will be maintained during the construction period in case any newts are encountered. This watching brief will be based upon an appropriate management plan detailing actions if newts are encountered. Given the potential terrestrial use by newts of the southern sector of the site, prior to construction in the built area, precautionary newt fences will be erected to prevent individuals venturing onto the construction site; and

- Other faunal species - whilst no evidence of breeding or nesting sites for other species has been identified at the Application Site, appropriate additional survey work will be undertaken during the detailed design stage and prior to construction so as to ensure no species are compromised by the works. The timing of the surveys will ideally be February to March and August to September for breeding birds, April to June and September for reptiles and May to September for invertebrates. Part of this survey work will allow provision for mitigation action if nesting or breeding sites of significance are encountered.

General Mitigation Measures

- Fencing - Prior to the commencement of any physical or intrusive works on site, the built area and other affected areas will be fenced off. This will prevent contractors / developers damaging surrounding habitats by controlling access to the Application Site and its surroundings habitats;

- Site compounds - Site compounds and access ways will be placed so as not to cause any unnecessary damage or pressure on surrounding habitats. Part of this process will be governed by an ecological constraints map which will be provided to all contractors and developers;

- Ecological Management Plan - All works at the site will be governed by an Ecological Management Plan which will enable all proposed construction works to appraise and therefore mitigate against the potential ecological impacts they may pose. This will include measures to be implemented to control water pollution, air quality and noise impacts, as described in Chapters 9.0, 11.0 and 12.0 respectively; and

- Ecological support and supervision - As part of the Ecological Management Plan, an independent ecological watching brief will be maintained during the construction works in order to monitor the performance of site operatives against the Ecological Management Plan and to also be on hand to offer guidance and advice.

6.4.3 Mitigation Measures Post-Construction

Once the village has been built and constructed, it is acknowledged that the ecological mitigation does not end there. It is therefore also intended that a programme of ecological management works will be adopted as part of the occupation, and future progression of the village.

Species-specific mitigation measures - Flora

- Hedgerows - The retained hedgerows will be gapped, strengthened and managed by Bournville Village Trust, so as to ensure the long term diversity and integrity of the hedgerow network is maintained and where possible enhanced; and

- Trees - The creation of new woodland planting of indigenous species of local provenance within and adjacent to the built area will improve habitat quality and increase diversity. It is also proposed that a new area of woodland be created north of Holywell Lane. The opportunity also exists for management of the existing woodland areas to improve their diversity and therefore value.

Species-specific mitigation measures - Fauna

- Badgers - Fencing and mammal underpasses will be provided at strategic points beneath the perimeter road, and on-going ecological monitoring of the resident badger populations will be undertaken;

- Bats - The quality of bat habitats within the village will be improved through a series of measures including hedgerow gapping and management and the provision of artificial roost sites using bat boxes for both summer and winter hibernation; and

- Other faunal species - The provision of an on-going management programme of the site's ecological features such as the hedgerow and open space areas will ensure that these habitats remain accessible and appropriate for feeding, roosting and movement purposes.

General Mitigation Measures

- Buffer Zone - The continued farming operation within the buffer zone will deter public access to the Wildlife Site and will therefore offer additional protection to its habitats; and

- Open Space - The maintenance of open space areas within the village will also further discourage unauthorised access to the Wildlife Site and The Dingle.

6.5 STATEMENT OF SIGNIFICANCE

Detailed ecological surveys of the Application Site and its surroundings have been undertaken over a number of years. These have confirmed that the majority of the Application Site comprises agricultural land (improved pasture and arable) that is species poor and of low ecological value.

The areas of ecological value within the Application Site comprise The Dingle ancient woodland and the mature hedgerows. With respect to flora in the wider Lightmoor area, the most ecologically valuable habitats are located in the Wildlife Site (which is designated on a county wide basis) to the south and east, outside the Application Site.

With the exception of Badgers, no important populations of protected species have been recorded within the Application Site. However, Badgers have been recorded as foraging in some parts of the site and a sett (sett 1) is located on the eastern edge of the Application Site.

Within the wider area the application site connects to the Wildlife Site and some movement of wildlife between the two sites is likely.

The application proposals have considered the information obtained from the baseline ecological surveys and key issues and concerns have been addressed at an early stage of the masterplanning process. Consequently, by considering and mitigating against these issues at an early stage, many of the potential impacts have been reduced or negated. Strategic mitigation measures include:

- The redefining of the boundary of the Application site (and the 'built area') to avoid the Wildlife Site;
- Creation of a buffer zone adjacent to the Wildlife Site to ensure protection and acknowledge linkage;
- Retention and enhancement of important hedgerows and woodland;
- Open space provision and maintenance of links across the site.

By considering these and the commitment to further mitigation at pre-, during and post-construction phases, including ecological management and supervision and repeat surveying, the impact of the development on the flora and fauna and ecological biodiversity of the Lightmoor area will be low. In addition there are opportunities for beneficial works, including the management of hedgerows and woodland to increase the value of these features for nature conservation.

Table 6.1: Summary of Ecological impacts

Ecological Receptor	Importance	Impact	Significance of Impact without Mitigation	Significance of Impact with Mitigation
Application Site				
Flora				
Improved Pasture/Grassland	Negligible	Loss	Negligible	Negligible
Arable	Negligible	Loss	Negligible	Negligible
Semi-improved Grassland	Local	Limited landtake	Low	Negligible
Ancient and Secondary Woodland	Regional	None (Positive enhancement)	-	Low positive gain
Hedgerows	Regional	Loss	Medium to High	Low to Medium
Fauna				
Badgers	Protected	Loss of foraging, Disturbance	Low to Medium	Low
Bats	Protected/Local	Loss of foraging	Negligible	Negligible
Amphibians (including Great Crested Newts)	Protected	Limited loss of foraging	Negligible	Negligible
Birds (including Barn Owls)	Local	Limited loss (Positive enhancement)	Negligible	Low positive gain
Reptiles	Protected/Local	Limited loss	Negligible	Negligible
Invertebrates	Local	Limited loss	Negligible	Negligible
Wildlife Site	Regional	Pollution risk, Disturbance	Negligible	Negligible

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1 Ove Arup & Partners (May 1998), Phase 1 (Extended) Ecological Survey - Interim Report for Preliminary Assessment Workshop

2 Ove Arup & Partners (June 1998), Phase 1 (Extended) Ecological Survey of Lightmoor, Telford {Draft 1}

3 Ove Arup & Partners (June 1998), Phase 1 (Extended) Ecological Survey of Lightmoor - Survey Findings

4 Institute of Environmental Assessments (1995), Guidelines for Baseline Ecological Assessment

5 Joint Nature Conservation Committee (1993), Handbook for Phase 1 Habitat Survey: A Technique for Environmental Audit

6 Clements, D K & Tofts, R J (1992), Hedgerow Evaluation and Grading System

7 Ove Arup & Partners (October 1998), Phase 2 Ecological Survey: Findings of Bat, Barn Owls and Great Crested Newt Surveys

8 Ove Arup & Partners (October 2000), Results of Breeding Bird Assessment

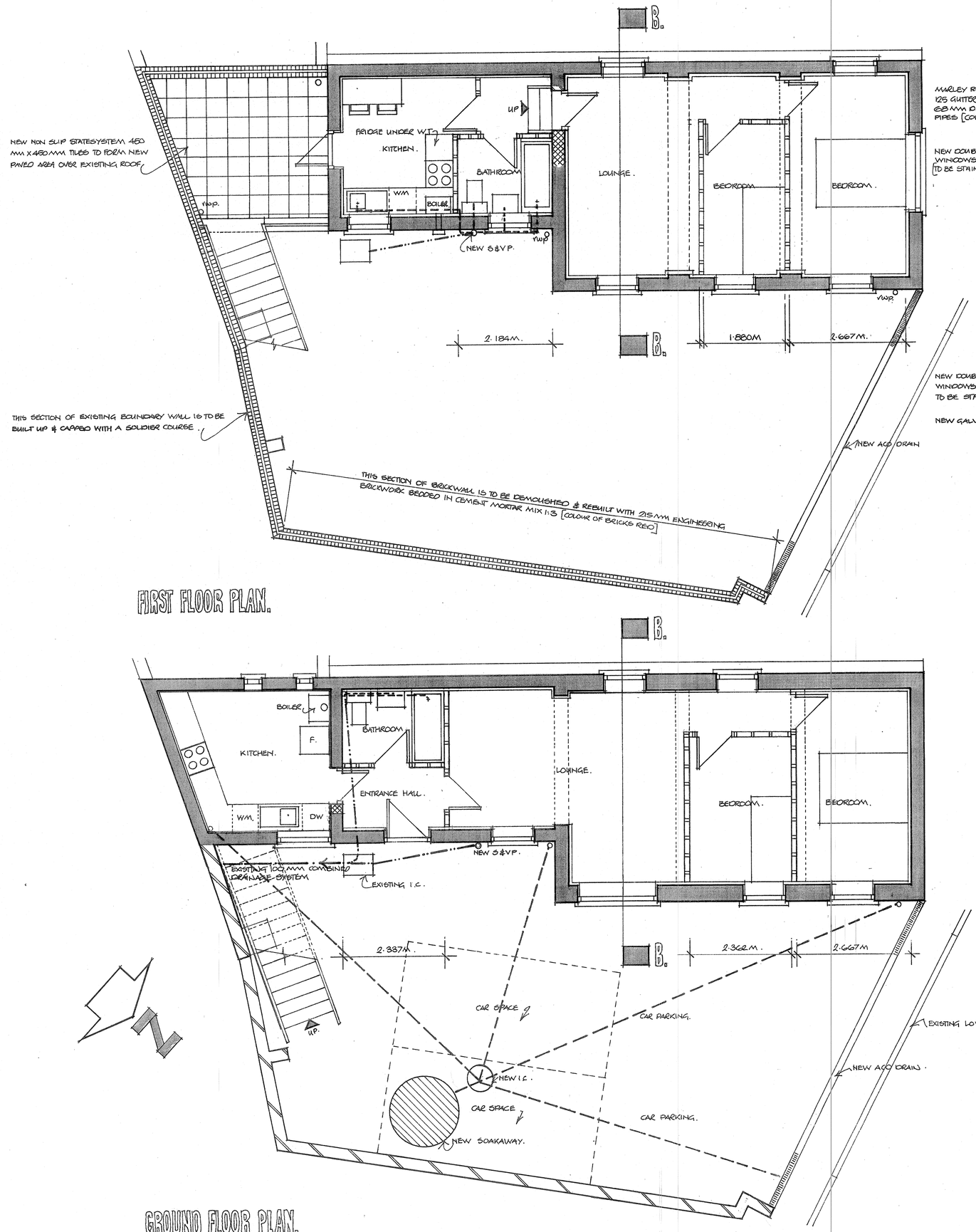
9 Ove Arup & Partners (January 1999), Badger Survey - Report of Baitmarking Survey

10 Ove Arup & Partners (July 1998), Phase 1 (Extended) Ecological Survey of Lightmoor, Telford {Executive Report}

11 Ove Arup & Partners (July 1998), Assessment of Ecological Survey Findings on Outline Development Plan

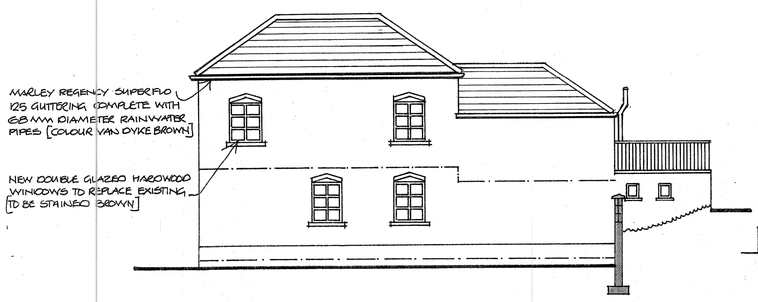
12 Ove Arup & Partners (January 2000), Scoping Report for Lightmoor Sustainable Wildlife Strategy - Ecology Mitigation Measures & Opportunities

13 Ove Arup & Partners (March 2002), Ecological Review and Update of the 1998 Phase 1 Habitat Survey

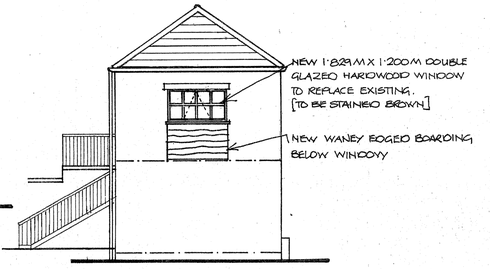


FIRST FLOOR PLAN.

GROUND FLOOR PLAN.



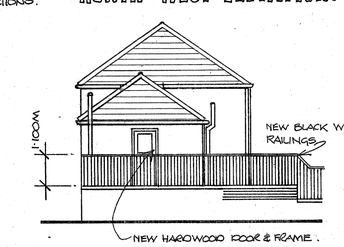
SOUTH WEST ELEVATION.



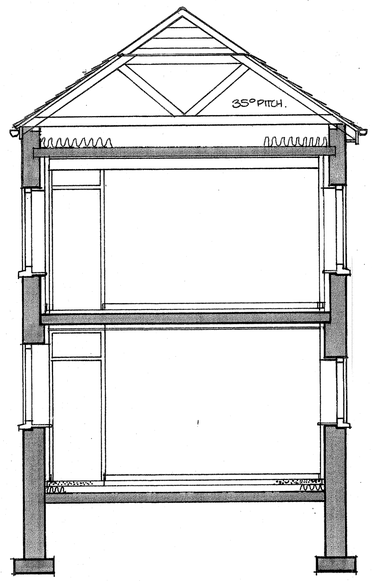
NORTH WEST ELEVATION.



NORTH EAST ELEVATION.



SOUTH EAST ELEVATION.



B-B.

NOTES:-

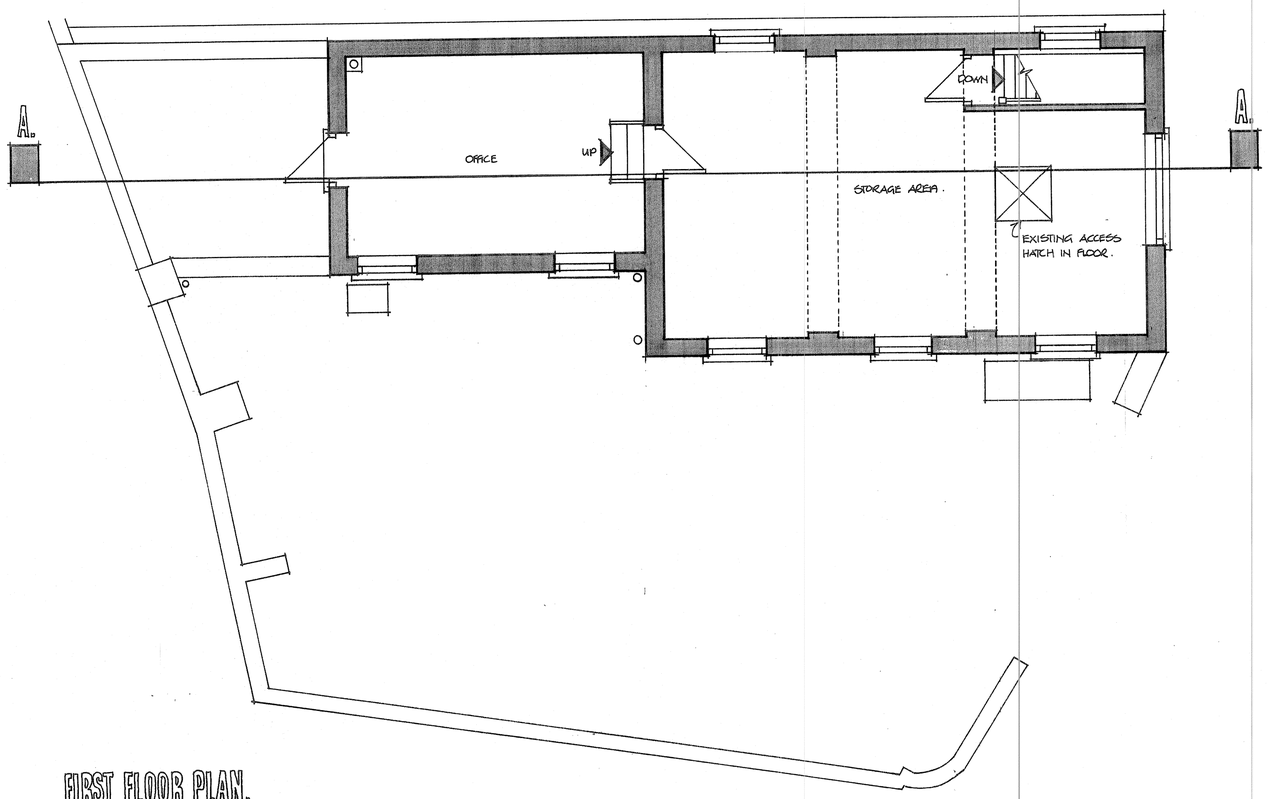
1] ALL NEW FOUL WATER DRAINAGE IS TO BE 110MM DIA PVCU PIPEWORK SURROUNDED WITH GRANULAR MATERIAL IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS.

2] ALL NEW STORMWATER DRAINAGE AS 1 ABOVE TO CONNECT TO A SOAKAWAY.

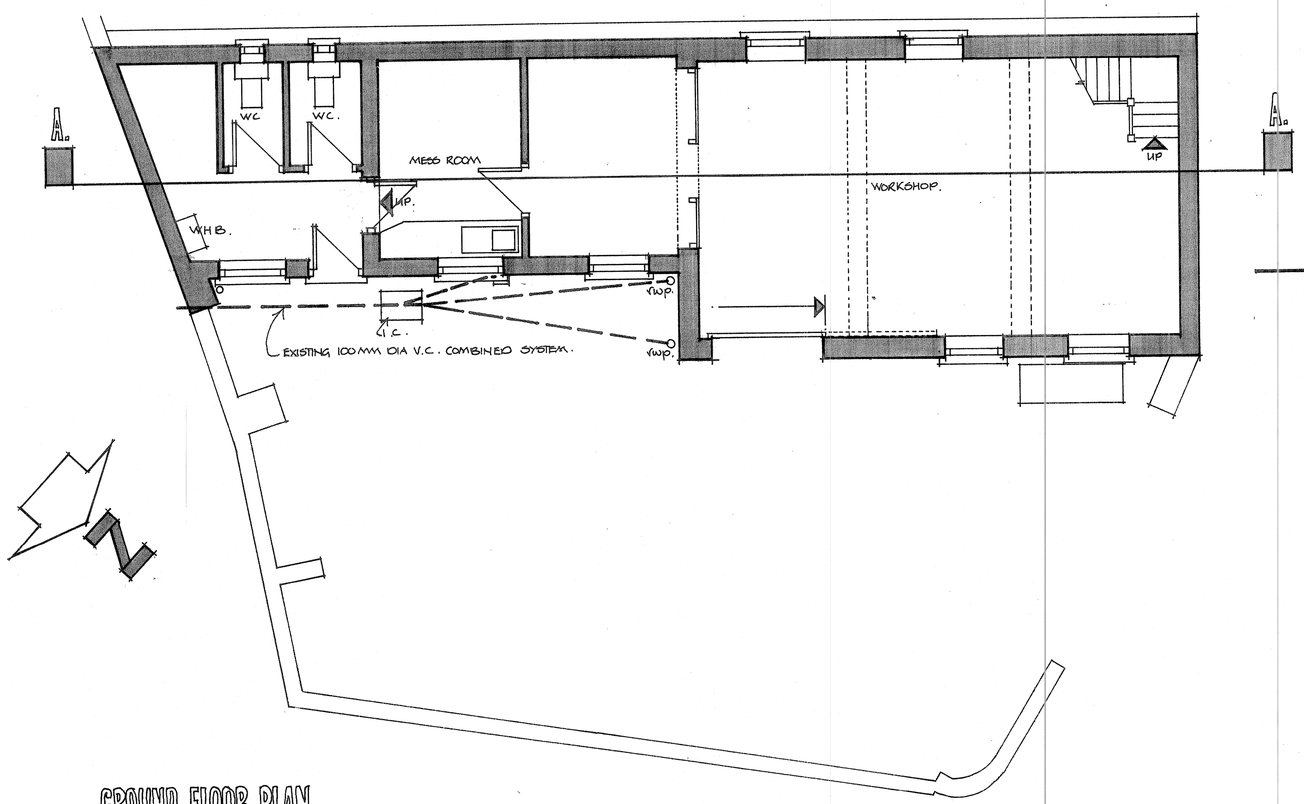
PROPOSED FLATS.
NEW ROAD,
WROCKWARDINEWOOD,
TELFORD,
TF2 6LA,

DRAWN EP
DATE OCTOBER 2008
SCALE 1:50 & 1:100

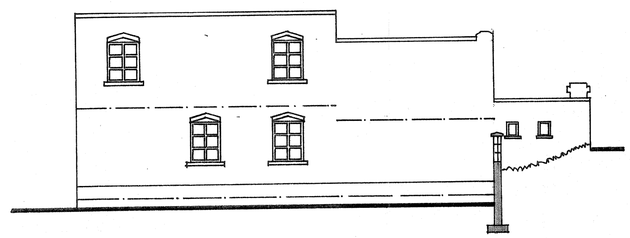
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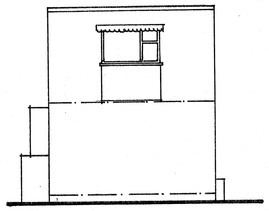
FIRST FLOOR PLAN.



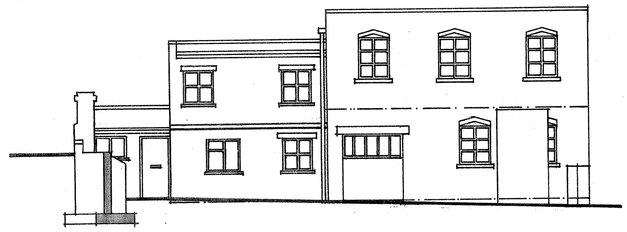
GROUND FLOOR PLAN.



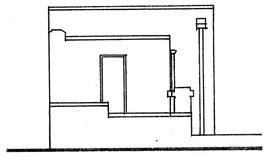
SOUTH WEST ELEVATION.



NORTH WEST ELEVATION.



NORTH EAST ELEVATION.



SOUTH EAST ELEVATION.

A-A.

EXISTING PLANS OF THE BEEHIVE WORKS.

NEW ROAD,
WROCKWARDINE WOOD,
TELFORD,
TF2 6LA,

DRAWN BY
DATE OCTOBER 2008.
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7.0 GEOLOGY

7.1 INTRODUCTION AND POTENTIAL IMPACTS

At all sites, the underlying geology is a fundamental factor in determining the environmental characteristics of the area. The type and structure of the geology is a prime influence upon landform and soil type. Whilst interactions and the relationship between soils and geology are apparent, the two issues will be dealt with separately due to the specific issues applicable to each topic. The soils are discussed in Section 8.0. The influence of geology has been all the more important in the history of the Lightmoor site in that the area was mined from the Industrial Revolution through to the early 1980s.

Potential geological impacts can be wide ranging, and certain types of development can trigger ground instability (subsidence or landslides), or interference with the existing groundwater or hydrological regime (the issue of hydrogeology is further examined in Section 9.0). A development may also trigger effects beyond the superficial boundaries of the site.

Geological features can be protected by virtue of designation as Sites of Special Scientific Interest (SSSI) or Regionally Important Geological Sites (RIGS) and therefore direct or physical works can impact upon the features themselves. No such designations are present on this Application Site.

Specific to the Application Site, potential geological impacts and considerations include:

- the impact of the historical mining activities such as subsidence and instability;
- the impact of the faulting within the area; and
- the impact from the underlying coal deposits.

Potential hydrogeological impacts due to historical mining activities are discussed in Chapter 9.0.

7.2 BASELINE SURVEYS

7.2.1 Relevant Studies and Investigations

The Lightmoor area and its surroundings have been subject to significant investigations and appraisals over recent years. With respect to this Environmental Statement, the following four phases of work are seen as critical to the understanding of the Application Site's ground conditions and underlying geology.

- WS Atkins, June to December 1997

  On behalf of the Commission for New Towns (now English Partnerships), WS Atkins undertook a series of investigations and assessments of ten

designated sites (referred to as ERMIS sites) within the Lightmoor area. These works considered the ground conditions and contaminative status of the individual sites, as well as providing risk assessments and judgements on adjacent landfill sites and the influence of geological faults and former opencast mining. The relevant report references, including the factual data which was obtained by Exploration Associates, are provided at the end of this chapter (references 1 to 16).

The WS Atkins work involved the drilling of 17 boreholes, as well as the excavation of 10 trial pits and associated soil, water and gas sampling and monitoring. All of these sampling locations fall within the Application Site boundary. This work was used to inform the subsequent phases of work undertaken by Campbell Reith Hill, as detailed below, and where necessary relevant conclusions and/or recommendations presented by WS Atkins are referenced in the subsequent discussion contained in this chapter.

- Campbell Reith Hill, 1997 to 1998

On behalf of Bournville Village Trust, and as part of the team led by Tibbalds Monro (now Tibbalds TM2), Campbell Reith Hill undertook detailed desk study appraisals of the Lightmoor area in order to obtain base information on the history, ground conditions, infrastructure provision and other constraints relevant to the proposed urban village development. This work was an on-going process to inform the development of the masterplan, therefore was not formally reported, although the initial results of the appraisal were presented in Campbell Reith Hill's Initial Report on Site Constraints in 1997 (reference 17). This work involved extensive data review and consultations with relevant organisations, as detailed below:

Organisation	Relevant Information
Commission for New Towns (now English Partnerships)	General information relating to CNT's involvement and knowledge of the site.
WS Atkins	Site investigations and appraisals, Ordnance Survey plans, aerial photographs, infrastructure details, historical mining records, Coal Authority reports.
The British Museum	Ordnance Survey plans.
Ironbridge Gorge Archaeological Trust	Archaeological reports for the Lightmoor area, information regarding the Shutfield Brick & Tile Works, various reference sources.
Wrekin District Council (now to Telford & Wrekin Council)	Site investigation reports, local site knowledge, landfill information.
Environment Agency	Landfill information.
Shropshire County Council	Site investigation reports.
British Geological Survey	Geological maps and memoirs and historical mining maps and records.

The accumulated findings of this desk study phase of work were subsequently used to inform the first phase of investigation work in June to July 1998. Part of this process involved the commissioning of a desk study by C L Associates (reference 18), which is contained in Appendix D.

- Campbell Reith Hill, June to July 1998

The first phase of site investigation work, which was undertaken by Exploration Associates on behalf of Campbell Reith Hill, was focussed on providing additional data with respect to the following:

- influence of historical mining activities and remaining coal seams;
- influence of faulting in the area;
- ground conditions;
- contaminative status of soils and groundwaters; and
- potential impact from adjacent landfill sites.

The investigation comprised the drilling of 11 boreholes (of which nine were fitted with groundwater and gas monitoring installations), 25 trial pits and 8 trial trenches, as well as associated geotechnical and contamination testing and monitoring. The factual data relating to this work is contained in Exploration Associates' reports dated 1998 (reference 19), which is contained in Appendix D.

Based upon the findings of this investigation, a series of cross-sections of the inferred geology (see Appendix D) and a report by Campbell Reith Hill entitled 'Preliminary Assessment of the Potential Risk from Ground Gases' (now superseded - see below) were produced. The results were also used to further inform the masterplan development. This information resulted in changes in the masterplan as a result of concerns about ground conditions.

- Campbell Reith Hill, November 1999 to October 2000

In order to provide further confidence in the development of the masterplan, and to further characterise and understand some of the issues arising from the earlier work phases, a second more comprehensive investigation was undertaken. The investigation was specifically designed to address the following issues:

- characterisation of the near surface soil properties (to inform the drainage solutions);
- appraisal of the underlying coal seams and former mining activities;
- hydrogeological monitoring;
- general geotechnical characterisations;
- hazardous gas issues (principally methane and carbon dioxide); and
- general contamination testing.

The investigation was again undertaken by Exploration Associates, and comprised the drilling of 32 boreholes (25 of which were fitted with gas

and groundwater monitoring installations), 40 trial pits and associated contamination and geotechnical testing and monitoring. The factual information is contained in Exploration Associates 2000 report (reference 20) and the subsequent interpretations are provided in Campbell Reith Hill's March 2000 reports for Soil Contamination and Geotechnical (references 21 and 22) and June 2000 Hazardous Gas Status Report (reference 23). All these reports are also contained in Appendix D.

7.2.2 Summary of Investigation Works

The above investigation works and survey works have enabled a comprehensive baseline appraisal of the Application Site, and Drawing 6479/ES-7-01 summarises all the investigation points across the Application Site. The findings with respect to the underlying geology and mining influences are summarised below, however the other issues covered by the baseline work are discussed in the following chapters:

- Soils and Contamination - Chapter 8.0 entitled 'Ground Conditions and Contamination'.
- Hydrogeology - Chapter 9.0 entitled 'Hydrology, Drainage and Hydrogeology'.

7.2.3 Regional Geology

British Geological Survey (BGS) maps for the area (reference 24) indicate that the area is underlain by superficial drift deposits of Boulder Clay, shown to be present discontinuously across the Application Site. The Boulder Clay is described as a stiff over consolidated red, brown and green mottled sandy clay with a variable content of sand and rock fragments. The drift deposits are underlain by Upper, Middle and Lower Coal Measures which in turn are underlain by Lydebrook Sandstone. These dip at a shallow angle (about 4°) to the south-east. The Solid geology is complicated by a series of northeast-southwest trending faults such that in an easterly direction younger rocks occur nearer the surface, as the faults generally down throw in this direction. The main faults are the Stocking Farm Fault, the Lightmoor Fault and to the west the Stoneyhill Fault. As well as the main faults, a number of other faults are present which include the Doseley Fault and other unnamed faults which traverse the area with a north-west to south-east alignment. The inclination of the faults ranges from 45° to vertical. Drawing 6479/ES-7-02 details the faulting in the general Lightmoor area.

To the east of the Lightmoor Fault, the Upper Coal Measures outcrop. The upper part of the sequence encountered is that of the Coalport Formation, consisting of sandstones and siltstones with some mudstones and the Main Sulphur Coal at its base. Below the Main Sulphur Coal and associated seat earths is the Hadley Formation with reddish mudstones and siltstones at the base of which is the Symon Unconformity marking the base of the Upper Coal Measures.

Despite being at a higher elevation than the rest of the Lightmoor area, the north western area is underlain by the older Lower Coal Measures due to the effect of faulting. These comprise mudstones and sandstones interbedded with coal

seams including the Best, Randle, Clod and Lancashire Ladies, in downward succession.

In the central area, between the Stocking Farm Fault and the Lightmoor Fault, various shallow coals occur within the Lower Coal Measures strata. These coals include the Clod and Little Flint with some thin undifferentiated coals at the base of the overlying Middle Coal Measures. Potentially present at the base of this series is the Crawstone Coal and Crawstone Ironstone. The predominant lithology of the rock is sandstone and mudstones. The Lower Coal Measures are underlain by Lydebrook Sandstone.

The area between Johnston's Pipes and the north and east of Woodlands Farm is underlain directly by the oldest strata in the Lightmoor area, namely the Lydebrook Sandstone. The Lydebrook Sandstone also outcrops beneath the central portion of the Application Site from the Stocking Farm Fault westwards for approximately 150m.

In the north west of the Lightmoor area, to the north west of the Stoneyhill Fault, the Little Wenlock Basalt lies between the Lydebrook Sandstone and the overlying Coal Measures. In the extreme north west of this area the basalt is overlain by the Coal Measures, while in the south eastern portion the basalt outcrops at the surface. The Wenlock Basalt is not present beneath the Application Site to the east of the Stoneyhill Fault.

In summary, approximately three quarters of the area is underlain by strata, mainly sandstones, that pre-date the lowest recorded coal seams. Coal is shown to be present or to have been present only in the extreme north west of the Application Site near Wellington Road, around the eastern edge of Stoneyhill Landfill site, extending almost 100m into the Application Site and to the south east of Stocking Farm. Drawing 6479/ES-7-02 summarises the near surface geology and faulting for the area, and Table 7.1 summarises the anticipated geology.

Table 7.1: The geological sequence underlying the Lightmoor area

Geology	Thickness	Description	Outcrop
Upper Coal Measures:			Outcrop east of Lightmoor Fault
Coalport Formation	20 - 30m (approx.)	Grey and red mudstones, siltstones and coarse, green to brown-grey, subordinate sandstones. The Main Sulphur Coal at the base of the Coalport Formation has been worked in the Lightmoor area.	
Hadley Formation	c. 20m	Reddish and purple mudstones with coarse lenticular sandstones ("espleys"). Clay worked in the south east for brick and tile making.	
Middle Coal Measures	25 - 30m	Predominantly grey mudstones with subordinate sandstones and ironstones. Many workable coals and ironstones - Top Coal, Yard, Big Flint Coals and Pennystone Ironstone worked in the area.	-
Lower Coal Measures	up to 70m	Massive, cream, well cemented sandstones (Farewell Rock) dominate in the basal section, with mudstones, siltstones, fireclays, and coals with subordinate sandstones in the upper section (c.15m). New Mine, Clunch, Two Foot, Best, Randle, Clod and Little Flint Coals and Crawstone Ironstone worked in the area.	Outcrop west of Lightmoor Fault over most of Lightmoor area except where Lydebrook Sandstone outcrops (see below)
Little Wenlock Basalt	up to 60m	Amygdaloidal olivine basalt. Columnar and horizontal jointing visible at Doseley Quarry.	Outcrops north west of Stoneyhill Fault
Lydebrook Sandstone	about 30m	Yellow to orange brown sandstone, partly pebbly or conglomeritic with occasional shale bands.	Outcrops in north east of Lightmoor area between Stocking Farm and Stoneyhill Faults and in centre of the Application Site immediately west of the Stocking Farm Fault
Wenlock Shales	>200m	Grey to bluish-grey silty and shaley mudstone.	-

No designated geological features (such as RIGS or SSSIs) exist within the Application Site or its immediate vicinity.

7.2.4 Historical Mining Activities

General

The area has had a long history of the extraction of coal, ironstone, clay for brick and tile making, and basalt for aggregate. A summary of the mining activity relating to the original ERMIS sites (see Drawing 6479/ES-7-03 which also overlays the current application boundary) was prepared by C L Associates (reference 18) and is summarised in Table 7.2.

Table 7.2: Summary of Coal Mining (from C L Associates, 1998)

ERMIS Site	Position	Notes
52200B	In north of built area and Application Site	Nearest mine shaft 230m to south-west. Nearest below ground workings 200m to the south-west (pre 1945) and 200m south-west opencast 1990-1991.
52160C	Centre of built area	Nearest shaft 140m to south-west. Mine workings 100m to south-west (pre 1945) and to west, opencast 1990-1991.
52150D	Centre of Application Site to the south of the built area	Nearest shaft 140m to north-west. Nearest mine workings 100m to south-east (pre 1945) and 200m west opencast 1990-1991.
52180	In the east of the Application Site and built area	Mine shafts within 210m south-east. A search in 1985 failed to find location of shafts. Position appeared to fall on high- wall of opencast - so presumed dug out during works. Site within likely zone of influence from workings
51290F	In south east of Application Site and outside of built area	Mining at shallow depth less than 100m pre 1906 in four seams (coal). Iron workings in two seams 70-100m depth, pre 1862. 4 mine shafts on site. Assumption made that they were dug out during opencast operations.
52170G	In south of Application Site to south of built area	Within the likely influence on surface from two seams of coal at depths of 50 to 80m, pre 1873. Ironstone workings in one seam 50m before 1875. 1 mine shaft within 20m within opencast site boundary treated under AMSC in 1992.
52210H	In south of Application Site to south of built area	Unrecorded working in coal or ironstone at very shallow depth, probably less than 10m.
52210I	In north west of Application Site and built area	Underground workings may be present. No knowledge of shafts.
60550K	In east of built area and Application Site	Shafts could be present. No coal mining report available.

The coal mining has been historically by drift, adit and traditional pillar and stall (where pillars are left as support for the mine roof) working together with more recent opencast operations for the extraction of the relatively shallow coals. In overall terms, most of the Lightmoor area has been mined for coal, with the majority of activities taking place to the east of the Stocking Farm Fault, where the final extraction has been by opencast methods. To the west of the Stocking Farm Fault, no old shafts are recorded. To the east of the Lightmoor Fault, historical workings from intensive mining of the Upper, Middle and Lower Coal Measures are present. Drawing 6479/ES-7-04 identifies the inferred extent of underground workings

Coal Seams

The coal seams which are known to have been mined in the area from the Upper, Middle and Lower Coal Measures are summarised below:

Upper Coal Measures	-	Main Sulphur Coal
Middle Coal Measures	-	Upper Coal
		Big Flint
Lower Coal Measures	-	New Mine
		Clunch/Vigar
		Two Foot (Top)
		Best and Randle
		Clod
		Little Flint
		Crawstone
		Lancashire Ladies

All of these seams are likely to be present and all have been mined to a greater or lesser degree. Between the Lightmoor Fault and the Stocking Farm Fault, the upper part of the sequence is missing as this area is uplifted by faulting, and all the coals are within the Lower Coal Measures with the Clod being the top coal. Associated fireclays have also been mined.

Ironstone

Extraction of ironstone has occurred from the Pennystone Ironstone at the base of the Middle Coal Measures, and possibly from a seam between the Clunch and Two Foot Coal which occurs towards the top of the Lower Coal Measures. The Crawstone Ironstone, which occurs at the base of the Lower Coal Measures, has been worked to the east of the Lightmoor Fault.

Mudstone and Basalt

To the south east of the Application Site, records indicate extensive workings of the red and yellow mudstones of the Hadley Formation. To the north-west (e.g. Horsehay), the Little Wenlock Basalt has been quarried, although not within the Application Site.

Opencast Workings

The coal within the zone between the Stocking Farm Fault and the Lightmoor Fault to the south east of the Application Site is known to have been previously mined by pillar and stall, but most was removed by opencast mining during the Second World War. The zones quarried are indicated in Drawing 6479/ES-7-04. The deepest seam worked appears to have been the Little Flint, leaving two thin coals at about 14m and 17m depth (125m and 122m AOD). These appear to be poor quality coal and, as they are thin (0.3 and 0.2m), are unlikely to have been worked. The floor level of the opencast workings was at about 134m AOD to the west and approximately 130m AOD in the east. The plan outline of the opencast works and the juxtaposition of buildings which are extant suggests that the quarry faces were quite steep, possibly near vertical within the Coal Measures strata.

Evidence of the buried high wall profile was obtained by electromagnetic profiling and 2D resistivity geophysical imaging methods which were commissioned by WS Atkins (reference 15). The results are in general agreement with the mapped mine closure records, suggesting near vertical walls to the east (down dip, parallel to the strike and adjacent to the Lightmoor Fault) and battered slopes on the other faces. The dip of the Lightmoor Fault on the eastern quarry face puts it at a slight overhang angle. The exact location of the highwall is however slightly uncertain.

Opencast working has been carried out at Stoneyhill, and Croppings Farm in the west of the Application Site. This was undertaken to extract residual coals and backfilling using arisings also included the emplacement of a low permeability seal to mitigate possible methane gas migration. The suspected extent of the application for these works is also shown in Drawing 6479/ES-7-04.

7.2.5 Site-Specific Geology

The various site investigations have revealed the Application Site to be underlain predominantly by sandstones with inferior bands of mudstone and siltstone. Near the surface the rocks exhibit considerable weathering and are highly fractured, often being observed as sands or clays containing a few lithorelicts. The degree of weathering tends to reduce slowly with depth with rockhead being encountered at depths between 0.3m and 5.0m. At some locations it was not possible to identify whether near surface deposits were of glacial origin or comprised completely weathered rock.

Made ground was encountered at a number of locations but predominantly around Stoneyhill Landfill site and Stocking Farm. The made ground around Stoneyhill comprises opencast spoil which was placed outside the opencast boundary to permit the working of the coal. When the pit was backfilled, some of the made ground was left behind. This is most notable around a valley feature to the north east of Croppings Farm which has been partially backfilled. A trial pit in this area revealed the presence of made ground to a depth of approximately

3.50m. Thinner coverings of fill material were observed in a number of other holes around Stoneyhill as far north as Woodlands Lane.

Around Stocking Farm, made ground was revealed to depths between 1.00 and 5.00m. The thickest fill material was present within the known former opencast sites of Holywell Lane and Stocking Farm (the Second World War Opencast mines) and to a lesser extent within the backfilled canal.

A number of exploratory holes encountered coal at shallow depth although there was little or no evidence of underground workings beneath the majority of the Application Site, except in the south east in the vicinity of the former Second World War Two opencast mines. Coal had been suspected in the very north west of the area near Wellington Road and it was encountered in two exploratory holes at depths between 1.60 and 2.40m below ground level. The coal is believed to represent the Little Flint Coal seam which is the lowest of the worked seams of the Lower Coal Measures.

Traces of coal were revealed in a number of holes around Stoneyhill from the Campbell Reith Hill investigations, although it is noted that boreholes sunk by Onyx Land Technologies in order to determine the feasibility of re-opening Stoneyhill (reference 25), did not identify any coal seams within or close to the Application Site. In this area the coal was generally present as fragments within a clay matrix and might be a results of shallow domestic workings as at Stocking Farm, or fill material from Stoneyhill.

Coal was revealed in a number of exploratory holes close to Stocking Farm, at depths between 1.20m and 2.50m near Woodlands Lane and at 2.10m to 2.20m a little to the south west of the farm buildings. A second very thin seam (60mm) was revealed in the trial pit to the south west of the farm. The north eastern boundary of Stocking Farm opencast site is formed by a fault with the downthrow to the south. It is known that the coal was worked to a depth of 9.00m within the Stocking Farm pit and the depth to any coal to the north of the fault around Stocking Farm will therefore be shallower. It is considered likely that the coal at shallow depth in this area comprises the Little Flint seam.

7.2.6 Hazardous Gases

Methane and Carbon Dioxide

The underlying Coal Measures have the potential to generate potentially significant concentrations of hazardous gases due to both anaerobic and aerobic processes and reactions. The investigation works undertaken across the Application Site have appraised this issue, and it is discussed in section 8.0, where the potential impact due to the existing landfills and made ground areas, as well as the underlying geology, is accounted for.

Radon Gas

Radon is a naturally occurring radioactive gas formed by the decay of uranium within rocks. Where there is a flow of gas, such as via natural fracturing or the

conduits provided by mining, radon can typically accumulate in combined spaces and seep into homes. The type of rock with the greatest risk of liberating radon, namely well-fractured granite, is not present in the general Lightmoor area. Radon has a short half-life, and may only present a threat when it is allowed to migrate to the surface.

BRE Report BR211 'Radon: Guidance on Protective Measures for New Dwellings' (reference 26) indicates that the Application Site is in an area that may have a high radon potential and consequently the report indicates that a geological assessment is required. The site investigations have proved that the Application Site is underlain by Alluvium, Glacial Till, Upper Coal Measures, Lower Coal Measures, Little Wenlock Basalt, Lydebrook Sandstone and Wenlock Shale. Consultations with the local authority indicate that the radon potential indicated in the BRE guidance may be due to radon incidence in limestone caverns in the area immediate to the Iron Bridge Gorge, to the south. No such formations were encountered in the ground investigation works at the site and nor are any anticipated to be present within effective depth in the vicinity of the Application Site.

Furthermore, reference to the National Radiological Protection Board (NRPB) publication 'Radon Atlas of England' (reference 27) indicates that the Application Site is in an area where less than 1% of homes are considered to be above the Radon Action Level (200Bq/m^3), although reference to their publication 'Radon in Dwellings in England: 1997 Review' (reference 28) indicates that for the postcode area TF, four out of the 211 properties monitored were above the Radon Action Level. Reference to the Sitescope web-site, which itself is also based on NRPB data, indicates that for the postcode area TF4 3QF applicable to the Application Site, radon represents a low risk.

Therefore, although a potential radon hazard has been identified at this Application Site, assessment of this hazard indicates that it represents a low risk. Furthermore, passive gas protection measures are required with respect to other ground gases such as methane and/or carbon dioxide and that the protection measures required for those gases are comparable to those required for radon gas, as given in BRE Report BR211. If further plot-specific appraisals identify a slight radon risk, the application of the gas protection measures would mitigate against any such risk.

7.3 ANALYSIS OF THE PREDICTED IMPACTS

7.3.1 General

By considering the nature of the proposed development and the baseline geological conditions encountered by the various phases of investigation, the following potential impacts upon and from the development have been identified:

- The impact from the historical mining activities;
- The impact of faulting within the area; and

- The impact from the underlying coal deposits.

No designated geological features (such as RIGS or SSSIs) exist within the Application Site or its immediate vicinity, therefore direct impacts from the development upon the underlying geology are considered unlikely.

The above identified potential impacts are discussed below in more detail. These impacts relate to the actual development proposals, and at the end of this impact section, the potential construction impacts on the geology are also appraised.

7.3.2 Historical Mining Activities

Subsidence / Instability - Underground Workings

A series of coal seams and ironstones have been mined beneath the Lightmoor area, and therefore the potential exists for subsidence due to void migration to the surface. This risk was identified in the 1998 Campbell Reith Hill / Exploration Associates investigation (reference 19), where Exploration Associates appraised the potential zones of migration based upon the seam thickness/rock cover criteria, the dip and strike of the seams in relation to the local topography, the evidence of actual voids and works and the productivity of the seam. A zoned map was prepared (see Figure 6 contained in Exploration Associates' report in Appendix D), which indicates zones of estimated high and moderate risk.

Based upon these findings, Campbell Reith Hill / Exploration Associates' 1999 to 2000 work further investigated this issue to enable potential zones of influence to be determined with more confidence. The findings from this work (references 20 and 22) concluded that the presence of coal workings beneath much of the Application Site can be discounted, and a refined plan of risk areas was prepared. Drawing 6479/ES-7-05 illustrates the zones within the Application Site where the possible presence of underground workings cannot be ruled out and drilling and grouting may be required (the areas of concern identified are referenced to arbitrary 'area' designations based upon Campbell Reith Hill's 2000 appraisals. These areas have no direct relationship to this current application). As the Drawing 6479/ES-7-05 shows, these zones are restricted to the west of the Application Site around Stocking Farm.

Subsidence / Instability - Opencast Workings

The principal area of concern within the Application Site relates to the former Second World War opencast mines to the south east near Stocking Farm (see Drawing 6479/ES-7-04). The 1997 WS Atkins work (reference 15) concluded that the infilled opencast sites would have a significant effect on the proposed development and that risks due to differential settlement by creep settlement and collapse compression existed. WS Atkins further concluded that the areas in the vicinity of the quarry highwalls were the most problematic due to the possibility of unacceptably high differential settlement of buildings straddling the high walls.

WS Atkins' findings and conclusions were further investigated in the Campbell Reith Hill / Exploration Associates' 1998 investigation (reference 19). This work concluded that whilst self-weight settlement is likely to be complete due to the age of the infilling, settlement caused by building loads could occur due to the potential for voids and the likely non-engineering standard of the fill materials. It also concluded that settlement would be unlikely to be uniform and that the highwalls pose a particular problem. These findings echo those of the 1997 WS Atkins appraisals.

Whilst opencast mining was undertaken in the 1980s in the vicinity of Stoneyhill, within the demise of the Application Site, the site investigation works have confirmed that the subsequent backfilling only involved the placement of limited depths of material, which comprised inert opencast arisings. These activities are not considered to represent an impact on the development proposals.

7.3.3 Faulting

The general Lightmoor area is heavily faulted, as Drawing 6479/ES-7-02 indicates. WS Atkins' appraisal of the faults in 1997 (reference 13) concluded that differential settlement of foundations presented a risk across fault zones in areas where shallow coal seams are anticipated or encountered due to the variation in geological strata due to the faulting and the potential weakening of the bedrock. However, this risk was qualified in that the low loading, limited plan areas and reasonable tolerance of foundations of the proposed residential properties would minimise any differential settlement across fault zones except in areas directly adjacent to the former opencast areas.

The faults were investigated by a series of trial trenches in the 1998 Campbell Reith Hill/Exploration Associates investigation (reference 19). This investigation concluded that under normal loading and assuming no major changes in groundwater (see chapter 9.0), fault movement would not be expected.

7.3.4 Presence of Coal Deposits

Combustion

The presence of coal seams in the region is considered to present a potential risk of subsurface combustion, albeit low level. This potential risk mainly applies to outcropping seams or seams revealed in excavations, typically within the surface two metres. Whilst this risk will exist regardless of the usage of the Application Site, the presence of domestic activities such as potential burning of garden wastes, bonfires or barbecues does slightly increase the potential of this risk.

Hazardous Gases - Carbon Dioxide and Methane

Methane gases associated with the coal measures strata are produced by the anaerobic decomposition of ancient vegetation trapped within the rock, whereas carbon dioxide typically results from the oxidation of methane, as well as iron-rich rocks.

The potential presence of hazardous gases therefore presents a risk and potential impact to the development. This issue is discussed in chapter 8.0.

Hazardous Gases - Radon

The baseline survey work has appraised the risk of radon gas generation in the general Telford and specific Application Site areas, and concluded that no significant risk exists. Consequently no impact is anticipated.

Acidic Conditions

Locally, markedly acidic conditions were encountered with pH's as low as 4.4 recorded. The low pH's generally corresponded to areas where coal had been encountered or where coal was present in made ground deposits. Such acidic conditions may impact on the specification requirements of concrete as part of the development.

7.3.5 Construction Impacts

Construction activities associated with development within the Application Site are not considered likely to impact upon the underlying geology.

7.4 MITIGATION

7.4.1 Historical Mining Activities

Subsidence / Instability - Underground Workings

To minimise the potential risk and impact from historical mine workings to the development, the following mitigation measures have been and will be implemented:

i. Development Planning - This measure has already been implemented. As part of the on-going masterplanning of the development over the last four years, the desk study and site investigation findings have been regularly inputted in order to identify potential constraints and hazards. The various appraisal works have confirmed the major historical underground workings to be located to the east of the Lightmoor Fault and to a lesser extent to the east of the Stocking Farm Fault. Consequently, as part of the masterplan decision, the designated area for construction of buildings, the built area, (as opposed to the Application Site) has been moved northwards. Such an action has reduced the number of properties being built above or within the vicinity of potential underground workings.

ii. Probing and Grouting - It is not possible to totally eliminate the potential impact of underground workings on the development due to the extensive and sometimes uncertain nature of such works. Consequently, some areas of potential risk exist, as Drawing 6479/ES-7-05 indicates. Prior to construction, probing will be carried out on a 6m by 6m grid beneath

housing blocks and over an area extending 7.5m beyond the footprints of buildings (including garages). Where this probing identifies that grouting is necessary, cement / filler grout will be placed via holes formed on a grid of 3m by 3m (or as determined by the probing), with a curtain formed around grouted areas from the tubes at 3m centres. The likely probing depths are detailed below in Table 7.3 (as referenced to the arbitrary 'area' designations previously described).

Table 7.3: Expected probing and grouting requirements

Area	Coal seam and thickness (m)	Likely probing depth (m)
1	Little Flint (0.80m)	5
5	Little Flint (0.80m)	10
6	Little Flint (0.80m)	8
7	Little Flint (0.80m)	10
10	Little Flint (0.80m)	10
12	Lancashire Ladies	5
13	Lancashire Ladies	5

These probing works will also inform the need for grout curtain 'cut offs' to minimise the risks of underground combustion (see Section 7.4.3).

Subsidence / Instability - Opencast Workings

To minimise the potential impact from the infilled opencast workings (the Second World War opencast mines), the following mitigation measures have been and will be implemented.

i. Development Planning - It was recommended following the 1998 investigation works (reference 19) that the knowledge of the quarried areas and location of the highwalls be used in the preliminary planning of the layout of the development to ensure clearance of these areas. This advice has been incorporated into the masterplan as best as possible, and the proposed building footprint (as opposed to the Application Site) has been positioned so as to ensure that the majority of new buildings are constructed above the quarry areas (the exception to this being the southern most part of the built area to the south of Stocking Farm, which slightly overlaps with one of the Second World War opencast mines. Drawing 6479/ES-7-04 demonstrates this position.

ii. Probing and Grouting - There remains a risk of underground workings associated with the opencast mines and highwalls. The potential risk has been discussed in the previous section (7.4.1) along with the mitigation measures to be implemented to minimise the potential impact.

iii. Plot - specific site investigation - In combination with the above measures, actual building plots will need to be investigated in detail in the vicinity of the opencast workings. This will enable further clarification of the

plot-specific ground conditions and will inform the need for any further remedial work if above and beyond the above described mitigation measures.

7.4.2 Faulting

The following mitigation measures will be implemented to minimise the potential impact from fault zones.

i. Development Planning - Construction in areas where faults separate bedrock overlain by superficial deposits from opencast backfill material will be avoided where possible. Foundations will be designed with a reasonable degree of robustness.

ii. Plot-specific site investigation - Engineering properties of the founding strata on both sides of each fault will be carefully assessed to ensure the appropriate parameters are chosen for use in foundation design, especially in those areas where there is no made ground or other superficial deposits overlying the solid strata.

iii. Plot-specific probing and grouting - Probing and grouting is to be carried out in the areas adjacent to the faults (such as areas C and E - see Drawing 6479/ES-7-05) where shallow coal seams are known to exist. If found and treated, or if proven absent, no specific requirements are anticipated with regard to the development of residential units over the line of the faults.

7.4.3 Presence of Coal Deposits

Combustion

The risk of the spread of underground fire will be mitigated by the construction of a grout curtain around areas of potential ignition, which will be determined by the probing works detailed in Section 7.4.1. The potential extent of this curtain is shown in Drawing 6479/ES-7-06, and recommended depths are shown in Table 7.4.

Table 7.4: Likely depths for grout curtain

Area	Depth (m)
1	3.5
5 (western edge)	3
7 (western edge)	3
10	3.5
13 (western edge)	3
13 (south west edge)	3.5

Hazardous Gases - Radon

Radon gas generation has not been identified as a potential issue at the Application Site, and consequently no impacts are predicted. Nonetheless, it is worth noting that the structural protection being implemented to address elevated levels of carbon dioxide and methane gases (see section 8.4.2) will also provide a prudent and conservative measure against radon gas.

Acidic Conditions

Where local conditions exhibit the presence of coal, or fill material, concrete complying with ACEC class AC-4z of BRE Special Digest 1 shall be used for underground concrete. Concrete complying with ACEC class AC-2z of the Digest is suitable elsewhere, subject to a site-specific investigation.

7.5 STATEMENT OF SIGNIFICANCE

The Application Site's underlying geology is complicated by a series of faults, but in summary comprises intermittent Boulder Clay deposits over Upper, Middle and Lower Coal Measures, which in turn are underlain by the Lydebrook Sandstone. The faulting has determined the outcrop Solid geology across the area. The geology has had an obvious effect on the character of the area, principally due to historical sub-surface and opencast mining. Whilst the development proposals will not impact upon the geology, the geology and mining influences will impact upon the development. Identified potential impacts include subsidence / instability due to the historical mining and the faulting and impacts from the underlying coal containing strata including combustion risk and acidic conditions. To minimise these impacts, a series of mitigation measures have been and will be implemented. These include the positioning of the proposed building footprints away from the areas most impacted by mining, probing and grouting works including 'cut off' curtains and plot specific investigation works to inform the need for such mitigation measures. Once implemented, the geology will not have a significant impact on the development. Table 7.5 summarises the impact appraisal of the underlying geology.

Table 7.5: Summary of Geological Impacts

Potential Impact	Type of Impact	Nature	Importance	Significance of impact without mitigation	Significance of impact with mitigation
Development proposals on geology	No impact predicted	-	-	-	-
Risk of subsidence/ instability due to underground workings	Adverse	Long term, Irreversible	Local	Medium to High	Low
Risk of subsidence / instability due to opencast workings	Adverse	Long term, Irreversible	Local	Medium to high	Low
Risk of subsidence / instability due to faulting	Adverse	Long term, irreversible	Local	Low to medium	Low
Risk of underground combustion of coal deposits	Adverse	Short to medium term, Irreversible	Local	Low to medium	Low
Risk of generation of Radon Gas	No impact predicted	-	-	-	-
Risk of acidic ground conditions	Adverse	Long term, Irreversible	Local	Low to medium	Low
Construction impacts on geology	No impact predicted	-	-	-	-

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4. W S Atkins Consultants Limited (July 1997), Disposal Report Lightmoor, Site 52180 (E). Report Ref. U2468/LA.341/E/NJO.

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12. W S Atkins Consultants Limited (August 1997), Preliminary Risk Assessment, Shutfield Landfill (TLF046). Report Ref. 198/AU2468/LA.346/B/DJ.

13. W S Atkins Consultants Limited (July 1997), Fault Influence Report Lightmoor Development Sites, Telford. Report Ref. 198/AU2468/LA.341B-K/DSL.

14. W S Atkins Consultants Limited (December 1997), Final Risk Assessment, Stoneyhill Waste Disposal Site (TLF012). Report Ref. 198/AU2468.LA.290/EEH/CRA0.

15. W S Atkins Consultants Limited (November 1997), Opencast Report, Lightmoor Development Sites, Telford. Report Ref. 275/AU2468/LA.341E-H/JCS.

16. W S Atkins Consultants Limited (December 1997), Final Risk Assessment Johnston Pipes Landfill (TLF014), Report Ref. 198/U2468.LA.289/EEH.CRA1.

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19. Exploration Associates (1998), Factual Report on Ground Investigation, dated August 1998 (Volume 1) and Interpretative Report on Ground Investigation, dated September 1998 (Volume 2), New Bournville Village, Telford, ref: 118172.

20. Exploration Associates (January 2000), Factual Report on Ground Investigation, dated January 2000, New Bournville Village, Telford, ref: 119359.

21. Campbell Reith Hill (March 2000), Soil Contamination Assessment, Lightmoor Urban Village, ref: 6479-1.

22. Campbell Reith Hill (March 2000), Geotechnical Review, Lightmoor Urban Village, ref: 6479-1.

23. Campbell Reith Hill (June 2000), Hazardous Gas Status Report, Lightmoor Urban Village, ref: 6479-1.

24. British Geological Survey Sheets 152 and 153, Solid and Drift Editions, 1:25,000.

25 Onyx boreholes logs provided by Telford & Wrekin Council

26 BRE Report BR211' Radon: Guidance on Protective Measures for New Dwellings', 1999.

27 National Radiological Protection Board (NRPB) publication 'Radon Atlas of England', 1996.

28 National Radiological Protection Board, Radon in Dwellings in England: 1997 Review.



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LEGEND

GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

HABITAT CLASSIFICATION:

- ANCIENT WOODLAND "THE DINGLE"
- SEMI-NATURAL BROADLEAVED WOODLAND
- IG — IMPROVED GRASSLAND
- SEMI-IMPROVED GRASSLAND
- UNIMPROVED GRASSLAND
- DENSE/CONTINUOUS SCRUB
- SCATTERED SCRUB
- MARSHY GRASSLAND
- STANDING WATER
- HEDGELINE
- (1) OWING TO RESTRICTED ACCESS IN 2001 SURVEY DUE TO FOOT & MOUTH, HABITAT VISUALLY ASSESSED FROM WOODLANDS LANE & BASED ON 1998 SURVEY
- (2) OWING TO RESTRICTED ACCESS IN 2001 SURVEY DUE TO FOOT & MOUTH, SPECIES RECORDED DURING 1998 COULD NOT BE ASSESSED IN DETAIL BUT ARE CONSIDERED TO REMAIN AS IMPROVED GRASSLAND AS IN 1998
- BOUNDARY OF WILDLIFE SITE (FROM SHROPSHIRE WILDLIFE TRUST RECORDS)

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6. BASED UPON OVE ARUP & PARTNERS 1998 & 2001 SURVEYS & DRAWING 55319 DATED 30-1-2002.

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Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

PHASE 1 HABITAT CLASSIFICATION

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- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

HEDGEROW SURVEY:

- GRADE 1 HEDGEROW
- GRADE 2 HEDGEROW
- GRADE 3 HEDGEROW
- GRADE 4 HEDGEROW
- H21 HEDGEROW REFERENCE NUMBER
- H21* RE-SURVEY OF HEDGEROW IN 2001 SURVEY WAS NOT POSSIBLE DUE TO FOOT & MOUTH RESTRICTIONS

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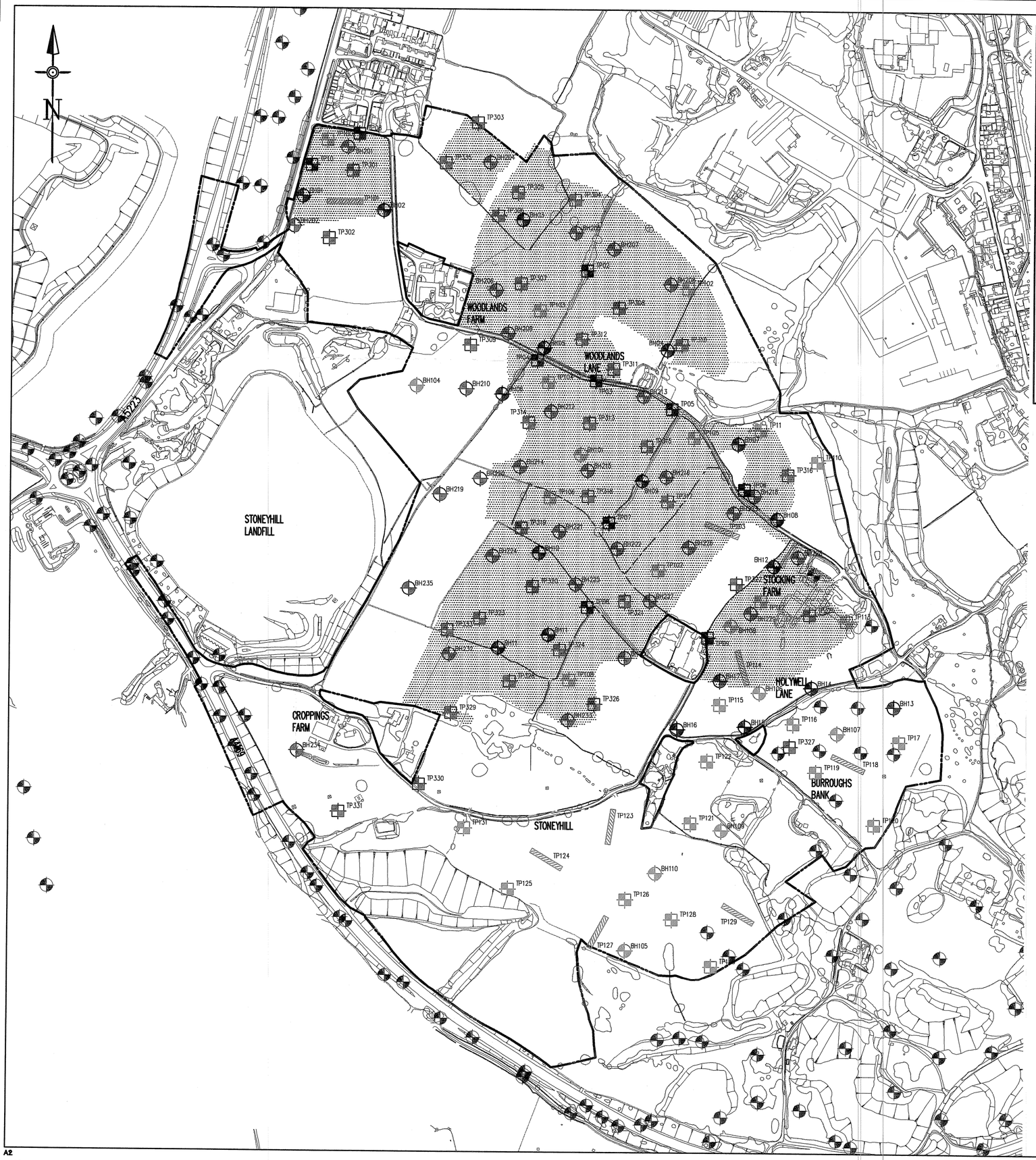
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HEDGEROW SURVEY RESULTS (Based on ARUP's 1998 & 2001 Surveys)

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GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

INVESTIGATION LOCATIONS:

- TP — TRIAL PIT (REF:301-340)
- BH — BOREHOLE (REF:201-235)

} CAMPBELL REITH HILL/EXPLORATION ASSOCIATES JUNE-JULY 1998

- TP101 — TRIAL PIT (REF:101-131)
- BH101 — BOREHOLE (REF:100A-110)

} CAMPBELL REITH HILL/EXPLORATION ASSOCIATES NOVEMBER-DECEMBER 1999

- TP — TRIAL TRENCH (REF: 301-340)
- TP101 — TRIAL PIT (REF:1-17)
- BH101 — BOREHOLE (REF:301-340)

} WS ATKINS/EXPLORATION ASSOCIATES JUNE-JULY 1997

- HISTORICAL BOREHOLES

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INVESTIGATION LOCATIONS

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- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

SURFACE GEOLOGY:

- GEOLOGICAL FAULT LINES APPROXIMATE POSITION OF FAULTS SHOWN ON BRITISH GEOLOGICAL SURVEY MAP. MARK INDICATES DOWNTHROWN SIDE
- INFERRED EXTENT OF CARBONIFEROUS COAL MEASURES
- INFERRED EXTENT OF OUTCROPPING LYDEBROOK SANDSTONE

N

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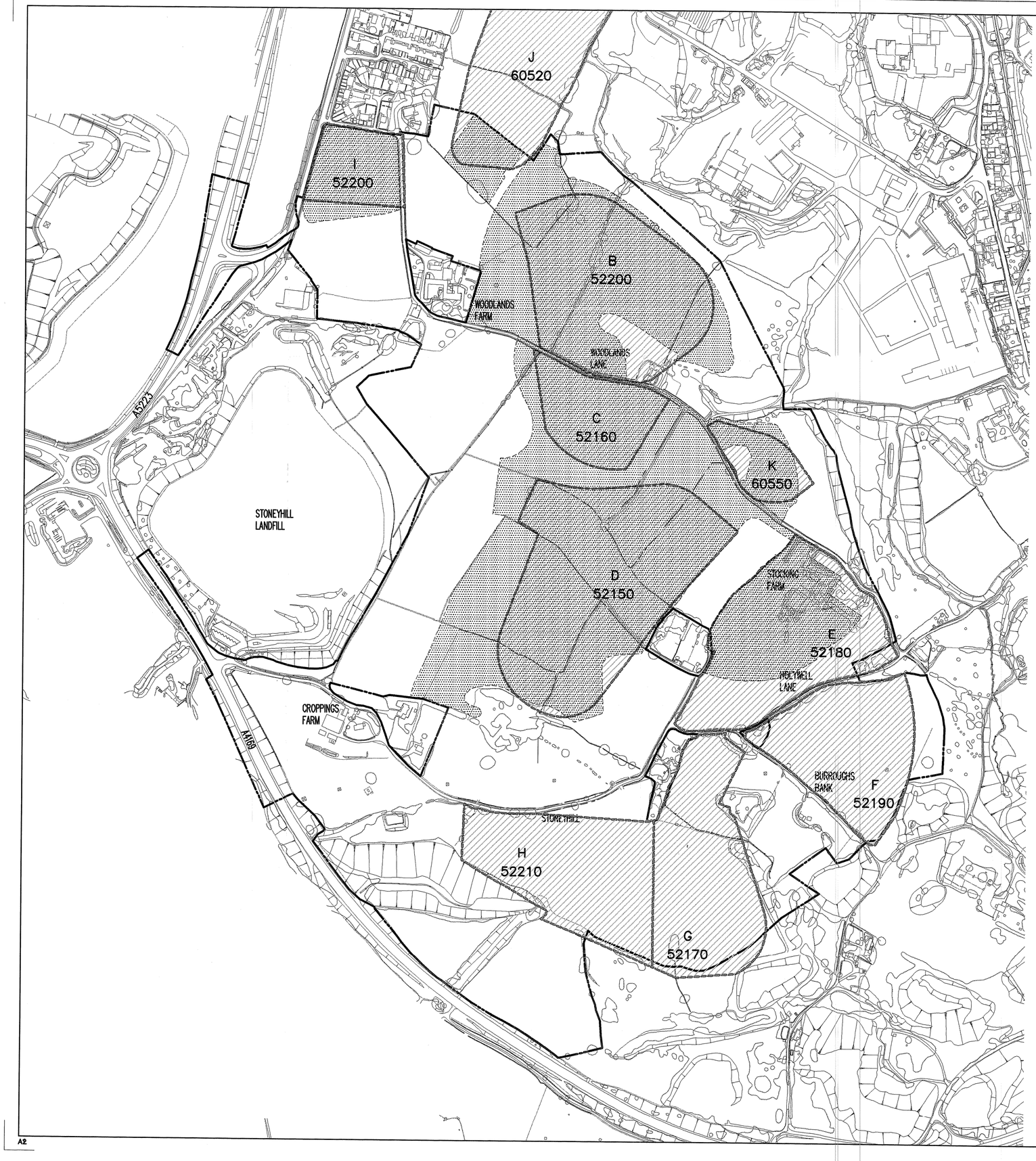
NEAR SURFACE GEOLOGY

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- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)
- ORIGINAL ERMIS SITES

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ORIGINAL ERMIS SITE DESIGNATIONS

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- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

HISTORICAL MINING ACTIVITIES:

- OPENCAST MINING AREAS (SHADING REPRESNTS EXTENT OF APPLICATION, NOT NECESSARY EXTENT OF MINING)
- MS MINE SHAFT
- W WELL
- ADIT
- UNDERGROUND WORKINGS — KNOWN OR SUSPECTED BELOW GROUND WORKINGS EXTENT UNKNOWN

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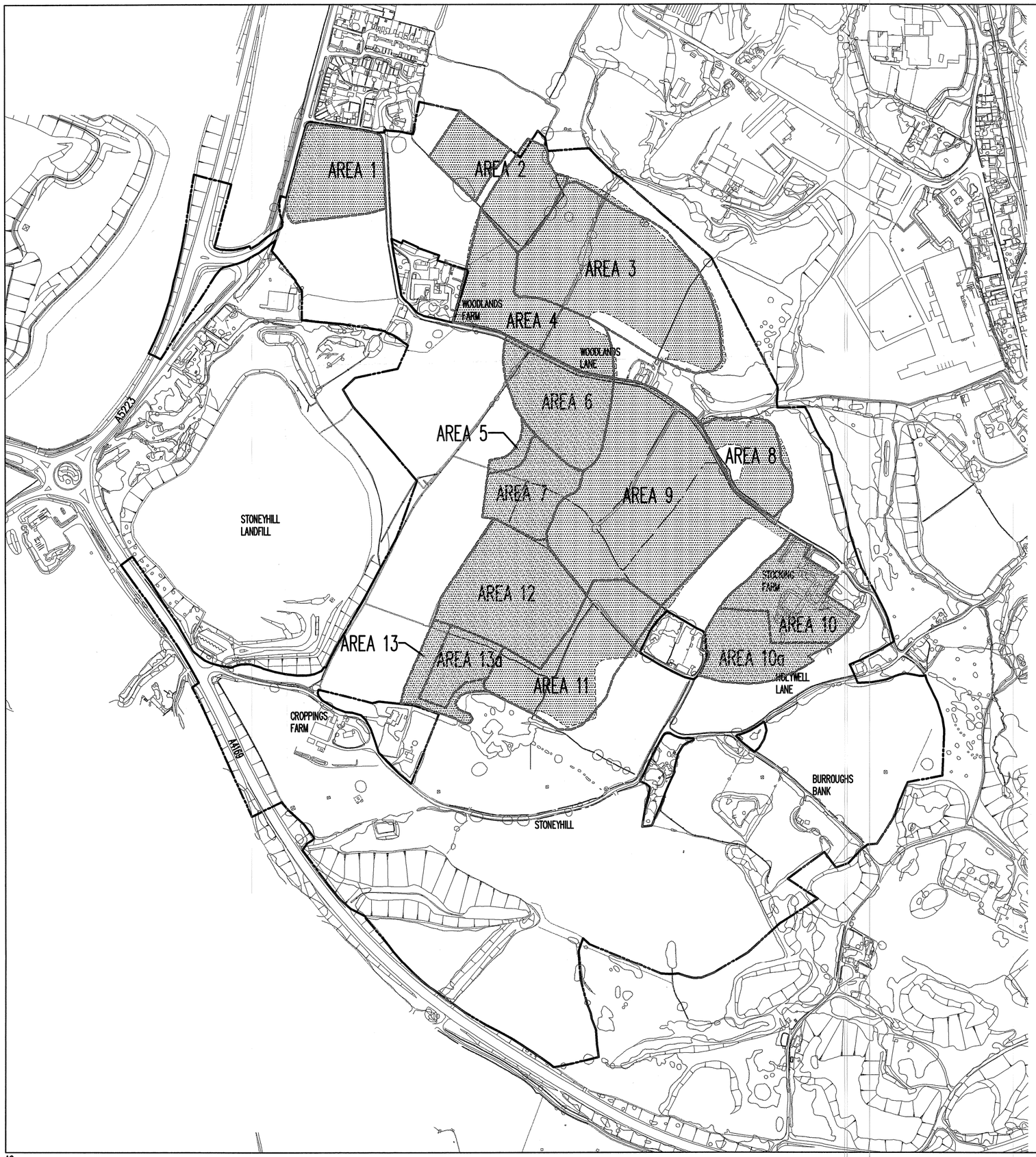
KNOWN EXTENT OF HISTORICAL MINING ACTIVITIES

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- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

DRILLING & GROUTING LOCATIONS:

- AREAS POTENTIALLY REQUIRING DRILLING & GROUTING

notes

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AREAS POTENTIALLY REQUIRING DRILLING & GROUTING

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GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)
- POTENTIAL CUT-OFF TRENCHES REQUIREMENTS

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Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

LOCATION OF POTENTIAL CUT-OFF TRENCH REQUIREMENTS

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8.0 SOILS AND CONTAMINATION

8.1 INTRODUCTION AND POTENTIAL IMPACTS

The Application Site and general Lightmoor area have had a history of former industrial usage, principally former mining activities associated with the winning of coal and ironstone. As a consequence of these activities, the ground conditions in many areas are characterised by the presence of made ground, spoil heaps and landfill areas. The nature and extent of these activities, along with a discussion of the potential physical impacts is presented in the Geology Section in Chapter 7.0.

Such activities have the potential to give rise to contamination, either in soils or waters, or as hazardous gases, which may pose risks to existing or proposed uses of the site. More specifically, hazards associated with potential contamination could include:

During Construction

- Disturbance and release of contamination either as dust, vapours or through waters thereby affecting neighbouring properties and the wider environment;
- Potential health and safety hazards to construction workers; and
- Construction techniques may introduce new potential migratory pathways eg. to the underlying groundwaters.

Affecting Development

- End users and occupiers may be introduced to residual contamination, particularly in garden and landscaped areas;
- Contamination may affect the integrity of the final development eg. aggressive ground conditions on building materials;
- Hazardous atmospheres may result eg. build up of hazardous gases in structures; and
- Contamination may affect the health of proposed vegetation and planting regimes.

On-going Liability

- Potential migration of any on site contamination affecting neighbouring land uses and properties;
- Contamination of the underlying groundwaters; and
- Contamination of the general environment such as the Wildlife Site.

Whilst the issues of ground conditions and contamination naturally overlap with the topic of geology (eg. hazardous gas generation), these aspects are purposefully being discussed separately in this Chapter in order to ensure a full and comprehensive appraisal. A discussion of the Geology has been presented in Chapter 7.0.

The following discussion has been considered based upon the nature of potential contamination specific to the Lightmoor site as follows:

Soil contamination	Potential sources include the former mining operations, made ground and landfill sites and other activities such as farming;
Water contamination	Potential to affect the surface waters and/or groundwaters through migration and movement of potential contamination such as leachate from the landfills. The issue of water contamination is more specifically discussed in Chapter 9.0; and
Hazardous gases	The potential exists for the generation and migration of gases (such as methane and carbon dioxide) from landfill and made ground sources, as well as natural generation from the underlying geological strata. A significant issue informing the masterplan design has been the presence of hazardous gases at the site, which may originate from a number of sources including the underlying coal-containing strata, local landfill sites and the made ground present across many of the former open cast mine areas. Consideration has already been given to the issue of radon gas in Chapter 7.0.

In addition to the issue of contamination, consideration also needs to be given to the potential loss of soils as a natural resource due to the development. This issue is also discussed in this Chapter in relation to the agricultural-status of the soils.

8.2 BASELINE SURVEYS

8.2.1 Introduction

Detailed desk study appraisals and subsequent site investigations of the Application Site have been undertaken in general accordance with current best practice guidance including the following:

- British Standards Institute, BS DD175:1988 (reference 1), This is now superseded by the following;
- British Standards Institute, BS 10175: 2001 (reference 2), Investigation of Potentially Contaminated sites: Code of Practice;
- Contaminated Land Research Report No. 3, 1994 (reference 3); and
- Policy Planning Guidance Note No. 23, 1994, (reference 4).

The results of the desk study work were used to inform the series of investigation works across the Application Site, which included appropriate contamination testing.

The background and basis of the site investigation reports and studies has been presented in the Geology Chapter, as well as the many information sources and consultees of relevance. Many of these are also relevant to this chapter as well.

8.2.2 History and Development

Based upon historical maps for the area (contained in CL Associates' Desk Study Report dated August 1998, reference 5, in Appendix D), the majority of the Application Site was used as agricultural land from the late 1800s to the present day. The Application Site is currently occupied by farmland, associated buildings and tracks.

The general area of the development has also had a long history of mineral extraction and has been mined for coal (by drift, traditional underground and opencast methods), ironstone, clay and basalt. The majority of this mining activity commenced in the latter part of the 1700s and continued in the early 1900s, mostly to the south and north west of the Application Site.

No other potentially contaminative uses appear to have been undertaken within the proposed Application Site. The agricultural usage has principally comprised low impact grazing activities.

Adjacent to the Application Site, a large industrial site occupied by Johnston Pipes for the manufacture of concrete pipes occupies the north eastern boundary of the site at Doseley and a concrete works is located is located to the south east at Lightmoor. Several landfill sites and areas of made ground also exist in the near vicinity of the Application Site (see Drawing 6479/ES-8-01).

8.2.3 Areas of Landfill and Made Ground

The former mining activities have resulted in the area being characterised by variable depths of made ground principally comprising mining spoils and waste arisings.

Opencast mining also occurred during the 1940s in the area of Stocking Farm to the west of the Lightmoor Fault to extract the coal measures, and a further area of opencast occurred in the early 1990s, as an extension to Stoneyhill landfill. Both of these have been backfilled with inert surrounding spoil. An extensive area of landfilling has also occurred to the north west of the Application Site. This landfill is known as Coalmoor. In addition to the mining activities, a large area of landfill exists where the infilling and levelling of a natural valley by Johnston Pipes has occurred.

The five principal areas of made ground within the vicinity of the Application Site are detailed in Drawing 6479/ES-8-01 and are summarised as follows:

- ***Stoneyhill*** *(located immediately west of the Application Site)*

  Stoneyhill landfill is located on the western boundary of the Application Site, and was originally an opencast mine between the 1930s and 1950s. It

remained derelict until 1984, when it was opened as a landfill for the disposal of domestic and commercial waste, general industrial waste and special waste. The landfill was closed in 1991, and has recently been used as a Household Waste Transfer and Recycling Centre (no actual tipping takes place at the site). The site has been capped by a layer of clay and a landfill gas collection system has been installed post-completion, which is vented with a flare. A post-completion leachate control system has also been installed. Concerns exist regarding the bulk properties of the material used to line the landfill cells prior to tipping. The eastern most part of the site was excavated as an opencast mine in the late 1980s/early 1990s and was backfilled with inert colliery spoil, demolition rubble and soils. Monitoring of this area by spike testing in 1991 by Shropshire Council identified up to 20% methane however by 1992, no methane and only low levels of carbon dioxide were recorded. A low permeability clay barrier was placed along the eastern boundary of Stoneyhill to isolate the landfill from the later opencast mining activities described above, however the effectiveness of this barrier is also questionable (reference 6).

- ***Second World War Opencast Mines*** *(located in the south east of the Application Site)*

  Three principal areas of backfill exist around Stocking Farm and Holywell Lane. Ground investigation information indicates that the sites, which were backfilled by 1945, were infilled with colliery spoil, probably originating from the original opencast workings. The made ground deposits have been encountered to depths of between 2m and 9m bgl. Unrecorded shallow mineworkings may occur beyond the confirmed highwalls within the opencast areas, in the area where coal seams are known to exist (reference 7).

- ***Johnston Pipes*** *(located to the north east of the Application Site)*

  The Johnston Pipes site, which is located to the north east of the Application Site, comprises two landfilled areas. One of these, a former quarry, was filled with general industrial waste between 1979 and 1986, although unrecorded wastes may also have been deposited. Prior to licensing in 1974, the site is believed to have operated as a domestic landfill site. The landfilling of the other site was more recently operated under a Waste Disposal Licence for landraising, which was revoked in 1992. Permitted wastes during the licensed period included concrete, plastics, containers and incinerator ash. No basal or perimeter lining was installed prior to the waste disposal activities (reference 8).

- ***Coalmoor Landfill*** *(located to the north west of the Application Site)*

  The Coalmoor landfill has been a licensed landfill site receiving a range of domestic and commercial wastes used to backfill and raise a former opencast area. The first date of input to the site was April 1991 and inputs prior to capping ceased in July 1997. The Environment Agency has estimated that the site received wastes including household (2%), inert

(8%), commercial (35%) and industrial (55%). The site is understood to have controlled leachate and gas control and collection systems.

- ***Shutfield Landfill*** *(located to the south east of the Application Site)*

  The history of the Shutfield Landfill has been assessed by WS Atkins in their report entitled 'Shutfield Landfill Preliminary Risk Assessment' dated August 1997 (reference 9). From the early 1800's to the mid 1900's, the site was occupied by the former Shutfield Tile and Brick Works. The works were quite extensive and comprised several drying sheds, kilns, water mills and an access tramway. Since the mid 1900's the site was occupied by an iron foundry, a steel fabrication yard and more latterly up to the mid 1980's by a metal reclamation scrap yard. The site was also used during the Second World War by the Ministry of Defence as a munitions dump and barracks. Since closure of the scrap yard, the site has remained derelict. The landfill therefore contains waste materials from a variety of industrial uses. WS Atkins report that 4 no. investigations have been undertaken at the site, and that made ground materials were found to mainly comprise clay with ash, clinker, brick, mudstone, tiles and concrete.

8.2.4 General Geological Setting

Published geological records show the Application Site's geology to be complicated by a series of north east to south west trending faults. The east of the study area, east of the Stocking Farm Fault, is underlain by the Lower Coal Measures, typically comprising mudstone, grey sandstone, seatearth and seams of coal and ironstone. West of the Stocking Farm Fault and to the east of the Stoneyhill Fault, the central part of the site is occupied by an upthrown horst block comprising shallow depths of dipping Lower Coal Measures to the east and outcropping Lydebrook Sandstone to the north and west. The Lydebrook Sandstone is the oldest strata at the site and unconformably underlies the Lower Coal Measures. North west of the Stoneyhill Fault, the Wenlock Basalt lies between the Lydebrook Sandstone and the outcropping Lower Coal Measures. Chapter 7.0 provides a more detailed appraisal of the geology.

Much of the Application Site is underlain by the Carboniferous Coal Measures, as demonstrated in Drawing 6479/ES-8-02. Methane gases associated with the Coal Measures strata can be produced by the anaerobic decomposition of ancient vegetation trapped within the rock, whereas carbon dioxide can result from the oxidation of methane, as well as from iron-rich rocks. Historical and recent mining activities, which are known to have occurred across the site, can further influence the generation and migration of mine gases.

9.2.5 Site Investigation Works

Based upon the desk study findings, the potential hazards due to soil, water and gas contamination were further investigated and appraised by a series of investigation works. These investigations have already been introduced in the Geology Chapter, but can be summarised as follows:

- W S Atkins, June to August 1997
  This involved the installation of 17 boreholes across the Application Site, of which boreholes 1 to 16 were fitted with installations, along with the excavation of 10 trial pits (references 10 to 19).

- Campbell Reith Hill, June to July 1998
  The installation of eleven boreholes (designated 101 to 110), of which nine were fitted with installations, along with the excavation of 25 trial pits and 8 trial trenches (reference 20).

- Campbell Reith Hill, November 1999 to October 2000
  The installation of 32 boreholes (designated 201 to 235) of which 25 were fitted with installations. Seven of the boreholes were fitted with double installations with deep and shallow response zones, along with the excavation of 40 trial pits (reference 21).

The reports relating the works commissioned by Campbell Reith Hill are contained in Appendix D, along with Campbell Reith Hill's interpretations with respect to soil contamination (reference 22) and hazardous gases (reference 23), which are also contained in Appendix D. Drawing 6479/ES-8-03 identifies the extent of investigation works across the Application Site.

8.2.6 Encountered Ground Conditions

Intrusive investigations have generally confirmed the inferred geology at the site, although the Solid geology was found to be overlain by intermittent glacial clay deposits. The underlying geology typically comprised sandstones and mudstones with inferior bands of siltstone.

Near surface deposits typically represent the soils with the greatest potential to be contaminated. Over the majority of the Application Site, the surface soils were found to comprise natural ground, however made ground was encountered in pockets across the Application Site and varied in thickness between 0.3m and 3.6m bgl, although greater depths local to the Second World War opencast mines were encountered. The made ground generally comprised clay with mudstone, sandstone, coal gravel and occasionally contained fragments of ceramic. No visual or olfactory evidence of potentially hazardous made ground deposits was encountered across the Application Site during the course of the soils investigations, such as odours or staining.

8.2.7 Encountered Soil Contamination

Soil sampling and analysis in the three phases of investigation work principally focussed on the near surface and made ground soils. The selection of the samples was also influenced by the identified historical land uses.

The three phases of investigation resulted in a combined total of 109 soil samples being analysed from the Application Site for a range of metallic, inorganic and organic species. Table 8.1 summarises the Application Site data for the various deteminands when compared to relevant guideline thresholds:

Table 8.1: Summary of Soil Analytical Data

Determinand	Number of Analyses	Minimum Concentration	Maximum Concentration	Guideline Threshold	Number of samples exceeding Threshold
Arsenic	109	<3	115	10[a]	23
Boron (water soluble)	109	<1.0	2	3[b]	0
Cadmium	109	<0.5	9.6	3[a]	4
Chromium (total)	109	4	51	600[a]	0
Chromium (hexavalent)	109	<0.1	0.6	25[a]	0
Cyanide (total)	109	<1	3	250[a]	0
Copper	109	3	81	130[b]	0
Cyanide (free)	109	<1	<1	25[a]	0
Lead	109	10	464	500[a]	0
Mercury	109	<0.04	0.13	1[a]	0
Nickel	109	<2	140	70[b]	4
Mineral Oils	109	39	1,200	2000[c]	0
PAHs	109	<10	127	50[a]	1
pH (in units)	109	4.6	7.9	less than 5.0[a]	8 (below 5.0)
Phenol	108	<0.5	2.5	5[a]	0
Selenium	109	<0.07	3.7	3[a]	1
Sulphate (acid soluble)	109	125	3,000	2,000[a]	1
Sulphide	109	<1	76	250[d]	0
Sulphur	109	<20	1,330	500[d]	1
Thiocyanate	109	<2	13	50[d]	0
Zinc	109	31	671	300[b]	24

All units in mg/kg unless otherwise stated.

[a] ICRCL Threshold trigger concentration (mg/kg) for domestic gardens and allotments

[b] ICRCL Threshold trigger concentration (mg/kg) for any use where plants are grown

[c] CRH guideline value based upon experience of hydrocarbon-contaminated sites

[d] ICRCL Threshold trigger concentration (mg/kg) for all end uses.

Subsequent to the identification and qualification of contaminant species in soils, it is necessary to assess their significance in view of the site's end use, which is to be predominantly residential. For the purposes of the assessment of the Application Site data, the ICRCL Guidance Note 59/83 (reference 24) has been used. Use of this guidance for comparison purposes provides a first phase

screening mechanism in order to identify potentially elevated contaminant levels. If potential elevations are observed, it is necessary to progress at a second more site-specific appraisal based upon risk assessment using the pollutant linkage concept.

Table 8.1 demonstrates only occasional low level elevated concentrations, principally by arsenic, cadmium, nickel and zinc. The observed levels are considered not to be representative of significant industrial or anthropogenic contamination, but to be more indicative of the natural geochemical status of the soils and rocks. For example, the Royal Commission on Environmental Pollution's Nineteenth Report on the Sustainable Use of Soil (reference 25) presented typical ranges of concentrations in natural soils and from weathering of metal-rich source rocks, which are summarised below in Table 8.2:

Table 8.2: Typical concentrations of metals in natural and weathered soils

	Arsenic	Cadmium	Nickel	Zinc
Typical range in natural soils	0.1 - 50	<1 - 2	2 - 1,000	10 - 300
Levels resulting from weathering of metal-rich source rocks	up to 2,500	up to 30	up to 8,000	10,000 or more

All results in mg/kg

These results demonstrate the encountered levels within the Application Site are consistent with natural and metal-rich soils.

By considering the observed concentrations of these parameters and the respective distributions, the fact that they are not considered representative of significant contamination suggests the absence of a hazard in terms of contaminated soils. Applying the pollutant linkage concept, the absence of a hazard means no significant risk exists.

This interpretation is consistent for the other parameters analysed, as well as the desk study findings. The encountered ground conditions demonstrate the areas of made ground and landfill within the Application Site to be generally inert arisings, probably resulting from mining activities that have occurred at the site.

Similarly, occasionally acidic soils were encountered, but these reflect the nature of the underlying rocks and were generally encountered where coal deposits were present.

8.2.8 Groundwater Contamination

The issue of potential groundwater contamination is discussed in Chapter 9.0.

8.2.9 Hazardous Gases

Monitoring Frequency

Monitoring of the boreholes installed as part of the three phases of investigation has been undertaken on several occasions and the collective results for all phases of monitoring are discussed together for the proposed Application Site. The monitoring exercises undertaken at the Application Site are summarised in Table 8.3.

Table 8.3: Summary of gas monitoring visits

Date	Boreholes Monitored	Monitoring Undertaken By
9-14 Jul 1997	1-16	Exploration Associates/WS Atkins for CNT
12-14 Aug 1997	1-16, 101-110	Exploration Associates/WS Atkins for CNT
14-15 Jul 1998	1-16, 101-110	Exploration Associates/CRH for BVT
6-8 Aug 1998	1-16, 101-110	Exploration Associates/CRH for BVT
25-26 Nov 1999	1-16, 101-110, 201-235	Exploration Associates/CRH for BVT
1-2 Dec 1999	1-16, 101-110, 201-235	Exploration Associates/CRH for BVT
2-7 Feb 2000	1-16, 101-110, 201-235	Exploration Associates/CRH for BVT
8-12 May 2000	1-16, 101-110, 201-235	Exploration Associates/CRH for BVT
3-7 Aug 2000	1-16, 101-110, 201-235	Exploration Associates/CRH for BVT
5 Sept 2000	1-16, 101-110, 201-235	Exploration Associates/CRH for BVT
5 Oct 2000	1-16, 101-110, 201-235	Exploration Associates/CRH for BVT

Monitoring results for the adjacent Stoneyhill landfill have also been obtained and reviewed. These results have been collated over a number of years for the landfill and have more recently been collected by Charles Ruxton on behalf of Telford & Wrekin Council, who are the current owners of Stoneyhill Landfill. Campbell Reith Hill's Hazardous Gas Report dated March 2000 (reference 23) presents a discussion of the data up to May 2000. Appendix D also contains a summary table of the gas monitoring data.

Subsequent to the identification and quantification of contaminant gases, it is necessary to assess their significance in view of the proposed use of the land. For the purposes of this appraisal, the following guidance has been consulted:

- Waste Management Paper 27, (reference 26)
- Waste Management Paper 26A, (reference 28)
- Construction Industry Research and Information Association (CIRIA), Report 149 (reference 28);
- Building Regulations, Approved Document C, 1991 (reference 29); and
- Building Research Establishment, Report 212 (reference 30)

Methane

Historically, methane traces were recorded in one borehole (BH104) near to Stoneyhill (at 0.68% by volume) and one borehole near to the Second World War backfilled areas (at 0.14% by volume) during the July 1998 monitoring exercise. These corresponded to a low atmospheric pressure event (where gas releases from soils tend to be higher) and are not elevated with respect to the published 1% by volume threshold where structural protection is required. These results were not recorded during the manual monitoring exercise, but upon analysis of collected gas samples. Subsequent monitoring of the wells did not repeat these results and these one-off recorded methane levels in their own are not considered significant.

Methane was not recorded in any of the other wells until the recent February 2000 monitoring visit, when 23.4% by volume was encountered in BH235 near to Stoneyhill. This event did not coincide with a low pressure event and no detectable gas flow was recorded. Subsequent repeat monitoring of this borehole confirmed the greater than 20% presence of both methane and carbon dioxide although two of last three visits did not detect methane. No putrescible or organic materials or soils were encountered during the installation of this borehole. No significant flow was observed associated with these readings and purging of the borehole with nitrogen gas has demonstrated relatively low emission rates. For example pre-purge methane and carbon dioxide levels of 22.5% by volume and 23.1% by volume respectively were recorded in the May 2000 visit. Following purging, these levels had returned to 0.7% and 1.0% respectively after an hour.

Borehole 235 is in close proximity to Stoneyhill landfill (approximately 30m away), which is considered to present a likely source, however adjacent boreholes (224 and 232 which are 120m and 100m away respectively) have not demonstrated elevated methane concentrations above the detection limit of 0.1% by volume.

Carbon Dioxide

The gas monitoring results from the various boreholes have consistently identified the presence of carbon dioxide across the majority of the Application Site. The encountered levels frequently exceeded the 5.0% guideline threshold where gas protection is recommended in the current published guideline thresholds.

Recorded concentrations are noticeably more elevated in the general north west area at levels of up to 19.3% by volume (near to Coalmoor and Stoneyhill) and in the south east at levels up to 23.2% volume (near to the Second World War opencast mines), although the main central zone of the proposed development has also been characterised by significant concentrations of carbon dioxide up to 10.1% by volume.

No significant gas flows were recorded in association with the elevated carbon dioxide levels, however purging of the wells with nitrogen demonstrated

significant recharge of wells, with concentrations of up to 6.9% by volume carbon dioxide recorded 1 hour after purging with nitrogen.

Oxygen

Oxygen depletion was encountered associated with the elevated gas readings and a corresponding increase in nitrogen levels when compared with ambient atmospheric levels. This may be due to the absorption of oxygen by iron-bearing rocks during oxidation leading to nitrogen rich atmospheres.

Isotope Ratios

Methane and carbon dioxide in the environment are derived either biogenically (by the reduction of organic matter by micro-organisms) or thermogenically (geological burial, compression and heating). It is well known that the character of gases produced by these different natural pathways differ in terms of their ^{13}C and ^{12}C isotopic ratios, and measurement of the isotope ratio (against an industrial standard) can be diagnostic of particular sources (reference 31).

In order to further understand the gas regime beneath the site and to potentially determine the source of the observed gases, gas samples were collected from selected boreholes during the last five monitoring visits (February to October 2000) and submitted for stable isotope analysis.

Samples collected from boreholes with low methane concentrations (below the 0.1% by volume detection limit) yielded tentative results (due to the low methane concentrations) in the range of $^{Del\ 13C}CH_4$ (‰) -44.66 to -49.75, however analysis of the methane collected from borehole 235 yielded a result of $^{Del\ 13C}CH_4$ (‰) -54.65. Similar analysis of the carbon dioxide components yielded results in the range of $^{Del\ 13C}CO_2$ (‰) -19.83 to -32.28. Comparison of these results with published data (reference 31) suggest that the gases are predominantly of biogenic origin as opposed to thermogenic. The abundance of landfill and made ground areas in the vicinity of the Application Site are consistent with these findings, although contributions from the natural Carboniferous Coal Measures cannot be ruled out.

Groundwater Analysis

In order to understand the possible migratory mechanisms for the identified gases, groundwater samples were also collected and analysed for dissolved methane. Borehole 235 which had previously demonstrated the greatest elevated levels of methane and carbon dioxide was dry, however the results from nearby boreholes indicated that the general groundwater across the site is not laden with dissolved methane, and levels of dissolved methane recorded are consistent with natural background levels.

8.2.10 Monitoring of Stoneyhill Landfill

Detailed reviews of the landfill gas monitoring results for Stoneyhill dating back to at least 1998 have been undertaken by Charles Ruxton on behalf of Telford & Wrekin Council. The monitoring is undertaken from 28 gas monitoring boreholes across the landfill. Significantly elevated concentrations of methane and carbon dioxide are consistently being recorded in many of the monitoring installations, although it is observed that the average methane readings are slightly decreasing in comparison to the longer term data sets.

Elevated monitoring results are consistently being recorded along the eastern boundary of the landfill (adjacent to the Application Site). More recent and on-going monitoring of the Stoneyhill landfill has confirmed the presence of significant concentrations of methane and carbon dioxide being generated from the landfill. Gas migration is acknowledged by the Council to be occurring, at least over short distances, based upon the perimeter borehole data, however it has been demonstrated that active gas extraction techniques have reduced the incidence of very high gas concentrations at the perimeter, although significant concentrations of both gas species are still being recorded.

During the 1999 monitoring visits undertaken by Charles Ruxton, methane and carbon dioxide concentrations frequently exceeding 5% by volume were recorded in boreholes along the eastern boundary with maximum concentrations of 12% (methane) and 13% (carbon dioxide) being recorded. These readings related to periods when the gas extraction system is operational.

8.2.11 Agricultural Land Classification (ALC)

The ALC was undertaken in accordance with the "Agricultural Land Classification of England and Wales: Revised Guidelines for grading the quality of agricultural land" (reference 38). This document provides a methodology for the grading of the agricultural land quality into five grades:

- Grade 1 - excellent quality agricultural land
- Grade 2 - very good quality agricultural land
- Grade 3 - good to moderate agricultural land
  - Subgrade 3a - good quality agricultural land
  - Subgrade 3b - moderate quality agricultural land
- Grade 4 - poor quality agricultural land
- Grade 5 - very quality agricultural land

The grades are based upon a combination of possible factors that may limit the agricultural potential. These factors are agroclimatic conditions (rainfall, temperature), site conditions (gradient, soils) and interactions between the two (soil wetness, droughtiness).

The classification was undertaken using site conditions information collected during site investigations, and agroclimatic data received under licence from the National Soil and Resources Institute, Cranfield University. The assessment of soil quality was undertaken using trial pit data collected during the site investigations.

This data did not allow for assessment based upon stoniness, but the low grades allocated by the other factors suggest that this omission has had no bearing on the outcome of the classification. Drawing 6479/ES-8-04 indicates the sample positions used to obtain both climatic and soil data.

Additionally, the Application Site gradients were calculated and a grade applied. The majority of the Application Site has a gradient of 12% or less, placing it in Grade 1, 2 or 3a. There are also areas with a gradient of between 12% and 20% (Grade 3b) and 20% to 33% (Grade 4). A limited area has a gradient of greater than 33% (Grade 5).

However, as Table 8.4 shows, the limiting factors across the Application Site are predominantly agroclimatic in nature, and thus gradient is not responsible for the overall ALC grade. Similarly, flood risk has not been assessed due to the existing poor quality of land. The results of the ALC appraisal for each of the factors is shown in Table 8.4.

Table 8.4: Agricultural Land Classification

Soil Survey Point	Climatic Limitations	Site Limitations	Soil Limitations	Interactive Limitations		Overall ALC Grade
	Local climatic factors	Gradient	Soil Depth	Soil Wetness Grade	Droughtiness	
TP 328	2	1 - 3a	1	4	4	4
TP 329	2	1 - 3a	1	4	4	4
TP 323	2	1 - 3a	1	4	4	4
TP 333	2	1 - 3a	1	4	4	4
TP 324	2	1 - 3a	1	4	4	4
TP 319	2	1 - 3a	1	4	4	4
TP 321	2	1 - 3a	1	4	4	4
TP 313	2	1 - 3a	1	2	2	3b*
TP 314	2	1 - 3a	1	3b	1	3b
TP 315	2	1 - 3a	1	2	3a	3b*
TP 318	2	1 - 3a	1	2	2	3b*
TP 317	2	1 - 3a	1	4	4	4
TP 325	2	3b	1	4	4	4
TP 309	2	1 - 3a	1	4	4	4
TP 306	2	1 - 3a	1	3b	2	3b
TP 305	2	1 - 3a	1	3b	3a	3b
TP 335	2	1 - 3a	1	3b	1	3b
TP 304	2	3b	1	3b	1	3b
TP 307	2	1 - 3a	1	4	4	4
TP 310	2	1 - 3a	1	4	4	4
TP 311	2	1 - 3a	1	3a	3a	3b*
TP 312	2	1 - 3a	1	3b	1	3b
TP 316	2	1 - 3a	1	3b	4	4
* Sand topsoil, therefore not eligible for Grades 1 -3a						

The overall ALC grades for the Application Site are shown on Figure 6479/ES-8-04. Where soil data has not been available, the classification of the adjacent land has been extended. Table 8.5 shows the approximate distribution of each Grade.

Table 8.5: Approximate area of individual ALC grades within the Application Site

ALC Grade	Area (ha)	As % of total area
1	0	0
2	0	0
3a	0	0
3b	29.5	41.55
4	38	53.52
5	3.5	4.93

The majority of the site is classified as Grade 4, representing poor quality agricultural land. A significant proportion is also classified as 3b, representing moderate quality agricultural land and a small area is Grade 5.

8.3 ANALYSIS OF PREDICTED IMPACTS

8.3.1 Soils

The observed levels of chemical compounds in the soils are not considered to be representative of potential contamination, and do not present significant hazards or contamination risks to a residential end-use of the site.

8.3.2 Hazardous Gases

Assessment and Historical Conclusions

Current thinking and best practice with respect to the interpretation and risk assessment of gas results advises against using the presence or absence of soil gases at specific concentrations alone as a basis for protection design, but rather assessing the risks posed by considering a number of principal parameters including the source of the gas, generation potential, gas flow rate, measured concentrations and the nature of the development (references 28, 32, 33, 34 and 35).

The historical investigations undertaken by WS Atkins focussed on a number of individual potential development sites which approximated generally to the current Application Site. The principal findings from the WS Atkins investigations (references 5 to 18) with respect to hazardous gases concluded:

- Elevated carbon dioxide was encountered and three potential sources were identified, namely the Stoneyhill landfill, the coal measures and the Johnston Pipes landfill;
- It was not possible based upon the data available to determine which is the predominant source of carbon dioxide;

- It was possible that there is a contribution from all three sources and therefore that migration of gas a significant distance from the Johnston Pipes or Stoneyhill landfills cannot be ruled out;
- A medium to high risk was assigned to potential landfill gas migration from the Johnston Pipes site along fault zones and Stoneyhill landfill was considered to pose a low to very low risk to the development sites.

Whilst contributions to observed gas levels from adjacent areas of landfill including the Johnston Pipes site are anticipated, the results of the two phases of investigation work undertaken by Campbell Reith Hill / Exploration Associates indicated that carbon dioxide levels were fairly consistent across the Application Site, whereas the main risk due to potential gas migration appeared to occur from Stoneyhill landfill. This appraisal superceded the above WS Atkins conclusions based upon the more comprehensive data set. Consequently, the migration risk from Stoneyhill was appraised.

Migration Potential From Stoneyhill

The presence of significant methane concentrations was identified at the eastern boundary of Stoneyhill from the gas monitoring commissioned by Telford & Wrekin Council, although active gas extraction appears to be minimising these levels. The strata in the vicinity of the landfill and the Application Site is acknowledged as presenting migration opportunities along fractures and fissures and a potential risk is therefore considered to exist. Importantly, the functioning of the gas extraction system is identified as being critical to the reduction of these risks. The original low to very low risk assigned by WS Atkins to Stoneyhill (reference 5) is therefore considered to be inappropriate in response to the more recent monitoring data.

In addition, significantly elevated concentrations of methane have been identified in Borehole 235 along the western sector of the Application Site near to Stoneyhill, along with consistently elevated carbon dioxide levels from this and other boreholes. Gas analyses from across the site, including from wells in the vicinity of Stoneyhill, suggest the gas source to be biogenic (such as landfills and/or made ground), as opposed to thermogenic although it is acknowledged that this represents an inference from the isotope analysis as opposed to a definitive interpretation. Only occasional evidence of organic coal deposits were encountered during the course of the various investigations, consistent with the extensive historical mining activities across the site.

The available data supports the notion that migration of gases from the Stoneyhill landfill towards the Application Site may be occurring where the integrity of both the lining (if present) and the clay barrier installed during the recent opencast works are considered questionable and the general geological setting is considered conducive to migration. Charles Ruxton's February 1998 Risk Assessment Report (reference 36) supports this conclusion and states:

"Gas migration is known to be occurring, at least over short distances, based on data from the boreholes around the perimeter of the site (Stoneyhill) *.... The strata around the site present opportunities for gas migration along fractures and*

fissures and gas migration therefore continues to represent a potential hazard to nearby properties and structures ..."

and in February 2000 Charles Ruxton's continued monitoring (reference 37) identified that "*Gas migration continues, particularly along the eastern boundary* (of Stoneyhill) ..."

Critical to the suspected migration of hazardous gases from Stoneyhill is the functioning of the gas abstraction system, which appears to reduce the levels of recorded gas, although not below published thresholds. The abstraction system appears to represent a necessary remedial system to control gas migration, however if the system fails, it is possible that potential gas migratory rates will be significantly increased. Active gas abstraction at Stoneyhill is therefore a crucial risk management requirement to minimise off-site migration towards the proposed urban village.

An assessment of the potential risks based upon the actual gas measurements and the suspected migratory potential from Stoneyhill can be broken down by focussing on methane and carbon dioxide separately.

- *Methane* - Methane has only been recorded at one borehole at significant concentrations, and this is outside of the proposed construction footprint within the Application Site. Nearby monitoring boreholes suggest that this encountered methane is not extensive, however its impact and influence on the nearby section of the development footprint is not known. The likely source of the methane, Stoneyhill landfill, is still actively generating landfill gas, and therefore significant generation potential exists, although significant gas flows have not yet been recorded. Based upon the proposed end use (residential), the actual recorded levels and the generation potential, a medium to high risk from the methane is considered to exist to the area of the proposed development in the vicinity of Borehole 235.

- *Carbon Dioxide* - consistently elevated carbon dioxide concentrations are being recorded along the western boundary of Stoneyhill. These are in general consistent with carbon dioxide levels recorded elsewhere across the site, and are considered to also be principally biogenic in origin. Purging of the wells has demonstrated rapid recharge of carbon dioxide, representing significant generation potential. In view of the recorded levels, the proximity of Stoneyhill and the nature of the development, the presence of carbon dioxide is considered to represent a medium risk.

Application Site In General

Potentially hazardous concentrations of carbon dioxide have also been frequently encountered across the Application Site, and gas analyses suggest biogenic eg. landfill and made ground sources, as opposed to the natural carboniferous rocks, although a degree of contribution from both is anticipated. It is therefore concluded that generation and migration of carbon dioxide from the other identified areas of landfill and made ground may also be occurring, and the

recorded elevated results in the north west and south east areas support this conclusion.

Consistent with the carbon dioxide results encountered along the development boundary with Stoneyhill, the encountered gas regime over the majority of the Application Site is also considered to represent a medium risk.

Generally lower levels of carbon dioxide have been recorded in boreholes in the north eastern sector of the site, although intermittent elevated concentrations greater than the 5% by volume threshold have been recorded. This part of the site is in close proximity to the Johnston Pipes landfills, and therefore despite the generally lower levels, a medium risk is still considered to exist.

Drawing 6479/ES-8-05 presents the assessed risk status of the site with respect to hazardous gases.

8.3.3 Agricultural Land

The proposed development will result in land take from the current agricultural use. However, the ALC appraisal has demonstrated that the soils are at best of moderate agricultural quality and over a large area are of poor quality. In this context, the soils are not considered to represent a significant soil resource, and therefore any agricultural land and soil loss is considered to be of low significance. Nonetheless, large areas of the Application Site will be open space and recreational space, where existing features will be retained and enhanced. Consequently, large areas of existing topsoil, although not considered to be of significant resource quality, will be retained.

8.4 MITIGATION

8.4.1 Soils

The investigation works and soil analyses have established that no significant contamination of the soils exists at the site, when considering a sensitive residential end use. On this basis no specific remedial measures are considered necessary.

However development plot-specific investigations will be undertaken which will enable validation of the chemical status of garden areas (once defined).

8.4.2 Gases

Based upon the gas monitoring results and conclusions, a series of mitigation measures have been and will be implemented in order to minimise the risks to the proposed development. These measures can be grouped into three areas and are as follows:

i. Development planning - This measure has already been implemented. As part of the on-going masterplanning of the development over the last four

years, the desk study and site investigations have been regularly inputted in order to identify potential constraints and hazards. These inputs and the resulting actions can be summarised as follows:

- With respect to risk posed by Stoneyhill Landfill, a buffer zone of approximately 100m wide has been applied to the masterplan to prevent building of structures near to the Landfill. Specific to the monitoring data, this will result in no structures being constructed within at least 50m of the elevated readings for methane recorded in borehole 235;

- The Second World War opencast mines appear to be responsible for elevated carbon dioxide levels in the south eastern corner of the Application Site. An indirect consequence of moving the development northwards will minimise the number of properties being built directly over these landfilled areas; and

- The moving of the Application Site northwards away from the Wildlife Site has also ensured that any impacts from the Shutfield Landfill have been eliminated.

ii. Protection of structures against hazardous gases - Provision of gas protection measures to all structures across the Application Site based upon the identified gas concentrations and risks will be implemented. The final design of the protection measures will be determined by plot specific risk appraisal at the detailed design stage, however in anticipation of these works, Drawing 6479/ES-8-07 identifies a typical gas protection specification which is likely to be required, and in summary comprises:

- Ventilation of confined spaces within the building;
- Well-constructed ground slab;
- Low permeability gas membrane; and
- Granular filled void.

iii. On-going monitoring and liaison - given the likely importance of the active gas extraction system employed at the Stoneyhill landfill in reducing the potential for gas migration onto the Application Site, it is proposed that consultations will be undertaken with Telford & Wrekin Council (the owners of Stoneyhill) in order to ensure the current gas control systems are regularly maintained and where possible upgraded.

In addition, it is proposed that an on-going monitoring programme will be established in order to further characterise the underlying gas regime, particularly around Stoneyhill and Borehole 235. It is proposed that this monitoring will be co-ordinated with the routine monitoring commissioned by Telford & Wrekin Council for Stoneyhill landfill. This additional monitoring work will determine and clarify the actions required in response to the presence of elevated methane concentrations associated with borehole 235 if above and beyond those already described.

8.4.3 Agricultural Land

Any agricultural land loss is considered to be of low significance, and therefore extensive mitigation is not considered necessary. Nonetheless, large areas of the Application Site will be open space and recreational space, where existing features will be retained and enhanced. Consequently, large areas of existing topsoil, although not considered to be of significant resource quality, will be retained.

8.5 STATEMENT OF SIGNIFICANCE

Detailed desk study appraisals of the Application Site's history and potential for contamination have been undertaken along with three phases of intrusive site investigation. These investigations have involved characterisation of the underlying ground conditions and geology, as well as assessments of soil, water and hazardous gas contamination. Historical activities of concern related to the former mining activities and subsequent infilling of former opencast areas.

Investigations of the chemical quality of the near surface and made ground soils have not identified evidence of significant contamination. Consequently, the chemical status of the soils is not considered to represent a risk or impact upon the development proposals, however as a prudent measure, once individual development areas are defined, specific validation of the soils will be undertaken and if necessary appropriate depths of topsoil will be allowed for. Water contamination is discussed in Section 9.0.

Extensive gas monitoring across the Application Site has identified consistently elevated carbon dioxide concentrations, which are considered to represent a medium risk to the proposed urban village development. Analysis of collected gas samples for stable carbon isotopes ($^{13}C/^{12}C$) suggest that the source of the recorded gases are biogenic in origin, such as the numerous landfill and made ground areas characterising much of the site. The local geological strata is however considered to also be contributing to the carbon dioxide levels. Significant methane concentrations have only been recorded at one location, Borehole 235, which is outside the current proposed building footprint and in close proximity to Stoneyhill landfill. Data provided by Telford & Wrekin Council acknowledges that limited gas migration from the landfill is occurring. The gas abstraction system at Stoneyhill (which was installed post-completion) is critical to the risk management of the generated landfill gas.

Based upon the gas monitoring results and conclusions, a series of mitigation measures have been and will be implemented in order to minimise the risks to the proposed development. Masterplanning of the proposed development has already allowed for the gas findings, and includes a 100m buffer zone around Stoneyhill Landfill. In addition, provision of gas protection measures to all structures across the Application Site will be implemented. The final design of the protection measures will be determined by plot specific risk appraisal at the detailed design stage. Finally, given the likely importance of the active gas extraction system employed at the Stoneyhill landfill in reducing the potential for

gas migration onto the Application Site, consultations will be undertaken with Telford & Wrekin Council (the owners of Stoneyhill) in order to ensure the current gas control systems are regularly maintained and where possible upgraded. This will be combined with an on-going monitoring programme to further characterise the underlying gas regime, particularly around Stoneyhill and Borehole 235, the results of which will be used to inform the detailed design phase of the development. Table 8.6 summarises the impact appraisal of the ground conditions and contamination.

Table 8.6: Summary of Ground Condition and Contamination Impacts

Potential Impact	Type of Impact	Nature	Importance	Significance of impact without mitigation	Significance of impact with mitigation
Development proposals on ground conditions	No impact predicted	-	-	-	-
Impact of soil contamination	No impact predicted	-	-	-	-
Presence of carbon dioxide	Adverse	Short to medium term	Local	Medium risk	Low risk
Presence of local methane around BH 235 (inferred migration from Stoneyhill landfill)	Adverse	Short to medium term	Local	High risk	Low risk
Loss of agricultural soils	Adverse	Long term, irreversible	Local	Low to negligible	-

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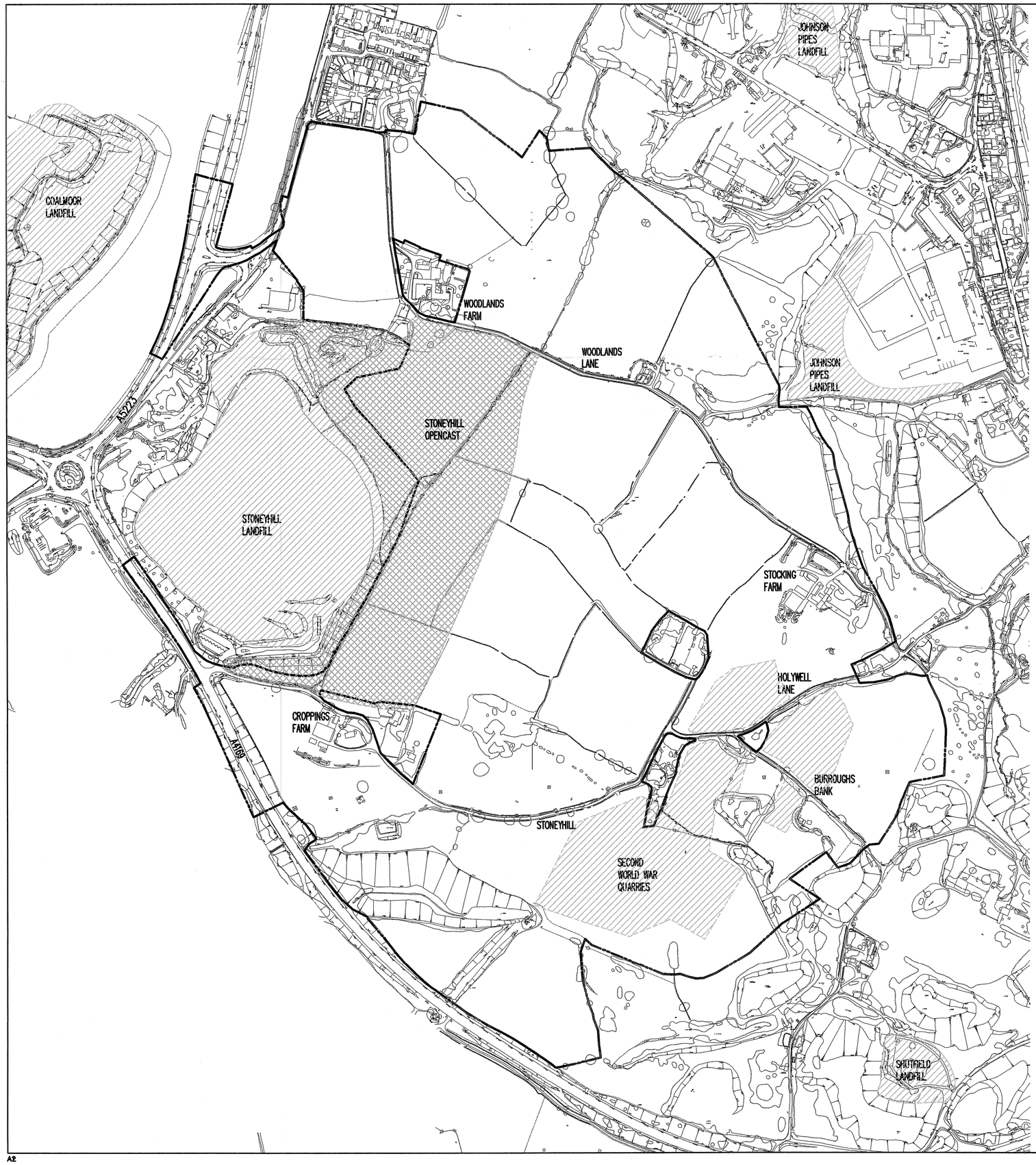
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LEGEND

GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

LANDFILL LOCATIONS:

- LANDFILL AREAS
- APPROXIMATE EXTENT OF "STONEYHILL OPENCAST" APPLICATION AREA (APPLICATION No: W89/1351 DATED 27/10/89 FOR EXTRACTION OF RESIDUAL COAL & BACKFILLING)

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Job Title: LIGHTMOOR VILLAGE, TELFORD

Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

LANDFILL SITES

drawn	date	scale	C1 checked	CAD filename
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Job No.	Drg No.	Status/Revision
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- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

SURFACE GEOLOGY:

- GEOLOGICAL FAULT LINES APPROXIMATE POSITION OF FAULTS SHOWN ON BRITISH GEOLOGICAL SURVEY MAP. MARK INDICATES DOWNTHROWN SIDE
- INFERRED EXTENT OF CARBONIFEROUS COAL MEASURES
- INFERRED EXTENT OF OUTCROPPING LYDEBROOK SANDSTONE

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NEAR SURFACE GEOLOGY

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- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

AGRIGULTURAL LAND CLASSIFICATION:

- GRADE 3B
- GRADE 4
- GRADE 5
- LOCATION OF CLIMATIC DATA POINT
- TP205 TRIAL PIT LOCATION FOR SOIL ASSESSMENT

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AGRICULTURAL LAND CLASSIFICATION

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- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

GAS RISKS:

- MEDIUM GAS RISK
- MEDIUM TO HIGH GAS RISK

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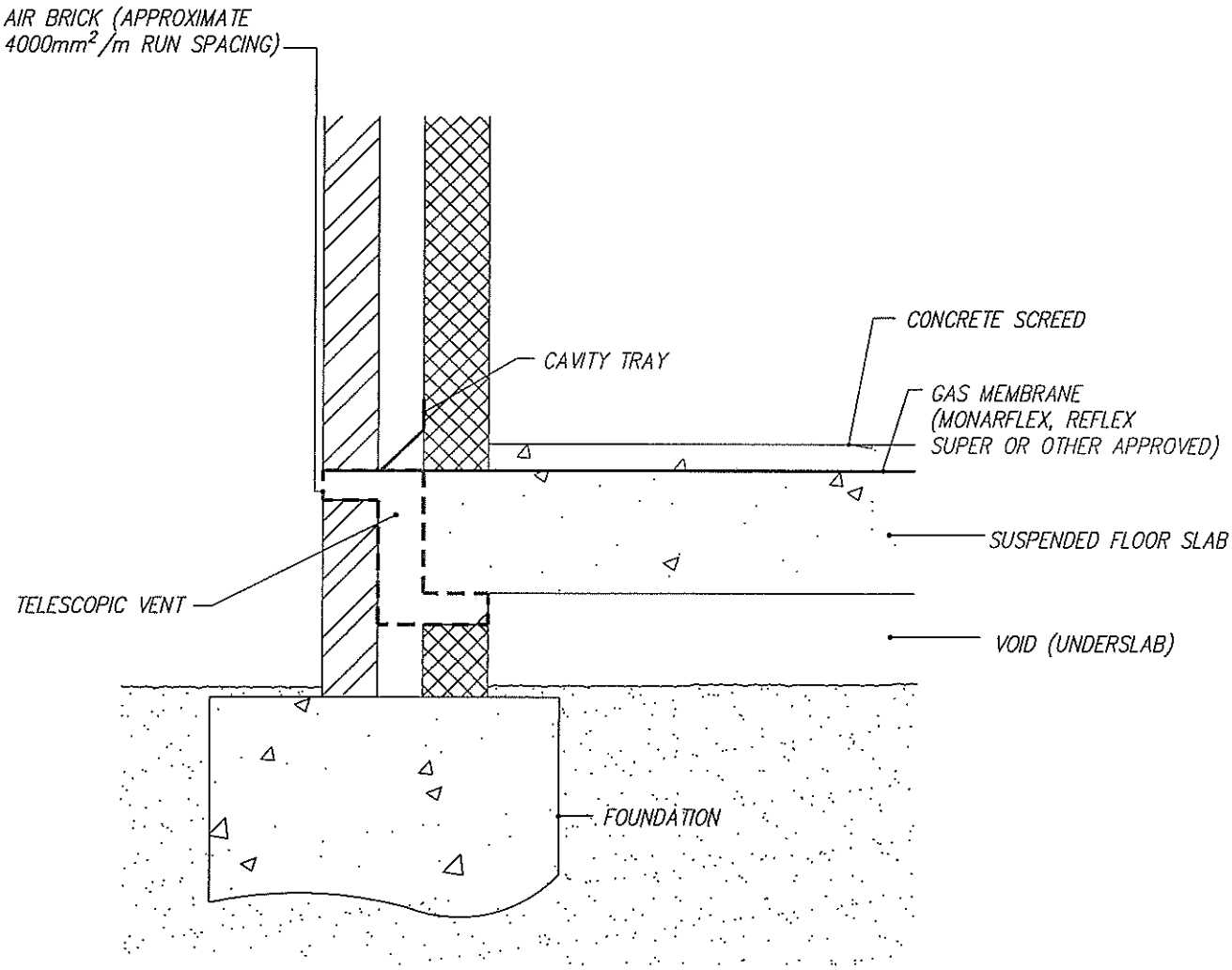
GAS RISK STATUS FOR BUILT AREAS

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Job Title
LIGHTMOOR VILLAGE, TELFORD

TYPICAL DETAIL FOR GAS PROTECTION MEASURES IN STRUCTURES

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Job No.	Drg No.	Status/Rev
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9.0 HYDROLOGY, DRAINAGE AND HYDROGEOLOGY

9.1 INTRODUCTION

Any major development has the potential to affect the water environment, both directly on-site and indirectly in the wider environment. Impacts can relate to both hydrological matters and water quality, as well as the utilisation of the water environment. Every catchment has its own hydrological characteristics which determine the balance of water flows between the different elements of the cycle, including:

- Infiltration through soils to recharge groundwater;
- Lateral flow through soils; and
- Surface flows as run-off to streams and drainage channels.

The absorption of water by soil and vegetation, and its gradual release to adjacent drains and streams, helps to even out stream and river flow compared with the variability of rainfall.

A major effect of development can be to alter the land surface characteristics and so affect the natural balance between surface and groundwater regimes. Development can often create large areas of impervious or semi-pervious surfaces, which combined with the provision of storm water drains, can increase peak flows in the watercourses, whilst reducing infiltration to groundwater and lateral flow. This can have a number of direct and indirect effects, including:

- Increasing the occurrence and risk of flooding downstream;
- Causing erosion on-site and downstream; and
- Reducing the recharge of aquifers.

Where waters are intercepted by the development, off site flows will be reduced, and this could impact upon water-dependant habitats in the lower regions of catchments. Likewise, where groundwater recharge is reduced, a fall in the watertable may follow with significant implications for watertable-dependant habitats on and surrounding the Application Site.

Water pollution is a complex subject, and when assessing the impact of pollution on a water environment, it is not just the concentration of a given pollutant in a waterbody, but also the likely effects of this pollution. Pollution may enter the hydrological system from a number of sources which will vary greatly depending on the nature of the Application Site and type of development.

Under the Water Resources Act 1991, it is an offence to pollute a watercourse, technically described in the legislation as 'controlled waters', which includes most inland and tidal surface waters together with groundwater. Water quality can be impacted upon by either point source discharges or by diffuse source, and regulatory controls and enforcements exist for such pollution.

9.2 BASELINE SURVEYS

9.2.1 Relevant Studies and Investigations

The Lightmoor area and its surroundings have been subject to significant investigations and appraisals over recent years. With respect to this chapter and establishing the baseline conditions, the following work elements are relevant:

- W S Atkins, June to December 1997

  The W S Atkins work involved the drilling of 17 boreholes, as well as the excavation of 10 trial pits and associated soil, water and gas sampling and monitoring (references 1 to 16).

- WS Atkins, July 1998

  A detailed analysis of the Lightmoor Catchment was undertaken (reference 17).

- Campbell Reith Hill, June to July 1998

  The investigation comprised the drilling of 11 boreholes (of which nine were fitted with groundwater and gas monitoring installations), 25 trial pits and 8 trial trenches, as well as associated geotechnical and contamination testing and monitoring including of surface waters. The factual data relating to this work is contained in Exploration Associates' reports dated 1998 (reference 18), which are contained in Appendix D.

- British Geological Survey, November 1999 to January 2000

  On behalf of Bournville Village Trust, the British Geological Survey was commissioned to produce a hydrogeological and hydrological desk study of the Lightmoor area and surroundings, including the actual Application Site and the Wildlife Site (reference 19), which is included in Appendix E.

- Campbell Reith Hill, November 1999 to October 2000

  The investigation was undertaken by Exploration Associates and comprised the drilling of 32 boreholes (25 of which were fitted with gas and groundwater monitoring installations), 40 trial pits and associated contamination and geotechnical testing and monitoring. The factual information is contained in Exploration Associates 2000 report (reference 20), which is contained in Appendix D.

- Campbell Reith Hill, March 2000

  This drainage design statement (reference 24) outlined the existing conditions, reviewed previous studies and outlined the design concepts, standards and design proposals for both storm and foul drainage.

9.2.2 Topography

Elevations are greatest at the crest of Stoneyhill, at over 192 metres above Ordnance Datum (mAOD) and along Wellington Road, on the north west margin of the Application Site, at about 178m mAOD. The topography slopes gently to the east and south east across the Application Site and is at a minimum of about 125m AOD in the Lightmoor area in the extreme south east. Topography in this corner (which is outside the Application Site) is distinctly uneven due to the presence of numerous coal mining spoil heaps and depressions created by clay extraction. Steeper slopes are encountered in the vicinity of the valley feature near Bath Spout associated with the springs and water course to the north of Woodlands Lane and also along the line of the Lightmoor valley on the eastern margin of the Application Site, but these lie outside the proposed Application Site. Steeper slopes also occur in the vicinity of the Stocking Farm Fault in the south western margin of the Application Site along the line of a valley feature approximately 150 metres to the east of Croppings Farm.

9.2.3 Hydrology and Drainage

General

No significant watercourses exist over much of the Application Site. The land is generally well drained and largely lacking any form of drainage ditches, although this is not the case in the area near Stoneyhill landfill which is less well drained. Short watercourses exist in the small valley located to the north of Woodlands Lane, originating at groups of springs before disappearing at the edge of an area of landfill (Johnston Pipes). The stream re-emerges from the Johnston Pipe Landfill and runs along the eastern margin of the Application Site in a southerly direction. From here, it flows southwards into the New Detention Reservoir, which regulates outflows from the Lightmoor catchment by means of a controlled orifice. This connects directly to the Burrough's Bank Sewer, a concrete culvert, which carries the water for some 465m and discharges to a watercourse adjacent to the A4169 Queensway.

The upper part of the stream runs over sandstones and is likely to be in hydraulic continuity with the underlying aquifer. Beyond the Lightmoor Fault, the stream runs over mudstones of the Upper Coal Measures, before being culverted.

A small tributary stream originates at springs located immediately to the north of Holywell Lane. The surface water features of the general area are detailed in Drawing 6479/ES-9-01.

There are no foul sewers in the main area of the Application Site with the exception of a small diameter foul sewer that provides drainage for Myford Village. This sewer bounds the existing housing and extends northwards to Horsehay to the rear of the properties. Doseley Pump Station, which has been recently refurbished by Severn Trent Water Authority, lies to the east of the Application Site on the east side of the Lightmoor Stream just to the north of Holywell Lane. It is believed that all properties within the application boundary are serviced by cesspits or septic tanks.

It is believed that surface waters from existing properties within the Application Site are discharged into soakaways or, where possible, discharge to existing watercourses.

Springs

A number of springs exist in the Application Site and are discussed as follows.

- Bath Spout Springs

  Several springs issue from the Lydebrook Sandstone along the foot of the bank on southern side of the small valley to the north of Woodlands Lane. The spring known as Bath Spout is located at NGR SJ 67503 06200 at an elevation of about 143mAOD. A second spring issues a few metres further up the valley. The combined flow from the two springs only flows for a distance of about 10 metres before disappearing into a broken concrete pipe.

  Further springs issue higher up the valley opposite a ruined building, which flow down the valley a short distance to combine with a low discharge from a clay pipe. The line of the pipe continues up the valley but the origin of the water is not known. The combined flow from the pipe and springs run down the valley, passing some distance from the stream issuing from Bath Spout, before crossing the Johnston Pipes perimeter fence to disappear into the fill material.

- Holywell Lane Springs

  Three potential springs have been observed on Holywell Lane. The first, located to the south west of the junction with Woodlands Lane, is only a minor seepage at the side of the track and may be associated with leakage from the adjacent property. To the north east of the junction, a small seepage occurs at the side of the track but a little lower down a spring issues from a pipe into a brick boxed structure. It is probable that this spring was used in the past to supply properties shown on the 1927 topographic map as being located along this lane. Water from the two springs flows along the side of the lane, to join the Lightmoor stream a short distance to the north east. It is notable that the position of the spring corresponds closely with the surface position of the Lightmoor Fault where Lower Coal Measures sandstones are juxtaposed against relatively impermeable Upper Coal Measures strata.

- Lightmoor stream "headwaters"

  The headwaters of the Lightmoor stream issue from two pipes of about 0.5 metre diameter which emerge from the Johnston Pipes landfill. One pipe is aligned in a westerly direction approximately parallel to the Johnston Pipes perimeter fence. The flow rate from the pipe is similar to the rate from Bath Spout spring. In view of the orientation of the pipe and flow rate, there is a

strong probability that it is the same pipe into which the Bath Spout spring flow disappears. The second pipe is orientated in a north easterly direction, towards the Johnston Pipes perimeter fence. Flow from this pipe is substantially greater. Discussions by BGS with Mr Musgrave (the Safety Officer for Johnston Pipes) indicate that the overflow from Horsehay Pool is culverted across the landfill area and is thought to exit in this vicinity. It was considered that some contribution to flow is also likely to originate from within the Johnston Pipes site. However, during BGS's site visit, no flow at the overflow in Horsehay Pool was observed, therefore the whole of the flow is likely to have originated from the Johnston Pipes site. This flow constitutes virtually the entire flow at the headwaters of the Lightmoor stream.

Ponds

A number of ponds are located in the vicinity of the Application Site although none actually exist within the Application Site. Horsehay Pool is not a natural feature but was originally a quarry. An overflow culvert is located at the south western corner of the pool, which may traverse the Johnston Pipes landfill area to emerge at the southern boundary of the Application Site, rather than near Holywell Lane as was stated by WS Atkins (reference 17).

The Doseley Quarry pool lies in the floor of the former basalt quarry, but much of the original area has been infilled to provide additional pipe storage areas for Johnston Pipes. Water levels in the pool are reported to fluctuate by 2 to 3 metres seasonally and it is considered highly probable that it is in hydraulic continuity with the Lydebrook Sandstone aquifer to the south. The elevation of the pool surface of about 140m AOD is consistent with this view.

The pools in the vicinity of Burroughs Bank are located within the Wildlife Site, outside of the Application Site. The water level in the western section of the pool, which straddles Burroughs Bank, is approximately two metres higher than that to the east and water runs across the track. This suggests that the culvert under the road is blocked. Discussions by BGS with a local resident, indicated that these pools did not exist as recently as 15 years ago, formerly having been a meadow used for grazing. This is supported by the 1920 and 1927 editions of topographic maps which do not show pools in the area. The resident worked at the former Shutfield Tile Works, which was located at the eastern end of the pools, and he reported that during the late 1960s a culvert was constructed across the site to prevent flooding. At that time the culvert was installed to drain water from the area of the ponds. Much of the area had also been subject to land filling. The ponds only started to form at about the time when the Ironbridge bypass, to the south of the area, was being constructed. It was thought that the culvert may have been damaged or partially blocked during road construction. This view may to some degree be supported in that much of the area formerly occupied by the tile works is boggy and some parts flooded. The whole area is heavily overgrown.

Both pools are situated on the outcrop of the Upper Coal Measures mudstones and clays and lie in depressions probably created by clay workings and mining waste spoil heaps.

Water Quality

The surface water analysis data obtained from the investigations indicate the surface waters (which are all outside of the Application Site boundary) to be of consistently good quality with no significant organic contaminants detected. Table 9.1 summarises the surface water monitoring data obtained from the three phases of investigation.

Table 9.1: Surface Water Analytical Data

Determinand	Number of analyses	Minimum concentration	Maximum concentration
Arsenic	21	<0.03	<0.03
BOD	21	1	7.5
Cadmium	21	<0.01	<0.01
Chromium (Sol)	21	<0.01	<0.02
COD	21	<5	63
Copper	21	<0.01	0.02
Cyanide	21	<0.1	0.5
Lead	21	<0.03	0.06
Mercury	21	<0.0001	<0.001
Nickel	21	<0.02	<0.02
pH	21	6.1	7.4
Phenols	21	<0.5	<0.5
Total Sulphate (S04) Dissolved	21	4.86	117
Sulphide (free S)	21	<0.2	0.4
TOC	21	2.8	132
Zinc	21	<0.01	0.12
Ammonical Nitrogen	21	<0.2	0.4
TPH	21	<0.2	1
TDS	21	108	521
Boron	21	<0.05	0.38
Selenium	21	<0.0002	<0.001

All units in mg/l unless otherwise stated.

Storm Water Capacity

A detailed analysis of the Lightmoor Catchment was carried out by WS Atkins in 1998 (reference 17). The study included consideration of water features beyond the Application Site and Wildlife Site including New Pool and Upper Furnace Pool located to the south and the Loamhole catchment, which also feeds into pools.

A combined hydrological and hydraulic assessment modelled the Lightmoor catchment and was utilised to analyse the flood regime both in the current form of the catchment and to take account of increased run-off resulting from any proposed development in the catchment including Lightmoor Village. This was calibrated by a flow and rain gauge survey.

The study highlighted the control on flow in the Lightmoor Stream exercised by the outlet at the New Detention Reservoir (to the south of the Application Site in the Wildlife Site), which was heavily silted, which results in available storage being rapidly filled, with subsequent overtopping of the reservoir surcharging flow in the culverted downstream section of the watercourse. WS Atkins concluded that additional run-off from the proposed development would cause these events to occur more rapidly, potentially leading to flooding downstream. Removal of siltation was however likely to provide greater control of flows, prevent overtopping and reduce downstream water levels, even if potentially increased flows from the proposed development were included.

It was also concluded by WS Atkins that increased flows from any proposed development were unlikely to have any significant effect on water levels in either New Pool or Upper Furnace Pool to the south of the development site. Increased flood levels were considered likely to occur at the Railway Bridge down stream of the culverted section of the watercourse.

Foul Water Capacity

Early meetings by Campbell Reith Hill with Telford & Wrekin Council, acting as agents for Severn Trent Water Authority, confirmed that the existing Myford sewers were at capacity and in poor condition, and also confirmed that the network to the north of the Application Site in Horsehay was also inadequately serviced by foul sewerage. Previous correspondence between the Council and WS Atkins confirmed that capacity was available in an existing foul sewer to the east of Castlefields roundabout. Discussions were held with the Council and subsequently Severn Trent Water Authority to discuss possible capacity in the Doseley Pump Station but it was confirmed that despite the recent reconstruction, there was no spare capacity due to confirmed storm water infiltration in to the system.

9.2.4 Hydrogeology

Regional Hydrogeology

The Carboniferous strata, which underlie the Application Site, form a complex multilayered aquifer in which the thicker, well cemented grits and sandstones effectively act as separate aquifers. The intervening horizons (mudstones, shales, fine clays and siltstones) act as aquicludes or aquitards. Groundwater movement and storage in the sandstone is predominantly through joints and fractures. Only minor intergranular flow is likely due to the well cemented and often massive nature of many of the sandstones. Borehole yields are dependent on the number, size and lateral extent of the fractures in the sandstone horizons penetrated. Yields are only rarely reported for boreholes penetrating the Carboniferous strata

in this area but appear to be generally in the range 0.5 to 1.5 litres per second (l/s) for very variable amounts of drawdown. High yields may occasionally be obtained where boreholes penetrate old workings. Initial yields are not always sustainable, sometimes declining with time as storage is depleted by pumping.

The underlying Coal Measures are described by the Environment Agency as a minor aquifer (reference 21) and the Environment Agency's Groundwater Vulnerability Map for the area (reference 22) also confirms the general minor aquifer status.

Local Hydrogeology

In terms of overall hydrogeological characteristics, the Application Site can be considered in two sections. To the west of the Stocking Farm Fault and within the Stocking Farm fault bounded block, the outcrop is almost entirely composed of Lydebrook Sandstone and Lower Coal Measures sandstones. The latter directly overlie the older Lydebrook Sandstone and in consequence are likely to form a single aquifer unit. Lower Coal Measures mudstones overlie the sandstones along parts of the western margin on the flank of Stoneyhill but the extent of this outcrop and very limited thickness of the mudstones is unlikely to be significant in terms of the hydrological regime in the area. The sandstones are underlain by the relatively impermeable Wenlock Shales, which locally form the base of the aquifer. On the northern fringes of the Application Site, the Little Wenlock Basalt outcrops. This is well jointed and likely to form an aquifer unit in hydraulic continuity with the underlying Lydebrook Sandstone.

The second section lies predominantly to the south east of the Lightmoor Fault but also includes the area to the south west of Stocking Farm underlain by Lower Coal Measures strata. A small area of Lower Coal Measures basal sandstones outcrop to the south west but are largely concealed beneath boulder clay. These sandstones are underlain by relatively impermeable Wenlock Shales, which constitute the effective base of the aquifer. The Upper Coal Measures strata that outcrop to the south east of the Lightmoor Fault are not likely to constitute a minor aquifer, although limited quantities of groundwater may be present in minor sandstone horizons. These conditions lead to the formation of ponds in low lying areas as a result of clay extraction or subsidence due to past sub-surface mining activities. It is also possible that natural hydrogeological conditions in this area have been modified by the effects of mining activities. Modification may have occurred either directly by the sinking of shafts, construction of adits and galleries or indirectly by the creation of or opening of fractures due to subsidence. This may hydraulically connect previously separate sandstone aquifer horizons that occur at depth beneath this area.

None of the superficial deposits present within the Application Site are likely to constitute an aquifer in their own right although it is possible that perched water tables may exist in some made ground deposits over impermeable clays.

Permeability

Permeability values from falling head tests or infiltration rates from soakage tests have been obtained from the 1998 and 1999/2000 investigations by Campbell Reith Hill / Exploration Associates (references 18 and 20). In general, values obtained from clay horizons and some sandstone horizons were of the order of 10^{-6} m/s, however permeabilities were considerably higher (ranging from 10^{-3} to 10^{-5} m/s) in the majority of sandstone intervals tested. The values of permeability obtained from all sandstones are generally consistent but are of an order which may be expected from very fine or silty sands rather than from well jointed sandstones. The reason for such low values may lie in the relatively narrow diameter of the boreholes which may not have penetrated many (if any) fractures. It is also possible that in the absence of borehole development, the drilling process may have clogged any fractures that were penetrated. Where clay strata were tested, these proved to be effectively impermeable during soakage tests.

The majority of the higher permeabilities and infiltration rates were measured in the area immediately to the south of Woodlands Lane, where borehole and trial pit records indicate that clays are either thin or absent. Drainage characteristics are likely to be good over the area to the south and much of the area to the north of Woodlands Lane.

Measured permeabilities and infiltration rates were at a minimum over much of the south west section of the Application Site, tests in the former opencast mining area (Second World War opencast mines), to the south of Stocking Farm, provided low infiltration rates in the made ground and clays. Drainage characteristics are likely to be relatively poor in these areas.

Groundwater Quality

The sampling data from the various investigations indicate that the underlying Carboniferous groundwaters are predominantly of calcium bicarbonate type. No distinction can be made between groundwaters originating from boreholes penetrating the Lydebrook Sandstones, Lower Coal Measures sandstones or mudstones. The analyses indicate waters of good quality with there being few indications of groundwater contamination. None of the analyses are indicative of contamination by mine waters. Table 9.2 summarises the groundwater monitoring data from the three phases of investigation.

Table 9.2: Summary of Groundwater Analytical Data

Determinand	Number of analyses	Minimum concentration	Maximum concentration
Ammonia	38	<0.2	<0.2
Arsenic	57	<0.001	<0.03
BOD	57	<0.1	5.5
Cadmium	57	<0.05	<0.01
Calcium	42	0.4	63
Chloride	42	10	471
Chromium (Soluble)	36	<0.02	<10
Chromium (hexavalent)	4	<0.02	<0.02
COD	57	<5	470
Copper	36	<0.01	0.01
Cyanide	36	<0.1	<0.1
Lead	36	<0.03	<0.03
Magnesium	42	0.6	95
Mercury	57	<0.0001	<0.001
Mineral Oils	17	<100	12,000
Nickel	36	0.02	0.04
PH (units)	57	4.6	7.2
Phenols	57	<0.05	0.26
Potassium	42	0.06	14
Sodium	42	0.02	16.1
Sulphate (Dissolved)	38	10.6	110
Sulphate (Total S)	19	10.6	447
Sulphide	17	<0.5	2.4
TOC	57	0.33	30
TON	38	0.11	9.6
Zinc	36	<0.05	0.16
TPH	19	<0.2	0
TDS	19	170	1,180
Boron	19	<0.05	0.81
Selenium	19	<0.0001	<0.001
Iron	4	<0.01	4.27
Alkalinity	38	<5	250

All units in mg/l unless otherwise stated.

Leachate Contamination from Landfill Sites

Several landfill sites exist is the vicinity of the Application Site, as detailed in Drawing 6479/ES-9-02. Appraisals of the risk of groundwater contamination due to leachate migration have been undertaken and can be summarised as follows:

- Stoneyhill Landfill

  Monitoring and sampling from Stoneyhill landfill by Charles Ruxton on behalf of Telford & Wrekin Council has confirmed that the landfill is producing significant quantities of leachate (reference 23). A leachate collection system has been installed at the site post-completion, and on-going monitoring of the perimeter wells is regularly undertaken. Uncertainty exists regarding the basal lining of the landfill, however the monitoring data from Charles Ruxton indicates that leachate piezometric levels in the landfill are appreciably higher than in the adjacent aquifer, suggesting that the impermeable mudstone layer beneath the fill has retained its integrity. Groundwater monitoring in the vicinity of the landfill (eg. boreholes 6, 10, 11, 104, 210, 214, 219, 220, 232 and 234 - see references 1 to 16, 18 and 20) have not detected any evidence of leachate contamination. WS Atkins' risk assessment of the landfill (reference 14) also concluded that there is no evidence to suggest that migration of leachate from Stoneyhill has occurred, and that is poses a low to very low risk to the adjacent Application Site.

- Johnston Pipes Landfill

  Groundwater monitoring in the vicinity of the landfill (eg. boreholes 4, 7, 8, 208, 213, 216 and 218) has not detected any evidence of leachate contamination. WS Atkins' risk assessment of the landfill (reference 16) found no evidence to suggest that migration of leachate from the Johnston Pipes landfill is occurring.

- Second World War Opencast Mines

  Groundwater monitoring in the vicinity of these infilled sites (eg. boreholes 14, 15, 107 and 109) has not detected any evidence of leachate contamination.

- Shutfield Landfill

  Groundwater monitoring in the vicinity of this landfill (eg. boreholes 105, 109 and 110) has not detected any evidence of leachate contamination. WS Atkins' risk assessment of the landfill (reference 12) concluded that the geological setting of the landfill has a low ability to transmit potential contamination to the Application Site and that the potential for leachate having high levels of contamination is very low.

Recharge

The Application Site to the north west of Stocking Farm Fault and in the immediate vicinity of Stocking Farm, is almost devoid of significant surface drainage features. The absence of run-off suggests that the soils and superficial deposits are sufficiently permeable to readily permit infiltration and recharge. Superficial clay deposits of appreciable thickness are widely present over the south western and north eastern sections of the Application Site. These clays are likely to inhibit but, in the absence of surface water features, not prevent infiltration and aquifer recharge.

Thicknesses of made ground and clay are considerably greater in the fault bounded former open cast mining area to the south west and south of Stocking Farm. The superficial deposits are underlain by Lower Coal Measures mudstones and recharge to the deeper sandstones is unlikely, although a perched aquifer level may exist in the fill materials. To the south west of this area small 'windows' of sandstone exist in the boulder clay cover through which aquifer recharge may occur.

To the south east of the Lightmoor Fault beyond the Application Site, the Upper Coal Measures are predominantly argillaceous in nature. The presence of pools in low lying areas and boggy ground conditions suggest that recharge in this area is limited and that groundwater is retained only in the uppermost weathered mudstone horizons. Poorly drained, very boggy ground conditions also exist in an area within 100 to 150 metres of the Stoneyhill landfill site. Such conditions are likely to have been caused by the stockpiling of overburden in these areas during open cast mining, some of which was not removed during back filling.

Groundwater Levels

Piezometric contours based upon BGS's interpretation of the investigation data (reference 19) are detailed in Drawing 6479/ES-9-03. The piezometric contours are largely a subdued reflection of surface topography. To the north west of Stocking Farm Fault the water table elevation is greatest in the vicinity of Stoneyhill and along the line of the Horsehay bypass, with gentle gradients to the south east and north east towards Doseley Quarry. This distribution of head suggests that recharge occurring to the north west of the by pass would flow into the Lightmoor area. A discharge zone exists at the Bath Spout group of springs located along the line of the small valley to the north of Woodlands Lane and at springs located along Holywell Lane. Although outside the Application Site, it is anticipated that there is a decline in water levels to the west and south west of Stoneyhill towards Loamhole Brook, which in its upper reaches would almost certainly be in hydraulic continuity with groundwater contained in the Lydebrook Sandstone.

Over much of the Application Site, there is an unsaturated thickness of at least 5 metres below ground level. The water level data have permitted a better definition of water level variations in the vicinity of Stocking Farm Fault, although some uncertainty remains regarding the effect of the fault on groundwater flow in its vicinity. The groundwater gradient in the vicinity of the fault and the

subsidiary parallel fault is considerably steeper than to the north west of the fault, indicating that the fault zone is likely to act as a partial barrier to groundwater flow. To the south east of the fault zone within the fault bounded block to the south of Stocking Farm, the pattern of water levels remains confused probably due to the highly variable nature of the material used to backfill the former open cast mining area.

The limited water level data to the south east of the Lightmoor Fault suggests that this fault has little effect on groundwater levels or flow directions. Groundwater gradients appear to continue to decline to the south east of the Application Site. Available information also suggests that the Stoneyhill Fault is likely to have little (if any) effect on groundwater levels or flow.

Surface coal mining has not occurred in the area for many decades. Water level recovery in response to the cessation of mine drainage is complete and there are no recorded occurrences of overflowing shafts or other workings within the study area. An examination of old mine working maps of the area indicates the presence of a sough or drainage adit which was driven northward at a shallow angle from the valley bottom somewhere to the east of Lightmoor Junction, in order to drain shallow workable coal seams. The sough extends northward to the Dawley area and appears to be connected to a cross adit, which extends almost to the Lightmoor Fault in the vicinity of Holywell Lane. It is possible that this sough may still be operational and would maintain water levels, in some parts of the Coal Measures to the east of the fault, at a lower level than would occur naturally.

Groundwater Abstractions

An examination of groundwater abstraction licence listings obtained from the Environment Agency indicates that there are no abstractions in the general vicinity of the study area. A single licence was held by Pioneer Concrete (UK) Ltd to abstract from surface waters on the south eastern margin of the area, however this is now closed.

Historical maps indicate many wells to be present in the general area, although they are predominantly located outside the Application Site (see Drawing 6479/ES-7-04). One well is located at Stocking Farm. Many if not all, of the locations of these wells appear to have originated on the 1920 edition of the topographic map of the area. The current condition/use of these wells is not known and such supplies are generally not subject to licensing by the Environment Agency (being below the licence threshold on 20m³/day).

9.3 ANALYSIS OF PREDICTED IMPACTS

9.3.1 Impacts of the Development on the Hydrology and Hydrogeology

General

The development will result in a built area of approximately 28 hectares which will introduce hardstanding and structures over much of the area. The principal hydrological/hydrogeological effect of the introduction of considerable paved areas due to development will relate to the potential creation of a much increased volume of surface run-off where currently there is little or none, combined with a decrease in aquifer or groundwater recharge. The only practical receptor for surface water discharges is the Lightmoor Stream to the east of the Application Site, which as noted above, is incapable of supporting additional run-off from the general area without additional surcharging and flooding or continuing maintenance works to the New Detention Pond. Two options for the treatment of surface waters have been considered: the use of 'in line' piped systems and the application of sustainable drainage systems.

'In Line' Surface Water Drainage

The catchment study carried out by WS Atkins (reference 17) assumed that all surface water drainage was collected in a network of storm water drainage pipes and discharged to the Lightmoor Stream just to the north of the New Detention Pond via a spillway. As noted above, this would result in significant impacts on the downsteam reaches of the Lightmoor Stream, unless the flows were held back on the Lightmoor site by attenuation ie. the storage of storm waters either 'on line' through oversized pipes or 'off line' by balancing ponds.

The impacts of the traditional type scheme without attenuation would be as follows:

- Impact on the maintenance requirements within the New Detention Pond which would continue to silt up through existing discharges from Johnston Pipes and new discharges from the Lightmoor catchment. The increased maintenance would impact on the existing marshy wetlands around the New Detention Pond which are within the Wildlife Site (see Section 6.0); and
- Potential impact on the Lightmoor Stream including the Burroughs Bank sewer and Brickworks culvert including flooding of properties on Burroughs Bank.

Mitigating against these impacts could involve reconstruction of existing sewers through the Wildlife Site or the carrying out of major desilting and reconstruction of the New Detention Pond. However, these mitigation measures in themselves would also have a significant impact due to the disruption and potential damage that would be caused to the Wildlife Site. The alternative measure as already noted would be the application of on-site attenuation.

The use of on-site attenuation would increase the size and depths of pipe construction on the Application Site, resulting in increased levels of construction activity, excavation and soil disposal, particularly along Holywell Lane between the junction with Woodlands Lane and the Lightmoor Stream. A pipe of at least 750mm diameter would need to be constructed in a lane which narrows to approximately 2.5m in this area. This would impact on the nature of the lanes and the hedgerows, which have been identified as being of significant nature conservation importance (see Section 6.0).

With respect to the impact of the traditional drainage system on the underlying groundwaters, the BGS report (reference 19) concludes that removal of the run-off from the Application Site would undoubtedly reduce the volume of aquifer recharge potentially leading to a long term reduction in groundwater levels in the vicinity of the development. The main visible effect of this would be a long term decline in spring discharges in the vicinity of Bath Spout along Holywell Lane and possibly in the upper portions of the Lightmoor Stream. It is considered that the springs and associated watercourses may dry completely, particularly during the summer months, resulting in potential changes to the existing habitat in the Bath Spout valley. From the available information, an impact on the Wildlife Site and its ponds is considered unlikely because this area does not receive surface water or groundwater flows from the proposed Application Site, although reduced groundwater levels in the general area may reduce the water volumes flowing through the Wildlife Site from the Lightmoor Stream. There may also be an impact on any private domestic sources used in the area down-groundwater gradient from the development, which may experience a derogation of water levels, yield and potentially water quality with time.

Sustainable Urban Drainage Systems (SUDS)

Sustainable urban drainage is the application of a range of techniques combining the attenuation of storm water flows at source and the infiltration of storm waters into the soil horizons to minimise the impact on existing management networks and the need for reinforcement of these networks. The application of SUDS aims to minimise the impact of urban development of a catchment, which can have major effects on existing hydrological regimes. The BGS report (reference 19) confirmed that it is feasible to utilise a range of infiltration methods such as ditches, swales and porous pipe in trenches (linear infiltration) and dry ponds and soakaways (point infiltration), as well as plain infiltration through open textured or grassed surfaces.

It is probable that the use of infiltration methods (with the possible exception of plain infiltration) would be likely to increase the total quantity of aquifer recharge over the year, and this is seen as the principal beneficial impact that could occur by using this method of drainage. Recharge during the winter months is likely to be very similar to that which would occur under natural conditions. Aquifer recharge events may also occur during the rest of the year, particularly in response to storm events. Under natural conditions rainfall occurring during the non-winter months will not usually cause aquifer recharge due to a combination of soil moisture deficit and high evapotranspiration. The use of infiltration methods will generally place run-off beneath the soil zone in which

evapotranspiraton occurs. This will promote aquifer recharge during heavy rainfall at all times of the year, rather than just during the winter months as would occur naturally. Groundwater levels are therefore unlikely to fall as much during the summer months (except in dry years) and spring discharges are likely to be maintained at higher rates throughout the year. This in turn could lead to slightly higher summer flow rates in water courses but not of sufficient additional volume to have any noticeable effect on the area.

This impact, although arguably desirable in overall terms, will be minimised by designing for 80% of all roof water to be collected and utilised for either rainwater recycling within the properties or disposal within the curtilage of the properties within the evapotranspiration zone by soakaways via a waterbutt which would be available for garden watering. It is therefore considered that the overall impact of the application of the SUDS system will be beneficial.

Further reduction in impact will be the attenuation of flows remaining within the linear system that will be provided to ensure that extreme water events can safely remove water flows. It is considered that there will be no significant impact on the Lightmoor Stream, the New Detention Pond or the Wildlife Site as a result of the application of the SUDS system. Some continued maintenance of the New Detention Pond will be required but this will be of the same magnitude as is currently required, as the flows into the pond are likely to be of a similar order to the existing surface and groundwater flows.

Construction impact will be significantly reduced as a result of the smaller diameter pipes and the shallower construction depths required.

Foul Drainage

The foul water drainage will be designed and installed to adoptable standards in accordance with the requirements of the water authority. The route of the sewers have been designed to avoid the Wildlife Site and other areas of ecological value such as the Dingle. No significant impacts from the construction of the foul drainage are anticipated.

9.3.2 Contamination Impacts

The source of the pollutants within surface run-off varies but includes debris deposited on roads, pavements and industrial areas and organic debris on roofs. Contamination can comprise of oil, rubber, dust, heavy metals and other debris from cars and lorries. Spillage of goods and chemicals or refuse and organic waste, whether unintentional or deliberate, can add to the problems. Whatever the source, higher levels will occur in surface water run-off during storms when pollution is rapidly transported by storm waters into the drainage systems and ultimately watercourses and rivers if effectively interceptors are not built into the system.

In the context of the proposed development, extensive contamination is not anticipated given the proposed end-users.

9.3.3 Impacts During Construction

The principal impact on the hydrology that could arise relates to the potential risk of contamination due to accidental releases or spillages of chemicals such as fuels. The principal receptor will be the surface water features, however all construction works will be undertaken remote from these therefore the risk is considered to be negligible. In terms of spillage to ground, potential risk to groundwaters do exist however these can be prevented by appropriate site management and vigilance. The contamination risk due to construction is therefore considered to be negligible.

9.3.4 Impacts due to Mining Activities

No evidence from the groundwater quality data indicates acid mine drainage to be present, and no evidence of rising mine water levels has been encountered. Consequently, no impacts are considered to exist from the historical mining activities.

9.3.5 Impacts due to Adjacent Landfills

No evidence of water-borne contaminant migration from the landfills in the vicinity of the Application Site has been encountered. Consequently, no impacts are anticipated.

9.4 MITIGATION

9.4.1 Storm water Drainage

i. Development Planning - The principal mitigation relates to the selection of the type of surface water drainage. BGS concluded in their hydrogeological desk study (reference 19) that:

"the use of infiltration drainage systems in combination with rainwater collection and use is considered to represent the option which is likely to minimise to impact on the hydrogeological regime. This option is unlikely to significantly reduce winter recharge but would put to an alternative use some proportion of additional recharge which could occur during the drier part of the year."

Therefore, a sustainable urban drainage option is being adopted at the site, much of which has been discussed in Section 9.3.1.

ii. Design and Maintenance - Run off will be attenuated to remove any significant impact on the Lightmoor Stream by the application of SUDS techniques designed and built to adoptable standards. All storm water will be designed in accordance with 'Sewers for Adoption', 5th Edition (published by the Water Authority Association) for 1 in 2 year storm frequencies with infiltration trenches, blankets and ponds to be designed in accordance with CIRIA Report 156 'Infiltration Drainage - Manual of Good

Practice'. Soakaways will be designed in accordance with BRE 365. All infiltration elements will be designed for a 1 in 10 year storm event and the whole system would be designed not to flood in a 1 in 30 year storm event.

iii. Contaminants - Interceptors will be incorporated in the SUDS system to deal with major spillages of contaminants. The impact of minor spillages will be controlled by the widespread use of permeable paving systems to catch pollutants and provide in-situ treatment. Organic matter will be screened by geotextile membranes within the permeable paving system and will be held within layers of small diameter stone to allow breakdown through anaerobic action. The organic matter assists the removal of hydrocarbons, rubber dust and metals by trapping contaminants within the permeable paving. Organic matter from roofs will be removed from water recycled by filters within the recycling system.

iv. Management - A 'users manual' will be provided to all householders explaining the use of recycled water and the application of SUDS, outlining the importance of the proper treatment of waste materials in accordance with Local Authority requirements.

9.4.2 Foul water Drainage

i. Development Planning - The principal mitigation relates to the route chosen for the foul water drainage which avoids the Wildlife Site and other areas of ecological value.

ii. Design and Maintenance - Drainage will be designed and constructed to adoptable standards. The proposed foul sewerage will consist of a traditional gravity system with sewers generally following the main road network of the village, from where it will discharge by gravity to a foul water pumping station on the Lightmoor Bypass to the south east of the Dingle. Two areas of the village will require pumping stations and rising mains to access the main gravity system.

9.4.3 During Construction

During construction, all works will be subject to an environmental management plan which will identify potential environmental hazards during construction and ensure that appropriate methods of work are adopted. The plan will cover the risk of environmental contamination, and will require constant vigilance and co-operation from on-site operatives. Standard requirements will include the appropriate bunding of all tanks and holding drums, temporary bunding to control unauthorised releases of sediment-laden waters and phasing and planning to ensure all construction related activities and movements are kept isolated from surface water features.

9.5 STATEMENT OF SIGNIFICANCE

A number of investigations and appraisals have been undertaken of the hydrogeological and hydrological/drainage characteristics of the Lightmoor area. These have confirmed that the Application Site is free from any significant surface watercourses and drainage features, and that infiltration and aquifer recharge (of the complex Lydebrook Sandstone/Lower Coal Measures minor aquifer) represents the principal drainage mechanism. The quality of groundwaters beneath the site is good and the waters show no evidence of impact due to either leachate migration from the landfills or from the former mining activities. To the east of the site exists the Lightmoor Stream, whose catchment does not include the Application Site. The Lightmoor Stream contributes to the wetland features and habitats which are characteristic of the Wildlife Site. These features are independent of the Application Site's current hydrological regime.

The principal hydrological effect of development will be the introduction of considerable areas of paving and therefore the increased volumes of surface water run-off. Two options for surface water drainage have been considered, namely 'in line' surface water drainage and sustainable urban drainage systems (SUDS). 'In line' could result in the discharge of the increased run-off into the Lightmoor Stream catchment with subsequent impacts including flooding, surcharging and silting of the New Detention Pond, as well as reduced aquifer recharge, which combined could affect the Wildlife Site and local groundwater abstractions and springs. SUDS would prevent these effects, with the only possible impact being an increase in aquifer recharge in the Summer months although this would partially be offset by designing for rainwater recycling. Consequently, SUDS is the option most likely to minimise any development-related impacts and is to be used as part of the development. With respect to foul drainage, waters are to be piped to the existing off-site network where sufficient capacity exists. The principal mitigation measure will be the routing of the foul drainage away from the Wildlife Site. Potential contamination impacts will be appropriately mitigated against both during and after construction. Table 9.3 summarises the hydrogeological, drainage and hydrological impact appraisal.

Table 9.3: Summary of Hydrogeological, Drainage and Hydrological Impacts

Potential Impact	Type of Impact	Nature	Importance	Significance of impact without mitigation	Significance of impact with mitigation
Impact on existing surface water network	Adverse	Long term, reversible	Local	Medium to high	Low to negligible
Impact on hydrogeology	Adverse	Long term, irreversible	Regional	Medium	Low to beneficial
Impact on the Wildlife Site	Adverse	Long term, irreversible	Regional	Medium	Negligible
Loss of hedgerows	Adverse	Long term, irreversible	Regional	Medium to high	Low to medium
Impact on Badgers	Adverse	Long term, reversible	Local	Low to medium	Low
Impact on existing foul drainage network	No impact predicted	-	-	-	-
Impact of construction related contamination	Adverse	Short term, reversible	Local	Low to medium	Low
Impact of long term related contamination	Adverse	Long term, reversible	Local	Low	Negligible
Impact due to adjacent landfills	No impact predicted	-	-	-	-
Impact due to historical mining activities	No impact predicted	-	-	-	-

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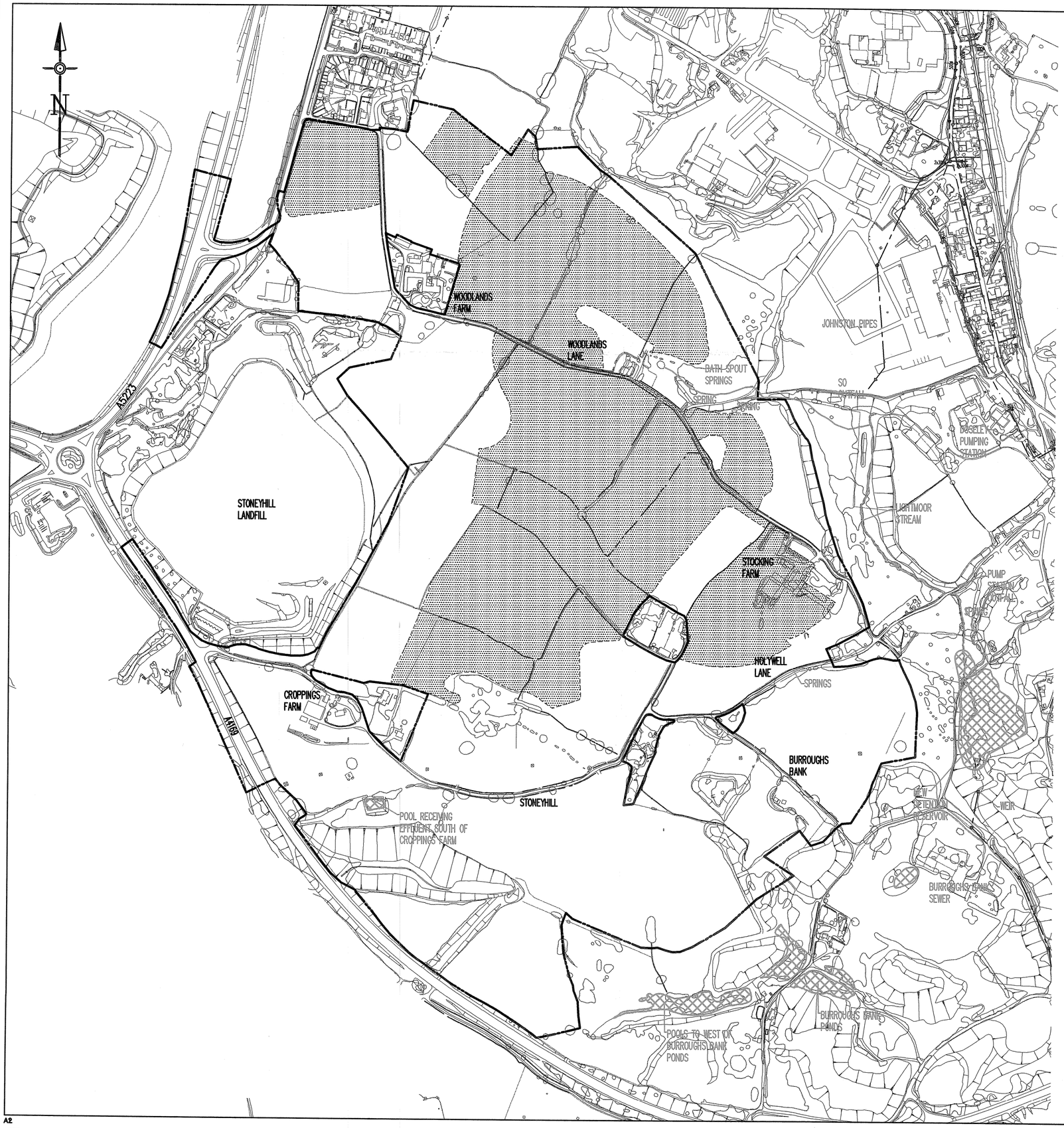
20. Exploration Associates (January 2000), Factual Report on Ground Investigation, dated January 2000, New Bournville Village, Telford, ref: 119359.

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24. Campbell Reith Hill (March 2000), Drainage Design Statement, ref: 6479.



LEGEND

GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

HYDROLOGICAL FEATURES:

- POND
- EXISTING STREAM/CULVERT
- EXISTING STORM WATER SEWER & MANHOLE
- EXISTING FOUL WATER SEWER & MANHOLE

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   D :- DESIGN DEVELOPMENT — Evolving final design drawings for approvals, tenders, billing etc.

   C :- CONSTRUCTION — Fully developed drawings issued under instruction for construction.

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Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

EXISTING HYDROLOGICAL & DRAINAGE FEATURES

drawn	date	scale	CI checked	CAD filename
SA	FEB'02	1:4000	-	ES-9-01-D1

Job No.	Drg No.	Status/Revision
6479	ES-9-01	D1

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LEGEND

GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

LANDFILL LOCATIONS:

- LANDFILL AREAS
- APPROXIMATE EXTENT OF "STONEYHILL OPENCAST" APPLICATION AREA (APPLICATION No: W89/1351 DATED 27/10/89 FOR EXTRACTION OF RESIDUAL COAL & BACKFILLING)

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LANDFILL SITES

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LEGEND

GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)
- GEOLOGICAL FAULT LINES APPROXIMATE POSITION OF FAULTAS SHOWN ON BRITISH GEOLOGICAL SURVEY MAP MARK INDICATES DOWNTHROWN SIDE
- GROUNDWATER CONTOURS (m AOD) BASED UPON DECEMBER 1999 MONITORING DATA

N

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Job Title: LIGHTMOOR VILLAGE, TELFORD

Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

APPROXIMATE GROUNDWATER CONTOURS (mAOD) FOR DECEMBER 1999

drawn	date	scale	C1 checked	CAD filename
SA	FEB'02	1:4000	-	ES-9-03-D1

Job No.	Drg No.	Status/Revision
6479	ES-9-03	D1

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10.0 TRAFFIC AND TRANSPORTATION

10.1 INTRODUCTION AND POTENTIAL IMPACTS

New built development, whether residential or commercial, will result in a change in traffic movements and volumes across the local, and some cases, regional transport network. Such changes can be both positive and negative, and vary in geographic scope.

A new development will attract new traffic movements on a local scale, and in an area of new build, this can make an important difference to existing traffic levels. Alternatively, the positioning of a new development where residential and employment functions are integrated can have positive effects on regional movement in the longer term, since journeys to work using the existing transport network may be reduced.

Impacts associated with changes in traffic flows affect various facets of the environment:

- Noise: an increase/decrease in traffic volume can have a profound effect upon levels of noise. However, this impact is limited to large changes in traffic flow. As a general rule, in order to effect a change in noise levels of 1 dB, the lowest perceptible level of change, a related change in traffic flow of 25% is required. Similarly, a doubling of traffic is expected to result in a change in noise levels of 3 dB, in real terms limit of perception for most people. Noise impact is considered in detail in Chapter 12.0.

- Air quality: changes in the traffic flow upon roads may have a significant impact upon local air quality, affecting human health. The air quality screening methodology suggests that changes in traffic flow of less than 100 vehicles per hour will result in an imperceptible change in air quality. The characteristics of traffic movement, including average speed and the effect of junctions have a significant impact upon the generation of air pollutants from vehicle exhausts. Air quality impact is considered in detail in Chapter 11.0.

- Disruption of the highway network: the highway network surrounding any development can be sensitive to changes in the level of traffic. The capacities of junction and road links can be at risk of exceedance , giving rise to queuing and thus disruption to existing journey times. It is this aspect that forms the focus of this chapter.

10.2 BASELINE SURVEY

A Transport Impact Assessment (TIA) has been undertaken by Campbell Reith Hill (reference 1) to assess the likely effects of the proposed development upon the surrounding area. This study has sought to assess the ability of the local highway network to accommodate the development in terms of traffic capacity and safety.

The methodology for the assessment was developed in accordance with consultations undertaken with Telford & Wrekin Council, and focussed upon access to the Horsehay Bypass (A5223), the Stoneyhill staggered junction onto the Ironbridge Bypass (A4169), and the Jigger Lane roundabout (A5223 and A4169). The full TIA is included in Appendix F.

The baseline survey has been based upon results obtained for the ARCADY 5 and PICADY 4.1 traffic models. In order to provide base data upon which the models can run, a traffic survey was commissioned from Count On Us Ltd, a specialist survey company. Following consultations with Telford & Wrekin Council, the manual classified counts were undertaken at three points.

- Junction of the A5223 and Wellington Road
- Roundabout at the intersection of the A4169 and the A5223 (Jiggers Roundabout)
- Junction of the A4169 and Stoneyhill

The survey was undertaken between the hours of 0730 - 0930 and 1630 - 1830, on 2nd December 1999. Data recorded included light vehicles, heavy vehicles, public service vehicles and pedal cycles. A time interval of 15 minutes was used.

The study required the calculation of anticipated development related traffic generation and the expected general traffic growth. Data was produced for future years using growth factors considered appropriate by the local highway authority (4%). From these, base forecasts were estimated, which are aggregated with new traffic movements to assess junction and road capacity.

10.3 ANALYSIS OF PREDICTED IMPACTS

10.3.1 Junction Capacities

The development has been designed to provide access to the north, onto the A5223, and to the west, onto the A4169. Existing lanes are maintained, but only for use by local traffic, pedestrians, cyclists and horses. The PICADY results show that the existing A5223 junction has sufficient capacity to accommodate the traffic flows generated by the village development, and those related to the forecast growth in national traffic.

The use of Stoneyhill as the western access will offer some relief to the northern access, although will require the introduction of a single lane dualling layout to enable the junction to operate safely.

Further analysis incorporating development traffic from possible additional, unconnected development (namely the expansion of the Johnston's Pipes plant, and new commercial development on land parcels north of the Application Site, known as "White Land") shows that with the village development and the Johnston's Pipe expansion, the A5223 junction remains adequate, but the application for additional commercial development of White Land pushes the junction beyond capacity.

The proposed new western access at Stoneyhill, being a secondary access, remains well within capacity, for all potential developments.

The Jiggers roundabout was assessed as having a high level of spare capacity in all future traffic scenarios.

10.3.2 Road Capacity

Using published design guidance (DETR - TA 46/97: Traffic Flow Ranges for Use in Assessment of New Rural Roads), the assessment further sought to classify the available capacity of the A5223 and A4169, the main roads surrounding the Application Site. Peak hour flows were calculated as being 1267 vehicles, with the peak hour capacity calculated as 2160. Therefore, the two major routes are sufficient to accommodate any anticipated increase in traffic flows.

10.4 MITIGATION

10.4.1 Junction Capacity

The assessment identified a potential exceedence of junction capacity at the northern access junction with the A5223. This would result in excess vehicle queues, during one or both, of the AM and PM peak hours. In order to reduce this potential impact, a further series of calculations was carried out to assess the mitigation potential of upgrading the junction to a roundabout access.

The resulting Ratio Flow Capacity (RFC) calculations show that the adoption of a roundabout increases available junction capacity, and thus eliminates the predicted excess vehicle queues. All improvements can be carried out within the existing highway boundaries and there is therefore no impact upon adjacent land.

10.4.2 Traffic Reduction Measures

Traffic reduction measures are proposed to reduce planned traffic generation and include the following:

- High to medium density development with local shopping, school and community facilities to minimise trip generation beyond the village to the surrounding areas, and encourage non-car use.

- A network of new cycle and pedestrian facilities designed to encourage and sustain safe pedestrian and cycle movements both within the village and the surrounding areas, to facilitate the adoption of a Development Travel Plan and Safe Routes to Schools policy.

10.4.3 Development Travel Plan

As part of the efforts to adhere to the principles of sustainability, a travel plan for the village will be developed, and implemented from first occupancy.

Travel plans have the potential to provide "a major contribution to easing congestion, especially during the rush hour" (reference 2), and as such form a major element of government transport policy. Effective sustainable development requires that the principle of subsidiary is followed, i.e. that initiatives take place at the lowest level possible, to be effective. Thus, locally focussed initiative such as travel plans seek to encourage individual organisations to organise their travel habits in a manner to minimise adverse environmental impacts.

By providing a co-ordinated strategy to reduce car use, a travel plan can result in economic, environmental, social and health benefits, whilst avoiding adverse effects upon the organisation/individuals taking part.

Benefits of Travel Plans are detailed below:

- Reduction in car usage (particularly single occupancy journeys) and increased use of public transport, cycling and walking;
- Reduce traffic speeds and improved road safety and personal security particularly for pedestrians and cyclists; and
- More environmentally friendly delivery and freight movements, including home delivery services

In the context of the village development, various individual travel plans will be necessary to ensure that efforts by organisations are focussed where they are most efficient. However, it is possible for an overarching strategy to inform the development of these individual plans. Therefore, the principal features of the Development Travel Plan are:

1) Appointment of a Travel Plan Co-ordinator, with following responsibilities

- Appointed from within the Joint Venture Partnership
- Preparation and distribution of a Travel Options Leaflet (see below)
- Acting as a point of contact and information for people living and working within the development
- Setting up and maintaining a car sharing register (see below). This register will be available for local residents and those working and visiting retail units and learning centre
- Being responsible for introducing, maintaining and updating Sustainable Travel Notice boards in the development
- Evaluating, monitoring, and updating the Plan
- Liaising with bus service providers and Telford & Wrekin Council
- Liaise with Telford & Wrekin Council to develop Safe Routes to Schools.

2) Production and Distribution of a Travel Option Leaflet, to include

- Map of the development, bus routes and links to the railway station.
- Description of distance, time cost and routes to travel from the development to Telford Town Centre and railway station by cycling, taxi and bus

- Information about bus, train and taxi services
- Delivered to all residents, employees, and regular visitors
- Updated periodically by Travel Plan Co-ordinator

3) Car Sharing scheme

- Reduce single occupancy of vehicles
- Establish and maintain register of interested participants

4) Encourage cycling

- The development includes a network of cycleways, with good links to areas beyond the village
- Provision of secure, well lit and conveniently located cycle parking at key public buildings
- Provision of showers, changing facilities, and secure storage within these buildings

5) Encourage walking

- New and improved footpaths to facilitate pedestrian movement
- New network provides good linkages to surrounding area
- Secure and safe walking routes

6) Introduction of new bus service

- Encourage increased use of public transport for business and private use
- In partnership with Telford & Wrekin Council, and bus operators Arriva, new services will be implemented
- Diversion of existing services initially, followed by the introduction of a 30 minute service in the 3rd year

10.4.4 Safe Routes to School

Journeys to schools are increasingly being conducted via cars, rather than the more "traditional" methods of cycling, walking and by bus, leading to an increase in peak time traffic flows on the road network.

In order to address this increased dependence upon private transport, the Safe Routes to Schools programme has been developed. A community initiative, the programme seeks to:

- encourage more people to walk and cycle to school safely
- improve road safety and reduce child casualties
- improve children's health and development
- reduce traffic congestion and pollution

In order to support this initiative, the Joint Venture Partnership aims to contribute to the well being of children by:

- Introducing cycling initiatives

  The village will be integrated with existing cycle routes with the construction of a new cycle path linking the primary school with the surrounding areas. Other measures including provision of lockers and cycle racks, a Safe Routes newsletter and a bike maintenance scheme run through the school.
- Introducing walking initiatives

  The school will be linked with existing footpaths, and a "walking bus" scheme possibly introduced.

- Pedestrian training

  All pupils will attend a classroom based pedestrian safety education programme, with volunteer parents providing practical training

- Off-site road improvements

  Routes to the village school, and those schools beyond the development will be reviewed in conjunction with Telford & Wrekin Council and safety enhancing localised improvements undertaken, e.g. footpath widening, improved signage and crossing facilities.

10.5 STATEMENT OF SIGNIFICANCE

The results of the detailed TIA undertaken shows that with mitigation the capacity of the junctions and roads surrounding the Application Site will not be exceeded by the construction of the development, or any further, unconnected, development of proximate land parcels (Johnston's Pipes, and White Land). The junction with the A5223 is potentially at risk of overload, but the adoption of a roundabout at this point will remove this risk and provide sufficient spare capacity to accommodate future traffic growth. Traffic reduction mitigation measures such as dense, sustainable mixed use development and the provision of a planned, safe and efficient pedestrian and cycle network, complemented by a Development Travel Plan and Safe Routes to School scheme serve to reduce future traffic levels, and attempt to achieve a modal shift away from vehicular reliance. Therefore, the negative impact of the proposed development upon the traffic network is considered to be low to negligible, with potential positive impacts caused by the initiatives included within the village design. Table 10.1 summarises the transport impact appraisal.

Table 10.1: Summary of Transport Impacts

Potential Impact	Type of Impact	Nature	Importance	Significance of impact without mitigation	Significance of impact with mitigation
Impact on traffic growth	Adverse	Long term, irreversible	Local	Low to Medium	Beneficial
Impact on junction capacities	Adverse	Long term	Local	Low to medium	Low to beneficial
Impact on road capacity	No impact predicted	-	-	-	-
Impact of modal shift	Beneficial	Long term	Local	-	-

REFERENCES

1 Campbell Reith Hill, Transport Impact Assessment Report, April 2002, ref: 6479.

2 A New Deal for Transport: Better for Everyone, 1998

13.0 LANDUSE

13.1 INTRODUCTION

As part of any development, it is necessary to appraise the environmental effects which development can have on primary land uses, which in general do not include the built environment. The variety of land uses affected need to be considered, which for the proposed village relate primarily to agriculture and recreation.

The protection of the best and most versatile agricultural land, the appearance of the countryside and the maintenance of the rural economy remain essential considerations as part of any proposed development. With respect to recreational uses, it is necessary to clarify the nature of the land, and any associated conservation, landscape or other heritage value it may have. In this respect, the recreational proposals of the development, the ecological and landscape considerations and the heritage value are covered in other chapters of this Statement.

13.2 BASELINE SURVEYS

13.2.1 Background

The site conditions, setting and history of the Application Site are described in detail in Chapters 2.0 (Site Description), 4.0 (Description of the Proposed Development) and Chapter 15.0 (Cultural Heritage). The Application Site has a strong industrial heritage and has had a long history of extractive industry, although more recently it has been used for low intensity agricultural use, mainly grazing. There are a number of residential properties on the Application Site, including properties at the western and eastern ends of Stoneyhill Lane, and at and adjacent to Woodlands Farm, at the northern end of Woodlands Lane. The two farms, Croppings Farm and Stocking Farm, are owned by English Partnerships and leased to their current occupants.

13.2.2 Agriculture

Current land use is agricultural, with pastural grazing forming the main type of land employment. This usage is determined primarily by the quality of the land. The Agricultural Land Classification reported in Chapter 8.0 (Section 8.2.11) establishes that the Application Site is predominantly of poor (Grade 4) and moderate quality (Grade 3b) agricultural land.

The Application Site is not therefore an important agricultural area and the soils are not considered to represent a significant natural resource in terms of their agricultural quality. This is further evidenced by the designation of the Application Site for housing as part of the Local Plan, and the existing 7(1) permission for housing, dating from 1991.

13.2.3 Recreation

There are a number of public footpaths crossing the Application Site, as shown in Drawing 6479/ES-13-01, and listed in Table 13.1.

Table 13.1: Public Rights of Way associated with the Application Site

Number	Designation	Route
161	Footpath	Runs eastwards from Woodlands Lane to join 162
162	Footpath	Connects to 161 and Canal Path outside of Application Site
164	Byway	Holywell Lane, running east towards southern end of St Lukes Road, and Little Dawley
166	Bridleway	Runs along Holywell Lane, between junction of Stoneyhill and Burroughs Bank
167	Footpath	Runs from the north end of Stoneyhill, across fields to Woodlands Lane, emerging just north of Stocking Farm
168	Footpath	Runs south of Woodlands Lane across fields before turning west to cross Stoneyhill Landfill, and joining the A4169
177	Footpath	East-west path linking Stoneyhill with the A4169
178	Bridleway	Runs along Stoneyhill, to junction with Holywell Lane
178A	Footpath	Generally southerly path running from Stoneyhill, across open fields, picking up the route of the former canal. Ends at the A4169
184	Footpath	Path linking 194 and 190
190	Byway	Burroughs Bank, spur leading to Lightmoor Road
194	Footpath	East-west path between junctions of 195/197/164, and 184
195 & 196	Byway	Woodlands Lane running north west to south east from Woodlands Farm to Stocking Farm and connecting with 164 (Holywell Lane)
197	Footpath	Southwards path between junctions of 195/197/164, and 190
199	Footpath	Runs between junction of 190/200/201 and 197
200	Byway	North-western arm of Burrough Bank to junction with Holywell Lane
201	Byway	South western arm of Burroughs Bank, running into 203
203	Byway	Continues route of 201 until the A4169
"Canal Path"	Permissive footpath	Runs northwards along ridgeline from 195 (below Stocking Farm) to junction at 161/162 at corner of Johnston Pipes site, along route of old canal.

The principal routes are along historic lanes, flanked by hedgerows, notably Woodlands Lane, Stoneyhill and Holywell Lane. These lanes are used for pedestrian, cycle and vehicular access to the properties along them, and for recreational purposes for walking, cycling and horse riding.

13.3 ANALYSIS OF THE PREDICTED IMPACTS

13.3.1 Agriculture

The low agricultural quality of the land within the Application Site, the prevalent agricultural practices and the status as land designated for housing all suggest that the impact upon agriculture of this land being redeveloped is negligible.

13.3.2 Recreation

The application proposal has been developed to co-ordinate and enhance accessibility and recreation opportunities. The development seeks to preserve existing lanes and footpaths, and incorporate their character into the fabric of the village. Consequently, existing access will maintained, and the provision of new pedestrian and cycle routes will ensure that recreation access is not compromised. Additionally, the provision of new recreational facilities, as described within Chapter 4.0, will improve the provision of managed, high quality recreation facilities. Therefore the impact of the proposed development on recreational uses will be negligible, and through the enhancement created by the development proposals the impact will be beneficial.

13.4 MITIGATION

Existing access will be maintained, and enhanced. The integration of the key elements of the Application Site (lanes, hedgerows) will ensure that the quality and quantity of accessibility will remain. Furthermore, the open space strategy and the retention of buffer zones around the built areas will mean that the actual land take is reduced, with many areas being retained or enhanced in their current form, thereby minimising what is already considered to be a negligible impact.

13.5 STATEMENT OF SIGNIFICANCE

The above assessment has concluded that although the character of the Application Site will change, the Application Site has been confirmed to be of low agricultural importance. In addition, it is designated for housing by both the existing 7(1) planning permission, and the Local Plan. Consequently, loss of agricultural land and impacts will be negligible. Recreational capacity will also be maintained and enhanced by the provision of well managed recreational facilities (sports pitches, cycle routes, green corridor), in addition to the existing pattern of lanes and footpaths. This will result in a beneficial impact upon the Application Site. Table 13.1 summarises the land use impact appraisal.

Table 13.1: Summary of Land Use Impacts

Potential Impact	Type of Impact	Nature	Importance	Significance of impact without mitigation	Significance of impact with mitigation
Loss of Agricultural Land	No impact predicted	-	-	-	-
Impact on recreational usage	No impact predicted	-	-	-	-
Impact on footpath network	No impact predicted	-	-	-	-

13.6 REFERENCES AND CONSULTATION

Telford & Wrekin Local Plan, 1995 - 2006

Andrew Careless, Rights of Way Officer, Telford & Wrekin Council

11.0 AIR QUALITY

11.1 INTRODUCTION

This section assesses the potential impacts to air quality, which may arise as a result of the development of the Lightmoor Village. It examines the existing baseline air quality (including dust) at the site and determines the extent and severity of any impacts associated with construction and operation of the proposed development upon local air quality, including potential receptors surrounding the Application Site.

The methodology for the air quality assessment of the effects of the proposed development have focussed upon a baseline assessment of local air quality, an evaluation of the effects of the construction and operational phase of the development, any potential areas for mitigation, and the significance of any residual impacts.

11.2 BASELINE SURVEYS

11.2.1 Air Quality Assessment

Information Sources

The principal sources of baseline air quality information and data used to assess the impact of the proposed development were:

- United Kingdom Automatic Urban and Rural Network (AURN) operated by the DETR
- Telford & Wrekin Council
- On site monitoring undertaken by EUS Ltd.

The assessment of the construction and operation of the proposed development was undertaken in line with the following guidance:

- Guidelines and methodology presented in the DETR's "New Approach To Appraisal, the Design Manual for Roads and Bridges" (reference 1);
- The United Kingdom National Air Quality Strategy (reference 2); and
- Review of the United Kingdom National Air Quality Strategy 2000 (reference 3).

Guidance on the potential sensitivity of receptors to nuisance dust is provided in the DoE guidance document: "The Environmental Effects of Dust From Surface Mineral Workings" (DoE, 1995 - reference 4). This document provides good guidance in regard to dust nuisance, and design and implementation of mitigation measures designed to reduce the potential impact of dust.

Potential Pollutants

It has been recognised that the principal potential pollutants of concern, in regard to this development, will be associated with road traffic. There are

expected to be no other significant sources of air pollution associated with this scheme.

The impacts were assessed based upon existing (or "baseline") air quality, and the potential effects due to the construction and operation of the proposed development.

The DMRB screening methodology, used to predict impacts of changed traffic flows and patterns over time, was adopted to allow predicted concentrations of criteria pollutants to be expressed in averaging periods that could be directly compared with standards and objectives stated in United Kingdom National Air Quality Strategy (UKNAQS) and it's review.

UK Approach to Air Quality Standards

The Air Quality Regulations 1997 are enforced under Part IV of the Environment Act 1995, and a number of air quality standards and objectives are to be achieved throughout the UK by an agreed timetable. The UKNAQS, and its subsequent review, has identified a number of pollutants that are of key importance to achieving a higher standard of air quality throughout the UK. Local authorities are obliged to undertake a staged review and assessment process throughout their respective regions in order to achieve the standards and objectives outlined within the UKNAQS. This air quality assessment has been based upon the standards and objectives of the Strategy, which are presented in Appendix G Tables 1 and 2, respectively.

Pollutants identified within the Strategy, which are known to result in potential acute health effects have been categorised into an Air Quality Banding system, which has been presented in Appendix G, Table 3. Background air quality at the monitoring position (see 11.2.3) can be described in accordance with the UK Air Quality Bandings System. The UK Air Quality Bandings System was designed to enhance public understanding of air pollution. The threshold between the "Low" and "Moderate" bands is based on the National Standards established in UKNAQS for a number of pollutants. The UK Air Quality Banding System reproduced does not include pollutants in UKNAQS with which only chronic health impacts are associated (eg. benzene).

Principal Road Traffic Pollutants

- Carbon monoxide (CO)

  Carbon monoxide is a colourless, odourless gas, and is recognised as being highly toxic. Carbon monoxide restricts the capacity of blood to carry oxygen to the heart, particularly in those suffering from heart diseases. Carbon monoxide is created by the incomplete combustion of petroleum. Nationally, vehicle emissions account for nearly 75% of UK total emissions of carbon monoxide, although greater proportions may be measured within urban areas (reference 3). It is currently predicted that the carbon monoxide objectives will be achieved, principally due to improvements in fuel and vehicle engine performance, and particularly the use of catalytic converters.

- Oxides of nitrogen (NO_X)

  Oxides of nitrogen (NO_X) comprise a number of compounds, which primarily include nitric oxide (NO) and nitrogen dioxide (NO_2). Nitrogen dioxide, sometimes called dinitrogen tetroxide, is a colourless to pale yellow or pale brown gas, and is of concern as there are known health risks associated with exposure, including irritation of the airways of the lungs, and increasing the symptoms of those suffering from lung diseases. Vehicle emissions account for approximately 50% of the total UK emission of oxides of nitrogen in 1997 although greater proportions may be measured in urban areas (reference 3). Nitric oxide is produced by thermal oxidation of nitrogen in the engine, and is rapidly oxidised to nitrogen dioxide in the atmosphere.

- Fine particulate matter (as PM_{10})

  Nationally, it is estimated that road traffic accounts for approximately 25% of all particulate emissions, which may comprise unburnt fuel particles, dusts from tyre wear and resuspended dusts, and secondary particles formed by atmospheric reaction of gaseous pollutants, such as SO_2 and NO_2. The emission of PM_{10} from road traffic is dependent upon a wide range of factors, although fuel type has a significant impact upon exhaust emission concentration. This is particularly relevant to diesel vehicles, which emit significantly higher amounts of PM_{10} than petrol fueled vehicles.

- Benzene (C_6H_6)

  Benzene is a colourless liquid hydrocarbon and has been identified as a known carcinogen (i.e. causing cancer). The main emission sources of benzene in the UK have been identified as petrol fueled vehicles and the petrol distribution system (including refining, fuel distribution and petrol station forecourts).

Assessment Methodology

The assessment of baseline air quality and dust deposition was conducted by specific on-site monitoring. This data was collated and has been presented in line with the requirements of the UKNAQS Standards and Objectives and the Bandings System, as appropriate.

Background air quality data and available traffic data was used to predict future air quality surrounding the site by the use of the DMRB predictive screening model.

Area of Influence

The potential air quality impacts originating from the development of a new scheme are widely regarded as being difficult to apportion, particularly in the sense of health related effects. However, general health effects relating to both

short term and long term exposure to designated pollutants are well documented (reference 2), Committee on the Medical Effects of Air Pollutants (COMEAP) (reference 5).

In order to identify the potential impacts upon local air quality by the proposed development, it is necessary not only to identify the pollutants of concern, but also those groups that are most inclined to be affected by them. These groups are known as "sensitive receptors" and include the young, the sick and the elderly. Sensitive receptors are locations where those who may be particularly sensitive to the effects of air pollution spend a significant period of time. The Highways Agency (HA) has identified educational establishments, homes for the aged and hospitals as examples of sensitive receptors in terms of air pollution (reference 1).

Sensitive receptors were identified from a mapping study of the local area, and were categorised into the following:

- High Sensitivity Receptors: e.g., hospitals and clinics, hi-tech industries, food processing
- Medium Sensitivity Receptors: e.g., schools: residential areas, food retailers, offices
- Low Sensitivity Receptors: e.g., farms, light and heavy industry, outdoor storage.

11.2.2 Dust Baseline Assessment

Dust is defined in BS6069 as particulate matter with mean hydraulic diameters within the size range of 1um (0.001mm) to 75um (0.075mm). The dispersion, or movement, of dust particles is dependent upon the strength and direction of the prevailing winds.

UK Approach to Dust Nuisance

There are no agreed standards or guidelines for the nuisance impact of deposited dusts in the UK.

However, for reference, several international dust nuisance standards have been reproduced in Table 11.1.

Problems with the implementation of any deposited dust nuisance standards in the UK arise from a number of factors:

- Collection efficiency variation of dust collection devices;
- A lack of survey information on individual perception of dust nuisance;
- The level of dust deposition that may cause a nuisance impact;
- The limited consistent data on UK dust deposition rates;
- The wide variability in dust emissions which may be found; and
- The subjective nature of the perception of dust nuisance.

Table 11.1: International Dust Nuisance Standards

Standard and origin	Description of standard	Value	Units
Nuisance Standard, Washington, USA	Residential areas	187	$mg.m^{-2}.day^{-1}$ (as monthly mean)
Nuisance Standard Germany	Possible nuisance Likely nuisance	350 650	$mg.m^{-2}.day^{-1}$ (as monthly mean)
Nuisance Standard Western Australia	Loss of amenity Unacceptable reduction in air quality	133 333	$mg.m^{-2}.day^{-1}$ (as monthly mean)
Soiling levels "sticky pads guideline" - public response	Possible complaint Probable complaint Serious complaint	0.5 2.0 5.0	$\%EAC.day^{-1}$
Surface soiling levels "glass slide guidelines"		20-25	Soiling units (as $Su.week^{-1}$)

In the UK the main requirements with respect to dust control from industrial or trade premises is that provided in section 79 of Part III of the Environmental Protection Act (1990). The Act defines nuisance as:

"*any dust steam, smell or other effluvia arising on industrial trade or business premises and being prejudicial to health or a nuisance.*"

Enforcement of the Act, in regard to nuisance, is currently under the jurisdiction of the local Environmental Health Department.

Dispersion of Dust

Generally, as dust particles are dispersed by wind, the smaller particles remaining airborne for longer with the larger particles being deposited at a faster rate. Stronger winds may support larger particles for longer durations, but these would normally be returned to the surface at faster rates. Smaller particles are hence dispersed more widely than larger particles.

Research undertaken to date is not conclusive in regard to the potential distances that dust particles may be carried by the wind. Studies undertaken at mineral extraction sites indicate that particles with a mean hydraulic diameter greater than 30 μm will usually be deposited within 100m of the source. Intermediate sized particles within the range of 10 μm to 30 μm may travel 250m to 500m from their source, whilst smaller sized particles that are less than 10 μm in diameter may be carried up to 1km from their source.

Dust deposition and ambient dust concentrations may be extremely variable in the short term, and will depend on a large number of factors: location of monitoring; emissions concentrations at source; receptor location, and; meteorological conditions.

Dust nuisance is often characterised by a few or occasional dusting events with relatively high rates of dust deposition, which may be caused by output of emissions sources and particular combinations of local microclimate conditions.

The rate of dust deposition is dependent on local sources of dust, in terms of processes and/or activities, and the distance of the source from monitoring and receptor locations. For this reason dust monitoring over short periods has the potential to over or underestimate the dependent on the prevailing meteorological conditions.

11.2.3 Results of Baseline Surveys

Air Quality

In order to corroborate regional and local baseline air quality data at the proposed Application Site, a programme of ambient air quality and dust monitoring was commissioned in order to determine the specific baseline air quality conditions at the proposed Application Site.

The monitoring programme was undertaken within the boundaries of the proposed Application Site, as indicated in Drawing 6479/ES-11-01. The principle for undertaking the monitoring at the Application Site was to enable representative background levels of air quality and dust to be determined. Consequently, the monitoring positions were located at an adequate distance from identified emission sources such as road traffic. Monitoring was conducted between 4th February 2002 and 4th March 2002.

Carbon monoxide was measured using an infrared analyser. A period average 8-hour mean concentration of 0.76 ppm (0.88 $\mu g.m^{-3}$) was determined, which is less than the appropriate UKNAQS objective of 10ppm (11.6 $\mu g.m^{-3}$). No significant pollution episodes were measured over this period, and no concentrations in excess of the UKNAQS objective were measured.

PM_{10} was measured using a ß-attenuation gauge. The 24-hour mean PM_{10} concentration measured over the monitoring period was 14.20 $\mu g.m^{-3}$ which is less than the appropriate UKNAQS objective of 40 $\mu g.m^{-3}$ (not to be exceeded more than 35 times per year). No significant pollution episodes were measured over this period, and no concentrations in excess of the annual mean threshold were measured.

Nitrogen dioxide was measured using a dual band chemiluminescence analyser. The 1-hour mean nitrogen dioxide concentration measured over the monitoring period was 8.3 ppb (15.8 $\mu g.m^{-3}$) which is less than the UKNAQS objective of 105ppb (200 $\mu g.m^{-3}$), which is not to be exceeded more than 18 times per year. The corresponding 1-hour mean total oxides of nitrogen (NO^X) concentration over the monitoring period was 10.4 ppb (19.8 $\mu g.m^{-3}$ as NO_2).

Benzene was sampled onto three pretreated absorption tubes. The samples were extracted by thermal desorption, analysed by gas chromatography and quantified

by flame ionisation detector (FID). The mean benzene concentration measured over the monitoring period was 0.88 μg.m-3.

Using the Air Quality Bandings system, air quality (with reference to measured concentrations of carbon monoxide, nitrogen dioxide and PM10) may be described as "Low". There is no Banding established for benzene.

Existing background air quality data produced from the on-site monitoring is presented in Appendix G, Table 4, and selected data is summarised in Table 11.2.

Table 11.2: Measured Background Air Quality Data

Parameter	Carbon monoxide (CO)	Nitrogen dioxide (NO_2)	Oxides of nitrogen (NO_X)	Benzene (C_6H_6)	Particulate (PM_{10})
Concentration:	0.76 ppm	8.3 ppb	10.4 ppb	0.88 μg.m$_{-3}$	14.2 μg.m^{-3}
Measured as:	mean 8 hr	mean 1 hr	mean 1 hr	period mean	mean 24 hr

There were no significant pollution episodes measured over the monitoring period. The weather was generally wet and windy over this period, which may have contributed to the low background concentrations.

The data presented above is not significantly different than the national background air quality profiles for the region that may be accessed at http://www.aeat.co.uk/netcen/airqual/, and as such it is considered as representative of background air quality at the proposed development site.

Dust

Due to the proximity of local industry (such as Johnston Pipes) with the potential to generate dust nuisance a baseline dust assessment was also conducted as part of the baseline air quality assessment. A series of six 'inverted frisbee' depositional dust gauges were positioned across the proposed Application Site in accordance with BS 1747: Part 5 (1972). Monitoring was conducted between 4th February 2002 and 4th March 2002.

The mean daily dust deposition rate determined across the proposed development site was 29.15 mg.m^{-2}.day^{-1} (as a monthly mean). This accounts for all determinations at the six discrete monitoring positions, and should be regarded as the most accurate measurement of dust deposition at the proposed development site, based on available data.

There was some significant variation in the deposition rates (expressed as weekly means) over the monitoring period, with the minimum recorded as 14.38 mg.m^{-2}.day^{-1} during Week 1, and a corresponding maximum of 81.07 mg.m^{-2}.day^{-1} during week 2. Table 11.3 indicates the range of determined deposition rates at the six dust deposition monitoring locations, and as a site mean.

Table 11.3: Measured Background Dust Deposition Rates

Monitoring Location	Measured Deposition Rate $mg.m^{-2}.day^{-1}$
Location 1	25.76
Location 2	26.88
Location 3	22.75
Location 4	23.14
Location 5	32.79
Location 6	43.56
Overall	29.15

11.2.4 Summary of Baseline

Air Quality

Measured air quality data indicates that background air pollution in the area may be regarded as "Low". This is supported by data presented within the National Air Quality Archive, although it must be noted that there are no automatic monitoring stations in close proximity to the proposed development site.

Short-term exceedences of UKNAQS objectives are routinely measured, particularly in more urbanised areas, where there are high rates of road usage and other emission sources. DEFRA accept that short-term pollution episodes are likely to be measured, and have focussed the UKNAQS to achieving a decline in the general trends of air pollutants, hence the reason for stipulating that annual measurements should not be exceeded by a number of times per year.

No pollution episodes were measured at the background monitoring position used in this baseline assessment..

Dust

There are currently no UK nor EC statutory nuisance guidance with regard to dust nuisance. Existing 'international' dust nuisance standards and/or guidance have been reproduced Table 11.1.

Measured dust deposition rates are below the international dust deposition rates indicating that, based upon the data measured during the baseline assessment, dust deposition should not be regarded as likely to cause Statutory Nuisance in the local area. However, as short-term elevated concentrations were noted the potential for dust nuisance to occur, especially during hot dry summer months and particularly where this might coincide with harvesting of arable land, should not be discounted.

11.3 ANALYSIS OF THE PREDICTED IMPACTS

11.3.1 Basis of Impact Assessment

The potential impacts of 'air quality' and dust have been assessed separately using the following bases of prediction.

Air Quality

The DMRB (reference 6) has been used as the basis of the 'air quality' assessment for both the construction and operational phases of the development. The DMRB assessment is a predictive screening tool examining 'worst case' scenario conditions and as such over estimates pollutant concentrations, particularly with regard to nitrogen dioxide. The procedure predicts ambient levels of carbon monoxide, nitrogen dioxide, benzene and suspended particulate matter (as PM_{10}) due to emission from road traffic and the results may be compared with the UKNAQS air quality standards and objectives.

In order to assess the air quality impacts associated with changes in traffic patterns, comparisons have been made between the existing air quality conditions with predictions of future traffic flows. The traffic data applied to this assessment is illustrated in Appendix G, Table 5.

The DMRB was used to assess the impact upon air quality of altered traffic flows and patterns. Impacts due to changes in traffic management and flow may be assessed against the following:

- High — a significant change which involves a variation in predicted concentrations of more than 50% of the air quality criterion;
- Medium — a noticeable change which involves a variation in predicted concentrations of 30% to 50% of the air quality criterion;
- Low — a barely perceptible change which involves a variation in predicted concentrations of 10% to 30% of the air quality criterion;
- Negligible — an imperceptible change which involves a variation in predicted concentrations of less than 10% of the air quality criterion.

Dust

The potential impacts associated with the "construction" phase, include any demolition, ground clearance, ground preparation and building work.

The redevelopment of the site has the potential to impact on local air quality at sensitive receptors at and surrounding the site boundaries and along access routes to the proposed development. The likely impacts may potentially take the form of dust nuisance and/or 'air quality' impacts. The DMRB provided the basis for the assessment of construction impacts on air quality.

There are no UK or EU regulatory standards for deposited dust. The perception of nuisance is determined by officers of the local authority under the Environmental Protection Act (EPA) 1990.

The potential for dust nuisance during construction activities is difficult to quantify and is dependent on a number of interrelated factors, including; construction activities; soil and substrata composition; atmospheric humidity; prevailing wind speed and direction; physical characteristics of the particles (such as shape, size, density), and; moisture content of dust particles.

There are significant technical difficulties in determining representative levels of dust emissions from a large construction site, as dust emission rates may vary significantly over time and across the site, and may be extremely short-term in duration. Due to these problems, emphasis is placed upon the identification of the potential causes of dust emissions, and ensuring that suitable control and mitigation measures are formulated to restrict those emissions from occurring ie control at source.

The following classification system was adopted for the assessment of potential air quality impacts arising from dust generated by construction activities associated with the proposed scheme. Dust Impacts of areas in proximity to construction may be assessed against the following:

- High — Area affected is less than 10 m from an active construction site
- Medium — Area affected is within 100 m of a major active construction site
- Low — Area affected is between 100 m and 200 m of a major active construction site or up to 100 m from a minor active construction site, a demolition site or construction compound
- Negligible — Area affected is 100 m from any minor construction activity or 200 m from any major construction activity.

Impacts due to dust may include the following:

- reduced visibility;
- deposition of dusts upon surfaces;
- physio-chemical contamination and corrosion of buildings;
- coating of vegetation;
- contamination of soils;
- health effects due to inhalation; and
- health risks due to deposition on the skin.

Dust levels upwind of construction site activities are likely to be representative of the ambient dust levels whilst dust levels downwind of construction site activities are likely to be higher than ambient dust levels.

Activities giving rise to dust emissions may include; demolition of existing structures; site preparation and ground clearing; excavation; storage and use of

cement or other fine particulate materials; wind blown materials from stockpiles; material transfer to and from delivery vehicles; material spills during transportation and handling; vehicle and plant movements on unpaved roads and over the construction site and concrete batching and finishing.

The potential for dust nuisance impact is most likely to arise from the demolition of existing structures and site grading. This is most likely to create a nuisance during periods of dry and sunny weather, resulting in a reduction in soil moisture and a subsequent decrease in soil particle cohesion.

The degree of perceived nuisance to the potential impact of dust from the construction phase will vary in relation to the distance of sensitive receptors from the construction areas, perception of any dust nuisance by individuals, the perceived need or desirability for the development by the local community, in addition to the timescale and duration of the potential nuisance.

11.3.2 Prediction of Impacts

Construction Phase - Air Quality

The DMRB stipulates that air quality impacts should not be expected due to changes in traffic flows of less than 100 vehicle movements per hour. The construction phase is expected to generate 26 vehicle movements per working day, which equates to approximately 5 vehicle movements per hour (over a 5.5 hour working day). As the burden of construction traffic is believed to be less than the lower threshold of 100 vehicle movements per day, the impact upon air quality due to traffic related pollutants is considered to be negligible.

Construction Phase - Dust

No 'high sensitivity' receptors have been identified within 100m of the proposed boundary plan for the development. The closest identified existing residential receptors to the development are located along Wellington Road and Woodlands Lane. These residencies are likely to be within 100m, but not closer than 10m of the development. The Wildlife Site is located to the east and south-east of the proposed development site. At its closest point, the Wildlife Site lies approximately 50m from areas designated for construction of housing and services.

Using the methodology defined above, the unmitigated short-term impact of dust from construction phase activities is likely to be low. Mitigation measures designed to reduce the likely impact of dust from construction are outlined in the following section. It is however noted that no demolition works, which have the greatest potential for dust generation, are included within the development proposals.

Operational Phase - Air Quality

The impact of the operation of the proposed scheme upon local air quality is likely to be associated with:

- changes in overall levels of traffic throughout the local road network; and
- changes in traffic management, or other changes in traffic patterns as a result of re-ordered road junctions; roads junctions experiencing increased queuing; where roads have been stopped or closed; where the number of road carriageways have been reduced; and where new traffic is generated on parallel roads to those directly affected by the scheme implementation.

The assessment methodology takes into account factors such as mean vehicle speed, the distance between the receptor and the road(s), the proportion of HGVs to the total vehicle flow, and changes in future exhaust emissions, based upon current knowledge and trends.

Receptors

The DMRB screening method was used to predict pollution concentrations at a number of receptors surrounding the proposed development, and at various distances from roads which are predicted to experience alterations in traffic flow due to the operation of the scheme and associated traffic management.

The nominated receptors, chosen to reflect traffic changes along the A5223 and A4169 from national traffic growth and the proposed development, are presented in Appendix 6 and include the following:

- Croppings Farm, Forester Arms PH, Wellington Road;
- Residential properties along Wellington Road near junction with A5223; and
- Residential properties along Wellington Road near junction with Woodlands Lane.

Concentrations of various pollutants associated with traffic emissions were predicted using the DMRB screening model for the following scenarios at the above nominated discrete receptors:

- Year 2002 baseline conditions;
- Year 2006 (estimated completion year) without any development; and
- Year 2006 (estimated completion year) with development.

Additionally, the predicted concentrations of carbon monoxide, nitrogen dioxide, benzene and fine particulate matter (as PM_{10}) were predicted at distances of 10m, 25m, 50m and 100m from the A5223 and A4169 link roads. Predicted concentrations at these distances are presented in Appendix G.

The annual average hourly traffic flows (AADT/24), mean vehicle speeds and HGV proportions used within the assessment of air quality were based upon calculated traffic data from the TIA (see Chapter 10.0). These data are shown in Appendix G Table 4.

The DMRB screening methodology is not intended to be representative of a detailed modelling approach to determining the likely impacts of altered road

usage patterns upon air quality. It comprises a broader based predictive screening approach. In accordance with the DMRB methodology, sensitive receptors located at distances of greater than 200m from road links are unlikely to result in exceedences of the UKNAQS standards, due to changes in traffic flows.

Screening Predictions At Nominated Receptors

Predicted concentrations of carbon monoxide, benzene, nitrogen dioxide and PM_{10} were found to remain well within the appropriate UKNAQS standards and objectives at the identified sensitive receptors, in all scenarios: as a current baseline condition, without the development in the estimated completion year 2006 and with the proposed development in 2006.

Appendix G resents the predicted air quality concentrations at the nominated receptors. Using the impact classification system presented above, all the predicted impacts may be regarded as: negative, negligible. This classification covers an imperceptible change which involves a variation in predicted concentrations of less than 10% of the air quality criterion.

Screening Predictions With Distance From Roads

Predicted concentrations at roadside distances of 10 m, 25 m, 50 m, 100 m and 150 m, of carbon monoxide, benzene, nitrogen dioxide and fine particulate matter (as PM_{10}) were found to remain well within the appropriate UKNAQS standards and objectives.

Appendix 6 present the predicted air quality concentrations with distances from the two link routes. All nominated link routes were predicted to have negligible effects.

Operational Phase Dust

The rates of dust generation from the operation of the proposed development and associated traffic are likely to be extremely marginal, and may be considered negligible.

11.4 MITIGATION

11.4.1 Construction Phase - Air Quality

The overall unmitigated effect of construction phase vehicle emissions upon air quality has been identified as negligible, as there is predicted to be no measurable change in air quality due to the marginal increase in traffic due to construction. The following control measures will be undertaken as prudent measures to further reduce any impact on air quality from construction traffic:

- location of stationary construction equipment well away from sensitive receptors; and

- careful consideration of diversion routes to avoid congestion at busy junctions.

11.4.2 Construction Phase - Dust

The overall unmitigated effects of construction phase dust impacts have been identified as low but short term. These predicted impacts can be mitigated by suitable dust control techniques at source. It must be stressed that the impact of any dust nuisance will be limited to a relatively short duration.

Observations of potential and actual dust generation and dispersion conditions will be made by suitable supervision staff and dust will be suppressed should it give rise to a perceived nuisance.

All potential dust generating activities and conditions will be identified prior to the commencement of any construction activities. Dust generation will be controlled at source by good housekeeping, the use of appropriate plant handling techniques and regular maintenance. The following control measures will be implemented as suitable mitigation measures:

- the implementation of a suitable and sympathetic phased construction programme to minimise identified potential dust generation activities;
- the use of dust sealed roadways, where appropriate and practicable, to minimise dust generation by resuspension of settled dust;
- restriction of access routes to minimise surface destruction;
- restriction of site vehicle speeds;
- minimisation of dust from loading of trucks by the use of appropriate loading machines;
- control of dust emissions from vehicles leaving the site by efficient cleaning and sheeting of vehicles;
- provision of mandatory wheel wash facilities prior to vehicles exiting the site;
- minimisation on-site storage of construction materials;
- storage areas to be located away from potentially sensitive receptors;
- storage of cement and other potential dust generating materials in silos with appropriate filters, as appropriate;
- location of stationary construction equipment well away from sensitive receptors, as appropriate;
- access roads will be swept periodically to remove dust from hard surfaces, as required;
- non-dust sealed site roads will be watered when necessary to maintain moisture content and hence reduce dust generation;
- design and implementation of a programme to monitor the construction process in order to enforce controls and modify methods of work if dusty conditions arise; and
- careful consideration of diversion routes to avoid congestion at busy junctions

In addition, local residents will be informed in advance of the intention to commence work and the projected duration of the work, as well as being provided with contact names and phone numbers.

11.4.3 Operational Phase - Air Quality

The overall unmitigated effects of the operation of the development are predicted to be negligible, involving an imperceptible change which involves a variation in predicted concentrations of less than 10% of the air quality criterion. As such, no mitigation is regarded as necessary.

11.4.4 Operational Phase - Dust

There are no identifiable sources of dust generation associated with the operation of the proposed development and as such no mitigation is thought necessary. The predicted impacts of the operation of the proposed development upon dust generation is regarded as negligible.

11.5 STATEMENT OF SIGNIFICANCE

The impacts of the proposed development were examined with regard to a number of issues: that of dust arising as a result of the construction phase of the site (demolition, site clearance and building); the potential impact of construction traffic upon air quality, and; the potential impact of operational traffic upon air quality. The impact of dust was determined to cause a low but short-term impact due to the close proximity of existing housing to the development site, and the neighboring Wildlife Site. The impact of dust will be mitigated by close control of the potential sources of dust emissions, sympathetic construction phasing and suitable measures within a comprehensive Construction Code of Practice. The impact of construction traffic upon air quality is expected to be negligible.

Concentrations of carbon monoxide, benzene, nitrogen dioxide and fine particulate matter (as PM_{10}) were predicted at a number of receptors and road side locations within the vicinity of the proposed development site. The DMRB air quality screening methodology was employed which enabled concentrations of particular pollutants to be calculated and compared with appropriate UKNAQS standards and objectives. Concentrations of carbon monoxide, benzene, nitrogen dioxide and fine particulate matter were predicted to be well below their respective air quality criteria for the receptors identified with and without the proposed development scheme. The introduction of an additional source of road traffic was predicted to have an overall negligible impact on air quality within the immediate area. Based upon this assessment, further monitoring of air quality is not required. Table 11.4 summarises the air quality impact appraisal.

Table 11.4: Summary of Air Quality Impacts

Potential Impact	Type of Impact	Nature	Importance	Significance of impact without mitigation	Significance of impact with mitigation
Impact due to construction traffic emissions	No impact predicted	-	-	-	-
Impact due to dust during construction	Adverse	Short term, reversible	Local	Low	Low to negligible
Impact during construction on Wildlife Site	Adverse	Short term, reversible	Local	Low	Low to negligible
Air quality impact of village	No impact predicted	-	-	-	-
Dust impact of village	No impact predicted	-	-	-	-

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LEGEND

GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

PUBLIC RIGHTS OF WAY LOCATIONS:

- FOOTPATH
- BRIDLEWAY
- BYEWAY OPEN TO ALL TRAFFIC
- PERMISSIVE FOOTPATH
- 252 FOOTPATH NUMBER

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Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

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6479	ES-13-01	D1

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LEGEND

GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

AIR & DUST MEASURMENT LOCATIONS:

- 1 LOCATION OF DEPOSITIONAL DUST GAUGE
- LOCATION OF MOBILE AIR QUALITY LABORATORY

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Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

LOCATION OF AIR QUALITY & DUST MONITORING POSITIONS

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LEGEND

GENERAL LEGEND:

- SITE BOUNDARY/APPLICATION LIMIT (TM DRG 1075-OPA-02)
- BUILT AREA OF VILLAGE (TM DRG 1075-OPA-04/A)

NOISE MEASURMENT LOCATIONS:

- 1 WELLINGTON ROAD/WOODLANDS LANE
- 2 CROPPINGS COTTAGE
- 3 STOCKING COTTAGES
- 4 JOHNSONS PIPES
- 4* CONCRETE CRUSHING AT JOHNSONS PIPES
- 5 WOODLANDS FARM
- 6 A4168

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4. All work is to be in accordance with the relevant specifications issued by Campbell Reith Hill, British Standard Codes of Practice, Statutory requirements and the Contract Documents.
5. DRAWING STATUS
   - S :- SCHEME — Outline/Scheme drawings for proposals, budgets etc.
   - D :- DESIGN DEVELOPMENT — Evolving final design drawings for approvals, tenders, billing etc.
   - C :- CONSTRUCTION — Fully developed drawings issued under instruction for construction.
   - :-

   ONLY STATUS C DRAWINGS TO BE USED FOR CONSTRUCTION.
6. NOISE MEASUREMENT POINTS TAKEN FROM FLEMING & BARRON BASELINE NOISE SURVEY (FEB'02).

Status/Rev	Description	Date	By
D1	ISSUED FOR INFORMATION	FEB'02	SA

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Job Title: LIGHTMOOR VILLAGE, TELFORD

Client: BOURNVILLE VILLAGE DEVELOPMENTS/ENGLISH PARTNERSHIPS

NOISE MEASUREMENT LOCATIONS

drawn	date	scale	CI checked	CAD filename
SA	FEB'02	1:4000	-	ES-12-01-D1

Job No.	Drg No.	Status/Revision
6479	ES-12-01	D1

A2

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12.0 NOISE AND VIBRATION

12.1 INTRODUCTION

Noise nuisance is an issue that has been growing in awareness in recent years, and thus is a fundamental aspect of any environmental appraisal. Noise issues for a new urban development that need to be addressed are two-fold: the impact of the development itself upon existing noise levels; and the situation with regard to planning guidance for new houses and existing noise sources.

For the Application Site, sensitive receivers and potential noise sources were identified. Using established legislation and guidance, existing noise levels are measured. This then allows for the quantification and prediction of impacts.

The following documents were consulted:

- PPG 24: "Planning and Noise", 1994 (reference 1)
- BS 4142 : 1997 "Method for rating industrial noise affecting mixed residential and industrial areas" (reference 2)
- BS 7445-1 : 1991 "Description and measurement of environmental noise - Part 1" (reference 3)
- Calculation of Road Traffic Noise (CRTN) (reference 4)

12.2 BASELINE SURVEYS

12.2.1 Background

The site is bounded by the A4169 road to the south and west. The road rises from the south to meet the Jiggers Bank roundabout. To the west, between the Application Site and the roundabout, is the former Stoneyhill landfill which is a closed landfill but has recently been used as a waste transfer station.

To the north-west and north of the Application Site, there is existing housing on Wellington Road and Woodlands Lane. Further west, there is the continuation of the main road north of the roundabout, here named the A5223. At the southern end of Wellington Road, bounding the Application Site, is a small depot for Rob Hughes haulage contractors.

To the north east, set at a lower level than the Application Site, there is a large industrial premises Johnston Pipes. The remaining areas surrounding the development to the north-east, east and south-east are farm fields.

Within the general area of the proposed development are several working farms, and small clusters of houses including those around Woodlands Farm, Stocking Cottages and Croppings Farm. Stocking Farm is unoccupied.

The survey was carried out on 14 and 15 January 2002. Measurement locations were chosen either to assess noise levels at existing residences or to assess noise levels for the proposed development. A further location was selected to

determine a reference noise level for the A4169 road. All locations were visited during the day and night, except for the position close to the A4169.

Noise levels were measured in terms of the L_{Aeq}, L_{AF10}, L_{AF90} parameters, generally in consecutive 15-minute periods. See Appendix H for a glossary of noise terms. The survey was made with reference to the outline procedures given in BS 7445 Part 1: 1991 (reference 3).

During the survey, the roundabout exit from the Jiggers Bank roundabout to Ironbridge was blocked so that traffic was forced to take a diversion. Since the diversion followed another road off the roundabout, the diversion is thought unlikely to have influenced noise levels around the Application Site, since the A4169 traffic flows are unlikely to have changed significantly.

12.2.2 Measurement Locations

Noise measurement locations for the survey are shown in Drawing 6479/ES-12-01 and described below in Table 12.1.

Table 12.1: Survey locations

Ref.	Name	Description of survey
1	Woodlands Lane	To determine noise levels near existing housing on Wellington Road / Woodlands Lane. Microphone set back approximately 19 metres from Wellington Road, in line with façade of houses. Total of 3 hours measurement during the day and ½-hour at night.
2	Croppings Cottage	A 24 hour measurement was undertaken to determine existing noise levels at residences in this area. The cottage itself was unoccupied at the time of the measurements The microphone was set up in the front garden approximately 5 metres from the house.
3	Stocking Cottages	To determine noise levels by existing housing. Measurement position was at intersection of lanes. One hour measurement during the day and ½-hour at night.
4	Johnston Pipes	To determine noise from concrete pipe works. Location chosen in field overlooking pipe works and distribution yard. Several measurements samples were taken during the day and night.
4*	Johnston Pipes	To determine noise from concrete pipe works. Adjacent to field as 4 above, but closer to concrete crusher activity.
5	Woodlands Farm	To determine noise levels at existing housing and farm buildings. One hour measurement during the day and ½-hour at night
6	A4169	Three hour measurement during day to establish reference noise level for road. This will be used in connection with traffic noise predictions as part of the environmental impact assessment.

At locations 1 & 6, traffic counts were also made. All measurements were made with the microphone approximately 1.2 metres above the local ground level.

12.2.3 Survey Equipment

Three sound level meters were used for the measurements. A Brüel & Kjær Type 2231 sound level meter was used for the 24-hour measurements at Croppings Cottage. A further Type 2231 sound level meter was used for the 3-hour measurements at locations 1 & 6. Other measurements were made with a Brüel & Kjær Type 2260 sound level meter. All equipment was calibrated with Brüel & Kjær Type 4230 and Type 4231 calibrators.

12.2.4 Weather

Noise surveys were conducted in conditions appropriate for environmental noise measurement. Winds were from a westerly direction, with occasional light showers. For attended surveys, no measurements were taken during rain events. The 24-hour unattended survey at Croppings Cottage continued during rainfall, where a weather-protected windshield was used.

12.2.5 Results

Full results of all measurements are detailed in Appendix H. The results are summarised below in terms of the daily and nightly noise level. Except for the site at Croppings Cottage, where a full 24 hour measurement was made, the measurements represent the typical L_{Aeq} and L_{A90} value for the day and night time periods. Typical noise levels are shown in Table 12.2.

Table 12.2: Typical daytime and night-time noise levels

Ref.	Location	Daytime Noise Levels		Night-time Noise Levels	
		L_{Aeq} dB	L_{A90} dB	L_{Aeq} dB	L_{A90} dB
1	Woodlands Lane	54	45	48	31
2	Croppings Cottage	52	47	42	31
3	Stocking Cottages	49	44	31	27
4	Johnston Pipes	47	31	43	26
4*	Johnston Pipes	58	--	--	--
5	Woodlands Farm	46	33	41	25
6	A4169	70	50	--	--

Notes: i. Reference time periods for the L_{Aeq} measurements are generally 1 hour during the day and ½-hour during the night except for Croppings Cottage where the L_{Aeq} represents a full 16-hour day and 8-hour night.
ii. The L_{A90} is reported as minimum 15-minute background noise level $L_{AF90,\ 15\ mins}$ measured over the survey period.

Noise levels in the area are dominated by road traffic on the A4169. However, at night, a distant hum could be heard at all locations. This was most likely noise from the Iron Bridge Power Station.

The noise climate at each measurement location is described below:

- Noise at Wellington Road / Woodlands Lane

  Noise levels are mainly determined by traffic from the main road to the north (A5223). The road lies within a cutting but this road dominates as Wellington Road has only intermittent traffic. Noise is also audible from the Haulage Contractors "Rob Hughes" most noticeably from reversing beepers while the lorries manoeuvre. Aggregate lorry engines were observed to start at 05.20 hours in the yard and at this position, some 220 metres from the yard, a noise level of 47 dB(A) was recorded with the lorries idling. The activities in the yard may be disturbing to any future residents closer to the haulage yard.

  During the day time measurements at around 12.45 hours on the 14th January, a low level of noise was heard from the east. Subsequent measurements indicated that this was from the concrete crushing activity at Johnstons Pipes. Noise levels at Wellington Road were not affected by this activity.

- Noise at Croppings Cottage

  An unattended noise monitor was set up at this position to monitor existing noise levels at the properties in this location. Noise is dominated by road traffic on the A4169. Noise levels show steady noise levels during the day with a morning and afternoon peak, reflecting the rush hour periods.

- Noise at Stocking Cottages

  Noise was monitored at the intersection of the roads near the small group of cottages. Noise levels were generally quiet but noise from the A4169 could be heard during the day. During the night the distant hum of what was thought to be the Iron Bridge Power Station could be heard.

- Noise from Johnstons Pipes

  Position 4 was chosen to assess noise from the concrete pipe factory. Perceptible noise was low although sporadic vehicle movements in the yard could be heard during the day and night. During the survey a concrete crusher with associated 360° excavator and dump truck movements was being used further to the north of position 4. This noise was also heard at Woodlands Lane during the previous day but the source had not been

identified. A new position (4*) was then chosen to assess this noise, position. This was estimated to be approximately 100 - 150 metres from the concrete crusher. The mobile crushing machine is new to the site.

- Noise at Woodlands Farm

  Noise levels were monitored here to assess conditions at the existing dwellings. Noise levels were generally quiet. A local resident reported hearing the noise from the haulage contractors as their lorries start up in the morning.

- Noise from the A4169

  Measurements were made at 10 metres from the kerb of the A4169 road in conjunction with traffic counts to determine a reference noise level for this road. This was done to assess the contribution of this road to the overall noise climate. In this location, the road has three lanes as the uphill carriageway is provided with a crawler lane.

12.3 ANALYSIS OF THE PREDICTED IMPACTS

The noise impact has been assessed in four phases, to cover all facets of the potential impact: construction noise; traffic noise; non-residential impacts and residential impacts. Each of these is examined below:

12.3.1 Construction Noise and Vibration

Construction noise levels can be predicted using BS 5228: 1997 "Part 1 Noise control on construction and on open sites" (reference. 5). Vibration from piling operations is covered by Part 4 of the same standard, dated 1992.

BS 5228 does not specify criteria for acceptable levels of construction noise. Instead, a number of factors influencing the acceptability of noise levels are given. The Department of the Environment Advisory Leaflet (AL) 72 "Noise control on building sites" (reference. 6) is out of print but the leaflet provide some guidance on acceptable levels of construction noise. The leaflet states that during the daytime period (07.00 to 19.00 hrs), the noise level outside the nearest occupied room should not exceed: 75 dB(A) in urban areas close to main roads; and 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise sources. The levels are generally taken as façade L_{Aeq} values. The lower value is applicable in this instance.

Construction noise and vibration is usually a short-term effect. Given the scale of the project and the three to four year construction timescale, noise and vibration from construction may occur over a longer period. This may affect both existing

dwellings and new occupied dwellings in a completed part of the development, whilst construction of another part of the site continues.

The construction of the housing itself will be a fairly quiet operation, but noisier operations will occur during the preparation of the site. It is likely piling and grouting will be required to stabilise the ground in certain areas. Augered piling is a moderately noisy operation. Using a figure of 112 dB LWA, taken from BS 5228: Part 1, an on-time of 50% and soft ground attenuation, predicted noise levels are 68 dB L_{Aeq} at 50 metres. Therefore it will be possible to achieve the recommended targets in AL 72 provided that that the piling rig is no closer than 50 metres to existing housing.

In addition, ground preparation work is likely to involve the use of excavators and dump trucks to level the site. This will involve moving material largely within site and therefore will not involve significant haul movements off site. In summary, the predicted impact will be short to medium term, and will be of low to medium significance.

12.3.2 Traffic Noise

Traffic noise is predicted in terms of the $L_{A10\ 18\ hour}$ index as described in CRTN (reference 4). The L_{A10} is defined as the noise level exceeded for 10% of the measurement time. Various studies have been carried out into levels of annoyance from road traffic noise and the Design Manual for Roads and Bridges (DMRB) Volume 11, Part 7 (reference 7) states a relationship between the $L_{A10\ 18\ hour}$ index and the percentage of people bothered very much by traffic noise for roads where the traffic noise exposure has been fairly stable.

Noise from roads is proportional to the traffic flow and, if all other factors are equal, noise levels will increase according to the relationship:

Increase in noise = $10\log(Q_D/Q_B)$

Where Q_D is the total 18-hour traffic flow with the development and Q_B the baseline traffic flow in the assessment year (including growth). To predict the increase in traffic noise arising from the development it is necessary to compare the traffic noise levels with and without the development at the completion of the project. This allows the with development traffic noise to be assessed against what the traffic noise would have been assuming a certain percentage growth in traffic.

Predictions of the increase in traffic noise have been carried out for the A5223 and A4169 based on 1999 measured data and projections of 2006 situation with and without the development (see Transport Impact Assessment, discussed in Chapter 10). The data has been interpolated to derive the current traffic flows for 2002. The traffic flows and predicted noise levels are set out below in Table 12.3.

Table 12.3: Traffic flows and Predicted Noise Levels

Road	Two-way 18 hr traffic flows			Increase 2006+Dev compared with 2006 without development		Increase 2006+Dev compared with 2002	
	2002	2006	2006+Dev	%	dB	%	dB
A5223	11742	15431	26566	72	2.4	126	3.5
A4169	10893	12941	16841	30	1.1	55	1.9

The traffic noise impact of the development is equal to the difference between the 2006 flows with and without the development. An increase in noise of 2.4 dB arising from the development for the A5223 is predicted. This is regarded as a minor noise impact but in absolute terms, noise levels over most of the site will remain below 55 dB L_{Aeq}. The impact is therefore considered to be low to negligible.

At Wellington Road / Woodlands Lane noise levels are expected rise by 3.5 dB overall, considering both the new development traffic and the projected rise in traffic flows. This increase is sufficient to place the built area close to the road into Noise Exposure Category B as discussed in Section 12.3.4.

Noise from the A4169 has been measured at Croppings Cottage at level of 51 dB $L_{A10\ 18\ hour}$. With the development and the projected rise in traffic noise flows in 2006, noise levels are expected to rise by around 2 dB overall. Such a small change in noise would barely be perceptible and noise levels would be still within the 55 dB L_{Aeq} limit of Noise Exposure Category A.

12.3.3 Noise from New Non-Residential Noise Sources

The new village contains a primary school, a retail centre and a pub/restaurant. These can cause noise problems in urban areas: occasionally from schools (in the form of shouts and screams from school playgrounds), but more commonly from refrigeration units and deliveries serving shops and music noise from pubs. Traffic serving these premises should also be considered. No guidance exists regarding assessment of noise from schools. Noise from any ventilation or refrigeration or other plant can be predicted by the mechanical services engineers and assessed using BS 4142:1997 (reference 2). When detailed proposals are available for the development of this area, an assessment will be necessary to ensure that complaints are kept to a minimum.

Assessment of noise from pubs and restaurants and music is a contentious issue and a proposed Institute of Acoustics Code of Practice from Noise and Pubs has been held up in draft form. New premises however can be designed with good sound insulation and sensible layout can also alleviate most problems.

Music noise can be predicted using BS EN 12354 Part 4 "Transmission of Indoor Sound to the Outside" (reference 8). The only way to ensure no noise disturbance from music is to ensure that it is inaudible inside the nearest affected residential

premises. In practice this can be achieve by ensuring that the music noise is 10-15 dB(A) below the background noise outside the residence. Therefore, through mitigation impact will be low.

12.3.4 Suitability of the Development for New Housing

A noise impact assessment for new housing should also consider whether the land is suitable for residential development. The government's guidance in this respect is Planning Policy Guidance Document PPG 24 "Planning & Noise" (reference. 1). Potential development sites are categorised into one of four noise exposure categories (NEC) as set out below in Table 12.4.

Table 12.4: Noise Exposure Categories (NECs), from PPG 24

NEC	Daytime $L_{Aeq,16\ Hour}$ 0700-2300	Night-time $L_{Aeq,8\ Hour}$ 2300-0700	PPG 24 Planning Guidance
A	< 55 dB	< 45 dB	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	55 - 63 dB	45 - 57 dB	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	63 - 72 dB	57 - 66 dB	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	> 72 dB	> 66 dB	Planning permission should normally be refused.

The majority of the Application Site exhibits low noise mostly within Noise Exposure Category A of PPG 24. For these areas, noise need not be an issue in determining the planning application. However, further assessment will be required when individual land parcels are developed.

PPG 24 Assessment for Croppings Cottage

Noise levels in the PPG 24 assessment periods are 52 dB $L_{Aeq\ 16\ hour}$ and 42 dB $L_{Aeq\ 8\ hour}$ during the day and night time periods respectively. Therefore in planning terms, the land close to Croppings Cottage lies within Noise Exposure Category A and would be acceptable for new housing without noise being an issue. All of the built area lies further back from Croppings Cottage so noise levels from the A4169 would be lower than that measured at Croppings Cottage. The lower short-term measurements at Woodlands Farm and Stocking Cottages concur with this analysis. Therefore impact is negligible

PPG 24 Assessment for Wellington Road / Woodlands Lane

The proposed new housing on Wellington Road south and west of Woodlands Lane will be affected by noise from the A5223 and from the nearby depot of the Haulage Contractors Rob Weston. The built area sensibly locates a buffer zone between the proposed housing and the haulage depot, and the sporadic nature of noise from the depot is unlikely to affect the PPG 24 categorisation, which is based on a sixteen-hour day and eight-hour night.

Currently, the baseline noise level measured at Woodlands Lane is just within the 55 dB limit of NEC A, but noise levels are predicted to rise with increased traffic flows. This will place the site into the low end of NEC B, which is still suitable for housing, albeit with mitigation measures to control internal noise levels. Impact is expected to be Low to Moderate.

Land near Johnston's Pipes

Although the concrete pipe factory Johnstons Pipes, is mostly quiet, concrete crushing activity was observed at location 4*. This activity is likely to continue as a daytime activity only. PPG 24 recommends that industrial noise sources be rated in terms of BS 4142. This standard adopts a relative approach comparing the specific noise with the background noise in the absence of the specific noise.

Therefore on the basis of the measured specific noise level, 58 dB L_{Aeq}, and a background noise level of 44 dB L_{A90}, the specific noise is 14 dB above the background noise. In this situation, BS 4142 predicts that complaints would be likely, but it is important to remember that absolute levels are low and only just above the 55 dB L_{Aeq} specified by the World Health Organisation as the guideline value for noise in an "outdoor living area" (Guidelines for Community Noise, reference. 9).

The concrete crushing activities have only recently commenced and these works are being undertaken using mobile plant. Consequently, it is anticipated that noise levels will vary and that its impact may not be long-term. Appropriate further study will therefore be carried out at the detailed design stage.

12.3.5 Predicted Noise Impact from the Development

Predicted impacts from the development are limited due to housing being a land use associated with low noise levels. The future noise climate will be similar to that currently experienced in the existing Lightmoor village and at Horsehay.

The design of the built area within the development has sought to minimise noise impacts. The new roads servicing the development avoid passing the existing buildings and therefore there will be no impact to them from increased traffic passing the existing buildings. Traffic noise levels around the overall site will however slightly increase.

The development has also groups the service centre of the village and proposes a small village green between the pub / restaurant, retail area and primary school. This will minimise the impact of these premises.

In summary, predicted noise impact from the development is low to negligible.

12.4 MITIGATION

12.4.1 Construction Noise

BS 5228 lists a number of factors, which can influence the likelihood of complaints from construction noise. Specifically these are:

- Site location
- Existing ambient noise levels
- Duration of site operations

- Hours of work
- Attitude of the contractor
- Noise characteristics of the work being carried out.

To minimise complaints the following measures will be undertaken:

- Best practicable means to reduce noise as defined in the Control of Pollution Act 1974 Section 72 will be used to reduce noise levels at all times and at all locations.

- No construction work which is audible at residential properties shall be permitted outside of the following hours: 08.00 to 18.00 hours, Monday to Friday and 08.00 hours to 13.00 hours Saturday. Construction work will not take place on a Sunday.

- Noise levels within the permitted work hours will be limited to 70 dB L_{Aeq} at 1 metre from the façade of existing dwellings (or future occupied dwellings already built).

- The new permanent roads will be constructed at an early stage of the project so that construction site traffic is not permitted to use the existing lanes. Other haul roads will be located as far away as possible from existing housing.

- Nearby residents will be kept informed of the construction activity taking place especially with regard to particularly noise operations such as piling.

12.4.2 **Traffic Noise**

Traffic noise due to the development will increase slightly, although such increases will be barely perceptible. However, where increases in traffic noise cause a change in NEC, suitable mitigation measures providing windows with enhanced sound insulation and acoustic trickle ventilators will be adopted. This requirement will be determined by plot specific noise appraisals at the time of detailed designed.

12.4.3 **Other Noise Sources**

Noise emanating from the transport depot and Johnstons Pipes is variable in nature, and appropriate mitigation measures will be "designed in" at the detailed design stage, following appropriate plot-specific survey work.

12.4.2 **Pub / Restaurant, Shops and School**

The local amenities serve the new village and are unlikely to attract significant traffic from other areas. Therefore the overall noise impact will be small, particularly as the facilities have been grouped together and well laid out to minimise noise effects at nearby residences. BS 8233:1999 (reference. 10) gives some general advice on site layout to minimise disturbance and planning

conditions can be imposed on the shops and pub / restaurant and the hours of any deliveries to ensure that no disturbance arises.

Plant noise should be designed and rated in accordance with BS 4142. The local authority should be consulted for any advice of standard noise conditions. In order to meet standards may require careful planning of plant and selection of noise control measures may be required.

With regard to "entertainment" land uses, Planning Policy Guidance PPG 24 "Planning & Noise". Department of the Environment (DoE) 1994 states the following:

"Commercial developments such as fast food restaurants, discos, night clubs and public houses pose particular difficulties, not least because associated activities are often at their peak in the evening and late at night. Local planning authorities will wish to bear in mind not only the noise that is generated within the premises but also the attendant problems of noise that may be made by customers in the vicinity. The disturbance that can be caused by traffic and associated car parking should not be underestimate".

Therefore, during the development of specific plans for such functions, noise impacts will be addressed at an early stage to ensure that impacts are minimised through a combination of good design and management.

12.5 STATEMENT OF SIGNIFICANCE

Potential noise effects arising from the development have been identified as construction noise, increased traffic noise and noise from the operation of the new amenities provided for the village. The overall noise impact will be Negligible because:

- construction noise impact is a short-term effect only
- traffic noise increase is very small
- noise from the local amenities will be controlled by the imposition of planning conditions, and plant noise targets based on BS 4142.

With the mitigation measures described above there should be no residual noise impacts other than a very small, insignificant increase in traffic noise levels.

Existing noise from concrete crushing activity at Johnston Pipes gives rise to noise levels of 58 dB L_{Aeq} at the built area closest to the concrete crusher. A further study will be undertaken to reassess this noise source at the detailed design stage.

Similarly, noise from the Rob Hughes Transport depot will be reassessed at the detailed design stage, and appropriate mitigation "designed in" to the ensuing development. Table 12.5 summarises the noise impact appraisal.

Table 12.5: Summary of Noise Impacts

Potential Impact	Type of Impact	Nature	Importance	Significance of impact without mitigation	Significance of impact with mitigation
Impact due to construction noise and vibration	Adverse	Short to medium term, reversible	Local	Low to medium	Low
Increase in traffic related noise	Adverse	Long term, reversible	Local	Low to negligible	-
Impact of noise generated by the village	Adverse	Long term, reversible	Local	Low	Negligible
Impact of existing noise sources - highways	No impact predicted	-	-	-	-
Impact of existing noise sources - Haulage Depot	Adverse	Short to medium term, reversible	Local	Low to medium	Low
Impact of existing noise sources - Johnston Pipes	Adverse	Uncertain duration, reversible	Local	Low to medium	Low

REFERENCES

1. Planning Policy Guidance Notes (PPG) 24 "Planning and Noise", Department of Transport, Local Government and the Regions

2. BS 4142 : 1997 "Method for rating industrial noise affecting mixed residential and industrial areas", British Standards Institution

3. BS 7445 : 1991 Part 1 "Description and measurement of environmental noise" British Standards Institution

4. Calculation of Road Traffic Noise (CRTN), 1998, Department of Transport, HMSO

5. BS 5228: 1997 "Part 1 Noise control on construction and on open sites" British Standards Institution

6. The Department of the Environment Advisory Leaflet (AL) 72 "Noise control on building sites"

7. Design Manual for Roads and Bridges (DMRB) 1994, Volume 11, Section 3, Part 7 "Traffic Noise and Vibration", Department of Transport, Local Government and the Regions

8. BS EN 12354 Part 4 "Transmission of Indoor Sound to the Outside" British Standards Institution

9. Guidelines for Community Noise, 2001, World Health Organisation

10. BS 8233:1999 "Sound Insulation and Noise Reduction for Buildings – Code of practice", British Standards Institution

14.0 LANDSCAPE AND VISUAL IMPACT

14.1 INTRODUCTION

This section sets out the landscape and visual impact assessment of the proposed development at Lightmoor. The methodology is based on the Guidelines for Landscape and Visual Impact Assessment (reference 1) produced by the Landscape Institute in association with the Institute of Environmental Assessment in 1995. The methodology may be summarised as follows:

- Baseline studies, using existing information and field surveys, were used to review the existing landscape and visual resource of the site and its context. The baseline information was analysed, and a summary produced in the form of written notes and plans. The baseline studies include identification of potential receptors of landscape and visual impacts.

- The impact assessment uses the data collected for the baseline studies as the basis for assessing the magnitude and significance of the predicted landscape and visual impacts. The baseline studies have informed the design of the proposed development from its earliest stages. Mitigation has therefore been embedded within the proposals, and this section describes the proposed mitigation measures.

- The final section provides a statement of the significance of the impacts.

The summary of Baseline Studies and the Impact Assessment have been divided into two sections: the first addresses the site in its wider context, and the second addresses the site in its more immediate, local context. The Baseline Studies involved a process of undertaking an initial desk study, followed one or more field surveys to check and confirm the findings of the desk study, and then an analysis to identify potential receptors of landscape and visual impacts.

14.2 BASELINE SURVEYS: THE APPLICATION SITE IN ITS WIDER CONTEXT

14.2.1 Description of the Site

The description of the site in its context is based on three sources of information:

- the Countryside Character Initiative produced by the Countryside Agency (reference 2);
- Telford and Wrekin's study of the wildlife and landscape of Wrekin District, undertaken as part of the Councils Agenda 21 initiative (reference 3); and
- Desk top and field survey work carried out by Tibbalds TM2.

The Countryside Character Initiative

The Countryside Character Initiative (CCI) came about because it was recognised that there was a need for a new approach to Landscape Assessment which would look at the whole of England's countryside, rather than just specific designated

areas, and provide a consistent national framework within which more detailed local landscape assessments would sit. This new approach led to the mapping of England into 159 separate, distinctive character areas.

The Lightmoor site falls predominantly within area 66: Mid Severn Sandstone Plateau, although area 65: Shropshire Hills lies directly to the west of the site and forms an important context for the proposed development. Area 66 includes Telford in the North, and Kidderminster and the Wyre Forest to the south. It stretches to the edges of the urban conurbation of Dudley, Wolverhampton and Birmingham in the east, and includes the River Severn just within its western boundary. Key characteristics of the Mid Severn Sandstone Plateau are described in the CCI as:

- Rolling landform with open, arable cultivation dominating an often weak hedgerow pattern.
- Prominent urban fringes.
- Contrasting areas of smaller fields, and mixed field pattern with more distinctive hedgerows in west.
- Parklands and estate conifer and deciduous woodland.
- Patches of heathland.
- Extensive mixed woodland together with scattered mining and forest edge housing forming distinctive Wyre Forest landscape.
- Stour and Severn valleys with frequent villages and historic bridging towns.
- Narrow, steep-sided wooded dingles found throughout the area.
- Steep, wooded gorges of the Severn Valley.
- Coalfield remnant landscape along the Severn Valley.
- The Staffordshire and Worcestershire canal an important man-made feature.
- New town landscape of Telford.

Being such a large area, many of area 66s features do not apply to the immediate context of the Lightmoor area. However, the landscape character of the part of the area that includes the Application Site is described in the CCI as follows:

North of the Ironbridge gorge is a landscape of gentle valleys and escarpments forming the east Shropshire (Coalbrookdale) Coalfield, dominated by the new town of Telford. Open land, including former agricultural landscapes, forms a mosaic with built-up areas, industry, houses and reclaimed land. There is a developing woodland framework. Three settlement patterns are overlaid. The underlying pattern of small villages and hamlets has been largely lost under sprawling 19th century settlement, abandoned open-cast reclaimed land and other industrial sites. The new town and motorway in turn lay down a strong 20th century pattern. The strongest impression is of industrial history, whether as areas of derelict land, pit heaps, subsidence pools, canals or railways. However, at the edges, arable is still present on the flatter land of this northern area and, on the steeper ground, mixed or predominately pasture land, is present within small hedged fields.

Area 65: Shropshire Hills is a large area that encompasses pasture and arable fields, distinctive landmarks such as Long Mynd, Wenlock Edge, the Wrekin and

Clee peaks, and scattered farms. It stretches from the River Severn in the east to the Welsh border in the west. Most of the area has little relationship with the Application Site. However, the exception is the Wrekin, which lies to the north-west of the Application Site, and it is described in area 65 as:

The Wrekin is an isolated hill at the northern end of the area. Its steeply-sloping, rounded form rises from the Shropshire plain to the north and is recognisable from afar. The surrounding land has arable fields divided by hedges and copses but the Wrekin itself rises abruptly, clothed in woodland and topped by barren, rocky outcrops and radio masts. Much of the woodland is conifer plantations which, with their mix of ragged straight-sided edges, have altered the character of this famous landmark in recent years.

The Landscape and Wildlife of Wrekin District

As part of its Agenda 21 initiative, Telford & Wrekin Council has identified the various landscape character areas within the District. This provides a more detailed level of descriptive information that sits within the strategic landscape framework provided by the Countryside Character Initiative. Wrekin District is described as follows:

In the south, the steep banks of the Severn Gorge are well wooded and have been greatly influenced by past history. There is a central area of former coalfields which have been extensively open cast and mined, leaving distinctive regenerated pitmounds. In the north, the Shropshire Plain, a flat, open, intensively farmed agricultural area with heathland and wetland features. To the west are the Wrekin Hills, a volcanic outcrop, which form a distinctive local landmark and to the east runs a ridge of sandstone, well wooded in places. All these areas have a distinctive quality and individual identity.

The Telford & Wrekin Council study identifies two regional character areas:

- The North Shropshire Plain; and
- The East Shropshire Coalfield.

The Application Site lies within the East Shropshire Coalfield. The Telford & Wrekin Study sub-divides this area into 10 smaller character areas. The Application Site lies within the Western Telford Coalfield, although the northern and eastern fringes are immediately adjacent to the Telford Coalfield area. These character areas are described as follows:

- Western Telford Coalfield: Land between the foothills of the Wrekin and Telford New Town, influenced by past mining activities and open cast operations. A mix of old and new landscapes, ancient roads and tracks, regenerated woodland. Open with few features, land reshaped and restored to agriculture with some recent structure planting.

- Telford Coalfield: Telford lies on a carboniferous Coalfield, extensively mined over the last century. Its present character is a patchwork of small relic landscapes, pitmounds, railways and canals, contrasted against housing,

industry and new landscape structure planting giving it a well-wooded appearance.

14.2.2 Desktop and Field Survey

Tibbalds TM2 carried out a desktop study of the site in its context, drawing on information from Ordnance Survey maps, aerial photographs, the Telford & Wrekin Local Plan and the ecological and archaeological studies referred to elsewhere in this Environmental Statement. The desktop study, together with field surveys, identified:

- landscape and open space designations;
- topography, landscape and settlement pattern; and
- potential receptors of landscape and visual impact.

Landscape and Open Space Designations

The Wildlife Site lies immediately adjacent to the Application Site's eastern boundary. It is one of the largest and most cohesive areas of wildlife value remaining in the south-west of Telford's urban area. The Wildlife Site contains a wide variety of habitat types, predominantly regenerated pitmounds. Chapter 6.0, Ecology and Nature Conservation, describes this area in detail.

South of the Application Site is an Area of Special Landscape Character focussed on Coalbrookdale, Ironbridge and the Severn Valley. This area cannot be seen from the Application Site. The steep, narrow valley of Loamhole Dingle lies to the west of the Application Site, and is designated as a Site of Special Scientific Interest (SSSI). Loamhole Dingle contains ancient Woodland.

The Wrekin forms a distinctive landmark for Telford and the surrounding area, and can be seen from the Application Site, The hill itself and the area surrounding it contains a number of designated areas including: a SSSI, ancient woodland, Wildlife Site, and a local nature reserve. Drawing 6479/ES-14-01 shows the Application Site in its wider context, and identifies the landscape designations identified above.

Topography, Landscape and Settlement Pattern

The topography of the sites context is varied and undulating, with narrow valleys contrasting with more open, gently rolling farmland. The edges of southern Telford are clearly defined by ring roads, leading to fragmentation between the woodland and fields lying outside the Application Site and those lying within. Telford itself is made up of a series of development clusters separated by open space. Some of these clusters are centred around older areas (e.g. Dawley), but most are new developments planned as part of the New Town. The various clusters are linked by roads and roundabouts, which are characterised by new landscape structure planting giving the Town a well wooded appearance. The undulating topography and heavy landscape result in little visual connection between the different areas of Telford.

Drawing 6479/ES-14-02 illustrates the topography of the sites context, showing:

- the steep valley leading down to Coalbrookdale south of the site;
- the tightly enclosed Severn valley at Ironbridge;
- the more open character of the Severn valley to the west of Ironbridge;
- the distinctive landmark of The Wrekin to the north-west of the site;
- the undulating form of Telford, with the area of Woodside occupying the plateau to the south of the Application Site; and
- the general north-west to south-east slope of the Application Site.

Potential Receptors of Visual Impact

The topography plan together with a field survey undertaken by Tibbalds TM2 in November 2001 identified potential receptors of visual impact in the areas around the site. The undulating topography of the surrounding area, substantial landscape cover and pockets of private residential development make it difficult to identify all possible long distance views of the Application Site. The field study of the sites context therefore concentrates on identifying key views to the site, and these are shown on Drawing 6479/ES-14-01: Site Context Plan and the accompanying photographs in Drawing 6479/ES-14-03, and are detailed below in Table 14.1.

Table 14.1: Visual Receptors

Ref	Location	Description
1,2	The Wrekin and land close to Little Wenlock	The site drops by some 50 metres from the Stoneyhill Waste Site south eastwards towards the Lightmoor Wildlife Site. It is difficult to determine the location of the site from these viewpoints. Long views are therefore restricted to very small parts of the flatter areas of the site immediately adjacent to Horsehay. The majority of the site falls away out of sight.
3,4	Woodside	The steep, wooded valleys to the south and west of the site do not allow views of the Application Site. However, the plateau occupied by the Woodside area of Telford lies to the south-east of the site across one of these valleys and it has long views of the central part of the site.
5	Little Dawley	There are various views of the Application Site from Little Dawley and the south-western edge of Dawley. As the site rises up away from these areas, it is often very prominent although trees, hedgerows and buildings frequently frame or partially screen the various views.

Landscape impacts are addressed in the next section, as the key impacts are related to landscape features within the Application Site and immediately adjacent to it (e.g. the Lightmoor Wildlife Site and Stoneyhill Waste Site) rather than more distant features such as the Wrekin.

14.3 BASELINE SURVEYS: THE SITE IN ITS LOCAL CONTEXT

Tibbalds TM2 carried out a desktop study of the site in its local context, drawing on information from Ordnance Survey maps, aerial photographs, the Telford & Wrekin Local Plan and the ecological and archaeological studies referred to elsewhere in this Environmental Statement. The desktop study, together with field surveys, identified:

- landscape and open space designations;
- landscape character; and
- potential receptors of landscape and visual impact.

14.3.1 Landscape and Open Space Designations

The Application Site has three designated areas: the ancient woodland of the distinctive Dingle in the south; areas defined as forming part of Telford's Green Network of open space; and a small Wildlife Site lying partly within the Application Site to the north adjacent to the Stoneyhill Waste Site. These are shown in Drawing 6479/ES-14-04.

14.3.2 Landscape Character

Tibbalds TM2 developed an appraisal form based on the Landscape Institutes Guidelines for Landscape and Visual Impact Assessment, and this was used to systematically assess the landscape character of the site and its immediate context. Completed forms are included in Appendix I, and these address two sets of issues:

- a description of each character area, including land uses, views, trees, ground cover, and enclosure; and
- an assessment of the quality of the area, in terms of importance, local distinctiveness, rarity, tranquillity, scale and its ability to be mitigated.

The results of the assessment were mapped on two plans:

- Drawing 6479/ES-14-05: Character area plan, setting out the different landscape character areas within the Application Site; and
- Drawing 6479/ES-14-06: A tree and hedgerow survey of the Application Site.

Summarising these two plans, the existing landscape character of the site may be broadly defined as two areas:

- the area to the north of Stoneyhill and Holywell Lanes, which is characterised by large arable fields enclosed by a strong hedgerow structure, made up mostly of hawthorn, and hazel, there are also pockets of mature trees, ash with some oak and rowan; and
- the area to the south east, where the character is more varied and derived from more substantial beech and oak tree cover, irregular topography, the

regenerated birch woodland of the Wildlife Site and open areas of grazing land.

Northern Area

This area generally slopes gently towards the south east, although there is a steep slope running approximately from Stoneyhill in the south-west to Woodlands Lane in the north-east. There are attractive, panoramic views out over Telford from the top of this steep slope. Strong hedgerows enclose the lanes and these are not only of high landscape value, but are also of ecological and historical importance. The structure of these hedges is typically hawthorn, hazel, ash, and blackthorn although there is also some holly, willow and elderberry. Many of the hedgerows are ecologically important due to the diverse nature of the ground flora and fauna within them. The lanes provide access to residential properties, and are also used by local people as leisure routes.

The field pattern is generally well defined by hedgerows or fences, although some of the hedgerows have many gaps and have not been well maintained and others have been largely replaced by fences. The hedgerows north of Woodlands Lane are generally of greater landscape value than those to the south, and this is also the case in terms of ecological value. The land is farmed and is intensively managed. Although its appearance may change with the seasons, its character is largely static.

There is generally a lack of tree cover in the northern area, with trees mostly being confined to hedgerows. However, there are some areas of woodland and these are:

- the attractive area of beech trees to the north of Stocking Farm / Woodlands Lane that runs down the small, steeply sided valley towards Johnston Pipes;
- the attractive area again to the north of Stocking Farm that defines the steep sided area running down to the old canal where there are some mature willow trees growing amongst younger self seeded trees; and
- the conifer plantation in the small valley to the east of Croppings Farm.

There are long views south-eastwards over Telford from most parts of the northern area. Conversely, the central part of the northern area is highly visible from other parts of Telford, especially the Woodside area. There are some attractive views along the lanes within the site. Views northwards to the Stoneyhill Waste Site are unattractive, although somewhat softened by the tree planting at the Site. There are some unattractive glimpse views of Johnston Pipes. Areas of the Application Site close to Johnston Pipes are affected by noise from the factory's manufacturing processes.

Southern Area

The southern area has open areas of grazing land separating Stoneyhill, Burroughs Bank and Holywell Lane from the dense regenerated woodland of the Wildlife Site. These generally arable and semi-improved open areas have a

relatively flat topography that reveals their history of opencast mining during the second world war. The Wildlife Site has an irregular topography of spoil heaps or pitmounds that reveal the history of coal mining in the area. The planting within the Wildlife Site is predominately oak and birch and there is a good ground cover of ivy, ferns and honeysuckle. Other shrub species include: holly, rowan and particularly hazel which has been coppiced in places. The woodland is at an interesting stage in its life cycle: the birch is reaching the end of its dominant period and is starting to allow the climax species, the oak, to take over.

As in the northern area, strong hedgerows enclose the lanes and these are not only of high landscape value, but are also of ecological and historical importance. The hedgerows at the confluence of Stoneyhill, Burroughs Bank and Holywell Lane are particularly substantial and include attractive mature oak trees.

The south's major contrast to the northern area is the substantial tree cover. This is varied in character and ranges from the elm and ash ancient woodland of The Dingle to the regenerated woodland of the Wildlife Site. Being lower than the northern area, long views are less extensive from the southern area. This, together with the greater degree of tree cover, makes the area feel more enclosed. There are areas of archaeological and cultural interest in the southern part of the site, and these include the line of the old canal, which can be seen running north of the Squatter Cottage (signposted as canal walk) and close to the Dingle ancient woodland.

14.3.3 Potential Receptors of Landscape and Visual Impact

Landscape and Visual Sensitivity

Detailed field surveys have been undertaking throughout the process of designing the proposed development at Lightmoor. Two final site visits were undertaken by Tibbalds TM2 in November 2001 to complete the work. These surveys identified the following potential receptors and landscape and visual impact, and assessed their sensitivity. Sensitivity is based on Table 14.2, which gives examples for both landscape and visual sensitivity:

Table 14.2: Landscape and Visual Sensitivity

	Landscape Receptors	Visual Receptors: Examples of types of use
High Sensitivity	Important components of landscape of particularly distinctive character susceptible to relatively small changes	Residential properties and public rights of way
Medium Sensitivity	A landscape of moderately valued characteristics reasonably tolerant of change	Sporting and recreational facilities, office buildings, public buildings
Low Sensitivity	A relatively unimportant landscape, the nature of which is potentially tolerant of substantial change.	Industry

Existing Buildings

Table 14.3 details the residential dwellings are likely be receptors of landscape and visual impact:

Table 14.3: Residential dwellings likely be receptors of landscape and visual impact

Ref	Location	Sensitivity
1	Nos. 27, 28 and 29 Woodlands Lane, along with Melloray (no.30) and Myford House.	High
2	Wyverd and Arcadia at Myford	High
3	Woodlands Farm: Sunset Cottage	High
4	Woodlands Farm: Woodlands House	High
5	Woodlands Farm: Woodlands View	High
6	Three buildings at the western end of Stoneyhill: Croppings Farm, Croppings Cottage and the house adjacent to Croppings Cottage	High
7	The single house on the corner of Stoneyhill and Burroughs Bank	High
8	Two semi-detached cottages at the end of Stoneyhill close to Stocking Farm	High
9	Small cottage at the top of the hill at the end of Stoneyhill close to Stocking Farm	High
10	Woodlands Cottage close to the junction of Woodlands Lane and Holywell Lane.	High
11	Bungalow close to the junction of Woodlands Lane and Holywell Lane.	High
12	Houses on Boatwell Meadow.	High

Routes

There are views of the Application Site from adjacent roads, including glimpses from the Ironbridge By-Pass to the south, Wellington Road to the north, and Holly Road to the east. The views from these roads are restricted by landscape features such as embankments, woodland and hedgerows. There are also views of the Application Site from Woodlands Lane, Stoneyhill, Holywell Lane and Burroughs Bank. These views vary considerably throughout the site area, and are sometimes restricted by the high, dense hedgerows running along the lanes. The sensitivity of the routes is summarised in Table 14.4.

Table 14.4: Sensitivity of Routes to Landscape and Visual Impact

Ref	Location	Sensitivity
13	Ironbridge By-Pass	Medium
14	Wellington Road	Medium
15	Woodlands Lane	High
16	Stoneyhill	High
17	Holywell Lane	High
18	Burroughs Bank	High

Drawings 6479/ES-14-06 to 6479/ES-14-09 illustrate the views from the dwellings and routes.

Landscape Features

The following landscape features may be directly affected by the proposed development:

Table 14.5: Sensitivity of Landscape Features to Landscape and Visual Impact

Ref	Feature	Sensitivity
A	Hedgerows adjacent to Woodlands Lane in the north of the Application Site	High
B	Hedgerows and trees to the north of Woodlands Lane	High
C	Mature woodland north of Woodlands Lane	High
D	Woodlands Lane and its associated hedgerows	High
E	Hedgerows and isolated trees in the central area of the Application Site	High
F	Coniferous planting in the central area of the Application Site	Low
G	Stoneyhill Waste Site	Low
H	Stoneyhill and its associated hedgerows	High
J	The western end of Burroughs Bank where it intersects with Holywell Lane	High
K	The area of fields, paddocks and hedgerows to the south of Stoneyhill and Holywell Lane	High
L	The Lightmoor Wildlife Site south of Holywell Lane,	High
M	The Lightmoor Wildlife Site north of Holywell Lane, including canal Walk	High
N	Woodland adjacent to Johnston Pipes	Medium

14.4 ANALYSIS OF PREDICTED IMPACTS

As for the Baseline Studies, the impact assessment is split into two sections: the first addresses impacts on the sites wider context, the second addresses the local area of the site.
The terms used for the assessment of visual impact are defined as:

- Major visual impact — where there is a change in view which permanently and substantially affects the visual amenity of sensitive receptors such as residential property and public open space
- Moderate visual impact — where there is a change in view which is readily apparent when viewed, but does not constitute a substantial impact on visual amenity
- Slight visual impact — where an actual change in view is apparent when sought, but does not maintain an obvious alteration to visual amenity
- No visual impact — where there is no change in view.

The terms used for the assessment of landscape impact are defined as:

- Major landscape impact — where there is a notable change in landscape characteristics over an extensive area, or a very intensive change over a more limited area
- Moderate landscape impact — where there are moderate changes in landscape character in a localised area
- Slight landscape impact — where changes in landscape character are virtually imperceptible
- No landscape impact — where there are no changes in landscape character.

Landscape and visual impacts are therefore considered on a graded scale of major, moderate, slight or none, and classed as adverse or beneficial. Impacts have been assessed in both the short term (during construction) and the long term (following construction). The long-term impacts have been assessed with mitigation as set out in the outline planning application in place. Where appropriate, recommendations for further mitigation at reserved matters stage are made. However, as these recommendations do not form part of the outline application, they have not been taken into account in assessing impacts. The impact assessment therefore presents a worst case scenario, and it is possible that impacts could be further mitigated at the detailed design stage.

The following tables (Tables 14.6 to 4.8) provide an assessment of the landscape and visual impacts of the development. The process of designing the development has involved careful consideration of the landscape setting of the proposals, the special characteristics of the site, and the visual impact on existing dwellings and other areas. Therefore, mitigation is considered as part of this impact assessment rather than as a separate section.

Table 14.6: The Application Site in its Wider Context

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
	VISUAL RECEPTORS				
1, 2	The Wrekin North of Little Wenlock	No impact / Slight adverse	No impact	It is very difficult to identify the site from long viewpoints to the west. A very small portion of the northern part of the site can just be seen from the Wrekin and land north of Little Wenlock. There may possibly be a slight adverse impact during construction of the northern part of the development only, when the site appears neither as part of the built area of Telford nor as open space. Once complete, the development will appear very much as part of the urban area from this viewpoint	None required
3	Woodside	Moderate adverse	Moderate adverse	A substantial part of the centre of the proposed development will be seen from Woodside, which currently enjoys long views over the fields of Lightmoor.	The proposed planting on the edges of the village and the retention of existing hedgerows and trees will help to set the new development sensitively into the landscape. However, the proposed planting will take several years to mature and, in the short term, new development will be highly visible from Woodside.
4	Woodside	Moderate adverse	Moderate adverse	Comments as above.	As above
5	Little Dawley (Holly Road)	Moderate adverse	Moderate adverse	There are various views of the Application Site from Little Dawley and the south-western edge of Dawley. This is a typical example of one such view. The Application Site rises up towards Stoneyhill Waste Site, and development will be visible.	The retention of existing trees and hedgerows will provide partial screening. Proposed planting on the edges of the development will also soften views.

Table 14.7: The Application Site in its Local Context

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
	VISUAL RECEPTORS				
1	Nos. 27, 28 and 29 Woodlands Lane, along with Melloray (no.30) and Myford House.	Major adverse	Major adverse	The dwellings on Woodlands Lane currently look southwards over open fields. Myford House has a restricted outlook southward, but has views over open fields to the south and east. Residential development will be located immediately south of the dwellings on Woodlands Lane, having a major impact on views.	An open meadow is proposed adjacent to Woodlands Lane, and this together with the proposed woodland planting to the east of Myford House will soften the visual impact of the new development on Myford House. Detailed design at the reserved matters stage will provide opportunities for mitigating the impact on the visual amenity of dwellings on Woodlands Lane.
2	Wyverd and Arcadia at Myford	Major adverse	Major adverse	These dwellings back onto the area to be developed by Johnston Pipes and Lightmoor Villages proposed employment village. They currently have good views over the fields, and these will be restricted by the new development.	The landscaped mound proposed as part of the Johnston Pipes development will screen views from these dwellings of the northern part of the site. Woodland planting is proposed south of the mound to further screen views and soften the visual impact of the new development.
3	Sunset Cottage (*Check name)	Moderate adverse	Moderate adverse	Sunset cottage is oriented so that its windows look east and west. It will continue to have views over an open field to the west. However, the proposed residential development south of Horsehay will be visible, especially from the buildings upper storey.	New hedgerow and tree planting is proposed along the new High Street, which will help to screen views of the road from Sunset Cottage. It will also create an enclosed field to the west of the dwelling that retains a similar character to the existing field. No further mitigation proposed as open views are retained.
4	Woodlands House	Moderate adverse	Moderate adverse	Woodlands House is oriented principally south, and views are partially screened by outbuildings and/or landscape, including Woodlands Lanes hedgerows. A strong hedgerow to the east obscures views over fields from ground floor windows, although the upper floor has long views.	Open space is proposed to the north and south of Woodlands House, maintaining open views in both directions. Formal and informal tree planting is proposed along the western edge of the proposed development, softening its visual impact across the open space of Woodlands Park. Detailed design at the reserved matters stage will provide opportunities for mitigating the impact on views eastwards from the upper floors of Woodlands House.

Table 14.7: The Application Site in its Local Context (continued)

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
5	Woodlands View	Major adverse	Major adverse	This bungalow has its principal windows facing east, and has long views over open fields. It also has some views to the south. A substantial hedgerow obscures views to the north. Residential development is proposed to the east of the bungalow, separated by its driveway and recently planted hedgerow. Views out from the bungalow will be significantly changed as a result of the proposed development.	Detailed design at the reserved matters stage will provide opportunities for mitigating the impact on views eastwards from Woodlands View. It is recommended that an open space is located immediately to the east of Woodlands View, to maintain an open aspect.
6	Three buildings at the western end of Stoneyhill: Croppings Farm, Croppings Cottage and the house adjacent to Croppings Cottage	Moderate adverse	Moderate adverse	The ground rises steeply to the north of this group of dwellings, preventing long views outwards. Dense screen planting / hedgerow to the northern boundary of the group also restricts views out, particularly from the ground floors. The house adjacent to Croppings Cottage has views westward over a small paddock, and these are constrained by the bulk of the Stoneyhill Waste Site. All three dwellings will be able to view the proposed High Street, and the proposed planting in the open spaces associated with the village. However, views of built development are likely to be restricted to glimpses.	Hedgerow and tree planting proposed along the High Street will help to reduce the visual impact of cars. The rising ground and existing planting will restrict views to the north. However, the proposed stands and groups of trees along the western edge of the development will help to soften any glimpse views. Woodland planting is proposed to the east of Croppings Cottage, and this will help to reinforce the existing line of trees on the boundary, reducing the visual impact of the proposed village.
7	A single house on the corner of Stoneyhill and Burroughs Bank	Slight adverse	Slight adverse	This house is strongly enclosed by high hedgerows and trees. Its principal façade is oriented to face south west, away from the proposed development. There are ground floor windows looking north westwards towards the proposed development, which is located on land sloping upwards away from the enclosure provided by Stoneyhills hedgerows.T he orientation and existing landscape of this dwelling reduce the impact of views of the development.	Mitigation has been designed in to the application by removing development from south of Holywell Lane and Stoneyhill (see summary of design and mitigation process in Section 14.5) The proposed planting of stands and groups of trees on the eastern boundary of the proposed built area will help to soften any glimpse views of the development.

Table 14.7: The Application Site in its Local Context (continued)

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
8	Two semi-detac hed cottages at The Stocking	Moderate adverse	Moderate adverse	These dwellings are oriented so that their principal windows face approximately north-south. The eastern dwelling has windows looking west. Substantial landscape screens the northern boundary of the houses. The view southwards will remain open, although new development will be apparent at the top of the slope. Views to the north are screened by existing landscape, and are over the proposed Stocking Park and the edge of the new development. The view to the east will be obstructed by new development, and visual impacts are therefore most significant in this area.	The principal outlook south is retained as an open area. Stands and groups of trees on the eastern boundary of the villages built area will help to soften views of the development up the hill. Detailed design at the reserved matters stage will provide opportunities for mitigating the impact on views eastwards.
9	Small cottage at the top of the hill, accessed via The Stocking	Moderate adverse	Moderate adverse	The windows of this building face predominantly east. There is one rooflight on the north western part of the roof, immediately adjacent to the proposed development area. Whilst the dwelling is very close to the proposed development, its outlook remains fairly open although new development around Stocking Farm will be visible.	Detailed design at the reserved matters stage will provide opportunities for mitigating the impact of development to the north of the dwelling. It is recommended that a strip of land is kept free of built development and public access immediately to the north of the property to protect its residential amenity.
10	Bungalow west of junction of Woodlands Lane and Holywell Lane	Moderate adverse	Moderate adverse	This dwelling is set slightly below the level of the field surrounding Stocking Farm, and its principal windows look north eastwards and south westwards parallel to Holywell Lane. Its outlook towards Stocking Farm is somewhat restricted by a number of small outbuildings. The proposed new development will be readily apparent from this dwelling.	The location of open space around the southern edge of the proposed development protects the open views parallel to Holywell Lane. Detailed design at the reserved matters stage will provide opportunities for mitigating the impact of development to the north of the dwelling.

Table 14.7: The Application Site in its Local Context (continued)

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
11	Bungalow east of Woodlands Lane and Holywell Lane	Slight adverse	Slight adverse	This bungalow is protected by distance and topography from the proposed development. However, there may be a slight impact on more distant views up the slope towards the Stoneyhill Waste Site.	The planting of stands and groups of trees on the eastern edge of the proposed built area of the village will help to soften views from this dwelling.
12	Houses on Boatwell Meadow	Slight adverse	Slight adverse	This group of dwellings enjoy long views south westwards across the Wildlife Site towards the Application Site. The dense vegetation screens the proposed development area, but some views of new buildings and landscape will be apparent.	The planting of stands and groups of trees on the eastern edge of the proposed built area of the village will help to soften views from these dwellings.
13	Ironbridge By-Pass	Slight adverse	Slight adverse	The Application Site can only be viewed for some 200 metres between the Dingle and the Lightmoor Wildlife Site. Few pedestrians use this route, and most viewers will see the site from a moving vehicle. The substantial hedgerows and trees of Stoneyhill and Burroughs Bank will screen much of the view of the proposed development. However. Westbound vehicles will have views up the sloping areas of the site, where development will be more prominent.	Mitigation has been designed in to the application by removing development from south of Holywell Lane and Stoneyhill (see summary of design and mitigation process in Section 14.5) The proposed woodland planting at Croppings Park will screen views of the built area of the village from the road. The planting of stands and groups of trees on the eastern edge of the proposed built area of the village will also help to soften views.
14	Wellington Road	Major adverse	Major adverse	There are currently open views across the northern part of the site from Wellington Road. These will be obstructed by the new development, although an open field is retained to the west of the group of buildings at Woodlands Farm, allowing this attractive view to remain.	The proposed hedgerow and tree planting along the new road will help to set it into its environment and reduce views of vehicles across the open field immediately to the west of the group of dwellings at Woodlands Farm.

Table 14.7: The Application Site in its Local Context (continued)

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
15	Woodlands Lane	Major adverse	Major adverse	Woodlands Lane varies from a raised, open character towards the north of the site, to a sunken, tightly enclosed character near Stocking Farm. Views out therefore very along its length. For most of its length, Woodlands Lane will have development on at least one side of it. Views out will therefore be adversely affected.	Detailed design at the reserved matters stage will provide opportunities for mitigating the impact on views from Woodlands Lane.
16	Stoneyhill	Moderate adverse	Slight adverse	Stoneyhill is generally a very enclosed lane, lined with mature hedgerows and trees. There are glimpse views north and south over the application area through gaps in the hedgerows. As open space is proposed along both sides of Stoneyhill, views out will remain fairly open although new development will be visible from some areas. Construction equipment may make the development more prominent during construction than on completion.	Mitigation has been designed in to the application by removing development from south of Holywell Lane and Stoneyhill (see summary of design and mitigation process in Section 14.5) Woodland planting in Croppings Park and stands and groups of trees on the edges of the built area of the village will help to soften views of the proposed development to the north of the lane.
17	Holywell Lane	Major adverse	Moderate adverse	Holywell Lane will have new development to the north of it, separated from the land by and an area of public open space. No development to the south of the lane. During construction and before new planting has had time to mature, the visual impact of the new development on views to the north from the lane will be major. However, the absence of development to the south and the proposed public open space means that the long-term visual impact is assessed as moderate.	Mitigation has been designed in to the application by removing development from south of Holywell Lane (see summary of design and mitigation process in Section 14.5) Detailed design at the reserved matters stage will provide opportunities for mitigating the impact on views northwards from Holywell Lane.

Table 14.7: The Application Site in its Local Context (continued)

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
18	Burroughs Bank	Slight adverse	No impact	Burroughs Bank is enclosed by hedgerows and trees. No development is proposed adjacent to it. The meeting point of Burroughs Bank, Stoneyhill and Holywell lane is a distinctive and attractive part of the site. It is highly enclosed by trees and hedgerows, but there may be some glimpse views of the proposed development around Stocking Farm. These are unlikely to have an adverse impact on views.	No mitigation proposed

Table 14.8: Landscape Impact

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
A	Woodlands Lane	Major adverse	Major adverse	The hedgerows along Woodlands lane will largely remain intact. However they will be broken twice to allow the proposed High Street to cross the lane. The landscape character within the lanes will be retained as far as possible. However, as Woodlands Lane will be a major leisure route, some lighting may need to be introduced and some improvements to the lanes surface may be required both would significantly change its character. The character of the hedgerows from the field side will change significantly as built development rather than open space will generally be adjacent to them.	It is proposed that hedgerows are reinforced with new planting to improve and maintain their ability to screen residential development. At least one side of hedgerows will remain in the public realm to allow access for maintenance purposes. A strategy for protecting landscape during construction should be produced as part of reserved matters applications
B	Hedgerows, trees and fields north of Woodlands Lane	Major adverse	Major adverse	Whilst the hedgerows will be retained as far as possible, they will be located within built areas of development and so their landscape setting will be significantly changed.	It is recommended that hedgerows are retained, and at least one side remains in the public realm to allow access for maintenance purposes. A strategy for protecting landscape during construction should be produced as part of reserved matters applications
C	Mature woodland	Moderate adverse	Slight adverse	This wooded valley is an unusual area of mature beech trees and little ground cover on steep slopes. Some low density residential development is proposed close to its edges. However, open space is also proposed on three sides of the area, helping to maintain its setting. Impacts are likely to be greater during construction, when new buildings and landscape are implemented adjacent to the edges of the woodland. However, the essential enclosed nature of the woodland will remain.	A strategy for protecting landscape during construction should be produced as part of reserved matters applications
D	Hedgerows, trees and fields in centre of site	Major adverse	Major adverse	Whilst the hedgerows are generally of a lower landscape quality than those in other parts of the site, the landscape character of this area will be significantly changed.	It is recommended that hedgerows are retained, and at least one side remains in the public realm to allow access for maintenance purposes.

Table 14.8: Landscape Impact (continued)

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
E	Coniferous planting	No impact	Moderate beneficial	This areas of coniferous planting contrasts with the native species over the remainder of the study area. Some trees appear to be nearing the end of their life. This area offers low visual landscape amenity and little ecological diversity.	The proposed new woodland planting will enhance this area.
F	Stoneyhill Waste Site	No impact	Moderate beneficial	The waste site is outside of the application boundary, and is a significant and rather unattractive landmark feature in the area.	There are opportunities to sensitively landscape the edge of the Application Site so that the Waste Site sits more naturally into its surroundings. Tree planting has already taken place on the edges of the waste site, and new woodland buffer planting proposed on the edge of the Application Site will help blend the two environments.
G	Stoneyhill	No Impact for most of the lanes length Moderate adverse at the northern end	No impact for most of the lanes length Moderate adverse at the northern end	Stoneyhill forms a boundary between open space that is proposed as part of the network of leisure and recreation areas for the village, and the buffer zone to the Wildlife Site. As open space is proposed along both sides of Stoneyhill, the landscape character of the lane will remain largely unchanged. The exception is in the north, where the proposed new High Street intersects with Stoneyhill. By introducing informal open space in place of farming land, and increasing tree and shrub planting along the lane, the ecological corridor formed by the significant hedgerows along the lane will be enhanced. These proposed changes are unlikely to adversely affect the existing landscape.	No mitigation proposed for most of the length of the lane. There are opportunities to design the intersection of the proposed new High Street and Stoneyhill sensitively so as not to adversely affect the character of the lane at its northern end. This should be addressed as part of a reserved matters application.
H	Burroughs Bank	No Impact	No Impact	Burroughs Bank lies outside the area intended for built development, and it will continue to be flanked by open space. There is therefore likely to be no impact on the landscape character of the lane.	No mitigation proposed

Table 14.8: Landscape Impact (continued)

	LOCATION	SHORT TERM IMPACT During construction	LONG TERM IMPACT Following construction	COMMENTS	MITIGATION
J	Fields to the south of Stoneyhill & Holywell Lane	No impact	Moderate beneficial	The intention is for these fields to act as a buffer between the proposed village and the Wildlife Site to the south east. The sustainable urban drainage system proposed for the village will help to maintain the water table as existing, so there are unlikely to be any negative landscape impacts arising from changes in the sites natural drainage regime.	New hedgerow planting and reinforcement of existing hedgerows will enhance the landscape character of the area.
K	The Dingle	No impact	No impact	As the proposed built area of the village is contained to the north of Stoneyhill, the area around the Dingle will remain undeveloped and the present context will be maintained. It is expected therefore that there will be no landscape impact.	No mitigation proposed

14.5 MITIGATION

14.5.1 Mitigation and Enhancement Proposals

The approach to the design of Lightmoor Village has been informed by site appraisals from an early stage. The landscape and visual impact appraisals, together with studies of the sites ecology, ground conditions and ecology, have informed the design of the Village and enabled it to respond sensitively to its surroundings.

14.5.2 Design History

The initial feasibility stage of masterplanning took place in late 1997. At the time, background information on the site and its context was restricted to desktop studies and site visits. The Outline Development Plan produced at the end of 1997 closely reflected both the 7(1) consent and the allocation as shown on Telford and Wrekin's local plan proposals map.

Consultation with local people identified a number of issues, including concerns that the sites ecology needed further investigation before decisions could be made regarding the feasibility of development at Lightmoor. Other sections of this Environmental Statement set out the influence that the ecological, archaeological and ground conditions investigations had on the masterplanning process. These resulted in a design decision to make the development more compact, and move it north of Stoneyhill and Holywell Lanes. This had a number of advantages from a landscape and visual impact viewpoint which may be summarised as:

- Removing development from the area south of Stoneyhill and Holywell Lane significantly reduced the visual impact on the Ironbridge By-Pass and dwellings immediately to the east of the site;
- A more compact form of development enables more cohesive areas of open space to be created so that, whilst the landscape impact is marginally increased in the north of the site, it is significantly reduced in the sensitive areas adjacent to Burroughs Bank, the Dingle and the Wildlife Site.
- The realignment of the High Street has reduced the severance of the lanes from the original proposal of five crossing points to four, significantly reducing impacts on the southern area of the site.

The disadvantage with this approach, however, is that focussing development in the northern area of the site increases its visual impact on views from Woodside, Little Dawley, Woodlands Farm and Woodlands View.

The masterplanning process has therefore built-in mitigation to the southern part of the Application Site by concentrating built development in the north. Further mitigation measures are proposed in the north as part of this outline planning application, and these have been set out in Tables 14.6 to 14.8 in Section 14.4.

14.6 STATEMENT OF SIGNIFICANCE

Visual impacts on the Application Site's wider area will be of slight to moderate significance. Over time, as the landscape matures, the proposed development will appear as a normal, intrinsic part of the urban area of Telford. In the local context, visual impacts are slight to moderate within and close to the south-eastern area of the Application Site. Again, as the landscape matures, the proposed development will appear as a normal part of Telford's townscape.

However, visual impact within and close to the northern part of the Application Site are of moderate to major significance, and views from some existing dwellings will be substantially changed. The outline application includes mitigation measures such as: the planting of woodland and stands and groups of trees; the retention of hedgerows; and the retention of areas of open space. It should be noted that landscape will take time to mature, and on-going maintenance will be required to ensure it is successfully established. Recommendations for further mitigation measures to be designed at reserved matters stage have also been made.

The masterplanning process has integrated ecological, landscape and cultural heritage considerations into the proposed development. Whilst there will be some significant landscape impacts on the northern part of the site, the proposed development has been designed to protect and enhance the landscape character of the adjacent Lightmoor Wildlife Site; the buffer zone; the existing lanes; and as far as possible the site's existing hedgerows.

REFERENCES

1. Landscape Institute/Institute of Environmental Assessment, 1995, Guidelines for Landscape and Visual Impact Assessment

2. The Countryside Agency, 1999, Countryside Character vol. 5: West Midlands

3. Wrekin Council, in association with The Countryside Commission, English Nature, and the Severn Gorge Countryside Trust, The Landscape and Wildlife of Wrekin District

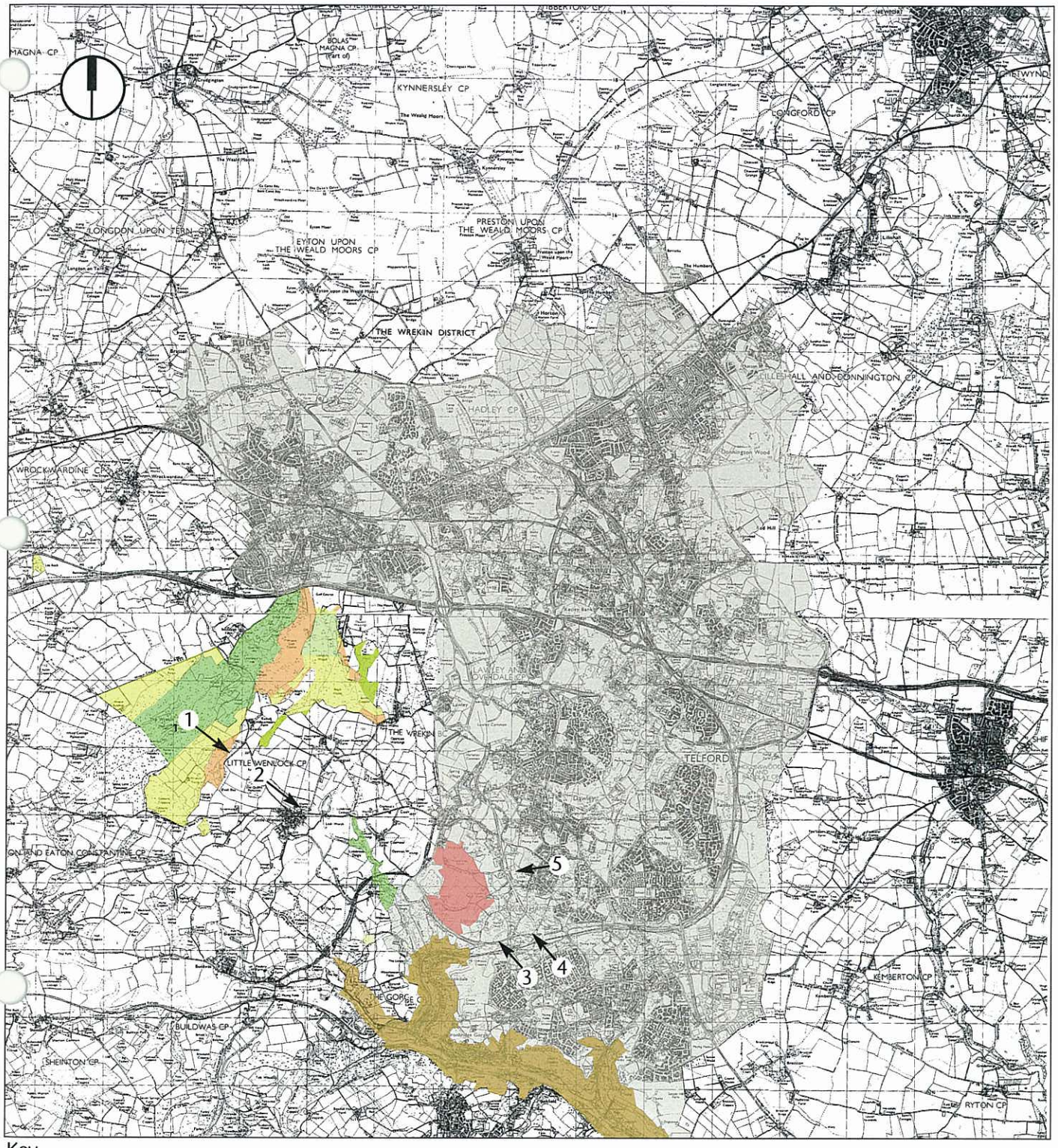
General

Department of the Environment, 1995, Preparing Environmental Statements for Planning Projects; A Good Practice Guide, London, HMSO

Landscape Institute, 2000, Evidence submitted to the Royal Commission Study of Environmental Planning Theme 5: Assessment Approaches

Lightmoor Action Group, 1997, Lightmoor, Loss of a Unique Landscape

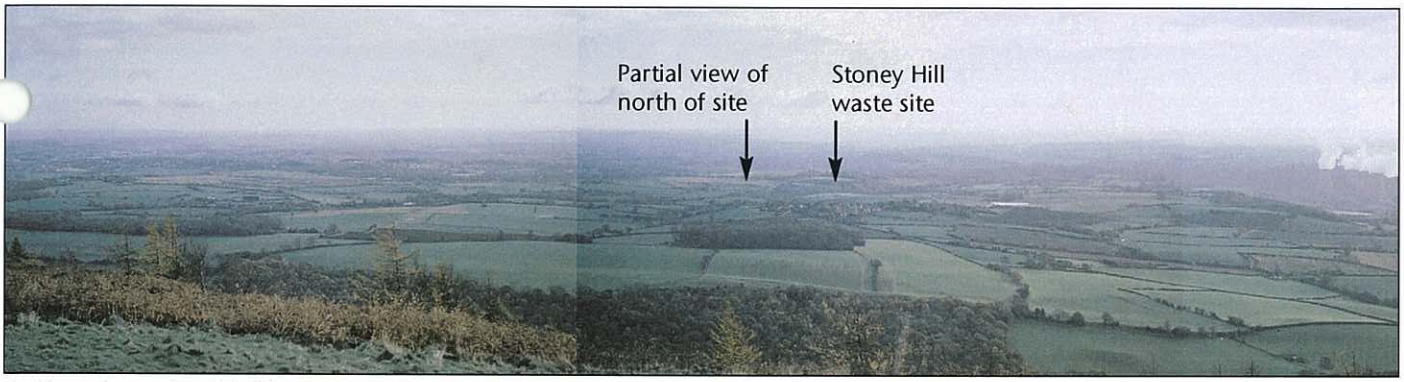
Ove Arup and Partners, 1998, Phase 1 (Extended) Ecological Survey of Lightmoor, Telford: Survey Findings



Key

- *Wildlife Site*
- *Area of Outstanding Natural Beauty*
- *Wildlife site and Area of Outstanding Natural Beauty*
- *Site of Specific Scientific Interest and Area of Outstanding Natural Beauty*
- *Local Nature Reserve and Area of Outstanding Natural Beauty*
- *Area of Special Landscape Character*
- *Application Site*
- *Urban area of Telford*
- *Potential Receptor of Visual Impact* (5)

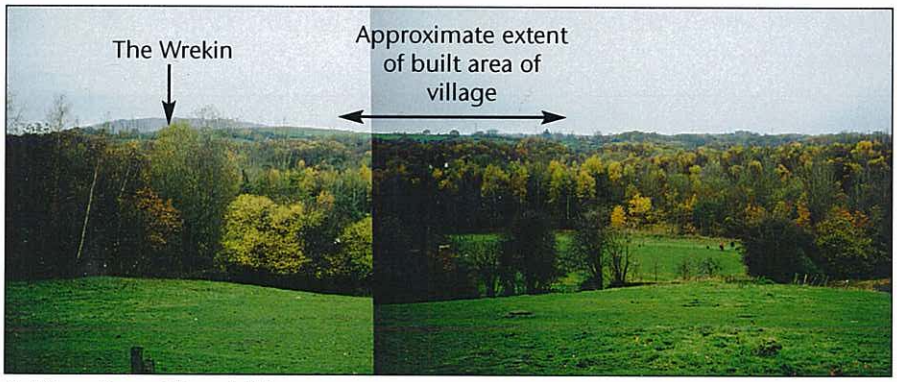
Drawing 6479/ES-14-1: Site in its Context : Landscape Designations



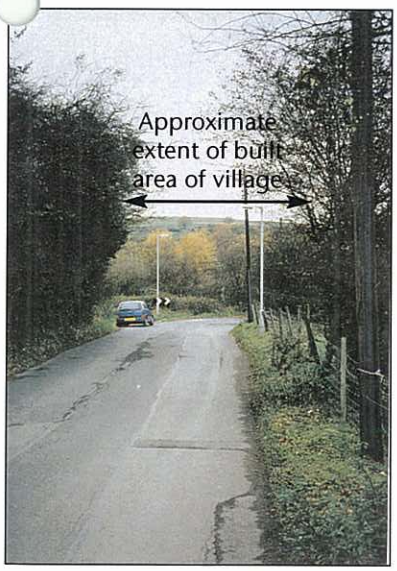
1. View from the Wrekin



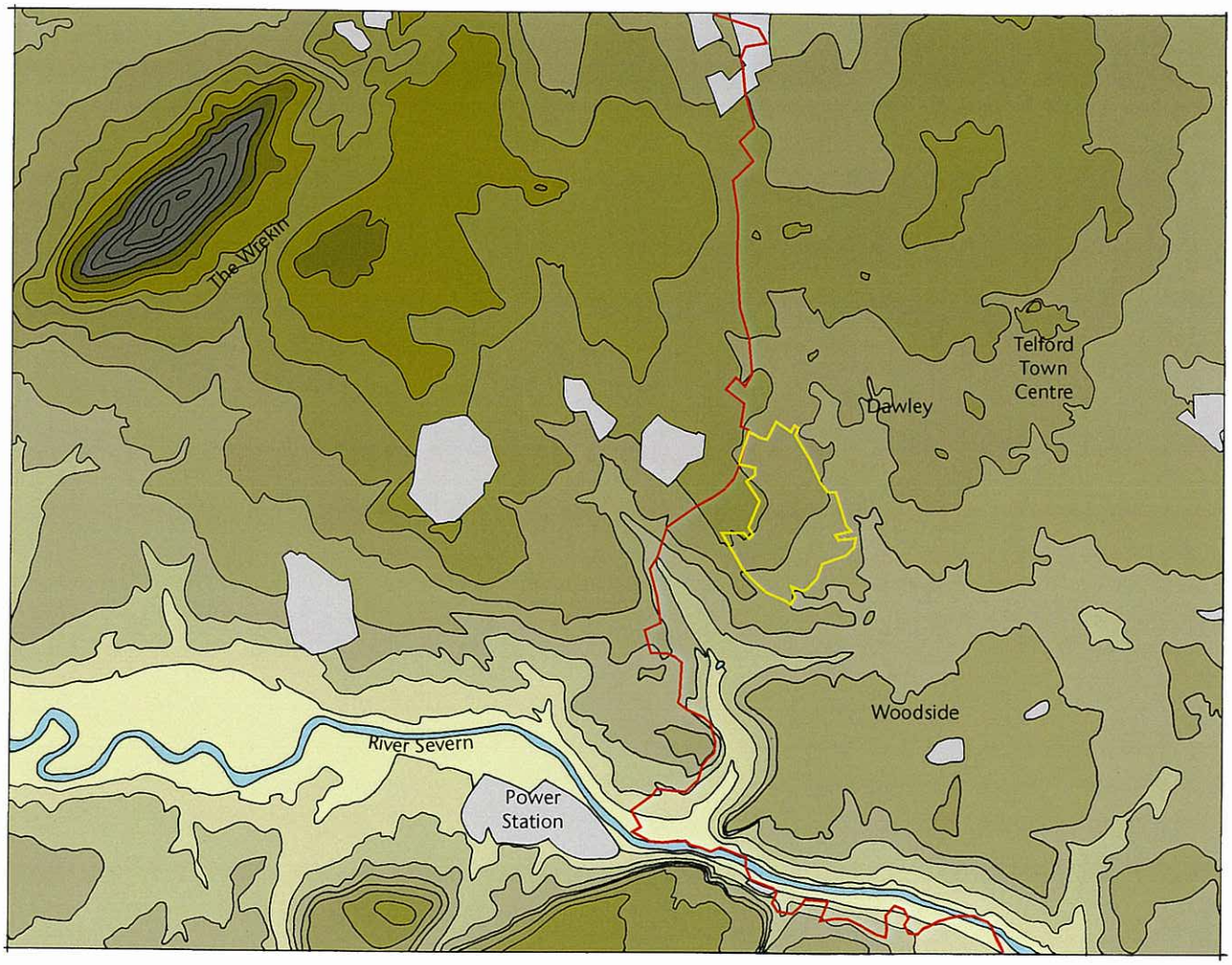
2. View from north of Little Wenlock: unable to identify site



4. View from Woodside



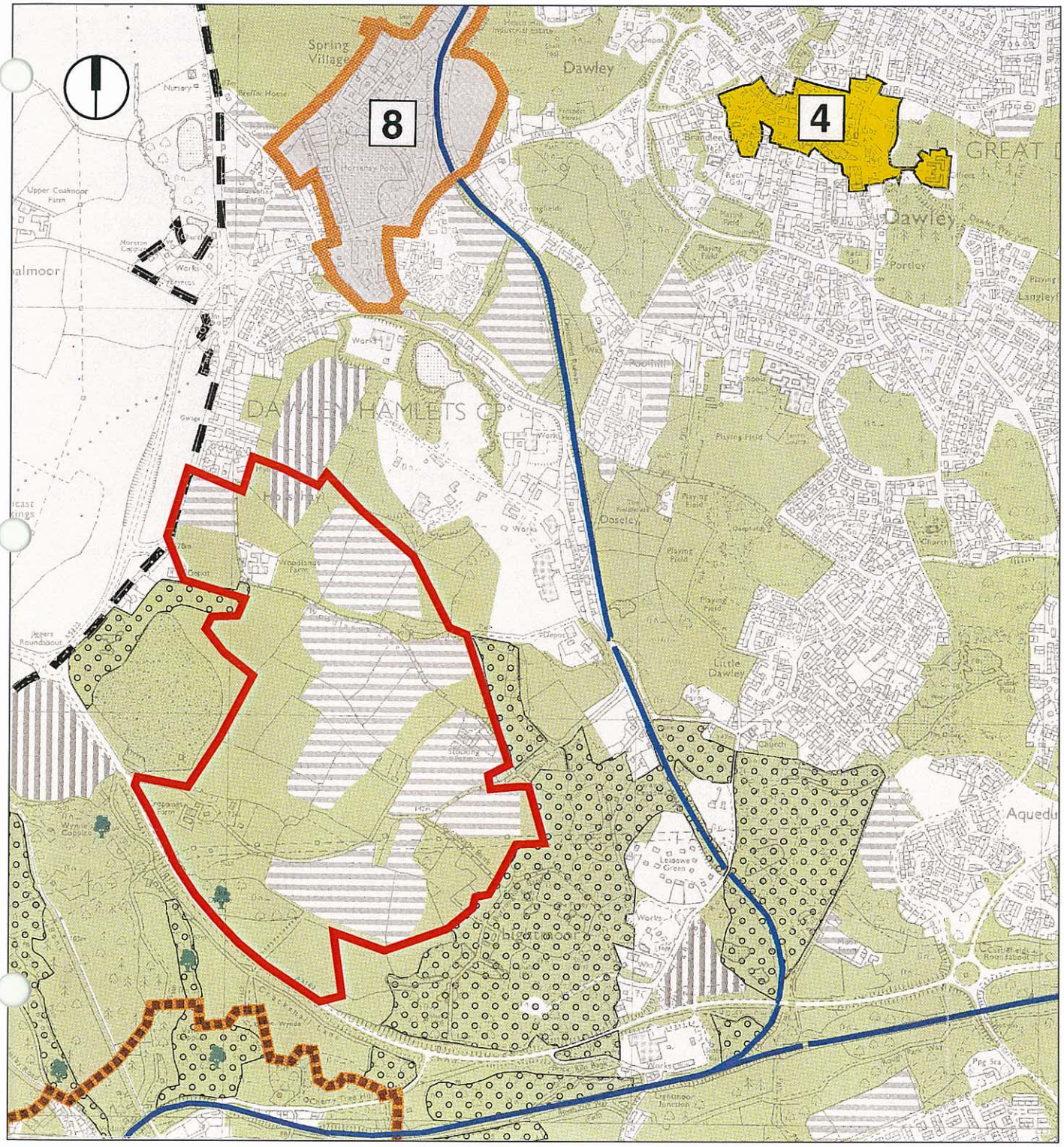
5. View from Holly Lane



Key

- 50m
- 50-75m
- 75-100m
- 100-125m
- 125-150m
- 150-175m
- 175-200m
- 200-225m
- 225-250m
- 250-300m
- 300m +
- River Severn
- Former Opencast sites
- Telford urban area boundary
- Application Site boundary

Drawing 6479/ES-14-3: Site in its Context: Topography

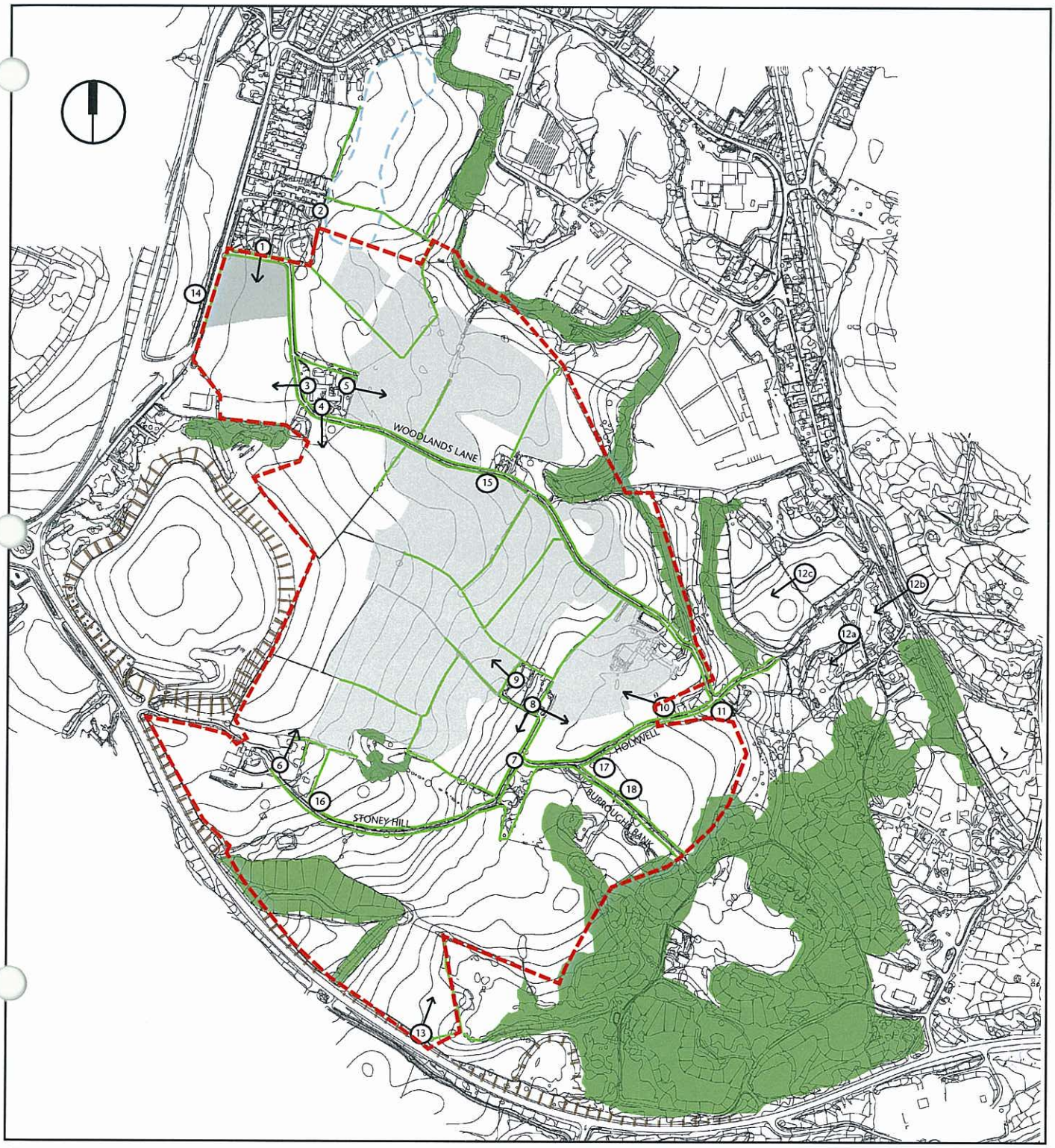


Key

- *Approximate Application Site Boundary*
- *Green Network*
- *Wildlife Site*
- *Ancient Woodland*

Source: Telford and Wrekin Local Plan Proposals Map

Drawing 6479/ES-14-4: Landscape and Open Space Designations



Key

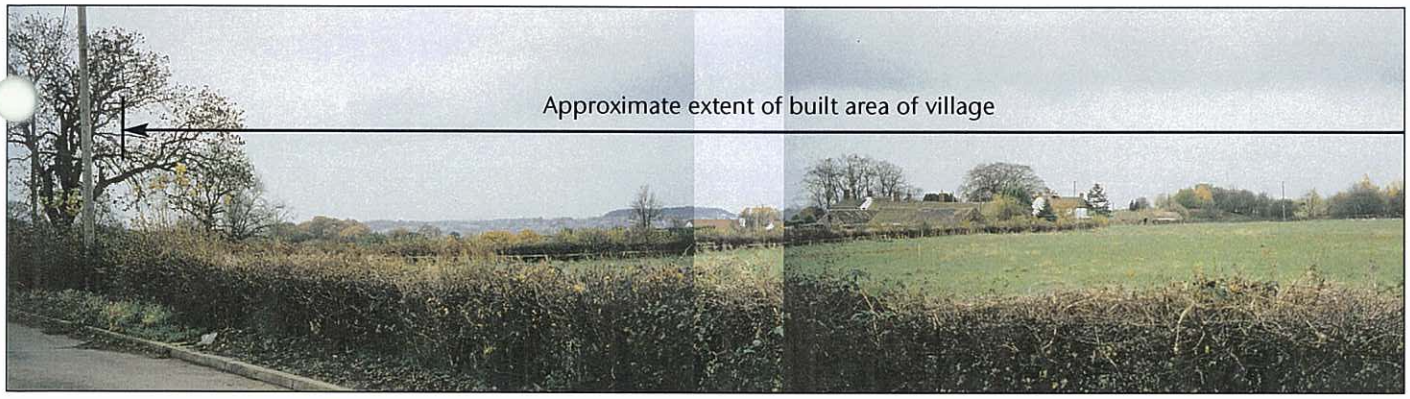
FEATURES DEFINING VISIBILITY

- *Application boundary*
- *Proposed built area of village*
- *Woodland*
- *Hedgerow*
- *Ridge or embankment*
- *Proposed Johnson's Pipes landscaped mound*

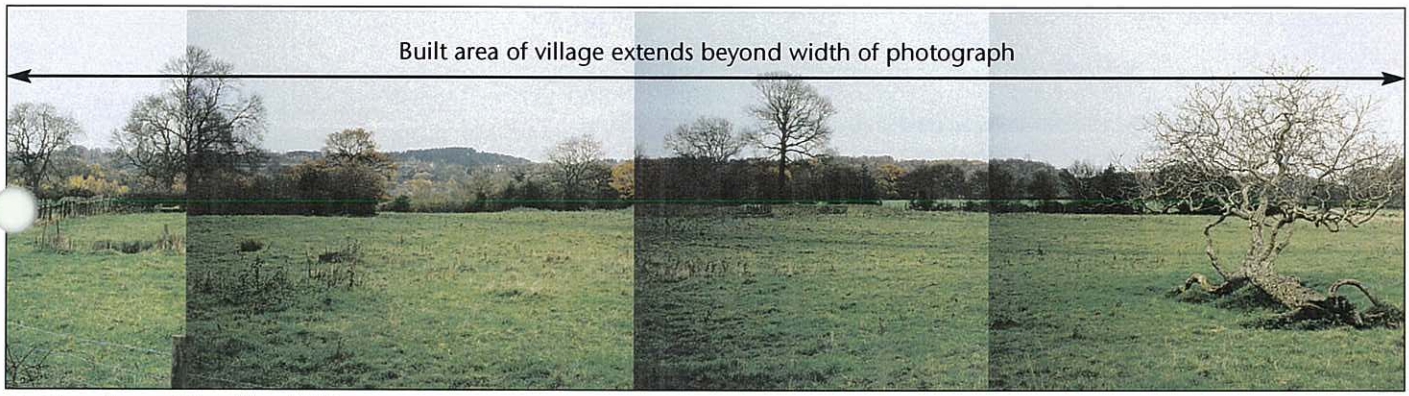
POTENTIAL RECEPTORS OF VISUAL IMPACT

- *Location of photograph. Refer to figure following*

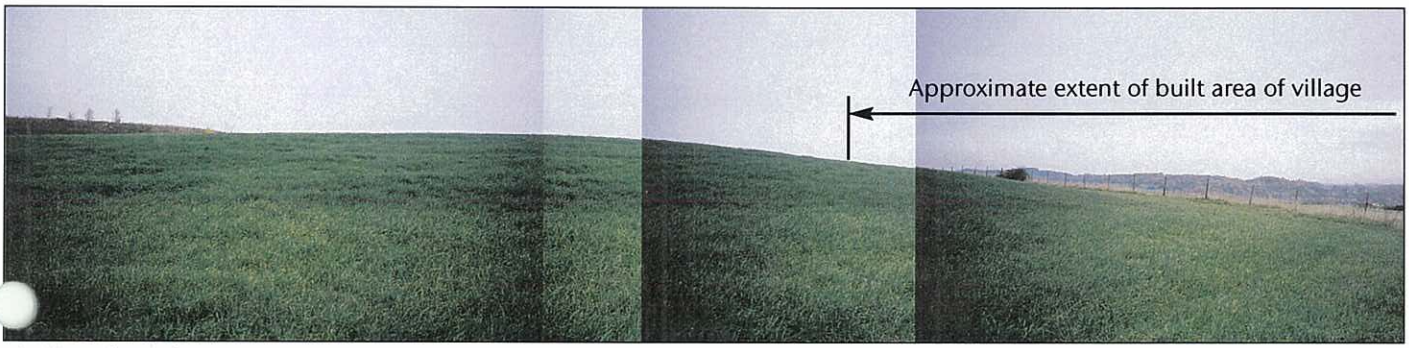
Drawing 6479/ES-14-5: Potential Receptors of Visual Impact



1. View from Woodlands Lane



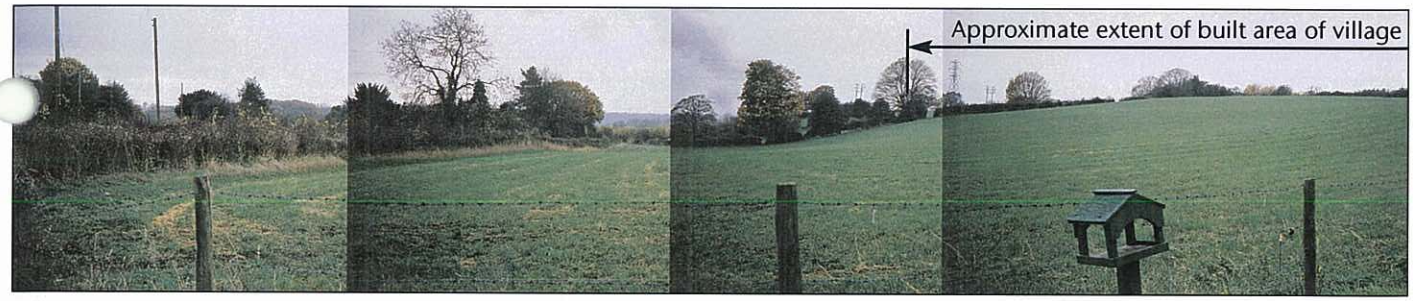
5. View from Woodlands View



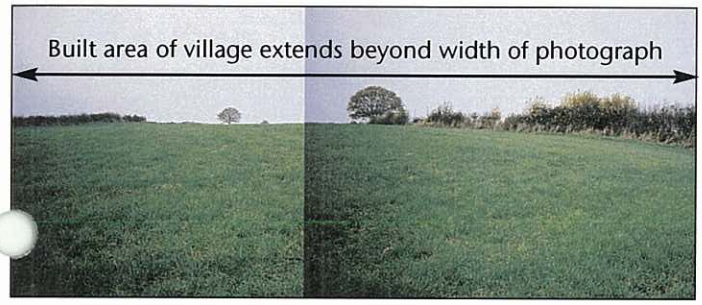
6. View from house north of Croppings Farm



8a. View south east from Cottages on The Stocking



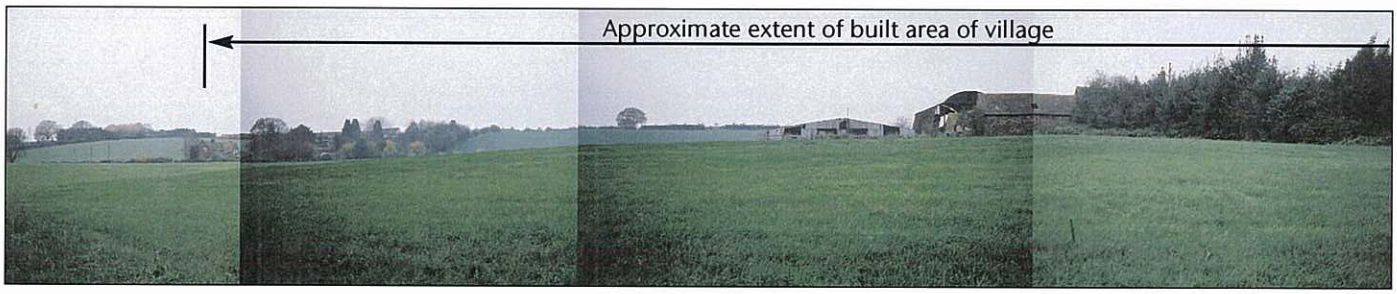
8b. View south west from Cottages on The Stocking



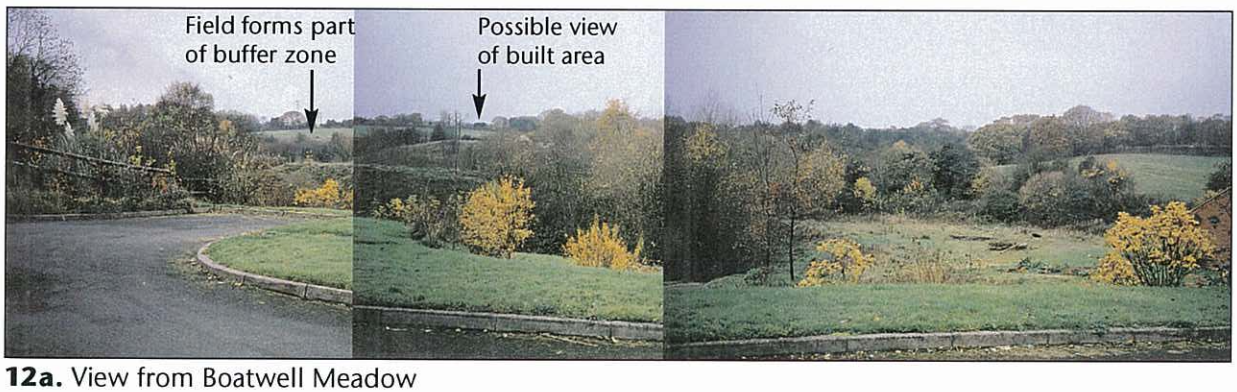
9a. View north west from cottage at top of hill



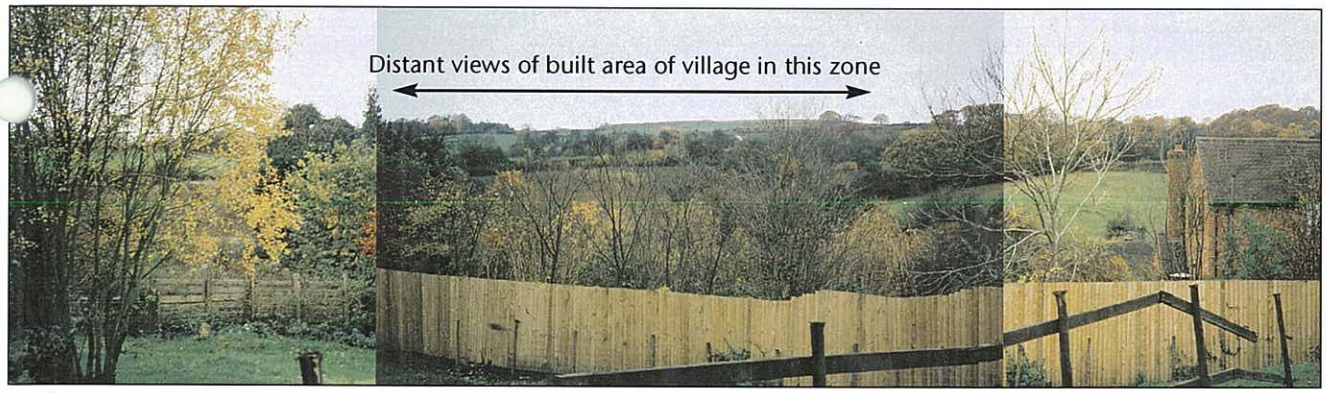
9b. View of cottage at top of hill



10. View from bungalow on Holywell Lane



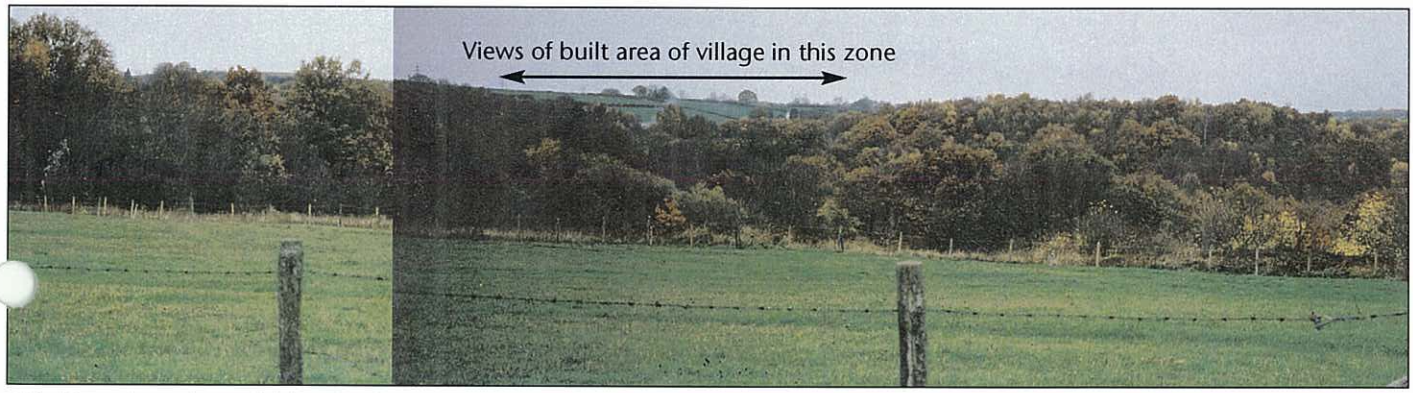
12a. View from Boatwell Meadow



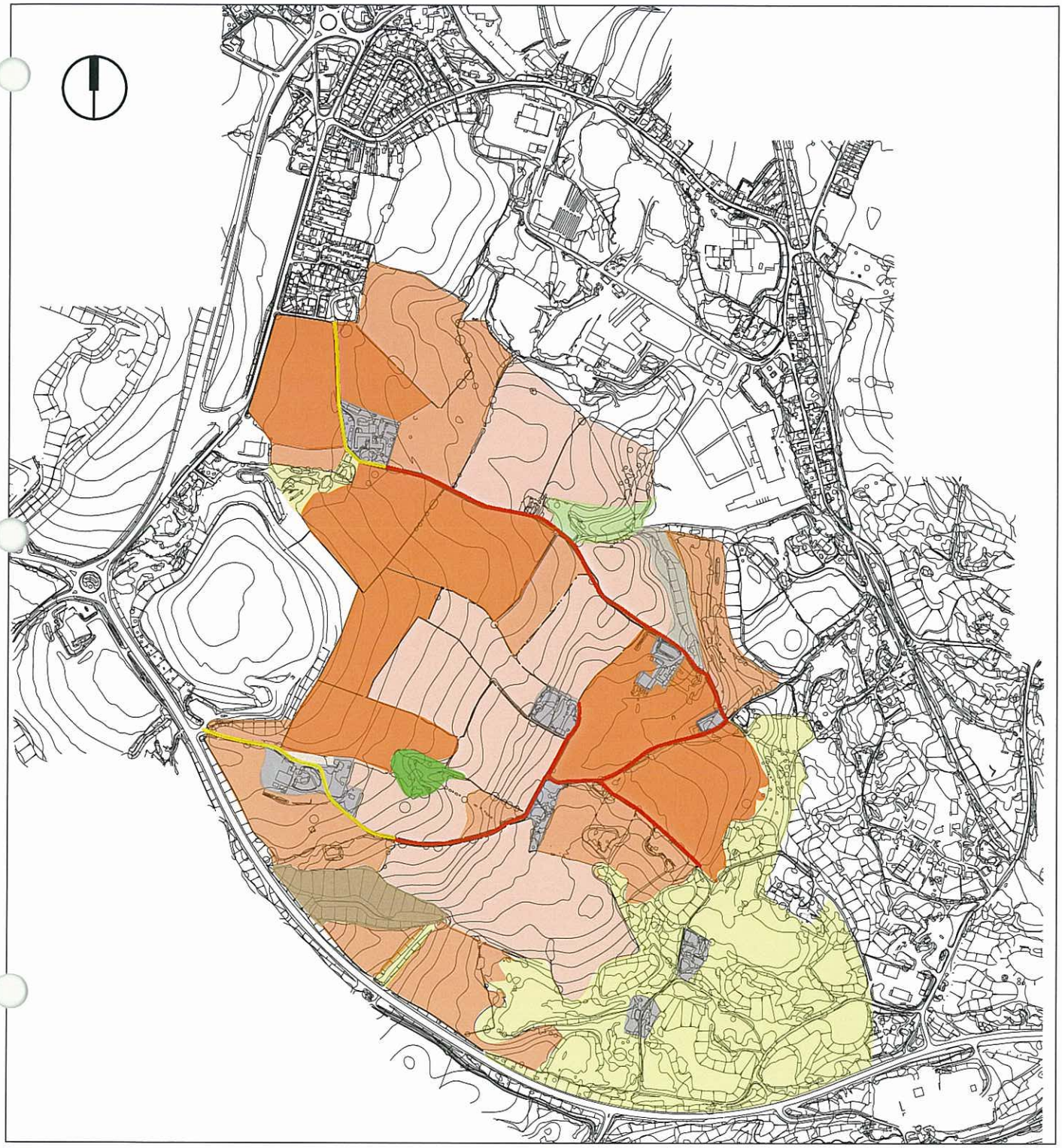
12b. View from Gravel Leasowes



12c. View from west of site



13. View from Iron Bridge By-Pass



Wildlife site

Open, large flat fields, improved

Paddock type areas of grassland

Some enclosure, prairie like fields

Enclosed linear landscape (lanes)

Linear landscape (canal)

Little enclosure, linear landscape (lanes)

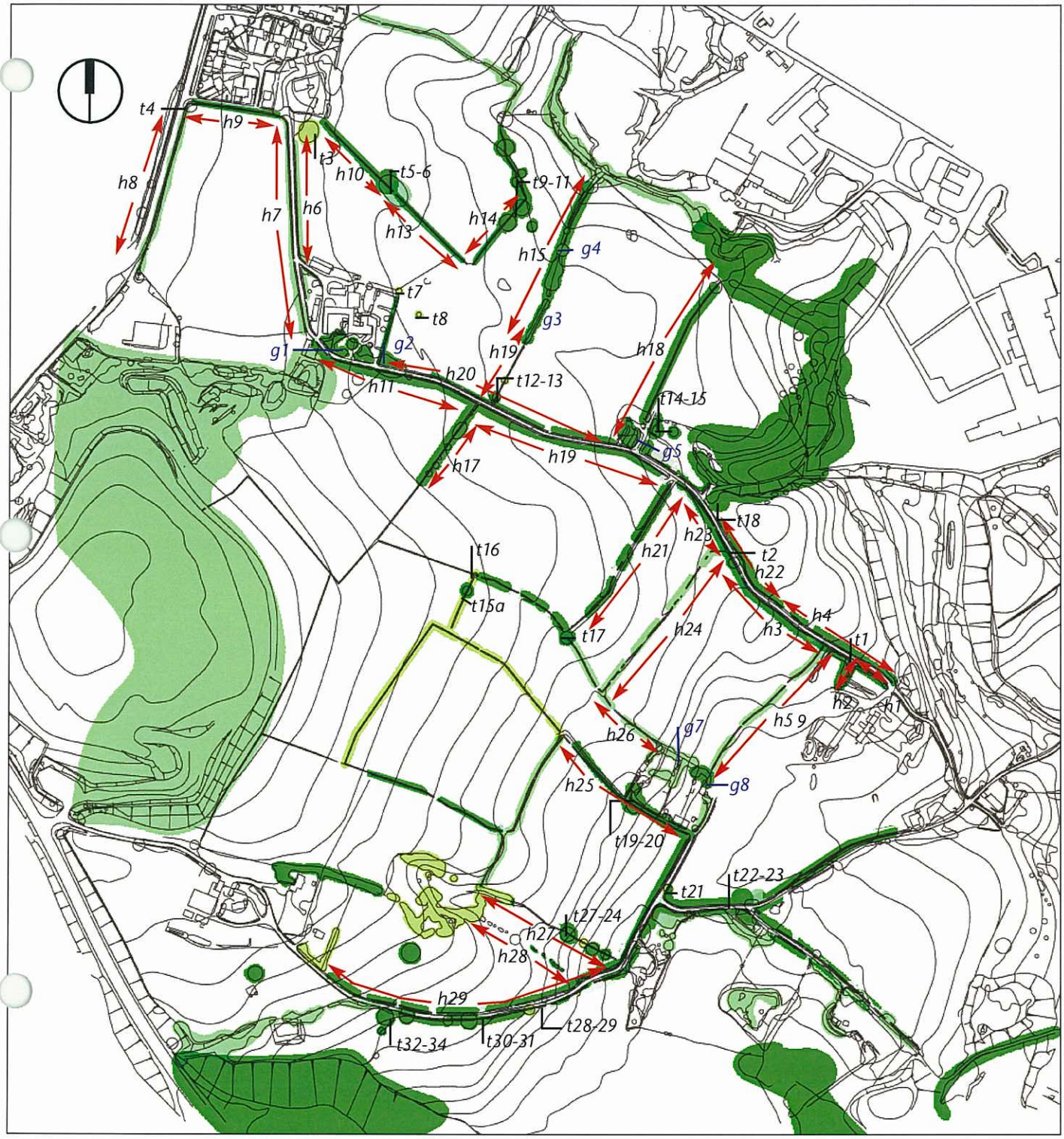
Mature wood, sloping topography

Coniferous Plantation

Mature/ ancient woodland

Houses and farm buildings

Drawing 6479/ES-14-9: Landscape Assessment: Landscape Character



Key

h29 — *Hedge-of good landscape value*

t9-11 — *Tree-of good landscape value*

g5 — *Tree group-of good landscape value*

h24 — *Hedge-with some merit and landscape value*

t6 — *Tree- with some merit and landscape value*

g7 — *Tree group- with some merit and landscape value*

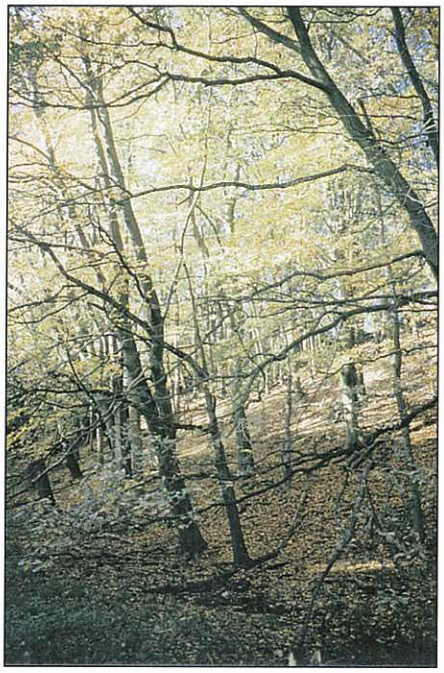
Hedge-with little landscape value

t3 — *Tree-little landscape value*

Drawing 6479/ES-14-10: Landscape Assessment: Existing Vegetation



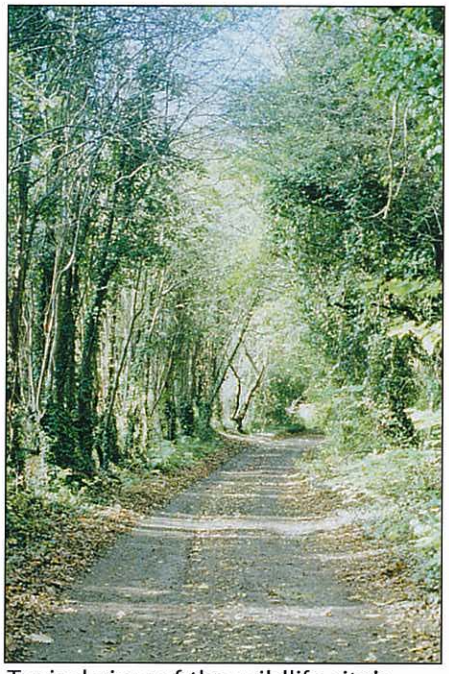
Stoneyhill: An enclosed lane bounded by high hedgerows containing a variety of species and mature oaks



Beech and oak woodland with little ground cover



Woodlands Lane: A more open character in parts than Stoneyhill. Hedgerows contain a wide variety of native species.



Typical view of the wildlife site's regenerated woodland and good ground cover.



The fields vary in character, but are typically improved grassland bounded by hedgerows or fences.

Drawing 6479/ES-14-11: Landscape Assessment: Site Photographs

15.0 CULTURAL HERITAGE

15.1 INTRODUCTION

Cultural heritage refers to the aspects of the environment which reflect the history of human activities, and embraces the subject areas of history, archaeology, architecture and design and landscape.

Archaeology is the study of the past through its surviving structures, artefacts and environmental data, and archaeological remains are a fundamental part of our heritage. These remains can be built and upstanding structures, buried features such as foundations or ruins or scattered and buried artefacts such as tools or bones. The principle archaeological periods assessed are:

- Prehistoric - ranging from Palaeolithic times around half a million years ago to the Late Iron Age (before Roman invasion of AD43)
- Roman - AD43 to AD410
- Medieval - fifth to sixteenth centuries AD
- Post-medieval - late sixteenth century to early eighteenth century
- Industrial - mid eighteenth century onwards

The Application Site lies between the foothills of the Wrekin and Telford New Town. It is in an area influenced by past mining activities and open cast operations, and contains a mix of old and new landscapes, ancient roads and tracks, railways and canals, and regenerated woodland. The cultural heritage of the site is particularly focussed on its industrial history, and this chapter sets out the baseline studies, assessment and mitigation that have informed the approach to archaeology in the application.

15.2 BASELINE SURVEYS

The baseline studies consist of the following:

- a review of Ironbridge Gorge's Museum Trust's Archaeological and Historical Commentary on the Commission for New Town's 7(1) submission for the Lightmoor Site (reference 1)
- a report on the site and the initial outline development plan by John Samuels Archaeological Consultants (reference 2); and
- a review of the planning policy framework

15.2.1 Ironbridge Gorge Museum Trust's Commentary

The early stages of the design process for Lightmoor Village took place in September to December 1997, during which time an Outline Development Plan was produced. The design process was informed by the Ironbridge Gorge Museum Trust's (IGMT) Archaeological and Historical Commentary on the Commission for New Town's 7(1) submission for the Lightmoor Site (reference 1). Produced in 1991, this commentary proved invaluable in enabling the design team to predict potential impacts on the site's archaeology at an early stage in

the design process. It is reproduced in Appendix J. The three key areas identified by the design team were:

- the hedgerow / lane structure;
- the Wildlife Site (then known as the Prime Site for Nature Conservation); and
- a number of individual features.

Hedgerows and Lanes

The IGMT's report states that the field structure of Lightmoor dates back to at least 1086, when a series of 'assarts' or cleared areas in former woodland were created. Each assart would have consisted of two or three fields, and these small holdings were farmed by tenant farmers. The report suggests that 'on the basis of map evidence, many of the hedges are up to 500 years old and probably earlier'. The map accompanying the report, and reproduced in Drawing 6479/ES-15-01, shows the majority of existing hedgerows as being in place in 1772 and 1840. The network of lanes dates back to at least 1772, and these are often bounded by stone walls and early hedgerows.

Wildlife Site

The area that now forms the Wildlife Site owes its ecological value to its industrial history. Coal mining in this area took place from 1800 onwards, and the remains of this activity are a series of distinctive spoil heaps or pitmounds. Clay was also extracted in this area to serve the neighbouring Lightmoor Brickworks, Cherry Tree Hill Brick and Tile Works, and Shutfield Tileries.

Individual Features

The Lightmoor Ironworks were located in the triangle of land east of Lightmoor Road, outside of the Application Site. The works closed in 1878 and although most of the complex was demolished, part of the furnaces remain and are listed Grade II.

A canal was built in 1789 to link Coalbrookdale with the main canal network at Doseley. The canal became disused in 1794 and was replaced by a railway. The line of the canal can still be seen in some parts of the Application Site, and these are:

- the cutting and line of trees adjacent to The Dingle in the southern part of the Application Site, with a public right away on its eastern side; and
- north of Stocking Farm, where the form of the canal and its towpath is highly visible. A stone bridge also survives just off Woodlands Lane near Stocking Farm. A permissive footpath signposted 'Canal Walk' follows the towpath.

A Squatter Cottage stands on Woodlands Lane, close to Stocking Farm. This is the only complete example of a once important building type in the area. Squatter Cottages were built on unregulated wasteland by individuals who paid an annual fine at the Manorial court. Such communities housed a substantial part of the working population of the Coalbrookdale Coalfield during the

Industrial Revolution. Until the 1970s, a squatter community survived along Holywell Lane nearby. The houses have since been demolished or modernised.

The Woodlands Lane Cottage is unusual in the Telford area because it has not been modernised. Few changes to the building have taken place since the 1850s. It is thought to date from 1797, and the site was known as Beggarly Bank. Over the years, the cottage was occupied by colliers, miners or labourers. It was owned by the tilemaker William Taylor in the 1850s, who may have installed some of the tiled features. The cottage is listed Grade II.

Table 15.1 below sets out the key predicted impacts known at the beginning of the masterplanning process in 1997, and summarises the mitigation approach taken as the design evolved in its early stages

Table 15.1: Masterplanning Process - 1997: Predicted Impacts

Feature	Predicted Impact	Early Mitigation Approach
Existing Lanes	Development could obliterate the lanes If lanes are retained, development could adversely affect the character of the lanes	Retain the lanes in their existing locations Retain the character of the existing lanes as far as possible – avoid introducing additional vehicular access; ensure hedgerows and trees are protected; keep severance by new roads to a minimum; keep the surface as existing
Existing hedgerows	Hedgerows could be lost to development Hedgerows, if retained, could be adversely affected by new development.	Retain hedgerows where possible Design layout to allow at least one side of hedgerow to be in public realm so that they can be maintained
Wildlife Site	Development within the Wildlife Site would have a major negative impact.	No development within the Wildlife Site Provide a buffer zone between the built area of the village and the Wildlife Site (no clear guidance at the time on how large this should be)
Squatter Cottage	May be lost to new development If retained, its setting could be adversely affected by development	Retain and refurbish squatter cottage Avoid surrounding by new development – retain something of its tranquil setting
Line of the Old Canal	Can be seen in two areas – unlikely to be lost, but linking area (where it cannot be seen) could be developed, losing continuity and possibly destroying underground remains	Respect line of old canal by keeping it as positive open space within new development
Stocking Farm	Buildings could be demolished and lost to new development If retained, setting could be adversely affected	Retain buildings if possible Ensure new development respects existing buildings

15.2.2 John Samuels Archaeological Consultants Report

By using the IGMT's commentary to predict impacts at an early stage in the design process, avoidance of archaeological remains and/or mitigation strategies had been designed into the proposed village from the start. However, to identify any archaeological remains which may be affected by the development proposals, Bournville Village Trust (BVT) commissioned John Samuels Archaeological Consultants (JSAC) to carry out a desk-based archaeological assessment of the proposed new urban village at Lightmoor, Telford (reference 2). A copy of this report is provided in Appendix J.

JSAC's assessment methodology conforms to:

- Planning Policy Guidance: Archaeology and Planning (PPG16) (reference 3);
- Management of Archaeological Projects (English Heritage 1991) (reference 4);
- Professional Standards: Code of Conduct (Institute of Field Archaeologists, 1994) (reference 5); and
- Standards and Guidance for Archaeological Desk-Based Assessment (Institute of Field Archaeologists, 1994) (reference 6).

The desk-based research comprised analysis of relevant information contained in and provided by the Shropshire Sites and Monuments Record (SMR), and searches of relevant material held in the Shropshire Record Office. Information regarding Scheduled Ancient Monuments (SAM) was obtained from Shropshire SMR and English Heritage. A site visit and walkover survey was undertaken by JSAC to examine the topography of the site and identify any previously unrecorded above ground archaeology.

General Archaeological and Historical Background

The Application Site is situated on coal measures. The drift cover is mainly boulder clay. Part of the Application Site has either been open cast at the end of the second world war, or has spoil from these operations spread over it.

There is little recorded pre-medieval activity within the study area. A find of an axe or arrowhead, apparently of Neolithic date, was made in a field adjacent to Woodlands Farm at NGR 6720 0625.

The Application Site lies in the parish of Dawley, to the south-west of Little Dawley. Little Dawley is mentioned in the Domesday Book of 1086, when it contained a serf, a vellein and two boardars. The place name 'Dawley', like several others in the locality, contains the Old English element 'leah' which suggests clearance from woodland. Domesday states that Dawley contained a league of woodland in 1086 and field name evidence indicates that much of the township west of Horsehay Dingle was wooded during the medieval period. This evidence, combined with the type and pattern of fields, lanes and hedges, indicates that the area operated a wood pasture economy during the medieval period.

Mining for coal an ironstone was first recorded in Dawley in the sixteenth century. The mining industry expanded after 1758, when large iron furnaces were built at Horsehay and Lightmoor. Much evidence for early coalworkings has been removed by opencast coal mining since the second world war. The eighteenth and nineteenth century development of the study area should be seen in the context of the expansion of industry and settlement in Ironbridge Gorge. Abraham Darby first smelted iron using coal at Coalbrookdale during the first decade of the eighteenth century and the iron making industry expanded rapidly between 1755 and 1780.

Predicted Impacts

The JSAC report provided the design team with an archaeological appraisal of the Outline Development Plan produced in December 1997. This is reproduced in Drawing 6479/ES-15-02, and areas are identified by letters. The assessment is summarised in Table 15.2.

Table 15.2: JSAC Archaeological Assessment

Area	Potential Archaeological Remains	Importance	Predicted Impacts
A	No known or suspected archaeological remains	n/a	None
B,C,D,E	An axe or arrowhead, apparently of Neolithic date, was made in a field adjacent to Woodlands Farm. This is likely to be a stray find. The development of Area B would disturb this field. Bath Spout Farm (NGR SJ 6744 0624) had been constructed in the valley south of parcels D and E close to a water supply by 1825, and is shown on the survey map produced by the Earl of Craven in that year. The building seems to have been intact during the early 1950s, but has now collapsed, with only the stack and one wall surviving.	Negligible Local to regional	None, as no development is proposed in this area. Instead an open space is proposed to the west of the valley.
F,G	There seem to have been at least two cottages and another building within this area, and these are shown on the 1772 survey map produced for the Earl of Craven. The sites are located at NGR 6740 0625 south of Woodlands Lane. However, the 1833 OS one-inch to the mile map does not show individual buildings here, but indicates a field boundary around the site. The OS map of 1903 does not show any buildings, and it may therefore be that they had already disappeared by 1833.	Local / possibly regional	If buildings were located here, then proposed development could damage any buried remains.
H	No known or suspected archaeological remains	n/a	None
J,K,L,M	A tramway built before 1833 follows the southernmost field boundary in these Application Site and remains may now also lie under the access road to the cottages south-west of Stocking Farm.	Local / possibly regional	If development is proposed in this area, any remains of tramway may be damaged.
R,S	This Application Site surrounds Stocking Farm. The buildings are not listed, although they have some merit from the point of view of vernacular architecture. The date of the farm is unclear: one building appears on the 1772 Craven Survey map, the rest appear to be early nineteenth century. The Squatter Cottage opposite Stocking Farm is listed Grade II. The line of the former canal follows the southern edge of these development parcels.	Local National	Potential loss of buildings. To be retained. However, its setting could be adversely affected by development. None, so long as development avoids line of old canal.
U, T	The site of an eighteenth century (1772) or earlier building, and two buildings south of Holywell Lane outside of the proposed development parcels.	Local	None
W, X, Y, Z	These areas largely overlie areas of former opencast coal mining. The line of the former Shropshire Union Canal runs through these	Local	Underground remains of old canal could be damaged by development.
Lanes	The lane pattern indicates that many lanes within the site area are early in origin. The outline development plan aims to leave them untouched as far as possible, retaining the existing gravel / earth surfaces, and restricting vehicular traffic to access to existing dwellings only.		Although lanes will be retained, development could adversely affect their character - e.g. new houses located close to them; streets cutting across.

Area	Potential Archaeological Remains	Importance	Predicted Impacts
Hedgerows	There are a number of known or suspected historic hedgerows which may be affected by the proposed new road through the site.		Some hedgerows could be lost to development. Hedgerows, if retained, could be adversely affected by new development.
Woodlands Farm	This is an early 19th century model farm, apparently constructed before 1817 although no buildings are shown on the Craven Survey Map of 1772. Although interesting from the point of view of vernacular architecture, the buildings are not listed.	Local	Building in private ownership and will therefore not form part of development. However, setting could be adversely affected by new development.
Former Canal	The western branch of the Shropshire Union Canal ran through the site. It was short lived, being in use for around five years before being replaced by an early railway. Parts of the monument have been obliterated by opencast mining. However, the line of the canal remains as a linear earthwork in places. The remains of a canal bridge, now levelled, are known at SJ 676 059.	Local	Underground remains could be damaged by development.
Ironbridge Gorge	To the south of the site itself is the Ironbridge Gorge, part of which has been designated a World Heritage Site (ICOMOS 1994). Although the World heritage Site boundary is only some 200 metres from the south-eastern boundary of the study area, the sites are divided by the Ironbridge By-Pass. This, together with the steep sided valleys, means that none of the World Heritage Site is visible from the Lightmoor Site.	International	No impact
Scheduled Ancient Monuments	There are no Scheduled Ancient Monuments (SAM) within the Application Site. The nearest SAM to the site is the Darby Ironworks in Coalbrookdale.	n/a	No impact

15.2.3 Review of the Planning Policy Framework

The planning framework for Lightmoor Village is provided by Planning Policy Guidance Note 16 : Archaeology and Planning (1990) (reference 3); the Shropshire and Telford & Wrekin Joint Structure Plan (1996 - 2011) (reference 7); and the Telford & Wrekin Local Plan (1995-2006) (reference 8).

- Planning Policy Guidance (PPG16)

  The Department of the Environment published its Planning Policy Guidance Note 16: Archaeology and Planning (PPG 16) in November 1990. This set out the Secretary of States guidance on archaeological remains, and provided recommendations many of which have been integrated into local development plans. The key points in PPG 16 may be summarised as follows:

  - Archaeological remains should be seen as a finite and non-renewable resource, and in many cases highly fragile and vulnerable to damage and destruction. Appropriate management is therefore essential to ensure that they survive in good condition. In particular, care must be taken to ensure that archaeological remains

are not needlessly or thoughtlessly destroyed. They can contain irreplaceable information about our past and the potential for an increase in future knowledge. They are part of our sense of national identity and are valuable both for their own sake and for their role in education, leisure and tourism.

- Where nationally important archaeological remains, whether scheduled or not, and their settings, are affected by a proposed development there should be a presumption in favour of their physical preservation. Cases involving archaeological remains of lesser importance will not always be so clear cut and planning authorities will need to weigh the relative importance of archaeology against other factors including the need for the proposed development. Regardless of the circumstances, taking decisions is much easier if any archaeological aspects of a development site can be considered early on in the planning and development control process.

- The key to informed and reasonable planning decisions is for consideration to be given early, before formal planning applications are made, to the question of whether archaeological remains are known to exist on a site where development is planned and the implications for the development proposal.

- When important remains are known to exist, or when archaeologists have good reason to believe that important remains exist, developers will be able to help by preparing sympathetic designs using, for example, foundations which avoid disturbing the remains altogether or minimise damage by raising ground levels under a proposed new structure, or by careful siting of landscaped or open areas. There are techniques available for sealing archaeological remains underneath buildings or landscaping, thus securing their preservation for the future even though they remain inaccessible for the time being.

- If physical preservation in situ is not feasible, an archaeological excavation for the purposes of preservation by record may be an acceptable alternative. From an archaeological point of view, this should be regarded as a second best option.

• Shropshire and Wrekin Joint Structure Plan

The Joint Structure Plan is currently under review. The Deposit Draft June 2000 provides road guidance on archaeological sites, and notes that Local Planning Authorities may ask for appropriate archaeological investigations to determine the importance of a site before a planning application is determined.

- Telford & Wrekin Local Plan

The Telford & Wrekin Local Plan 1995-2006 notes that the Telford area has a "particularly rich legacy of industrial archaeological remains, charting its growth and development as a centre for industry and commerce over many centuries, based on the extraction, utilisation and transportation of rich local mineral supplies. These early processes provided the basis for the later focus of industrial and manufacturing activity in the Severn Gorge. The archaeological remains here rank as the country's most important remains from the Cradle of the Industrial Revolution and are internationally significant. This is recognised by its designation as a World Heritage Site in 1986".

The archaeology policies relating to the proposed development at Lightmoor Village are as follows:

HE21 SCHEDULED ANCIENT MONUMENTS AND ARCHAEOLOGICAL SITES
The Council will protect and enhance scheduled ancient monuments, other sites of national, regional or particular local archaeological importance and their settings. Development that would result in the loss of, damage to, or that would otherwise adversely affect these sites or their settings will be refused.

HE22 ARCHAEOLOGICAL EVALUATION AND ASSESSMENTS
Where archaeological remains are known to exist as part of the established record or research indicates that they may exist, the Council will require that the results of an archaeological assessment are submitted as part of any planning application.

HE23 ARCHAEOLOGY AND DEVELOPMENT
Following the submission of an archaeological assessment, where development affecting any archaeological site or its setting is considered to be acceptable in principle, the Council will require that:

a. any archaeological remains are preserved in-situ by the careful design, layout and siting of new development.

b. where in-situ preservation is not justified or proves impractical or inappropriate, the developer will be required (by condition, legal or voluntary agreement or arrangement), to make provision for recording and/or excavation by a competent archaeological organisation, tot he satisfaction of the Council, prior to the commencement of development.

The approach taken to archaeology during the design of Lightmoor Village embraces the above planning policies, in particular:

- consideration has been given to archaeology at an early stage in the design process, and impacts generally avoided or minimised through design (PPG16; Joint Structure Plan)

- recommendations for further investigations to determine the need for sympathetic designs are made in the next section where there is reason to believe that archaeological remains may exist (PPG16)
- the proposals allow for preservation in-situ of any remains, and are generally unlikely to require preservation by record (PPG16; HE23)
- this chapter of the Environmental Statement, together with the reports in the appendices, fulfils Policies HE22 and HE23 of the Telford & Wrekin Local Plan.

15.3 ANALYSIS OF PREDICTED IMPACTS

JSAC report concludes that the Outline Development Plan took into account the recommendations made in the Ironbridge Gorge Museum Trust's commentary on the 7(1) application. The most important archaeological sites would be preserved and the intention is to retain as many landscape features as possible.

The JSAC report was one of a number of studies commissioned by the Bournville Village Trust at the end of the initial feasibility stage of the design of Lightmoor Village. These studies informed a number of key design decisions regarding the layout and siting of Lightmoor Village. Key issues include:

- Ecological studies suggested that a buffer zone of at least 50 metres be provided to the Wildlife Site, with a 'no-build' zone of up to 250 metres around the Burroughs Bank pools;
- Intrusive site investigation surveys recommended avoiding some of the areas of poor ground conditions in the south of the Application Site
- A landscape assessment identified that many of the most valuable areas are located in the south of the Application Site, e.g. the confluence of Stoneyhill, Burroughs Bank and Holywell Lane; the Dingle ancient woodland; and the Wildlife Application Site.

As a result of these studies, a Revised Outline Development Plan was produced that moved all built development north of Stoneyhill and Holywell Lanes. This not only addressed many of the ecological, engineering and landscape issues identified in the various reports, it also resulted in a development form that:

- Removed areas W, X, Y and Z from the area adjacent to the Dingle, leaving the line of the old canal undisturbed.
- Removed areas T and U from the development, so reducing the impact on the character of Burroughs Bank and Holywell Lane.
- Provides a more compact form of development by extending the area adjacent to parcel M and removing the other parcels listed above. This results in a more efficient use of land and giving the potential for a better urban form where village centre facilities are within easy walking distance for residents.
- Reduced the number of points at which existing lanes are severed by the proposed High Street.

15.4 MITIGATION

However, a number of possible archaeological impacts remained, and these were chiefly related to:

- the remains of buildings in areas F and G, south of Woodlands Lane
- Stocking Farm
- the listed Squatter Cottage;
- those parts of the lanes crossed by the proposed access road
- the hedgerows throughout the Application Site

The JSAC report proposed ways of mitigating these impacts, and these were taken on board in developing the proposals for Lightmoor Village for which outline consent is being sought. These mitigation measures are set out in Table 15.3.

Table 15.3: Mitigation Measures

Area	Description	Mitigation
B,C,D,E	Site of axe or arrowhead find. Bath Spout Farm (NGR SJ 6744 0624) had been constructed in the valley south of parcels D and E close to a water supply by 1825, and is shown on the survey map produced by the Earl of Craven in that year. The building seems to have been intact during the early 1950s, but has now collapsed, with only the stack and one wall surviving.	None required, although a geophysical survey will be commissioned prior to detailed design to confirm the sites status. Proposed open space at valley will protect remains from development. Suggest that remains will survive in better condition for longer if maintained in present, relatively unobtrusive state. Recommend removal of vegetation from stack, but retention of nettle bed around structure to deter access.
F,G	Two cottages and another building within this area close to Woodlands Lane.	Possible that in situ remains of these structures may survive below ground. Geophysical surveys will be undertaken followed by either a design solution to avoid development over remains, or trial trenching to determine the state of preservation, perhaps followed by area excavation before development commences.
J,K,L,M	A tramway built before 1833 follows the southernmost field boundary in this Application Site and remains may now also lie under the access road to the cottages south-west of Stocking Farm.	The tramway will be retained as part of the network of pedestrian and cycle route, as a buffer zone running adjacent to the hedgerow.
R,S	This Application Site surrounds Stocking Farm. The buildings are not listed, although they have some merit from the point of view of vernacular architecture. The date of the farm is unclear: one building appears on the 1772 Craven Survey map, the rest appear to be early nineteenth century. The Squatter Cottage opposite Stocking Farm is listed Grade II. The line of the former canal follows the southern edge of these development parcels.	The buildings at Stocking Farm will be retained. Also a scheme of recording on the farm buildings at Stocking Farm and possible further archaeological work before development will be undertaken.
W, X, Y, Z	Line of old canal runs through these parcels.	Parcels removed from development. Line of old canal (defined as public footpath) retained and integrated into movement network.

Area	Description	Mitigation
Lanes	Woodlands Lane runs through the proposed built area of the village. Stoneyhill and Holywell Lane mark the boundary of open associated with the village and the buffer zone to the Wildlife Site, and are unaffected by built development. Burroughs Bank lies outside the built area of the village.	The High Street was realigned to join Stoneyhill at its northern end, avoiding the severance effect of the alignment shown in the outline development plans. The proposals aims leave the lanes untouched as far as possible, retaining the existing gravel / earth surfaces, and restricting vehicular traffic to access to existing dwellings only. Only the proposed High Street severs hedgerows on lanes - all other streets stop at lanes. No further mitigation required, except for during construction, when sections of hedges will be removed under archaeological supervision so that the associated earthworks may be examined.
Hedgerows	There are a number of known or suspected historic hedgerows which may be affected by the proposed development.	Hedgerows retained as far as possible. Minimisation of the number of points at which hedgerows are severed by new roads. During construction, sections of hedges will be removed under archaeological supervision so that the associated earthworks may be examined.
Woodlands Farm	An early 19th century model farm.	Open setting retained to north and south.

15.5 STATEMENT OF SIGNIFICANCE

With the exception of the Squatter Cottage, none of the Application Site's features is of more than regional significance. However, the proposals have been designed and developed to preserve the archaeological sites and to retain as many of the historic landscape features as possible. As part of the masterplanning process, opportunities for enhancement and interpretation of the Application Site's history and archaeology were identified. Those that are specifically included within this application are:

- The squatter cottage on Woodlands Lane will be retained and refurbished for an appropriate use
- The line of the old canal running through the Application Site around Stocking Farm will remain as open space
- The tramway adjacent to the hedgerow running north westwards from the group of cottages The Stocking will be retained as part of the network of pedestrian and cycle route
- Further design consideration of the High Street has significantly changed its alignment at the northern end of Stoneyhill. Stoneyhill is no longer severed twice by the proposed road, and its character remains largely intact
- The pedestrian movement network has been designed to link new routes to existing routes (e.g. Canal Walk), so that there are opportunities for interpretation and the creation of a heritage trail; and
- A commitment to retaining and refurbishing Stocking Farm subject to survey.

REFERENCES

1. Archaeological and Historical Commentary on Telford Development Corporation Section 7(1) Submission No. 243, Ironbridge Gorge Museum Trust, 1991

2. A Desk-based Assessment of Lightmoor, Telford, John Samuels Archaeological Consultants, 1998

3. Planning Policy Guidance: Archaeology and Planning (PPG16), Department of Transport, Local Government and the Regions

4. Management of Archaeological Projects, English Heritage, 1991

5. Professional Standards: Code of Conduct, Institute of Field Archaeologists, 1994

6. Standards and Guidance for Archaeological Desk-Based Assessment, Institute of Field Archaeologists, 1994

7. Shropshire and Wrekin Joint Structure Plan, 1996 - 2011, Deposit Draft

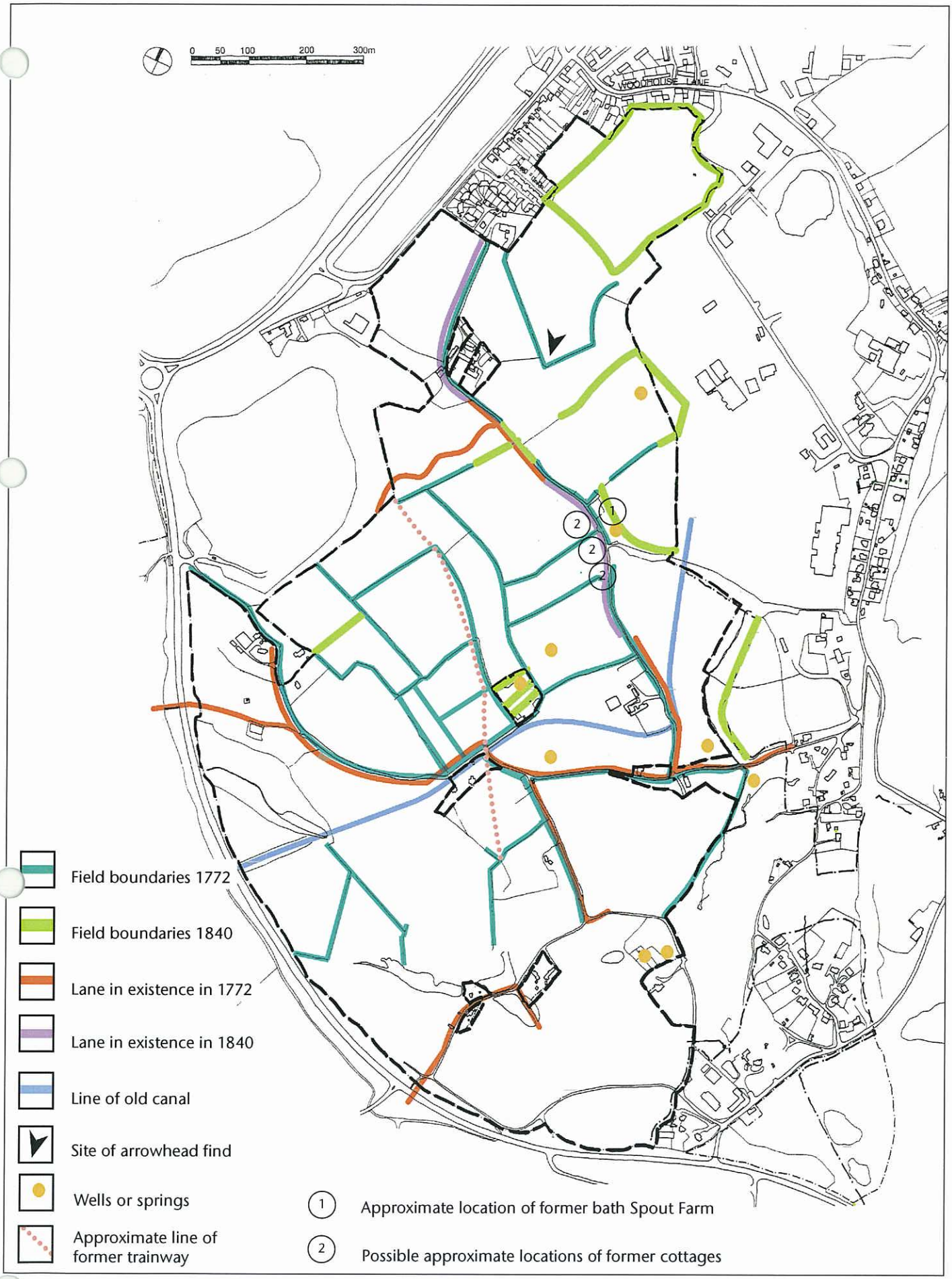
8. Telford & Wrekin Local Plan, 1995 - 2006

General

Shropshire Sites and Monuments Record

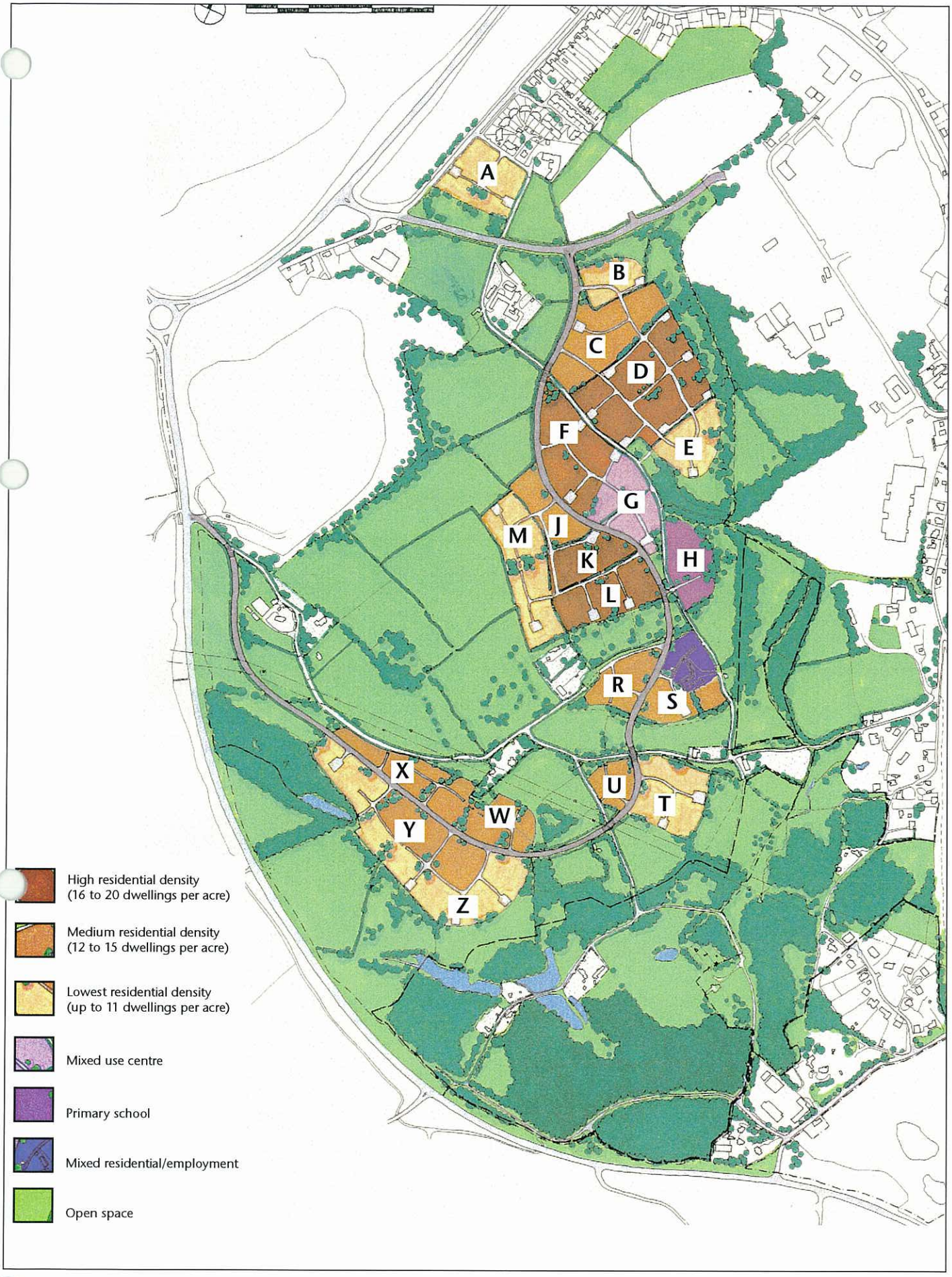
Shropshire Record Office

English Heritage



Drawing 6479/ES-15-1: Archaeological Features

Source: Ironbridge Gorge Museum Trust and John Samuels Archaeological Consultants



Drawing 6479/ES-15-2: 1997 Outline Development Plan

Kearney, Declan

From: Phipps, Stephen [stephen.phipps@environment-agency.gov.uk]
Sent: 22 November 2007 10:42
To: Wheeler, Iain; Jones, Kate
Subject: Stoneyhill Gas Samples
Attachments: Kate Jones.doc

Kate, Iain,
Please see attached prelim report. Full list against USEPA TO14 compounds to follow
Steve

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National Laboratory Service
Nottingham Laboratory
Meadow Lane
Nottingham
NG2 3HN
Tel: 0115 986 0325

For the attention of:

Kate Jones
Environmental Scientist
Telford and Wrekin Council
Darby House
PO Box 212
Telford TF3 4LB

Please find set out below the preliminary results for the sample taken at Stoneyhill on the 9th November 2007 Quantification of trace components given under "Others" and reporting limits for trace components not detected to follow.

Major and minor components

Sample id	Nitrogen % by vol	Oxygen % by vol	Carbon dioxide % by vol	Methane % by vol	Carbon monoxide ppm by vol	C_2 hydro-carbons ppm by vol	C_3 hydro-carbons ppm by vol	Helium ppm by vol	H_2S ppm by vol
Gas Line 1	27.5	5.02	23.9	43.8	<50	<50 (ethane 7)	<50	<20	<50
Gas Line 2	12.1	1.17	30.5	56.5	<50	<50	<50	<20	<50
BH21D	74.3	19.8	2.17	3.00	<50	<50	<50	<20	<50
BH25D	24.3	1.80	30.0	44.1	<50	<50	<50	<20	<50

Trace components all mg/m^3

Sample id	Vinyl Chloride	Benzene	Toluene	Ethyl benzene	Xylene	Tri-chloro-ethylene	Tetra-chloro-ethylene	Others
Gas Line 1	1.7	0.38	2.5	4.1	11	<0.2	<0.2	Aliphatic hydrocarbons in the range C4 to C11 including pinene and limonene. CFCs and HCFCs
Gas Line 2	2.1	0.71	9.2	9.4	23	0.75	1.0	Aliphatic hydrocarbons in the range C4 to C11 including pinene and limonene. CFCs and HCFCs
BH21D	<0.1	0.26	<0.1	<0.1	<0.1	<0.2	<0.2	Trace aliphatic hydrocarbons.
BH25D	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	Trace aliphatic hydrocarbons in the range C4 to C10. CFCs and HCFCs

CFC = chlorofluorocarbons
HCFC = hydrochlorofluorocarbons

Comments:
Concentration of vinyl chloride and chlorinated organic compounds in gas lines, low.
Methane to carbon dioxide ratio, trace components and absent of helium in borehole gas samples indicate the source is landfill gas.

S. Phipps
Technical Specialist (Waste)
22/11/2007

Kearney, Declan

From: NLS Commercial [nls-leeds@environment-agency.gov.uk]
Sent: 22 November 2007 13:47
To: Jones, Kate
Subject: Analytical Report - 20004910 - 1
Attachments: 20004910_ 1 - Telford and Wrekin Council.PDF

Dear Kate,

Please find your analytical report attached.

If you have any questions or queries please do not hesitate to contact us.

Kind regards,

Bob Unsworth

Customer Service Advisor
National Laboratory Service
Olympia House
Leeds
LS12 6DD
Tel: 0113 231 2177
Fax: 0113 231 2116
Email:nls@environment-agency.gov.uk

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National Laboratory Service

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Analytical Report

Final Report

Report ID - 20004910 - 1

Printed on: 21-Nov-2007

Kate Jones
Telford and Wrekin Council
Environment and Regeneration
Darby House
PO Box 212
Telford
TF3 4LB

Dear Kate

Please find attached the results for the batch of samples described below.

Samples taken on:	09-Nov-2007
Samples Registered on:	19-Nov-2007
Analysis commenced on:	21-Nov-2007
Results for Batch Number	20004910

You will be invoiced shortly by our accounts department.

If we can be of further assistance then please do not hesitate to contact us.

Yours sincerely



William Fardon
Customer Services Team Leader
Tel: (0113) 231 2177
nls@environment-agency.gov.uk

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation. Details of analytical procedures and performance data are available on request. The date of sample analysis is available on request.

The Environment Agency carries out analytical work to high standards and within the scope of its UKAS accreditation, but has no knowledge of whether the circumstances or the validity of the procedures used to obtain the samples provided to the laboratory were representative of the need for which the information was required.
The Environment Agency and/or its staff does not therefore accept any liability for the consequences of any acts or omissions made on the basis of the analysis or advice or interpretation provided.

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Analytical Report

Final Report

Report ID - 20004910 - 1

Printed on: 21-Nov-2007

Client: Telford and Wrekin Council
Folder No: 000512574
Comments: Gas Line 1

Project: Forensic
Sampled on: 9-Nov-07 @ 00:00

	Result	Units	MRV	Accred	Lab / TestCode
Forensic Analysis - Report	1	Text		None	No 950

Gas analysis results :

Methane : 44.08%
Carbon dioxide : 30.01%
Oxygen : 1.80%
Nitrogen : 24.32%
Helium : <20ppm
Carbon monoxide : <20ppm
C2 hydrocarbons : <20ppm
C3 hydrocarbons : <20ppm
Vinyl chloride : <0.1ug/l
Benzene : <0.1ug/l
Toluene : <0.1ug/l
Ethyl benzene : <0.1ug/l
m/p-xylene : <0.1ug/l
o-xylene : <0.1ug/l
Trichloroethene : <0.1ug/l
Tetrachlorothene : <0.1ug/l

Others : Trace levels of aliphatic hydrocarbons C4-C10, CCIF2, CHCl2F, CCl3F, TCTFE & DCM.

National Laboratory Service

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Analytical Report

Final Report

Report ID - 20004910 - 1

Printed on: 21-Nov-2007

Client: Telford and Wrekin Council
Folder No: 000512575
Comments: Gas Line 2

Project: Forensic
Sampled on: 9-Nov-07 @ 00:00

	Result	Units	MRV	Accred	Lab / TestCode
Forensic Analysis - Report	1	Text		None	No 950

Gas analysis results :

Methane : 3.00%
Carbon dioxide : 2.17%
Oxygen : 19.76%
Nitrogen : 74.29%
Helium : <20ppm
Carbon monoxide : <20ppm
C2 hydrocarbons : <20ppm
C3 hydrocarbons : <20ppm
Vinyl chloride : <0.1ug/l
Benzene : 0.26ug/l
Toluene : <0.1ug/l
Ethyl benzene : <0.1ug/l
m/p-xylene : <0.1ug/l
o-xylene : <0.1ug/l
Trichloroethene : <0.1ug/l
Tetrachlorothene : <0.1ug/l

Others : DCM @ slightly higher level than benzene. Trace levels of aliphatic hydrocarbons & methyl methacrylate.

National Laboratory Service

Science. Service. Solutions.

Analytical Report

Final Report

Report ID - 20004910 - 1

Printed on: 21-Nov-2007

Client: Telford and Wrekin Council
Folder No: 000512576
Comments: BH 21D

Project: Forensic
Sampled on: 9-Nov-07 @ 00:00

	Result	Units	MRV	Accred	Lab / TestCode
Forensic Analysis - Report	1	Text		None	No 950

Gas analysis results :

Methane : 56.54%
Carbon dioxide : 30.47%
Oxygen : 1.17%
Nitrogen : 12.07
Helium : <20ppm
Carbon monoxide : <20ppm
C2 hydrocarbons : <20ppm
C3 hydrocarbons : <20ppm
Vinyl chloride : 2.13ug/l
Benzene : 0.71ug/l
Toluene : 9.16ug/l
Ethyl benzene : 9.42ug/l
m/p-xylene : 19.6ug/l
o-xylene : 3.66ug/l
Trichloroethene : 0.75ug/l
Tetrachlorothene : 1.03ug/l

Others : C4-C11 range of aliphatic hydrocarbons,including pinene & limonene.
CHClF2,CCl2F2,DCM, Acetone & MEK

National Laboratory Service

Science. Service. Solutions

Analytical Report

Final Report

Report ID - 20004910 - 1

Printed on: 21-Nov-2007

Client: Telford and Wrekin Council
Folder No: 000512577
Comments: BH 25D

Project: Forensic
Sampled on: 9-Nov-07 @ 00:00

	Result	Units	MRV	Accred	Lab / TestCode
Forensic Analysis - Report	1	Text		None	No 950

Gas analysis results :

Methane : 43.76%
Carbon dioxide : 23.91%
Oxygen : 5.02%
Nitrogen : 27.45
Helium : <20ppm
Carbon monoxide : <20ppm
C2 hydrocarbons : <20ppm
C3 hydrocarbons : <20ppm
Vinyl chloride : 1.65ug/l
Benzene : 0.38ug/l
Toluene : 2.51ug/l
Ethyl benzene : 4.08ug/l
m/p-xylene : 8.47ug/l
o-xylene : 2.35ug/l
Trichloroethene : <0.2ug/l
Tetrachlorothene : <0.2ug/l

Others : C4-C11 range of aliphatic hydrocarbons,including pinene & limonene.
CCIF2,CHCIF2,CHCI2F,DCM,chloroform,1,2-dichloroethene,2-BuOH & Methyl methacrylate

Key to Accreditation: UKAS = Methodology accredited to ISO/IEC 17025:2005, MCertS = Methodology accredited to MCertS Performance Standard for testing of soils, none = Methodology not accredited

Key to Lab Code: Le = Leeds, Ll = Llanelli, No = Nottingham, Sx = Starcross, SC = Sub-Contracted outside NLS



Item 2A

Item 2B



Item 2c

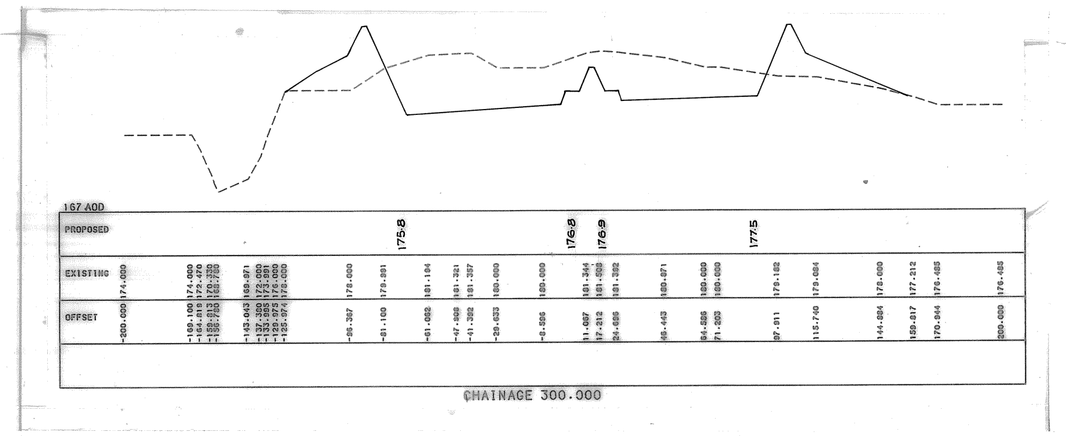


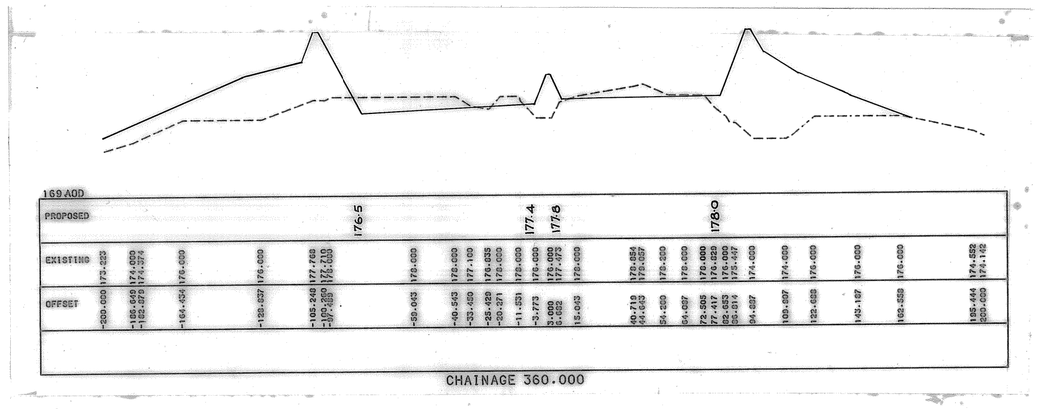
Stoneyhill Waste Disposal Site Cross Sections 265-420

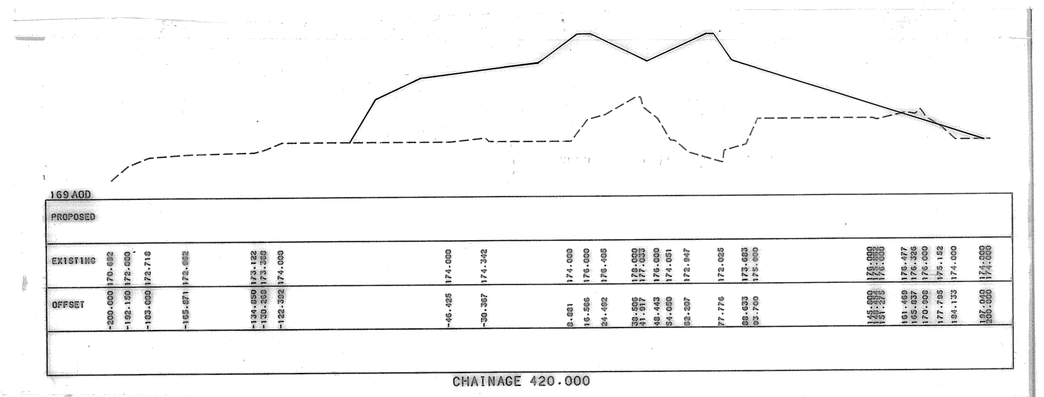
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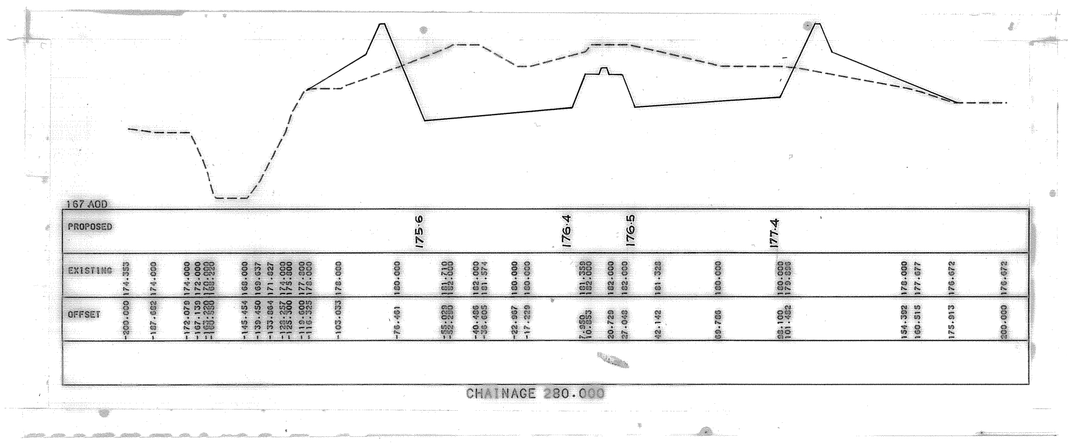
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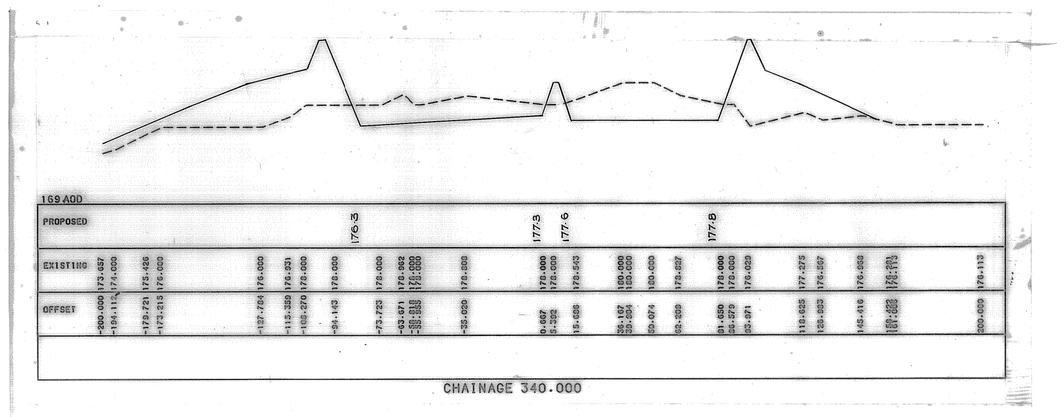
DRG. No.

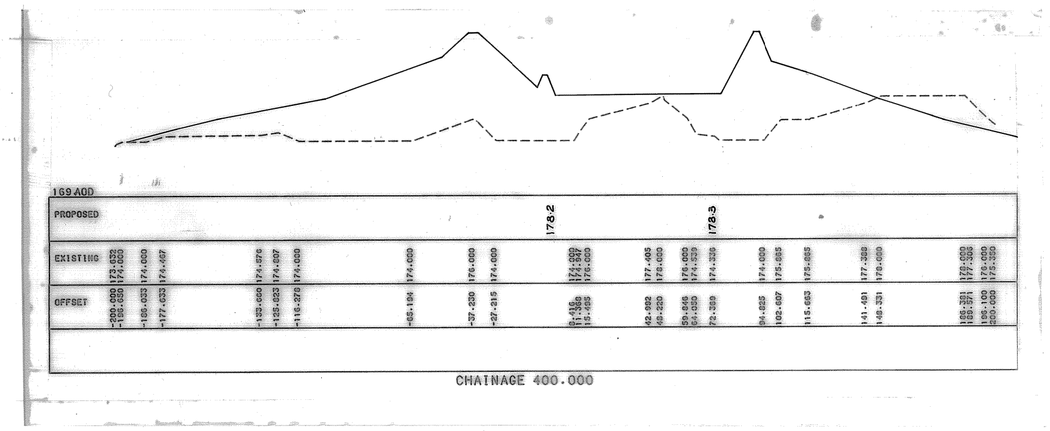


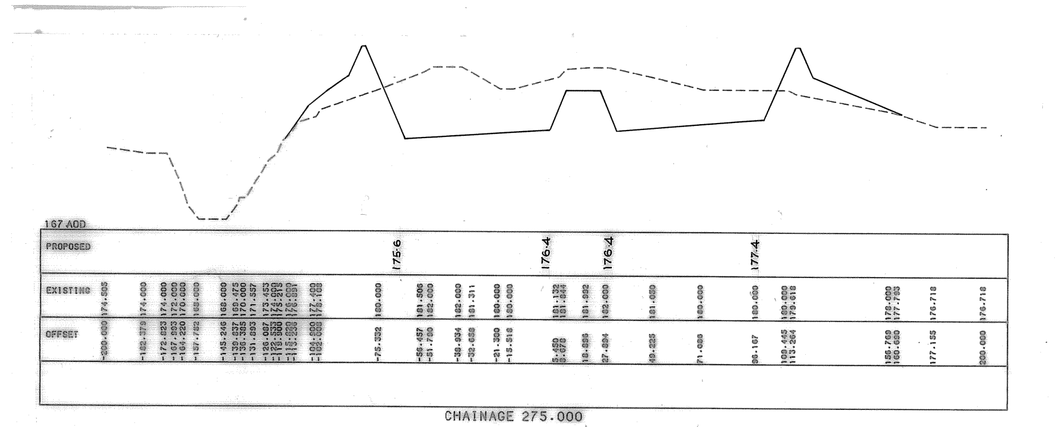


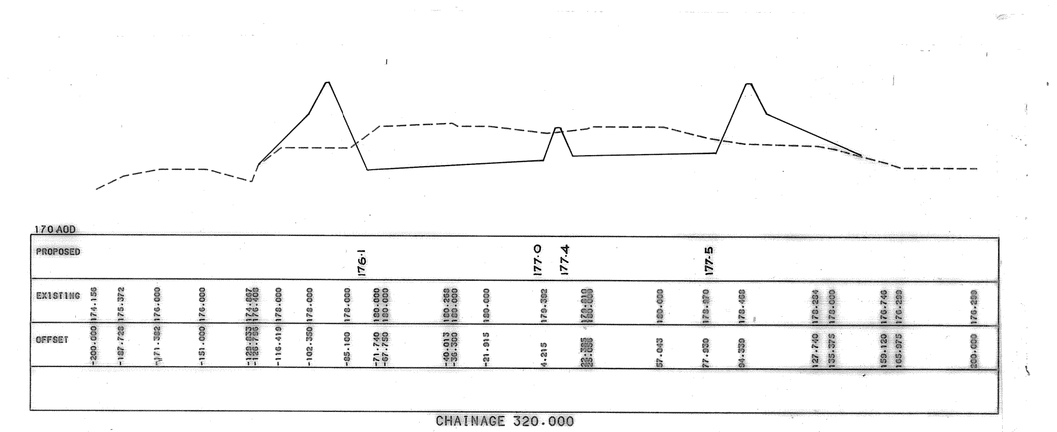


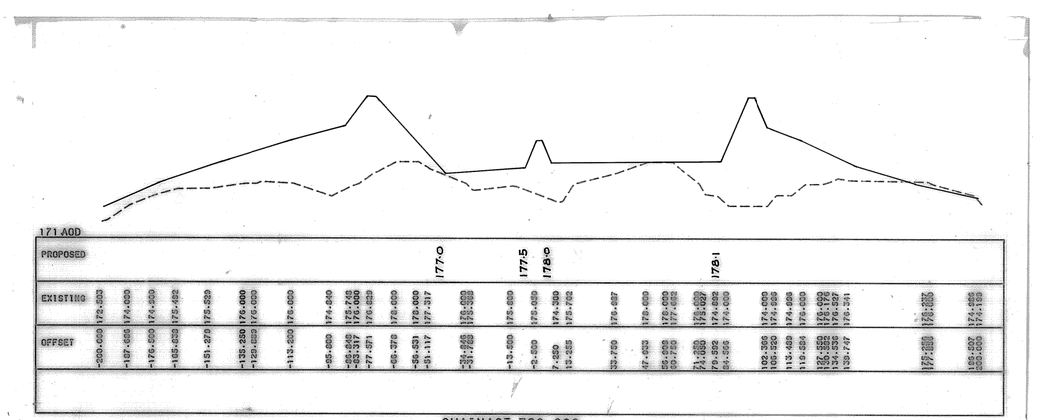


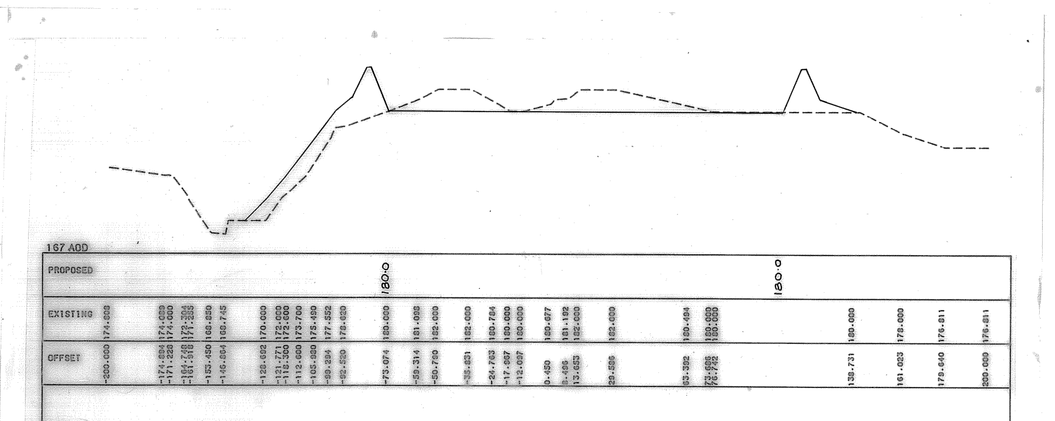












County of Shropshire K.B. MADELIN M.Sc., C.Eng., COUNTY SURVEYOR, SHIREHALL, ABBEY FOREGATE, SHREWSBURY. Tel. 222556	Stoneyhill Waste Disposal Site Cross Sections **265-420** REF No 037	REVISIONS
SCALES: HORIZONTAL : 1/2000 VERTICAL : 1/400	DRAWN: / CHECKED: / SHEET TRACED: J.A.C. / DATE: APRIL '84	DRG. No. 929/11/4

Stoneyhill Waste Disposal Site. 929/10/2 R3/11
Offer Copy General Layout & Method of Working.

DRG. No.

To Horsehay

From Coalbrookdale

Existing 9" drain

CP6 (existing)

CP7 (existing)

CP4 Existing 9" drain

Proposed balancing pool

STONEYHILL

Existing pool to be retained as balancing reservoir and silt trap

Draft Line of Ironbridge By-pass

PHASE 1

PHASE 2

PHASE 3

PHASE 4

PHASE 5

CP1

CP2

CP3

Civic Amenity Area

Garage

H1

H2

Site Office

Wheel wash

Cesspool

Limit to works on Stoneyhill Lane

Arbitrary grid

KEY

- Chain link security fence with straining post positions.
- Piped drainage.
- Open ditch with headwall.
- Catchpit.
- Open sump (1 metre deep at pipe invert with 1 in 2 side slopes.)
- Metalled road.
- Unmetalled road
- W — Water supply pipe with stop valve.

County of Shropshire

K.B. MADELIN M.Sc., C.Eng.,
COUNTY SURVEYOR,
SHIREHALL,
ABBEY FOREGATE,
SHREWSBURY. Tel. 222556

Stoneyhill Waste Disposal Site.
General Layout Plan and Method of Working — Scheme No 4
REF No. 0146

SCALE 1/1000

DRAWN: J.N.J. CHECKED: SHEET

TRACED: J.A.C. DATE: May '84

DRG. No.929/10/2

REVISIONS

Geological Plan
Stoneyhill

929/02/1
1:2500

Drg. No.

HORSEHAY FAULT

STONEYHILL FAULT

CLAY COLLIERY
Opencast Working

IRONBRIDGE BY-PASS

BH 9
BH 11
BH 12
BH 5
BH 6
BH 7
BH 8
BH 10
BH 11a

Opencast Working

Croppings Farm

Stoneyhill

Myford

Woodlands Farm

Horsehay Dingle

Doseley Quarries (Stone)

Pipe Works

Doseley

St Luke's Church (C of E)

Lower Coalmoor Farm

Wynne's Coppice

Mount Pleasant

Stocking Farm

Old Canal

Sandy Bank

Doseley Hall

Pumping Station

Foresters Arms (P.H.)

Sunday School

War Memorial (Lych Gate)

Old Quarry

Sewage Tank

Diwood Shaft

Horsehay Flash

Lyde Brook

Yorks Brook

Little Brook

Waterfall

Ponds

Sinks

Issues

Spring

Pond

Garage

Tank

Ruins

Crane

Conveyor

Chalybeate Spring

Cheshire Cheese Inn (P.H.)

Wells

Co. Coun. & U.D. Boys

Foundry

Woodhouse

Woodlands Lane

Doseley Road

Doseley Lane

Stoneyhill Lane

Horsehay Lane

Dark Lane

Doseley Brook

Shropshire Union Railway & Canal Co.

Great Western Railway

Shrewsbury & Birmingham Railway

Telegraph

Tk

Tks

W.B.

Ch

Sch

P.O.

Sta

Ho

Cott

Bdy

Fm

Cl

Ind Est

Rec

Cem

Allot

Gdns

Bk

Ct

Ho

Ind

Pk

Ave

Rd

Ln

Cres

Dr

Cl

Gdns

Sq

Ct

Pl

Gr

Ter

Wk

Mdw

Hts

Vw

Cft

Cnr

Cotts

Bldgs

Yd

Sta

Ho

Cott

Bdy

Fm

Cl

Ind Est

Rec

Cem

Allot

Gdns

Bk

Ct

Ho

Ind

Pk

Ave

Rd

Ln

Cres

Dr

Cl

Gdns

Sq

Ct

Pl

Gr

Ter

Wk

Mdw

Hts

Vw

Cft

Cnr

Cotts

Bldgs

Yd

KEY

- Conjectured position of coal outcrop
- L.L Lancashire ladies seam
- L.F Little flint seam
- C Clodcoal
- Conjectured position of fault
- Abandoned mine shaft
- JL Abandoned adit
- Approximate position of opencast boundary
- Landfill boundary
- Land in County Council ownership
- Boreholes drilled for Ironbridge By-pass
- Boreholes drilled for Horsehay By-pass

Taken from O.S. Sheets S.J 6606-6706, S.J 6605-6705 both Editions 1958

Revisions	DRAWN:	Shropshire County Council	STONEYHILL WASTE DISPOSAL SITE
	TRACED:	K.B. MADELIN M.Sc., C. Eng., COUNTY SURVEYOR SHIREHALL ABBEY FOREGATE SHREWSBURY SY2 6ND	REF No. 078
	CHECKED:		
	DATE: FEB 90		Scale 1/2500 — Drg. No. 929/02/1

Shropshire County Council
Plan 929/13/7 ..... F/K 8/31

DRG. No.

To Horsehay

From Coalbrookdale

STONEY HILL

Draft Line of Ironbridge By-pass

TURNBUTS

300N OE

200E

200N OE

500

300

178 170 174 172

170 172 174 176

187·5 187 186·5 186 185 184 182 180 178 176 172

188·5 188 187·5 187 186·5 186 185 184 182 180 178 176 174 172

County of Shropshire

K.B. MADELIN M.Sc., C.Eng.,
COUNTY SURVEYOR,
SHIREHALL,
ABBEY FOREGATE,
SHREWSBURY. Tel. 222556

Stoneyhill Waste Disposal Site.
Working Contours before Settlement

REF No. 067.

SCALE 1/1000

DRAWN: J.N.J. CHECKED: SHEET
TRACED: J.A.C. DATE: MAY '84.

REVISIONS

DRG. No. 929/13/7

Stoneyhill Waste Disposal Site
Final Contours
Access and Drainage (Draft Plan) 1:1

File 6/3/1

DRG. No.

To Horsehay

From Coalbrookdale

Existing outlet

Invert 169·75

225 mm drain @ 1 in 60 gradient

French drain

Balancing Reservoir & Silt Trap.

Invert 172·26

Invert 173·33

Invert 175·00

Cut off ditch

T.P. access road

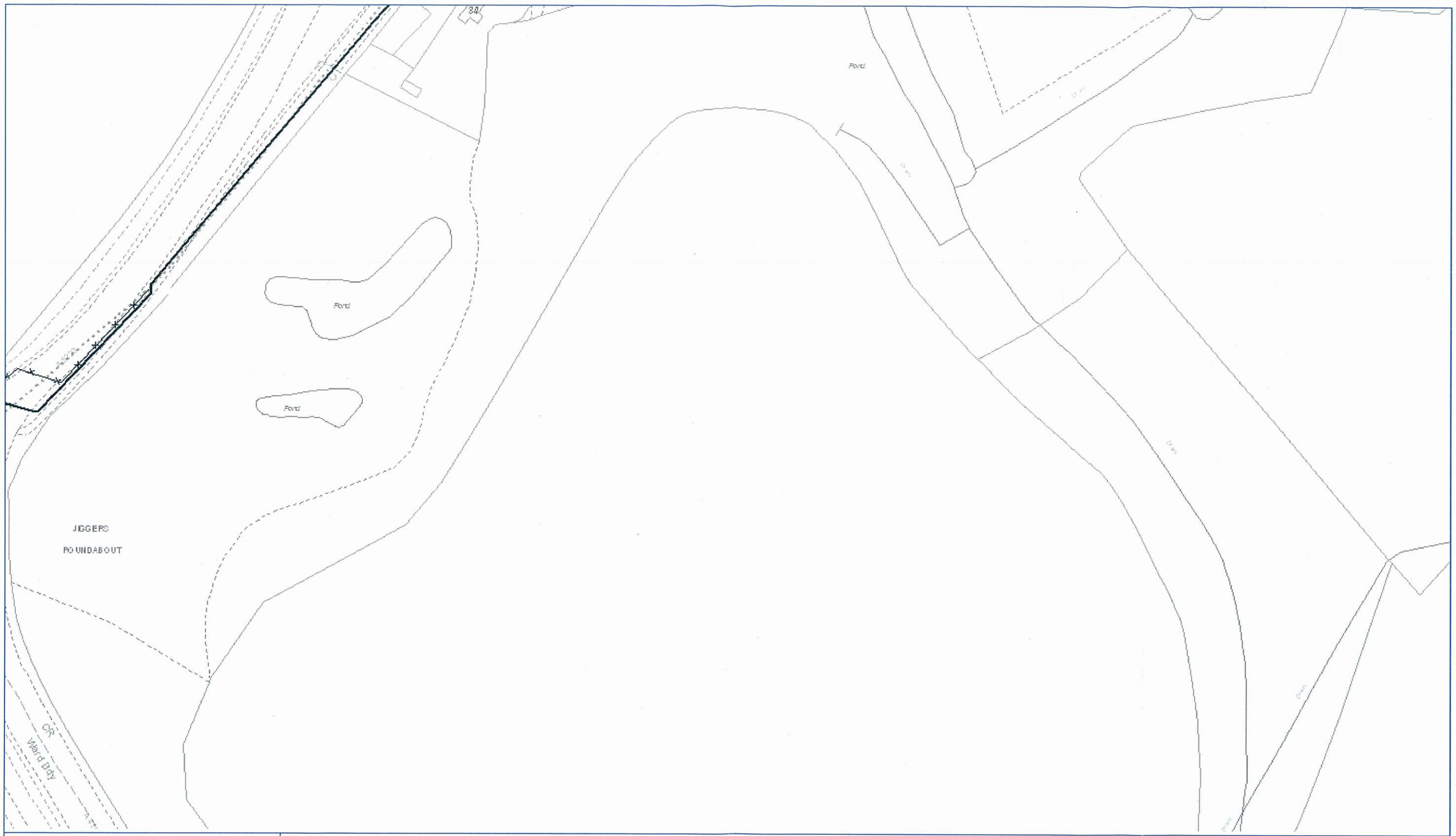
County of Shropshire K. B. MADELIN M.Sc., C. Eng. COUNTY SURVEYOR, SHIREHALL, ABBEY FOREGATE, SHREWSBURY. Tel. 222	Stoneyhill Waste Disposal Site. Final Contours Access and Drainage (Draft Plan)				REVISIONS
	SCALE 1/1.000	DRAWN: T.M.S	CHECKED:	SHEET	DRG. No.929/16/1
		TRACED:	DATE:		

Stoney Hill Landfill Site

Position Statement & Management Plan

APPENDIX B

UTILITY INFORMATION



Water main
Fire main
Fire hydrant
Non-return valve
High voltage cable
Duct
Aqueduct
Water valve
Washout hydrant
Anode
Low voltage cable
Abandoned pipe
Air valve
Bulk meter
Discharge
Instrumentation

Severn Trent Water

Severn Trent Water Limited
Waterworks Road
Edgbaston
Birmingham
B16 9DD
Telephone: 0845 607 6616

Water Mains Record

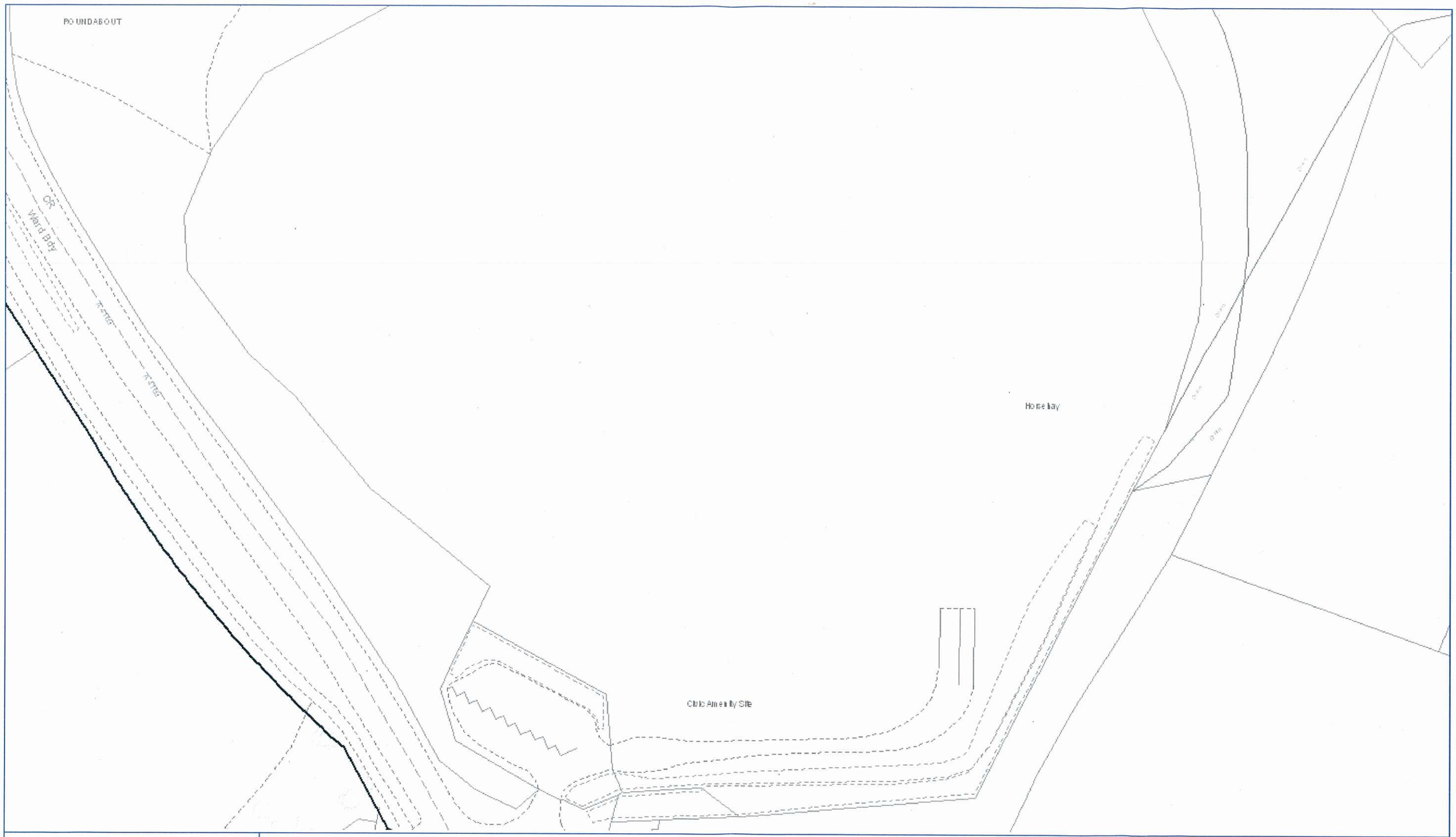
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Date of Issue: 01 04 2009

This map is centered upon OS Grid Ref:
x - 366833.0 y - 306147.0

Do not scale off this drawing

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Water main
Aqueduct
Abandoned pipe
Fire main
Water valve
Air valve
Fire hydrant
Washout hydrant
Bulk meter
Non-return valve
Anode
Discharge
High voltage cable
Low voltage cable
Instrumentation
Duct

Severn Trent Water

Severn Trent Water Limited
Waterworks Road
Edgbaston
Birmingham
B16 9DD
Telephone: 0845 607 6616

Water Mains Record

O/S Map scale: Approx. 1:1250

Date of Issue: 01 04 2009

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Public foul gravity
Public combined gravity
Public surface water gravity
Pressurised foul
Pressurised combined
Pressurised surface water
Section 104 sewers are shown in green
Private sewers are shown in magenta
All Non-Sewer Standard (NSS) Lateral Drains are shown in Orange
Abandoned sewer
Culverted watercourse
Highway drain
Manhole - foul / combined
Manhole - surface water
Duct
Lamphole
Blind shaft
Head node
Overflow
Outfall
Combined Lateral Drain (SS)
High voltage cable
Foul Lateral Drain (SS)
Low voltage cable
Surface Water Lateral Drain (SS)
Instrumentation

Severn Trent Water

Severn Trent Water Limited
Waterworks Road
Edgbaston
Birmingham
B16 9DD
Telephone: 0845 607 6616

Sewer Record

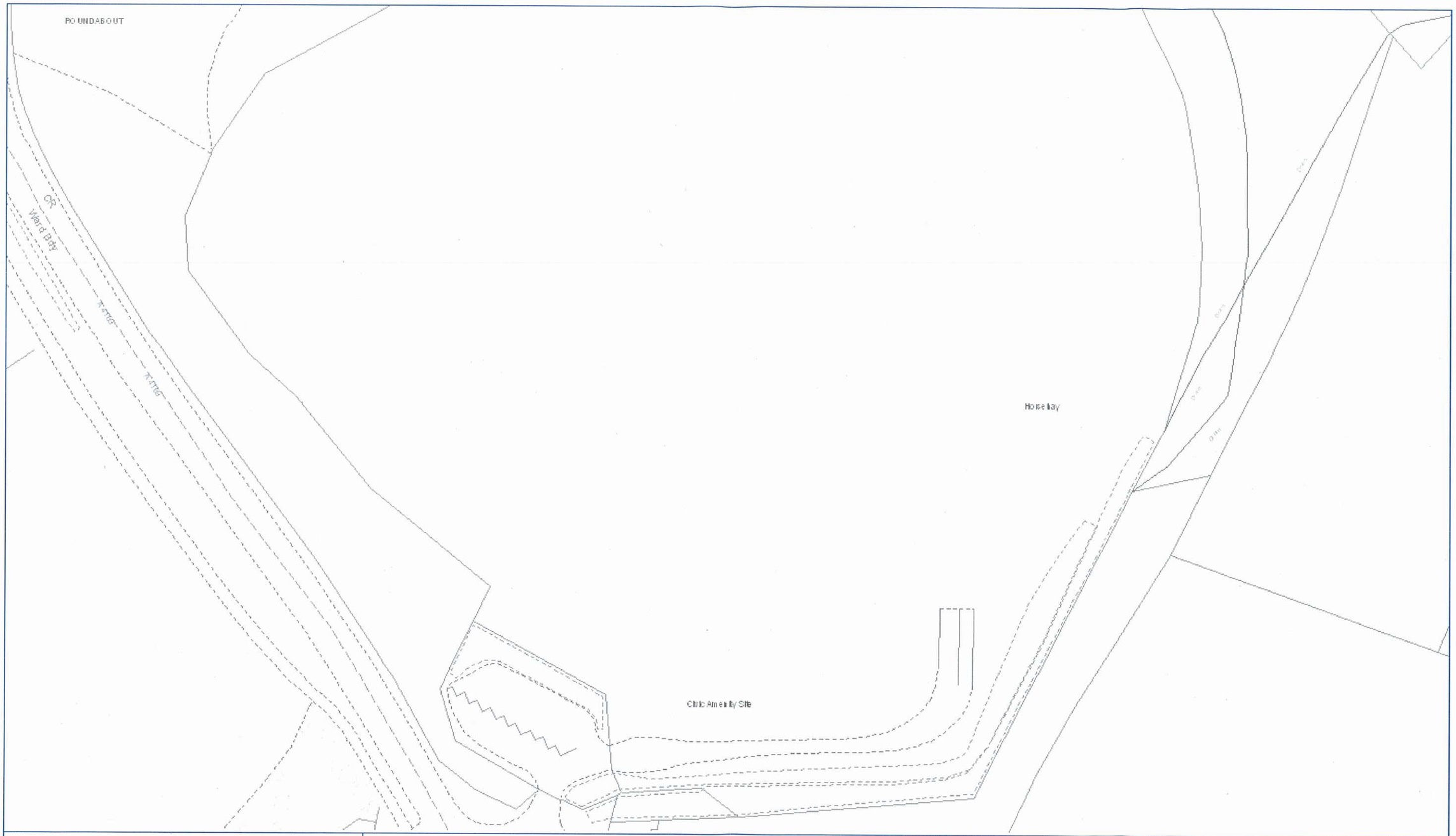
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Public foul gravity
Pressurised foul
Public combined gravity
Pressurised combined
Public surface water gravity
Pressurised surface water

Section 104 sewers are shown in green
Private sewers are shown in magenta
All Non-Sewer Standard (NSS) Lateral Drains are shown in Orange

Abandoned sewer
Culverted watercourse
Highway drain
Manhole - foul / combined
Manhole - surface water
Dust
Lamphole
Blind shaft
Head node
Overflow
Outfall
Combined Lateral Drain (SS)
High voltage cable
Foul Lateral Drain (SS)
Low voltage cable
Surface Water Lateral Drain (SS)
Instrumentation

Severn Trent Water

Severn Trent Water Limited
Waterworks Road
Edgbaston
Birmingham
B16 9DD
Telephone: 0845 607 6616

Sewer Record

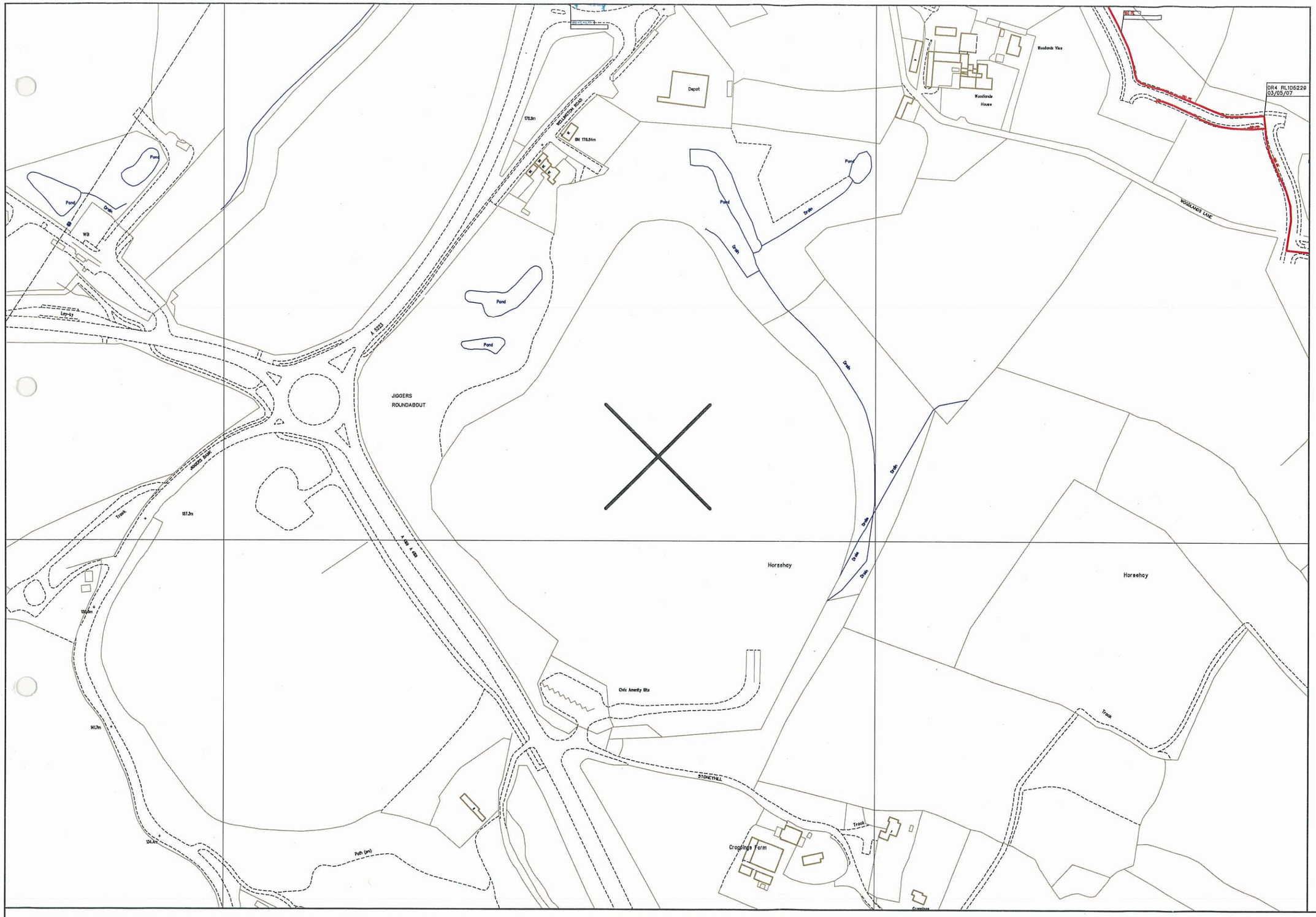
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Date of Issue: 01 04 2009

This map is centered upon OS Grid Ref:
x - 366833.0 y - 305977.0

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SCALE: Not to scale

USER ID: ERKAJO

DATE: 01/04/2009

EXTRACT DATE: 11/12/2008

MAP REF: SJ6606

CENTRE: 366833, 306065

LP MAINS

MP MAINS

IP MAINS

LHP MAINS

NHP MAINS

Some examples of Plant Items:

Valve | Depth of Cover | Syphon | Diameter Change | Material Change

This plan shows those pipes owned by National Grid Gas plc in their role as a Licensed Gas Transporter (GT). Gas pipes owned by other GTs, or otherwise privately owned, may be present in this area. Information with regard to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc. are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by National Grid Gas plc or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue. Further information on all DR4s can be determined by calling the DR4 hotline on 01455 892426 (9am-5pm) A DR4 is where a potential error has been identified within the asset record and a process is currently underway to investigate and resolve the error as appropriate.

MAPS Viewer Version 5.6.1.0

Local Machine

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Unspecified User
1:1250 SJ668061
01/04/2009 09:29:48

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Central Networks

A company of e·on

NDS
Toll End Road
Tipton DY4 0HH
T 0121 522 6177
F 0121 522 6176

DRAWING No.	SCALE 1:1250
SJ668061	DATE 01/04/2009
	PREP. BY Unspecified User
ORDNANCE REF.:	

LEGEND

VOLTAGE/ITEM	UNDERGROUND CABLES		OVERHEAD CABLES	
	EXISTING	PROPOSED	EXISTING	PROPOSED
132 kV.				
66 33 kv.				
11 kV/6.6 kV				
240 415 VOLT				
PILOT TELEPHONE				
CONDUITS				
MAJOR CON LINES				
SERVICES				

COMPASS

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IMPORTANT NOTE

CABLE DEPTHS ARE NORMALLY BETWEEN 0.4 AND 1.5 METRES. THOSE MARKED * HAVE BEEN LAID AFTER 1.10.88 GENERALLY AS FOLLOWS

LV INCLUDING SERVICES	0.4 - 0.6 METRES
HV	0.5 - 0.9 METRES
ALL ROAD CROSSINGS	0.6 - 1.0 METRES
33-66-132kV	0.9 - 1.5 METRES

ANY DEPTHS SHOWN ON THIS PLAN ARE SPECIFIC TO THAT POINT, AT THE DATE INDICATED OR TIME OF INSTALLATION TO THE BEST OF OUR KNOWLEDGE AND BELIEF.
NOTE THERE MAY BE WIDE VARIATIONS FROM NORMAL OR EVEN INDICATED DEPTHS FOR VARIOUS REASONS E.G. CHANGED SURFACE LEVELS AND UNDERGROUND OBSTRUCTIONS. THEREFORE ALL CABLES IN THE VICINITY OF WORKS MUST BE CAREFULLY LOCATED ON SITE.
GUIDANCE FOR SAFE WORKING PROCEDURES IS CONTAINED IN HEALTH AND SAFETY EXECUTIVE GUIDANCE, BOOKLET HSG47 AVAILABLE FROM HSE BOOKS
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V4.0 NW 13.2.2004

Unspecified User
1:1250 SJ668058
01/04/2009 09:36:31

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IRONBRIDGE BY PASS

LV3c25

112404
SITE SUPPLY
STONEYHILL

STONEY HILL

11kV2w50AAAC

112405

11kV2w50AAAC

112403
CROPPINGS
FARM

112416
WYNNS COPPICE

CROPPINGS FARM

Central Networks

A company of E.ON

NDS
Toll End Road
Tipton DY4 0HH
T 0121 522 6177
F 0121 522 6176

DRAWING No.	SCALE	1:1250
SJ668058	DATE	01/04/2009
	PREP. BY	Unspecified User
ORDNANCE REF.:		

LEGEND

VOLTAGE/ITEM	UNDERGROUND CABLES		OVERHEAD CABLES	
	EXISTING	PROPOSED	EXISTING	PROPOSED
132 kV.				
66 33 kV.				
11 kV/6.6 kV				
240 415 VOLT				
PILOT TELEPHONE				
CONDUITS				
MAJOR CON LINES				
SERVICES				

COMPASS

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IMPORTANT NOTE

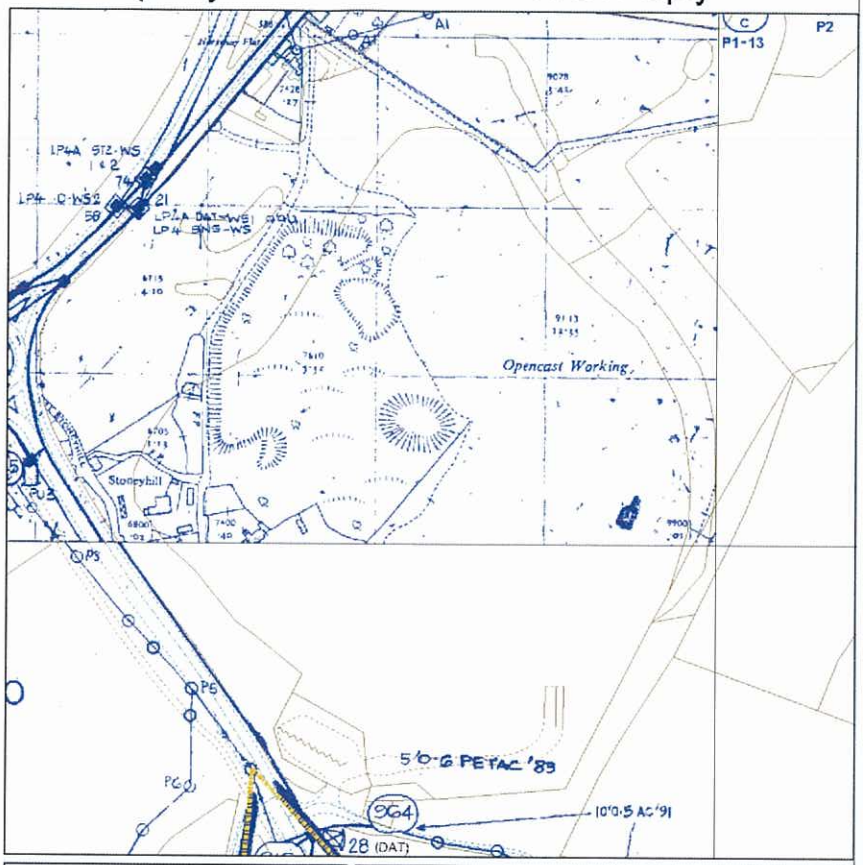
CABLE DEPTHS ARE NORMALLY BETWEEN 0.4 AND 1.5 METRES. THOSE MARKED * HAVE BEEN LAID AFTER 1.10.88 GENERALLY AS FOLLOWS

LV INCLUDING SERVICES	0.4 - 0.6 METRES
HV	0.5 - 0.9 METRES
ALL ROAD CROSSINGS	0.6 - 1.0 METRES
33-66-132kV	0.9 - 1.5 METRES

ANY DEPTHS SHOWN ON THIS PLAN ARE SPECIFIC TO THAT POINT, AT THE DATE INDICATED OR TIME OF INSTALLATION TO THE BEST OF OUR KNOWLEDGE AND BELIEF.
NOTE THERE MAY BE WIDE VARIATIONS FROM NORMAL OR EVEN INDICATED DEPTHS FOR VARIOUS REASONS E.G. CHANGED SURFACE LEVELS AND UNDERGROUND OBSTRUCTIONS. THEREFORE ALL CABLES IN THE VICINITY OF WORKS MUST BE CAREFULLY LOCATED ON SITE.
GUIDANCE FOR SAFE WORKING PROCEDURES IS CONTAINED IN HEALTH AND SAFETY EXECUTIVE GUIDANCE, BOOKLET HSG47 AVAILABLE FROM HSE BOOKS
NO LIABILITY IS ACCEPTED BY CENTRAL NETWORKS FOR ANY ERROR IN OR OMISSION FROM THE PLAN WHETHER DUE TO NEGLIGENCE OR OTHERWISE THIS SHALL NOT AFFECT LIABILITY FOR DEATH OR PERSONAL INJURY RESULTING FROM NEGLIGENCE.

V4.0 NW 13.2.2004

Maps by email Plant Information Reply



IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy. It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.

DIAL BEFORE YOU DIG

FOR PROFESSIONAL ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS

ADVANCE NOTICE REQUIRED
(Office hours: Monday-Friday 08.00 to 17.00)

Tel: 0800 9173993
E-mail: dbyd@openreach.co.uk
Website: www.dialbeforeyoudig.com

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KEY TO BT SYMBOLS

UNDERGROUND PLANT	POLE
A/C, D/W or W OVERHEAD PLANT	CABINET
JOINT BOX	BURIED JOINT
DP or SP DISTRIBUTION POINT	J JOINTING POST
MH or 72 MANHOLE	PROPOSED U/G
DP BOUNDARY	A/C, D/W or W PROPOSED O/H
BT OTHER BT BOUNDARY	PROPOSED BOX

Other proposed plant is shown using dashed lines. BT symbols not listed above may be disregarded. Existing BT plant may not be recorded. Information valid at the time of preparation.

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a BT Group business

BT ref: DFT09544C

Map reference (centre): SJ6683306065

Issued: 01/04/09 09:55:50

Stoney Hill Landfill Site

Position Statement & Management Plan

TABLE 1

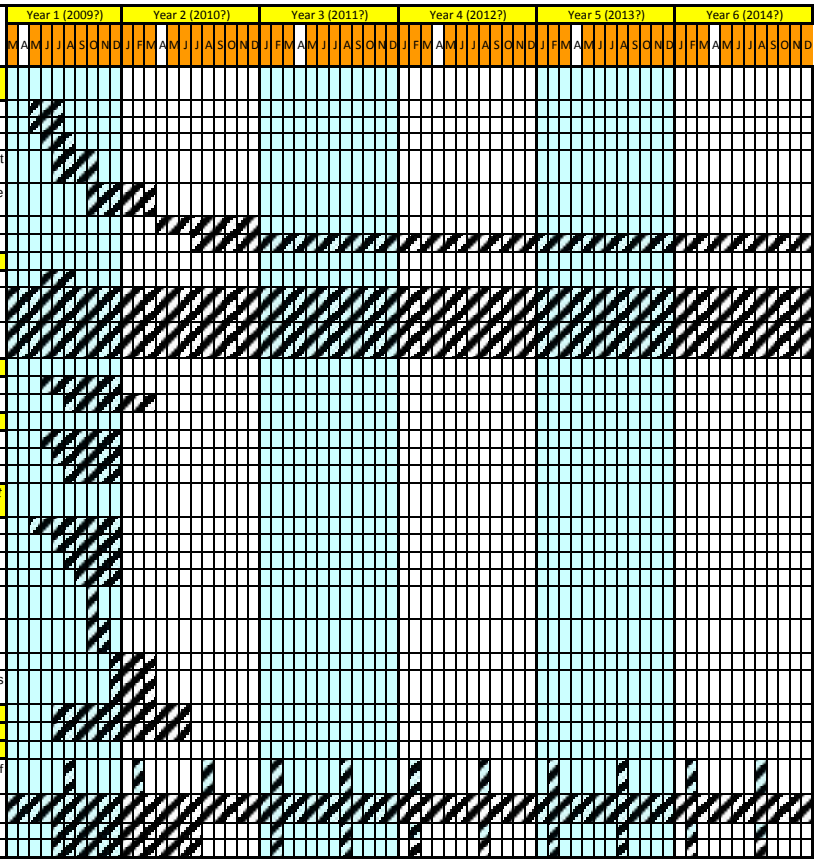
5 Year Management Plan
Task List

Table 1: Five Year management Plan Tasks: Telford & Wrekin Council, Engineering Services Department, Proposed Programme of Works for Stoney Hill landfill Site.

Introduction: This table should only be referred to in conjunction with report reference 'Stoney Hill Landfill, Summary Report & Management Plan' dated April 2009. Based on the findings and conclusions summarised in the aforementioned report, a list of key tasks, described below, have been prepared which form the 5 year Management Plan Action List. These tasks have been given a preliminary priority status (it should be noted that some tasks must be completed prior to commencing other linked tasks). Additionally, different options will be interrogated for certain tasks (e.g. leachate disposal) and the option finally employed will be decided upon on an iterative basis.

This table must be read in conjunction with notes 1 to 5 below the table.

Task	Priority	Budget Cost	Revenue Costs (2009/2010). On-going costs in red.	Capital Costs (2009/2010)	Description of proposed work.
1					*Preparation of a strategy for the potential disposal of landfill leachate to Severn Trent's Foul Water System.*
1A	**H**	£5k	£5,000.00		Chemically analyse leachate from landfill.
1B	**H**				Complete Severn Trent's Trade Effluent Notice (TEN).
1C	**H**				Severn Trent meetings / discussions.
1D	**H**				Cost benefit analysis: 'disposal by tanker Versus disposal by discharge to foul sewer'. (to include an assessment of short haul disposal by tanker direct to sewer).
1E	**M**	£15k	£15,000.00		Pending outcome of previous items, complete the detailed design and cost a Foul Water disposal and possible pre-treatment system.
1F	**M**	£350k	£35,000.00	£315,000.00	Civils works (installation of foul water pipe / possible pump & pretreatment facilities etc.)
1G	**M**	£125k	£25,000.00		Disposal of leachate to foul sewer on an on-going basis.
2					*Preparation of tender documents for continued leachate disposal by tanker & Maintenance Contract.*
2A	**H**	£3,000	£3,000		Tender process.
2B	**H**	£250k (5 years)	£50,000.00		Continued disposal of leachate by tanker (assuming Task 1 proves to be financially unviable).
2C	**H**	£250k (5 years)	£40,000.00		Biogas on-going management of the site. Includes all maintenance.
3					*Replace and modernise Gas Flare System: Replacement of the elevated flare by a ground flare.*
3A	**H**	£3k	£3,000		Tender process.
3B	**H**	£100k	£12,000	£88,000.00	Ground and Civils works. New flare, gas pipe network.
4					*Ground Investigation Works (to plug gaps in the contamination Conceptual Site Model, CSM).*
4A	**L**	£34k	£3,000		Design and procure Ground Investigation works.
4B	**L**			£26,000.00	Contractor to carry out Ground Investigation
4C	**L**		£5,000.00		Telford & wrekin Council to analyse findings of Ground Investigation.
5					*Collate and review information on all existing landfill installations and periphery monitoring points. Construct new wells/pumps and required infrastucture (larger tanks, pipes etc.)*
5A	**H**	£180k	£30,000	£150,000	Update a comprehensive drawing showing all boreholes and wells inside and adjacent to the landfill.
5B	**H**				Detailed walkover survey. Collate/tabulate all field information.
5C	**H**				Decommission redundant holes.
5D	**H**				Prepare an updated drawing which shows only active boreholes/wells for future monitoring.
5E	**H**				Tabulate on a drawing (task 5D), the co-ordinates, construction details and open depth of all active 'holes'.
5F	**H**				Overlay landfill cell details onto drawing. Identify efficiency of sampling points. Design new installations/pumps.
5G	**H**				Tender process (for new installations and pumps).
5H	**H**				Contractor to construct new installations/ large pumping wells (to include installations outside landfill to address landfill gas migration). New compressor and 3 phase electrical supply connection.
6	**L**	£1,500	£1,500		*Collate all existing chemical information into a master set of spreadsheets.*
7	**M**	£3k	£3,000.00		*Collate onto a master drawing all existing mine-entry related information including mine-entry status .*
8	**O**				*Routine Environment & Regeneration Site Management:*
8A	**O**	5 years £20,000	£4,000.00		6-monthly walkover suvey and maintenance checks by Telford & Wrekin Council Engineers to include sampling of leachate from tank for chemical analysis.
8B	**O**	5 years £220,000	£40,000.00		General on-going site Management by Telford & Wrekin Council Engineering Services Department.
8C	**H**	£50k	£5,000.00	£45,000.00	Health & Safety: Modification, replacement of on-site welfare facilities. On-going maintenance required by contractor.
8D	**H**	£50k	£5,000	£45,000	Health & Safety: Replacement/installation of security fence. Replace all safety signs.



	Notes
1	This proposed programme of works has been prepared by Engineering Services T&WC, April 2009.
2	The programme may vary depending on the findings at each stage of the research or field works.
3	The budget cost for each Task has been included. These costs are indicative and will vary pending more detailed deign works and in cases, a tendering exercise.
4	Highlighted cells indicate time windows within which the work may be carried out (pending securement of funding) .
5	In relation to tasks 1 & 2 above, (i.e. leachate disposal), the volume of leachate to be disposed of will significantly increase compared with current volumes. Current pumped and disposed volumes are having little effect in lowering the levels of leachate within the landfill.

	Key to understanding task Priority
H	High priority tasks - Priority based on current legislation and Health & Safety issues. Immediate action required.
M	Medium Priority Tasks - Tasks considered necessary to the effective management of the landfill but which can be programmed for future
L	Low priority tasks - Tasks considered necessary to the effective management of the landfill but which can be programmed for future completion.
O	On-going tasks - These tasks require an on-going management commitment.

Total budget 'ball park' 5 year costs for tasks 1 to 8 above.	**£1.4mln.**