

*Contaminated Land
Air Quality
Environmental Audit*



Partnership No: OC 300776

**REDWITHER CENTRAL AREA
WREXHAM INDUSTRIAL ESTATE,
WREXHAM**

**STAGE 2 CONTAMINATION
INVESTIGATION**

**For: Wrexham County
Borough Council**

December 2011

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Industrial Estate

Stage 2 Contamination Investigation

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REDWITHER CENTRAL, WREXHAM INDUSTRIAL ESTATE

STAGE 2 CONTAMINATION INVESTIGATION

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1. Introduction

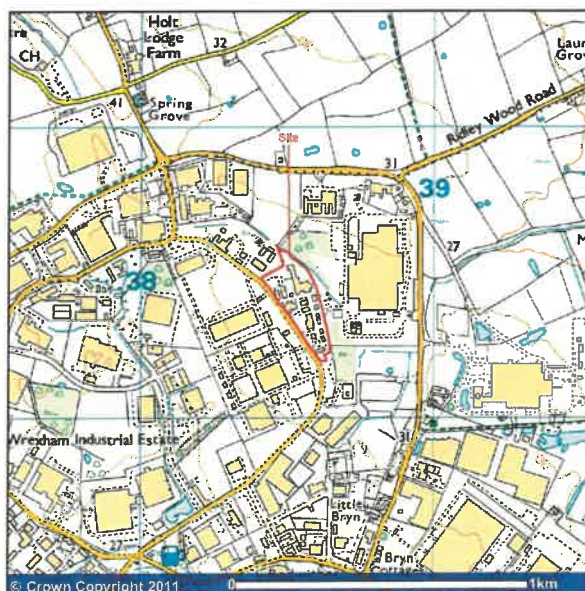
1.1. Wrexham County Borough Council (WCBC) instructed Smith Grant LLP (SGP) to undertake a Stage 2 Contamination Investigation of an area of land located on the Wrexham Industrial Estate, Wrexham.

1.2. The site details are:

Table 1.1: Site Details

Address	Redwither Central Area, off Abbey Road, Wrexham Industrial Estate, Wrexham
National Grid Reference	338540 350400
Local Authority	Wrexham County Borough Council (WCBC)
Site Area	~3.83 ha
Current Nature of Site	series of light to medium industrial units and workshops
Boundaries	southwest: trees / hedgerow to Abbey Road south: no defined boundary or fenceline east: trees and fence northwest: mound and trees
Adjoining Land	southwest: Abbey Road, Redwither Industrial Complex south: light industrial units on Tower Close southeast: trees east / northeast: Kellogg's food production plant northwest: light industrial units on Abbey Close, small electricity sub-station
Site Access	Elm Road off Abbey Road

Figure 1.1: Site Location



- 1.3. WCBC currently owns the land and is considering selling the land for redevelopment. SGP previously undertook and reported a Stage 1 Preliminary Environmental Risk Assessment (report ref: R1570-R01-v2, dated 28th February 2011) of the site to determine any potential liabilities with regard to contamination associated with the historical and current use of the site and surrounding land that may impact both on-going use of the site and any future redevelopment.
- 1.4. To provide further information prior to the proposed sale of the site WCBC instructed SGP to undertake intrusive investigation works at the site, the results of which are provided in this following report.
- 1.5. The investigation and assessment comprised the excavation of trial pits, drilling of probeholes; the collection of soil and groundwater samples for analysis; and ground gas monitoring. This report contains a qualitative risk assessment and where appropriate makes recommendations for further investigations and remedial actions appropriate to the current and potential future use of the site.
- 1.6. The assessment methodology follows the framework described in the EA / DEFRA Contaminated Land Report 11: 'Model Procedures for the Management of Land Contamination' 2004.
- 1.7. It should be noted that the site investigations involve the inspection or analysis of a very small proportion of the soils, water or gas present. Conditions can and do vary between sampling positions and times. Inferences drawn from observations are based upon rational judgments and experience, but are inevitably subject to practical limitations. In particular, estimating the quantities of contamination and pollution within a site and any consequent liabilities is subject to inevitable uncertainty.

2. Site History and Characterisation

- 2.1. The available information on the site development and characterisation is summarised below in Table 2.1. For further details reference should be made to the previous Stage 1 report.

Table 2.1: Site History and Characterisation

Site Details and Activities	The site presently comprises a series of predominantly small to medium sized light industrial units accessed via three entrances from Abbey Road. At the time of the intrusive investigations all the units were disused, having been vacated earlier in the year, other than Unit 226 which forms the largest unit on
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	the site and which remained in use by Wrexham General Engineering. During the course of subsequent monitoring this unit was also vacated. Prior to cessation of activities in 2011 the units were used for a wide range of activities, including general engineering, steel fabrication and metal finishing. All of the units, other than Unit 245, appear to be of original brick construction, and other than the northern end of Unit 226 which is provided with asbestos cement sheeting, are provided with flat felt roofs. During the walkover undertaken to identify potential service locations prior to intrusive investigations, an underground storage tank(s) was noted to the entrance way to Unit 226. The structure comprises the remains of 3 entries, 2 blocked and 1 accessible via a circular steel cover visible at the surface and appearing to contain oil / oily water. The structure may comprise 1 large tank with 3 compartments or 3 separate tanks. Investigation entries were therefore targeted in this area. The feature appears consistent with a feature marked on the 1960s historical mapping located alongside a former mineral railway line accessing the nearby unit. Photographs are provided in Appendix A. Visual inspections were also possible to the main area of Unit 226, which forms the largest unit on the site and to which access had not been previously possible. The internal area is provided with a solid concrete floor which appears in good condition with no evidence of significant spills or leaks. An area of potentially recent surface contamination with hydrocarbons close to Unit 245 was also noted on the walkover.
Development History	The site is located within a large industrial estate which was originally developed from agricultural land to a Royal Ordnance Factory in the late 1930s. The ROF predominantly undertook the manufacture of cordite and the main manufacturing operations are believed to have been located to the south of the site. The site itself comprised a series of individual brick construction buildings, a number of which had mineral railway line access from the north. The site subsequently former part of the British Celanese Ltd (later Courtaulds) plant undertaking the manufacture of viscose rayon. The site itself is indicated as being the 'general workshop' area. Following acquisition by WCBC in the 1980s the units have been used for a wide range of activities as detailed above.
Surrounding landuse	Modern light industrial units are located to the immediate north and south on Abbey Close and Tower Close. Kellogg's food factory is located to the east. Other major industrial facilities within 500m of the site include Sterile Technologies, operating a household waste incinerator 470m to the south. A waste recycling centre (civic amenity site) is located 150m to the southeast.

	A small relatively modern electricity sub-station is located to the immediate northwest of the site beyond the northern most access point.
Topography	The site is located at about 28m aod as indicated by a benchmark shown on OS mapping on the Redwither Industrial Complex beyond Abbey Road to the west. The site itself appears generally level. Locally small raised areas of ground are present in the northeastern and northwestern corners of the site.
Geology	BGS mapping and pre-intrusive investigation site observations indicate the following ground conditions: <u>made ground</u>: a thin veneer of made ground may be present in areas on the site associated with the original construction of the buildings and levelling of the site; however based on the local topography and historical development of the site substantial depths of made ground are not anticipated other than in any areas of backfilled drains and foundations. Pockets of deeper made ground may also exist in the areas of three former ponds on the site. Locally small raised areas of made ground are present in the northeast and northwest corners of the site. <u>superficial deposits</u>: glacial till – heterogeneous deposits varying from structureless silty and sandy pebbly clays to claybound gravels; rockhead mapped at about -25m aod, providing in the order of 60m of drift deposit cover <u>bedrock</u> – Erbistock Formation of the Carboniferous Coal Measures
Drainage	Parts of the site are provided with hardstanding and surface water drainage is likely to be towards drainage systems across the site. A surface water drain is believed to flow eastwards across the centre of the site and to be culverted across the Kellogg's facility and ultimately entering a network of ditches / streams that flow north-eastwards across open fields towards the River Dee 3km distant. Elsewhere, in areas where paved hardstanding is absent or damaged drainage will be via infiltration and sub-surface flow. The site is not identified on the EA website as within an area potentially subject to flooding.
Hydrogeology	Site is classified as overlying a Secondary A aquifer associated with the Coal Measures present at depth; low permeability non-water bearing drift deposits occur at the surface and overlie the aquifer. Shallow groundwater may be present within any underlying made ground and sand and grave lenses within the glacial till.
Water Resources	Site is not located within a Source Protection Zone (SPZ)
Excavation and Landfilling	There are no indications from the site observations or the historical site

	development of any substantial excavation and subsequent landfilling activities having been undertaken on the site or in the immediate vicinity. A large partly vegetated screening mound is present in the northeastern corner of the site to the rear of Unit 226 which comprises a black ash type material. The material is also spread extensively across the surface of the rear yard area. No other significant raised areas are present on site. Elsewhere a thin veneer of made ground may be present, with localised areas of deeper made ground associated with infilled ponds and voids / drains and any demolition materials, particularly in open vegetated areas. Parts of the surrounding industrial estate has been subject to the historical tipping and disposal of waste materials, substantial areas of which have undergone subsequent reclamation although residual areas are known to remain. However, there are no indications this has extended onto the site itself, the layout of the site remaining broadly similar from original development in the early 1940s to the present day. PCB contaminated soils from areas of the estate lying to the south were placed in the 1980s in a containment 'cell' 350m to the southeast of the site. The site is owned by WAG and is maintained under a waste management licence (ref: 37009 / 37011). A former landfill site, British Celanese, is located about 650m to the southwest of the site beyond Ash Road South. Available data suggests that industrial waste disposal occurred at the site from 1953 to 1974. No further information is available but it is noted the area is presently developed to an industrial unit. A second former landfill site has been identified 630m to the southeast. Available data indicates BICC Ltd deposited inert wastes and liquid sludges from 1968 to 1977.
Mining	The Coal Authority report states that the site is not within the zone of likely physical influence on the surface from past or present underground coal workings. No known mine entries are present within, or within 20m, of the boundary of the site.
Nature Conservation	No statutory nature conservations areas such as SSSIs, SPAs or Ramsar sites have been identified in the vicinity of the site Great crested newts are known to be present on areas of the Industrial Estate. No ponds are located on the site but areas of open space may act as foraging or corridor routes.

3. Investigation Methodology

3.1. Objectives and Rationale

3.1.1. The findings and observations of the Stage 1 were used to develop a Conceptual Site Model (CSM) for the site based on the current and potential future landuse.

3.1.2. The Stage 1 identified the potential for contamination to be present on the site as follows:

Table 3.1: Summary of Principal Sources of Contamination

landuse	activity	location	dates	potential contaminants
former ponds	potentially infilled	east and south	2 infilled by late 1900s; 1 infilled by 1940s	metals / metalloids, PAHs
Royal Ordnance Factory, mineral railway lines	possible workshop area for factory manufacturing cordite	across the site; railway lines in north and to east / southeast	1939-1945	explosive residues, metals / metalloids, PAHs, hydrocarbons
British Celanese (Courtaulds); mineral railway lines	workshop area for factory manufacturing viscose rayon	across the site	1945 - ?1980s	pH, carbon disulphide, metals / metalloids, PAHs, hydrocarbons, solvents, degreasers, acids / alkalis, asbestos, paints, oils
industrial units	activities include engineering / steel fabrication, metal finishing, joinery	across the site; engineering in north and metal finishing in south	1980s- current	metals / metalloids, solvents, degreasers, oils, paints, acids / alkalis, asbestos, PCBs
	possible electrical sub- station	unit 229	?1961 – current	localised PCBs

3.1.3. In addition contamination of areas of the estate to the south of the site has occurred through the use of PCBs in electronics manufacturing. The spread of PCB wastes could affect the site.

3.1.4. To provide further information to inform the proposed sale and future redevelopment of the site intrusive investigations have therefore been undertaken to:

- confirm the ground conditions underlying the site;
- assess the presence, extent and nature of any made ground and contamination across the site;
- obtain information on the presence and depth to groundwater;
- determine the presence of ground gas;
- determine the potential liabilities associated with the proposed purchase of the site and possible future redevelopment.

3.2. Fieldwork

3.2.1. The site investigation utilised trial pits and probeholes to permit visual inspection and logging of shallow strata, to obtain samples from the made ground and shallow natural strata and to undertake ground gas and groundwater monitoring.

3.2.2. The investigation was undertaken on the 25th-26th October 2011 under the supervision of SGP Geo-Environmental Consultants Dr A Smith (Partner) and Mr D Wayland (Consultant). Subsequent monitoring was undertaken from the 1st – 18th November 2011. The investigation was undertaken in accordance with appropriate guidance (BS 10175 and CLR11).

3.2.3. Works involved:

- excavation of 19 trial pits (TP1-TP6, TP8-TP20) using a wheeled excavator to depths of 1.0m to 2.3m bgl (below ground level)
- drilling of 7 probeholes (WS1b-WS3, WS5-WS7) using a window sampler to maximum depths of 4.00m bgl;
- screening of all soil arisings with a photo-ionisation detector (PID) for volatiles, inspection and logging of ground conditions;
- completion of 6 wells (WS1b-WS3 and WS5-WS7) as combined gas / groundwater monitoring wells;
- collection of 23 soil samples during trial pitting and drilling and submission for chemical analysis as detailed below;
- collection and analysis of additional hand-dug soil sample (S1) of the black 'ash' material near Unit 226;
- collection of 5 groundwater samples and submission for chemical contamination analysis, as detailed below;
- collection of 1 oil / oily water sample ('oil tank') from the UST;
- 3 rounds of ground gas monitoring.

3.2.4. All intrusive works were undertaken in the external areas of the site as shown on Drawing D02. Access in the northern area of the site was partially limited by the need to minimise disturbance to the activities of Wrexham General Engineering. Elsewhere investigation locations were slightly restricted by the need to avoid potential underground services to the units.

3.2.5. Investigation entries were located to provide both non-targeted and targeted information. Overall a grid spacing of about 50m was achieved. Targeted locations were as follows:

Table 3.1: Summary of Trial Pit and Probehole Locations

Probehole Ref	Location
Targeted Locations	
WS1, WS1b, TP3, TP4	in close proximity to the identified UST in the northwest site corner
TP8	possible former electricity sub-station building (hazard signs present)
TP11, TP18	former pond feature
TP20	area of surface hydrocarbon staining

3.2.6. Due to the potential presence of services and drainage systems hand dug service pits were initially excavated in each probehole location prior to drilling. An influx of oily contaminated water was noted at 0.80m in WS1 in close proximity to the UST during hand digging in the made ground and this probehole was therefore relocated to WS1b.

3.2.7. All soil arisings were immediately screened in the open air for VOCs using a PID (photoionisation detector) MiniRae 2000.

3.2.8. All the probeholes were installed with combined gas / groundwater monitoring wells. Installed response zones were from 1.0m depth to the base of the probehole.

3.3. Chemical Analysis

3.3.1. All chemical analysis of soils and waters was carried out by Jones Environmental Laboratories, Queensferry, working where possible to MCERTS and / or ISO 17025 accreditation. Soil and water samples were stored in appropriate containers as advised by the laboratory, placed in a cool box, and delivered to Jones Environmental within 6 hours of collection. Chain of custody documentation was completed and is retained by SGP.

3.3.2. Soil samples were obtained from the following horizons and submitted for chemical analysis as detailed in Appendix C and summarised below:

Table 3.2: Summary of Soil Chemical Analysis

Strata	description	depth range (m bg)	analytical suite (number of samples)
made ground	variable sandy gravel fills		pH (12), metals (12), PAHs 16 speciated (15), SOM (4), phenols (5), cyanides (3), asbestos (7), EPH (1), CWG BTEX (7), VOCs (3), SVOCs (3), BRE 2:1 water soluble sulphate (3), PCBs (5) leachate – metals (4)
glacial till	variable soft to firm red / brown / grey clays	0.8-2.2	pH (3), metals (3), PAHs 16 speciated (1), SOM (2), EPH (1), CWG BTEX (3), VOCs (1), SVOCs (1), BRE 2:1 water soluble sulphate (7)

Metals = As, Cd, Cu, Cr, Hg, Ni, Pb, Se, Zn

3.3.3. The additional sample collected of the black ash material located on the ground surface within the external rear area of Unit 226 (sample S1, 12.11.11) was submitted for analysis for pH, metals and PAHs and leachable pH and metals.

3.3.4. Groundwater samples were collected from all the probeholes on the 3rd November 2011, with samples from WS1b, WS2, WS3, WS5 and WS7 being submitted for chemical analysis. Due to the slow water influx into WS1b, WS2, WS3 and WS6 it was not possible to fully purge these wells prior to sampling. WS5 and WS7 were each purged for 3 times the well volume. The samples were submitted for chemical analysis as follows:

Table 3.3: Summary of Groundwater Analysis

Probehole Ref	Analytical Suite
WS1b	pH, metals, PAHs (16 speciated), EPH, phenol, total cyanide, PCBs, VOCs, SVOCs,
WS2	pH, metals, PAHs (16 speciated), EPH, phenol, total cyanide, GRO, BTEX
WS3	pH, metals, PAHs (16 speciated), EPH, phenol, total cyanide, PCBs, VOCs, SVOCs
WS5	pH, metals, PAHs (16 speciated), EPH, phenol, total cyanide, GRO, BTEX
WS7	pH, metals, PAHs (16 speciated), EPH, phenol, total cyanide, PCBs, VOCs, SVOCs

Metals = As, Cd, Cu, Cr, CrVI, Hg, Ni, Pb, Se, Zn

3.3.5. An additional sample was collected of the oily water (labelled 'oil tank') contained within the underground storage tank in the northern part of the site and submitted for analysis for 'whole oil'.

3.4. Ground Gas Monitoring

3.4.1. Ground gas monitoring was undertaken on 4 occasions following installation of the wells. Monitoring was undertaken for flammable gas (calibrated for methane), carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide, borehole pressure and gas flow for each well. Monitoring for VOCs was undertaken on one occasion. The depth to groundwater was recorded in each borehole and the atmospheric pressure recorded at the start and finish of each monitoring round. One monitoring round coincided with low and falling atmospheric pressure (<1,000 mb).

4. Investigation Observations

4.1. Physical Observations

4.1.1. The trial pit and probehole logs are presented in Appendix B.

4.1.2. Investigation entries were generally located in areas of hardcore hardstanding. WS2 was located within a residual concrete slab in the northwest corner of the site.

4.1.3. Ground conditions typically comprised a thin veneer (0.5-0.8m) of made ground over natural clays. Made ground generally comprised limestone gravel or sand with brick fragments. In TP1, to the rear of Unit 226, frequent metal wire, plastic and wood fragments were encountered in the shallow fills to 0.75m bgl. Ground in TP19 in the southeast corner of the site contained a thin layer (to 0.40m bgl) of clay with metal, plastic waste and brick. Deeper areas of made ground were encountered in TP3 (sand and gravel to 1.1m bgl), close to the UST on the access road to Unit 226, and TP18 (possible reworked clays to 1.1m bgl), in the area of a former pond feature marked on historical mapping. Reworked natural clay was present to 1.5m in TP13 surrounding a relict drain and contained an isolated tree branch. Limestone gravel was present to 2.20m bgl in WS5, with high organic content soils (rootlets) at 2.9-3.0m bgl and 3.5-3.8m bgl, possibly indicative of an infilled pond feature.

4.1.4. In all locations the made ground was underlain by soft to firm red / brown / grey clays indicative of glacial till. Occasional bands of sandy clay were present (WS2 and WS6). Peat was encountered in WS7 under firm brown clay at 3.6-4.0m bgl. The overlying clay in this location is therefore likely to either be reworked made ground or alluvial deposits.

4.1.5. The strata can be summarised as:

Table 4.1: Summary of Ground Conditions

depth (m bgl)	thickness (m)	strata	description	comment
0.0-0.2	0.1-0.2	surface	hardcore hardstanding / paved hardstanding / some grass	
0.1-0.8	0.1-0.8	made ground	limestone gravel / sand with brick fragments	majority of locations frequent wire, plastic and wood to 0.75m bgl in TP1; some metal and plastic in clay matrix in TP19 surface hydrocarbon staining in TP20
0.1-1.1	1.0	made ground	reworked sand and gravel	TP3 - close to UST; hydrocarbon contamination throughout made ground
0.1-1.5	1.5	made ground	reworked clays	TP13 (including tree branch) and TP18 (horizon of topsoil at 1.8m bgl; possible infilled pond feature); possible re-worked clays in WS7.

depth (m bgl)	thickness (m)	strata	description	comment
0.1-2.2	2.1	made ground	Limestone gravel	WS5 – possible infilled pond feature
0.1->4.0	>3.9	glacial till	soft to firm sandy / silty grey / red / brown clay	encountered in all locations occasional sandy lenses present
3.6-4.0	0.4	peat	firm to stiff laminated peat	only in WS7

4.1.6. The encountered ground conditions are generally consistent with the mapped geology of glacial till and those expected from the historical development of the site and the current topography.

4.1.7. The above evidence of stratigraphy is taken from discreet locations. Given the apparent similar ground conditions between locations, it appears reasonable to infer that similar conditions (predominantly thin made ground over natural clays) may extend between these locations, although caution should always be exercised as the nature of the ground can vary between investigating positions.

4.2. Groundwater Conditions

4.2.1. An oily contaminated seep was noted at 0.8m within the made ground in WS1, in close proximity to the UST. In TP3, also in close proximity to the UST, oily water was noted at 0.4m bgl along concrete wall assumed to be the tank bund sidewall and a viscous green liquid entered the southern end of the trial pit from a sand layer at 0.8-1.0m. A seep was noted at 2.90m bgl within a band of sandy clay in WS6. Elsewhere groundwater was not encountered during the trial pitting or drilling.

4.2.2. The water depths encountered during the subsequent monitoring rounds are summarised below:

Table 4.2: Summary of Groundwater Depths

probehole ref	water depth (m bgl)		base of probehole (m bgl)	response zone	strata
	min	max			
WS1b	1.53	1.65	4.00	1.0-base	glacial till
WS2	0.60	1.20	3.00	1.0-base	glacial till
WS3	2.10	2.18	3.00	1.0-base	glacial till
WS5	2.21	2.29	4.00	1.0-base	made ground / glacial till
WS6	1.14	1.27	4.00	1.0-base	glacial till
WS7	0.30	0.47	4.00	1.0-base	made ground? / glacial till

4.2.3. The absence of groundwater during initial drilling and slow recharge during sampling in WS1b, WS2, WS3 and WS6 suggests the groundwater is most likely to be associated with seeps within the clays.

4.3. Contamination Indicators

4.3.1. Visual and olfactory indicators of hydrocarbon contamination were noted in TP3 and WS1 as detailed above. In TP3 a layer of sand at 0.8-1.0m contained a green viscous liquid. The underlying made ground contained pockets of gravel with a black tarry substance. The underlying stiff natural clays appeared free of significant contamination.

4.3.2. Surface contamination with oils was noted in the area of Unit 245 and was targeted by TP20. The contamination did not visually penetrate beyond 0.20m bgl. It is understood this results from recent spillages that have arisen since vacation of the units.

4.3.3. No potential asbestos containing materials were observed during the intrusive investigations. However, a piece of corrugated asbestos cement sheeting is present within the rear yard area of Unit 226.

4.3.4. All groundwater samples collected during the subsequent monitoring round appeared free of visual contamination.

4.3.5. VOCs were undetected (<0.1ppm) in any soil arisings.

5. Investigation Results

5.1. Results of Soil Chemical Analysis

5.1.1. The complete soil analytical data are presented in Appendix C.

5.1.2. The results of the soil analyses are compared to human health critical values (CVs) for initial screening purposes. The CVs adopted are appropriate to the environmental setting, the current industrial use and the potential future industrial use of the site, and are taken primarily from CLEA Soil Guideline Values (SGVs) published by the Environment Agency and the LQM / CIEH Generic Assessment Criteria (GACs). These criteria are generally derived using the CLEA v1.04 or 1.06 model under a standard default commercial land-use scenario (sandy loam soil); and have been adjusted by SGP with 1% soil organic matter as a conservative assumption. The SGV for lead has been withdrawn by the EA, with a replacement pending. GACs produced using the CLEA v1.06 model and previous TOX report give reduced CVs, but the TOX data is currently unsupported. Previously DEFRA proposed a substantial rise in the SGV in its "Way

Forward" document. In view of the uncertainty with respect to a future lead SGV, continued use is made of the previous value in this assessment.

5.1.3. Where published human health critical values are unavailable or inappropriate (because the substances does not significantly affect human health but might have an effect on other receptors), then other commonly-used screening values are used, as noted below.

5.1.4. The results of the made ground and natural soils analysis are summarised below:

Table 5.1: Summary of Soils Analysis

Contaminant	Number of Samples	Range of Concentrations (mg/kg or indicated)	Soil Standard Adopted and Concentration (mg/kg or indicated)	Exceedances
pH	14	7.6-11.7	WRAS <5	none
arsenic	14	1.2-92.3	CLEA SGV 640	none
cadmium	14	<0.1-2.2	CLEA SGV 230	none
chromium (total)	14	3.0-96.2	LQM/CIEH 35 (Cr VI) LQM/CIEH 30,400 (Cr III)	4 (TP1.S1, TP4.S1, TP10.S2, TP18.S2) none
chromium (VI)	4	<0.3-0.8	LQM/CIEH 35 (Cr VI)	none
copper	14	6-1,459	LQM/CIEH 71,700 DEFRA Plant 200	none 1 (TP1.S1)
lead	14	13-419	former CLEA SGV 750	none
mercury	14	<0.1-1.2	CLEA SGV 3,600	none
nickel	14	4.5-120	CLEA SGV 1,800 DEFRA Plant 70	none 1 (TP1.S1)
selenium	14	<1-2	CLEA SGV 13,000	none
zinc	14	29-2,455	LQM/CIEH 665,000 DEFRA Plant 300	none 2 (TP1.S1, WS6.S1)
Soil Organic Matter %	5	0.5-4.1	EA inert waste limit 6%	none
asbestos screen	8	nfd-fd	Fibres present	1 (TP19.S1)
total cyanide	3	<0.5-1.2	none	n/a
total phenols	3	<0.15	CLEA SGV 3200	none
PCBs (7 congeners)	5	<0.035-0.15	20 REM	none
soluble sulphate (BRE 2:1)(g/l)	11	0.0067-0.6	0.5 BRE SD1	1 (TP19.S1)
naphthalene	15	<0.04-0.42	LQM/CIEH 480	none

Contaminant	Number of Samples	Range of Concentrations (mg/kg or indicated)	Soil Standard Adopted and Concentration (mg/kg or indicated)	Exceedances
benzo(a)pyrene	15	<0.04-9.96	LQM/CIEH 14	none
total PAH	15	0.6-98.7	none	n/a
EPH (>C8-C40)	3	<35-187	none	n/a
MTBE	8	<0.005	none	n/a
benzene	8	<0.005	CLEA 28	none
toluene	8	<0.005-0.017	CLEA 870	none
m/p-Xylene	8	<0.005-0.028	CLEA 520	none
o-xylene	8	<0.005-0.01	CLEA 525	none
aliphatic C5-C6	8	<0.1	LQM / CIEH 3,400 (304) ¹	none
aliphatic C6-C8	8	<0.1	LQM / CIEH 8,3000 (144) ¹	none
aliphatic C8-C10	8	<0.1	LQM / CIEH 2,100 (78) ¹	none
aliphatic C10-C12	8	<0.2-60.2	LQM / CIEH 10,000 (48) ¹	none
aliphatic C12-C16	8	<4-869	LQM / CIEH 61,000 (24) ¹	none
aliphatic C16-C21	8	<7-819	LQM / CIEH 160,000	none
aliphatic C21-C35	8	<7-11,375	LQM / CIEH 160,000	none
aromatic C6-C7	8	<0.1	LQM / CIEH 28,000	none
aromatic C7-C8	8	<0.1	LQM / CIEH 59,000	none
aromatic C8-C10	8	<0.1	LQM / CIEH 3,700	none
aromatic C10-C12	8	<0.2-8.8	LQM / CIEH 17,000	none
aromatic C12-C16	8	<4-438	LQM / CIEH 36,000	none
aromatic C16-C21	8	<7-829	LQM / CIEH 28,000	none
aromatic C21-C35	8	<7-4,299	LQM / CIEH 28,000	none

Notes to table:

CLEA SGV:

sandy loam soil

LQM / CIEH:

DEFRA plant

BRE SD1:

1:

Only the PAH indicators naphthalene and benzo(a)pyrene and any for which exceedances are recorded are listed.

REM – 1980s WDA reclamation criterion for PCBs during the industrial estate clean up

Soil guideline value published by DEFRA/EA, 'commercial' land use scenario (adjusted for 1% SOM);

Generic assessment criteria published by Chartered Institute of Environmental Health and Land Quality Management Ltd, commercial land use scenario; 2nd Edition (at 1% SOM)

Threshold guideline for the protection of sensitive plant species used by MAFF

Building Research Establishment Special Digest 1

CV exceeds of solubility saturation limit provided in (), i.e. possibility of free product at this level

5.1.5. The soil organic matter (SOM) concentration of the samples submitted for SOM analysis ranges from 0.5% to 4.1% and hence it is considered appropriate to refer to the CVs for 1% SOM for a screening assessment.

- 5.1.6. Asbestos fibres (amosite) were detected in one sample of made ground, from TP19 at 0.0-0.4m bgl, in the southern part of the site.
- 5.1.7. None of the samples contained any contaminants in exceedance of the CVs established for the protection of human health for commercial / industrial landuse.
- 5.1.8. There is no CV for total chromium, the preliminary analysis undertaken on the samples. Chromium exists in the environment in a number of states and the CVs are established for Cr(III) and Cr(VI). The most prevalent natural form of chromium is Cr(III), Cr(VI) only being present due to anthropogenic sources. The two oxidation states are in dynamic equilibrium, but in most cases Cr(VI) is converted to Cr(III) in the natural environment. The results are initially compared to the GAC for Cr(VI), the more toxic form of chromium. Four samples exceeded this value for commercial landuse. The respective CV for Cr(III) is substantially higher at 30,400 mg/kg and all results are about three orders of magnitude below this concentration. The two samples containing the highest total chromium concentrations were also submitted for Cr(VI) analysis, along with two additional samples; all samples contained Cr(VI) substantially below the CV with a maximum of 0.8 mg/kg. In the absence of a specific source of Cr (VI) on site and on the basis that the chromium identified is likely to be present in the Cr(III) form, possibly due to natural mineralisation, a significant risk is therefore not indicated.
- 5.1.9. TP3 was excavated in the northern part of the site alongside the UST. Samples S1 and S2 each contained total TPH at 4,358 and 3,802 mg/kg, both aromatic and aliphatic fractions in the <C10 range. Traces of toluene, ethylbenzene and xylenes were present, along with a number of PAHs, including naphthalene and benzo(a)pyrene, and all were substantially below the assessment criteria. Sample S3 collected from the underlying clays contained TPH at 275 mg/kg, with BTEX and PAHs below the limit of detection. The sample of shallow made ground from WS1b, excavated to the east of the UST, contained elevated TPH at 9,769 mg/kg, again both aliphatic and aromatic fractions and predominantly in the >C21 range, although there were no significant olfactory and visual indicators of contamination. BTEX was undetected and PAH concentrations were low.
- 5.1.10. TP4, excavated to the south of the UST, contained EPH (>C10-C40) at 708 mg/kg, with low levels of PAHs and traces of ethylbenzene, toluene and xylenes, all below the assessment criteria. The near-surface sample from TP4 (0.0-0.4m bgl) contained traces of PCBs at 0.153 mg/kg (PCBs 138, 153 and 180). There are no current assessment criteria for these 7 PCB congeners. During reclamation of the industrial estate in the 1980s a criteria of 20 mg/kg was used. Previous investigations undertaken by WCBC on the industrial estate have referred to a criterion of 7.2 mg/kg that was derived by BAE Systems for WCBC (not known if the criterion refers to specific aroclor formation, particular congeners or total PCBs). Under the EA Technical Guidance Note WM2, 'Interpretation of the definition and classification of hazardous

waste', waste containing in excess of 2,500 mg/kg PCBs are classified as hazardous. The concentration of PCBs found in TP4 is several orders of magnitude below these criteria and hence are not considered significant.

5.1.11. TP20 was excavated in the southwest of the site, in the area of surface oil spillages. Samples S1 (0.0-0.1m bgl) and S2 (0.1-0.4m bgl) contained 8,853 and 16,030 mg/kg TPH, predominantly in the heavier end >EC16 and predominantly comprising aliphatic fractions. BTEX and PAHs were below the limit of detection.

5.1.12. The SVOC analysis identified traces of a number of PAHs in sample WS3-S1 with benzo[a]pyrene being above the assessment criteria. No other VOCs or SVOCs were identified.

5.1.13. The product layer in the sample collected from the UST was identified as lubricating oil with the carbon range of C20-35.

5.1.14. The soil leachate analysis indicates the metals chromium, lead, copper and zinc within the made ground to be potentially leachable.

5.1.15. The sample of black 'ash' from the rear of Unit 226 contained elevated levels of arsenic (681 mg/kg), lead (1,482 mg/kg), copper (7,736 mg/kg), zinc (14,990 mg/kg) and nickel (224.5 mg/kg), with the concentrations of arsenic and lead being marginally above the assessment criteria for commercial / industrial landuse where it is assumed the majority of the ground is provided with hardstanding. The sample is likely to be highly phytotoxic.

5.1.16. The sample of shallow mixed fill from TP1 in the northern part of the site contained copper, zinc and nickel at concentrations that may pose a risk to sensitive plant species if present in shallow soils.

5.2. Results of Groundwater Analysis

5.2.1. There are no existing water quality standards for groundwaters. Therefore, groundwater results are compared against Environment Quality Standards (EQSs) for surface waters as detailed in Part 5 of the River Basin Districts Surface Water and Groundwater Classification (Water Framework Directive) (England and Wales) Direction 2010. Where EQS have not been published under the Water Framework Directive reference has been made to the EQSs referred to under the EC Dangerous Substances Directive 76/464/EEC. For a number of determinands the EQS is hardness related. No hardness data is available on the EA website for surface watercourses in the vicinity of the site, and hence the lowest hardness band of <50 mg/l has been referred to for a conservative assessment.

5.2.2. In the absence of an EQS for a particular contaminant reference has been made to the standards provided for groundwater drinking water protected areas or in the Water Supply (Water Quality) Regulations 2000, (typically referred to as the UK Drinking Water Standards or UK DWS). It should be noted that these are particularly stringent as they are used to protect drinking water consumers and hence, although they provide an indication of the presence of any contamination, they are not necessarily directly applicable to the site itself.

5.2.3. Results are summarised below and provided in detail in Appendix C.

Table 5.2: Summary of Groundwater Results

Determinant	Number of samples	Range of Concentrations (µg/l or indicated)	Quality standard adopted and concentration (µg/l or indicated)	Exceedances
pH	5	7.48-7.97	6-8.5 (pH units) EQS	none
arsenic	5	2.1-9.3	50 EQS	none
cadmium	5	<0.03-0.04	0.08 EQS WFD ¹	none
chromium III	5	2-6.1	4.7 AA EQS WFD 32 95P EQS WFD	2 (WS2, WS7) none
chromium VI	5	<0.002	3.4 AA EQS WFD	none
copper	5	<3-5	1 EQS WFD ¹	-
lead	5	2.4-5	7.2 EQS WFD	none
mercury	5	<0.01	0.05 EQS WFD	none
nickel	5	1.6-3	20 EQS WFD	none
selenium	5	1.2-12	10 DWS	1 (WS2)
zinc	5	<1.5-3.4	40 EQS WFD ¹	none
sulphate (mg/l)	3	62-521	500 BRE SD1	1 (WS7)
phenols (mg/l)	5	<10	7.7 AA EQS WFD 46 95P EQS WFD	none none
total cyanide (mg/l)	5	<0.01	1 AA EQS WFD 5 95P EQS WFD	none none
PCBs	3	<0.7	none	n/a
EPH (C8-40)(mg/l)	5	<10	10 DWS	none
GRO	2	<0.1	none	n/a
benzene	2	<0.005		none
toluene	2	<0.005	50 AA EQS WFD 380 95P EQS WFD	none none
ethylbenzene	2	<0.005		
xylene	2	<0.005		
naphthalene	5	<0.014-0.05	2.4 EQS WFD	none
benzo(a)pyrene	5	<0.016	0.05 EQS WFD	none
benzo(bk)fluoranthene	5	<0.018	0.03 EQS WFD	none
benzo(ghi)perylene + indeno(123-cd)pyrene	5	<0.022	0.002 EQS WFD	none

Determinant	Number of samples	Range of Concentrations (µg/l or indicated)	Quality standard adopted and concentration (µg/l or indicated)	Exceedances
anthracene	5	<0.013	0.1 EQS WFD	none
fluorathene	5	<0.012	0.1 EQS WFD	none
total PAHs	5	<0.195	none	n/a
1,1-dichloroethane	3	<3-12	none	n/a

Notes:

All metals are as dissolved unless stated otherwise; all other determinands are total concentrations

EQS: National Environmental Quality Standard for inland surface waters, annual average

UK DWS: Water Supply (Water Quality) Regulations 2000

AA – annual average; 95P – 95th percentile

¹ – hardness related; reference made to most conservative hardness band <50 mg/l

LOD – limit of detection

5.2.4. Chromium III was present in samples from WS2 and WS7 marginally above the annual average EQS; concentrations were however substantially below the 95th percentile. Elevated sulphate concentrations were also present in WS7.

5.2.5. The VOC, 1,1-dichloroethane (1,1-DCE), was detected in the sample from WS1b at 12 µg/l. Unlike 1,2-dichloroethane (1,2-DCE), 1,1-DCE is not identified as a Priority Substance under the Water Framework Directive and accordingly an EQS is not available. No other VOCs were detected in WS1b above the limit of detection.

5.2.6. EPH was undetected in any sample, including WS1b.

5.2.7. In addition, 4 samples of made ground (TP2.S2, TP4.S1, TP10.S1, TP17.S2) were subject to leachate analysis for metals. The sample TP4.S1 contained substantially elevated chromium at 56.3 µg/l above both the annual average and 95th percentile EQS. TP4.S1 and TP2.S also contained marginally elevated copper and lead as summarised below.

Table 5.3: Summary of Soil Leachate Results

Determinant	Number of samples	Range of Concentrations (µg/l or indicated)	Quality standard adopted and concentration (µg/l or indicated)	Exceedances
arsenic	4	<2.5-3.5	50 EQS	none
cadmium	4	<0.5	0.08 EQS WFD ¹	-
chromium	4	<1.5-56.3	4.7 AA EQS WFD 32 95P EQS WFD	1 (TP4.S1) 1 (TP4.S1)
copper	4	<7-23	1 EQS WFD ¹	-
lead	4	<5-10	7.2 EQS WFD	2 (TP2.S2, TP4.S1)
mercury	4	<1	0.05 EQS WFD	-

Determinant	Number of samples	Range of Concentrations (µg/l or indicated)	Quality standard adopted and concentration (µg/l or indicated)	Exceedances
nickel	4	<2	20 EQS WFD	none
selenium	4	<3	10 DWS	none
zinc	4	<3-9	40 EQS WFD ¹	none

Notes:

All metals are as dissolved unless stated otherwise; all other determinands are total concentrations

EQS: National Environmental Quality Standard for inland surface waters, annual average

UK DWS: Water Supply (Water Quality) Regulations 2000

AA – annual average; 95P - 95th percentile

¹ – hardness related; reference made to most conservative hardness band <50 mg/l

5.2.8. The sample of black ash material contained elevated leachable copper and zinc at 64 µg/l and 130 µg/l respectively.

5.3. Results of Soluble Sulphate Analysis

5.3.1. 3 samples of the made ground and 8 samples of the underlying natural clays were submitted for 2:1 soluble sulphate and 3 samples of groundwater for sulphate and pH analysis. One sample (TP19.S1; made ground) contained water soluble sulphate in exceedance of the BRE Special Digest SD1 (2005) threshold of 0.5 g/l that would indicate the potential requirement for the use of sulphate resistant concrete within the development. All 8 samples of natural clays contained soluble sulphate below the BRE threshold. Groundwater in one sample (WS7) contained sulphate in excess of the 0.4 g/l BRE threshold.

5.3.2. The groundwater is classified as mobile, and based on the groundwater pH results, the overall ACEC classification is DS-2 AC-2 as follows:

Table 8.3: Summary of Soluble Sulphate Analysis

Determinand	Number of Samples	Range results	BRE SD1 sulphate assessment	
			Characteristic value	Table 5.2 classification
soluble sulphate mg/l (2:1 extract) – made ground	3	0.002-0.6	0.6 ¹ (0.5-1.5)	
soluble sulphate mg/l (2:1 extract) – natural clays and mudstones	8	0.007-0.10	<0.5 (<0.5) ²	
sulphate mg/l - groundwater	3	62-521	521 (400-1,400) ¹	DC-2
pH - groundwater	5	7.48-7.97	7.48 (>5.5) ³	AC-2

1. highest result of data set; 2. mean of highest 2 results (20% of data set); 3 – lowest result of data set

5.4. Results of Ground Gas Monitoring

5.4.1. Guidance published by CIRIA ("Assessing risk posed by hazardous ground gases to buildings", CIRIA C665, 2007), CIEH ("The Local Authority Guide to Ground Gas", CIEH, 2008) and BS8485:2007 ("Code of Practice for the Characterisation and Remediation of Ground Gas in Affected Developments") has been referred to in determining potential risks posed by ground gases. Screening assessment criteria of 1% methane, 5% carbon dioxide and 0.07 l/hr gas screening value have been referred to initially. The gas screening value (GSV) is the product of gas concentration and flow.

5.4.2. The results of the ground gas monitoring are summarised below and presented in detail in Appendix D.

Table 8.3: Summary of Gas Monitoring Results

probehole	no of monitoring rounds	max CH4 (%)	max CH4 GSV (l/hr)	max CO2 (%)	max CO2 GSV (l/hr)	min O2 (%)	max VOC (ppm)
WS1b	4	<0.1	<0.07	9.2	<0.07	5.6	<0.1
WS2	4	<0.1	<0.07	0.4	<0.07	12.7	<0.1
WS3	4	<0.1	<0.07	1.4	<0.07	18.2	<0.1
WS5	4	<0.1	<0.07	0.2	<0.07	19.2	<0.1
WS6	4	<0.1	<0.07	1.2	<0.07	18.0	<0.1
WS7B	1	<0.1	<0.07	1.5	0.18	16.7	nm

Based on 4 rounds of data; VOC data based on 1 round of data; 1 round of data available for WS7 due to shallow groundwater resulting in flooding of monitoring equipment

GSV – Gas Screening Value (=maximum gas concentration x maximum gas flow over the monitoring period)

Atmospheric pressure ranged from 980 mb to 1022 mb; nm – not measured

5.4.3. The atmospheric pressure was below 1,000mb on two monitoring occasions and on one of these the general trend over the preceding days had been falling.

5.4.4. Methane was undetected in any location on any monitoring round.

5.4.5. Carbon dioxide has been detected in all locations on the majority of monitoring rounds. The highest concentrations were consistently detected in WS1b at levels above the assessment criteria and to a maximum of 9.2%, with corresponding depleted oxygen. Gas flows were negligible with the resulting GSV for this borehole being below 0.07 l/hr.

5.4.6. Lower concentrations of carbon dioxide were detected elsewhere with no other recorded exceedances of the assessment criteria, with the next highest levels being 1.4% in WS2 and 1.2% in WS6.

- 5.4.7. Due to very shallow groundwater being present in WS7 this borehole was only monitored on one occasion; the shallow water resulting in flooding of the monitoring equipment. On this occasion a high gas flow of 12 l/hr was recorded; this is likely to be associated with fluctuations in the shallow groundwater table and is not considered representative of the site.
- 5.4.8. An initial high gas flow was recorded in WS2 on one occasion, falling rapidly to negligible flow.
- 5.4.9. Based on the maximum flow and gas concentration measured at each location, the results place the site into CIRIA characteristic situation 1 (CS1) "very low risk" for methane and characteristic situation 2 (CS2) 'low risk' for carbon dioxide.
- 5.4.10. VOCs have been undetected (<0.1ppm).

6. Conceptual Site Model and Risk Assessment

6.1. Methodology

- 6.1.1. Information from the desk study and site investigation has been used to identify the likely source-pathway-target relationships that may exist at the site during and following the proposed development. Principal factors that may determine potential sources of contamination at the site, receptor vulnerability and potential pathways have been identified and each assessed in turn to revise the Conceptual Site Model (CSM).

6.2. Source Risk Assessment

- 6.2.1. The available information shows the site to have originally been developed in the late 1930s from open farmland to form part of the Royal Ordnance Factory. The site later formed part of British Celanese Ltd and appears to have principally formed a series of workshops and open storage yards. The site has subsequently been used for a wide range of activities including light to medium engineering works, which many have included the use of oils, fuels, chemicals and solvents.
- 6.2.2. The site is predominantly provided with a thin veneer of made ground (0.5-0.8m thick), which is underlain by firm to stiff silty sandy clay. No indicators of contamination have been identified in the majority of site investigation entries and ground conditions have generally been as anticipated from the Stage 1 assessment. However, the following sources of contamination have been identified:
- a large mound of fine black 'ash' (possible flue dust) is present in the northeast corner of the site to the rear of Unit 226. The material is also spread extensively across the local

area surface. The material contains elevated concentrations of arsenic, lead, copper and zinc;

- an underground storage tank is present in the accessway to Unit 226. This structure appears to be associated with the original buildings on site and the accessible contents have been identified as lubricating oil. The extent and volume of the tank has not been confirmed as part of this investigation and may include separate compartments;
- contamination of the ground in the vicinity of the tank has been identified; an influx of 'oily' water was noted at 0.8m bgl to the immediate east of the UST (investigation location abandoned); in TP3, to the immediate west of the UST, a strong hydrocarbon odour was present in the soils at 0.1-0.4m bgl and a green viscous liquid and black tarry substance were present at 0.8-1.0m bgl; elevated TPH was noted in the shallow fills in WS1b;
- asbestos fibres (amosite) were detected in the shallow fills (sand and brick with minor quantities of metal and plastic) which were present in TP19 in the southeast corner of the site to 0.4m bgl; asbestos was undetected in any other locations across the site although a fragment of asbestos cement sheeting is present on the ground surface in the rear yard area to Unit 226;
- an area of surface hydrocarbon contamination is present in proximity to Unit 245 (TP20) which is understood to be associated with a recent spillage; the contamination does not appear to extend into the clays beyond 0.4m bgl;
- in the northeast of the site (TP1) made ground contained metal, plastic and wood fragments to 0.75m bgl; the shallow made ground in TP1 contained elevated zinc and copper; similar deleterious materials were not encountered elsewhere on site;
- relatively low levels of metals / metalloids are present within the near-surface fills; although chromium, and to a lesser extent copper and lead, are potentially leachable;
- elevated carbon dioxide has been detected in one location (WS1b) with corresponding depleted oxygen; it is probable that the elevated ground gas is associated with the identified hydrocarbon contamination in the area;
- the groundwater in two locations (WS2 and WS7) contain elevated concentrations of chromium III; elevated sulphate in WS7;
- 1,1-dichloroethane (1,1-DCE) has been detected in the groundwater in WS1b;
- 3 potential infilled pond features have been identified on site, 2 of which appear to have been infilled with reworked clays.

6.2.3. Peat was encountered at depth (3.6-4.0m bgl) in WS7 in the far southeastern corner of the site. Peat was not encountered elsewhere on site, but given its presence at the maximum depth of the probeholes, its absence has not been confirmed. Peat may give rise to ground gas, albeit at low concentrations and flows.

6.3. Potential Targets

6.3.1. Full details on the proposed development of the site have not been provided but proposals are understood to be for light industrial / commercial landuse. It is envisaged the development will primarily comprise buildings with associated infrastructure, areas of paved / unpaved hardstanding and possible areas of soft landscaping. The principal vulnerable receptors to any contamination will therefore be:

- construction workforce
- future site users
- on-site buildings and infrastructure (units; services)
- plants with any soft landscaping areas;
- shallow groundwater with sand and gravel lenses within the glacial till;
- nearby surface watercourses to the east of the site.

6.4. Human Health Risk Assessment

6.4.1. The 'ash' material (thought to possibly be flue dust) present in the northeast corner of the site contains arsenic and lead at concentrations above the assessment criteria established for the protection of human health for the proposed landuse. These metals principally pose a potential risk to human health via ingestion / inhalation / dermal contact when present in near-surface / exposed soils. Given the nature of the material this will require remediation as part of the reclamation works prior to redevelopment.

6.4.2. The UST near to Unit 226 contains residual lubricating oils and will require emptying and decommissioning (removal or backfilling) as part of the site reclamation works. The size and extent of the UST has not been determined as part of these investigation works. Concentrations of hydrocarbons, including BTEX, have not been found in the surrounding soils at concentrations that pose a risk to human health given the proposed landuse, either through exposure to soil in landscaped areas or through vapour migration of organic gases. However, the extent of hydrocarbon contamination in the area of the UST has not been confirmed at this stage, and further investigation and assessment will be necessary.

6.4.3. The principal potential risk associated with the hydrocarbon contamination with respect to human health is the generation of volatile gases and inhalation. VOCs could potentially be harmful if able to enter buildings and be inhaled over long periods. Raised VOCs however have not been detected in the ground gas monitoring undertaken and can be readily prevented from migrating into buildings by the use of barriers; these would also serve to mitigate against potential odour issues. The presence of carbon dioxide ground gas in this area presently classifies the site as CIRIA Characteristic Situation 2.

6.4.4. Similarly the concentrations of hydrocarbons present in the shallow soils in TP20 do not pose a risk to human health, although they may give rise to odour and visual impact issues.

6.4.5. The asbestos fibres detected within shallows fills in TP19 in the southeastern site corner do not pose a risk where retained at depth under buildings and paved hardstanding. However disturbance as a result of construction activities could lead to the release of fibres to the air with consequent risks of inhalation by site workers and future utility service engineers if extensive asbestos is present in this area. Further investigation and assessment will be necessary to determine the extent of asbestos.

6.5. Controlled Waters Risk Assessment

- 6.5.1. Shallow groundwater has been recorded within the clay strata below the site. The variances in the groundwater levels, and lack of groundwater noted during drilling and cohesive clayey nature of the soils indicates the groundwater is unlikely to be present as a continuous water table, and is associated both with perched groundwater within the near-surface fills and with thin discontinuous sand and gravel lenses within the clays. Flow rates are likely to be low given the relative impermeability of the soils and noted slow rates of recharge during sampling. The shallow groundwater is not abstracted locally and the groundwater is considered primarily as a contamination migration route rather than a receptor in its own right.
- 6.5.2. 'Oily' water was noted in the shallow soils in immediate proximity to the UST, likely to have been perched on the underlying clays, although this did not extend as far as WS1b. A green liquid (possible oil) was also noted at 0.8m depth associated with a sand lens in TP3 close to the UST. Hydrocarbons have not been detected in the groundwater in the nearby borehole (WS1b). The extent of hydrocarbon contamination within the groundwater may therefore be relatively contained in this area, and the identified oil fraction within the tank is likely to have very low solubility or mobility in soils.
- 6.5.3. The VOC 1,1-DCE has been detected in the groundwater in WS1b. 1,1-DCE is used as a solvent / degreaser and is also a degradation product of the solvent trichloroethene (TCE). The absence of any other degradation products, such as vinyl chloride, in WS1b, suggests the 1,1-DCE may be a source contaminant rather than present as the result of degradation. 1,1-DCE has not been identified as a Priority Pollutant under the Water Framework Directive and there are no assessment criteria available. The presence of 1,1-DCE in the groundwater, and absence of any identifiable hydrocarbons associated with the nearby UST, may however indicate another nearby source of contamination which will require further investigation and assessment.
- 6.5.4. Marginally elevated Cr III has been detected in the shallow groundwaters in WS2 and WS7, although concentrations are substantially below the 95th percentile EQS. The chromium in the groundwater is likely to be associated with leaching of the relatively low concentrations of chromium present in the shallow fills, the leachate analysis for the sample of near-surface fill

from TP4.S1 showing the chromium present to be leachable (soil concentration 86.1 mg/kg; leachate concentration 56.3 µg/l).

6.5.5. A culvert is believed to run west to east across the centre of the site. This drain was historically open on the eastern edge of the site although now also appears culverted across the adjoining Kellogg's site. This therefore forms the nearest surface watercourse to the site. A second drain is indicated to flow northwest to southeast within 15m of the northeastern site boundary to converge with the main drain within the Kellogg's facility, although newly constructed manholes covers in the northeast corner of the site indicate this may have recently been reconstructed. The hydrocarbons detected in the area of the UST are predominantly low volatility / low mobility substances that are likely to be strongly absorbed to the soil matrix within the site, and the risk of migration towards these watercourses under current conditions is considered to be low, although is dependant on the state of the culvert and the presence of any unknown drainage systems. Construction works may however result in the mobilisation of hydrocarbons into the shallow groundwater or drains.

6.6. Property Risk Assessment

6.6.1. The proposed development of the site is likely to include buildings, road access ways, drainage infrastructure, utility services and areas of soft landscaping.

6.6.2. The fills in TP1 in the northeast corner of the site contained zinc, copper and nickel at concentrations that may pose a risk to sensitive plant species if present within near-surface soils in areas of soft landscaping.

6.6.3. Levels of leachable sulphate within the made ground and natural soils (BRE 2:1 sulphate) are low to moderate and potential moderate risks of aggressive conditions to concrete are indicated

6.6.4. It is noted that that the presence of hydrocarbons in the soils around the UST and surface soils near Unit 245 will require consideration with particular respect to the protection of buildings and services. Underground services coming into contact with free product could be damaged or contaminated. Plastic drinking water mains would be at particular risk and normal protection measures would include the use of steel pipes and construction of clean trenches above the water table.

6.6.5. The peat encountered at depth in the southeastern corner of the site may give rise to ground gas. However, this is likely to be of low flow and is covered with clays and hence presents a low risk to property.

6.6.6. Potential pollution linkages between the identified contamination sources and existing and future receptors are summarised in Table 6.1 below:

7. Outline Remedial Strategy

- 7.1. Redevelopment of the site is proposed to commercial / light industrial use. A number of remedial measures will be necessary to ensure the site is suitable for the development and to protect the surrounding environment. The fundamental requirements will be to break existing and future potential linkages via containment, treatment and / or disposal. The conceptual model of the site was developed to provide a systematic risk assessment for the development of an appropriate remedial strategy. This took into account the likely requirements of the site development, including technical, commercial, practical and sustainability issues. The following outlines the likely remedial options that will be necessary, although a full options appraisal has not been undertaken at this stage.
- 7.2. Site preparation works will involve the clearance of residual surface materials, demolition of all site buildings and breaking out of the ground and structures. Given the potential presence of asbestos containing materials to be within the buildings, and presence of cement sheeting on at least one building, a Type 3 pre-demolition asbestos survey will be necessary prior to any demolition works. All asbestos stripping of existing structures and removal should be undertaken in accordance with current legislation, HSE codes of practice and waste disposal legislation. All potentially usable brick and concrete should be stockpiled and retained on site for use within the development.
- 7.3. The black 'flue' dust spread across the area to the rear of Unit 226 will require remediation. The material is likely to be classified as 'hazardous' waste due to the concentrations of zinc present (potential ecotoxic risks) in the absence of further information as the source of the material and actual substances present and hence removal and disposal could be expensive. Alternatively the material may be suitable for cement stabilisation and retention below hardstanding or landscaping areas.
- 7.4. The UST located in the access way to Unit 226 will require emptying and decommissioning; this is most likely to involve the excavation and removal of the tank along with removal of surrounding impacted soils to leave an unobstructed site. Alternatively the tank could be foam or concrete filled. Further investigations will be necessary in this area to assess the extent and nature of contamination with noted contamination including a green viscous liquid, a black tar substance and 'oily' water. The presence of 1,1-DCE in the nearby borehole, WS1b, suggest there may also be another contamination source in the area.

- 7.5. The hydrocarbon impacted surface soils in the area of Unit 245 should also be removed off-site or treated (bioremediation).
- 7.6. Relict structures and foundations are likely to require breaking out and any deleterious demolition / waste materials that are present removed. To date only small quantities of deleterious materials have been encountered on site and extensive deposits are not indicated as being present. Further investigations should be undertaken in the area of TP19 to ascertain the extent of the asbestos contamination within the fills. Additional investigations and testing should also be undertaken in the area of water storage near Unit 229 and open ground to the rear of Unit 227.
- 7.7. The requirements for the provision of gas protection measures within new buildings will require re-assessment after decommissioning of the UST and determination of the extent and nature of hydrocarbon impacted soils in this area. However, it is likely that the majority of the site will not require gas protection.
- 7.8. The current available information indicates that sulphate resistant concrete should be used in the development; this may be re-assessed following obtaining further data.
- 7.9. The provision of a clean soil cover is likely to be necessary in areas of soft landscaping.
- 7.10. A water supply pipeline risk assessment will be necessary following completion of the earthworks in accordance with the UKWIR guidance (UKWIR: Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, report ref: 10/WM/03/21, 2010). This will take the form a site investigation in accordance with the guidance (PID survey and soil sampling) and in liaison with the relevant water company.
- 7.11. The overall remedial strategy is likely to comprise:
- clearance and off-site disposal of all site surface / stored materials including the black ash to the rear of Unit 226;
 - Type 3 asbestos survey all existing structures prior to demolition;
 - asbestos stripping of existing structures and removal in accordance with legislation, HSE codes of practice and waste disposal legislation;
 - breaking out of concrete slabs, foundations, brick structures, voids and drains with inspection of materials and excavations, and testing as necessary; off-site removal of deleterious materials as necessary;
 - removal of UST contents and decommissioning of UST; stabilisation or removal of tank and backfilling void; additional investigations to determine the extent and nature of contamination; removal / treatment of hydrocarbon impacted soils / liquids;

- removal / treatment of hydrocarbon impacted surface soils in area of Unit 245;
- retention and stockpiling for crushing of all suitable engineering materials (concrete, brick etc);
- additional intrusive investigations in the southeast area to determine extent of asbestos contamination;
- additional investigations in the external storage areas near Units 227 and 229;
- derivation of appropriate remedial target criteria;
- preparation of Remedial Strategy and provision to Wrexham County Borough Council;
- placement of 300mm clean cover soil layer in areas of soft landscaping;
- provision of sulphate resistant concrete within the development;
- assessment of requirements for provision of gas protection measures into built development;
- placement of all services in trenches excavated and backfilled with clean materials; utilisation of appropriate water pipe materials (as advised the utility provider).

7.12. Remedial targets and validation testing will be necessary to demonstrate that the site has been remediated successfully, is suitable for the proposed end-use and does not pose an unacceptable risk to human health or the wider environment.

7.13. The following testing and assessment is likely to be required:

- validation and testing of any excavated hydrocarbon hotspots;
- validation of replacement fills used to fill voids, service corridors etc;
- validation testing of cover materials and recording of cover depths;
- inspection and validation of any installed gas protection measures;
- provision of a Completion Report detailing all on-site inspections; in-situ monitoring, soil and groundwater analysis, cover validation, gas protection measure validation etc to all relevant parties.

8. Conclusions and Recommendations

8.1. The site investigation confirms that the majority of the site appears generally suitable for future redevelopment for commercial / light industrial use, without major environmental liabilities. An underground storage tank is present in the northwestern corner of the site which appears to contain lubricating oil; the size and volume of the tank has not been confirmed as part of these investigations and the structure appears to be associated with the original 1940s development. Hydrocarbon contamination has also been noted in the shallow and deeper soils in this area, although appears to be relatively contained. The tank will require emptying and

decommissioning and surrounding impacted soils removed for treatment or disposal. 1,1-DCE has also been encountered in the nearby shallow groundwater, which may have arisen from a different source, and should also be subject to further investigation and assessment.

- 8.2. Extensive deposits of a black ash, believed to be flue dust, are present across the northeastern corner of the site. This material contains elevated levels of lead, arsenic, copper and zinc and will require removal and off-site disposal or possible on-site treatment. In the absence of specific information on the source of the material and the actual substances present it is likely the material will be classified as 'hazardous' waste due to the concentrations of zinc present (ecotoxic risks).
- 8.3. Elsewhere on site extensive deleterious deposits or areas of significant contamination have not been encountered, although the potential does exist for such materials to be present between the investigation entries. Asbestos fibres have been found in the made ground in the southeastern corner of the site which will require further investigation during the redevelopment works to assess potential risks to construction workers. Some metal, wood and plastic were encountered to 0.75m bgl in the northeastern corner, the extent of which will also require determination during the works. Relict foundations and structures may be present, particularly in the northern area associated with historical mineral railway lines and larger buildings, which will require breaking out and any backfilled deleterious materials removed.
- 8.4. Other general remedial measures likely to be required include the provision of clean cover to areas of soft landscaping, possible provision of gas protection measures (dependant on further observations in the area of the UST and development design), provision of sulphate resistant concrete (subject to further testing) and protection of water mains.

8.5. Limitations

Stratigraphy

- 8.5.1. The evidence of stratigraphy is taken from discrete borehole and trial pit locations, and from factual information provided by other parties. Whilst it is usually reasonable to infer that similar conditions may extend between these locations, caution should be exercised.

Contamination

- 8.5.2. The site investigation involved sampling at discrete locations, and it should be recognised that further areas or types of contamination may exist between investigation positions. The analyses performed are drawn from a typical suite of tests used to screen potentially contaminated land, and specified to fall within the available budget. It is always possible that other substances may be present that have not been included within the standard range of tests.

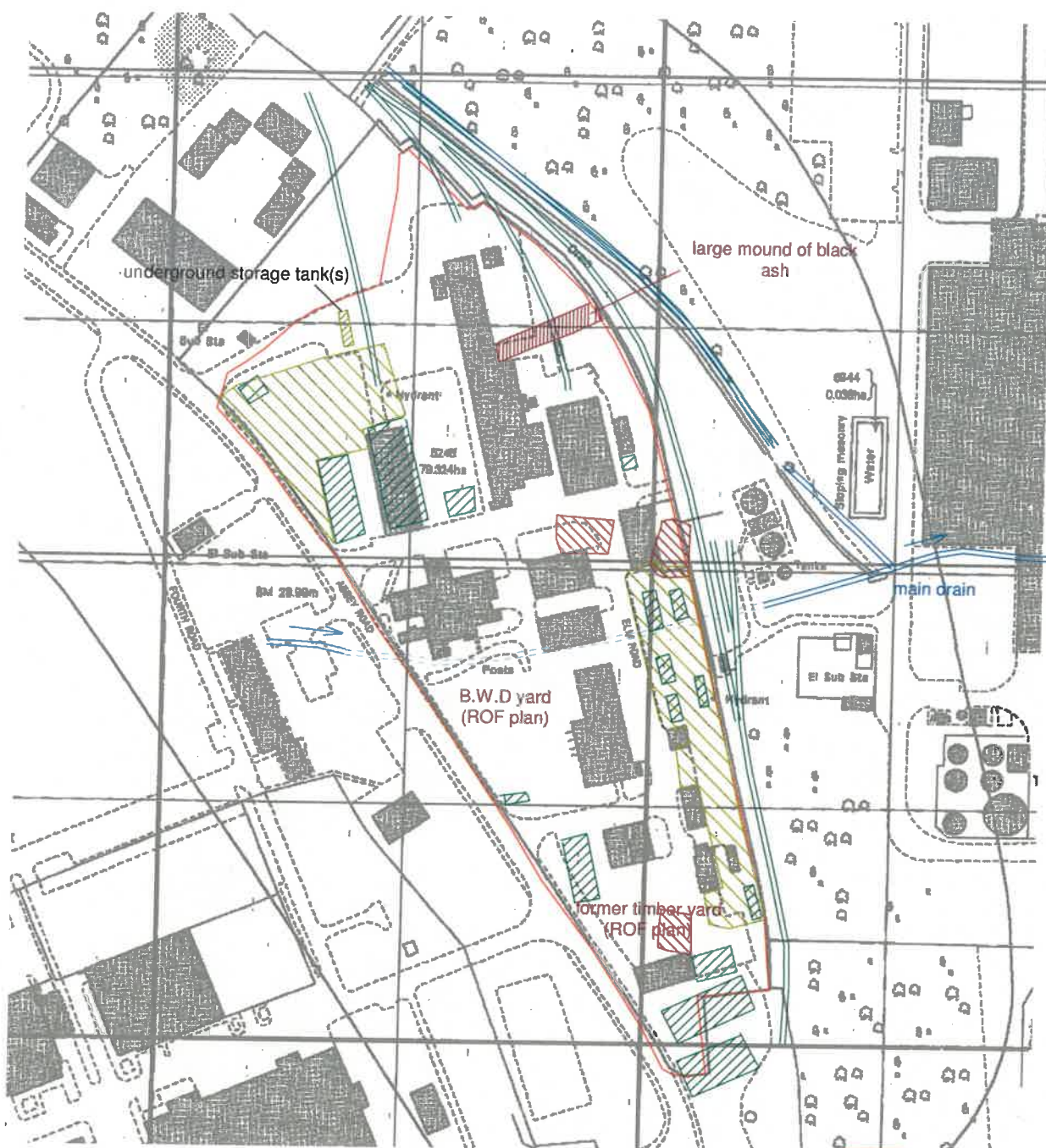
Soil gas and groundwater

8.5.3. Any comments made on gas and/or groundwater conditions are based on observations or tests made at the time that the work was carried out. It should be noted that gas concentrations and pressures and groundwater levels and concentrations of substances may vary according to seasonal or weather related effects, sometimes in an unpredictable fashion.

General

- 8.5.4. This report has been prepared by SGP for the sole and exclusive use of Wrexham County Borough Council. All reasonable skill, care and diligence has been exercised within the budget available, and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet undetected may exist. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context.
- 8.5.5. SGP reserves the right to alter any of the foregoing information in the event of new information being disclosed or provided and in the light of changes to legislation, guidelines and responses by the statutory and regulatory authorities.

DRAWINGS



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Project: Redwither Central Area,
Wrexham Industrial Estate
Wrexham
Drawing: Current Site Layout
and
Historical Features

Drawn: KEH

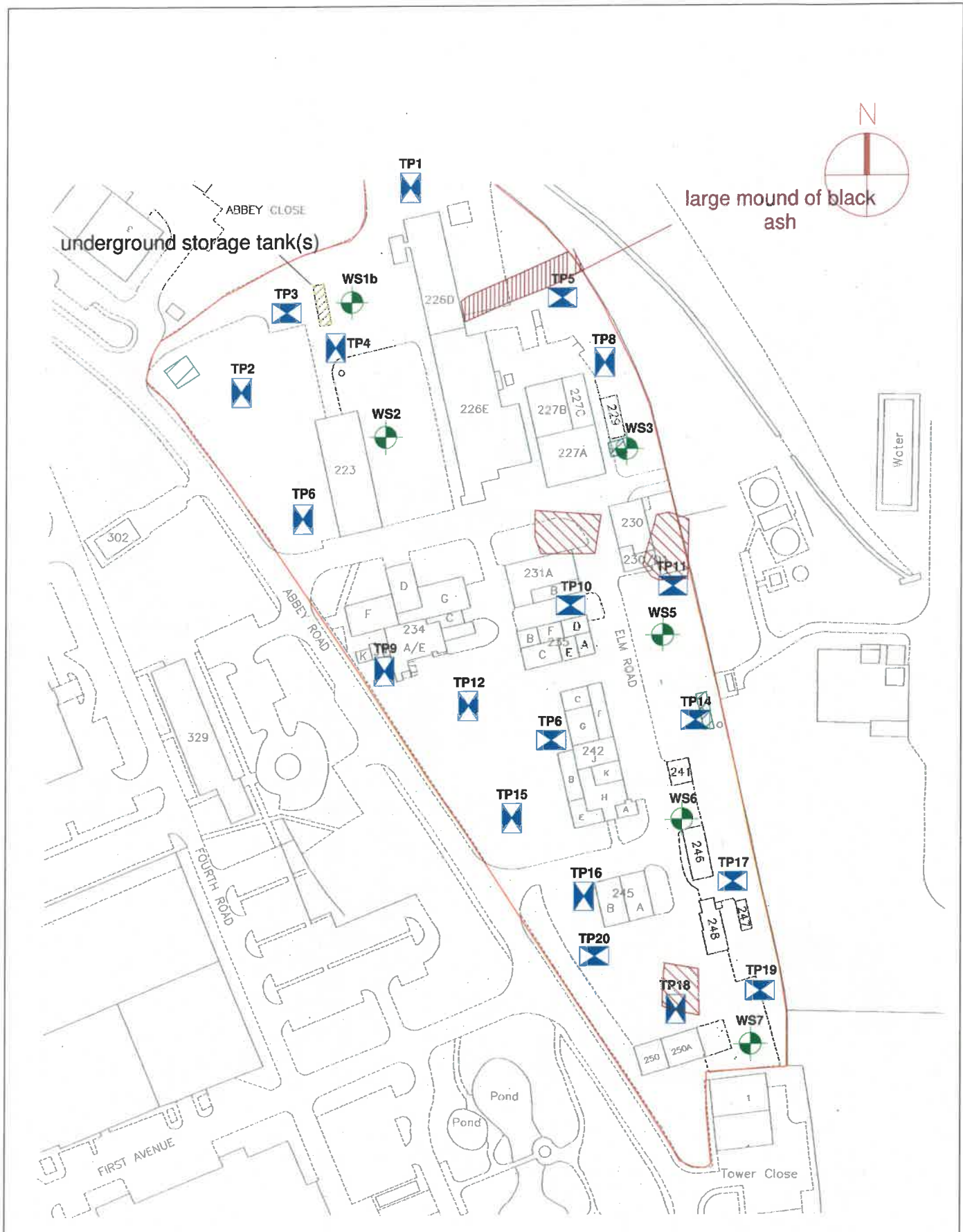
Checked: AFS

Date: 05.01.11

Scale: 1:2,500
@ A4

Job No: R1662

Drg No: D01



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Project:
Redwither Central Area,
Wrexham Industrial Estate

Drawing: Site
Investigation Locations

Drawn: KEH Checked: AFS

Date: 29.09.11 Scale: 1:1,250
@ A3

Job No: R1662 Drg No: D02

APPENDIX A

Photographs



Underground storage tank(s) in entrance way to Unit 226



Underground storage tank(s)



Underground storage tank(s)



Mound of black ash / flue dust to rear of Unit 226



Surface area of black ash



Mound of black ash along rear fence



Internal area to Unit 226D



Internal area to Unit 226D

R1662 Redwither Central, Wrexham Industrial Estate
Additional observation during intrusive works

APPENDIX B

Site Investigation Logs

TRIAL PIT RECORD
Trial Pit No: 1

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.00	Fine sandy silt with limestone gravel, frequent pieces of metal wire, plastic, wood and red brick fragments	TP1.S1 (0-0.5m)			Made Ground
0.75	Soft to firm grey clay with frequent organic matter (rootlets)				Natural glacial deposits
1.2	Stiff red clay with grey mottles	TP1.S2 (1.3-1.5m)			Natural glacial deposits
1.5	Base of excavation				



Comments:
No odour, no hydrocarbons
PID <0.1ppm

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Project: Redwither Central Area, Wrexham Industrial Estate	Drawn: DW	Date: 02.11.2011	Job No: R1662
Drawing: TP1	Checked:	Scale: NTS	Drg No: TP1

TRIAL PIT RECORD
Trial Pit No: 2

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Fine sandy loam with some pieces of red brick	TP2.S1 (0-0.3m)			Topsoil
0.3	Light red fine sandy silty loam with small fragments of brick, angular gravel and occasional cobbles	TP2.S2 (0.3-0.6m)			Made Ground
0.6	Very stiff dark grey clay . Possible relict cast iron pipe intercepted at ~1m bgl				Natural glacial deposits
1.2	Soft grey silty clay				Natural glacial deposits


Comments:

No odour, no hydrocarbons

PID <0.1ppm

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Drawing:	TP2	Checked:		Scale:	NTS	Drg No:	TP2

TRIAL PIT RECORD
Trial Pit No: 3

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Fine clayey limestone gravel				Made Ground
0.1	Black clayey gravel with strong hydrocarbon odour. Frequent pieces of red brick and angular gravel	TP3.S1 (0-0.4m)			Made Ground
0.4	Concrete sidewall – possibly of underground storage tank			Oily water	Made Ground
0.8	Medium sand	TP3.S2 (0.8-1.0m)		Viscous Green liquid	Made Ground
1.0	Red clayey sandy gravel with pieces of red brick, strong hydrocarbon odour. Pockets of gravel stuck together with black tarry substance				Made Ground
1.1	Very stiff light brown clay	TP3.S3 (1.1-1.3m)			Natural glacial deposits
1.3	Base of Excavation				


Comments:

Strong hydrocarbon odour through Made Ground until Natural. Oily water entering trial-pit alongside concrete slab and green viscous secretion through horizon of sand
PID <0.1ppm

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Drawing: TP3	Checked:	Scale: NTS	Drg No: TP3

TRIAL PIT RECORD
Trial Pit No: 4

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Sandy clay soil with limestone angular gravel and cobbles	TP4.S1 (0-0.6m)			Made Ground
0.1	Dark brown to black clayey sand with fine gravel				Natural glacial deposits
0.3	Stiff light brown clay	TP4.S2 (1.5-1.8m)			Natural glacial deposits
1.8	Base of excavation – sidewalls collapsing				Natural glacial deposits


Comments:

No odour, no hydrocarbons
PID <0.1ppm

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Drawing: TP4	Checked:	Scale: NTS	Drg No: TP4

TRIAL PIT RECORD

Trial Pit No: 5

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Fine gravelly sand with limestone cobbles. Mild hydrocarbon odour	TP5.S1 (0-0.5m)			Made Ground
0.3	Fine red clayey gravel				Natural glacial deposits
0.5	Stiff light brown clay	TP5.S2 (0.8-1.0m)			Natural glacial deposits
1.0	Base of excavation				



Comments:
Mild hydrocarbon odour
PID <0.1ppm

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Drawing: TP5	Checked:	Scale: NTS	Drg No: TP5

TRIAL PIT RECORD
Trial Pit No: 6

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	White to grey clayey fine gravel with occasional cobbles of limestone	TP6.S1 (0-0.3m)			Made Ground
0.3	Medium to fine light brown sand				Natural glacial deposits
2.3	Soft light brown clay				Natural glacial deposits
2.3	Base of Excavation				


Comments:

No odour, no hydrocarbons
PID <0.1 ppm

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Drawing: TP6	Checked:	Scale: NTS	Drg No: TP6

TRIAL PIT RECORD
Trial Pit No: 8

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Grey clayey gravel with angular limestone	TP8.S1 (0-0.5m)			Made Ground
0.5	Dark brown stiff clay	TP8.S2 (1.0-1.3m)			Natural glacial deposits
2.0	Base of excavation				




Comments:
 No odour, no hydrocarbons
 PID <0.1ppm

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Drawing: TP8	Checked:	Scale: NTS	Drg No: TP8

TRIAL PIT RECORD
Trial Pit No: 9

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Tarmac				Tarmac
0.05	Relict drain in concrete				Concrete
0.1	Red silty gravel with fragments of red brick	TP9.S1 (0.1-0.5m)			Made Ground
0.5	Soft light grey clay	TP9.S2 (0.5-0.8m)			Natural glacial deposits
0.8	Firm light brown clay with grey mottles				Natural glacial deposits
1.8	Base of Excavation				


Comments:

No odour, no hydrocarbons
PID <0.1ppm

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Drawing: TP9	Checked:	Scale: NTS	Drg No: TP9

TRIAL PIT RECORD
Trial Pit No: 10

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Light brown fine gravel sandy clay with horizons of red gravelly sand and fine fragments of red brick	TP10.S1 (0-0.5m)			Made Ground
0.5	Fine fragments of crushed red brick				
0.6	Stiff light brown clay with grey mottles	TP10.S2 (1.8-2.1m)			Natural glacial deposits
2.1	Base of excavation				


Comments:

No odour, no hydrocarbons
PID <0.1ppm

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Drawing: TP10	Checked:	Scale: NTS	Drg No: TP10

TRIAL PIT RECORD
Trial Pit No: 11

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Concrete slab				Slab
0.1	Brown to red clayey soil with frequent gravel and occasional red brick	TP11.S1 (0.1-0.3m)			Made Ground
0.3	Firm dark grey clay with rootlets. Clay grading to dark brown/grey mottles				Natural glacial deposits
1.8	Base of excavation				


Comments:

No odour, no hydrocarbons

PID <0.1ppm

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Drawing:	TP11	Checked:		Scale:	NTS	Drg No:	TP11

TRIAL PIT RECORD
Trial Pit No: 12

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Compacted gravel fill with fine sandy clay soil				Made Ground
0.05	Red medium sand clay fill with fine pieces of red brick, pieces of tile and angular cobbles of red limestone	TP12.S1 (0-0.5m)			Made Ground
0.5	Stiff grey clay with occasional horizon of organic matter	TP12.S2 (0.5-0.8m)			Natural glacial deposits
2.3	Base of excavation				


Comments:

No odour, no hydrocarbons
PID <0.1ppm

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Drawing: TP12	Checked:	Scale: NTS	Drg No: TP12

TRIAL PIT RECORD
Trial Pit No: 13

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Limestone chippings in dark grey sandy clay				Made Ground
0.1	Light brown to white sandy clay	TP13.S1 (0-0.4m)			Made Ground
0.2	Red sandy clay gravel with fine fragments of red brick				Made Ground
0.4	Stiff dark grey clay with rare organic matter (tree branch)	TP12.S2 (1.0-1.5 m)			Re-worked Natural
1.3	Re-worked natural surrounding relict drain and some red bricks				Re-worked Natural
1.5	Stiff dark brown clay with grey mottles				Natural glacial deposits
2.3	Base of excavation				




Comments:
 No odour, no hydrocarbons
 PID <0.1ppm

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Drawing: TP13	Checked:	Scale: NTS	Drg No: TP13

TRIAL PIT RECORD
Trial Pit No: 14

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Coarse sandy silt gravel with angular limestone gravel	TP14.S1 (0-0.3m)			Made Ground
0.3	Stiff dark brown clay				Natural glacial deposits
0.5	Clayey gravel with angular gravel	TP14.S2 (0.5-0.65m)			Natural glacial deposits
0.65	Stiff dark brown clay with rare pieces of coal				Natural glacial deposits
2.0	Base of excavation				


Comments:

No odour, no hydrocarbons
PID <0.1ppm

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Drawing: TP14	Checked:	Scale: NTS	Drg No: TP14

TRIAL PIT RECORD
Trial Pit No: 15

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	White sandy clay gravel				Made Ground
0.1	Dark brown to red sandy gravel with reworked natural (lumps of clay) and angular cobbles of limestone	TP15.S1 (0.2-0.6m)			Made Ground
0.6	Stiff dark brown clay	TP15.S2 (1.5-1.8m)			Natural glacial deposits
1.8	Base of excavation				




Comments:
 No odour, no hydrocarbons
 PID <0.1ppm

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Drawing: TP15	Checked:	Scale: NTS	Drg No: TP15

TRIAL PIT RECORD
Trial Pit No: 16

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Dark brown gravel with clayey soil				Made Ground
0.04	Light brown to white coarse sandy clay gravel	TP16.S1 (0.04-0.5m)			Made Ground
0.5	Dark brown stiff clay with some organic matter (roots)	TP16.S2 (0.5-0.9m)			Natural glacial deposits
1.1	Stiff red clay with grey mottles				Natural glacial deposits
1.8	Base of excavation				


Comments:

No odour, no hydrocarbons

PID <0.1ppm

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Drawing:	TP16	Checked:		Scale:	NTS	Drg No:	TP16

TRIAL PIT RECORD
Trial Pit No: 17

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Sandy loam with organic matter (roots) and fragments of red brick	TP17.S1 (0-0.5m)			Topsoil
0.5	Clay with very fine gravel, red brick dust and larger pieces of brick	TP17.S2 (0.5-0.6m)			Made Ground
0.6	Firm dark brown to dark grey clay				Natural glacial deposits
1.5	Base of excavation				


Comments:

No odour, no hydrocarbons
PID <0.1ppm

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Drawing: TP17	Checked:	Scale: NTS	Drg No: TP17

TRIAL PIT RECORD
Trial Pit No: 18

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Sandy gravel with angular stone				Made Ground
0.4	Soft dark brown clay	TP18.S1 (0-0.4m)			Possible Re-worked Natural
1.8	Soft dark brown clay with horizons of dark clayey topsoil (roots)	TP18.S2 (1.8-2.2m)			Possible Re-worked Natural
2.2	Base of excavation				


Comments:

No odour, no hydrocarbons
PID <0.1ppm

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Drawing: TP18	Checked:	Scale: NTS	Drg No: TP18

TRIAL PIT RECORD
Trial Pit No: 19

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Clayey loam with gravel, angular pieces of brick and rare pieces of metal and plastic waste	TP19.S1 (0-0.4)			Made Ground
0.4	Firm pieces of clay, dark brown with rare pieces of brick. Mild hydrocarbon odour	TP19.S2 (0.4-0.7)			Re-worked Natural
0.7	Stiff light brown with grey mottled clay				Natural glacial deposits
1.0	Base of excavation				


Comments:

Mild hydrocarbon odour from spoil
PID <0.1ppm

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Drawing: TP19	Checked:	Scale: NTS	Drg No: TP19

TRIAL PIT RECORD
Trial Pit No: 20

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Fine black gravel with strong oil odour	TP20.S1 (0-0.1m)			Made Ground
0.1	Light brown to white sandy clay gravel with angular cobbles of limestone	TP20.S2 (0.1-0.4m)			Made Ground
0.4	Stiff dark brown clay with grey mottles	TP20.S3 (1.8-2.1)			Natural glacial deposits
2.1	Base of excavation				



Comments:
No odour, no hydrocarbons
PID <0.1ppm

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Project:	Redwither Central Area, Wrexham Industrial Estate	Drawn:	DW	Date:	02.11.2011	Job No:	R1662
Drawing:	TP20	Checked:		Scale:	NTS	Drg No:	TP20

GEO-VENTURES (UK) LIMITED <i>Geotechnical and Environmental Services</i>						Site Redwither Central, Wrexham Industrial Estate, Wrexham		Number WS 1	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client		Job Number 12-362	
		Location		Dates 26/10/2011		Engineer Smith Grant LLP		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.50	D		Seepage(1) at 0.75m.		(0.50)	MADE GROUND : stone (drillers description)		V1	
					0.50 (0.30)	MADE GROUND : red ash / burnt shale			
					0.80	Complete at 0.80m			
Remarks Service pit excavated by hand to 1.00m						Scale (approx) 1:50	Logged By J. Crook	Figure No. 12-362.WS 1	

GEO-VENTURES (UK) LIMITED <i>Geotechnical and Environmental Services</i>						Site Redwither Central, Wrexham Industrial Estate, Wrexham		Number WS 1A	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client		Job Number 12-362	
		Location		Dates 26/10/2011		Engineer Smith Grant LLP		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.50	D				(0.35)	MADE GROUND : stone (drillers description)			
					0.35	MADE GROUND : black ash and cinder with fragments of broken brick			
1.00	D				(0.45)				
					0.80	Firm / stiff to stiff grey / brown CLAY			
2.00	D				(1.20)				
					2.00	Firm brown boulder CLAY with bands of sand (drillers description)			
3.00	D				(0.50)				
					2.50	Firm / stiff brown CLAY with occasional fine sub-rounded gravel			
4.00	D				(1.50)				
					4.00	Complete at 4.00m			

Remarks
Service pit excavated by hand to 1.00m

Scale (approx)
1:50

Logged By
J. Crook

Figure No.
12-362.WS 1

GEO-VENTURES (UK) LIMITED <i>Geotechnical and Environmental Services</i>						Site Redwither Central, Wrexham Industrial Estate, Wrexham		Number WS 2	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client		Job Number 12-362	
		Location		Dates 26/10/2011		Engineer Smith Grant LLP		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.50	D				(0.15)	MADE GROUND : concrete (drillers description)			
					0.15	MADE GROUND : coarse brown sand and fine to coarse angular gravel			
1.00	D				(0.43)				
					0.58	Firm / stiff to stiff grey / brown CLAY			
2.00	D				(0.92)				
					1.50	Firm brown sandy gravelly CLAY			
3.00	D				(0.60)				
					2.10	Firm / stiff brown CLAY with occasional fine sub-rounded gravel			
					(0.90)				
					3.00	Complete at 3.00m			

Remarks
Service pit excavated by hand to 1.00m

Scale (approx)
1:50

Logged By
J. Crook

Figure No.
12-362.WS 1

GEO-VENTURES (UK) LIMITED
Geotechnical and Environmental Services

Redwither Central, Wrexham Industrial Estate, Wrexham

Number
WS 3

Excavation Method
Drive-in Window Sampler

Dimensions

Ground Level (mOD)

Client	
---------------	--

Job Number
12-362

Location

Dates 26/10/2011

Engineer

Smith Grant LLP

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D				(0.40)	MADE GROUND : stone (drillers description)		
					0.40	MADE GROUND : stiff / very stiff grey / brown clay		
1.00	D				(0.40)	Firm / stiff brown CLAY with occasional fine sub-rounded gravel		
2.00	D				(2.20)			
								
								
								
								
								
3.00	D				3.00			
4.00	D				Complete at 4.00m			

Remarks
Service pit excavated by hand to 1.00m

Scale (approx)

Logged
By

1:50

J. Crook

Figure No.

12-362.WS 1

GEO-VENTURES (UK) LIMITED

Geotechnical and Environmental Services

Site
Redwith Central, Wrexham Industrial Estate, Wrexham

Number
WS 5

Excavation Method Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client	Job Number 12-362
	Location	Dates 26/10/2011	Engineer Smith Grant LLP	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D					MADE GROUND : broken limestone		
1.00	D				(2.20)			
2.00	D				2.20	Firm / stiff grey / brown CLAY		
3.00	D				3.00	Soft / firm to firm brown CLAY		
4.00	D				4.00	Complete at 4.00m		

Remarks
Service pit excavated by hand to 1.00m

Scale (approx)
1:50

Logged By
J. Crook

Figure No.
12-362.WS 1

GEO-VENTURES (UK) LIMITED Geotechnical and Environmental Services						Site Redwither Central, Wrexham Industrial Estate, Wrexham		Number WS 6	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client		Job Number 12-362	
		Location		Dates 26/10/2011		Engineer Smith Grant LLP		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.50	D				(0.65)	MADE GROUND : brown clay, sand and gravel			
1.00	D				0.65 (0.25) 0.90	Grey CLAY (drillers description)			
2.00	D				(2.00)	Firm / stiff grey / brown CLAY			
3.00	D		Seepage(1) at 2.90m.		2.90 (0.50) 3.40 (0.60) 4.00	Firm brown very sandy CLAY		V1	
4.00	D					Firm / stiff brown slightly sandy CLAY with occasional fine sub-rounded gravel			
						Complete at 4.00m			

Remarks Service pit excavated by hand to 1.00m		Scale (approx) 1:50	Logged By J. Crook
		Figure No. 12-362.WS 1	

GEO-VENTURES (UK) LIMITED <i>Geotechnical and Environmental Services</i>						Site Redwither Central, Wrexham Industrial Estate, Wrexham		Number WS 7	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client		Job Number 12-362	
		Location		Dates 26/10/2011		Engineer Smith Grant LLP		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.50	D				(0.50)	MADE GROUND : stone and brick (drillers description)			
					0.50 (0.20)	Firm / stiff brown CLAY			
					0.70	Firm / stiff grey / brown CLAY			
1.00	D								
									
									
									
2.00	D				(2.90)				
									
									
									
3.00	D								
									
									
									
									
									
4.00	D				3.60 (0.40) 4.00	Firm / stiff black / brown laminated PEAT			
						Complete at 4.00m			

Remarks
Service pit excavated by hand to 1.00m

Scale (approx)
1:50

Logged By
J. Crook

Figure No.
12-362.WS 1

GEO-VENTURES (UK) LIMITED

Geotechnical and Environmental Services

Site

Redwither Central, Wrexham Industrial Estate, Wrexham

Borehole

Number
WS 1A

Installation Type
Single Installation

Dimensions

Internal Diameter of Tube [A] = 35 mm
Diameter of Filter Zone = 80 mm

Client

Job
Number
12-362

Location

Ground Level (mOD)

Engineer

Smith Grant LLP

Sheet
1/1

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling										
						Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)	
											5 min	10 min	15 min	20 min		
				0.10	Concrete											
					Bentonite Seal											
				1.00		Groundwater Observations During Drilling										
						Start of Shift					End of Shift					
						Date	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
						Instrument Groundwater Observations										
						Inst. [A] Type : Slotted Standpipe										
						Instrument [A]				Remarks						
						Date	Time	Depth (m)	Level (mOD)							
				4.00	Well Screen											

Remarks

GEO-VENTURES (UK) LIMITED

Geotechnical and Environmental Services

Site
Redwither Central, Wrexham Industrial Estate, Wrexham

Borehole Number
WS 2

Installation Type
Single Installation

Dimensions
Internal Diameter of Tube [A] = 35 mm
Diameter of Filter Zone = 80 mm

Client

Job Number
12-362

Location

Ground Level (mOD)

Engineer

Smith Grant LLP

Sheet
1/1

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling													
				0.10	Concrete	Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)				
									5 min	10 min	15 min	20 min							
									Groundwater Observations During Drilling										
				Date	Start of Shift					End of Shift									
					Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)					
										Instrument Groundwater Observations									
									Inst. [A] Type : Slotted Standpipe										
Date	Instrument [A]			Remarks															
	Time	Depth (m)	Level (mOD)																

Remarks

GEO-VENTURES (UK) LIMITED <i>Geotechnical and Environmental Services</i>	Site Redwither Central, Wrexham Industrial Estate, Wrexham	Borehole Number WS 3
--	--	---------------------------------------

Redwither Central, Wrexham Industrial Estate, Wrexham

**Borehole
Number
WS 3**

Dimensions
Internal Diameter of Tube [A] = 35 mm
Diameter of Filter Zone = 80 mm

Engineer
Smith Grant LLP

Job Number
12-362

Ground Level (mOD)

Sheet
1/1

[illegible]

Remarks

[illegible]

GEO-VENTURES (UK) LIMITED
Geotechnical and Environmental Services

Redwither Central, Wrexham Industrial Estate, Wrexham

**Borehole
Number**
WS 6

Dimensions
Internal Diameter of Tube [A] = 35 mm
Diameter of Filter Zone = 80 mm

Engineer
Smith Grant LLP

Job Number
12-362

Ground Level (mOD)

Sheet
1/1.

[illegible]

Remarks

GEO-VENTURES (UK) LIMITED <i>Geotechnical and Environmental Services</i>					Site Redwith Central, Wrexham Industrial Estate, Wrexham		Borehole Number WS 7		
Installation Type Single Installation		Dimensions Internal Diameter of Tube [A] = 35 mm Diameter of Filter Zone = 80 mm			Client 		Job Number 12-362		
		Location		Ground Level (mOD)		Engineer Smith Grant LLP		Sheet 1/1	

Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling										
						Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)	
				0.10	Concrete							5 min	10 min	15 min	20 min	
					Bentonite Seal											
				1.00		Groundwater Observations During Drilling										
						Start of Shift					End of Shift					
						Date	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
						Instrument Groundwater Observations										
						Inst. [A] Type : Slotted Standpipe										
						Instrument [A]				Remarks						
						Date	Time	Depth (m)	Level (mOD)							
					Well Screen											
				4.00												

Remarks

APPENDIX C

Analytical Results



Jones Environmental Laboratory

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LL14 6DL

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Fax: +44 (0) 1244 833781



No.4225



Attention : Katrina Hawkins
Date : 15th November, 2011
Your reference : R1662
Our reference : Test Report 11/7587 Batch 1 Schedule A
Location : REDWITHER INDUSTRIAL ESTATE
Date samples received : 25th October, 2011
Status : Final report
Issue : 1

Thirty samples were received for analysis on 25th October, 2011. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

J W Farrell-Jones CChem FRSC
Chartered Chemist

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Reference: R1662

Location: REDWITHER INDUSTRIAL ESTATE

Contact: Katrina Hawkins

JE Job No.: 11/7587

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1-2	3-4	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	Please see attached notes for all abbreviations and acronyms		
Sample ID	TP1 S1	TP1 S2	TP2 S2	TP3 S1	TP3 S2	TP3 S3	TP4 S1	TP4 S2	TP5 S1	TP5 S2			
Depth	0.05	1.3-1.5	0.3-0.5	0-0.4	0.8-1.1	1.1-1.3	0-0.6	1.5-1.8	0-0.5	0.8-1.0			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	LOD	Units	Method No.
Arsenic ^{RM}	92.3	-	18.0	-	-	-	12.6	-	-	13.4	<0.5	mg/kg	TM30/PM15
Cadmium ^{RM}	1.9	-	0.4	-	-	-	0.6	-	-	0.2	<0.1	mg/kg	TM30/PM15
Chromium ^{RM}	96.2	-	29.8	-	-	-	88.1	-	-	55.0	<0.5	mg/kg	TM30/PM15
Copper ^{RM}	1459	-	47	-	-	-	40	-	-	44	<1	mg/kg	TM30/PM15
Lead ^{RM}	265	-	52	-	-	-	153	-	-	24	<5	mg/kg	TM30/PM15
Mercury ^{RM}	<0.1	-	0.1	-	-	-	<0.1	-	-	<0.1	<0.1	mg/kg	TM30/PM15
Nickel ^{RM}	120.0	-	38.2	-	-	-	18.8	-	-	80.3	<0.7	mg/kg	TM30/PM15
Selenium ^{RM}	2	-	2	-	-	-	<1	-	-	1	<1	mg/kg	TM30/PM15
Zinc ^{RM}	2455	-	89	-	-	-	204	-	-	154	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene ^{RM}	0.10	-	<0.04	0.42	0.07	<0.04	0.14	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	-	<0.03	0.18	0.22	<0.03	0.06	-	<0.03	-	<0.03	mg/kg	TM4/PM8
Acenaphthene ^{RM}	<0.05	-	<0.05	0.33	0.82	<0.05	<0.05	-	<0.05	-	<0.05	mg/kg	TM4/PM8
Fluorene ^{RM}	<0.04	-	<0.04	0.30	0.54	<0.04	<0.04	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Phenanthrene ^{RM}	0.23	-	0.58	1.41	1.53	0.07	0.81	-	0.06	-	<0.03	mg/kg	TM4/PM8
Anthracene [#]	<0.04	-	0.21	0.95	1.42	<0.04	0.29	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Fluoranthene ^{RM}	0.10	-	0.62	8.05	13.57	0.06	1.99	-	<0.03	-	<0.03	mg/kg	TM4/PM8
Pyrene [#]	0.11	-	0.55	7.30	13.25	0.07	1.68	-	0.24	-	<0.03	mg/kg	TM4/PM8
Benz(a)anthracene [#]	0.10	-	0.43	4.80	5.12	0.07	1.01	-	0.07	-	<0.06	mg/kg	TM4/PM8
Chrysene ^{RM}	0.09	-	0.29	4.11	4.99	0.06	1.11	-	0.07	-	<0.02	mg/kg	TM4/PM8
Benzo(b)fluoranthene ^{RM}	0.10	-	0.44	7.84	9.96	0.12	2.23	-	<0.07	-	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	<0.04	-	0.24	4.73	5.63	0.06	1.35	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene ^{RM}	<0.04	-	0.19	3.56	4.42	0.06	0.92	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	<0.04	-	<0.04	0.41	0.46	<0.04	0.28	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	0.04	-	0.16	3.32	3.30	<0.04	0.88	-	<0.04	-	<0.04	mg/kg	TM4/PM8
PAH 16 Total	0.9	-	3.7	47.7	65.3	<0.6	12.8	-	<0.6	-	<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.07	-	0.32	5.64	7.17	0.09	1.61	-	<0.05	-	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.03	-	0.12	2.20	2.79	0.03	0.62	-	<0.02	-	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	103	-	104	96	110	111	104	-	105	-	<0	%	TM4/PM8
EPH >C8-C10 [#]	-	-	-	-	-	-	<5	-	-	<5	<5	mg/kg	TM5/PM8
EPH >C10-C20 [#]	-	-	-	-	-	-	45	-	-	<10	<10	mg/kg	TM5/PM8
EPH >C20-C30 [#]	-	-	-	-	-	-	364	-	-	<10	<10	mg/kg	TM5/PM8
EPH >C30-C40 [#]	-	-	-	-	-	-	299	-	-	<10	<10	mg/kg	TM5/PM8
EPH >C8-C40 [#]	-	-	-	-	-	-	708	-	-	<35	<35	mg/kg	TM5/PM8

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Report : Solid

Reference: R1662

Location: REDWITHER INDUSTRIAL ESTATE

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Katrina Hawkins

JE Job No.: 11/7587

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-2	3-4	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	Please see attached notes for all abbreviations and acronyms		
Sample ID	TP1 S1	TP1 S2	TP2 S2	TP3 S1	TP3 S2	TP3 S3	TP4 S1	TP4 S2	TP5 S1	TP5 S2			
Depth	0.05	1.3-1.5	0.3-0.5	0-0.4	0.8-1.1	1.1-1.3	0-0.6	1.5-1.8	0-0.5	0.8-1.0			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD	Units	Method No.
Date of Receipt	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011			
TPH CWG													
Aliphatics													
>C5-C6 ^{RM}	-	-	-	<0.1	<0.1	<0.1	-	-	<0.1	-	<0.1	mg/kg	TM36/PM12
>C6-C8 ^{RM}	-	-	-	0.1	<0.1	<0.1	-	-	<0.1	-	<0.1	mg/kg	TM36/PM12
>C8-C10	-	-	-	0.3	1.8	<0.1	-	-	<0.1	-	<0.1	mg/kg	TM36/PM12
>C10-C12 ^{RM}	-	-	-	12.8	60.2	2.1	-	-	<0.2	-	<0.2	mg/kg	TM5/PM16
>C12-C16 ^{RM}	-	-	-	388	869	61	-	-	24	-	<4	mg/kg	TM5/PM16
>C16-C21 ^{RM}	-	-	-	603	819	76	-	-	460	-	<7	mg/kg	TM5/PM16
>C21-C35 ^{RM}	-	-	-	310	261	62	-	-	385	-	<7	mg/kg	TM5/PM16
Total aliphatics C5-35	-	-	-	1314	2011	201	-	-	869	-	<19	mg/kg	TM5/PM16/PM21/PM15
Aromatics													
>C5-EC7	-	-	-	<0.1	<0.1	<0.1	-	-	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC7-EC8	-	-	-	<0.1	<0.1	<0.1	-	-	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC8-EC10 ^{RM}	-	-	-	<0.1	<0.1	<0.1	-	-	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC10-EC12 ^{RM}	-	-	-	2.6	8.8	<0.2	-	-	<0.2	-	<0.2	mg/kg	TM5/PM16
>EC12-EC16 ^{RM}	-	-	-	159	438	19	-	-	11	-	<4	mg/kg	TM5/PM16
>EC16-EC21 ^{RM}	-	-	-	769	829	45	-	-	308	-	<7	mg/kg	TM5/PM16
>EC21-EC35 ^{RM}	-	-	-	2113	515	10	-	-	260	-	<7	mg/kg	TM5/PM16
Total aromatics C5-35	-	-	-	3044	1791	74	-	-	579	-	<19	mg/kg	TM5/PM16/PM21/PM15
Total aliphatics and aromatics(C5-35)	-	-	-	4358	3802	275	-	-	1448	-	<38	mg/kg	TM5/PM16/PM21/PM15
MTBE [#]	-	-	-	<5	<5	<5	-	-	<5	-	<5	ug/kg	TM31/PM12
Benzene [#]	-	-	-	<5	<5	<5	-	-	<5	-	<5	ug/kg	TM31/PM12
Toluene [#]	-	-	-	17	11	<5	-	-	<5	-	<5	ug/kg	TM31/PM12
Ethylbenzene [#]	-	-	-	<5	32	<5	-	-	<5	-	<5	ug/kg	TM31/PM12
m/p-Xylene [#]	-	-	-	<5	28	<5	-	-	<5	-	<5	ug/kg	TM31/PM12
o-Xylene [#]	-	-	-	<5	10	<5	-	-	<5	-	<5	ug/kg	TM31/PM12
Total Phenols HPLC	-	-	-	-	-	-	<0.15	-	-	-	<0.15	mg/kg	TM26/PM21
Hexavalent Chromium	<0.3	-	-	-	-	-	0.8	-	-	-	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext)	-	0.0102	-	-	-	0.0095	-	0.0067	-	0.0195	<0.0015	g/l	TM38/PM20
Total Cyanide	-	-	-	-	-	-	1.2	-	-	-	<0.5	mg/kg	TM89/PM45
Organic Matter	1.9	-	-	-	-	-	4.1	-	-	-	<0.2	%	TM21/PM24
Fibre Screen*	NFD	-	NFD	-	-	-	NFD	-	-	-	None	Subcontracted	
Asbestos Type*	-	-	-	-	-	-	NAD	-	-	-	None	Subcontracted	
pH ^{RM}	7.72	-	7.56	-	-	-	7.91	-	-	8.02	<0.01	pH units	TM73/PM11
Sample Type	Clay	Clay	Clay	Other	Sand	Clay	Clay	Clay	Other	Clay	None	PM13/PM0	
Sample Colour	Medium Brown	Medium Brown	Medium Brown	Dark Brown	Red	Medium Brown	Medium Brown	Medium Brown	Medium Grey	Medium Brown	None	PM13/PM0	
Other Items	stones	none	stones	stones	stones	nones	stones	none	stones	none	None	PM13/PM0	

Please include all sections of this report if it is reproduced

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Report : Solid

Reference: R1662

Location: REDWITHER INDUSTRIAL ESTATE

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Katrina Hawkins

JE Job No.: 11/7587

Please see attached notes for all abbreviations and acronyms

J E Sample No.	27-28	29-30	31-32	41-42	43-44	45-46	49-50	51-52	53-54	55-56			
Sample ID	TP8 S2	TP10 S1	TP10 S2	TP16 S2	TP17 S1	TP17 S2	TP18 S2	TP19 S1	TP19 S2	TP20 S1			
Depth	1.0-1.5	0-0.5	1.8-2.1	0.5-0.9	0-0.5	0.5-0.6	1.8-2.2	0-0.4	0.4-0.7	0-0.1			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	LOD	Units	Method No.
Arsenic ^{RM}	-	2.6	11.2	-	-	11.3	11.8	NDP	-	-	<0.5	mg/kg	TM30/PM15
Cadmium ^{RM}	-	0.5	0.2	-	-	0.2	0.3	NDP	-	-	<0.1	mg/kg	TM30/PM15
Chromium ^{RM}	-	7.3	44.7	-	-	31.6	48.4	NDP	-	-	<0.5	mg/kg	TM30/PM15
Copper ^{RM}	-	13	28	-	-	23	26	NDP	-	-	<1	mg/kg	TM30/PM15
Lead ^{RM}	-	24	20	-	-	33	43	NDP	-	-	<5	mg/kg	TM30/PM15
Mercury ^{RM}	-	0.3	<0.1	-	-	<0.1	0.1	NDP	-	-	<0.1	mg/kg	TM30/PM15
Nickel ^{RM}	-	6.6	48.6	-	-	30.5	44.4	NDP	-	-	<0.7	mg/kg	TM30/PM15
Selenium ^{RM}	-	<1	<1	-	-	<1	<1	NDP	-	-	<1	mg/kg	TM30/PM15
Zinc ^{RM}	-	43	85	-	-	77	112	NDP	-	-	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene ^{RM}	-	-	-	-	-	-	-	0.29	<0.04	<0.40	<0.04	mg/kg	TM4/PM8
Acenaphthylene	-	-	-	-	-	-	-	0.22	<0.03	<0.30	<0.03	mg/kg	TM4/PM8
Acenaphthene ^{RM}	-	-	-	-	-	-	-	<0.25	<0.05	<0.50	<0.05	mg/kg	TM4/PM8
Fluorene ^{RM}	-	-	-	-	-	-	-	<0.20	<0.04	<0.40	<0.04	mg/kg	TM4/PM8
Phenanthrene ^{RM}	-	-	-	-	-	-	-	1.68	<0.03	<0.30	<0.03	mg/kg	TM4/PM8
Anthracene [#]	-	-	-	-	-	-	-	0.70	<0.04	<0.40	<0.04	mg/kg	TM4/PM8
Fluoranthene ^{RM}	-	-	-	-	-	-	-	3.10	<0.03	<0.30	<0.03	mg/kg	TM4/PM8
Pyrene [#]	-	-	-	-	-	-	-	2.66	<0.03	<0.30	<0.03	mg/kg	TM4/PM8
Benz(a)anthracene [#]	-	-	-	-	-	-	-	2.45	<0.06	<0.60	<0.06	mg/kg	TM4/PM8
Chrysene ^{RM}	-	-	-	-	-	-	-	1.97	<0.02	<0.20	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene ^{RM}	-	-	-	-	-	-	-	3.69	<0.07	<0.70	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	-	-	-	-	-	-	-	2.32	<0.04	<0.40	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene ^{RM}	-	-	-	-	-	-	-	2.01	<0.04	<0.40	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	-	-	-	-	-	-	-	0.54	<0.04	<0.40	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	-	-	-	-	-	-	-	2.00	<0.04	<0.40	<0.04	mg/kg	TM4/PM8
PAH 16 Total	-	-	-	-	-	-	-	23.6	<0.6	<6.0	<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	-	-	-	-	-	-	-	2.66	<0.05	<0.50	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	-	-	-	-	-	-	-	1.03	<0.02	<0.20	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	-	-	-	-	-	-	-	92	100	109	<0	%	TM4/PM8
EPH >C8-C10 [#]	-	-	-	-	-	-	-	-	-	-	<5	mg/kg	TM5/PM8
EPH >C10-C20 [#]	-	-	-	-	-	-	-	-	-	-	<10	mg/kg	TM5/PM8
EPH >C20-C30 [#]	-	-	-	-	-	-	-	-	-	-	<10	mg/kg	TM5/PM8
EPH >C30-C40 [#]	-	-	-	-	-	-	-	-	-	-	<10	mg/kg	TM5/PM8
EPH >C8-C40 [#]	-	-	-	-	-	-	-	-	-	-	<35	mg/kg	TM5/PM8

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Report : Solid

Reference: R1662

Location: REDWITHER INDUSTRIAL ESTATE

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Katrina Hawkins

JE Job No.: 11/7587

J E Sample No.	27-28	29-30	31-32	41-42	43-44	45-46	49-50	51-52	53-54	55-56	Please see attached notes for all abbreviations and acronyms		
Sample ID	TP8 S2	TP10 S1	TP10 S2	TP16 S2	TP17 S1	TP17 S2	TP18 S2	TP19 S1	TP19 S2	TP20 S1			
Depth	1.0-1.5	0-0.5	1.8-2.1	0.5-0.9	0-0.5	0.5-0.6	1.8-2.2	0-0.4	0.4-0.7	0-0.1			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD	Units	Method No.
Date of Receipt	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011			
TPH CWG													
Aliphatics													
>C5-C6 ^{MM}	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8 ^{MM}	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 ^{MM}	-	-	-	-	-	-	-	-	<0.2	0.2	<0.2	mg/kg	TM5/PM16
>C12-C16 ^{MM}	-	-	-	-	-	-	-	-	<4	20	<4	mg/kg	TM5/PM16
>C16-C21 ^{MM}	-	-	-	-	-	-	-	-	<7	260	<7	mg/kg	TM5/PM16
>C21-C35 ^{MM}	-	-	-	-	-	-	-	-	<7	6372	<7	mg/kg	TM5/PM16
Total aliphatics C5-35	-	-	-	-	-	-	-	-	<19	6652	<19	mg/kg	TM5/PM16
Aromatics													
>C5-EC7	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10 ^{MM}	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12 ^{MM}	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	mg/kg	TM5/PM16
>EC12-EC16 ^{MM}	-	-	-	-	-	-	-	-	<4	<4	<4	mg/kg	TM5/PM16
>EC16-EC21 ^{MM}	-	-	-	-	-	-	-	-	<7	79	<7	mg/kg	TM5/PM16
>EC21-EC35 ^{MM}	-	-	-	-	-	-	-	-	<7	2122	<7	mg/kg	TM5/PM16
Total aromatics C5-35	-	-	-	-	-	-	-	-	<19	2201	<19	mg/kg	TM5/PM16
Total aliphatics and aromatics(C5-35)	-	-	-	-	-	-	-	-	<38	8853	<38	mg/kg	TM5/PM16
MTBE [#]													
Benzene [#]	-	-	-	-	-	-	-	-	<5	<5	<5	ug/kg	TM31/PM12
Toluene [#]	-	-	-	-	-	-	-	-	<5	<5	<5	ug/kg	TM31/PM12
Ethylbenzene [#]	-	-	-	-	-	-	-	-	<5	<5	<5	ug/kg	TM31/PM12
m/p-Xylene [#]	-	-	-	-	-	-	-	-	<5	<5	<5	ug/kg	TM31/PM12
o-Xylene [#]	-	-	-	-	-	-	-	-	<5	<5	<5	ug/kg	TM31/PM12
Total Phenols HPLC													
Hexavalent Chromium	-	-	-	-	-	-	-	0.6	-	-	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext)	0.0171	-	-	-	-	0.0107	0.1041	-	-	-	<0.0015	g/l	TM38/PM20
Total Cyanide													
Organic Matter	-	-	-	3.4	-	-	-	NDP	-	-	<0.2	%	TM21/PM24
Fibre Screen*	-	-	-	-	NFD	NFD	-	DETECTED	-	-		None	Subcontracted
Asbestos Type*	-	-	-	-	-	-	-	Amosite	-	-		None	Subcontracted
pH ^{MM}	-	8.39	7.87	-	-	8.14	7.75	7.87	-	-	<0.01	pH units	TM73/PM11
Sample Type	Clay	Other	Clay	Clay	-	Clay	Clay	Clayey Loam	Clay	Other		None	PM13/PM0
Sample Colour	Medium Brown	Light Grey	Medium Brown	Medium Brown	-	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Light Grey		None	PM13/PM0
Other Items	none	stones	stones	none	-	stones	none	stones	none	stones		None	PM13/PM0

Please include all sections of this report if it is reproduced

JE Job No.: 11/7587

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms.

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

7 of 14

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Reference: R1662

Location: REDWITHER INDUSTRIAL ESTATE

Contact: Katrina Hawkins

NDP Reason Report

Matrix : Solid

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	NDP Reason
11/7587	1	TP19 S1	0-0.4	51-52	Asbestos detected in sample

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 11/7587

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any analysis that may be compromised highlighted on your schedule/ report by the use of a symbol.

The use of any of the following symbols indicates that the sample was deviating and the test result may be unreliable:

\$	Sample temperature on receipt considered inappropriate for analysis requested.
^	Samples exceeding recommended holding times.
&	Samples received in inappropriate containers (e.g. volatile samples not submitted in VOC jars/vials).
~	No sampling date given, unable to confirm if samples are with acceptable holding times.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

All solid results are expressed on a dry weight basis unless stated otherwise.

ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
M	MCERTS accredited.
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
SS	Calibrated against a single substance.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
W	Results expressed on as received basis.
+	Accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
DR	Dilution required.
B	Indicates analyte found in associated method blank.
NA	Not applicable.

[illegible]



Jones Environmental Laboratory

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No.4225

Attention : Katrina Hawkins
Date : 17th November, 2011
Your reference : R1662
Our reference : Test Report 11/7587 Batch 1 Schedule B
Location : REDWITHER INDUSTRIAL ESTATE
Date samples received : 25th October, 2011
Status : Final report
Issue : 1

Thirty samples were received for analysis on 25th October, 2011. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

J W Farrell- Jones CChem FRSC
Chartered Chemist

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

2 of 5

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 11/7587

SOILS

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It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

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Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

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As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any analysis that may be compromised highlighted on your schedule/ report by the use of a symbol.

The use of any of the following symbols indicates that the sample was deviating and the test result may be unreliable:

\$	Sample temperature on receipt considered inappropriate for analysis requested.
^	Samples exceeding recommended holding times.
&	Samples received in inappropriate containers (e.g. volatile samples not submitted in VOC jars/vials).
~	No sampling date given, unable to confirm if samples are with acceptable holding times.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

ABBREVIATIONS and ACRONYMS USED

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*	Analysis subcontracted to a Jones Environmental approved laboratory.
W	Results expressed on as received basis.
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++	Result outside calibration range, results should be considered as indicative only and are not accredited.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
DR	Dilution required.
B	Indicates analyte found in associated method blank.
NA	Not applicable.

Test Method No.

Test Method No.



Jones Environmental Laboratory

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Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780

Fax: +44 (0) 1244 833781



No.4225

Attention : Katrina Hawkins
Date : 19th December, 2011
Your reference : R1662
Our reference : Test Report 11/7587 Batch 1 Schedule C
Location : REDWITHER INDUSTRIAL ESTATE
Date samples received : 25th October, 2011
Status : Final report
Issue : 1

Thirty samples were received for analysis on 25th October, 2011. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

J W Farrell-Jones CChem FRSC
Chartered Chemist

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Report : Solid

Reference: R1662

Location: REDWITHER INDUSTRIAL ESTATE

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Katrina Hawkins

JE Job No.: 11/7587

J E Sample No.	11-12	19-20	25-26	53-54							Please see attached notes for all abbreviations and acronyms		
Sample ID	TP3 S2	TP5 S1	TP8 S1	TP19 S2									
Depth	0.8-1.1	0-0.5	0-0.3	0.4-0.7									
COC No / misc													
Containers	V J	V J	V J	V J									
Sample Date	25/10/2011	25/10/2011	25/10/2011	25/10/2011									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1							LOD	Units	Method No.
Date of Receipt	25/10/2011	25/10/2011	25/10/2011	25/10/2011									
PCB 28 #	<5	<5	<5	<5							<5	ug/kg	TM86/PM8
PCB 52 #	<5	<5	<5	<5							<5	ug/kg	TM86/PM8
PCB 101 #	<5	<5	<5	<5							<5	ug/kg	TM86/PM8
PCB 118 #	<5	<5	<5	<5							<5	ug/kg	TM86/PM8
PCB 138 #	<5	<5	<5	<5							<5	ug/kg	TM86/PM8
PCB 153 #	<5	<5	<5	<5							<5	ug/kg	TM86/PM8
PCB 180 #	<5	<5	<5	<5							<5	ug/kg	TM86/PM8
Total 7 PCBs #	<35	<35	<35	<35							<35	ug/kg	TM86/PM8

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 11/7587

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any analysis that may be compromised highlighted on your schedule/ report by the use of a symbol.

The use of any of the following symbols indicates that the sample was deviating and the test result may be unreliable:

\$	Sample temperature on receipt considered inappropriate for analysis requested.
^	Samples exceeding recommended holding times.
&	Samples received in inappropriate containers (e.g. volatile samples not submitted in VOC jars/vials).
'	The pH was not tested within 6 hours of sampling and therefore the sample is considered deviating.
~	No sampling date given, unable to confirm if samples are with acceptable holding times.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
M	MCERTS accredited.
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
SS	Calibrated against a single substance.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
DR	Dilution required.
B	Indicates analyte found in associated method blank.
NA	Not applicable.

[illegible]



Jones Environmental Laboratory

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No.4225



Attention : Katrina Hawkins
Date : 16th November, 2011
Your reference : R1662
Our reference : Test Report 11/7587 Batch 2
Location : REDWITHER INDUSTRIAL ESTATE
Date samples received : 27th October, 2011
Status : Final report
Issue : 1

Twenty five samples were received for analysis on 27th October, 2011. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

J W Farrell-Jones CChem FRSC
Chartered Chemist

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Report : Solid

Reference: R1662

Location: REDWITHER INDUSTRIAL ESTATE

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Katrina Hawkins

JE Job No.: 11/7587

J E Sample No.	63-64	65-66	69-70	71-72	77-78	79-80	83-84	85-86	91-92	95-96	Please see attached notes for all abbreviations and acronyms		
Sample ID	TP12.S2	TP13.S1	TP15.S1	TP15.S2	TP9.S1	WS1B.S1	WS1B.S2	WS3.S1	WS2.S1	WS5-S1			
Depth	0.5-0.8	0.0-0.4	0.2-0.6	1.5-1.8	0.1-0.5	0.5-0.6	2.5-2.8	0.2-0.5	0.1-0.6	0.2-0.5			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	2	2	2	2	2	2	2	2	2	2			
Date of Receipt	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	LOD	Units	Method No.
Arsenic ^{RM}	-	6.8	3.0	-	6.6	-	-	-	8.4	-	<0.5	mg/kg	TM30/PM15
Cadmium ^{RM}	-	0.9	0.8	-	1.0	-	-	-	0.1	-	<0.1	mg/kg	TM30/PM15
Chromium ^{RM}	-	8.8	8.9	-	15.3	-	-	-	18.8	-	<0.5	mg/kg	TM30/PM15
Copper ^{RM}	-	21	15	-	27	-	-	-	18	-	<1	mg/kg	TM30/PM15
Lead ^{RM}	-	108	28	-	47	-	-	-	13	-	<5	mg/kg	TM30/PM15
Mercury ^{RM}	-	<0.1	<0.1	-	1.2	-	-	-	<0.1	-	<0.1	mg/kg	TM30/PM15
Nickel ^{RM}	-	7.3	8.7	-	18.9	-	-	-	20.8	-	<0.7	mg/kg	TM30/PM15
Selenium ^{RM}	-	<1	<1	-	<1	-	-	-	1	-	<1	mg/kg	TM30/PM15
Zinc ^{RM}	-	96	37	-	239	-	-	-	54	-	<5	mg/kg	TM30/PM15
PAH MS													
			x5 dilution										
Naphthalene ^{RM}	-	0.12	<0.20	-	0.83	0.27	-	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Acenaphthylene	-	0.04	0.25	-	0.82	0.03	-	-	<0.03	-	<0.03	mg/kg	TM4/PM8
Acenaphthene ^{RM}	-	0.10	0.36	-	0.64	<0.05	-	-	<0.05	-	<0.05	mg/kg	TM4/PM8
Fluorene ^{RM}	-	0.08	0.29	-	0.80	<0.04	-	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Phenanthrene ^{RM}	-	1.40	6.65	-	10.02	0.32	-	-	0.27	-	<0.03	mg/kg	TM4/PM8
Anthracene [#]	-	0.24	2.49	-	6.15	0.04	-	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Fluoranthene ^{RM}	-	1.07	18.79	-	42.80	0.21	-	-	0.18	-	<0.03	mg/kg	TM4/PM8
Pyrene [#]	-	1.01	15.69	-	40.24	0.20	-	-	0.16	-	<0.03	mg/kg	TM4/PM8
Benz(a)anthracene [#]	-	0.49	6.34	-	22.69	0.11	-	-	0.07	-	<0.06	mg/kg	TM4/PM8
Chrysene ^{RM}	-	0.69	9.86	-	31.87	0.11	-	-	0.08	-	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene ^{RM}	-	1.23	14.94	-	65.55	0.14	-	-	0.10	-	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	-	0.78	9.49	-	40.78	0.05	-	-	0.04	-	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene ^{RM}	-	0.59	7.34	-	34.11	0.07	-	-	0.04	-	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	-	0.12	0.63	-	2.90	<0.04	-	-	<0.04	-	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	-	0.53	5.53	-	23.81	0.07	-	-	<0.04	-	<0.04	mg/kg	TM4/PM8
PAH 16 Total	-	8.5	98.7	-	323.8	1.6	-	-	0.9	-	<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	-	0.89	10.76	-	47.20	0.10	-	-	0.07	-	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	-	0.34	4.18	-	18.35	0.04	-	-	0.03	-	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	-	96	88	-	86	98	-	-	99	-	<0	%	TM4/PM8
EPH >C8-C10 [#]	-	-	-	-	-	-	<5	-	-	-	<5	mg/kg	TM5/PM8
EPH >C10-C20 [#]	-	-	-	-	-	-	<10	-	-	-	<10	mg/kg	TM5/PM8
EPH >C20-C30 [#]	-	-	-	-	-	-	<10	-	-	-	<10	mg/kg	TM5/PM8
EPH >C30-C40 [#]	-	-	-	-	-	-	<10	-	-	-	<10	mg/kg	TM5/PM8
EPH >C8-C40 [#]	-	-	-	-	-	-	<35	-	-	-	<35	mg/kg	TM5/PM8

Please include all sections of this report if it is reproduced

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Reference: R1662

Location: REDWITHER INDUSTRIAL ESTATE

Contact: Katrina Hawkins

JE Job No.: 11/7587

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	63-64	65-66	69-70	71-72	77-78	79-80	83-84	85-86	91-92	95-96	LOD	Units	Method No.
Sample ID	TP12.S2	TP13.S1	TP15.S1	TP15.S2	TP9.S1	WS1B.S1	WS1B.S2	WS3.S1	WS2.S1	WS5-S1			
Depth	0.5-0.8	0.0-0.4	0.2-0.6	1.5-1.8	0.1-0.5	0.5-0.6	2.5-2.8	0.2-0.5	0.1-0.6	0.2-0.5	LOD	Units	Method No.
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J	LOD	Units	Method No.
Sample Date	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011	26/10/2011			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	LOD	Units	Method No.
Batch Number	2	2	2	2	2	2	2	2	2	2			
Date of Receipt	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	27/10/2011	LOD	Units	Method No.
TPH CWC													
Aliphatics													
>C5-C6 ^{RM}	-	-	-	-	-	<0.1	-	-	-	-	<0.1	mg/kg	TM36/PM12
>C6-C8 ^{RM}	-	-	-	-	-	<0.1	-	-	-	-	<0.1	mg/kg	TM36/PM12
>C8-C10	-	-	-	-	-	<0.1	-	-	-	-	<0.1	mg/kg	TM36/PM12
>C10-C12 ^{RM}	-	-	-	-	-	8.0	-	-	-	-	<0.2	mg/kg	TM5/PM16
>C12-C16 ^{RM}	-	-	-	-	-	61	-	-	-	-	<4	mg/kg	TM5/PM16
>C16-C21 ^{RM}	-	-	-	-	-	660	-	-	-	-	<7	mg/kg	TM5/PM16
>C21-C35 ^{RM}	-	-	-	-	-	5247	-	-	-	-	<7	mg/kg	TM5/PM16
Total aliphatics C5-35	-	-	-	-	-	5976	-	-	-	-	<19	mg/kg	TM5/PM16/2PM18
Aromatics													
>C5-EC7	-	-	-	-	-	<0.1	-	-	-	-	<0.1	mg/kg	TM36/PM12
>EC7-EC8	-	-	-	-	-	<0.1	-	-	-	-	<0.1	mg/kg	TM36/PM12
>EC8-EC10 ^{RM}	-	-	-	-	-	<0.1	-	-	-	-	<0.1	mg/kg	TM36/PM12
>EC10-EC12 ^{RM}	-	-	-	-	-	2.4	-	-	-	-	<0.2	mg/kg	TM5/PM16
>EC12-EC16 ^{RM}	-	-	-	-	-	22	-	-	-	-	<4	mg/kg	TM5/PM16
>EC16-EC21 ^{RM}	-	-	-	-	-	216	-	-	-	-	<7	mg/kg	TM5/PM16
>EC21-EC35 ^{RM}	-	-	-	-	-	3553	-	-	-	-	<7	mg/kg	TM5/PM16
Total aromatics C5-35	-	-	-	-	-	3793	-	-	-	-	<19	mg/kg	TM5/PM16/2PM18
Total aliphatics and aromatics(C5-35)	-	-	-	-	-	9769	-	-	-	-	<38	mg/kg	TM5/PM16/2PM18
MTBE #	-	-	-	-	-	<5	-	-	-	-	<5	ug/kg	TM31/PM12
Benzene #	-	-	-	-	-	<5	-	-	-	-	<5	ug/kg	TM31/PM12
Toluene #	-	-	-	-	-	<5	-	-	-	-	<5	ug/kg	TM31/PM12
Ethylbenzene #	-	-	-	-	-	<5	-	-	-	-	<5	ug/kg	TM31/PM12
m/p-Xylene #	-	-	-	-	-	<5	-	-	-	-	<5	ug/kg	TM31/PM12
o-Xylene #	-	-	-	-	-	<5	-	-	-	-	<5	ug/kg	TM31/PM12
Hexavalent Chromium	-	<0.3	-	-	<0.3	-	-	-	-	-	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext)	0.0756	-	-	0.0494	-	-	-	-	-	-	<0.0015	g/l	TM38/PM20
Organic Matter	0.5	-	-	-	3.4	-	-	-	-	-	<0.2	%	TM21/PM24
Fibre Screen*	-	NFD	-	-	NFD	-	-	-	-	-	None	Subcontracted	
Asbestos Type*	-	NAD	-	-	NAD	-	-	-	-	-	None	Subcontracted	
pH ^{RM}	-	8.60	8.22	-	8.42	-	-	-	11.71	-	<0.01	pH units	TM73/PM11
Sample Type	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	None	PM13/PM0	
Sample Colour	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Dark Brown	Medium Brown	Medium Brown	Medium Brown	Medium Grey	None	PM13/PM0	
Other Items	none	stones and shale	stones	none	stones and shale	stones and shale	none	stones	stones and sand	stones	None	PM13/PM0	

Please include all sections of this report if it is reproduced

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 11/7587

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any analysis that may be compromised highlighted on your schedule/ report by the use of a symbol.

The use of any of the following symbols indicates that the sample was deviating and the test result may be unreliable:

\$	Sample temperature on receipt considered inappropriate for analysis requested.
^	Samples exceeding recommended holding times.
&	Samples received in inappropriate containers (e.g. volatile samples not submitted in VOC jars/vials).
~	No sampling date given, unable to confirm if samples are with acceptable holding times.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
M	MCERTS accredited.
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
SS	Calibrated against a single substance.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
W	Results expressed on as received basis.
+	Accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
DR	Dilution required.
B	Indicates analyte found in associated method blank.
NA	Not applicable.

JE Job No 11/7587

[illegible]



Jones Environmental Laboratory

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No.4225

Attention : Katrina Hawkins
Date : 16th November, 2011
Your reference : R1622
Our reference : Test Report 11/7815 Batch 1
Location : REDWITHER, WREXHAM INDUSTRIAL PARK
Date samples received : 3rd November, 2011
Status : Final report
Issue : 1

Seven samples were received for analysis on 3rd November, 2011. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

J W Farrell- Jones CChem FRSC
Chartered Chemist

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Report : Liquid

Reference: R1622

Location: REDWITHER, WREXHAM INDUSTRIAL PARK

Contact: Katrina Hawkins

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle

JE Job No.: 11/7815

H=H₂SO₄, Z=ZnAc, N=NaOH, HN=HNO₃

J E Sample No.	1-3	4-6	7-9	10-12	16-18						Please see attached notes for all abbreviations and acronyms		
Sample ID	WS1.GW	WS2.GW	WS3.GW	WS5.GW	WS7.GW								
Depth													
COC No / misc													
Containers	V G	V G	V G	V G	V G								
Sample Date	03/11/2011	03/11/2011	03/11/2011	03/11/2011	03/11/2011								
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water								
Batch Number	1	1	1	1	1								
Date of Receipt	03/11/2011	03/11/2011	03/11/2011	03/11/2011	03/11/2011								
											LOD	Units	Method No.
Dissolved Arsenic #	5.5	2.1	9.3	4.7	3.7						<0.9	ug/l	TM30/PM14
Dissolved Cadmium #	<0.03	<0.03	<0.03	0.04	0.04						<0.03	ug/l	TM30/PM14
Total Dissolved Chromium #	1.3	5.3	0.2	1.9	6.1						<0.2	ug/l	TM30/PM14
Dissolved Copper #	<3	<3	<3	5	4						<3	ug/l	TM30/PM14
Dissolved Lead #	4.0	3.8	4.4	2.4	4.9						<0.4	ug/l	TM30/PM14
Dissolved Mercury #	<0.5	<0.5	<0.5	<0.5	<0.5						<0.5	ug/l	TM30/PM14
Dissolved Nickel #	2.1	2.0	2.8	1.6	1.9						<0.2	ug/l	TM30/PM14
Dissolved Selenium #	<1.2	12.4	<1.2	8.0	7.0						<1.2	ug/l	TM30/PM14
Dissolved Zinc #	<1.5	<1.5	<1.5	3.4	3.1						<1.5	ug/l	TM30/PM14
Mercury Dissolved by CVA#	<0.01	<0.01	<0.01	<0.01	<0.01						<0.01	ug/l	TM61/PM38
PAH MS													
Naphthalene #	0.050	<0.014	<0.014	<0.014	<0.014						<0.014	ug/l	TM4/PM30
Acenaphthylene #	<0.013	<0.013	<0.013	<0.013	<0.013						<0.013	ug/l	TM4/PM30
Acenaphthene #	<0.013	<0.013	<0.013	<0.013	<0.013						<0.013	ug/l	TM4/PM30
Fluorene #	<0.014	<0.014	<0.014	<0.014	<0.014						<0.014	ug/l	TM4/PM30
Phenanthrene #	0.020	<0.011	<0.011	<0.011	<0.011						<0.011	ug/l	TM4/PM30
Anthracene #	<0.013	<0.013	<0.013	<0.013	<0.013						<0.013	ug/l	TM4/PM30
Fluoranthene #	<0.012	<0.012	<0.012	<0.012	<0.012						<0.012	ug/l	TM4/PM30
Pyrene #	<0.013	<0.013	<0.013	<0.013	<0.013						<0.013	ug/l	TM4/PM30
Benz(a)anthracene #	<0.015	<0.015	<0.015	<0.015	<0.015						<0.015	ug/l	TM4/PM30
Chrysene #	<0.011	<0.011	<0.011	<0.011	<0.011						<0.011	ug/l	TM4/PM30
Benzo(b)fluoranthene #	<0.018	<0.018	<0.018	<0.018	<0.018						<0.018	ug/l	TM4/PM30
Benzo(a)pyrene #	<0.016	<0.016	<0.016	<0.016	<0.016						<0.016	ug/l	TM4/PM30
Indeno(123cd)pyrene #	<0.011	<0.011	<0.011	<0.011	<0.011						<0.011	ug/l	TM4/PM30
Dibenzo(ah)anthracene #	<0.01	<0.01	<0.01	<0.01	<0.01						<0.01	ug/l	TM4/PM30
Benzo(ghi)perylene #	<0.011	<0.011	<0.011	<0.011	<0.011						<0.011	ug/l	TM4/PM30
PAH 16 Total #	<0.195	<0.195	<0.195	<0.195	<0.195						<0.195	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01						<0.01	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01						<0.01	ug/l	TM4/PM30
PAH Surrogate % Recovery	109	109	101	103	106						<0	%	TM4/PM30
EPH (C8-C40) #	<10	<10	<10	<10	<10						<10	ug/l	TM5/PM30
GRO (C4-C8) #	-	<100	-	<100	-						<100	ug/l	TM36/PM12
GRO (C8-C12) #	-	<100	-	<100	-						<100	ug/l	TM36/PM12
GRO (C4-12) #	-	<100	-	<100	-						<100	ug/l	TM36/PM12
MTBE #	-	<5	-	<5	-						<5	ug/l	TM36/PM12
Benzene #	-	<5	-	<5	-						<5	ug/l	TM36/PM12
Toluene #	-	<5	-	<5	-						<5	ug/l	TM36/PM12
Ethylbenzene #	-	<5	-	<5	-						<5	ug/l	TM36/PM12
m/p-Xylene #	-	<5	-	<5	-						<5	ug/l	TM36/PM12
o-Xylene #	-	<5	-	<5	-						<5	ug/l	TM36/PM12

Please include all sections of this report if it is reproduced

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Report : Liquid

Reference: R1622

Location: REDWITHER, WREXHAM INDUSTRIAL PARK

Contact: Katrina Hawkins

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle

JE Job No.: 11/7815

H=H₂SO₄, Z=ZnAc, N=NaOH, HN=HN0₃

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	16-18								
Sample ID	WS1.GW	WS2.GW	WS3.GW	WS5.GW	WS7.GW								
Depth													
COC No / misc													
Containers	V G	V G	V G	V G	V G								
Sample Date	03/11/2011	03/11/2011	03/11/2011	03/11/2011	03/11/2011								
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water								
Batch Number	1	1	1	1	1								
Date of Receipt	03/11/2011	03/11/2011	03/11/2011	03/11/2011	03/11/2011								
											LOD	Units	Method No.
PCB 28	<0.1	-	<0.1	-	<0.1						<0.1	ug/l	TM86/PM30
PCB 52	<0.1	-	<0.1	-	<0.1						<0.1	ug/l	TM86/PM30
PCB 101	<0.1	-	<0.1	-	<0.1						<0.1	ug/l	TM86/PM30
PCB 118	<0.1	-	<0.1	-	<0.1						<0.1	ug/l	TM86/PM30
PCB 138	<0.1	-	<0.1	-	<0.1						<0.1	ug/l	TM86/PM30
PCB 153	<0.1	-	<0.1	-	<0.1						<0.1	ug/l	TM86/PM30
PCB 180	<0.1	-	<0.1	-	<0.1						<0.1	ug/l	TM86/PM30
Total 7 PCBs	<0.7	-	<0.7	-	<0.7						<0.7	ug/l	TM86/PM30
Phenol [#]	<0.01	<0.01	<0.01	<0.01	<0.01						<0.01	mg/l	TM26/PM0
Sulphate [#]	-	256.09	-	61.67	520.94						<0.05	mg/l	TM38/PM0
Total Cyanide [#]	<0.01	<0.01	<0.01	<0.01	<0.01						<0.01	mg/l	TM89/PM0
Hexavalent Chromium	<0.002	<0.002	<0.002	<0.002	<0.002						<0.002	mg/l	TM38/PM0
Chromium III	<2.0	5.3	<2.0	<2.0	6.1						<2.0	ug/l	TM30/PM14
pH	7.48	7.78	7.87	7.97	7.91						<0.01	pH units	TM73/PM0

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Report : Product

Reference: R1622

Location: REDWITHER, WREXHAM INDUSTRIAL PARK

Contact: Katrina Hawkins

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle

JE Job No.: 11/7815

H=H₂SO₄, Z=ZnAc, N=NaOH, HN=HNO₃

J E Sample No. 19-20 Sample ID 011 TANK Depth COC No / misc Containers V G Sample Date 03/11/2011 Sample Type Product Batch Number 1 Date of Receipt 03/11/2011										Please see attached notes for all abbreviations and acronyms		
										LOD	Units	Method No.
Whole Oil Trace	See Attached										None	TM1/PM0
Carbon Range	c20-c35										None	TM1/PM0
Boiling Point Range	344-491									<50	Degrees C	TM1/PM0
Interpretation	Lubricating Oil										None	TM1/PM0
Pristane/Phytane Ratio	Not Present										None	TM1/PM0
nC17/Pristane Ratio	Not Present										None	TM1/PM0
Age (± 2 years) (Christensen & Larsen 1993)	Not possible as relevant markers are either not present or values are above the permitted range										Years	TM1/PM0

Please include all sections of this report if it is reproduced



Jones Environmental Forensics Ltd

Whole Oil Analysis by GC-FID



Job Number: 11/7815-20
Client ID: 011 TANK
Description: Black Oil

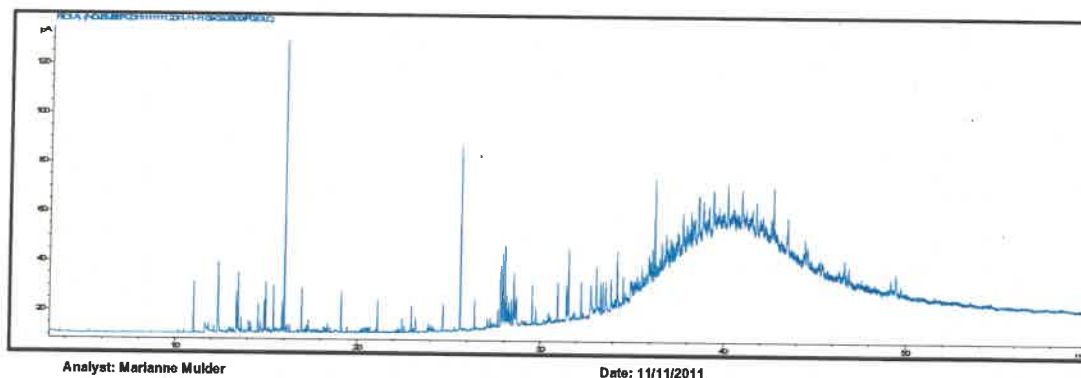
Carbon Range: nC20 to nC35
Boiling Point Range: 344°C to 491°C

Pristane/Phytane Ratio: Not Present
nC17/Pristane Ratio: Not Present

Age(+/-2 years) Not possible as relevant markers are either not present or values are above the permitted range

Fingerprint: Lubricating Oil

Chromatogram



SVOC Report : Liquid

J E Sample No.	1-3	7-9	16-18								Please see attached notes for all abbreviations and acronyms		
Sample ID	WS1.GW	WS3.GW	WS7.GW										
Depth													
COC No / misc													
Containers	V G	V G	V G										
Sample Date	03/11/2011	03/11/2011	03/11/2011										
Sample Type	Ground Water	Ground Water	Ground Water										
Batch Number	1	1	1										
Date of Receipt	03/11/2011	03/11/2011	03/11/2011										
											LOD	Units	Method No.
SVOC MS													
Other SVOCs													
1,2-Dichlorobenzene	<10	<10	<10								<10	ug/l	TM16/PM30
1,2,4-Trichlorobenzene	<10	<10	<10								<10	ug/l	TM16/PM30
1,3-Dichlorobenzene	<10	<10	<10								<10	ug/l	TM16/PM30
1,4-Dichlorobenzene	<10	<10	<10								<10	ug/l	TM16/PM30
2-Nitroaniline	<10	<10	<10								<10	ug/l	TM16/PM30
2,4-Dinitrotoluene	<10	<10	<10								<10	ug/l	TM16/PM30
2,6-Dinitrotoluene	<10	<10	<10								<10	ug/l	TM16/PM30
3-Nitroaniline	<10	<10	<10								<10	ug/l	TM16/PM30
4-Bromophenylphenylether	<10	<10	<10								<10	ug/l	TM16/PM30
4-Chloroaniline	<10	<10	<10								<10	ug/l	TM16/PM30
4-Chlorophenylphenylether	<10	<10	<10								<10	ug/l	TM16/PM30
4-Nitroaniline	<10	<10	<10								<10	ug/l	TM16/PM30
Azobenzene	<10	<10	<10								<10	ug/l	TM16/PM30
Bis(2-chloroethoxy)methane	<10	<10	<10								<10	ug/l	TM16/PM30
Bis(2-chloroethyl)ether	<10	<10	<10								<10	ug/l	TM16/PM30
Carbazole	<10	<10	<10								<10	ug/l	TM16/PM30
Dibenzofuran	<10	<10	<10								<10	ug/l	TM16/PM30
Hexachlorobenzene	<10	<10	<10								<10	ug/l	TM16/PM30
Hexachlorobutadiene	<10	<10	<10								<10	ug/l	TM16/PM30
Hexachlorocyclopentadiene	<10	<10	<10								<10	ug/l	TM16/PM30
Hexachloroethane	<10	<10	<10								<10	ug/l	TM16/PM30
Isophorone	<10	<10	<10								<10	ug/l	TM16/PM30
N-nitrosodi-n-propylamine	<10	<10	<10								<10	ug/l	TM16/PM30
Nitrobenzene	<10	<10	<10								<10	ug/l	TM16/PM30

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 11/7815

SOILS

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It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any analysis that may be compromised highlighted on your schedule/ report by the use of a symbol.

The use of any of the following symbols indicates that the sample was deviating and the test result may be unreliable:

\$	Sample temperature on receipt considered inappropriate for analysis requested.
^	Samples exceeding recommended holding times.
&	Samples received in inappropriate containers (e.g. volatile samples not submitted in VOC jars/vials).
~	No sampling date given, unable to confirm if samples are with acceptable holding times.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

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ND	None Detected (usually refers to VOC.and/SVOC TICs).
SS	Calibrated against a single substance.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
W	Results expressed on as received basis.
+	Accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
DR	Dilution required.
B	Indicates analyte found in associated method blank.
NA	Not applicable.

[illegible]



Jones Environmental Laboratory

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
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CH5 2UA

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Ruabon
Wrexham
LL14 6DL

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781



No.4225



Attention : Katrina Hawkins
Date : 28th November, 2011
Your reference : R1662
Our reference : Test Report 11/8136 Batch 1
Location :
Date samples received : 17th November, 2011
Status : Final report
Issue : 1

One sample was received for analysis on 17th November, 2011. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

J W Farrell-Jones CChem FRSC
Chartered Chemist

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.:

11/8136

SOILS

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Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

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WATERS

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\$	Sample temperature on receipt considered inappropriate for analysis requested.
^	Samples exceeding recommended holding times.
&	Samples received in inappropriate containers (e.g. volatile samples not submitted in VOC jars/vials).
~	No sampling date given, unable to confirm if samples are with acceptable holding times.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

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*	Analysis subcontracted to a Jones Environmental approved laboratory.
W	Results expressed on as received basis.
+	Accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
DR	Dilution required.
B	Indicates analyte found in associated method blank.
NA	Not applicable.

JE Job No 11/8136

[illegible]



Jones Environmental Laboratory

Unit 3 Deeside Point
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Smith Grant LLP
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Wrexham
LL14 6DL

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

Attention : Katrina Hawkins
Date : 16th December, 2011
Your reference : R1662
Our reference : Test Report 11/8136 Batch 1 Schedule B
Location :
Date samples received : 17th November, 2011
Status : Final report
Issue : 1

One sample was received for analysis on 17th November, 2011. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

J W Farrell-Jones CChem FRSC
Chartered Chemist

Jones Environmental Laboratory

Client Name: Smith Grant LLP

Report : NRA Leachate

Reference: R1662

Location:

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Katrina Hawkins

JE Job No.: 11/8136

J E Sample No.	1-2										Please see attached notes for all abbreviations and acronyms		
Sample ID	S1												
Depth													
COC No / misc													
Containers	V J												
Sample Date	12/11/2011												
Sample Type	Soil												
Batch Number	1										LOD	Units	Method No.
Date of Receipt	17/11/2011												
Dissolved Arsenic	4.6										<2.5	ug/l	TM30/PM14
Dissolved Boron	<12										<12	ug/l	TM30/PM14
Dissolved Cadmium	<0.5										<0.5	ug/l	TM30/PM14
Dissolved Chromium	<1.5										<1.5	ug/l	TM30/PM14
Dissolved Copper	64										<7	ug/l	TM30/PM14
Dissolved Lead	<5										<5	ug/l	TM30/PM14
Dissolved Mercury	<1										<1	ug/l	TM30/PM14
Dissolved Nickel	<2										<2	ug/l	TM30/PM14
Dissolved Selenium	<3										<3	ug/l	TM30/PM14
Dissolved Zinc	130										<3	ug/l	TM30/PM14

Please include all sections of this report if it is reproduced

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 11/8136

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\$	Sample temperature on receipt considered inappropriate for analysis requested.
^	Samples exceeding recommended holding times.
&	Samples received in inappropriate containers (e.g. volatile samples not submitted in VOC jars/vials).
'	The pH was not tested within 6 hours of sampling and therefore the sample is considered deviating.
~	No sampling date given, unable to confirm if samples are with acceptable holding times.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

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*	Analysis subcontracted to a Jones Environmental approved laboratory.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
DR	Dilution required.
B	Indicates analyte found in associated method blank.
NA	Not applicable.

JE Job No 11/8136

[illegible]

APPENDIX E

Gas Monitoring Results

Assessment of methane and carbon dioxide based on CIRIA C665
Sheet 1: Gas Data

CIRIA C665 Gas Concentration
(development other than low rise housing)

	CH4 %	CO2 %
CS1	<1	<5
CS2 - CS6	>1	>5

CIRIA C665 gas screening volume (GSV)
(development other than low rise housing)

	CH4 or CO2 l/hr
CS1	<0.07
CS2	<0.7
CS3	<3.5
CS4	<15
CS5	<70
CS6	>70

		DATE	03.11.11	12.11.11	17.11.11	29.11.11
WS1b	CH4 (peak)	% v/v	18.9	18.9	18.9	18.9
	limiting volume		0.00	0.00	0.00	0.00
	CO2 (peak)	% v/v	7.7	7.7	7.7	7.7
	limiting volume		0.00	0.00	0.00	0.00
	O2 min	% v/v	7.4	7.4	7.4	5.6
	CO	ppm	1	1	1	1
	H2S	ppm	1	1	1	1
	VOCS	ppm	0.1	0.1	0.1	0.1
	Gas Flow	l/hr	0	0	0	0
	Borehole Pressure	mBar	0	0	0	0
	Water	m btoc	1.65	1.56	1.6	1.53
WS2	CH4 (peak)	% v/v	18.9	18.9	18.9	18.9
	limiting volume		0.00	0.00	0.00	0.00
	CO2 (peak)	% v/v	7.7	7.7	7.7	7.7
	limiting volume		0.00	0.00	0.00	0.00
	O2 min	% v/v	18.9	12.7	16.4	16.4
	CO	ppm	1	1	1	1
	H2S	ppm	1	1	1	1
	VOCS	ppm	0.1	0.1	0.1	0.1
	Gas Flow	l/hr	0	0	0	0
	Borehole Pressure	mBar	0	0	0.01	0.01
	Water	m btoc	0.6	1.2	1.1	1.1
WS3	CH4 (peak)	% v/v	18.9	18.9	18.9	18.9
	limiting volume		0.00	0.00	0.00	0.00
	CO2 (peak)	% v/v	7.7	7.7	7.7	7.7
	limiting volume		0.00	0.00	0.00	0.00
	O2 min	% v/v	18.5	18.2	18.4	18.5
	CO	ppm	1	1	1	1
	H2S	ppm	1	1	1	1
	VOCS	ppm	0.1	0.1	0.1	0.1
	Gas Flow	l/hr	0	-0.2	0	0
	Borehole Pressure	mBar	0	0	0.03	0
	Water	m btoc	2.18	2.1	2.12	2.1
WS5	CH4 (peak)	% v/v	18.9	18.9	18.9	18.9
	limiting volume		0.00	0.00	0.00	0.00
	CO2 (peak)	% v/v	7.7	7.7	7.7	7.7
	limiting volume		0.00	0.00	0.00	0.00
	O2 min	% v/v	19.5	19.2	19.2	19.9
	CO	ppm	1	1	1	1
	H2S	ppm	1	1	1	1
	VOCS	ppm	0.1	0.1	0.1	0.1
	Gas Flow	l/hr	0	0	0	0
	Borehole Pressure	mBar	0	0	0.05	0
	Water	m btoc	2.23	2.21	2.29	2.25
WS6	CH4 (peak)	% v/v	18.9	18.9	18.9	18.9
	limiting volume		0.00	0.00	0.00	0.00
	CO2 (peak)	% v/v	7.7	7.7	7.7	7.7
	limiting volume		0.00	0.00	0.00	0.00
	O2 min	% v/v	18	18.1	18.4	19.1
	CO	ppm	1	1	1	1
	H2S	ppm	1	1	1	1
	VOCS	ppm	0.1	0.1	0.1	0.1
	Gas Flow	l/hr	0.4	0	0	0
	Borehole Pressure	mBar	0	0.12	0	0
	Water	m btoc	1.4	1.18	1.14	1.27
WS7	CH4 (peak)	% v/v	18.9	18.9	18.9	18.9
	limiting volume		0.00	0.00	0.00	0.00
	CO2 (peak)	% v/v	7.7	7.7	7.7	7.7
	limiting volume		0.00	0.00	0.00	0.00
	O2 min	% v/v	16.7	16.7	16.7	16.7
	CO	ppm	1	1	1	1
	H2S	ppm	1	1	1	1
	VOCS	ppm	0.1	0.1	0.1	0.1
	Gas Flow	l/hr	12	12	12	12
	Borehole Pressure	mBar	8.5	8.5	8.5	8.5
	Water	m btoc	0.47	0.33	0.3	0.3

		Min	Max
WS1b	CH4 (peak)	% v/v	0.1
	limiting volume		0
	CO2 (peak)	% v/v	7.7
	limiting volume		0
	O2 min	% v/v	5.6
	CO	ppm	1
	H2S	ppm	1
	VOCS	ppm	0.1
	Gas Flow	l/hr	0
	Borehole Pressure	mBar	0
	Water	m btoc	1.53
WS2	CH4 (peak)	% v/v	0.1
	limiting volume		0
	CO2 (peak)	% v/v	0.2
	limiting volume		0
	O2 min	% v/v	12.7
	CO	ppm	1
	H2S	ppm	1
	VOCS	ppm	0.1
	Gas Flow	l/hr	0
	Borehole Pressure	mBar	0
	Water	m btoc	0.6
WS3	CH4 (peak)	% v/v	0.1
	limiting volume		-0.0002
	CO2 (peak)	% v/v	1.1
	limiting volume		-0.0028
	O2 min	% v/v	18.2
	CO	ppm	1
	H2S	ppm	1
	VOCS	ppm	0.1
	Gas Flow	l/hr	-0.2
	Borehole Pressure	mBar	0
	Water	m btoc	2.1
WS5	CH4 (peak)	% v/v	0.1
	limiting volume		0
	CO2 (peak)	% v/v	0.1
	limiting volume		0
	O2 min	% v/v	19.2
	CO	ppm	1
	H2S	ppm	1
	VOCS	ppm	0.1
	Gas Flow	l/hr	0
	Borehole Pressure	mBar	0
	Water	m btoc	2.21
WS6	CH4 (peak)	% v/v	0.1
	limiting volume		0
	CO2 (peak)	% v/v	0.6
	limiting volume		0.0048
	O2 min	% v/v	18
	CO	ppm	1
	H2S	ppm	1
	VOCS	ppm	0.1
	Gas Flow	l/hr	0
	Borehole Pressure	mBar	0
	Water	m btoc	1.14
WS7	CH4 (peak)	% v/v	0.1
	limiting volume		0.012
	CO2 (peak)	% v/v	1.5
	limiting volume		0.18
	O2 min	% v/v	16.7
	CO	ppm	1
	H2S	ppm	1
	VOCS	ppm	0
	Gas Flow	l/hr	12
	Borehole Pressure	mBar	8.5
	Water	m btoc	0.3

atm pressure	start	980	1022	1011	995
	finish	980	1022	1011	995

GROUND GAS MONITORING REPORT

Site name:	Redwither Central	Job number:	R1662	Barometric pressure at start:	980	mb	finish:	980	mb
Time at:	start	10.3	Date:	03.11.11	Pressure trend:	Falling	(previous 3 days)		
	finish	11.45	Staff:	DW	Instruments:	GA2000 ¹ , MiniRAE 2000 PID ²			
Record code:	R1662-G01	Weather conditions:	7/8 clid, 15°C, overcast			Ground conditions:	damp with surface water		

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ³ ppm	Gas flow l/hr		Well pressure mb	Depth to water m bgl	Notes
	Peak	steady	peak	steady	min	steady				peak	steady			
WS1b	<0.1	<0.1	7.7	7.7	7.4	7.4	1	<1	-	0	0	0	1.65	base @ 3.87
WS2	<0.1	<0.1	0.2	0.2	18.9	18.9	<1	<1	-	0	0	0	0.6	gas tap installed open. Closed and monitored approx. 1 hr later. Base @ 2.95
WS3	<0.1	<0.1	1.4	1.4	18.5	18.5	<1	<1	-	0	0	0	2.18	base @ 3.94
WS5	<0.1	<0.1	0.2	0.2	19.5	19.5	<1	<1	-	0	0	0	2.23	base @ 3.90
WS6	<0.1	<0.1	1.2	1.2	18	18	<1	<1	-	0.4	0.4	0	1.4	base @ 3.46
WS7	-	-	-	-	-	-	-	-	-	-	-	-	0.47	gas analyser sucked up water after 20secs; base @ 4.03
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm					
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%					

1. Date of last calibration 29.03.11

2. Calibrated with 100ppm isobutylene gas in air

3. PID malfunction; no VOCs readings taken

GROUND GAS MONITORING REPORT

Site name:	Redwither central	Job number:	R1662	Barometric pressure at start:	1022	mb	finish:	1022	mb
Time at:	start	10.15	Date:	12.11.11	Pressure trend:				(previous 3 days)
	finish	11.15	Staff:	keh	Instruments:	GA2000 ¹ , MiniRAE 2000 PID ²			
Record code:	R1662-G02	Weather conditions:	warm, dry, calm, 15°C	Ground conditions:		ponded areas from evening rain			

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ppm	Gas flow l/hr		Well pressure mb	Depth to water m bgl	Notes
	Peak	steady	peak	steady	min	steady				peak	steady			
WS1b	-	-	-	-	-	-	-	-	-	-	-	-	1.56	gas analyser malfunction; not monitored; base @ 3.90
WS2	<0.1	<0.1	0.4	0.4	12.7	12.7	<1	<1	-	>>>	0	0	1.2	base @ 2.95
WS3	<0.1	<0.1	1.4	1.4	18.2	18.2	<1	<1	-	-0.2	-0.2	0	2.1	base @ 3.94
WS5	-	-	-	-	-	-	-	-	-	-	-	-	2.21	gas analyser malfunction; not monitored; base @ 3.90
WS6	<0.1	<0.1	1.1	1.1	18.1	18.1	<1	<1	-	-5.5	0	0.12	1.18	base @ 3.45 (silty)
WS7	<0.1	<0.1	1.5	1.5	16.7	16.7	<1	<1	-	12	8.5	0	0.33	gas analyser sucked up water during monitoring period; base @ 4.1
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm					
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%					

1. Date of last calibration 29.03.11

2. Calibrated with 100ppm isobutylene gas in air

3. PID malfunction; no VOCs readings taken

Site name:	Redwither central	Job number:	R1662	Barometric pressure at start:	1011	mb	finish:	1011	mb
Time at:	start	12.00	Date:	17.11.11	Pressure trend:	(previous 3 days)			
	finish	12.55	Staff:	LD	Instruments:	GA2000 ¹ MiniRAE 2000 PID ²			
Record code:	R1662-G02		Weather conditions:			b/s cloud, dry			
						Ground conditions:			
						dry			

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ³ ppm	Gas flow l/hr		Well pressure mb	Depth to water m.bgl	Notes
	Peak	steady	peak	steady	min	steady				peak	steady			
WS1b	<0.1	<0.1	8.5	8.5	7.4	7.5	<1	<1	<0.1	0	0	0	1.6	base @ 3.90
WS2	<0.1	<0.1	0.2	0.2	16.4	16.4	<1	<1	<0.1	0	0	0.01	1.1	base @ 2.95
WS3	<0.1	<0.1	1.1	1.1	18.4	18.4	<1	<1	<0.1	0	0	0.03	2.12	base @ 3.96
WS5	<0.1	<0.1	0.1	0.1	19.2	19.2	<1	<1	<0.1	0	0	0.05	2.29	base @ 3.90
WS6	<0.1	<0.1	1.1	1.1	18.4	18.4	<1	<1	<0.1	0	0	0	1.14	base @ 3.42 (silty)
WS7	-	-	-	-	-	-	-	-	-	-	-	-	-	not monitored - flooded
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm					
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%					

1. Date of last calibration 29.03.11

2. Calibrated with 100ppm isobutylene gas in air

GROUND GAS MONITORING REPORT

Site name:	Redwither central	Job number:	R1662	Barometric pressure at start:	995	mb	finish:	995	mb
Time at:	start 13.30	Date:	29.11.11	Pressure trend:	(previous 3 days)				
	finish 14.30	Staff:	DW	Instruments:	GA2000 ¹ , MiniRAE 2000 PID ²				
Record code:	R1662-G02	Weather conditions:	8/8 cloud, 9°C, heavy to light rain					Ground conditions:	ponded areas from rain

Well No.	Methane %vol		Carbon dioxide %vol		Oxygen %vol		Carbon monoxide ppm	Hydrogen sulphide ppm	VOCs ³ ppm	Gas flow l/hr		Well pressure mb	Depth to water m bgl	Notes
	Peak	steady	peak	steady	min	steady				peak	steady			
WS1b	<0.1	<0.1	9.2	9.2	5.6	5.6	<1	<1	-	0	0	0	1.53	base @ 3.90
WS2	-	-	-	-	-	-	-	-	-	-	-	-	-	Pool of water over borehole
WS3	<0.1	<0.1	1.1	1.1	18.5	18.5	<1	<1	-	0	0	0	2.1	base @ 3.06
WS5	<0.1	<0.1	<0.1	<0.1	19.9	19.9	<1	<1	-	0	0	0	2.25	base @ 3.90
WS6	<0.1	<0.1	0.6	0.6	19.1	19.1	<1	<1	-	0	0	0	1.27	base @ 3.42 (silty)
WS7	-	-	-	-	-	-	-	-	-	-	-	-	0.3	gas analyser sucked up water during monitoring period; base @ 4.2
Limit of Detection	0.1%		0.1%		0.1%		1ppm	1ppm	0.1ppm					
Accuracy (% of reading)	±3.0%		±3.0%		±0.5%		±5%	±5%	±5%					

1. Date of last calibration 29.03.11

2. Calibrated with 100ppm isobutylene gas in air

3. PID malfunction; no VOCs readings taken

