Cannock Chase District Council

Environmental Protection Act 1990, Part 2A: Exploratory Site Investigation

Land East of Hunter Road, Cannock

April 2013

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1 INTRODUCTION

1.1 Terms of Reference

In January 2010, Grontmij Limited (Grontmij) was appointed by Cannock Chase District Council (the Council) to assist in the implementation of the Council's Part 2A Contaminated Land inspection strategy. Part 2A of the Environmental Protection Act 1990 (Part 2A) requires each local authority to inspect areas of land which it believes may constitute Part 2A Contaminated Land.

Contaminated Land is defined in Section 78(2) of Part 2A of the Environmental Protection Act 1990 as:

"any land which appears to the local authority in whose area the land 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) significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.*

Further information is provided in the Act and the April 2012 Contaminated Land Statutory Guidance.

Grontmij assisted the Council to prioritise a list of sites which could constitute Part 2A contaminated land for inspection, on the basis of the Council's Part 2A Inspection Strategy. The site subject to this report, located to the east of Hunter Road, Cannock (hereafter referred to as 'the site') was identified as a priority for inspection. The site was considered as a priority for inspection because:

- There are 35 residential properties with gardens and 12 blocks of two/three storey maisonettes with communal gardens which overlie an area of infilled land, recognised as a former (1940s/50s) landfill site.
- The site is underlain by two secondary A aquifers (superficial and bedrock geology), potential at risk from leachate from the infill and or leachable concentrations from the infill soils.

The inspection process has been undertaken in series of phases which has included a desk study and phased approached site investigations. The previous works undertaken by Grontmij included:

- Appointed by the Council to undertake a Desk Top Study (completed August 2010) and subsequent limited initial (shallow excavation by hand pitting) exploratory site investigation. This investigation was undertaken in December 2010 and reported in May 2011.

- Site investigation undertaken in November 2011 based on the recommendations within the May 2011 report which included gaining further soil and leachate data together with the installation of gas monitoring wells with subsequent gas monitoring. These works were Capital Project Grant Funded and the report associated with these works was submitted to the Council in March 2012.

Further details of these previous investigations are discussed in Section 2.2.

Based on the findings of the November 2011 investigation, a further refined phase of investigation was undertaken, which concentrated solely on polycyclic aromatic hydrocarbons (PAH) and asbestos in relation to human health as these were the only pollutant linkages which remained as requiring further assessment. These works were also Capital Project Grant Funded and were undertaken in September 2012. The information contained herein details the results and findings of this 2012 investigation and incorporates the PAH and asbestos results of the previous investigations to provide and overall assessment of the site with regard to these determinands.

A final phase of work was undertaken in by Grontmij in February 2013. The scope of this phase of work was to obtain more soil samples in the northwest corner of the site for asbestos analysis and identification.

The report and the information contained herein, is the reporting aspect requirement of the Council's 2012 Capital Project grant application and presents the findings of the November 2011, September 2012 and February 2013 exploratory investigation with regard to PAH and asbestos within the soil, together with an assessment on the condition of the land with regard Part 2A.

This Exploratory Site Investigation Report is subject to the limitations presented in Appendix A.

2 BACKGROUND INFORMATION

2.1 Site Setting

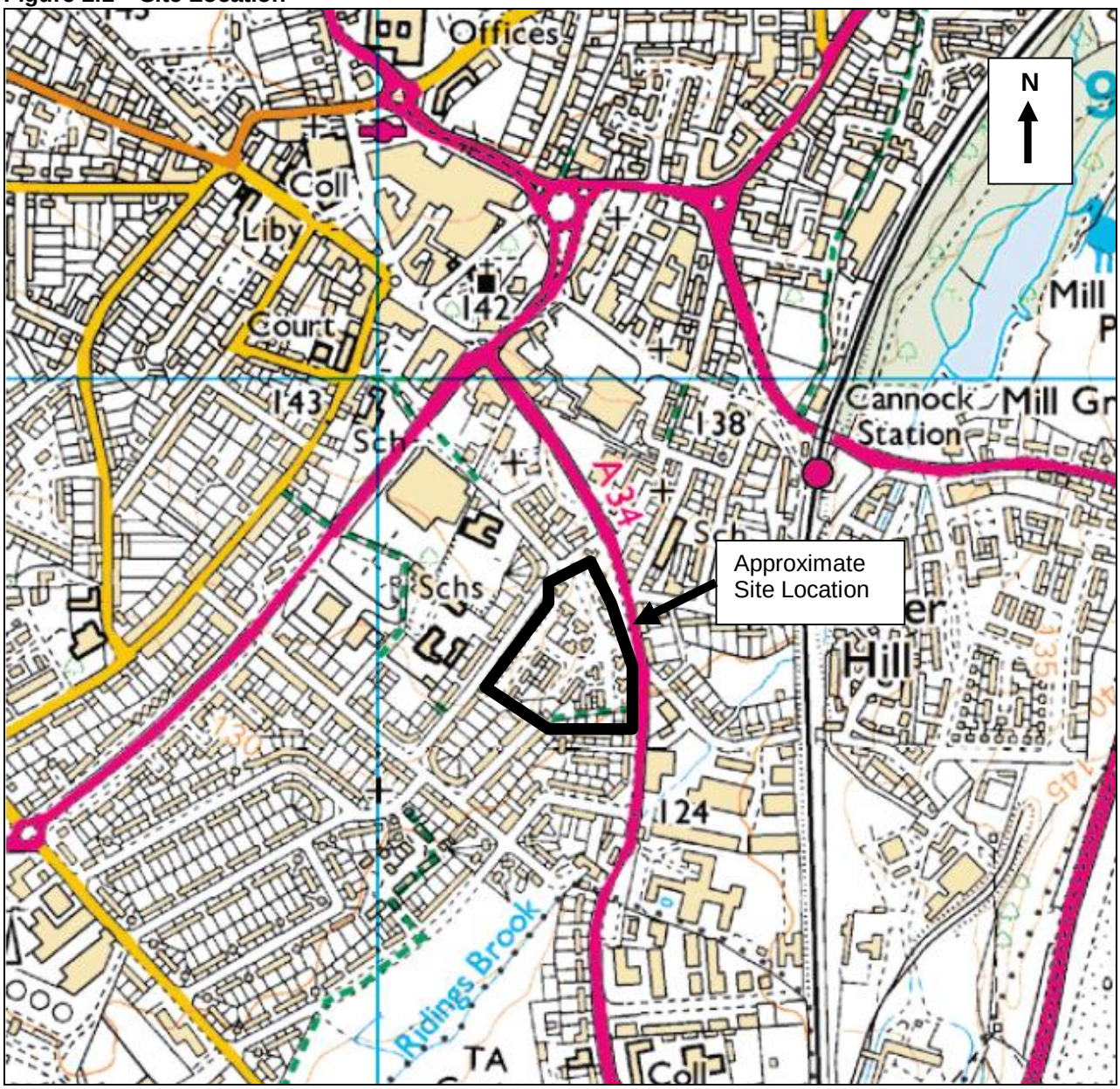
The site's setting and location are summarised in Table 2.1 and Figure 2.1.

Table 2.1 - Site Setting

Data	Information
Address	Hunter Road and Carfax (and roads branching off this road), north of Bridgtown, Cannock, Staffordshire. Nearest postcode: WS11 0YT.
Current site use	Mix of two storey terraces with private gardens (predominantly southern end of site) and three-storey flats surrounded by communal landscaped areas. Architectural style of buildings indicates that the buildings date from the 1960s or 1970s. Council records indicate approximately 50% are privately owned and 50% within housing association ownership.
Grid Reference	Approximate centre of site is located at NGR 398250, 309650
Site Area	The site occupies approximately 3 ha
Topography	General topographic gradient within the area is moderate, sloping downwards towards the south east. However, the site is on multiple levels as a result of cut and fill earthworks.
Surrounding land use	The site is located within a wider residential area. The A34 road is adjacent to the eastern boundary of the site. St Marys Primary School is located 50m to the north west of the site.
Mapped Geology	British Geological Survey (BGS) mapping indicates that the north and west of the site (comprising approx 66% of the total site) is underlain by superficial glaciofluvial deposits (sand and gravel), while the east and south of the site (approx 33% of the total site) is underlain by Diamicton Till (clay, silt, sand and gravel). The superficial deposits are underlain by bedrock of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation.
Hydrogeology	Both the bedrock and superficial deposits are Secondary A aquifers. Secondary A aquifers are "*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers*".
Groundwater Abstractions	The closest public potable abstraction wells are located approximately 7km to the north and east.
Source Protection Zones (SPZs)	The Environment Agency indicate that the site does not lie within a SPZ.
Surface Waters	Ridings Brook is located 200m south east (inferred downgradient) of the site based on the topography of the area.
Historical Land Use	Environment Agency data provided to the Council indicate that the site comprises a former landfill site, operational between 1945 and 1955. The type of waste received by the site is unknown. The operational period pre-dates the Control of Pollution Act 1974 and thus is unlikely to have operated under a formal licence.
Ecologically designated sites[1]	MAGIC search indicates no statutory protected ecologically significant sites exist within 500m of site boundary.
Scheduled Monuments	Pastscape website indicates no monuments on site or in close proximity.

[1] Includes sites designated as Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Special Area of Conservation (SAC, including candidate sites), Special Protection Area (SPA including potential sites), listed Wetlands of International Importance (Ramsar site) and Local Nature Reserves (LNR).

Figure 2.1 – Site Location



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2.2 Previous Investigations and Reports

2.2.1 Grontmij Desk Top Study and Preliminary Site Investigation

Grontmij has previously completed a desktop assessment of the site (August 2010). The assessment included the review of on-line data resources, in-house mapping and records provided by the Council, and a site walkover. Based on the findings of the desk study a limited, shallow preliminary site investigation, comprising five shallow hand-dug trial holes and chemical analysis of five soil samples, was undertaken in December 2010 and reported in May 2011. The exploratory holes were labelled as TP1 to TP5 and the chemical testing comprised:

- 5 x soils metals and inorganics analysis (arsenic, barium beryllium, boron (water soluble), cadmium, chromium (trivalent and hexavalant), copper, lead, mercury, nickel, selenium, vanadium, zinc)
- 5 x soil speciated PAH analysis
- 5 x Soil organic matter (SOM)
- 3 x Asbestos screen and identification

The initial investigation identified PAH concentrations which could potentially pose an unacceptable risk to sensitive receptors (both human health and environmental receptors. The Conceptual Site Model (CSM) of potential pollutant linkages, developed upon completion of the initial investigation (2010) in accordance with the model procedures[2], and statutory guidance[3] was used to identify the further investigation requirements (undertaken in November 2011). The recommendation of the initial study was that further soil and leachate data was required together with the installation of gas monitoring wells with subsequent gas monitoring and this formed the basis of the exploratory work that was undertaken in November 2011.

2.2.2 Grontmij November 2011 Site Investigation

The November 2011 investigation report was issued to the Council in March 2012. This 2012 report (which includes the Grontmij 2010 desk study and initial May 2011 investigation as an appendix) is reproduced in Appendix B. The site works comprised:

- 7 No. window sample holes (WS01 – WS07), to a maximum depth of 4.0m bgl and installed with gas monitoring wells.
- 20 No. hand dug pits (HP06 to HP24, plus HPA) to a maximum depth of 0.9mbgl
- 5 No. gas monitoring rounds recording concentrations of methane (CH_4), carbon dioxide (CO_2), oxygen (O_2), carbon monoxide (CO) and hydrogen sulphide (H_2S), together with flow rates, differential pressure and atmospheric pressure.

The chemical analysis comprised both soil and leachate analysis. The soil analysis consisted of:

- 28 No. soil metal analysis (as previous investigation)
- 22 No. soil PAH analysis
- 4 No. soil Total petroleum hydrocarbons Criteria Working Group (TPHCWG) (which includes BTEX (benzene, toluene, ethylbenzene, xylene) analysis
- 10 asbestos screen and identification.
- 5 No. soil volatile organic compound (VOC) analysis and 9 No soil semi volatile organic compound (SVOC) analysis
- 19 No. soil SOM analysis
- 8 No. pH and sulphate total analysis

The soil leachability analysis comprised:

- 6 No metals analysis (arsenic, boron, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, zinc)
- 5 No. speciated PAH analysis

[2] CLR11 Model Procedures for the Management of Land Contamination (EA & DEFRA September 2004)
[3], Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance:, April 2012 .

Tap water samples were also obtained from 6 of the residential properties and analysed for a suite of metals and speciated PAHs.

The findings of the November 2011 investigation are discussed below.

- The **metal** concentrations at the site pose a **very low risk** to human health and controlled waters. With regard to human health all of the metal concentrations which exceeded Tier 1 screening values (arsenic, copper, nickel, vanadium, zinc) were recorded in soil samples obtained from one location (WS07) at depths of 1.8 mbgl and below. Therefore, dermal contact with the soils and subsequent ingestion (directly or via contact with home-grown vegetables) is unlikely. A sample taken at a shallower depth (0.7 mbgl) from the same exploratory location recorded concentrations less than the screening value for all metals analysed thus validating the lack of exposure scenario. The depth of the contamination, the lack of risk associated with the shallower soils and that the location of where these soils were identified is public open space and not within a residential plot all reduce the potential risk posed by these contaminants to human health. With regard to inhalation (vapour) risk from these contaminants, under “normal” conditions, the metals detected are not volatile, nor produce and/or form a gaseous state. Therefore, the inhalation pathway was also deemed as negligible. As for groundwater no leachable metals were recorded greater than the UK drinking water standards (DWS). Leachable concentrations of cadmium and copper were recorded in excess of Environmental Quality Standards (EQS). However, both copper and cadmium are hardness dependent and the EQS value used for screening was taken as the most stringent of the values which could have been used. Therefore, even though copper and cadmium exceed it is unlikely that the concentrations recorded would pose a risk to surface water (which is located 200 m from the site).

- **PAHs** were recorded at leachable concentrations greater than UKDWS and EQS. However, it is unlikely that concentrations that exceed the UKDWS would result in significant pollution or the significant possibility of significant pollution of controlled waters. Given the relatively low concentrations observed within the soil and subsequent leachate analysis, the lack of a continuing source combined with the lower sensitivity of the site (subject to confirmation that there are no private water abstractions in proximity to the site) the risk to **groundwater** from the soils at the site is **not significant**. With regard to **surface water**, given the distance to the nearest downgradient surface water receptor (200m), and the opportunity for attenuation and dilution along this flow-path, the PAH recorded leachable concentrations are of **very low risk** to the surface water receptor.

- The TPH, VOC, SVOC and BTEX concentrations at the site were deemed as not sufficient to pose a significant risk to human health and/or controlled waters.

- The concentrations of contaminants within drinking water in six samples tested are compliant with UK drinking water standards. Therefore, the risk to residents and/or the pipe work integrity is very low.

- The results of the gas monitoring indicated that, in regard to CH_4 and CO_2 a CIRIA characteristic situation 1 was likely suitable protection measures which would need to be applied to dwellings. This is the lowest risk category (of six) presented in CIRIA report 665, and indicates that no special gas precautions would be required in the construction of new buildings. Additionally, zero H_2S and CO was recorded. In view of the

monitoring results highlighted above, ground gases are unlikely to pose a risk to the housing or residents at the site.

The viable pollutant linkages that remained as a result of the November 2011 investigation are discussed below.

- PAH were found in the Made Ground at concentrations which may pose a risk to human health as they exceeded residential with plant uptake GACs. Further sampling in residential gardens was recommended to improve confidence that the results to date are representative of the Made Ground at the site. Assuming greater concentrations are not identified, it is likely that further qualitative risk assessment would allow the concentrations identified to date to be viewed as posing an acceptable level of risk to residents.

- ACM was found in one sample (WS02), although “free” asbestos fibres were not found in the surrounding soil. Further sampling around this location was recommended to improve confidence that there is not a (relatively localised) asbestos-affected area at the site.

The previous 2011 investigation report (reported in March 2012), which includes the desk study and initial investigation as an appendix, is included within Appendix B.

3 GROUND INVESTIGATION

In order to further examine the remaining significant potential pollutant linkages identified in Table 2.2, (associated with PAH and asbestos with regard to human health) a further exploratory site investigation was undertaken on the 10th to 12th September 2012 and the 13th February 2013 to take additional samples. This section describes the two site investigations undertaken, the results obtained and a discussion of the results.

3.1 Scope, Methodology and Rationale

The scope, methodology and rationale of the intrusive site investigation undertaken in November September 2012 was as follows:

- 29 No. hand dug pits (HP101-HP129) to a maximum depth of 0.85m bgl.
    - HP101-HP105 were positioned within a grassed open space area (with one sample in a rear garden) where ACM had been identified in a single location (WS02) in the November 2011 investigation, in order to examine whether ACM is widespread in this part of the site;
    - HP106-114 and HP118-125 were positioned in residential gardens which were not investigated in the November 2011 investigation, to ensure an overall coverage of at least one soil sample would be analysed for PAHs per residential garden;
    - During the advancement of the hand pits described above further suspected ACM was identified in two of the locations (HP112 and HP125). As such a dynamic strategy was adopted, whereby further samples were taken around the potential ACM to allow the relative abundance of ACM to be assessed. Three additional hand pits (HP115-117) were advanced at 4 Oriel Close and four additional pits (HP126-129) at 30/32 Hunter Road for this purpose.

Based on the presence of ACM identified within the September 2012 investigation (at 30/32 Hunter Road), a further delineation exercise was undertaken in February 2013 in the northwest area of the site and comprised the following:

- Two hand dug pits (HP130/HP131) positioned in 17/15 High Bank front landscaped garden.
- Three hand dug pits in 34/36 Hunter Road rear landscaped garden facing onto High Bank (HP132-HP134)
- Two hand dug pits (HP135-HP136) in the front garden of 34/36 Hunter Road
- Two hand dug pits advanced in 30/32 Hunter Road (HP137-HP138).

During each of the investigations logging of soil arisings was undertaken in accordance with BS5930:1999, and also, the any visual or olfactory evidence of potential contamination was noted.

Representative soil samples of the strata encountered were retained, which were selected on the basis of field observations of potential contamination and the aim of achieving good spatial and depth coverage of the site.

The retained samples were submitted to Scientific Analytical Laboratory (SAL) of Manchester in cooled coolboxes and under full chain of custody documentation. A total of 18 No. soil samples were scheduled for speciated PAH analysis, with a further 30 (20 as part of the September 2012 investigation and 10 as part of the February 2013 investigation) No. for asbestos screen and identification and presence of fibres. Four samples were also analysed for SOM.

The results of the fieldwork programme outlined above and where appropriate the previous investigations are discussed in the following sections.

3.2 Ground Conditions

The ground conditions have been based on information obtained from all four site investigations undertaken at site. Exploratory hole logs, providing full details of the strata encountered, are included within Appendix C for the 2012 and 2013 investigations and within the report included in Appendix B for the previous (2010 and 2011) investigations.

The ground conditions encountered at the site generally comprised Made Ground over gravelly sand (firm clay in one location), as detailed below:

Made Ground
The Made Ground was predominantly granular in nature, consisting of gravelly sand. The gravel content of the Made Ground was variable, including fine to coarse gravel of ash, clinker, brick, ceramics, slate, (locally) possible asbestos tile, metal fragments and cobbles of brick and concrete. Further details of field evidence of potential contamination are provided in Section 3.2.3. Made Ground was encountered to a maximum depth of 3.2 mbgl, within WS07, although this exploratory hole was atypical, with Made Ground generally being encountered to a maximum of 1.3 mbgl.

Superficial Deposits
Superficial deposits were encountered across the site within the windowless sampler holes. The superficial deposits generally comprised sand and gravel, consistent with the mapped geology of fluvio-glacial deposits. The superficial deposits were encountered from a minimum depth of 0.4 mbgl, within HP09 and were generally encountered to a maximum (unproven) depth of 3 mbgl (termination depth of WS01 and WS02), although sand and gravel was also encountered beneath the made ground in WS07 at 3.2m and was proven to 4.0m bgl.

Within WS06, drilled towards the eastern site boundary, firm to stiff gravelly clay was encountered from 1.4 mbgl to termination depth of 2.0 mbgl. This material is consistent with the mapped superficial deposit of Diamicton Till indicated in the east part of the site.

Groundwater
Groundwater was not encountered during the advancement of any of the exploratory holes.

3.2.1 Adequacy of Investigation Depth and Spatial Extent

Superficial deposits were encountered across the site during the investigations, meaning that the full depth of the Made Ground beneath the site has been encountered and that the data collected is likely to be representative of the site as a whole. The exploratory hole coverage is considered to provide good coverage of the site, with a deliberate emphasis on properties which have private gardens and where exposure to subsurface contaminants is more likely than within communal grassed landscaped parts of the site.

3.3 Field Evidence of Contamination

The drilling arisings were inspected for visual and olfactory evidence of potential contamination. A summary of field observations recorded is presented in Table 3.1:

Table 3.1 - Field Evidence of Potential Contamination

Date	Exploratory Hole	Depth from (mbgl)	Depth to (mbgl)	Visual and Olfactory Evidence of Contamination[1]
December 2010	TP1	0	0.8	Ash, clinker and slag
	TP2	0	0.8	Ash and clinker
	TP3	0	1.0	Ash
	TP4	0	0.7	Ash
	TP5	0	0.7	Ash
November 2011	WS02	0	0.1	Clinker
	WS04	0.6	1.25	Clinker
	WS07	0.5	0.9	Clinker
	WS07	1.5	3.2	Ash and clinker, green/blue discolouration
	HP07	0	0.8	Clinker
	HP08	0.4	0.55	Ash
	HP10	0	0.6	Clinker
	HP11	0	0.7	Clinker
	HP18	0	0.5	Clinker
	HP20	0	0.3	Clinker
	HP22	0	0.5	Clinker
	HP23	0.4	0.5	Clinker
September 2012	HP101	0	0.48	Ash
	HP102	0	0.45	Ash
	HP103	0	0.5	Ash
	HP104	0	0.5	Ash
	HP105	0	0.35	Ash
	HP106	0	0.55	Ash
	HP107	0	0.85	Ash
	HP109	0	0.7	Black staining and odour from 0.45 to 0.65m bgl
	HP110	0	0.7	Rare clinker
	HP111	0	0.75	Rare clinker
	HP112	0	0.7	Potential ACM
	HP114	0	0.6	Rare clinker
	HP117	0	0.4	Ash
	HP112	0	0.2	Clinker
	HP124	0	0.6	Clinker
	HP125	0	0.6	Possible ACM material
	HP126	0	0.3	Ash, clinker and possible ACM
	HP127	0	0.3	Clinker and possible ACM
	HP128	0	0.1	Potential ACM material
	HP129	0	0.28	Ash
February 2013	HP132	0	0.3	Clinker

[1] Visual and olfactory evidence noted within the soil matrix

4 RISK ASSESSMENT

4.1 Soil Analysis Results

Soil samples were submitted for laboratory analysis, under full chain of custody documentation and within chilled coolboxes, to Scientific Analysis Laboratories (SAL) Ltd of Manchester. SAL Ltd holds UKAS and/or MCERTS accreditation for most analyses performed. The samples were selected for analysis on the basis of the observations of potential contamination made in the field, and to achieve good spatial coverage of the site.

Table 4.1 presents a summary of the analysis results. As PAHs and asbestos were the only contaminants concluded to be (during the previous investigations) remaining as a possible risk to receptors only data relating to PAH and asbestos (from all four investigations) has been included.

The PAH soil results were compared to screening values protective of human health, assuming the receptor is a residential property where plant uptake of contaminants occurs, and the plants are subsequently ingested by humans. The screening values used were:

- Generic Assessment Criteria (GAC) published by Land Quality Management Limited (LQM) – 2nd Edition 2009

Full analytical testing results for the 2012 and 2013 investigations are included as Appendix D. The previous analytical testing results of the 2010 and 2011 investigations are included with the report contained within Appendix B.

Tier 1 Soil screening tables including the data from all of the four investigations are included within Appendix E

Table 4.1 - Soil Analysis Results Summary

Determinand	No. of Samples Tested	Minimum Value	Maximum Value	SGV / GAC[1]	Locations where SGV or GAC are exceeded
Polyaromatic Hydrocarbons (PAHs)	45	Some of the speciated PAH screening values were exceeded, see below. Full speciated results are presented in Appendix D			-
Benz(a)anthracene	45	<0.1	**21**	4.7	**8 locations**
Benzo(a)pyrene	45	<0.1	**15**	0.94	**21 locations**
Benzo(b)fluoranthene	45	<0.1	**18**	6.5	**6 locations**
Chrysene	45	<0.1	**16**	8	**4 locations**
Dibenzo(ah)anthracene	45	<0.1	**3.4**	0.86	**7 locations**
Indeno(123-cd)pyrene	45	<0.1	**8.5**	3.9	**5 locations**
Asbestos screen	30	**Asbestos-containing material detected in six samples:** WS02 0.2m bgl: amosite & chrysotile detected within tile HP112 0.3m bgl: chrysotile detected in asbestos-cement HP125 0.2m bgl: chrysotile detected in asbestos-cement HP126 0.2m bgl: chrysotile in insulation board HP127 0.1m bgl: chrysotile free fibres in asbestos-cement HP128 0.05m bgl: amosite and chrysotile in insulation board **Note that in all above cases, the soil matrix surrounding the ACM did NOT contain asbestos fibres.**			

Values presented in mg/kg, correct to two significant figures (screening values presented without any rounding).
[1] 23 samples were tested for Soil Organic Matter (%SOM) content. An SOM average of 5% was calculated based on the soil samples tested. Therefore as a conservative estimate, SGVs and GAC generated using a 2.5% SOM value was used in the above screen

4.2 Discussion of Results

4.2.1 Soils

The concentrations of PAH compounds in 21 of the 45 samples analysed exceeded the adopted Tier 1 screening values. The specific PAHs were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene chrysene, dibenzo(ah)anthracene and indeno(123-cd)pyrene. The locations where more than one speciated PAH was detected at a concentration greater than the GAC were: TP1, TP5, HP07, HP08, HP20, HP106, HP124 and WS02. All are located within the southern half of the site. Given the spatial extent of the exceedances, PAH continues to be considered as a potential contaminant of concern and has been taken through for further assessment.

ACMs were identified in six samples (WS02, HP112 and also HP125, HP126, HP127 HP128 to the southeast of properties 30/32 Hunter Road. However, “free” asbestos fibres within the soil matrix were not encountered in these samples. During the February 2013 investigation (which was designed to delineate the extent of asbestos in this area) confirmed no presence of Asbestos as “free fibres” or ACM within the vicinity of HP130 to HP138. Therefore, asbestos is only located within isolated areas of the site and not within the soil matrix but contained within fragments of ACM sporadically present at the site.

4.2.2 Leachability Assessment

The impact of leachable metals and organics at the site was identified as not being significant with regard to groundwater or surface water during the previous (November 2011) investigation. Therefore no further leachate sampling or analysis was undertaken.

4.2.3 Ground Gas Assessment

The impact of ground gas at the site was identified as not being significant with regard to sensitive receptors during the previous (November 2011) investigation. Therefore no further gas monitoring and/or analysis were undertaken.

4.2.4 Safety of Water Supply Pipes

The impact of contaminants within the soil at the site was identified as not being significant with regard to pipe integrity or water supply during the previous (November 2011) investigation. Therefore no further tap sampling or analysis was undertaken.

5 ASSESSMENT OF POTENTIAL HUMAN HEALTH RISKS

The results of the intrusive investigations with regard to PAHs identified the following species of PAH as a potential human health risk:

- Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, chrysene, indeno(123cd)pyrene,

The assessment of the degree of the potential human health risks posed from these contaminants is considered in the following report sections.

5.1 Benzo(a)pyrene

The concentration of benzo(a)pyrene was greater than the adopted Tier 1 screening value at the following locations:

- TP1, TP2, TP4, TP5, HP06 to HP10, HP20 to HP22, WS2, HP106 to HP108, HP111, HP113 to HP115 and HP124 to HP125.

The results at these locations ranged from 0.1 mg/kg to 15 mg/kg. Therefore, these concentrations were greater than a limit which is representative of a concentration at which risk to human health would be negligible (i.e greater than a GAC). Given these exceedances, further assessment was required and undertaken. The approach adopted to form the basis of risk of exposure to benzo(a)pyrene (and the other PAHs identified) was based on the work undertaken by the Institute of Occupational Medicine and is detailed below. This approach considers the toxicology of PAHs and specifically the concentrations in soils that may represent a significant possibility of significant harm..

5.2 Institute of Occupational Medicine (IOM) – Assessment of benzo(a)pyrene and other PAHs

This section provides an outline summary of the IOM approach to generating its assessment criterion for benzo(a)pyrene and other PAHs. Further, more detailed information is included within Appendix F and should be read in conjunction with the sections below.

5.2.1 Use of GAC within Part 2A

The assessment criterion used for benzo(a)pyrene and other PAHs throughout the previous phases of the work was the GAC (derived by the CIEH and LQM). Soil GAC are criteria which combine a set of generic, conservative assumptions regarding exposure with toxicological criteria (health criteria values or HCVs), which represent minimal risks to health.

With regard to GACs, the 2012 revised Statutory Guidance states that:

"*GACs relating to human health risk assessment represent cautious estimates of levels of contaminants in soil at which there is considered to be no risk to health or, at most, a minimal risk to health.*

(a) They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health. This is on the basis that they are designed to estimate levels of contamination at which risks are likely to be negligible or minimal and far from posing a significant possibility of significant harm to human health.

(b) They should not be used as direct indicators of whether a significant possibility of significant harm to human health may exist."

Therefore, on this basis Grontmij considered that an exceedance of the GAC of 0.94 mg/kg benzo(a)pyrene in soil derived by CIEH/LQM does not constitute a *significant possibility of significant harm* SPOSH (Category 1). However, further assessment would still required, as the maximum concentration encountered at the site was 15 mg/kg, over an order of magnitude greater than the GAC, suggesting the potential of more than a "minimal" risk to human health remains.

5.2.2 Selection of Assessment Criterion

To provide further assessment of those concentrations which exceed the GAC (i.e those which may pose more than a minimal risk to human health) the assessment criterion value derived by IOM has been used.

The IOM carried out a review for Brent Council on polycyclic aromatic hydrocarbons (PAHs) in 2009, to assess the toxicological properties of PAH above GACs in residential housing sites to support Brent Council to make an assessment of soil concentrations above which may constitute significant possibility of significant harm (SPOSH) at the Brent site.[4] Although the report was developed specifically for one site in Brent, the toxicological considerations used provide a useful input into other similar sites. The IOM toxicological review has been assessed by Grontmij and is considered authoritative and the lines of evidence appropriate for use at other situations.

Following review of the IOM work it has been agreed between Grontmij and the Council that an assessment criterion of 17 mg/kg will be adopted for benzo(a)pyrene as a threshold below which SPOSH will not be considered to occur.

5.2.3 Derivation of IOM Assessment Criterion

The information provided below is a summary of the how the derivation of the IOM value of 17mg/kg was achieved. Further, more detailed information is provided within Appendix F.

The value of 17 mg/kg is the lower end of a range (for which the upper end is 36 mg/kg) proposed by IOM as a concentration range at which it could be argued that, if greatly exceeded "*the potential for significant harm would be significant, unless measures are in place to prevent exposure*"[5].

The range of 17mg/kg to 36 mg/kg benzo(a)pyrene was derived by considering a number of toxicological assumptions, and assumptions about exposure. These are described in detail within Appendix F. Appropriate toxicological criteria for cancer endpoints were identified by expert toxicologists and were based on rodent studies for the oral route of entry and on epidemiological studies for the inhalation pathway. IOM selected appropriate uncertainty factors, based on guidance from the Committee on Carcinogenicity.

IOM identified "a typical toddler aged between 1 and 2 years with a body weight of 11.4 kg" as the critical receptor and assumed a "long term mean intake of soil and dust" of 100 mg/day. This is a conservative assumption as typically the critical receptor is identified as being a young child between 0 and 6 years of age. An additional allowance of a factor of two was made for inhalation

[4] Toxicological Review of the Risks of Exposure to Soil Containing Polycyclic Aromatic Hydrocarbons 2009
[5] The report also notes that "*It would clearly be inappropriate to discriminate between soils that contained PAH contents that were marginally above a discrete guideline value from those that were marginally below that value.*"

of indoor dust. An adjustment was also made for the fact that other PAHs besides benzo(a)pyrene were present within the soil. This resulted in a range of 1.7 mg/kg to 3.6 mg/kg. This range was adjusted by a further factor of ten to exclude normal background concentrations of benzo(a)pyrene content in urban soils, resulting in the range of 17 mg/kg to 36 mg/kg of benzo(a)pyrene in soil.

It is also noted that the report undertaken by IOM states that:

"*Given that the exposure modelling is based on reasonable worst case assumptions, soil concentrations between 7 and 17 mg/kg may be tolerable given that the removal of contaminated soils could give rise to temporary exposure of residents to B[a]P during any remediation works and that this could have a much greater impact on their lifetime exposure than if the soil had remained undisturbed.*"

5.2.3.1 Other Assessment Criterion

It should be noted that it is acknowledged that the Health Protection Agency[6] identified a different toxicological criterion for the assessment of land contamination, which is lower than that used in the derivation of the IOM value of 17 mg/kg. The different toxicological criterion was the use of a lower range of Point of Departure[7] (POD) which in the case of Benzo(a)pyrene is referred to as a $BMDL_{10}$.[8] However, the differences between the two values are relatively small, compared to the uncertainty factors that are subsequently applied. Further discussion regarding the different criterion used is provided in Appendix F. Equally we are aware of decisions on SPOSH made by other local authorities where selecting a different POD has resulted in the threshold of SPOSH has been selected at higher soil concentrations.

Overall the arguments presented by IOM are considered to be a robust starting point for considering the question of SPOSH at sites where PAH contamination is present.

5.2.4 Use of benzo(a)pyrene as a Surrogate Marker Compound

The HPA Contaminated Land Information Sheet (CLIS) proposes the use of benzo(a)pyrene as a surrogate marker (a single substance that may be used to represent a wider group of substances) for total PAHs in soils, provided that the profile of PAHs is of sufficient similarity to the mixture used within a study on which their toxicological assessment is based. The HPA CLIS reports a study of 52 contaminated sites across the UK and notes that:

"*Categorisation of the data, according to previous industrial use, showed no substantial differences in the relative PAH profiles. Moreover, the PAH profile in contaminated land was similar to that found in industrial, urban and rural UK soil samples and in other surveys of soil within the UK.*"

It would therefore appear that benzo(a)pyrene is a good surrogate marker for total PAHs in contaminated soil. As the criterion derived by IOM is considered to be a robustly derived and an authoritative criterion, appropriate as a value below which land will not be considered to be contaminated, the approach of using benzo(a)pyrene as a marker compound for the other four

[6] HPA Contaminated Land Information Sheet Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs), Health Protection Agency v5 2010
[7] POD
[8] $BMDL_{10}$

speciated PAHs which exceeded their GAC is considered suitable for evaluation of the total PAH concentrations at the Hunter Road site.

5.2.5 Conclusion

As the maximum concentration for benzo(a)pyrene from the 45 soils samples analysed was 15mg/kg is less than the IOM value of 17 mg/kg the site is not considered to present a significant possibility of significant harm with regard to benzo(a)pyrene.

Also, using benzo(a)pyrene as a surrogate marker for total PAHs the other four PAHs which exceeded their GAC are also considered to be at concentrations which would not pose an unacceptable risk to human health.

5.3 Asbestos

ACM has been found at the site within isolated areas. The 2012 investigation determined that the ACM within WS02 0.2m bgl (amosite & chrysotile detected within tile) and HP112 0.3m bgl (chrysotile detected in asbestos-cement) were isolated occurrences. This was because delineation samples taken around these locations recorded no asbestos material or fibres within the soil samples obtained. Therefore, these areas are not considered to pose an unacceptable risk to human health.

The initial delineation samples taken in 2012 from the area surrounding HP125 (where chrysotile was detected in asbestos-cement) identified more ACM (but no fibres) within the surrounding soils. This area was in soft landscaping adjacent to 30/32 Hunter Road. The 2013 additional investigation recorded no further ACM and no asbestos fibres within the soils surrounding this soft landscaped area. Therefore, it can be concluded that the ACM is contained within the landscaped area adjacent to 30/32 Hunter Road but is confined to the material within which it is found. As no free fibres were detected, the risk from asbestos in this area to human health is reduced.

6 UPDATED CONCEPTUAL SITE MODEL

Based on the information provided from the September 2012 report and subsequent additional asbestos analysis, the CSM for the site has been revised. This is presented as Table 6.1 overleaf and is based on the recognised contamination/pathway/receptor relationships and identification of their contaminant linkages[9].

The CSM presented in Table 6.1, relates to those pollutant linkages that remained post the 2011 investigation, i.e. those linkages associated with PAHs and asbestos posing a risk to human health. For clarification those linkages discounted post 2011 are presented below.

Human Health:

Receptor	Contaminant(s)	Pathway(s)	Risk
• Residents of properties above infilled ground	CH_4, CO_2, H_2S and CO from decomposition of degradable elements of landfill material	Movement into buildings, subsequent asphyxiation and explosion risk	Low
	Metal contamination within the soils	Dermal, ingestion. inhalation of soils and vapours	Low

Groundwater:

Receptor	Contaminant(s)	Pathway(s)	Risk
• Secondary A aquifer (superficial sand and gravel) beneath site	Leachable benzene and PAHs	Leaching of soil contaminants to aquifer	Low / Moderate
• Secondary A aquifer (solid geology; Pennine Middle Coal Measures) beneath site	Leachable benzene and PAHs	No obvious pathway	Low

Surface Water:

Receptor	Contaminant(s)	Pathway(s)	Risk
• Ridings Brook 200m to south-east	Leachable metals and PAHs	Migration of dissolved phase contaminants within fluvioglacial sand and gravel deposits (assuming hydraulic connectivity)	Low / Moderate

Property and services:

Receptor	Contaminant(s)	Pathway(s)	Risk
• Subsurface services serving the buildings (principally water supply)	UKWIR soil guidelines exceeded, but testing of drinking water quality identified metals, cyanide and PAH concentrations were less than UK drinking water standards	Chemical attack of pipes and/or tainting / contamination of drinking water supply	Very low
• Property (structures) – sub-surface concrete	Sulphate and pH	Contact between contaminants and concrete	Low / Moderate
• Property (structures) – residential buildings on site	Decomposable or compressible elements of infill	Differential settlement of infill, causing structural failure of buildings	Low

[9] The 2012 revised Statutory Guidance for Part 2A of the 1990 Environmental Protection Act uses the terminology "contaminant/source/receptor"

Table 6.1 - Pollutant Linkages, Post-2012 Site Investigation

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Residents of properties above infilled ground (including children playing in gardens)	Concentrations of PAH compounds in shallow soils greater than GAC	Dermal contact and direct ingestion, inhalation of dust/vapours consumption of home-grown vegetables	Minor	Low Likelihood	Very Low	Concentrations of benzo(a)pyrene, (also used as a surrogate compound for other PAHs) were recorded less than 17 mg/kg, which is the value demonstrated by work undertaken by IOM that the human health risk, whilst not negligible, is still acceptably low. Based on the above, the potential severity of the linkage has been reduced to minor, as the concentrations identified are not regarded as posing "significant harm" as defined in the 2012 Statutory Guidance.
Residents of the Hunter Road/Carfax estate	Asbestos containing material (ACM) found in six samples taken at between 0.05m and 0.5m bgl in an open space area, possibly used for play. • WS02 0.2m bgl: amosite & chrysotile detected within tile • HP112 0.3m bgl: chrysotile detected in asbestos-cement • HP125 0.2m bgl: chrysotile detected in asbestos-cement • HP126 0.2m bgl: chrysotile in insulation board • HP127 0.1m bgl: chrysotile free fibres in asbestos-cement • HP128 0.05m bgl: amosite and chrysotile in insulation board However, in all above cases, the soil matrix surrounding the ACM did NOT contain asbestos fibres.	Inhalation of asbestos fibres	Medium	Unlikely	Low	The asbestos results identified isolated areas of the site contained ACM. However, only in one sample were fibres detected. These fibres were not identified within the soil matrix but contained within the material from which it was found. The lack of "free fibres" reduces the severity to medium. During the follow up investigation in February 2013 there were no "free fibres" or ACM within the Made Ground matrix – HP130-38. Therefore, the ACM is likely to be confined to the open space area adjacent to 30/32 Hunter Road. The likelihood has been reduced to low given the absence of fibres within the soil.

1 Taken from Table 6.3, CIRIA report 552 (Contaminated Land Risk Assessment – A Guide to Good Practice. Severity classified as minor, mild, medium or severe. Probability classified as unlikely, low, likely or high. Overall risk considers both the severity and probability of the linkage (very low, low, moderate, high or very high). See Appendix G for further details

7 SUMMARY AND CONCLUSION

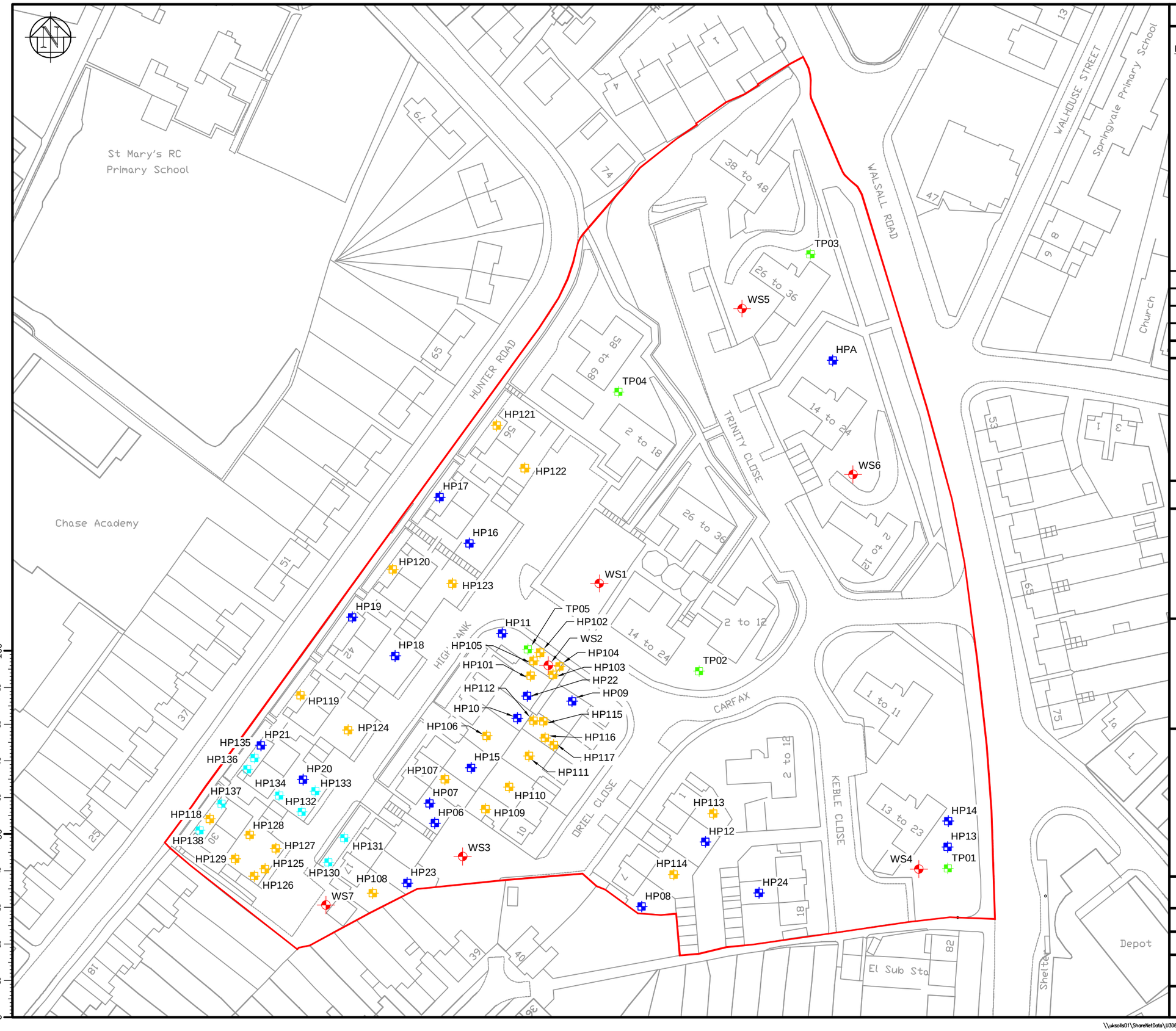
7.1 Summary

- A review of historical mapping and EA records provided to Cannock District Council, plus anecdotal evidence obtained during public consultation, identified that a parcel of land south-east of Hunter Road, Cannock was infilled with unknown material in the 1940s/1950s. The residual material potentially posed a risk to the health of residents now living at the site, and a risk to the quality of controlled waters.
- Exploratory investigations in December 2010, November 2011 and September 2012 identified ground conditions comprising a typical thickness of 1.3m of Made Ground (3.2m of made ground in one location), which included ash, clinker, brick, ceramics, slate, metal fragments and concrete. The underlying strata, interpreted to be Glacio-fluvial Deposits where generally sand and gravel were identified and Diamicton Till where clay was encountered in one location. This observation was consistent with geological mapping.
- Previous investigations (December 2010 and November 2011) determined that metals, TPH, VOC, SVOCs, BTEX and ground gas do not present an unacceptable risk to human health , controlled waters, buildings/services.
- PAHs and asbestos with regard to human health were the only significant pollutant linkages identified after the 2011 investigation which required further assessment.
- The September 2012 investigation obtained more soil samples for PAH analysis and asbestos detection. The results of the PAH analysis identified PAH concentrations greater than Tier 1 GACs but all samples were recorded at a concentration less than the greatest PAH concentration recorded in December 2010.
- Using IOM assessment criterion of 17mg/kg for benzo(a)pyrene and using benzo(a)pyrene as a marker compound for all other PAHs, as a value which if concentrations are less than would not pose an unacceptable risk to human health, the site is not deemed as constituting a significant possibility of significant harm with regard the PAHs recorded at the site.
- Asbestos containing material (ACM) was found in a further five samples during the 2012 investigation. Delineation of these areas as part of the 2012 investigation and additional February 2013 investigation indicated that the asbestos affected area is contained within landscaped area adjacent to 30/32 Hunter Road and that in this area, the asbestos was contained within the material in which it was found and that no free fibres were detected within the soil.

7.2 Conclusion

On the basis of the information obtained and the limitations listed in Appendix A, we conclude that it is unlikely that the site would meet the definition of contaminated land under Part 2A of the Environmental Protection Act 1990.

DRAWINGS



NOTES

KEY

- STUDY SITE BOUNDARY
- WS1 — WINDOW SAMPLER HOLES (6No.), (1+2 REAR WEST HP'S)
- TP1 — TRIAL PITS, DECEMBER 2010
- HP1 — HAND PITS, NOVEMBER 2011
- HP1 — HAND PITS, SEPTEMBER 2012
- HP1 — HAND PITS, FEBRUARY 2013

REV	AMENDMENTS	BY	CHKD	APR'D	DATE
D	DEC 2010 HP CHANGED TO TP	MIC	JS	GT	12.04.13
C	FEB 2013 INFO ADDED	MIC	JS	GT	01.03.13
B	SEPT 2012 INFO ADDED	PSN	RH	GT	11.10.12
A	FIRST ISSUE	SW	RH	GT	06.02.12

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CLIENT
Cannock Chase Council

PROJECT
HUNTER ROAD

TITLE
EXPLORATORY HOLE LOCATION PLAN

STATUS
FOR INFORMATION ONLY

DRAWN	CHECKED	APPROVED
S.WHELAN	R.HEARN	G.TAYLOR
DATE 06.02.12	DATE 06.02.12	DATE 06.02.12

SCALE 1:1000 @ A3
ORIGINAL DRAWING SIZE 297 x 420 - A3

DRAWING No 106270-600
REV. D

\\uksolls01\ShareNetData\U3064\proj\106270 Cannock 2a batch 2\011 Hunter Rd Sept 2012\Drawings & sketches\DWG\Hunter Road – 106270-600-C.dwg

APPENDIX A
LIMITIATIONS STATEMENT

Appendix A: Limitations Statement

1. This report has been prepared for the exclusive use of Cannock Chase District Council and copyright subsists with Grontmij Limited. Prior written permission must be obtained to reproduce all or part of the report.

2. This report and/or opinions have been prepared for the specific purpose stated in the document. The recommendations should not be used for other purposes or adjacent sites without further reference to Grontmij Limited.

3. Observations were made of the site and soil arisings as indicated within the report. Where access to portions of the site was unavailable or limited, Grontmij Limited renders no opinion as to the environmental status of such parts of the site.

4. Grontmij has relied upon the existing desktop study data provided by Cannock Chase District Council and other information supplied by third parties, such and laboratory test data, to be accurate, and has not taken steps to independently check the accuracy of the data provided. We cannot therefore accept any responsibility for the accuracy of the data used in this study, only that its interpretation has been carried out with due skill, care and diligence.

5. Similarly, our interpretation of any regulatory database information (including the MAGIC and British Geological Survey websites) within an earlier report, and relied upon in this report, assumes that the data provided is accurate. A disclaimer provided by database search companies is as follows: ' the data is derived from historical sources or information available in public records or from third parties and is supplied to us without warranty by data suppliers and we cannot warrant the accuracy or completeness of the data or the reports.' We cannot therefore accept any responsibility for the accuracy of the data used in this study, only that its interpretation has been carried out with due skill, care and diligence.

6. The conclusions and recommendations submitted in this report are based in part upon the data obtained from soil samples from exploratory holes. The nature and extent of variations between the exploratory holes is inferred in the report and could only be confirmed by further investigation. If variations or other latent conditions become evident, it will be necessary to re-evaluate the recommendations of this report.

7. The generalised soil profile described in the text is intended to convey trends in sub-surface conditions. The boundaries between strata are approximate and idealised and have been developed in interpretations of widely spaced explorations and samples; actual soil transitions may be more gradual. For specific information, refer to the exploration logs.

8. Water levels and/or gas readings have been taken in the borings and/or observation wells at times and under conditions stated on the exploration logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater or gas may occur due to variations in rainfall, atmospheric pressure and other factors different from those prevailing at the time the measurements were made.

9. The conclusions and recommendations of this report are based in part upon various types of chemical analysis of soil, water or gases, and are contingent upon their validity. These data have been reviewed and interpretations made in the report.

Variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time and other factors. Should additional analytical or monitoring data become available in the future, these data should be reviewed and conclusions and recommendations presented herein modified accordingly.

10. Chemical analyses have been performed for specific parameters during the course of this study, as detailed in the text. It must be noted that additional constituents not searched for during the current study may be present in soil, groundwater and soil voids at the site.

APPENDIX B

Grontmij March 2012 Investigation Report (incorporating 2010 Desk Study and 2010 investigation)

Cannock Chase District Council

Environmental Protection Act 1990, Part 2A: Exploratory Site Investigation

Land East of Hunter Road, Cannock

March 2012

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1 INTRODUCTION

1.1 Terms of Reference

In January 2010, Grontmij Limited (Grontmij) was appointed by Cannock Chase District Council (the Council) to assist in the implementation of the Council's Part 2A Contaminated Land inspection strategy. Part 2A of the Environmental Protection Act 1990 (Part 2A) requires each local authority to inspect areas of land which it believes may constitute Part 2A Contaminated Land.

Contaminated Land is defined in Section 78(2) of Part 2A of the Environmental Protection Act 1990 as:

"any land which appears to the local authority in whose area the land is situated to be in such a condition, by reason of substances in, on or under the land, that

- *significant harm is being caused or there is a significant possibility of such harm being caused; or*
- *pollution of controlled waters is being, or is likely to be, caused.*

Further information is provided in the above Act and associated statutory guidance[1] (DEFRA Circular 01/2006 – EPA 1990, Part 2A: Contaminated Land).

Grontmij assisted the Council to prioritise a list of sites which could constitute Part 2A contaminated land for inspection, on the basis of the Council's Part 2A Inspection Strategy. The site subject to this report, located at / east of Hunter Road, Cannock (hereafter referred to as 'the site') was identified as a priority for inspection. The site is considered to be sensitive as 35 residential properties with gardens and 12 blocks of two/three storey maisonettes with communal gardens overlie an area of infilled land, indicated on the Environment Agency website to be a 1940s/50s landfill site. The site is also underlain by two secondary aquifers, which leachate from the infill could be adversely affecting.

Following the completion of a desktop study (see Appendix A), Grontmij was subsequently appointed by the Council to implement a limited shallow initial exploratory site investigation, which was undertaken in December 2010 and reported in May 2011 (Appendix A). The initial investigation identified PAH concentrations which could potentially pose an unacceptable risk to sensitive receptors, meaning that further soil and leachate data was required and the installation of gas monitoring wells with gas monitoring was also recommended. Further exploratory work was therefore undertaken in November 2011. This report presents the findings of the November 2011 exploratory investigation and assesses the significance of the contaminant and gas concentrations detected.

This report is subject to the limitations presented in Appendix B.

[1] Note that revised draft statutory guidance has been laid in parliament on 7/2/12 and will come into force / be published on / shortly after 6/4/12 if neither house of parliament objects. The existing regulations currently remain in force. See http://www.defra.gov.uk/environment/quality/land/ for more details

2 BACKGROUND INFORMATION

2.1 Site Setting

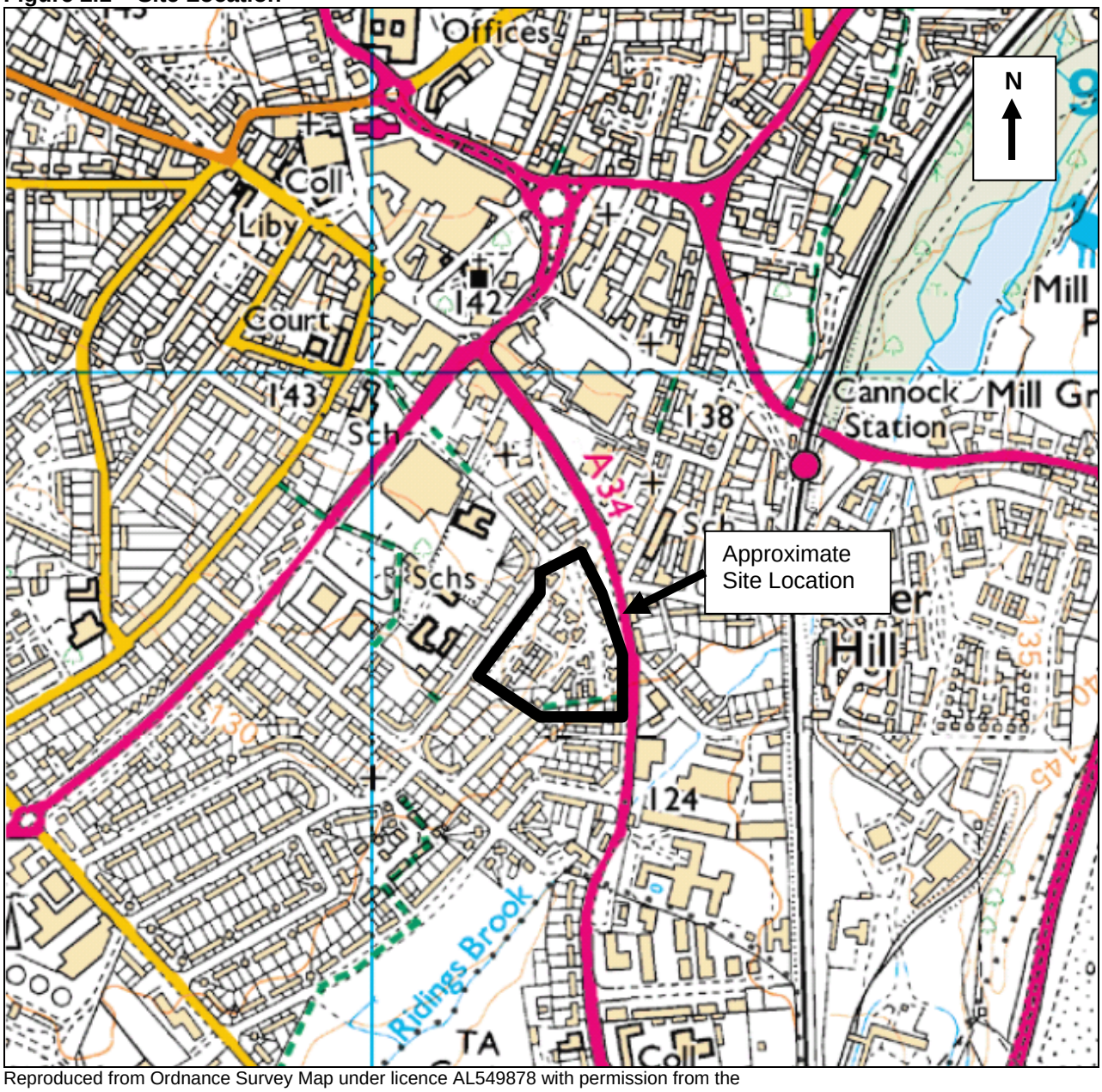
The site's setting and location are summarised in Table 2.1 and Figure 2.1.

Table 2.1 - Site Setting

Data	Information
Address	Hunter Road and Carfax (and roads branching off this road), north of Bridgtown, Cannock, Staffordshire. Nearest postcode: WS11 0YT
Current site use	Mix of two storey terraces with private gardens (predominantly southern end of site) and three-storey flats surrounded by communal landscaped areas. Architectural style of buildings indicates that the buildings date from the 1960s or 70s. Council records indicate approximately 50% are privately owned and 50% within housing association ownership
Grid Reference	Approximate centre of site is located at NGR 398250, 309650
Site Area	The site occupies approximately 3 ha
Topography	General topographic gradient within the area is moderate, downwards towards the south east. The site is on multiple levels as a result of cut and fill earthworks
Surrounding land use	The site is located within a wider residential area. The A34 is adjacent to the eastern boundary of the site. St Marys Primary School is located 50m to the north west of the site
Mapped Geology	British Geological Survey (BGS) mapping indicates that the north and west of the site (comprising approx 66% of the total site) is underlain by superficial glaciofluvial deposits (sand and gravel), while the east and south of the site (approx 33% of the total site) is underlain by Diamicton Till (clay, silt, sand and gravel). The superficial deposits are underlain by bedrock of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation
Hydrogeology	The Environment Agency website indicates both the bedrock and superficial deposits to be Secondary A aquifers. Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers
Groundwater Abstractions	Environment Agency website indicates that the closest public potable abstraction wells are located approximately 7km to the north and east
Source Protection Zones (SPZs)	The Environment Agency website indicates that the site does not lie within a SPZ
Surface Waters	Ridings Brook is located 200m south east (inferred downgradient) of the site
Historical Land Use	Environment Agency data provided to the council and the Environment Agency "What's In Your Back Yard" website indicate that the site comprises a former landfill site, operational between 1945 and 1955. The type of waste received by the site is unknown. The operational period pre-dates the Control of Pollution Act 1974 and thus is unlikely to have operated under a formal licence
Ecologically designated sites[2]	MAGIC search indicates none exist within 500m of site boundary
Scheduled Monuments	Pastscape website indicates no monuments on site or in close proximity

[2] Includes sites designated as Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Special Area of Conservation (SAC, including candidate sites), Special Protection Area (SPA including potential sites), listed Wetlands of International Importance (Ramsar site) and Local Nature Reserves (LNR).

Figure 2.1 – Site Location



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2.2 Previous Investigations and Reports

Grontmij has previously completed a desktop assessment of the site, as presented within Appendix A. The assessment included the review of on-line data resources, in-house mapping and records provided by the council, and a site walkover.

A limited, shallow preliminary site investigation, comprising five shallow hand-dug trial holes and chemical analysis of five soil samples, was undertaken in December 2010. The investigation report is included as Appendix A. The initial investigation identified PAH concentrations which could potentially pose an unacceptable risk to sensitive receptors. The conceptual site model of potential pollutant linkages, developed upon completion of the initial investigation in accordance

with the model procedures[3], and statutory guidance[4] and used to identify further investigation requirements, is reproduced as Table 2.2 overleaf:

.

[3] CLR11 Model Procedures for the Management of Land Contamination (EA & DEFRA September 2004)
[4] DEFRA Circular 02/2006, Environmental Protection Act 1990: Part IIA Contaminated Land:, September 2006.

Table 2.2 - Potential Pollutant Linkages

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Residents of properties above infilled ground (including children playing in gardens)	Elevated concentrations of benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenz(ah)anthracene and indeno(1,2,3,cd)pyrene in shallow soils (up to 0.3m bgl) – particularly in HP5	Dermal contact and direct ingestion, inhalation of dust/vapours, consumption of home-grown vegetables	Medium	Likely	Moderate	Insufficient data available to draw firm conclusion (only a basic suite of testing was undertaken, only five samples have been obtained, limited depth-specific analysis can be undertaken) – infill has been identified across the site and higher contaminant concentrations may be present. Further assessment is required in order to increase the sample population and determine the significance of the detected concentrations.
Residents of properties above infilled ground	Methane and carbon dioxide from decomposition of deleterious elements of landfill material	Movement into buildings, subsequent asphyxiation and explosion risk	Medium	Likely	Moderate	As monitoring of landfill gases were not undertaken during the limited investigation (as not considered appropriate within shallow hand pits which did not prove the base of the infill/waste) gas risk is unknown. Further assessment is therefore required, to include wells drilled to the base of the infill/waste material and measurement of ground gas concentrations & flow rates

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Subsurface services serving the buildings (principally water supply)	pH values in shallow soils exceed UKWIR and WRAS guideline screening criteria	Chemical attack and tainting of water supply could occur at high contaminant concentrations / severe pH levels	Mild	Likely	Low / Moderate	Limited investigation data is available (note no relevant parameters for UKWIR guidelines were analysed). Materials used for connection of each house to the South Staffordshire Water main are unknown, and assumed to be potentially susceptible to attack. Hence further assessment is required. Prior experience dictates that concentrations of contaminants in most Made Ground soils tend to exceed UKWIR guidelines, which are normally used to specify materials for new pipework and are deliberately conservative. Tap water testing is recommended to assess current risk to residents
Property (structures) – sub-surface concrete	Sulphate and pH	Contact between contaminants and concrete	Mild	Likely	Low / Moderate	Based on limited investigation data (sulphate analysis was not undertaken) further assessment is required
Property (structures) – residential buildings on site	Decomposable or compressible elements of infill	Differential settlement of infill, causing structural failure of buildings	Medium	Unlikely	Low	Although a detailed inspection of buildings has not been undertaken, no obvious evidence of structural failure was noted in the field and all properties at the site appear to be currently occupied. As buildings appear to be fit for occupancy, it is unlikely that significant harm to the building has been caused or is being caused (ref: DEFRA Circular 01/2006 p86 – this is statutory guidance accompanying the Environmental Protection Act 1990)

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Secondary A aquifer (superficial deposits; fluvioglacial sand and gravels) beneath site	Potential contaminants including (but not limited to) metals, hydrocarbons; including PAHs, VOCs and SVOCs within landfill material	Leaching of soil contaminants to aquifer (no aquiclude is indicated on BGS mapping)	Mild	Likely	Low / Moderate	Due to limited depth of initial investigation holes, which did not prove the base of the infill/waste material, and lack of soil leachate analysis, further assessment is required
Secondary A aquifer (solid geology; Pennine Middle Coal Measures) beneath site	Dissolved dense contaminants or DNAPL (e.g. solvents) which have leached to the overlying fluvioglacial sand and gravel aquifer (assuming both strata are in hydraulic connectivity)	Vertical migration of dense contaminants	Mild	Low	Low	Contaminant migrating vertically will first encounter the aquifer in the superficial deposits; most contaminants (except any DNAPL) are likely to mix and dissolve in the shallower unit. Coal measures normally contain significant mudstone bands, likely to behave as aquitards. No further assessment proposed
Ridings Brook 200m to south-east (inferred down-hydraulic gradient on basis of topography). Fish within the brook (assumed to be subject to fishing rights)	Contaminants including (but not limited to) metals, hydrocarbons; including PAHs, VOCs and SVOCs within landfill material	Migration of dissolved phase contaminants within fluvioglacial sand and gravel deposits (assuming hydraulic connectivity)	Medium	Low	Low / Moderate	Although distance of receptor from site mitigates risk to an extent (due to attenuation along the 200m “flowpath”) the lack of current information makes further assessment necessary to improve understanding of site CSM and provide clarity on potential risk

[1] Taken from Table 6.3, CIRIA report 552 (Contaminated Land Risk Assessment – A Guide to Good Practice. Severity classified as minor, mild, medium or severe. Probability classified as unlikely, low, likely or high. Overall risk considers both the severity and probability of the linkage (very low, low, moderate, high or very high). See extract in Appendix F

3 EXPLORATORY SITE INVESTIGATION

In order to further examine the potential pollutant linkages identified in Table 2.2, a further exploratory site investigation was undertaken on the 14th to 17th November 2011, with gas monitoring undertaken until March 2012. This section describes the site investigation undertaken and results obtained.

3.1 Scope, Methodology and Rationale

The intrusive site investigation undertaken in November 2011 – March 2012 included the following:

- A consultation exercise with residents living at the site, including a mailshot and a public open evening;
- Obtaining plans of underground services and CAT-scanning proposed drilling locations, using a Radiodetection CAT1 and signal generator;
- Drilling seven window sample holes (WS01 – WS07) to a maximum depth of 4.0m bgl, at the locations shown on Drawing 1. The window sample holes, which were drilled by Sherwood Drilling Services, were positioned in areas of public open space above the extent of infill, as indicated on historical mapping. Window sampler positions were selected on the basis of achieving representative coverage of the site, but including locations in proximity to HP5, where the highest PAH concentrations were detected in the initial investigation. The purpose of the window sample holes was to examine shallow and deeper soil conditions (including determination of presence / otherwise of clay or mudstone beneath the made ground, to restrict leaching), enable the retention of samples for laboratory testing, and facilitate the installation of 50mm diameter dedicated gas monitoring wells in each window sampler hole;
- Advancing twenty hand dug pits (HP06 to HP24, plus HP A) to a maximum depth of 0.9m, to examine shallow soil conditions and augment the coverage of the site provided by the above window sampler holes;
- Logging soil arisings in accordance with BS5930:1999, and additionally noting any visual or olfactory evidence of potential contamination;
- Retaining representative soil samples of the strata encountered, which were selected on the basis of field observations of potential contamination and the aim of achieving good spatial and depth coverage of the site;
- Submitting retained samples to Scientific Analytical Laboratory (SAL) of Manchester in cooled coolboxes and under full chain of custody documentation, and instructing the analysis of samples;
- Undertaking five ground gas monitoring rounds, using a Gas Data Ltd GFM435 gas analyser with internal flow pod, and
- Collection of tap water samples from five representative properties, for analysis at SAL and screening against UK drinking water standards, to examine the risk of contaminant permeation into the drinking water supply.

The results of the entire fieldwork programme outlined above are discussed in the following sections.

3.2 Results and Discussion

3.2.1 Ground Conditions

The ground conditions encountered at the site generally comprised Made Ground over gravelly sand (firm clay in one location), as detailed below:

Made Ground
The Made Ground was predominantly granular in nature, consisting of gravelly sand. The gravel content of the Made Ground was variable, including fine to coarse gravel of ash, clinker, brick, ceramics, slate, possible asbestos tile, metal fragments and concrete; cobbles of brick and concrete were also encountered. Ash and/or clinker was encountered in twelve exploratory holes, as detailed in Section 3.2.3. Made Ground was encountered to a maximum depth of 3.2m bgl, within WS07, although this exploratory hole was atypical, with made ground generally being encountered to a maximum of 1.3m bgl.

Superficial Deposits
Superficial deposits were encountered across the site. The superficial deposits generally comprised sand and gravel, consistent with the mapped geology of fluvio-glacial deposits. The superficial deposits were encountered from a minimum depth of 0.4m, within HP09 and were generally encountered to a maximum depth of 3m bgl (termination depth of WS01 and WS02), although sand and gravel was also encountered beneath the made ground in WS07 at 3.2m and was proven to 4.0m bgl.

Within WS06, drilled towards the eastern site boundary, firm to stiff gravelly clay was encountered from 1.4 to termination depth of 2.0m bgl. This material is consistent with the mapped superficial deposit of Diamicton Till indicated in the east part of the site.

Groundwater
Groundwater was not encountered during the advancement of the exploratory holes.

The above findings are discussed further in Section 4 (updated Conceptual Site Model). Exploratory hole logs, providing full details of the strata encountered, are included within Appendix C.

3.2.2 Adequacy of Investigation Depth and Spatial Extent

Superficial deposits were encountered across the site during this investigation, meaning that the full depth of the Made Ground beneath the site has been encountered and that the data collected is likely to be representative of the site as a whole. The exploratory hole coverage is considered to provide good coverage of the site, with a deliberate emphasis on properties which have private gardens and where exposure to subsurface contaminants is more likely than within communal grassed landscaped parts of the site.

3.2.3 Field Evidence of Contamination

The drilling arisings were inspected for visual and olfactory evidence of potential contamination. A summary of field observations recorded is presented in Table 3.1:

Table 3.1 - Field Evidence of Potential Contamination

Exploratory Hole	Depth from	Depth to	Visual and Olfactory Evidence of Contamination[1]
WS02	0	0.1	Clinker
WS04	0.6	1.25	Clinker
WS07	0.5	0.9	Clinker
WS07	1.5	3.2	Ash and clinker, green/blue discolouration
HP07	0	0.8	Clinker
HP08	0.4	0.55	Ash
HP10	0	0.6	Clinker
HP11	0	0.7	Clinker
HP18	0	0.5	Clinker
HP20	0	0.3	Clinker
HP22	0	0.5	Clinker
HP23	0.4	0.5	Clinker

[1] Visual and olfactory evidence noted within the soil matrix

3.2.4 Soil Analysis Results and Discussion

Thirty-three samples were submitted for laboratory analysis, under full chain of custody documentation and within chilled coolboxes, to Scientific Analysis Laboratories (SAL) Ltd of Manchester. SAL Ltd holds UKAS and/or MCERTS accreditation for most analyses performed. The samples were selected for analysis on the basis of the observations of potential contamination made in the field, and to achieve good spatial coverage of the site.

Tables 3.2 and 3.3 present a summary of the analysis results. The tables incorporate the results from the earlier preliminary investigation, undertaken in December 2010, and is therefore a summary of all chemical testing undertaken for the site. The results have been compared to screening values protective of human health, assuming the receptor is a residential property where plant uptake of contaminants occurs, and the plants are subsequently ingested by humans. The screening values used, in order of preference, comprise:

- 2009 Soil Guideline Values (SGVs) published by the Environment Agency / DEFRA, generated using the latest Contaminated Land Exposure Assessment (CLEA) model, version 1.06
- Generic Assessment Criteria (GAC) published by Land Quality Management Limited (LQM) or the Environmental Industries Commission (EIC), or calculated by Grontmij, all using CLEA
- SGVs published by the Environment Agency / DEFRA between 2002 and 2007, calculated using prior versions of the CLEA model (applies to lead only).

Full analytical testing results are included as Appendix D.

Table 3.2 - Soil Analysis Results Summary (Metals, TPH, BTEX and Asbestos)

Determinand	No. of Samples Tested	Minimum Value	Maximum Value	SGV / GAC[1]	Locations where SGV or GAC are exceeded
Boron (H20 Soluble)	33	<1.0	180	291	-
Arsenic	**33**	**5.0**	**140**	**32**	**WS07, 1.8m and 2.15m**
Cadmium	33	0.48	7.0	10	-
Chromium (trivalent)	33	7.0	38	627	-
Copper	**33**	**15**	**22000**	**2330**	**WS07 2.15**
Lead[2]	33	30	450	450	-
Mercury[3]	33	<0.14	<1.0	170	-
Nickel	**33**	**8.0**	**240**	**130**	**WS07 1.8m and 2.15m**
Selenium	33	<1.0	<3.0	350	-
Zinc	**33**	**61**	**7800**	**3750**	**WS07 2.15**
Chromium (hexavalent)	33	<0.6	<1.2	4.3	-
Vanadium	**33**	**11**	**110**	**75**	**WS07 1.8m and 2.15m**
Beryllium	33	0.9	25	51	
Barium	33	56	910	1300[4]	
Asbestos screen	10	**Asbestos-containing material detected in one sample**			**WS02 0.2m bgl, ACM found to contain amosite. No "free" fibres were detected within surrounding soil matrix**
Benzene	4	<0.01	<0.02	0.16	**-**
Toluene	4	<0.01	<0.02	270	**-**
Ethyl Benzene	4	<0.01	<0.02	150	**-**
Xylene	4	<0.01	<0.02	98[5]	**-**
TPH – CWG Hydrocarbons	7	None of the banded aliphatic/aromatic TPH-CWG screening criteria were exceeded. Full speciated results are presented in Appendix D			-

Values presented in mg/kg, correct to two significant figures (screening values presented without any rounding). **Bold values** indicate locations where observed concentrations exceed the screening value.

[1] Nineteen samples were tested for Soil Organic Matter (%SOM) content. A minimum value of 0.7% and a maximum of 23% were recorded, with a mean of 5.04% and a median of 3.9%. It is therefore justified, as a conservative measure, to use the SGVs and GAC generated using a 2.5% SOM value in CLEA in an initial screen, where the SGVs/GAC are SOM-dependant (mercury, phenol, PAHs, TPH-CWG and abovementioned VOCs and SVOCs). All other SGVs / GAC are not SOM-dependant

[2] SGV quoted was generated by DEFRA using earlier version of CLEA. An Environment Agency announcement on how lead will be addressed, including agreement of an acceptable "safe" level, and whether to consider an "uptake" model such as CLEA or alternative "intake" model, is awaited.

[3] Testing results presented represent total mercury. SGV presented is for inorganic mercury, whereas SGV presented is for inorganic mercury. Although the most stringent of the SGVs is for elemental mercury, the Environment Agency SGV for mercury in soil science report SC050021/Mercury SGV indicate that in cases where preliminary risk assessment has not identified a mercury issue at the site or conditions such as peaty or flooded soils then 'For general surface contamination and to simplify the assessment, the SGVs for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and methyl mercury compounds are likely to be very low'.

[4] EIC GAC for "residential without uptake of homegrown produce" used, as a GAC including produce consumption has not been calculated (calculation of plant uptake factors was excluded from the EIC project due to a lack of available volunteer time). The provided GAC is therefore not strictly comparable to the measured soil concentrations, but is presented to give an idea of the likely magnitude of a future GAC which accounts for plant uptake of contaminants and subsequent human consumption.

[5] SGV for para-xylene quoted (most stringent of the three isomers)

Table 3.3 - Soil Analysis Results Summary – PAHs, VOCs and SVOCs

Determinand	No. of Samples Tested	Minimum Value	Maximum Value	SGV / GAC[1]	Locations where SGV or GAC are exceeded
Polyaromatic Hydrocarbons (PAHs)	29	Some of the speciated PAH screening values were exceeded, see below. Full speciated results are presented in Appendix D			-
Benz(a)anthracene	29	<0.1	**21**	4.7	**WS02 0.2, HP08 0.5, HP07 0.7, HP20 0.4, TP1 0.1m, TP5 0.1m**
Benzo(a)pyrene	29	<0.1	**15**	0.94	**12 locations; concentrations >10mg/kg in HP07 0.7m, HP08 0.5m, TP5 0.1m**
Benzo(b)fluoranthene	29	<0.1	**18**	6.5	**WS02 0.2, HP08 0.5, HP07 0.7, HP20 0.4, TP5 0.1m**
Chrysene	29	<0.1	**16**	8	**WS02 0.2, HP08 0.5, HP07 0.7, TP5 0.1m**
Dibenz(ah)anthracene	29	<0.1	**3.4**	0.86	**WS02 0.2, HP08 0.5, HP07 0.7, HP20 0.4, TP5 0.1m**
Indeno(123-cd)pyrene	29	<0.1	**8.5**	3.9	**WS02 0.2, HP08 0.5, HP07 0.7, TP5 0.1m**
Volatile Organic Compounds and Semi-Volatile Organic Compounds (excl.above)	3	All laboratory results were below limit of detection with exception of below:			-
2,6-Dinitotoluene	9	<0.1	0.9	1.7	-
2-Methylnaphthalene	9	<0.1	0.2	No GAC[6]	-
Bis (2-ethylhexyl)phthalate	9	<0.1	0.4	610	-
Carbazole	9	<0.1	3.1	No GAC[6]	-
Di-n-butylphthalate	9	<0.1	0.2	31	-
Dibenzofuran	9	<0.1	1.5	No GAC[7]	-

[6] The EIC considered generating a GAC for this substance but there was insufficient data available for the volunteer group to agree upon a health criteria value (HGV) – thus precluding the generation of GAC
[7] A GAC or SGV has not yet been published for this compound

The concentrations of PAH compounds within six samples taken at <1m depth (12 samples in the case of benzo(a)pyrene) and the concentration of some metals with in WS07 1.8m and 2.15m exceeded the adopted Tier 1 screening values. The samples exceeding the metals screening criteria were taken at 1.8 to 2.15m bgl, at which dermal contact with soils and subsequent ingestion (directly or via contact with home-grown vegetables) is unlikely. As such the metal concentrations recorded in sample WS07 1.8m and 2.15m are not of concern in regard to human health.

3.2.5 Leachability Assessment

The strata underlying the made ground were identified to be predominantly granular, and are unlikely to prevent leaching. Moderate PAH concentrations and high heavy metal concentrations were recorded in the made ground. On this basis, soil samples were retained for leachability testing, in order to consider the potential risk to controlled waters at the site (secondary aquifer, and surface watercourse 200m from site).

Six soil samples were submitted for soil leachate analysis (BS12457 2:1 single stage test, which supersedes the older NRA leachate test) at SAL Ltd. The samples were selected for analysis on the basis of field observations of potential contamination, plus with the aim of achieving good site coverage. Samples analysed included WS07 at 1.8m, where blue/green discolouration was noted in the field.

Table 3.3 presents a summary of the leachate analysis results. Where threshold values have been published, the testing results have been compared to the following:

- For the secondary aquifer, groundwater threshold values protective of general groundwater quality (not in a drinking water protected area) and of groundwater migrating to a surface watercourse, as quoted in the River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions 2010 ("WFD Directions") and, where no WFD Directions standard exists, UK Drinking Water Standards listed in the Water Supply (Water Quality) Regulations 2000 (as amended). It is noted that such screening values are potentially very conservative, assuming there are no private water abstractions in proximity to the site (there are no public groundwater abstractions for potable use within a 1km radius)
- For the closest surface water feature, 200m downgradient, the most stringent of Environmental Quality Standards published in The Surface Waters (Dangerous Substances)(Classification) Regulations 1989 and amendments (from 1992, 1997 and 1998), and standards protective of inland freshwaters in the above WFD Directions.

Full analytical testing results are included in Appendix D.

Table 3.4 - Soil Leachate Analysis Results Summary

Contaminant	No of Samples Tested	Minimum Value	Maximum Value	Adopted Groundwater Screening Value	Adopted Surface Water Screening Value
Arsenic	6	2.2	7.2	7.5	50
Boron	6	0.01	0.33	750	2000
Cadmium	6	**0.09**	**0.25**	3.75	**0.08 to 0.25****
Chromium	6	<50	**<50**	50	**3.4 (VI) / 4.7 (III)**
Copper	6	**3.5**	**12**	1500	**1 to 28****
Lead	6	2	5.9	10	7.2
Nickel	6	2	11	15	20
Zinc	6	**4**	**130**	3750	**8 to 250****
Mercury	6	<0.05	<0.05	0.75	0.05
Vanadium	6	<2	11	n/s	20
Benzene	5	**<1**	**<1**	**0.75**	10
Toluene	5	<1	<1	51	50
Xylenes	5	<1	<1	30	30
Benzo(a)pyrene	5	**<0.02**	**2.8**	**0.01**	**0.05**
Naphthalene	5	<0.02	<0.05	2.4	2.4
Sum of Benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene*	5	<MDL	**8**	**0.10**	n/s
Sum Benzo(b)fluoranthene, benzo(k)fluoranthene	5	<MDL	**4.1**	n/s	**0.03**
Sum benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene*	5	<MDL	**3.9**	n/s	**0.002**

Values are presented as **ug/l** and are rounded as applicable to the screening values used. <MDL is less that the laboratory method detection limit for each compound summed.
Bold values indicate locations where observed concentrations exceed the quoted screening value.
*There are no screening values in the WSWQ Regulations 2000 (as amended) for the remaining commonly analysed 16 PAH compounds
**Dependant on hardness of receiving surface watercourse

Comments on Groundwater Screening: concentrations of benzene and PAHs in excess of the adopted groundwater Tier 1 screening values were recorded in the analysed leachate. In the case of benzene, the exceedance was only because the method detection limit exceeded the adopted Tier 1 value, and the recorded result of <1ug/l in all five samples tested is not indicative of gross pollution of an aquifer. Slightly elevated PAH concentrations were detected in leachate, but the recorded concentrations are considered to be acceptable, and not indicative of SPOSH, given the lower sensitivity of the site (subject to confirmation that there are no private water abstractions in proximity to the site).

Comments on Surface Water Screening: concentrations of heavy metals within the hardness-dependant acceptability Tier 1 range, or in excess of the Tier 1 value but only because the method detection limit exceeded the adopted value, have been recorded. On the basis of the 200m distance to the nearest downgradient surface water receptor, and the opportunity for dilution along this flow-path, the recorded metals concentrations are considered to be acceptable, and not indicative of SPOSH.

Moderate concentrations of PAHs have been recorded, in some cases many times greater than the very conservative Tier 1 screening values adopted. However, on the basis of the 200m distance to the nearest downgradient surface water receptor, and the opportunity for attenuation and dilution along this flow-path, the recorded PAH concentrations are considered to be acceptable, and not indicative of SPOSH.

A controlled waters risk assessment would allow the confidence in the above assessment to be increased. We consider that it is unlikely that such a risk assessment would conclude that a SPOSH was posed to controlled waters, and at worst, that the site would fall into the grey area between what is, and what is clearly not, Contaminated Land. In light of the new draft statutory guidance laid before parliament and soon to become law, we consider that it is appropriate to cease the consideration of controlled waters at this point, on the assumption that further enquires identify that there are no private water abstractions in proximity to the site.

3.2.6 Ground Gas Assessment

Four initial rounds of ground gas monitoring were undertaken, using a Gas Data Instrument GFM435 with internal flow pod; as a moderate CO2 concentration was recorded during the last scheduled round, a further fifth round was also undertaken to confirm that there was not a rising CO2 trend at the site. A summary of the maximum gas monitoring results recorded at each well is presented in Table 3.4, with full monitoring data in Appendix E

Table 3.5 - Summary of Gas Monitoring Data

Well	Maximum Values Recorded During Monitoring Events:					Gas Screening Value[1] (l/hr)	Situation "A" Characteristic Situation[1]
	Peak CH_4 (%)	*Steady CO_2 (%)*	*Steady CO (ppm)*	*Steady H_2S (ppm)*	*Flow (l/hr)*		
WS01	0.0	0.9	0	0	0.0	<0.01	1
WS02	0.0	0.8	0	0	0.0	<0.01	1
WS04	0.0	1.6	0	0	0.0	<0.01	1
WS05	0.0	1.6	0	0	0.0	<0.01	1
WS06	0.0	1.1	0	0	0.0	<0.01	1
WS07	0.0	4.2	0	0	0.0	<0.01	1

Atmospheric Pressure and trend during day of monitoring, and weather while on site:	07/12/2011	993mb, rising; sunny but cold
	09/01/2012	1017mb, rising; overcast and drizzle
	18/01/2012	1010mb, steady; overcast
	26/01/2012	991mb, gently rising; cloudy
	23/03/2012	1026mb, steady; sunny and unseasonably warm (15°C)

Readings obtained within a 3 minute measurement period, obtained with a GFM435 gas analyser.
CH_4 – methane; O_2 – oxygen; CO_2 carbon dioxide; CO – carbon monoxide;
H_2S – hydrogen sulphide; mbgl – metres below ground level mb – millibars l/hr – litres per hour.
[1]CIRIA Characteristic Situation based on methodology presented in CIRIA Report C665, Assessing Risks Posed by Hazardous Gases to Buildings. Where the flow rate recorded in the field is zero or negative, a flow of 0.01 l/hr is assumed

The summary data presented above indicates that, in regard to methane and carbon dioxide, CIRIA characteristic situation 1 should be applied to all of the wells. This is the lowest risk category (of six) presented in CIRIA report 665, and indicates that no special gas precautions would be required in the construction of new buildings. Additionally, zero hydrogen sulphide and carbon monoxide was recorded.

In view of the monitoring results highlighted above, ground gases are unlikely to pose a risk to the housing at the site given that natural strata was encountered in the advancement of all monitored

window sample locations, the total depth of the fill has been encountered as such the gas monitoring undertaken is likely to be representative of the whole body of fill.

3.2.7 Safety of Water Supply Pipes

As a preliminary assessment, soil quality data was screened against current stringent UKWIR parameters[5]. This preliminary assessment indicates that the concentrations of VOCs and BTEX in soil are too high for the use of PE pipe within the soils tested. A summary of the UKWIR screen is presented in Table 3.6:

Table 3.6 UKWIR Screen Summary

Sample Identity	HP06 0.1	HP08 0.5	HP20 0.4	WS4 0.65	WS7 2.15
Depth	0.1	0.5	0.4	0.65	2.15
1.VOC Suite	0.90	0.90	1.6	0.90	1.5
1a. BTEX and MTBE	10	0.01	10	10	20
2. SVOCs	1.1	0.00	0.10	0.00	0.00
2b. Nitrobenzene	0.05	0.05	0.05	0.05	0.05
2c. Ketones	0.05	0.05	0.05	0.05	0.05
2e. Phenols	0.00	0.00	0.00	0.00	0.00
4. Mineral Oil C11-C20	0.00	0.00	0.00	0.00	0.00
4. Mineral Oil C21-C40	0.00	0.00	0.00	0.00	0.00
6. Amines	0.00	0.00	0.00	0.00	0.00

Red cells indicate concentration in excess of UKWIR guidelines. Green = acceptable.

The UKWIR screening values, and methodology of assessment, is recognised within the industry as being flawed. As an alternative means of assessing whether human health may be adversely affected by drinking water from pipes in contact with soil containing contaminants, samples of drinking water were collected from taps at six properties on 9th March 2012. The samples were generally taken from properties where the highest concentrations of contaminants were encountered in soil, i.e. at locations where the greatest risk to drinking water quality may theoretically be posed.

At the instruction of Cannock Chase Council, samples were obtained after allowing the tap to run for one minute. The samples were submitted to Alcontrol Geochem of Hawarden for chemical analysis for metals, cyanide and PAHs, as commonly occurring contaminants and parameters for which drinking water standards can be applied. The results of the analyses are summarised in Table 3.7, along with a comparison to UK Drinking Water Standards (UKDWS) taken from the Water Supply (Water Quality) Regulations 2000 (as amended). Full testing results are included in Appendix D:

[5] 10/WM/03/21 Guidance for the Selection of Water Supply Pipes to be Use in Brownfield Sites. UK Water Industry Research, 2010 (as re-issued)

Table 3.7- Tap Water Analysis Results

Contaminant	No of Samples Tested	Minimum Value µg/l	Maximum Value µg/l	UKDWS µg/l
Arsenic	6	0.72	0.93	10
Boron	6	26	29	1000
Cadmium	6	<0.1	<0.1	5.0
Chromium	6	<0.22	<0.22	50
Copper	6	11	100	2000
Lead	6	0.09	0.13	10
Nickel	6	1.0	1.7	20
Zinc	6	6.4	14	5000
Mercury	6	<0.01	<0.01	1.0
Cyanide (total)	6	<5.0	<5.0	50
Sum of Benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene*	6	<0.04	<0.04	0.10
Benzo(a)pyrene*	6	<0.01	<0.01	0.01

*There are no screening values in the WSWQ Regulations 2010 for the remaining commonly analysed 16 PAH compounds
**Limit of detection of analytical method

The maximum recorded metal and PAH concentrations within tap water did not exceed the corresponding UK Drinking Water Standards.

4 UPDATED CONCEPTUAL SITE MODEL

The CSM presented in the earlier Grontmij desk study report (see Appendix A) has been updated, using the findings of the site investigation, as presented overleaf.

Table 4.1 - Pollutant Linkages, Post-Site Investigation

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Residents of properties above infilled ground (including children playing in gardens)	Elevated concentrations of six PAH compounds in shallow soils	Dermal contact and direct ingestion, inhalation of dust/vapours, consumption of home-grown vegetables	Medium	Likely	Moderate	Concentrations recorded could possibly be consistent with "normal" or "background" concentrations as discussed in draft statutory guidance and imminent BGS research paper. This should be reviewed prior to progressing to the proposed further assessment below. Concentrations to date are probably within the range where a Margin of Exposure (MoE) approach would demonstrate that the human health risk, whilst not negligible, is still acceptably low. This is based on a similar study undertaken by Institute of Occupational Medicine (IOM), now in public domain. Further sampling needed in garden areas, to arrive at density of at least one per garden, to increase confidence that the identified PAH concentrations are representative of site. Following this, a "lines of evidence" approach including MoE calculations is recommended. IOM or similar toxicological risk assessment specialists should be consulted as part of the process.

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Residents of the Carfax estate	Asbestos containing material (ACM) found in one sample taken at 0.2m bgl in an open space area, possibly used for play. Free fibres not present in soil	Inhalation of asbestos fibres	Medium (arguably severe)	Low	Low/moderate	Asbestos identified to date within the affected area (single trial hole) was found as "bound" ACM and not as "free" fibres, lowering perceived risk. However, further sampling in affected area recommended to increase confidence that worse conditions (i.e. "free" fibres) are not abundant.
Residents of properties above infilled ground	Methane, carbon dioxide, H2S and CO from decomposition of degradable elements of landfill material	Movement into buildings, subsequent asphyxiation and explosion risk	Medium	Unlikely	Low	Low gas concentrations and flow rates recorded. No further assessment proposed
Subsurface services serving the buildings (principally water supply)	UKWIR soil guidelines exceeded, but testing of drinking water quality identified metals, cyanide and PAH concentrations were below UK drinking water standards	Chemical attack of pipes and/or tainting / contamination of drinking water supply	Mild	Unlikely	Very low	Very low risk indicated by sampling undertaken. Situation could theoretically change over time, so the most risk-averse strategy would be to periodically monitor. However, considering the number of properties constructed over made ground within the council's jurisdiction, such a strategy is unrealistic.
Property (structures) – sub-surface concrete	Sulphate and pH	Contact between contaminants and concrete	Mild	Likely	Low / Moderate	Remains a theoretical risk but considered a low priority for further assessment at this stage.

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Property (structures) – residential buildings on site	Decomposable or compressible elements of infill	Differential settlement of infill, causing structural failure of buildings	Medium	Unlikely, as direct result of land contaminants (see comments)	Moderate	Although a detailed inspection of buildings has not been undertaken, a number of significant cracks (many infilled) were noted on properties, particularly those on the steepest sloping land. Majority of properties at the site appear to be currently occupied and are thus, arguably, fit for purpose. Given the very low gas monitoring results recorded, it does not appear that settlement is occurring as a result of decomposition of degradable fill material (and virtually no such material was noted in the field). As buildings appear to be fit for occupancy, and any settlement is more likely to be due to poor selection of / implementation of foundations, it is unlikely that significant harm to the building has been caused or is being caused ***as a result of contaminated land*** (ref: DEFRA Circular 01/2006 p86)
Secondary A aquifer (superficial sand and gravel) beneath site	Leachable benzene and PAHs > Tier 1 values	Leaching of soil contaminants to aquifer (no aquiclude is indicated on BGS mapping)	Mild	Likely	Low / Moderate	Concentrations considered to be tolerable, given lower sensitivity of aquifers (no public potable abstractions within 1km of site boundary). Need to confirm no private abstractions.

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Secondary A aquifer (solid geology; Pennine Middle Coal Measures) beneath site	Leachable benzene and PAHs > Tier 1 values	No obvious pathway, other than mixing in the aquifers, as these contaminants are LNAPLs and will not naturally "sink" to the base of the groundwater units	Mild	Low	Low	Any benzene and PAHs migrating vertically will first encounter the aquifer in the superficial deposits and are likely to mix and dissolve in the shallower unit. Coal measures normally contain significant mudstone bands, likely to behave as aquicludes. No further assessment proposed
Ridings Brook 200m to south-east (inferred down-hydraulic gradient on basis of topography). Fish within the brook (assumed to be subject to fishing rights)	Leachable metals (slightly) and PAHs (more significantly) in excess of Tier 1 values	Migration of dissolved phase contaminants within fluvioglacial sand and gravel deposits (assuming hydraulic connectivity)	Medium	Low	Low / Moderate	The 200m flowpath to the receptor allows significant opportunity for dilution and attenuation of contaminants, such that concentrations reaching brook are probably acceptable. Further DQRA would allow further confidence in this conclusion, but it is considered appropriate to cease the assessment at this point, particularly in light of the new draft statutory guidance

1 Taken from Table 6.3, CIRIA report 552 (Contaminated Land Risk Assessment – A Guide to Good Practice. Severity classified as minor, mild, medium or severe. Probability classified as unlikely, low, likely or high. Overall risk considers both the severity and probability of the linkage (very low, low, moderate, high or very high). See Appendix F for further details

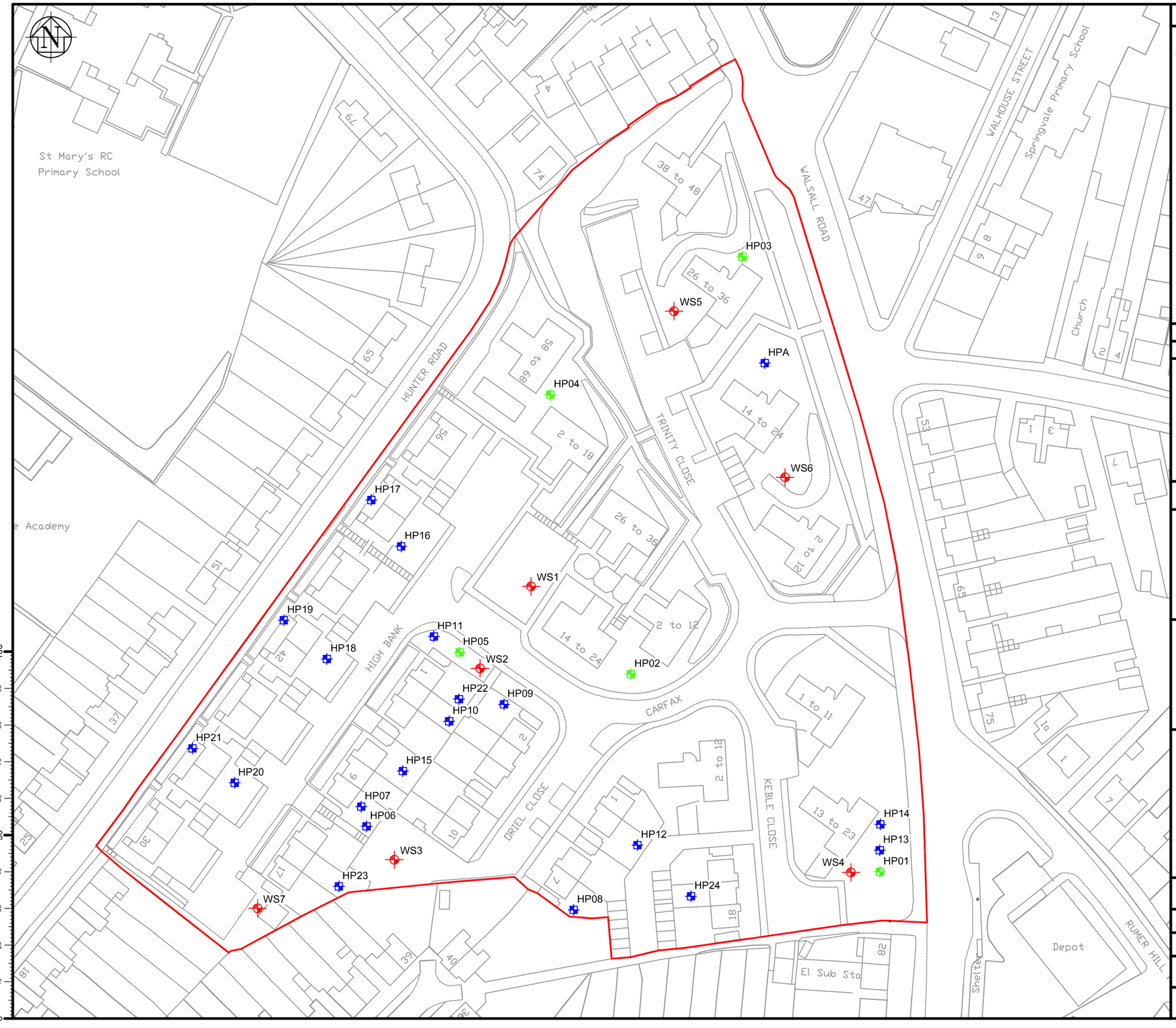
5 SUMMARY AND CONCLUSION

- Part 2A of the Environmental Protection Act 1990 requires local authorities to inspect land which, due to an industrial legacy, may meet the definition of Contaminated Land due to possible health risks or potential environmental pollution.
- A review of historical mapping and EA records provided to Cannock District Council, plus anecdotal evidence obtained during public consultation, identified that a parcel of land south-east of Hunter Road, Cannock was infilled with unknown waste material in the 1940s/1950s. The material potentially posed a risk to the health of residents now living at the site, and a risk to the quality of controlled waters.
- An exploratory investigation identified ground conditions comprising a typical thickness of 1.3m of Made Ground (3.2m of made ground in one location), which included ash, clinker, brick, ceramics, slate, metal fragments and concrete, plus possible asbestos tile in one location. The underlying strata generally comprised sand and gravel, although clay was encountered in one location. This observation was consistent with geological mapping.
- Moderately elevated polyaromatic hydrocarbon (PAH) concentrations were found in the Made Ground. The recorded concentrations could possibly be consistent with “normal” or “background” concentrations as discussed in draft statutory guidance and imminent BGS research paper. This should be reviewed prior to progressing to any further assessment. If the recorded concentrations are higher than what can be considered “normal” or “background”, further sampling in residential gardens is recommended to improve confidence that the results to date are representative of the made ground at the site. Assuming higher concentrations are not identified, it is likely that further qualitative risk assessment would allow the concentrations identified to date to be viewed as posing an acceptable level of risk to residents. This is not a zero risk level or a “as low as reasonably possible” concentration.
- Asbestos containing material (ACM) has been found in one sample, although “free” asbestos fibres were not found in the surrounding soil. Further sampling around this location is recommended to improve confidence that there is not a (relatively localised) asbestos-affected area at the site.
- Leaching tests identified moderate concentrations of leachable metals and hydrocarbons, but the lower sensitivity of the groundwater, from which there are no nearby potable abstractions, and the distance to the nearest surface watercourse, some 200m away, indicate that the leachable concentrations identified are tolerable. The Council should confirm that there are no private water abstractions on record in vicinity of the site.
- Gas monitoring within six wells has identified that the concentrations and flow rates of hazardous gases beneath the site are unlikely to pose a human health or explosion risk to the housing at the site.
- The concentrations of contaminants within drinking water in six samples tested are compliant with UK drinking water standards.

On the basis of the information obtained to date and the limitations listed in Appendix B, it is possible that the site could meet the definition of contaminated land under Part 2A of the Environmental Protection Act 1990. Further work is recommended in order to sufficiently improve confidence that the site is unlikely to meet the definition of contaminated land, as follows:

- Confirm that there are no nearby private abstractions for potable supply
- Examine the imminent BGS paper and draft statuatroy guidance, in regard to “normal” and “background” concentrations, and confirm concentrations recorded at the site are in excess of such concentrations.
- If the recorded concentrations at the site are in excess of what could be considered “normal” or “background”, obtain further shallow soil samples for PAH analysis. Assuming concentrations recorded are similar to those obtained to date, undertake further qualitative risk assessment to examine whether the risk posed to PAHs to human health can be considered as acceptable. Previous studies by the Institute of Occupational Medicine (IOM) suggest that the level of risk at the Hunter Road site is probably tolerable; IOM risk assessors should be consulted as part of the further qualitative risk assessment.
- Advance five further hand dug pits to a target of 0.7m bgl within the open space / possible play area where the sample containing ACM was identified. Submit samples for asbestos analysis, to confirm absence / low abundance of asbestos fibres within soil matrix. Re-examine likely risk to residents, including children at play, accordingly.

DRAWINGS



NOTES

KEY

- STUDY SITE BOUNDARY
- WS1 — WINDOW SAMPLER HOLES (6No.), (1+2 REAR WEST HP'S)
- HP1 — HAND PITS, DECEMBER 2010
- HP1 — HAND PITS, NOVEMBER 2011

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CLIENT

Cannock Chase Council

PROJECT

HUNTER ROAD

TITLE

EXPLORATORY HOLE LOCATION PLAN

STATUS: FOR INFORMATION ONLY

DRAWN	CHECKED	APPROVED
S.WHELAN	R.HEARN	G.TAYLOR
DATE 06.02.12	DATE 06.02.12	DATE 06.02.12

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DRAWING No: 106270-600

REV.: A

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APPENDIX A

Cannock Chase District Council

Environmental Protection Act 1990, Part 2A: Initial Exploratory Site Investigation

Landfill Site off Hunter Road, North of Bridgtown, Cannock, Staffordshire

May 2011

Prepared for:

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APPENDICES

1 INTRODUCTION

1.1 Terms of Reference

In January 2010, Grontmij Limited (Grontmij) was appointed by Cannock Chase District Council (the Council) to assist in the implementation of the Council's Part 2A Contaminated Land inspection strategy. Part 2A of the Environmental Protection Act 1990 (Part 2A) requires each local authority to inspect areas of land which it believes may constitute Part 2A Contaminated Land.

Contaminated Land is defined in Section 78(2) of Part 2A of the Environmental Protection Act 1990 as:

"any land which appears to the local authority in whose area the land is situated to be in such a condition, by reason of substances in, on or under the land, that

- *significant harm is being caused or there is a significant possibility of such harm being caused; or*
- *pollution of controlled waters is being, or is likely to be, caused.*

.

Further information is provided in the Act and associated statutory guidance (DEFRA Circular 01/2006 – EPA 1990, Part 2A: Contaminated Land).

Grontmij has assisted the Council to prioritise a list of sites which could constitute Part 2A contaminated land for inspection, on the basis of the Council's Part 2A Inspection Strategy. The site subject to this report, at Hunter Road, Cannock, is considered to be sensitive as 35 residential properties with gardens and 12 blocks of two/three storey maisonettes with communal gardens overlie a former landfill site. The site is also underlain by two secondary aquifers, which leachate from the infill could be adversely affecting.

The site occupies an area of approximately 3 ha.

Following the completion of a desktop study (see Appendix A), Grontmij subsequently implemented a limited initial exploratory site investigation, comprising five hand-dug pits and limited chemical testing, in December 2010. The purpose of the investigation was to examine shallow soil conditions and evaluate the requirement for a detailed assessment of the site.

This report presents the findings of the exploratory investigation, assesses the significance of the contaminant concentrations detected, and makes recommendations for further work.

This report is subject to the limitations presented in Appendix B.

2 BACKGROUND INFORMATION

2.1 Site Setting

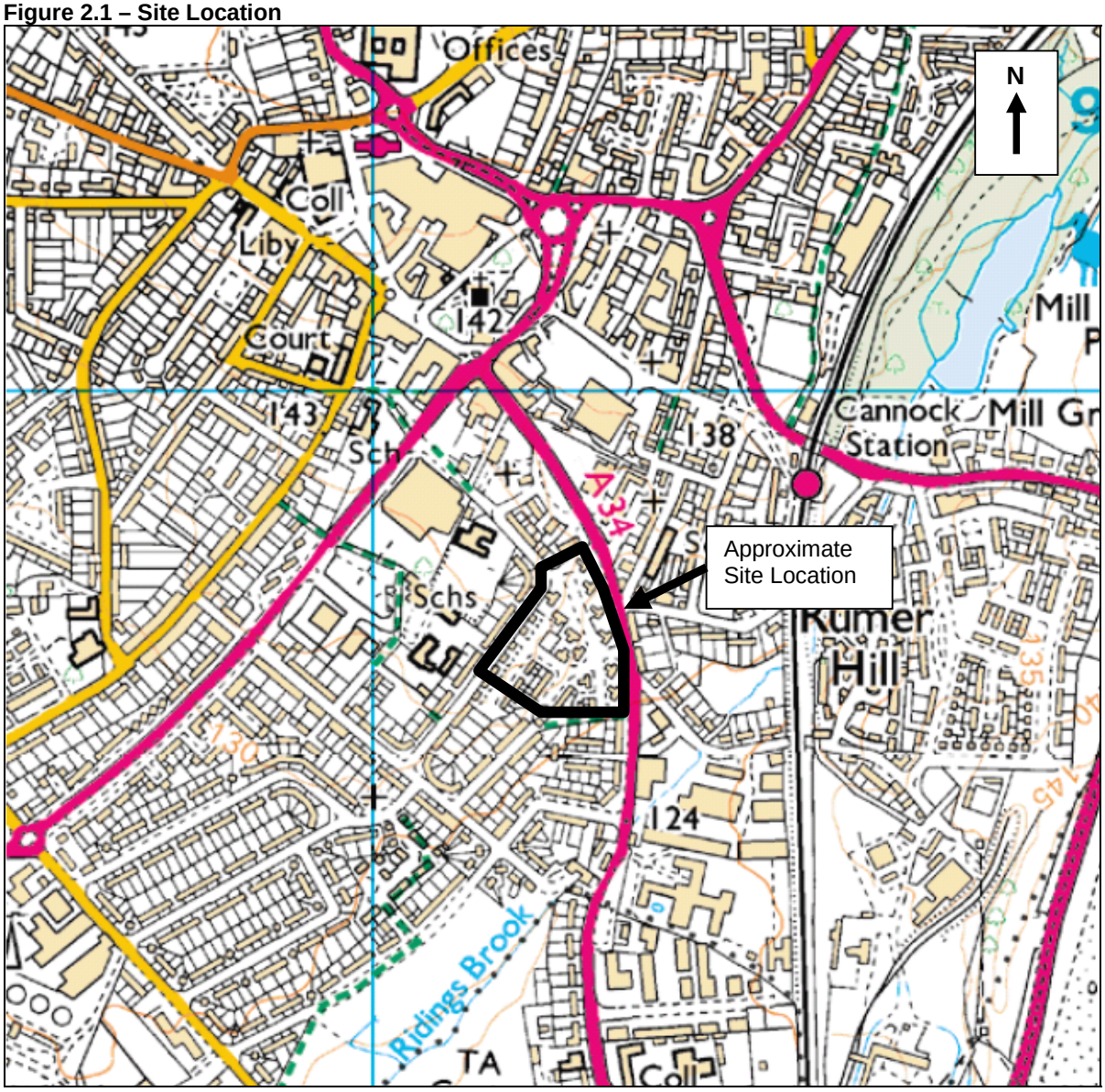
The site's setting and location are summarised in Table 2.1 and Figure 2.1. The site setting is also shown on Drawing 1.

Table 2.1 - Site Setting

Data	Information
Address	Hunter Road, North of Bridgtown, Cannock, Staffordshire Nearest postcode: WS11 0YT
Current site use	Residential houses and gardens; architectural style indicates that the buildings date from the 1960s or 70s
Grid Reference	Centre of site is located at approximately NGR 398250, 309650
Site Area	The site occupies approximately 3 ha
Topography	Moderate downwards gradient towards south east (residential area lies on multiple levels as a result of cut and fill earthworks)
Surrounding land use	The site is located within a wider residential area. The A34 lies adjacent to the eastern edge of the site. St Marys Primary School is located 50m to the north west of the site
Mapped Geology	British Geological Survey (BGS) mapping indicates the site is underlain by superficial glaciofluvial deposits (sand and gravel). The superficial deposits are underlain by bedrock of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation
Hydrogeology	The Environment Agency website indicates both the bedrock and superficial deposits to be Secondary A aquifers. Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers
Source Protection Zones (SPZs)	The Environment Agency website indicates that the site does not lie within a SPZ
Surface Waters	Ridings Brook is located 200m south east (inferred downgradient) of the site
Historical Land Use	Environment Agency data provided to the council and the Environment Agency "What's In Your Back Yard" website indicate that the site comprises a former landfill site, operational between 1945 and 1955. The type of waste received by the site is unknown. The operational period pre-dates the Control of Pollution Act 1974 and thus is unlikely to have operated under a formal licence
Ecologically designated sites[1]	MAGIC search indicates none exist within 500m of site boundary
Scheduled Monuments	Pastscape website indicates no monuments on site or in close proximity

[1] Includes sites designated as Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Special Area of Conservation (SAC, including candidate sites), Special Protection Area (SPA including potential sites), listed Wetlands of International Importance (Ramsar site) and Local Nature Reserves (LNR).

Figure 2.1 – Site Location



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2.2 Previous Reports

Grontmij has previously completed a desktop assessment of the site, as presented as Appendix A. The assessment included the review of on-line data resources, in-house mapping and records provided by the council, and a site walkover. The desk study report included an initial Conceptual Site Model (CSM) of potential pollutant linkages, developed in accordance with the model procedures[2] and statutory guidance[3]. The CSM is re-presented as Table 2.2 overleaf.

[2] CLR11 Model Procedures for the Management of Land Contamination (EA & DEFRA September 2004)
[3] DEFRA Circular 02/2006, Environmental Protection Act 1990: Part IIA Contaminated Land:, September 2006.

Table 2.2 - Potential Pollutant Linkages

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Residents of properties above infilled ground (including children playing in gardens)	Contaminants including (but not limited to) metals, hydrocarbons; including PAHs, VOCs, SVOCs and asbestos within landfill material	Dermal contact and direct ingestion, inhalation of dust/vapours, consumption of home-grown vegetables	Medium	Likely	Moderate	Risk is greatest where possibly impacted soils are exposed or could be encountered, for example, when digging a vegetable patch or when children play outdoors. Properties are constructed directly above a potentially significant contamination source. Sample collection and analysis required to refine conclusion on risk
Residents of properties above infilled ground	Methane and carbon dioxide from decomposition of deleterious elements of landfill material	Movement into buildings, subsequent asphyxiation and explosion risk	Medium	Likely	Moderate	Installation and monitoring of wells for gases and flow rates is required to refine conclusion on risk
Subsurface services serving the buildings (principally water supply)	Contaminants including (but not limited to) metals, hydrocarbons; including PAHs, VOCs and SVOCs within landfill material	Chemical attack and tainting of water supply could occur at high contaminant concentrations / severe pH levels	Mild	Likely	Low to moderate	Further investigation data needed to refine assessment/CSM
Property (structures) – sub-surface concrete	Sulphate and pH	Contact between contaminants and concrete	Mild	Likely	Low to moderate	Further investigation data needed to refine assessment/CSM

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Secondary A aquifer (superficial deposits; fluvioglacial sand and gravels) beneath site	Contaminants including (but not limited to) metals, hydrocarbons; including PAHs, VOCs and SVOCs within landfill material	Leaching of soil contaminants to aquifer (no aquiclude is indicated on BGS mapping)	Mild	Likely	Low / Moderate	Risk will depend upon depth and concentration of contaminants, and leaching potential of contaminants. Initial leachability testing (soils) and dissolved phase analysis (groundwater) required to improve understanding of site
Secondary A aquifer (solid geology; Pennine Middle Coal Measures) beneath site	Dissolved dense contaminants or DNAPL (e.g. solvents) which have leached to the overlying fluvioglacial sand and gravel aquifer (assuming both strata are in hydraulic connectivity)	Vertical migration of dense contaminants	Mild	Low to Likely	Low / Moderate	Risk will depend upon concentration/mobility of contaminants and presence/thickness and hydraulic connectivity of overlying fluvioglacial deposits. Initial leachability testing (soils) and dissolved phase analysis (groundwater in fluvioglacial sand and gravel) required to improve understanding of site

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Ridings Brook 200m to the south east (inferred down-hydraulic gradient on basis of topography). Fish within the brook (assumed to be subject to fishing rights)	Contaminants including (but not limited to) metals, hydrocarbons; including PAHs, VOCs and SVOCs within landfill material	Migration of dissolved phase contaminants within fluvioglacial sand and gravel deposits (assuming hydraulic connectivity)	Medium	Low	Low / Moderate	Risk will depend upon concentration and mobility of contaminants. Although the brook is inferred to be hydraulically downgradient of the site, there is significant opportunity for dilution and attenuation of contaminants along the 200m flowpath to the Brook. Initial dissolved phase analysis (groundwater within fluvioglacial deposit) required to improve understanding of site

[1] Taken from Table 6.3, CIRIA report 552 (Contaminated Land Risk Assessment – A Guide to Good Practice. Severity classified as minor, mild, medium or severe. Probability classified as unlikely, low, likely or high. Overall risk considers both the severity and probability of the linkage (very low, low, moderate, high or very high). See extract in Appendix B.

3 INITIAL EXPLORATORY SITE INVESTIGATION

In order to further examine the potential pollutant linkages identified in Table 2.2, an initial exploratory site investigation was designed with refence to BS10175:2001 and undertaken on the 10th December 2010. This section describes the site investigation undertaken and results obtained.

3.1 Scope and Methodology

The intrusive site investigation included the following:

- A consultation exercise with residents living at the site, including a mailshot and a public open evening;
- Obtaining plans of underground services and CAT-scanning proposed drilling locations, using a Radiodetection CAT1 and signal generator;
- Advancing five hand dug pits (TP1-TP5) to a maximum depth of 1m, to examine shallow soil conditions;
- Logging soil arisings in accordance with (BS5930:1999), and additionally noting any visual or olfactory evidence of potential contamination;
- Retaining representative soil samples of the strata encountered, which were selected on the basis of field observations of potential contamination and achieving good spatial and depth coverage of the site;
- Submitting retained samples to Alcontrol Geochem in cooled coolboxes and under full chain of custody documentation, and instructing the analysis of samples.

3.2 Results

3.2.1 Ground Conditions

Made ground
Made ground was encountered from ground level / below a turf surface cover to the base of all hand pits, which were excavated to a maximum depth of 1m below ground level (bgl). The Made Ground was predominantly granular in nature, comprising brown clayey sand and gravels (gravels comprising fine to coarse quartz, with some ash, metal, slag, clinker, brick, concrete and coal fragments).

Superficial soils were not encountered.

Groundwater
Groundwater was not encountered during the investigation.

The above findings are discussed further in Section 4 (updated CSM). Hand pit logs are included within Appendix C.

3.2.2 Adequacy of Investigation Depth and Extent

The advanced hand dug pits provided adequate spatial coverage of the site for an initial exploratory site investigation, but further spatial coverage is required to improve the understanding of the site (see Sections 4 to 6). The base of the Made Ground was not proven during the investigation, meaning that the full profile of infill/waste and associated contaminants

and gas generating potential remains unknown (and requiring of further investigation). Additionally, the hand pits were advanced in lower-risk areas of the site (i.e. open space), so it is desirable to obtain analyses from higher-risk areas (i.e. residential gardens) where such areas exist.

3.2.3 Field Evidence of Potential Contamination

The hand pit arisings were inspected for visual and olfactory evidence of potential contamination. A summary of field observations recorded is presented in Table 3.1 below:

Table 3.1 - Field Evidence of Potential Contamination

Exploratory Hole	Visual and Olfactory Evidence of Contamination
TP1	0 – 0.8m bgl: made ground contains brick, ash, burnt shale, clinker, metal and slag fragments
TP2	0 – 0.8m bgl: made ground contains brick, ash, clinker and coal fragments
TP3	0 – 1m bgl: made ground contains brick, ash and plastic fragments
TP4	0 – 0.7m bgl: made ground contains brick and ash fragments
TP5	0 – 0.7m bgl: made ground contains brick and ash fragments

3.2.4 Soil Analysis Results

Five samples were submitted for laboratory analysis, under full chain of custody documentation and within chilled coolboxes, to ALcontrol Geochem of Deeside. ALcontrol is UKAS accredited and holds MCERTS accreditation for most analyses performed. The samples were selected for analysis on the basis of the observations of potential contamination made in the field, and to achieve adequate spatial coverage of the site.

Table 3.2 presents a summary of the analysis results. The results have been compared to screening values protective of human health, assuming the receptor is a residential property where plant uptake of contaminants occurs, and the plants are subsequently ingested by humans. The screening values used, in order of preference, comprise:

- 2009 Soil Guideline Values (SGVs) published by the Environment Agency / DEFRA, generated using the latest Contaminated Land Exposure Assessment (CLEA) model, version 1.06;
- Generic Assessment Criteria (GAC) published by Land Quality Management Limited (LQM) or the Environmental Industries Commission (EIC), or calculated by Grontmij, all using CLEA 1.06;
- SGVs published by the Environment Agency / DEFRA between 2002 and 2007, calculated using prior versions of the CLEA model;

Full analytical testing results are included as Appendix D.

Table 3.2 – Soil Analysis Results Summary

Determinand	No. of Samples Tested	Minimum Value	Maximum Value	SGV / GAC[1]	Locations where SGV or GAC are exceeded
Arsenic	5	6.4	11	32	-
Barium	5	130	150	1,300	-
Beryllium	5	0.90	1.1	51	-
Boron (water-soluble)	5	<1	180	291	-
Cadmium	5	0.48	1.2	10	-
Chromium, hexavalent	5	<0.60	<1.2	4.3	-
Chromium, total	5	9.9	37	3,000	-
Copper	5	27	40	2,330	-
Lead[2]	5	56	120	450	-
Mercury[3]	5	<0.14	<0.14	170	-
Nickel	5	14	25	130	-
Selenium	5	<1.0	<1.0	350	-
Vanadium	5	16	46	75	-
Zinc	5	100	230	3,750	-
Asbestos screen	3	No asbestos containing materials (including fibres) detected			-
Polycyclic Aromatic Hydrocarbons (PAHs)	5	All concentrations below GAC for individual compounds, with exception of results below:			-
Benzo(a)pyrene	5	0.73	**15**	**0.94**	**TP1 at 0.1m bgl, TP2 at 0.3m bgl, TP4 at 0.3m bgl and TP5 at 0.1m bgl**
Benzo(b)fluoranthene	5	0.75	**18**	**6.5**	**TP5 at 0.1m bgl**
Chrysene	5	0.54	**16**	**8**	
Dibenz(ah)anthracene	5	0.12	**2.0**	**0.86**	
Indeno(1,2,3,cd)pyrene	5	0.47	**6.8**	**3.9**	

Values presented in mg/kg, correct to two significant figures (screening values presented without any rounding). **Bold values** indicate locations where observed concentrations exceed the screening value.

[1] Eleven samples were tested for Soil Organic Matter (%SOM) content. A minimum value of 0.9% and a maximum of 3.4% were recorded, with a mean of 2.3% and median of 2.4%. It is therefore justified, where SGVs or GAC are influenced by SOM, to use the SGVs and GAC generated using a 2.5% SOM value in CLEA in an initial screen. *Italics values* indicate where no 2.5% value available for metals 6.0% SOM Values were used as an initial screen.

[2] SGV quoted was generated by DEFRA using earlier version of CLEA. A value using the latest version of CLEA is awaited.

[3] Testing results presented represent total mercury, whereas SGV presented is for inorganic mercury. Although the most stringent of the SGVs is for elemental mercury, the Environment Agency SGV for mercury in soil science report SC050021/Mercury SGV indicate that in cases where preliminary risk assessment has not identified a mercury issue at the site or conditions such as peaty or flooded soils then '*For general surface contamination and to simplify the assessment, the SGVs for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and methyl mercury compounds are likely to be very low'.*

3.2.5 Safety of Water Supply Pipes

Two publications have been reviewed in regard to potential risks to water supply pipes posed by contaminants in the ground:

- "Guidance for the Protection of Water Supply Pipes to be Used in Brownfield Sites" (UK Water Industry Research {UKWIR}, ref 10/WM/03/21, 2010 (re-issued version));
- The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land (Water Regulations Advisory Scheme {WRAS}, ref 9-04-03, October 2002).

Both reports present methodologies for the assessment of soil conditions and the specification of appropriate pipework materials for new pipes to mitigate the presence of contaminants. *As such, the screening values presented in such reports are particularly conservative.*

WRAS Screen

A comparison between the chemical analysis results obtained from samples taken at 0.3 - 0.6m bgl and the older WRAS screening values is presented in Table 3.4. The deepest three soil samples were selected for comparison as 1.2m is the typical maximum depth at which water pipes are laid within the highway, with local service connections to properties typically much shallower (note, the table below does not constitute a full screen against all WRAS parameters; e.g. sulphate, cyanide and coal tar have not been tested for).

Table 3.3 - WRAS Threshold Screen

Analyte	Maximum Analysis Result (mg/kg)	WRAS Threshold Value (mg/kg)
pH	7.84 – **8.41**	<5 or **>8**
Arsenic	9.3	10
Cadmium	1.2	3
Chromium (hexavalent)	<1.2	25
Chromium (total)	33	600
Lead	120	500
Mercury	<0.14	1
Selenium	<1.0	3
Polyaromatic Hydrocarbons	12	50

Bold values indicate exceedance of WRAS threshold value

The maximum pH value recorded exceeds the WRAS threshold value.

UKWIR Screen

The UKWIR approach is the most recent and reflects further studies undertaken since the WRAS document was published in 2002. Key features of the UKWIR report include:

- A pipework material-specific assessment procedure (Table 3.1 of the report). This allows chemical analysis results to be compared to various threshold criteria associated with six possible pipework material types;
- The discounting of metallic pipework (other than copper or steel/ductile iron with protective wrapping) as a modern pipework material;
- The specification of a different chemical testing suite to that recommended in the earlier WRAS document, including the use of physio-chemical parameters and exclusion of analysis for metals (given the above discounting of metallic pipework).

However as the chemical analysis for the site was scheduled prior to the publication of the re-issued UKWIR report (despite a re-issue data of 2010, the report was not available until January 2011), no relevant parameters (apart from pH) required for a UKWIR screen (as summarised in Appendix G) have not been analysed for and hence further assessment is not possible.

Screening Summary

Based on the existing investigation data it is possible that the concentrations of contaminants at the site could adversely effect drinking water quality, depending on the materials used for water distribution (South Staffordshire Water pipes) and local connections to the South Staffordshire network (probably installed by the house builder).

The results of the intrusive investigation are discussed in more detail within the following section.

4 UPDATED CONCEPTUAL SITE MODEL

4.1 Introduction

The CSM presented in the earlier Grontmij desk study report (Appendix A) was updated, using the findings of the site investigation, as presented in the following sections.

4.2 Contaminants

The “contaminants” term in the conceptual model has been evaluated by comparing the chemical analysis results obtained during the site investigation with published generic screening values (Tables 3.1, 3.2 and 3.4).

- Concentrations of benzo(a)pyrene in four soil samples and benzo(b)fluoranthene, chrysene, dibenz(ah)anthracene and indeno(1,2,3,cd)pyrene in one soil sample were detected at concentrations in excess of the screening values relevant for a residential site with plant uptake.

Soil pH was detected in soil at values which exceed UKWIR and WRAS guidelines, protective of water distribution pipework.

Gas concentrations within the infill/waste material beneath the site, and leachable contaminant concentrations within the infill/waste, have not been determined to date.

4.3 Receptors

Table 4.1 indicates the receptors considered to be present at the site. The critical human receptor is the on-site resident; while off-site residents and commercial workers are also present, the concentrations of contaminants and, in the case of commercial workers, their exposure frequency and duration, is likely to be less than on-site residents, and are not considered further.

See Appendix A (desk study report) for a detailed discussion of the receptors included in the conceptual model.

4.4 Pathways

Pathways (pollutant linkages) are also examined as part of Table 4.1, overleaf.

Table 4.1 – Pollutant Linkages, Post-Site Investigation

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Residents of properties above infilled ground (including children playing in gardens)	Elevated concentrations of benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenz(ah)anthracene and indeno(1,2,3,cd)pyrene in shallow soils (up to 0.3m bgl)	Dermal contact and direct ingestion, inhalation of dust/vapours, consumption of home-grown vegetables	Medium	Likely	Moderate	Insufficient data available to draw firm conclusion (only a basic suite of testing was undertaken, only five samples have been obtained, limited depth-specific analysis can be undertaken) – infill has been identified across the site and higher contaminant concentrations may be present. Further assessment is required in order to increase the sample population and determine the significance of the detected concentrations (see section 6). This should include further analysis of shallow (c. 0.1m) samples where exposure is potentially greatest.
Residents of properties above infilled ground	Methane and carbon dioxide from decomposition of deleterious elements of landfill material	Movement into buildings, subsequent asphyxiation and explosion risk	Medium	Likely	Moderate	As monitoring of landfill gases were not undertaken during the limited investigation (as not considered appropriate within shallow hand pits which did not prove the base of the infill/waste) gas risk is unknown. Further assessment is therefore required (see section 6) to include wells drilled to the base of the infill/waste material and measurement of ground gas concentrations & flow rates

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Subsurface services serving the buildings (principally water supply)	pH values in shallow soils exceed UKWIR and WRAS guideline screening criteria	Chemical attack and tainting of water supply could occur at high contaminant concentrations / severe pH levels	Mild	Likely	Low / Moderate	Limited investigation data is available (note no relevant parameters for UKWIR guidelines were analysed). Materials used for connection of each house to the South Staffordshire Water main are unknown, and assumed to be potentially susceptible to attack. Hence further assessment is required. Prior experience dictates that concentrations of contaminants in most Made Ground soils tend to exceed UKWIR guidelines, which are normally used to specify materials for new pipework and are deliberately conservative. Tap water testing is recommended to assess current risk to residents (see section 6)
Property (structures) – sub-surface concrete	Sulphate and pH	Contact between contaminants and concrete	Mild	Likely	Low / Moderate	Based on limited investigation data (sulphate analysis was not undertaken) further assessment is required (see section 6)

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Property (structures) – residential buildings on site	Decomposable or compressible elements of infill	Differential settlement of infill, causing structural failure of buildings	Medium	Unlikely	Low	Although a detailed inspection of buildings has not been undertaken, no obvious evidence of structural failure was noted in the field and all properties at the site appear to be currently occupied. As buildings appear to be fit for occupancy, it is unlikely that significant harm to the building has been caused or is being caused (ref: DEFRA Circular 01/2006 p86 – this is statutory guidance accompanying the Environmental Protection Act 1990)
Secondary A aquifer (superficial deposits; fluvioglacial sand and gravels) beneath site	Potential contaminants including (but not limited to) metals, hydrocarbons; including PAHs, VOCs and SVOCs within landfill material	Leaching of soil contaminants to aquifer (no aquiclude is indicated on BGS mapping)	Mild	Likely	Low / Moderate	Due to limited depth of initial investigation holes, which did not prove the base of the infill/waste material, and lack of soil leachate analysis, limited further assessment is required (see section 6)
Secondary A aquifer (solid geology; Pennine Middle Coal Measures) beneath site	Dissolved dense contaminants or DNAPL (e.g. solvents) which have leached to the overlying fluvioglacial sand and gravel aquifer (assuming both strata are in hydraulic connectivity)	Vertical migration of dense contaminants	Mild	Low	Low	Contaminant migrating vertically will first encounter the aquifer in the superficial deposits; most contaminants (except any DNAPL) are likely to mix and dissolve in the shallower unit. Coal measures normally contain significant mudstone bands, likely to behave as aquicludes. No further assessment proposed

Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
Ridings Brook 200m to south-east (inferred down-hydraulic gradient on basis of topography). Fish within the brook (assumed to be subject to fishing rights)	Contaminants including (but not limited to) metals, hydrocarbons; including PAHs, VOCs and SVOCs within landfill material	Migration of dissolved phase contaminants within fluvioglacial sand and gravel deposits (assuming hydraulic connectivity)	Medium	Low	Low / Moderate	Although distance of receptor from site mitigates risk to an extent (due to attenuation along the 200m "flowpath") the lack of current information makes further assessment necessary to improve understanding of site CSM and provide clarity on potential risk (see section 6)

1 Taken from Table 6.3, CIRIA report 552 (Contaminated Land Risk Assessment – A Guide to Good Practice. Severity classified as minor, mild, medium or severe. Probability classified as unlikely, low, likely or high. Overall risk considers both the severity and probability of the linkage (very low, low, moderate, high or very high). See Appendix F for further details

5 SUMMARY AND CONCLUSION

- Environment Agency data provided to the council and the Environment Agency "What's In Your Back Yard" website indicates that the site comprises a former landfill site, operational between 1945 and 1955, although the type of waste received is unknown. The operational period pre-dates the Control of Pollution Act 1974 and thus is unlikely to have operated under a formal licence. The waste material potentially poses a risk to human health, water supply pipes and controlled waters;
- An initial exploratory site investigation encountered 1m of infill material, which was noted to contain ash and brick fragments within all hand pits, and clinker, metal, coal, slag and plastic fragments were also noted in some pits. The base of infill material was not proven;
- Chemical analysis identified that the concentration of benzo(a)pyrene in four soil samples and benzo(b)fluoranthene, chrysene, dibenz(ah)anthracene and indeno(1,2,3,cd)pyrene in one soil sample (of five analysed) exceeds the generic screening value applicable to the generic residential housing scenario, where plants are grown for human consumption. Given the clear presence of infill at the site, limited further shallow investigation is recommended to enhance the dataset and enable confidence in conclusions in regard to risk posed to human health;
- Gas monitoring has not been undertaken, hence the potential for infill material to generate significant quantities of ground gases cannot be currently assessed;
- The potential for contamination within the infill material to leach to controlled waters (i.e. groundwater within the fluvioglacial sand and gravel deposits) is not currently known.

On the basis of the preceding assessment, limitations listed in Appendix B, and initial soil sample analysis at the site we consider that the site has the potential to meet the definition of contaminated land under Part 2A of the Environmental Protection Act 1990. However as this assessment is based on limited information, further investigation is required as detailed within the following section.

6 RECOMMENDATIONS FOR FURTHER WORK

The initial exploratory site investigation has established that the concentration of PAHs in soil exceed the SGV/GAC applicable to the generic residential housing scenario. The base of the landfill has not been proven, and the potential of the site to generate ground gases or leachate is unknown. Shallow soil contamination may pose a risk to drinking water supply pipes.

Based on these risks, it is recommended that a second phase of intrusive investigation is undertaken at the site. This investigation will comprise fifteen hand dug trial pits to 1.0m bgl to provide greater spatial coverage (in particular within garden areas, not targeted during the initial exploratory site investigation) and six drilled boreholes to approximately 6m bgl to prove the base of / examination the composition of the entire depth of landfill, enable well installation for gas monitoring, and determine whether the landfill is a potential source of vertical contaminant leaching to groundwater beneath the site. The soil sampling will include collection and analysis of shallow (c. 0.1m) soil samples, where potential exposure to soils is greatest.

As there are a number of open space areas at the site which can be accessed by a smaller drilling rig, tracked window sampler holes are recommended for the borehole investigation.

Four initial rounds of gas monitoring are proposed, to be extended to six visits (in accordance with guidance in CIRIA report C665) if the initial monitoring dictates the need.

DRAWINGS
(of 2011 report)

62_LF_1
Hunter Road,
North Of Bridgtown,
Cannock

Drawing 1: Exploratory Hole Location Plan

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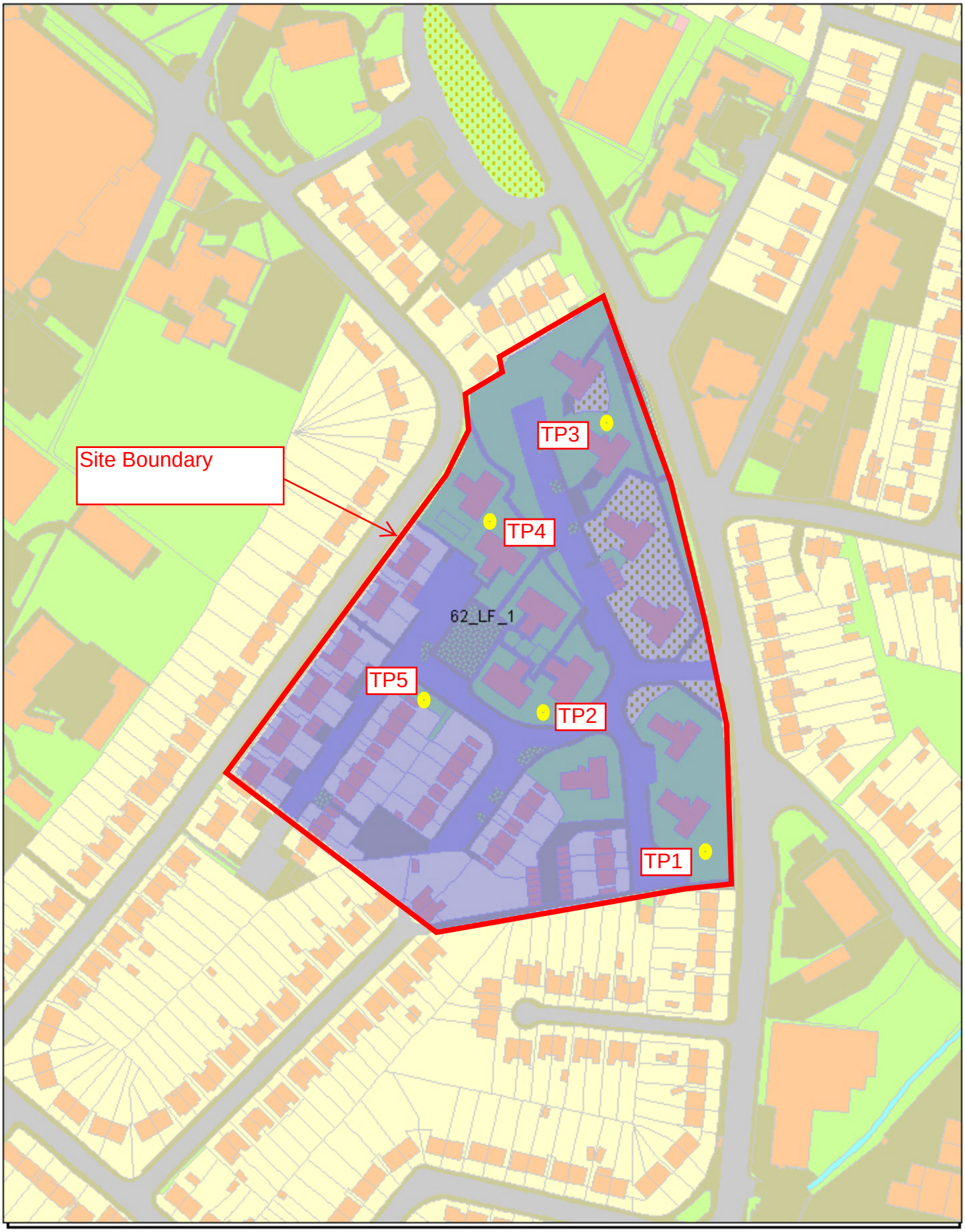

APPENDIX A
(of 2011 report)

Cannock Chase District Council

Environmental Protection Act 1990, Part IIa: Desktop Study and Walkover

Landfill Site off Hunter Road, North of Bridgtown, Cannock, Staffordshire

August 2010

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			Position	Senior Consultant	Principal Consultant	Principal Consultant

CONTENTS

1 INTRODUCTION

1.1 Terms of Reference

In January 2010, Grontmij Limited (Grontmij) was appointed by Cannock Chase District Council (the Council) to assist in the implementation of the Council's Contaminated Land Inspection Strategy. Part IIa of the Environmental Protection Act 1990 (Part IIa) requires each local authority to inspect areas of land which it believes may comprise Part IIa Contaminated Land.

The scope of work agreed between Grontmij and the Council included:

- Prioritisation of an initial list of potentially contaminated sites for intrusive investigation work, based upon the sensitivity of each site, using existing limited desktop study data provided by the Council; and,
- Undertaking desktop reviews and walkovers, culminating in the production of reports for each priority site to improve the understanding of the sites and inform the planning of intrusive site investigations.

The prioritisation exercise identified an initial 12 sites requiring detailed desktop study and walkovers, including the Landfill Site off Hunter Road, which is discussed within this report. The site consists of 35 residential properties with gardens and 12 blocks of two/three storey maisonettes with communal gardens, occupying an area of approximately 3 ha. The site is considered to be sensitive as the residential properties have been developed over a former landfill. The site is also underlain by a Secondary A and B aquifer.

This report is subject to the limitations presented in Appendix A.

1.2 Site Setting

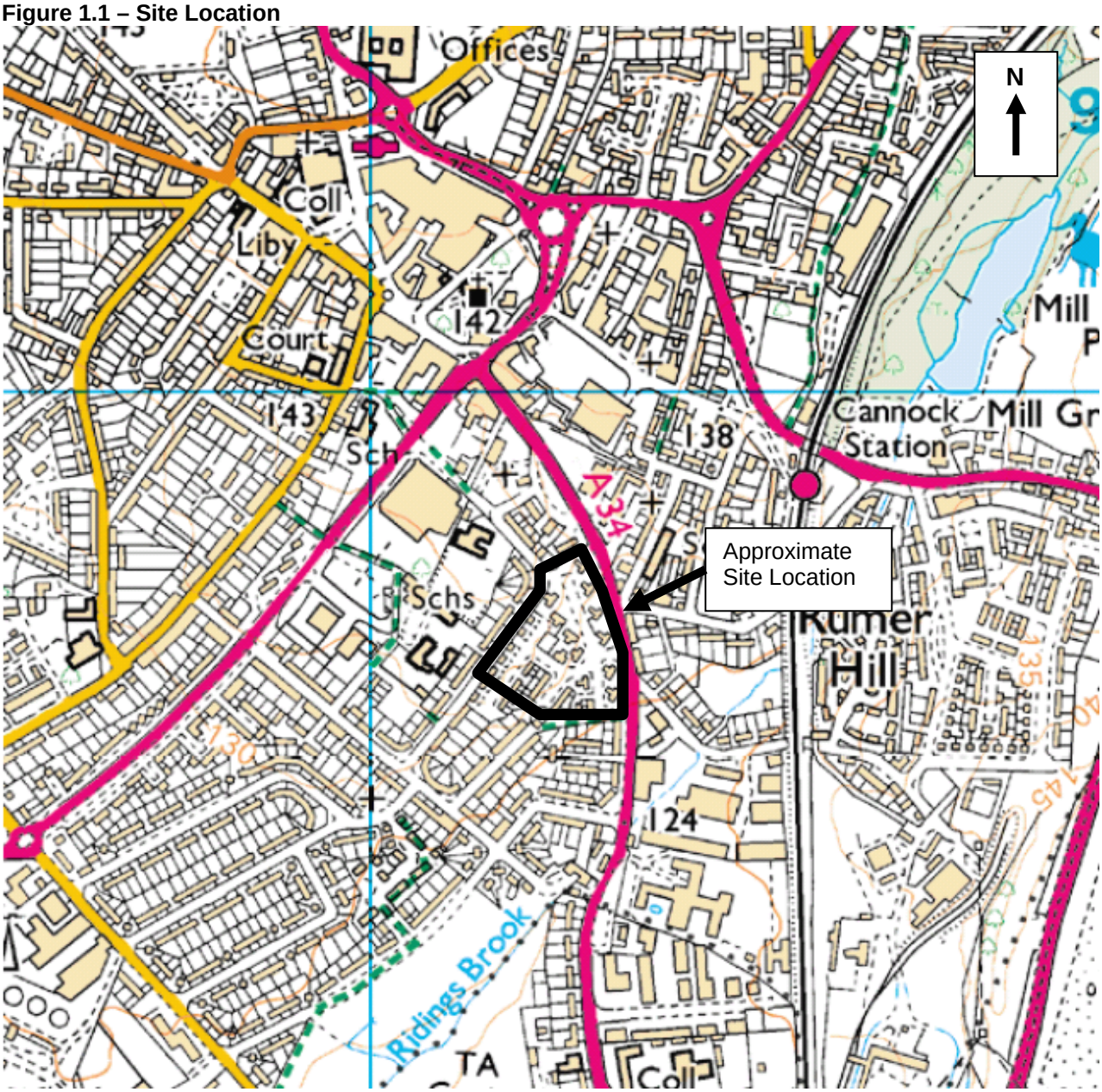
The setting of the site is summarised in Table 1.1. The location of the site is shown on Figure 1.1, and surrounding land-use on Drawing 1.

Table 1.1 – Site Setting

Data	Information
Address	Hunter Road, North of Bridgtown, Cannock, Staffordshire Nearest postcode: WS11 0YT
Current site use:	Residential houses and gardens; architectural style indicates that the buildings date form the 1960s or 70s
Grid Reference:	Centre of site is located at approximate NGR 398250,309650
Site Area:	The site occupies approximately 3 ha
Topography:	Moderate grade down towards south-east - the residential area is on multiple levels as a result of cut and fill earthworks
Surrounding land use	The site is located within a wider residential area. The A34 is adjacent to the eastern edge of the site. St Marys Primary School is located 50m to the north-west of the site.
Mapped Geology	British Geological Survey (BGS) mapping indicates the site is underlain by superficial glaciofluvial deposits (sand and gravel). The superficial deposits are underlain by bedrock of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation.
Hydrogeology	The Environment Agency website indicates both the bedrock and superficial deposits to be Secondary A aquifers. Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Source Protection Zones (SPZs)	The Environment Agency website indicates that the sites do not lie within a SPZ.
Surface Waters	Ridings Brook is located 200 m south east (inferred downgradient) of the site.
Historical Land Use	Environment Agency data provided to the council and the Environment Agency "What's In Your Back Yard" website indicate that the site comprises a former landfill site, operational between 1945 and 1955. The type of waste received by the site is unknown. The site pre-dates the Control of Pollution Act 1974 and thus is unlikely to have operated under a formal license.
Ecologically designated sites[1]	MAGIC search indicates none within 1km of site boundary

[1] Includes sites designated as Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Special Area of Conservation (SAC, including candidate sites), Special Protection Area (SPA including potential sites), listed Wetlands of International Importance (Ramsar site) and Local Nature Reserves (LNR).

Figure 1.1 – Site Location



Reproduced from Ordnance Survey Map under licence AL549878 with permission from the Controller of HMSO, © Crown Copyright
Plan is not to scale.

1.3 Summary of available site investigation information

The council is not aware of any previous investigation data.

1.4 Walkover

The site has been subject of a walkover, carried out from the public highway. . No obvious evidence of contamination was identified during the inspection, but such evidence is unlikely to be uncovered by a visual inspection of land occupied by residential properties.

2 PRELIMINARY CONCEPTUAL MODEL

2.1 Introduction

This section of the report presents a preliminary contaminated land assessment, on the basis of the available desktop data and information gathered during the walkover. The assessment presents an evaluation of the potential risks posed, should contaminants be present in the soil or groundwater beneath the site.

In the context of the Environmental Protection Act 1990 (EPA90), the Water Act 2003 and associated guidance[2,3], a preliminary (contaminated land) risk assessment should focus on whether the land at a subject site meets the statutory definition of Contaminated Land. Part IIA of the EPA90, as amended by the Water Act 2003, defines Contaminated Land as:

> *"any land which appears to the local authority in whose area it is situated to be in such condition by reason of substances in, on or under the land, that:*

- *significant harm is being caused or there is a significant possibility of significant harm being caused; or*
- *significant pollution of controlled waters is being caused or there is significant possibility of such pollution being caused".*

The procedure for assessing contaminated land involves the development of a Conceptual Site Model (CSM) comprising the assessment of potential contaminants, pathways and receptors.

2.1.1 Sources of Contaminants

The "contaminants" term in the conceptual model has been evaluated by inspection of existing desktop study data provided by the Council, and a site walkover. The following potential sources of contaminants have been identified:

- Infilled land which could contain contaminants including (but not limited to) metals, hydrocarbons, polyaromatic hydrocarbons (PAHs), volatile and semi-volatile organic compounds (VOCs and SVOCs);and,
- Methane and carbon dioxide gas, from the decomposition of any biodegradable material within the infill

[2] CLR11 Model Procedures for the Management of Land Contamination (EA & DEFRA September 2004)
[3] DEFRA Circular 02/2006, Environmental Protection Act 1990: Part IIA Contaminated Land: September 2006.

2.1.2 Receptors

DEFRA Circular 02/2006 defines a Receptor as:

> *"either (a) a living organism, a group of organisms, an ecological system or a piece of property which (i) is in a category listed in Table A as a type of receptor, and (ii) is being, or could be, harmed, by a contaminant; or (b) controlled waters which are being, or could be, polluted by a contaminant".*

Table 2.1 lists all of the receptors to be considered by a Part IIA or PPS23[4] assessment, and assesses whether the receptors are likely to be present at the site.

Table 2.1 - Potential Receptors

Receptor Type	Receptors	Present (✓ /✖)	Notes
Humans	On-site residents	✓	Residential properties (houses and gardens) above indicative extent of landfill. Gardens assumed to be used for growing food crops.
	Construction staff and site investigation personnel.	X	No known redevelopment proposed.
	Future occupants of the site	✓	Level of risk same as current residents so not considered further.
	Off site commercial workers or residents	✓	Possibly exposed to gases migrating off-site through permeable strata. Level of risk likely to be same, or lower, than on-site residents, and is not considered further
Ecosystems	Any designated ecological system[5], or living organism forming part of such a system	X	Inspection of MAGIC website has identified that the site does not lie within 1km of an ecologically designated site.
Property (Flora and Fauna)	Crops, including timber	X	Not present.
	Produce grown domestically, or on allotments for consumption	✓	Gardens assumed to be used for growing food crops. Risk posed is considered to be covered by human health (residential with gardens) pathway and is not considered further.
	Livestock	X	Not present.
	Other owned or domesticated animals	✓	Pets in residential properties. Risk posed is considered to be similar to that posed to on-site residents, and is not examined further
	Wild animals which are the subject of shooting or fishing rights	X	Fish in Ridings Brook, located 200m south-east of the site.
Property (Buildings & Structures)	A 'building' means any structure, including any part below ground level, but does not include plant or machinery within a building	✓	Residential houses (and in particular, water service pipes and foundations) above indicative extent of landfill.

[4] Planning Policy Statement (PPS) 23: Planning and Pollution Control, Annex 2: Development on Land Affected by Contamination
[5] Includes sites designated as Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Special Area of Conservation (SAC, including candidate sites), Special Protection Area (SPA including potential sites), listed Wetlands of International Importance (Ramsar site) and Local Nature Reserves (LNR).

Receptor Type	Receptors	Present (✓ /✖)	Notes
Controlled Waters[6]	Territorial waters	✖	None feasibly close enough to be affected.
	Coastal waters	✖	None feasibly close enough to be affected.
	Inland Freshwaters	✓	Ridings Brook is located 200 m south-east of the site.
	Groundwater	✓	2 no secondary A aquifers beneath site.

2.1.3 Pathways

DEFRA Circular 02/2006 defines a pathway as:

> *"one or more routes or means by, or through, which a receptor: (a) is being exposed to, or affected by, a contaminant; or (b) could be exposed or affected"*

Pathways are examined as part of Table 2.2.

2.1.4 Potential Pollutant Linkages

The pollutant linkages identified are presented in Table 2.2.

[6] As defined in the Water Resources Act 1991 (Part III, Section 104). Generally includes most surface water bodies excluding drains which discharge into sewers.

Table 2.2 - Potential Pollutant Linkages

No.	Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
1	Residents of properties above infilled ground (including children playing in gardens)	Contaminants including (but not limited to) metals, hydrocarbons, (including PAHs), VOCs and SVOCs) and asbestos within landfill material	Dermal contact and direct ingestion, inhalation of dust/vapours, consumption of home-grown vegetables	Medium	Likely	Moderate	Grass and/or topsoil coverage likely to mitigate risk to an extent – risk is greatest where possibly impacted soils are exposed or could be encountered, for example, when digging a vegetable patch or when children play outdoors. Properties are constructed directly above a potentially significant contamination source. Sample collection and analysis required to refine conclusion on risk
2	Residents of properties above infilled ground	Methane and carbon dioxide from decomposition of deleterious elements of landfill material	Movement into buildings, subsequent asphyxiation and explosion risk	Medium	Likely	Moderate	Installation and monitoring of wells for gases and flow rates is required to refine conclusion on risk
3	Subsurface services serving the buildings (principally water supply)	Contaminants including (but not limited to) metals, hydrocarbons, (including PAHs), VOCs and SVOCs) within landfill material.	Chemical attack and tainting of water supply could occur at high contaminant concentrations / severe pH levels	Mild	Likely	Low to moderate	Further investigation data needed to refine assessment/CSM
4	Property (Structures) – sub-surface concrete	Sulphate and pH	Contact between contaminants and concrete	Mild	Likely	Low to moderate	Further investigation data needed to refine assessment/CSM

No.	Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability Of Linkage Occuring[1]	Overall Risk[1]	Comments
5	Secondary aquifer (fluvioglacial sand and gravel,) beneath site	Contaminants including (but not limited to) metals, hydrocarbons, (including PAHs), VOCs and SVOCs within landfill material.	Leaching of soil contaminants to aquifer – no aquiclude is indicated on BGS mapping	Mild	Likely	Low / Moderate	Risk will depend upon depth and concentration of contaminants, and leaching potential of contaminants. Initial leachability testing (soils) and dissolved analysis (groundwater) required to improve understanding of site
6	Secondary aquifer (Pennine Middle Coal Measures) beneath site	Dissolved dense contaminants or DNAPL (e.g., solvents) which have leached to the overlying fluvioglacial sand and gravel aquifer	Downwards gravitational movement of dense contaminants	Mild	Low to Likely	Low / Moderate	Risk will depend upon concentration and mobility of contaminants. Initial leachability testing (soils) and dissolved analysis (groundwater in fluvioglacial sand and gravel) required to improve understanding of site
7	Ridings Brook 200m to south-east (inferred down-hydraulic gradient on basis of topography). Fish within the brook (assumed to be subject to fishing rights)	Contaminants including (but not limited to) metals, hydrocarbons, (including PAHs), VOCs and SVOCs within landfill material.	Leaching to fluvioglacial sand and gravel, migration as dissolved phase (or LNAPL) to downgradient brook. {plus uptake by fish}	Medium	Low	Low / Moderate	Risk will depend upon concentration and mobility of contaminants. Although the brook is inferred to be hydraulically downgradient of the site, there is significant opportunity for dilution and attenuation of contaminants along the 200m flowpath to the brook. Initial leachability testing (soils) and dissolved analysis (groundwater in fluvioglacial sand and gravel) required to improve understanding of site

[1] Taken from Table 6.3, CIRIA report 552 (Contaminated Land Risk Assessment – A Guide to Good Practice. Severity classified as minor, mild, medium or severe. Probability classified as unlikely, low, likely or high. Overall risk considers both the severity and probability of the linkage (very low, low, moderate, high or very high). See extract in Appendix B

3 CLOSING REMARKS

Potential pollutant linkages affecting the health of residents, controlled waters and property have been identified, and therefore an initial intrusive investigation should be undertaken to examine the likelihood of pollutant linkages existing at the site.

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Hunter Road,
North Of Bridgtown,
Cannock,
Staffordshire

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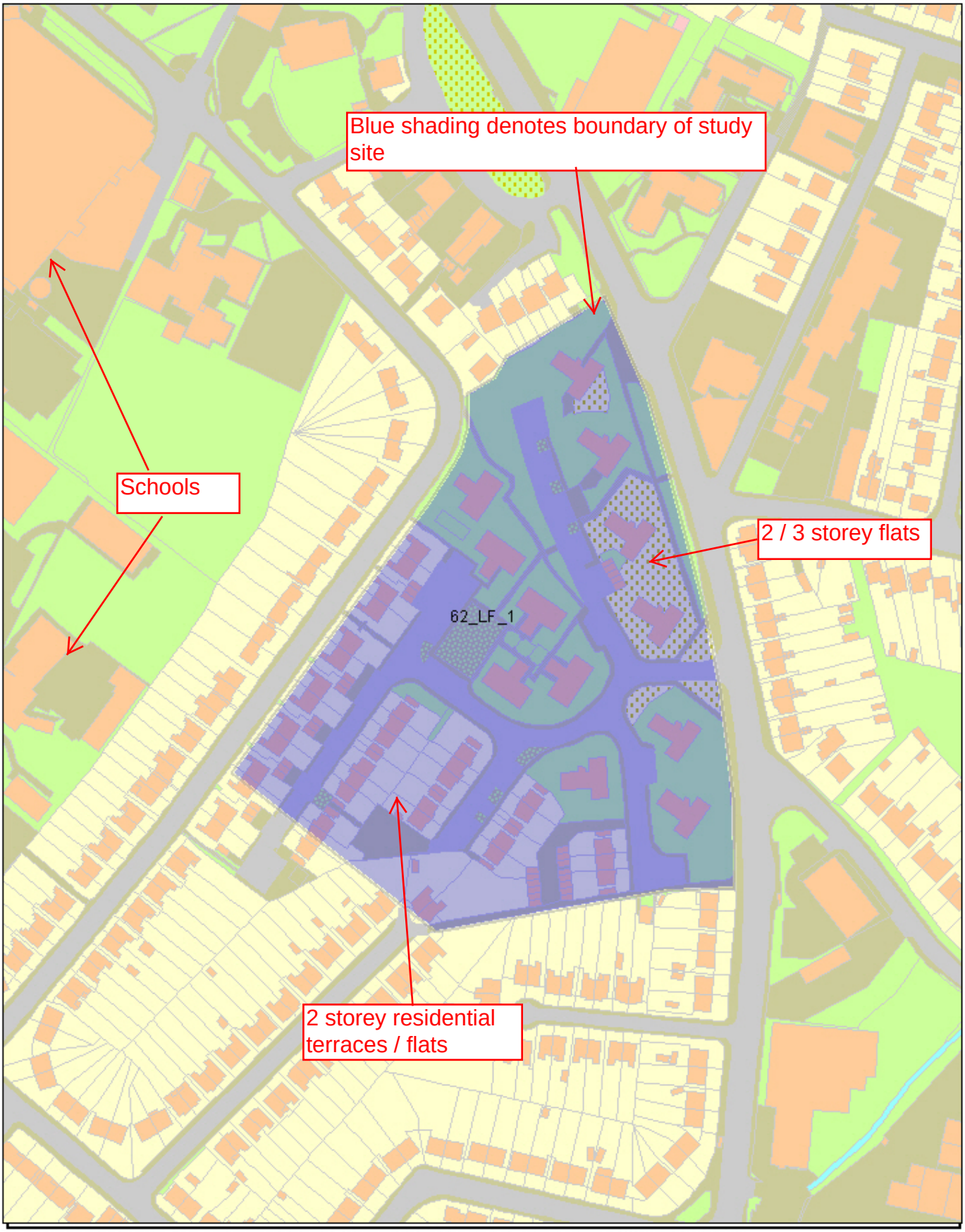

Appendix A (of desk study): Limitations Statement

1. This report has been prepared for the exclusive use of Cannock Chase District Council and copyright subsists with Grontmij Limited. Prior written permission must be obtained to reproduce all or part of the report.

2. This report and/or opinions have been prepared for the specific purpose stated in the document. The recommendations should not be used for other schemes on or adjacent to the site without further reference to Grontmij Limited.

3. Observations were made of the site and of structures on the site as indicated within the report.

4. Grontmij has relied upon the existing data provided by Cannock Chase District Council to be accurate, and has not taken steps to independently check the accuracy of the data provided.

5. Our interpretation of any regulatory database information (including the MAGIC, the Environment Agency and British Geological Survey websites) assumes that the data provided is accurate. A disclaimer provided by database search companies is as follows: '…*the data is derived from historical sources or information available in public records or from third parties and is supplied to us without warranty by data suppliers and we cannot warrant the accuracy or completeness of the data or the reports*.' We cannot therefore accept any responsibility for the accuracy of the data used in this study, only that its interpretation has been carried out with due skill, care and diligence.

6. The scope of this study, as agreed with Cannock Chase Council, comprised a review of available information, and data was not purchased from a proprietary database.

Appendix B (of desk study): Severity and Probability of Risk in Conceptual Site Models (after CIRIA552, Tables 6.3 to 6.5)

This report draws on guidance presented in CIRIA report 552, "Contaminated Land Risk Assessment, A Guide for Good Practice", wherein the "severity" term in the Conceptual Site Model is classified with reference to the sensitivity of the hazard and the receptor, as follows:

Situation	Category	Description	Examples
ACUTE PROBLEM	Severe	Acute risk to human health likely to result in "significant harm" as defined in EPA90, catastrophic damage to buildings or property, acute risk of major pollution of controlled waters, acute risk of harm to ecosystems (as defined in Contaminated Land Regulations 2006)	High cyanide concentrations at the surface of a recreation area Major spillage into controlled waters Explosion, causing building collapse
SIGNIFICANT HARM TO SENSITIVE RECEPTOR	Medium	Chronic risk to human health likely to result in "significant harm" as defined in EPA90, chronic pollution of sensitive controlled waters, significant change at a sensitive ecosystems or species, significant damage to buildings or structures	Contaminant concentrations at a site in excess of SGVs, GAC or similar screening values Leaching of contaminants to sensitive aquifer Death of a species within a nature reserve
SIGNIFICANT HARM TO LESS SENSITIVE RECEPTOR	Mild	Pollution of non-sensitive waters, significant damage to buildings, structures, services or crops, damage to sensitive buildings, structures, services or the environment, which nonetheless result in "significant harm"	Pollution to (former) non-aquifer or to non-controlled surface watercourse. Damage to building rendering it unsafe to occupy (e.g. foundation or structural damage)
NON-SIGNIFICANT HARM	Minor	Harm, not necessarily resulting in "significant harm" but probably requiring expenditure to resolve or financial loss. Non-permanent risks to human health that are easily mitigated, e.g. by wearing PPE. Easily-repairable damage to structures or services	Contaminant concentrations requiring the wearing of PPE during site work, but no other long-term mitigation. Discolouration of concrete

The likelihood of an event (probability) takes into account both the presence of hazard and receptor and the integrity of the pathway between hazard and receptor, and is assessed as follows:

Category	There is a pollution linkage and:
High	Event is likely in the short term and almost inevitable over the long term. Or there is evidence of actual harm at/to the receptor
Likely	Event is possible in the short term and likely over the long term
Low	Event is unlikely in the short term and possible over the long term
Unlikely	Event is unlikely, even in the long term

Potential severity and probability have been assessed in the following matrix, to give an overall risk rating:

	Severity			
Probability	Severe	Medium	Mild	Minor
High	Very high	High	Moderate	Low/moderate
Likely	High	Moderate	Low/moderate	Low
Low	Moderate	Low/moderate	Low	Very low
Unlikely	Low/moderate	Low	Very low	Very low

The above risk categories are likely to result in the following actions:

- Very high: urgent intervention / investigation needed, remediation likely to be required
- High: urgent intervention / investigation needed, remediation possibly required in short term and probably required in long term
- Moderate: investigation needed to clarify and refine risk; remediation may be required over the long term
- Low: it is possible that harm could arise to a receptor, but if realised, such harm is likely to be, at worst, mild
- Very low: it is possible that harm could arise to a receptor, but if realised, such harm is unlikely to be severe.

APPENDIX B
(of 2011 report)

Appendix B: Limitations Statement

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2. This report and/or opinions have been prepared for the specific purpose stated in the document. The recommendations should not be used for other purposes or adjacent sites without further reference to Grontmij Limited.

3. Observations were made of the site and soil arisings as indicated within the report. Where access to portions of the site was unavailable or limited, Grontmij Limited renders no opinion as to the environmental status of such parts of the site.

4. Grontmij has relied upon the existing desktop study data provided by Cannock Chase District Council to be accurate, and has not taken steps to independently check the accuracy of the data provided.

5. Our interpretation of any regulatory database information (including the MAGIC and British Geological Survey websites) within an earlier report, and relied upon in this report, assumes that the data provided is accurate. A disclaimer provided by database search companies is as follows: ‘ the data is derived from historical sources or information available in public records or from third parties and is supplied to us without warranty by data suppliers and we cannot warrant the accuracy or completeness of the data or the reports.’ We cannot therefore accept any responsibility for the accuracy of the data used in this study, only that its interpretation has been carried out with due skill, care and diligence.

6. The conclusions and recommendations submitted in this report are based in part upon the data obtained from soil samples from exploratory holes. The nature and extent of variations between the exploratory holes is inferred in the report and could only be confirmed by further investigation. If variations or other latent conditions become evident, it will be necessary to re-evaluate the recommendations of this report.

7. The generalised soil profile described in the text is intended to convey trends in sub-surface conditions. The boundaries between strata are approximate and idealised and have been developed in interpretations of widely spaced explorations and samples; actual soil transitions may be more gradual. For specific information, refer to the exploration logs.

8. Water levels and/or gas readings have been taken in the borings and/or observation wells at times and under conditions stated on the exploration logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater or gas may occur due to variations in rainfall, atmospheric pressure and other factors different from those prevailing at the time the measurements were made.

9. The conclusions and recommendations of this report are based in part upon various types of chemical analysis of soil, water or gases, and are contingent upon their validity. These data have been reviewed and interpretations made in the report. Variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time and other factors. Should additional analytical or monitoring data

become available in the future, these data should be reviewed and conclusions and recommendations presented herein modified accordingly.

10. Chemical analyses have been performed for specific parameters during the course of this study, as detailed in the text. It must be noted that additional constituents not searched for during the current study may be present in soil, groundwater and soil voids at the site.

APPENDIX C
(of 2011 report)

TRIAL PIT LOG

Grontmij

TRIAL PIT No: TP1

Project	Client	Logged By
Hunter Road	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	10-12-10 10-12-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10 0.30 0.60	ES ES ES					(0.80) 0.80	MADE GROUND: Grass over brown clayey very gravelly coarse grained SAND with occasional cobbles. Gravel is fine to coarse angular to rounded brick, quartz, ash, burnt shale, clinker and occasional metal and slag. Cobbles are angular brick	
							End of Trial Pit at 0.8m bgl.	

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Location: Public open space. No groundwater encountered	Final Depth
None Encountered		**0.8m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	hand dug trial pit	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ TP LOG BASIC HUNTER RD TP.GPJ AGS3_ALL.GDT 12/21/10

TRIAL PIT LOG

Grontmij

TRIAL PIT No: TP2

Project	Client	Logged By
Hunter Road	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	10-12-10 10-12-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10 0.30 0.60	ES ES ES					(0.80) 0.80	MADE GROUND: Grass over dark grey and brown clayey coarse grained SAND & GRAVEL. Gravel is fine to coarse angular ash, brick, coal and clinker	
							End of Trial Pit at 0.8m bgl.	

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Location: Public open space. No groundwater encountered	Final Depth
None Encountered		**0.8m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	hand dug trial pit	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ TP LOG BASIC HUNTER RD TP.GPJ AGS3_ALL.GDT 12/21/10

TRIAL PIT LOG

Grontmij

TRIAL PIT No: TP3

Project	Client	Logged By
Hunter Road	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	10-12-10 10-12-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10 0.30 0.60	ES ES ES					(1.00) 1.00	MADE GROUND: Grass over light brown clayey very sandy GRAVEL with many cobbles. Gravel is fine to coarse angular to sub rounded concrete, brick, quartz and occasional ash and plastic. Cobbles are angular concrete and brick	
							End of Trial Pit at 1m bgl.	

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Location: Public open space. No groundwater encountered	Final Depth
None Encountered		**1m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	hand dug trial pit	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ TP LOG BASIC HUNTER RD TP.GPJ AGS3_ALL.GDT 12/21/10

TRIAL PIT LOG

Grontmij

TRIAL PIT No: TP4

Project	Client	Logged By
Hunter Road	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	10-12-10 10-12-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10 0.30 0.60	ES ES ES					(0.70) 0.70	MADE GROUND: Grass over dark brown very clayey very gravelly coarse grained SAND. Gravel is fine to coarse angular to rounded quartz, ash, concrete and brick End of Trial Pit at 0.7m bgl.	

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Location: Public open space. No groundwater encountered	Final Depth
None Encountered		**0.7m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	hand dug trial pit	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ TP LOG BASIC HUNTER RD TP.GPJ AGS3_ALL.GDT 12/21/10

Grontmij

TRIAL PIT LOG

TRIAL PIT No
TP5

Project	Client	Logged By
Hunter Road	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	10-12-10 10-12-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10 0.30 0.60	ES ES ES					(0.70) 0.70	MADE GROUND: Grass over brown very clayey coarse grained SAND & GRAVEL. Gravel is fine to coarse angular to sub rounded quartz, brick and occasional ash.	
							End of Trial Pit at 0.7m bgl.	

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Location: Public open space. No groundwater encountered	Final Depth
None Encountered		**0.7m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	hand dug trial pit	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ TP LOG BASIC HUNTER RD TP.GPJ AGS3_ALL.GDT 12/21/10

APPENDIX D
(of 2011 report)

ALcontrol Laboratories

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: mkt@alcontrol.com
Website: www.alcontrol.com

Grontmij
Radcliffe House
3rd Floor
Blenheim Court, Lode lane
Solihull
West Midlands
B912AA

Attention: Gareth Taylor

CERTIFICATE OF ANALYSIS

Date:	11 January 2011
Customer:	H_GRONTMIJ_SOL
Sample Delivery Group (SDG):	101214-11
Your Reference:	
Location:	Hinter Road
Report No:	110394

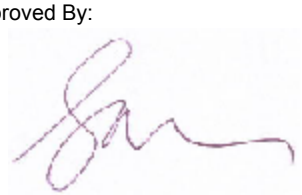
We received 15 samples on Tuesday December 14, 2010 and 5 of these samples were scheduled for analysis which was completed on Tuesday January 11, 2011. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Asbestos testing - we are not accredited for screening soil samples for asbestos fibres. We are only accredited to identify asbestos fibres in bulk material (ACM).

Approved By:



Sonia McWhan

Laboratory Manager

CERTIFICATE OF ANALYSIS

SDG:	101214-11	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	110394
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
2575492	TP1		0.10	10/12/2010
2575501	TP1		0.30	10/12/2010
2575542	TP1		0.60	10/12/2010
2575338	TP2		0.10	10/12/2010
2575356	TP2		0.30	10/12/2010
2575349	TP2		0.60	10/12/2010
2575517	TP3		0.10	10/12/2010
2575530	TP3		0.30	10/12/2010
2575526	TP3		0.60	10/12/2010
2575444	TP4		0.10	10/12/2010
2575361	TP4		0.30	10/12/2010
2575448	TP4		0.60	10/12/2010
2575438	TP5		0.10	10/12/2010
2575369	TP5		0.30	10/12/2010
2575372	TP5		0.60	10/12/2010

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	101214-11	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	110394
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Test Schedule

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)			2575492	2575356	2575526	2575361	2575438
Customer Sample Reference			TP1	TP2	TP3	TP4	TP5
AGS Reference							
Depth (m)			0.10	0.30	0.60	0.30	0.10
Container			250g Amber Jar	400g Tub	250g Amber Jar	400g Tub	250g Amber Jar	400g Tub	250g Amber Jar	400g Tub
Asbestos Containing Material Screen	All	NDPs: 0 Tests: 3			X		X			X
Boron Water Soluble	All	NDPs: 0 Tests: 5	X		X	X		X		X	
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 5		X	X		X		X		X
Metals by iCap-OES (Soil)	Arsenic	NDPs: 0 Tests: 5	X		X	X		X		X	
	Barium	NDPs: 0 Tests: 5	X		X	X		X		X	
	Beryllium	NDPs: 0 Tests: 5	X		X	X		X		X	
	Cadmium	NDPs: 0 Tests: 5	X		X	X		X		X	
	Chromium	NDPs: 0 Tests: 5	X		X	X		X		X	
	Copper	NDPs: 0 Tests: 5	X		X	X		X		X	
	Lead	NDPs: 0 Tests: 5	X		X	X		X		X	
	Mercury	NDPs: 0 Tests: 5	X		X	X		X		X	
	Nickel	NDPs: 0 Tests: 5	X		X	X		X		X	
	Selenium	NDPs: 0 Tests: 5	X		X	X		X		X	
	Vanadium	NDPs: 0 Tests: 5	X		X	X		X		X	
	Zinc	NDPs: 0 Tests: 5	X		X	X		X		X	
PAH by GCMS	All	NDPs: 0 Tests: 5	X		X	X		X		X	
pH	All	NDPs: 0 Tests: 5		X	X		X		X		X
Sample description	All	NDPs: 0 Tests: 5	X		X	X		X		X	
Total Organic Carbon	All	NDPs: 0 Tests: 5	X		X	X		X		X	

CERTIFICATE OF ANALYSIS

SDG:	101214-11	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	110394
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
2575492	TP1	0.10	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
2575356	TP2	0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	None
2575526	TP3	0.60	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
2575361	TP4	0.30	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
2575438	TP5	0.10	Dark Brown	Sand	0.1 - 2 mm	Stones	N/A

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	101214-11	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	110394
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of the individual compounds within the samples are not corrected for this recovery.

Component	LOD/Units	Method	Customer Sample R	TP1	TP2	TP3	TP4	TP5
			Depth (m)	0.10	0.30	0.60	0.30	0.10
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	10/12/2010	10/12/2010	10/12/2010	10/12/2010	10/12/2010
			Date Received	14/12/2010	14/12/2010	14/12/2010	14/12/2010	14/12/2010
			SDG Ref	101214-11	101214-11	101214-11	101214-11	101214-11
			Lab Sample No.(s)	2575492	2575356	2575526	2575361	2575438
			AGS Reference					
Asbestos Containing Material Screen	-	TM001			No ACM Detected	No ACM Detected		No ACM Detected
Soil Organic Matter (SOM)	<0.35 %	TM132		4.76 #	3.98 #	2.93 #	3.05 #	2.98 #
pH	1 pH Units	TM133		8.17 M	7.84 M	8.27 M	8.41 M	8.39 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<1.2 #	<0.6 #	<0.6 #	<0.6 #
Arsenic	<0.6 mg/kg	TM181		10.8 M	9.34 M	7.77 M	6.41 M	7.05 M
Barium	<0.6 mg/kg	TM181		125 #	147 #	144 #	127 #	131 #
Beryllium	<0.01 mg/kg	TM181		1.11 M	0.965 M	1.02 M	0.989 M	0.895 M
Cadmium	<0.02 mg/kg	TM181		1.12 M	0.832 M	1.24 M	0.481 M	0.73 M
Chromium	<0.9 mg/kg	TM181		9.92 M	11.9 M	25.9 M	32.6 M	36.9 M
Copper	<1.4 mg/kg	TM181		34.1 M	37.4 M	32.5 M	26.7 M	40.1 M
Lead	<0.7 mg/kg	TM181		67.7 M	77 M	121 M	55.8 M	64.6 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M
Nickel	<0.2 mg/kg	TM181		14.3 M	16.6 M	25.1 M	13.8 M	20 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		15.5 #	18.5 #	45.9 #	25.5 #	24.1 #
Zinc	<1.9 mg/kg	TM181		176 M	225 M	168 M	102 M	127 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	182 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	101214-11	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	110394
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of the individual compounds within the samples are not corrected for this recovery.

Component	LOD/Units	Method	Customer Sample R	TP1	TP2	TP3	TP4	TP5
			Depth (m)	0.10	0.30	0.60	0.30	0.10
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	10/12/2010	10/12/2010	10/12/2010	10/12/2010	10/12/2010
			Date Received	14/12/2010	14/12/2010	14/12/2010	14/12/2010	14/12/2010
			SDG Ref	101214-11	101214-11	101214-11	101214-11	101214-11
			Lab Sample No.(s)	2575492	2575356	2575526	2575361	2575438
			AGS Reference					
Naphthalene-d8 % recovery**	%	TM218		98.7	104	97.6	105	95.3
Acenaphthene-d10 % recovery**	%	TM218		97.8	102	96.4	103	93.5
Phenanthrene-d10 % recovery**	%	TM218		97.5	101	97.7	101	97.6
Chrysene-d12 % recovery**	%	TM218		98.3	99.5	95.5	100	95.6
Perylene-d12 % recovery**	%	TM218		100	102	101	102	91.5
Naphthalene	<9 µg/kg	TM218		198 M	283 M	45.3 M	81.1 M	142 M
Acenaphthylene	<12 µg/kg	TM218		1130 M	209 M	40.9 M	63.2 M	165 M
Acenaphthene	<8 µg/kg	TM218		249 M	52.5 M	31.5 M	26.5 M	9770 M
Fluorene	<10 µg/kg	TM218		1220 M	159 M	33.8 M	24.7 M	8140 M
Phenanthrene	<15 µg/kg	TM218		14700 M	1790 M	649 M	394 M	51500 M
Anthracene	<16 µg/kg	TM218		3420 M	193 M	140 M	141 M	15900 M
Fluoranthene	<17 µg/kg	TM218		16600 M	2150 M	1450 M	1740 M	65100 M
Pyrene	<15 µg/kg	TM218		12300 M	1630 M	1210 M	1550 M	44200 M
Benz(a)anthracene	<14 µg/kg	TM218		6400 M	827 M	614 M	959 M	20500 M
Chrysene	<10 µg/kg	TM218		5250 M	903 M	539 M	876 M	16100 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		5670 M	1170 M	752 M	1200 M	17700 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		2560 M	459 M	334 M	481 M	8560 M
Benzo(a)pyrene	<15 µg/kg	TM218		5220 M	973 M	729 M	1190 M	14800 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		2910 M	612 M	465 M	706 M	6760 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		768 M	160 M	124 M	173 M	1990 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		3160 M	750 M	602 M	886 M	7090 M
Polyaromatic hydrocarbons, Total	<118 µg/kg	TM218		81700 M	12300 M	7760 M	10500 M	288000 M

CERTIFICATE OF ANALYSIS

SDG:	101214-11	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	110394
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Table of Results - Appendix

REPORT KEY

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10-7

NDP	No Determination Possible	#	ISO 17025 Accredited	*	Subcontracted Test	M	MCERTS Accredited
NFD	No Fibres Detected	PFD	Possible Fibres Detected	»	Result previously reported (Incremental reports only)	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM001	In - house Method	Determination of asbestos containing material by screening on solids		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	101214-11	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	110394
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	2575492	2575356	2575526	2575361	2575438
Customer Sample Ref.	TP1	TP2	TP3	TP4	TP5
AGS Ref.					
Depth	0.10	0.30	0.60	0.30	0.10
Type	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos Containing Material Screen		06-Jan-2011	06-Jan-2011		06-Jan-2011
Boron Water Soluble	06-Jan-2011	07-Jan-2011	07-Jan-2011	06-Jan-2011	07-Jan-2011
Hexavalent Chromium (s)	07-Jan-2011	07-Jan-2011	07-Jan-2011	07-Jan-2011	07-Jan-2011
Metals by iCap-OES (Soil)	06-Jan-2011	07-Jan-2011	07-Jan-2011	06-Jan-2011	07-Jan-2011
PAH by GCMS	11-Jan-2011	11-Jan-2011	10-Jan-2011	11-Jan-2011	10-Jan-2011
pH	07-Jan-2011	07-Jan-2011	07-Jan-2011	06-Jan-2011	07-Jan-2011
Sample description	05-Jan-2011	06-Jan-2011	06-Jan-2011	05-Jan-2011	06-Jan-2011
Total Organic Carbon	06-Jan-2011	07-Jan-2011	07-Jan-2011	06-Jan-2011	07-Jan-2011

CERTIFICATE OF ANALYSIS

SDG:	101214-11	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	110394
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Appendix

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA Leach tests, flash point, ammonium as NH4 by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for both soil jars, tubs and volatile jars. All waters and vials will be discarded 10 days after the analysis is completed (e-mailed). All material removed during an asbestos containing material screen and analysed for the presence of asbestos will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be screened in house for the presence of large asbestos containing material fragments/pieces. If no asbestos containing material is found this will be reported as 'no asbestos containing material detected'. If asbestos containing material is detected it will be removed and analysed by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If asbestos containing material is present no further analysis will be undertaken. At no point is the fibre content of the soil sample determined.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample -similarly, if a headspace or sediment is present in the volatile sample. This will be flagged up as an invalid VOC on the test schedule or recorded on the log sheet.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

12. Results relate only to the items tested

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors
employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 14).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. Our MCERTS accreditation for PAHs by GCMS applies to all product types apart from Kerosene, where naphthalene only is not
accredited.

19. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

20. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

23. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials -whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute themajor part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

24. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C4 -C10 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D/C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENT EXTRACTABLE MATTER	D&C	DCM	SOXTHERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
THIN LAYER CHROMATOGRAPHY	D&C	DCM	SOXTHERM	IATROSCAN
ELEMENTAL SULPHUR	D&C	DCM	SOXTHERM	HPLC
PHENOLS BY GCMS	WET	DCM	SOXTHERM	GC-MS
HERBICIDES	D&C	HEXANE/ACETONE	SOXTHERM	GC-MS
PESTICIDES	D&C	HEXANE/ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH CWG BY GC	D&C	HEXANE/ACETONE	END OVER END	GC-FID
PCB TOT / PCB CON	D&C	HEXANE/ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE/ACETONE	MICROWAVE TM218.	GC-MS
C8-C40 (C8-C40) EZ FLASH	WET	HEXANE/ACETONE	SHAKER	GC-EZ
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE/ACETONE	SHAKER	GC-EZ
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DCM/ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH-MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
PCB TOTAL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC-MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PEST OCP/OPP	DCM	LIQUID/LIQUID SHAKE	GC-MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC-MS
PHENOLS-MS	DCM	SOLID PHASE EXTRACTION	GC-MS
TPH by INFRARED (IR)	TCE	LIQUID/LIQUID SHAKE	HPLC
MINERAL OIL by IR	TCE	LIQUID/LIQUID SHAKE	HPLC
GLYCOLS	NONE	DIRECT INJECTION	GC-MS

Identification of Asbestos in Bulk Materials

The results for asbestos identification for soil samples are obtained from possible Asbestos Containing Material, removed during the 'Screening of soils for Asbestos Containing Materials', which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: -
Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in MDHS 100.

The identification of asbestos containing materials falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

APPENDIX E
(of 2011 report)

Appendix E: Severity and Probability of Risk in Conceptual Site Models (after CIRIA552, Tables 6.3 to 6.5)

This report draws on guidance presented in CIRIA report 552, "Contaminated Land Risk Assessment, A Guide for Good Practice", wherein the "severity" term in the Conceptual Site Model is classified with reference to the sensitivity of the hazard and the receptor, as follows:

Severity Category	Description	Examples
Severe	Acute risk to human health likely to result in "significant harm" as defined in EPA90, catastrophic damage to buildings or property, acute risk of major pollution of controlled waters, acute risk of harm to ecosystems (as defined in Contaminated Land Regulations 2006)	High cyanide concentrations at the surface of a recreation area Major spillage into controlled waters Explosion, causing building collapse
Medium	Chronic risk to human health likely to result in "significant harm" as defined in EPA90, chronic pollution of sensitive controlled waters, significant change at a sensitive ecosystems or species, significant damage to buildings or structures	Contaminant concentrations at a site in excess of SGVs, GAC or similar screening values Leaching of contaminants to sensitive aquifer Death of a species within a nature reserve
Mild	Pollution of non-sensitive waters, significant damage to buildings, structures, services or crops, damage to sensitive buildings, structures, services or the environment, which nonetheless result in "significant harm"	Pollution to (former) non-aquifer or to non-controlled surface watercourse. Damage to building rendering it unsafe to occupy (e.g. foundation or structural damage)
Minor	Harm, not necessarily resulting in "significant harm" but probably requiring expenditure to resolve or financial loss. Non-permanent risks to human health that are easily mitigated, e.g. by wearing PPE. Easily-repairable damage to structures or services	Contaminant concentrations requiring the wearing of PPE during site work, but no other long-term mitigation. Discolouration of concrete

The likelihood of an event (probability) takes into account both the presence of hazard and receptor and the integrity of the pathway between hazard and receptor, and is assessed as follows:

Category	There is a pollution linkage and:
High	Event is likely in the short term and almost inevitable over the long term. Or, there is evidence of actual harm at/to the receptor
Likely	Event is possible in the short term and likely over the long term
Low	Event is unlikely in the short term and possible over the long term
Unlikely	Event is unlikely, even in the long term

Potential severity and probability have been assessed in the following matrix, to give an overall risk rating:

	Severity			
Probability	Severe	Medium	Mild	Minor
High	Very high	High	Moderate	Low/moderate
Likely	High	Moderate	Low/moderate	Low
Low	Moderate	Low/moderate	Low	Very low
Unlikely	Low/moderate	Low	Very low	Very low

The above risk categories are likely to result in the following actions:

- Very high: urgent intervention / investigation needed, remediation likely to be required
- High: urgent intervention / investigation needed, remediation possibly required in short term and probably required in long term
- Moderate: investigation needed to clarify and refine risk; remediation may be required over the long term
- Low: it is possible that harm could arise to a receptor, but if realised, such harm is likely to be, at worst, mild
- Very low: it is possible that harm could arise to a receptor, but if realised, such harm is unlikely to be severe

APPENDIX B

Appendix B: Limitations Statement

1. This report has been prepared for the exclusive use of Cannock Chase District Council and copyright subsists with Grontmij Limited. Prior written permission must be obtained to reproduce all or part of the report.

2. This report and/or opinions have been prepared for the specific purpose stated in the document. The recommendations should not be used for other purposes or adjacent sites without further reference to Grontmij Limited.

3. Observations were made of the site and soil arisings as indicated within the report. Where access to portions of the site was unavailable or limited, Grontmij Limited renders no opinion as to the environmental status of such parts of the site.

4. Grontmij has relied upon the existing desktop study data provided by Cannock Chase District Council and other information supplied by third parties, such and laboratory test data, to be accurate, and has not taken steps to independently check the accuracy of the data provided. We cannot therefore accept any responsibility for the accuracy of the data used in this study, only that its interpretation has been carried out with due skill, care and diligence.

5. Similarly, our interpretation of any regulatory database information (including the MAGIC and British Geological Survey websites) within an earlier report, and relied upon in this report, assumes that the data provided is accurate. A disclaimer provided by database search companies is as follows: ' the data is derived from historical sources or information available in public records or from third parties and is supplied to us without warranty by data suppliers and we cannot warrant the accuracy or completeness of the data or the reports.' We cannot therefore accept any responsibility for the accuracy of the data used in this study, only that its interpretation has been carried out with due skill, care and diligence.

6. The conclusions and recommendations submitted in this report are based in part upon the data obtained from soil samples from exploratory holes. The nature and extent of variations between the exploratory holes is inferred in the report and could only be confirmed by further investigation. If variations or other latent conditions become evident, it will be necessary to re-evaluate the recommendations of this report.

7. The generalised soil profile described in the text is intended to convey trends in sub-surface conditions. The boundaries between strata are approximate and idealised and have been developed in interpretations of widely spaced explorations and samples; actual soil transitions may be more gradual. For specific information, refer to the exploration logs.

8. Water levels and/or gas readings have been taken in the borings and/or observation wells at times and under conditions stated on the exploration logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater or gas may occur due to variations in rainfall, atmospheric pressure and other factors different from those prevailing at the time the measurements were made.

9. The conclusions and recommendations of this report are based in part upon various types of chemical analysis of soil, water or gases, and are contingent upon their validity. These data have been reviewed and interpretations made in the report.

Variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time and other factors. Should additional analytical or monitoring data become available in the future, these data should be reviewed and conclusions and recommendations presented herein modified accordingly.

10. Chemical analyses have been performed for specific parameters during the course of this study, as detailed in the text. It must be noted that additional constituents not searched for during the current study may be present in soil, groundwater and soil voids at the site.

APPENDIX C

WINDOW SAMPLE LOG

WINDOW SAMPLE No: **WS1**

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	16-11-11 16-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.20	ES					(0.80) 0.80	MADE GROUND: Grass over brown medium to coarse sand with abundant subrounded to subangular medium to coarse gravel, including of brick and concrete	
0.90	ES					(2.20) 3.00	Light brown coarse SAND with some medium to coarse subrounded to subangular gravel, including of quartzite, and occasional pockets of clay. Gravel becomes less abundant beyond 1.5m depth	
2.10	ES							
							End of Hole at 3m bgl.	

Groundwater			General Remarks	Final Depth
Strike Depth: (m)	Rising to: (m)	Groundwater Remarks	No groundwater encountered. Well installed for gas monitoring purposes.	**3m bgl**
		None Encountered		

Contractor	Method/ Plant Used	
Sherwood Drilling	Geotool w/sampler	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 HUNTER ROAD WS.GPJ AGS3_ALL.GDT 21/2/12

WINDOW SAMPLE LOG

WINDOW SAMPLE No: **WS2**

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	16-11-11 16-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.20	ES					(1.00)	MADE GROUND: Grass over brown medium to coarse sand with abundant angular medium to coarse gravel of brick and (occasional) clinker, abundant rounded gravel and some cobbles of brick. Possible fragment of asbestos board 5cm x 1cm x 0.5cm noted at 0.2mbgl.	
0.70	ES					1.00		
1.70	ES					(2.00)	Red-brown coarse SAND with occasional medium to coarse angular gravel of quartzite. Occasional clayey pockets present, and lens of clay identified at 2.6m to 2.7m bgl. Sand is fine to medium at 2.0m to 2.6m bgl.	
						3.00	End of Hole at 3m bgl.	

Groundwater			General Remarks	Final Depth
Strike Depth: (m)	Rising to: (m)	Groundwater Remarks	No groundwater encountered. Well installed for gas monitoring purposes.	**3m bgl**
None Encountered				

Contractor	Method/ Plant Used	
Sherwood Drilling	Geotool w/sampler	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 HUNTER ROAD WS.GPJ AGS3_ALL.GDT 21/2/12

WINDOW SAMPLE LOG

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WINDOW SAMPLE No **WS3**

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	16-11-11 16-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument Backfill
0.40	ES					(0.50) 0.50	MADE GROUND: Medium sand to cobbles of crushed brick with some brown slightly clayey medium sand, some cobbles of concrete and occasional fine to medium gravel of clinker. Material appears to have been placed to reinforce local area for car parking. Unable to hand pit beyond 0.5m due to denseness of the fill. Hole aborted. End of Hole at 0.5m bgl.	

Groundwater			General Remarks	Final Depth
Strike Depth: (m)	Rising to: (m)	Groundwater Remarks	No groundwater encountered. Not possible to safely reposition due to services and CAT signals.	**0.5m bgl**
		None Encountered		

Contractor	Method/ Plant Used	
Sherwood Drilling	Geotool w/sampler	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 HUNTER ROAD WS.GPJ AGS3_ALL.GDT 21/2/12

WINDOW SAMPLE LOG

WINDOW SAMPLE No: **WS4**

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	16-11-11 16-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.10	ES					(0.60) 0.60	MADE GROUND: Grass over dark brown medium to coarse sand with abundant angular medium to coarse gravel , including of brick and flint-like material. Sand becomes light brown beyond 0.35m.	
0.50	ES							
0.65	ES					(0.65) 1.25	MADE GROUND: Dark brown-grey slightly clayey slightly ashy sand with abundant fine to medium gravel, including brick and (occasional) clinker	
1.40	ES					(0.75) 2.00	Yellow-brown, becoming fawn at 1.4m, medium to coarse SAND with some subrounded medium to coarse gravel of quartzite. Trending towards light brown predominantly coarse sand at 1.8m and slightly moist.	
							End of Hole at 2m bgl.	

Groundwater			General Remarks	Final Depth
Strike Depth: (m)	Rising to: (m)	Groundwater Remarks	No groundwater encountered. Well installed for gas monitoring purposes.	**2m bgl**
None Encountered				

Contractor	Method/ Plant Used	
Sherwood Drilling	Geotool w/sampler	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 HUNTER ROAD WS.GPJ AGS3_ALL.GDT 21/2/12

WINDOW SAMPLE LOG

WINDOW SAMPLE No: **WS5**

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	17-11-11 17-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.10	ES					(0.90) 0.90	MADE GROUND: Dark brown coarse sand with abundant rounded medium to coarse gravel and abundant angular coarse gravel of brick and occasional cobbles of brick. Also, from 0.5m, with some angular fine to medium gravel of coal-like material	
0.70	ES							
1.60	ES					(1.10) 2.00	Red-brown coarse SAND with some rounded fine to medium black gravel. Occasional mottling noted around the black gravel (not looking like contamination smearing and no odour noted)	
							End of Hole at 2m bgl.	

Groundwater			General Remarks	Final Depth
Strike Depth: (m)	Rising to: (m)	Groundwater Remarks	No groundwater encountered. Well installed for gas monitoring purposes.	**2m bgl**
None Encountered				

Contractor	Method/ Plant Used	
Sherwood Drilling	Geotool w/sampler	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 HUNTER ROAD WS.GPJ AGS3_ALL.GDT 21/2/12

WINDOW SAMPLE LOG

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WINDOW SAMPLE No: **WS6**

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	17-11-11 17-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.30	ES					(1.00) 1.00	MADE GROUND: Grass over dark brown medium to coarse sand with abundant angular medium to coarse gravel and cobbles of brick and concrete, and occasional gravel of porcelain.	
						(0.40) 1.40	Light brown fine to medium SAND, clayey in pockets, with abundant subrounded medium gravel	
1.50	ES					(0.60) 2.00	Firm to stiff red-brown CLAY with sandy bands and with some subangular to subrounded fine to medium gravel, including of grey siltstone	
							End of Hole at 2m bgl.	

Groundwater			General Remarks	Final Depth
Strike Depth: (m)	Rising to: (m)	Groundwater Remarks	No groundwater encountered. Well installed for gas monitoring purposes.	**2m bgl**
None Encountered				

Contractor	Method/ Plant Used	
Sherwood Drilling	Geotool w/sampler	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 HUNTER ROAD WS.GPJ AGS3_ALL.GDT 21/2/12

WINDOW SAMPLE LOG

WINDOW SAMPLE No: **WS7**

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	17-11-11 17-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
						(0.50) 0.50	MADE GROUND: Grass over dark brown medium sand with abundant subrounded medium to coarse gravel.....with abundant cobbles of concrete and brick from 0.2m to 0.4m	
0.70	ES					(0.40) 0.90	MADE GROUND: Brown medium sand with abundant rounded medium gravel and some angular fine to medium gravel, including occasional clinker	
						(0.60) 1.50	MADE GROUND: Red-brown medium to coarse sand with abundant rounded medium to coarse gravel and occasional angular gravel of brick	
1.80	ES						MADE GROUND: Grey-black sand and gravel of ash with some gravel of brick and clinker and occasional shards of glass. Was notably easier to window sample through this stratum than other made ground at the site. At 2.1 to 2.2m bgl, approx 40% of the matrix has a slight green-blue discolouration	
2.15	ES					(1.70) 3.20		
3.40	ES					(0.80) 4.00	Red-brown coarse SAND with occasional medium to coarse rounded gravel.	
							End of Hole at 4m bgl.	

Groundwater		General Remarks	Final Depth
Strike Depth: (m)	Rising to: (m) Groundwater Remarks	No groundwater encountered. Well installed for gas monitoring purposes.	**4m bgl**
None Encountered			

Contractor	Method/ Plant Used	
Sherwood Drilling	Geotool w/sampler	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 HUNTER ROAD WS.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

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HAND PIT No: HP A

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	17-11-11 17-11-11			GVT

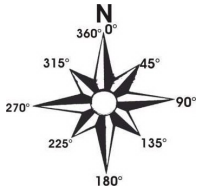
SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
						0.20	TOPSOIL: Brown medium sand	
0.25	ES					0.30	MADE GROUND: Light brown medium sand with occasional fine gravel, including shards of glass.	
							End of Trial Pit at 0.3m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D



Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Hand dug with trowel only	Final Depth
None Encountered		**0.3m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

Grontmij

HAND PIT No: HP06

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	14-11-11 14-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10	ES					0.30	MADE GROUND: Grass over dark brown medium to coarse sand with some medium to coarse subrounded to subangular gravel, including brick and porcelain (and occasional slate and coal), and occasional cobbles of brick.	
							End of Trial Pit at 0.3m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 360° 0° 45° 90° 135° 180° 225° 270° 315°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered	Residents commented children had become ill for a couple of days after playing at base of garden (i.e. this hand pit location)	**0.3m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP07

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	14-11-11 14-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.20	ES					(0.80)	MADE GROUND: Grass over dark brown medium to coarse sand with some medium to coarse subrounded to subangular gravel, including brick and porcelain (and occasional slate and porcelain), and occasional cobbles of brick. Some clinker 0.6m to 0.75m. Shard of metal at 0.7m bgl.	
0.70	ES					0.80	End of Trial Pit at 0.8m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° / 45° / 90° / 135° / 180° / 225° / 270° / 315° / 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered		**0.8m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

Grontmij

HAND PIT No: HP08

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	14-11-11 14-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10	ES							
0.50	ES					0.55 0.60	MADE GROUND: Sand to medium gravel of black ash with abundant medium to coarse gravel of brick and some dark brown medium to coarse sand MADE GROUND: Compacted cobbles of brick End of Trial Pit at 0.6m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° 45° 90° 135° 180° 225° 270° 315° 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered	Unable to hand pit beyond 0.6m - densely packed made ground	**0.6m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP09

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	14-11-11 14-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.30	ES					(0.40) 0.40	MADE GROUND: Dark brown medium to coarse loose sand with some medium to coarse subrounded to subangular gravel, including of porcelain and brick	
						(0.40) 0.80	Light brown medium to coarse loose SAND with abundant rounded medium to coarse gravel - probable natural strata	
							End of Trial Pit at 0.8m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° 45° 90° 135° 180° 225° 270° 315° 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered		**0.8m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP10

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	14-11-11 14-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.30	ES					(0.60) 0.60	MADE GROUND: Dark brown slightly clayey sand with abundant subrounded to subangular medium to coarse gravel, including of brick, with occasional platy gravel of slate, cobbles of brick and fine gravel of clinker.	
							End of Trial Pit at 0.6m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° 45° 90° 135° 180° 225° 270° 315° 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered	Unable to hand pit beyond 0.6m - densely packed brick	**0.6m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP11

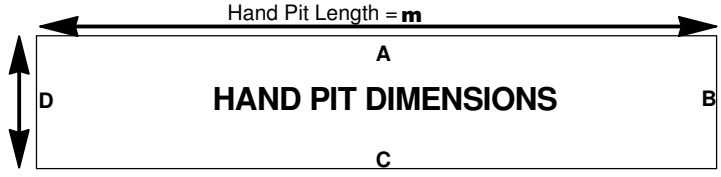
Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

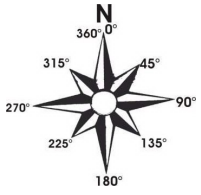
Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	14-11-11 14-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10	ES					(0.70)	MADE GROUND: Grass over loose brown medium to coarse sand with abundant rounded medium to coarse gravel and some medium to coarse angular gravel of brick and concrete. Abundant roots 0 to 0.2m. Very occasional fragments of fine wire. Occasional gravel of clinker from 0.4m onwards and some cobbles of brick from 0.5m onwards	
0.45	ES					0.70 0.80	Light brown to orange medium to coarse SAND with abundant medium to coarse rounded gravel End of Trial Pit at 0.8m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**





Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered		**0.8m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

Grontmij

HAND PIT No: HP12

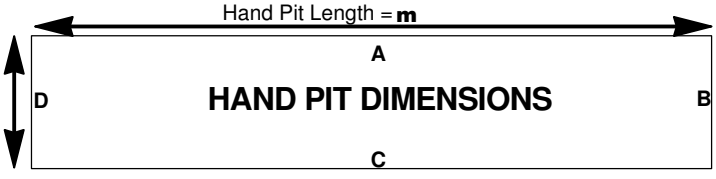
Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

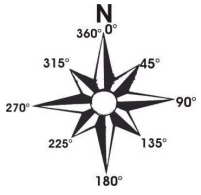
Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	14-11-11 14-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10 0.50	ES ES					(0.68) 0.68	MADE GROUND: Dark brown loose medium sand with some fine to medium subrounded to subangular gravel, including of brick and concrete. Crumpled shards of metal (20cm x 10cm) at 0.5m.	
							End of Trial Pit at 0.68m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**





Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered		**0.68m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

Grontmij

HAND PIT No: HP13

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	14-11-11 14-11-11			GVT

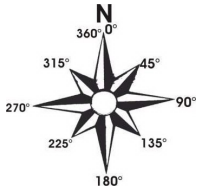
SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10 0.40	ES ES					(0.55) 0.55	MADE GROUND: Dark brown loose medium sand with some fine to medium subrounded to subangular gravel, including of brick, porcelain and concrete, and with some cobbles of brick from 0.5m onwards	
							End of Trial Pit at 0.55m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D



Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered	Unable to hand pit beyond 0.6m - solid packed brick and cobbles	**0.55m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

Grontmij

HAND PIT No: HP14

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	14-11-11 14-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.50	ES					(0.80) 0.80	MADE GROUND: Dark brown loose medium sand with some fine to medium subrounded to subangular gravel, including of brick, porcelain and concrete, some fragments of glass, and with some cobbles of brick from 0.2m onwards.	
						0.90	Light brown medium to coarse SAND with abundant medium to coarse rounded gravel	
							End of Trial Pit at 0.9m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° 45° 90° 135° 180° 225° 270° 315° 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered		**0.9m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP15

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.20 0.60	ES ES					(0.75) 0.75	MADE GROUND: Grass over dark brown medium to coarse loose sand with some fine to coarse rounded to subangular gravel, including of brick, porcelain and occasional clinker. Some cobbles of brick from 0.4m onwards. Occasional pockets of clay from 0.6m onwards	
							End of Trial Pit at 0.75m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° / 45° / 90° / 135° / 180° / 225° / 270° / 315° / 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered		**0.75m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP16

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

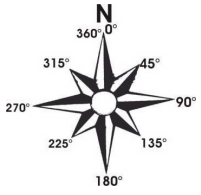
SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.30	ES					(0.55) 0.55	MADE GROUND: Grass over brown medium to coarse loose sand with medium to coarse rounded gravel to cobbles of brick and concrete	
						0.70	Light orange to brown medium to coarse SAND with medium rounded gravel	
							End of Trial Pit at 0.7m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D



Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered		**0.7m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

Grontmij

HAND PIT No: HP17

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.15	ES					0.30	MADE GROUND? - Dark brown medium to coarse sand with some medium to coarse gravel, sand becomes light brown at 0.2m	
							End of Trial Pit at 0.3m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° 45° 90° 135° 180° 225° 270° 315° 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Hand dug with trowel only in front garden (slopes steeply)	Final Depth
None Encountered		**0.3m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP18

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.40	ES					(0.50) 0.50	MADE GROUND: Brown medium to coarse sand with abundant medium to coarse subrounded gravel to cobbles. Occasional fine angular gravel of clinker	
						0.70	Light orange to brown coarse sand with abundant medium to coarse subrounded gravel	
							End of Trial Pit at 0.7m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 360° 0° 45° 90° 135° 180° 225° 270° 315°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered		**0.7m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP19

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.20	ES					0.30	MADE GROUND? - Dark brown medium to coarse sand with some medium to coarse gravel, sand becomes light brown at 0.2m. Sample was taken from the lighter brown soil.	
							End of Trial Pit at 0.3m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° 45° 90° 135° 180° 225° 270° 315° 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered	Hand dug with trowel only in front garden (slopes steeply)	**0.3m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP20

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
						0.30	MADE GROUND: Grass over dark brown medium sand with abundant gravel to cobbles of clinker and brick	
0.40	ES						End of Trial Pit at 0.6m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° 45° 90° 135° 180° 225° 270° 315° 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Refusal on dense brick	Final Depth
None Encountered		**0.6m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

Grontmij

HAND PIT No: HP21

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.10 0.20	ES ES					0.30	MADE GROUND? - Dark brown medium to coarse sand with some medium to coarse gravel, sand becomes light brown at 0.2m	
							End of Trial Pit at 0.2m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 360° 0° 45° 90° 135° 180° 225° 270° 315°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Hand dug with trowel only in front garden (slopes steeply)	Final Depth
None Encountered		**0.2m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

HAND PIT No: HP22

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.25	ES					(0.50) 0.50	MADE GROUND: Grass over dark brown medium sand with abundant medium (occasionally coarse) subrounded gravel, including brick and occasional slate and clinker.	
							End of Trial Pit at 0.5m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° 45° 90° 135° 180° 225° 270° 315° 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered	Refusal on dense brick. Pit dug adjacent to back fence - garden is on split level with material closest to house possibly a more recent import - soil closest to fence is most likely to be representative of the earlier infill	**0.5m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

HAND PIT LOG

Grontmij

HAND PIT No: HP23

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

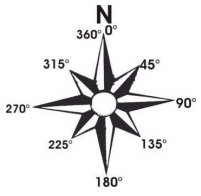
SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.15	ES					0.20	MADE GROUND: Grass over dark brown medium sand with abundant coarse angular gravel of brick and some fragments of plastic	
0.45	ES					0.40	MADE GROUND: Angular gravel of brick with some dark brown medium sand	
						0.50	MADE GROUND: Grass over dark brown medium sand with abundant coarse angular gravel of brick, some platy gravel of slate, and occasional gravel of clinker and fragments of rockwool.	
							End of Trial Pit at 0.5m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D



Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks Refusal on dense brick	Final Depth
None Encountered		**0.5m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

HAND PIT LOG

Grontmij

HAND PIT No: HP24

Project	Client	Logged By
Hunter Road	Cannock Chase DC	GVT

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
106270	15-11-11 15-11-11			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Backfill
0.20	ES					(0.50) 0.50	MADE GROUND: Patchy grass cover over dark brown clayey medium sand with some fine to medium subrounded gravel, including occasional angular gravel of brick. From 0.4m onwards, some cobbles of brick, some of which exhibit iron oxide-like discolouration on surface	
0.60	ES					0.70	Brown slightly clayey fine to medium SAND with some medium to coarse rounded gravel	
							End of Trial Pit at 0.7m bgl.	

Hand Pit Length = **m**

Hand Pit Width = **m**

HAND PIT DIMENSIONS

A / B / C / D

N 0° 45° 90° 135° 180° 225° 270° 315° 360°

Bearing from North = °

Shoring	Stability

Groundwater Strike Depth: (m) Rising to: (m) Groundwater Remarks	General Remarks	Final Depth
None Encountered		**0.7m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ HAND PIT LOG HUNTER ROAD.GPJ AGS3_ALL.GDT 21/2/12

APPENDIX D

Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
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Cornbrook
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M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 259230-1

Date of Report: 15-Dec-2011

Customer: Grontmij
3rd Floor
Radcliffe House
Blenheim Court
Lode Lane
Solihull
B91 2AA

Customer Contact: Mr Gareth Taylor

Customer Job Reference:
Customer Site Reference: Hunter Rd
Date Job Received at SAL: 17-Nov-2011
Date Analysis Started: 02-Dec-2011
Date Analysis Completed: 15-Dec-2011

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs

UKAS TESTING
1549

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked
and authorised by :
Mr Ross Walker
Customer Services Manager
(Land)

Issued by :
Mr Ross Walker
Customer Services Manager
(Land)

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
MCERTS Preparation

				SAL Reference	**259230 001**	**259230 003**	**259230 005**	**259230 007**	**259230 008**	**259230 009**	**259230 011**	**259230 013**	**259230 014**
				Customer Sample Reference	**HP06 0.1**	**HP07 0.7**	**HP08 0.5**	**HP010 0.3**	**HP 11 0.1**	**HP11 0.45**	**HP12 0.5**	**HP13 0.4**	**HP14 0.5**
				Depth	**0.1**	**0.7**	**0.5**	**0.3**	**0.1**	**0.45**	**0.5**	**0.4**	**0.5**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**									
Moisture	T277	AR	0.1	%	**13**	**7.4**	**12**	**12**	**9.5**	**9.0**	**11**	**7.1**	**8.2**
Moisture @ 105 C	T162	AR	0.1	%	**15**	**9.9**	**13**	**14**	**11**	**9.5**	**12**	**8.0**	**9.7**

SAL Reference: 259230
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				SAL Reference	**259230 017**	**259230 018**	**259230 019**	**259230 020**	**259230 021**	**259230 022**	**259230 023**	**259230 024**	**259230 026**
				Customer Sample Reference	**HP16 0.3**	**HP17 0.15**	**HP18 0.4**	**HP19 0.2**	**HP20 0.4**	**HP21 0.1**	**HP21 0.2**	**HP22 0.25**	**HP23 0.45**
				Depth	**0.3**	**0.15**	**0.4**	**0.2**	**0.4**	**0.1**	**0.2**	**0.25**	**0.45**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**									
Moisture	T277	AR	0.1	%	**7.9**	**7.9**	**7.6**	**9.4**	**11**	**11**	**7.8**	**10**	**14**
Moisture @ 105 C	T162	AR	0.1	%	**9.8**	**6.9**	**4.3**	**9.6**	**13**	**13**	**9.8**	**12**	**16**

SAL Reference: 259230
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MCERTS Preparation

				SAL Reference	**259230 028**	**259230 029**	**259230 033**	**259230 035**	**259230 036**	**259230 039**	**259230 040**	**259230 042**	**259230 044**
				Customer Sample Reference	**HP24 0.6**	**WS1 0.2**	**WS2 0.2(SOIL)**	**WS2 1.7**	**WS3 0.4**	**WS4 0.65**	**WS4 1.4**	**WS5 0.7**	**WS6 0.3**
				Depth	**0.6**	**0.2**	**0.2**	**1.7**	**0.4**	**0.65**	**1.4**	**0.7**	**0.3**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**									
Moisture	T277	AR	0.1	%	**15**	**11**	**12**	**5.5**	**9.0**	**12**	**8.1**	**5.9**	**14**
Moisture @ 105 C	T162	AR	0.1	%	**18**	**14**	**11**	**5.7**	**13**	**14**	**5.4**	**7.2**	**15**

SAL Reference: 259230
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MCERTS Preparation

				SAL Reference	**259230 045**	**259230 046**	**259230 047**	**259230 048**	**259230 050**
				Customer Sample Reference	**WS6 1.5**	**WS7 0.7**	**WS7 1.8**	**WS7 2.15**	**HP A 0.25**
				Depth	**1.5**	**0.7**	**1.8**	**2.15**	**0.25**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture	T277	AR	0.1	%	**9.7**	**4.3**	-	**25**	**16**
Moisture @ 105 C	T162	AR	0.1	%	**12**	**4.0**	**26**	**29**	**23**

SAL Reference: 259230
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CLEA Metals

				SAL Reference	**259230 001**	**259230 003**	**259230 005**	**259230 007**	**259230 008**	**259230 009**	**259230 011**	**259230 014**	**259230 017**	**259230 018**
				Customer Sample Reference	**HP06 0.1**	**HP07 0.7**	**HP08 0.5**	**HP010 0.3**	**HP 11 0.1**	**HP11 0.45**	**HP12 0.5**	**HP14 0.5**	**HP16 0.3**	**HP17 0.15**
				Depth	**0.1**	**0.7**	**0.5**	**0.3**	**0.1**	**0.45**	**0.5**	**0.5**	**0.3**	**0.15**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**										
Arsenic	T6	M40	2	mg/kg	**12**	**14**	**15**	**10**	**8**	**8**	**12**	**17**	**6**	**5**
Barium	T6	M40	1	mg/kg	**220**	**340**	**260**	**160**	**88**	**81**	**130**	**140**	**63**	**57**
Beryllium	T6	M40	2	mg/kg	**2**	**2**	**3**	<2	<2	<2	<2	**4**	<2	<2
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**17**	**22**	**17**	**14**	**13**	**13**	**15**	**18**	**11**	**8**
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	**60**	**95**	**70**	**44**	**28**	**27**	**50**	**51**	**25**	**15**
Lead	T6	M40	1	mg/kg	**170**	**370**	**240**	**120**	**65**	**63**	**140**	**120**	**55**	**30**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**23**	**25**	**38**	**17**	**17**	**15**	**21**	**33**	**12**	**8**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Vanadium	T6	M40	1	mg/kg	**22**	**28**	**37**	**19**	**19**	**19**	**20**	**35**	**15**	**11**
Zinc	T6	M40	1	mg/kg	**380**	**380**	**190**	**230**	**140**	**130**	**280**	**350**	**120**	**61**

SAL Reference: 259230
Project Site: Hunter Rd
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CLEA Metals

				SAL Reference	**259230 019**	**259230 020**	**259230 021**	**259230 022**	**259230 023**	**259230 024**	**259230 026**	**259230 028**	**259230 029**	**259230 033**
				Customer Sample Reference	**HP18 0.4**	**HP19 0.2**	**HP20 0.4**	**HP21 0.1**	**HP21 0.2**	**HP22 0.25**	**HP23 0.45**	**HP24 0.6**	**WS1 0.2**	**WS2 0.2(SOIL)**
				Depth	**0.4**	**0.2**	**0.4**	**0.1**	**0.2**	**0.25**	**0.45**	**0.6**	**0.2**	**0.2**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**										
Arsenic	T6	M40	2	mg/kg	**8**	**6**	**21**	**5**	**6**	**9**	**10**	**8**	**6**	**9**
Barium	T6	M40	1	mg/kg	**84**	**59**	**250**	**61**	**56**	**110**	**170**	**84**	**56**	**130**
Beryllium	T6	M40	2	mg/kg	<2	<2	**3**	<2	<2	<2	<2	<2	<2	<2
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**12**	**9**	**20**	**7**	**8**	**14**	**13**	**10**	**11**	**14**
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	**24**	**17**	**86**	**17**	**16**	**36**	**23**	**20**	**24**	**35**
Lead	T6	M40	1	mg/kg	**55**	**30**	**220**	**35**	**34**	**89**	**100**	**70**	**56**	**140**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**13**	**9**	**34**	**13**	**10**	**16**	**15**	**11**	**11**	**17**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Vanadium	T6	M40	1	mg/kg	**16**	**14**	**34**	**11**	**12**	**18**	**26**	**16**	**15**	**20**
Zinc	T6	M40	1	mg/kg	**110**	**69**	**630**	**95**	**140**	**190**	**150**	**74**	**110**	**200**

SAL Reference: 259230
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Soil Analysed as Soil
CLEA Metals

SAL Reference				**259230 036**	**259230 039**	**259230 042**	**259230 044**	**259230 046**	**259230 047**	**259230 048**	**259230 050**
Customer Sample Reference				**WS3 0.4**	**WS4 0.65**	**WS5 0.7**	**WS6 0.3**	**WS7 0.7**	**WS7 1.8**	**WS7 2.15**	**HP A 0.25**
Depth				**0.4**	**0.65**	**0.7**	**0.3**	**0.7**	**1.8**	**2.15**	**0.25**
Date Sampled				**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
Type				**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**							
Arsenic	T6	M40	2	mg/kg	**11**	**9**	**11**	**11**	**9**	**71**	**140**	**13**
Barium	T6	M40	1	mg/kg	**150**	**150**	**82**	**120**	**91**	**910**	**540**	**140**
Beryllium	T6	M40	2	mg/kg	<2	<2	<2	<2	<2	**20**	**25**	<2
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	**4**	**7**	<1
Chromium	T6	M40	1	mg/kg	**17**	**16**	**12**	**17**	**13**	**23**	**38**	**17**
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	**100**	**36**	**22**	**46**	**36**	**170**	**22000**	**620**
Lead	T6	M40	1	mg/kg	**74**	**100**	**55**	**140**	**78**	**310**	**450**	**120**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**22**	**19**	**16**	**22**	**17**	**180**	**240**	**23**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3	<3	<3
Vanadium	T6	M40	1	mg/kg	**31**	**25**	**21**	**25**	**21**	**90**	**110**	**21**
Zinc	T6	M40	1	mg/kg	**150**	**310**	**200**	**230**	**170**	**1900**	**7800**	**350**

SAL Reference: 259230
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Customer Reference:

Soil Analysed as Soil
Miscellaneous

SAL Reference					**259230 001**	**259230 003**	**259230 005**	**259230 008**	**259230 011**	**259230 014**	**259230 019**	**259230 020**	**259230 021**
Customer Sample Reference					**HP06 0.1**	**HP07 0.7**	**HP08 0.5**	**HP 11 0.1**	**HP12 0.5**	**HP14 0.5**	**HP18 0.4**	**HP19 0.2**	**HP20 0.4**
Depth					**0.1**	**0.7**	**0.5**	**0.1**	**0.5**	**0.5**	**0.4**	**0.2**	**0.4**
Date Sampled					**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
Type					**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**									
pH	T7	AR			-	**7.9**	**8.1**	-	-	-	-	-	**7.8**
Soil Organic Matter	T287	M40	0.1	%	**6.1**	**11**	-	**2.3**	**6.4**	**4.1**	**2.7**	**0.7**	**7.7**
SO4(Total)	T6	M40	0.01	%	-	**0.15**	**0.15**	-	-	-	-	-	**0.28**

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
Miscellaneous

SAL Reference					**259230 022**	**259230 023**	**259230 024**	**259230 026**	**259230 033**	**259230 035**	**259230 036**	**259230 039**	**259230 040**
Customer Sample Reference					**HP21 0.1**	**HP21 0.2**	**HP22 0.25**	**HP23 0.45**	**WS2 0.2(SOIL)**	**WS2 1.7**	**WS3 0.4**	**WS4 0.65**	**WS4 1.4**
Depth					**0.1**	**0.2**	**0.25**	**0.45**	**0.2**	**1.7**	**0.4**	**0.65**	**1.4**
Date Sampled					**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
Type					**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**									
pH	T7	AR			-	-	-	-	-	**7.4**	-	**7.5**	**7.4**
Soil Organic Matter	T287	M40	0.1	%	**1.8**	**0.9**	**3.9**	**2.4**	**5.5**	-	**1.9**	**4.2**	-
SO4(Total)	T6	M40	0.01	%	-	-	-	-	-	**0.11**	-	**0.12**	**0.01**

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
Miscellaneous

	SAL Reference	259230 042	259230 045	259230 046	259230 047	259230 048	259230 050
	Customer Sample Reference	WS5 0.7	WS6 1.5	WS7 0.7	WS7 1.8	WS7 2.15	HP A 0.25
	Depth	0.7	1.5	0.7	1.8	2.15	0.25
	Date Sampled	Deviating	Deviating	Deviating	Deviating	Deviating	Deviating
	Type	Sand	Sand	Sand	Sand	Sand	Sand
Determinand	Method / Test Sample / LOD / Units						
Ammonia expressed as NH3	T22 / AR / 5 / mg/kg	-	-	-	-	<5	-
Cyanide(Complex)	T85 / AR / 1 / mg/kg	-	-	-	-	<1	-
Cyanide(Total)	T546 / AR / 1 / mg/kg	-	-	-	-	<1	-
Cyanide(free)	T546 / AR / 1 / mg/kg	-	-	-	-	<1	-
pH	T7 / AR	-	7.4	-	7.6	-	-
Soil Organic Matter	T287 / M40 / 0.1 / %	1.2	-	1.5	(IS) -	23	8.6
SO4(Total)	T6 / M40 / 0.01 / %	-	0.03	-	0.50	-	-
(Water Soluble) SO4(2:1) expressed as SO4	T242 / AR / 10 / mg/l	-	-	-	-	1400	-
Sulphur (elemental)	T17 / M40 / 20 / mg/kg	-	-	-	-	90	-

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
Asbestos

	SAL Reference	259230 005	259230 011	259230 021	259230 024	259230 026
	Customer Sample Reference	HP08 0.5	HP12 0.5	HP20 0.4	HP22 0.25	HP23 0.45
	Depth	0.5	0.5	0.4	0.25	0.45
	Date Sampled	Deviating	Deviating	Deviating	Deviating	Deviating
	Type	Sand	Sand	Sand	Sand	Sand
Determinand	Method / Test Sample / LOD / Units					
Asbestos ID	T27 / AR	N.D.	N.D.	N.D.	N.D.	N.D.

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
Asbestos

	SAL Reference	259230 032	259230 033	259230 036	259230 039	259230 047
	Customer Sample Reference	WS2 0.2(PACM)	WS2 0.2(SOIL)	WS3 0.4	WS4 0.65	WS7 1.8
	Depth	0.2	0.2	0.4	0.65	1.8
	Date Sampled	Deviating	Deviating	Deviating	Deviating	Deviating
	Type		Sand	Sand	Sand	Sand
Determinand	Method / Test Sample / LOD / Units					
Asbestos ID	T27 / AR	Amosite Detected - Chrysotile Detected -	N.D.	N.D.	N.D.	N.D.

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
PAH US EPA 16 (B and K split)

				SAL Reference	**259230 001**	**259230 003**	**259230 005**	**259230 007**	**259230 009**	**259230 011**	**259230 013**	**259230 014**	**259230 018**	**259230 019**
				Customer Sample Reference	**HP06 0.1**	**HP07 0.7**	**HP08 0.5**	**HP010 0.3**	**HP11 0.45**	**HP12 0.5**	**HP13 0.4**	**HP14 0.5**	**HP17 0.15**	**HP18 0.4**
				Depth	**0.1**	**0.7**	**0.5**	**0.3**	**0.45**	**0.5**	**0.4**	**0.5**	**0.15**	**0.4**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**										
Naphthalene	T207	M105	0.1	mg/kg	<0.1	**0.4**	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	**0.3**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	**0.4**	**3.0**	**0.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	**0.2**	**2.2**	**0.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	**0.7**	**5.0**	**39**	**4.1**	**0.2**	**0.5**	**0.4**	**0.5**	**0.1**	<0.1
Anthracene	T207	M105	0.1	mg/kg	**0.2**	**1.4**	**6.3**	**0.9**	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	**3.0**	**18**	**46**	**6.2**	**0.6**	**2.0**	**1.1**	**0.8**	**0.4**	**0.2**
Pyrene	T207	M105	0.1	mg/kg	**2.9**	**16**	**35**	**5.4**	**0.5**	**1.9**	**1.0**	**0.7**	**0.3**	**0.2**
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	**1.1**	**8.3**	**15**	**1.3**	**0.3**	**1.0**	**0.4**	**0.4**	**0.2**	<0.1
Chrysene	T207	M105	0.1	mg/kg	**1.8**	**10**	**16**	**1.9**	**0.4**	**1.4**	**0.7**	**0.4**	**0.2**	**0.1**
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	**2.2**	**15**	**15**	**1.8**	**0.5**	**1.2**	**0.7**	**0.5**	**0.2**	**0.1**
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	**0.7**	**4.9**	**5.0**	**0.6**	**0.2**	**0.4**	**0.2**	**0.2**	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	**1.7**	**11**	**11**	**1.4**	**0.3**	**0.9**	**0.5**	**0.3**	**0.2**	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	**1.0**	**8.5**	**7.6**	**0.9**	**0.2**	**0.8**	**0.4**	**0.2**	**0.1**	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	**0.5**	**2.9**	**3.4**	**0.3**	<0.1	**0.3**	**0.2**	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	**1.3**	**9.8**	**7.4**	**1.0**	**0.2**	**0.9**	**0.6**	**0.2**	**0.1**	<0.1
PAH(total)	T207	M105	0.1	mg/kg	-	**110**	-	**27**	**3.4**	-	**6.2**	**4.2**	-	**0.6**
PAH(total)	T16	M105	0.1	mg/kg	**17**	-	**210**	-	-	**12**	-	-	**1.8**	-

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
PAH US EPA 16 (B and K split)

				SAL Reference	**259230 021**	**259230 022**	**259230 023**	**259230 024**	**259230 026**	**259230 033**	**259230 036**	**259230 039**	**259230 042**	**259230 046**
				Customer Sample Reference	**HP20 0.4**	**HP21 0.1**	**HP21 0.2**	**HP22 0.25**	**HP23 0.45**	**WS2 0.2(SOIL)**	**WS3 0.4**	**WS4 0.65**	**WS5 0.7**	**WS7 0.7**
				Depth	**0.4**	**0.1**	**0.2**	**0.25**	**0.45**	**0.2**	**0.4**	**0.65**	**0.7**	**0.7**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**										
Naphthalene	T207	M105	0.1	mg/kg	**0.4**	<0.1	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	**0.2**	<0.1	<0.1	<0.1	<0.1	**0.2**	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	**0.1**	**0.2**	<0.1	<0.1	<0.1	**0.7**	<0.1	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	**0.7**	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	**2.6**	**1.9**	**0.3**	**0.7**	**0.1**	**11**	<0.1	**0.3**	**0.2**	**0.6**
Anthracene	T207	M105	0.1	mg/kg	**0.7**	**0.5**	<0.1	**0.2**	<0.1	**3.5**	<0.1	<0.1	<0.1	**0.1**
Fluoranthene	T207	M105	0.1	mg/kg	**13**	**5.2**	**1.0**	**3.0**	**0.2**	**18**	<0.1	**0.7**	**0.8**	**1.0**
Pyrene	T207	M105	0.1	mg/kg	**13**	**4.5**	**0.9**	**2.9**	**0.2**	**14**	<0.1	**0.6**	**0.9**	**0.8**
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	**5.8**	**1.5**	**0.4**	**1.2**	<0.1	**7.5**	<0.1	**0.3**	**0.4**	**0.5**
Chrysene	T207	M105	0.1	mg/kg	**6.8**	**2.1**	**0.5**	**1.8**	**0.1**	**8.6**	<0.1	**0.3**	**0.5**	**0.6**
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	**7.8**	**2.1**	**0.7**	**2.0**	**0.1**	**8.4**	<0.1	**0.4**	**0.7**	**0.7**
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	**2.6**	**0.7**	**0.2**	**0.7**	<0.1	**2.8**	<0.1	**0.1**	**0.3**	**0.2**
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	**6.2**	**1.5**	**0.5**	**1.7**	<0.1	**6.1**	<0.1	**0.2**	**0.6**	**0.6**
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	**3.8**	**0.9**	**0.3**	**1.1**	<0.1	**4.0**	<0.1	**0.2**	**0.4**	**0.4**
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	**1.7**	**0.4**	**0.1**	**0.4**	<0.1	**1.5**	<0.1	<0.1	**0.2**	**0.1**
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	**4.0**	**1.0**	**0.3**	**1.3**	<0.1	**4.1**	<0.1	**0.2**	**0.4**	**0.4**
PAH(total)	T207	M105	0.1	mg/kg	-	**23**	**5.2**	**17**	**0.7**	-	<0.1	-	**5.4**	**6.0**
PAH(total)	T16	M105	0.1	mg/kg	**69**	-	-	-	-	**91**	-	**3.3**	-	-

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
PAH US EPA 16 (B and K split)

				SAL Reference	**259230 047**	**259230 048**
				Customer Sample Reference	**WS7 1.8**	**WS7 2.15**
				Depth	**1.8**	**2.15**
				Date Sampled	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Naphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	<0.1	**0.2**
Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	**0.1**	**0.3**
Pyrene	T207	M105	0.1	mg/kg	**0.1**	**0.2**
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	**0.2**	<0.1
Chrysene	T207	M105	0.1	mg/kg	**0.2**	**0.2**
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	**0.2**	**0.2**
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	**0.1**	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	**0.1**	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	**0.2**	<0.1
PAH(total)	T16	M105	0.1	mg/kg	**1.2**	**1.1**

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
Total Petroleum Hydrocarbons CWG

				SAL Reference	**259230 001**	**259230 021**	**259230 039**	**259230 048**
				Customer Sample Reference	**HP06 0.1**	**HP20 0.4**	**WS4 0.65**	**WS7 2.15**
				Depth	**0.1**	**0.4**	**0.65**	**2.15**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**				
Benzene	T209	M105	10	µg/kg	<10	<10	<10	(2) <20
Toluene	T209	M105	10	µg/kg	<10	<10	<10	(2) <20
EthylBenzene	T209	M105	10	µg/kg	<10	<10	<10	(2) <20
M/P Xylene	T209	M105	10	µg/kg	<10	<10	<10	(2) <20
O Xylene	T209	M105	10	µg/kg	<10	<10	<10	(2) <20
Methyl tert-Butyl Ether	T209	M105	10	µg/kg	<10	<10	<10	<20
TPH (C5-C6 aliphatic)	T209	M105	0.100	mg/kg	<0.100	<0.100	<0.100	(2) <0.200
TPH (C6-C8 aliphatic)	T209	M105	0.100	mg/kg	<0.100	<0.100	<0.100	(2) <0.200
TPH (C8-C10 aliphatic)	T209	M105	0.100	mg/kg	<0.100	<0.100	<0.100	(2) <0.200
TPH (C10-C12 aliphatic)	T206	M105	1	mg/kg	(9) <10	(9) <10	<1	<1
TPH (C12-C16 aliphatic)	T206	M105	2	mg/kg	(9) <10	(9) <10	<2	<2
TPH (C16-C21 aliphatic)	T206	M105	1	mg/kg	(9) <10	**12**	**1**	**1**
TPH (C21-C35 aliphatic)	T206	M105	4	mg/kg	(9) <10	**52**	<4	**7**
TPH (C6-C7 aromatic)	T209	M105	0.100	mg/kg	<0.100	<0.100	<0.100	(2) <0.200
TPH (C7-C8 aromatic)	T209	M105	0.100	mg/kg	<0.100	<0.100	<0.100	(2) <0.200
TPH (C8-C10 aromatic)	T209	M105	0.100	mg/kg	<0.100	<0.100	<0.100	(2) <0.200
TPH (C10-C12 aromatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	<1	<1
TPH (C12-C16 aromatic)	T8	M105	1	mg/kg	(9) <10	(9) <10	<1	<1
TPH (C16-C21 aromatic)	T206	M105	1	mg/kg	**18**	**40**	**4**	**2**
TPH (C21-C35 aromatic)	T206	M105	1	mg/kg	**50**	**150**	**10**	**7**

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
Semi-Volatile Organic Compounds (USEPA 625)

				SAL Reference	**259230 001**	**259230 005**	**259230 011**	**259230 018**	**259230 021**	**259230 033**	**259230 039**	**259230 047**	**259230 048**
				Customer Sample Reference	**HP06 0.1**	**HP08 0.5**	**HP12 0.5**	**HP17 0.15**	**HP20 0.4**	**WS2 0.2(SOIL)**	**WS4 0.65**	**WS7 1.8**	**WS7 2.15**
				Depth	**0.1**	**0.5**	**0.5**	**0.15**	**0.4**	**0.2**	**0.65**	**1.8**	**2.15**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**									
1,2,4-Trichlorobenzene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,5-Trichlorophenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,6-Trichlorophenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4-Dichlorophenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4-Dimethylphenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4-Dinitrophenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4-Dinitrotoluene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,6-Dinitrotoluene	T207	M105	0.1	mg/kg	**0.9**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Chloronaphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Chlorophenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methyl phenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	**0.2**	**0.1**	<0.1	<0.1	<0.1
2-Nitroaniline	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Nitrophenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3-Nitroaniline	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3/4-Methylphenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Bromophenyl phenylether	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Chloro-3-methylphenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Chloroaniline	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Chlorophenyl phenylether	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Nitroaniline	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Nitrophenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	**3.0**	<0.1	<0.1	**0.1**	**0.7**	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	**0.2**	<0.1	<0.1	**0.2**	**0.2**	<0.1	<0.1	<0.1
Anthracene	T207	M105	0.1	mg/kg	**0.2**	**6.3**	**0.1**	<0.1	**0.7**	**3.5**	<0.1	<0.1	<0.1
Azobenzene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	**1.1**	**15**	**1.0**	**0.2**	**5.8**	**7.5**	**0.3**	**0.2**	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	**1.7**	**11**	**0.9**	**0.2**	**6.2**	**6.1**	**0.2**	**0.1**	<0.1
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	**3.0**	**20**	**1.6**	**0.3**	**10**	**11**	**0.5**	**0.3**	**0.2**
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	**1.3**	**7.4**	**0.9**	**0.1**	**4.0**	**4.1**	**0.2**	**0.2**	<0.1
Bis (2-chloroethoxy) methane	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bis (2-chloroethyl) ether	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bis (2-chloroisopropyl) ether	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bis (2-ethylhexyl)phthalate	T207	M105	0.1	mg/kg	**0.2**	<0.1	**0.2**	**0.4**	<0.1	<0.1	<0.1	<0.1	<0.1
Butyl benzylphthalate	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbazole	T207	M105	0.1	mg/kg	<0.1	**3.1**	<0.1	<0.1	**0.2**	**1.9**	<0.1	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	**1.8**	**16**	**1.4**	**0.2**	**6.8**	**8.6**	**0.3**	**0.2**	**0.2**
Di-n-butylphthalate	T207	M105	0.1	mg/kg	**0.2**	<0.1	**0.1**	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1
Di-n-octylphthalate	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	**0.5**	**3.4**	**0.3**	<0.1	**1.7**	**1.5**	<0.1	<0.1	<0.1
Dibenzofuran	T207	M105	0.1	mg/kg	<0.1	**1.5**	<0.1	<0.1	**0.2**	**0.6**	<0.1	<0.1	<0.1
Diethyl phthalate	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethyl phthalate	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	**3.0**	**46**	**2.0**	**0.4**	**13**	**18**	**0.7**	**0.1**	**0.3**
Fluorene	T207	M105	0.1	mg/kg	<0.1	**2.2**	<0.1	<0.1	<0.1	**0.7**	<0.1	<0.1	<0.1
Hexachlorobenzene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorobutadiene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorocyclopentadiene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachloroethane	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	**1.0**	**7.6**	**0.8**	**0.1**	**3.8**	**4.0**	**0.2**	**0.1**	<0.1
Isophorone	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1	**0.1**	<0.1	**0.4**	**0.1**	<0.1	<0.1	<0.1
Nitrobenzene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pentachlorophenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil

Semi-Volatile Organic Compounds (USEPA 625)

				SAL Reference	**259230 001**	**259230 005**	**259230 011**	**259230 018**	**259230 021**	**259230 033**	**259230 039**	**259230 047**	**259230 048**
				Customer Sample Reference	**HP06 0.1**	**HP08 0.5**	**HP12 0.5**	**HP17 0.15**	**HP20 0.4**	**WS2 0.2(SOIL)**	**WS4 0.65**	**WS7 1.8**	**WS7 2.15**
				Depth	**0.1**	**0.5**	**0.5**	**0.15**	**0.4**	**0.2**	**0.65**	**1.8**	**2.15**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**									
Phenanthrene	T207	M105	0.1	mg/kg	**0.7**	**39**	**0.5**	**0.1**	**2.6**	**11**	**0.3**	<0.1	**0.2**
Phenol	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	T207	M105	0.1	mg/kg	**2.9**	**35**	**1.9**	**0.3**	**13**	**14**	**0.6**	**0.1**	**0.2**

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Soil Analysed as Soil
Volatile Organic Compounds (USEPA 624) (MCERTS)

				SAL Reference	**259230 001**	**259230 005**	**259230 021**	**259230 039**	**259230 048**
				Customer Sample Reference	**HP06 0.1**	**HP08 0.5**	**HP20 0.4**	**WS4 0.65**	**WS7 2.15**
				Depth	**0.1**	**0.5**	**0.4**	**0.65**	**2.15**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
1,1,1,2-Tetrachloroethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,1,1-Trichloroethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,1,2,2-Tetrachloroethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,1,2-Trichloroethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,1-Dichloroethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,1-Dichloroethylene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,1-Dichloropropene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,2,3-Trichloropropane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,2,4-Trimethylbenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,2-dibromoethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,2-Dichlorobenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,2-Dichloroethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,2-Dichloropropane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,3,5-Trimethylbenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,3-Dichlorobenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,3-Dichloropropane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
1,4-Dichlorobenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
2,2-Dichloropropane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
2-Chlorotoluene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
4-Chlorotoluene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Benzene	T209	M105	10	µg/kg	<10	<10	<10	<10	(2) <20
Bromobenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Bromochloromethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Bromodichloromethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Bromoform	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Bromomethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Carbon tetrachloride	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Chlorobenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Chlorodibromomethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Chloroethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Chloroform	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Chloromethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Cis-1,2-Dichloroethylene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Cis-1,3-Dichloropropene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Dibromomethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Dichlorodifluoromethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Dichloromethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
EthylBenzene	T209	M105	10	µg/kg	<10	<10	<10	<10	(2) <20
Isopropyl benzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
M/P Xylene	T209	M105	10	µg/kg	<10	<10	<10	<10	(2) <20
n-Propylbenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
O Xylene	T209	M105	10	µg/kg	<10	<10	<10	<10	(2) <20
p-Isopropyltoluene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
S-Butylbenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Styrene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
T-Butylbenzene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Tetrachloroethene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Toluene	T209	M105	10	µg/kg	<10	<10	<10	<10	(2) <20
Trans-1,2-Dichloroethene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Trans-1,3-Dichloropropene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Trichloroethene	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Trichlorofluoromethane	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100
Vinyl chloride	T209	M105	50	µg/kg	<50	<50	<50	<50	(2) <100

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Leachate to BS EN 12457-1 (2:1) Analysed as Water
CLEA Metals

				SAL Reference	**259230 005**	**259230 011**	**259230 021**	**259230 028**	**259230 039**	**259230 047**
				Customer Sample Reference	**HP08 0.5**	**HP12 0.5**	**HP20 0.4**	**HP24 0.6**	**WS4 0.65**	**WS7 1.8**
				Depth	**0.5**	**0.5**	**0.4**	**0.6**	**0.65**	**1.8**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**						
As (Dissolved)	T281	2:1	0.2	µg/l	**6.2**	**5.6**	**7.2**	**2.2**	**4.3**	**5.7**
Ba (Dissolved)	T281	2:1	1	µg/l	**22**	**61**	**89**	**20**	**30**	**68**
Be (Dissolved)	T281	2:1	0.05	µg/l	**0.09**	**0.08**	**0.08**	**0.07**	**0.11**	**0.10**
Boron	T6	2:1	0.01	mg/l	**0.01**	**0.05**	**0.13**	**0.02**	**0.32**	**0.33**
Cd (Dissolved)	T281	2:1	0.02	µg/l	**0.09**	**0.16**	**0.23**	**0.11**	**0.25**	**0.22**
Cr (Dissolved)	T281	2:1	1	µg/l	**25**	**6**	**8**	**5**	**6**	**10**
Chromium VI	T4	2:1	50	µg/l	<50	<50	<50	<50	<50	<50
Cu (Dissolved)	T281	2:1	0.5	µg/l	**5.9**	**8.8**	**6.5**	**5.3**	**12**	**3.5**
Pb (Dissolved)	T281	2:1	0.3	µg/l	**5.9**	**2.5**	**2.3**	**2.5**	**2.0**	**2.4**
Hg (Dissolved)	T281	2:1	0.05	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ni (Dissolved)	T281	2:1	1	µg/l	**3**	**6**	**11**	**2**	**5**	**6**
Se (Dissolved)	T281	2:1	0.5	µg/l	**0.8**	**1.3**	**2.4**	**0.8**	**2.0**	**7.1**
V (Dissolved)	T281	2:1	2	µg/l	**4**	**3**	**10**	<2	**6**	**11**
Zn (Dissolved)	T281	2:1	2	µg/l	**5**	**20**	**33**	**4**	**11**	**130**

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Leachate to BS EN 12457-1 (2:1) Analysed as Water
TPH

				SAL Reference	**259230 005**	**259230 011**	**259230 021**	**259230 039**	**259230 047**
				Customer Sample Reference	**HP08 0.5**	**HP12 0.5**	**HP20 0.4**	**WS4 0.65**	**WS7 1.8**
				Depth	**0.5**	**0.5**	**0.4**	**0.65**	**1.8**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
TPH (C5-C10)	T54	2:1	10	µg/l	<10	<10	<10	<10	<10

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Leachate to BS EN 12457-1 (2:1) Analysed as Water
PAH US EPA 16 (B and K split)

				SAL Reference	**259230 005**	**259230 011**	**259230 021**	**259230 039**	**259230 047**
				Customer Sample Reference	**HP08 0.5**	**HP12 0.5**	**HP20 0.4**	**WS4 0.65**	**WS7 1.8**
				Depth	**0.5**	**0.5**	**0.4**	**0.65**	**1.8**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Naphthalene	T149	2:1	0.01	µg/l	(100) <0.02	(100) <0.02	(100) <0.02	(100) <0.02	(100) <0.05
Acenaphthylene	T149	2:1	0.01	µg/l	**0.06**	(100) <0.02	(100) <0.02	(100) <0.02	(100) <0.05
Acenaphthene	T149	2:1	0.01	µg/l	**0.05**	(100) <0.02	**0.03**	(100) <0.02	(100) <0.05
Fluorene	T149	2:1	0.01	µg/l	**0.03**	(100) <0.02	(100) <0.02	(100) <0.02	(100) <0.05
Phenanthrene	T149	2:1	0.01	µg/l	**0.44**	(100) <0.02	(100) <0.02	**0.07**	(100) <0.05
Anthracene	T149	2:1	0.01	µg/l	**0.14**	(100) <0.02	(100) <0.02	(100) <0.02	(100) <0.05
Fluoranthene	T149	2:1	0.01	µg/l	**2.1**	**0.06**	**0.04**	**0.10**	(100) <0.05
Pyrene	T149	2:1	0.01	µg/l	**2.1**	**0.07**	**0.03**	**0.12**	(100) <0.05
Benzo(a)Anthracene	T149	2:1	0.01	µg/l	**1.3**	**0.04**	(100) <0.02	**0.07**	(100) <0.05
Chrysene	T149	2:1	0.01	µg/l	**1.8**	**0.07**	(100) <0.02	**0.08**	(100) <0.05
Benzo(b)fluoranthene	T149	2:1	0.01	µg/l	**1.6**	**0.07**	(100) <0.02	**0.07**	(100) <0.05
Benzo(k)fluoranthene	T149	2:1	0.01	µg/l	**2.5**	**0.09**	(100) <0.02	**0.10**	(100) <0.05
Benzo(a)Pyrene	T149	2:1	0.01	µg/l	**2.8**	**0.10**	(100) <0.02	**0.08**	(100) <0.05
Indeno(123-cd)Pyrene	T149	2:1	0.01	µg/l	**2.0**	**0.11**	(100) <0.02	**0.10**	(100) <0.05
Dibenzo(ah)Anthracene	T149	2:1	0.01	µg/l	**0.80**	**0.04**	(100) <0.02	**0.03**	(100) <0.05
Benzo(ghi)Perylene	T149	2:1	0.01	µg/l	**1.9**	**0.14**	(100) <0.02	**0.13**	(100) <0.05
PAH(total)	T149	2:1	0.01	µg/l	**20**	**0.79**	**0.10**	**0.95**	(100) <0.05

SAL Reference: 259230
Project Site: Hunter Rd
Customer Reference:

Leachate to BS EN 12457-1 (2:1) Analysed as Water
Volatile Organic Compounds (USEPA 624)

				SAL Reference	**259230 005**	**259230 011**	**259230 021**	**259230 039**	**259230 047**
				Customer Sample Reference	**HP08 0.5**	**HP12 0.5**	**HP20 0.4**	**WS4 0.65**	**WS7 1.8**
				Depth	**0.5**	**0.5**	**0.4**	**0.65**	**1.8**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
				Type	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
1,1,1,2-Tetrachloroethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,1,1-Trichloroethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,1,2-Trichloroethylene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,1-Dichloroethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,1-Dichloroethylene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,1-Dichloropropene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,2,3-Trichloropropane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,2,4-Trimethylbenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,2-dibromoethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,2-Dichloroethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,2-Dichloropropane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,3,5-Trimethylbenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,3-Dichloropropane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
2,2-Dichloropropane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
2-Chlorotoluene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
4-Chlorotoluene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Benzene	T54	2:1	1	µg/l	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1
Bromobenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Bromochloromethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Bromodichloromethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Bromoform	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Bromomethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Carbon tetrachloride	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Chlorobenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Chlorodibromomethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Chloroethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Chloroform	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Chloromethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Cis-1,2-Dichloroethylene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Cis-1,3-Dichloropropene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Dibromomethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Dichlorodifluoromethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Dichloromethane	T54	2:1	50	µg/l	<50	<50	<50	<50	<50
EthylBenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Isopropyl benzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
M/P Xylene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
n-Propylbenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
O Xylene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
p-Isopropyltoluene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
S-Butylbenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Styrene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
T-Butylbenzene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Tetrachloroethene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Toluene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Trans-1,2-Dichloroethene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Trans-1,3-Dichloropropene	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Trichlorofluoromethane	T54	2:1	1	µg/l	<1	<1	<1	<1	<1
Vinyl chloride	T54	2:1	1	µg/l	<1	<1	<1	<1	<1

Index to symbols used in 259230-1

Value	Description
AR	As Received
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
2:1	Leachate to BS EN 12457-1 (2:1)
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
N.D.	Not Detected
13	Results have been blank corrected.
2	LOD Raised Due to Matrix Interference
100	LOD determined by sample aliquot used for analysis
9	LOD raised due to dilution of sample
IS	Insufficient Sample
W	Analysis was performed at another SAL laboratory
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

The date of sampling has not been provided and therefore the time from sampling to analysis is unknown. It is possible therefore that the results provided may be compromised

Method Index

Value	Description
T287	Calc TOC/0.58
T6	ICP/OES
T162	Grav (1 Dec) (105 C)
T54	GC/MS (Headspace)
T4	Colorimetry
T7	Probe
T207	GC/MS(MCERTS)
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T546	Colorimetry (CF)
T17	HPLC
T277	Grav (1 Dec) (40 C)
T27	PLM
T149	GC/MS (SIR)
T209	GC/MS(Head Space)(MCERTS)
T281	ICP/MS (Filtered)
T206	GC/FID (MCERTS)
T8	GC/FID
T16	GC/MS
T85	Calc
T22	Titration

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Ammonia expressed as NH3	T22	AR	5	mg/kg	N	048
Cyanide(Complex)	T85	AR	1	mg/kg	N	048
Cyanide(Total)	T546	AR	1	mg/kg	M	048
Cyanide(free)	T546	AR	1	mg/kg	M	048
pH	T7	AR			M	003,005,021,035,039-040,045,047
Soil Organic Matter	T287	M40	0.1	%	N	001,003,008,011,014,019-024,026,033,036,039,042,046-048,050
SO4(Total)	T6	M40	0.01	%	N	003,005,021,035,039-040,045,047
(Water Soluble) SO4(2:1) expressed as SO4	T242	AR	10	mg/l	N	048
Sulphur (elemental)	T17	M40	20	mg/kg	WM	048
TPH (C5-C10)	T54	2:1	10	µg/l	N	005,011,021,039,047
As (Dissolved)	T281	2:1	0.2	µg/l	U	005,011,021,028,039,047
Ba (Dissolved)	T281	2:1	1	µg/l	U	005,011,021,028,039,047
Be (Dissolved)	T281	2:1	0.05	µg/l	U	005,011,021,028,039,047
Boron	T6	2:1	0.01	mg/l	N	005,011,021,028,039,047
Cd (Dissolved)	T281	2:1	0.02	µg/l	U	005,011,021,028,039,047
Cr (Dissolved)	T281	2:1	1	µg/l	U	005,011,021,028,039,047

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Chromium VI	T4	2:1	50	µg/l	N	005,011,021,028,039,047
Cu (Dissolved)	T281	2:1	0.5	µg/l	U	005,011,021,028,039,047
Pb (Dissolved)	T281	2:1	0.3	µg/l	U	005,011,021,028,039,047
Hg (Dissolved)	T281	2:1	0.05	µg/l	U	005,011,021,028,039,047
Ni (Dissolved)	T281	2:1	1	µg/l	U	005,011,021,028,039,047
Se (Dissolved)	T281	2:1	0.5	µg/l	U	005,011,021,028,039,047
V (Dissolved)	T281	2:1	2	µg/l	U	005,011,021,028,039,047
Zn (Dissolved)	T281	2:1	2	µg/l	U	005,011,021,028,039,047
Arsenic	T6	M40	2	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Barium	T6	M40	1	mg/kg	U	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Beryllium	T6	M40	2	mg/kg	U	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Boron (water-soluble)	T6	AR	1	mg/kg	N	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Cadmium	T6	M40	1	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Chromium	T6	M40	1	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Chromium VI	T6	AR	1	mg/kg	N	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Copper	T6	M40	1	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Lead	T6	M40	1	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Mercury	T6	M40	1	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Nickel	T6	M40	1	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Selenium	T6	M40	3	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Vanadium	T6	M40	1	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Zinc	T6	M40	1	mg/kg	M	001,003,005,007-009,011,014,017-024,026,028-029,033,036,039,042,044,046-048,050
Moisture	T277	AR	0.1	%	N	001,003,005,007-009,011,013-014,017-024,026,028-029,033,035-036,039-040,042,044-048,050
Moisture @ 105 C	T162	AR	0.1	%	N	001,003,005,007-009,011,013-014,017-024,026,028-029,033,035-036,039-040,042,044-048,050
Naphthalene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Acenaphthylene	T207	M105	0.1	mg/kg	U	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Acenaphthene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Fluorene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Fluoranthene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Chrysene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
PAH(total)	T207	M105	0.1	mg/kg	U	003,007,009,013-014,019,022-024,026,036,042,046
PAH(total)	T16	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Naphthalene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Acenaphthylene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Acenaphthene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Fluorene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Phenanthrene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Anthracene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Fluoranthene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Pyrene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Benzo(a)Anthracene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Chrysene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Benzo(b)fluoranthene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Benzo(k)fluoranthene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Benzo(a)Pyrene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Indeno(123-cd)Pyrene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Dibenzo(ah)Anthracene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
Benzo(ghi)Perylene	T149	2:1	0.01	µg/l	U	005,011,021,039,047
PAH(total)	T149	2:1	0.01	µg/l	U	005,011,021,039,047
1,2,4-Trichlorobenzene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
1,2-Dichlorobenzene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
1,3-Dichlorobenzene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
1,4-Dichlorobenzene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
2,4,5-Trichlorophenol	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
2,4,6-Trichlorophenol	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
2,4-Dichlorophenol	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
2,4-Dimethylphenol	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
2,4-Dinitrophenol	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
2,4-Dinitrotoluene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
2,6-Dinitrotoluene	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
2-Chloronaphthalene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
2-Chlorophenol	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
2-methyl phenol	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
2-Methylnaphthalene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
2-Nitroaniline	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
2-Nitrophenol	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
3-Nitroaniline	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
3/4-Methylphenol	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
4-Bromophenyl phenylether	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
4-Chloro-3-methylphenol	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
4-Chloroaniline	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
4-Chlorophenyl phenylether	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
4-Nitroaniline	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
4-Nitrophenol	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Anthracene	T207	M105	0.1	mg/kg	U	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Azobenzene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Bis (2-chloroethoxy) methane	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Bis (2-chloroethyl) ether	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Bis (2-chloroisopropyl) ether	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Bis (2-ethylhexyl)phthalate	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Butyl benzylphthalate	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Carbazole	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Di-n-butylphthalate	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Di-n-octylphthalate	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Dibenzofuran	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Diethyl phthalate	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Dimethyl phthalate	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Hexachlorobenzene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Hexachlorobutadiene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Hexachlorocyclopentadiene	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Hexachloroethane	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Isophorone	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Nitrobenzene	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Pentachlorophenol	T207	M105	0.1	mg/kg	U	001,005,011,018,021,033,039,047-048
Phenanthrene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
Phenol	T207	M105	0.1	mg/kg	M	001,005,011,018,021,033,039,047-048
Pyrene	T207	M105	0.1	mg/kg	M	001,003,005,007,009,011,013-014,018-019,021-024,026,033,036,039,042,046-048
EthylBenzene	T209	M105	10	µg/kg	M	001,005,021,039,048
M/P Xylene	T209	M105	10	µg/kg	M	001,005,021,039,048
Methyl tert-Butyl Ether	T209	M105	10	µg/kg	M	001,021,039,048
TPH (C5-C6 aliphatic)	T209	M105	0.100	mg/kg	N	001,021,039,048
TPH (C6-C8 aliphatic)	T209	M105	0.100	mg/kg	N	001,021,039,048
TPH (C8-C10 aliphatic)	T209	M105	0.100	mg/kg	N	001,021,039,048
TPH (C10-C12 aliphatic)	T206	M105	1	mg/kg	N	001,021,039,048
TPH (C12-C16 aliphatic)	T206	M105	2	mg/kg	N	001,021,039,048
TPH (C16-C21 aliphatic)	T206	M105	1	mg/kg	M	001,021,039,048
TPH (C21-C35 aliphatic)	T206	M105	4	mg/kg	M	001,021,039,048
TPH (C6-C7 aromatic)	T209	M105	0.100	mg/kg	N	001,021,039,048
TPH (C7-C8 aromatic)	T209	M105	0.100	mg/kg	N	001,021,039,048
TPH (C8-C10 aromatic)	T209	M105	0.100	mg/kg	N	001,021,039,048
TPH (C10-C12 aromatic)	T8	M105	1	mg/kg	N	001,021,039,048
TPH (C12-C16 aromatic)	T8	M105	1	mg/kg	N	001,021,039,048
TPH (C16-C21 aromatic)	T206	M105	1	mg/kg	M	001,021,039,048
TPH (C21-C35 aromatic)	T206	M105	1	mg/kg	M	001,021,039,048
1,1,1,2-Tetrachloroethane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,1,1-Trichloroethane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,1,2,2-Tetrachloroethane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,1,2-Trichloroethane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,1,2-Trichloroethylene	T54	2:1	1	µg/l	U	005,011,021,039,047
1,1-Dichloroethane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,1-Dichloroethylene	T54	2:1	1	µg/l	U	005,011,021,039,047
1,1-Dichloropropene	T54	2:1	1	µg/l	U	005,011,021,039,047

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
1,2,3-Trichloropropane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,2,4-Trimethylbenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
1,2-dibromoethane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,2-Dichlorobenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
1,2-Dichloroethane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,2-Dichloropropane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,3,5-Trimethylbenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
1,3-Dichlorobenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
1,3-Dichloropropane	T54	2:1	1	µg/l	U	005,011,021,039,047
1,4-Dichlorobenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
2,2-Dichloropropane	T54	2:1	1	µg/l	U	005,011,021,039,047
2-Chlorotoluene	T54	2:1	1	µg/l	U	005,011,021,039,047
4-Chlorotoluene	T54	2:1	1	µg/l	U	005,011,021,039,047
Benzene	T54	2:1	1	µg/l	U	005,011,021,039,047
Bromobenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
Bromochloromethane	T54	2:1	1	µg/l	U	005,011,021,039,047
Bromodichloromethane	T54	2:1	1	µg/l	U	005,011,021,039,047
Bromoform	T54	2:1	1	µg/l	U	005,011,021,039,047
Bromomethane	T54	2:1	1	µg/l	U	005,011,021,039,047
Carbon tetrachloride	T54	2:1	1	µg/l	U	005,011,021,039,047
Chlorobenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
Chlorodibromomethane	T54	2:1	1	µg/l	U	005,011,021,039,047
Chloroethane	T54	2:1	1	µg/l	U	005,011,021,039,047
Chloroform	T54	2:1	1	µg/l	U	005,011,021,039,047
Chloromethane	T54	2:1	1	µg/l	U	005,011,021,039,047
Cis-1,2-Dichloroethylene	T54	2:1	1	µg/l	U	005,011,021,039,047
Cis-1,3-Dichloropropene	T54	2:1	1	µg/l	U	005,011,021,039,047
Dibromomethane	T54	2:1	1	µg/l	U	005,011,021,039,047
Dichlorodifluoromethane	T54	2:1	1	µg/l	U	005,011,021,039,047
Dichloromethane	T54	2:1	50	µg/l	N	005,011,021,039,047
EthylBenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
Isopropyl benzene	T54	2:1	1	µg/l	U	005,011,021,039,047
M/P Xylene	T54	2:1	1	µg/l	U	005,011,021,039,047
n-Propylbenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
O Xylene	T54	2:1	1	µg/l	U	005,011,021,039,047
p-Isopropyltoluene	T54	2:1	1	µg/l	U	005,011,021,039,047
S-Butylbenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
Styrene	T54	2:1	1	µg/l	U	005,011,021,039,047
T-Butylbenzene	T54	2:1	1	µg/l	U	005,011,021,039,047
Tetrachloroethene	T54	2:1	1	µg/l	U	005,011,021,039,047
Toluene	T54	2:1	1	µg/l	U	005,011,021,039,047
Trans-1,2-Dichloroethene	T54	2:1	1	µg/l	U	005,011,021,039,047
Trans-1,3-Dichloropropene	T54	2:1	1	µg/l	U	005,011,021,039,047
Trichlorofluoromethane	T54	2:1	1	µg/l	U	005,011,021,039,047
Vinyl chloride	T54	2:1	1	µg/l	U	005,011,021,039,047
1,1,1,2-Tetrachloroethane	T209	M105	50	µg/kg	M	001,005,021,039,048
1,1,1-Trichloroethane	T209	M105	50	µg/kg	M	001,005,021,039,048
1,1,2,2-Tetrachloroethane	T209	M105	50	µg/kg	U	001,005,021,039,048
1,1,2-Trichloroethane	T209	M105	50	µg/kg	M	001,005,021,039,048
1,1-Dichloroethane	T209	M105	50	µg/kg	M	001,005,021,039,048
1,1-Dichloroethylene	T209	M105	50	µg/kg	M	001,005,021,039,048
1,1-Dichloropropene	T209	M105	50	µg/kg	M	001,005,021,039,048
1,2,3-Trichloropropane	T209	M105	50	µg/kg	U	001,005,021,039,048
1,2,4-Trimethylbenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
1,2-dibromoethane	T209	M105	50	µg/kg	M	001,005,021,039,048
1,2-Dichlorobenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
1,2-Dichloroethane	T209	M105	50	µg/kg	M	001,005,021,039,048
1,2-Dichloropropane	T209	M105	50	µg/kg	M	001,005,021,039,048
1,3,5-Trimethylbenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
1,3-Dichlorobenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
1,3-Dichloropropane	T209	M105	50	µg/kg	M	001,005,021,039,048
1,4-Dichlorobenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
2,2-Dichloropropane	T209	M105	50	µg/kg	U	001,005,021,039,048
2-Chlorotoluene	T209	M105	50	µg/kg	U	001,005,021,039,048
4-Chlorotoluene	T209	M105	50	µg/kg	U	001,005,021,039,048
Benzene	T209	M105	10	µg/kg	M	001,005,021,039,048
Bromobenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
Bromochloromethane	T209	M105	50	µg/kg	M	001,005,021,039,048
Bromodichloromethane	T209	M105	50	µg/kg	M	001,005,021,039,048
Bromoform	T209	M105	50	µg/kg	M	001,005,021,039,048

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Bromomethane	T209	M105	50	µg/kg	U	001,005,021,039,048
Carbon tetrachloride	T209	M105	50	µg/kg	M	001,005,021,039,048
Chlorobenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
Chlorodibromomethane	T209	M105	50	µg/kg	M	001,005,021,039,048
Chloroethane	T209	M105	50	µg/kg	M	001,005,021,039,048
Chloroform	T209	M105	50	µg/kg	M	001,005,021,039,048
Chloromethane	T209	M105	50	µg/kg	U	001,005,021,039,048
Cis-1,2-Dichloroethylene	T209	M105	50	µg/kg	M	001,005,021,039,048
Cis-1,3-Dichloropropene	T209	M105	50	µg/kg	M	001,005,021,039,048
Dibromomethane	T209	M105	50	µg/kg	M	001,005,021,039,048
Dichlorodifluoromethane	T209	M105	50	µg/kg	M	001,005,021,039,048
Dichloromethane	T209	M105	50	µg/kg	U	001,005,021,039,048
Isopropyl benzene	T209	M105	50	µg/kg	M	001,005,021,039,048
n-Propylbenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
O Xylene	T209	M105	10	µg/kg	M	001,005,021,039,048
p-Isopropyltoluene	T209	M105	50	µg/kg	M	001,005,021,039,048
S-Butylbenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
Styrene	T209	M105	50	µg/kg	U	001,005,021,039,048
T-Butylbenzene	T209	M105	50	µg/kg	M	001,005,021,039,048
Tetrachloroethene	T209	M105	50	µg/kg	M	001,005,021,039,048
Toluene	T209	M105	10	µg/kg	M	001,005,021,039,048
Trans-1,2-Dichloroethene	T209	M105	50	µg/kg	M	001,005,021,039,048
Trans-1,3-Dichloropropene	T209	M105	50	µg/kg	M	001,005,021,039,048
Trichloroethene	T209	M105	50	µg/kg	M	001,005,021,039,048
Trichlorofluoromethane	T209	M105	50	µg/kg	M	001,005,021,039,048
Vinyl chloride	T209	M105	50	µg/kg	M	001,005,021,039,048
Asbestos ID	T27	AR			SU	005,011,021,024,026,032-033,036,039,047

ALcontrol Laboratories

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Manor Road (off Manor Lane)
Hawarden
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Fax: (01244) 528701
email: mkt@alcontrol.com
Website: www.alcontrol.com

Grontmij
Radcliffe House
3rd Floor
Blenheim Court, Lode lane
Solihull
West Midlands
B912AA

Attention: Gareth Taylor

CERTIFICATE OF ANALYSIS

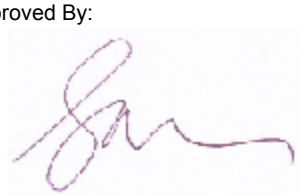
Date:	22 March 2012
Customer:	H_GRONTMIJ_SOL
Sample Delivery Group (SDG):	120311-10
Your Reference:	
Location:	Hinter Road
Report No:	175071

We received 6 samples on Saturday March 10, 2012 and 6 of these samples were scheduled for analysis which was completed on Thursday March 22, 2012. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	120311-10	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	175071
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
5306639	16 KEBLE CLOSE			09/03/2012
5306635	17 HIGH BANK			09/03/2012
5306637	3 HIGH BANK			09/03/2012
5306636	30 TRINITY CLOSE			09/03/2012
5306640	34 A HUNTER ROAD			09/03/2012
5306638	7 HIGH BANK			09/03/2012

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	120311-10	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	175071
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

LIQUID

Results Legend

X Test

N No Determination Possible

			Lab Sample No(s)	5306637	5306638	5306639	5306635	5306636	5306640
			Customer Sample Reference	3 HIGH BANK	7 HIGH BANK	16 KEBLE CLOSE	17 HIGH BANK	30 TRINITY CLOSE	34 A HUNTER ROAD
			AGS Reference						
			Depth (m)						
			Container	1l green glass bottle	1lplastic (ALE221)	1l green glass bottle	1lplastic (ALE221)	1l green glass bottle	1lplastic (ALE221)	1l green glass bottle	1lplastic (ALE221)	1l green glass bottle	1lplastic (ALE221)
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 6			X		X		X	X	X		X
Low Level Cyanide (W)	All	NDPs: 0 Tests: 6		X		X		X		X	X	X	
Mercury Dissolved	All	NDPs: 0 Tests: 6		X		X		X		X	X	X	
PAH Low level*	All	NDPs: 0 Tests: 6		X		X		X		X	X	X	

CERTIFICATE OF ANALYSIS

SDG:	120311-10	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	175071
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Deviating sample.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	34 A HUNTER ROAD	3 HIGH BANK	7 HIGH BANK	17 HIGH BANK	16 KEBLE CLOSE	30 TRINITY CLOSE
			Depth (m)	.	.	.	.	.	.
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	09/03/2012	09/03/2012	09/03/2012	09/03/2012	09/03/2012	09/03/2012
			Date Received	10/03/2012	10/03/2012	10/03/2012	10/03/2012	10/03/2012	10/03/2012
			SDG Ref	120311-10	120311-10	120311-10	120311-10	120311-10	120311-10
			Lab Sample No.(s)	5306640	5306637	5306638	5306635	5306639	5306636
			AGS Reference						
Acenaphthene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (a) anthracene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (a) pyrene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz (a,h) anthracene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno (1,2,3)	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PAH, Total	µg/l	SUB		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Antimony (diss.filt)	<0.16 µg/l	TM152		<0.16 #	<0.16 #	<0.16 #	<0.16 #	<0.16 #	<0.16 #
Arsenic (diss.filt)	<0.12 µg/l	TM152		0.921 #	0.929 #	0.817 #	0.785 #	0.717 #	0.815 #
Boron (diss.filt)	<9.4 µg/l	TM152		27.3 #	27.9 #	26.8 #	27.6 #	26.3 #	28.9 #
Cadmium (diss.filt)	<0.1 µg/l	TM152		<0.1 #	<0.1 #	<0.1 #	<0.1 #	<0.1 #	<0.1 #
Chromium (diss.filt)	<0.22 µg/l	TM152		<0.22 #	<0.22 #	<0.22 #	<0.22 #	<0.22 #	<0.22 #
Copper (diss.filt)	<0.85 µg/l	TM152		11.1 #	57.5 #	13.1 #	15.7 #	23.3 #	102 #
Lead (diss.filt)	<0.02 µg/l	TM152		0.088 #	0.092 #	0.096 #	0.096 #	0.107 #	0.132 #
Nickel (diss.filt)	<0.15 µg/l	TM152		1.02 #	1.7 #	1.08 #	1.46 #	1.06 #	1.25 #
Selenium (diss.filt)	<0.39 µg/l	TM152		0.988 #	1.02 #	1.01 #	1.04 #	0.899 #	0.61 #
Zinc (diss.filt)	<0.41 µg/l	TM152		14.4 #	10.3 #	6.39 #	12.3 #	6.87 #	10.8 #
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #
Cyanide, Total (low level)	<5 µg/l	TM279		<5 § #	<5 § #	<5 § #	<5 § #	<5 #	<5 § #

CERTIFICATE OF ANALYSIS

SDG:	120311-10	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	175071
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Notification of Deviating Samples

Sample Number	Customer Sample Ref.	Depth (m)	Matrix	Test Name	Component Name	Comment
5306643	30 TRINITY CLOSE		LIQUID	Low Level Cyanide (W)	Cyanide, Total (low level)	Sample holding time exceeded
5306646	17 HIGH BANK		LIQUID	Low Level Cyanide (W)	Cyanide, Total (low level)	Sample holding time exceeded
5306650	34 A HUNTER ROAD		LIQUID	Low Level Cyanide (W)	Cyanide, Total (low level)	Sample holding time exceeded
5306654	7 HIGH BANK		LIQUID	Low Level Cyanide (W)	Cyanide, Total (low level)	Sample holding time exceeded
5306662	3 HIGH BANK		LIQUID	Low Level Cyanide (W)	Cyanide, Total (low level)	Sample holding time exceeded

Note : Test results may be compromised

CERTIFICATE OF ANALYSIS

SDG:	120311-10	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	175071
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
SUB		Subcontracted Test		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM279		Determination of Low Level Easily Liberatable (Free) Cyanides and Total Cyanides in Waters using the Skalar SANS+ System Segmented Flow Analyser		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	120311-10	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	175071
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	5306640	5306637	5306638	5306635	5306639	5306636
Customer Sample Ref.	34 A HUNTER ROAD	3 HIGH BANK	7 HIGH BANK	17 HIGH BANK	16 KEBLE CLOSE	30 TRINITY CLOSE
AGS Ref.						
Depth						
Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Dissolved Metals by ICP-MS	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012
Low Level Cyanide (W)	19-Mar-2012	19-Mar-2012	19-Mar-2012	19-Mar-2012	19-Mar-2012	19-Mar-2012
Mercury Dissolved	19-Mar-2012	19-Mar-2012	19-Mar-2012	19-Mar-2012	19-Mar-2012	19-Mar-2012
PAH Low level*	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012

Analytical Services
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F: +44 (0)24 7685 6575

www.stsanalytical.com

Ms Dykes
Alcontrol Laboratories
Units 7 & 8 Hawarden Business Park
Manor Road
Hawarden
Deeside CH5 3US
Cheshire

21 March 2012

Test Report: COV/846301/2012

Dear Ms Dykes

Analysis of your sample(s) submitted on 15 March 2012 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out will be sent under separate cover.

Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using Severn Trent Services and we look forward to receiving your next samples.

Yours Sincerely,

Signed: A I Horobin

Name: A. Horobin

Title: Team Leader

Report Summary

1314
1229
0897
4409

Ms Tracy Dykes
Alcontrol Laboratories
Units 7 & 8 Hawarden Business Park
Manor Road
Hawarden
Deeside
Cheshire

Date of Issue: **21 March 2012**

Report Number: **COV/846301/2012** Issue **1**

Job Description: Ground Water Analysis

Number of Samples included in this report **6**

Job Received: **15 March 2012**

Number of Test Results included in this report **102**

Analysis Commenced: **15 March 2012**

Signed: A I Horobin

Name: **A. Horobin** Date: **21 March 2012**

Title: **Team Leader**

Severn Trent Services was not responsible for sampling unless otherwise stated. Sampling is not covered by our UKAS accreditation.

Information on the methods of analysis and performance characteristics are available on request.
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. The results relate only to the items tested.
Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory.

Certificate of Analysis

1314
1229
0897
4409

SEVERN TRENT SERVICES

Report Number: **COV/846301/2012** Issue **1**
Laboratory Number: **12906879** Sample **1** of **6**

Sample Source: **Alcontrol Laboratories**
Sample Point Description: **Water Analysis**
Sample Description: **5319642 5306638-7 High Bank**
Sample Matrix: **Ground waters**
Sample Date/Time:
Sample Received: **15 March 2012**
Analysis Complete: **21 March 2012**

Test Description	Result	Units	Accreditation	Method
Acenaphthene	<0.01	ug/l	Y Cov	GEO19
Acenaphthylene	<0.01	ug/l	Y Cov	GEO19
Anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (g,h,i) perylene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) pyrene	<0.01	ug/l	Y Cov	GEO19
Benzo (b) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Benzo (k) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Chrysene	<0.01	ug/l	Y Cov	GEO19
Dibenz (a,h) anthracene	<0.01	ug/l	Y Cov	GEO19
Fluoranthene	<0.01	ug/l	Y Cov	GEO19
Fluorene	<0.01	ug/l	Y Cov	GEO19
Indeno (1,2,3) cd pyrene	<0.01	ug/l	Y Cov	GEO19
Naphthalene	<0.01	ug/l	Y Cov	GEO19
Phenanthrene	<0.01	ug/l	Y Cov	GEO19
Pyrene	<0.01	ug/l	Y Cov	GEO19
PAH, Total	<0.01	ug/l	N Cov	GEO19

Analyst Comments for 12906879: The date of sampling has not been provided and therefore sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised. The sample for PAH was received in a container inappropriate for this parameter. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: A I Horobin Name: **A. Horobin** Date: **21 March 2012**
Title: **Team Leader**

Certificate of Analysis

1314
1229
0897
4409

SEVERN TRENT SERVICES

Report Number: **COV/846301/2012** Issue **1**
Laboratory Number: **12906880** Sample **2** of **6**

Sample Source: **Alcontrol Laboratories**
Sample Point Description: **Water Analysis**
Sample Description: **5319656 5306640-34 A Hunter Road**
Sample Matrix: **Ground waters**
Sample Date/Time:
Sample Received: **15 March 2012**
Analysis Complete: **21 March 2012**

Test Description	Result	Units	Accreditation	Method
Acenaphthene	<0.01	ug/l	Y Cov	GEO19
Acenaphthylene	<0.01	ug/l	Y Cov	GEO19
Anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (g,h,i) perylene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) pyrene	<0.01	ug/l	Y Cov	GEO19
Benzo (b) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Benzo (k) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Chrysene	<0.01	ug/l	Y Cov	GEO19
Dibenz (a,h) anthracene	<0.01	ug/l	Y Cov	GEO19
Fluoranthene	<0.01	ug/l	Y Cov	GEO19
Fluorene	<0.01	ug/l	Y Cov	GEO19
Indeno (1,2,3) cd pyrene	<0.01	ug/l	Y Cov	GEO19
Naphthalene	<0.01	ug/l	Y Cov	GEO19
Phenanthrene	<0.01	ug/l	Y Cov	GEO19
Pyrene	<0.01	ug/l	Y Cov	GEO19
PAH, Total	<0.01	ug/l	N Cov	GEO19

Analyst Comments for 12906880: The date of sampling has not been provided and therefore sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised. The sample for PAH was received in a container inappropriate for this parameter. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: A I Horobin Name: **A. Horobin** Date: **21 March 2012**
Title: **Team Leader**

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Certificate of Analysis

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0897
4409

SEVERN TRENT SERVICES

Report Number: **COV/846301/2012** Issue **1**
Laboratory Number: **12906881** Sample **3** of **6**

Sample Source: **Alcontrol Laboratories**
Sample Point Description: **Water Analysis**
Sample Description: **5319698 5306637-3 High Bank**
Sample Matrix: **Ground waters**
Sample Date/Time:
Sample Received: **15 March 2012**
Analysis Complete: **21 March 2012**

Test Description	Result	Units	Accreditation	Method
Acenaphthene	<0.01	ug/l	Y Cov	GEO19
Acenaphthylene	<0.01	ug/l	Y Cov	GEO19
Anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (g,h,i) perylene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) pyrene	<0.01	ug/l	Y Cov	GEO19
Benzo (b) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Benzo (k) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Chrysene	<0.01	ug/l	Y Cov	GEO19
Dibenz (a,h) anthracene	<0.01	ug/l	Y Cov	GEO19
Fluoranthene	<0.01	ug/l	Y Cov	GEO19
Fluorene	<0.01	ug/l	Y Cov	GEO19
Indeno (1,2,3) cd pyrene	<0.01	ug/l	Y Cov	GEO19
Naphthalene	<0.01	ug/l	Y Cov	GEO19
Phenanthrene	<0.01	ug/l	Y Cov	GEO19
Pyrene	<0.01	ug/l	Y Cov	GEO19
PAH, Total	<0.01	ug/l	N Cov	GEO19

Analyst Comments for 12906881: The date of sampling has not been provided and therefore sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised. The sample for PAH was received in a container inappropriate for this parameter. It is therefore possible that the results provided may be compromised.

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Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: A I Horobin Name: **A. Horobin** Date: **21 March 2012**
Title: **Team Leader**

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SEVERN TRENT SERVICES

Report Number: **COV/846301/2012** Issue **1**
Laboratory Number: **12906882** Sample **4** of **6**

Sample Source: **Alcontrol Laboratories**
Sample Point Description: **Water Analysis**
Sample Description: **5319735 5306636-30 Trinity Close**
Sample Matrix: **Ground waters**
Sample Date/Time:
Sample Received: **15 March 2012**
Analysis Complete: **21 March 2012**

Test Description	Result	Units	Accreditation	Method
Acenaphthene	<0.01	ug/l	Y Cov	GEO19
Acenaphthylene	<0.01	ug/l	Y Cov	GEO19
Anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (g,h,i) perylene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) pyrene	<0.01	ug/l	Y Cov	GEO19
Benzo (b) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Benzo (k) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Chrysene	<0.01	ug/l	Y Cov	GEO19
Dibenz (a,h) anthracene	<0.01	ug/l	Y Cov	GEO19
Fluoranthene	<0.01	ug/l	Y Cov	GEO19
Fluorene	<0.01	ug/l	Y Cov	GEO19
Indeno (1,2,3) cd pyrene	<0.01	ug/l	Y Cov	GEO19
Naphthalene	<0.01	ug/l	Y Cov	GEO19
Phenanthrene	<0.01	ug/l	Y Cov	GEO19
Pyrene	<0.01	ug/l	Y Cov	GEO19
PAH, Total	<0.01	ug/l	N Cov	GEO19

Analyst Comments for 12906882: The date of sampling has not been provided and therefore sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised. The sample for PAH was received in a container inappropriate for this parameter. It is therefore possible that the results provided may be compromised.

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Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: A I Horobin Name: **A. Horobin** Date: **21 March 2012**
Title: **Team Leader**

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SEVERN TRENT SERVICES

Report Number: **COV/846301/2012** Issue **1**
Laboratory Number: **12906883** Sample **5** of **6**

Sample Source: **Alcontrol Laboratories**
Sample Point Description: **Water Analysis**
Sample Description: **5319751 5306639-16 Keble Close**
Sample Matrix: **Ground waters**
Sample Date/Time:
Sample Received: **15 March 2012**
Analysis Complete: **21 March 2012**

Test Description	Result	Units	Accreditation	Method
Acenaphthene	<0.01	ug/l	Y Cov	GEO19
Acenaphthylene	<0.01	ug/l	Y Cov	GEO19
Anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (g,h,i) perylene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) pyrene	<0.01	ug/l	Y Cov	GEO19
Benzo (b) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Benzo (k) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Chrysene	<0.01	ug/l	Y Cov	GEO19
Dibenz (a,h) anthracene	<0.01	ug/l	Y Cov	GEO19
Fluoranthene	<0.01	ug/l	Y Cov	GEO19
Fluorene	<0.01	ug/l	Y Cov	GEO19
Indeno (1,2,3) cd pyrene	<0.01	ug/l	Y Cov	GEO19
Naphthalene	<0.01	ug/l	Y Cov	GEO19
Phenanthrene	<0.01	ug/l	Y Cov	GEO19
Pyrene	<0.01	ug/l	Y Cov	GEO19
PAH, Total	<0.01	ug/l	N Cov	GEO19

Analyst Comments for 12906883: The date of sampling has not been provided and therefore sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised. The sample for PAH was received in a container inappropriate for this parameter. It is therefore possible that the results provided may be compromised.

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Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: A I Horobin Name: **A. Horobin** Date: **21 March 2012**
Title: **Team Leader**

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SEVERN TRENT SERVICES

Report Number: **COV/846301/2012** Issue **1**
Laboratory Number: **12906884** Sample **6** of **6**

Sample Source: **Alcontrol Laboratories**
Sample Point Description: **Water Analysis**
Sample Description: **5319761 5306635-17 High Bank**
Sample Matrix: **Ground waters**
Sample Date/Time:
Sample Received: **15 March 2012**
Analysis Complete: **21 March 2012**

Test Description	Result	Units	Accreditation	Method
Acenaphthene	<0.01	ug/l	Y Cov	GEO19
Acenaphthylene	<0.01	ug/l	Y Cov	GEO19
Anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) anthracene	<0.01	ug/l	Y Cov	GEO19
Benzo (g,h,i) perylene	<0.01	ug/l	Y Cov	GEO19
Benzo (a) pyrene	<0.01	ug/l	Y Cov	GEO19
Benzo (b) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Benzo (k) fluoranthene	<0.01	ug/l	Y Cov	GEO19
Chrysene	<0.01	ug/l	Y Cov	GEO19
Dibenz (a,h) anthracene	<0.01	ug/l	Y Cov	GEO19
Fluoranthene	<0.01	ug/l	Y Cov	GEO19
Fluorene	<0.01	ug/l	Y Cov	GEO19
Indeno (1,2,3) cd pyrene	<0.01	ug/l	Y Cov	GEO19
Naphthalene	<0.01	ug/l	Y Cov	GEO19
Phenanthrene	<0.01	ug/l	Y Cov	GEO19
Pyrene	<0.01	ug/l	Y Cov	GEO19
PAH, Total	<0.01	ug/l	N Cov	GEO19

Analyst Comments for 12906884: The date of sampling has not been provided and therefore sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised. The sample for PAH was received in a container inappropriate for this parameter. It is therefore possible that the results provided may be compromised.

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Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
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I/S=Insufficient sample

Signed: A I Horobin Name: **A. Horobin** Date: **21 March 2012**
Title: **Team Leader**

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CERTIFICATE OF ANALYSIS

SDG:	120311-10	**Location:**	Hinter Road	**Order Number:**	
Job:	H_GRONTMIJ_SOL-44	**Customer:**	Grontmij	**Report Number:**	175071
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Appendix

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 2 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors
employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5 -C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D&C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENT EXTRACTABLE MATTER	D&C	DCM	SOXTHERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
ELEMENTAL SULPHUR	D&C	DCM	SOXTHERM	HPLC
PHENOLS BY GCMS	WET	DCM	SOXTHERM	GC-MS
HERBICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
PESTICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH CWG BY GC	D&C	HEXANE:ACETONE	END OVER END	GC-FID
PCB AROCLOR 1254 / PCB CON	D&C	HEXANE:ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE:ACETONE	MICROWAVE TM218.	GC-MS
>C6-C40	WET	HEXANE:ACETONE	SHAKER	GC-FID
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE:ACETONE	SHAKER	GC-FID
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DCM:ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
PCB AROCLOR 1254	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PESTOC PCP P	DCM	LIQUID/LIQUID SHAKE	GC MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC MS
PHENOLS MS	ACETONE	SOLID PHASE EXTRACTION	GC MS
TPH by INFRARED (IR)	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
MINERAL OIL by IR	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
GLYCOLS	NONE	DIRECT INJECTION	GC FID

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials or those identified as potentially asbestos containing during sample description which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: -
Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

APPENDIX E

Well	Date	CH4	CO2	O2	CO	H2S	flow	pressure	GSV
		%	%	%	ppm	ppm	l/hr	mb	
ambient	07/12/2011	0	0	19.8	0	0	n/a	993	
	09/01/2012	-0.1	0	19.2	-2	-10	n/a	1017	
	18/01/2012	-0.1	0	19	0	0	n/a	1010	
	26/01/2012	-0.1	0.1	18.8	-2	0	n/a	991	
	23/03/2012	0	0	20.4	0	0	n/a	1010	
WS1	07/12/2011	0	0.6	19.3	0	0	0	992	0.00006
	09/01/2012	-0.1	0.8	18.5	-2	-10	-0.1	1015	0.00008
	18/01/2012	-0.1	0.9	17.7	-2	-10	-0.1	1008	0.00009
	26/01/2012	-0.1	0.8	18.1	-10	-4	-0.7	991	0.00008
	23/03/2012	0	0.9	19.7	0	0	0	1011	0.00009
WS2	07/12/2011	0	0.3	19	0	0	0	992	0.00003
	09/01/2012	0	0.3	19	-2	-10	0	1015	0.00003
	18/01/2012	0	0.8	18.4	-2	0	-0.1	1009	0.00008
	26/01/2012	-0.1	0.8	18	0	-2	-0.6	991	0.00008
	23/03/2012	0	1	19.5	0	0	0	1012	0.0001
WS4	07/12/2011	0	1.6	17	0	0	0	992	0.00016
	09/01/2012	-0.1	0.9	16.8	-4	-10	0	1016	0.00009
	18/01/2012	-0.1	1.3	17.6	-2	0	-0.1	1010	0.00013
	26/01/2012	-0.1	0.8	16.5	-4	0	-0.7	991	0.00008
	23/03/2012	0	2.2	18.2	0	0	0	1011	0.00022
WS5	07/12/2011	0	1.6	17.7	0	0	-0.1	992	0.00016
	09/01/2012	-0.2	1.6	17.5	-4	-10	0	1016	0.00016
	18/01/2012	-0.1	1.5	17.5	0	0	-0.3	1010	0.00015
	26/01/2012	-0.1	0.6	17.7	0	0	-1.2	991	0.00006
	23/03/2012	0	1.1	19	0	0	0	1011	0.00011
WS6	07/12/2011	0	1.1	17.8	0	0	-0.1	992	0.00011
	09/01/2012	-0.2	0.8	18.1	-4	0	0	1016	0.00008
	18/01/2012	-0.1	0.8	18.2	-10	-2	-0.3	1010	0.00008
	26/01/2012	-0.1	0.8	17.8	-10	0	-1	991	0.00008
	23/03/2012	0	0.8	19.7	0	0	0	1010	0.00008
WS7	07/12/2011	0	0.9	18.6	0	0	0	992	0.00009
	09/01/2012	0	0.6	18.4	-2	-10	0	1015	0.00006
	18/01/2012	0	1.9	17.6	-2	-10	0	1008	0.00019
	26/01/2012	-0.3	4.2	14.4	0	0	-0.7	992	0.00042
	23/03/2012	0	3.1	17.1	0	0	0	1012	0.00031

Pressure trend data **sources:** http://www.worldweatheronline.com/weather/United-Kingdom/806139/Cannock/808864/info.aspx?day=0:
http://www.metoffice.gov.uk/weather/uk/wm/coleshill_latest_weather.html

	07/12/2011	09/01/2012	18/01/2012	26/01/2012	23/03/2012
midnight	1001	1027	1024	1006	1026
3am	1000	1027	1022	1006	1026
6am	1002	1027	1020	1005	1026
9am	1004	1027	1019	1005	1026
noon	1007	1028	1021	1005	1026
3pm	1010	1029	1022	1007	1026
6pm	1013	1032	1023	1009	1026
9pm	1016	1033	1022	1010	1026
midnight	1017	1033	1022	1012	1026

Date	Person	Time	Weather
07/12/2011	GVT	10:00	sunny but cold
09/01/2012	RJH	14:30	Overcast some drizzle
18/01/2012	RJH	13:00	Overcast
26/01/2012	RJH	10:15	cloudy
23/03/2012	GVT	17:00	Sunny and warm for se

eason (15 C)

APPENDIX F

Appendix F: Severity and Probability of Risk in Conceptual Site Models (after CIRIA552, Tables 6.3 to 6.5)

This report draws on guidance presented in CIRIA report 552, "Contaminated Land Risk Assessment, A Guide for Good Practice", wherein the "severity" term in the Conceptual Site Model is classified with reference to the sensitivity of the hazard and the receptor, as follows:

Severity Category	Description	Examples
Severe	Acute risk to human health likely to result in "significant harm" as defined in EPA90, catastrophic damage to buildings or property, acute risk of major pollution of controlled waters, acute risk of harm to ecosystems (as defined in Contaminated Land Regulations 2006)	High cyanide concentrations at the surface of a recreation area Major spillage into controlled waters Explosion, causing building collapse
Medium	Chronic risk to human health likely to result in "significant harm" as defined in EPA90, chronic pollution of sensitive controlled waters, significant change at a sensitive ecosystems or species, significant damage to buildings or structures	Contaminant concentrations at a site in excess of SGVs, GAC or similar screening values Leaching of contaminants to sensitive aquifer Death of a species within a nature reserve
Mild	Pollution of non-sensitive waters, significant damage to buildings, structures, services or crops, damage to sensitive buildings, structures, services or the environment, which nonetheless result in "significant harm"	Pollution to (former) non-aquifer or to non-controlled surface watercourse. Damage to building rendering it unsafe to occupy (e.g. foundation or structural damage)
Minor	Harm, not necessarily resulting in "significant harm" but probably requiring expenditure to resolve or financial loss. Non-permanent risks to human health that are easily mitigated, e.g. by wearing PPE. Easily-repairable damage to structures or services	Contaminant concentrations requiring the wearing of PPE during site work, but no other long-term mitigation. Discolouration of concrete

The likelihood of an event (probability) takes into account both the presence of hazard and receptor and the integrity of the pathway between hazard and receptor, and is assessed as follows:

Category	There is a pollution linkage and:
High	Event is likely in the short term and almost inevitable over the long term. Or, there is evidence of actual harm at/to the receptor
Likely	Event is possible in the short term and likely over the long term
Low	Event is unlikely in the short term and possible over the long term
Unlikely	Event is unlikely, even in the long term

Potential severity and probability have been assessed in the following matrix, to give an overall risk rating:

	Severity			
Probability	Severe	Medium	Mild	Minor
High	Very high	High	Moderate	Low/moderate
Likely	High	Moderate	Low/moderate	Low
Low	Moderate	Low/moderate	Low	Very low
Unlikely	Low/moderate	Low	Very low	Very low

The above risk categories are likely to result in the following actions:

- Very high: urgent intervention / investigation needed, remediation likely to be required
- High: urgent intervention / investigation needed, remediation possibly required in short term and probably required in long term
- Moderate: investigation needed to clarify and refine risk; remediation may be required over the long term
- Low: it is possible that harm could arise to a receptor, but if realised, such harm is likely to be, at worst, mild
- Very low: it is possible that harm could arise to a receptor, but if realised, such harm is unlikely to be severe

APPENDIX C
EXPLORATORY HOLE LOGS

Grontmij

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Trialpit No
HP101
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012

Location: Hunter Road, Cannock

Dimensions: 0.30m
Depth 0.50m
0.40m

Scale 1:25

Client: Cannock Chase Council

Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30-0.40	T, J,		0.48 0.50			MADE GROUND; Grass over brown/ orange brown gravelly SAND. Gravel is fine to coarse sub angular to rounded of quartz, brick, glass coal with rare ash and tarmac. Cobble of brick at 0.3m Orange/red brown gravelly SAND. Gravel is fine to coarse subrounded to rounded of quartz Trialpit Complete at 0.50 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP102
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.60m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20-0.30	T					MADE GROUND; Grass over light brown/ orange brown gravelly SAND with fine rootlets. Gravel is fine to coarse subangular to rounded of quartz, concrete, plastic sheet, ash and ceramic. Occasional cobble of brick
0.35-0.45	J,V		0.45			Orange/red brown gravelly SAND. Gravel is fine to coarse subrounded to rounded of quartz
			0.60			Trialpit Complete at 0.60 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP103
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012

Location: Hunter Road, Cannock

Dimensions: 0.30m
Depth 0.60m
0.40m

Scale 1:25

Client: Cannock Chase Council

Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.40-0.50	T, J,		0.50			MADE GROUND; Grass over dark brown gravelly slightly cobbly SAND, Gravel is fine to coarse sub angular to rounded of quartz, brick, ceramic, concrete and rare ash. Cobbles of brick and concrete
			0.60			Orange/red brown gravelly SAND. Gravel is fine to coarse subrounded to rounded of quartz
						Trialpit Complete at 0.60 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP104
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.70m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20-0.30	T					MADE GROUND; Grass over dark brown gravelly slightly cobbly SAND, Gravel is fine to coarse sub angular to rounded of quartz, brick, ceramic, concrete and rare ash. Cobbles of brick and concrete
0.50	J,V		0.50			Orange/red brown gravelly SAND. Gravel is fine to coarse subrounded to rounded of quartz
			0.60			Trialpit Complete at 0.70 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP105
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.35m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.25-0.35	T,J,V		0.35			MADE GROUND; Grass over light brown/ orange brown gravelly SAND with fine rootlets. Gravel is fine to coarse subangular to rounded of quartz, concrete, plastic sheet, ash and ceramic. Occasional cobble of brick and concrete. Terminated on concrete obstruction at 0.35m
						Trialpit Complete at 0.35 m

1
2
3
4

Remarks: Terminated on concrete obstruction

Groundwater:

AGS

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Trialpit No
HP106
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.70m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20-0.30	J,V					MADE GROUND; Grass over brown gravelly SAND. Gravel is fine to coarse subangular to rounded of brick, quartz, concrete, occasional metal fragments, rare ash and glass
			0.55			
0.60-0.70	J,V					MADE GROUND; as previous strata becoming less gravelly
			0.70			Trialpit Complete at 0.70 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP107
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.70m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.40 0.40	J,V T					MADE GROUND; Grass over dark brown gravelly SAND. Gravel is fine to coarse sub angular to rounded of quartz, brick, ceramic, concrete and rare ash, clinker and glass. Piece of fibrous lagging identified at 0.4m (sampled)
0.70-0.80	J,V		0.85			Trialpit Complete at 0.70 m

1
2
3
4

Remarks:

Groundwater:

AGS

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Trialpit No
HP108
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.85m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.50-0.60	J,V		0.65			MADE GROUND; Grass over brown gravelly slightly cobbly SAND. Gravel is fine to coarse sub angular to rounded of quartz, brick, glass, concrete and rare clinker. Cobbles of brick
			0.70			Orange/red brown gravelly SAND, Gravel is fine to coarse subrounded to rounded of quartz
						Trialpit Complete at 0.85 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP109
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012
Location: Hunter Road, Cannock		Dimensions: Depth 0.70m, 0.30m x 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.03			MADE GROUND; Peas Gravel on anti weed membrane
0.20-0.30	J,V					MADE GROUND; brown gravelly SAND. Gravel is fine to coarse subangular to rounded of quartz, brick and some wood fragments. Black (organic) staining and odour from 0.45-0.65m
0.50-0.60	J,V					
			0.70			Trialpit Complete at 0.70 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP110
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012

Location: Hunter Road, Cannock

Dimensions: 0.30m
Depth 1.10m
0.40m

Scale 1:25

Client: Cannock Chase Council

Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30-0.40	J,V					MADE GROUND; Grass over brown gravelly slightly cobbly SAND. Gravel is fine to coarse sub angular to rounded of quartz, brick, glass, concrete and rare clinker. Cobbles of brick. Logged from exposed face in garden where re-profiling has recently taken place in garden
			1.10			Trialpit Complete at 1.10 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP111
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012

Location: Hunter Road, Cannock

Dimensions: 0.30m
Depth 0.75m
0.40m

Scale 1:25

Client: Cannock Chase Council

Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10-0.20	J,V					MADE GROUND; Grass over brown gravelly SAND, Gravel is fine to coarse sub angular to rounded of quartz, brick, glass, ceramic and rare clinker. Becoming darker brown at 0.35m
0.35-0.45	J,V					
			0.75			Trialpit Complete at 0.75 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP112
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	10/09/2012

Location: Hunter Road, Cannock

Dimensions: 0.30m
Depth 0.70m
0.40m

Scale 1:25

Client: Cannock Chase Council

Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30 0.30-0.40	T J,V					MADE GROUND; Grass over brown gravelly SAND. Gravel is fine to coarse sub angular to rounded of quartz, brick and glass. Piece of possible asbestos tile identified at 0.3 (sampled)
			0.70			Trialpit Complete at 0.70 m

1
2
3
4

Remarks:

Groundwater:

AGS

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Trialpit No
HP113
Sheet 1 of 1

Project Name Cannock Part 2a	Project No. 106270-011	Co-ords: - Level: -	Date 11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m Depth 0.70m 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30-0.40	J,V					MADE GROUND; Dark brown gravelly slightly cobbly SAND. Gravel is fine to coarse sub angular to rounded of quartz, brick, glass and concrete. Cobbles of brick and concrete
			0.70			Trialpit Complete at 0.70 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP114
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.60m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND; Bark over dark brown gravelly slightly cobbly SAND. Gravel is fine to coarse subangular to rounded of sandstone, quartz, brick and rare clinker. Cobble of concrete with re-bar.
0.50-0.60	J,V		0.60			Trialpit Complete at 0.60 m

Remarks: Terminated on cobble obstruction

Groundwater:

AGS

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Trialpit No
HP115
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.50m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.40	T		0.45 0.50			MADE GROUND; Grass over brown gravelly SAND. Gravel is fine to coarse sub angular to rounded of quartz, brick and glass. Orange/red brown gravelly SAND. Gravel is fine to coarse subrounded to rounded of quartz Trialpit Complete at 0.50 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP116
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.50m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30	T		0.50			MADE GROUND; Grass over brown with some orange pockets gravely slightly cobbly SAND. Gravel is fine to coarse, subangular to subrounded of quartz, sandstone, wood (former fence post) and rare cobble of brick. Grey tile noted but did not appear fibrous
						Trialpit Complete at 0.50 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP117
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.42m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	T					MADE GROUND; Grass over brown with orange pockets gravelly SAND. Gravel is fine to coarse subangular to rounded of quartz, sandstone and brick with rare glass and ash.
			0.40			MADE GROUND; Pea gravel indicative of services no further excavation undertaken
			0.42			Trialpit Complete at 0.42 m

Remarks: Terminated on pea gravel above possible drain

Groundwater:

AGS

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Tel: 01217 116600

Trialpit No
HP118
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012

Location: Hunter Road, Cannock

Dimensions: 0.30m
Depth 0.20m
0.40m

Scale 1:25

Client: Cannock Chase Council

Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	J,V		0.20			MADE GROUND; Scrub vegetation over orange/brown gravelly SAND. Gravel fine to medium subrounded to rounded of quartz with rare fragments of coal and brick
						Trialpit Complete at 0.20 m

Remarks:

Groundwater:

AGS

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Tel: 01217 116600

Trialpit No
HP119
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.20m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	J,V		0.20			MADE GROUND; Scrub vegetation over light brown gravelly SAND. Gravel is fine to medium subrounded to rounded of quartz. Some rootlets.
						Trialpit Complete at 0.20 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP120
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.20m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	J,V		0.20			MADE GROUND; Grass over light brown/orange fine to medium gravelly SAND. Gravel is fine to medium subrounded to rounded of quartz with frequent rootlets.
						Trialpit Complete at 0.20 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP121
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.20m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	J,V		0.20			MADE GROUND; Scrub vegetation over light brown gravelly SAND. Gravel is fine to medium subrounded to rounded of quartz. Some rootlets.
						Trialpit Complete at 0.20 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP122
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.60m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	J,V		0.20			MADE GROUND; Grass over light brown gravelly SAND. Gravel is fine to medium of brick, quartz, glass, coal and rare fragments of clinker and tile
			0.60			Orange/brown gravelly SAND. Gravel is fine to coarse with rare sub rounded cobbles of quartz and coal.
						Trialpit Complete at 0.60 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP123
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.20m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Light brown fine to medium SAND
			0.20			
			0.30			MADE GROUND; Dark brown gravelly SAND. Gravel is subangualr of quartz and brick. Some rootlets.
0.40	J,V					MADE GROUND; Light brown gravelly SAND. Gravel is coarse with cobbles of quartz and rare cobbles of brick.
			0.50			
			0.60			Orange gravelly SAND. Gravel is subrounded of quartz.
						Trialpit Complete at 0.20 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP124
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.60m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.50	J,V		0.60			MADE GROUND; Turf over light/dark brown gravelly SAND. Gravel is fine to medium subangular of brick, quartz, slate, glass with rare bottle tops, bone and clinker. Rare boulder of clinker recovered at 0.3m and a section of metal pipe approx 50cm long.
						Trialpit Complete at 0.60 m

Remarks: Terminated on concrete obstruction

Groundwater:

AGS

Grontmij

Grontmij Solihull
1st Floor Yorke House
Arleston Way
Solihull B90 4LH
Tel: 01217 116600

Trialpit No
HP125
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	11/09/2012

Location: Hunter Road, Cannock

Dimensions: 0.30m
Depth 0.60m
0.40m

Scale 1:25

Client: Cannock Chase Council

Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20-0.60 0.20-0.60	J,V T		0.60			MADE GROUND; Light brown gravelly SAND. Gravel is fine to coarse subrounded to subangular of quartz brick with occasional coal fragments. 3No. Whole bricks recovered. Possible ACM material identified at 100mm (sampled) Trialpit Complete at 0.60 m

1
2
3
4

Remarks: Terminated on cobble obstruction

Groundwater:

AGS

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Trialpit No
HP126
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	12/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.30m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.25-0.30 0.30	V J,V		0.30			MADE GROUND; Grass over gravelly SAND. Gravel is fine to coarse subangular of gravel ,ash, clinker, quartz and concrete with rare brick fragments. Whole brick recovered at 0.2m. Potential ACM material recovered (sampled) Trialpit Complete at 0.30 m

Remarks:

Groundwater:

AGS

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Trialpit No
HP127
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	12/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m (Depth 0.30m, 0.40m)	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10-0.30	J		0.30			MADE GROUND; Grass over brown fine to coarse gravelly SAND with some roots. Gravel is rounded to subangular of quartz, clinker, brick, glass, concrete, roof felt, ceramic, plastic and concrete. Potential ACM material (roof felt)
						Trialpit Complete at 0.30 m

Remarks:

Groundwater:

AGS

Grontmij

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Tel: 01217 116600

Trialpit No
HP128
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	12/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.10m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10-0.28	V		0.10			MADE GROUND; Grass over brown gravelly SAND. Gravel is fine to coarse subangular to angular of quartz, brick, plastic, concrete. Potential ACM material in the form of plaster board, ceramic and glass.
						Trialpit Complete at 0.10 m

1
2
3
4

Remarks:

Groundwater:

AGS

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Solihull B90 4LH
Tel: 01217 116600

Trialpit No
HP129
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	12/09/2012
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.28m, 0.40m	Scale 1:25
Client: Cannock Chase Council			Logged By RJH

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20-0.28	J		0.28			MADE GROUND; Grass over brown gravelly SAND. Gravel is fine to coarse subangular to rounded mainly of quartz, initially with glass, metallic fragments (gate post fitting) brick ash and concrete increasing from 0.1. Rare cobble sized fragments of quartz. End of hole at 0.28 on cobble of sandstone. No visual evidence of ACM material.
						Trialpit Complete at 0.28 m

1
2
3
4

Remarks:

Groundwater:

AGS

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Tel: 01217 116600

Trialpit No
HP130
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	13/02/2013

Location: Hunter Road, Cannock

Dimensions: 0.30m (Depth 0.30m, 0.30m)

Scale 1:25

Client: Cannock Chase Council

Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30	D		0.30			MADE GROUND: Grass over dark brown fine to medium gravelly SAND. Gravel is subangular of quartz and crushed brick. Rare fragments of wood and whole brick recovered at 0.3m
						Trialpit Complete at 0.30 m

Remarks: Hand dug pit to 0.30mbgl. No visual or olfactory evidence of contamination noted.

Groundwater:

AGS

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Arleston Way
Solihull B90 4LH
Tel: 01217 116600

Trialpit No
HP131
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	13/02/2013

Location: Hunter Road, Cannock

Dimensions: 0.30m (Depth 0.30m, 0.30m)

Scale 1:25

Client: Cannock Chase Council

Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	D		0.30			MADE GROUND: Grass over dark brown fine to medium gravelly SAND. Gravel is subangular to rounded of quartz and brick with rare slate.
						Trialpit Complete at 0.30 m

Remarks: Hand dug pit to 0.30mbgl. No visual or olfactory evidence of contamination noted.

Groundwater:

AGS

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Arleston Way
Solihull B90 4LH
Tel: 01217 116600

Trialpit No
HP132
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	13/02/2013
Location: Hunter Road, Cannock		Dimensions: 0.30m (Depth 0.30m, 0.30m)	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					MADE GROUND: Grass over dark brown fine to medium slightly gravelly SAND with occasional rootlets. Gravel is subangular to rounded of quartz and brick with rare slate and clinker.
			0.30			Trialpit Complete at 0.30 m

Remarks: Hand dug pit to 0.30mbgl. Clinker noted, however no olfactory evidence of contamination noted.

Groundwater:

AGS

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Tel: 01217 116600

Trialpit No
HP133
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	13/02/2013
Location: Hunter Road, Cannock		Dimensions: 0.30m (Depth 0.30m, 0.30m)	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30	D		0.30			MADE GROUND: Grass over light brown fine to medium gravelly SAND with rare rootlets. Gravel is subangular to rounded of quartz with rare red plastic packaging.
						Trialpit Complete at 0.30 m

Remarks: Hand dug pit to 0.30mbgl. No visual or olfactory evidence of contamination noted.

Groundwater:

AGS

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Solihull B90 4LH
Tel: 01217 116600

Trialpit No
HP134
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	13/02/2013
Location: Hunter Road, Cannock		Dimensions: 0.30m	Scale 1:25
Client: Cannock Chase Council		Depth 0.30m (0.30m)	Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30	D		0.30			MADE GROUND: Grass over dark brown fine to medium gravelly SAND with rare rootlets. Gravel is subangular to rounded of quartz and brick.
						Trialpit Complete at 0.30 m

Remarks: Hand dug pit to 0.30mbgl. No visual or olfactory evidence of contamination noted.

Groundwater:

AGS

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Solihull B90 4LH
Tel: 01217 116600

Trialpit No
HP135
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	13/02/2013
Location: Hunter Road, Cannock		Dimensions: 0.30m (Depth 0.30m, 0.30m)	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	D		0.30			MADE GROUND: Scrub vegetation over dark brown fine to medium gravelly SAND with rare rootlets. Gravel is subrounded of quartz.
						Trialpit Complete at 0.30 m

Remarks: Hand dug pit to 0.30mbgl. No visual or olfactory evidence of contamination noted.

Groundwater:

AGS

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Solihull B90 4LH
Tel: 01217 116600

Trialpit No
HP136
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	13/02/2013
Location: Hunter Road, Cannock		Dimensions: 0.30m (Depth 0.30m, 0.30m)	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D		0.25 0.30			MADE GROUND: Scrub vegetation over dark brown fine to medium gravelly SAND with rare rootlets. Gravel is subrounded of quartz with rare brick. MADE GROUND: Orange fine to medium SAND. Trialpit Complete at 0.30 m

Remarks: Hand dug pit to 0.30mbgl. No visual or olfactory evidence of contamination noted.

Groundwater:

AGS

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Solihull B90 4LH
Tel: 01217 116600

Trialpit No
HP137
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	13/02/2013
Location: Hunter Road, Cannock		Dimensions: 0.30m	Scale 1:25
Client: Cannock Chase Council		Depth 0.30m (0.30m)	Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30	D		0.30			MADE GROUND: Scrub vegetation over dark brown fine to medium gravelly SAND with rare rootlets. Gravel is subrounded of quartz with rare brick.
						Trialpit Complete at 0.30 m

Remarks: Hand dug pit to 0.30mbgl. No visual or olfactory evidence of contamination noted.

Groundwater:

AGS

Grontmij

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Tel: 01217 116600

Trialpit No
HP138
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Cannock Part 2a	106270-011	Level: -	13/02/2013
Location: Hunter Road, Cannock		Dimensions: 0.30m, Depth 0.30m, 0.30m	Scale 1:25
Client: Cannock Chase Council			Logged By JS

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	D		0.30			MADE GROUND: Scrub vegetation over dark brown fine to medium gravelly SAND with rare rootlets. Gravel is subrounded to rounded of quartz with occasional brick. Rare bone fragments at base of IP.
						Trialpit Complete at 0.30 m

Remarks: Hand dug pit to 0.30mbgl. No visual or olfactory evidence of contamination noted.

Groundwater:

AGS

APPENDIX D
LABORATORY CHEMICAL ANAYLSIS RESULTS

Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: Supplement to 295391-1

Date of Report: 09-Oct-2012

Customer: Grontmij
3rd Floor
Radcliffe House
Blenheim Court
Lode Lane
Solihull
B91 2AA

Customer Contact: Mr Gareth Taylor

Customer Job Reference: 106270
Customer Site Reference: Hunter Road
Date Job Received at SAL: 12-Sep-2012
Date Analysis Started: 18-Sep-2012
Date Analysis Completed: 21-Sep-2012

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs

UKAS TESTING
1549

Report checked
and authorised by :
Mr Ross Walker
Customer Services Manager
(Land)

Issued by :
Mr Ross Walker
Customer Services Manager
(Land)

SAL Reference: 295391
Project Site: Hunter Road
Customer Reference: 106270

Soil Analysed as Soil
PAH US EPA 16 (B and K split)

					SAL Reference	**295391 008**	**295391 010**	**295391 013**	**295391 015**	**295391 016**	**295391 018**	**295391 020**	**295391 021**	**295391 022**	**295391 023**
					Customer Sample Reference	**HP106 0.2**	**HP107 0.4**	**HP108 0.5**	**HP109 0.5**	**HP110 0.3**	**HP111 0.35**	**HP112 0.3-0.40**	**HP113 0.3**	**HP114 0.5**	**HP115 0.4**
					Date Sampled	**10-SEP-2012**	**10-SEP-2012**	**10-SEP-2012**	**10-SEP-2012**	**10-SEP-2012**	**10-SEP-2012**	**10-SEP-2012**	**11-SEP-2012**	**11-SEP-2012**	**11-SEP-2012**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**											
Naphthalene	T149	AR	0.01	mg/kg		**0.43**	**0.07**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.05**	**0.05**	**0.05**
Acenaphthylene	T149	AR	0.01	mg/kg		**2.1**	**0.08**	**0.05**	**0.02**	**0.04**	**0.02**	**0.04**	**0.07**	**0.04**	**0.06**
Acenaphthene	T149	AR	0.01	mg/kg		**0.49**	**0.07**	**0.15**	**0.03**	**0.03**	**0.01**	**0.02**	**0.03**	**0.04**	**0.03**
Fluorene	T149	AR	0.01	mg/kg		**2.5**	**0.08**	**0.11**	**0.03**	**0.03**	**0.01**	**0.03**	**0.05**	**0.04**	**0.04**
Phenanthrene	T149	AR	0.01	mg/kg		**15**	**1.3**	**1.9**	**0.39**	**0.83**	**0.30**	**0.44**	**0.92**	**0.62**	**0.60**
Anthracene	T149	AR	0.01	mg/kg		**4.1**	**0.33**	**0.55**	**0.12**	**0.23**	**0.09**	**0.12**	**0.29**	**0.20**	**0.12**
Fluoranthene	T149	AR	0.01	mg/kg		**17**	**4.2**	**4.5**	**1.4**	**2.7**	**1.2**	**1.4**	**2.8**	**1.8**	**1.5**
Pyrene	T149	AR	0.01	mg/kg		**13**	**3.7**	**3.8**	**1.2**	**2.3**	**0.99**	**1.2**	**2.4**	**1.5**	**1.3**
Benzo(a)Anthracene	T149	AR	0.01	mg/kg		**6.4**	**1.9**	**2.0**	**0.69**	**1.4**	**0.58**	**0.73**	**1.5**	**0.97**	**0.85**
Chrysene	T149	AR	0.01	mg/kg		**5.9**	**1.9**	**2.0**	**0.68**	**1.4**	**0.58**	**0.77**	**1.4**	**0.95**	**0.86**
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg		**5.8**	**2.4**	**1.7**	**0.78**	**1.5**	**0.57**	**0.85**	**1.4**	**1.1**	**1.1**
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg		**5.4**	**2.0**	**1.9**	**0.71**	**1.6**	**0.62**	**0.78**	**1.5**	**0.94**	**0.93**
Benzo(a)Pyrene	T149	AR	0.01	mg/kg		**6.2**	**2.5**	**2.0**	**0.84**	**1.7**	**0.65**	**0.87**	**1.5**	**1.1**	**1.1**
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg		**3.3**	**1.6**	**1.1**	**0.47**	**1.0**	**0.38**	**0.59**	**0.79**	**0.64**	**0.66**
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg		**1.1**	**0.51**	**0.39**	**0.16**	**0.33**	**0.13**	**0.23**	**0.28**	**0.22**	**0.22**
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg		**3.7**	**1.9**	**1.3**	**0.51**	**1.2**	**0.42**	**0.69**	**0.85**	**0.72**	**0.75**
PAH(total)	T149	AR	0.01	mg/kg		**92**	**25**	**23**	**8.1**	**16**	**6.6**	**8.8**	**16**	**11**	**10**

SAL Reference: 295391
Project Site: Hunter Road
Customer Reference: 106270

Soil Analysed as Soil
PAH US EPA 16 (B and K split)

					SAL Reference	**295391 026**	**295391 027**	**295391 028**	**295391 029**	**295391 030**	**295391 031**	**295391 032**	**295391 033**
					Customer Sample Reference	**HP118 0.2**	**HP119 0.2**	**HP120 0.2**	**HP121 0.2**	**HP122 0.2**	**HP123 0.4**	**HP124 0.5**	**HP125 0.2**
					Date Sampled	**11-SEP-2012**	**11-SEP-2012**	**11-SEP-2012**	**11-SEP-2012**	**11-SEP-2012**	**11-SEP-2012**	**11-SEP-2012**	**11-SEP-2012**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**									
Naphthalene	T149	AR	0.01	mg/kg		**0.01**	**0.04**	**0.02**	**0.01**	**0.02**	**0.01**	**0.25**	**0.04**
Acenaphthylene	T149	AR	0.01	mg/kg		**0.01**	**0.02**	**0.02**	**0.01**	**0.01**	**0.01**	**0.18**	**0.03**
Acenaphthene	T149	AR	0.01	mg/kg		**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	<0.01	**1.3**	**0.02**
Fluorene	T149	AR	0.01	mg/kg		**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	<0.01	**0.85**	**0.02**
Phenanthrene	T149	AR	0.01	mg/kg		**0.10**	**0.25**	**0.14**	**0.26**	**0.18**	**0.06**	**7.5**	**0.44**
Anthracene	T149	AR	0.01	mg/kg		**0.03**	**0.07**	**0.04**	**0.07**	**0.04**	**0.02**	**2.4**	**0.12**
Fluoranthene	T149	AR	0.01	mg/kg		**0.38**	**1.2**	**0.58**	**0.87**	**0.61**	**0.30**	**17**	**1.4**
Pyrene	T149	AR	0.01	mg/kg		**0.41**	**1.1**	**0.55**	**0.76**	**0.55**	**0.29**	**14**	**1.3**
Benzo(a)Anthracene	T149	AR	0.01	mg/kg		**0.20**	**0.59**	**0.39**	**0.44**	**0.38**	**0.20**	**7.0**	**0.93**
Chrysene	T149	AR	0.01	mg/kg		**0.21**	**0.69**	**0.43**	**0.47**	**0.39**	**0.21**	**6.7**	**0.92**
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg		**0.27**	**0.74**	**0.58**	**0.51**	**0.49**	**0.31**	**7.3**	**1.2**
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg		**0.24**	**0.59**	**0.54**	**0.46**	**0.42**	**0.24**	**6.7**	**1.1**
Benzo(a)Pyrene	T149	AR	0.01	mg/kg		**0.26**	**0.61**	**0.56**	**0.49**	**0.47**	**0.30**	**7.5**	**1.2**
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg		**0.16**	**0.42**	**0.38**	**0.34**	**0.30**	**0.21**	**4.5**	**0.72**
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg		**0.06**	**0.17**	**0.13**	**0.14**	**0.10**	**0.07**	**1.5**	**0.25**
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg		**0.18**	**0.49**	**0.44**	**0.40**	**0.35**	**0.25**	**5.1**	**0.81**
PAH(total)	T149	AR	0.01	mg/kg		**2.5**	**7.0**	**4.8**	**5.3**	**4.3**	**2.5**	**90**	**11**

SAL Reference: 295391
Project Site: Hunter Road
Customer Reference: 106270

Soil Analysed as Soil
Asbestos

SAL Reference	295391 001	295391 002	295391 004	295391 005	295391 007	295391 010	295391 011	295391 019	295391 023	295391 024
Customer Sample Reference	HP101 0.3	HP102 0.2	HP103 0.4	HP104 0.2	HP105 0.25	HP107 0.4	HP107 0.4 ACM	HP112 0.3	HP115 0.4	HP116 0.3
Date Sampled	10-SEP-2012	10-SEP-2012	10-SEP-2012	10-SEP-2012	10-SEP-2012	10-SEP-2012	10-SEP-2012	10-SEP-2012	11-SEP-2012	11-SEP-2012

Determinand	Method	Test Sample	LOD	Units									
Asbestos ID	T27	AR			N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	Chrysotile Detected -	N.D.	N.D.

SAL Reference: 295391
Project Site: Hunter Road
Customer Reference: 106270

Soil Analysed as Soil
Asbestos

SAL Reference	295391 025	295391 033	295391 034	295391 035	295391 036	295391 037	295391 038	295391 039	295391 040	295391 041
Customer Sample Reference	HP117 0.2	HP125 0.2	HP125 0.2	HP126 0.3	HP126 0.2 ACM	HP127 0.1	HP127 0.1 ACM	HP128 0.05-0.1	HP128 0.05 ACM	HP129 0.2
Date Sampled	11-SEP-2012	11-SEP-2012	11-SEP-2012	12-SEP-2012	12-SEP-2012	12-SEP-2012	12-SEP-2012	12-SEP-2012	12-SEP-2012	12-SEP-2012

Determinand	Method	Test Sample	LOD	Units									
Asbestos ID	T27	AR			N.D.	N.D.	Chrysotile Detected -	N.D.	Amosite Detected -	N.D.	Chrysotile Detected -	N.D.	Chrysotile Detected - Amosite Detected -	N.D.

SAL Reference: 295391
Project Site: Hunter Road
Customer Reference: 106270

Soil Analysed as Soil
SOM

SAL Reference	295391 016	295391 021	295391 030	295391 031
Customer Sample Reference	HP110 0.3	HP113 0.3	HP122 0.2	HP123 0.4
Date Sampled	10-SEP-2012	11-SEP-2012	11-SEP-2012	11-SEP-2012

Determinand	Method	Test Sample	LOD	Units				
Soil Organic Matter	T287	AR	0.1	%	**3.5**	**8.0**	**5.5**	**1.0**

Index to symbols used in Supplement to 295391-1

Value	Description
AR	As Received
N.D.	Not Detected
S	Analysis was subcontracted
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos Comments:

019 - Detected in cement
034 - Detected in cement
036 - Detected in insulation board
038 - Detected in cement
040 - Detected in insulation board

Supplemental report to include additional asbestos information

Method Index

Value	Description
T149	GC/MS (SIR)
T27	PLM
T287	Calc TOC/0.58

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Naphthalene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Acenaphthylene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Acenaphthene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Fluorene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Phenanthrene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Anthracene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Fluoranthene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Pyrene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Chrysene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
PAH(total)	T149	AR	0.01	mg/kg	U	008,010,013,015-016,018,020-023,026-033
Asbestos ID	T27	AR			SU	001-002,004-005,007,010-011,019,023-025,033-041
Soil Organic Matter	T287	AR	0.1	%	N	016,021,030-031

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
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Tel : 0161 874 2400
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Report Number: 317955-1

Date of Report: 01-Mar-2013

Customer: Grontmij
1st Floor
Yorke House
Arleston Way
Shirley
Solihull
B90 4LH

Customer Contact: Ms Sasha Layton

Customer Job Reference: 106270
Customer Site Reference: Hunter Road
Date Job Received at SAL: 22-Feb-2013
Date Analysis Started: 25-Feb-2013
Date Analysis Completed: 01-Mar-2013

The results reported relate to samples received in the laboratory
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22

Report checked
and authorised by :
Mr Ross Walker
Customer Services Manager
(Land)

Issued by :
Mr Ross Walker
Customer Services Manager
(Land)

SAL Reference: 317955
Project Site: Hunter Road
Customer Reference: 106270

Soil Analysed as Soil
Miscellaneous

SAL Reference	**317955 001**	**317955 002**	**317955 003**	**317955 004**	**317955 005**
Customer Sample Reference	**HP130**	**HP131**	**HP132**	**HP133**	**HP134**
Date Sampled	**13-FEB-2013**	**13-FEB-2013**	**13-FEB-2013**	**13-FEB-2013**	**13-FEB-2013**

Determinand	Method	Test Sample	LOD	Units					
Asbestos ID	T27	AR			N.D.	N.D.	N.D.	N.D.	N.D.

SAL Reference: 317955
Project Site: Hunter Road
Customer Reference: 106270

Soil Analysed as Soil
Miscellaneous

SAL Reference	**317955 006**	**317955 007**	**317955 008**	**317955 009**
Customer Sample Reference	**HP135**	**HP136**	**HP137**	**HP138**
Date Sampled	**13-FEB-2013**	**13-FEB-2013**	**13-FEB-2013**	**13-FEB-2013**

Determinand	Method	Test Sample	LOD	Units				
Asbestos ID	T27	AR			N.D.	N.D.	N.D.	N.D.

Index to symbols used in 317955-1

Value	Description
AR	As Received
N.D.	Not Detected
S	Analysis was subcontracted
U	Analysis is UKAS accredited

Method Index

Value	Description
T27	PLM

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Asbestos ID	T27	AR			SU	001-009

APPENDIX E
TIER 1 SCREENING SPREADSHEETS

APPENDIX E1
SOILS

Multiplier:		1	x"<"	Cannock Chase Council | Hunter Rd (106270-010-011)												
	Strata															
	Observed Contamination															
	Sample Description															
	Date	-		Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11
	Sample ID	-		HP06 0.1	HP07 0.7	HP08 0.5	HP010 0.3	HP 11 0.1	HP11 0.45	HP12 0.5	HP14 0.5	HP16 0.3	HP17 0.15	HP18 0.4	HP19 0.2	
	Depth	m		0.1	0.7	0.5	0.3	0.1	0.45	0.5	0.5	0.3	0.15	0.4	0.2	
Screening Level	Substance	Units														
-																
-																
480	Acenaphthene	mg/kg		<0.1	0.4	3	0.4	<0.1			<0.1			<0.1	<0.1	
400	Acenaphthylene	mg/kg		<0.1	0.3	0.2	<0.1	<0.1			<0.1			<0.1	<0.1	
4900	Anthracene	mg/kg		0.2	1.4	6.3	0.9	<0.1			<0.1			<0.1	<0.1	
4.7	Benz(a)anthracene	mg/kg		1.1	**8.3**	**15**	1.3	0.3			0.4			0.2	<0.1	
0.94	Benzo(a)pyrene	mg/kg		**1.7**	**11**	**11**	**1.4**	0.3			0.3			0.2	<0.1	
6.5	Benzo(b)fluoranthene	mg/kg		2.2	**15**	**15**	1.8	0.5			0.5			0.2	0.1	
46	Benzo(ghi)perylene	mg/kg		1.3	9.8	7.4	1	0.2			0.2			0.1	<0.1	
9.6	Benzo(k)fluoranthene	mg/kg		0.7	4.9	5	0.6	0.2			0.2			<0.1	<0.1	
8	Chrysene	mg/kg		1.8	**10**	**16**	1.9	0.4			0.4			0.2	0.1	
0.86	Dibenz(ah)anthracene	mg/kg		0.5	**2.9**	**3.4**	0.3	<0.1			<0.1			<0.1	<0.1	
460	Fluoranthene	mg/kg		3	18	46	6.2	0.6			0.8			0.4	0.2	
380	Fluorene	mg/kg		<0.1	0.2	2.2	0.3	<0.1			<0.1			<0.1	<0.1	
3.9	Indeno(123-cd)pyrene	mg/kg		1	**8.5**	**7.6**	0.9	0.2			0.2			0.1	<0.1	
3.7	Naphthalene	mg/kg		<0.1	0.4	<0.1	<0.1	<0.1			<0.1			<0.1	<0.1	
200	Phenanthrene	mg/kg		0.7	5	39	4.1	0.2			0.5			0.1	<0.1	
1000	Pyrene	mg/kg		2.9	16	35	5.4	0.5			0.7			0.3	0.2	
-																
55	Aliphatic EC 5-6	mg/kg														
160	Aliphatic EC >6-8	mg/kg														
46	Aliphatic EC >8-10	mg/kg														
230	Aliphatic EC >12-16	mg/kg														
1700	Aliphatic EC >12-16	mg/kg														
64000	Aliphatic EC >16-35	mg/kg														
64000	Aliphatic EC >35-44	mg/kg														
-		mg/kg														
130	Aromatic EC 5-7 (benzene)	mg/kg														
270	Aromatic EC >7-8 (toluene)	mg/kg														
65	Aromatic EC >8-10	mg/kg														
160	Aromatic EC >10-12	mg/kg														
310	Aromatic EC >12-16	mg/kg														
480	Aromatic EC >16-21	mg/kg														
1100	Aromatic EC >21-35	mg/kg		50												
1100	Aromatic EC >35-44	mg/kg														
-																
-	Sulphate	mg/kg														
-	pH low limit															
-	pH high limit															
0.1	Asbestos					0				0						
-	PAHs total	mg/kg														
-	Petroleum Hydrocarbons	mg/kg														
-																
-	1,2,4-Trichlorobenzene															
-	1,2-Dichlorobenzene															
-	1,3-Dichlorobenzene															
-	1,4-Dichlorobenzene															
-	2,4,5-Trichlorophenol															
-	2,4,6-Trichlorophenol															
-	2,4-Dichlorophenol															
-	2,4-Dimethylphenol															
-	2,4-Dinitrophenol															
-	2,4-Dinitrotoluene															
-	2,6-Dinitrotoluene															
-	2-Chloronaphthalene															
-	2-Chlorophenol															
-	2-methyl phenol															
-	2-Methylnaphthalene															
-	2-Nitroaniline															
-	2-Nitrophenol															
-	3-Nitroaniline															
-	3/4-Methylphenol															
-	4-Bromophenyl phenylether															
-	4-Chloro-3-methylphenol															
-	4-Chloroaniline															
-	4-Chlorophenyl phenylether															
-	4-Nitroaniline															
-	4-Nitrophenol															
480	Acenaphthene			<0.1		3				<0.1			<0.1			
400	Acenaphthylene			<0.1		0.2				<0.1			<0.1			
4900	Anthracene			0.2		6.3				0.1			<0.1			
-	Azobenzene															
4.7	Benzo(a)Anthracene			1.1		**15**				1			0.2			
0.94	Benzo(a)Pyrene			**1.7**		**11**				0.9			0.2			
-	Benzo(b/k)Fluoranthene			3		20				1.6			0.3			
46	Benzo(ghi)Perylene			1.3		7.4				0.9			0.1			
-	Bis (2-chloroethoxy) methane															
-	Bis (2-chloroethyl) ether															
-	Bis (2-chloroisopropyl) ether															
-	Bis (2-ethylhexyl)phthalate															
-	Butyl benzylphthalate															
-	Carbazole															
8	Chrysene			1.8		**16**				1.4			0.2			
-	Di-n-butylphthalate															
-	Di-n-octylphthalate															
0.86	Dibenzo(ah)Anthracene			0.5		**3.4**				0.3			<0.1			
-	Dibenzofuran															
-	Diethyl phthalate															
-	Dimethyl phthalate															
460	Fluoranthene			3		46				2			0.4			
380	Fluorene			<0.1		2.2				<0.1			<0.1			
-	Hexachlorobenzene															
-	Hexachlorobutadiene															
-	Hexachlorocyclopentadiene															
-	Hexachloroethane															
3.9	Indeno(123-cd)Pyrene			1		**7.6**				0.8			0.1			
-	Isophorone															
3.7	Naphthalene			<0.1		<0.1				0.1			<0.1			
-	Nitrobenzene															
-	Pentachlorophenol															
200	Phenanthrene			0.7		39				0.5			0.1			
-	Phenol															
1000	Pyrene			2.9		35				1.9			0.3			

1															
Strata															
Observed Contamination															
Sample Description															
Date	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11
Sample ID	HP20 0.4	HP21 0.1	HP21 0.2	HP22 0.25	HP23 0.45	HP24 0.6	WS1 0.2	WS2 0.2(SC	WS3 0.4	WS4 0.65	WS5 0.7	WS6 0.3	WS7 0.7	WS7 1.8	
Depth	0.4	0.1	0.2	0.25	0.45	0.6	0.2	0.2	0.4	0.65	0.7	0.3	0.7	1.8	
Substance															
Acenaphthene	0.1	0.2	<0.1	<0.1	<0.1			0.7	<0.1	<0.1	<0.1		<0.1	<0.1	
Acenaphthylene	0.2	<0.1	<0.1	<0.1	<0.1			0.2	<0.1	<0.1	<0.1		<0.1	<0.1	
Anthracene	0.7	0.5	<0.1	0.2	<0.1			3.5	<0.1	<0.1	<0.1		0.1	<0.1	
Benz(a)anthracene	**5.8**	1.5	0.4	1.2	<0.1			**7.5**	<0.1	0.3	0.4		0.5	0.2	
Benzo(a)pyrene	**6.2**	**1.5**	0.5	**1.7**	<0.1			**6.1**	<0.1	0.2	0.6		0.6	0.1	
Benzo(b)fluoranthene	**7.8**	2.1	0.7	2	0.1			**8.4**	<0.1	0.4	0.7		0.7	0.2	
Benzo(ghi)perylene	4	1	0.3	1.3	<0.1			4.1	<0.1	0.2	0.4		0.4	0.2	
Benzo(k)fluoranthene	2.6	0.7	0.2	0.7	<0.1			2.8	<0.1	0.1	0.3		0.2	<0.1	
Chrysene	6.8	2.1	0.5	1.8	0.1			**8.6**	<0.1	0.3	0.5		0.6	0.2	
Dibenz(ah)anthracene	**1.7**	0.4	0.1	0.4	<0.1			**1.5**	<0.1	<0.1	0.2		0.1	<0.1	
Fluoranthene	13	5.2	1	3	0.2			18	<0.1	0.7	0.8		1	0.1	
Fluorene	<0.1	<0.1	<0.1	<0.1	<0.1			0.7	<0.1	<0.1	<0.1		<0.1	<0.1	
Indeno(123-cd)pyrene	3.8	0.9	0.3	1.1	<0.1			**4**	<0.1	0.2	0.4		0.4	0.1	
Naphthalene	0.4	<0.1	<0.1	<0.1	<0.1			0.1	<0.1	<0.1	<0.1		<0.1	<0.1	
Phenanthrene	2.6	1.9	0.3	0.7	0.1			11	<0.1	0.3	0.2		0.6	<0.1	
Pyrene	13	4.5	0.9	2.9	0.2			14	<0.1	0.6	0.9		0.8	0.1	
Aliphatic EC 5-6															
Aliphatic EC >6-8															
Aliphatic EC >8-10															
Aliphatic EC >12-16															
Aliphatic EC >12-16															
Aliphatic EC >16-35															
Aliphatic EC >35-44															
Aromatic EC 5-7 (benzene)															
Aromatic EC >7-8 (toluene)															
Aromatic EC >8-10															
Aromatic EC >10-12															
Aromatic EC >12-16															
Aromatic EC >16-21															
Aromatic EC >21-35	150									10					
Aromatic EC >35-44															
Sulphate															
pH low limit															
pH high limit															
Asbestos	0			0	0			**1**	0	0				0	
PAHs total															
Petroleum Hydrocarbons															
1,2,4-Trichlorobenzene															
1,2-Dichlorobenzene															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
2,4,5-Trichlorophenol															
2,4,6-Trichlorophenol															
2,4-Dichlorophenol															
2,4-Dimethylphenol															
2,4-Dinitrophenol															
2,4-Dinitrotoluene															
2,6-Dinitrotoluene															
2-Chloronaphthalene															
2-Chlorophenol															
2-methyl phenol															
2-Methylnaphthalene															
2-Nitroaniline															
2-Nitrophenol															
3-Nitroaniline															
3/4-Methylphenol															
4-Bromophenyl phenylether															
4-Chloro-3-methylphenol															
4-Chloroaniline															
4-Chlorophenyl phenylether															
4-Nitroaniline															
4-Nitrophenol															
Acenaphthene	0.1							0.7		<0.1				<0.1	
Acenaphthylene	0.2							0.2		<0.1				<0.1	
Anthracene	0.7							3.5		<0.1				<0.1	
Azobenzene															
Benzo(a)Anthracene	**5.8**							**7.5**		0.3				0.2	
Benzo(a)Pyrene	**6.2**							**6.1**		0.2				0.1	
Benzo(b/k)Fluoranthene	10							11		0.5				0.3	
Benzo(ghi)Perylene	4							4.1		0.2				0.2	
Bis (2-chloroethoxy) methane															
Bis (2-chloroethyl) ether															
Bis (2-chloroisopropyl) ether															
Bis (2-ethylhexyl)phthalate															
Butyl benzylphthalate															
Carbazole															
Chrysene	6.8							**8.6**		0.3				0.2	
Di-n-butylphthalate															
Di-n-octylphthalate															
Dibenzo(ah)Anthracene	**1.7**							**1.5**		<0.1				<0.1	
Dibenzofuran															
Diethyl phthalate															
Dimethyl phthalate															
Fluoranthene	13							18		0.7				0.1	
Fluorene	<0.1							0.7		<0.1				<0.1	
Hexachlorobenzene															
Hexachlorobutadiene															
Hexachlorocyclopentadiene															
Hexachloroethane															
Indeno(123-cd)Pyrene	3.8							**4**		0.2				0.1	
Isophorone															
Naphthalene	0.4							0.1		<0.1				<0.1	
Nitrobenzene															
Pentachlorophenol															
Phenanthrene	2.6							11		0.3				<0.1	
Phenol															
Pyrene	13							14		0.6				0.1	

1															
Strata															
Observed Contamination															
Sample Description															
Date	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Nov-11	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12
Sample ID	WS7 2.15	HP A 0.25	WS2 1.7	WS4 1.4	WS6 1.5	HP12 0.5	HP13 0.4	HP101	HP102	HP103	HP104	HP105	HP106	HP107	HP108
Depth	2.15	0.25	1.7	1.4	1.5	0.5	0.4	0.3	0.2	0.4	0.2	0.2	0.2	0.4	0.5
Substance															
Acenaphthene	<0.1					<0.1	<0.1						0.49	0.07	0.15
Acenaphthylene	<0.1					<0.1	<0.1						2.1	0.08	0.05
Anthracene	<0.1					0.1	<0.1						4.1	0.33	0.55
Benz(a)anthracene	<0.1					1	0.4						**6.4**	1.9	2
Benzo(a)pyrene	<0.1					0.9	0.5						**6.2**	**2.5**	**2**
Benzo(b)fluoranthene	0.2					1.2	0.7						5.8	2.4	1.7
Benzo(ghi)perylene	<0.1					0.9	0.6						3.7	1.9	1.3
Benzo(k)fluoranthene	<0.1					0.4	0.2						5.4	2	1.9
Chrysene	0.2					1.4	0.7						5.9	1.9	2
Dibenz(ah)anthracene	<0.1					0.3	0.2						**1.1**	0.51	0.39
Fluoranthene	0.3					2	1.1						17	4.2	4.5
Fluorene	<0.1					<0.1	<0.1						2.5	0.08	0.11
Indeno(123-cd)pyrene	<0.1					0.8	0.4						3.3	1.6	1.1
Naphthalene	<0.1					0.1	<0.1						0.43	0.07	0.04
Phenanthrene	0.2					0.5	0.4						15	1.3	1.9
Pyrene	0.2					1.9	1						13	3.7	3.8
Aliphatic EC 5-6															
Aliphatic EC >6-8															
Aliphatic EC >8-10															
Aliphatic EC >12-16															
Aliphatic EC >12-16															
Aliphatic EC >16-35															
Aliphatic EC >35-44															
Aromatic EC 5-7 (benzene)															
Aromatic EC >7-8 (toluene)															
Aromatic EC >8-10															
Aromatic EC >10-12															
Aromatic EC >12-16															
Aromatic EC >16-21															
Aromatic EC >21-35	7														
Aromatic EC >35-44															
Sulphate															
pH low limit															
pH high limit															
Asbestos															
PAHs total															
Petroleum Hydrocarbons															
1,2,4-Trichlorobenzene															
1,2-Dichlorobenzene															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
2,4,5-Trichlorophenol															
2,4,6-Trichlorophenol															
2,4-Dichlorophenol															
2,4-Dimethylphenol															
2,4-Dinitrophenol															
2,4-Dinitrotoluene															
2,6-Dinitrotoluene															
2-Chloronaphthalene															
2-Chlorophenol															
2-methyl phenol															
2-Methylnaphthalene															
2-Nitroaniline															
2-Nitrophenol															
3-Nitroaniline															
3/4-Methylphenol															
4-Bromophenyl phenylether															
4-Chloro-3-methylphenol															
4-Chloroaniline															
4-Chlorophenyl phenylether															
4-Nitroaniline															
4-Nitrophenol															
Acenaphthene	<0.1														
Acenaphthylene	<0.1														
Anthracene	<0.1														
Azobenzene															
Benzo(a)Anthracene	<0.1														
Benzo(a)Pyrene	<0.1														
Benzo(b/k)Fluoranthene	0.2														
Benzo(ghi)Perylene	<0.1														
Bis (2-chloroethoxy) methane															
Bis (2-chloroethyl) ether															
Bis (2-chloroisopropyl) ether															
Bis (2-ethylhexyl)phthalate															
Butyl benzylphthalate															
Carbazole															
Chrysene	0.2														
Di-n-butylphthalate															
Di-n-octylphthalate															
Dibenzo(ah)Anthracene	<0.1														
Dibenzofuran															
Diethyl phthalate															
Dimethyl phthalate															
Fluoranthene	0.3														
Fluorene	<0.1														
Hexachlorobenzene															
Hexachlorobutadiene															
Hexachlorocyclopentadiene															
Hexachloroethane															
Indeno(123-cd)Pyrene	<0.1														
Isophorone															
Naphthalene	<0.1														
Nitrobenzene															
Pentachlorophenol															
Phenanthrene	0.2														
Phenol															
Pyrene	0.2														

1															
Strata															
Observed Contamination															
Sample Description															
Date	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12	Sep-12
Sample ID	HP109	HP110	HP111	HP112	HP112	HP113	HP114	HP115	HP118	HP119	HP120	HP121	HP122	HP123	HP124
Depth	0.5	0.3	0.35	0.3	0.4	0.3	0.5	0.4	0.2	0.2	0.2	0.2	0.2	0.4	0.5
Substance															
Acenaphthene	0.03	0.03	0.01		0.02	0.03	0.04	0.03	0.01	0.01	0.01	0.01	0.01	<0.01	1.3
Acenaphthylene	0.02	0.04	0.02		0.04	0.07	0.04	0.06	0.01	0.02	0.02	0.01	0.01	0.01	0.18
Anthracene	0.12	0.23	0.09		0.12	0.29	0.2	0.12	0.03	0.07	0.04	0.07	0.04	0.02	2.4
Benz(a)anthracene	0.69	1.4	0.58		0.73	1.5	0.97	0.85	0.2	0.59	0.39	0.44	0.38	0.2	**7**
Benzo(a)pyrene	0.84	**1.7**	0.65		0.87	**1.5**	**1.1**	**1.1**	0.26	0.61	0.56	0.49	0.47	0.3	**7.5**
Benzo(b)fluoranthene	0.78	1.5	0.57		0.85	1.4	1.1	1.1	0.27	0.74	0.58	0.51	0.49	0.31	**7.3**
Benzo(ghi)perylene	0.51	1.2	0.42		0.69	0.85	0.72	0.75	0.18	0.49	0.44	0.4	0.35	0.25	5.1
Benzo(k)fluoranthene	0.71	1.6	0.62		0.78	1.5	0.94	0.93	0.24	0.59	0.54	0.46	0.42	0.24	6.7
Chrysene	0.68	1.4	0.58		0.77	1.4	0.95	0.86	0.21	0.69	0.43	0.47	0.39	0.21	6.7
Dibenz(ah)anthracene	0.16	0.33	0.13		0.23	0.28	0.22	0.22	0.06	0.17	0.13	0.14	0.1	0.07	**1.5**
Fluoranthene	1.4	2.7	1.2		1.4	2.8	1.8	1.5	0.38	1.2	0.58	0.87	0.61	0.3	17
Fluorene	0.03	0.03	0.01		0.03	0.05	0.04	0.04	0.01	0.01	0.01	0.01	0.01	<0.01	0.85
Indeno(123-cd)pyrene	0.47	1	0.38		0.59	0.79	0.64	0.66	0.16	0.42	0.38	0.34	0.3	0.21	**4.5**
Naphthalene	0.02	0.04	0.02		0.04	0.05	0.05	0.05	0.01	0.04	0.02	0.01	0.02	0.01	0.25
Phenanthrene	0.39	0.83	0.3		0.44	0.92	0.62	0.6	0.1	0.25	0.14	0.26	0.18	0.06	7.5
Pyrene	1.2	2.3	0.99		1.2	2.4	1.5	1.3	0.41	1.1	0.55	0.76	0.55	0.29	14
Aliphatic EC 5-6															
Aliphatic EC >6-8															
Aliphatic EC >8-10															
Aliphatic EC >12-16															
Aliphatic EC >12-16															
Aliphatic EC >16-35															
Aliphatic EC >35-44															
Aromatic EC 5-7 (benzene)															
Aromatic EC >7-8 (toluene)															
Aromatic EC >8-10															
Aromatic EC >10-12															
Aromatic EC >12-16															
Aromatic EC >16-21															
Aromatic EC >21-35															
Aromatic EC >35-44															
Sulphate															
pH low limit															
pH high limit															
Asbestos				**1**											
PAHs total															
Petroleum Hydrocarbons															
1,2,4-Trichlorobenzene															
1,2-Dichlorobenzene															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
2,4,5-Trichlorophenol															
2,4,6-Trichlorophenol															
2,4-Dichlorophenol															
2,4-Dimethylphenol															
2,4-Dinitrophenol															
2,4-Dinitrotoluene															
2,6-Dinitrotoluene															
2-Chloronaphthalene															
2-Chlorophenol															
2-methyl phenol															
2-Methylnaphthalene															
2-Nitroaniline															
2-Nitrophenol															
3-Nitroaniline															
3/4-Methylphenol															
4-Bromophenyl phenylether															
4-Chloro-3-methylphenol															
4-Chloroaniline															
4-Chlorophenyl phenylether															
4-Nitroaniline															
4-Nitrophenol															
Acenaphthene															
Acenaphthylene															
Anthracene															
Azobenzene															
Benzo(a)Anthracene															
Benzo(a)Pyrene															
Benzo(b/k)Fluoranthene															
Benzo(ghi)Perylene															
Bis (2-chloroethoxy) methane															
Bis (2-chloroethyl) ether															
Bis (2-chloroisopropyl) ether															
Bis (2-ethylhexyl)phthalate															
Butyl benzylphthalate															
Carbazole															
Chrysene															
Di-n-butylphthalate															
Di-n-octylphthalate															
Dibenzo(ah)Anthracene															
Dibenzofuran															
Diethyl phthalate															
Dimethyl phthalate															
Fluoranthene															
Fluorene															
Hexachlorobenzene															
Hexachlorobutadiene															
Hexachlorocyclopentadiene															
Hexachloroethane															
Indeno(123-cd)Pyrene															
Isophorone															
Naphthalene															
Nitrobenzene															
Pentachlorophenol															
Phenanthrene															
Phenol															
Pyrene															

1									
Strata									
Observed Contamination									
Sample Description									
Date	Sep-12	Sep-12	Sep-12	Sep-12	Dec-10	Dec-10	Dec-10	Dec-10	Dec-10
Sample ID	HP125	HP126	HP127	HP128	TP1	TP2	TP3	TP4	TP5
Depth	0.2	0.2	0.1	0.05	0.1	0.3	0.6	0.3	0.1
Substance									
Acenaphthene	0.02				0.249	0.0525	0.0315	0.0265	9.77
Acenaphthylene	0.03				1.13	0.209	0.0409	0.0632	0.165
Anthracene	0.12				3.42	0.193	0.14	0.141	15.9
Benz(a)anthracene	0.93				**6.4**	0.827	0.614	0.959	**20.5**
Benzo(a)pyrene	**1.2**				**5.22**	**0.973**	0.729	**1.19**	**14.8**
Benzo(b)fluoranthene	1.2				5.67	1.17	0.752	1.2	**17.7**
Benzo(ghi)perylene	0.81				3.16	0.75	0.602	0.886	7.09
Benzo(k)fluoranthene	1.1				2.56	0.459	0.334	0.481	8.56
Chrysene	0.92				5.25	0.903	0.539	0.876	**16.1**
Dibenz(ah)anthracene	0.25				0.768	0.16	0.124	0.173	**1.99**
Fluoranthene	1.4				16.6	2.15	1.45	1.74	65.1
Fluorene	0.02				1.22	0.159	0.0338	0.0247	8.14
Indeno(123-cd)pyrene	0.72				2.91	0.612	0.465	0.706	**6.76**
Naphthalene	0.04				0.198	0.283	0.0453	0.0811	0.142
Phenanthrene	0.44				14.7	1.79	0.649	0.394	51.5
Pyrene	1.3				12.3	1.63	1.21	1.55	44.2
Aliphatic EC 5-6									
Aliphatic EC >6-8									
Aliphatic EC >8-10									
Aliphatic EC >12-16									
Aliphatic EC >12-16									
Aliphatic EC >16-35									
Aliphatic EC >35-44									
Aromatic EC 5-7 (benzene)									
Aromatic EC >7-8 (toluene)									
Aromatic EC >8-10									
Aromatic EC >10-12									
Aromatic EC >12-16									
Aromatic EC >16-21									
Aromatic EC >21-35									
Aromatic EC >35-44									
Sulphate									
pH low limit									
pH high limit									
Asbestos	**1**	**1**	**1**	**1**					
PAHs total									
Petroleum Hydrocarbons									
1,2,4-Trichlorobenzene									
1,2-Dichlorobenzene									
1,3-Dichlorobenzene									
1,4-Dichlorobenzene									
2,4,5-Trichlorophenol									
2,4,6-Trichlorophenol									
2,4-Dichlorophenol									
2,4-Dimethylphenol									
2,4-Dinitrophenol									
2,4-Dinitrotoluene									
2,6-Dinitrotoluene									
2-Chloronaphthalene									
2-Chlorophenol									
2-methyl phenol									
2-Methylnaphthalene									
2-Nitroaniline									
2-Nitrophenol									
3-Nitroaniline									
3/4-Methylphenol									
4-Bromophenyl phenylether									
4-Chloro-3-methylphenol									
4-Chloroaniline									
4-Chlorophenyl phenylether									
4-Nitroaniline									
4-Nitrophenol									
Acenaphthene									
Acenaphthylene									
Anthracene									
Azobenzene									
Benzo(a)Anthracene									
Benzo(a)Pyrene									
Benzo(b/k)Fluoranthene									
Benzo(ghi)Perylene									
Bis (2-chloroethoxy) methane									
Bis (2-chloroethyl) ether									
Bis (2-chloroisopropyl) ether									
Bis (2-ethylhexyl)phthalate									
Butyl benzylphthalate									
Carbazole									
Chrysene									
Di-n-butylphthalate									
Di-n-octylphthalate									
Dibenzo(ah)Anthracene									
Dibenzofuran									
Diethyl phthalate									
Dimethyl phthalate									
Fluoranthene									
Fluorene									
Hexachlorobenzene									
Hexachlorobutadiene									
Hexachlorocyclopentadiene									
Hexachloroethane									
Indeno(123-cd)Pyrene									
Isophorone									
Naphthalene									
Nitrobenzene									
Pentachlorophenol									
Phenanthrene									
Phenol									
Pyrene									

Substance		Screening Criteria		Number of Analyses	Reported Minimum Value	Reported Maximum Value	Statistical Mean	Standard Deviation	Number of Exceedances
		-	-						-
Boron (H20 Soluble)	mg/kg	291	GAC (2.5% SOM)						
Arsenic	mg/kg	32	GAC (2.5% SOM)						
Cadmium	mg/kg	10	GAC (2.5% SOM)						
Chromium (trivalent)	mg/kg	627	GAC (2.5% SOM)						
Copper	mg/kg	2330	GAC (2.5% SOM)						
Lead (using old SGV)	mg/kg	450	GAC (2.5% SOM)						
Mercury (elemental)	mg/kg	0.42	GAC (2.5% SOM)						
Mercury (methyl)	mg/kg	9.6	GAC (2.5% SOM)						
Mercury (inorganic)	mg/kg	170	GAC (2.5% SOM)						
Nickel	mg/kg	130	GAC (2.5% SOM)						
Selenium	mg/kg	350	GAC (2.5% SOM)						
Zinc	mg/kg	3750	GAC (2.5% SOM)						
Chromium (hexavalent)	mg/kg	4.3	GAC (2.5% SOM)						
Antimony	mg/kg	550	EIC-Cl:aire						
Vanadium	mg/kg	75	SGV / GAC (6% SOM)						
Berylium	mg/kg	51	SGV / GAC (6% SOM)						
Barium	mg/kg	1300	EIC-Cl:aire						
Molybdenum	mg/kg	670	EIC-Cl:aire						
Thiocyanate	mg/kg	-	-						-
Cyanide (free)	mg/kg	-	-						-
Cyanide (Total)	mg/kg	-	-						-
Phenols (Total)	mg/kg	290	GAC (2.5% SOM)						
		-	-						-
Benzene	mg/kg	0.16	GAC (2.5% SOM)						
Toluene	mg/kg	270	GAC (2.5% SOM)						
Ethylbenzene	mg/kg	150	GAC (2.5% SOM)						
m-Xylene	mg/kg	100	GAC (2.5% SOM)						
o-Xylene	mg/kg	110	GAC (2.5% SOM)						
p-Xylene	mg/kg	98	GAC (2.5% SOM)						
		-	-						-
Acenaphthene	mg/kg	480	GAC (2.5% SOM)	45	<0.01	9.77	0.42	1.5	0
Acenaphthylene	mg/kg	400	GAC (2.5% SOM)	45	0.01	2.1	0.16	0.34	0
Anthracene	mg/kg	4900	GAC (2.5% SOM)	45	0.02	15.9	0.97	2.61	0
Benz(a)anthracene	mg/kg	4.7	GAC (2.5% SOM)	45	<0.1	20.5	2.28	4.07	8
Benzo(a)pyrene	mg/kg	0.94	GAC (2.5% SOM)	45	<0.1	14.8	2.18	3.31	21
Benzo(b)fluoranthene	mg/kg	6.5	GAC (2.5% SOM)	45	<0.1	17.7	2.57	4.16	6
Benzo(ghi)perylene	mg/kg	46	GAC (2.5% SOM)	45	<0.1	9.8	1.47	2.16	0
Benzo(k)fluoranthene	mg/kg	9.6	GAC (2.5% SOM)	45	<0.1	8.56	1.32	1.91	0
Chrysene	mg/kg	8	GAC (2.5% SOM)	45	<0.1	16.1	2.33	3.8	4
Dibenz(ah)anthracene	mg/kg	0.86	GAC (2.5% SOM)	45	0.06	3.4	0.49	0.74	7
Fluoranthene	mg/kg	460	GAC (2.5% SOM)	45	<0.1	65.1	5.99	12.2	0
Fluorene	mg/kg	380	GAC (2.5% SOM)	45	<0.01	8.14	0.41	1.29	0
Indeno(123-cd)pyrene	mg/kg	3.9	GAC (2.5% SOM)	45	<0.1	8.5	1.34	2.02	5
Naphthalene	mg/kg	3.7	GAC (2.5% SOM)	45	0.01	0.43	0.11	0.099	0
Phenanthrene	mg/kg	200	GAC (2.5% SOM)	45	0.06	51.5	3.75	9.8	0
Pyrene	mg/kg	1000	GAC (2.5% SOM)	45	<0.1	44.2	4.74	8.84	0
		-	-						-
Aliphatic EC 5-6	mg/kg	55	GAC (2.5% SOM)						
Aliphatic EC >6-8	mg/kg	160	GAC (2.5% SOM)						
Aliphatic EC >8-10	mg/kg	46	GAC (2.5% SOM)						
Aliphatic EC >12-16	mg/kg	230	GAC (2.5% SOM)						
Aliphatic EC >12-16	mg/kg	1700	GAC (2.5% SOM)						
Aliphatic EC >16-35	mg/kg	64000	GAC (2.5% SOM)						
Aliphatic EC >35-44	mg/kg	64000	GAC (2.5% SOM)						
	mg/kg	-	-						-
Aromatic EC 5-7 (benzene)	mg/kg	130	GAC (2.5% SOM)						
Aromatic EC >7-8 (toluene)	mg/kg	270	GAC (2.5% SOM)						
Aromatic EC >8-10	mg/kg	65	GAC (2.5% SOM)						
Aromatic EC >10-12	mg/kg	160	GAC (2.5% SOM)						
Aromatic EC >12-16	mg/kg	310	GAC (2.5% SOM)						
Aromatic EC >16-21	mg/kg	480	GAC (2.5% SOM)						
Aromatic EC >21-35	mg/kg	1100	GAC (2.5% SOM)	4	7	150	54.3	66.8	0
Aromatic EC >35-44	mg/kg	1100	GAC (2.5% SOM)						
		-	-						-
Sulphate	mg/kg	-	-						-
pH low limit		-	-						-
pH high limit		-	-						-
Asbestos		0.1	1 is eqaul to detection	14		1	0.43	0.51	6
PAHs total	mg/kg	-	-						-
Petroleum Hydrocarbons	mg/kg	-	-						-
		-	-						-
1,2,4-Trichlorobenzene		-	-						-
1,2-Dichlorobenzene		-	-						-
1,3-Dichlorobenzene		-	-						-
1,4-Dichlorobenzene		-	-						-
2,4,5-Trichlorophenol		-	-						-
2,4,6-Trichlorophenol		-	-						-
2,4-Dichlorophenol		-	-						-
2,4-Dimethylphenol		-	-						-
2,4-Dinitrophenol		-	-						-
2,4-Dinitrotoluene		-	-						-
2,6-Dinitrotoluene		-	-						-
2-Chloronaphthalene		-	-						-
2-Chlorophenol		-	-						-
2-methyl phenol		-	-						-
2-Methylnaphthalene		-	-						-
2-Nitroaniline		-	-						-
2-Nitrophenol		-	-						-
3-Nitroaniline		-	-						-
3/4-Methylphenol		-	-						-
4-Bromophenyl phenylether		-	-						-
4-Chloro-3-methylphenol		-	-						-
4-Chloroaniline		-	-						-
4-Chlorophenyl phenylether		-	-						-
4-Nitroaniline		-	-						-

Substance	Screening Criteria		Number of Analyses	Reported Minimum Value	Reported Maximum Value	Statistical Mean	Standard Deviation	Number of Exceedances
4-Nitrophenol	-	-						-
Acenaphthene	480	GAC (2.5% SOM)	9	<0.1	3	0.49	0.96	0
Acenaphthylene	400	GAC (2.5% SOM)	9	<0.1	0.2	0.13	0.05	0
Anthracene	4900	GAC (2.5% SOM)	9	<0.1	6.3	1.24	2.2	0
Azobenzene	-	-						-
Benzo(a)Anthracene	4.7	GAC (2.5% SOM)	9	<0.1	15	3.47	5.11	3
Benzo(a)Pyrene	0.94	GAC (2.5% SOM)	9	<0.1	11	2.94	3.91	4
Benzo(b/k)Fluoranthene	-	-	9	0.2	20	5.21	6.97	-
Benzo(ghi)Perylene	46	GAC (2.5% SOM)	9	<0.1	7.4	2.03	2.57	0
Bis (2-chloroethoxy) methane	-	-						-
Bis (2-chloroethyl) ether	-	-						-
Bis (2-chloroisopropyl) ether	-	-						-
Bis (2-ethylhexyl)phthalate	-	-						-
Butyl benzylphthalate	-	-						-
Carbazole	-	-						-
Chrysene	8	GAC (2.5% SOM)	9	0.2	16	3.94	5.5	2
Di-n-butylphthalate	-	-						-
Di-n-octylphthalate	-	-						-
Dibenzo(ah)Anthracene	0.86	GAC (2.5% SOM)	9	<0.1	3.4	0.87	1.14	3
Dibenzofuran	-	-						-
Diethyl phthalate	-	-						-
Dimethyl phthalate	-	-						-
Fluoranthene	460	GAC (2.5% SOM)	9	0.1	46	9.28	15.2	0
Fluorene	380	GAC (2.5% SOM)	9	<0.1	2.2	0.4	0.7	0
Hexachlorobenzene	-	-						-
Hexachlorobutadiene	-	-						-
Hexachlorocyclopentadiene	-	-						-
Hexachloroethane	-	-						-
Indeno(123-cd)Pyrene	3.9	GAC (2.5% SOM)	9	<0.1	7.6	1.97	2.62	2
Isophorone	-	-						-
Naphthalene	3.7	GAC (2.5% SOM)	9	<0.1	0.4	0.13	0.1	0
Nitrobenzene	-	-						-
Pentachlorophenol	-	-						-
Phenanthrene	200	GAC (2.5% SOM)	9	<0.1	39	6.06	12.8	0
Phenol	-	-						-
Pyrene	1000	GAC (2.5% SOM)	9	0.1	35	7.56	11.7	0
	-	-						-

APPENDIX F
PAH RISK ASSESSMENT

APPENDIX F

PAH Risk Assessment Approach

1. Introduction

Cannock Chase District Council (the Council) are required to make a decision about the concentration of substances including PAH / benzo(a)pyrene in soil below which it would not consider that there is significant possibility of significant harm (SPOSH) to human health.

The 2012 revised Statutory Guidance states (4.16) that;

> *"The decision on whether the possibility of significant harm being caused is significant is a regulatory decision to be taken by the relevant local authority. In deciding whether the possibility of significant harm being caused is significant, the authority is deciding whether the possibility of significant harm posed by contamination in, on or under the land is sufficiently high that regulatory action should be taken to reduce it, with all that would entail. In taking such decisions, the local authority should take account of the broad aims of the regime set out in Section 1 of this Guidance."*

The Statutory Guidance considers that there are four categories into which a local authority may assign land under Part 2A of the 1990 Environmental Protection Act. The description of the four categories differs for human health and controlled waters. For human health a basic description of the four categories are described below. For the full definitions reference should be made to Sections 4.19 to 4.25 of the Statutory Guidance 2012.

- **Category 1:** *"Unacceptably high probability, supported by robust science based evidence that significant harm would occur if no action taken to stop it."*
- **Category 2:** *"A strong case for considering that the risks from the land are of sufficient concern that the land poses SPOSH".*
- **Category 3:** *"The strong case described for Category 2 does not exist, thus the legal test for SPOSH is not met. (Note that the risk may not be low but regulatory intervention is not warranted)".*
- **Category 4:** *"No risk or that the level of risk is low (no relevant contaminant linkage / within normal range of background concentrations / GAC[1] not exceeded)."*

The Council is required to decide which Category the site falls into based on the data available from the site inspection.

2. Rationale for Requirement to Progress Beyond GAC

With specific regard to the PAH Benzo (a) pyrene, the initial risk assessment screening criterion of 0.94 mg/kg is a GAC derived by the Chartered Institute of Environmental Health (CIEH) and Land Quality Management Ltd (LQM) [2]. Soil GAC are criteria which combine a set of generic, conservative assumptions regarding exposure with toxicological criteria (health criteria values or HCVs), which represent *minimal* risks to health.

[1] Generic assessment criteria, explained below.

[2] Statutory Guidance 2012 accepted GAC – Paragraph 3.27 to 3.30 and associated footnote of the Statutory Guidance 2012)

The 2012 revised Statutory Guidance states that:

> "*GACs relating to human health risk assessment represent cautious estimates of levels of contaminants in soil at which there is considered to be no risk to health or, at most, a minimal risk to health.*
>
> *(a) They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health. This is on the basis that they are designed to estimate levels of contamination at which risks are likely to be negligible or minimal and far from posing a significant possibility of significant harm to human health.*
> *(b) They should not be used as direct indicators of whether a significant possibility of significant harm to human health may exist."*
> *(c) They should not be seen as screening levels which describe the boundary between Categories 3 and 4 in terms of Section 4 (of the Statutory Guidance) (i.e. the two Categories in which land would not be contaminated land on grounds of risks to human health). In the very large majority of cases, these SGVs/GACs describe levels of contamination from which risks should be considered to be comfortably within Category 4.(also see footnote 3 of paragraph 3.29)*.
> *(d) They should not be viewed as indicators as levels of contamination above which detailed risk assessment would automatically be required under Part 2A*
> *(e) They should not be used as generic remediation targets under Part 2A.*

For the full details of the appropriate use of GAC reference should be made to Paragraphs 3.27 to 3.30 of the Statutory Guidance.

Based on the available data, Grontmij do not consider that there is an unacceptable high probability that significant harm would occur to humans at the site. Thus, Category 1 does not exist, and Category 4 was also discounted on the basis of the results obtained.

Therefore, given the maximum concentration recorded of 15 mg/kg and the number of samples which exceeded the GAC, further assessment was required to assist the Council to establish whether or not one or more properties within the site fall into **Category 2** or **Category 3** (i.e. to decide if there is a strong case that SPOSH exists or not). As discussed above, GAC cannot be used for this purpose and thus other types of assessment are needed to be considered.

The Statutory Guidance states that technical tools and or advice maybe used to aid with informing a decision. This is provided that these have been undertaken by "*government bodies, regulators of other organisations in the land contamination sector*" (Section 3.30 of the Statutory Guidance) and/or *"that they have been produced in an objective, scientifically robust and expert manner by reputable organisation* (Section 3.28 of the statutory Guidance).

Therefore, work undertaken by these bodies, or institutions of repute with regard to (for example but not limited to) toxicological properties of a substance, or bodily uptake of a contaminant could be critically assessed for its suitability (it is required under the Part 2A definition that the work is developed in a manner which is scientifically-based, authoritative, and relevant) and used as a means to more closely assess whether there is strong case that SPOSH exists at the site.

In the case of benzo(a)pyrene, the Institute of Occupational Medicine carried out a review for Brent Council on polycyclic aromatic hydrocarbons (PAHs) in 2009. This assessed the

toxicological properties of PAH to support Brent Council in making an assessment of soil concentrations above which they may constitute significant possibility of significant harm (SPOSH) at the Brent site.[3] .

Therefore, this approach to assessing whether there is a strong case that SPOSH exists from benzo(a)pyrene was examined in relation to the circumstances at the Hunter Road site

A summary of their approach and how it relates to the Hunter Road site is described in the following sections.

3. Selection of Assessment Criterion from IOM Report

Origin of Assessment Criterion

The IOM carried out a review for Brent Council on polycyclic aromatic hydrocarbons (PAHs) in 2009. The review assessed the toxicological properties of PAH to support Brent Council in making an assessment of soil concentrations of PAH above which they may constitute a significant possibility of significant harm (SPOSH) at the Brent site.

Although the report was developed specifically for one particular site in Brent, the toxicological considerations used provide a useful input into other similar sites.

Grontmij consider the IOM toxicological review to be authoritative and the lines of evidence are appropriate for the circumstances at the Hunter Road site.

Following review of the IOM work it has been agreed between Grontmij and the Council that an assessment criterion of 17 mg/kg produced by IOM for Brent Council will be adopted for benzo(a)pyrene as a threshold below which SPOSH will not be considered to occur.

Derivation of IOM Assessment Criterion

The value of 17 mg/kg is the lower end of a range (for which the upper end is 36mg/kg) proposed by IOM as a concentration range at which it could be argued that, if greatly exceeded "*the potential for significant harm would be significant, unless measures are in place to prevent exposure*"[4].

The range of 17 mg/kg to 36 mg/kg benzo(a)pyrene has been derived by considering a number of toxicological assumptions, and assumptions about exposure. Both toxicological assessment and exposure assessment are subject to considerable uncertainties. In toxicological assessment, studies on animals and/or epidemiological studies are used to determine either:

a) the concentration of a substance at which no observable adverse effect is occurring,
b) the lowest concentration at which an observable adverse effect is occurring,
c) the level at which a certain percentage of animals develop a tumour.

The general term for the latter is the "Point of Departure (POD)" and to this a variety of uncertainty factors are applied. These uncertainty factors in relation to the IOM work are discussed below.

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[3] Toxicological Review of the Risks of Exposure to Soil Containing Polycyclic Aromatic Hydrocarbons 2009

[4] The report also notes that "*It would clearly be inappropriate to discriminate between soils that contained PAH contents that were marginally above a discrete guideline value from those that were marginally below that value.*"

Uncertainty Factors

Point of Departure

Benzo(a)pyrene is a genotoxic carcinogen. Although there is human epidemiological data for the inhalation route, there is no human data for the ingestion route. Therefore toxicological criteria are based on rodent studies and there is considerable uncertainty in their derivation. It is therefore common practice to identify a range of PODs.

Expert toxicologists within IOM selected a POD for benzo(a)pyrene, referred to as a $BMDL_{10}$[5] of 0.5-1 mg/kg bodyweight/day from pooled studies on rat and mouse estimates based on total tumour incidence.

Toxicity Equivalency Factor and Margin of Exposure

The toxicologists took into account that there were other PAHs at the site, some more and some less potent than benzo(a)pyrene using an approach referred to as toxicity equivalency factor (TEF). In the case of the site in question, IOM determined that an appropriate TEF for the PAHs in soils was1.6[6].

They applied an uncertainty factor (referred to as a "margin of exposure" (MoE)[7]) of 10,000, which they based on the fact that the Committee on Carcinogenicity "have indicated that a MoE of <10,000 may be of concern, whereas a MoE of between 10,000-100,000 was unlikely to be of concern." This resulted in an index dose for benzo(a)pyrene as a marker of total PAH exposure of 0.0312 –0.0625 µg/kg/day by ingestion.

Human type and index dose

IOM considered the exposure of "a typical toddler aged between 1 and 2 years with a body weight of 11.4 kg" with a "long term mean intake of soil and dust" of 100 mg/day and calculated a concentration in soil of benzo(a)pyrene at which the index dose would not be exceeded of 3.56-7.11 mg/kg.

Exposure by inhalation

After defining the index dose, IOM then took into account an additional allowance of a factor of two "for exposure by inhalation to re-suspended soil dust in the indoor environment" on the basis that "*Given the apparently greater potency of inhaled B[a]P over ingested B[a]P although inhalation exposures may be <10% of the ingested dose, they could potentially contribute to >50% of the potential for significant harm*". This resulted in a range of 1.7 mg/kg to 3.6 mg/kg[8].

Differentiation from normal urban soils

Having derived this range value, IOM noted that this was within one standard deviation of the average benzo(a)pyrene content in urban soils, (based on work by the Environment Agency), and therefore decided that, as Part 2A is meant to differentiate contaminated sites

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[5] *A $BMDL_{10}$ is the 95% lower confidence limit on a dose associated with a 10% extra tumour risk level.*

[6] It is noted that the TEF for the St Raphael's site in Brent may not be representative of the total PAH profile for the Admiral Parker Drive site, and, moreover that the TEF approach is not endorsed by the HPA.

[7] MoE is the ratio of the point of departure (in mg kg-1 bw day-1 for example) divided by the human exposure to the chemical (in the same units)

[8]. IOM did not consider other pathways on the grounds that "*exposure, uptake and cancer risk are dominated by inadvertent ingestion and inhalation, the contribution of other routes of exposure to cancer risk is extremely small.*"

from normal concentrations, it was appropriate to multiply this range by ten (effectively reducing the MoE (uncertainty factor) to 1,000), resulting in the range of 17 mg/kg to 36 mg/kg of benzo(a)pyrene in soil.

In justification for reducing the MoE to 1000, IOM stated that an MoE of above 1000 "*may pose a risk*" in the view of the Committee on Carcinogenicity.

Exposure During Remedial Works

Grontmij has noted that the IOM report states that:

"*Given that the exposure modelling is based on reasonable worst case assumptions, soil concentrations between 7 and 17 mg/kg may be tolerable given that the removal of contaminated soils could give rise to temporary exposure of residents to B[a]P during any remediation works and that this could have a much greater impact on their lifetime exposure than if the soil had remained undisturbed.*".

Consideration of the impact on health risk of remediation activities is one of the factors that the revised 2012 Statutory Guidance states that a local authority may take into account, if they consider that the line between Category 2 and Category 3 land is unclear, based on a consideration of the health risks alone.

4. Other Approaches for Derivation of an Assessment Criterion for PAHs (Sensitivity Analysis)

It is considered prudent that other potential approaches are assessed to provide robust argument to the use of the IOM report. It is acknowledged that the Health Protection Agency [9]stated that

" *it would seem prudent to base the index dose (ID) on the $BMDL_{10}$ values proposed by EFSA[10] and JECFA[11] derived from the Culp et al. study [1] [12](0.07 and 0.1 milligrams per kilogram bodyweight per day (mg/kg bodyweight/day)*."

This range is significantly lower than the range of $BMDL_{10}$ of 0.5mg/kg/bodyweight/day to 1 mg/kg/bodyweight/day used within the IOM report. It is noted that the Culp *et al.* mouse study was one of the studies considered within the IOM's derivation of a $BMDL_{10}$ but that the authors considered it more justifiable to consider a wider range of rat and mouse studies.

A full evaluation of the merits of the choice of $BMDL_{10}$ within the widely accepted IOM report has not been carried out . However it is noted that the EFSA report[13] cites the JECFA choice of $BMDL_{10}$ of 0.1 mg/kg bodyweight/day as being the lower end of the calculated range of 0.10-0.23 mg benzo[*a*]pyrene/kg bodyweight per day, i.e. the most conservative choice. EFSA used the same data as JECFA but calculated $BMDL_{10}$ values which ranged from 0.07 to 0.20 mg/kg bodyweight per day with 0.12 mg/kg bodyweight per day representing the best fit.

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[9] HPA Contaminated Land Information Sheet Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs), Health Protection Agency v5 2010

[10] European Food Safety Authority

[11] Joint FAO/WHO Expert Committee on Food Additives

[12] Culp, S.J., et al., *A comparison of the tumors induced by coal tar and benzo[a]pyrene in a 2-year bioassay.* Carcinogenesis, 1998. 19(1): p. 117-24.

[13] Polycyclic Aromatic Hydrocarbons in Food Scientific Opinion of the Panel on Contaminants in the Food Chain, *The EFSA Journal* (2008) 724, 1-114

However, despite the fact that 0.12 mg/kg bodyweight per day was the best fit, the lowest value in the range of 0.07 mg/kg bodyweight per day was chosen “in order to be prudent”. There is therefore only approximately a factor of 2 between the upper end of the JECFA and EFSA ranges and the lower end of the IOM range. The IOM range is then subject to a reduction to account for the TEF of 1.6 for total PAHs, whereas the JECFA and EFSA studies use BaP as a surrogate marker (discussed below). Therefore, there is less difference between the selections of $BMDL_{10}$ than it would at first appear.

Based on the above, the differences between the two values (HPA and IOM) are relatively small, compared to the uncertainty factors that are subsequently applied.

Other than the approach by the HPA, Grontmij note that decisions on SPOSH have been made by other local authorities, where selecting a different POD has resulted in the threshold of SPOSH being selected at greater soil concentrations than those of IOM.

Overall the arguments presented by IOM are considered to be a robust starting point for considering the question of SPOSH at sites where PAH contamination is present.

5. Use of BaP as a Surrogate Marker Compound

It is recognised that the TEF approach that has been used within the IOM report is not endorsed for PAHs by the HPA Contaminated Land Information Sheet (CLIS). The HPA CLIS does propose the use of benzo(a)pyrene as a surrogate marker(a single substance that may be used to represent a wider group of substances) for total PAHs in soils, provided that the profile of PAHs is of sufficient similarity to the mixture used within the Culp *et al.* report, and, specifically that the ratio of seven genotoxic PAHs (benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(ah)anthracene, indeno(1,2,3 cd pyrene) and benzo(ghi)perylene) is within an order of magnitude, in either direction, of the mean ratios established by Culp *et al.*

The HPA CLIS reports a study of 52 contaminated sites across the UK and notes that:

“*Categorisation of the data, according to previous industrial use, showed no substantial differences in the relative PAH profiles. Moreover, the PAH profile in contaminated land was similar to that found in industrial, urban and rural UK soil samples and in other surveys of soil within the UK.*”

It would therefore appear that benzo(a)pyrene is a good surrogate marker for total PAHs in contaminated soil, and this approach is therefore considered suitable for evaluation of the total PAH concentrations at the Hunter Road site. It is noted that, as the value of 17 mg/kg for benzo(a)pyrene considers a TEF of 1.6 for a variety of genotoxic PAHs, this introduces an element of conservatism into the assessment.

6. Conclusions

It is explicitly acknowledged within the Statutory Guidance within paragraph 3.32 that “*The uncertainty underlying risk assessments means there is unlikely to be any single “correct” conclusion on precisely what is the level of risk is posed by land, and it is possible that different suitably qualified people could come to different conclusions when presented with the same information. It is for the local authority to use its judgement to form a reasonable view of what it considers the risks to be on the basis of a robust assessment of available evidence in line with this Guidance.*”

The criterion of 17 mg/kg derived by IOM for benzo(a)pyrene to be used as both a value for benzo(a)pyrene and as a surrogate marker for total PAHs is considered to be a robustly derived and authoritative criterion, appropriate as a value to establish below which the site will not present a significant possibility of significant harm.

APPENDIX G
SEVERITY AND PROBABILITY OF RISK (after CIRIA 552)

Appendix G: Severity and Probability of Risk in Conceptual Site Models (after CIRIA552, Tables 6.3 to 6.5)

This report draws on guidance presented in CIRIA report 552, "Contaminated Land Risk Assessment, A Guide for Good Practice", wherein the "severity" term in the Conceptual Site Model is classified with reference to the sensitivity of the hazard and the receptor, as follows:

Severity Category	Description	Examples
Severe	Acute risk to human health likely to result in "significant harm" as defined in EPA90, catastrophic damage to buildings or property, acute risk of major pollution of controlled waters, acute risk of harm to ecosystems (as defined in Contaminated Land Regulations 2006)	High cyanide concentrations at the surface of a recreation area Major spillage into controlled waters Explosion, causing building collapse
Medium	Chronic risk to human health likely to result in "significant harm" as defined in EPA90, chronic pollution of sensitive controlled waters, significant change at a sensitive ecosystems or species, significant damage to buildings or structures	Contaminant concentrations at a site in excess of SGVs, GAC or similar screening values Leaching of contaminants to sensitive aquifer Death of a species within a nature reserve
Mild	Pollution of non-sensitive waters, significant damage to buildings, structures, services or crops, damage to sensitive buildings, structures, services or the environment, which nonetheless result in "significant harm"	Pollution to (former) non-aquifer or to non-controlled surface watercourse. Damage to building rendering it unsafe to occupy (e.g. foundation or structural damage)
Minor	Harm, not necessarily resulting in "significant harm" but probably requiring expenditure to resolve or financial loss. Non-permanent risks to human health that are easily mitigated, e.g. by wearing PPE. Easily-repairable damage to structures or services	Contaminant concentrations requiring the wearing of PPE during site work, but no other long-term mitigation. Discolouration of concrete

The likelihood of an event (probability) takes into account both the presence of hazard and receptor and the integrity of the pathway between hazard and receptor, and is assessed as follows:

Category	There is a pollution linkage and:
High	Event is likely in the short term and almost inevitable over the long term. Or, there is evidence of actual harm at/to the receptor
Likely	Event is possible in the short term and likely over the long term
Low	Event is unlikely in the short term and possible over the long term
Unlikely	Event is unlikely, even in the long term

Potential severity and probability have been assessed in the following matrix, to give an overall risk rating:

	Severity			
Probability	Severe	Medium	Mild	Minor
High	Very high	High	Moderate	Low/moderate
Likely	High	Moderate	Low/moderate	Low
Low	Moderate	Low/moderate	Low	Very low
Unlikely	Low/moderate	Low	Very low	Very low

The above risk categories are likely to result in the following actions:

- Very high: urgent intervention / investigation needed, remediation likely to be required
- High: urgent intervention / investigation needed, remediation possibly required in short term and probably required in long term
- Moderate: investigation needed to clarify and refine risk; remediation may be required over the long term
- Low: it is possible that harm could arise to a receptor, but if realised, such harm is likely to be, at worst, mild
- Very low: it is possible that harm could arise to a receptor, but if realised, such harm is unlikely to be severe